

Large MM 5 Metallographic Microscope



9247-56

Le Chatelier type

Equipment and optical performance to satisfy the most exacting demands

For brightfield, polarized light, phase contrast and darkfield observation

Exceptionally large field of view through plano objectives and widefield eyepieces

Binocular observation from 6.3 x magnification upwards (28mm field of view)

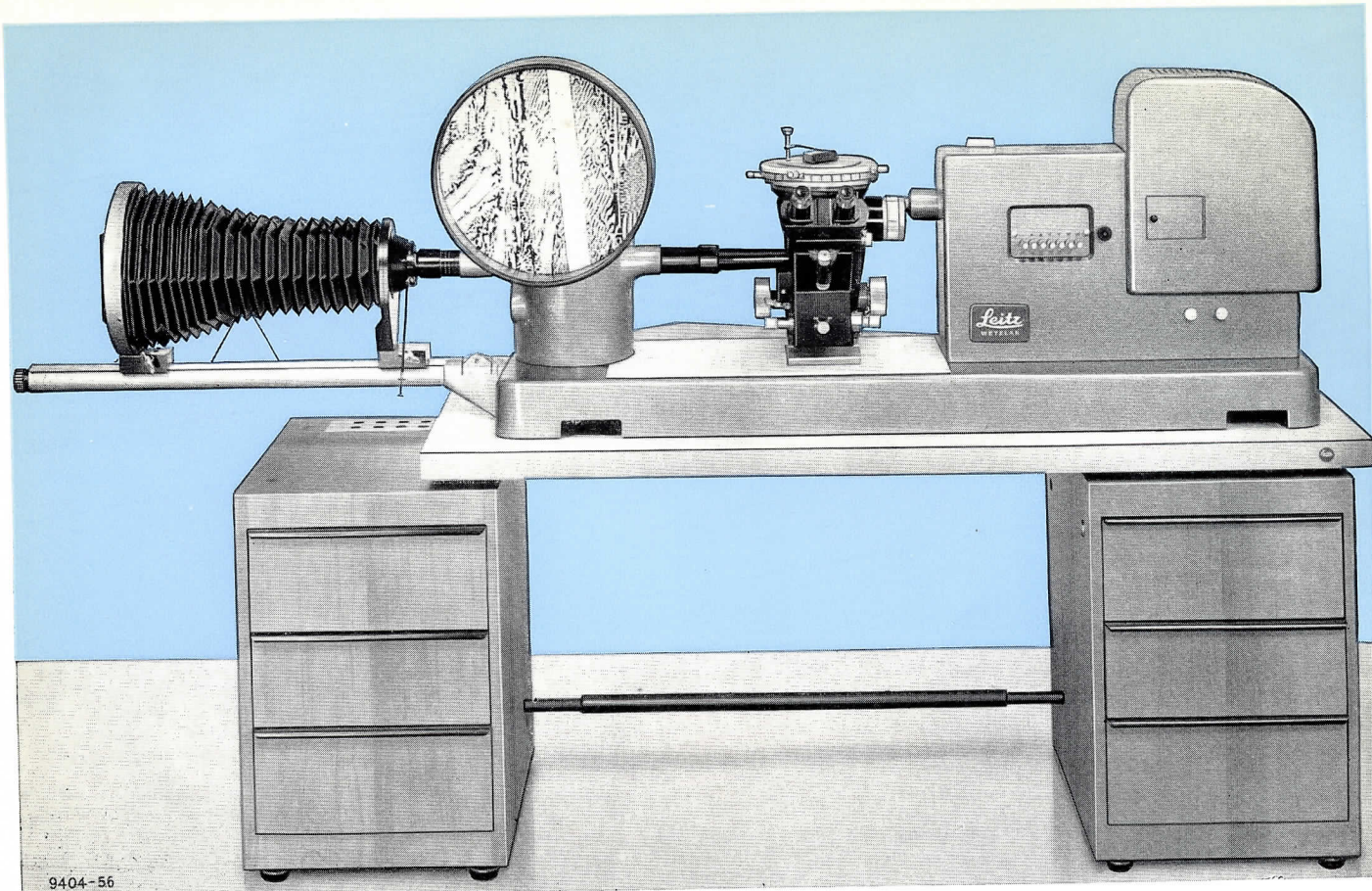
Large groundglass projection screen for image observation free from eye strain

Alternative illumination by high-power Xenon discharge and low-voltage filament lamps

Photographic equipment for sizes from 13 x 18cm (5 x 7") to 24 x 36mm

E R N S T L E I T Z G M B H W E T Z L A R

560-12e/Engl.



The MM 5 px large LEITZ metallographic microscope on its work bench

The LEITZ MM 5 px large horizontal Le Chatelier type Metallographic Microscope incorporates the latest advances in the technical and optical field. Its design and performance satisfy the most exacting demands.

Enlarged, flat field of view

The very rigid stand has been designed for our novel plano objectives and widefield eyepieces. Compared with the conventional type of special metallurgical objectives the plano objectives give a flatter field of view and higher contrast, so that in conjunction with our new GW widefield eyepieces*) a considerably enlarged field can be made available for observation. The field of view produced by this combination at a given magnification has a diameter which is approximately 50 % larger than that obtained with the eyepieces of our standard bench stands. Thus, the area under observation is approximately 2.5 x larger with the position of the specimen unchanged.

An additional advantage lies in the fact that it has now become possible to cover all magnifications, including the range of low magnifications from 6.3 x upwards with visual (binocular) observation and photomicrography in brightfield. At 6.3 x magnification a 28mm field of view is available. The standard magnifications of 20 x, 50 x, 100 x, 200 x, 500 x, and 1,000 x are obtained with their appropriate objectives visually without change of eyepiece, and photographically without alteration of the bellows extension.

Brightfield, polarized light, phase contrast and darkfield illumination can be used as required. The existing possibilities are listed in the table on p. 5.

Large stand for binocular observation

The microscope has a large, 200mm ϕ revolving stage mounted on ball bearings and graduated in degrees. It incorporates a mechanical stage with a traversing range of 20 x 20mm. The large binocular tube provides optical compensation for variations in the interpupillary distance of individual observers; sharpness and magnification of the images therefore remain unaffected during the adjustment of the eyepiece tubes for any interpupillary distance.

High-intensity light source

A 12 v 60 w low-voltage filament lamp is provided for visual observation in brightfield. This is supplemented by a high-intensity light source (XBO 450 W high-pressure xenon lamp) which permits effortless focusing of the microscope camera on the groundglass screen even at high magnifications, in darkfield, phase contrast, polarized light, or through strong filters.

*) Large field of view and wide tube

Push-button filter changer

The filters used with the high-intensity light source are changed by push-buttons; filters no longer required automatically swing out of the beam path. This greatly simplifies brightness adjustment during the change from visual observation to projection on the groundglass screen and vice versa, or to photomicrography.

Screen observation without eye strain

Generally, the xenon lamp permits observation of the projected image in comfort even in brightly-lit laboratories. The groundglass screen of the projection unit has a diameter of 340mm; the image field shown on it is the same as that covered by the GW 8x eyepiece used in the microscope tube (field diameter 26mm). The image is magnified 1.6x compared with the image seen with visual observation; at the comfortable viewing distance of about 40cm (16") it therefore appears at about the same size as the visually observed image.

Often, particularly in routine serial investigations, the metallographer will find that observing a projected image will greatly facilitate his work; fatigue will be very largely reduced.

The projection screen can be swung to one side through approx. 30° to enable additional viewers to observe the image.

Bellows camera

for formats of up to 13 x 18cm (5 x 7")

The 13 x 18cm bellows camera has a revolving darkslide carrier which permits easy selection of the picture area. Simple deflecting elements (beam splitters or mirrors) are used to change from visual observation in the microscope or the projection groundglass screen to photomicrography.

The images in the eyepiece, on the projection screen, and on the focusing screen of the camera are parfocal. It therefore suffices to focus visually either through the microscope or directly on the projection groundglass screen, when the camera will be ready for immediate use.

35mm camera attachment

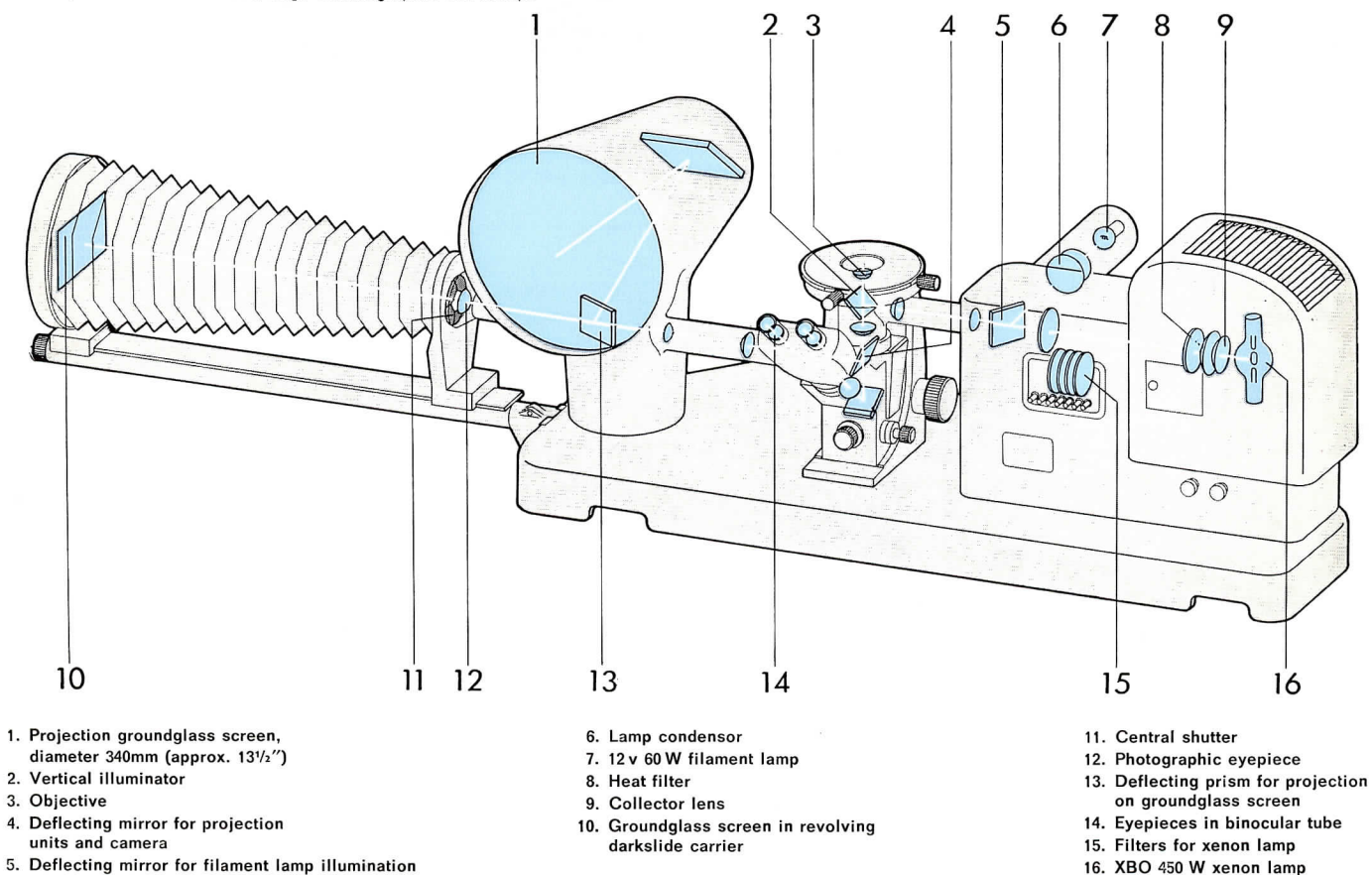
In order to take full advantage of the LEICA® camera system for serial photographs etc., a LEICA camera attachment has been designed as an alternative to the bellows camera on the guide bar. The image is focused by means of the reflex attachment.

The LEITZ MM 5 px large metallographic microscope is equipped as follows: -

MM 5 px

Large universal model incorporating low-voltage filament lamp attachment and XBO 450 W xenon lamps, microscope with vertical illuminators and plano objectives, large binocular tube with optical compensation for different interpupillary distances, 30mm GW eyepieces, 13 x 18cm (5 x 7") bellows camera, large swivelling projection unit with 340mm groundglass screen.

Beam path in the LEITZ MM 5 large metallographic microscope



Technical details

The LEITZ MM 5 px Large Metallographic Microscope consists of

1. Base plate
2. Microscope
3. Alternative illuminating equipment with filament and xenon lamps
4. 13 x 18cm (5 x 7") bellows camera
5. 35mm camera attachment
6. Projection equipment

1. Base plate

The base plate is mounted on vibration dampers; room vibrations are therefore largely absorbed instead of transmitted to the microscope or the camera.

2. Microscope

a) **Stand.** The microscope stand is fixed permanently on the base plate and incorporates changing devices for the vertical illuminators and the observation tube.

The large object stage is particularly sturdy. It has a diameter of 200mm, rotates on ball bearings through 360° and can be arrested in any position. Freedom of rotation can be adjusted to any desired degree by a friction clutch. A mechanical stage is built into this stage, also running on ball bearings, with a 20mm traverse in both directions. The adjustment can be read off millimeter scales. There is a choice of four plane parallel glass plates with different apertures for insertion in the stage to accommodate objects of varying sizes. The stage can be vertically adjusted with two large conveniently arranged knobs and clamped at any level with a toggle. For visual observation with the plano objectives it is usually lowered as far as possible.

Beam splitters and mirrors are built into the stand to direct the light beam as required for

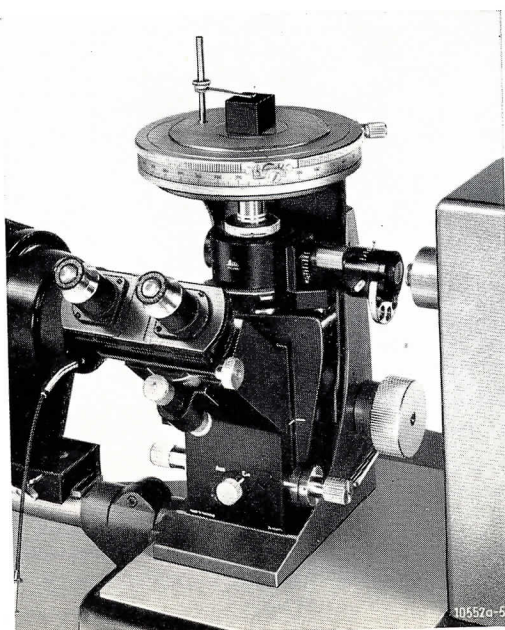
1. Visual observation through the eyepiece
2. Observation of the image on the camera groundglass screen or on that of the projection unit
3. Simultaneous formation of the microscope image in the eyepiece and on the groundglass screen of the projection unit or of the camera.

Hence it is possible to obtain photomicrographs actually during visual observation in the microscope.

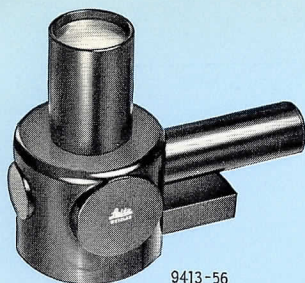
The fine adjustment can be operated on knurled knobs on both sides of the stand; it runs on ball bearings and actuates the mount of the vertical illuminator. It can be coupled with the remote control knob on the camera (see p. 6).

For examining the rear focal plane of the objectives, e.g. in phase contrast work, a focusing, swing-out auxiliary lens has been built into the tube.

b) **Tube.** The basic outfit includes a large interchangeable binocular tube with interpupillary distance compensation, automatically allowing for alterations of the tube length when the interpupillary distance is varied. Provided the camera eyepiece is adjusted to the bellows extension used, the microscope image will be simultaneously in focus in the microscope eyepiece and on the groundglass screen of the projection unit or of the bellows camera. The tube accepts either GW eyepieces, of 30mm external diameter or standard diameter (23.2mm) eyepieces in the adapter, Code No. 513 122.

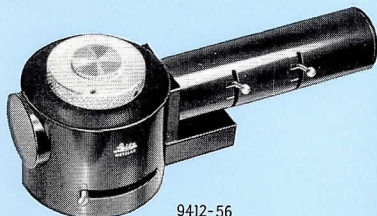


The stand of the LEITZ MM 5 px large metallographic microscope shown here with the binocular tube and the vertical illuminator for brightfield work, polarized light, and oblique illumination. The object stage is raised in order to show more clearly such details as the objective, the vertical illuminator, etc.



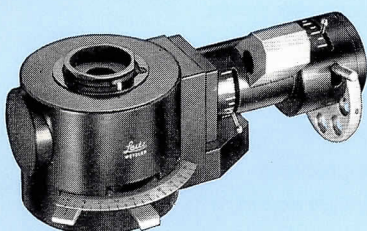
9413-56

Vertical illuminator for low-power observation

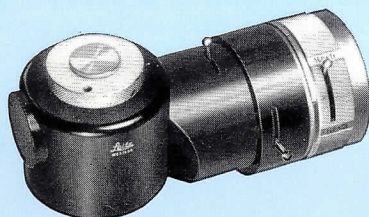


9412-56

Vertical illuminator for brightfield and darkfield work



Vertical illuminator for brightfield, oblique illumination, and polarized light



Vertical illuminator for brightfield and phase contrast

c) Vertical illuminators. The following illuminators with suitable light tubes are available for the LEITZ MM 5 px Large Metallographic Microscope.

1. Illuminator for low-power observations

It has a fixed objective. Its magnification has been chosen so that the visual final magnification of the microscope is identical with the primary magnification of the eyepiece used. Thus, with an 8 x eyepiece the final magnification will also be 8 x.

2. Illuminator for bright- and darkfield observation

The illuminator has aperture and field diaphragms as well as a built-in central stop, which is swung into the light path during the change-over from bright- to darkfield observation, so that only the objectives have to be changed.

3. Illuminator for brightfield, oblique illumination, and orientating observations in polarized light

This illuminator incorporates, in addition to a field diaphragm, a decentring aperture diaphragm for oblique illumination. The polarizing equipment consists of a prism polarizer, and of a filter analyser. An aperture disc with 7 central stops and a full aperture completes this outfit.

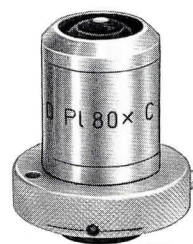
4. Vertical illuminator for brightfield and phase contrast

This illuminator is used mainly for phase contrast investigations, however, orientating bright-field examinations are also possible with phase contrast objectives by inserting a diffusing disc into the beam path.

d) Plano objectives: Three series of plano objectives are available: -

- Objectives for brightfield and orientating polarized-light observations.
- Objectives with matched condensers for darkfield observations.
- Objectives with built-in phase rings for phase contrast observations.

All objectives have centring rings with changing mounts for attachment to the vertical illuminators. Brightfield and phase contrast objectives with apertures exceeding 0.25 are provided with a spring-loaded front lens mount.



LEITZ plano objectives for bright- and darkfield observations

8682-56

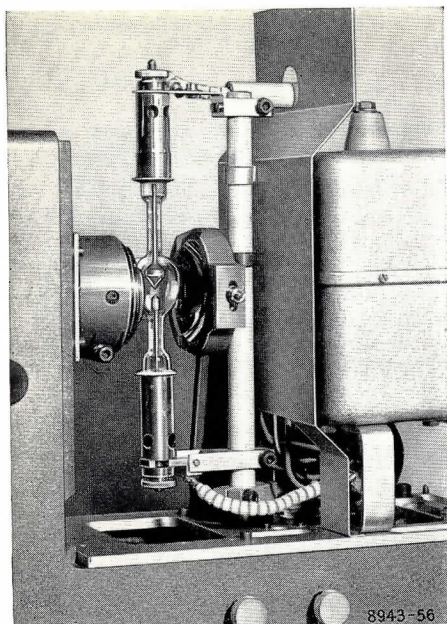
Chart of magnifications and fields of view obtainable with the plano objectives on the LEITZ MM 5 large metallographic microscope

For technical reasons, plano objectives cannot be made strainfree. In polarized light, they can therefore be used for orientating observations only.

The two low-power darkfield objectives are fully satisfactory also for brightfield observations. The high-power darkfield objective has a lower aperture than the brightfield objective but can also be used for brightfield observations. Phase contrast objectives are generally suitable for brightfield work, too, although the use of the special brightfield objectives is recommended where the utmost image quality is essential.

*) The magnifications shown in brackets can be obtained only on the 9x12cm (1/4 pl.) format with 20cm bellows extension.

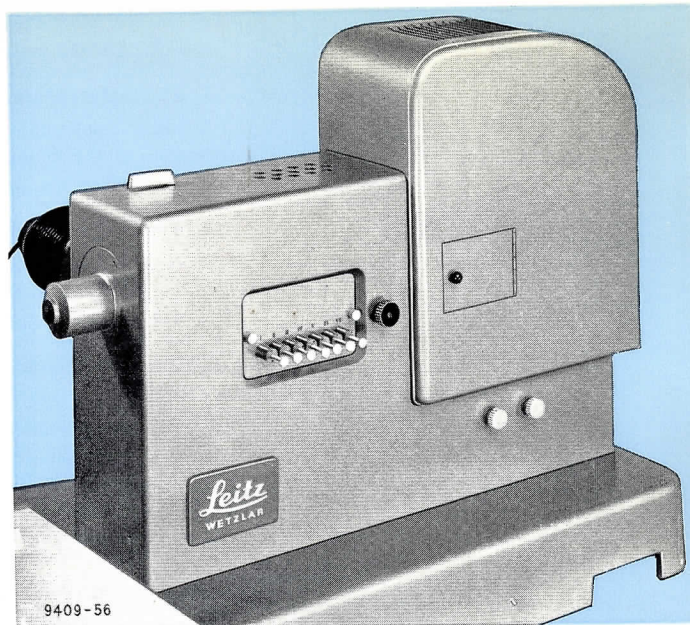
Objectives								
Brightfield and polarized light	Low power vertical illuminator (bright field only)	PI 3.2 x/0.06	PI 8 x/0.18	PI 16 x/0.30	PI 32 x/0.50	PI 80 x/0.95	PI 160 x/0.95	PI Apo OI 160 x/1.40
Phase contrast	—	—	Phaco PI 8 x/0.18	—	Phaco PI 32 x/0.50	Phaco PI 80 x/0.95	Phaco PI 160 x/0.95	Phaco PI OI 160 x/1.40
Darkfield	—	—	—	D PI 16 x/0.30	D PI 32 x/0.50	D PI 80 x/0.75	—	—
Standard magnification with GW 8 x	8 x	20 x	50 x	100 x	200 x	500 x	1000 x	
Range of visual magnification with eyepieces GW 6.3 x to GF 25 x	6.3 x to 25 x	16 x to 63 x	40 x to 160 x	80 x to 320 x	160 x to 630 x	400 x to 1600 x	800 x to 3200 x	
Diameter of field with eyepieces GW 6.3 x to GF 25 x	28.0 mm to 10.0 mm	11.2 mm to 4.0 mm	4.4 mm to 1.6 mm	2.2 mm to 0.8 mm	1.1 mm to 0.4 mm	0.44 mm to 0.16 mm	0.22 mm to 0.08 mm	
Range of magnifications with 13x18cm (5x7 in.) camera *) and eyepieces GW 6.3 x, GW 8 x, GW 10 x	(5 : 1) 8 : 1 to 25 : 1	(12.5 : 1) 20 : 1 to 63 : 1	(32 : 1) 50 : 1 to 160 : 1	(63 : 1) 100 : 1 to 320 : 1	(125 : 1) 200 : 1 to 630 : 1	(320 : 1) 500 : 1 to 1600 : 1	(630 : 1) 1000 : 1 to 3200 : 1	
Projection equipment	12.5 : 1	32 : 1	80 : 1	160 : 1	320 : 1	800 : 1	1600 : 1	



XBO 450 W xenon lamp,
with starter unit on the right

Technical data of the
XBO 450 W xenon discharge lamp: -

Practically continuous spectrum
throughout the visible range
Colour temperature 6260 °K.
Luminous density in the cathode spot
in excess of 100.000 sb,
medium density of the arc
approximately 25.000 sb.
Light flux 13.500 lumens
Average life 800 hrs
(with switching on and
off once every 3 working hours)



Alternative illumination with push-button filter changer

3. Interchangeable xenon/filament illumination

The large, double-walled housing contains: -

Centring 12 v 60 W low-voltage filament lamp in attached housing.

High-pressure XBO 450 W xenon lamp as high-intensity light source, with starter unit.

Push-button filter changer.

Mirror with changing lever for the alternative use of either light source.

The brightness of the low-voltage filament lamp is perfectly adequate for all ordinary bright-field investigations as well as for photomicrography. Photographic filters and a blue ground-glass disc can be inserted in the light beam.

The xenon discharge lamp has the great advantage over the carbon arc lamp that once adjusted, it needs no further attention. The colour of its light closely approaches the daylight effect of mixed sun- and skylight. The luminous density is superior to that of the carbon arc and independent of mains voltage fluctuations.

Push-button filter selection

The following filters can be inserted into the beam path of the xenon lamp, either singly or in groups, simply by pressing a push-button: -

Diffusing disc,

Lenticular diffuser,

Neutral density filter, 5% transmission,

Neutral density filter, 0.2% transmission,

Green filter for photography,

2 filter holders for insertion of special filters.

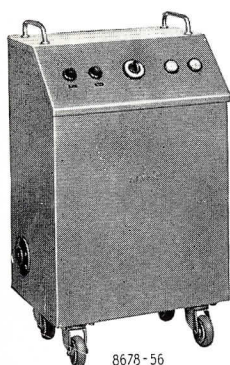
4. 13 x 18 cm (5 x 7") bellows camera

The bellows camera for 13 x 18cm (5 x 7") plates slides on a stout monobar at the end of the base plate. A remote-control transmission of the fine adjustment for the final focusing of the image during observation of the camera groundglass screen passes through this monobar. Generally, however, this fine adjustment is required only if the camera is used with eyepieces other than the GW eyepieces which are adjustable for the bellows extension.

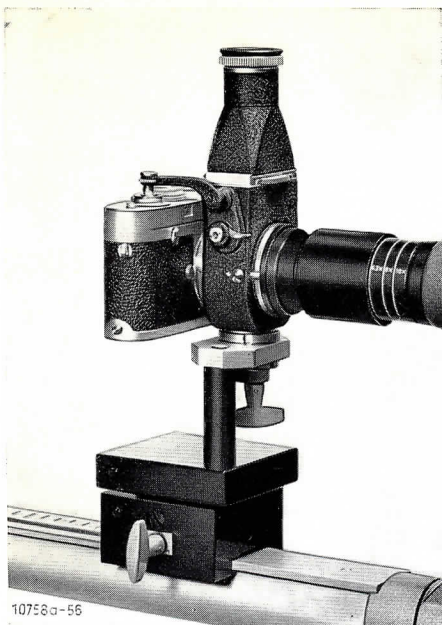
A revolving darkslide carrier allows selection of the most suitable picture area, e.g. when adjustment to a banded structure becomes necessary. The self-winding, flash-synchronized central shutter with vibration-absorbing suspension has speeds from 1 to 1/125 sec. and time. The bellows can be extended from 16 to 64cm (setting for standard magnification: - bellows extension 32cm, eyepiece GW 6.3 x). Thus, the reproduction ratio can be varied within wide limits by adjusting the extension of the bellows.

The reproduction ratios obtainable with the camera are tabulated on p. 5.

The equipment includes adapters for 9 x 12cm and 6.5 x 9cm plates, as well as clear and groundglass focusing screens.



Mobile control unit (mains rectifier) for the
xenon lamp; either for full 25 amp load
only, or alternatively for full load
and reduced load (17 amp).
A switchboard can be supplied for use on
the work bench, permitting remote control
of the on-off and the 24/17 amp switches.



With the eyepiece GW 6.3 x in the microscope the projected image has the following diameters (approximately): -

at 32cm bellows extension the diagonal of 13 x 18cm (5 x 7")

at 25cm bellows extension the diagonal of 10.4 x 16.4cm (4 x 6")

at 20cm bellows extension the diagonal of 8.1 x 11.2cm (3 1/4 x 4 1/4")

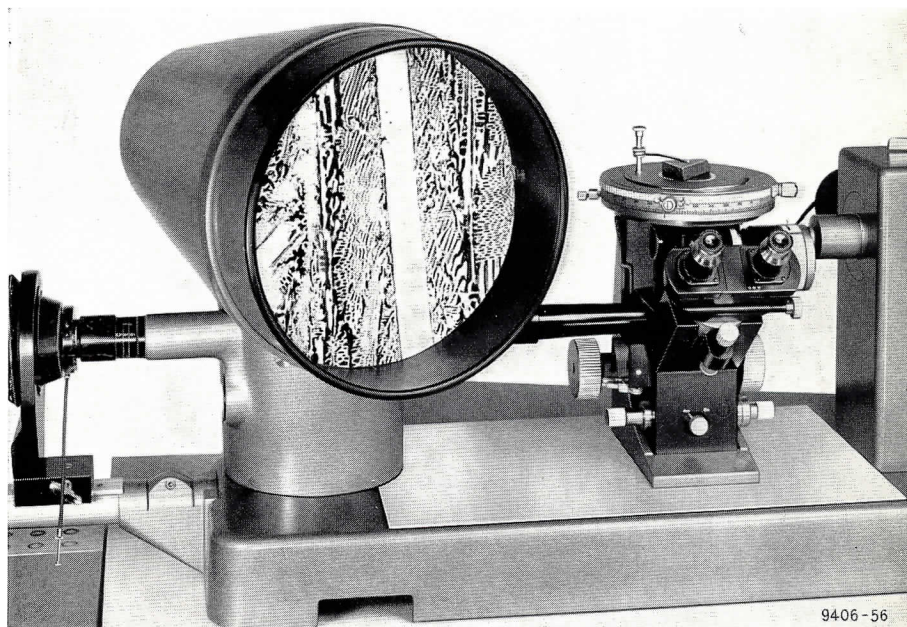
at 16cm bellows extension the diagonal of 6.5 x 9cm (2 1/2 x 3 1/2").

Accessories for the use of a Polaroid attachment on request.

5. 35 mm attachment

The equipment consists of a carrier with reduction lens, a reflex housing with clear glass and groundglass screen, and a focusing magnifier. The reducing lens reduces the magnification to 1/4 of the total magnification. With the widefield eyepieces GW 6.3 x, 8 x, 10 x, and GF 12.5 x, fields are obtained which enlarged to 13 x 18cm (5 x 7"), 9 x 12cm (1/4 pl.), 7.5 x 10cm (3 x 4") and 6 x 9cm (2 1/2 x 3 1/2") correspond to the respective standard magnifications.

The ORTHOMAT® fully automatic microscope camera can also be used for 35mm photography. Details on request.



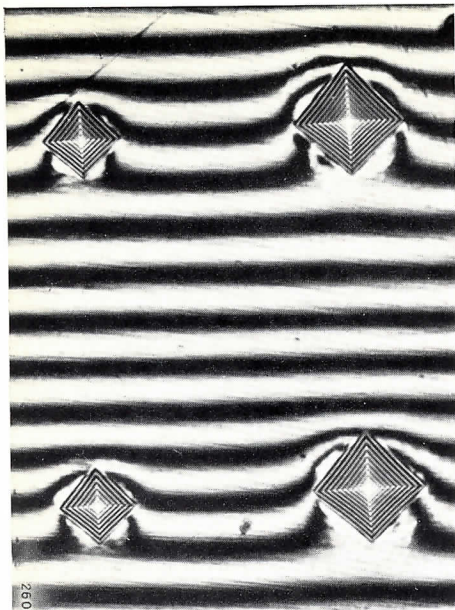
The large, bright image on the projection screen can be studied in comfort

6. Projection equipment

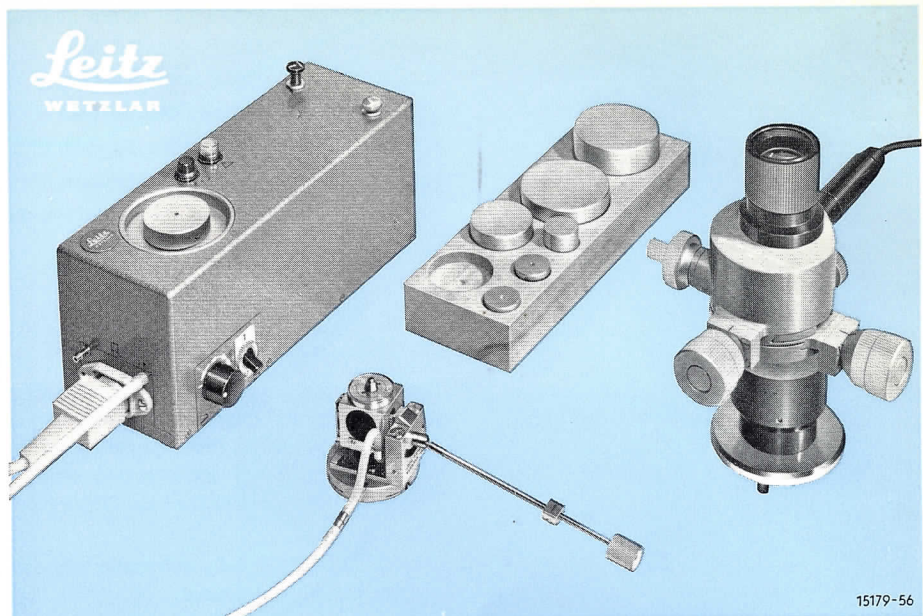
The projection housing can be rotated horizontally through 30° so that the projection screen is turned either to face the observer seated at the microscope, or forward to give a clear view to a number of observers. The image on the projection groundglass screen is parfocal, and has a field of view which is identical, with that of the visual image and remains completely unchanged when the projection housing is turned. The 340mm diameter groundglass screen is covered by a Fresnel lens which concentrates the light in the direction of the observer so that a very clear image is obtained normally even in well-lit rooms without blackout.

The image on the projection screen corresponds to that seen through the GW 8 x eyepiece 1.6 x enlarged (cf. table on p. 5). Hence, the finest microscopic detail is larger than the grain of the groundglass screen or the grooves of the Fresnel lens above it.

The base of the projection unit contains a movable prism which either passes the beam straight to the camera or diverts it to the projection groundglass screen. An aperture is provided for the insertion of an exposure meter.



Vickers hardness indentations under the incident-light interference microscope, 500 x



From left to right: - Control unit, indenter, set of weights, micrometer eyepiece.

7. Micro-hardness tester

The Micro-hardness tester permits aimed hardness determinations by the Vickers- and the Knoop method. An indentation is produced by a diamond pyramid and optically evaluated. The Vickers pyramid has a square, the Knoop pyramid a rhombic base.

Technical description

The micro-hardness tester consists of two components, the indenter with interchangeable diamond and objective, and the control unit. The micrometer eyepiece required for measuring the diamond indentation is described in List 72 - 1.

Operation of the hardness tester could not be simpler. Instead of the usual objective, the indenter is placed on the opak illuminator of the MM 5. After focusing the desired object detail the diamond, arranged at an angle of 90° to the objective, is introduced simply by operating a flexible shaft. A magnet stop ensures that the diamond is always perfectly orientated.

After the desired load has been placed in position the diamond is pneumatically lowered into the test piece. As soon as the air pressure generated by the motor-driven pump built into the control unit corresponds to the load applied, the motor is automatically switched off, which is indicated by the extinction of a light. The mechanism is switched off after 5 - 10 secs'. duration of action, the diamond returns to its starting position, and the pump to its zero position. It is now possible immediately to observe and measure the indentation.

Test loads: 2, 5, 10, 25, 50, 100, 200, and 400 g.

Magnification 400 x (in combination with micrometer eyepiece).

Spotting accuracy $\pm 2 \mu\text{m}$.

Design subject to alteration without notice.

® = Registered trademark

ERNST LEITZ GMBH WETZLAR GERMANY

Subsidiary: Ernst Leitz (Canada) Ltd., Midland, Ontario