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Ng-MICROSCOPES

Instructions for use

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Introduction

The N-series of microscopes represents a type of instrument which harmonically combines conventional construction principles with quite a number of new features, originating from decades of practical experience and from the knowledge gained in the field of modern design and technology on one hand, and from wishes and demands submitted to us on the part of microscopists of all fields of activities on the other.

Primarily the construction of these microscopes is based on the reflections that in modern microscopy, operators must be in a position to take their choice between several methods of observation. Built-in illumination and the interchangeability of components and units form part of our endeavours to meet these requirements, satisfying at the same time the demand of modern engineering for standardization and limitation of the number of components.

The following accessories of the Ng-microscope can be interchanged:

Objectives, eyepieces, condensers, tubes, objective-changing devices, stages, condenser support nz, phase contrast equipment, filter holder, microscope mirror.

In order to maintain proper function of the microscope, the condenser supports no and nd cannot arbitrarily be interchanged. They require an adjustment that can be carried out by trained staff only and must be used in conjunction with the instrument to which they are fitted.

These accessories, which are bound to be used with a specific stand, are marked at their points of connection by the serial number of the respective stands.

The Ng-Microscope is a transmitted-light microscope, meeting maximum requirements with regard to resolving power, image quality and accuracy. Its range of application is versatile and permits of the observation of specimens by several illumination methods which can be changed in quick succession.

It goes without saying that we complied with the demand of modern examination techniques for maximum operating comfort and for as best an elimination of operating errors as possible.

Design and Construction of the Ng-Microscope

The Ng stand (Fig. 1) is provided with a box-type base (19) into which are built-in the illuminating system with filament lamp 6V 15W, collector, diffusing screen, field stop and deflecting mirror as well as the necessary manipulative elements (1, 2, 17, 18, 20). The light emerges vertically via an opening in the upper side of the base (16). This opening serves at the same time the purpose of taking up colour filters of 32 mm in diameter (cf. pamphlet No. 30–328) and is closed by means of a protective glass disc, thus preventing the deflecting mirror from getting dusty (Fig. 4).

The motion box (5) is attached to the base, containing coarse motion, fine motion and condenser motion. The **coarse motion** (4) operates on rack and pinion; its movable parts are arranged in such a way that they will not be visible, not even in the end position of their range of motion. In this way the best possible protection from dust is given for the coarse motion. The tube carrier may be vertically moved by abt. 40 mm by means of the coarse motion, whereby the pinion head makes abt. 1.3 revolutions and maintains its position relative to the table top. The smoothness of its run may be adjusted by the operator (cf. p. 8).

The **fine motion** (3) and the coarse motion are coaxially arranged. The fine motion runs on ball bearings and is designed according to the well known Meyer-principle. It has a range of abt. 1.8 mm obtained by abt. 18 revolutions. The scale interval of the fine-motion drum reads to 2 microns.

The condenser motion (4, Fig. 2) consists of rack, pinion and pinion head.

The condenser supports with condenser (15, Fig. 1) are fixed to the condenser motion box.

The stage carrier (14) is of annular shape and supports the specimen stage (13) by a quick-change annular dovetail (cf. Fig. 10). Tube carrier (7), serving at the same time as a handle for carrying the microscope, is provided with tube carrier head (11), well-known from our L-series of stands, with dovetail slide for interchanging the objective turret (12) and with quick-change annular dovedail (Fig. 14) for interchanging the tubes.

Some Hints for Manipulation

As a rule, the Ng-microscope should be used in such a way that the tube carrier and the illumination cable are away from the operator (cf. Figs. 1 and 2).

The most frequently used manipulative elements for specimen, stage and optics will thus be more easily accessible to the operator.
Only when employing special microscope lamps (cf. Figs. 19 and 26) or when the instrument is intended for micrurgical or photomicrographic work, it should be used the other way round.

Inserting the Lamp (Fig. 3)

The lamp to be used for illumination in the Ng-stands is a 6V 15W clear-glass bulb on pre-centered base.
It is strongly recommended to use clear-glass bulbs only, since a swing-out type of diffusing screen (lever 2) is built-in into the stand. In the case of dark-ground observations f. i., which can be made with clear-glass bulbs only, the interchange of lamps could thus be dispensed with. Lamp (5) is screwed into socket (3) and the latter introduced into focusing sleeve (4). It is then being inserted into the base (6) in such a manner that the guide pin (1) engages in the helical slot of the focusing sleeve. The lamp ist connected to the a. c. mains via the ordinary transformer or regulating transformer (Figs. 16, 17), or to the d. c. mains via a resistance (cf. pamphlet 30–360).

When **adjusting the illumination,** the deflecting mirror should also be centered and the lamp focused relative to the collector.
Focusing is done by rotating the focusing sleeve which is guided in the helical slot by the guiding pin (1, Fig. 3). Critical focusing can be observed when placing a diffusing screen into the filter-holding opening (16, Fig. 1). It is advisable in this case to stop down the field stop (20) to a certain extent.
Correct centering can be achieved by tilting and turning the deflecting mirror with the aid of the two centering screws (17, 18). Rotation of the mirror about its optical axis is being effected by the left screw and the tilt about its transverse axis by the right one. Since the mirror is surface-silvered, it may by no means be cleaned with a piece of cloth or leather nor with blotting paper or tissue paper etc. The use of solvents of all kinds should also be dispensed with. The only permissible method of removing dust is a soft camel's hair brush, previously degreased in ether. Care should be taken not to touch the mirror surface with your fingers. If necessary, the mirror (9, Fig. 4) can be taken out of the base together with its cylindrical fixture. To this end, the microscope is carefully laid on one side and the bayonet locking of the sleeve (8) eased by turning it counterclockwise. Attention must be paid in this case that the annular

dovetail is securely clamped in position in the tube and the glass disc on the light-exit aperture be not removed. Reinserting and locking is then carried out in reversed order. The mirror housing is so introduced that its light entrance aperture lies beside the helical spring of the centering device (Fig. 4).
For use in photomicrographic work and with special-type lamps, the Ng-microscope can be provided with a conventional microscope mirror (Fig. 5). In this case, the filter holder (16, Fig. 1) is to be reploced by the microscope mirror on holder.
Interchanging the condensers can be carried out after having loosened the clamping screw (3, Fig. 2).

The following **condenser supports and condensers** are available:

1. **Condenser support no** with condenser quick-changing device and iris diaphragm (2, Fig. 6)
   The following condensers may be used:
   Condenser 1,2 (7); aplanatic condenser 1,4 (6); spectacle-lens condenser (8).
   The condensers are inserted by obliquely shifting its annular dovetail against the pressure of the resilient click-in pin (2, Fig. 7), care being taken thereby that the latter engages in the groove of the condenser annular dovetail. This will be the case as soon as the red marking points on condenser mount and support are facing each other. Taking out the condensers is executed in reversed order.

2. **Condenser support nd** with condenser quick-changing device and laterally displaceable iris diaphragm (4, Fig. 6)
   Applicable are in this case the same condensers, as found in support no, which are also exchanged in the same way. The condenser support nd is intended for setting up unilaterally oblique illumination.

3. **Condenser support nz** with centering-type of holder for special condensers (Fig. 8)
   The following condensers may be applied to this support:
   Dissecting change-over condenser (10) (cf. pamphlet 30-G502)
   Aplanatic-achromatic condenser n. A. 1,4 (9)
   Mirror condensers n. A. 0,40 and 0,60 (6 and 8)
   Cardioid condenser (5)
   Quartz condenser n. A. 0,85 and 1,25

The condensers are shifted into sliding sleeve of the condenser support (2) as far as they will go and then clamped in position by means of screw (3). Centering is effected with the aid of centering screws (1 and 4).

4. **Aplanatic phase contrast condenser** 0,9/e with revolving disc for annular stops (Fig. 18)
   For particulars cf. p. 15.

The **smoothness of run of the coarse motion** is adjustable within certain limits according to operators' requirements (Fig. 9). This will be reached by inserting the pin wrench (to be found in the accessories case) in one of the holes of the ring between the right coarse-motion control knob and the tube carrier and by altering the degree of smoothness by turning the ring accordingly. The brake is thereby eased by turning the pin towards the operator and is tightened by turning away from him.

In order to **interchange the specimen stages** (Fig. 10), the clamping screw (1) of the stage carrier (2) is to be slackened and, after having tilted the stage near the clamping screw, it may be taken out of its seating. Replacing another stage may be done in reversed order. The clamping screw must be tightened slightly and by hand only.

The following specimen stages are applicable:
B3, B4, C3, H4, K1 (Fig. 11).

The procedure of **centering the specimen stages** B3, B4 and H4 is as follows (a to d, Fig. 12):

1) Bring objective of lowest magnification in alignment with the centering glass for mechanical stages. To facilitate matters, an adjustable eyepiece (cf. Fig. 21) with inserted crossweb ought to be used.
2) Orient line figures in such a way that points of intersection are coinciding (a).
3) Turn stage relative to the maximum migration of a line figure that can still be made out in the visual field (b and c).
4) Re-establish coincidence as under a (Fig. 12), by returning half of the migration by means of the object traverser and the other half by means of the centering screws.
5) Repeat this procedure until line figures remain constant when rotating the stage through 360^0 (a).

6) Change over to objective of next higher magnification and repeat procedure as under a to d (Fig. 12).

The **objective-changing devices** are also interchangeable and can be shifted into the dovetail slide of the tube carrier head (11, Fig. 1). The dovetail fits rather tightly in its slide and it should be observed therefore that the new changing device is pushed in as far as it will go.

The following changing devices can be used:

Quadruple objective turret with dovetail slide,
Quintuple objective turret with dovetail slide (Fig. 13),
Objective dovetail slide 26 mm (Fig. 20).

The objectives are fastened to the changing device in the usual manner by means of standardized threads. In order to have the good centering of the individual objectives relative to each other maintained, their threads and contacting surfaces must be kept conspicuously clean. In the case of several sets of objectives being alternatively used, it is recommended, to acquire one revolving turret for each set, thus saving the time-consuming screwing-in and out of the objectives.

Optical Equipment

The following objectives and eyepieces may be employed:

Achromats and eyepieces
Apochromats and K or PK-eyepieces, respectively
Ph-objectives and eyepieces
Plane-field Achromats, Phv-plane field Achromats and PK-eyepieces
M-objectives without eyepieces
Monochromats and quartz eyepieces
Mirror objectives and eyepieces of the orthoscopic type or quartz eyepieces

Magnification Tables for our Microscope Optics

Achromatic Objectives			Huygenian Eyepieces					Compensation Eyepieces					
Systems	Imaging Scale	Numerical Aperture	Single-Lens Magnification										
			5×	7×	10×	12,5×	17×	5×	7×	10×	15×	20×	30×
			Field of View Number										
			23	18	14	16	13	23	18	16	11	8	5.7
Dry Systems	3		15	21	30	37,5	51						
	8	0.20	40	56	80	100	136						
	10	0.30	50	70	100	125	170						
	20	0.40	100	140	200	250	340						
	40	0.65	200	280	400	500	680	200	280	400	600		
Homogeneous Oil Immersion	90	1,25	450	630	900	1125	1530	450	630	900	1350	1800	2700

Apochromatic Objectives			Compensation Eyepieces					
Systems	Imaging Scale	Numerical Aperture	Single-Lens Magnification					
			5×	7×	10×	15×	20×	30×
			Field of View Number					
			23	18	13	11	8	5.7
Dry Systems	10	0.30	50	70	100	150	200	300
	20	0.65	100	140	200	300	400	600
	40	0.95	200	280	400	600	800	1200
Homogeneous Oil Immersion	60	1.00	300	420	600	900	1200	1800
	60	1.40	300	420	600	900	1200	1800
	90	1.30	450	630	900	1350	1800	2700

Plane-Field Objectives			Compensation Eyepieces for Plane-Field Objectives (PK)					
Systems	Imaging Scale	Numerical Aperture	Single-Lens Magnification					
			63×	8×	10×	12.5×	16×	25×
			Field of View Number					
			26.5	18.4	15.5	16	12	7
Dry Systems	2.5	0.07	15	20	25	30	40	60
	4	0.11	25	30	40	50	60	100
	6.3	0.16	40	50	65	80	100	160
	16	0.32	100	130	160	200	255	400
	40	0.65	250	320	400	500	640	1000
Homogeneous Oil Immersion	100	1,25	630	800	1000	1250	1600	2500

Plane-Field Achromats			Compensation Eyepieces for Plane-Field Objectives (PK/w) (Diameter of the Mount = 30 mm)					
Systems	Imaging Scale	Numerical Aperture	Single-Lens Magnification					
			6.3×	8×	10×	12.5×	16×	20×
			Field of View Number					
			26.5	25	20	16	12	10
Dry Systems	2.5	0.07	15	20	25	30	40	50
	4	0.11	25	30	40	50	60	80
	6.3	0.16	40	50	65	80	100	125
	16	0.32	100	130	160	200	255	320
	40	0.65	250	320	400	500	640	800
Homogeneous Oil Immersion	100	1.25	630	800	1000	1250	1600	2000

The field of view number of the eyepiece divided by the imaging scale of the objective gives as a result the diameter of the visual field (in mm) in the object plane; in the case of objective 10/0.30 and eyepiece 7× f. i. 18:10 = 1.8 mm. The field of view number multiplied by the single-lens magnification of the eyepiece shows the image produced at a distance of 250 mm; in the case of the 7× eyepiece f. i. 18×7 = 126 mm.

Should, however, some device be interposed between objective and eyepiece which, with the aid of its optics, changes the magnification of the image produced by the objective, the result obtained from objective and eyepiece magnification must in addition be multiplied by the changing factor engraved on the device.

For the purpose of rapidly **interchanging the various kinds of tubes,** the annular dovetail (Fig. 14), well-known for a number of years in other microscopes, has been retained. The procedure is as follows:

Screw back the clamping screw as far as possible, shift the annular dovetail of the tube underneath the studs of the tube carrier head and push it down. This done, retighten the clamping screw.
The following tubes can be applied (Fig. 15):

Monocular straight tube
Monucular straight tube, extensible type
Monocular straight tube for eyepieces with enlarged field of view
Binocular straight tube, factor 1
Elbow-tube D 30^0, factor 1

In conjunction with all straight tubes, this elbow-tube affords a convenient observation under an angle of 30^0.

„MF"-tube L
(For details on the construction of the photomicrographical equipment „MF" please cf. pamphlet 30–605.)

Transformers

The built-in illumination must be connected to the mains via a transformer.

The following instruments can be supplied:

Transformer 220/6V 15W (Fig. 16)
Regulating transformer 220/4 up to 6V (Fig. 17)

Cf. pamphlet 30–360.

Setting the Microscope for Various Methods of Observation

1. Bright-Field Observations

1.1 Close aperture (15, Fig. 1) and field stop (20).
1.2 Swing out diffusing screen (1).
1.3. Critically depict lamp filament onto aperture stop by rotating focusing sleeve (4, Fig. 3).
1.4 Focus the object by means of an objective of medium and an eyepiece of low magnification.
1.5 Depict field stop in the object plane by focusing with condenser pinion head (4, Fig. 2).
1.6 Center image of the field stop by means of centering screws (17, 18, Fig. 1).
1.7 Open field stop (20) to such an extent that the field of vision of the objective is just fully illuminated.
1.8 Open aperture stop as far as required. Relating to image contrast and resolution, the best possible compromise should be tried out. Generally, opening the aperture stop to abt. $1/2$ up to $3/5$ of its diameter has proved satisfactorily.
1.9 Swing-in diffusing screen. If structure of diffusing screen is seen in the object, lower condenser slightly until the disturbing phenomenon disappears.
1.1.0 Introduce further objectives or eyepieces, respectively. Make sure that field is fully illuminated in accordance with par. 1.8.

2. Dark-Ground Observations

2.1 **with cardioid condenser** (5 Fig. 8) and objectives of apertures $\geqq 0{,}65$ (also cf. pamphlet 30–G306)
2.1.1 Swing out diffusing screen.
2.1.2 Insert condenser support nz (2, Fig. 8).
2.1.3 Remove objective, eyepiece and condenser and adjust the light beam until a uniformly illuminated circular field appears concentrically either on a piece of transparent paper or on a diffusing screen placed onto the tube. Having finished the adjustment, take care not to displace the deflecting mirror.

2.1.4 Insert cardioid condenser and move condenser support nz up as far as it will go.

2.1.5 Apply immersion oil*) onto condenser front lens. Observe that oil does not run down the condenser and that no bubble will be present within the oil.

2.1.6 Lower condenser to such an extent that the level of the applied oil is below that of the stage, then put the specimen in place and slowly lift the condenser until a bubble-free connection between specimen carrier and condenser is obtained.

2.1.7. Critically focus specimen by means of a low-power eyepiece and objective.

2.1.8 Focus condenser so that the light phenomenon in the specimen is as small as possible, has sharp outlines and appears evenly illuminated. Please check by opening and closing the field stop, whether the light phenomenon in the specimen corresponds to an image of the field stop.

2.1.9 Center the light phenomenon mentioned under 2.1.8 by means of the centering screws of the condenser support.

2.1.10 Switch over to eyepieces and objectives of higher magnification.

2.2 **Observation with dissecting change-over condenser/nz** (10, Fig. 8) and objectives of aperture $\leq$ 0,65 (also cf. pamphlet 30-G502)

The dissecting change-over condenser is intended for the observation of specimens in cells. Owing to its long focal intercept the observation cells employed may have a height up to 10 mm. The condenser is used to advantage for dark-ground illuminations with objectives of apertures $\leq$ 0,65.

The following manipulations will be necessary:

2.2.1 Introduce condenser support nz (2, Fig. 8).

2.2.2 Insert condenser.

2.2.3 Adjust condenser in bright-field according to par. 1.1 up to 1.10.

2.2.4 Swing-in dark-ground stop as far as it will go.

2.2.5 Fully open aperture and field stop.

*) If the operator knows beforehand that he need not utilize the maximum resolving power of the microscope, it will be sufficient to use water as an immersion fluid for the condenser immersion. For the objective immersion, however, use must be made of an immersion fluid which corresponds with the construction of the objective.

3. Observations by means of the Phase Contrast Method

(Fig. 18)

Provided the Phv-condenser being the only one available:

3.1 Attach Phv-condenser to motion box and turn it up as far as it will go.

3.2 With the diffusing screen swung out and the field stop narrowed down, depict filament of the lamp onto the iris diaphragm of the phase condenser (1). The image can be easily observed by way of a mirror placed in front of the stand base.

3.3 Check the exactly centered position of the filament by slowly turning the lamp.

3.4 Correct position of the filament image relative to the iris diaphragm of the condenser if necessary, by readjusting the centering screws (7, 8, Fig. 1) protruding from the base of the stand.

3.5 Apply well discernible specimen, screw Phv-objectives to the revolving turret in such a way that, when turning the turret in clockwise direction, the magnification of the objectives shows a rising tendency.

3.6 Set annular-stop revolving disc of Phv-condenser (7, Fig. 18) to the free-passage position (0).

3.7 Focus the object by means of Achromat 10/0.30 Phv or plane-field Achromat 16/0.32 Phv.

3.8 Image luminous field stop into the object plane by lifting and lowering the condenser.

3.9 Correct image of the field stop, if necessary, by actuating the centering screws of the condenser (2, Fig. 18).

If the Phase Contrast Equipment and a second bright-field condenser has been purchased together with the stand:

3.10 Check again centering of Phv-condenser, according to rules laid down under par. 3.1 up to 3.7 and adjust, if necessary.

The Phase Contrast Equipment must be operated according to the Instructions for Use (pamphlet No. 30-G304).

4. Observations in Luminescent Light (Fig. 19)

The microscope should be arranged as follows:

4.1 Introduce microscope mirror according to p. 6.

4.2 Set-up microscope lamp L in accordance with Instructions for Use (pamphlet No. 30-G359).

4.3 Set-up microscope according to section 3 of Instructions for Use (pamphlet 30-G359).

For sets of filters for luminescence microscopy, please cf. pamphlet 30–328.

5. Observations in Polarized Light (Fig. 20)

The microscope should be arranged as follows:

5.1 Insert polarizer (8, Fig. 20) into the filter holder (Direction of vibration is sagittal in general).

5.2 Attach stage B4 with graduation (7).

5.3 Introduce dovetailed objective holder (6).

5.4 Attach intermediate tube „Pol F" (3).

The Polarization Equipment is operated according to instructions laid down in pamphlet 30–331.

Measuring and Counting

If it is intended to measure or to count with the microscope, a number of accessories are required (cf. pamphlet 30-G491).

The following assembly is recommended:

Adjustable eyepieces with eyepiece measuring plates and stage micrometers for measuring distances.

Micrometer eyepiece and stage micrometer for measuring distances at a higher accuracy as it will be possible with the previous equipment.

Adjustable eyepieces with eyepiece squared micrometer, eyepiece measuring and counting plates, or Ehrlich-type eyepiece stops for counting individual objects in the visual field.

How to use these accessories

1. **Adjustable eyepieces** (Fig. 21)

1.1 Detach screw flange, in order to make eyepiece stop (5) accessible.

1.2 Place eyepiece measuring plate (4) onto the eyepiece stop (5) in such a way that the numbers of the graduation appear to be in upright position, when looking through the eyepiece (1, 3).

1.3 Assemble eyepiece, put it in its place, and focus the adjustable eye lens (1) so that graduation, or eyepiece stop and object will be seen sharply depicted with the eye completely relaxed.

1.4 Provide microscope with the respective optical equipment and focus the stage micrometer in such a manner that the lines of both stage micrometer and the eyepiece measuring plate may be observed simultaneously and free from parallax (Fig. 22).

1.5 Superimpose both scales in the visual field so that they lie in the same direction and that they partly overlap each other (Fig. 22).

1.6 Determine under consideration of a larger distance of the field of view, how many intervals of both graduations are overlapping each other.

1.7 The scale value in microns related to the object plane is obtained by the number of overlapping intervals from the formula

$$\frac{\text{stage micromete x 10}}{\text{eyepiece measuring plate}}$$

Example: 42 intervals of the eyepiece measuring plate overlap 34 intervals of the object micrometer.

Therefore: Scale value, related to object plane:

$$\frac{34 \times 10}{42} = 8.1 \text{ microns}$$

1.8 Interchange stage micrometer for the object to be measured and orient it in the visual field so that its image and that of the eyepiece graduation are coinciding, thus making one end of the measuring distance overlap the zero-point of the graduation. Count the number of scale divisions of the eyepiece measuring plate that correspond to the distance to be measured and multiply by the scale value found. The result is the length of the distance in microns.

Hint: The scale value must be ascertained for every objective/eyepiece combination, which is to be used for measuring purposes. If measurements are taken more frequently, it is recommended to write down the values just found out (cf. pamphlet No. 30-G491).

2. **Micrometer Eyepiece** (Fig. 23)

2.1 Insert eyepiece and fix it by means of clamping screw (2).

2.2 Focus eye lens (4) so that graduation and object will be seen sharply depicted with the eye completely relaxed.

2.3 Provide microscope with the respective objectives and focus on a stage micrometer in such manner that its graduation and that of the micrometer eyepiece is simultaneously sharply depicted.

2.4 Align both scales in the field of vision so that they lie in the same direction and that they overlap each other at least partly (Fig. 24).

2.5 Determine under consideration of as large a section of both graduations as possible, how many intervals of both graduations are coinciding. It is recommended, to bring to coincidence the zero-mark of the graduation in the micrometer eyepiece with one of the longest lines of the object division and to start from this end determining the number of intervals of both. Please note that 1 interval of the graduation of the micrometer eyepiece corresponds to 100 intervals of the measuring drum (5).

2.6 Calculate scale value according to par. 1.7. The result is the scale value for 1 interval of the measuring drum.

2.7 Interchange stage micrometer for the object to be measured.
Contact with measuring mark (diagonal cross-wire) the two end points of the distance to be measured by rotating the measuring drum (Fig. 25), write down both drum settings, taking into consideration, if necessary, the intervals of the fixed graduation of the micrometer eyepiece (1 interval = 100 drum divisions), take the difference of the reading or the average of the differences of several readings and multiply by the scale value of the objective in question. The result is the length of the distance in microns.

Hint: Ascertain a special scale value for each objective used for measuring purposes. In the case measurements being carried out more frequently, it is recommendable to write down the scale values obtained.

3. **Compound Stage and Cross-line Eyepiece**
In order to measure distances in the object longer than the diameter of the visual field, the following procedure can be applied:

3.1 Bring to coincidence the beginning of the distance to be measured with the centre of the cross-line and write down position of both lines and verniers (position x_1 and y_1).

3.2 Set the end of the distance onto the centre of the cross and write down positions of the scales and verniers (position x_2 and y_2).

3.3 Find the differences between the readings $\triangle x$ and $\triangle y$.

3.4 Reckon out the wanted length according to the following formula:

$$L = \sqrt{\triangle x^2 + \triangle y^2}$$

Should you succed in applying the distance to be measured to one of the two stage motions with an adequate degree of accuracy, then the length is equal to the difference of the readings in one direction of motion of the stage.

Drawing

When it is intended to make drawings by projecting the microscopic image onto a sheet of paper by means of a mirror, the microscope must be equipped with a monocular tube. Whether it will be possible to work with the built–in illumination, or whether the lamp F and the microscope mirror should be preferred (Fig. 26) depends on the observation method employed and on the specific properties of the specimen.

Using the Microscope Lamp 12/100 F, it will be appropriate, to put it up under an angle of 30^0 to 45^0 to the sagittal plane and by swinging up the blind of the lamp, to screen the light against the direction of vision of the operator in such a manner that the latter will not be dazzled when unintentionally looking into the light exit.

When drawing the virtual image by means of the Drawing Equipment for Microscopes please consult pamphlet 30–205 (Fig. 27).

Projection

Projection of microscopic specimens will be possible by using our Micro-Projection Apparatus. To this end, the deflecting mirror (Fig. 4) must be removed according to instructions given on p. 6, and the microscope being placed onto the centering-type of carrier-plate of the Micro Projection Apparatus (Fig. 28). For this purpose, connecting pieces must be screwed into the threaded holes of the base (5, Fig. 4), into which the holding screws of the Micro Projection Apparatus (6, Fig. 28) are threaded.

Microscope and Projection Apparatus are operated according to instructions given in pamphlet 30–G765.

Photomicrography (Fig. 29)

Owing to the many possibilities applicable in photomicrographic work with 35 mm film, roll-film 6×6 cm, plates and flat film 6.5×9 and 9×12 cm, may we request you to ask for a special quotation (cf. pamphlet 30–605).

Micrurgy

The application of a Sliding Micromanipulator and its accessories in conjunction with Stand Ng is possible. Please ask for special quotation.

Captions

Fig. 1

NgoB3-Microscope, monocular, right side

1 Knob for moving the built-in diffusing screen

2 Holder of 6 V 15 W filament lamp

3 Fine-motion control knob, coaxial with (4)

4 Coarse-motation control knob

5 Motion box

6 Centering screw for specimen stage

7 Tube carrier

8 Elbow tube D 30 ^{0}

9 Monocular straight tube

10 Eyepiece

11 Tube carrier head

12 Objective turret

13 Specimen stage B 3

14 Stage carrier W

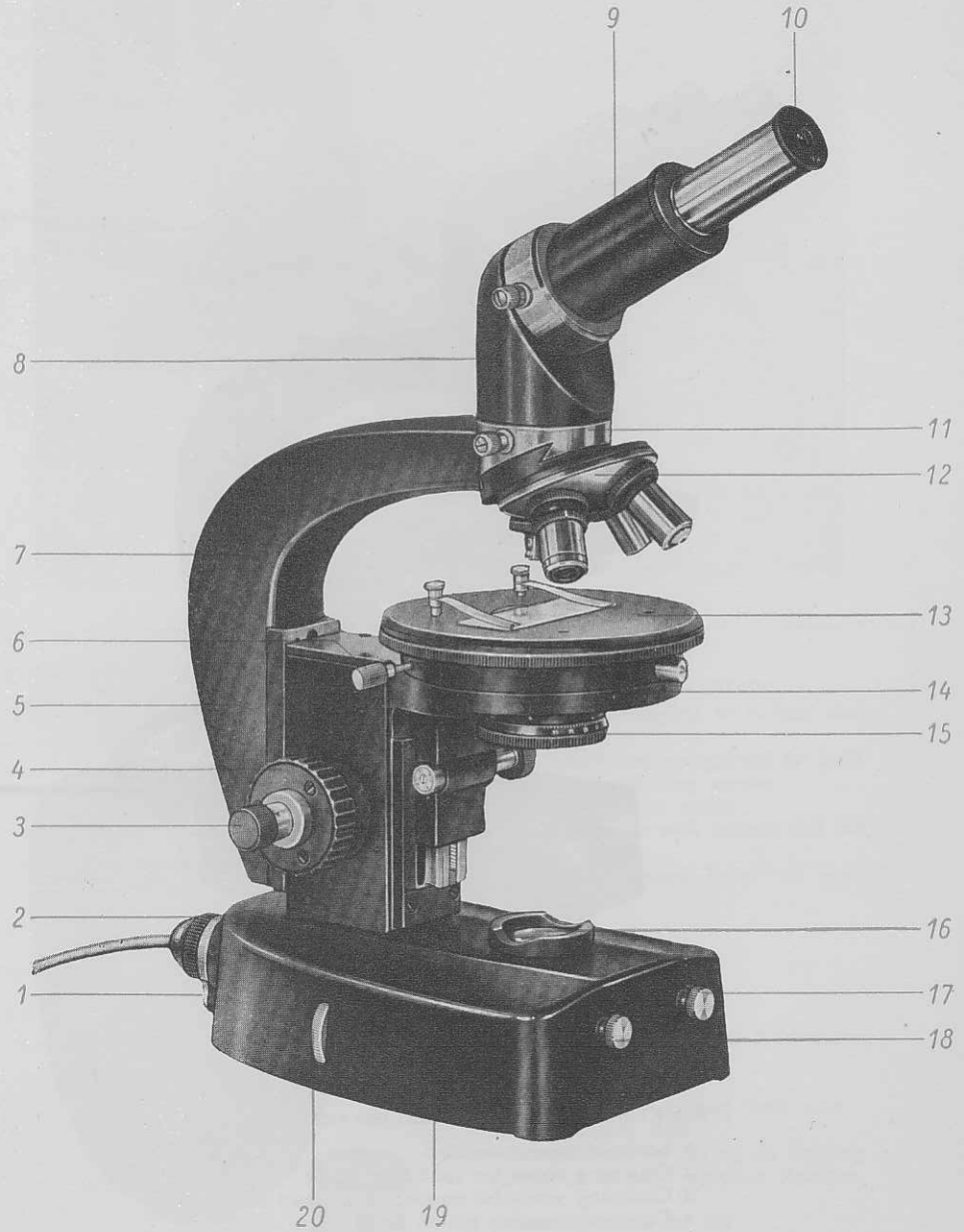
15 Condenser support no

16 Light exit with provisions for taking up colour filters 32 ∅

17/18 Centering screws for deflecting mirror

19 Microscope base

20 Luminous-field stop



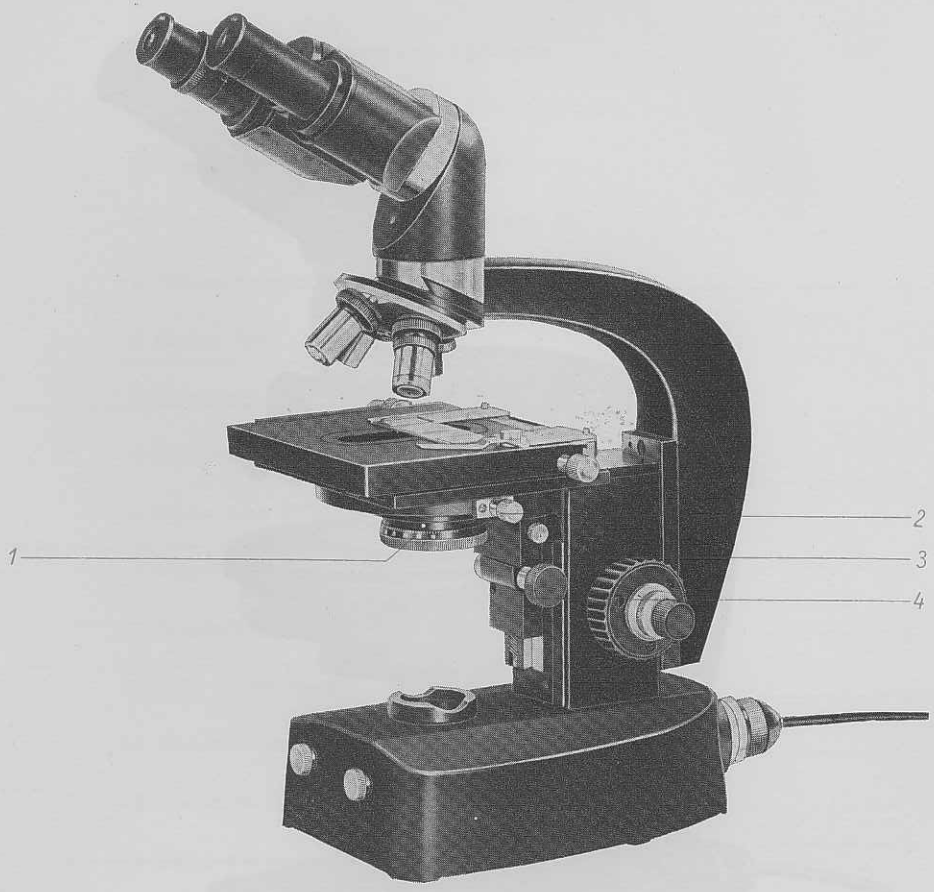
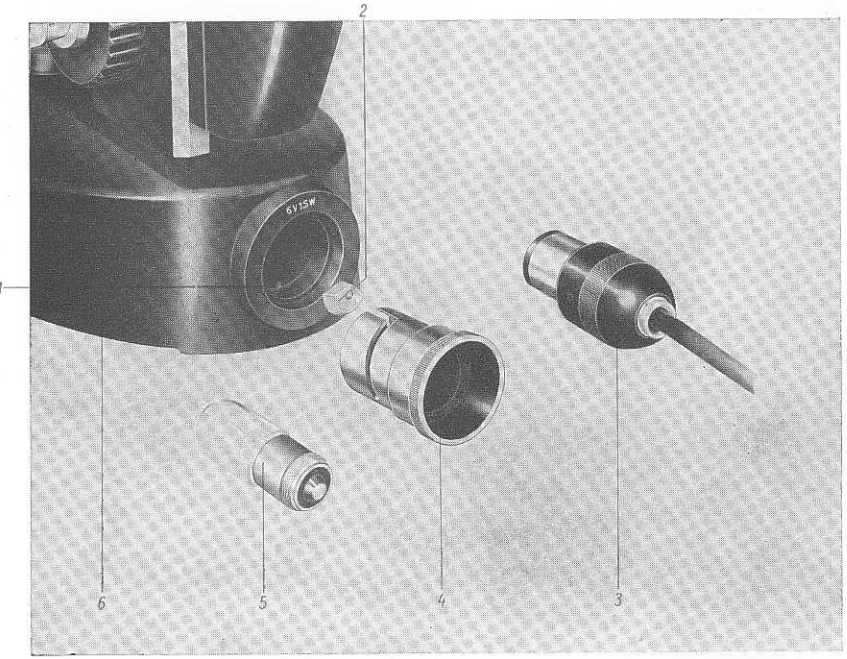


Fig. 2

NgoK1-Microscope, binocular, left side

1 Scale of aperature stop
2 Clamping screw for specimen stage
3 Clamping screw for condenser support no
4 Condenser-motion pinion head



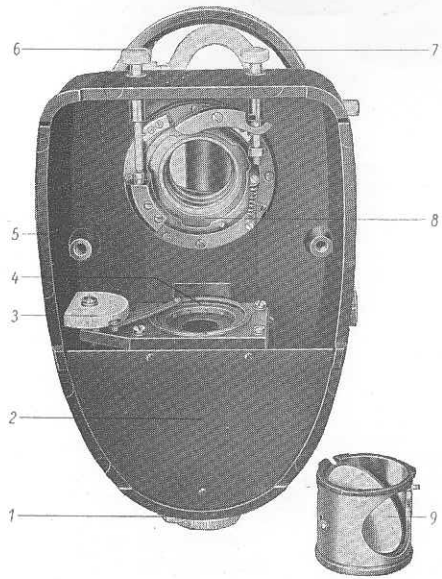


Fig. 3

Illumination for Ng-Microscope

1 Guide pin engaging in helical slot of (4)
2 Knob (knurled-disc segment) for built in movable diffusing screen
3 Lamp socket with cable
4 Focusing sleeve with helical slot for guide pin (1)
5 6 V 15 W filament lamp on pre-centered base
6 Stand base

Fig. 4

Ng base from below

1 Knurled-disc segment for moving the diffusing screen
2 Lamp housing
3 Knurled disc for setting field stop
4 Luminous-field stop
5 Threaded hole for taking up holding screws of Micro-Projection Apparatus
6 Centering screw for (9)
7 Centering screw for (9)
8 Bayonet lock for (9)
9 Deflecting mirror in housing

Fig. 5

Microscope mirror for special microscope lamps

The dust-protective cover glass (right-hand in the picture) which serves at the same time as a filter holder, must be removed and the base of the mirror introduced in its place into the light exit opening.

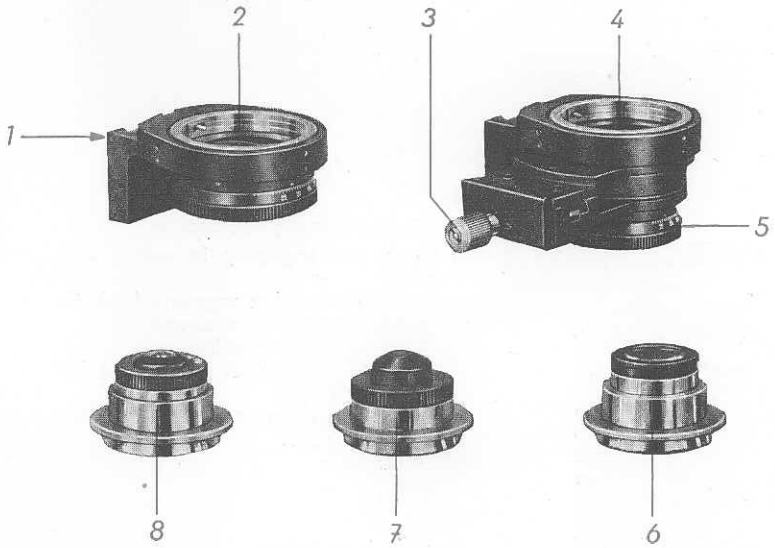


Fig. 6

Condenser support no, nd and condensers

1 Clamping screw
2 Condenser support no with iris diaphragm
3 Knurled knob for the lateral displacement of the iris diaphragm
4 Condenser support nd with laterally adjustable iris diaphragm
5 Setting ring of iris diaphragm
6 Aplanatic condenser 1.4
7 Condenser 1.2
8 Spectacle lens condenser in interchangeable mount

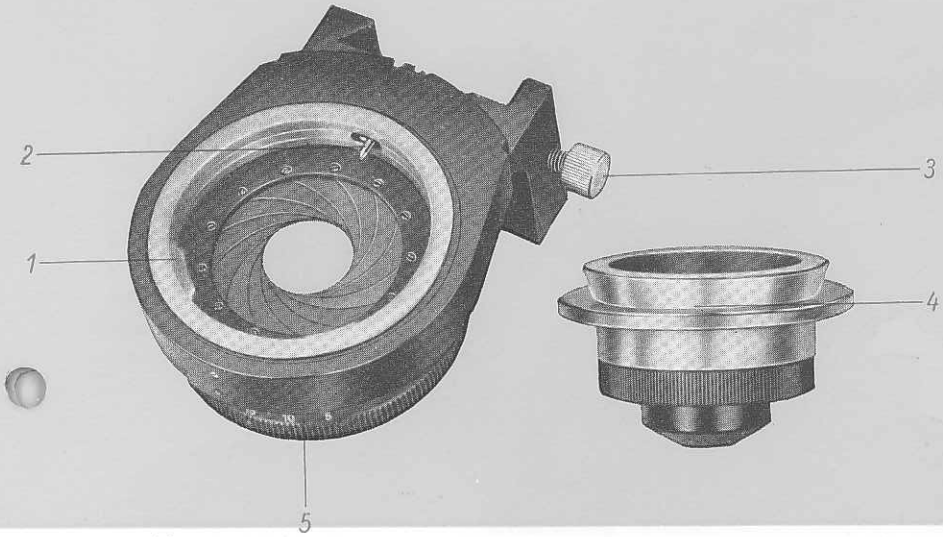


Fig. 7

Condenser quick changing device

1 Lobe
2 Resilient pin
3 Clamping screw
4 Click-in grove for (2)
5 Numbers for aperture stop

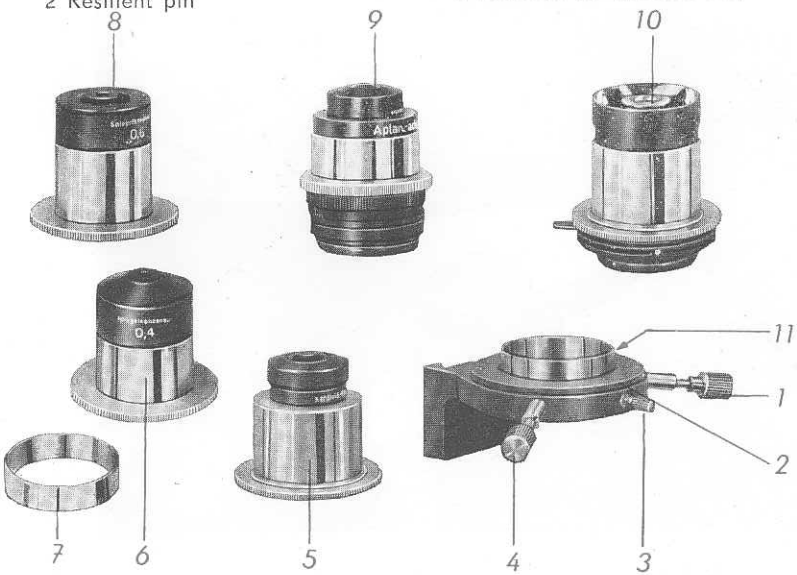


Fig. 8

Condenser support nz and condensers

1 Centering screw
2 Condenser support nz
3 Condenser-clamping screw
4 Centering screw
5 Cardioid condenser
6 Mirror condenser 0.4
7 Intermediate ring Z 41 for mirror condensers
8 Mirror condensers 0.6
9 Achromatic aplanatic condensers 1.4
10 Dissecting change-over condenser
11 Clamping screw

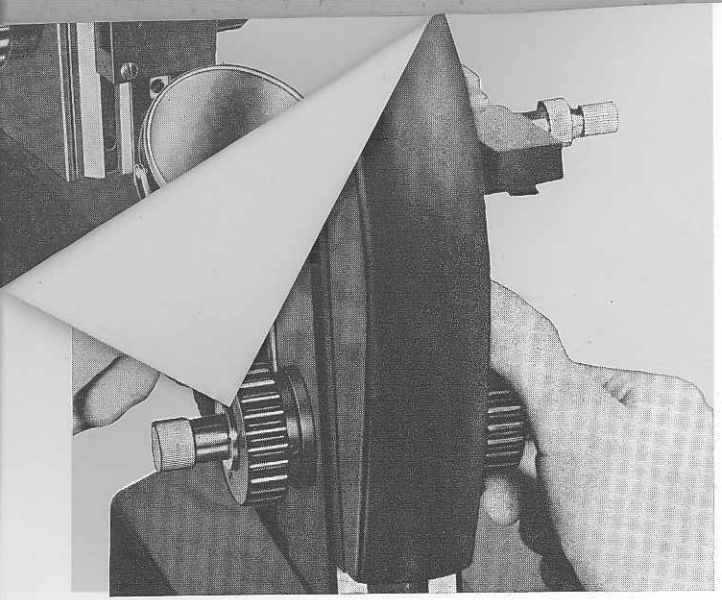


Fig. 9

Adjusting the smoothness of run of the coarse motion

With the right hand holding the control knob, adjust the clamping ring by means of a pin wrench.

Fig. 10

Interchanging the specimen stage

1 Clamping screw
2 Stage carrier
3 Annular dovetail of stage
4 Centering screws of stage

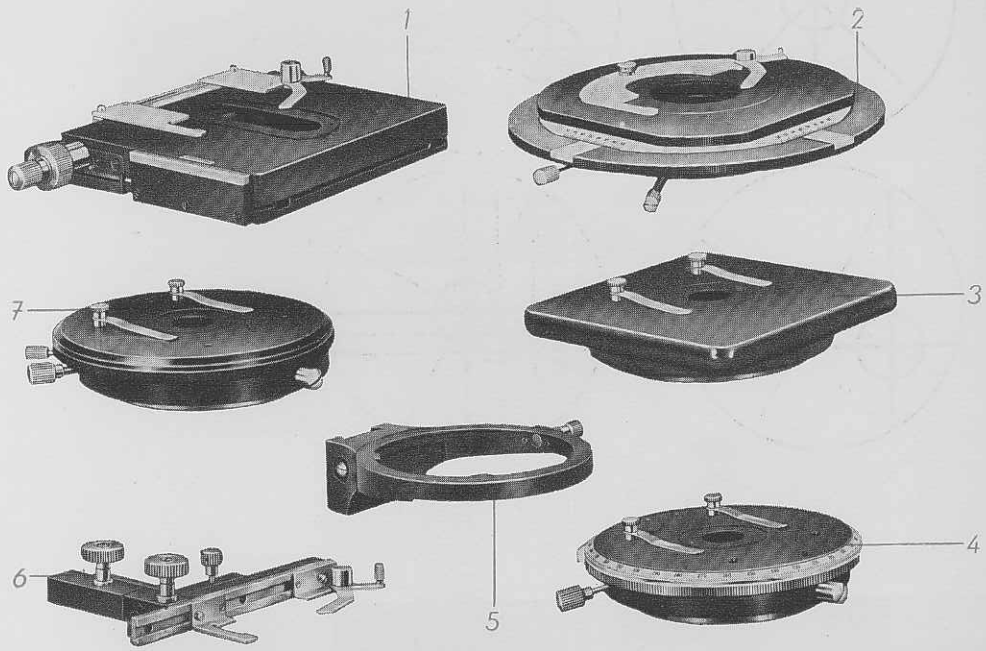


Fig. 11

Stages to be used with the Ng-Microscope

Top row from left: Coaxial mechanical stage K1, floating stage H4,

Intermediate row from left: circular, rotatable and centering stage B3, stage carrier W, stage C3 with vulcanite plate

Bottom row from left: Attachables specimen traverser for B and C stages Rotatable and centering stage B4 with graduation for polarization microscopy

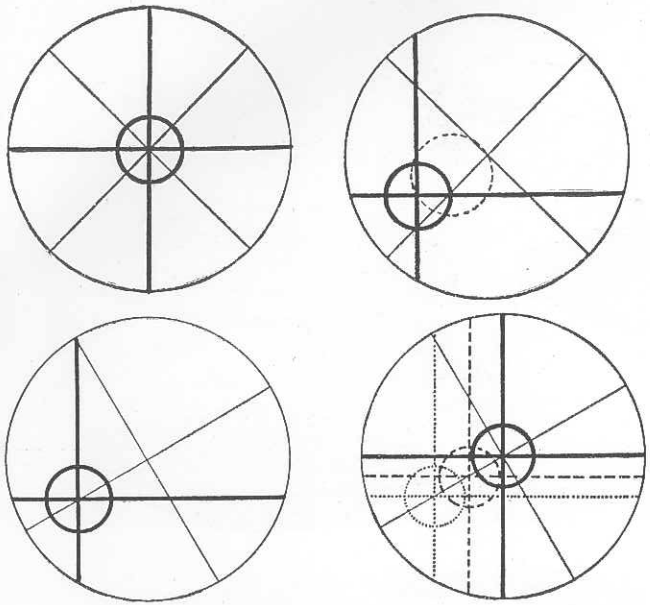


Fig. 12

Centering of stage; diagram

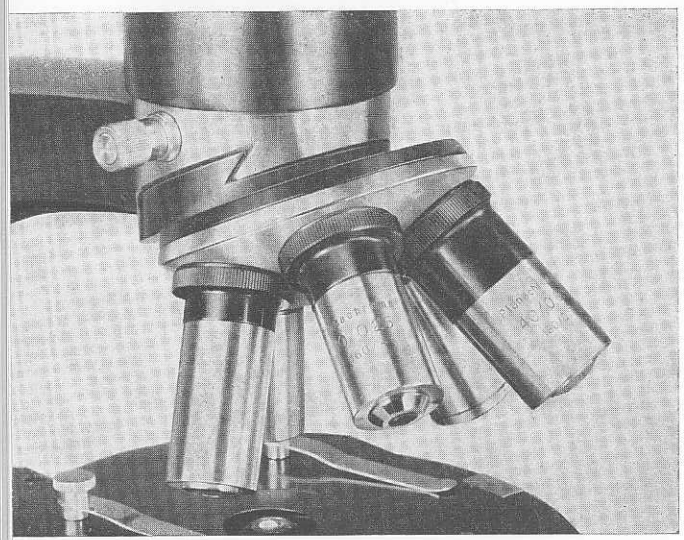


Fig. 13

Quintuple objective turret

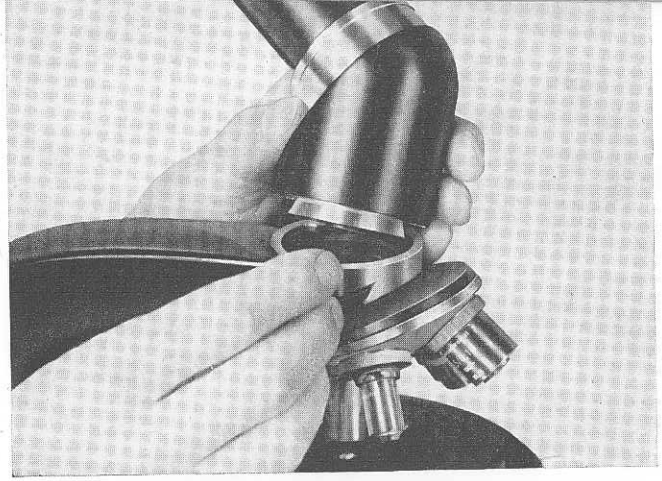


Fig. 14

Operating the tube quick-changing device

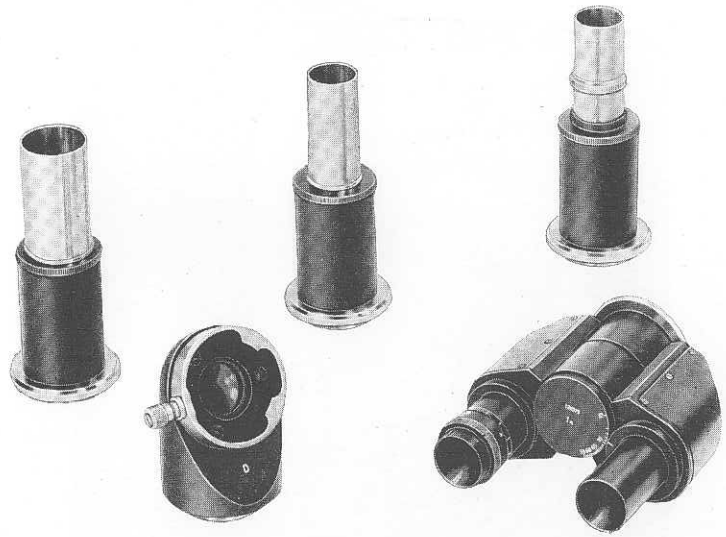


Fig. 15

Tubes to be used with Ng-Microscopes

Back row from left: Monocular straight tube for eyepieces with enlarged field of vision, monocular straight tube, monocular straight tube, extensible type

Front row from left: Elbow tube D 30 ^{0} factor 1 for taking up straight monocular and binocular tubes, binocular straight tube factor 1

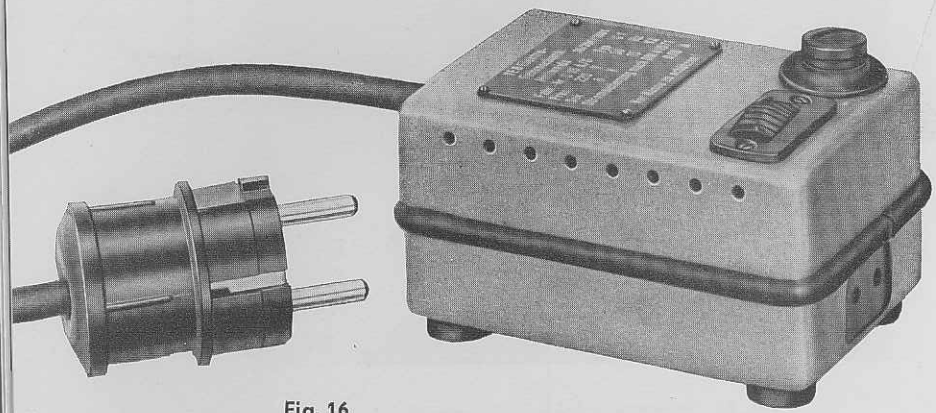


Fig. 16
220/6 V 15 W transformer

Fig. 17
220/4 to 6 V 15 W regulating transformer

The pilot lamp is situated in the center of the housing above the voltmeter. Below the latter, on the left-hand side, is the regulating knob and on the right-hand side the switch. The fuse links are be found in the rear side of the housing.

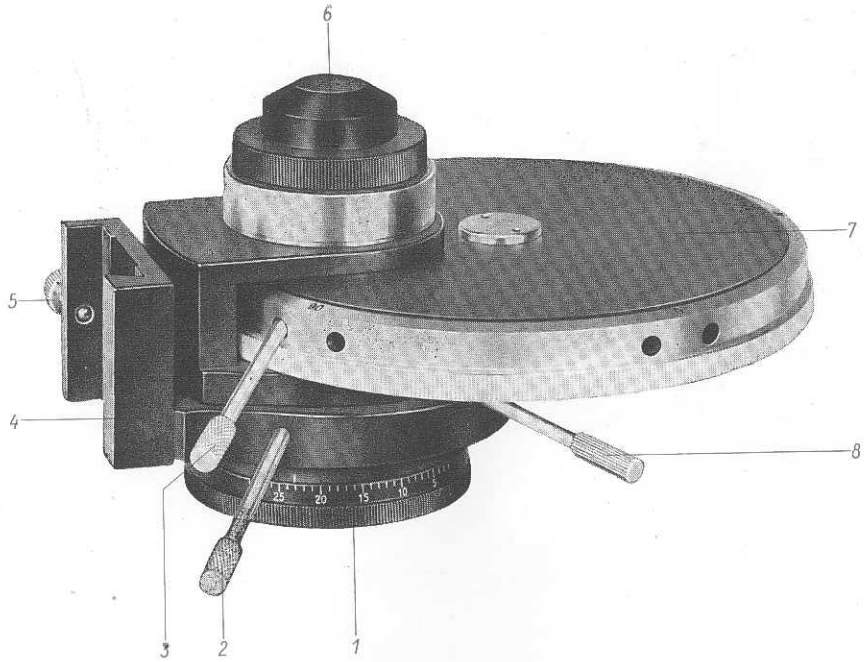


Fig. 18

Aplanatic phase-contrast condenser 0.9/e

1 Setting ring of aperture stop
2 Wrench for centering the condenser*)
3 Wrench for centering the annular stop*)
4 Support for attaching to condenser motion box
5 Clamping screw
6 Aplanatic condenser 0.9/e
7 Housing for annular stop revolving disc
8 Screw for centering the aperture stop

*) The wrenches can be detached. When not in use, they should be kept in their proper places in the container for phase contrast condenser.

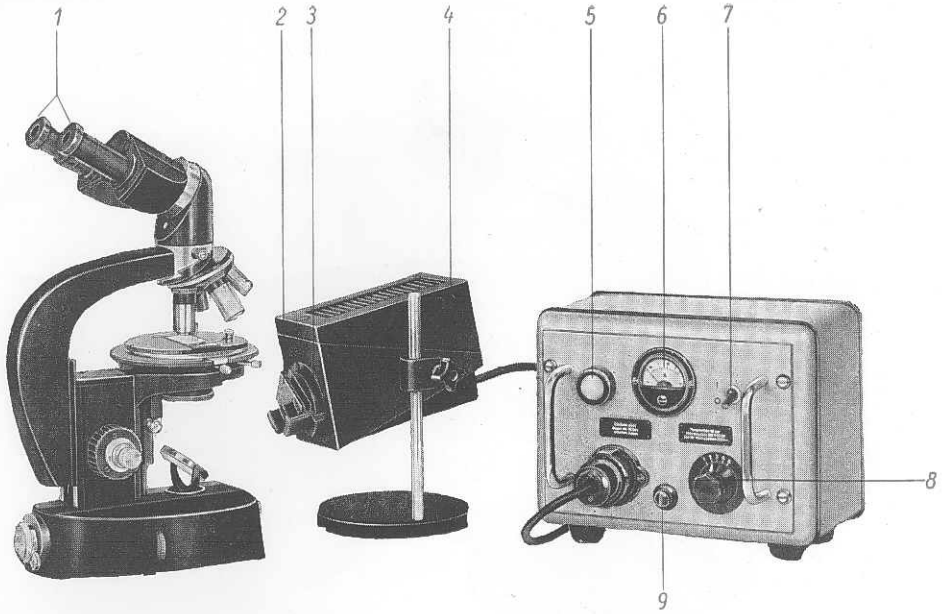


Fig. 19

NgoH4-Microscope equipped for luminescence microscopy

Left: Microscope with eyepiece barrier filters

Center: Microscope lamp L with exitation light filter

Right: Power unit for lamp

1 Eyepiece barrier filter
2 Exitation light filter
3 Luminous field stop
4 Clamping screw for lamp
5 Pilot lamp of igniter
6 Ammeter
7 Switch
8 Regulating knob for lamp current
9 Fuse link

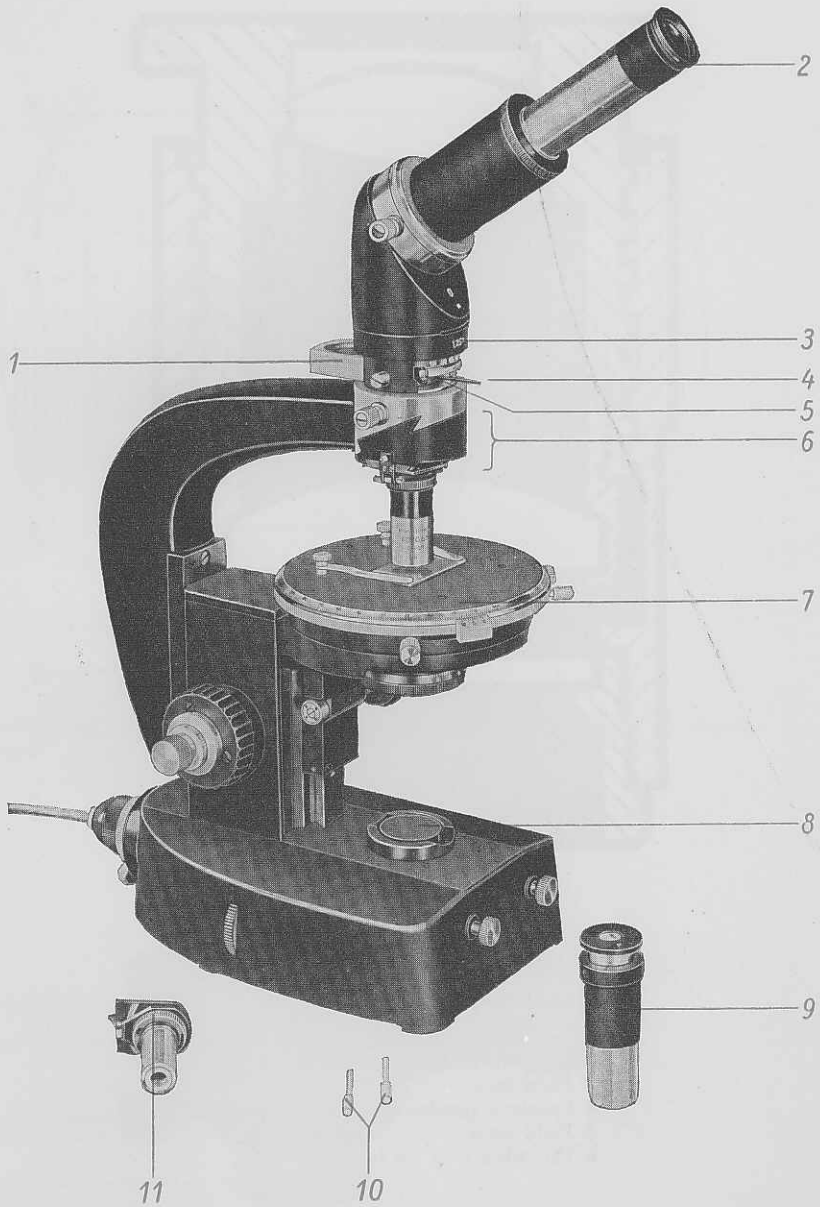


Fig. 20

NgoB4-Microscope equiped for polarization microscopy

1 Analyzer slide
2 Adjustable eyepiece
3 Intermediate tube „Pol F"
4 Setting lever for compensator
5 Lever for changing the position of the analyzer
6 Dovetailed objective holder
7 Rotatable and centering specimen stage B4 with graduation and vernier
8 Polarizer in the filter holder
9 Auxiliary microscope for conoscopic observation
10 Centering wrenches for (11)
11 Objective-changing slide with centering-type holder and attached objective

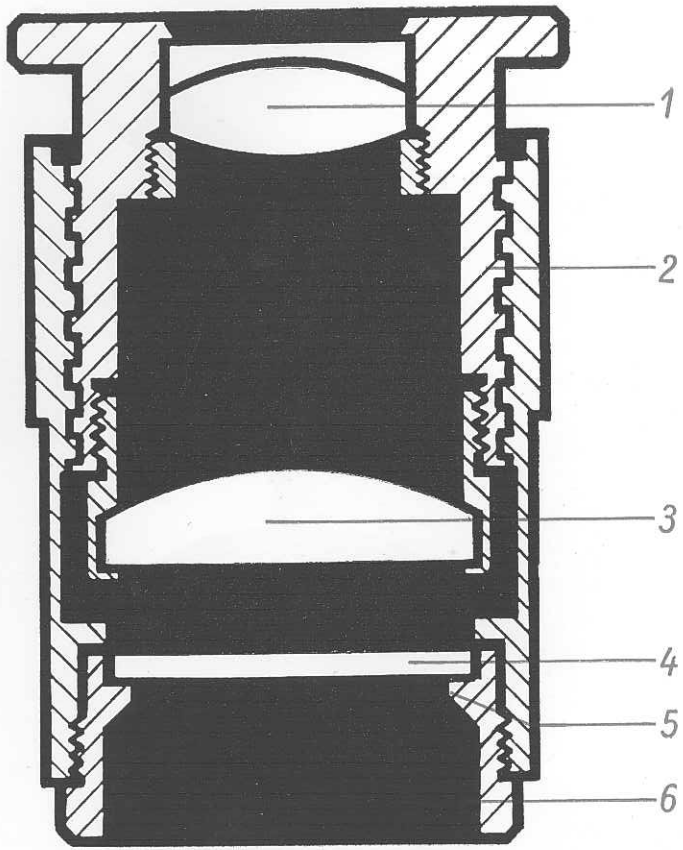


Fig. 21

Measuring eyepiece; diagram

1 Eye lens
2 Acme thread for (1) and (3) to (4)
3 Field lens
4 Eyepiece graticule
5 Field stop
6 Threaded ring for (4)

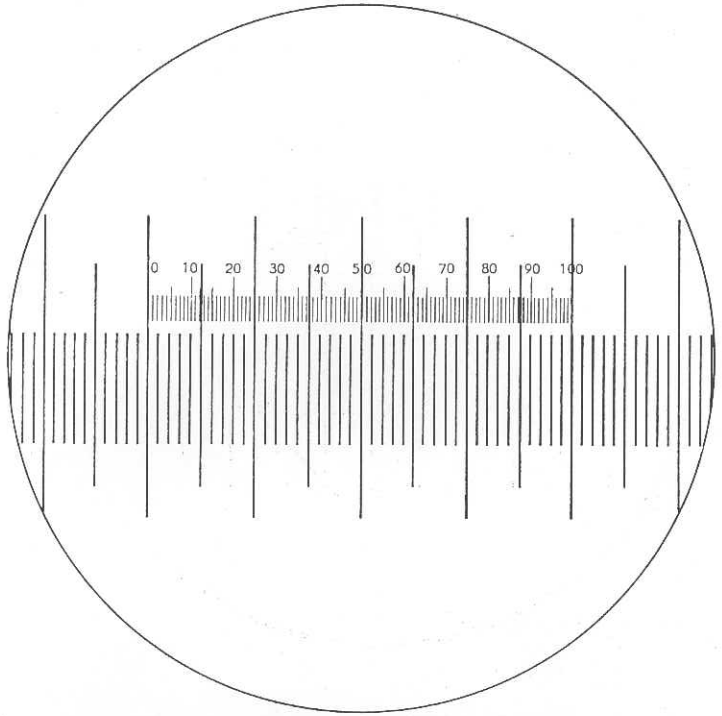


Fig. 22

Determining the scale value of a measuring eyepiece by means of an object micrometer

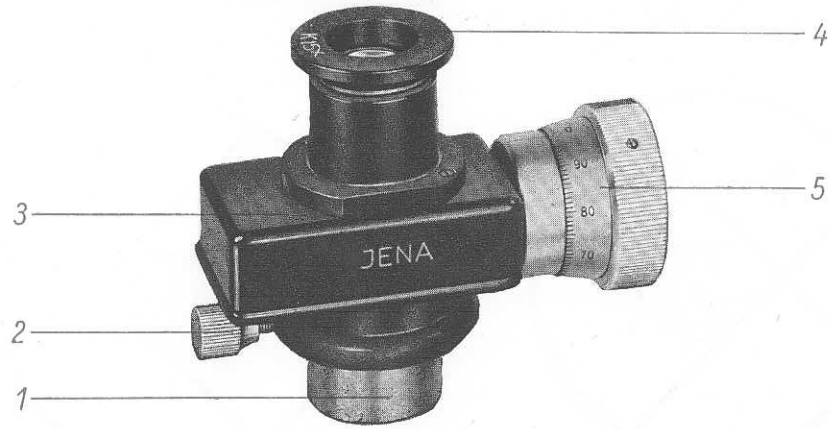


Fig. 23

Micrometer eyepiece

1 Plug-in tube end
2 Clamping screw
3 Housing containing micrometer graduations
4 Adjustable eye lens
5 Measuring drum

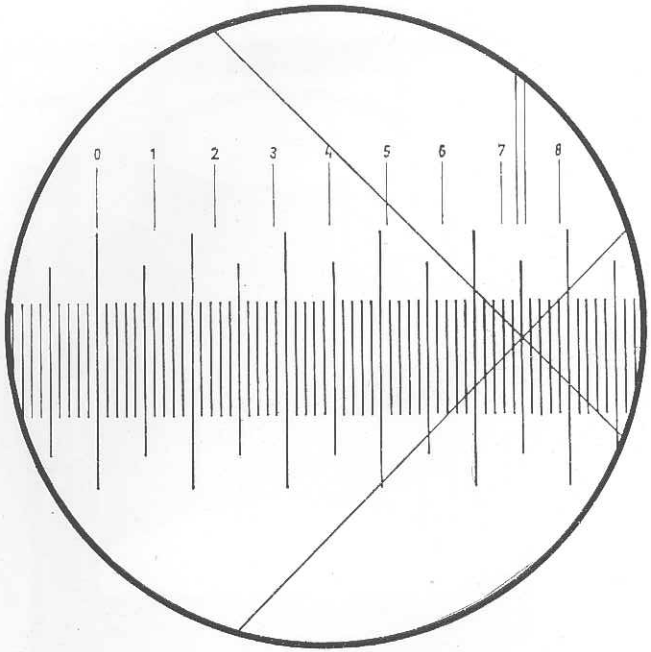


Fig. 24

Determining the scale value of a micrometer eyepiece by means of an object micrometer
Graduation without figures: Object micrometer
Graduation with figures: Scale of eyepiece screw micrometer
Oblique cross and double line: Measuring marks of micrometer eyepiece

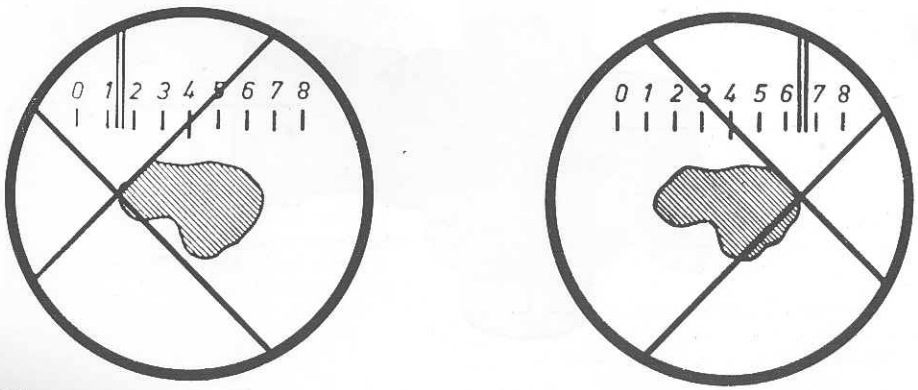


Fig. 25

Contacting the measuring mark with the object to be measured and taking the scale reading

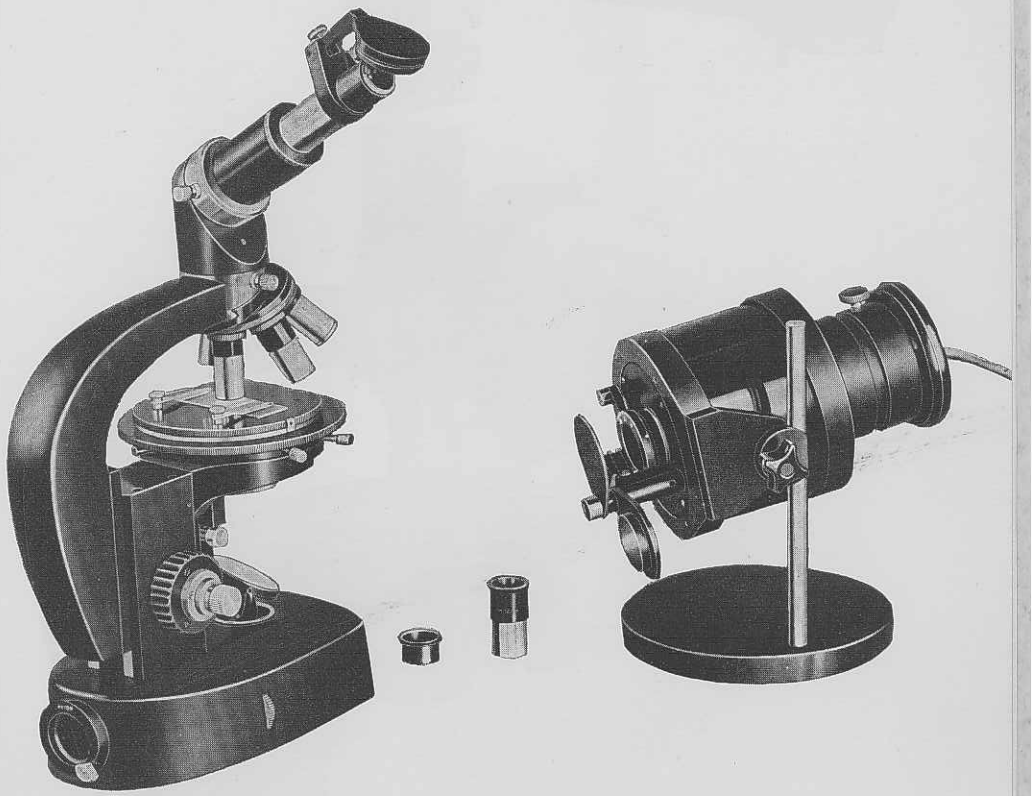


Fig. 26

NgoH4-Microscope equipped with projection drawing mirror and 220/12 V 100 W F microscope lamp

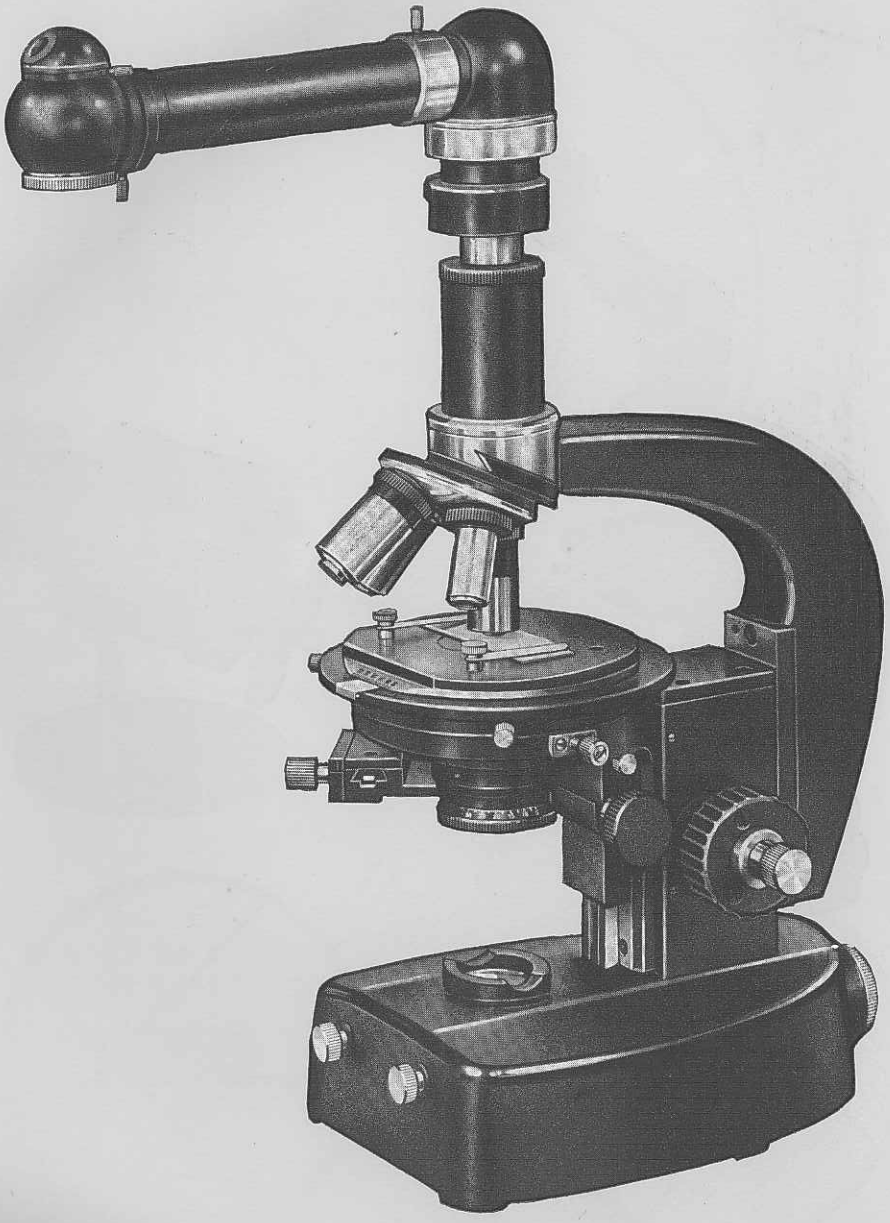


Fig. 27
NgdH4 with drawing equiment

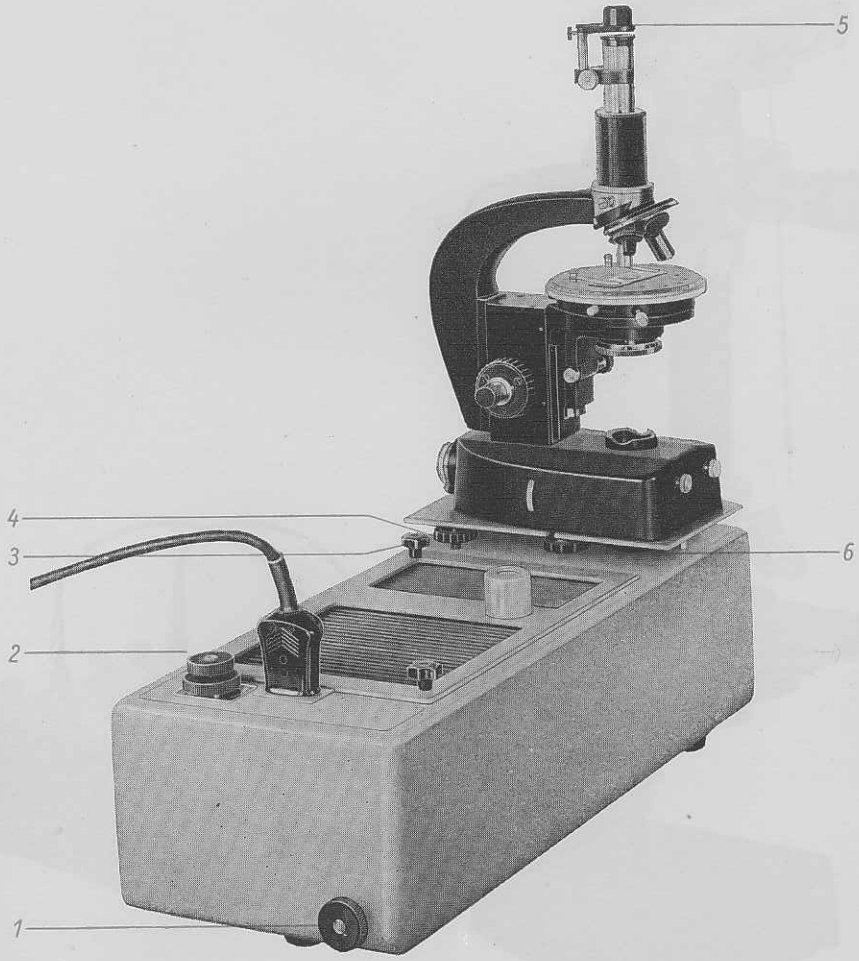


Fig. 28

NgoB4-Microscope in position on the Micro-Projection Apparatus

1 Knurled knob for setting the luminous-field stop
2 Knurled knobs for regulating the feed of the carbons
3 Star knob screw for fixing lamp house cover in position
4 Leveling screw for the carrier plate
5 Projection prism
6 Screw for holding the microscope in position

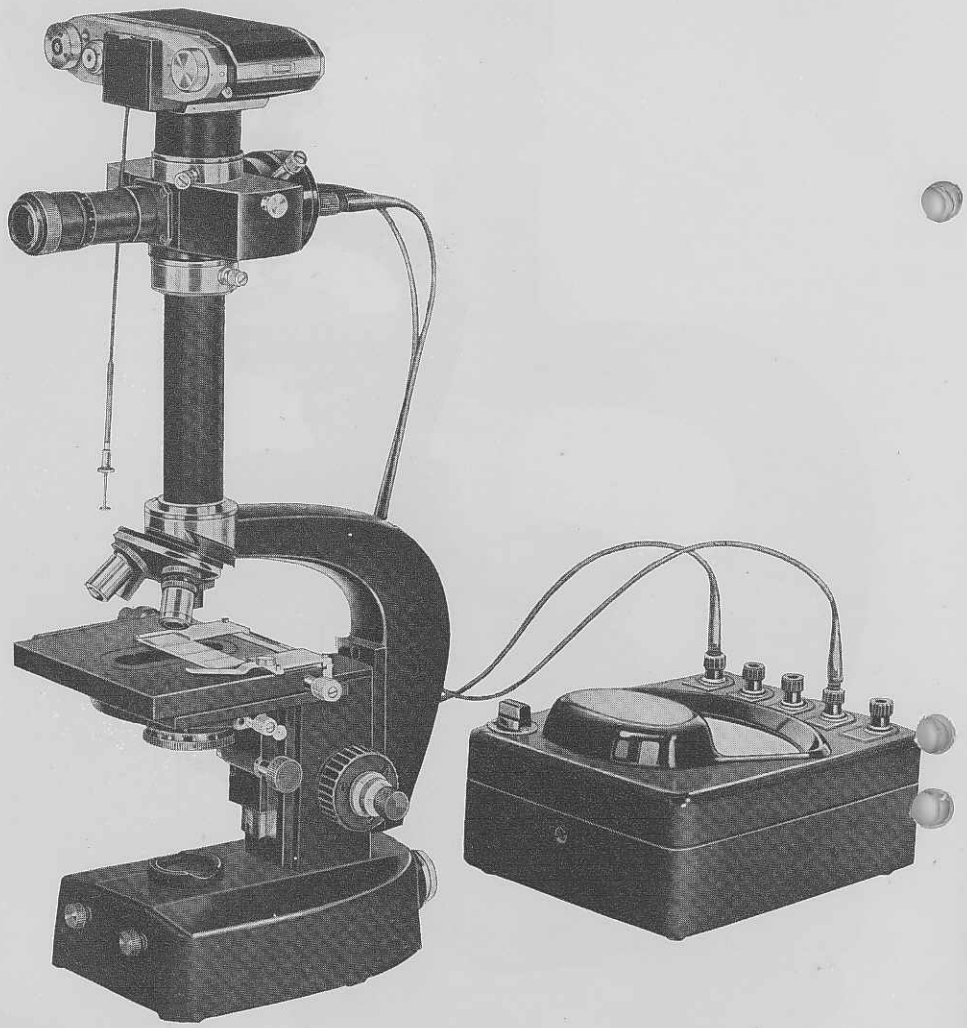


Fig. 29

NgoK1-Microscope with „MF" basic body for measuring exposure times, „MF"-camera attachment 24 x 36 and light-mark galvanometer