Fine WoodWorking January/February 1988

Building a Chest of Drawers

Joinery and design considerations

by Christian Becksvoort

Anyone who has worked with wood knows that building a piece of furniture involves a series of decisions, from choice of wood, to design and construction details, to selecting the final finish. Even if you build identical pieces over a period of years, you'll probably find yourself making small changes each time—perfecting the proportions, or perhaps just exploring different joineries. In this article, I'll discuss the range of decisions and processes involved in designing and building a chest of drawers, as well as presenting some of the methods that I employ.

One of the first things to consider in designing a chest—and perhaps the most subjective part of design—is the chest's overall appearance. You should style the piece to suit your tastes or to fit into the decor of the room the chest will inhabit. Since I live near one of the last two Shaker communities and have restored several original Shaker pieces, my designs show the strong influence of their simple, unadorned style. I prefer my furniture to

By manipulating the design, construction, and materials, a chest of drawers can be built for any purpose or to fit into any decor. The trim lines of the author's cherrywood chest, left, display the usual austerity of the Shaker style. Inside the chest, below left, web frames support the drawers and add rigidity to the carcase. A dust panel fitted into the bottom frame keeps the chest clean inside. The finished back, below right, is built like a door and permanently fixed to the edges of the carcase, allowing the chest of drawers to be freestanding.

have clean, functional lines that are more at home in a wide spectrum of settings than avant-garde or strictly traditional forms. One nice thing about Shaker-based designs is that you can begin with a basic carcase, then manipulate details like tops, moldings and bases for different effects. Moreover, Shaker construction techniques are sound and durable, yet not so involved that a novice can't employ them.

I begin a chest design by considering what will be stored in it, since the number and size of drawers will determine the chest's overall size. Bulky items, like clothes, will require deep drawers, while smaller items will do well in a larger number of shallow drawers. Casepieces vary widely in their approach to drawer storage. Most chests, however, have drawers of graduated depth, with the deepest drawers at the bottom, the shallowest at the top. This serves to anchor the case visually and keeps the heaviest objects in the lower drawers. Instead of a single shallow drawer at the top of the case, Shaker cabinetmakers often used a pair of drawers, separated by a vertical divider.

Storage capacity and where the chest will be—freestanding, against a wall, at the foot of a bed—will dictate the overall size of the case and its dimensions. Proper proportions are important to the success of a chest design. If you aren't confident about what dimensions to use, measure a piece similar to the one you want to build or find a successful design in a book and go from there. One worthwhile option is to rely on the standard dimensions for furnishings in *Architectural Graphic Standards* by Ramsey and Sleeper (John Wiley & Sons, Inc., 605 Third Ave., New York, N.Y. 10158). The volume costs more than $100, but most larger libraries have a copy. If you need the size of an average dresser, school chair, or even a tuba, it's all there in 750 invaluable pages. Another useful source for design standards is *Human Factors Design Handbook* by Wesley E. Woodson (McGraw-Hill, Inc., 1221 Ave. of the Americas, New York, N.Y. 10020).

When design standards don't suggest useful solutions, you'll have to dimension the piece. Sketching on note pads is a good way to do this. If you are more comfortable with scale or even full-size drawings, by all means use them. They often help uncover tricky details you might otherwise overlook. As a general rule, square shapes don't work well visually for chests—they appear monolithic and squat. However, a chest with a relatively squarish front—that is as wide as it is tall—can still look fine, as long as its depth is less than about a third of its height. Rectangular shapes, for both the chest's front and side views, are far more pleasing than squares. And rectangles based on the golden mean are an excellent starting place. The golden mean is the oldest and most widely understood proportioning method and can be expressed as a simple ratio: 5 to 8. Thus, a golden rectangle is one whose short side measures 1.0 to the long side's 1.6.

In instances where a chest's frontal dimensions aren't fixed by spacial constraints, it makes sense to build proportions around drawer depth. Generally, a drawer for clothes should be 16 in. to 20 in. deep and about 10 in. to 12 in. high. A deeper drawer has two drawbacks: you have to take an awkward step back to open it fully; and the carcase will have to be unpleasingly deep to accommodate the drawers. Very shallow drawers, say less than 14 in., are also a problem. It's too easy to accidentally pull them entirely out of the case, dumping the contents on the floor. Unless there's a concrete reason to do so, such as having to store large sheets of paper flat, I don't alter basic drawer dimensions much.

A case can be as wide as it needs to be, but drawers themselves shouldn't be much wider than 40 in.; otherwise they tend to twist in the opening and bind. Wide cases can have two side-by-side drawers with a vertical divider between them.

In casework, as in any furniture, the basic construction of the carcase affects both the look and the function of the piece. As is the case in designing anything, there are many paths leading to the same point. Your choice of joinery for instance, will depend on your level of skill or the amount of time you want to spend. Material selection also plays a role in joinery methods. Although you may choose to use flat, dimensionally stable plywood, the following discussion of joinery will focus on solid-wood methods, which I prefer. Once its movement is understood and allowed for, the advantages of solid-wood joinery and grain selection far outweigh the drawbacks, in my opinion.

All of the Shaker casework, and virtually all of the 19th-century furniture I've worked with, is constructed in one of two ways, with solid-wood carcase sides or by solid-wood panels let into frames. I use both methods, but I'll focus here on what I call slab-sided construction. For more on frame and panel Shaker construction, see *FWW*#58. Figure 1 shows the basic anatomy of a solid-wood chest of drawers. The construction is really quite simple, and once you've decided on the design of your chest, you have only to select the joinery appropriate to the material and details you wish to employ.

Although the Post-Modern design movement has revived interest in the use of architectural details and moldings on furniture, I prefer relatively unadorned designs. Still, a simple carcase lends itself to a variety of subtle details. To a large extent, these details will determine the kind of joinery you use to assemble the carcase.

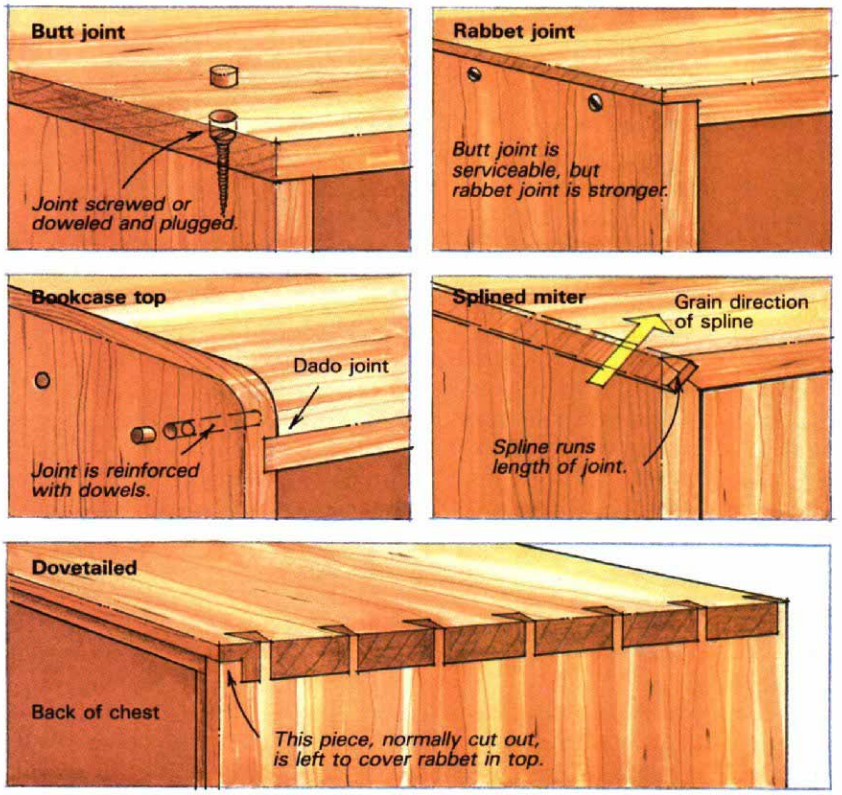
I prefer to join the top with dovetails, because they are strong and decorative. But they aren't absolutely necessary and there are several other options, as shown in figure 1A. The easiest, perhaps, is the butt joint. When it's screwed and plugged or doweled, it's more than strong enough to properly join the case together. The rabbet joint is slightly more work, and if planned correctly, it can be screwed from the side. A splined-miter joint, although strong, is tricky to cut if the panels are even slightly warped. Another more contemporary-looking top joint is what I call a bookcase top, where the carcase sides extend beyond the top, which is let into the sides with a dado, a rabbet and groove, or if you're ambitious, a sliding dovetail.

Moldings can define edges and corners, crown or "set off" tops, break up monotonous surfaces, or cover up dowel and screw holes (see figure 1B). Further, even a simple cove molding can define the top of the case, without giving it the look of a period piece. A molding carried around the top edge of the carcase is another design option. Obviously, this introduces cross-grain construction—the carcase side will shrink and swell, eventually loosening the molding. I've yet to see an old chest that hasn't succumbed to this problem. So if you choose to use a molding, you'll have to live with it. I glue the miter and about the first 1½ in. of the moldings, and nail the rest with brads or finish nails. The nails allow some wood movement. Another way of having a molded top without worrying about it falling off is to build an applied top. Attach the top anyway you choose, such as with blind dowels or tenons. In any case, there's no cross-grain problem since the top moves in the same direction as the carcase sides.

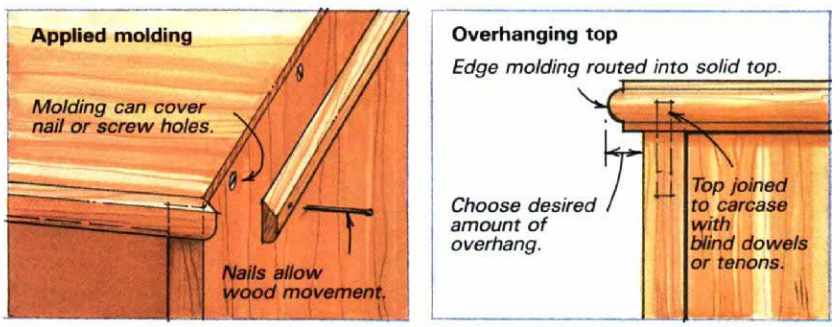
Deciding on the base presents another series of choices and figure 1C illustrates some options. A dovetailed case can sit directly on the floor, with or without a molding at the bottom edge. This is neat, since you don't have to dust under the case, but it can look heavy and the chest won't sit flat on an uneven

Fig. 1: Chest-of-drawers design options

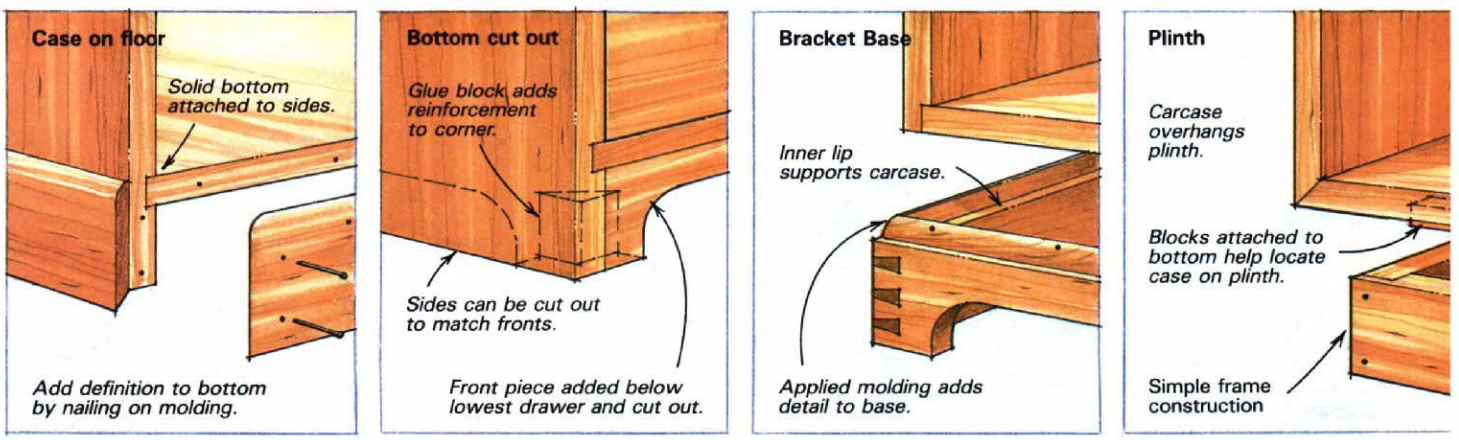
A. Joinery options



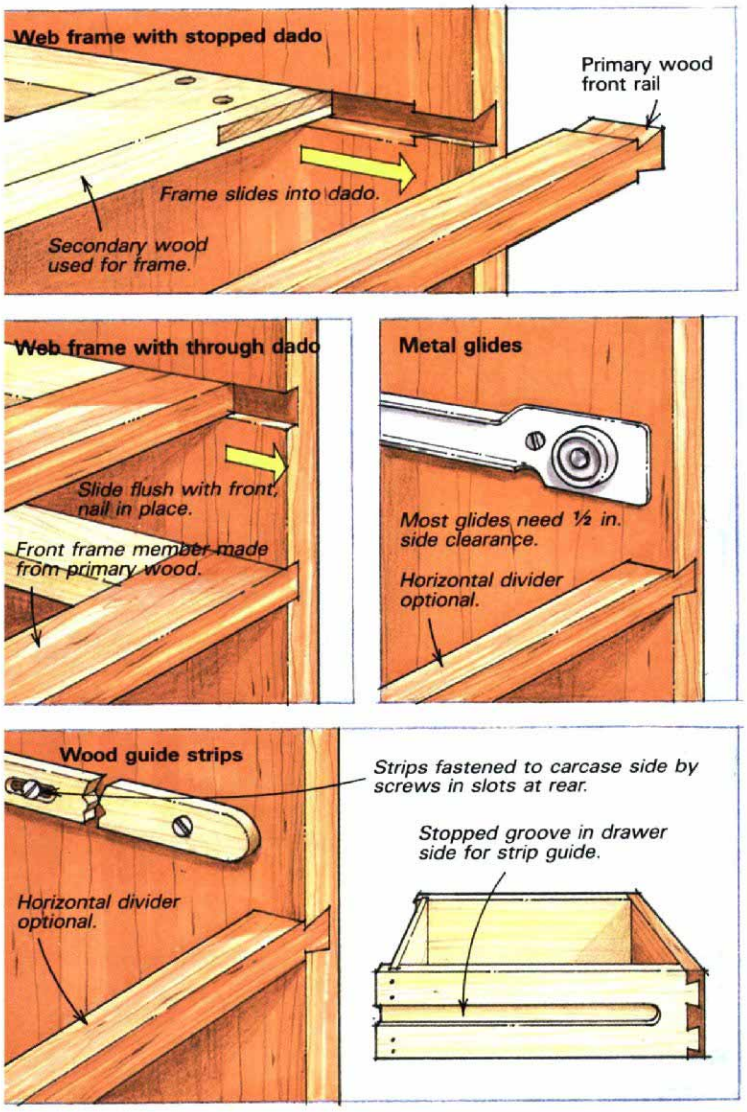
B. Molding edge treatments



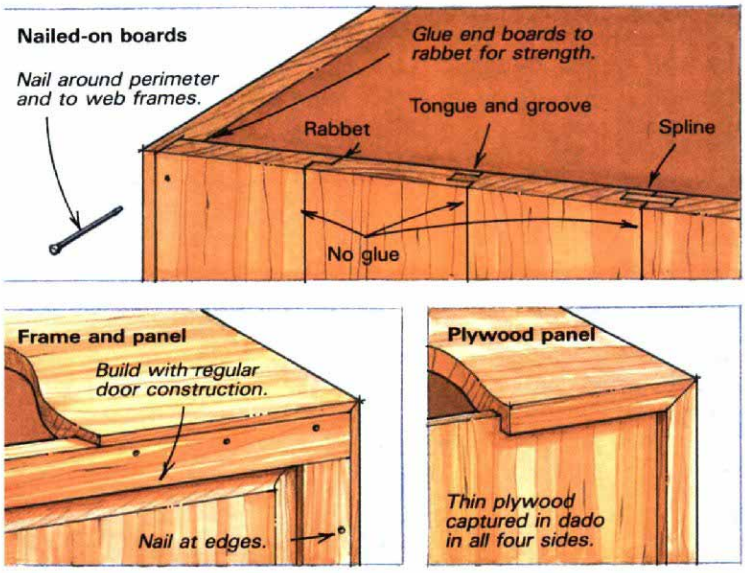
C. Base options



D. Drawer-mounting options



E. Backs



Drawings: Joel Katzowitz

floor. To add visual lightness, you can raise the case a few inches off the floor using any of several methods. One easy-to-make raised base is the plinth, which is simply a frame slightly smaller than the footprint of the case bottom and 3 in. to 5 in. high. The plinth is a good contemporary treatment that would probably go nicely with a bookcase top. Another way is to shape cutouts at the front and/or sides of the chest. In this case, a web frame or solid bottom of the carcase will have to be joined to the sides using one of the joints suitable for a bookcase top. Besides giving the chest some visual lightness, shaped feet also raise the bottom drawer so it won't drag on the floor upon opening. The most involved base treatment I use is the traditional bracket base. Bracket feet suffer from one major drawback—the back feet are bracketed only on one side, and pulling the chest across the floor can easily break them off.

I start building a chest by cutting and gluing up panels for the top and sides (and bottom, depending on the base). Once the glued-up sides and top panels are dry, I rip them to width. To cut the carcase sides to length, I usually clamp them together and cut both at once on the radial-arm saw. These cuts must be absolutely square. Checking for squareness along each step of the way is essential as minor errors early in the construction process tend to accumulate and cause real headaches later.

Lay out the interior of the carcase by clamping the two sides together so that all the edges are flush, and mark the positions of the drawers across the front edges. To figure vertical drawer spacing, first calculate the available drawer space—the total inside measurement of the carcase minus reveal at the top, width of the drawer rails and any applied moldings. Now divide this by the number of drawers to get an average drawer height. If you want the drawers to be evenly graduated from top to bottom, say in 1-in. increments, and you have an uneven number of drawers, figure the middle drawer will be the average height; each drawer above it will be 1 in. smaller than the one below it; and each drawer below it will be 1 in. larger than the one above it. If you have an even number of drawers, add ½ in. to the average drawer height for the drawer just below center and 1 in. to each drawer below it; subtract ½ in. from the average for the drawer just above center and 1 in. from every drawer above it.

Before assembling the basic carcase, you must decide how the drawers will be supported and what they will ride on (figure 1D). Then, prepare the inside of the case accordingly. Very early or primitive chests often had solid-board dividers or bottoms between drawers. Later, light wooden web frames let into the carcase were developed. These support each drawer and add stiffness to the carcase without excess weight. Another all-wood method involves mounting guide strips inside the case that ride in grooves cut into the drawer sides. This works well on banks of small drawers when you don't want to lose drawer height to all those web frames. But the drawer sides must be ⅜ in. or thicker to accept the groove.

For fully extending drawers, such as file cabinets, you'll probably want to use metal drawer glides. These come in many styles and sizes (available from Grant Hardware Co., High Street, West Nyack, N.Y. 10994-0600 or Accuride, 12311 S. Shoemaker Ave., Santa Fe Springs, Calif. 90670). They're strong and easy to mount, but most require ½-in. clearance between the carcase and drawer, so drawer fronts must be wider than the drawers to cover the gap.

If you choose to use web frames (the method I prefer), you'll need to cut the dadoes before assembly. You can use a dado blade on the table or radial-arm saw, but if the sides have a slight

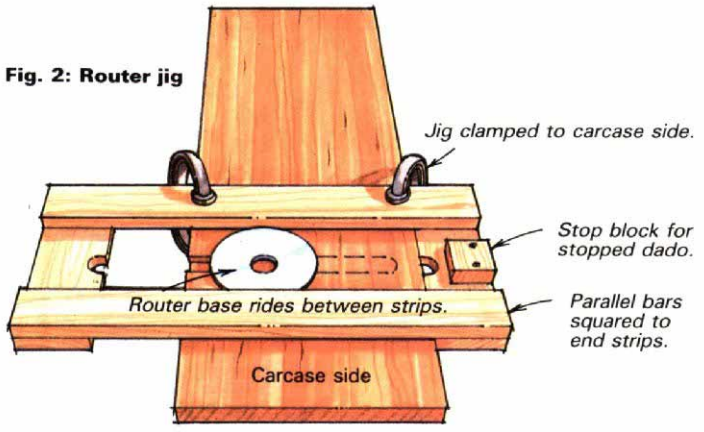


Fig. 2: Router jig

warp and won't lay flat, cut them by hand or with a router to ensure a consistent depth. For the router method, I made a jig with two parallel bars, spaced the width of the router base and about 30 in. long (see figure 2). The jig is clamped up square to the carcase side and a ¾-in. bit ploughs a groove for the web frame at each location. The dado cuts can either be all the way across or stopped ½ in. to ¾ in. shy of the front edge to allow the fitting of a drawer rail front strip, which I prefer.

Web frames can be four-piece assemblies, but on wider chests, a fifth center member adds stiffness to the carcase. Frames, as well as other interior parts, can be made of a secondary wood, such as poplar or pine. Measure the depth of the frame inside the carcase to the front edge, or to the stopped dado if you add the dovetailed primary-wood drawer rail across the front, as detailed in figure 1D. I mortise and tenon the joints, then glue and pin the frames for strength. Set the case on its back and cut, dovetail, and glue these into place. I prefer half-blind dovetails for a cleaner look on the side of the case, although through dovetails are acceptable and easier to cut. An easier option is to run through-dadoes across the sides and use primary wood for the front members of the frames.

High-style period pieces that have web frames are often fitted with dust panels, which are thin panels let into grooves in the web frames. The purpose of these dust panels is twofold: to keep clothing from getting tangled in adjacent drawers and to provide a barrier against dust. Some makers still use these dust panels, but I find them unnecessary. If I use a web frame, I do, however, install a dust panel for the carcase bottom.

Before the carcase is assembled, you need to decide on the kind of back it will have (figure IE). Traditional chest backs consist of individual boards (secondary wood is fine) joined together, let into a rabbet and nailed in place. A spline joint is perhaps the best way to join the individual boards since it's easy to make and locks the boards against misalignment in both planes. Under no circumstances should the back boards be glued to each other—the whole idea is to let the boards move. Each board is simply nailed to the top, all web frames and bottom, and the nails are set. Freestanding pieces can have a frame-and-panel back built like a cabinet door out of primary wood and fit into the back rabbet. Panels can be flush, recessed or raised. A frame-and-panel back not only looks much better, but gives the case tremendous strength against racking.

Some notes on assembly—After all the dadoes are in the right places and of equal depth and web frames are identical in length, and square, the case should be dry clamped and tested for square. This is vital. If it's out of square, the drawers will be a pain to fit. Now's the time to find out. Check for square by measuring diagonally from the top left to the bottom right corner and vice versa: The readings should be identical. If not, shift or clamp the "longer" dimension until they are. Sight across all the web frames to check for a warped case. This is seldom a problem, unless the top panel is severely warped.

To install the frames, turn the case back side up and slide each frame into its pair of dadoes. Drive and set a few finishing nails (6d if you're using ¾-in. stock) at a steep angle through the frame into the case. Check the angle carefully, lest the nails come out the other side of the frame or, worse yet, out the side of the case. Even though the frame grain runs perpendicular to the case side, wood movement is no problem, since the nails allow for adequate movement. Purists who disdain the use of nails might use a sliding-dovetail joint instead. I have no problem with nails since they're found in almost all the traditional furniture I've examined.

I won't go into detail about drawer construction here; for that, I suggest you refer to *FWW on Things to Make,* pp. 20-24. However, I'd like to add a few of my own thoughts. First, I fit my drawer sides directly to the opening, making them about ⅛ in. shorter than the case depth. I cut the two sides and front first, then run grooves ¼ in. to ½ in. above the bottom edge to allow room for half a dovetail below the groove. Then I plane 1/32 in. from the bottom edge of the drawer front to keep it from dragging on the drawer rail. I lay out the dovetails on the sides with half dovetails, top and bottom, and as many full dovetails as necessary in between. Avoid cutting one directly on the groove for the drawer bottom—that will leave a hole in the front. When the joints are cut, glued and assembled, measure the diagonals to check for square, After sanding, the bottom can be fitted. Make sure the grain runs side-to-side; if it runs front-to-back, any expansion of the bottom forces out the sides, weakens the joints and binds the drawer.

One trick sometimes found on old pieces is to let the bottom act as a drawer stop. The bottom extends ⅛ in. to ½ in. beyond the drawer, so it hits the case back. When the drawer is fitted, the bottom is trimmed until the front is flush. Seasonal moisture changes that cause the case sides to expand and contract will also make the drawer bottom expand and contract, and, in theory at least, the drawer fronts remain flush. Some makers install stops on the web frames that hit the inside top or bottom edges of each drawer, keeping it flush with the case front despite carcase expansion and contraction.

A final word on finishing: I like to belt sand with 120-grit and 150-grit, then vibrate to 220-grit and 320-grit, followed by hand-sanding with 320-grit and 600-grit. On some surfaces, I finish-scrape using my secret weapon: single-edge razor blades (available in boxes of 100 from most paint or hardware stores). Those who don't care for the ritual of sharpening scrapers will find these blades a real boon. They're tremendously sharp and stay that way long enough to do one or two sides. They can then be tossed out or saved as glue scrapers. Although I use an oil finish, the finish you use is not as important as *how* you finish. All exposed surfaces, top and bottom, inside and out, must be finished, because uneven moisture absorption causes uneven wood movement and warping. Many antiques were not finished inside, yet they were seldom built in the Northeast and shipped to the Southwest, nor were they exposed to the forced-air heating common in modern homes. □

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