A UNITRON Inverted Metallurgical Microscope

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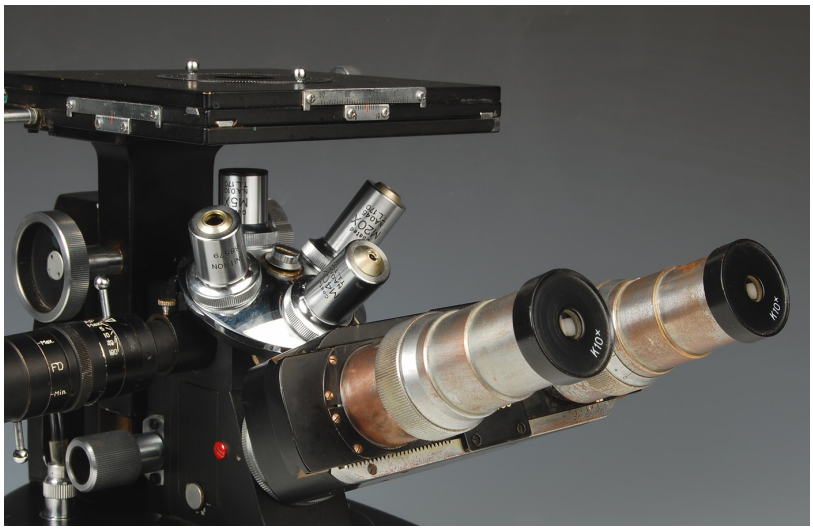
Last fall I purchased a UNITRON MeC-6613 inverted metallurgical microscope from www.shopgoodwill.com. It came with the original wooden case and a set of five objectives.

It was missing the binocular head and I was able to track one down online. Since the oculars were missing, I substituted a pair of 10X LOMOs.

UNITRON USA was able to provide a .pdf file of the manual for the Monocular Series MEC and the Binocular Series BMEC. My body is an MeC monocular body, but it appears the illuminator/condenser is for a BMEC body, so even before I put the bincular head on it, the scope was a hybrid.

The microscope has a four position objective turret. The set came with 5X, 10X, 20X, 40X and 100X Oil objectives.



Immediately below the turret is the “PLANE GLASS REFLECTOR” lever, which is the beam splitter for epi-illumination. The beam splitter in my sample was so far gone, I replaced it with a glass coverslip. By eyeballing the illumination as the lever is rotated, one can find optimum illumination. However, rotating this lever requires imaginative maneuvers with hand tools.
As I have noted, when I cobbled this rig back together, I used 10X LOMO eyepieces in the binocular head. The standard UNITRON eyepieces that shipped with scopes are the WFH10XR.

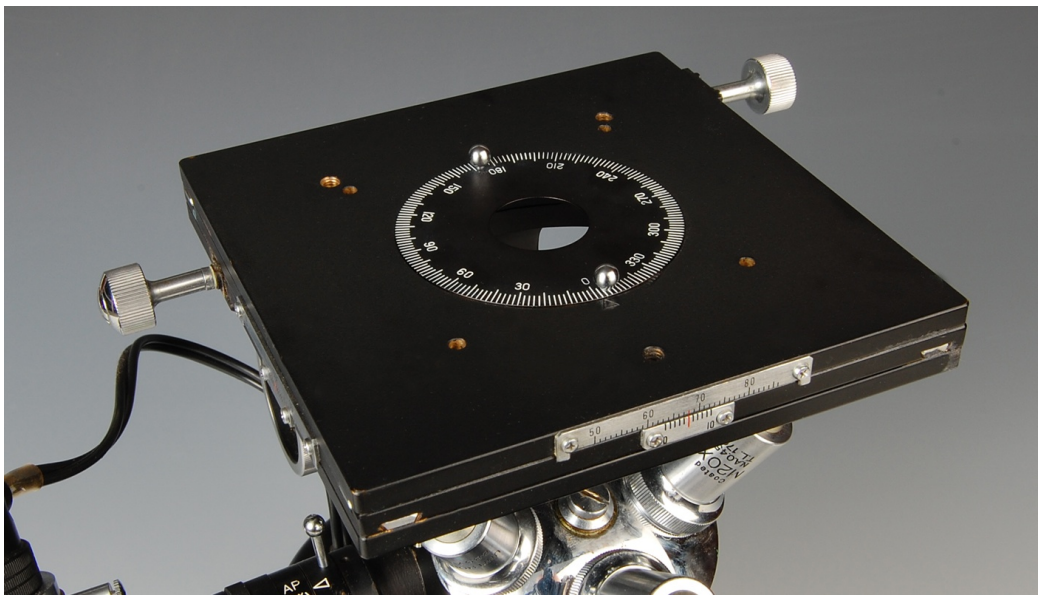
The binocular head can be adjusted to interpupillary distance by rotating the knurled collar on the left eyepiece tube. Rotation of the diopter collar on the right eyepiece tube allows compensation of differences in vision between the two eyes.
The WFH10XR oculars are designed to accept a number of 19mm diameter reticles.
The manual describes a trick I never would have imagined when using reticles:
”The reticle may be allowed to remain in the eyepiece when not actually needed. If the scale proves distracting, turn the focusing collar clockwise all the way so as to throw the pattern out of focus. (For binocular models, remember to make the same adjustment in the other eyepiece).”

The manual does address flatness of field with the stock objectives:
“Because of the inherent limitations of standard achromatic objectives, it is not to be expected that the outer edges of the field will be in perfectly sharp focus when the image is focused at the center (especially when using the higher powered objectives). However, this fact is not a serious limitation since it is the central portion of the field which primarily occupies the observer’s attention…Of course, those models equipped with either the MPL or Plan M planachromatic objectives will have fields of view in focus across the entire field of view.”

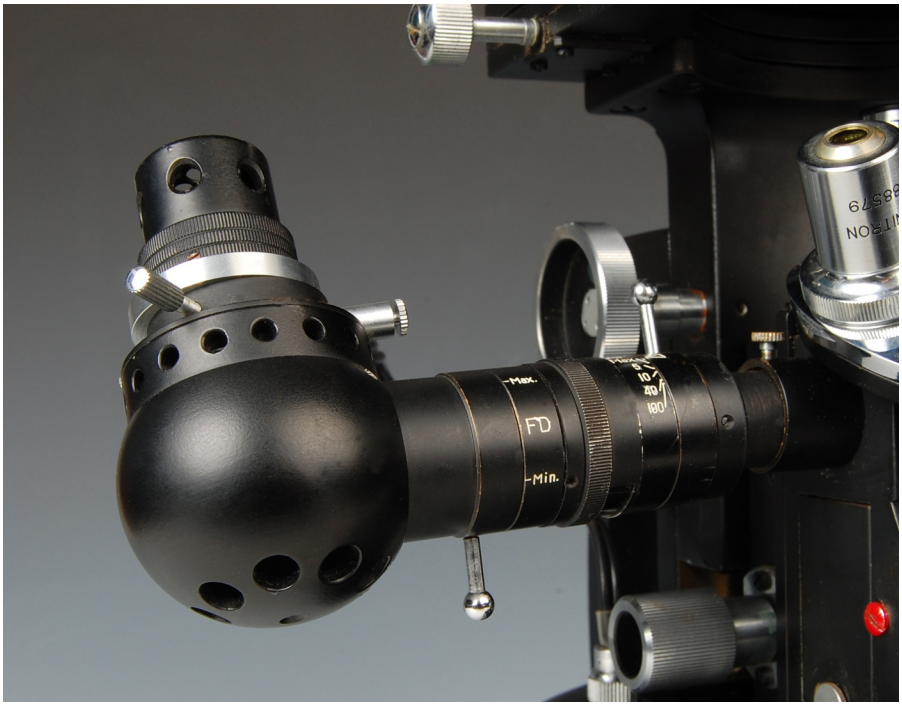
Another item the manual addresses is the potential discomfort of using an inverted microscope due its low eye point:
“For the most comfortable observation, the operator should sit in a chair which is relatively low to the table. The height of the chair should be such that the eye is approximately at the level of the microscope eyepiece tubes. With this arrangement, the operator may rest his arms on the table and in this position manipulate the stage, specimen, and all microscope controls more conveniently than is possible with the conventional type of microscope. Where these ideal conditions for operation are not available, you may wish to elevate the microscope. As an optional accessory, an elevating base may be purchased which also features a built-in storage drawer, and rubber-inlaid top surface.”

Indeed, I found the best way to use this microscope was to elevate it about 7 inches above the tabletop.

The microscope shipped with for interchangeable circular stage plates with apertures of different diameters. My sample only came with the stage plate marked in degrees for cross-polarization microscopy.



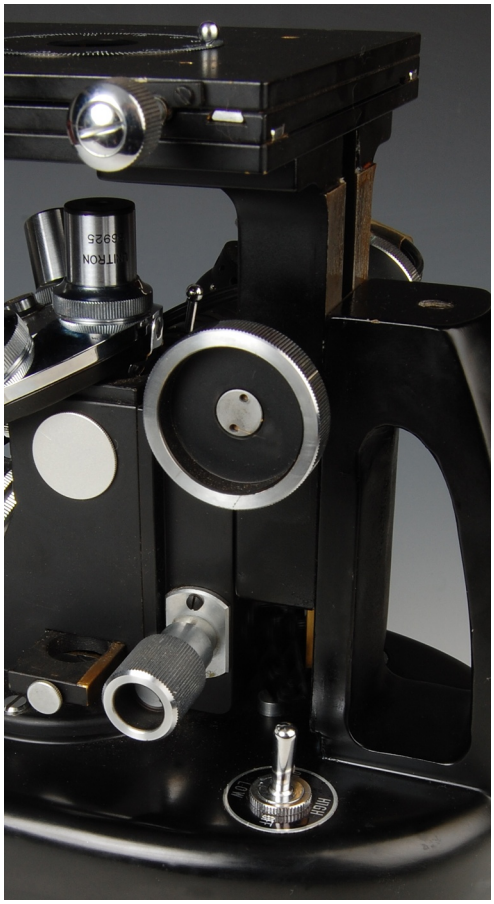
The stage plates have beveled edges so they simply drop in. The stage is also threaded to accept stage clips. The X-Y movements of the stage can accommodate gross specimens.
As I mentioned earlier, the illuminator on my sample may not be the original, but rather, a substitute.



The illuminator uses a very weak 8 volt, 12 watt EL-2 bulb. The lamp house has centering screws to align the lamp filament with the condenser. The condenser has a Field Diaphragm and an Aperture

Diaphragm. The opening travel on the Field Diaphragm is very generous, whereas the travel on the Aperture Diaphragm starts at small and goes to smaller. So, if one expects to enhance contrast and depth-of-field by stopping down the Aperture Diaphragm with a 12-watt lamp, the resultant image is very murky.
The illuminator also has a filter slot to accept system filters. The microscope originally shipped with the following filters: Green, yellow, and Daylight Blue, as well as a polarizer. When the scope is set up for cross-polarization, the polarizer is in the illuminator and the analyzer is just below the monocular/binocular head.

Focus controls are for coarse focus and fine focus. Coarse focus is done on the stage and fine focus is done on a focus block attached to the turret.



There are knobs for coarse and fine focus on both sides of the microscope. The drag on the coarse focus (the stage) can be adjusted by gripping both coarse focus knobs and turning them against each other to the desired tension.

The focusing travel of the fine focusing mechanism is 2mm. On the left side of the fine focus focusing block is a scale which should be centered to provide a full range of fine focus.
Just below the focus controls is the ON-OFF AND INTENSITY SWITCH. The LOW position should provide adequate illumination intensity for normal visual observations (my experience – very dark) and the HIGH position gives extra-high intensity for photography, polarized light, etc. (a digital SLR could not even get an image other than noise).

The 120 VAC cord plugs into the rear base of the microscope. The voltage to the illuminator is controlled by the ON/OFF/HIGH/LOW selector toggle switch. The third lead is grounded to the microscope chassis. The illuminator uses a two-pronged plug.

The UNITRON metallurgical series also feature a camera port.

The port could accept the accessory TYPE MC-M35 35mm camera back or a Polaroid camera for instant photography. I was not able to track down either of these cameras. Just below the fine focus knob on the left side is a “slideway” that allows images to be directed to either the viewing head or the camera port. Moving the slideway to the right sends the image to the viewing head and sliding it to the left sends the image to the camera port.

The supplied stock objectives are all achromats, and the manual even advises that the best viewing will be through a green filter.
The specs on the objectives are:

5X Coated M5X N.A. 0.10 T.L. 170
UNITRON 86925

10X Coated M10X N.A. 0.30 T.L. 170
UNITRON 88579

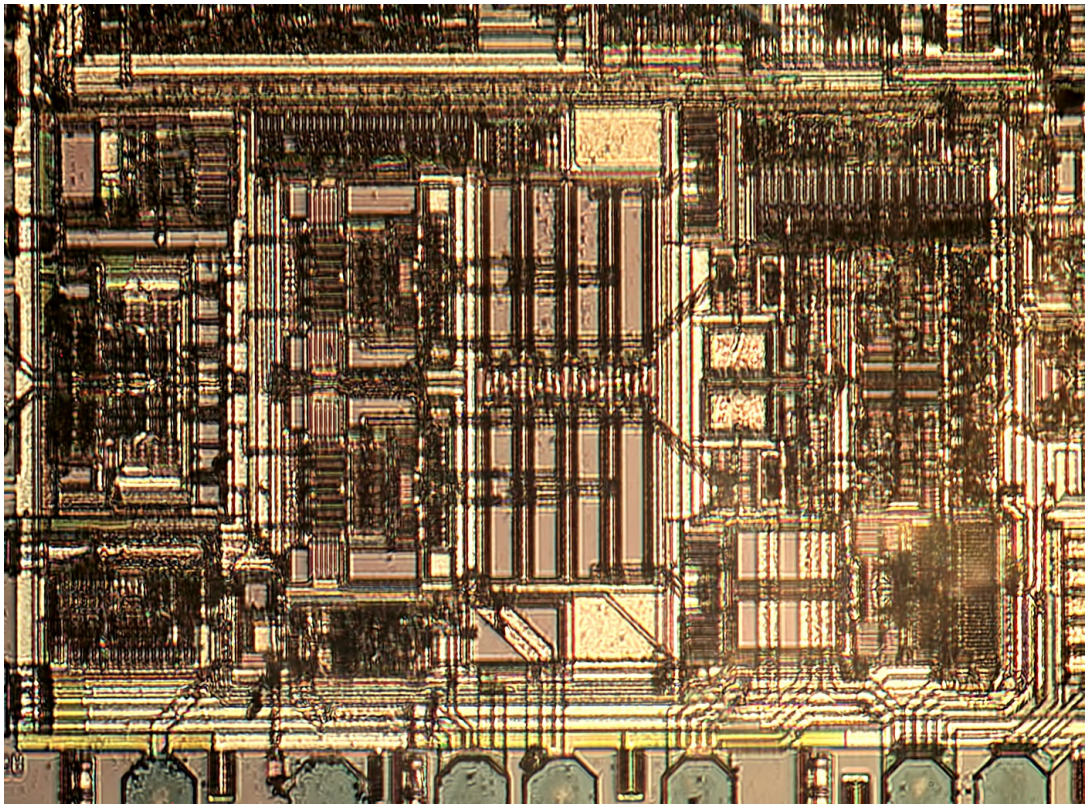
20X Coated M20X N.A. 0.45 T.L. 170
UNITRON 82801

40X Coated M40X N.A. 0.65 T.L. 170
UNITRON 88385

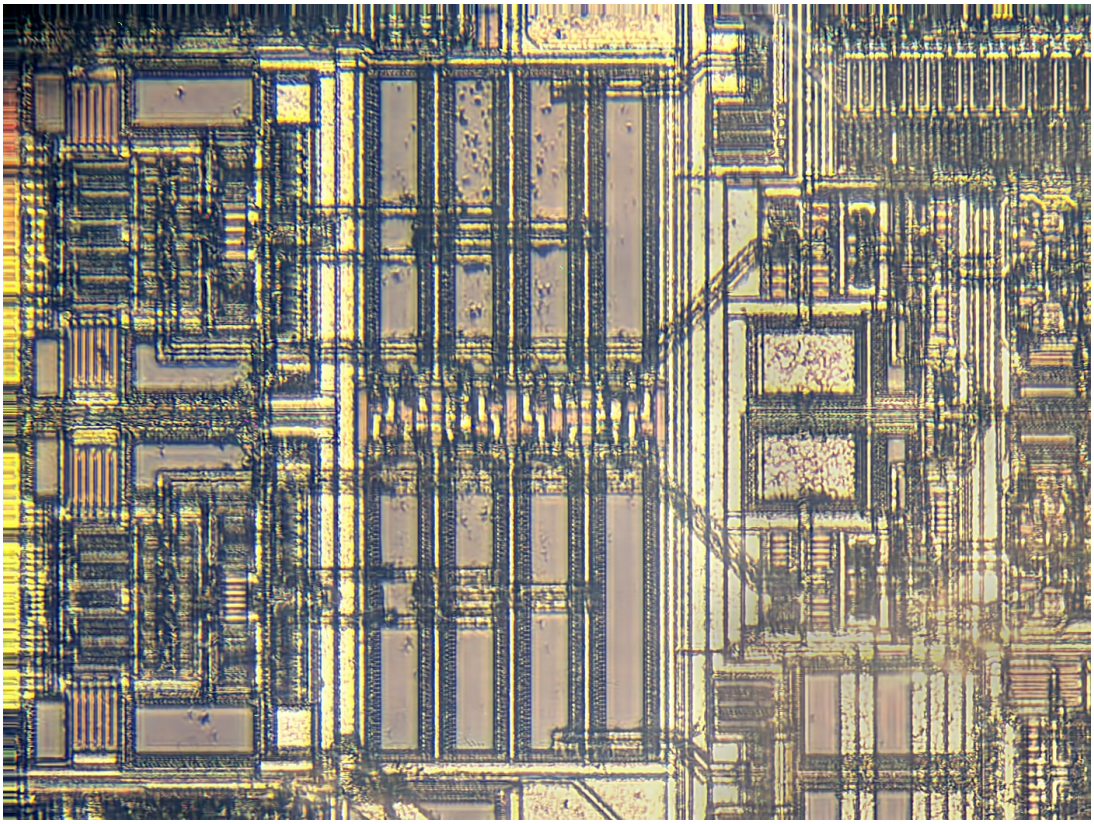
100X Coated Oil M100X N.A. 125 T.L.170
UNITRON 82648

In all fairness, when I shot the objective test images, my DSLRs would show nothing but noise with the stock illuminator, so I removed the condenser/illuminator and blew a lot of light into the scope with a Kodak Carousel projector. The 5X and 10X objectives were passable, but beyond that, the image quality was not very good.

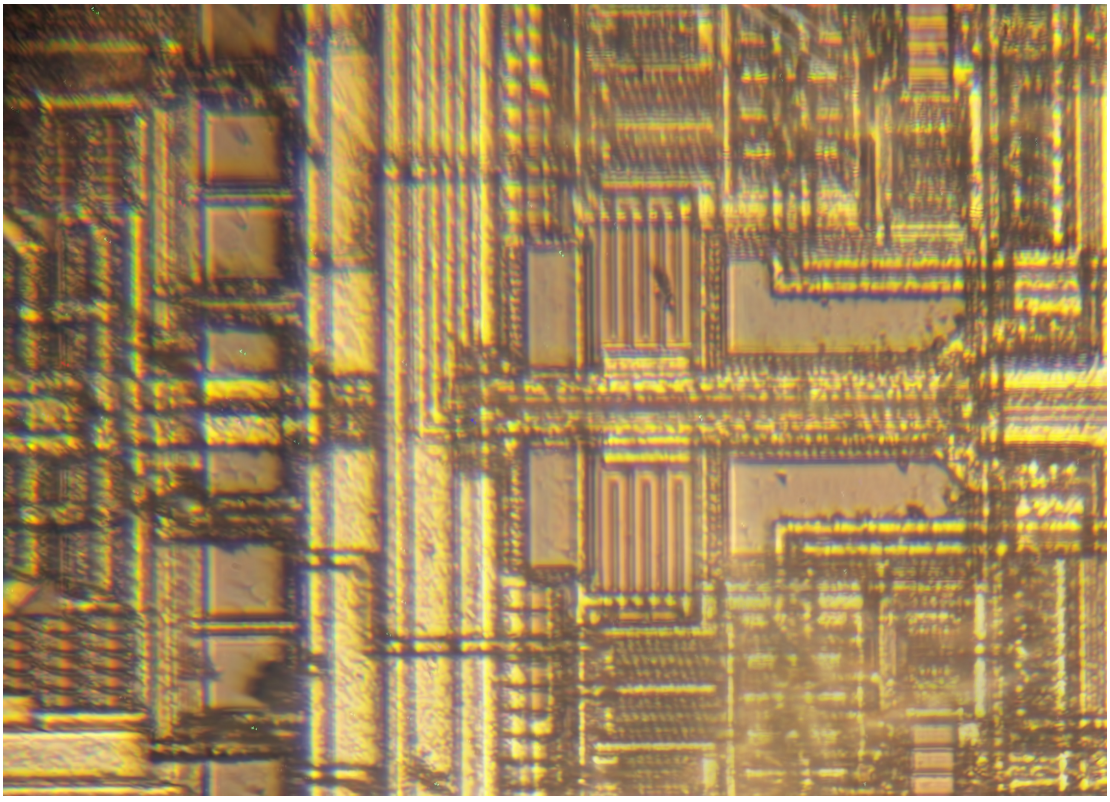
5X



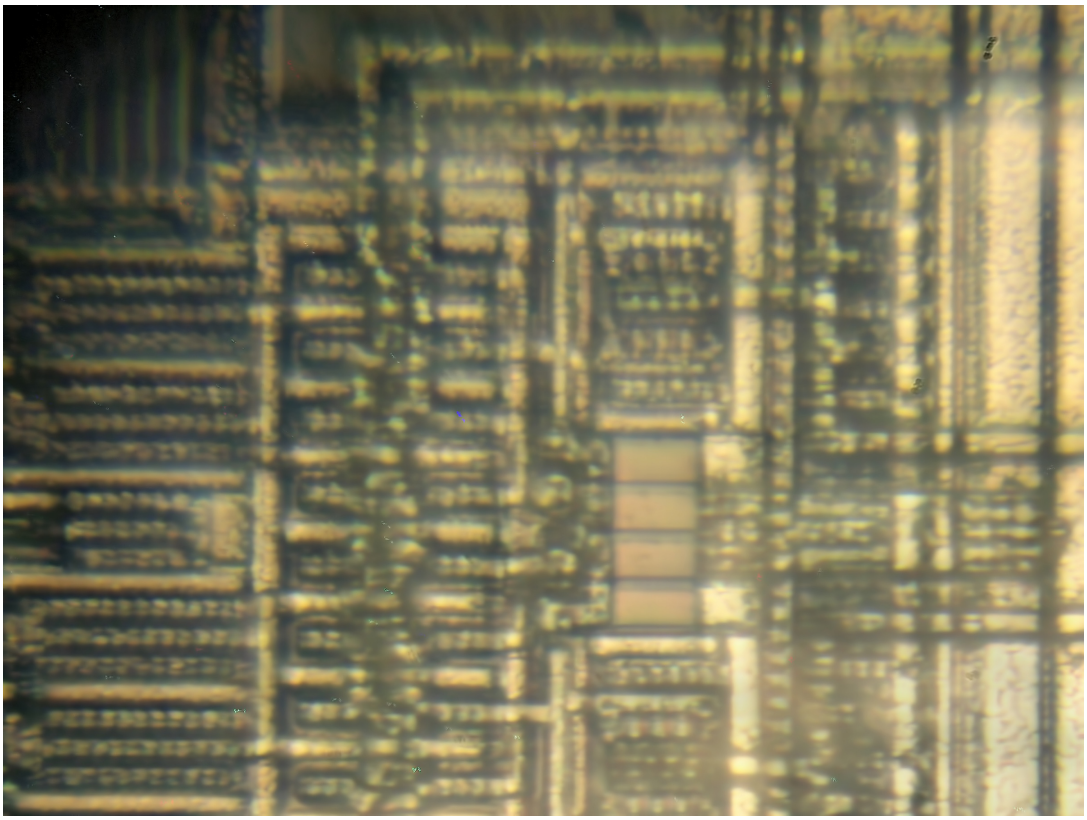
10X



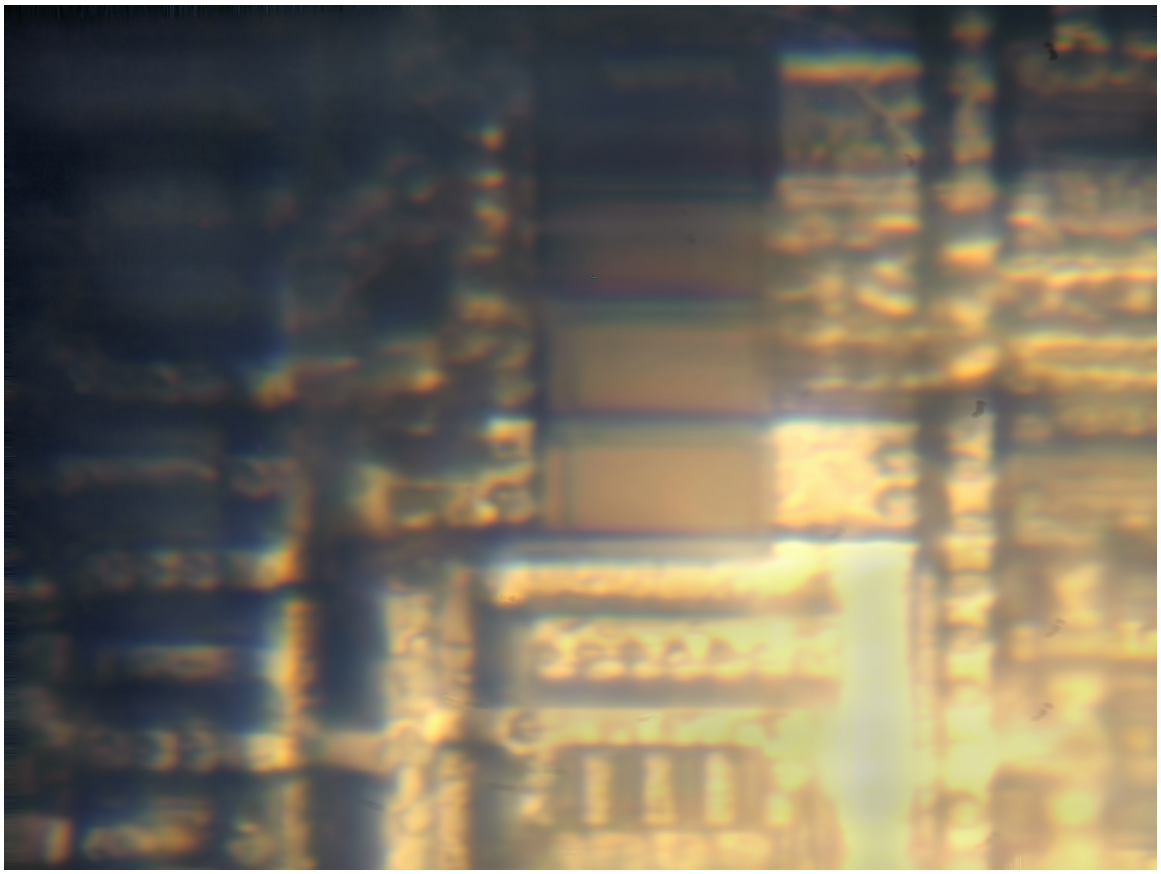
20X



40X



100X Oil



All monocular model MEC-CM and binocular BMEC-CM included a 35mm camera coupling 4X phototube to allow the use of the MC-M35 camera back. The photo tube was designed to accept, without lens, any 35mm camera back with Leica-type threading. The image magnification on 35mm film will be equal to four times the power of the objective being used for photography.
The Polaroid Attachment is fitted with a camera coupling tube of its own which inserts into the camera port.
Accessories for the system include, among other items, an exposure meter, 3X objective, 60X objective, 80X planachromatic objective, advanced Plan M Series objectives (10X, 20X, 40X and 100X), stage micrometers, and an Austenite Grain Size Reticle.

All in all, a very curious instrument.

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