Leitz Laborlux S Nosepiece and Head Mount – Maintenance Notes

Scope

These maintenance notes describe the disassembly, cleaning, greasing and reassembly of a Laborlux S 5-piece nosepiece and head mount - both items sitting at the end of the microscope arm. Refer to Figure 1 and Figure 2 for the parts involved and the names used.

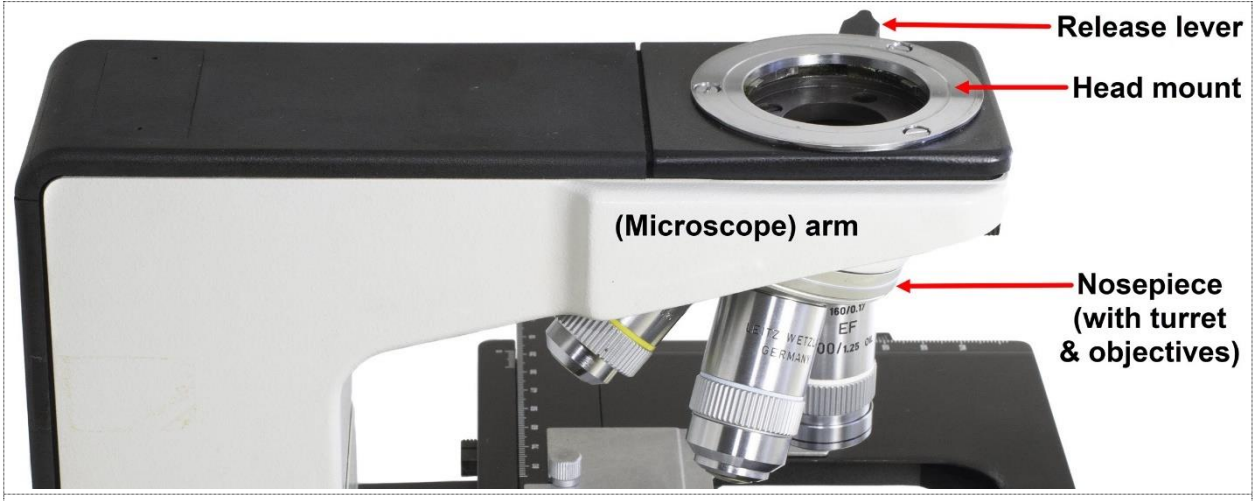

Figure 1: The arm of a Laborlux S microscope.

The nosepiece/turret appears to be quite rugged mechanically and very little affected by aged and hardened grease. If the turret appears to move smoothly and to nicely snap into the detent stops, then there is hardly any reason to disassemble the nosepiece.

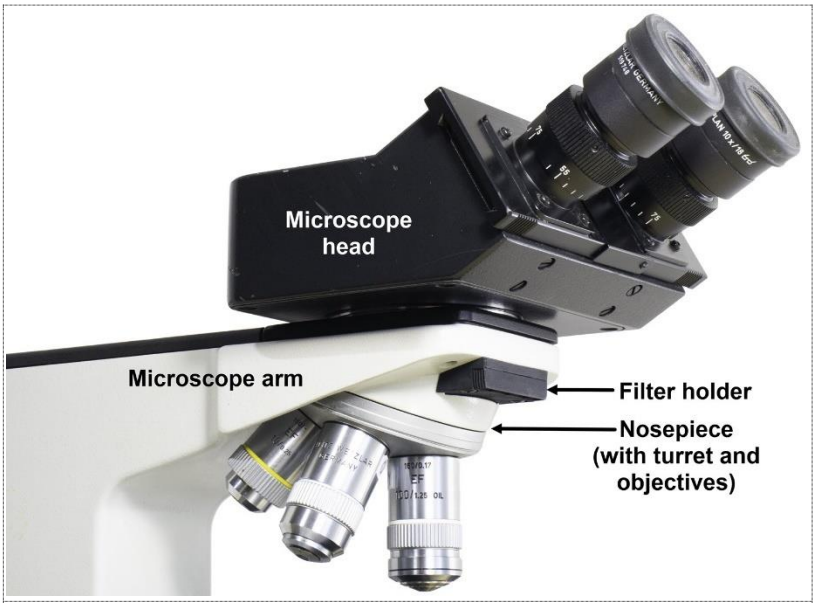

Figure 2: The arm of a Laborlux S microscope with an attached binocular head.

The nosepieces of the Leitz Laborlux microscope family (Laborlux 9, 11, 12, K, D and S) are all inclined away from the user and towards the back of the stand (Figure 2.) Other contemporary Leitz microscope models (like Dialux 20/22, Diaplan, and some Aristoplan configurations) have nosepieces that are inclined towards the user. The nosepieces of the Laborlux microscopes are not of the removable type; they are permanently attached to the microscope arm.

The special nosepieces/turrets for Laborlux polarizing microscopes are not covered in these notes.

The head mount has a diameter of 42.0 mm and will not fit to the sometimes similar-looking heads from the 170 mm tube length generations. The most common head mount fault is typically sluggishness due to aged grease in the moving parts of the head release mechanism.

The head mount is designed to provide a very snug fit with the microscope head. After any maintenance of the mount, it is important to readjust and check it to ensure that the head perfectly fits and attaches into it. If the head doesn't slip down perfectly into the mount, the head may be left sitting with even a very slight tilt, which noticeably jeopardizes the collimation of the microscope's optical path. Unfortunately, because this error is inconspicuous, it is very easy to miss. Subsection 9 describes how the head mount is adjusted to ensure that it properly locks with the microscope head.

In most parts these maintenance notes should also apply to other Leitz Laborlux microscope models (like Laborlux 9, 11, 12, D or K) from the 160 mm tube length generation.

Grease

Without having any special insights about microscope lubrication, I have used Super Lube Multi-Purpose Synthetic Grease with Syncolon, NLGI grade 2, for the Laborlux nosepiece and head mount. Feel free to use any other grease that you believe may be more suitable. Note however that the involved moving parts are very close to sensitive optical glass surfaces, particularly the objectives. Therefore, it's important to choose a grease that doesn't emit any components that can condense on the glass surfaces and that doesn't creep or migrate.

For fear of causing problems by using an unsuitable grease I have in one Laborlux S microscope tried to leave the head mount and the nosepiece entirely ungreased. It still appears to work well and smoothly, but of course as an amateur microscopist I'm subjecting the microscope to far less wear and tear than a professional user would. Note that it appears that Leitz at manufacturing didn't grease the large ball bearing in the periphery of the turret (point 5. below.)

Maintenance Notes

1. Protect or remove all sensitive components from the microscope.

To facilitate the work and to avoid contamination of sensitive optics, the objectives, the head (see subsection 2 below if the head is stuck on the microscope arm) with the eyepieces, and the condenser should be removed from the microscope and stored protected from dust.

Protect the field lens in the microscope foot by covering it with a suitable lid (for example, from a food container) and tape it so it doesn't fall off.

With the coarse focus controls move the stage to its lowest position.

2. Remove the microscope head from the microscope.

To access the head mount and the nosepiece the microscope head must be removed. Push the head release lever (Figure 1) towards the back of the microscope and lift off the head. The release lever may be sluggish or even appear stuck due to old and hardened grease. Although the head release mechanism is quite robust, excessive force should be avoided. Generally, gentle warming is very effective to soften

hardened grease in preparation for cleaning and regreasing. The downside with heat treatment in this case is that it is impossible to avoid to also heat the stuck head, and temperatures that differ from room temperature, or generally any temperature variations, are not healthy for optical components. However, if the lever really is stuck you don't have any choice, so remove the eyepieces from the head, cover the eyepiece tubes, and let the microscope sit for several hours in a cabinet (or any similar enclosed space where the temperature can be raised) at approx. 30°C (85°F) and then again try to push the lever backwards. Hopefully, the lever will slowly give and move until the head releases. In difficult cases it may be necessary to increase the temperature treatment to 35 or even 40°C (95 - 105°F).

Once the head has been removed, you will typically find that the dovetail mount on its underside (Figure 3) is sticky from old grease. Clean the dovetail with a piece of cloth or cotton swabs wetted with solvent (white spirit.) Be careful not to touch or contaminate the glass window in the center of the dovetail mount.

Figure 3: Dovetail mount on the underside of the head.

3. Disassemble the head mount.

Remove the three chromium plated M3x8 screws from the head mount collar (Figure 4) and remove the collar. Take note of how the three head clamps below are oriented (Figure 5 and Figure 6.) Remove the head release lever, the three head clamps and the spring.

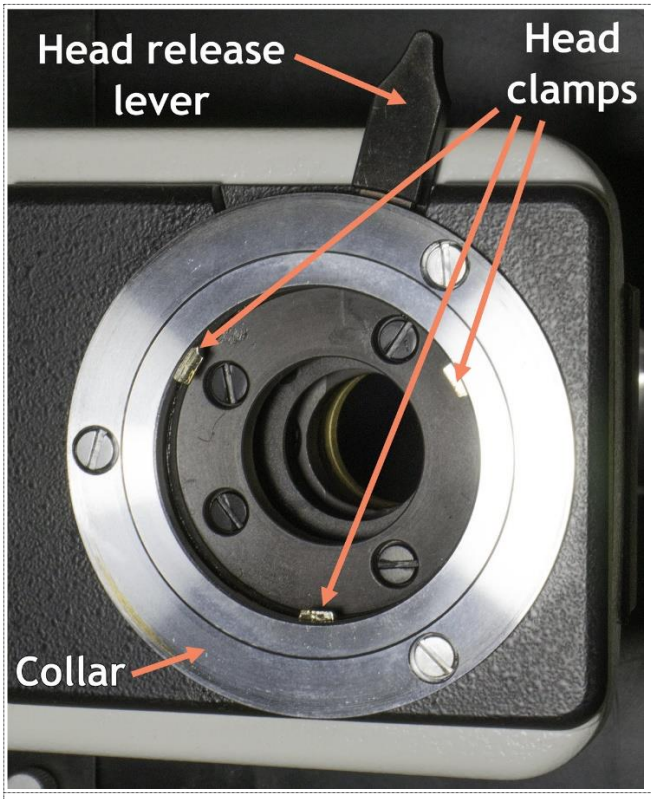

Figure 4: View from above of the microscope arm down on the head mount (with the head removed.)

Figure 5: View down on the head mount, collar removed, showing the head release mechanism (lever and three metal clamps).

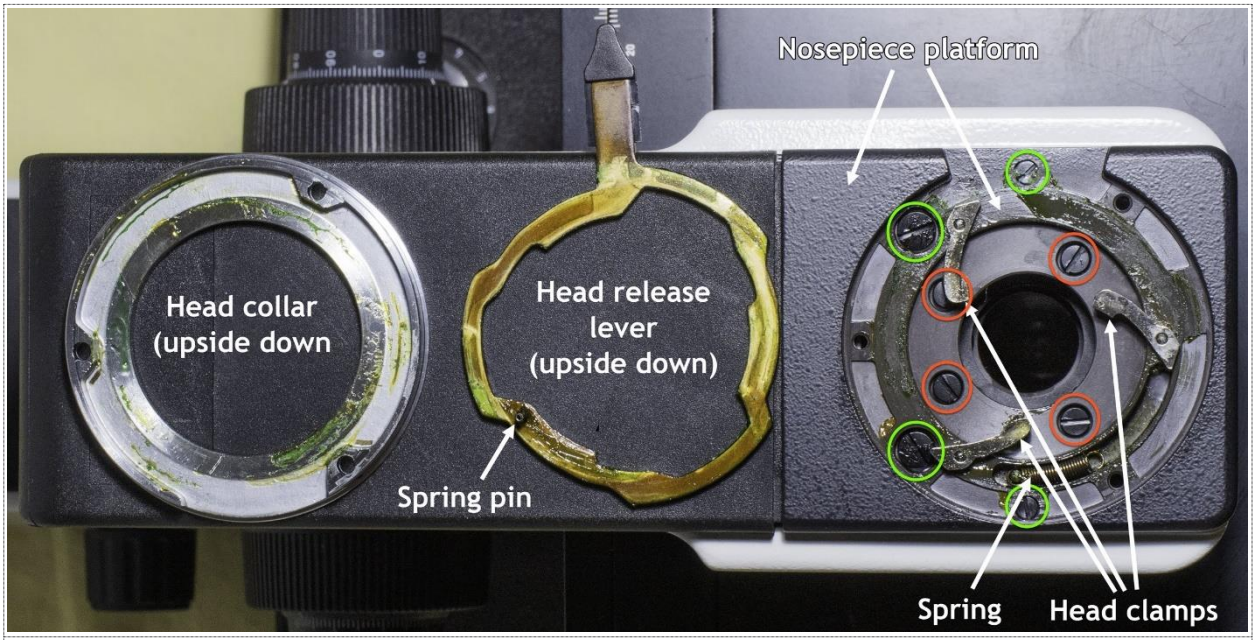

Figure 6: View down on the head mount, with the head release mechanism disassembled.
Screws that hold the nosepiece attached to the microscope arm are surrounded by orange circles.
Screws that hold the nosepiece platform attached to the arm are surrounded by green circles.

4. Remove the nosepiece.

Pull out and remove the filter (or the dust protector) from the nosepiece's black plastic filter holder (Figure 2 and Figure 7.) From the underside of the filter holder remove the two black M3x10 Philips screws that hold it attached to the microscope arm and pull the holder out from the arm.

Remove the four black M3x8 screws that hold the nosepiece (surrounded by orange circles in Figure 6 and Figure 7) and carefully remove the nosepiece assembly (Figure 8 and Figure 9) from the underside of the microscope arm.

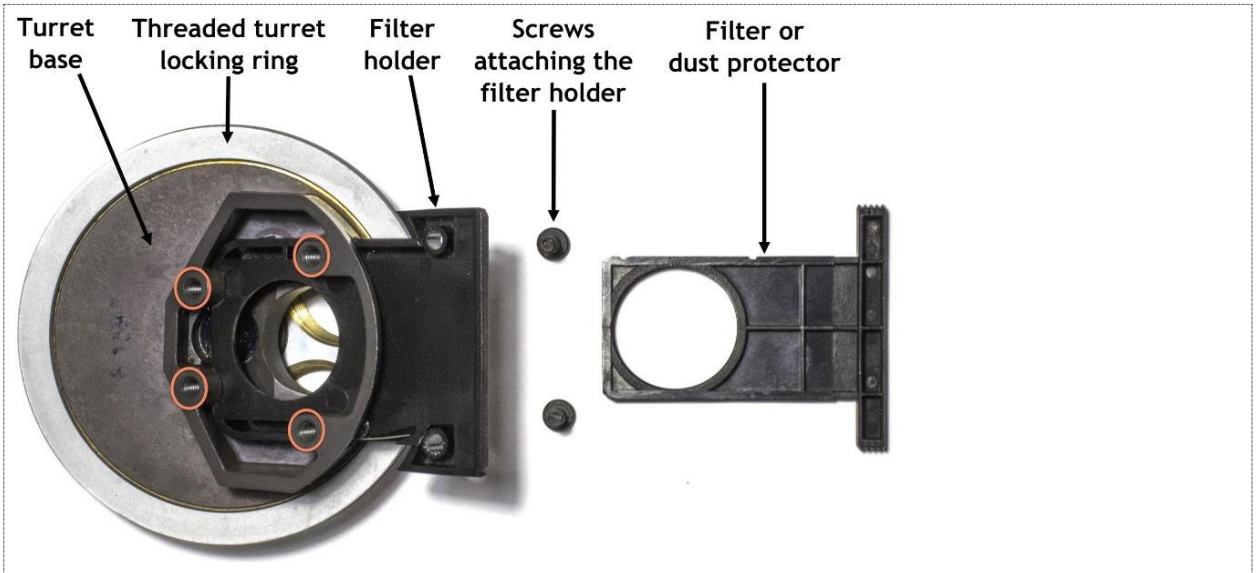

Figure 7: The nosepiece - view from the top after the nosepiece has been removed from the microscope arm. Also showing the filter dust protector and the filter holder.
Screw holes for the screws from the nosepiece platform that hold the turret attached are surrounded by orange circles.

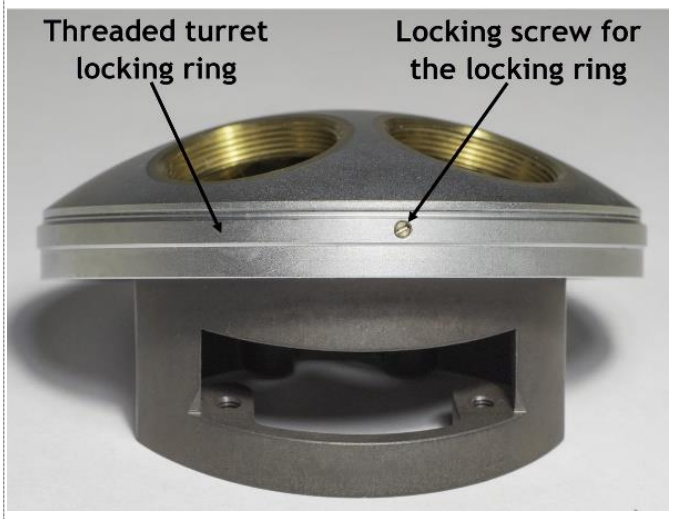

Figure 8: The nosepiece (upside down), view from the front.

Figure 9: The nosepiece, view from the top.

[The black nosepiece platform (Figure 6) is a somewhat complex part, apparently milled from aluminium. For the work described in these maintenance notes it can be left attached to the nosepiece. If you for other maintenance tasks still need to remove it, do as follows: From the underside of the microscope arm remove both chromium plated M3x10 screws (Figure 10, where the screw holes are surrounded by blue circles.) Next, from the top of the nosepiece platform remove the two black M3x12 screws and the two black M4x12 screws (Figure 6 and Figure 10, labeled by green circles.) The nosepiece platform can now easily be removed.]

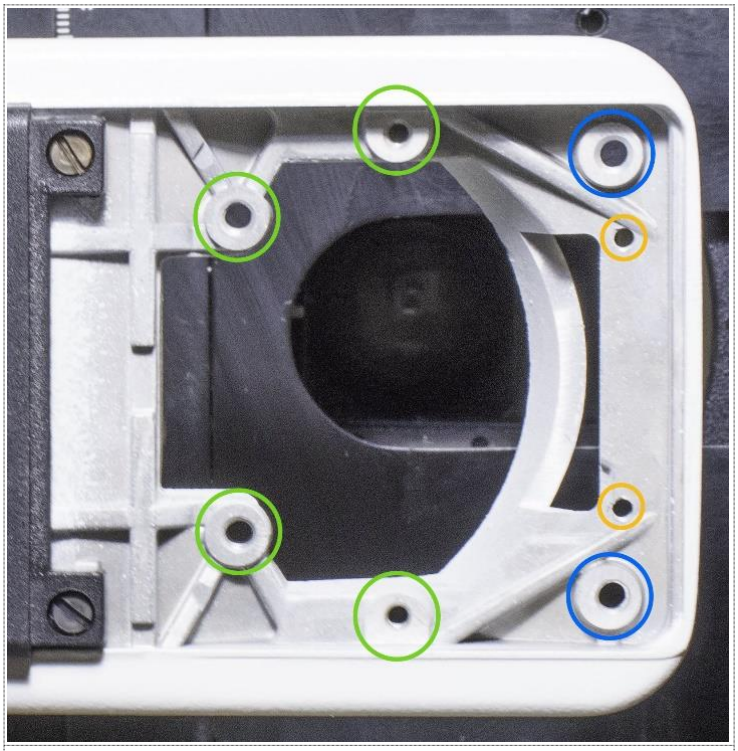

Figure 10: View from the top down on the microscope arm after the nosepiece platform has been removed.
The screw holes for the nosepiece platform are surrounded by green and blue circles.
The screw holes for the filter holder are surrounded by yellow circles.

5. Disassemble the nosepiece.

Unscrew and remove the very small locking screw on the edge of the threaded turret locking ring (Figure 8.) With the turret's objective side facing down hold the turret with your fingers in the objective openings and carefully unscrew and remove the locking ring from the turret with your other hand – the

RMS threads in the objective openings are sharp, so you may need to protect your fingers by wearing gloves.

Be careful while removing the locking ring from the turret base - the large turret ball bearing just below the locking ring is now unconfined (Figure 11, Figure 12 and Figure 13) and the small bearing balls may easily come loose and perhaps become lost.) The large ball bearing was typically not greased by Leitz, so there is nothing that will make the balls to stick to the bearing.

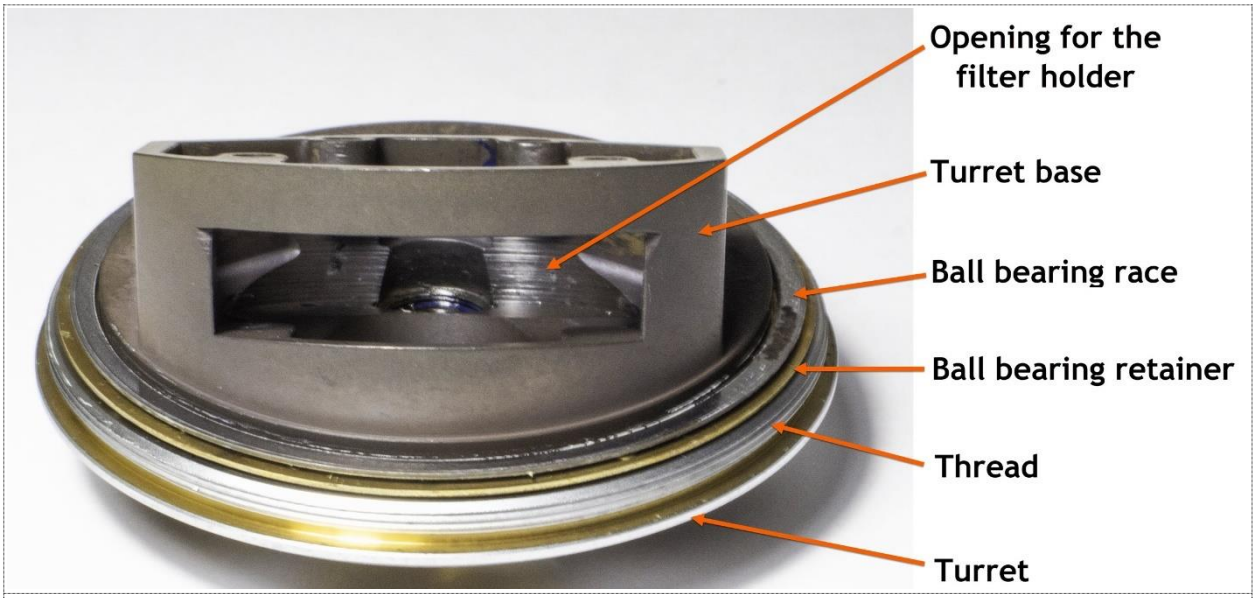

Figure 11: The nosepiece after the turret's locking ring has been removed. The large turret ball bearing rests on the rim of the turret base. The bearing balls are not visible here because they are below the ball bearing race.

Figure 12: The nosepiece, after the threaded turret locking ring has been removed. The large turret ball bearing is now visible. The bearing balls are not visible because they are below the ball bearing race.

Figure 13: The nosepiece after the threaded turret locking ring and the bearing race have been removed. The bearing retainer (made of brass) and the bearing balls are now visible.

Carefully remove the bearing races (steel), the bearing retainer (brass), and collect all bearing balls (Figure 14.) The ball bearing will typically contain 18 bearing balls, each 1.5 mm in diameter.

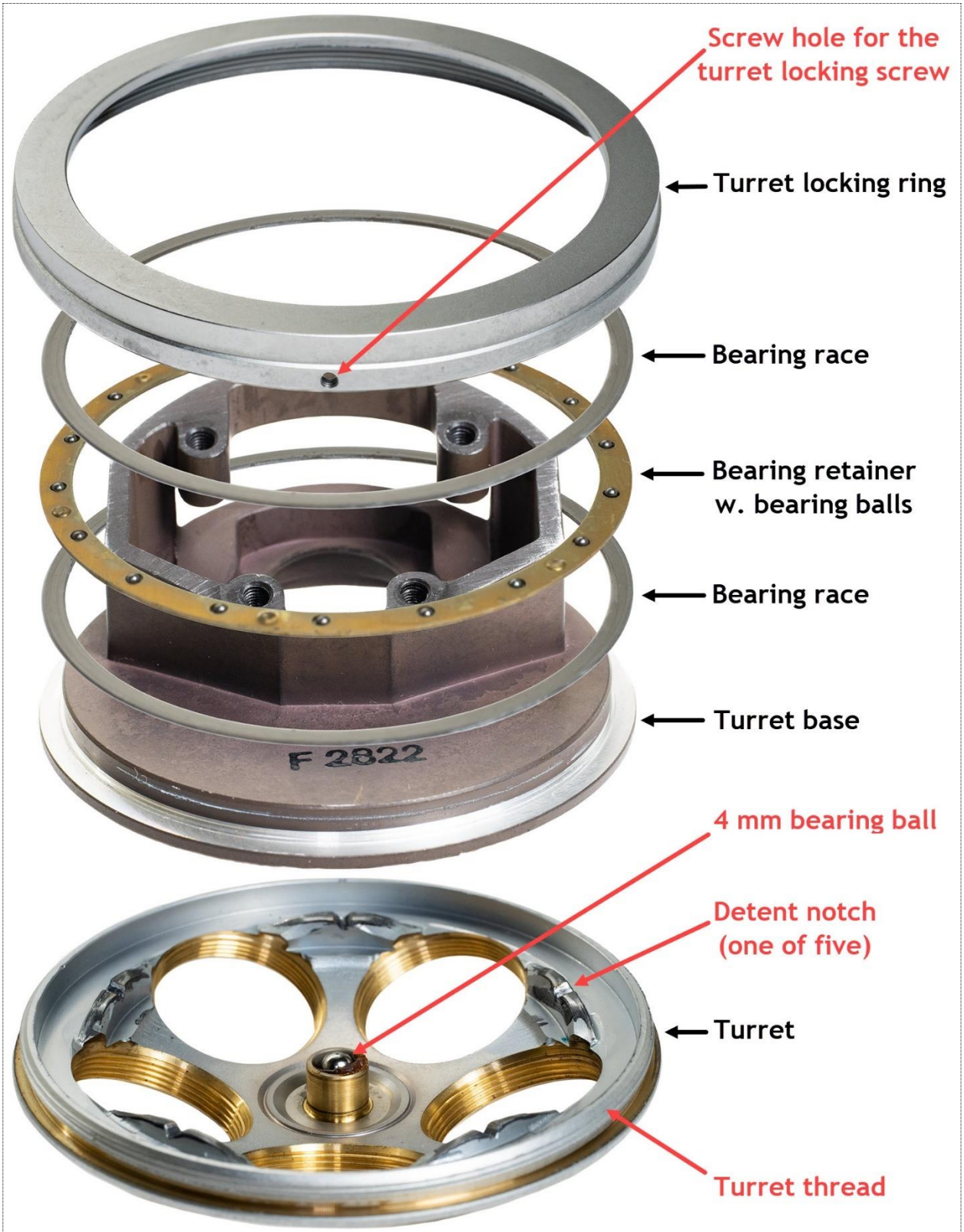

Figure 14: Exploded view of the nosepiece with the turret's large ball bearing.

You may find out that the turret locking ring is stuck on the nosepiece and can't be removed with your bare hands. Here are some suggestions that should help. First, to get a better grip around the slippery locking ring wrap a wide rubber band around it, or even better, hold it with a suitable rubber lined jar opener, like the one in Figure 15.

Figure 15: A useful jar opener with a rubber strap. This one is wrapped around a microscope eyepiece.

Second, to get a better grip of the turret I have a suggestion that will sound painful to any microscopist: Firmly attach two microscope objectives in two opposite objective threads in the turret and use them as handles to leverage the necessary force to release the locking ring from the turret. (Perhaps you can find some faulty objectives in your drawers?) In any case, be careful not to damage the objectives - particularly protect the front lenses.

Once the large ball bearing and all its parts have been removed hold the turret with one hand and the turret base with other hand. Rotate the turret back and forth while carefully pulling the turret off from the turret base until the parts separate (Figure 14 and Figure 16). On the inside of the turret, you will find a detent mechanism that holds the objectives in the optical path, and a simple center ball bearing consisting of a single steel ball (4.0 mm diameter) embedded in grease.

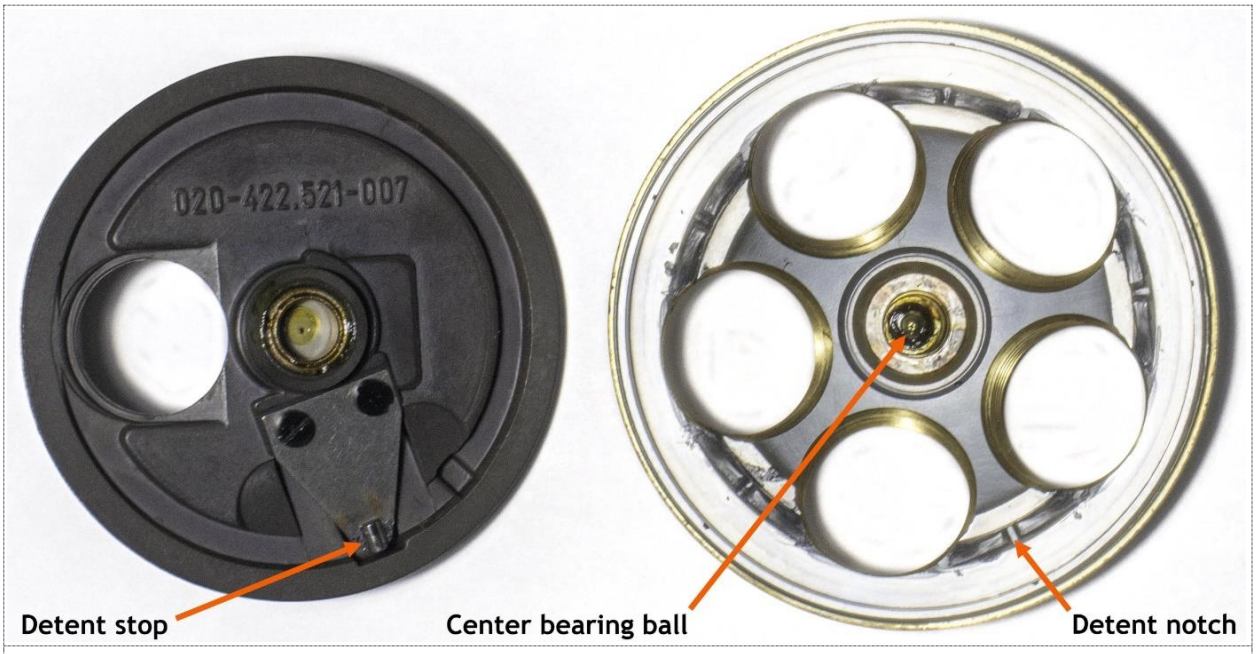

Figure 16: The insides of the turret base (left) and the turret (right) after the parts have been taken apart.

6. Clean the nosepiece from old grease.

Although the large ball bearing originally didn't have any grease, the bearing parts should anyway be cleaned. Soak the small bearing balls in a small vial with solvent (white spirit is recommended), pick them up one by one with tweezers, wipe them dry using a lint free microfiber cloth and collect them in another dry vial. Don't use tissue paper to wipe the bearing balls because it leaves a lot of paper fiber that stick to the ball surfaces.

Use pieces of cloth or cotton swabs wetted with solvent to clean the bearing races and the bearing retainer.

Clean the 4 mm center bearing ball (Figure 14 and Figure 16) and all center axle surfaces with solvent to remove any old grease.

Clean the detent stop and all detent notches (Figure 14 and Figure 16) with solvent to remove any old grease.

7. Grease and reassemble the nosepiece.

Put a blob of grease (e.g., Super Lube Multi-Purpose Synthetic Grease with Syncolon, NLGI grade 2) into the turret's hollow axle (Figure 16), insert the 4 mm steel ball, and then apply grease to the outer surfaces of the turret axle.

Apply grease sparsely to and just around the detent notches (Figure 16.)

Put the turret on the table with the objective side down. Attach the turret base all the way down over the turret axle while turning the base back and forth. Check that the turret freely turns on the turret base and check that the detent stops work as expected.

Now we are ready to assemble the large ball bearing. Put the nosepiece/turret on the table again with the objective side down.

Put one of the ball bearing races on the shiny surface along the rim of the turret base (Figure 14.) Place the ball bearing retainer on top the race. (If you wish to grease the large ball bearing, then first apply some grease both sides of the retainer.) Use forceps to put all bearing balls into the retainer holes. Gently put the remaining ball bearing race over the retainer with its balls.

Making sure not to disturb the races and the bearing balls, carefully screw the threaded locking ring on the turret. Initially the locking ring will turn easily, once it closes in over the ball bearing it will start to feel tighter. At this point, tighten the locking ring only slightly more, perhaps only 1 cm more (referring to the locking ring periphery.) Finally, secure the locking ring with the small locking screw (Figure 8.) Tighten the locking screw only lightly – its pointed tip will dig down into the turret and hold the ring locked.

From the underside of the microscope arm attach the assembled nosepiece to the microscope's nose-piece platform using the four black M3x8 screws (Figure 6.) Note that the holes for the screws and the screw heads allow for some minor sideways play of the nosepiece. With the help of special tools (an autocollimator) this may be used by professionals to precisely align the nosepiece with the microscope's optical axis. This is out of reach for us amateurs, the best we can do is to watch how the screw heads sit in the holes and try to keep the nosepiece as centered as possible when we tighten the screws.

Push the filter holder into the slot in the nosepiece and attach it with the two black M3x10 Philips screws (Figure 2 and Figure 7.)

Perform a final check that the turret still turns freely and that the detent mechanism works as supposed for all objective positions.

8. Clean, grease (if desired), and reassemble the head mount mechanism.

Clean the upper side of the nosepiece platform, the head release lever, the head collar and the three head clamps (Figure 4, Figure 5 and Figure 6) from old grease using solvent (white spirit.) Scrub the parts with pieces of cloth or cotton swabs wetted with solvent and allow the parts to dry.

If desired, use a suitable metal polish (Autosol, Peek, or similar) to remove any tarnish from the head release lever (which is made of brass.) It requires some elbow grease, but not only will the lever look like new, but hopefully the absence of metal oxides may slow down any grease decomposition. After finished polishing thoroughly wash the head release level with a brush and warm water with dish detergent. This is important to make sure that none of the abrasive polish particles remain attached and eventually fall down into the microscope objectives.

If you wish to continue with Leitz' grease approach, then apply grease to all sliding surfaces of the head release mechanism (including the underside of the head collar.) Re-assemble all parts as indicated in Figure 5 and Figure 6. The spring should be attached by one end to a pin on the nosepiece platform and by the other end to the spring pin on the head release lever. Use the three chromium plated M3x8 screws to attach the head collar to the nosepiece. Screw the screws all the way down, but don't yet tighten them, leave them just barely loose.

9. Align the collar of the head mount.

The dovetail mount on the underside of a Leitz microscope head has a very tight fit to the microscope arm's head mount, or more exactly, to the socket in the bottom of the head mount (Figure 17.) This is to ensure that the head always is steadily and reliably attached in the microscope's optical path.

Due to the narrow tolerances, the head's dovetail just barely fits through the collar and down into the head mount's socket. This means that the collar must be precisely aligned with the socket, otherwise the head will not be properly attached in the head mount. An improper head attachment can be inconspicuous, why it is a good idea to visually check every time you attach a head (or any other accessory) to the microscope's head mount. Look from the side against a bright background to check that the head completely rests on the head mount's collar

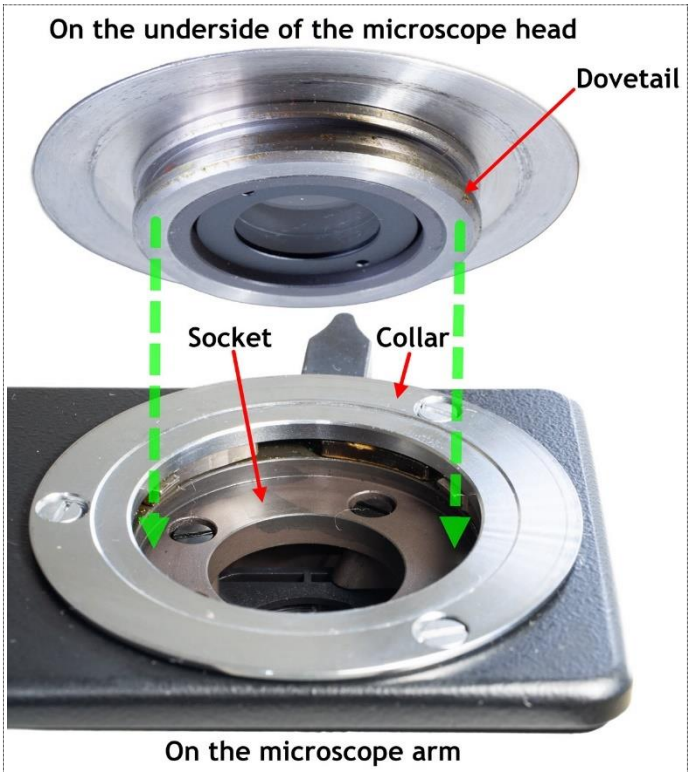

Figure 17: How the head dovetail attaches to the head mount.

and that there is no gap visible anywhere between the head's underside and the collar (see Figure 18.)

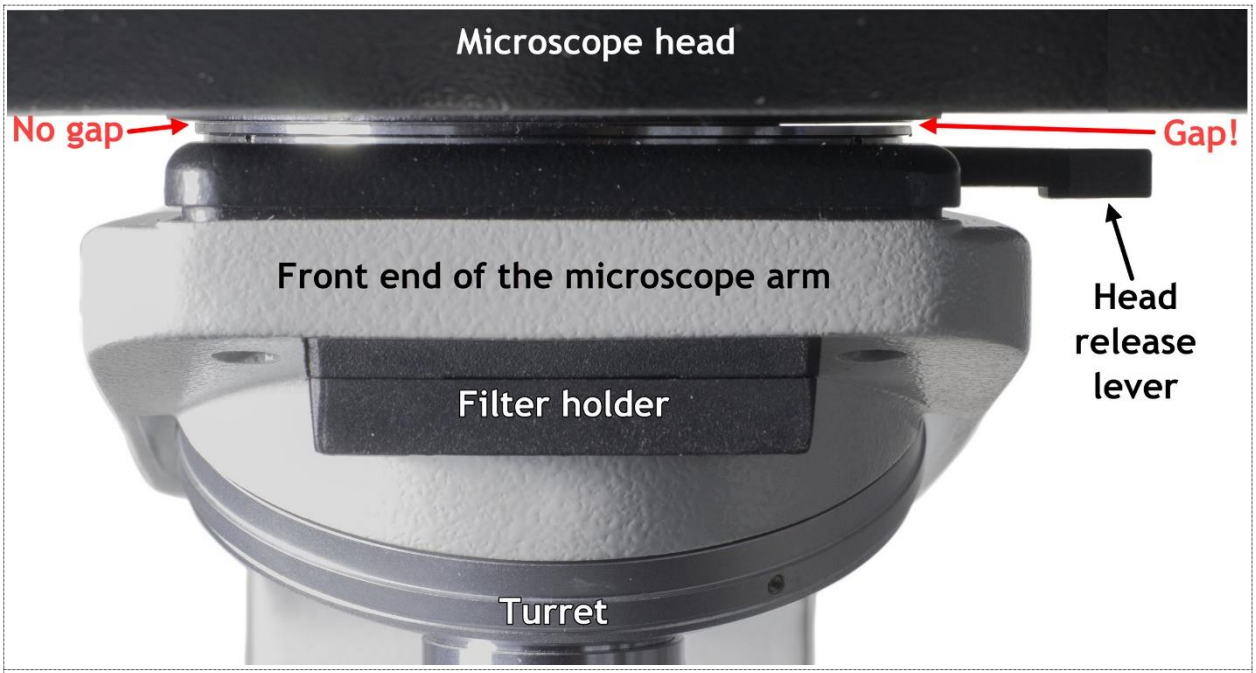

Figure 18: A small gap between the underside of the head and the collar of the microscope's head mount reveals that the head is not properly attached to the microscope. The head in this image is slightly tilted in the microscope's optical path.

If the head can't be attached to the microscope without there being a gap (which typically happens after the collar has been disassembled), the problem must be fixed by aligning the head mount's collar with the socket. The socket is fixed in the head mount and can't be adjusted, but fortunately there is a small play in the collar's screw holes which makes it possible to align the collar.

For the alignment it is a good idea to obtain an improvised alignment tool. To match the insides of the collar and the socket such a tool must be of a cylindrical shape with an outer diameter of exactly 42.0 mm. I have found that a 42 mm steel ball bearing (Figure 19) with a thickness of at least 12 mm makes a very good alignment tool, and it is not difficult to find (and inexpensive) on Amazon or eBay. The advantage with using a steel ball bearing is that ball bearings are manufactured to tight dimensional tolerances which ensures that the bearing snugly fits in the collar and in the socket.

An alternative alignment tool option is to use a piece of a 42 mm PVC pipe (Figure 20.) The disadvantage

Figure 19: Improvised alignment tool: A 42.0 mm steel ball bearing (12 mm thick).

Figure 20: Optional improvised alignment tool: A PVC pipe with 42 mm (1.65") outer diameter.

with a plastic pipe (or any other plastic alignment tool) is that it may not provide the diameter accuracy that is needed. If the pipe is slightly too thick to fit into the collar and the socket, then a 1-2 cm section at its end can be slightly sandpapered down until it fits. Wrap a 2 cm strip of sandpaper around the end of the pipe, hold the sandpaper between the thumb and the index finger and turn it back and forth to evenly reduce the diameter of the pipe's end. Remember to wash the pipe with water to remove any dust and wipe it dry before checking its diameter in the head mount. If, on the other hand, the pipe is slightly too thin, the diameter can be increased by evenly applying regular transparent office tape around the end. With a plastic pipe, it is also important to ensure that the end is cut precisely perpendicularly.

The collar alignment should be done to conclude the head mount maintenance after the mount has been completely reassembled.

Start the collar alignment by barely loosening the three screws that attach the collar (Figure 4) – it should now be possible to move the collar sideways as far as the play in the screw holes allows, but the collar should still remain sitting rather tightly on the microscope's nosepiece platform.

Push back the head release lever as far as it goes and keep holding it there to ensure that the head clamps (Figure 4) are disengaged. Put the alignment tool all the way down into the bottom of the socket (Figure 23.) Thanks to the tight tolerances this forces the collar to align with the socket. Complete the alignment by tightening the three screws in the collar. Remove the alignment tool from the head mount and release the head release lever.

Figure 21: The "naked" nosepiece platform with the socket for the microscope head.

Figure 22: The head mount completely reassembled (except the collar screws.)

Figure 23: The head mount with the alignment tool (42.0 mm ball bearing) inserted.

Check that the head attaches properly to the head mount. Look from the sides to be sure that the head is completely seated on the head mount, particularly that there is no gap between the head and the collar (Figure 18.)

It is possible, albeit onerous, to align the collar with the socket without the help of an alignment tool by only using the microscope head. The problem is that for obvious reasons the collar screws can't be tightened while the head is attached. The procedure would be to remove the head and initially only very lightly tighten the collar screws. Then the head is attached, which will force the collar into alignment. After gently removing the head, the collar screws can be fully tightened to preserve the alignment. The trick is to make the initial tightening of the collar screws just loose enough to allow the collar to move sideways as much as is required to give place for the head, while at the same time the screws must be tight enough so the collar isn't pushed out of alignment when the head is removed. It can be done, but it will probably require several trials to get the initial screw tightness just right.