Ship's Wheel Tutorial

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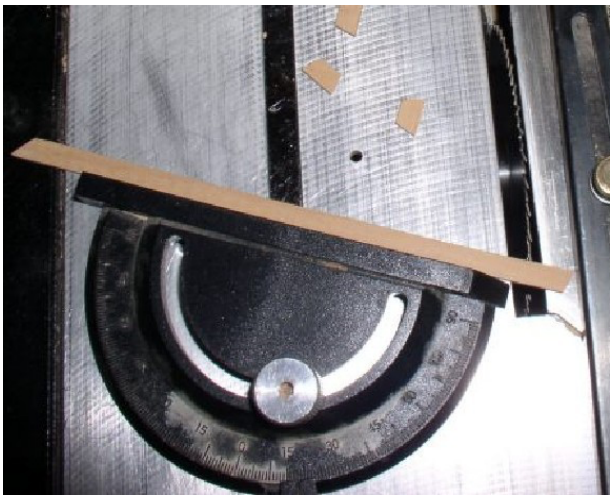
Building the ship's wheel can be done in several ways. A mill and drill press help but are absolutely not necessary. They save time but an equally good quality wheel can be made with hand tools. I have tried several other methods to make ships wheels over the years but find this to be the best for me so far. Basic how-to's are taken from Volume II of The Fully Framed Model by David Antscherl. The drawings in the background of several photos in this tutorial are also from The Fully Framed Model.

There are several parts to be made for the wheel, plus the drum and stanchions. The wheel rim should be made in 10 or 12 segments depending on the number of spokes. MOST real ships never had 8 spoked wheels, so if realism is important to you, figure 10 or 12 spokes. A notable exception is the USS Constitution's double wheel, which is in Wiley Hall on the grounds of the US Merchant Marine Academy in Kings Point, New York.

Another point to which attention should be paid is scale. Personally, I have never seen a store-bought wheel that is properly scaled. They may be out there, but I would imagine the price would be prohibitive. The spoke handles on these prefabricated units are often around 6" diameter, not the proper 2" or so dimension one needs to get his hand around it. The rim is only about 2-3" thick and about 3-4 inches wide in most cases. These make for delicate parts in ¼" scale, and darned fragile in smaller scales. PLEASE do not use any wood that is not hard and close-grained. It will not hold up to semi-rough handling and proper finishing.

The wheel diameter overall is about 5'2" including the spokes. Again, this varied a little so if yours turns out to be 5'1" or 5'4", no problem; just be sure to adjust the stanchion height accordingly so the spokes do not hit the deck. For a wheel with ten spokes, there will be 10 rim segments, 10 spokes, one hub and two rim rings unless one chooses to make these rim rings as part of the initial rim segments. The basic wheel designs were consistent for many years from ship to ship, but the actual construction varied from yard to yard.

To start construction, draw a circle of the appropriate diameter for the hub, rim inner diameter (ID) and outer diameter (OD), and outside of the spoke handles. Next, draw in 10 lines radiating from the center, 36 degrees apart. From this drawing you can measure the length of the short and long edges of any one of the rim segments. Cut a strip of wood that is 3 or 4 times the final width of the rim. Set up a cutting jig, or if using a small table saw, set it up to cut 10 pieces with 18 degree angles on each end of the segment making sure the length is the length of the long edge of each segment measured on the drawing. It is critical that all of the pieces are identical, or you will not get a tight fit all the way around.



Once the segments are made, epoxy them together. Carpenters glue is not too good for this application as you are gluing very small surface areas, and end grains at that. Using epoxy will give you a few minutes to move the segments a tiny bit to get a decagon for a ten spoke wheel or dodecagon if making a twelve spoked wheel. Let the epoxy cure completely. The picture shows the rim segments glued together with epoxy. Note the slight gap in the joint closest to the camera. This is not a problem because it is outside the finished outer diameter of the wheel.

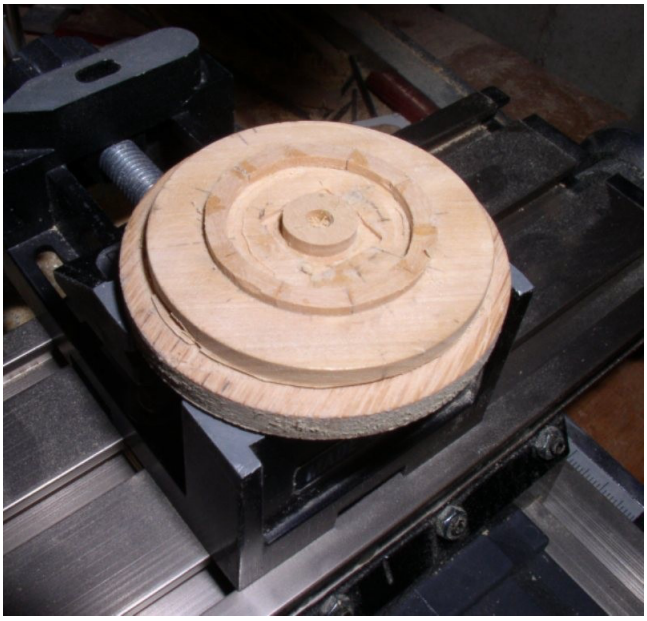
While the epoxy cures, you can work on other parts including the hub. If you are using hand tools, start by making a square strip into an octagon, then sand and file the piece it to a cylinder shape. Make it from a piece that is long enough to handle easily. If you have a lathe, you can turn a piece. If you have an X-Y table and drill press, you can use an end mill to round the hub and rim with a single set-up.

I have a simple jeweler's drill press and inexpensive X-Y table, so I will describe how these are used for the wheel that I made. Again, this can all be done with hand tools. I made a wooden Lazy Susan, the base of which is clamped in a vise on the X-Y table. There is more information and pictures on this in the Capstan Tutorial on the same resources page of the NRG website where you found this document, or on modelshipworld.com under resources/furniture.

Begin by drilling a hole in the exact center of the cylinder. In these photos, the hub and rim segments were rubber cemented to the Lazy Susan turntable seen in the photos. Unfortunately, the wheel was severely damaged in trying to separate it from the turntable. In my second attempt I glued a round piece of hot-pressed medium weight illustration board onto the turntable. Ten lines at 36º radiating from the center point were drawn onto it. The idea is that the paper coating of the board will easily tear off when removing the assembled wheel.

Mill the hub to the proper diameter by turning the Lazy Susan against the fixed cutter. Note that the 36º angle marks lie in between the rim segment joints. These mark where the slots for the spokes will go.

Note that a center square of the illustration board (or in the accompanying photos, the wood) is milled down about 1”, and a little larger than the diameter of the hub. This accounts for the 2” difference in thickness between the hub and the rim. Using this method of making the hub and rim at the same time assures that they are centered in relation to each other. Even if you are making this with only hand tools, I would recommend that you use a piece of illustration board glued to a slab of scrap wood to maintain correct centering.



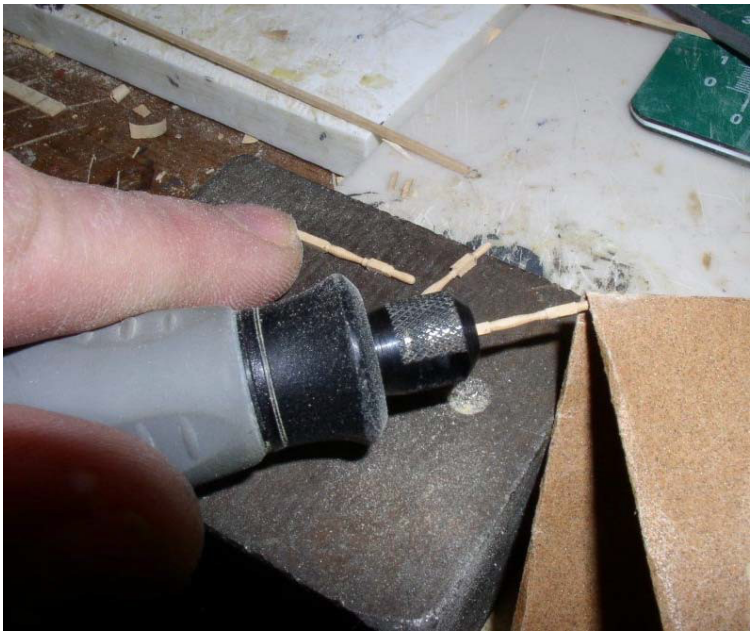
Once the rim and hub are shaped, the slots for the spokes are cut into the rim and hub. A mark anywhere on the non-turning part of the table is needed as a reference point. The 36º marks are then aligned one at a time. Theoretically you should be able to cut all the way across from one side of the rim, through the hub and into the opposite side of the rim. If the alignment is off even 1º, the spokes will look uneven. I cut from the rim to and through the hub to the center point, then move 36º and cut again moving from the center out, then move the table 36º and cut in, continuing this procedure until all ten sets of slots are done. That way if one is slightly off, it is not noticeable.

The slots are cut slightly under half way through the thickness of the rim. The rim thickness started out at 4” and the spoke about 3” so there is some room to finish sanding the rim without hitting the spokes. The photo shows four spokes temporarily in place.

The spokes are an interesting project in themselves. As the part that goes through the rim and the hub are square stock, the entire spoke is made from square stock, not miniature dowels. I have tried making them by hand and on a lathe and have not been satisfied with the results. I believe the material is too easily flexed to use a conventional lathe without some way of keeping the piece from flexing.

Make up some square stock to the proper dimensions and then mark one piece VERY carefully with a SHARP pencil point to know where the square stock starts and stops and the various high and low spots of the rounded sections. Cut the piece about ½" longer on the hub end than necessary. Chuck this hub end in your Dremel or equivalent. Jeweler's files are then used to shape the spoke. Once shaped, sand it VERY lightly. Next, the square sections are notched to match the notches in the rim and hub. I use a new #11 blade for the notching, then finish with a file.

Shaping the spoke



Sanding the spoke

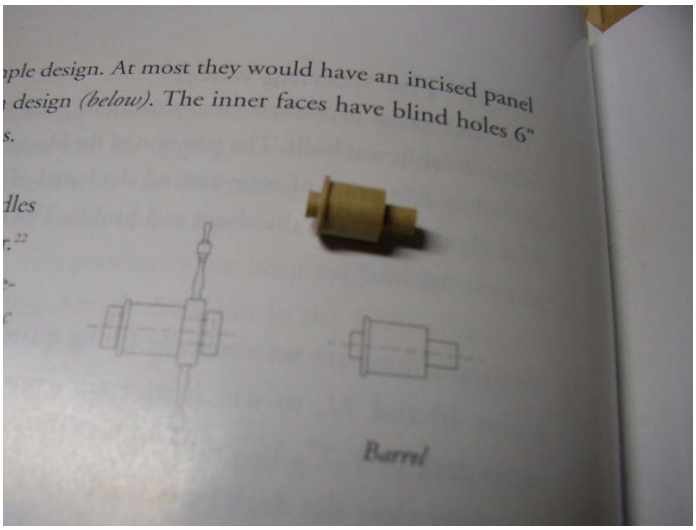
Notched spoke

I used the first spoke as a pattern to mark and shape the remaining 9 spokes. Taking your time, you will get 10 matched spokes. Next I temporarily assembled the spokes and touched them up where necessary with fine sandpaper. Once satisfied, the spokes are glued in with carpenter's glue. You can see in the photo that the notching of the spokes and rim allow the square sections of the spokes to sit flush with the rim.

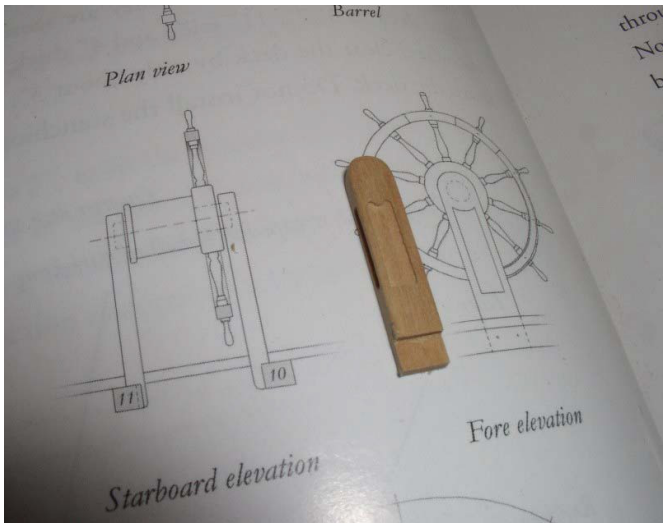
The last step is to make and glue on what I call rim covers. If they are to look like part of the original rim segments, they should be made of the same wood. I chose a contrasting look and used Swiss pear rings over the boxwood rim. The pear stock was thickness sanded to 1/64", then cut using circle templates and a new #11 X-acto blade.

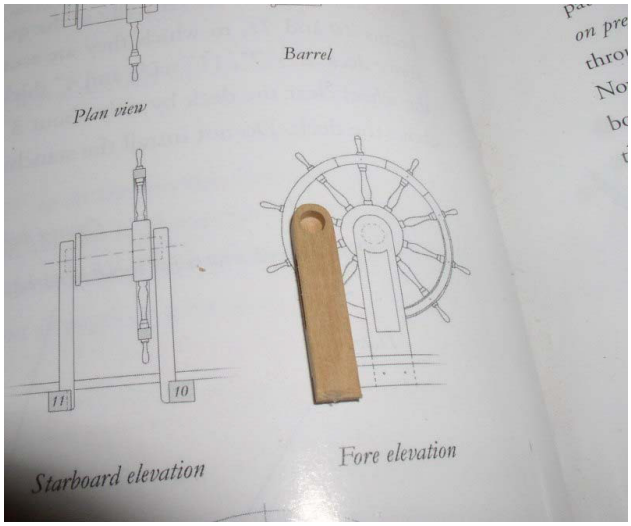
The next items to be made are the barrel and stanchions. Mine are made of boxwood.

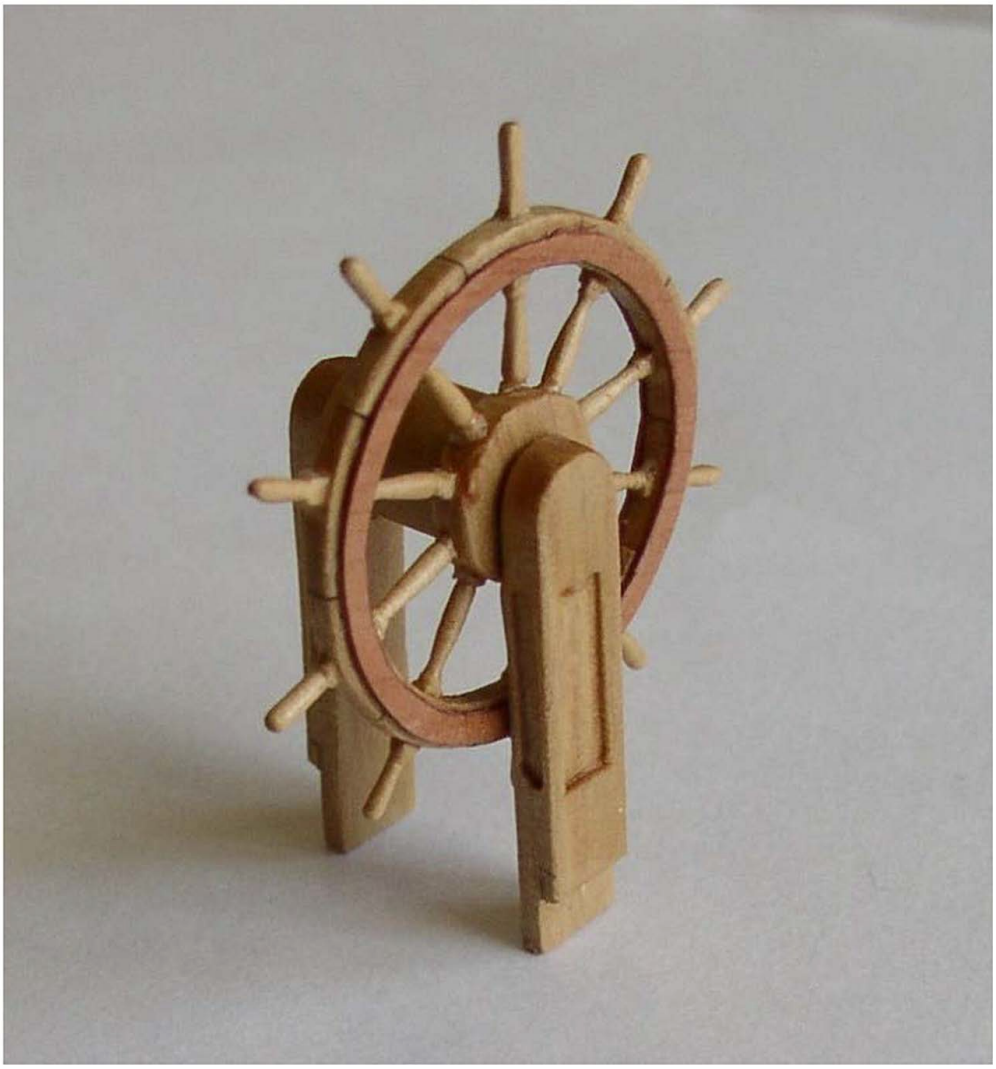
I turned the barrel on the lathe. I did not make the axle pieces as they would not be seen and I had no intention of making it a working wheel.



The stanchions on early 18th century and older vessels were somewhat ornate. In the interest of saving money, they became plainer as time went on. Still, some simple grooving and/or paneling would be appropriate even for later vessels. Note that the bottoms of the stanchions are notched so they can be secured to the deck beams. They do not sit on the deck planks. The inner side of the stanchion is mortised to accept the barrel.







The last step is to assemble the parts, install on board and rig.