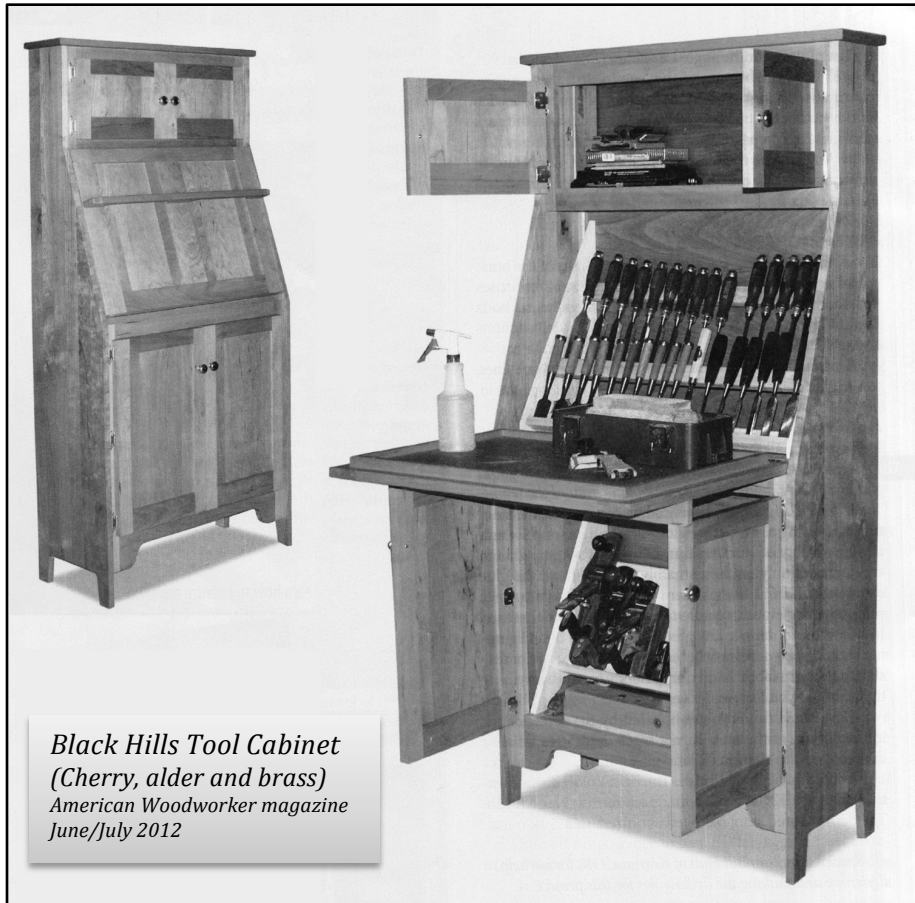


Wood Movement



*Black Hills Tool Cabinet
(Cherry, alder and brass)
American Woodworker magazine
June/July 2012*

You've heard the words 'joiner' and 'joinery' before. They're old-fashioned terms once commonly used to describe the people and the practices involved in joining pieces of wood together.

Before the advent of aliphatic resin (yellow woodworking) glue and its predecessor white glue, there was hide glue. This was made from various parts of animals and was water-reactive. That is, you could use it to glue a wood joint, and come back decades later and soak it in water to take the joint apart. (It's still used for some specialty applications, including veneering.)

Hide glue goes back a while. The Egyptians were using it in joinery two thousand years before Christianity.

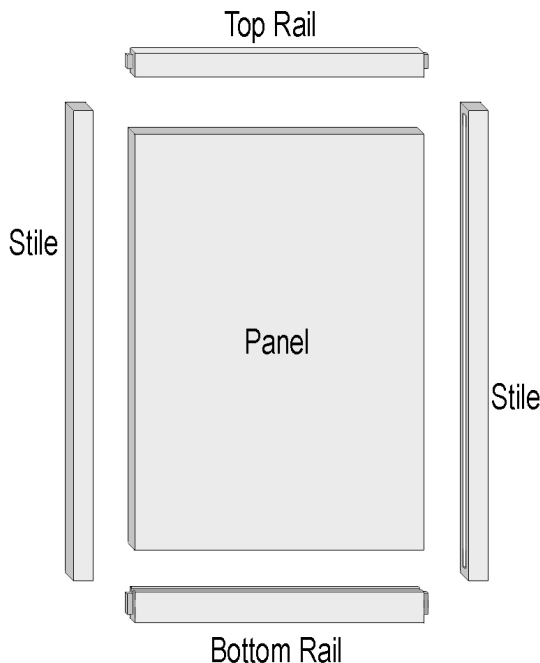
The Greeks and Romans both used hide glue in marquetry and veneering. (Parquetry is making geometric designs, and marquetry is creating figural pictures with veneer.) Hide glue was common in furniture and casework joinery until the middle of the last century, when resins became commercially viable.

What all of those ancient joiners understood was that dry wood joints don't work very well, even when they are pinned or pegged. Over time, the wood shrinks or expands as it reacts to changes in moisture levels in the air (ambient humidity levels), and the joints tend to loosen. Sometimes the pegs fall out. By adding a water-based glue, they could fill small voids in the joinery. The water would also swell the cells, and the hide would impregnate the fibers so that they stayed swollen after the water evaporated. Hide glue can give a little over time – one reason Grandma's chairs were always a bit rickety.

When we build with wood, we still face the same issues today. However, we do have two advantages over the ancients: advances in technology, and experience.

Frame & Panel Construction

The tool cabinet on page 34 was designed and built for an issue of *American Woodworker* a few years ago. Note how the middle door drops down and rests on top of the two bottom doors, creating a nice workspace for sharpening.



workspace for sharpening. All of the cabinet's doors are built with frame and panel construction, and each is made up of five parts. There is the panel, two sides called stiles, and the top and bottom components, which are called rails (top rail and bottom rail). In most doors, the panel is not glued to the frame: it is a 'floating' panel. That is done to avoid any problems being caused by wood movement. If the wood can't move, the panel will probably crack and split over time.

On cabinet doors, the panel is usually 1/8" to 1/4" smaller in height and width than the grooves in the frame would allow. If it's 1/8", then there is 1/16" all around for expansion. The grooves are generally 1/4" to 1/2" deep (most shops make them a little deeper on larger doors), to accommodate shrinkage. That is, if the panel gets a little smaller, it won't slip out of the grooves, or show an exposed edge. These depths are often determined for you by the router bit being used to make the grooves.

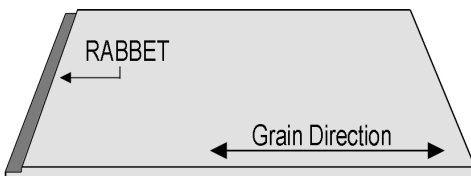
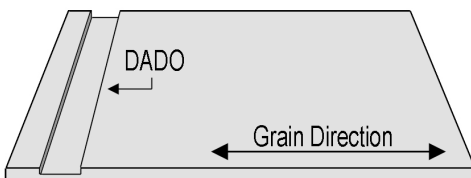
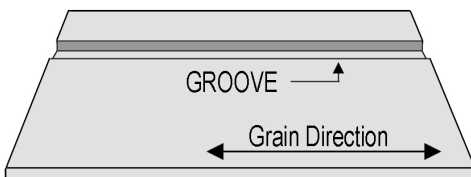
Solid wood panels expand and contract quite a bit across their width. There is very little movement lengthwise. The amount of travel depends somewhat on species, a lot on cut (plain sawn, quartersawn), and of course location plays a role. Wood moves a lot more in Seattle or Miami than it does in the Wyoming desert.

Plywood panels still move, but a lot less than solid wood.

The cabinet sides are solid boards, and not frame and panel construction. This is because they're not confined. They could have been built as frames, but there was no need. If the solid wooden sides expand or contract, the cabinet will just get a bit deeper or shallower. But if the doors were solid wood and expanded, they might bind because they are confined. Confinement simply means that a panel will butt up against something if it moves.

In the case of the doors, they would butt up against each other in the middle. That's because the hinges confine the outside edges. They won't let them move.

The fixed shelves in a cabinet can actually be free-floating, too. They can sit in grooves without being glued in. A groove is a channel that is plowed along the grain (at left). A dado is a channel that is plowed across the grain. And a rabbet is a channel that is plowed along the edge of a board or panel. Rabbets (called rebates by British woodworkers) run in both grain directions.



Grooves and dados are used in cabinetmaking to trap edges. They also help prevent the edges of panels and boards from warping. And they add a great deal of strength.

These channels can also be used to accommodate wood movement. After milling a dado or groove and then inserting the edge of another component in it, one can often use glue in a smart way. By gluing only the middle of the panel edge in the groove, and allowing most of it to move, you can secure the joint and still accommodate movement. It's a good compromise. Of course, if both parts are plywood, then you can go ahead and glue the whole joint. But if they are hardwood, this limited use of glue can help a piece of furniture survive climate variations over the years.

Other joinery practices that have evolved over the centuries also play a part in controlling or accommodating wood movement. For example, we have learned that joining several narrow plain sawn boards together makes a more stable panel than using one wide board. And alternating the grain on these narrow boards will distribute movement in a manner that counters distortion...



Notice in the drawing that, on every other board, the grain is crowning either up or down? Plain sawn boards like to cup away from the pith (the center of the tree), and if all of the boards have the same grain orientation, then the entire glued-up board will cup. But by spreading the tension evenly, the tendencies counter each other and the board stays relatively flat.

Usually...

Wood movement isn't always across the width of the board. Sometimes, boards change shape in other ways. They can bow, cup, crook and twist. A bow (below) means that the ends of the board 'lift' in the same direction, so looking down the narrow edge, with the board on its edge, you can see a gradual curve. A cup (top of page 38) means that the edges of the board have lifted, and it now has a U-shape. This is most common in plain sawn lumber.



A crook (below) describes a board that is relatively flat but the edges curve in one direction, so looking down the wide face with the board lying flat, you can see the curve.

And a twist means that the ends have decided to wander off in different directions: one tilts to the left, and the other to the right. These behaviors are generally caused by uneven drying, reaction growth, storage problems or some combination of these factors.

In drying, if a green (wet) board is, for example, exposed to direct sunlight or hot air in a kiln on one face only, then that face will dry more rapidly than the other and that can cause it to warp.

If the wood came from a limb rather than the trunk of a tree, and it grew horizontally, then it was fighting gravity all its life. The grain in the bottom of the limb will be a lot tighter than the grain in the top. This is called reaction wood. When that limb is sawn into boards, all that stress is released and the board reacts to the new tensions. It will often warp. (Sometimes, this kind of wood 'springs' when it is run through the table saw – the two halves take off in different directions.)

If boards have been stored vertically against a wall, rather than lying flat on a level surface, they can often develop a bow. Some lumberyards will store most of their stock on pallets in a warehouse where the pros shop, and they'll leave a few boards of each species and cut in vertical racks in the store for hobbyists who only purchase one or two at a time. If possible, buy the boards that were stored flat.

A few of the big box stores are finally understanding this, and they have begun to display hardwood in flat bins, rather than vertically.

