Microsurgery

(or Repairing an Old Microscope)

By Fritz Schulze

A friend of mine, who travels a lot, brought back an old German brass microscope from a trip to Vienna. He could acquire the instrument at a good price as it was incomplete and in a poor shape. It was actually a rather fortuitious find as it dates back to before 1860 when its makers *Bénèche & Wasserlein* (Berlin) were still together, before Rudolf Wasserlein left to open his own workshop.

Knowing my predilection for resurrecting old microscopes he brought it to me and asked if I could possibly “fix” it. That was a challenge I could not refuse particularly as at present I had no “active project” in the works. He also had bought several of my own

microscopes seeing that I am in the process of disposing of my collection (“She who must be obeyed” made it quite clear that she, who is several years younger than I, does not relish the thought of having to dispose of my treasures once I am no longer among the living, which is why I have most reluctantly began to sell them off).

The microscope had alrady been tampered with. What unfortunately many inexperienced antique dealers do in the false assumption that a shiny brass instrument brings more money is to attack it with a buffing wheel. The circular base, the stage and the vertical column of this microscope were thus highly polished which was witnessed by all threaded holes being full of green polishing compound. The base itself, of course,

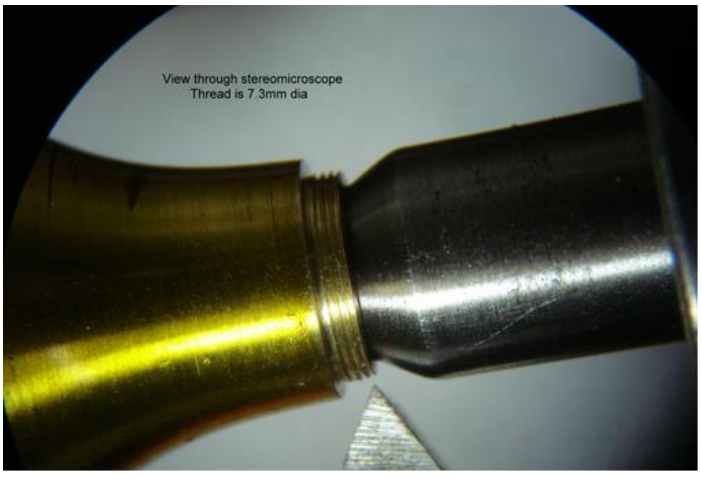
also showed the typical wavy polished surface. Fortunately, the tubes and sleeves were left alone with their original well preserved lacquer.

The orginal fine focus was of the type where the stage itself is tilted by a screw. For this the stage has two arms that grasp the vertical column and is suspended with two pointed screws which engage in two steel bearings inserted in the wall of the hollow column. Due to the weight of the stage and mishandling, these points had broken off. Furthermore, the block against which the focusing screw acts was missing.

Most worrying was the damage done to the fine and delicate thread for the objective at the bottom end of the tube and that the only thing left of the mirror was the concave glass mirror, showing sign of old age.

Metric pitch gauge

I started with reconstructing the objective thread. I could establish a pitch of 0.25mm and was glad to discover that I had the necessary gears to cut such a thread on my EMCO Compact lathe. The steel gear shown I had made earlier for another project at a time when I had no source of buying parts for my lathe. It now turned out (no pun intended!) that the Selligue objectives sold with the microscope could not be the original ones: the damaged thread was of too large a diameter! Setting up my stereomicroscope with a supplementary lens for a long working distance I carefully cut the thread until the objective (s) fitted nicely.



A view through the microscope while cutting the thread (I just held my small Sony Cybershot camera over the eyepiece)

My microscope set-up at the lathe, using a live centre to stabilize the tube

The gear train on the lathe. The blank steel gear I had hand-made earlier

Next I looked at the broken bearing screws of the stage. I thought that the easiest way to solve this problem is to insert pointed steel tips. I found suitable positioning pins in my stock which I sharpened to a point on one end and inserted into a central bore of the screws. These screws are located in a slotted bearing with a tightening screw to prevent their unintentional shifting (and thus releasing the stage). I had no suitable screws in my stock, so I was forced to tap a somewhat larger M2.5 thread. That done, I now searched the Internet for illustrations of similar microscopes to find details of the fine focusing mechanism. All illustrations I came across showed the fine focusing movement being counterbalanced by a spring. There were, however, no indications of such an arrangement on this particular microscope so I came to the conclusion that the weight of the heavy stage itself was considered enough when lowering it. All I needed then was a post for the focusing screw to act against. The tapped hole on the underside of the stage was only about 3mm deep. A machined brass post with an integral short thread would, in my opinion, have been weak, so I preferred the solution of a threaded steel pin firmly set in the stage and accepting a similarly threaded brass post. The latter received a flat surface in the correct orientation for the tilting screw to act against.

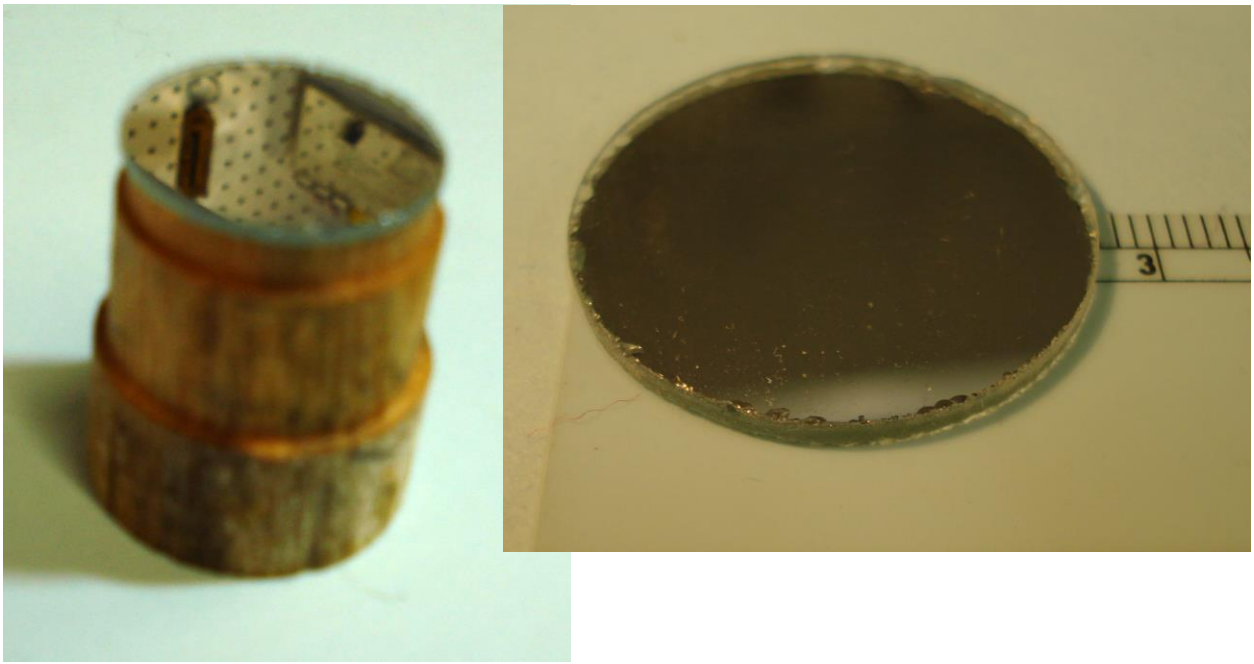
Two small cylinder-headed screws serving as lateral stops for the double diaphragm on the underside of the stage completed this part.

Enlarged view of one of the two bearing screws

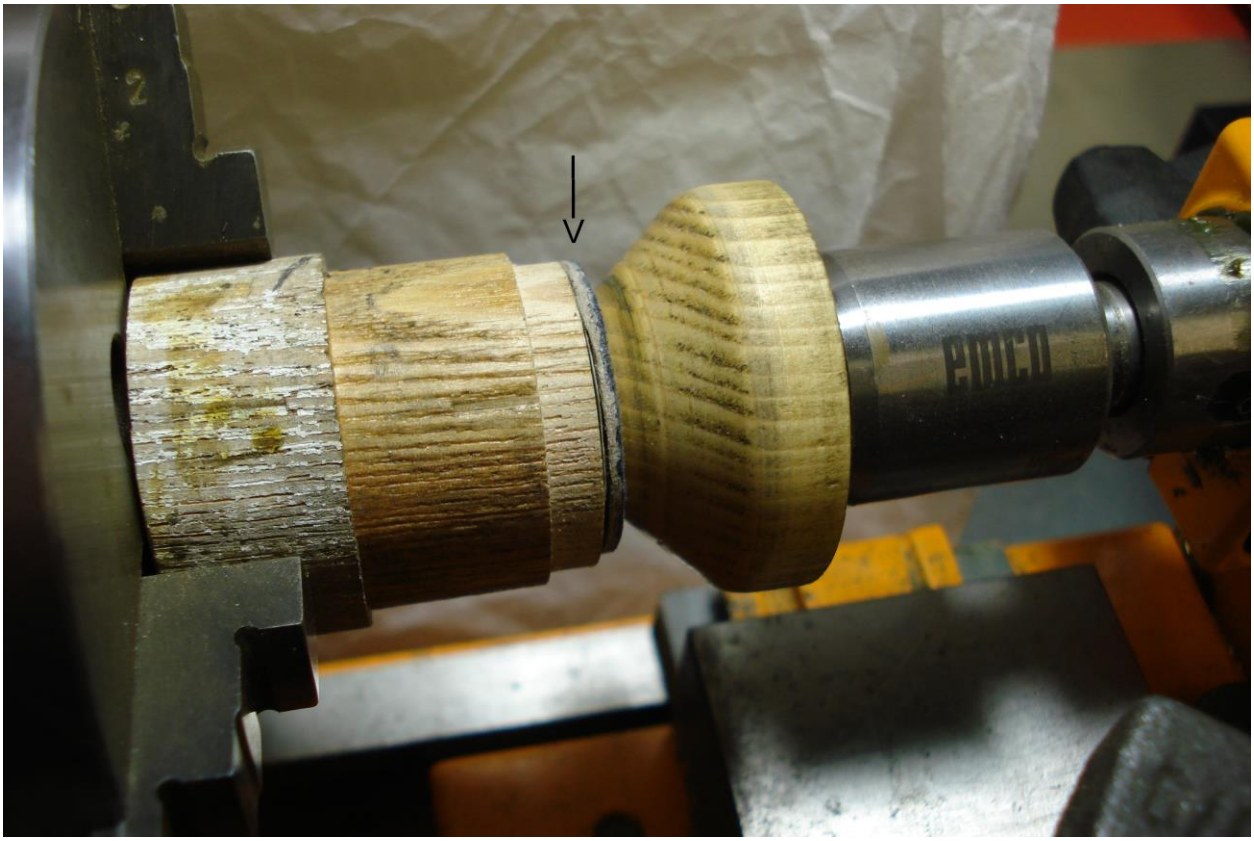
Now to the mirror. I found a piece of thin mirror glass in my “junk box” (I am a hopeless hoarder and keep whatever may some day be useful in labelled boxes. It pays!) and managed to cut and nibble it aproximately round with my grozing pliers and then rounding it more precisely off on my glass grinder (built from an old Kodak Carousel projector, believe it or not! I like to build the craziest machines and, once built, hardly use them). The concave mirror that came with the microscope had a diameter of 27.8mm and I planned to grind the plane mirror to the same dimension.

To this end I cut a dowel of suitable size and machined a plane end on my lathe. Next I attached the mirror with double-sided tape on this dowel. To prevent it from coming loose, I pressed a wooden cone fixed to a live centre on the tailstock against the mirror, interposing a cardboard disk for protection. With a wet grinding stone I then carefully ground the mirror to the required diameter. The glass proved to be rather brittle and the circumference showed many tiny chips which I hoped the mount would hide.

The wooden cone referred to I made to support long microscope tubes while polishing them on the lathe. It is just slipped over the tip of the live centre and rotates with it.



The plane mirror on the mounting dowel and, right, the finished mirror



Grinding the mirror on the lathe (shown here with a cardcoard substitute). The wooden cone on the right is to prevent the mirror from falling off. It is supported by a live centre.

The underside of the stage showing the mounting of the fine focusing post and the bearing screws with the steel pin.

The machining of the mirror mount was uneventful, I left a thin edge for securing the glass components in the frame (I heated the brass with a propane torch to soften the metal and prevent any breaking of the thin edge). I then used brass black to “oxidize” the brass and make it look old. I inserted the concave mirror first, then a narrow cardboard spacer ring and finally the plane mirror. Under my stereomicroscope I tried to “hammer” the thin edge inward to secure the mirrors but found it ought to have been thinner. I succeded only partially and in the end finished the job my applying some glue around the edge (glazier’s putty might have been better). Not professional, I admit, but it worked and does not look bad. This is a problem I have not been able to solve: how to remove broken lenses/mirrors from their mount or, vice versa, mount them with the means at my disposal. The old masters probably spun the thin edge inward on a lathe using a special tool.

Another problem one meets when repairing old microscopes is how to replace missing screws. Brass screws of suitable dimensions are hard to find and to make them is time consuming and difficult, particularly the very fine cut for the screw driver. One needs a razorthin sawblade. So, unless I find a fitting screw in my special box I have to resort to using modern steel screws, sometimes made to look better by means of yellow stained lacquer. The restoration is then Not to the Original. Then, again, how far do you go making compromises?

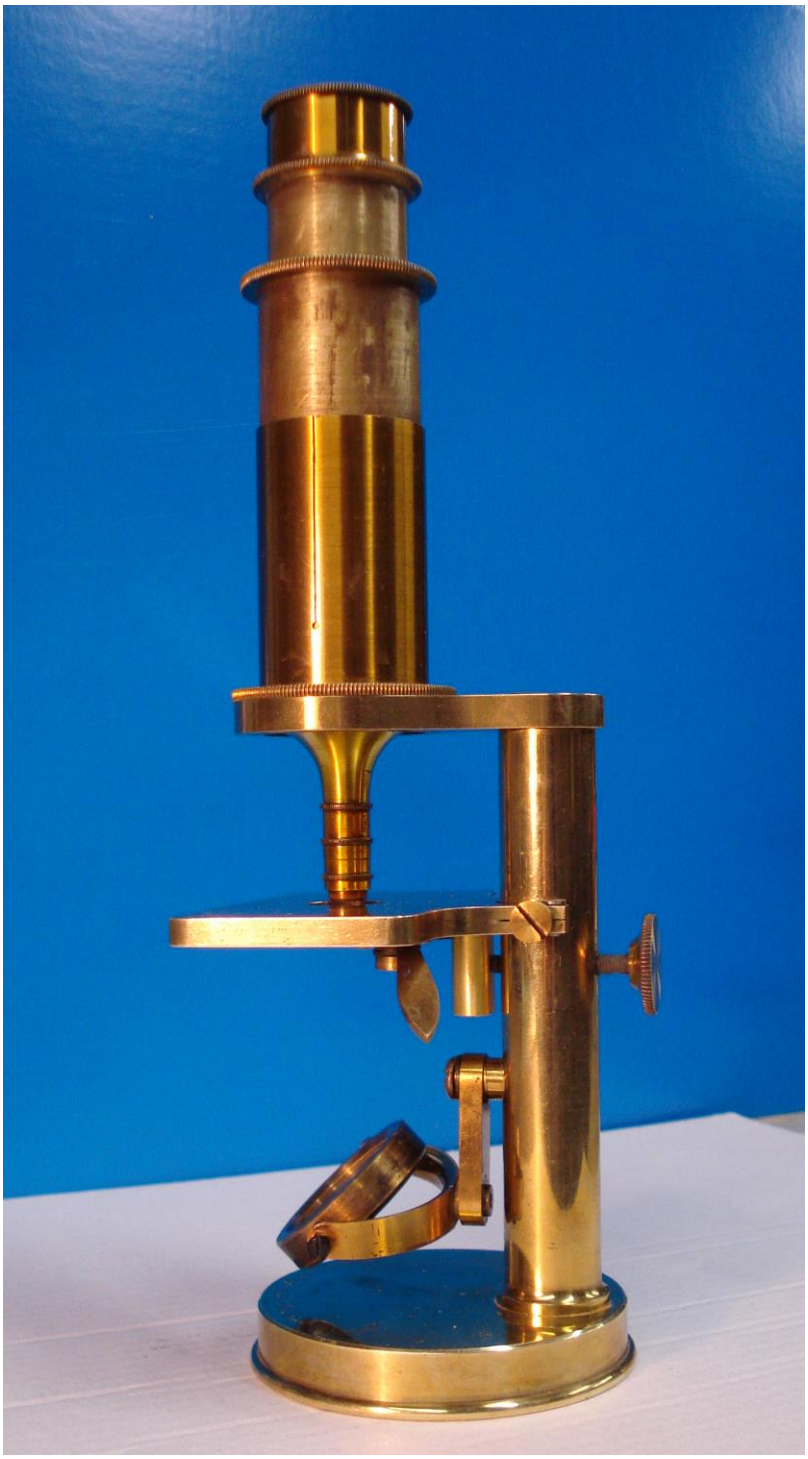
The finished mirror assembly

Cleaned, lubricated and finally assembled, the old microscope looks fine, standing 22cm tall and fitting nicely into its box. One final defeat: I could not find a working key for the lock, and the lock cannot be removed as its mounting screws inside the box are hidden by a thin veneer of wood! So it is trial and error with filing the biting of the key in the hope that the lock will suddenly operate.

My friend will be happy to see his newlyfound treasure restored to life and I can pin another success to my list of “surgically restored old microscopes”.

Bénèche & Wasserlein, Berlin Nr. 1780

The microscope in its case



The finished microscope

Written in November 2016 by Fritz Schulze, Vineland, Ontario, Canada
glenelly@sympatico.ca