

Spoked wheels tutorial for Hip Pocket Aeronautics George Kandylakis, 7-8-2018

Back in 2014 I posted a short tutorial thread in SFA about some methods on how to make spoked wheels. With SFA gone, a large volume of information like this has been lost, probably forever.

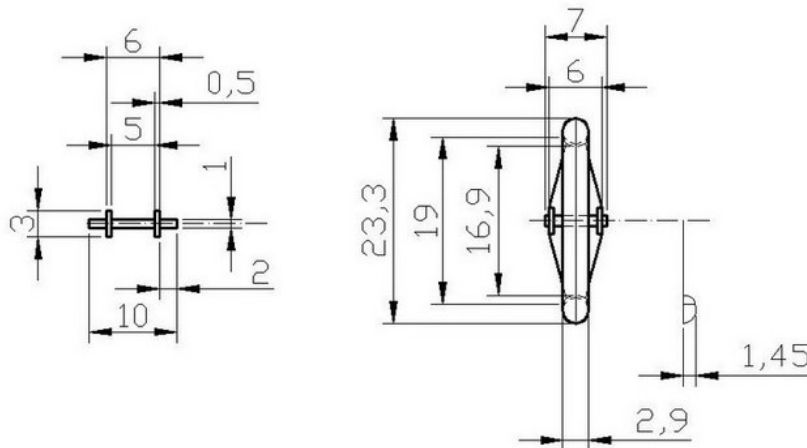
While recently writing in another forum about spoked wheels and trying to explain a possible way to make them, I thought about re-posting the tutorial in HPA, with the hope that it might be helpful for someone in the future...

I am not claiming originality or that it is the best/only way to make spoked wheels, but it sure is a successful way. I got the main technique from Beno Sabel of Germany many years ago. Many will remember his beautiful pioneer designs from the 70s and 80s...

The wheels described are best suited for indoor scale models, but they can also work outdoors, even if more sensitive.

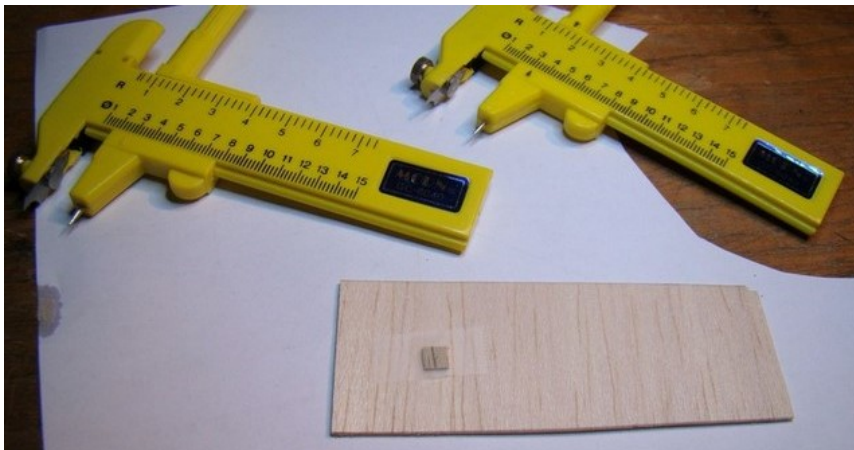
The basic concept involves making two wheel halves out of balsa, using a jig to position thread for spokes and gluing the halves together. There is also a wheel axle of course...

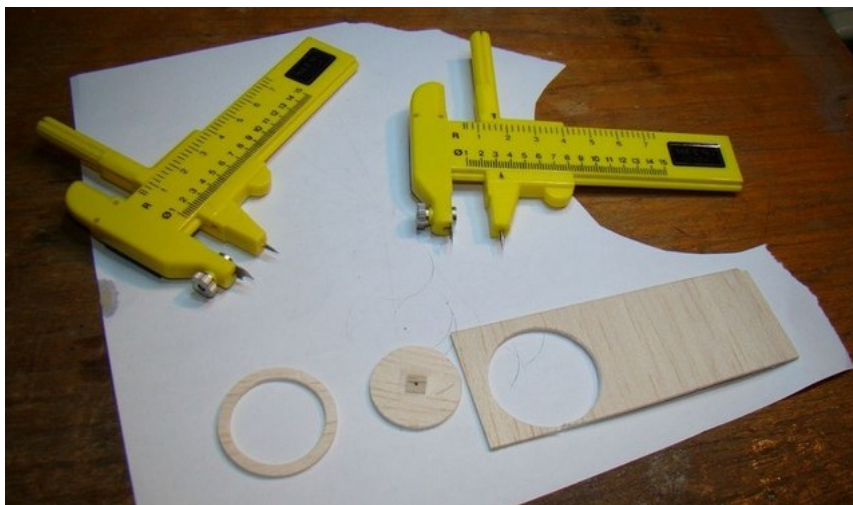
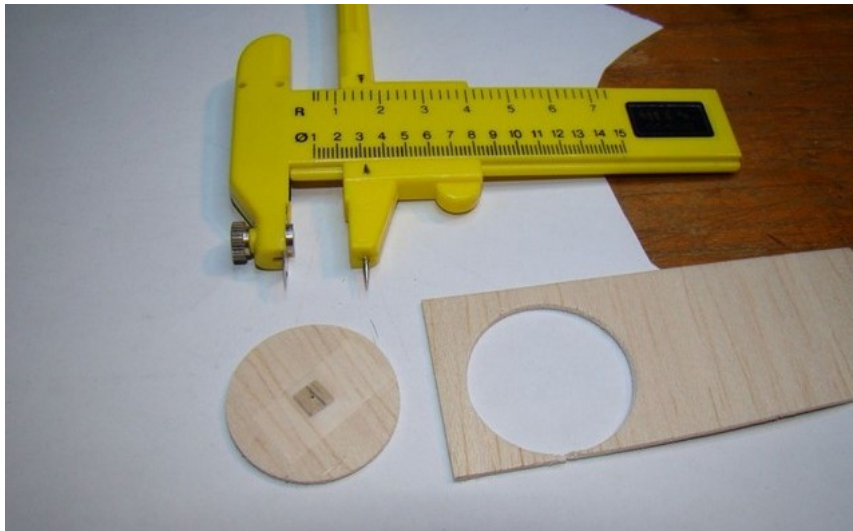
We start with a sketch or a drawing of the projected wheel, to define the basic dimensions.



In order to make the wheel halves, the simplest way is to use a rotary cutter, or better two, set at the inner and outer diameter of the wheel, so you do not have to readjust the one for every cut. (I have managed to own three of them in the end, but it is a very useful tool).

Notice the little ply piece glued in the middle, serves as a better center for having coaxial cuts.





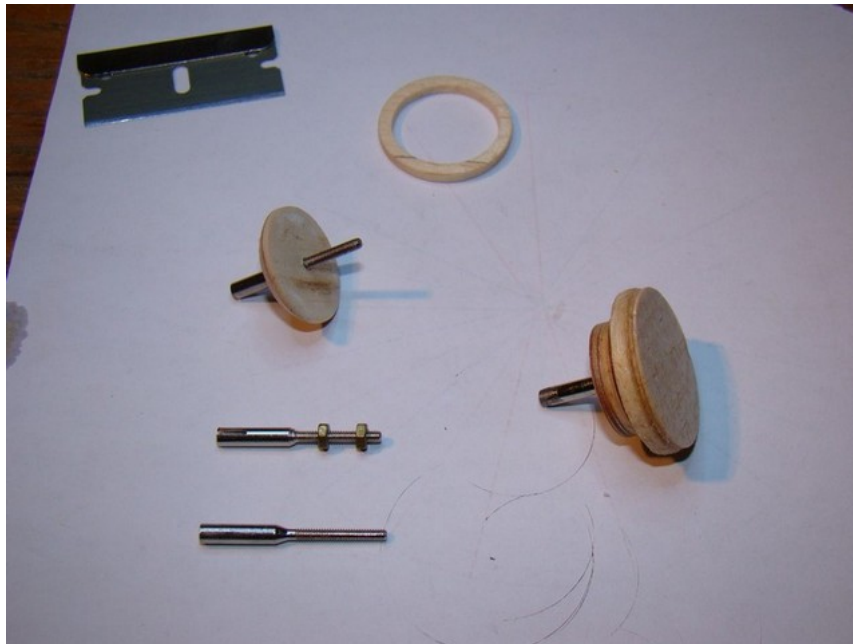
After cutting, one has to sand the section to a semi-circular one. It can be done by hand, but is tedious and not too accurate. But still, it is possible.

Last picture shows a result that can be achieved, even with simple hand shaping and sanding. They look battered enough, but this is because of the flying, or rather the long taxiing of a stubborn model...



Second possibility, one I used for many years, is to shape the halves on a rotary tool, such as a Dremel or a Proxxon, using a contour template.

My initial, very primitive setup was a simple battery operated can motor. On the motor a simple mandrel was glued and on it the balsa pieces to be turned.



The template was nothing more than a shaped ply piece glued to a brass tube.

The brass tube slides over the mandrel, so it is centered and with the motor running, pushed against the balsa disk, slowly forming a profile. Use of needle files or sanding tools can help rough form the outline. The template takes care of the fine forming. If you dope the finished part, while still on the mandrel, let dry and make another pass, you get a nice smooth surface.





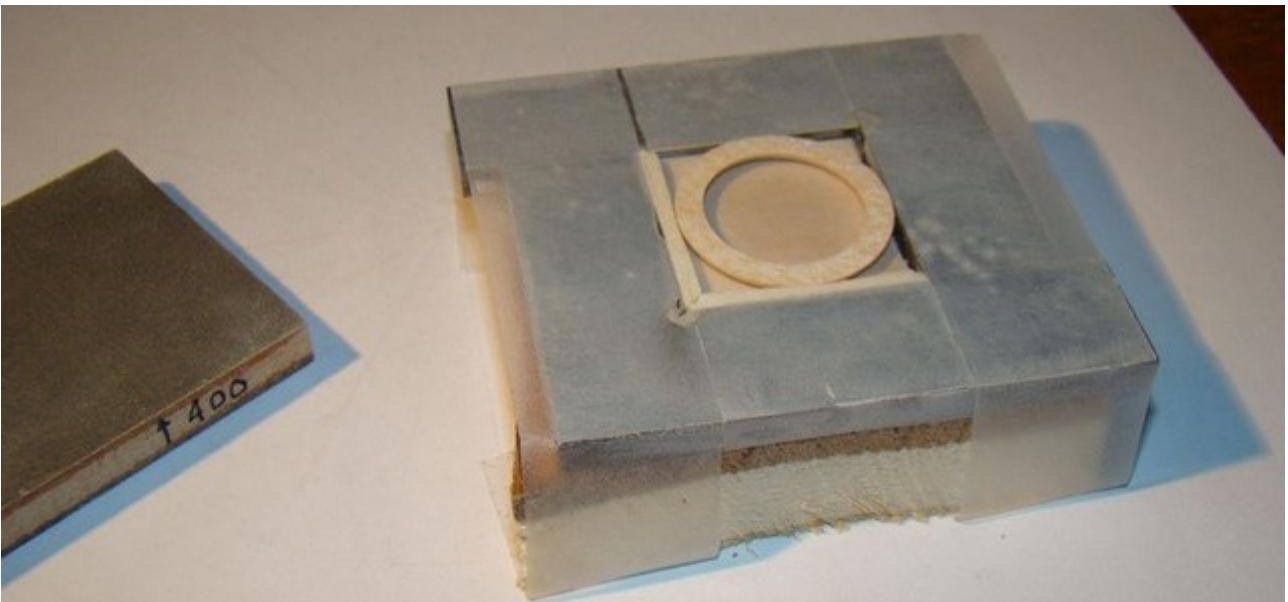
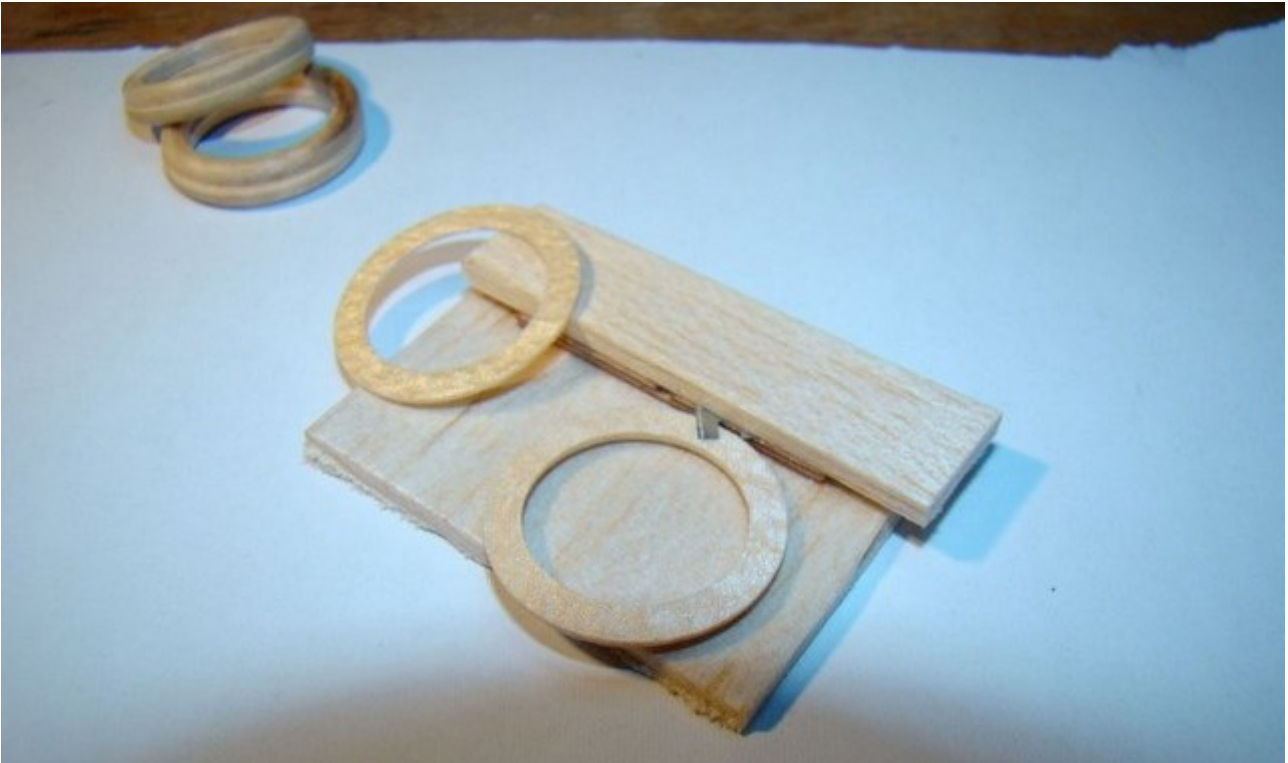
A more advanced setup involves the rotary tool held on a base. Years ago I bought a (rather expensive then and now) X-Y table, so I could make a temporary lathe. A proper lathe will work much better of course, if one has access to it.

Again a template, in this case a carbon blade, has been shaped with a grinding disk to the desired outline and using the X-Y table, was used to make 8 nearly identical disks.



My experience has been that it is best not to mess too much with the disk thickness while shaping, just go oversize.

When finished with the contour, it is very easy, using simple jigs, to cut and sand everything to the desired thickness = tyre thickness/2



With the wheel halves done, the other missing component is the wheel axle.

Metal tubing of suitable diameter is an obvious choice. For small peanuts I have also used tissue rolled tubes, for lightness.

I have recently become a great fan of Albion Alloys LTD tubing, available in a variety of diameters,

down to 0,5x0,3 mm !!! Of course, anything will do, if you can get the inner and outer diameter you need.

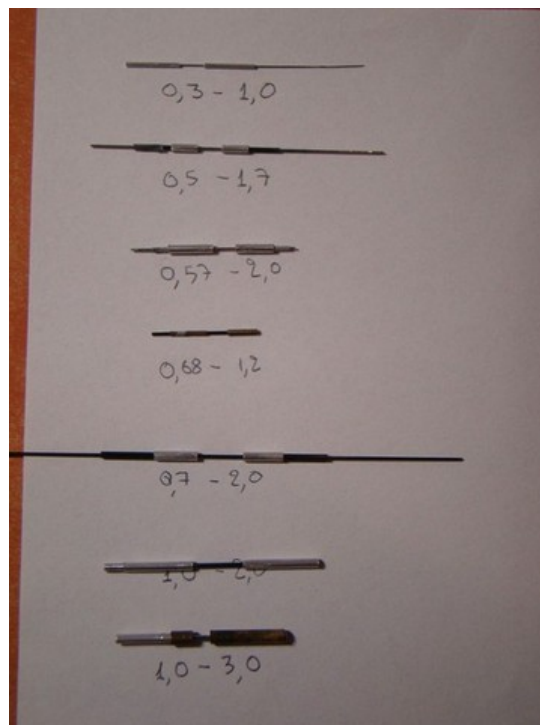
Small ply (or plastic, or whatever) disks are glued to each end of the tubing, as flanges. Note here, and in the initial drawing, that the axle length is made oversize, the extra will be sanded after final assembly. Prior to that, I have often had difficulty with spoke thread simply jumping over the tubing, before glue was applied. This will become clearer later...

Again nothing special is needed for the disks, just a center axle and bigger tubes that serve as guides for cutting and sanding to a round shape. Any other method will do, if you can think of it, in order to get the end part, this is just a suggestion, which works well, however (for me, that is...).

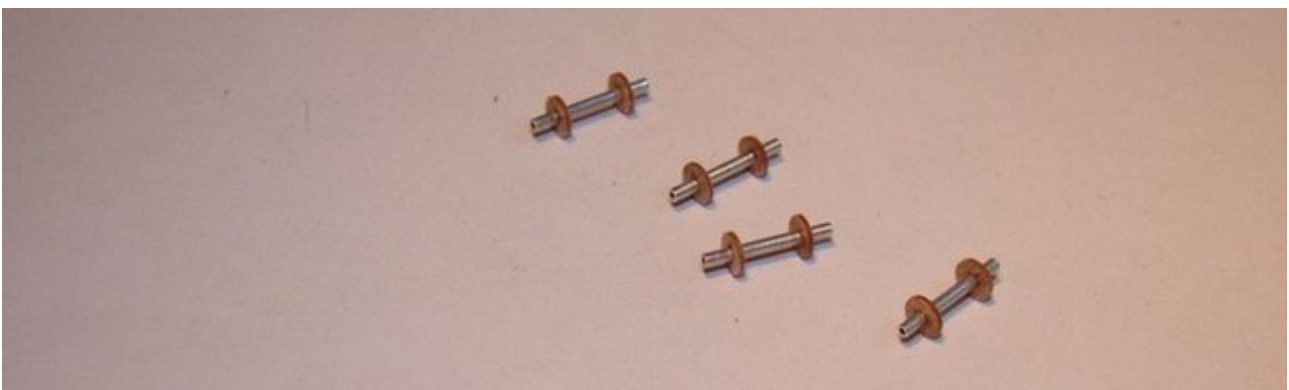




It is very easy to create a large assortment of diameter combinations that will fill every need in small disk making.

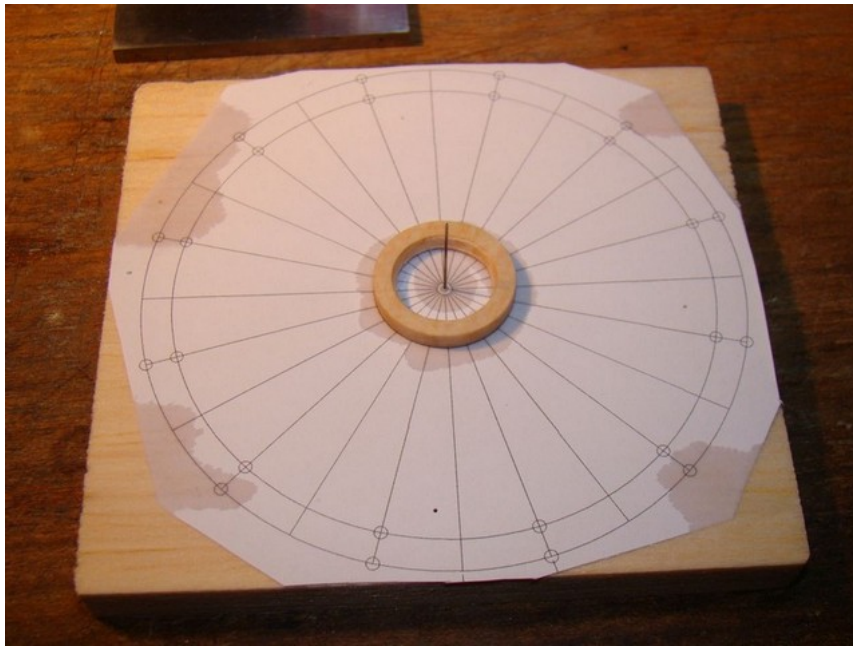


The ply disks are glued to the aluminium axles. It is a good idea to sand rough the aluminium for better grip. Also, to use a simple spacer as a jig, in order to achieve equal distances.

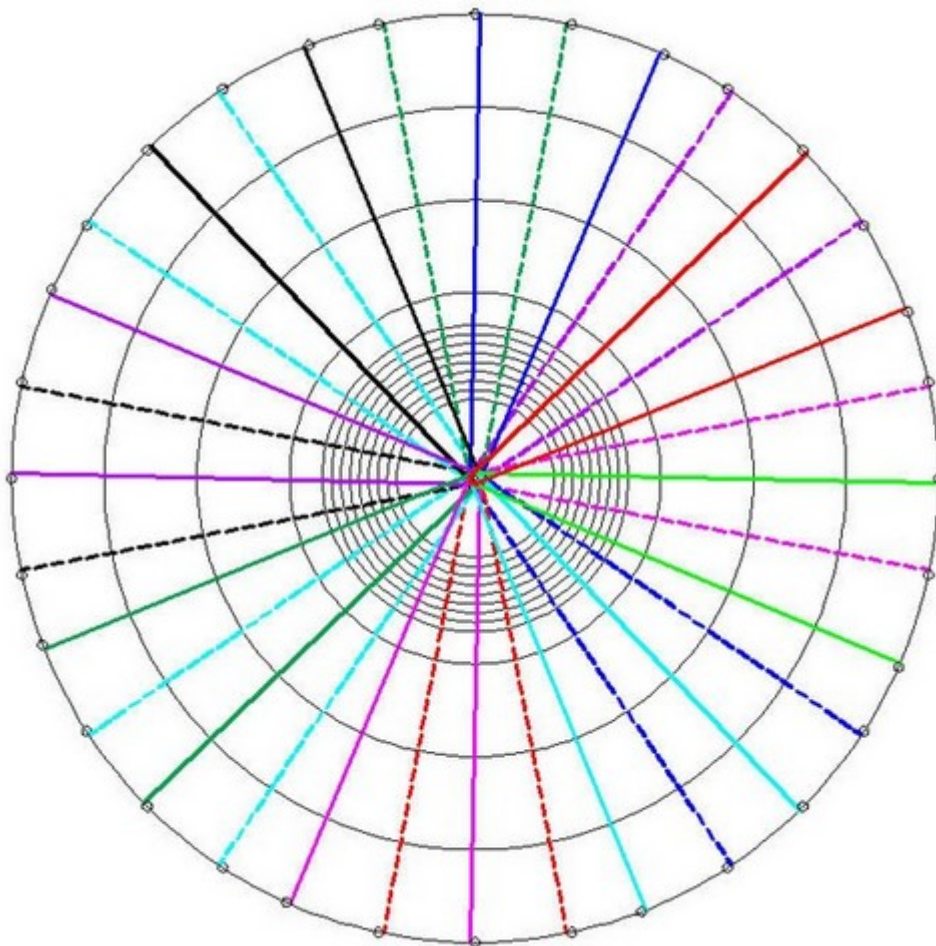


And now we come to the assembly jig.

This is simply a flat piece of any material than can accept pins, with a jig layout drawing glued on it (CA stains are proof of a really quick and dirty job...).



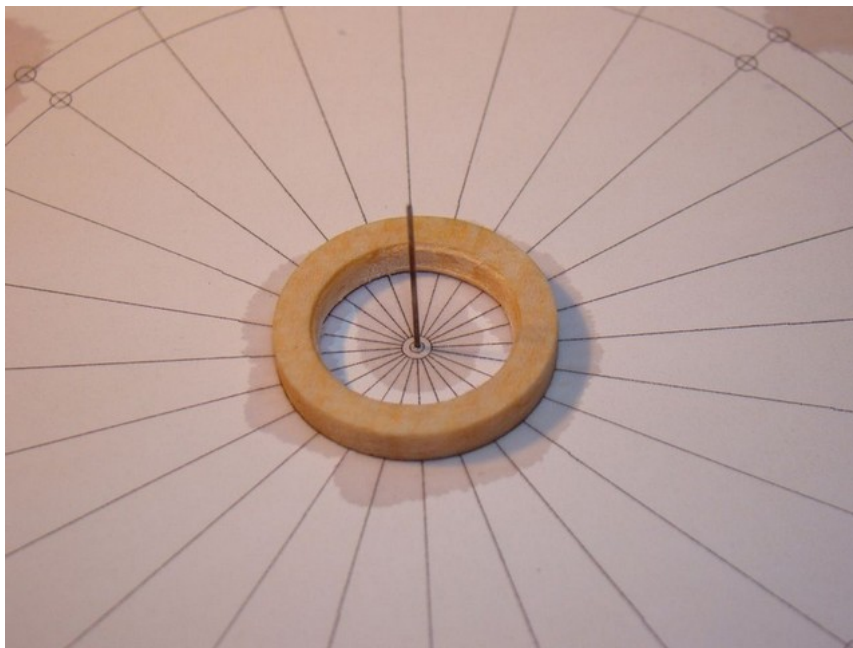
A sample drawing for a jig is shown; of course you can draw your own with desired diameters and number of spokes.



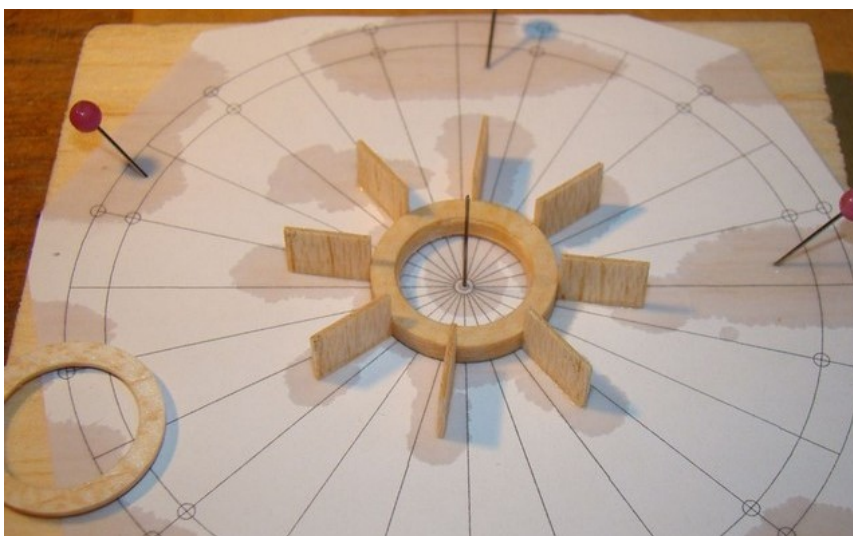
A couple of balsa disks are glued in the middle, in order to lift the plane of the wheel and allow the axle, which anyway extends downwards, to sit on the jig. Some calculations are needed here, to arrive at the proper heights, as well as some trial and error, to make sure everything is ok.

Purpose here is to have everything symmetrical, unless of course you are making something like a Sopwith Camel wheel with no covers, which was not symmetric.

Also necessary is a center pin, a steel wire of the same diameter as the inside of the wheel axle tube and small balsa pieces to make sure the wheel disks sit centered on the base disks. No need to stress out that the pin must be completely perpendicular to the base plane, or you get a wobbly rotating wheel as a result.

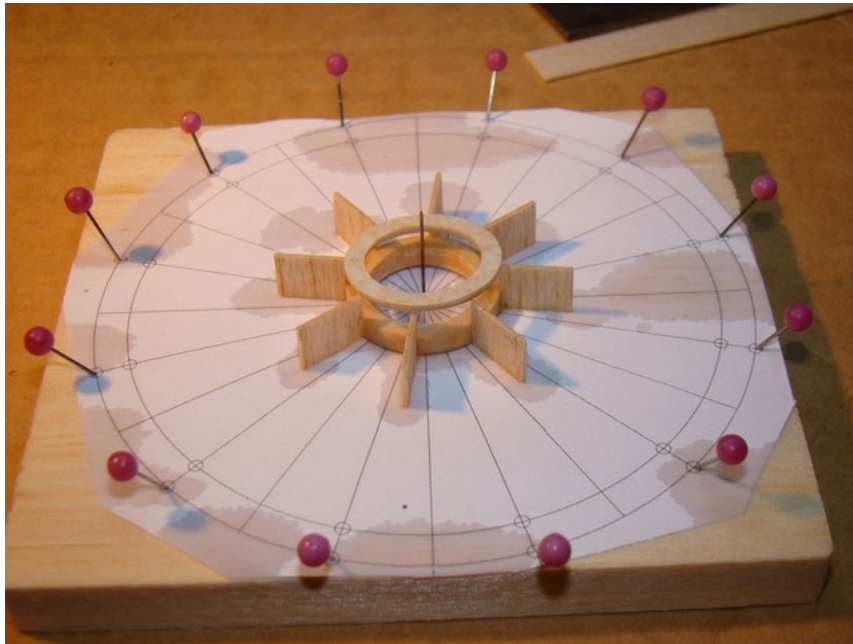


They need to be placed between spoke lines, so as not to interfere with them. A slight sanding - trimming may be required, until a wheel disk can properly fit, not too loose and not too tight...

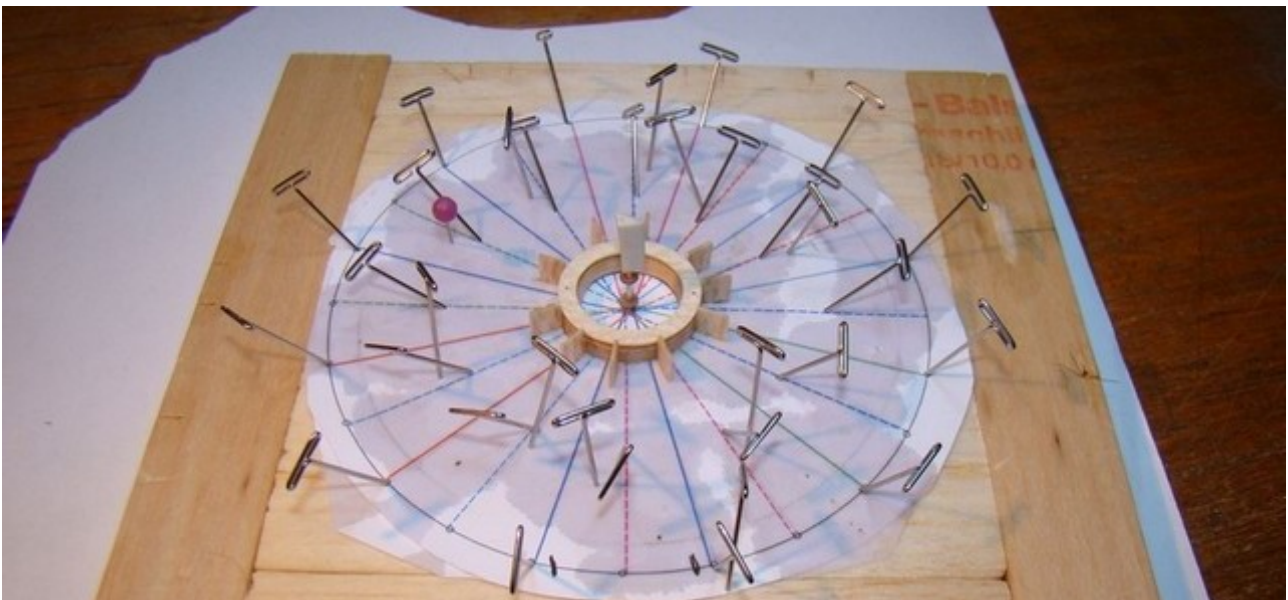


A wheel half is placed in the jig, an axle too, held in position with a piece of rubber eraser.

Pins are added for the routing of the bottom spokes, and you start routing thread for the one side. These are the purple pins.



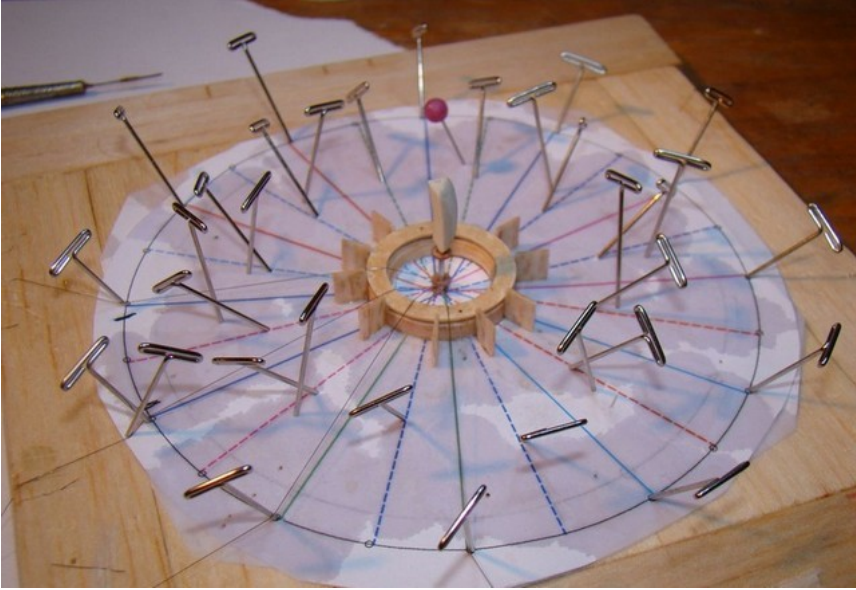
Next photos show T-pins, too many of them, left over from the previous wheel created. They do not have to be removed, as long as you do not get confused by the extra ones. Thread is routed and aligned with the line below. You have to look completely perpendicular to the plane, to have the proper position.



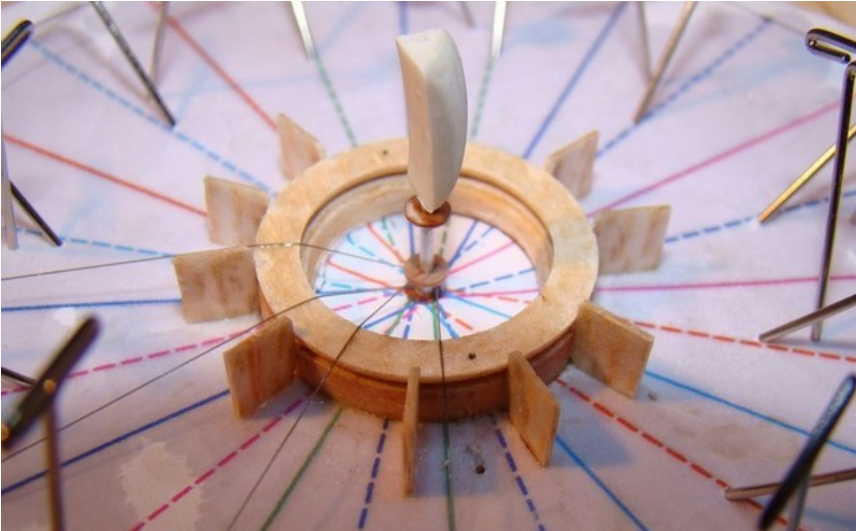
Regarding spoke material, it is a matter of choice... I use fine polyamide thread, extremely smooth and strong. Silk thread is also possible, or whatever else you can find, depending on the wheel size and loads expected. Remember, they have to be well glueable too (word is correct or too Greek?).

It is very crucial to have the thread under proper and equal tension, a matter of getting the feel of it... Also, you can glue or tack-glue it to the wheel disk, in order to get some stability.

First four spokes for the underside in place



Close up



All bottom spokes done

