Stave Construction

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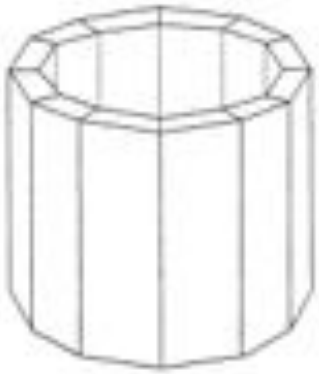
Overview:

I will give a basic discussion of the use and reason for staves. Construction of staves will include wood choices, sizes, thickness, gluing, and holding for turning. Examples showing how these staves can be incorporated will be discussed. I will use the examples of decorative indoor birdhouses and outdoor birdhouses.

What are staves:

Wooden staves have been around for thousands of years. First used in containers, buckets, and musical instruments, staves are simply enlongated segments of wood. Staves that are all parallel to each other are called simple staves. Buckets usually use a compound stave that flairs out and produces a larger diameter at one end than the other.



My turning philosophy:

Many woodturners including myself are impatient by nature and choose woodturning in part because of its speed. Using segments and staves slows the process but allows the use of color, grain, and patterns in interesting ways. This is at a much cheaper price in board form compared to turning blocks. I am not striving for museum quality pieces but for pieces that one must examine closely to tell the difference. So I choose methods that are quick, cheap, repeatable, and simple that produce excellent results.

Why use staves:

One can sum up the use of segments with design, color, and grain pattern. Woods of different color and grain can be mixed to produce interesting designs. Veneers separating staves can further enhance the design. Many grain patterns are available in lumber but rare to find in turning stock. These can be oriented in different ways to best emphasise the patterns.

But why use staves? Staves are simply long segments. There are pieces that have a design that calls for fairly straight vertical walls where you would like the grain pattern to remain unbroken for the length of the segments. Staves can save time. Cutting one set of staves can take the place of many segmented rings.

Wood choices and orientations:

One sometimes finds a board that has a beautiful pattern on the surface. One can cut staves lengthwise with the normal grain direction, which is called ripping or one can cut staves perpendicular to the normal grain direction, which is called cross cutting. Which method you use should depend on the pattern of the wood. With a little practice, you can imagine how the wood would look turned either way. The best use of the wood requires that you learn a method of cutting each.

Wood thickness:

The shape of the object depends on the thickness of the board often referred to as a number of quarters. So four quarter would be one inch. Six quarter would be one and a half inches. The thickness of the wood determines how much diameter variation you can have in the cylinder you are creating. The thicker the wood the greater variation in diameter. If you need the piece to say go from a small diameter at the bottom to a large diameter at the top, you will need thicker wood. For a piece where the sides will be straight up and down, the wood can be fairly thin.

Stave size:

The size of the stave refers to the width and height of the stave. The wider the stave, the larger the diameter of the finished stave cylinder. Rather than calculating the width of each stave, I use marked wedges to directly measure the width. I find this method to be accurate and much easier to use than tables.

The height of the stave determined the height of the cylinder.

Number of staves:

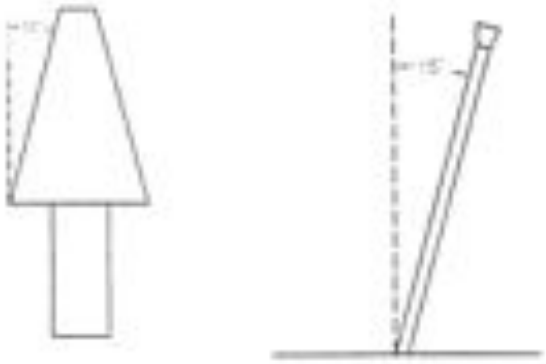
The number of staves you will use is somewhat of a person-

al choice as to what you believe looks best for your project. The angles you cut on your staves determine the number of staves in a ring. Common numbers of staves are 6,8,10,12, and 18 although you can use any number of staves you wish. The angles for the common number of staves are:

6 staves - 30^0
8 staves - 22.5^0
10 staves - 18^0
12 staves - 15^0
18 staves - 10^0

We determine the angle by takes 180 and dividing by the number of staves.

This angle will either be the angle on the router bit or the angle of tilt of the table saw blade from vertical.



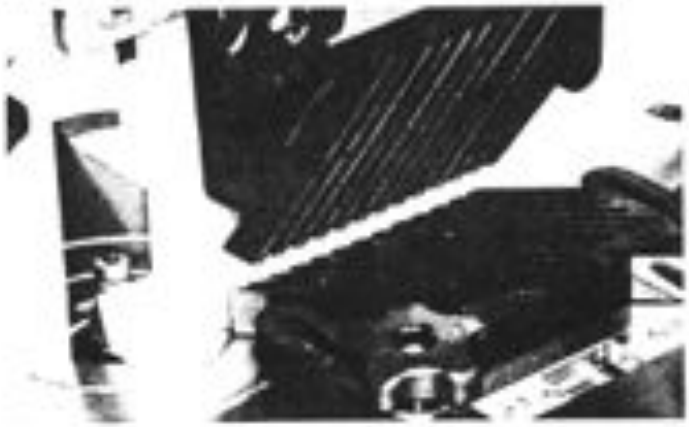
Cutting the staves:

Each of the methods used has some positives and negatives so what I would recommend would be what fits your equipment and methods best. Although one could rip or cross cut all your staves, having both methods available is best.

None of these methods will work properly if the wood is not properly dressed first so that the board is flat and has square sides. I use a jointer, planer and tablesaw. One can get acceptable results by using a tablesaw to true up the wood if you pick wood that is fairly flat and level to begin. Using a table saw requires that the blade angle be set properly to cut accurately fitting joints. You should use cheap wood such as pine to cut test strips. Until a full number of strips are cut to make a circle, you will not know the true accuracy of your blade. The blade needs to be sharp and clean (free of pitch). Set the table saw close to the angle either using angle measuring gauges you might have or using the table saw gauge. My table saw has the blade leaning toward the right to toward the fence on the right side. If the test shows gaps on the inside of the circle, raise the blade toward the vertical. Do the opposite for gaps on the outside. Softer thin woods will tend to compress in a clamp and may hide an inaccurate cut. Using a thick light colored hardwood such as hard maple will show the true angles best.

Router table (Ripping):

Cutting staves or segments with a router has become more popular in the last few years. I bought a set of 5 router bits with different angles in a box that shows the number of segments each bit makes. It can be difficult to cut the angle in one pass if you are removing a lot of wood. I have not had luck getting good angles on the wood when I took two for more passes to cut the angles on each side.



Positives: Most accurate method. Joints can almost disappear.

Negatives: Boards have to be less than one inch thick. Wood can move around and angles change if holddowns are not properly used. Best to cut angles in one pass on each side. Narrow wood hard to hold down properly.

Against table saw fence (Ripping):

This can be the most dangerous method because of kickback and closeness to the blade. You should always use a push stick of some kind. The fence must be set parallel to the blade or very close.

Positives: Allows the cut to be made in one pass on each side. Can use longer pieces of wood.

Negatives: This is the most dangerous method. Kickback is possible and you have to get close to the blade in some instances. Short pieces should not be cut this way.

Sliding jig along saw fence (Ripping):

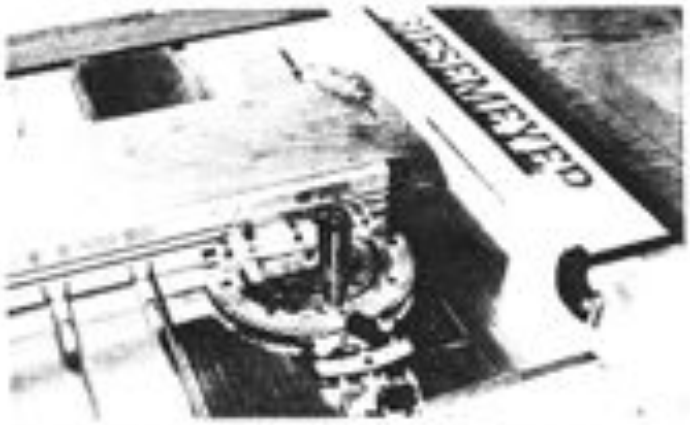
This is the method that I use for short pieces. This requires that your table saw fence is set parallel to your blade.

Positives: Quick and easy.

Negatives: Have to make a jig. Wood should not be longer than your jig. Jig must ride along the fence during entire cut.

Miter gauge (Cross Cut):

This is the simple way to do the cross cutting but requires an accurate miter gauge and some way to hold a long piece against the fence. The gauge must be set perpendicular to the blade.



Positives: Simple to use. Miter gauges are common

Negatives: Flex in miter gauges can cause error. Miter gauge must be set accurately. Blade needs to be parallel to miter slot. Need to have stop block to set width of staves.

Cross cut sled (Cross Cut):

This is the most complicated method because you have to make a sled.

Positives: May be safest method. Very easy to reproduce

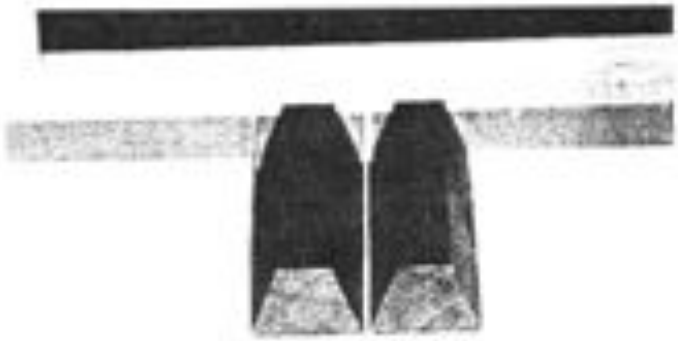
Negatives: Most complicated jig to make. Must buy some parts. Wood can get pinched between the blade and the stop block.

Gluing the staves:

If your staves are not cut properly, glue will not hide your mistakes. I will clamp the staves before gluing to check for fit. If they do not fit for some reason, it is not worth wasting the glue. I adjust the angle and cut staves that fit without gaps. Then you are ready for gluing.

Arranging Staves:

I have developed a method for arranging staves that saves me time and effort. Other segmented turners are the inspiration for this method. I use a piece of plywood with formica top. A long straight piece of wood is fixed to the edge of the board. Take a piece of masking tape and arrange it close to and parallel to the fence with the sticky side up. Place the first stave on the end of the tape with the wide part of the stave on the sticky side. The end of the stave butts against the fence. A second piece of tape is put under the stave toward the other end and parallel to the first piece of tape. The next stave butts against the fence with the edge of the staves meeting. I leave a little tape sticking out after the last stave is put down. Roll up the staves and use the tape at the end to secure the whole roll. Check for fit. If it is right, then proceed to apply the glue.



Type of Glues:

I like Titebond I glue because it is fast drying and has a shorter setup time. My method has everything ready to glue and clamp so I require less set up time. Titebond II and III are longer working and setting glues. I do use Titebond III when I need a water resistant glue for outside work. Polyurethane glue has it uses but has many negatives such as tendancy to set up in the bottle, toxic dangers, and price. I only use the glue when I need a water resistance glue or the object will be subject to heat.

Glue Bottles:

A good glue bottle is important to me so that I can apply glue evenly, quickly, and I can find a bottle top when finished. I have used all types of containers, every type of food squeeze bottle I can find, and the expensive bulb-shaped rubberized glue bottle. What works best is a cheap $1 clear plastic squeeze bottle with the long spout. I lose the tops but have spares that I keep when I have to throw other bottles away.

Spreading the glue:

Keep in mind that tests show that the best glue joint for strength is between .002 and .006 inches in thickness. Not putting enough glue or squeezing too much can produce a glue starved joint. Putting a lot of glue and squeezing it out is a waste, messy, and may produce a joint with too much glue. With practice you learn how much glue to apply. I align all the pieces on the tape, apply the glue to one side of each joint and spread the glue. I use an artists metal palette knife. The flexibility and small size makes it easy to get into the joints and spread the glue.

Clamps:

After rolling up the pieces and connecting the loose tape, I set the cylinder upright. I use a quick release hose clamp on each end and if the tube is longer than about 4 inches, I will use another one on the center. I have a nut driver that I use on the clamps. The quick release clamps are very fast and convenient but can not take tremendous tightening torque. I get them for less than $2 each at MSC. The nut driver gives me just enough pressure for a good fit without breaking many clamps. I have to use a fair amount of hand strength. For those with reduced hand strength you can use a rachet drive or a drill if it is set on a low torque setting.

Holding the staves for turning:

Chucks:

These are handy for holding the outside of one end of the glued cylinder if your chuck is equiped with large jaws. If the inside diameter is large enough you may be able to fit the jaws inside. Be very careful not to expand the jaws and break the staves apart. Using a chuck equipped with long parallel jaws is the best way to turn the inside of the cylinder after turning the outside. If you clamp on the outside, be sure to use many layers of thick tape to protect the turned wood from the jaws.

Faceplates:

This the easiest way to turn the outside of the cylinder if you do not have a chuck or jaws that fit the cylinder. Take a piece of 2x pine lumber wide enough to be larger than the inside diameter of the cylinder. Pine is cheaper, easier to get, and softer so it will conform better. Cut a circle of pine larger than the inside diamter and mount it on the faceplate. Turn an angle on the pine so it fits partially inside the cylinder. This will drive the cylinder.

Live Centers:

Place a live center in the tail stock. If your live center has cones that fit inside the cylinder, use those. Otherwise make a pine tapered plate to fit inside the cylinder and held in place by the live center. Bring the live center up to apply pressure on the pine plate you have inserted. Tap the pine with a hammer to make the plate run true without wobble and finish applying pressure. Do not overtighten or the tapered piece might push the staves apart.