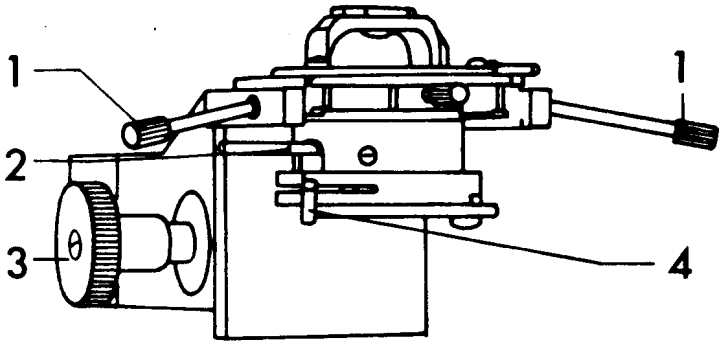


Fig. 29

from objective 10/0,25

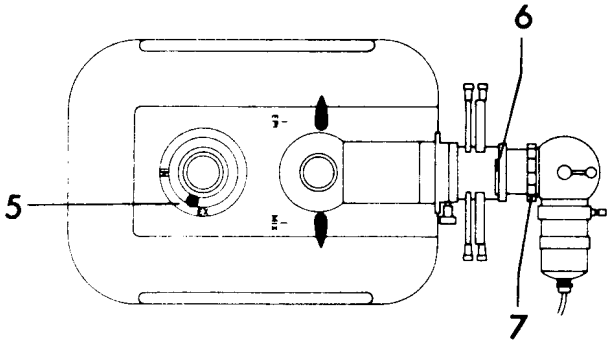


Fig. 30

up to objective 6,3/0,16

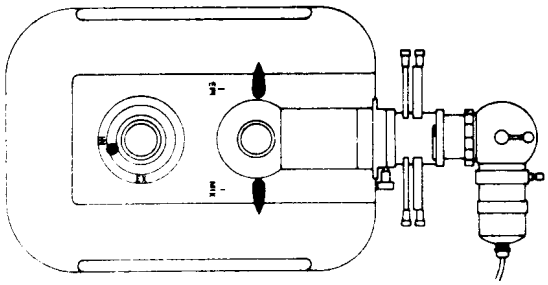


Fig. 31

Working with the 2-lens condenser 0,90 N.A. with swing-out front lens, Fig. 29

a) Adjusting the illumination for working with the objective 10/0,25, or higher power objectives.

Place the specimen on the stage; swing in the 10/0,25 objective.

Switch on the lamp, insert a neutral filter and set the illumination lens with pin (5) to "EX".

Swing-out the condenser front lens with lever (2) in the case of the 10/0,25 objective, swing it in again from the objective 16/0,32 upwards.

Focus on the specimen with the coarse and fine motions.

Slightly close the lamp field diaphragm with the lever (6), focus on its image in the field by raising or lowering the condenser with knob (3), and move it into the center with the two centering screws (1). Open the field diaphragm to just beyond the edge of the field.

Adjust for the most uniform illumination of the field with the lamp collector ring (7).

Close the aperture iris diaphragm with lever (4) until the clearest and most contrasting microscopic image is obtained.

When changing over to higher power objectives (from 16/0,32 upwards) the front lens of the condenser is swung in and the positions of the field and aperture iris diaphragm have to be corrected.

b) Adjusting the illumination for work with the objective 6,3/0,16 and lower power objectives

Swing-out the condenser front lens, set the illumination lens to "IN", fully open lamp field diaphragm and aperture iris diaphragm.

Working with the achromatic aplanatic condenser 1,35 N.A., Fig. 32

This condenser is intended specially for the most stringent requirements in photomicrography, and is used mainly with higher power objectives from 40 X magnification upwards. If the front lens of the condenser is unscrewed it is possible to work also with the objectives 16/0,32 and 25/0,45.

Place a specimen on the stage, swing in the 40/0,65 objective or the next higher magnification objective.

Switch on the lamp, insert a neutral filter and set the illumination lens to "EX" with the pin (5).

Focus on the specimen with the coarse and fine motions.

Slightly close the lamp field diaphragm with lever (6), focus on its image in the field by raising or lowering the condenser with the control (3), and move it into the center with the two centering screws (1). Open the field diaphragm to just beyond the boundary of the field.

Adjust the lamp collector ring to obtain the most uniform illumination of the field.

Close the aperture iris diaphragm with lever (8) to obtain the clearest and most contrasting microscopic image.

When changing over to higher power objectives the settings of the field and aperture iris diaphragms have to be checked.

To utilize the full aperture of the condenser it is necessary to employ oil immersion from the objective 40/0,65 upwards (alternatively water or glycerine).

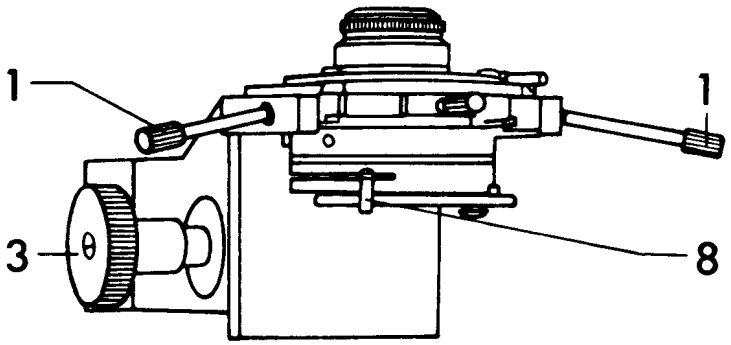


Fig. 32

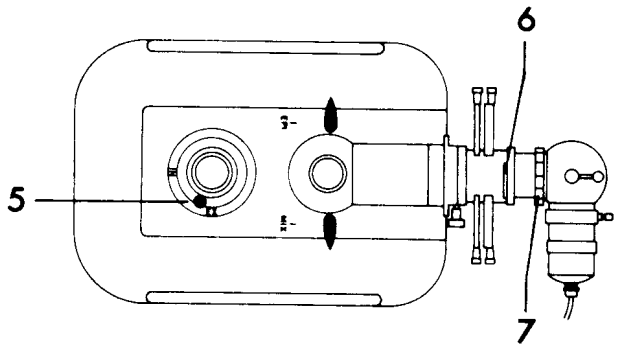


Fig. 33

Working with the 2-lens wide-field condenser, Fig. 34

The 2-lens wide-field condenser (9) provides uniform illumination of the field when using low-power objectives up to 4 X magnification, especially for photomicrography.

Place a specimen on the stage and swing in an objective, e.g. 2,5/0,08.

Switch on the lamp, insert a neutral filter and set the illumination lens to "EX" with pin (5).

Focus on the specimen with coarse and fine motions.

Fully close the lamp field diaphragm with lever (6) and focus its image in the field by raising and lowering the condenser with control (3). Move it into the center with the centering screws (1), then fully open the lamp field diaphragm and set the condenser with the control (3) to its lowest position furthest away from the specimen.

Swing in the frosted screen on the low-voltage lamp and adjust the knurled ring on the lamp collector to obtain the brightest and most uniform illumination of the field.

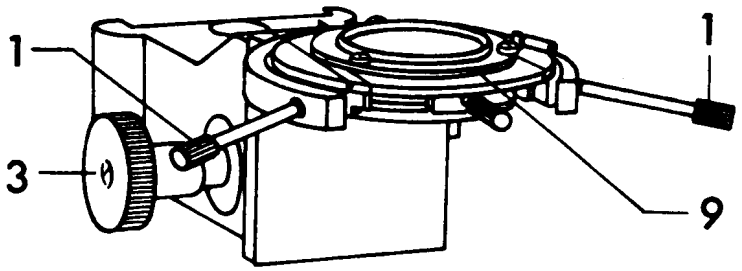


Fig. 34

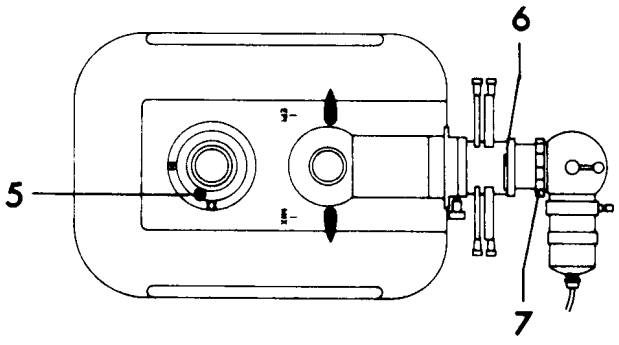


Fig. 35

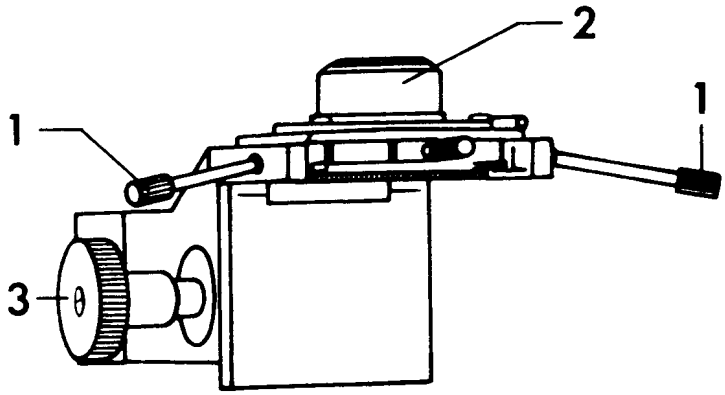


Fig. 36

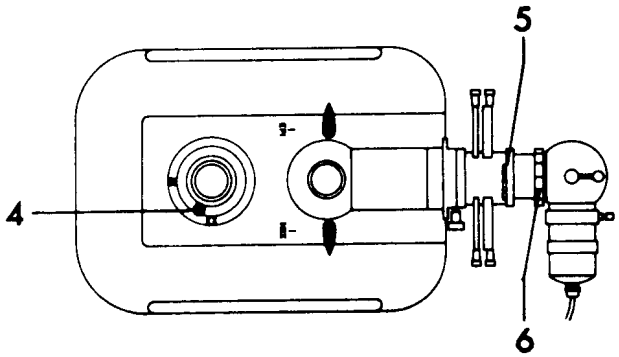


Fig. 37

B) Transmitted-light dark ground

Working with the immersion dark ground condenser

a) Dark ground specimens

Slides for use with the immersion dark ground condenser (2) must never be thicker than 1,3 mm but should also not be appreciably thinner. The slide and the cover slip must be perfectly clean since even the slightest dirt causes a diffused brightening which would interfere with the microscopic image.

b) Objective aperture diaphragms

The immersion dark ground condenser has numerical apertures between 1,18 and 1,42. In order to prevent excessive illumination all objectives with apertures above 0,65 must be fitted with an aperture diaphragm. These either may be built-in aperture iris diaphragms which can be stopped down as required, or funnel stops. To insert the funnel stop unscrew the fixed diaphragm which is at the back of the objective near the objective thread. The funnel stop is screwed into the fixed diaphragm and the latter is then screwed back into the objective together with the funnel stop,

For bright ground observation the aperture iris diaphragm is fully opened or the funnel stop is removed again.

c) Adjusting the dark ground illumination

Switch on the lamp, swing out all light filters and also the frosted screen. Fully open the lamp field diaphragm. Set the illumination lens to "EX" with pin (4).

Place a few drops of immersion liquid on the condenser front lens; e.g. water or immersion oil, or glycerine with 10 % water in the case of fluorescence work.

Place a dark ground specimen on the stage, then carefully raise the condenser with control (3) until uniform liquid contact is obtained between condenser and specimen and the latter lights up.

Swing in a low-power objective, e.g. 10/0,25, and focus on the specimen with the coarse and fine motions. Only a few bright spots will be visible in the field at first; lowering the condenser produces a dark circle which should fill approximately 2/3 of the field. This circle is centered to the middle of the field with the centering screws (1). The condenser is then raised again until the dark circle disappears and the center of the field is brightly illuminated. Adjust the lamp collector to obtain the brightest and most uniform illumination of the field.

When changing over to higher power objectives check the adjustment of the lamp collector and the centering of the condenser. A satisfactory dark ground image is obtained with objectives from 40 X magnification upwards, in conjunction with the eyepiece PK 10 X. Larger fields, i.e. when using objectives with a magnification below 25 X, can only be illuminated with a dry dark ground condenser.

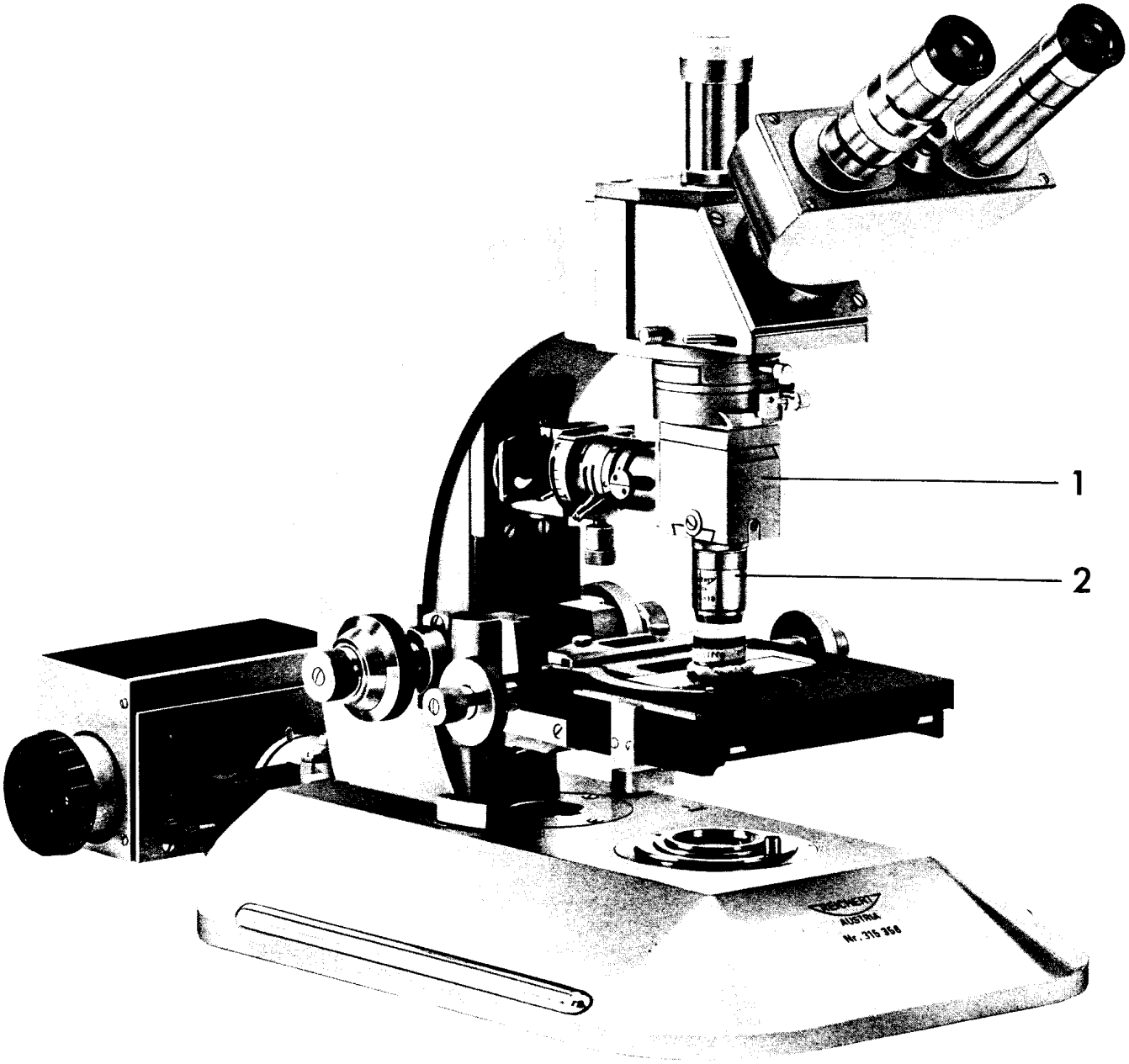


Fig. 38

"ZETOPAN" with incident light illumination equipment

1 Universal opaque illuminator
2 Incident light objective

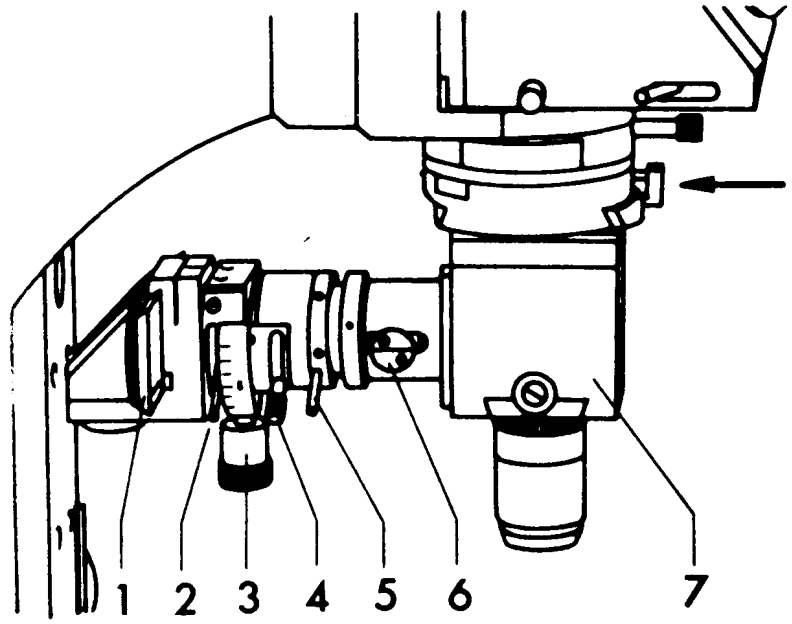


Fig. 39

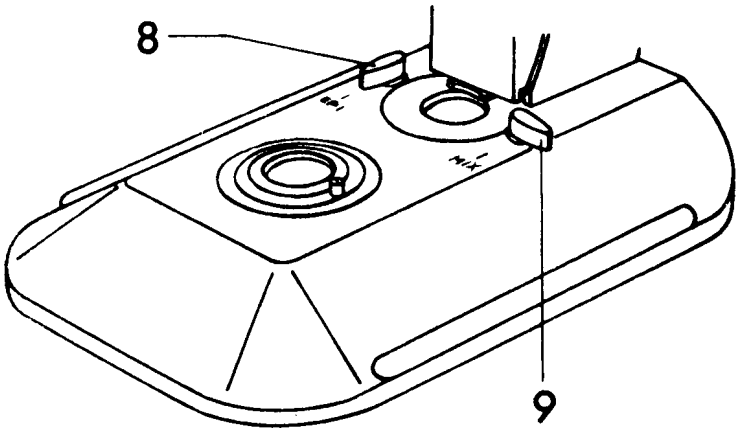
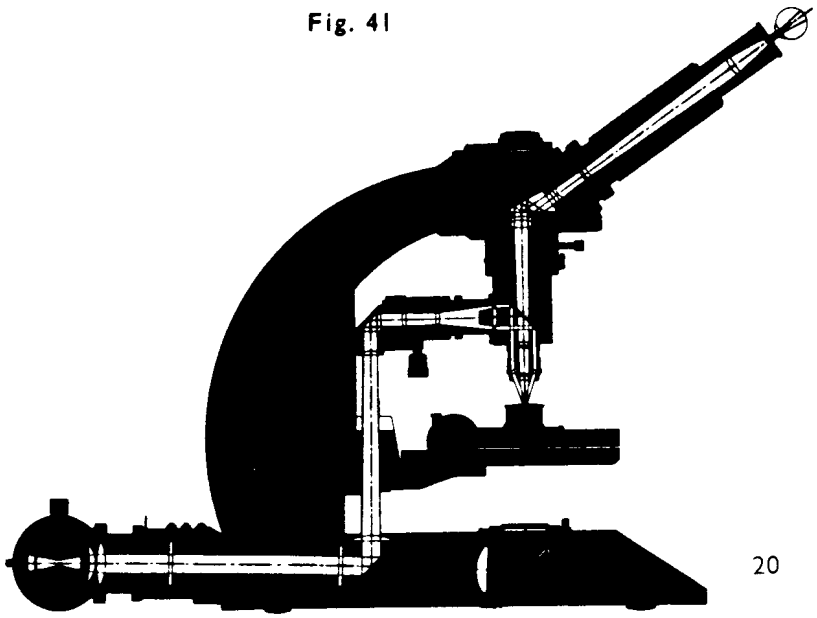


Fig. 40

Fig. 41



INCIDENT–LIGHT ILLUMINATION EQUIPMENT

For incident light microscopy the substage is normally removed from the stand and the stage support lowered to the index mark on the stand, see also pages 10 and 11. In the case of higher incident-light specimens the stage support can be lowered down to the stop.

Universal opaque illuminator and incident-light objective

Lower the stage with the coarse motion.
Slightly unscrew knob (8) (Fig. 22) on the microscope head, slide in the universal opaque illuminator (7) from the front up to the stop and clamp it in position.

Insert an incident-light objective on slide, e.g. 5,5/ 0,15, into the guide on the opaque illuminator in place of the blank slide.

The opaque illuminator should always be covered with the blank slide or an objective to protect it against dust !

Incident-light illumination optics

Move the lever (9) for mixed light illumination outwards to the right. The deviating mirror for incident-light illumination is inserted into the illumination beam by turning lever (8) toward to position "EPI".

Fig. 41 shows the light path during incident-light microscopy.

Adjusting the incident-light bright ground illumination

a) The incident-light specimen (attached to a slide with plasticine, see page 25) is placed on the stage.

b) Switch on the low-voltage lamp and insert a filter to reduce the light intensity. Fully open the lamp field diaphragm; it remains open during all observations with the universal opaque illuminator.

c) Move slider (1) to its center position. Fully open the field diaphragm with lever (5) and the aperture iris diaphragm with the lever (2) – both levers pointing upwards at an angle.

d) Best image quality can only be achieved if the aperture iris diaphragm is imaged by the illumination lens in the rear focal plane of the objective. The best setting for each case is obtained in the following positions after clamping the knurled nut (4) :

	Upper stop	Dot	Lower stop
Incident-light bright ground		o	
Incident-light bright ground steep-oblique			
up to objective 5,5/0,15			o
from objective 11/0,25		o	
Incident-light dark ground	o		
Incident-light dark ground one-sided		o	

e) Center the aperture iris diaphragm to the optical axis with knob (3); the knob has a click stop in the center position.

f) Swing-out the central diaphragm with knob (6); the index line on the knob is horizontal.

g) Focus on the specimen with coarse and fine motions.

h) Close the field iris diaphragm with lever (5) so that it becomes visible in the field, and then open it again until just beyond the edge of the field. Further opening produces excessive illumination and loss of contrast in the microscopic image.

i) Set the aperture iris diaphragm with lever (2) to obtain the clearest and most contrasting microscopic image. This is the case when the objective rear lens (viewed through the Bertrand lens) is illuminated to about 2/3 of its diameter, see Fig. 42.

A scale near lever (2) is provided to permit reproducible diaphragm settings, especially for photomicrography.

j) Adjust the lamp collector to obtain the brightest and most uniform illumination of the field.

k) When changing objectives or eyepieces it is necessary to check the settings of the field and aperture-iris diaphragms and of the lamp collector.

Adjusting the steep-oblique incident-light bright ground illumination ("pseudo-relief")

Adjustment as for incident-light bright ground illumination, but the aperture iris diaphragm is closed further than normally with lever (2). Then de-center the aperture diaphragm with the knob (3) to steep-oblique internal illumination until the desired relief effect is obtained. The optimum adjustment has been reached when the rear lens of the objective (seen with the Bertrand lens) is illuminated as shown in Fig. 44. Up to objective 5,5/0,15 the knurled nut (4) of the illumination lens for the aperture-iris diaphragm is against its lower stop; with higher power objectives, i.e. from 11/0,25, it is in the central position.

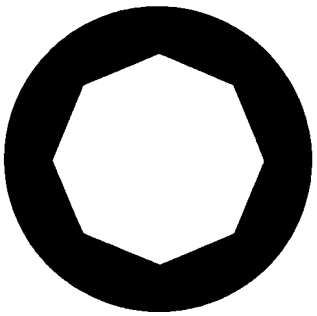


Fig. 42

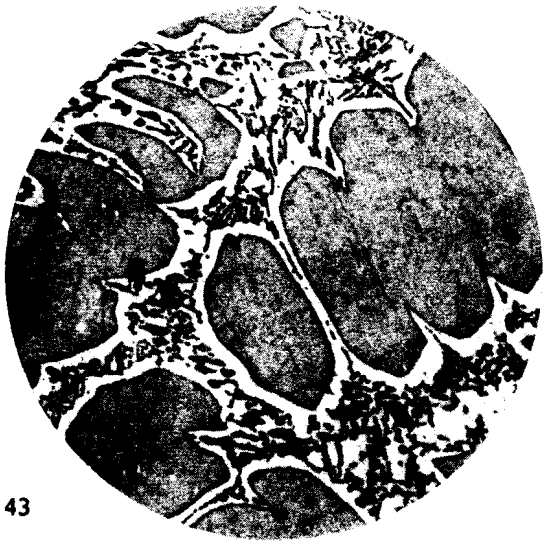


Fig. 43

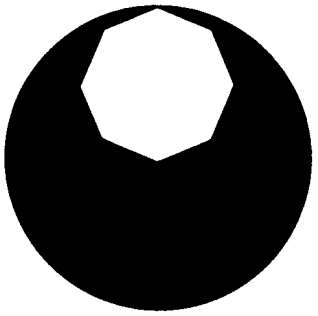


Fig. 44

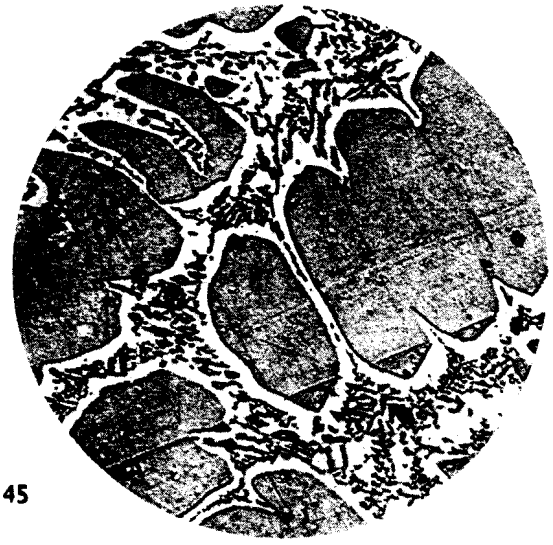


Fig. 45

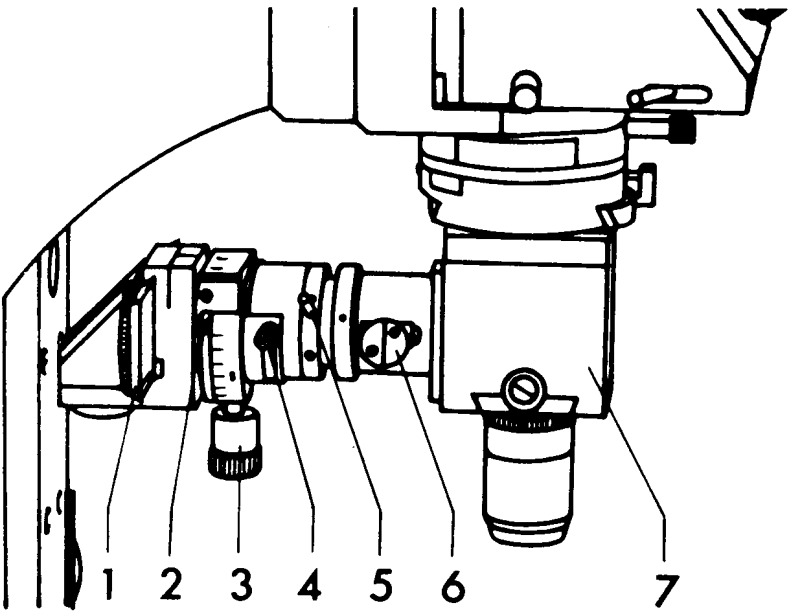


Fig. 46

Fig. 47

Fig. 48

Adjusting the incident-light dark ground illumination

a) Place a specimen on the stage, insert an Epilum objective into the universal opaque illuminator.

b) Switch on the low-voltage lamp and swing out all filters in the lamp. The lamp field diaphragm is fully opened; it remains open during all observation with the opaque illuminator.

c) Move the slider (1) to its center position. Fully open the field diaphragm with lever (5) and the aperture iris diaphragm with lever (2); both levers now point upwards at an angle.

d) Set the illumination lens for the aperture-iris diaphragm; slide knurled nut (4) to its upper stop and clamp it in position.

e) Center the aperture-iris diaphragm to the optical axis with the rotating knob (3); the knob has a click stop in its center position.

f) Insert the central diaphragm with knob (6); the index line on the rotating knob is vertical.

g) Focus on the specimen with coarse and fine motions.

h) Adjust the lamp collector to obtain the brightest and most uniform illumination of the field.

Adjusting the one-sided incident-light dark ground illumination

Adjustment as for normal incident-light dark ground illumination but the knurled nut (4) of the illumination lens is clamped in the center position.

Move slider (1) to the right up to the stop to introduce the sector diaphragm into the beam. Rotate the sector diaphragm to find the best adjustment.

Universal opaque illuminator with objective nosepiece

The universal opaque illuminator can be supplied with a permanently built on objective nosepiece. The height of the nosepiece increases the tube length from 190 to 210 mm and the objective magnifications from 5,5 X to 6,3 X and from 11 X to 12,5 X.

When screwing the objectives into the nosepiece, the 12,5/0,25 objective is, at first, screwed into the threaded hole marked with a point. The other objectives are screwed into the threaded holes in such a way that clockwise rotation of the nosepiece always swings-in the next more powerful objective.

MIXED ILLUMINATION

For the examination of opaque specimens up to about 2,5 mm thick, e.g. very small fossils, insects, small crystals, grains, powders, wires, fibres, textiles and papers. By introducing different colors for the transmitted and incident-light beams both the surface and the outline of a specimen are rendered clearly visible at the same time.

Setting up the microscope for mixed light illumination

First fit the substage and stage, then insert the condenser into the substage. Finally insert the universal opaque illuminator into the microscope head and fit the incident-light objective.

Mixed-light illumination optics

Turn lever (8) for incident-light illumination outwards to the left.

Turn lever (9) for mixed illumination to the front into position "MIX" so that the partially transparent mirror is inserted into the illumination beam. This mirror diverts 50 % of the light from the low-voltage lamp to the universal opaque illuminator while the remaining light passes into the condenser.

Fig. 50 shows the light path for mixed illumination.

Adjusting the mixed illumination

First adjust for transmitted light illumination, e.g. with the 2-diaphragm condenser, then obtain incident-light illumination with the opaque illuminator as described in the preceding sections.

For improved differentiation of the transmitted or incident-light image it is possible to place light filters of different color on the light exit apertures in the microscope base.

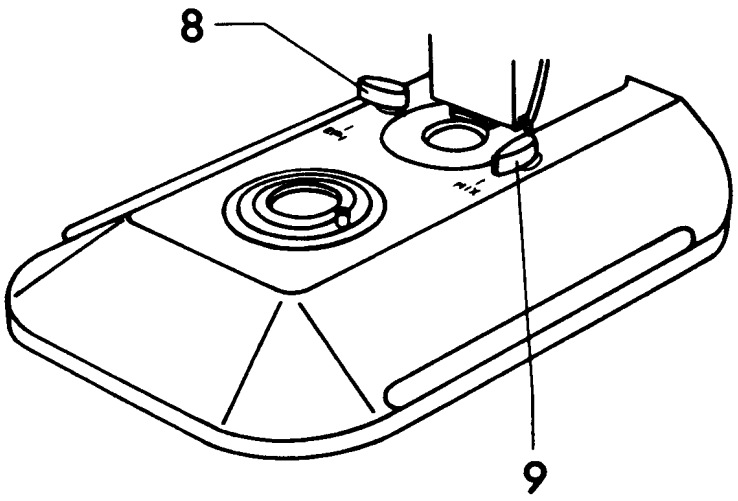
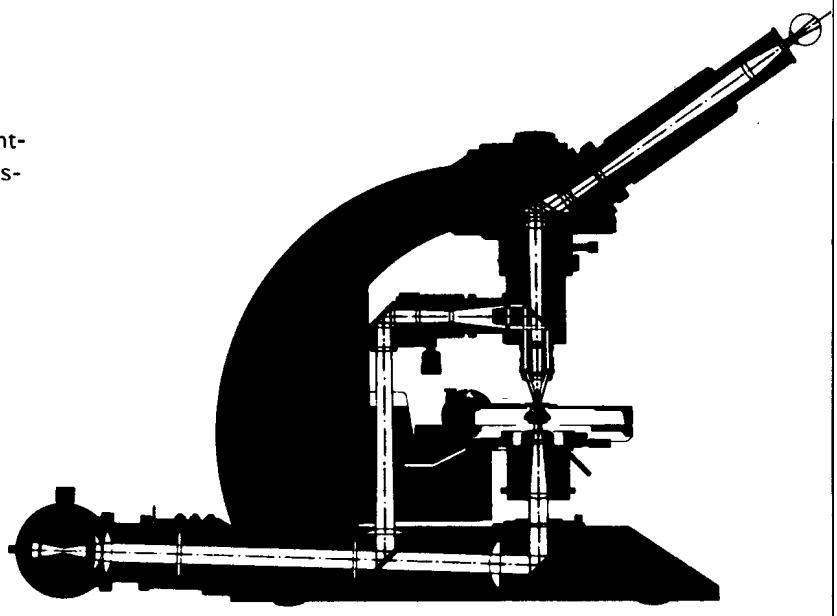


Fig. 49

Fig. 50



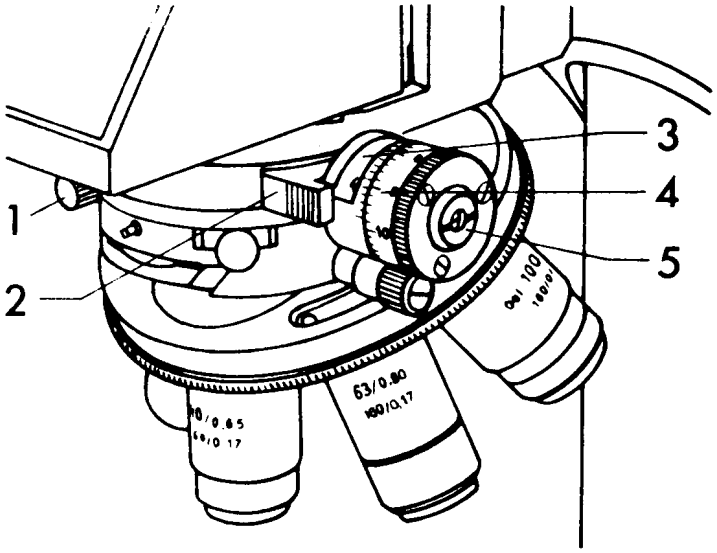


Fig. 51

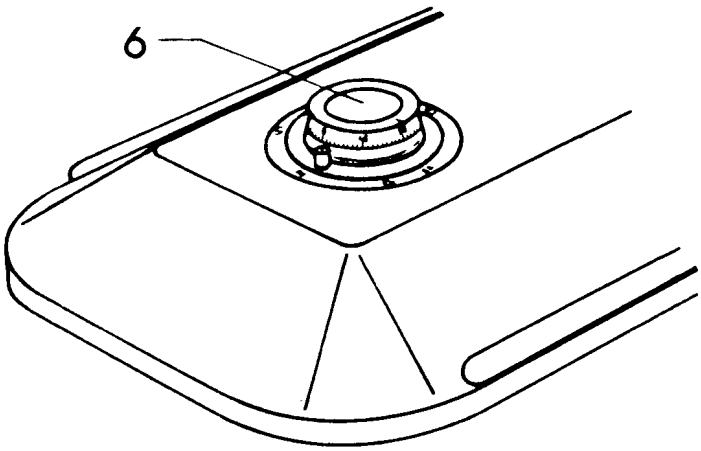
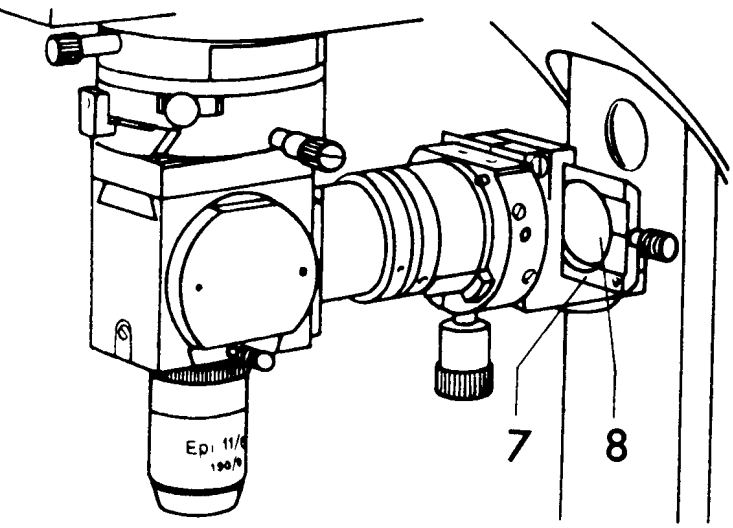


Fig. 52

Fig. 53



MICROSCOPE ACCESSORIES

Simple polarization equipment

a) Filter analyzer

Open clamping screw (1) on the front of the "ZETOPAN"-microscope head and remove the blank slide. Slide the analyzer (2) into the slot. After tightening screw (1) the analyzer can be moved backwards and forwards between two stops : when moved in up to the stop the analyzer is inserted into the beam, when it is moved out up to the stop it is out of the beam.

The filter analyzer can be rotated through 360°. The range is visible in the window (3) in steps of 45°, the measuring drum (4) is divided into 45 degrees, and the vernier permits reading to the nearest 0,1°. When the measuring drum is rotated, an excentric cam at the same time moves the range graduation in the window, resulting in an uneven movement of the graduation.

In the "0°" position the analyzer is oriented north-south.

The analyzer can be readjusted as follows : the measuring drum is held in the "0°" position and the screw (5) is then rotated with a coin until the field is completely dark with the polarizer crossed (east-west).

b) Transmitted-light filter polarizer

The transmitted-light filter polarizer (6) is placed on the light exit aperture in the base so that its locating pin engages in the hole provided for this purpose in the base. The polarizer can be rotated through 360°, is graduated in 5° steps, and has click stops at 0, 90, 180 and 270°. In the 0° position the plane of vibration of the polarized light is oriented east-west.

c) Incident-light filter polarizer

The incident-light filter polarizer (8) is permanently mounted in the slider (7) of the universal opaque illuminator and oriented east-west.

To insert the polarizer the slide is moved to the left up to the stop.

Further details on polarization body, rotating stage and various polarization accessories are contained in the Operating Instructions for the "ZETOPAN-POL" Polarization Microscope.

Mounting press

The mounting press (10) is used to align the polished face of an incident light specimen parallel to the slide. The slide (11) together with the specimen mounted on plasticine is placed on the anvil (12). A piece of paper is placed on the specimen to protect the polished surface. Press down head (9) by hand until the specimen is accurately parallel.

If several specimens have to be set to the same height, prepare the first specimen as described above but maintain the hand pressure on the head. With the other hand loosen clamping screw (14) and move height stop (13) up against the top of the frame; secure it there with the clamping screw.

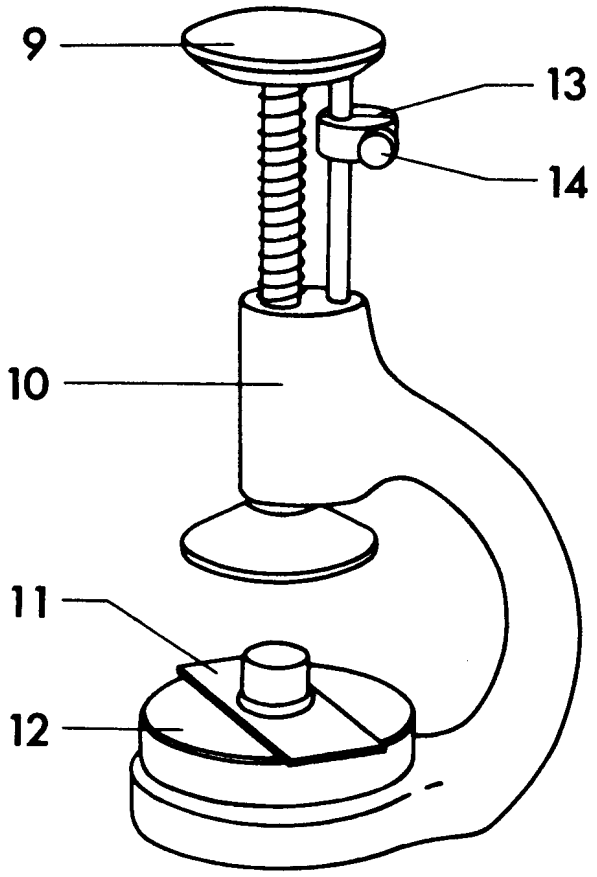


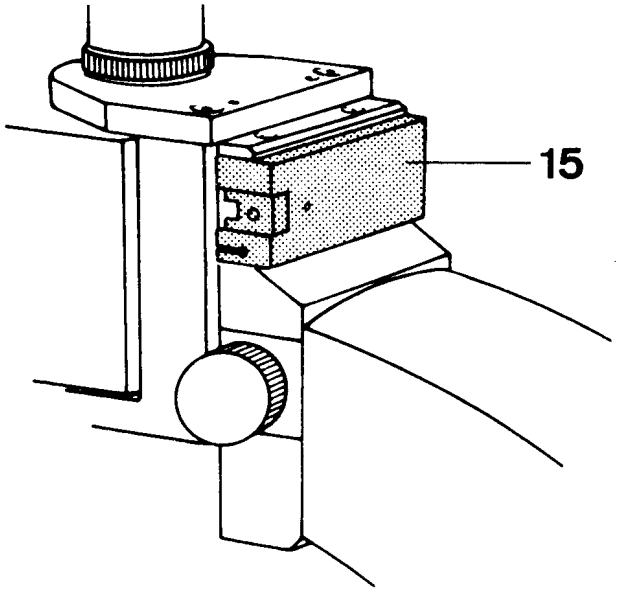
Fig. 54

Spacer

To relieve the tube head and for examination of higher incident light specimens the 20 mm spacer (15) Ref.No.46 40 30 can be clamped to the guideway of the tube head.

After the spacer has been clamped the tube head is lowered up to its stop and fixed with the clamping screw.

Fig. 55



MEASURING AND MICROMETER VALUES

Measuring

Insert a measuring eyepiece in the body. When using the binocular body the measuring eyepiece is fitted into the right eyepiece tube. Length measurements in the specimen plane can be carried out with the measuring eyepiece by first observing how many divisions of the scale visible in the eyepiece correspond to the specimen length to be measured; this number is then multiplied by the "micrometer value M (in µm)", which depends on the objective used. The result is the true length of the distance being measured, expressed in µm (1 µm = 0,001 mm). The micrometer value can be taken from the table below.

MICROMETER VALUE "M"

$$M = \frac{\text{Const}}{M_{obj}}$$

Measuring eyepiece PK 6,3 X m . . . Const. = 140
" " PK 8 X m . . . Const. = 130
" " PK 12,5 X m . . . Const. = 100

Objective magnification M_{obj}	Micrometer value M (µm) for measuring eyepiece PK 6,3 X m	PK 8 X m	PK 12,5 X m
Transmitted-light objectives			
2,5	55	52	40
4	34	33	25
6,3	22	21	16
10	14	13	10
16	8,5	8,2	6,3
25	5,5	5,2	4,0
40	3,4	3,3	2,5
63	2,2	2,1	1,6
100	1,4	1,3	1,0
Incident-light objectives			
2,8	50	47	36
5,5	25	24	18
11	13	12	9,1
28	5	4,6	3,6
45	3,1	2,9	2,2
56	2,5	2,3	1,8
90	1,6	1,4	1,1

Determining the micrometer value

For very accurate measurements it is advisable to determine the micrometer value by means of the stage micrometer which is graduated in 0,01 mm.

After focusing both on the eyepiece reticle and on the graduation of the stage micrometer, the eyepiece is rotated in the microscope body so that the two distances to be measured are exactly parallel. The stage micrometer is then moved until the zero points of the two distances coincide, and the two graduations just overlap (viz Fig. 55).

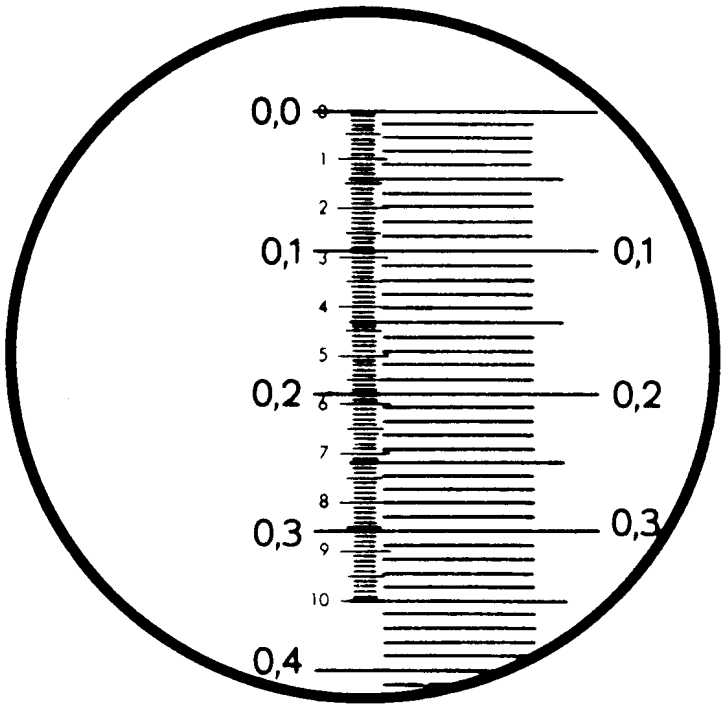
Now read how many divisions of the stage micrometer, i.e. how many multiples of 0,01 mm, correspond to 100 divisions of the eyepiece reticle. From this it is easy to calculate the micrometer value which indicates the numbers of microns (µm) corresponding to 1 graduation on the eyepiece scale.

Example : Achromatic objective 40/0,65
Measuring eyepiece PK 6,3 X m

EYEPIECE SCALE	STAGE MICROMETER
100 divisions	35 divisions
	1 division = 0,01 mm = 10 µm
	35 divisions = 0,35 mm = 350 µm
1 division	= 3,5 µm

The micrometer value is therefore 3,5 µm.

Fig. 56



OPERATING INSTRUCTIONS FOR "ZETOPAN" ACCESSORY EQUIPMENTS

Instruction Manual for the "ZETOPAN–POL" Large Polarization Microscope.

Instruction Manual for the "TRANSMITTED–LIGHT–INTERFERENCE–CONTRAST–EQUIPMENT" on the "ZETOPAN" Research Microscope.

Instruction Manual for the "PHASE–CONTRAST– AND ANOPTRAL–CONTRAST–EQUIPMENT" on tne "ZETOPAN" Large Research Microscope.

Instruction Manual for the "PHASE–CONTRAST– AND ANOPTRAL–CONTRAST–EQUIPMENT" with the "LONG–FOCUS CONTRAST CONDENSER" on the "ZETOPAN" Large Research Microscope.

Instruction Manual for the "INCIDENT–LIGHT–INTERFERENCE–CONTRAST–EQUIPMENT.

Instruction Manual for the "BIOTHERM" Biological Hot Plate.

Instruction Manual for the "KAM VBX" photomicrographic camera and the "REMICA III" photomicrographic miniature camera

Instruction Manual for the "REMIPHOT" exposure meter

Instruction Manual for the "KINEKONNEX" cinephotomicrographic equipment

Instruction Manual "REICHERT PHOTOAUTOMATIC"

Instruction Manual for the twin-lamp unit "BINOLUX II"

"FLUORESCENCE MICROSCOPY WITH FLUOROCHROMES" – Recipes and Tables

Instruction Manual for the "MICRO FLASH EQUIPMENT"

Instruction Manual for "REICHERT MICROPHOTOMETER"

Instruction Manual for the "VIEWING SCREEN"

SPARES

Spares and ordering numbers

Low-voltage quartz halogen bulb 12 V, 100 W	86 00 15
Low-voltage bulb 6 V, 30 W.	15 69 01
Transmitted-light stage micrometer	89 00 01
Incident-light stage micrometer	48 16 01