

To Make a Leeuwenhoek Microscope Replica

Alan Shinn

For some time now I have been studying Antony Van Leeuwenhoek's microscopes and building prototypes, and have finally settled on a design that I would like to offer to the public.

They are made of thin beaten brass, about 47 mm tall by 25 mm wide, with the lens captured between two such sheets. The subject is placed on a metal pin, adjusted with screws, to change the focus and position. One of the adjusting screws protrudes down from the body and also serves as a handle. These microscopes look very much like the one in the museum at Utrecht (circa ~ 1690). They have a lens made of a 2 mm diameter glass ball and have a power of about 180X, with surprisingly good resolution.

If you want plans, eMail me or send SASE plus 50 cents (for photocopying). I am also offering to sell these microscopes for \$85.00 for students and educators and \$135.00 to others.

Should you be interested in building your own, which I recommend, the following should illustrate the challenge:

All of my brass stock, except for the focus block, comes from the hobby section of my local hardware store. The material for the focus block is a rectangular rod 3/16" x 3/8" x 3" that I found at a scrap metal yard. You can find a bolt or something to saw it out from.

Let's start with the main plate (two mirror image pieces). Buy 1" x 12" x 1/64" brass at the hobby section of the hardware store. Pound both sides against an anvil with a large ball peen or planishing hammer (I have a 2" diameter hardened steel ball) of about 4" of this sheet until it looks like you made the sheet from some lump of brass (or start with a lump if you have the time). The sheet should be fairly flat (no curl) when you are done. Keeping in mind which sides will be out, mark the outlines and cut two pieces with tin snips (a little over size). Clamp them together and drill 1 of the 1/16" rivet holes through both places. Rivet together temporarily with 1/16" aluminum tubing. Now drill the other 1/16" rivet hole through both pieces and again rivet together. Where the 4-40 bracket hole goes, drill another 1/16" hole and rivet. Now, file and smooth the outline to size. Drill the 0.04" lens hole oversized (0.030") as it will stretch. Drill out the rivet where the 4-40 hole goes with the 4-40 tap drill and while clamped together near the hole, tap through. Gently drill off the other two rivet heads and separate the two sheets, being careful not to bend them. Finish smoothing the edges with fine sandpaper.

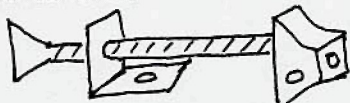
The four screws are made from 0.115" brass rod (this is for 4-40 thread). I have been making 4-40 screws but I recently found a 4-32 tap and die set that will probably make screws that look closer to the originals, but I haven't tried them yet. I thread the rods first, using my electric hand drill on slow speed and a threading die. Then pound the thumb screw end with a ball peen hammer (for the short screws I thread a piece of tubing to use as a handle). File and sand as needed for a pleasing shape. The little ball handle for the subject pin is made from 1/8" rod (or use the same 0.115" stock) with an electric hand drill and some jewelers files. The subject pin and ball are either pressed together or soldered.

The focus block is sawed out from stock and filed to size and shape. The radius is filed with a round file then drilled and tapped.

The bracket is made from 1/16" x 1/4" rod stock. I cut it oversize, bend and then cut to size.

Drill the two holes and tap one of them.

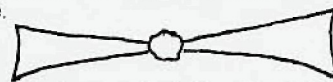
Thread the focus screw through the bracket about a inch, put the smooth end of the screw into the non-tapped hole in the focus block, being sure to get the orientation correct.



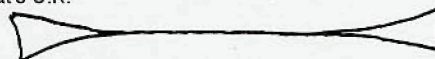
Now it is time to discuss the lens. Antoni Van Leeuwenhoek made many, many microscopes, all with different focal lengths, depending on the

subject to be examined. I have settled on a 2 mm diameter ball for my replica. I have found a source for ground and polished balls (you can get them from Edmund Scientific). However, you can make your own (only lightly inferior) ball lens with some glass and a propane torch.

WEAR EYE PROTECTION for the next three steps!!! Break a jar and find the two longest shards. Fuse them together in the flame until you have a fairly large melted zone.



Remove from the flame and quickly pull apart, forming a thread of glass several inches long and about 0.01" to 0.02" in diameter. It probably won't be round, but that's O.K.

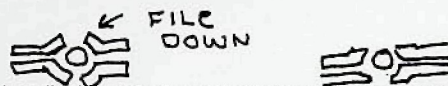


Break off the thread and save it (wear eye protection, pieces zing around when you break it). Now, slowly feed the thread into a small flame forming a ball as the glass melts, keep rotating the thread by twirling between your fingers. Continue until the desired size is reached. Work over a protected surface (like wet news paper) as sometimes the little ball drops off and can burn the table top (makes significant others mad). You now have a (almost) perfect sphere with a little handle attached.

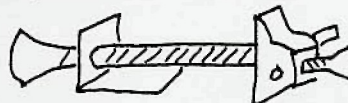


Make several, you will need one to use as a tool.

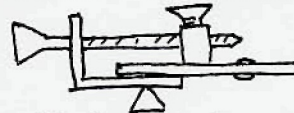
Now to finish. Place the least pleasing of the balls seated into the 1 mm hole in one of the main plate parts and place the other plate over it (also seated). Place the works on the end grain of a piece of wood and, using another end grain piece of wood as a buffer, strike with a hammer such as to dent the sheets of metal to form seats for the ball. If the ball shatters use another until both sheets are nicely dimpled. File the outer side of the sheets (see sketch) so that an object can be brought close to the ball.



Finally, place the lens into its pocket between the two sheets and rivet the two sheets together. Insert the focus screw and the subject pin into the focus block.



Attach the bracket to the main plate with the short screw.



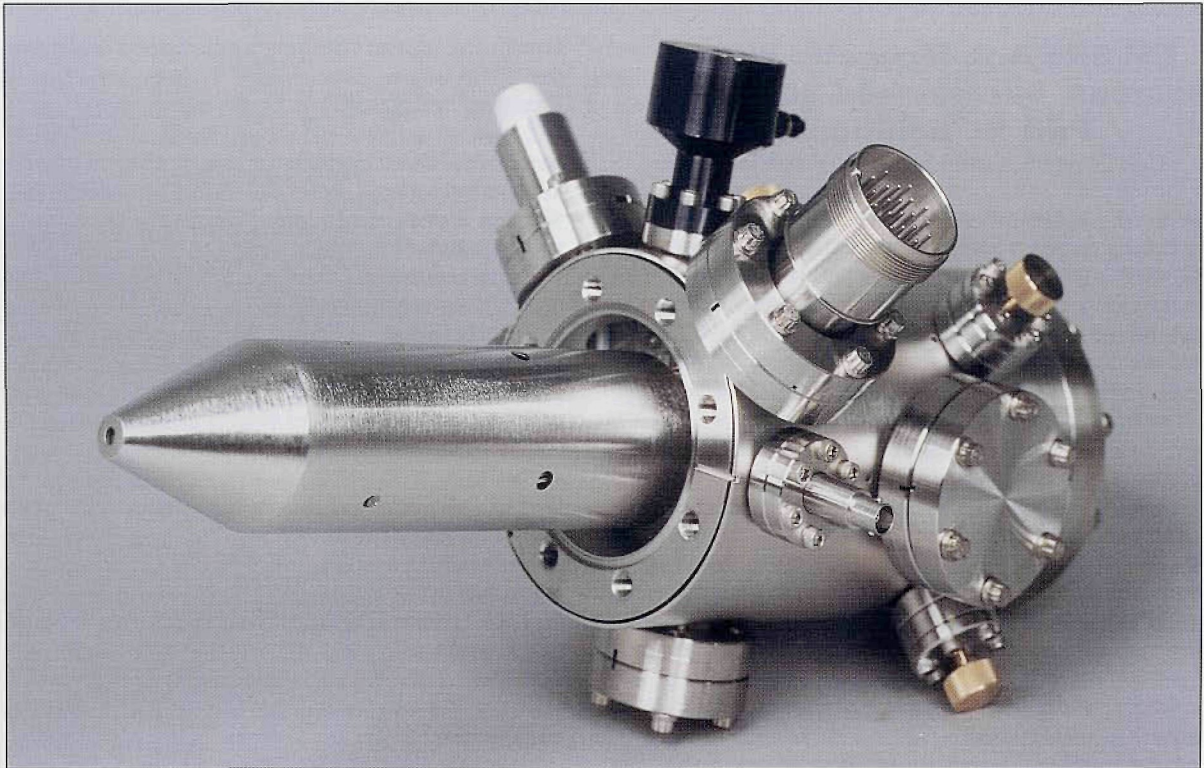
Now stick something (like a hair root or a very thin shaving of cork) onto the subject pin with some beeswax and look at it through the microscope. With this lens, you will probably have the most luck looking towards a small light source like a 60 watt bulb at 5 feet - experiment to find the best source for you. (My fused lenses seem to have too much astigmatism to use with large light sources).

Happy scoping!

By the way, you might want to start out with these lenses and crude nipped up bits of soda cans with punched holes and adjust things by squishing wax, instead of building the whole works. You can be doing microscopy in less than an hour that way instead of spending all day (or more) making the brass replica.

If this is too much, you can buy a completed microscope from me. Or perhaps even parts (like ground and polished ball lenses).

Alan Shinn
2429 McGee
Berkeley CA 94703
(510)548-2048, alshinn@sirius.com



Two lens focusing column

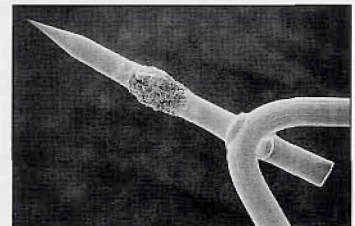
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