NU

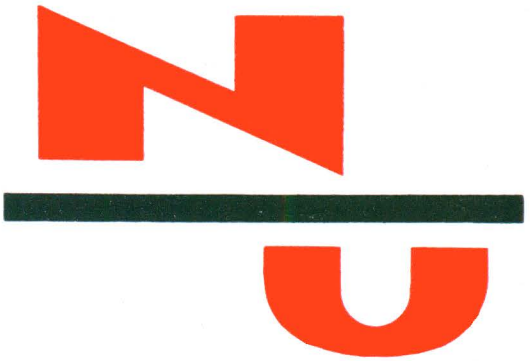
Large Universal Research Microscope

NU

CARL ZEISS
JENA

Large Universal Research Microscope Nu

In modern microscopy there are certain objects on which different observation methods have to be applied in quick succession. Moreover, microscopists demand to have any optional transmitted-light method available alternately or combined with a defined incident-light method. In addition to subjective observations the photomicrographic way of recording has become an integral part of investigations with the microscope.



To the designer of a really modern and universal microscope this means that provisions have to be made for quick change-overs from one observation method to the other, leaving the object examined untouched. Further, for a rational research, the microscope should only make such servicing demands on the observer, as can be carried out without interrupting his concentration on the research work. Therefore the microscope has to be adjusted so that it does not entail any waste of time, difficulties or disrupting centering work for the observer during his examinations. The possibility of faulty or careless operations must be considerably eliminated and should occur only in those parts of the equipment which can be re-set by the user with the aid of the instruction manual, without any special knowledge of the apparatus and with tools belonging to the microscope equipment. Needless to say that – with all these properties – a maximum of imaging performance must be obtainable in each individual examination method, be it for subjective observation or photomicrographic recording.





An ideal solution of all the mechanical, optical and constructive problems in connection with the requirements just described is reached by our new **Large Universal Research Microscope "Nu".**

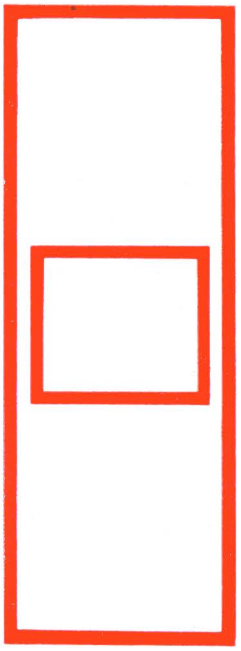
In close cooperation between scientists, designing engineers and artisans, a microscope has been created which cannot be excelled in its wide range of uses, its imaging performance and simplicity of operation; in the ease of preception and consistency of its construction as well as in its workmanship.

The perfect appearance as evidence of highest efficiency and technical elegance adds to the impression of a top product of the opto-scientific industry.

For the Large Universal Research Microscope "Nu" **a particular working desk** has been developed which contributes towards rapid, convenient and safe operation. The desk contains a vibration damping plate for the microscope that can be engaged to completely ward off any external shocks during delicate observations, measurements or photomicrographic work. Apart from the electrical components with convenient switching arrangements, the working desk includes drawers with room for all the necessary accessories and supplementary units. The large clear working surface of the desk provides space for preparatory work; the cover of the table, which is of chemically resistant material, provides sufficient protection against the action of conventional reagents.

To correspond with the requirements of every working task the "Nu" is provided with **four microscope illuminants of differing spectral ranges and intensities.** The xenon maximum pressure lamp "XBO 100" and the 12 V 100 W filament lamp are fitted on the working desk; the switching over is done by a rotary switch. The intensity of the beam can be adjusted free from colour tinges to meet various requirements by an **elevenstep light regulator.**



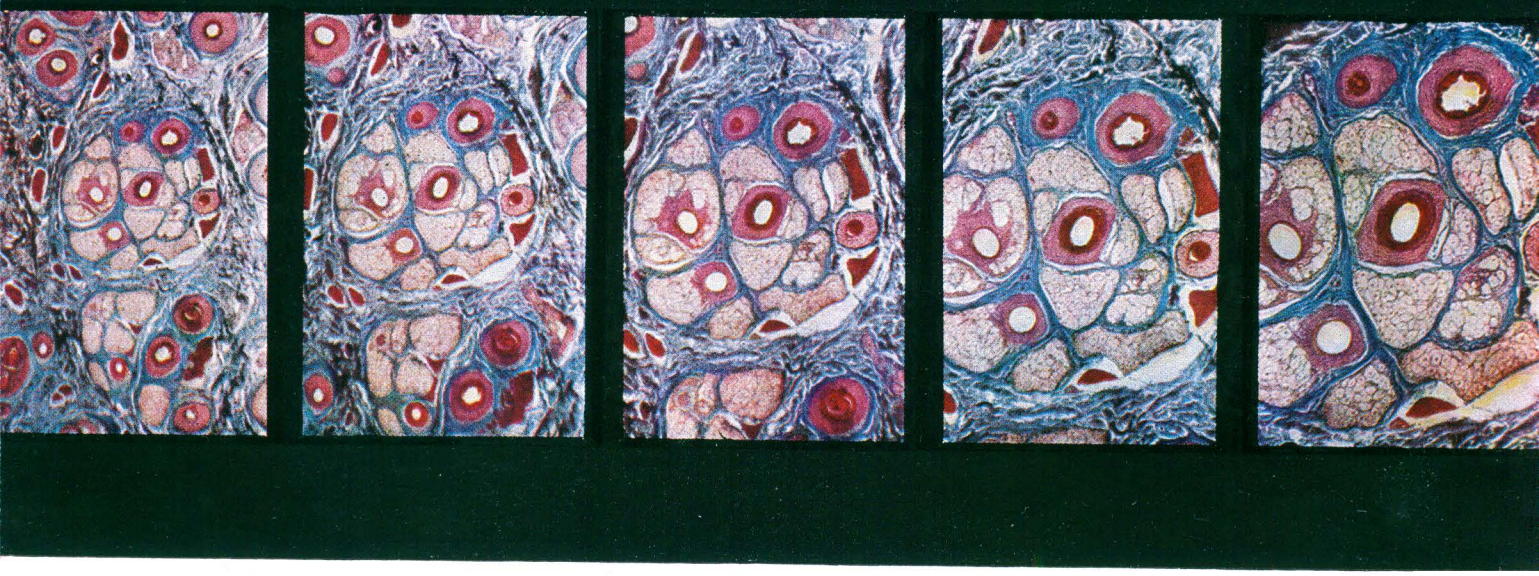


The mercury maximum pressure lamp "HBO 50" or the 6 V 30 W filament lamp may be mounted on the stand itself, if desired. Only a few manipulations are necessary to exchange the two illuminants.

With regard to the diverse requirements made by modern applied microscopy on the illumination arrangements of microscopes, the user of the "Nu" has a large number of possibilities to choose from to obtain the optimum performance for investigations with transmitted light and also with incident light, as well as with combinations of transmitted- and incident-light methods.

All objectives – **plane-field objectives** – are designed for infinite image position and are parfocalized. Thus, no coarse re-focusing is necessary when changing the magnification.

A quite extraordinary achievement in construction and manufacture is **the pancratic eyepiece** that has been used for the first time in practical microscopy in the "Nu". This optical system saves the observer the trouble of changing the eyepieces. The **magnification** can be **continuously increased or decreased** during observation by turning

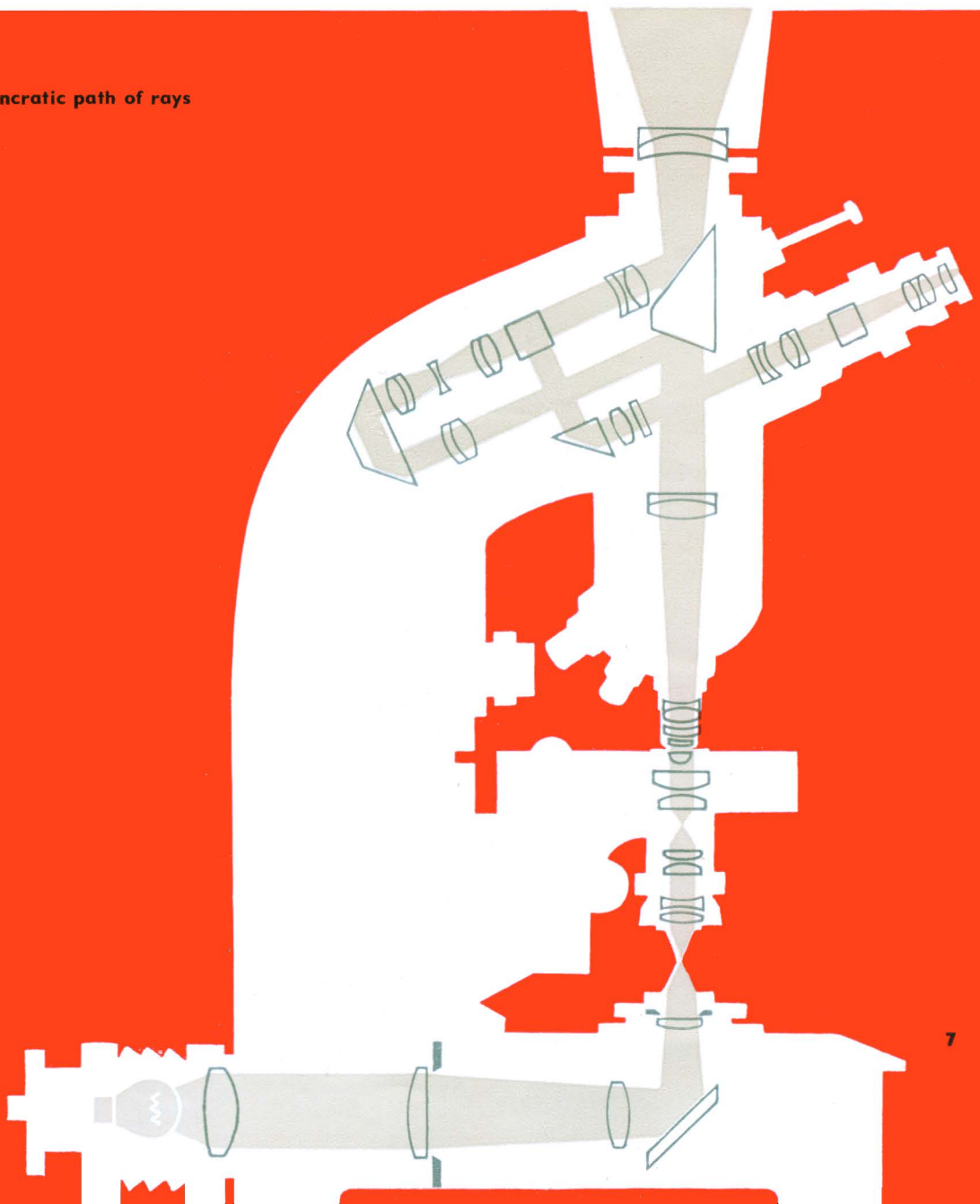


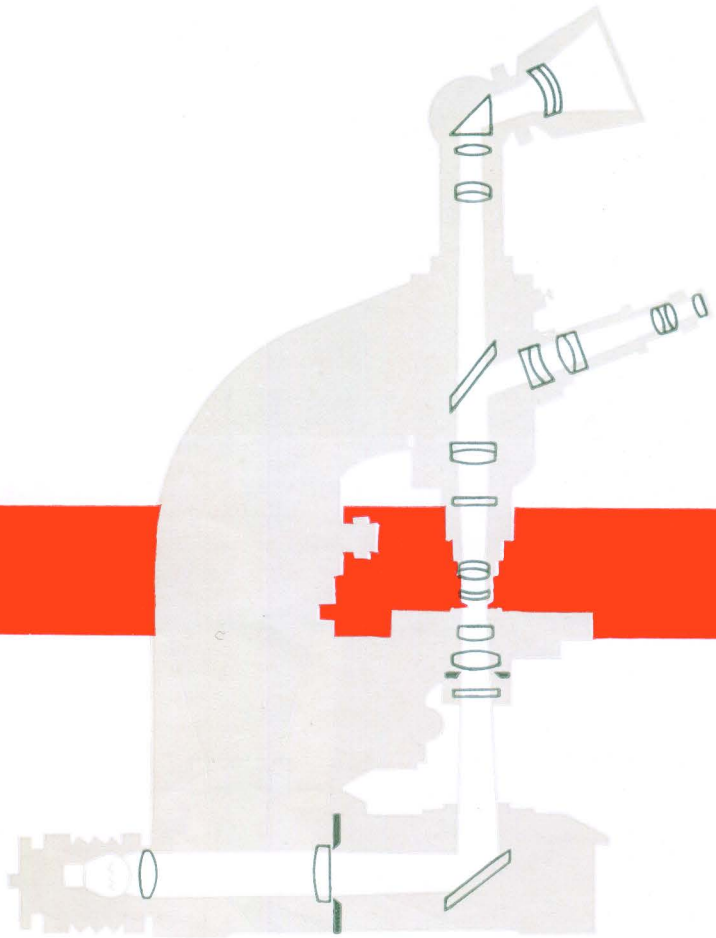
Demonstration of the effect of the pancratic eyepiece · Cross section through human scalp, azan-coloured

a knob in order to find the optimum magnification of the eyepiece for the object examined (pancratic path of rays). Neither the image-definition (no re-focusing is required) nor the position of the image central point alter during this procedure. In connection with the eyepiece PK ×12.5 (field number 14 mm) this pancratic system varies the effective magnification of the eyepiece between ×8 and ×25 so that the useful magnification range of each objective can be fully utilized. The effective magnification for which the eyepiece is set can be read on a scale at the knob.

Certain delicate investigation methods command to have as few optical elements in the path of rays as possible. By pushing a button the pancratic eyepiece system can, therefore, be put out of action, thus converting the "Nu" into a conventional type microscope with condenser, objective and eyepiece – **direct path of rays.** This arrangement is mainly meant for observations in dark-field, in polarized light and in fluorescence light.

Transmitted light in pancratic path of rays





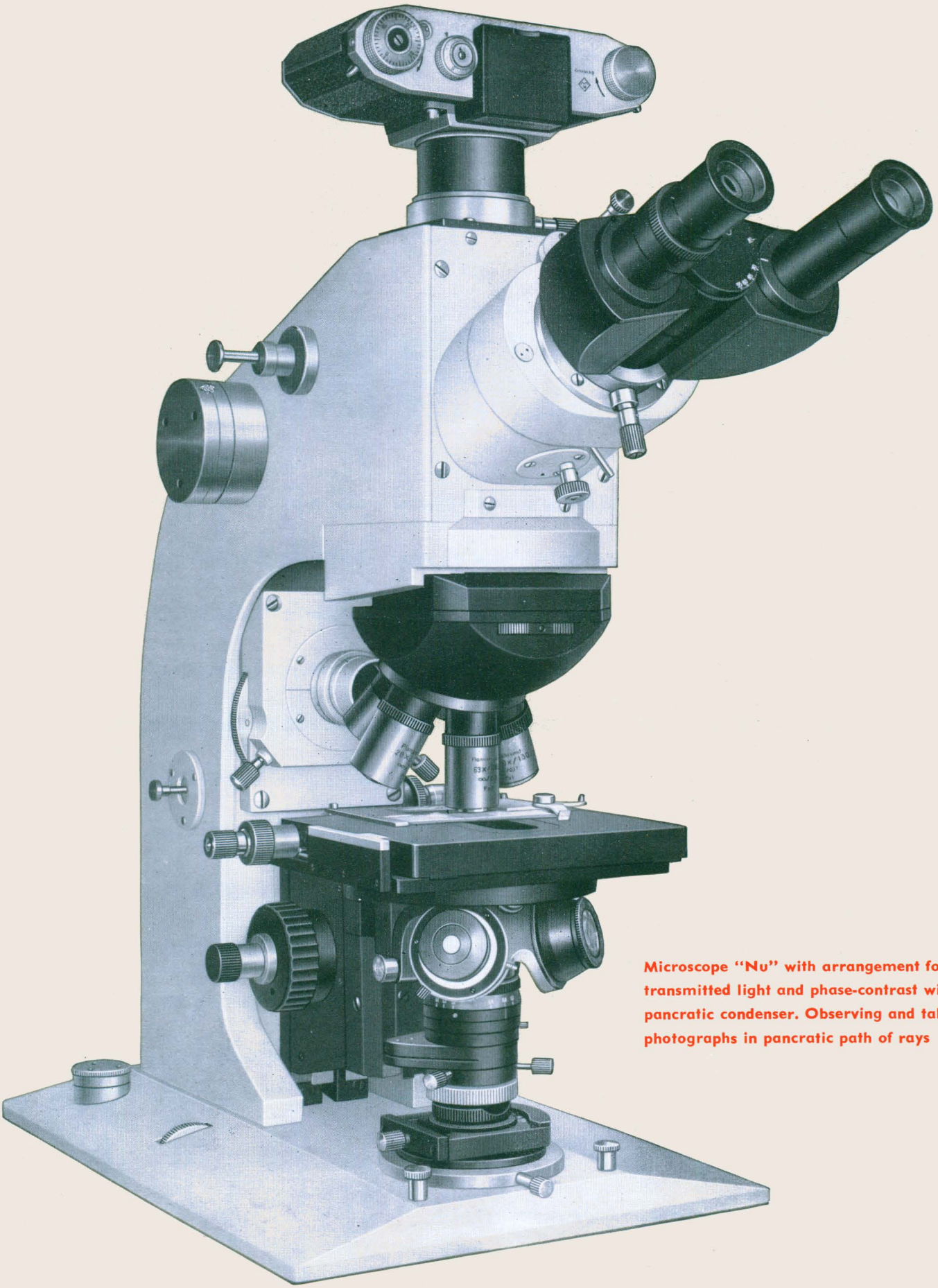
Transmitted light in direct path of rays

Most of the **standardized interchangeable stages** supplied with the "Nu" are already known from our stands "Ng", "Nf" and "Polmi A". A rotatable mechanical stage K 2 forms part of the basic outfit and is provided with coaxial driving knobs for the longitudinal and transverse motions. Sliding stages H are used for the rapid exploration of a specimen; they are supplied in two models – for transmitted light and for reflected light. For polarisation-optical investigations, the round object stage M, provided with ball-bearing and divisions, can be attached to the "N" microscope.

With the Large Universal Research Microscope "Nu" **all the classical and modern investigation methods of practical significance in the visible spectrum range** can be carried out. The change-over from one kind of observation to another is easily to be effected.

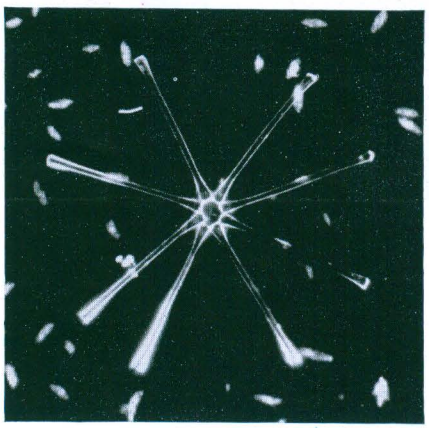
A **total magnification range of ×32 to ×2500** can be attained by the set of objectives of the microscope. The useful range – according to Abbe – is between ×50 and ×1300, while the ranges above and below these limits are at the disposal for special purposes in which the phenomenon of an empty magnification can or must be taken into account.

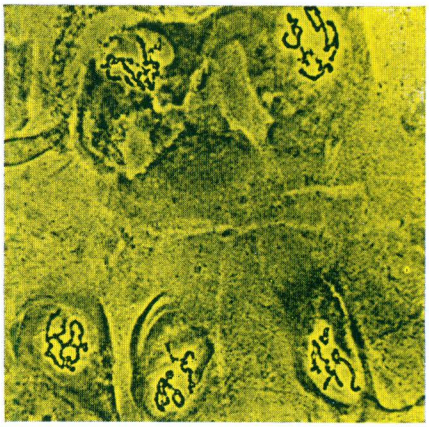
Several arrangements are at the disposal of the user for illuminating the object in transmitted light. The one most used and to a great extent universally applicable is **the pancratic illumination system with condenser revolver** (aplanatic bright-field condenser 1.4, large-field condenser for Köhler illumination principle and cardioid dark-field condenser) and attachable annular stop. This pancratic condenser allows easy, quick and correct adaptation of the illuminating beam to the objective aperture under full utilization of the luminous field as provided by the light source. For **bright-field** and **dark-field work** and investigations with **variable phase-contrast,** it guarantees in every case the realization of the Köhler illumination principle with sufficient accuracy for practical microscopy. The pancratic illuminating system, with its variable focal length, offers an excellent basis for quick and accurate adjustment



Microscope "Nu" with arrangement for transmitted light and phase-contrast with pancratic condenser. Observing and taking photographs in pancratic path of rays

Asterionella gracillima (diatoms),
star-shaped colony.
Transmitted light – dark-field.
Image scale ≈ 1000:1

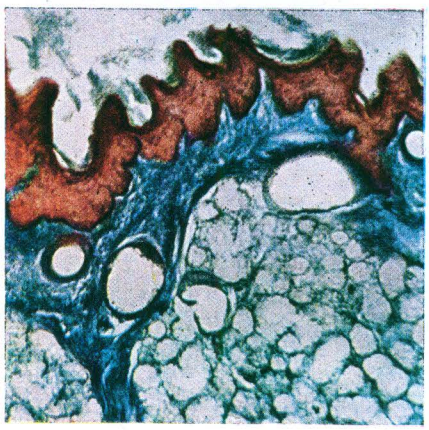




Chironomus Plumosus (red twitch gnat),
cells from the salivary gland of the larva; crush
specimen. Transmitted light – phase-contrast.
Image scale ≈ 160:1

of the effective optical elements in the variable phase-contrast procedure. In order to control this adjustment an auxiliary lens having adjustable focal length is built into the apparatus, which can be flipped into position and with the eyepiece forms an auxiliary microscope. Thus, in the "Nu" one can adjust binocularly; no extra auxiliary microscope is needed.

Young rabbit, cross-section of tongue,
azan-coloured. Transmitted light – bright-field.
Image scale ≈ 80:1

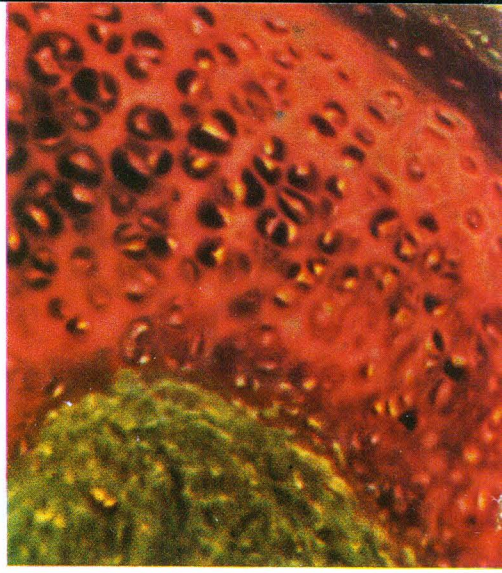




Norite from Bamle, Norway.
Transmitted light – bright-field; polarizers crossed.
Image scale ≈ 50:1



Ascaris megalocephala (round worm),
Ovary cross-section, Acridinorange-fluorochroming.
Transmitted light – Fluorescene.
Image scale ≈ 160:1

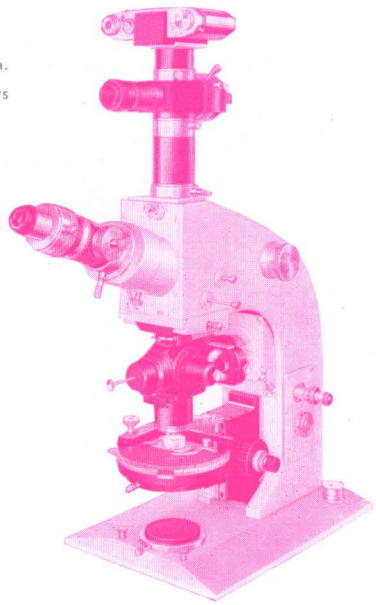


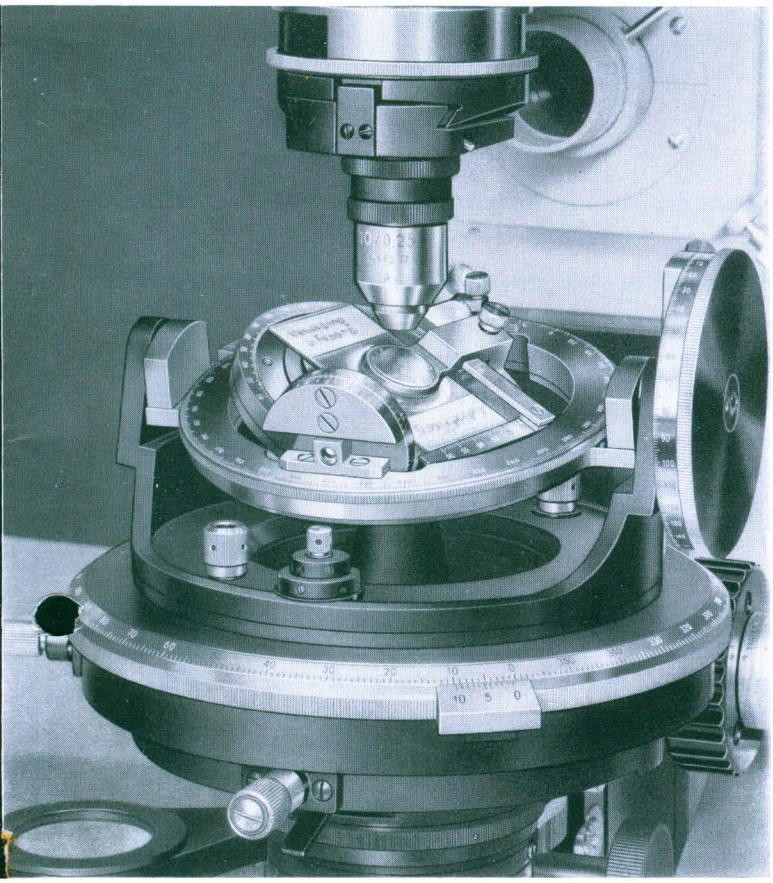
Brown frog. Cross-section through the lip.
Acridinorange-fluorochroming;
blue-light excitation; Image scale ≈ 160:1

For investigation methods requiring condensers of higher correction or with a shorter way in glass, **a series of single condensers** are at disposal in the complete Abbe illumination apparatus or in centring mount, e. g. an aplanatic-achromatic condenser, a special condenser for polarizing microscopy among others.

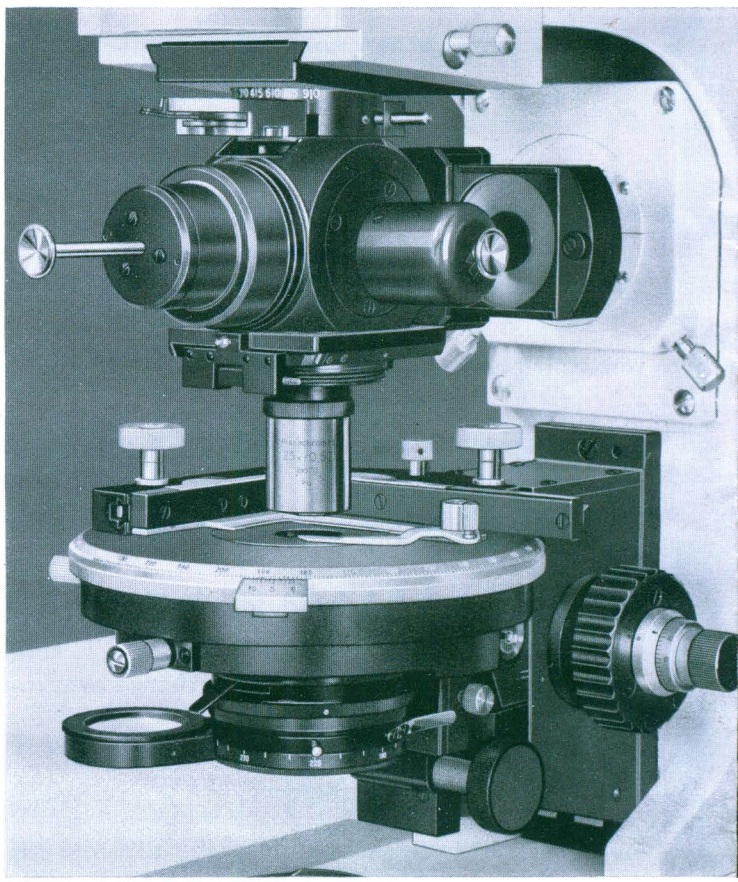
When equipped for polarization-optical investigations, the "Nu", in contrast with other large microscopes, appears as **a perfect polarizing microscope** for direct and indirect qualitative and quantitative work. The construction of the filter polarization equipment of highest quality corresponds to that of our polarizing microscope "Polmi A". All the measuring equipment used there (wedge- and rotary-compensators, Wright's eyepiece and four-axial universal stage) can be applied in the "Nu" without limitations.

Microscope "Nu" with arrangement for incident-light polarization.
Observing and taking photographs in direct path of rays

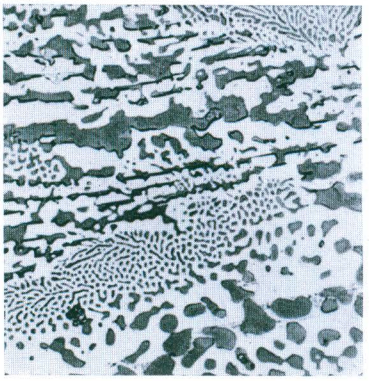
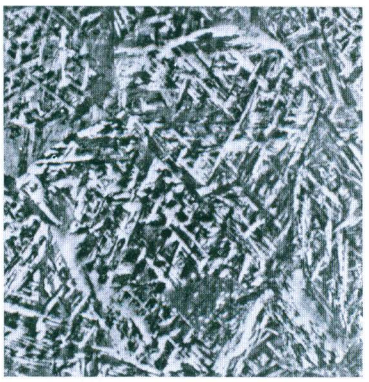
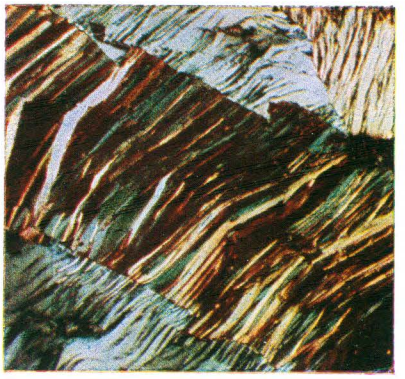




Four-axial universal stage on the "Nu" microscope



Combined incident- and transmitted-light illumination in polarized ligh

Apart from the transmitted-light methods already mentioned, **fluorescence microscopic investigations** with ultraviolet, blueviolet and ultraviolet-free blue light, as well as all conventional **measuring procedures** can also be carried out. For measuring purposes an adjustable eyepiece PK × 12.5 is used to which a set of eyepiece graticules as well as an eyepiece micrometer K × 15 with special tube belong. Measurements with the eyepiece micrometer PK × 12.5 are done binocularly. The advantage offered by the pancratic eyepiece in this case is that the measurements can be made with scale readings of whole numbers.

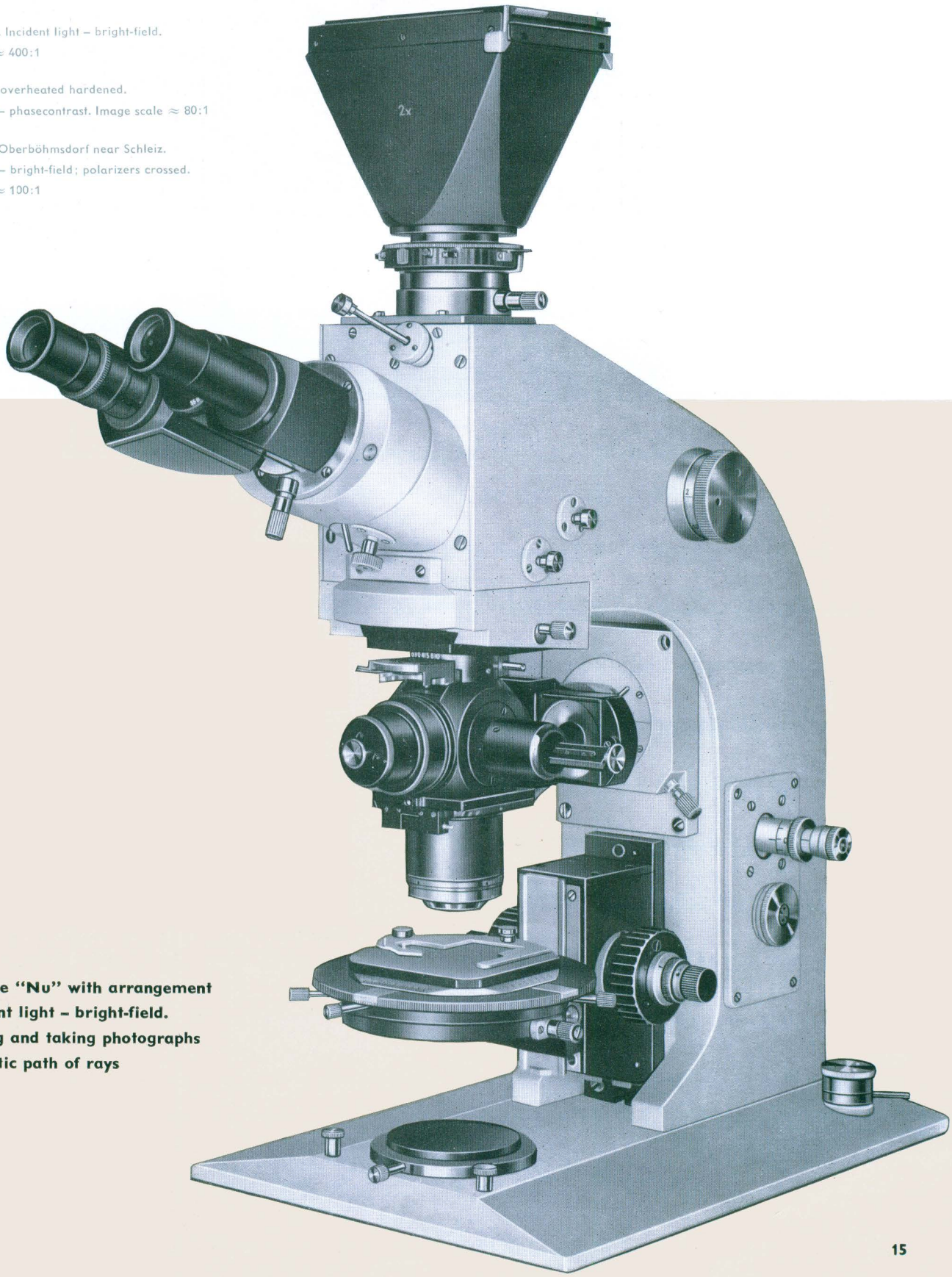
For investigations in incident light **a new combined incident-light condenser** is available which permits of **bright-field work** with natural and **polarized light,** with **variable phase-contrast,** as well as **fluorescence** and **dark-field microscopy,** under strict adherance to the Köhler illumination principle. By appropriate arrangement, only a few manipulations are necessary to change over from one method to another. Thus the incident-light attachment offers unexcelled rational work.

Special arrangements requiring **transmitted and incident light** alternately or **simultaneously** can be realized conveniently on the "Nu", an exact guidance of the two illuminating beams being guaranteed.

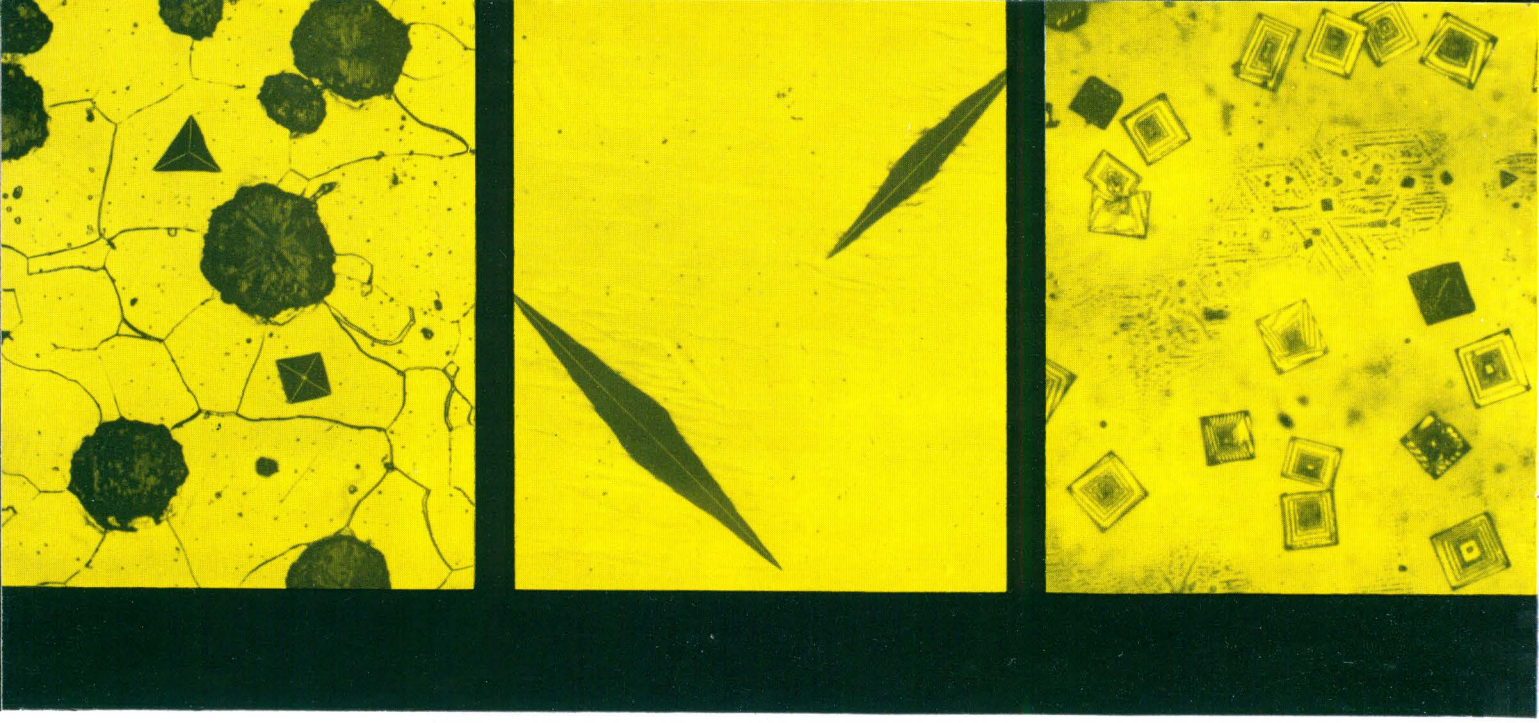
Specular iron. Incident light – bright-field.
Image scale ≈ 400:1

Carbon steel, overheated hardened.
Incident light – phasecontrast. Image scale ≈ 80:1

Stibnite from Oberböhmsdorf near Schleiz.
Incident light – bright-field; polarizers crossed.
Image scale ≈ 100:1



Microscope "Nu" with arrangement for incident light – bright-field. Observing and taking photographs in pancratic path of rays



For specific investigations, **one filter set** each for the transmitted-light and the incident-light equipments are available, each consisting of 19 different glass filters. The filters most frequently used are built into a rotary filter disc of the quintuple objective nose-piece, e. g. yellow-green filter, daylight filter and barrier filter for fluorescence microscopy. For polarization-optical measurements, appropriate metal interference filters can be supplied upon request for the C, D and F lines, also for the conventional transmission maximum of the white light.

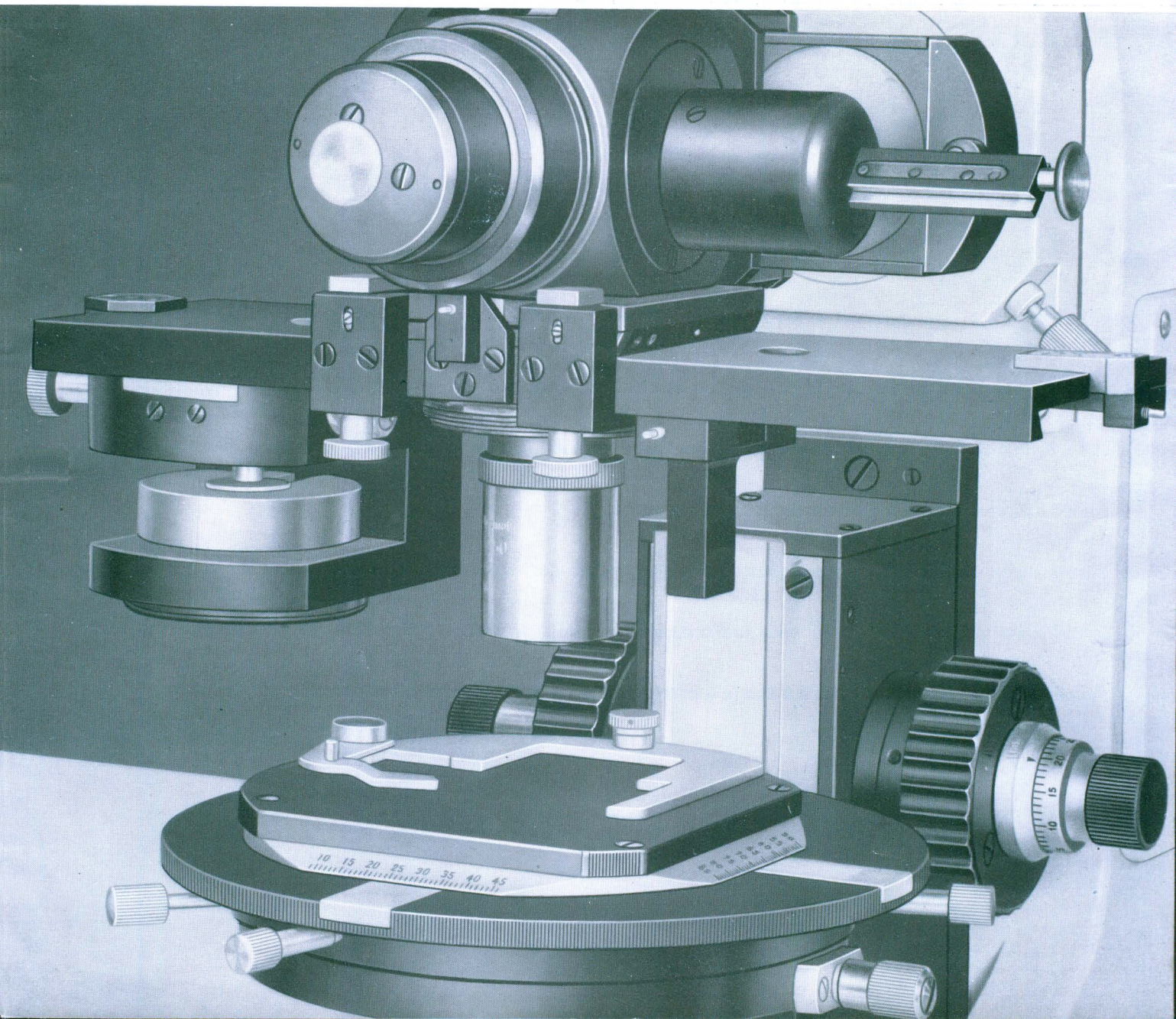
A **newly developed microhardness testing equipment "H"** can be used with the "Nu" to determine the microhardness of solid bodies. The equipment excels in its impacting accuracy of 2 to 3 μ, its **interchangeable indenting tools** of various shapes (Vickers, Berkovich, Knoop pyramids), and testing loads which are geometrically stepped. The hardness testing equipment can be combined with normal dry objectives of any magnification according to the hardness of the material tested.

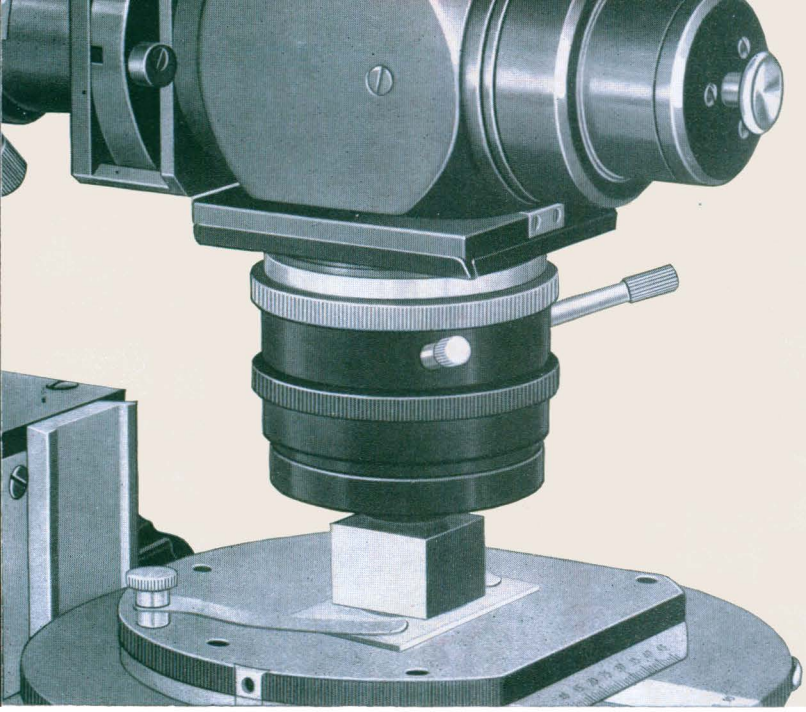
Microhardness testing equipment "H" attached to the "Nu" microscope

Sphero-cast with ferrite ground mass.
Microhardness test – Vickers and Berkovich indentations.
Image scale ≈ 630:1

Zinc (monocrystal). Microhardness test – Knoop indentation.
Image scale ≈ 630:1

Potassium iodide crystal. Incident light – interference;
plane uncoated plate.
Image scale ≈ 160:1





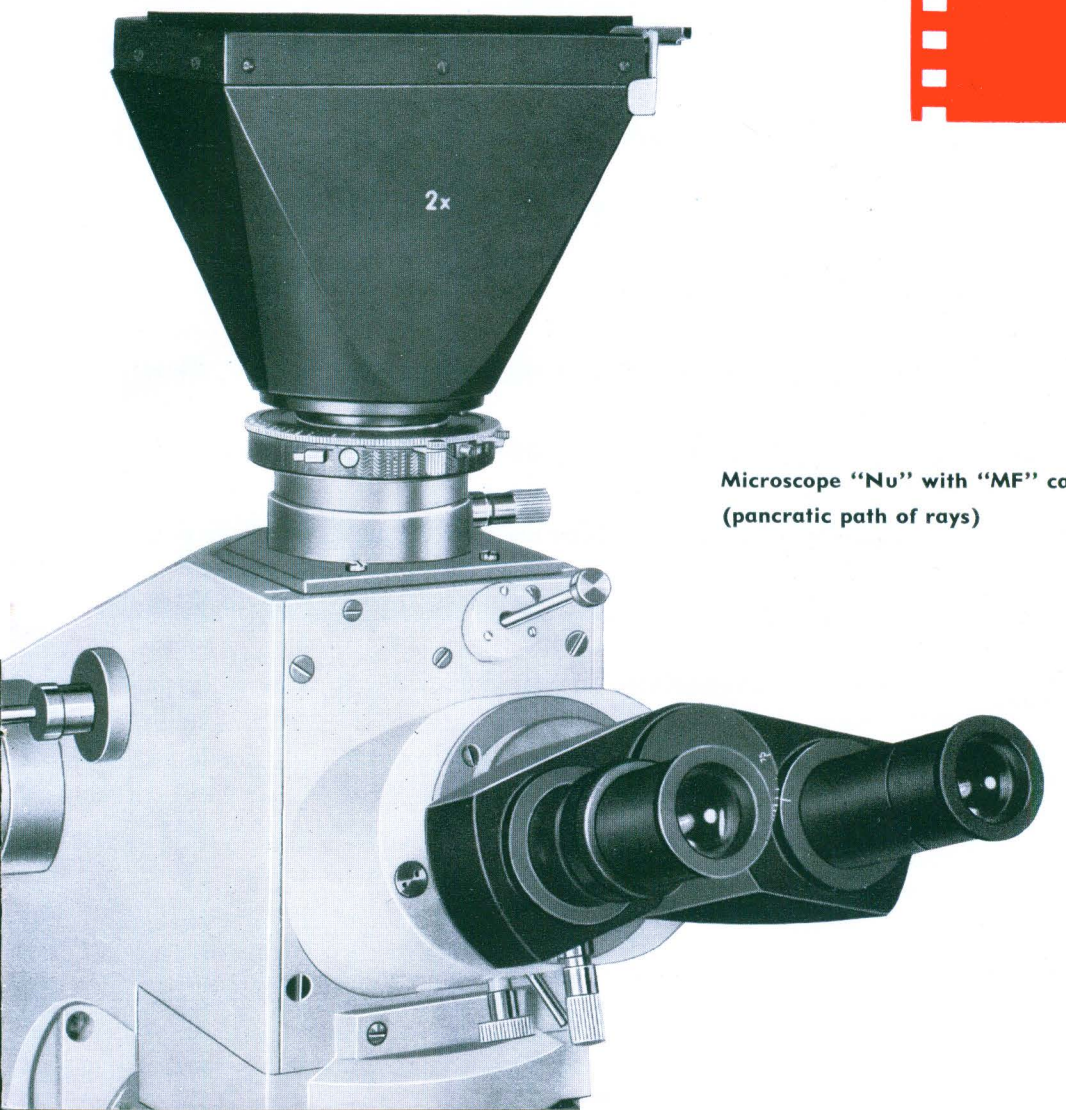
Interference attachment

Surface inspections can be carried out with an **interference attachment** based on the Tolansky multi-beam principle. By this objective method surfaces of various shapes can be inspected at magnifications from ×50 to ×250, using coated and uncoated, plane or convex comparison plates.

It is possible to take **photomicrographs** of all objects under examination in the pancratic or in direct path of rays; for the latter method a "MF" basic body and a set of "MF" projectives are supplied. The pancratic path of rays offers the advantage that the focusing of the image is carried out by using the normal binocular tube; for defining the image

section to be recorded a slide-in graticule outlining the various formats is reflected into the image plane. A beam-splitting cube ensures that the image remains visible during the exposure, thus rendering the instrument immediately ready to take photographs.

When the pancratic eyepiece is not in use, focusing is carried out either with the adjusting telescope of the "MF" basic body, or on the camera ground-glassscreen or, with the help of a magnifier, on a clear-glassscreen.



Microscope "Nu" with "MF" camera attachment 6×6 (pancratic path of rays)

Microscope "Nu" with "MF" basic body Pol and "MF" multi-picture attachment (direct path of rays)

Microscope "Nu" with "MF" automatic exposure regulation and "MF" camera attachment 24×36 (direct path of rays)

Photographs can be taken on plates, cut film, film packs, or roll film format 6 cm×6 cm and on standard film 24 mm ×36 mm. For 6×6 we supply the "MF" Camera Attachment 6×6 with appropriate plate-holders, for standard film photographs the "MF" Camera Attachment 24×36. Commercial cameras with interchangeable lenses as well as the "MF" Multi-Picture Attachment can be used.

A selenium barrier-cell arranged in the pancratic path of rays serves **to determine the exposure time,** it receives the light required for the measurement when a key is pressed. When taking photomicrographs in the direct path of rays, the "MF" basic body for exposure time measurement or the "MF" basic body Pol is used for the same purpose. The exposure is read off an appropriate galvanometer, the instrument being chosen in accordance with the sensitivity dictated by the respective investigation.





For work where the exposure time is frequently changed, the use of our "MF" automatic exposure device is recommended. This consists of the **"MF" basic body for automatic exposure** and a switching apparatus which can be coveniently placed on the working table. The "MF" basic body for automatic exposure is fitted on the microscope in the same manner as any other "MF" basic body. The work with the "MF" automatic exposure device does not differ from that with the other "MF" basic bodies. The degree of the exposure required is controlled photo-electrically. The switching apparatus has only to be set to a value corresponding to the film speed and to the "MF" camera attachment used; this value can be taken from the calibration table for the automatic exposure or determined by a single calibration. After the right value has been set, the exposition is released by pressing a key and controlled automatically. The automatic process produces negatives which can be printed or transparencies suitable for projection.

Microscope for visual observation and for photomicrography built on a special working table with vibration damping

Illumination:

Filament bulbs 6 V 30 W and 12 V 100 W, Xenon maximum pressure lamp "XBO 100", mercury maximum pressure lamp "HBO 50" with collectors, luminous-field diaphragms and ground-glass screens, to be used alternately and in combination

2 sets of light filters each consisting of 19 glass filters

Pancratic illumination system with triple condenser revolver which can be interchanged for special condensers and condenser attachments;

Combined incident-light condenser

Light regulator with 11 switch positions for control of brightness

Specimen stage,

can be interchanged; 4 different models

Objectives for transmitted and incident light:

Plane-field Achromats 4×/0.10 ∞/–, 10×/0.20 ∞/–

Objectives for transmitted light:

Plane-field Achromats 25×/0.50 ∞/0.17, 63×/0.80 ∞/0.17, HI 100×/1.30 ∞/0.17

Objectives for incident light:

Plane-field Achromats 25×/0.50 ∞/0, 63×/0.80 ∞/0, HI 100×/1.30 ∞/0

All objectives are mounted to be as tension free as possible for polarization microscopy

Objectives for variable phase-contrast in transmitted light:

Plane-field Achromats 10×/0.20 ∞/– Phv, 25×/0.50 ∞/017 Phv, 63×/0.80 ∞/0.17 Phv, HI 100×/1.30 ∞/0.17 Phv

Change of the objectives

by quintuple turret or by centerable slide fittings

Eyepieces:

PK ×12.5, PK ×12.5 adjustable, PK ×10/w and PK ×16/w (for polarization microscopy), micrometer eyepiece K ×15, pancratic eyepiece ×0.63 · · · ×2

Range of magnification:

×32 · · · ×2500, total range · ×50 · · · ×1300, useful range according to Abbe

Viewing:

20° oblique, binocular or monocular

Photography:

Medium size 6 cm × 6 cm · Miniature size 24 mm × 36 mm

Exposure measurement (in direct and pancratic path of rays)

Automatic exposure regulation (in direct path of rays) · Image scale 16 : 1 · · · 1000 : 1 on the negative

Observation methods

Transmitted light:

Bright-field, dark-field, phase-contrast, fluorescence, polarization, measuring and counting

Incident light:

Bright-field, dark-field, phase-contrast, fluorescence, polarization, measuring and counting, interference, microhardness testing

Combined transmitted and incident light:

Bright-field, dark-field, fluorescence, polarization – each can be combined with any of the others

The Optical Works in Jena, production centre of world-renowned opto-finemechanical instruments



aus Jena

precision and quality of world renown

Progressive improvements made on our products forbid illustrations and text herein to be binding as to details of latest design. Copyright and right of translation reserved. Reproductions of illustrations – as far as available – will be gladly supplied to interested parties.

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Designation	Cat. No.
Standard Equipment	
Large Universal Research Microscope Nu for Transmitted and Incident Light	**30-0-039 C**
comprising:	
Nu Stand with pancratic condenser	301049 A
Transport case for stand	309319 A
Plastic envelope for above transport case	029522 CR
Working desk Nu	306403 A
Transport case for working desk	309318 A
Plastic envelope for above transport case	029522 HS
Plastic cover for Nu	029513 Z
Incident-light condenser for bright and dark field as well as polarization	304103 A
Concave mirror condenser 11 (for plane-field achromat 4×/0.10)	304091
2 concave mirror condensers 12 (for plane-field achromats 10×/0.20 ∞/–, 25×/0.50 ∞/0 and 63×/0.80 ∞/0	304092
Object stage K 2	305310 B
Object stage H 6	305309 B
Stage carrier W	304801 A
Binocular straight tube, factor 1	305003 D
Objective slide 52 mm	305215
4 objective slides 52 mm, centerable	305215 C
Plane-field achromat 4×/0.10 ∞/–	302132 A
Plane-field achromat 10×/0.20 ∞/–	302134 C
Plane-field achromat 25×/0.50 ∞/0.17	302121 C
Plane-field achromat 63×/0.80 ∞/0.17	302125 A
Plane-field achromat HI 100×/1.30 ∞/0.17	302123 A
Plane-field achromat 25×/0.50 ∞/0	302136 C
Plane-field achromat 63×/0.80 ∞/0	302139 A
Plane-field achromat HI 100×/1.3 ∞/0	302138 A
Double flask	308720
10 cm³ of immersion oil	308721

Designation	Cat. No.
2 eyepieces PK 12.5×	303304 B
Lamp 6/30 KN	304212 B
3 filament bulbs T-31/6 V 30 W	TGL 10619 sm
Lamp 12/100 for Nu	304216 A
3 filament bulbs 12/100	2444 ZN 54
Lamp XBO 100 for Nu	304218 A
Maximum-pressure xenon lamp XBO 100	6210 ZN 54
MF Camera attachment 6×6, factor 2	306040 A
2 metal dark slides 6.5×9	308650
Ultraviolet filter UG 1 32 ∅/1.5	304755-01
Ultraviolet filter UG 1 32 ∅/3.5	304755-02
Blue filter BG 3 32 ∅/2	304755-021
Blue filter BG 12 32 ∅/2	304755-022
Blue filter BG 7 32 ∅/3	304755-023
Yellow-green filter VG 4 32 ∅/2	304755-041
Yellow-green filter VG 9 32 ∅/4	304755-042
Yellow filter GG 11 32 ∅/2	304755-051
Yellow filter GG 13 32 ∅/2	304755-052
Orange filter OG 3 32 ∅/2	304755-062
Red filter RG 5 32 ∅/2	304755-071
Red filter RG 2 32 ∅/2	304755-073
Heat-protective filter BG 17 32 ∅/4	304755-0111
Daylight filter FGB 4 32 ∅/2	304755-0124
Frosted Screen with cross-line 7° 32 ∅/1.5	304755-0134
Neutral filter NG 4 32 ∅/3	304755-0102
Filter polarizer	305900
Selenium barrier-cell for Nu	306150 A
Dust brush	—
Hair brush	—
Leather rag	—
Cleaning rags for optics	—
Cellophane bag 240×300	—
Supplementary Equipments	
Phase-Contrast Equipment Phv	**30-1-043**
comprising:	
Phase ring diaphragm with iris	304328 B
Plane-field achromat 10×/0.20 ∞/– Phv	302185 A
Plane-field achromat 25×/0.50 ∞/0.17 Phv	302186 A
Plane-field achromat 63×/0.80 ∞/0.17 Phv	302187 A
Plane-field achromat HI 100×/1.30 ∞/0.17 Phv	302188 A
Microhardness Testing Equipment H	**30-1-045 A**
comprising:	
Microhardness Tester H	305853 A

Designation	Cat. No.
Indentor with Vickers pyramid	305854 A
Set of weights for microhardness tester H	305855 A
Eyepiece screw micrometer AZ/K 15×	305732 B
Monocular straight tube 23.2/91	305004 D
Pliers for changing the indenting tools	305857 A
Pincers	—
Container	309681 A
In addition:	
Indentor with Knoop pyramid	305854 B
Equipment for observations in the direct path of rays	**30-1-046**
comprising:	
2 eyepieces PK 8×	303311 B
2 eyepieces PK 20×	303306 A
MF tube for Nu	306010 A
MF elbow-type intermediate tube for Nu	306014 B
MF projective K 4 : 1	303226 A
MF projective K 6.3 : 1	303227 A
MF projective K 10 : 1	303234 A
Ground-glass screen for MF camera attachment 6×6	308668 C
Clear-glass screen for MF camera attachment 6×6	308669 C
Focussing magnifier 6×	606265
Connecting piece for selenium barrier-cell	306151 A
Polarization Equipment for Transmitted and Incident Light	**30-1-044**
comprising:	
Intermediate tube Pol for Nu	305915 C
5 objective slides 36 mm, centerable	305216 E
Plane-field achromat 4×/0.10 ∞/– Pol	302132 B
Plane-field achromat 10×/0.20 ∞/– Pol	302134 D
Plane-field achromat 25×/0.60 ∞/0.17 Pol	302121 D
Plane-field achromat 63×/0.80 ∞/0.17 Pol	302125 B
Plane-field achromat HI 100×/1.30 ∞/0.17 Pol	302123 B
Compensator G Red 1	305980 G
Compensator G 1/4 λ	305986 G
Eyepiece PK 10×/w Pol	303345
Eyepiece PK 16×/w Pol	303347 A
Monocular straight tube	
Bottom part 98 for Nu	305029 C
Monocular straight tube Pol 30/22	305029 E

Designation	Cat. No.
Stage carrier M	304801 B
Object stage M	305311
Object traverser for object slide 45 × 26 mm	305110 D
Polarization condenser/e	304391 A
Filter holder 32 ∅	304802 B
Plane-field achromat 25 ×/0.50 ∞/0 Pol	302136 D
Plane-field achromat 63 ×/0.80 ∞/0 Pol	302139 B
Plane-field achromat HI 100/1.30 ∞/0 Pol	302138 B
Insert for object stage 56 ∅/0	305188-22
Objective slide 52 mm, centerable	305215 C
Fedorov Universal Stage	
comprising:	
Universal Stage	305123 A
Pair of segments Fn_D 1.516	304712 B
Pair of segments Fn_D 1.648	304712 C
Achromat 5/0.15 160 S	302070 A
Achromat 10/0.25 160 S with iris diaphragm	302071 A
Achromat 20/0.65 160 S with iris diaphragm	302072 A
3 objective slides 36 mm, centerable, with tube length correction lens	305216 G
Condenser pinion box W 4, of short length	301090 D
Cross-slide FA	305124 A
Cross-slide FB	305124 B
Illuminating lens F 0.25 S	304703 F
Container	309604 A
Further Supplementaries:	
Pair of segments Fn_D 1.556	304712 A
Achromat 30/0.60 160 S with iris diaphragm	302073 A
Illuminating lens F 0.60 S (for Achromats 20/0.35 and 30/0.60)	304703 H
Stereographic net	305993 A
Microscope Lamp 220/HBO 50 LN with bayonet connection	
comprising:	
Lamp 220/HBO 50 LN	304208 B
Power supply unit for lamp HBO 50	367004 B
Maximum pressure mercury lamp HBO 50	6305 ZN 54