

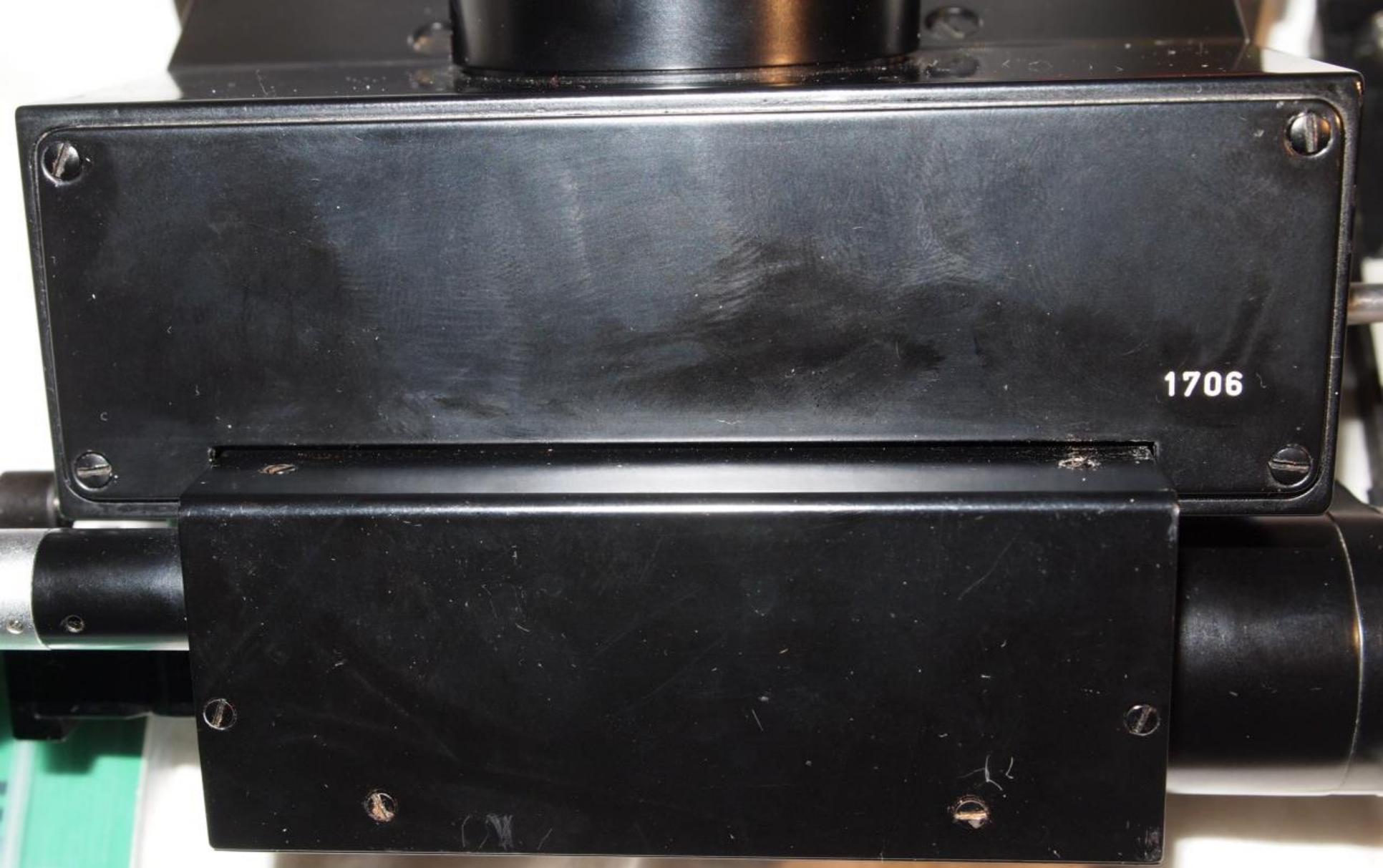
# Repair of the Bertrand Lens Focus Control Wire Leitz Orthoplan FSA-50 Pol-Photo Tube

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March 01, 2014

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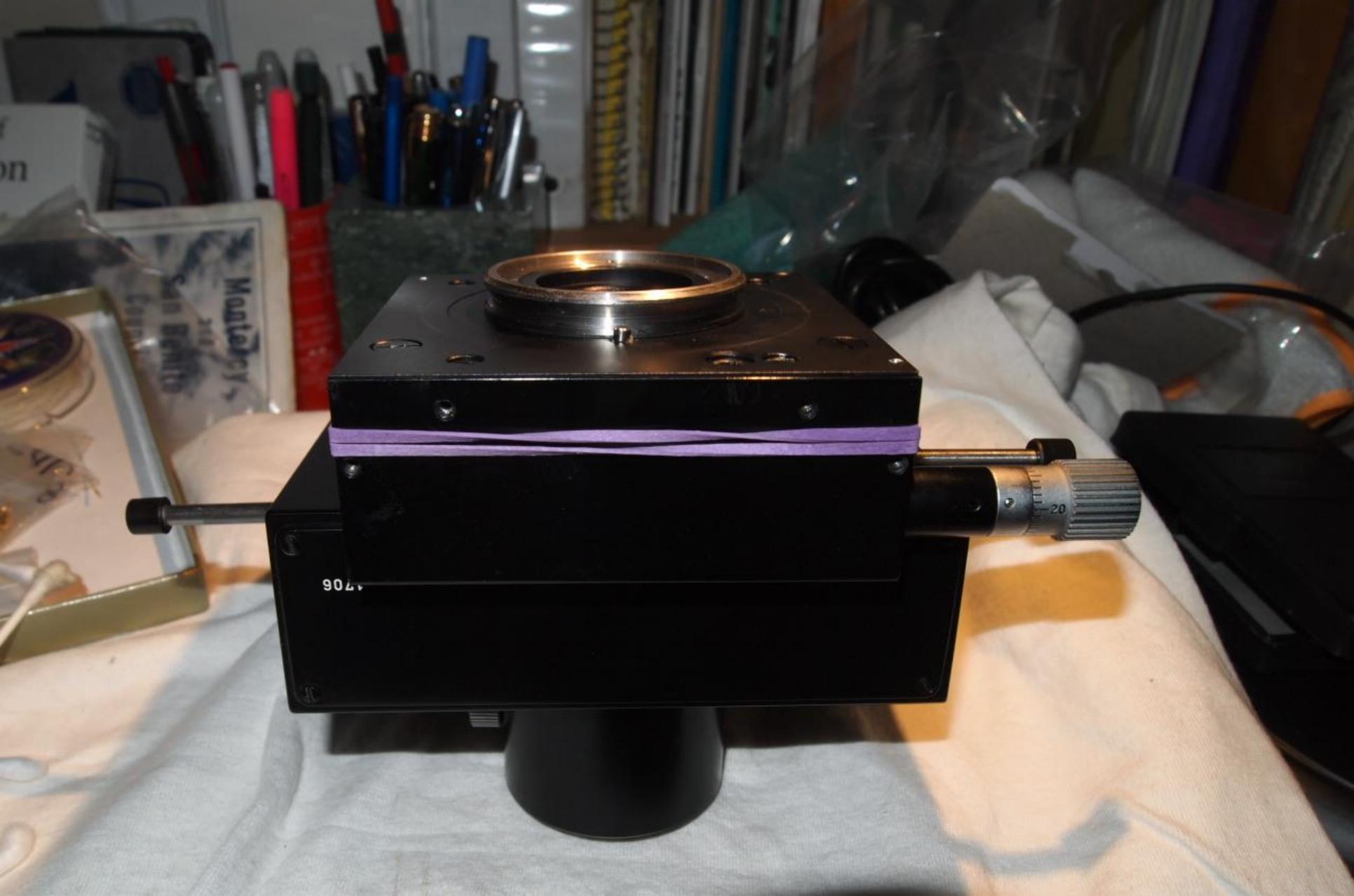


Tube on clean cotton cloth, ready for repair. Tools, cleaning supplies, and magnets at the ready. Before working, take a trip to your local camera shop to get lint-free cleaning supplies. Have a can of compressed gas for blowing off dust and lint. Make sure it is safe for coated microscope lenses and parts.



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Back of the tube showing upper and lower covers. The lower cover is held on by six screws. The upper cover is held on by four screws. The lower cover has a lip that fits under the upper cover, so remove the upper cover first.



I use rubber bands to hold on the back cover and keep the springs retained. Once secured, my hands are free to deal with the cover screws easily. Don't lose those screws!!



There are three springs resting at a right angle to the back of the lower cover, so hold the cover in place while removing the screws. Rubber bands can be used, so you have both hands free to work.



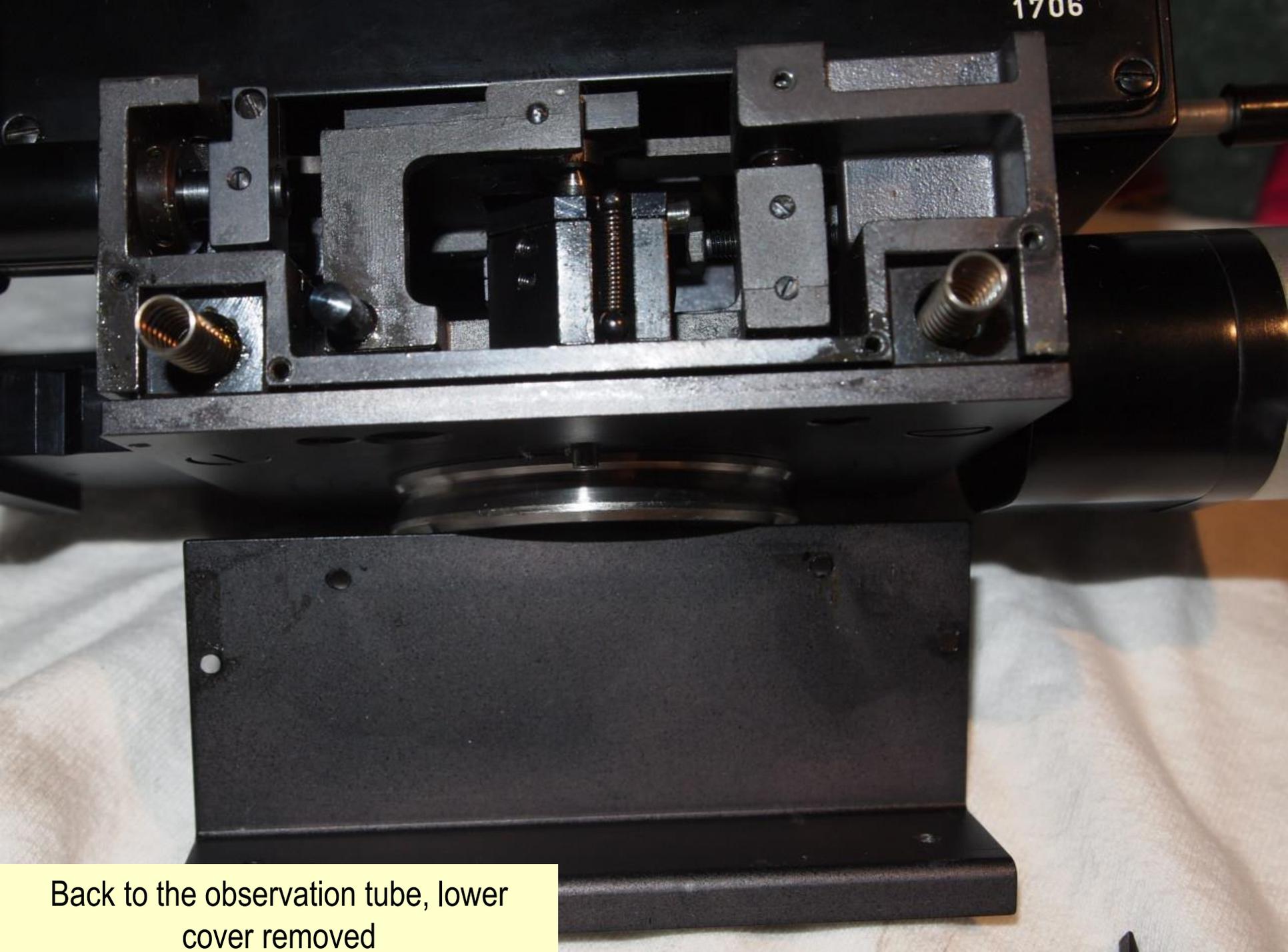
Tip up the cover to remove it, slowly releasing the spring pressure. The outside larger springs put pressure on the analyzer drum slide rollers. The little spring with the black cap is for the swing-out Bertrand lens. The analyzer drum was left in place here, to help orient the reader, but normally take it out (and the eyepieces) before beginning work.



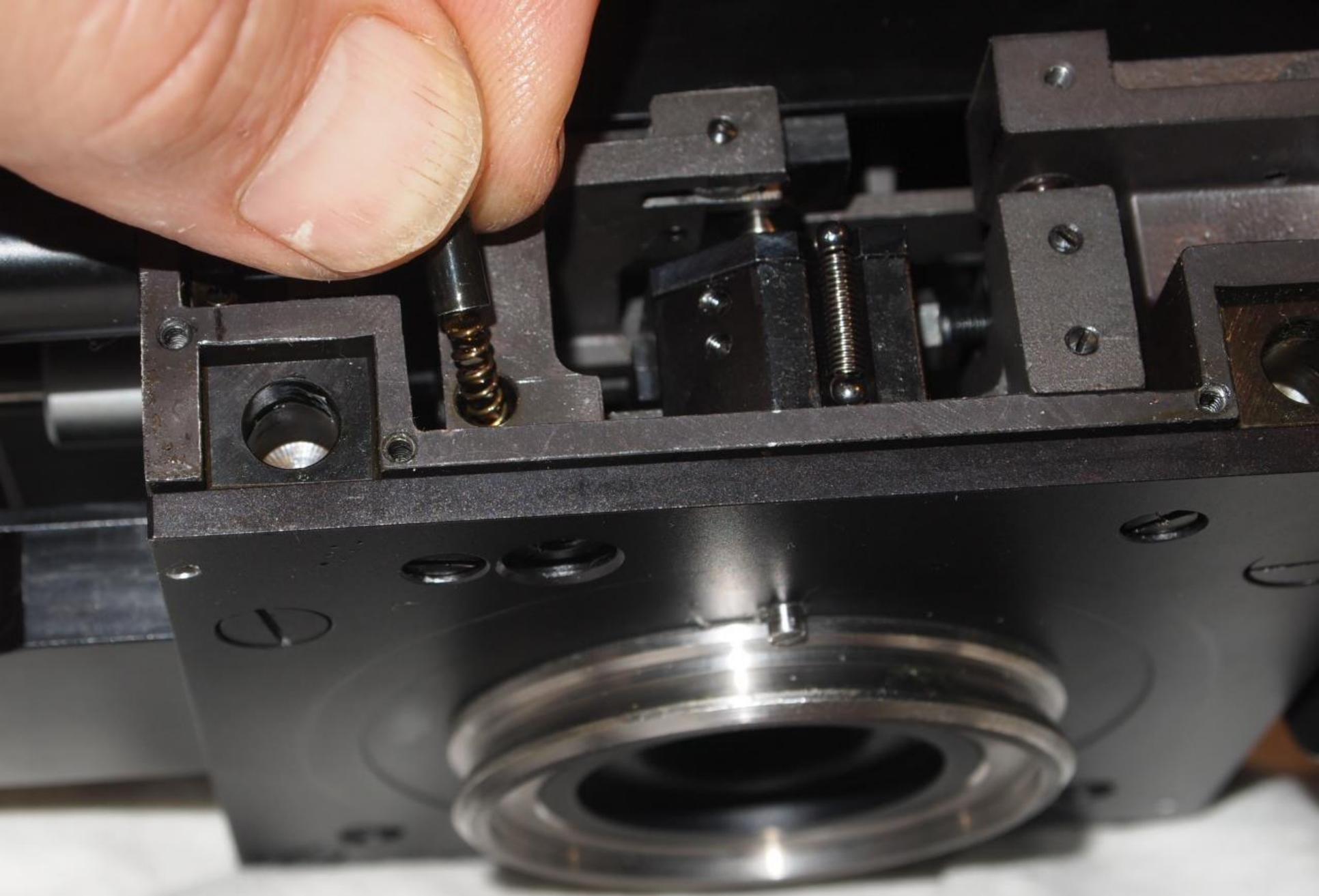
The analyzer retention plate is removed in order to slide out the assembly. This poor little scope has not been in the greatest of environments, as one can see by the corrosion on the retention screw, but it was manufactured in 1982, so we can't be too critical.



This is a good time to inspect and clean the analyzer.



Back to the observation tube, lower cover removed



The spring (with cap) for the swing-out Bertrand lens carrier.



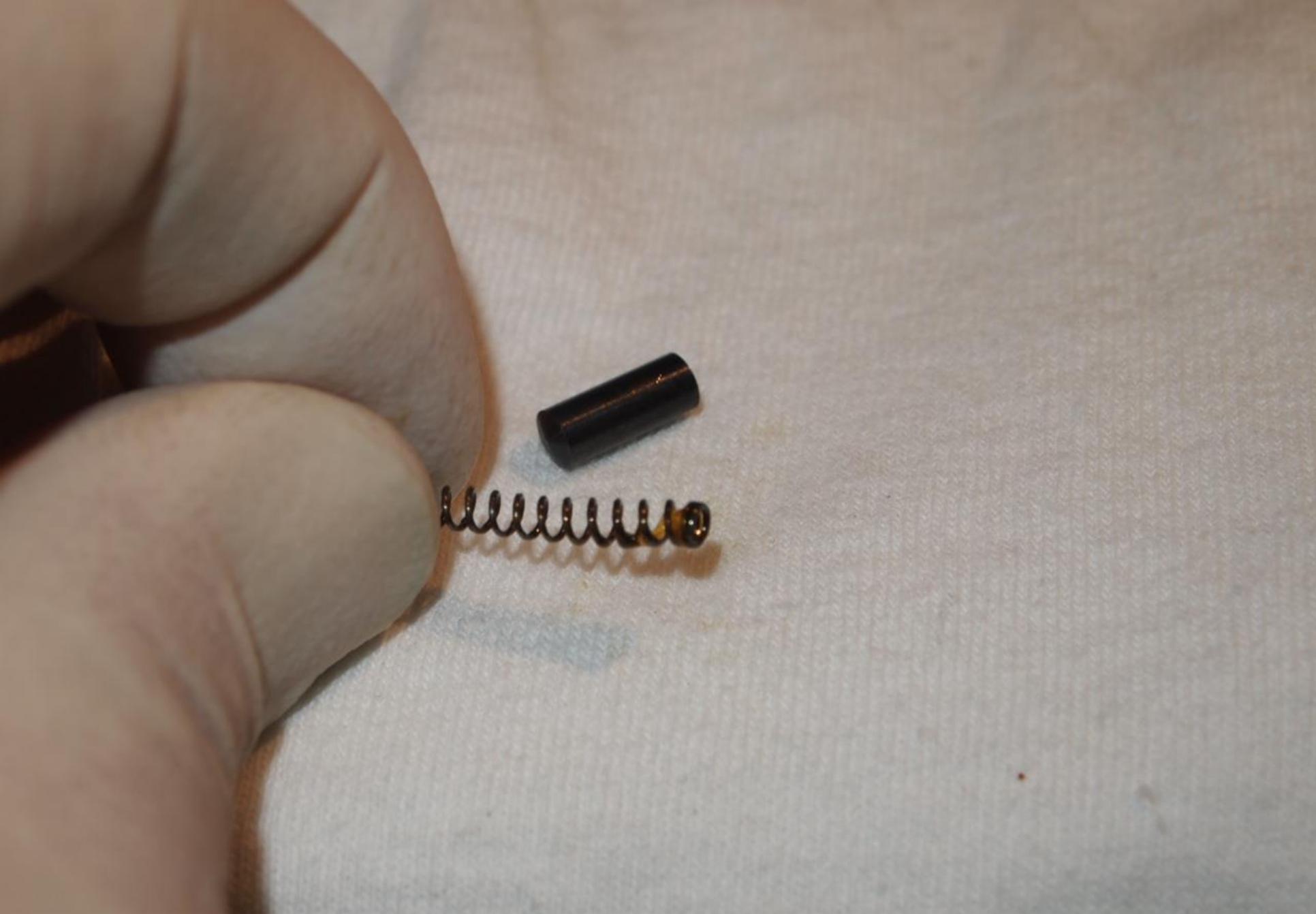
Time to put on nitrile gloves and begin the cleaning process to remove old sticky oil.



This is what the magnets are for. You do not want to lose any of the little screws or springs. This is also why I work on clean, white, cotton cloth. I use a separate magnet for the screws of each cover, plate, or mechanism I remove. Another option, if repairs are more complicated, is a piece of sticky paper cut into the shape of the object, as if all it's walls and top were folded down, like a cardboard box before it is assembled. Each removed part is placed on the sticky pad in the exact position from where it was removed. No more visual confusion about what goes where!



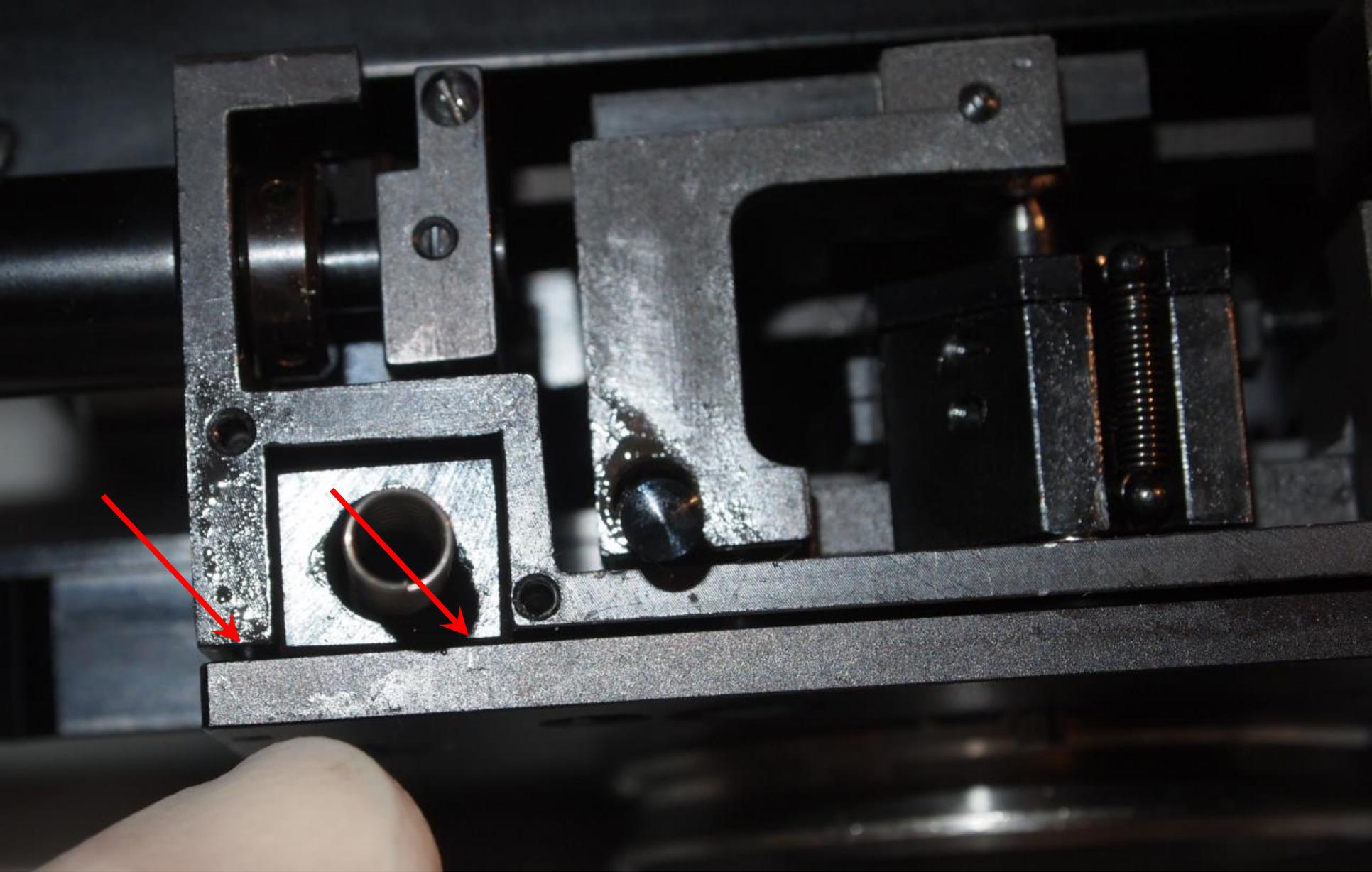
Spring cleaning, very punny! I am using IPA to clean, but not near any of the coated optics! Methylated spirits are death to those. Leitz recommends xylene for cleaning. I do use xylene, but in a fume hood, never indoors where I live. As long as you are in the tube, use premium-quality lens cleaner and tissue to remove any oil fogging etc. that might be on the optics. Use gentle pressure and keep changing the tissue. The rule on optics is to clean them as little as possible, so as to preserve the coatings. For non-optical items, repeat, repeat, repeat, until they are clean.



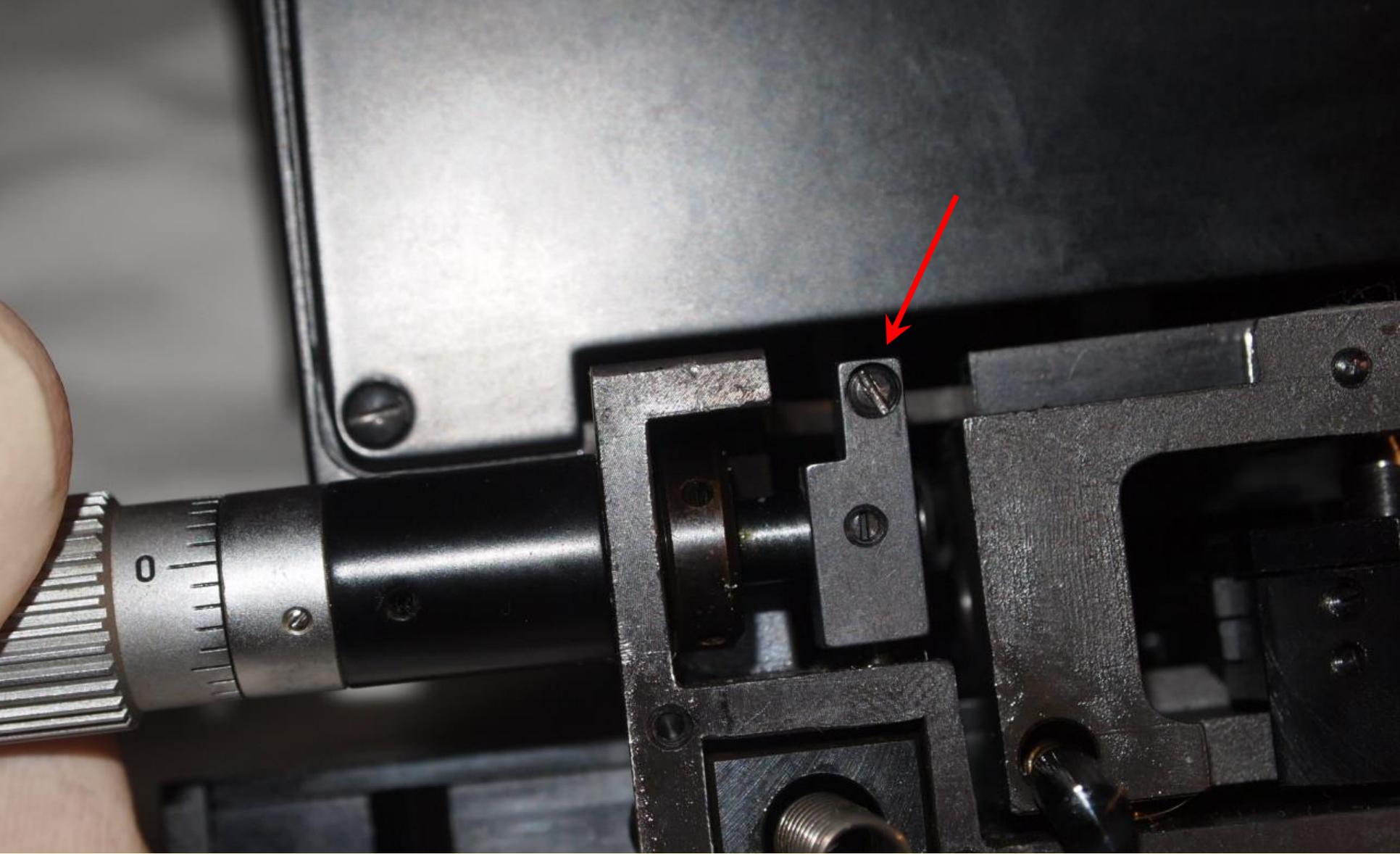
Sticky old oil crud- it's like glue!



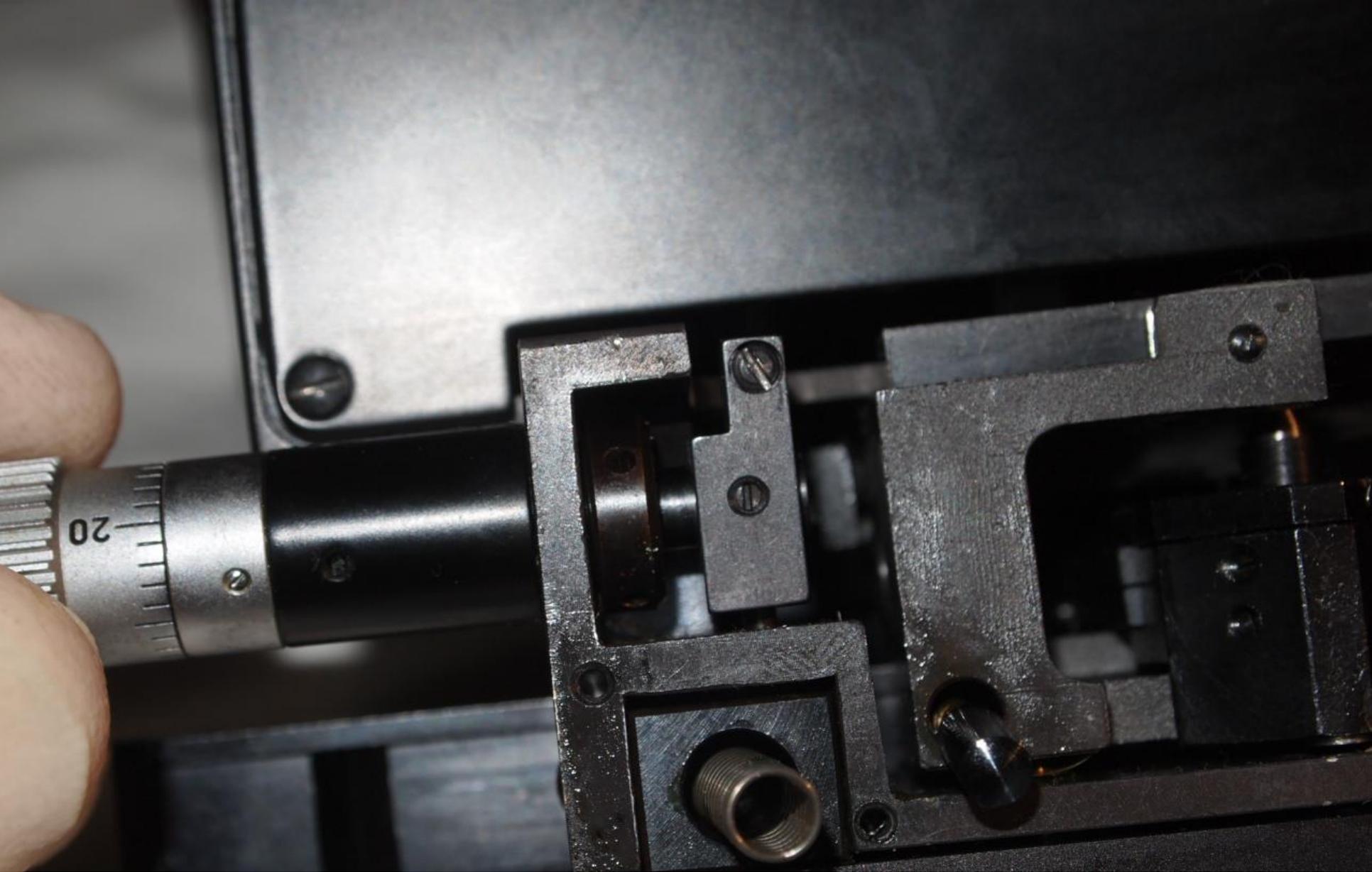
Looks like bearing oil, not microscope grease.



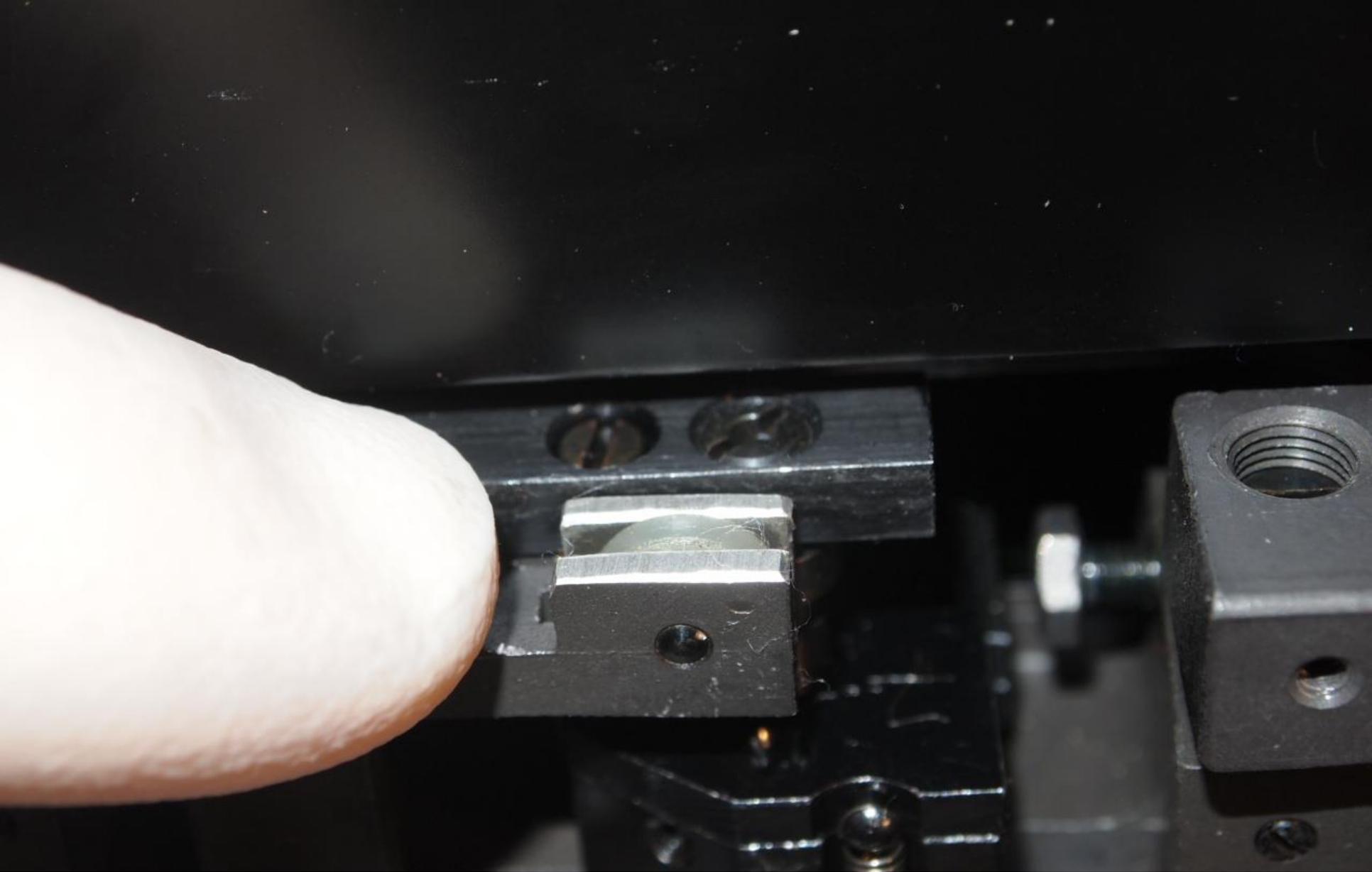
There are some serious fit and alignment problems here. The slider roller blocks are being used to prop up (align) the tube base plate!



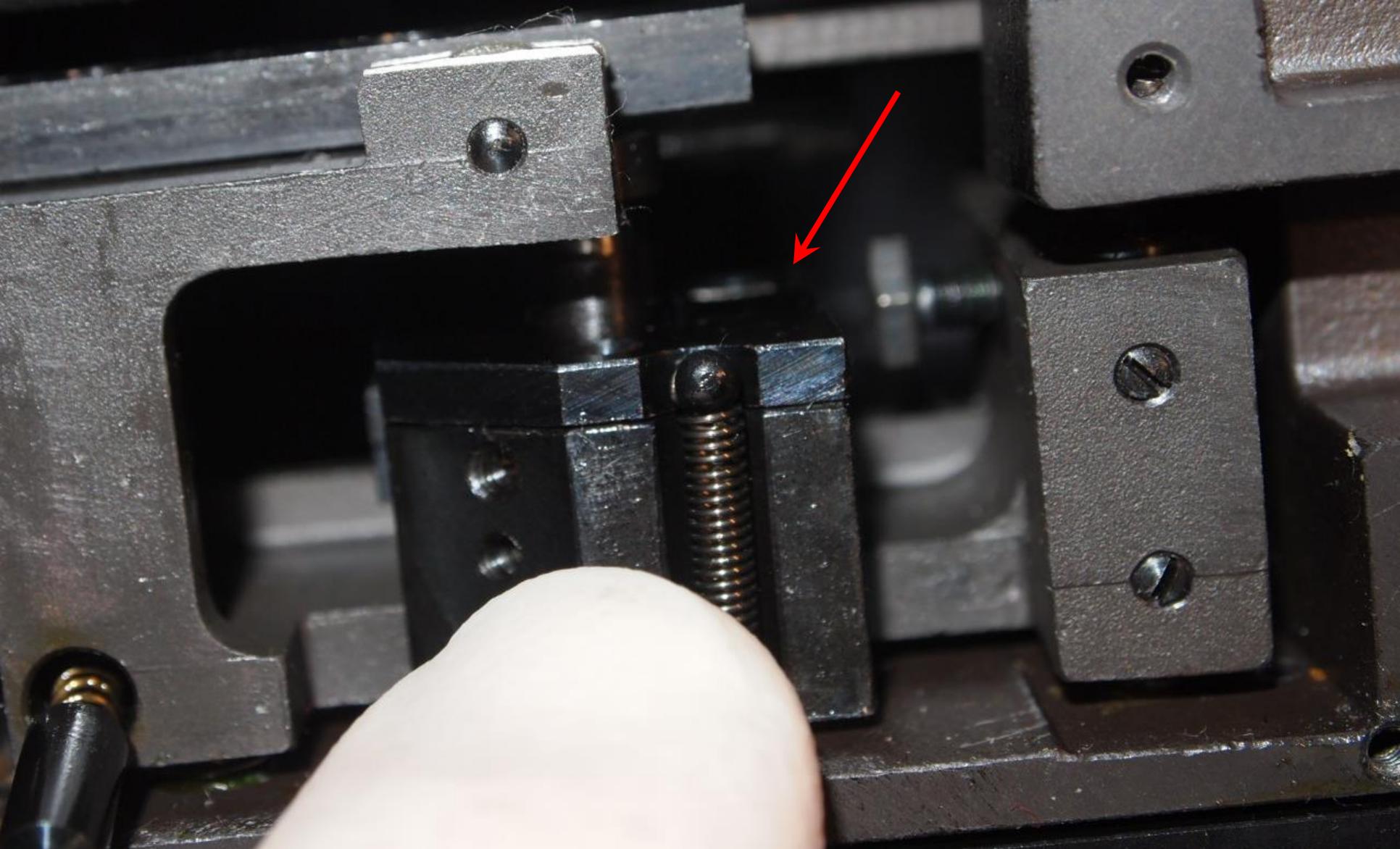
The Bertrand lens focus is not working because the control wire is broken – it's also no where to be found! Someone's been messing around in here. The wire used to be clamped by the top (larger) screw (arrow) on the retention plate.



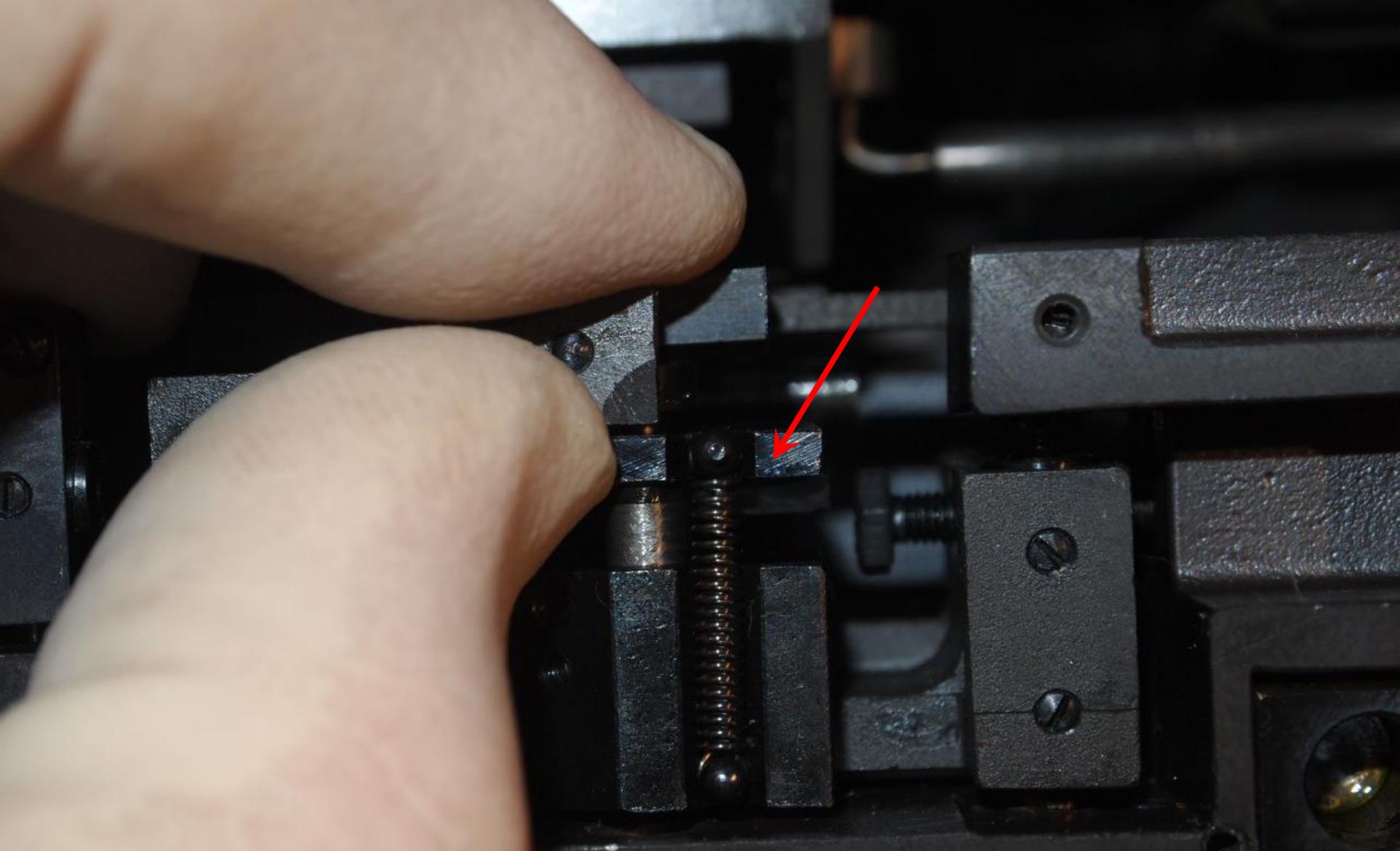
When you turn the adjusting knob, the wire retention plate moves to the left and right. The zero position is all of the way to the right.



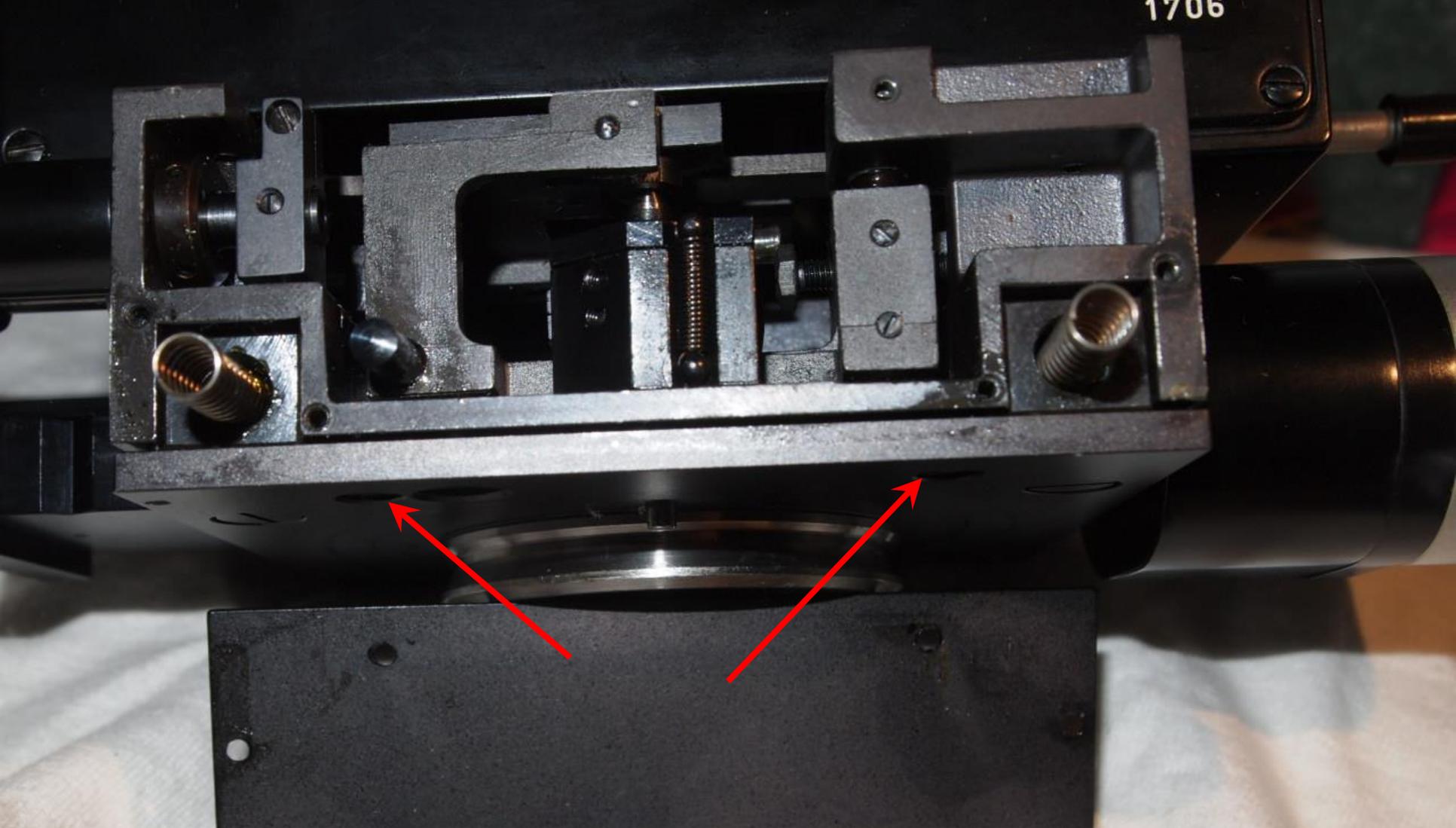
The wire runs over a little pulley and down to the focusing block below.



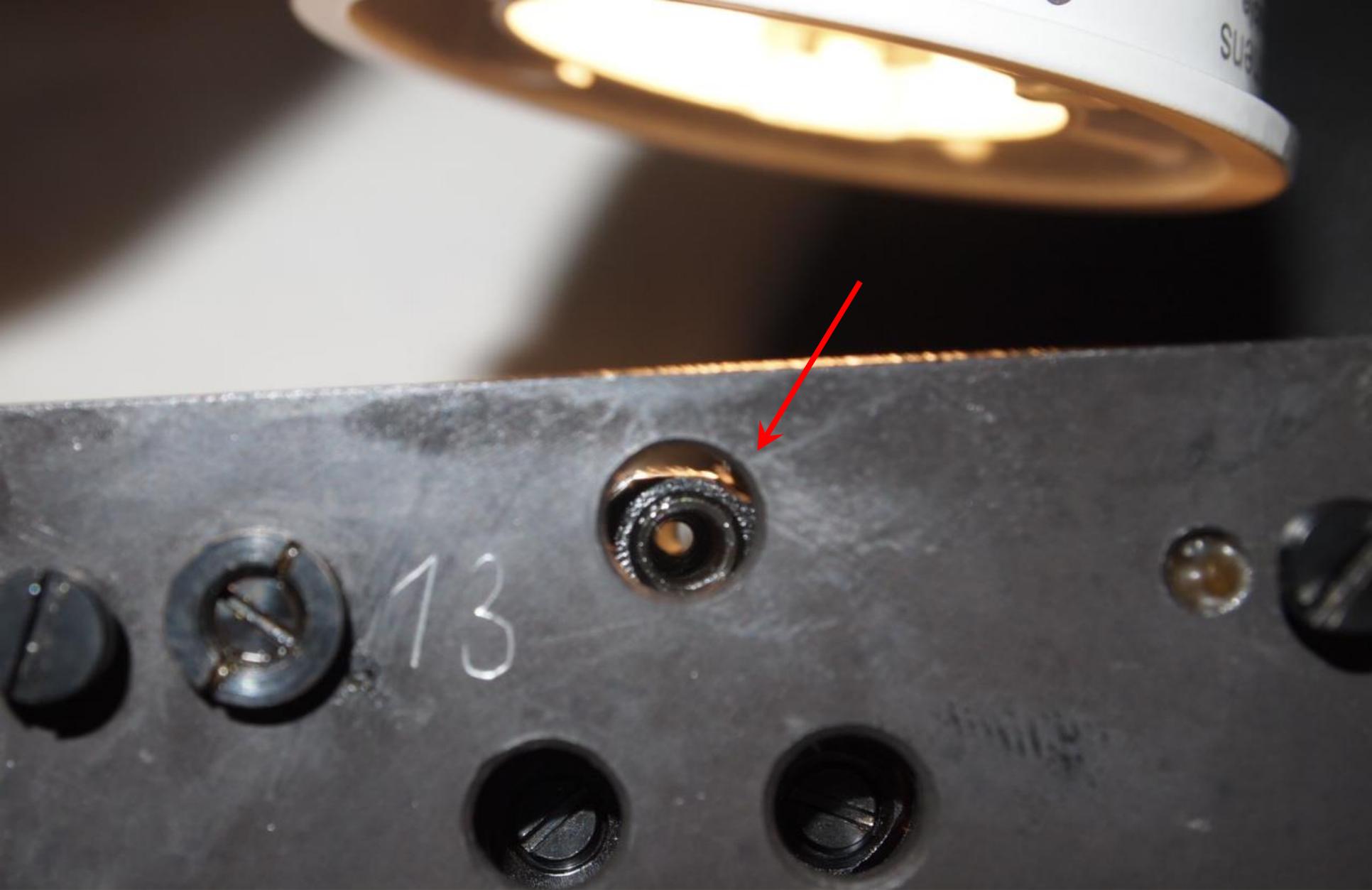
The focusing block moves up and down on a guide rod. Oil gets sticky over time, and someone forced the adjustment knob. It does not take much pressure. This broke the wire. Who needs conoscopic interference analysis anyway!?



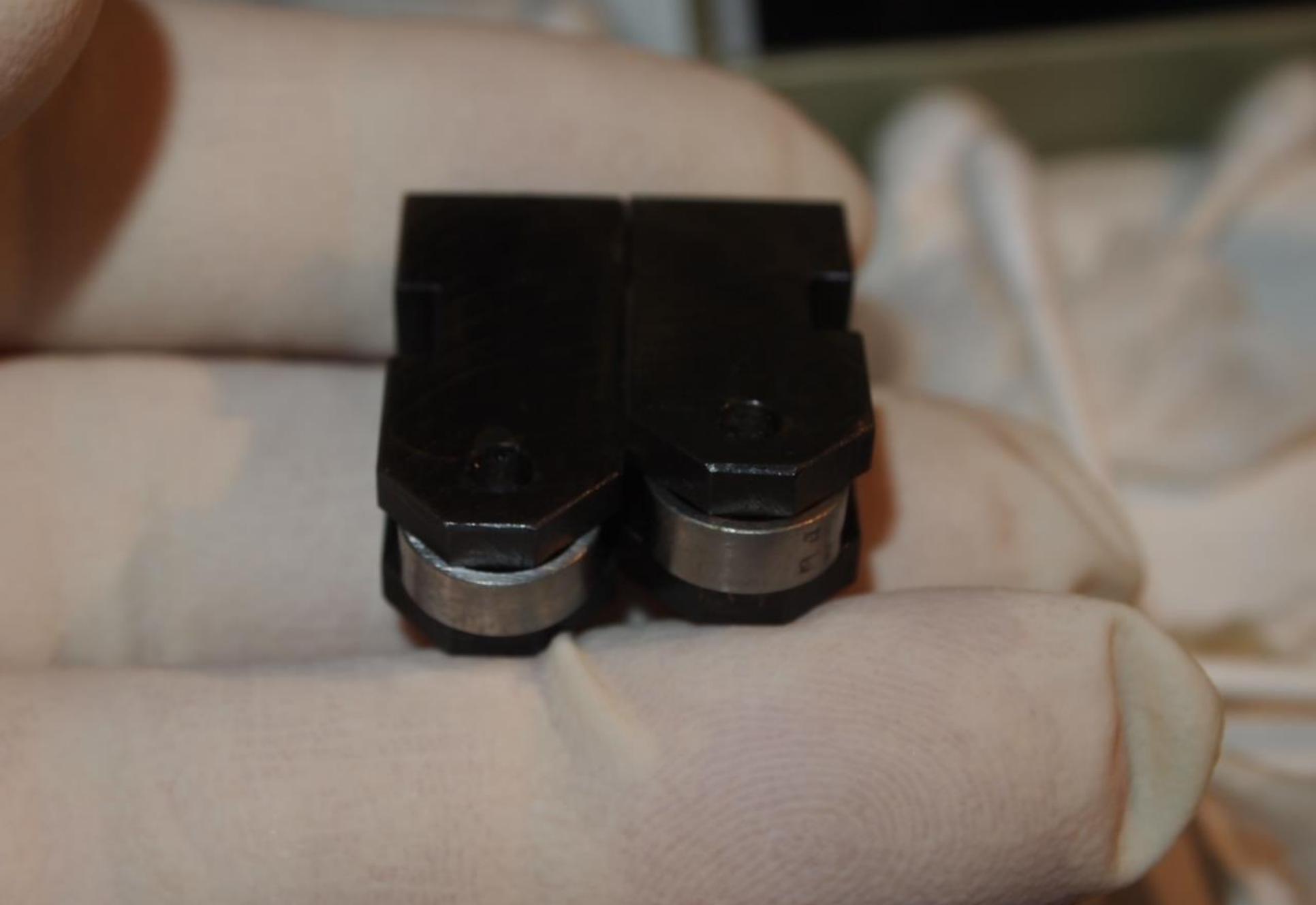
A tiny drop of xylene (no drips!) is used to dissolve the gunk and then new microscope oil is dabbed on. As I said, I never use methylated spirits around optics. It takes a few repetitions to get the block rods (plungers) moving freely.



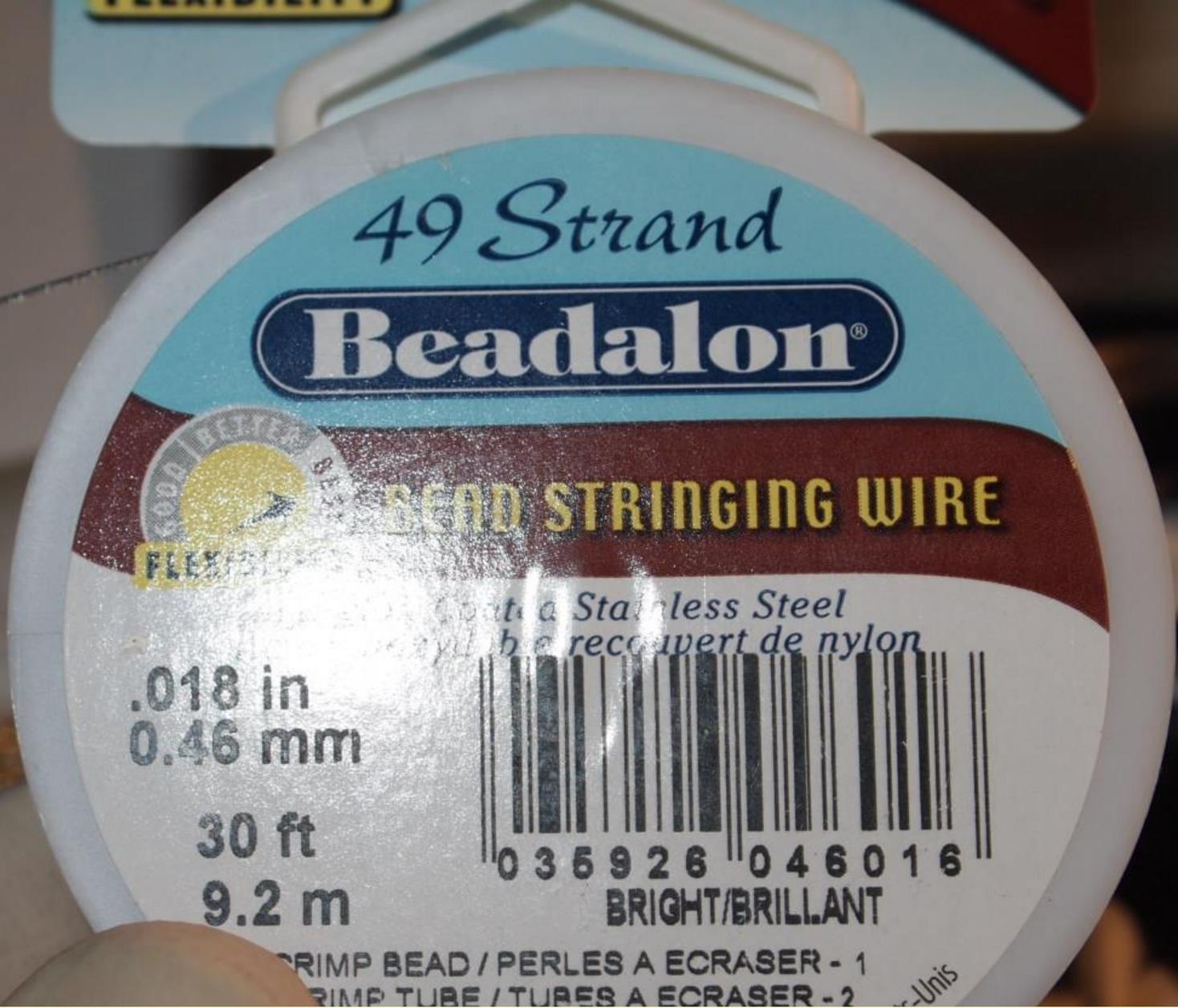
In order to replace the focusing wire, the tube base (mounting) plate has to be taken off by removing four smaller-head screws. This is serious stuff. Optical alignment may be effected and will have to be fixed later. There is no way to do the repair properly without removing the base plate.



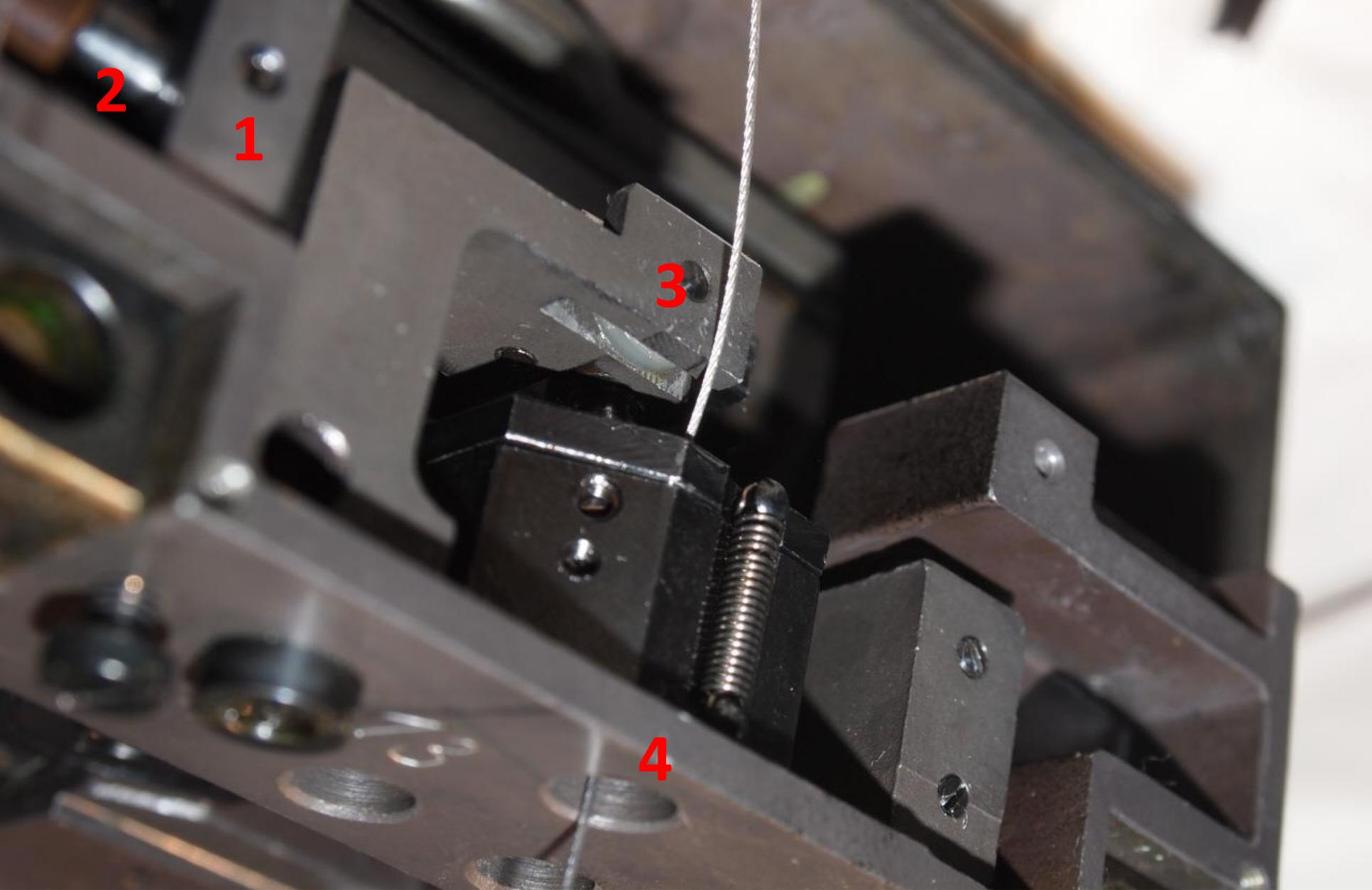
The base plate is off and one can see the bottom of the guide tube. Why this is important will be clear in the next few slides.



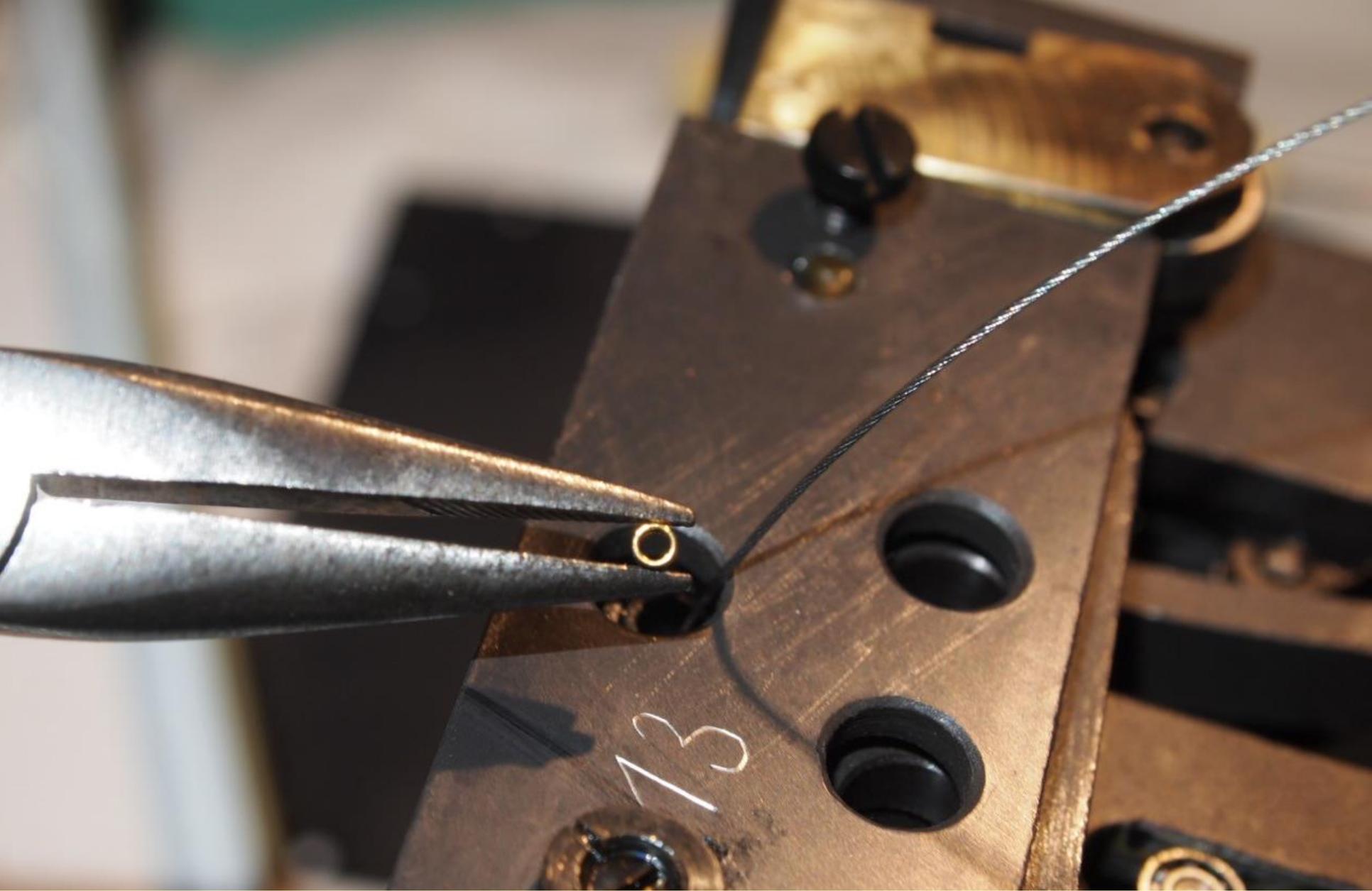
This is a good time to clean the analyzer guide rollers.



I am going to use jeweler's beading wire to replace what has been lost. I also plan to use a 14-K gold crimp at the end of the wire. I love this wire.



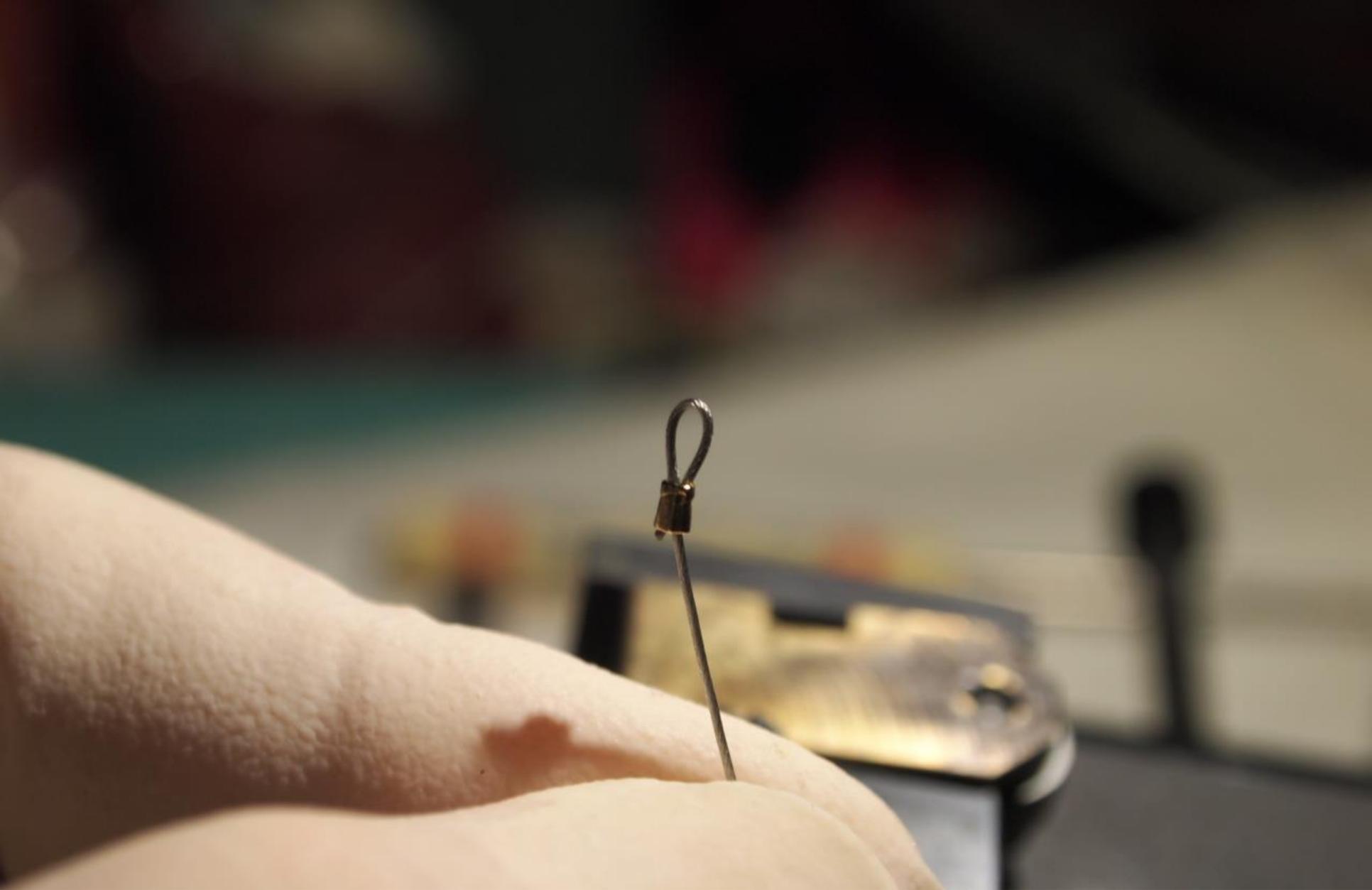
A wire runs from the clamping block (1) at the end of the adjustment actuator (2), over the pulley (3), and down through the focus block rod (4).



Here is the wire protruding from the bottom of the tube assembly and a size-2 crimp tube destined to keep it in place. I double the wire over.



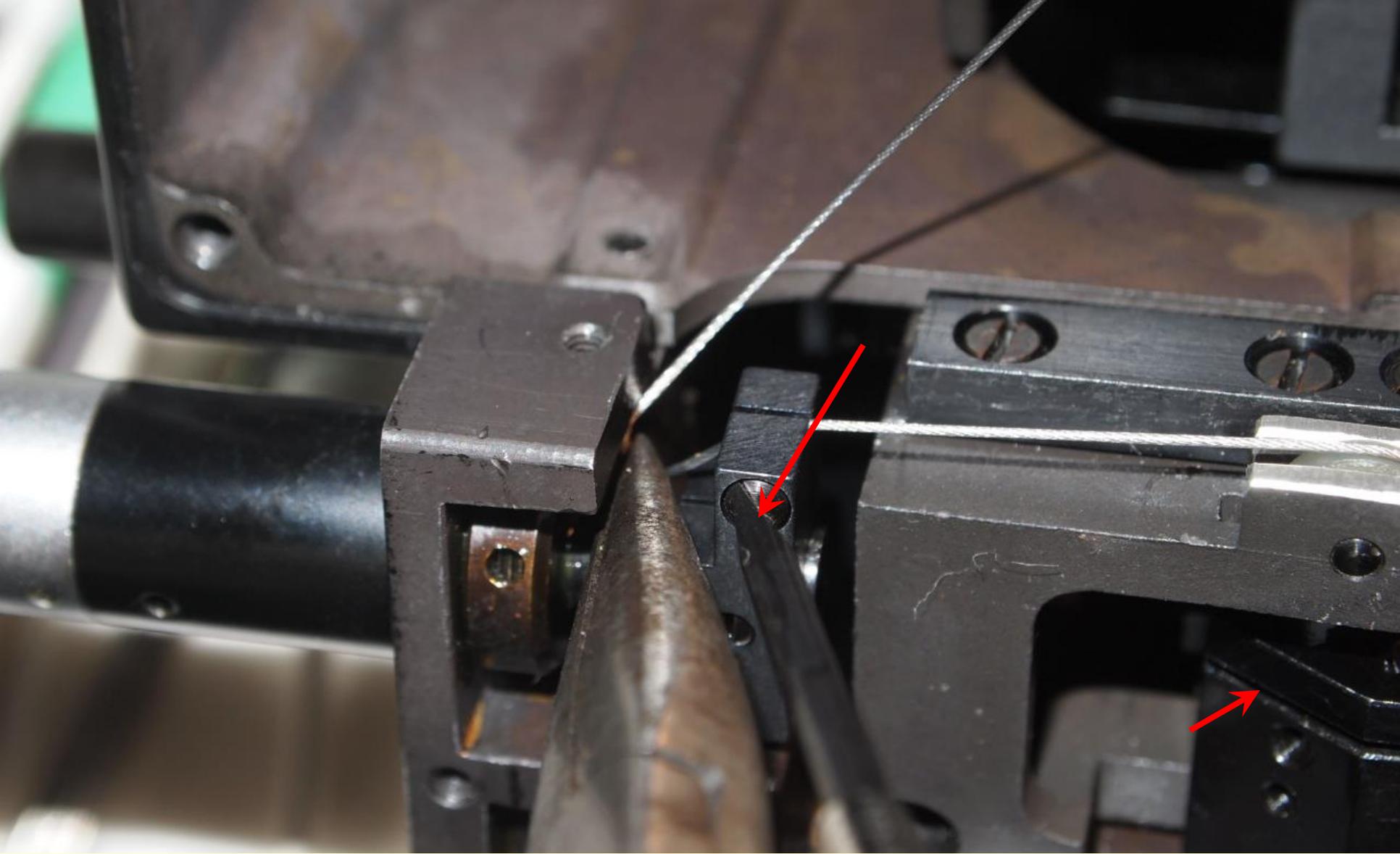
The crimping tool is available where jewelry beading supplies are sold.



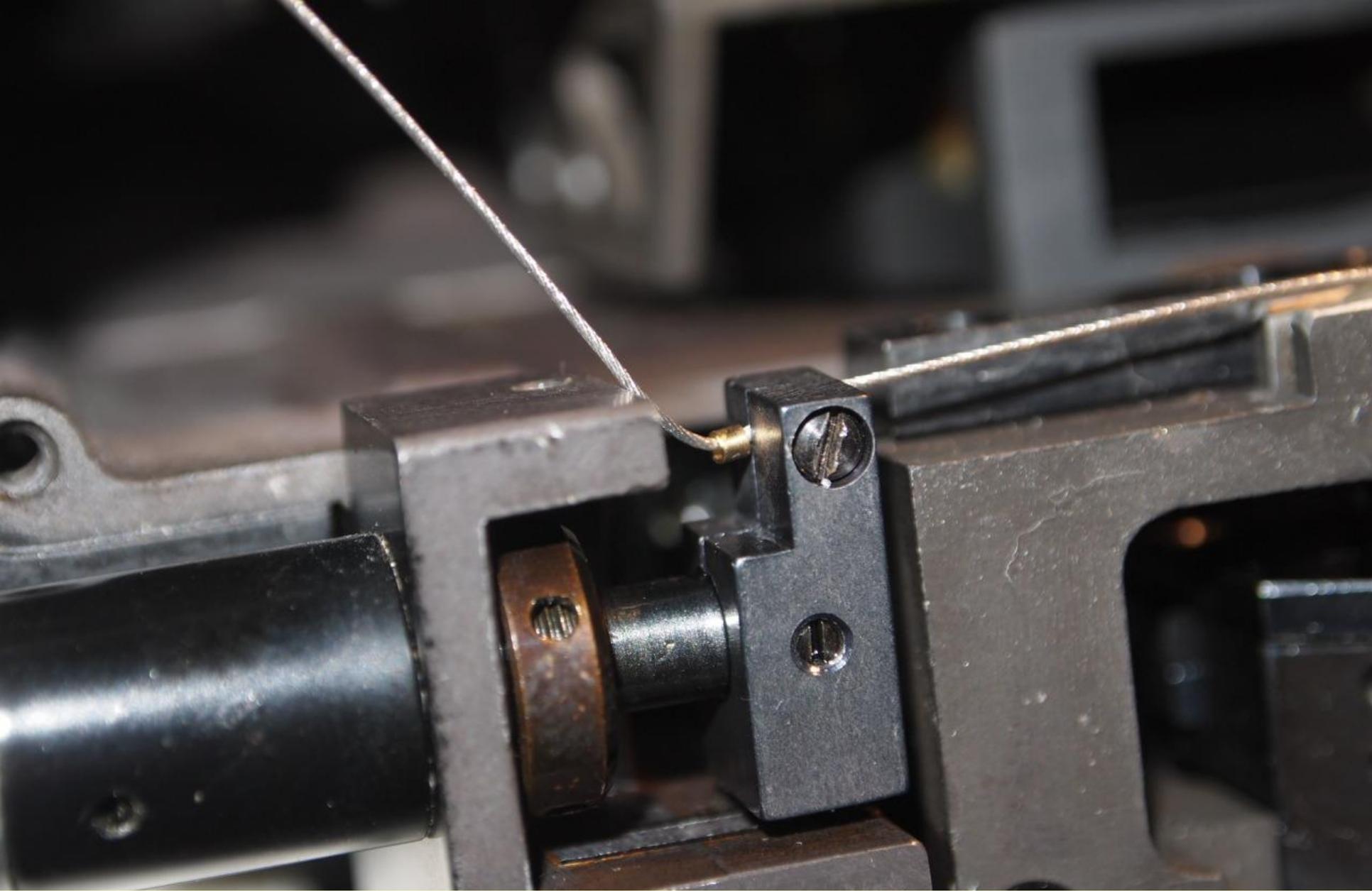
This is the bottom of the wire. It will sit inside the focus block tube and pull up on it as the actuator is turned.



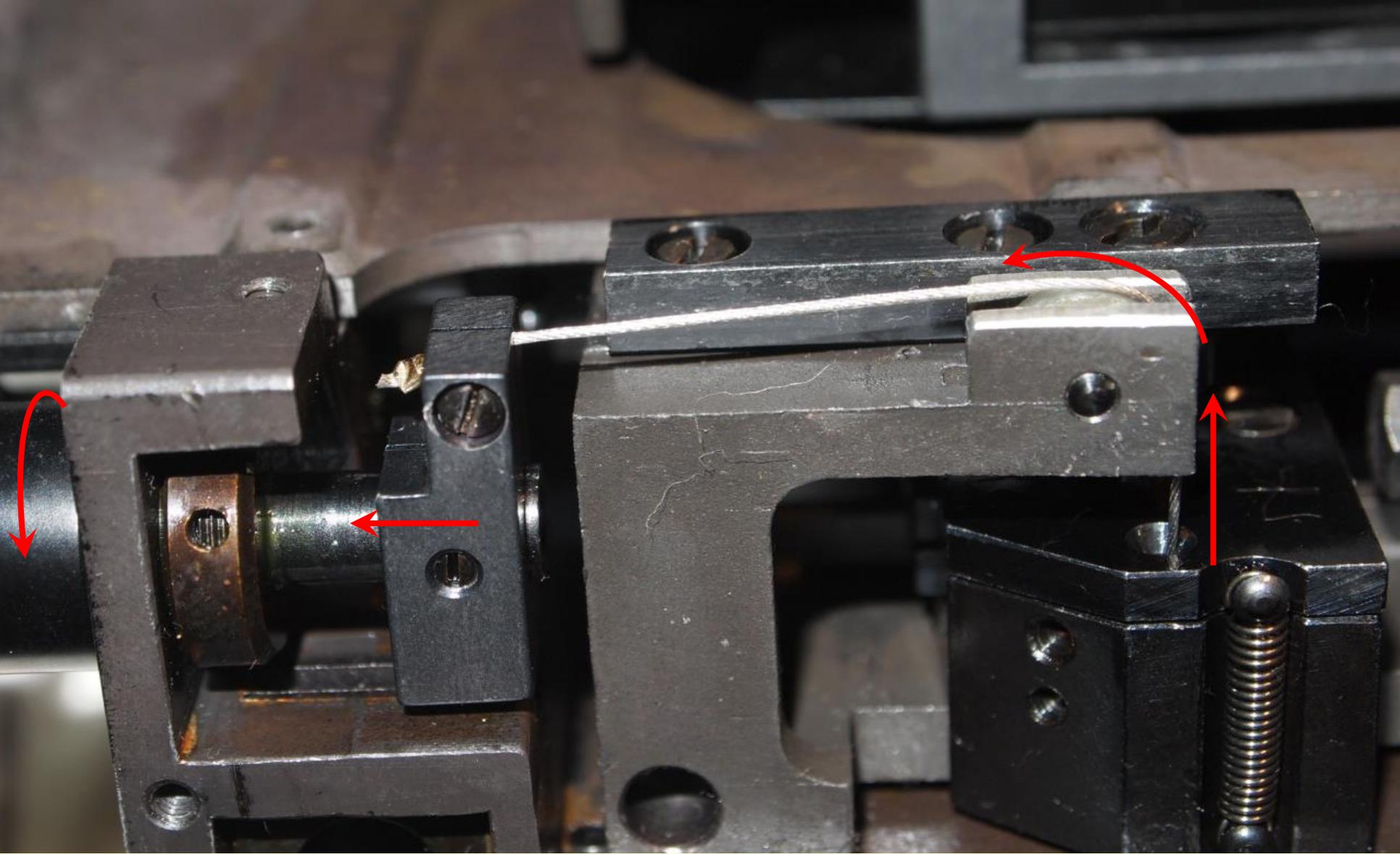
The wire has been pulled into the focus block tube and cannot be seen. The crimp is small enough to fit into the tube and large enough not to slip out the smaller hole at the other end. The two screws in the guide roller slots (small arrows, far left and far right) were not tight, and this was the cause of the misalignment seen earlier. In earlier slides you can see the roller blocks sitting at an angle. They were clamped by the base plate as a result, and the analyzer slider was not properly guided by the spring-loaded roller blocks.



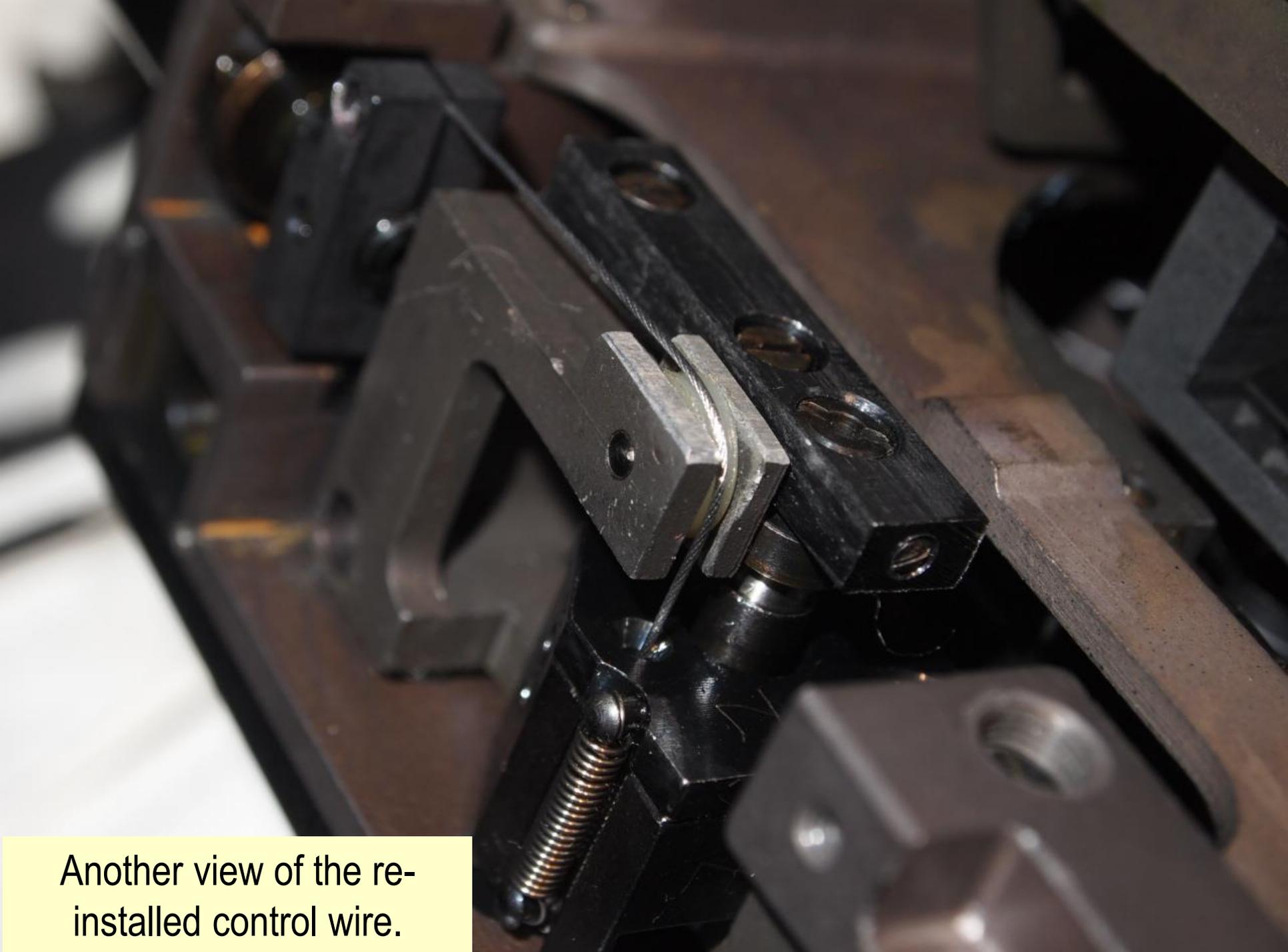
The bottom plate is back on. The wire has been placed over the roller and into the clamping block slot (after loosening the clamping screw (arrow)). The adjustment knob (just out of view to the left, has been set to zero. Fine needle-nose pliers are used to tension the wire while tightening the clamping screw. Note the focusing block (small arrow at the lower right) is ever so slightly elevated.



Some folks like to put a crimp at the back of the wire. OK, I can be one of those folks too! I think the idea is a backup to the clamping screw.



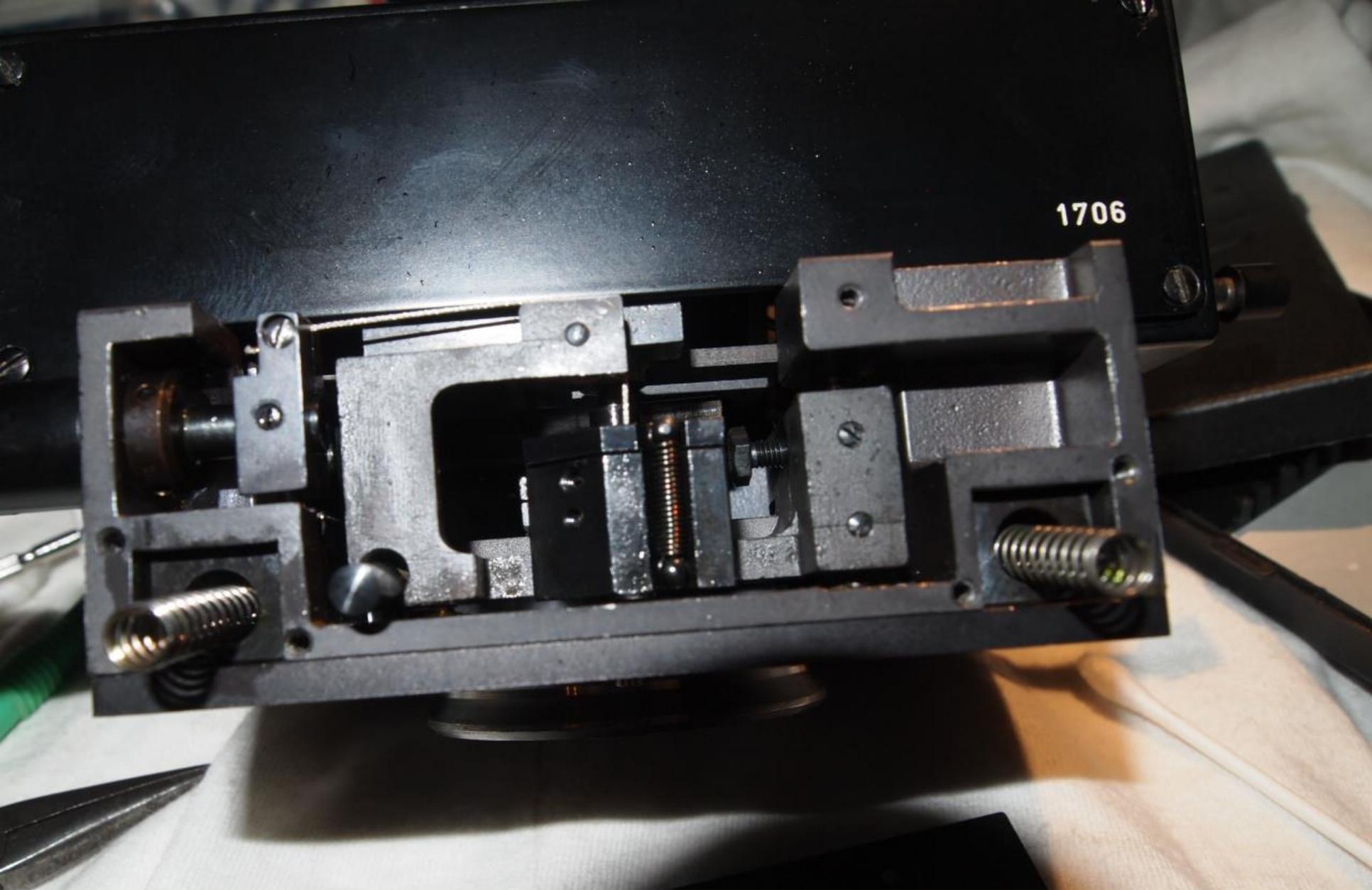
The wire is in place. The adjustment knob is turned to be sure the focus block moves up and down smoothly. The block is fully returned just as the adjustment knob reaches zero on the scale. Happy day!



Another view of the re-installed control wire.



Exercise it for a while, and then recheck that the block seats just as the control knob is zeroed. The wire is easy to adjust- just loosen the clamping screw and use the fine needle nose pliers to adjust the tension. It is not that critical anyway.



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Everything has been cleaned. The springs are back in place. The analyzer slider rollers now move back and forth smoothly, and the base plate fits snugly.



Back to where I started. When I set the cover, I make sure the springs are perpendicular to the cover. This takes a little finesse, because the cover swings into place. Once secured, my hands are free to put in the cover screws easily. Don't loose those screws!! Time for a beer. I'll deal with any alignment problems later.