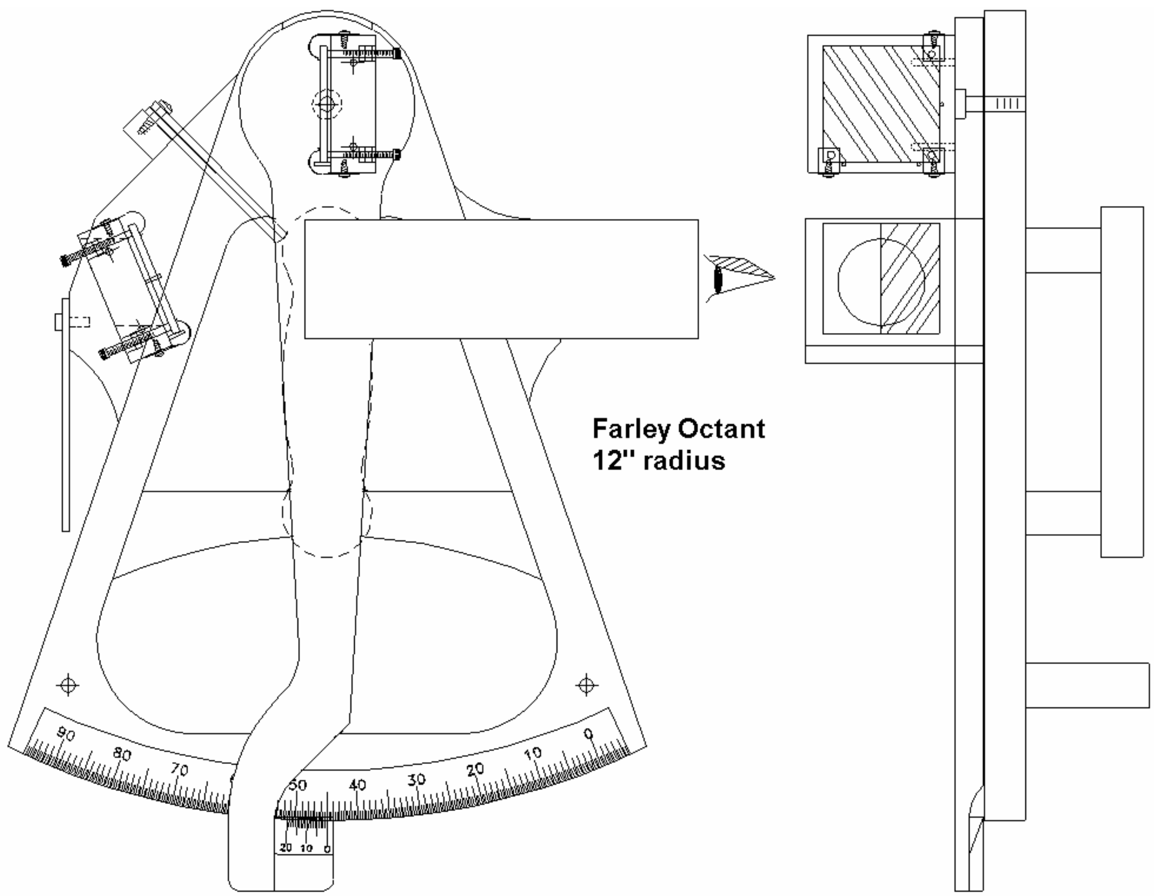
# *Making the Farley Octant*

Frames for octants can be made from just about any clear wood.  In the case of the author's octant, it was made from ¾ inch thick clear maple, and epoxied to form the fine-boned frame shown here.  The mirrors are indexed to their position using 3 brads, 2 along the bottom forming a horizontal line, and the third brad along the side to index side-to-side motion.  Brass shim stock cut into rectangles and formed over a round pencil produced the U-shaped mirror retaining springs.  One-inch long #4-40 screws and nuts are used to make a 3-point adjustable platform for mirror alignment




The arc degree scale and Vernier scale were drawn in a 2-D computer aided design program and printed out at 1:1 scale.  The laser and bubble jet printers of today are amazingly accurately.  The Vernier scale should not go edge to edge with the degree scale, but rather overlap it on a tapered ramp.  This means that you do not need to sand the wood edge perfectly arc-shaped, so only the degree scale needs to be placed with accuracy.  The Vernier scale is moved radially in and out until it lines up perfectly with the degree scale, only then is it glued to the index arm.

***Mirrors***

Surprisingly good mirrors can be found in craft stores, 2"x2" for about 25¢ each. Terrible mirrors can be had at the dollar store out of compacts. The quality can be surmised by tilting the mirror until you are seeing a small glancing reflection of something. Ripples (slope errors) will be quite evident at these high reflection angles. The ripples may be just in one direction, and so the mirror can be oriented on the sextant to minimize altitude distortions. The next best is to order a second surface mirror (50mm square) from an optics house such as Edmunds Scientifics for about $4. In their specialty house, you can order first surface mirrors for maybe $20. The second surface mirrors are good enough for a homemade (and professional) sextant. Removing the aluminized surface for the horizon mirror requires patience, and is best accomplished with a fixture to hold the mirror and a guide for the tool. The back has a protective coating that must be removed to get to the reflective material. For a tool, I use a very well sharpened/honed 1" wide wood chisel. The edges should be slightly rounded so as not to dig in. Under no circumstances should you use a scotch-brite pad to remove the silvering, as it will scratch glass. The silvering can best be removed with a metal polisher such as Brasso, using a moist soft cloth.

***Shades***

Shades for the sky and horizon filters can be made from welder's mask replacement filter plates, available at welding supply houses for about $1.65. They cut out 99.9% of harmful UV and infrared heat as well as act as neutral density filters to reduce the over-all amount of visible light. The welding shades are numbered 1 thru 16, 1 being the lightest and 16 the darkest. Shades can be additive, that is a #5 shade plus a #6 shade is equivalent to a #11 shade. A #4 shade allows about 13% visible transmission, while a #5 allows around 5%. Shades equivalent to a commercial sextant (by unscientific methods) is approximately 14, 10, 4 for the sky filters and 8, 4 for the horizon filters. Most of these welder's shades will turn the Sun green. Replacement shade filter plates typically can be found for 4 thru 14. Use a 5, a 10, and a 14, which would seem to cover all viewing situations without having to double-up on filters (the glass is not perfect, and more than one filter will distort the Sun's image slightly). A 4 and 6 for the horizon will give 4, 6, and 10. The problem of contrast arises, a green sun disk on a green horizon. But safety of your eyes is paramount, no sense of increasing chances of cataracts due to ultraviolet overexposure. Buy the plates in a 2 by 4.25 inch size, and cut them in half to make 2 squares. Now glass cutting these thick plates is no laughing matter. I have found that if you score lines with a handheld glass cutter on the front and back (and edges too) so that the lines are right over each other, you stand a much better chance of a successful cut. This will require practice…the high impact glass being much more difficult to cut straight without crazing.

***Springs***

Torsion springs to hold the mirrors in place can be easily made by wrapping thin (0.015”) music wire around larger diameter music wire or brad nails. Leaf type springs can be cut out from 0.010” brass sheet stock or tin can lids, and wrapped around a pencil to get a ‘U’ shape.

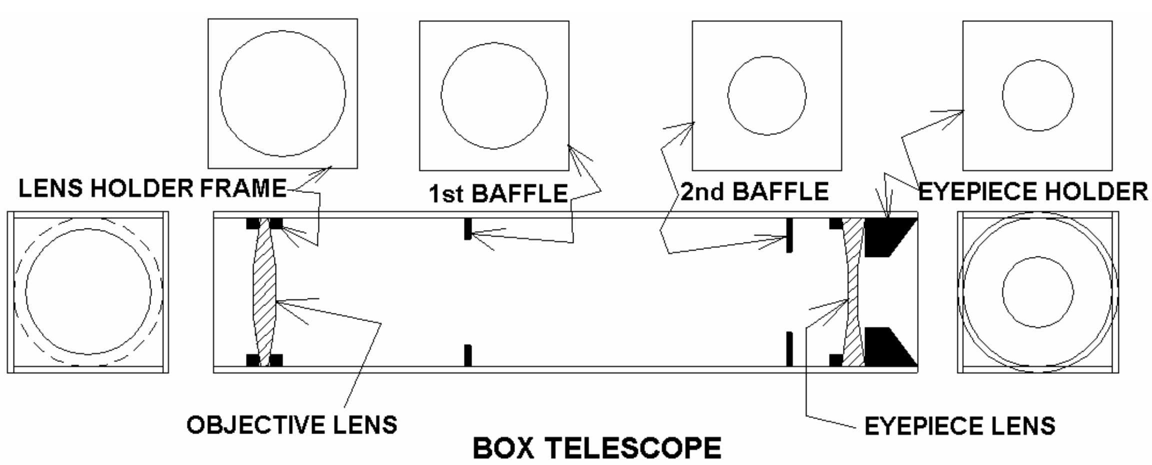
***Sighting telescope***

A simple Galilean telescope can be made with a convex lens for the objective lens, and a concave lens for the eyepiece. The image will be upright, and the magnification need not be greater than 3. The convex lens has a positive focal length (FL1), while the concave lens has a negative focal length (FL2). The spacing ‘S’ between the lenses should be FL1+FL2, and the magnification ‘M’ is -FL1/FL2. For example, if the objective lens has a focal length of 300mm and the eyepiece lens has a focal length of -150mm, then:

Spacing S = FL1 + FL2 = 300 + (-150) = 150mm

Magnification M = - (FL1/FL2) = -(300 / (-150)) = 2

Edmunds Scientifics sells 38mm diameter lenses for about \$3 to \$4 each. The tubes can be made with a square cross section using basswood or thin hobby plywood.




Paint the insides of the tube flat black. The baffles are used to keep stray light from glaring up the insides of the tube, which then reflect into the eyepiece. These baffles effectively trap the unwanted light. Generally speaking, the more baffles, the better the image contrast.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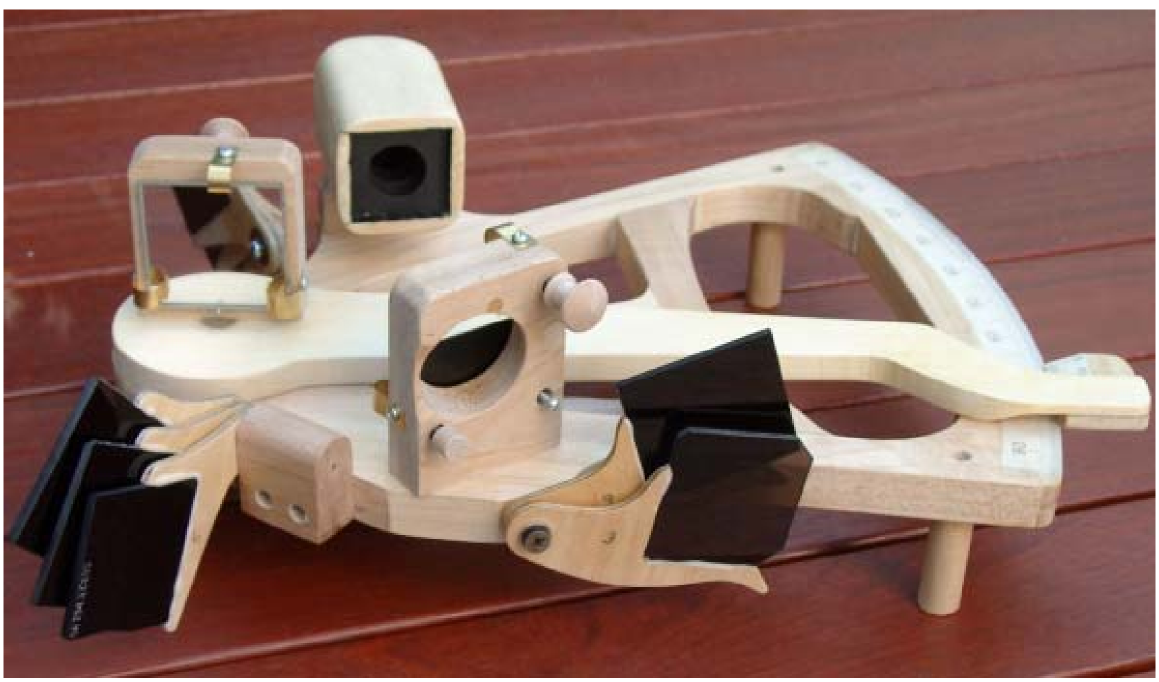

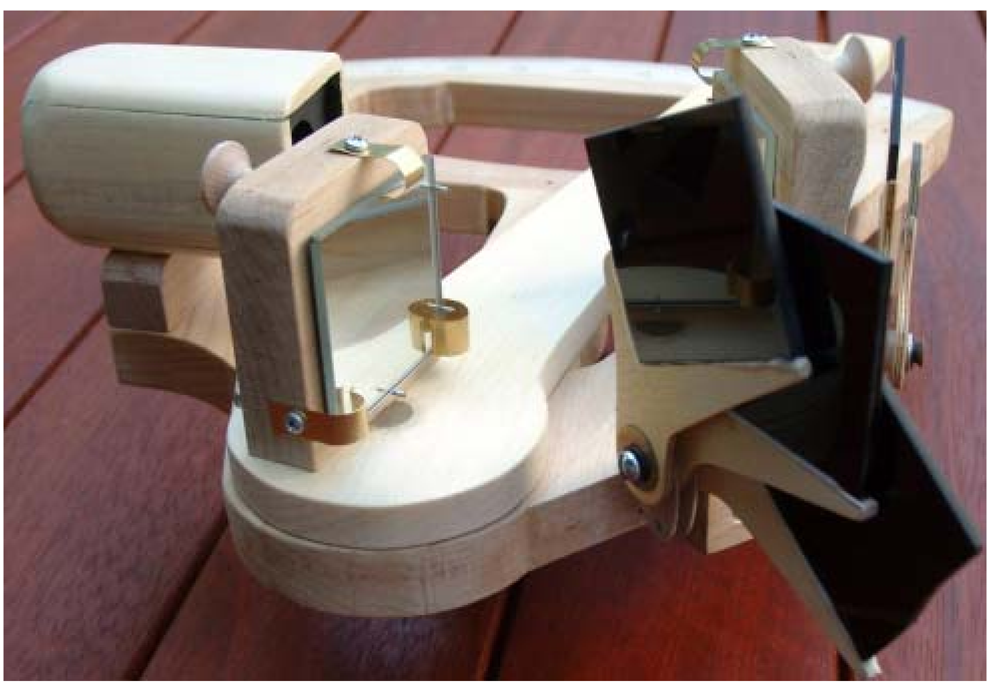

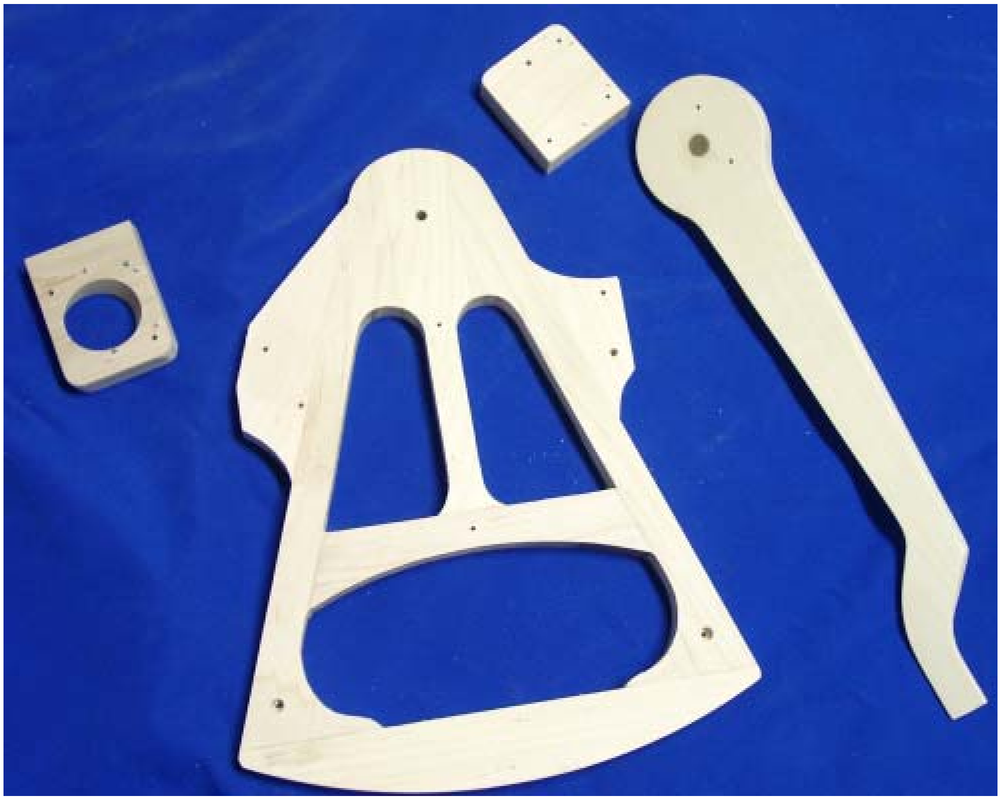

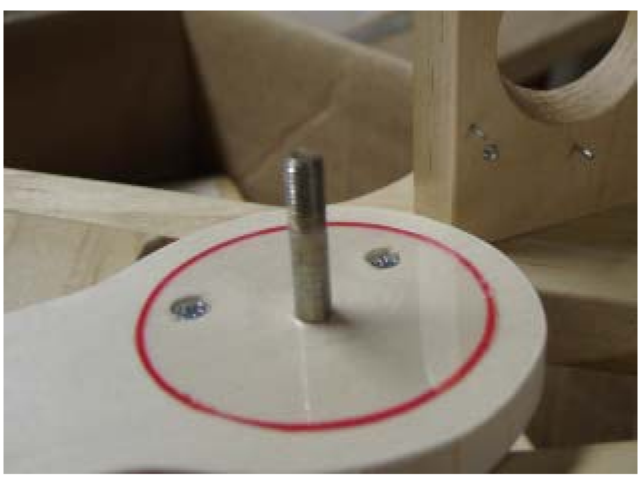

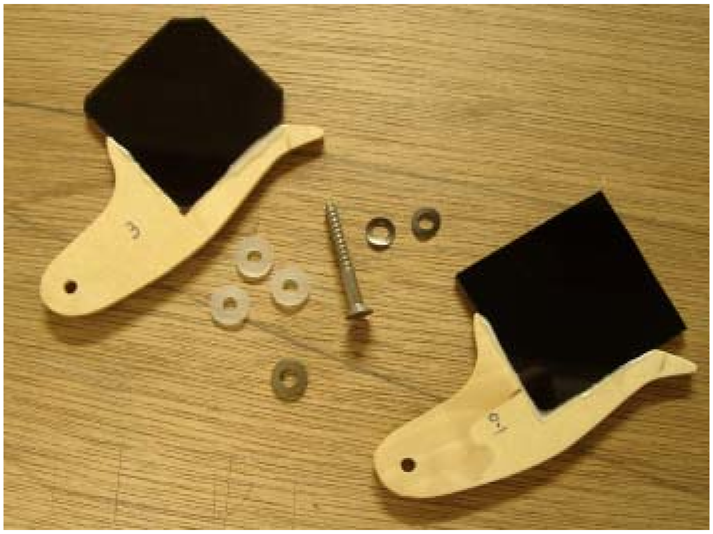

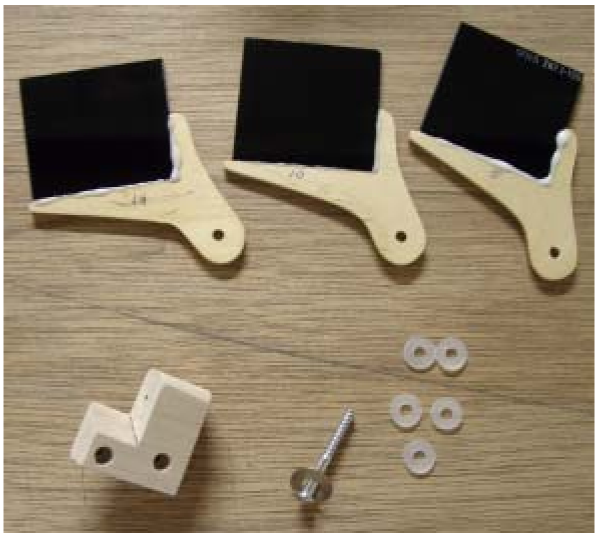

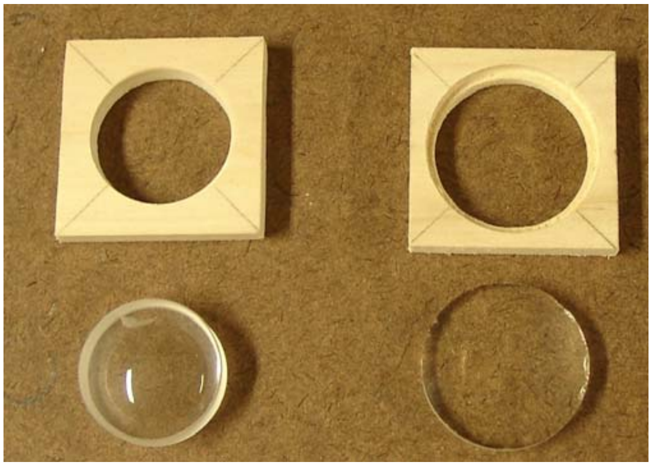


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