Leitz EF 40/0.65 objective (160 mm tube length) with stuck spring-loaded retraction

Introduction

Many objectives with magnifications higher than 10x have a spring-loaded tip that retracts upward into the objective barrel in case the user accidentally turns the microscope's focus control too far down and into the object glass with the specimen. It protects the sensitive front lens (and the observed specimen) from damage and has probably saved innumerable expensive objectives from ending up in the landfill (or on the used market…) An often-encountered problem with these objectives is that the spring-loaded retractable tip may become sluggish or even stuck. This of course nullifies the desired function. The reason for the sluggishness is that immersion oil has penetrated into the mechanism and then progressively hardened. The problem is most often seen with 40x objectives (Figure 1) as these typically are next in turn when someone after having used an oil immersion objective forgets to wipe off the oil drop from the object glass before rotating the next objective into position thereby contaminating its front lens. It is still a mystery how the oil then finds its way into the spring-loaded retraction mechanism where, if undetected, it eventually solidifies.

Figure 1: A Leitz EF 40/0.65 objective for 160 mm tube length.

Figure 2 and Figure 3 illustrate how the spring-loaded retraction mechanism looks after disassembly.

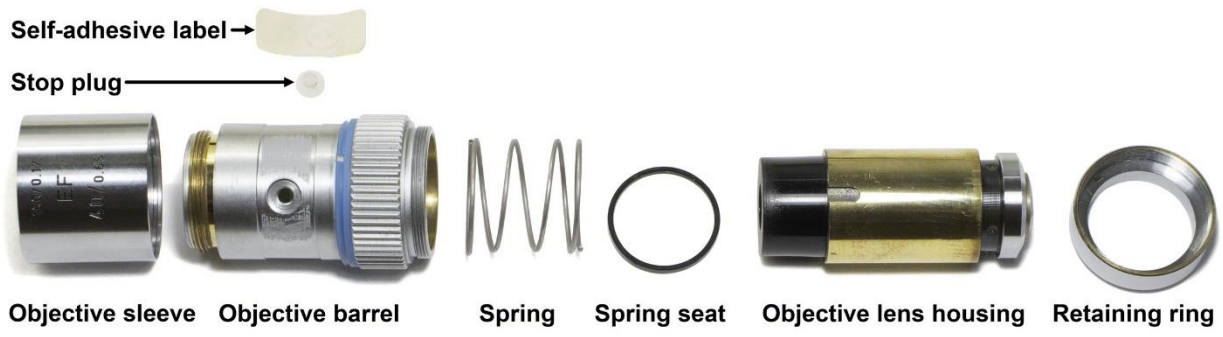

Figure 2: The spring-loaded retraction mechanism taken apart.

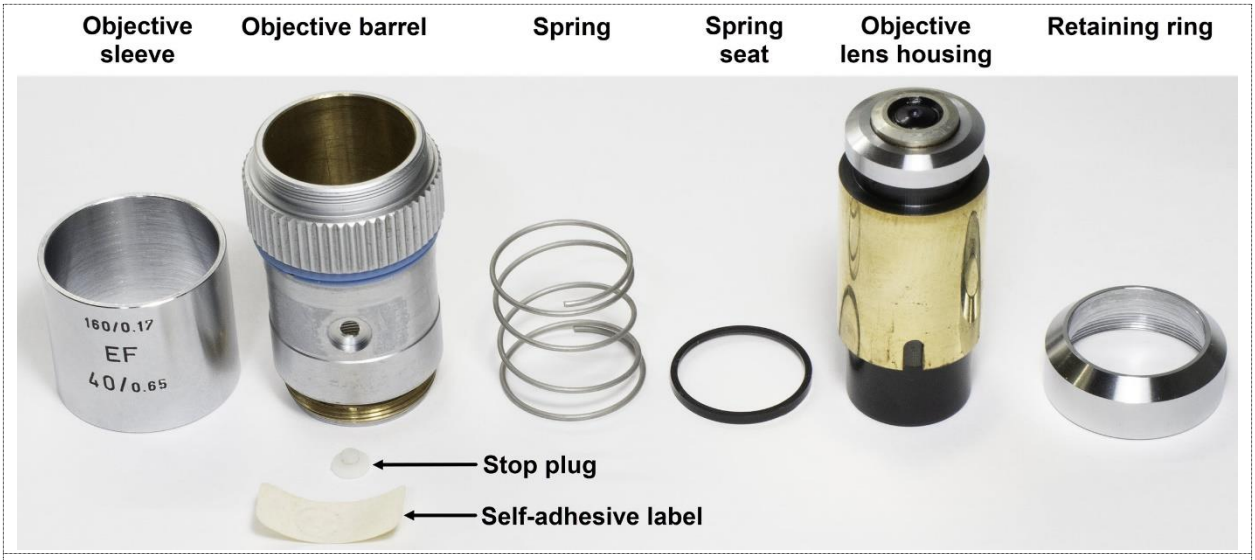

Figure 3: The spring-loaded retraction mechanism taken apart.

As can be seen in these images, the objectives strictly speaking do not have a spring-loaded retractable "tip" of "front", it is actually the entire objective lens housing that retracts into the objective barrel.

Scope

These maintenance notes describe the disassembly, cleaning, and reassembly of a spring-loaded retractable Leitz EF 40/0.65 objective that has become sluggish. The notes should also be (with some obvious modifications) applicable for other Leitz objectives from the 160 mm tube length era.

Maintenance Notes

1. Remove the objective sleeve from the objective.

Figure 4: The objective barrel after the sleeve has been removed.

Get a good grip with your fingers around the objective's knurled ring (Figure 1) and pull off the objective sleeve over the objective's mount (Figure 4.) The sleeve is attached to the plastic color code ring and may require a good pull to release. (Be prepared for the jerk so you don't drop the objective!) Occasionally the plastic in the color code ring may have aged or become worn out; in such cases the sleeve may be only loosely attached. (As an aside, this may be risky if you unscrew the objective from the microscope while holding it by the sleeve – if the sleeve unexpectedly releases, you may drop and damage the objective.)

2. Remove the stop plug from the objective barrel.

Remove the self-adhesive label from the side of the objective barrel (Figure 4). The label may be more or less loose due to aged glue. The label covers a small white plastic stop plug (Figure 5.)

Use a very small screwdriver (with a thin tip approx. 1.5 mm wide) to carefully pry off the stop plug (Figure 6) below the label.

Figure 5: The objective barrel after the label has been removed.

The tip of the plug reaches down into a short groove in the side of the objective lens housing (Figure 3.) This limits the how far the lens housing can retract into the barrel and also prevents the lens housing from rotating in the barrel.

Figure 6: The stop plug.

3. Remove the retaining ring.

The retaining ring holds the objective lens housing securely in the objective barrel. It is attached to the objective barrel front by threads and requires considerable force to release. Gripping with the fingers will probably not be good enough but try anyway with a wide rubber band wrapped around the retainer ring to increase the friction. Trying to release the ring with pliers is not recommended as it may cause damage. However, with two rather inexpensive small strap wrenches with rubber straps (Figure 7) the ring should be easy to gently unscrew without damage.

Figure 7: A small strap wrench, in this case wrapped around an eyepiece barrel.

Wrap one of the strap wrenches around the objective's knurled ring and the other around the retainer ring. Tighten the straps and release the ring by turning the wrenches in opposite directions. Unscrew the ring carefully so the spring doesn't uncontrollably shoot out the lens housing from the barrel. Gently pull out the lens housing from the barrel (Figure 8.)

Figure 8: The lens housing removed from the objective barrel.

Remove the black plastic spring seat and the spring from the inside of the objective barrel.

Use pieces of cloth or cotton swabs wetted with solvent (white spirit) to clean all surfaces from any oil contamination. Protect the lens housing from excessive wetting by the solvent.

4. Reassemble the cleaned objective.

Put back the spring into the objective barrel. If one end of the spring is wider, put the spring back with the wider end first.

Put the spring seat (Figure 9) over the spring in the barrel. The slanted side should face the spring.

Figure 9: The plastic spring seat.

Carefully push the lens housing against the spring in the barrel while lining up the groove in its side with the barrel's stop plug hole (as in Figure 8.) Once the groove is visible just below the stop plug hole loosely attach the retainer ring to keep the lens housing in the barrel (Figure 10.) Carefully insert the stop plug while very slightly moving the lens housing back and forth to align the groove with the stop plug. Once the stop plug is fully seated attach a new self-adhesive label over it. Cut the label to be small enough to fit within the shallow groove on the side of the barrel (refer to Figure 4.)

Figure 10: The lens housing groove slightly off sideways when viewed through the stop plug hole.

Tighten the retainer ring as tightly as possible with the fingers only.

Check that the spring-loaded retraction works as expected.

Reattach the objective sleeve (make sure to turn it the proper way) over the barrel and to the color code ring. Check that the sleeve doesn't come loose too easily from the color code ring. If it does, apply two very small drops of solvent based hobby cement (glue) to opposite sides of the color code ring before attaching the sleeve. Be careful to avoid that any of the cement penetrates between the color code ring and the barrel before it hardens. The glue should only attach the sleeve to color code ring and must not prevent the free rotation of the sleeve.