A WWII Vintage AO Spencer Metallurgical Microscope Kit

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My most recent winning auction at www.shopgoodwill.com rewarded me with a World War II vintage AO Spencer metallurgical kit for the modest sum of $91.00.

The scope was in remarkably good condition considering it's age at possibly seventy years. The lubricants were not frozen up and the optics free of fungus. Apparently this instrument had been very well cared for.

The kit came in an olive drab wooden case, which leads me to suspect this was a "milspec" (military specification) design. The optics were stored in a drawer in the case above the scope.

The kit included a selection of optics, two bolts for securing the scope to a bench through the ¼-20 socket in the microscope's base, a monocular tube, and a mirror, presumably for transmitted light illumination from below the stage.

The kit came with an array of oculars: Two 15x Hyperplane, two 10x and a single 6x.

The kit included three objectives, marked Spencer 15mm 10x, Spencer 8mm 20x and Spencer 4mm 40x.

Each objective was mounted in a bayonet flange which fitted the objective into the base of the beam splitter assembly used for epi-illumination.

The flange itself has an RMS thread mount, so the objective can be removed to use the monocular tube, which I will discuss later.

The beam splitter assembly itself mounts onto the frame of the scope using an RMS thread mount. The stage has a locking lever to position

the stage up and down on a dovetail mount to accept thicker specimens so that focus can be attained with stage focus, head focus or a combination of both.

The beam splitter assembly has two iris diaphragms operated by levers. The outside one appears to function as a field diaphragm for the illuminator. The inside one appears to function as a condenser diaphragm just in front of the condenser lens. The silver collar between the two diaphragms, slides back to reveal filter trays. The large knob on the front of the beam splitter is used to rotate the angle of beam splitter for maximum illumination through the objective.

I later found that in order to get a large enough field of illumination using a goose-neck microscope illuminator, I had to remove the field

diaphragm to obtain a large enough field of illumination on the subjects.

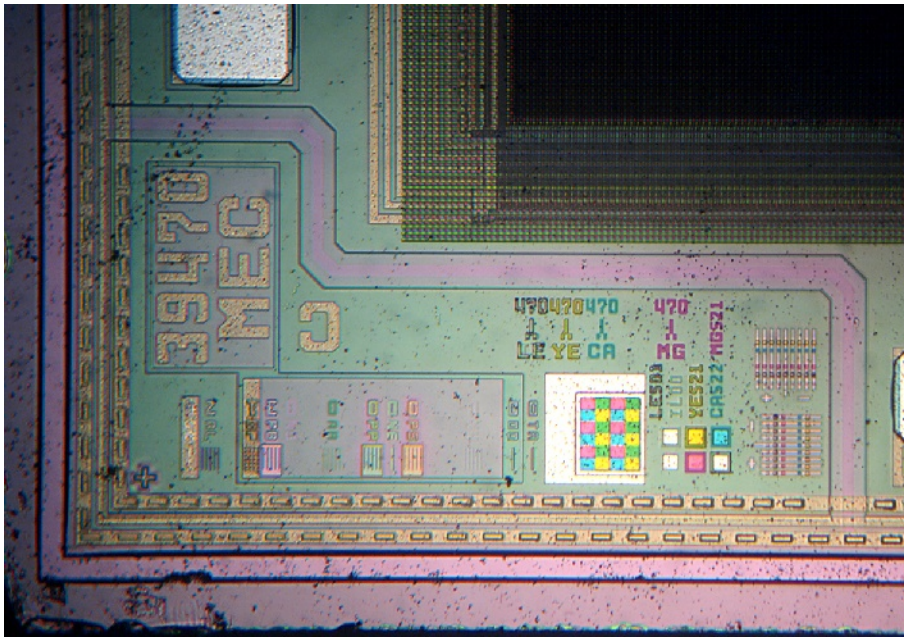
The binocular head is held onto the limb of the instrument by a lock screw. It can be easily removed and replaced with a monocular tube that accepts the objectives when they are removed from the mounting flanges. The beam splitter is replaced by the RMS mount objectives.

As you can see, the tube length can be varied. The tube does not feature a tube lens.

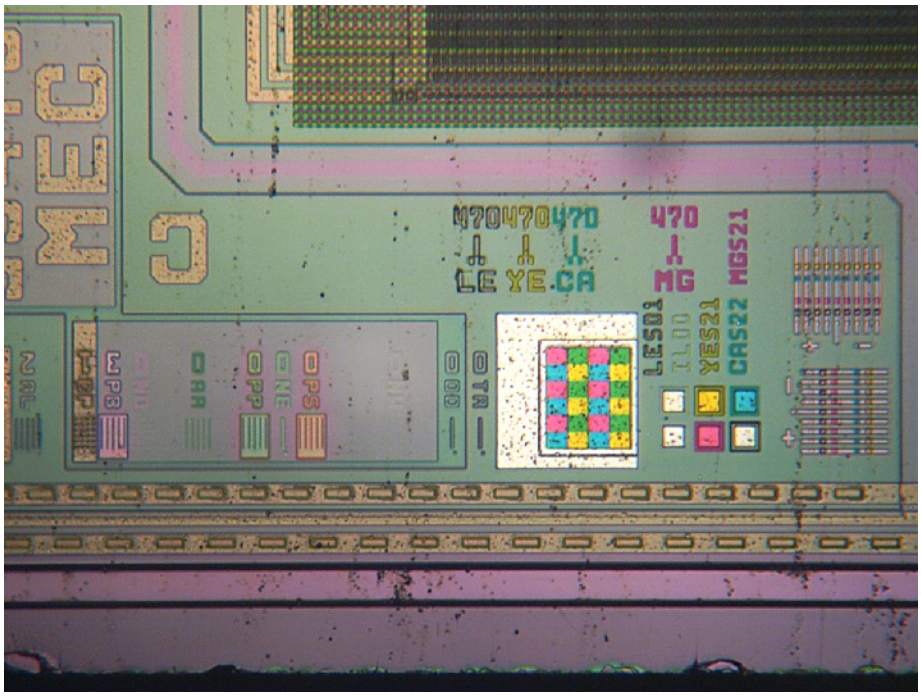
So, how does this circa 70-year old instrument hold up today? I made some test shots of a digital camera CCD sensor using an Olympus E-510 DSLR mounted on the right tube of the binocular head using a superb $20 Four Thirds microscope adapter from India, which I found on eBay. Unfortunately, the setup could not be made parfocal, so I had to focus through the camera.

I apologize for all of the dirt on the sensor, but I had to machine away the glass window on the sensor to get within the working distance of the objectives.

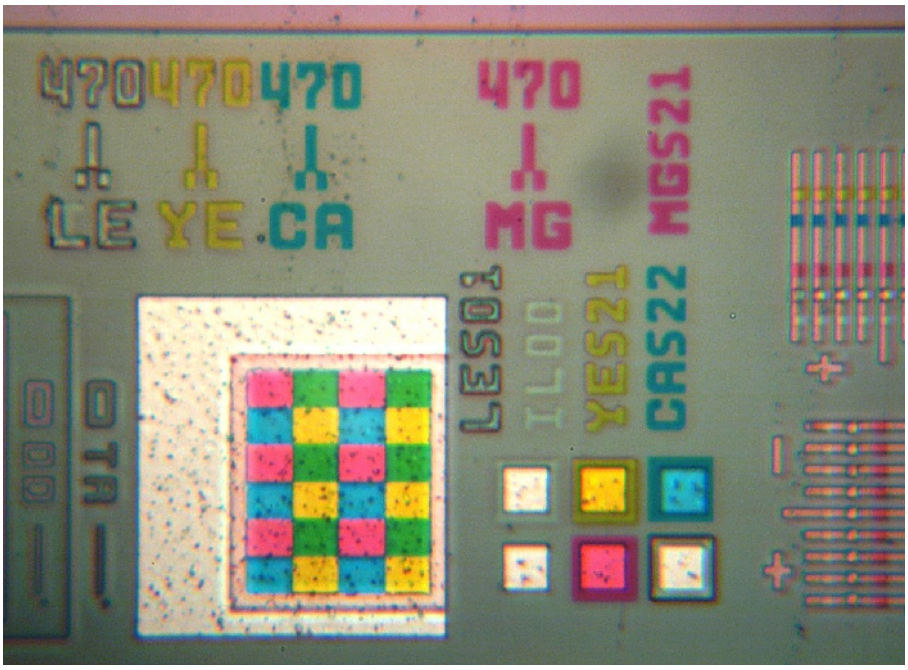
I started with the 6x ocular and the 10x objective. The pixel field of the sensor is the upper right quadrant of the image.



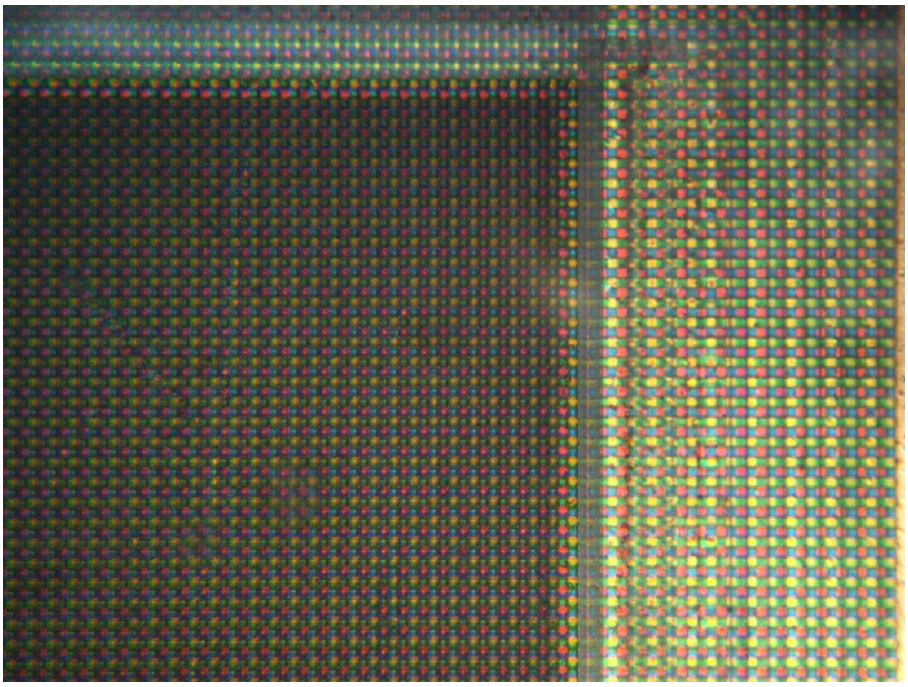
Next is the 10x ocular with the 10x objective.



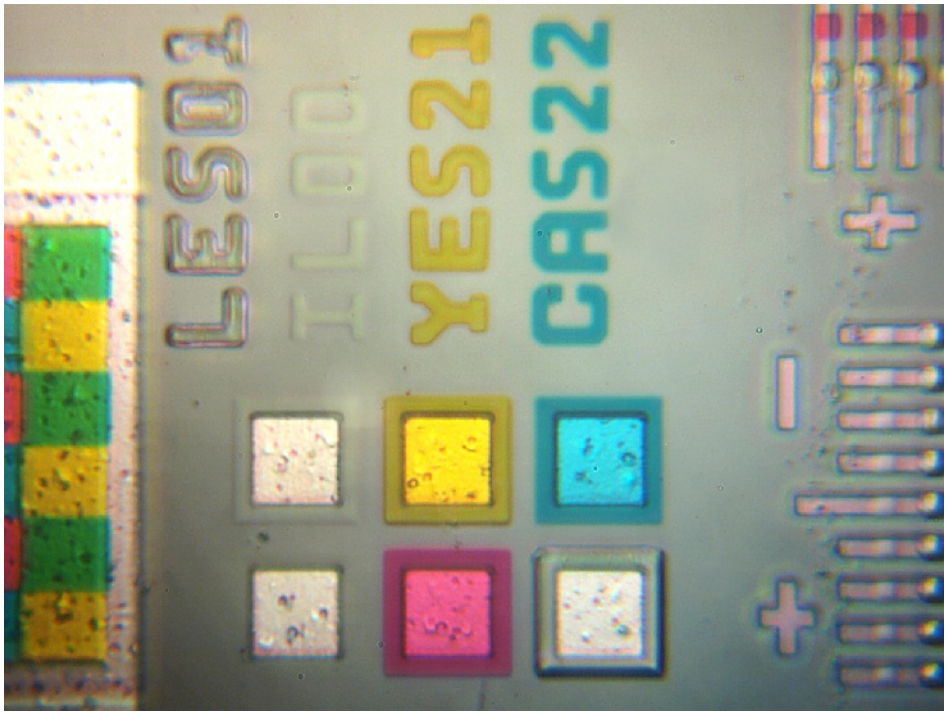
Here is the 10x ocular and the 20x objective.



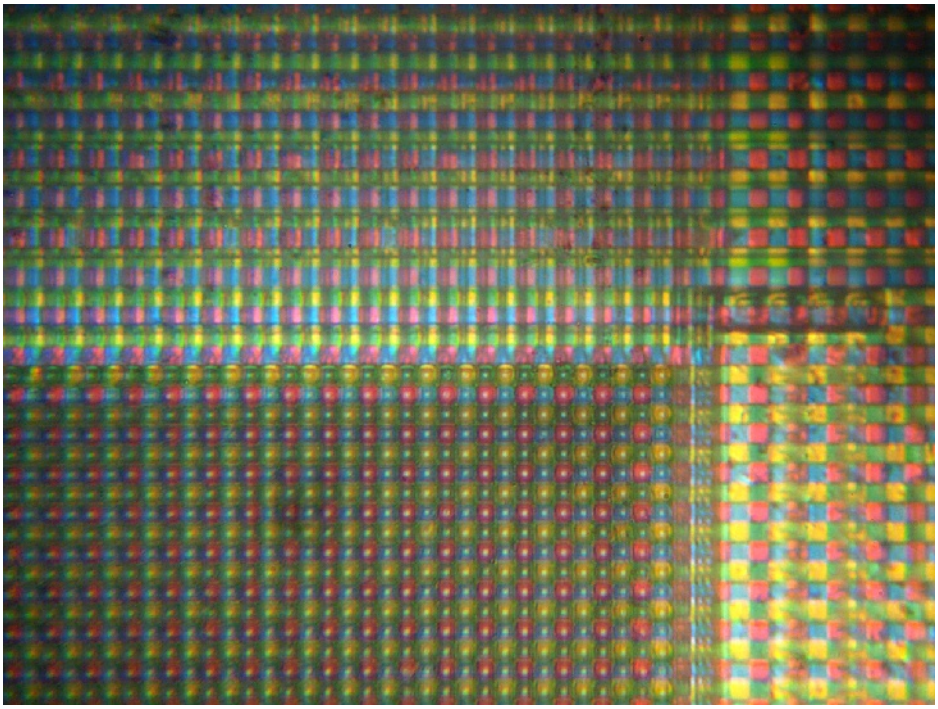
Here is a section of the pixel field with the 10x ocular and 20x objective.



A test shot showing the 10x ocular and 40x objective.

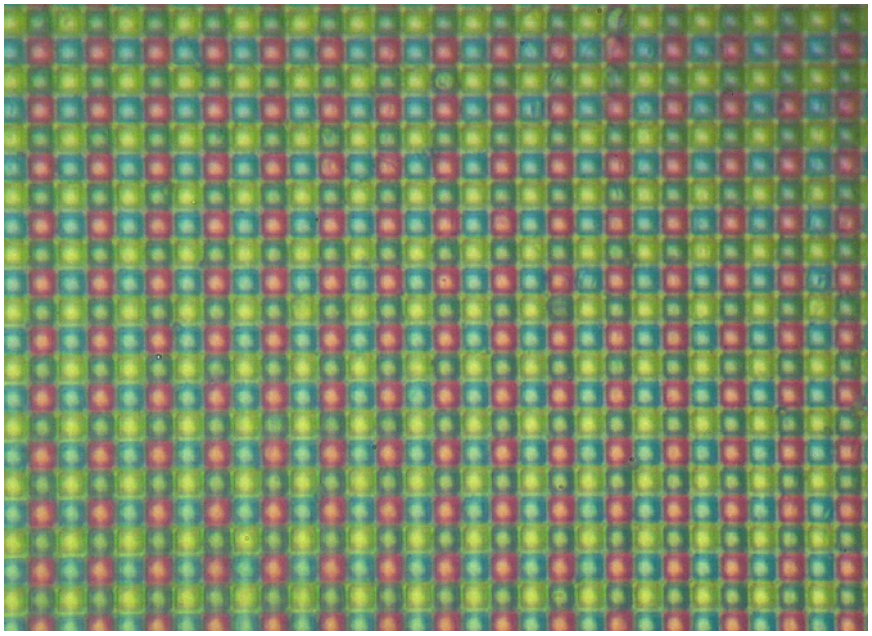


And the pixel field for the 40x objective…



I’m not a big fan of 15x oculars, but since the kit included a pair of them, I was curious to see how well they performed. This is a shot of

the pixel array in the center of the CCD with the 15x ocular and the 40x objective:



I found at higher magnifications I obtained much greater image quality by closing the condenser diaphragm all the way down. Considering its age, the AO Spencer performed commendably. To put the performance into perspective, the individual pixel sites you see in the image above are about 4 microns wide. A human blood cell is about 8 microns wide. I always marvel that our technology can not produce these miniscule pixels and their amplifiers at this scale, but also the Bayer Filter to accompany them.

If any one has details about this particular model, they would be greatly appreciated. Comments can be forwarded to me at Amoeba1@rcn.com.

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