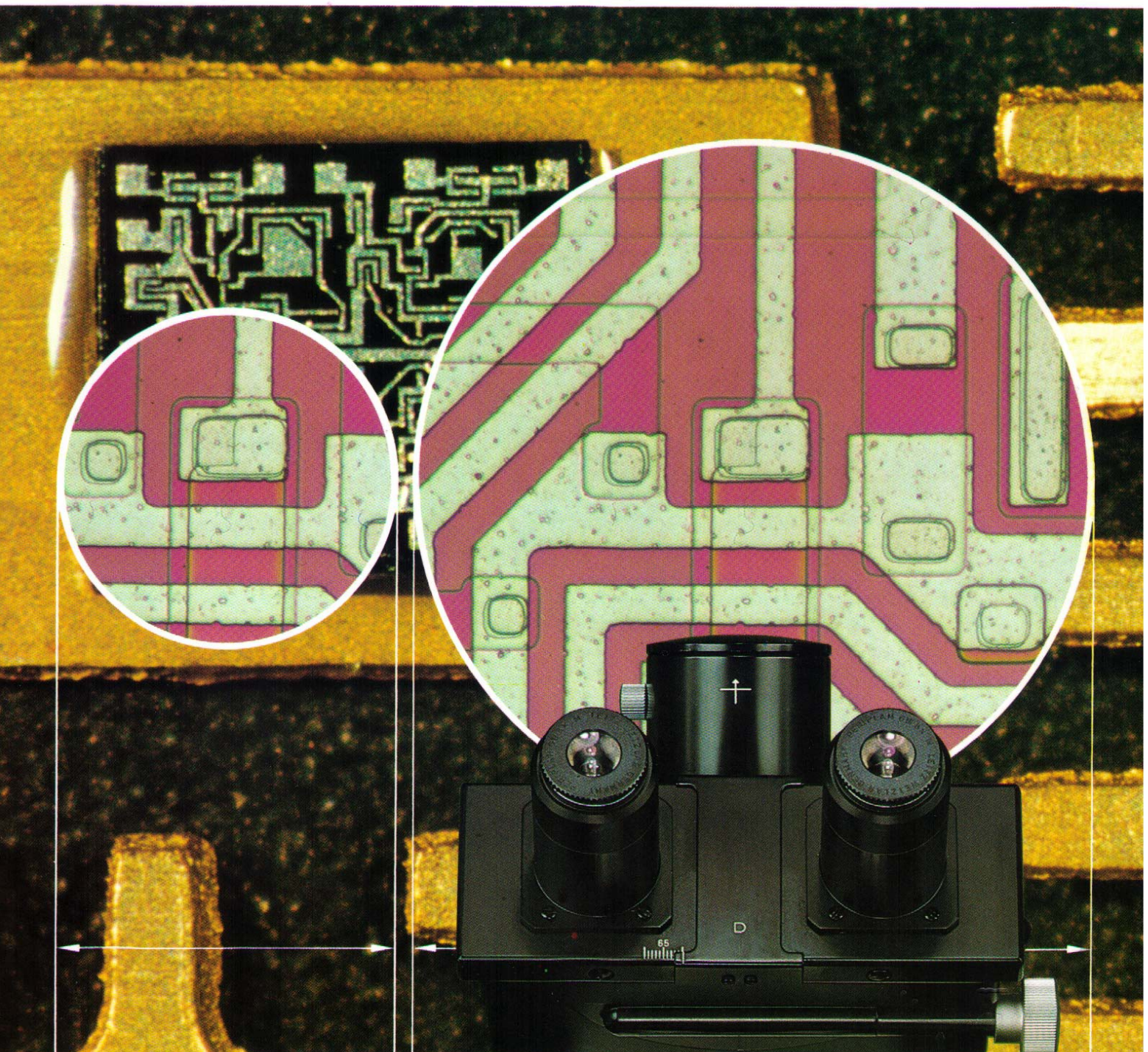


LEITZ

METALLOPLAN-HL 6 x 6

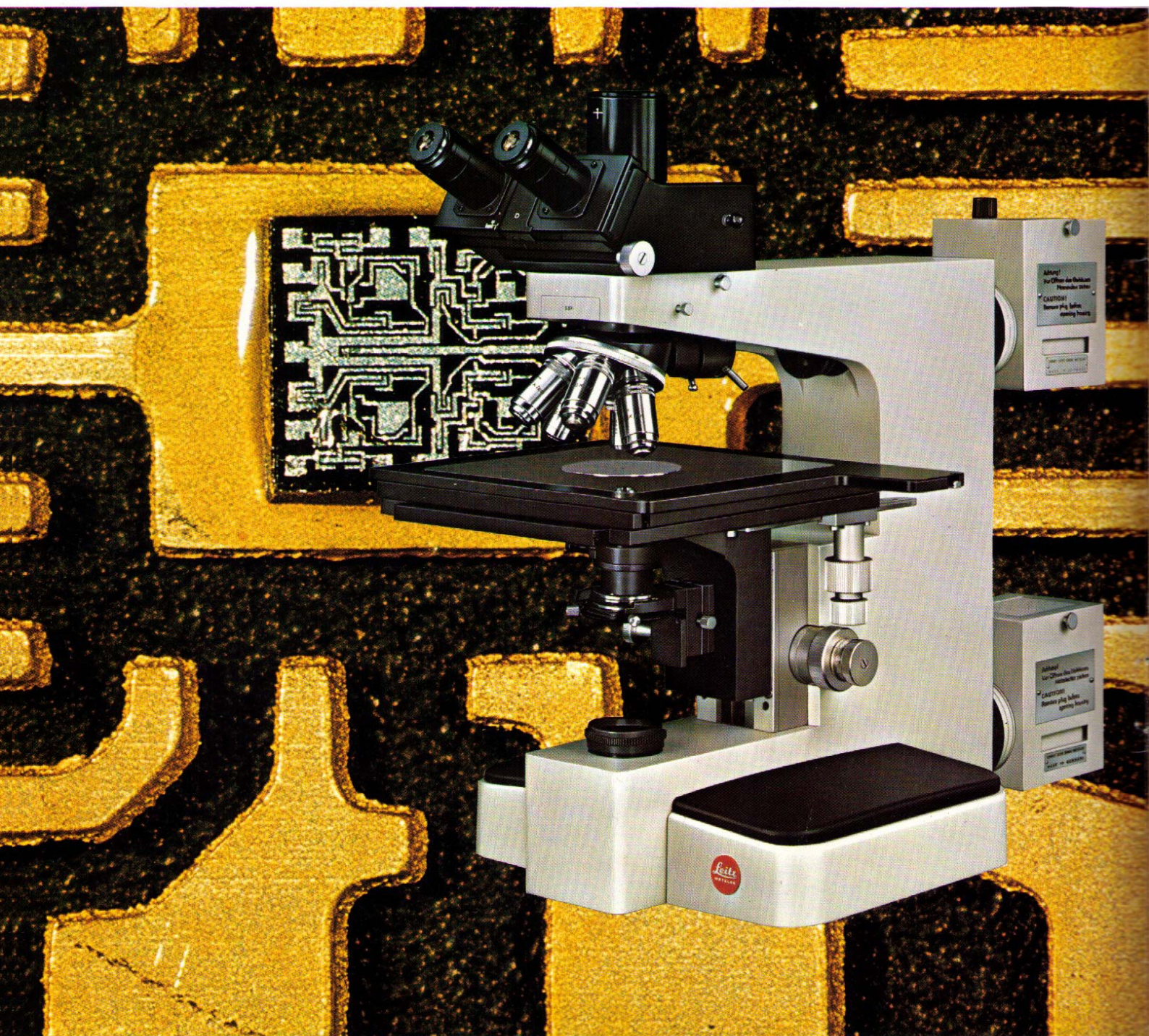


**Largefield microscope for the examination
of semi-conductor elements**



LEITZ METALLOPLAN-HL 6 x 6

Largefield microscope for the New Generation of Masks and Wafers





The development and production of 127.0mm and 152.4mm masks and wafers requires microscope with which such large objects can be examined economically.

The LEITZ METALLOPLAN-HL 6 x 6 semi-conductor microscope meets this requirement almost ideally.

- with a specially designed stand with interchangeable 152.4mm x 152.4mm mechanical stage,
- and an adjustment range of 155mm in the x and y direction,
- with plano objectives of highest resolving power, optimum contrast rendering, and maximum sharpness over the entire microscopic image and of tube factor 0.8x,
- with widefield eyepieces (PERIPLAN® GF) of field-of-view index 28 and therefore
- presentation of an area which is almost 4 times as large as that of conventional eyepieces of field-of-view index 18 at the same high definition (no need to adjust the object), resulting in
- considerable speed-up of examination or much more time available for more careful examination through reduction of object adjustments and focusing corrections to about $\frac{1}{3}$ rd.
- LEITZ modular system for close adaptation of the outfit to techniques of examination required in research, development, and quality control
- therefore favourable cost efficiency ratio of all outfit variants.

Stand

Light sources

Compact, smooth, easy to handle

The compact shape of the microscope stand is readily accommodated by the so-called flow boxes, which have been introduced in the quality control of semi-conductor production for the protection against dirt of the structural elements to be examined.

The smooth design not only permits rapid and convenient exchange of the various component units of the microscope, but also facilitates adaptation of manipulators, tools, holders etc.

The arrangement of the controls, the viewing level and angle of the observation tube fully meet the ergonomic demands the LEITZ METALLOPLAN-HL has to fulfil. Faulty settings are practically impossible even when users are inexperienced.

For incident or transmitted light, separately or combined

The Lamp Housing 100 or 100 Z with 12v 100W tungsten halogen lamp forms part of the basic outfit of the LEITZ METALLOPLAN-HL 6 x 6. In the 100 Z version the user has an externally operated centring device for all illuminating elements. This makes the lamp housing particularly well suited for gas discharge and spectrum lamps of up to 100W. Depending of the method of examination to be used the Lamp Housing 100 (Z) can be attached alternatively in incident or in transmitted-light position.

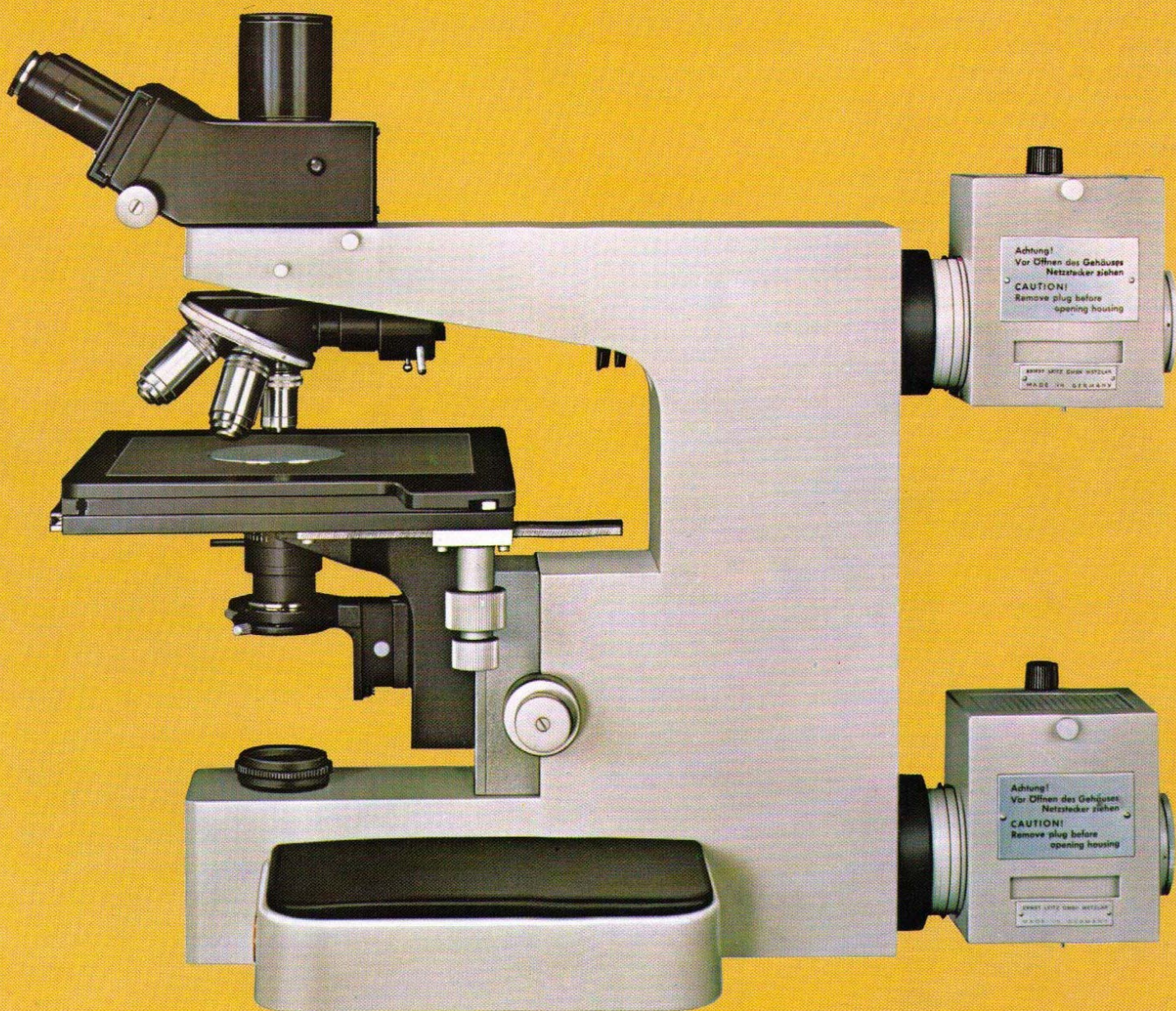
The use of a second lamp housing obviates this change-over, and, if necessary, permits simultaneous illumination with incident and transmitted light. The **Lamp Housing 250** can be directly attached to the bayonet mount for incident-light illumination. For transmitted light and the alternative use of this lamp housing as transmitted or incident light source a Mirror Housing 250 S is required. This also offers the additional possibility of simultaneous connection of a further lamp housing with a light source of the user's choice.

The Lamp Housing 250 is provided for the following light sources:

Xenon lamps of up to 150W

200W ultra-high-pressure mercury lamp

250W halogen arc lamp.



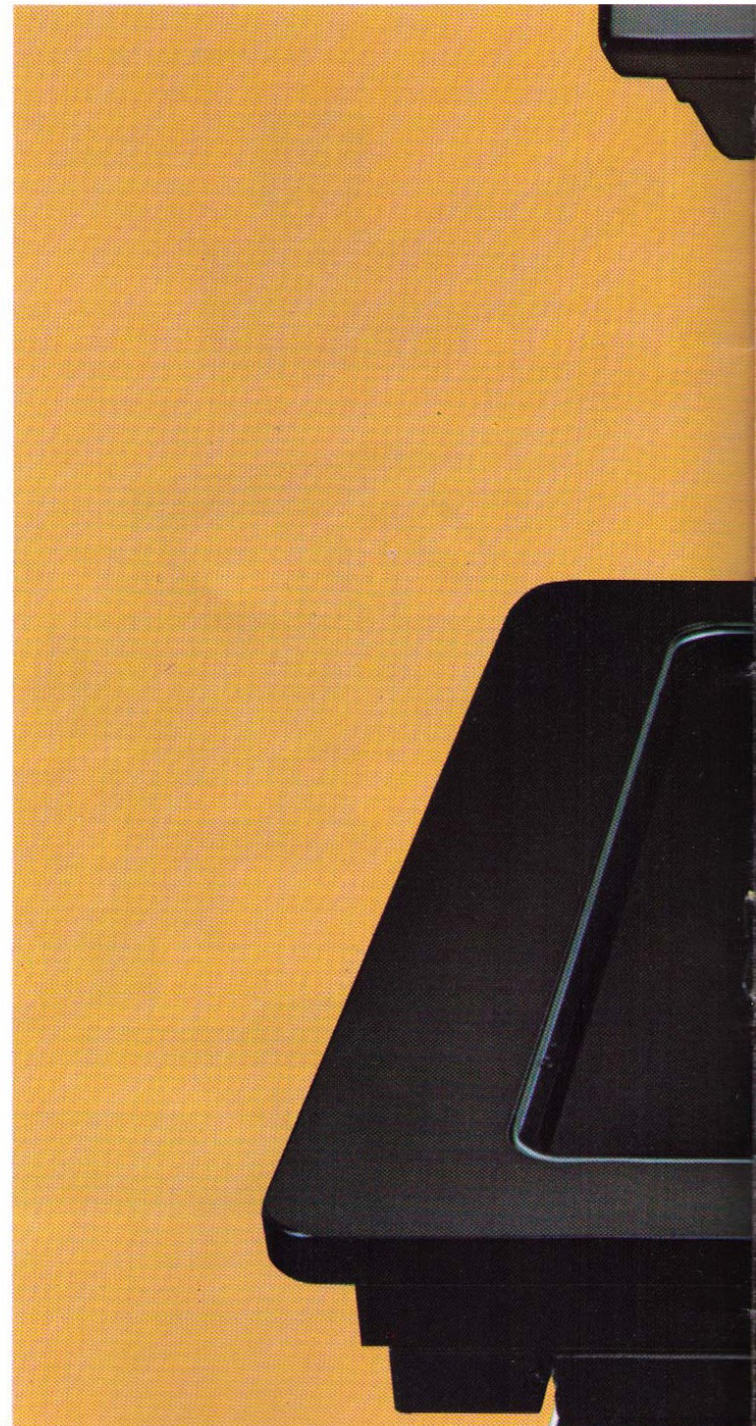
Object stage

For mask and wafer sizes of up to 152.4mm

The LEITZ METALLOPLAN-HL 6 x 6 semi-conductor microscope has been specially conceived for the very long stage movement of 155mm in the x and y direction. It therefore meets the requirement of the electronics industry for a scanning range of up to 152.4mm x 152.4mm. The 152.4mm x 152.4mm object stage has a glass plate for the transmitted-light investigation of transparent semi-conductor elements.

The coaxial knurled knobs for the stage movement are readily accessible above the right-hand handrest. This practically prevents fatigue even during prolonged operation.

If such a large movement range of the object is not immediately required, the LEITZ METALLOPLAN-HL 6 x 6 can also be supplied with the smaller object stage for masks and wafers of up to 108mm. The large 152.4mm x 152.4mm object stage can be simply fitted by the user whenever required.





Optical outfits

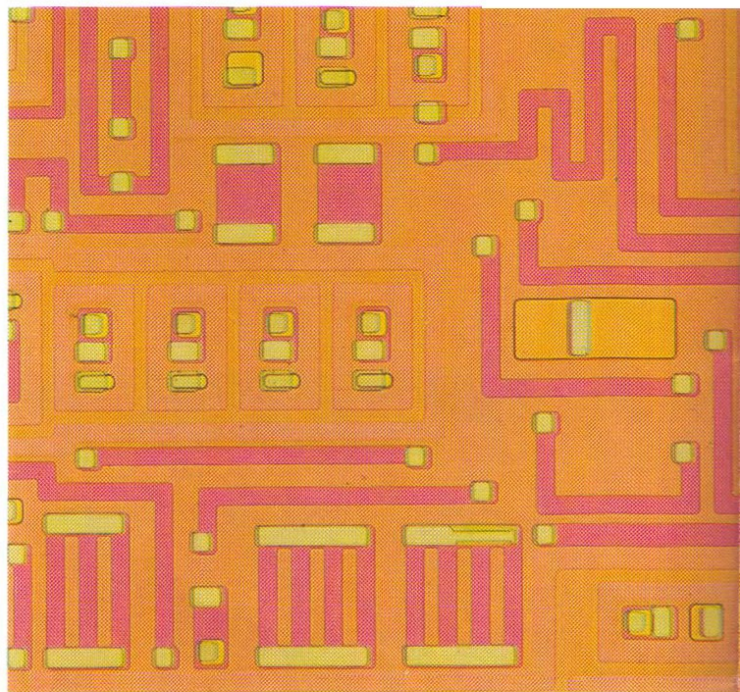
for all microscopic examinations of semi-conductor elements in incident light.

All vertical illuminators of the LEITZ METALLOPLAN/ORTHOPLAN® microscopes can be used on the LEITZ METALLOPLAN-HL 6 x 6 without restriction.

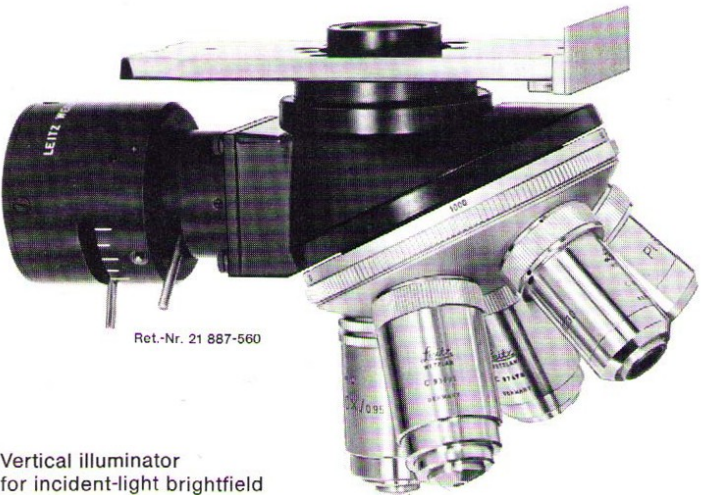
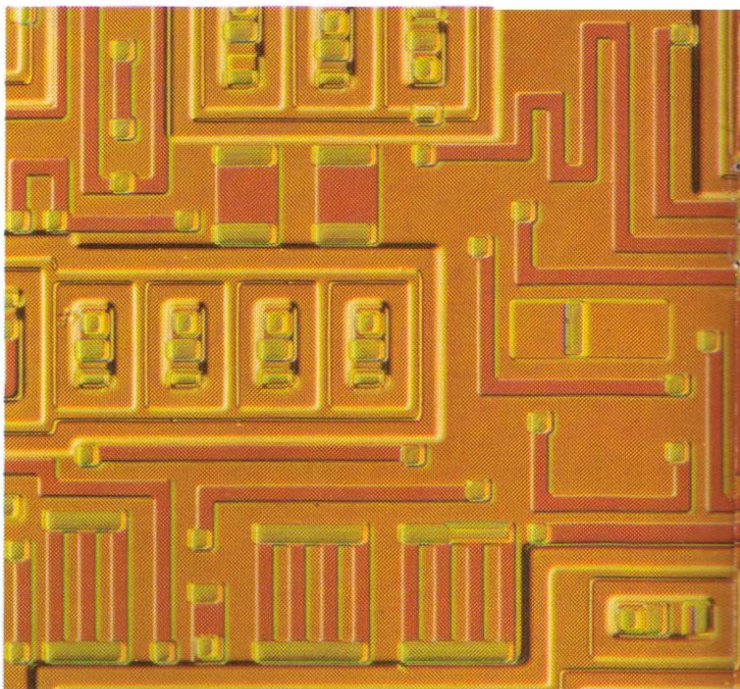
The large semi-conductor microscope fully reveals its performance range with plano objectives and eyepieces covering fields of view of 28mm diameter especially in investigations in brightfield and darkground. Owing to the reduction factor of the 0.8x tube lens built into the vertical illuminator sharp and contrasty images of object areas larger by over 275% (almost 4 times as large) than with conventional microscopes of field-of-view index 18 and the same objective magnification are formed at the full resolving power offered by the objective.

The vertical illuminator with 0.8x tube lens can also be used with NPL P objectives for observation in incident-light interference contrast. Here the field-of-view index of the eyepieces should not be higher than 18 (PERIPLAN 12.5x with sleeve adapter). But even here the object area covered is about 56% larger than with conventional instruments of field-of-view index 18.

Section of an integrated circuit in brightfield, objective PL 16x/0.30

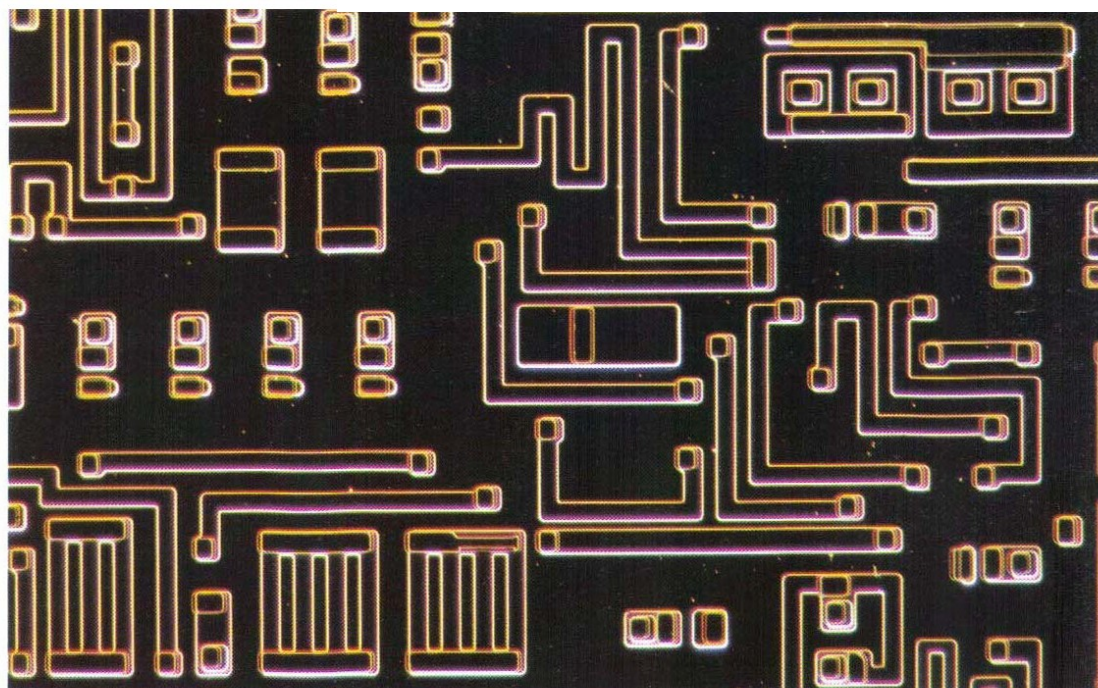
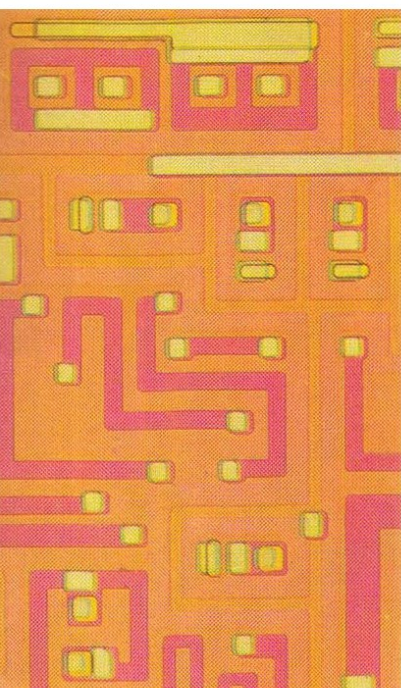


As above, but in interference contrast

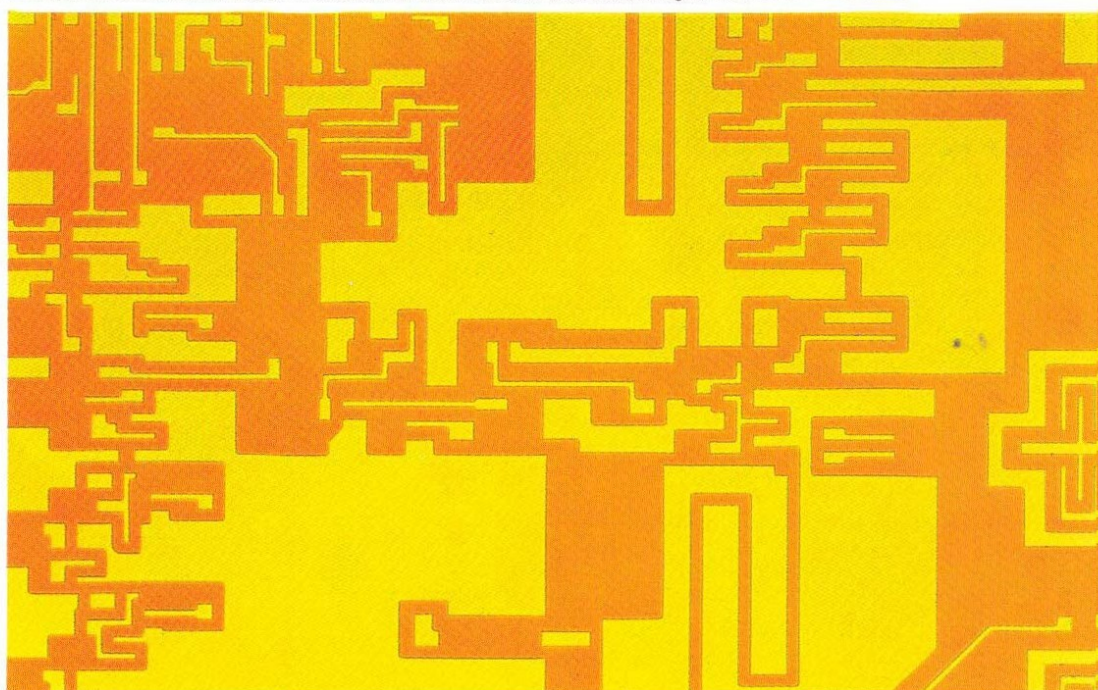
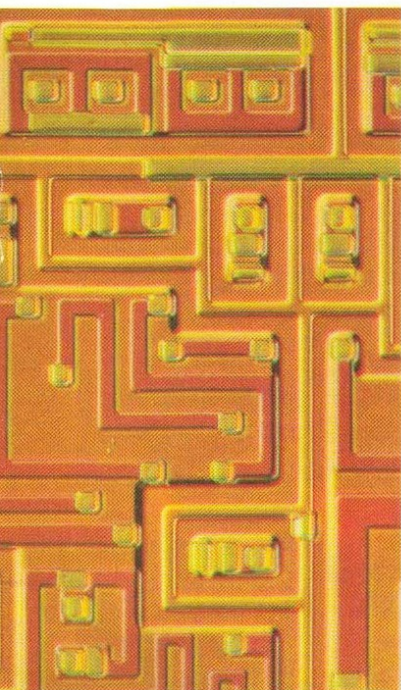


Vertical illuminator for incident-light brightfield

As on the left, but in darkground



Section of a chromium mask in combined incident and transmitted light, objective PL 8x/0.18



Optical outfits

Vertical illuminator for incident-light brightfield with PL Plano objectives

Light tube with incident-light illuminating optical systems, centring field diaphragm, aperture diaphragm, adjustable for oblique illumination;

revolving nosepiece for 5 plano objectives, 0.8x tube lens system.

The vertical illuminator is mounted on a precision dovetail guide and inserted in the METALLOPLAN stand in a horizontal fitting. Code No. 563 281

HD vertical illuminator for incident-light darkground and incident-light brightfield with DPL and PL plano objectives

Light tube with incident-light illuminating optical system, disengageable central stop for darkground illumination, field diaphragm and aperture diaphragm.

Revolving nosepiece for 4 objectives, 0.8x tube lens system.

The larger diameter of the DPL darkground plano objectives made necessary by their special optical design requires larger threads on the revolving nosepiece. Brightfield plano objectives can therefore be used on the HD vertical illuminator only with the adapters provided for the purpose.

Attachment or exchange of the HD vertical illuminator on the METALLOPLAN stand see above. 563 184

Objective and eyepieces for examination in incident-light interference contrast

NPL 10x/0.20 P objective 559 109

Adapter with Wollaston prism for the 10x objective 553 296

NPL 20x/0.40 P objective 559 111

Adapter with Wollaston prism for the 20x objective 553 308

Polarizer with pre-polarizer 553 235

Analyser in slide 513 406

Case for the interference contrast device 553 281

Pair of PERIPLAN GF 10x M eyepieces 519 127

Pair of eyepieces sleeve adapters 513 256

Interference contrast device complete 553 262

Other objectives for examination in incident-light interference contrast

NPL 50x/0.80 P objective 559 113

Adapter with Wollaston prism for the 50x objective 553 241

NPL 100x/0.90 P objective 559 112

Adapter with Wollaston prism for the 100x objective 553 295
5x/0.09 objective 559 080

Adapter with Wollaston prism for the 5x objective 553 238

Plano objectives for incident-light brightfield and qualitative investigation in polarized light

for the use on the vertical illuminator for incident-light brightfield, tube factor 0.8x

or

on the vertical illuminator for incident-light darkground and incident-light brightfield.

The use of the PL objectives for observations in brightfield on the HD vertical illuminator requires adapters for the larger threads in the revolving nosepiece.

Ring adapter 563 115

Engraving Magnification	Aperture	Free working distance in mm	Code No.
PL R 2x	0.04	18	569 094
PL 3.2x	0.06	12	569 007
PL 8x	0.18	13	569 008
PL 16x	0.30	7.0	569 068
PL 32x	0.50	0.38	569 090
PL 80x	0.95	0.08	569 151
PL 160x	0.95	0.08	569 012
PL APO 160x OEL	1.40	0.27	569 150

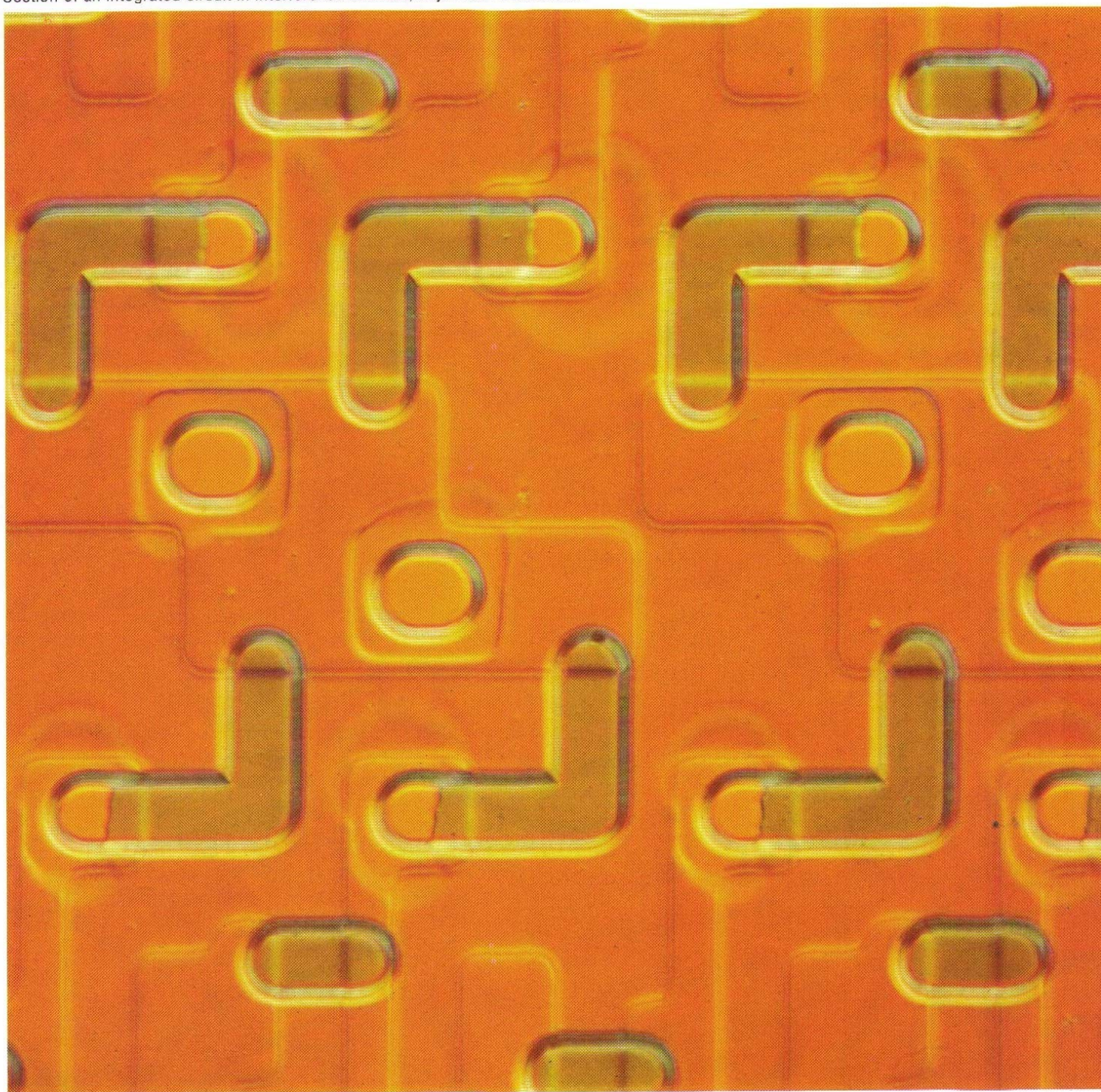
DPL Plano objectives for darkground (and brightfield)

With special thread M 30 x 0.75 for the exclusive use on the HD vertical illuminator.

All three objectives can also be used there for brightfield observation. But if highest demands of detail resolution are to be met the PL 80/0.95 brightfield objective is preferable to the DPL 80/0.75 darkground objective on account of its larger aperture.

Engraving Magnification	Aperture	Free working Distance in mm	Code No.
DPL 16x	0.30	6.9	569 082
DPL 32x	0.50	0.38	569 083
DPL 80x	0.75	0.16	569 084

Section of an integrated circuit in interference contrast, objective PL 50x/0.80 P



Optical outfits

for microscopic examination in transmitted light of masks for semi-conductor manufacture

In the electronics industry transmitted-light observation of transparent objects or observation in simultaneous incident and transmitted light is usually carried out to check the mask elements for exactness and take place in brightfield. To ensure optimum illumination of the object area a special condenser is available, which can be mounted below the mechanical stage whenever required and vertically adjusted by means of a rack-and-pinion drive. This fully preserves the large stage movement of the LEITZ METALLOPLAN-HL 6 x 6 also in this technique of examination.

Rack-and-pinion mechanism with dovetail fork for the vertical adjustment of the condenser	512 534
Bottom part of condenser	562 210
Condensor top S 15	513 502

For transmitted-light examination in phase and in interference contrast or in polarized light the condensers of the LEITZ ORTHOPLAN and ORTHOPLAN POL microscopes can be used, although this restricts the stage movement. Observation in phase and interference contrast also requires a quintuple revolving nosepiece for transmitted light and the appropriate objectives.

For details see list No. 512-082.

for microscopic examinations in polarized light

Observation in polarized incident or transmitted light of electronic components is essential when magnetic ranges of so-called bubble memories are to be made visible.

The LEITZ METALLOPLAN-HL 6 x 6 can be adapted quickly and simply also for this type of investigation. For this purpose, the normal observation tube, the incident-light illuminator, and objectives and eyepieces are merely replaced by the appropriate elements for polarized light.

Binocular phototube FSA 50 with disengageable analyser, rotatable through 360°	552 166
Pol vertical illuminator with prism polarizer	533 333
Objectives NPL 10x/0.20 P	559 109
NPL 20x/0.40 P	559 111
NPL 50x/0.85 P	559 113
NPL 100x/0.90 P	559 112
Pair of PERIPLAN GF 10x M eyepieces	519 281

A special objective of 2.5mm free working distance is available for the observation of bubbles of completed memories, i.e. through the carrier plate of about 0.5mm thickness. Objective 50x/0.50 P 559 197

This objective has been computed for a carrier plate thickness ($n=1.97$) of 0.05 ± 0.15 mm and is made of non-magnetic material. Its external diameter is 13mm, so that magnets can be moved close to the object area observed in the microscope.

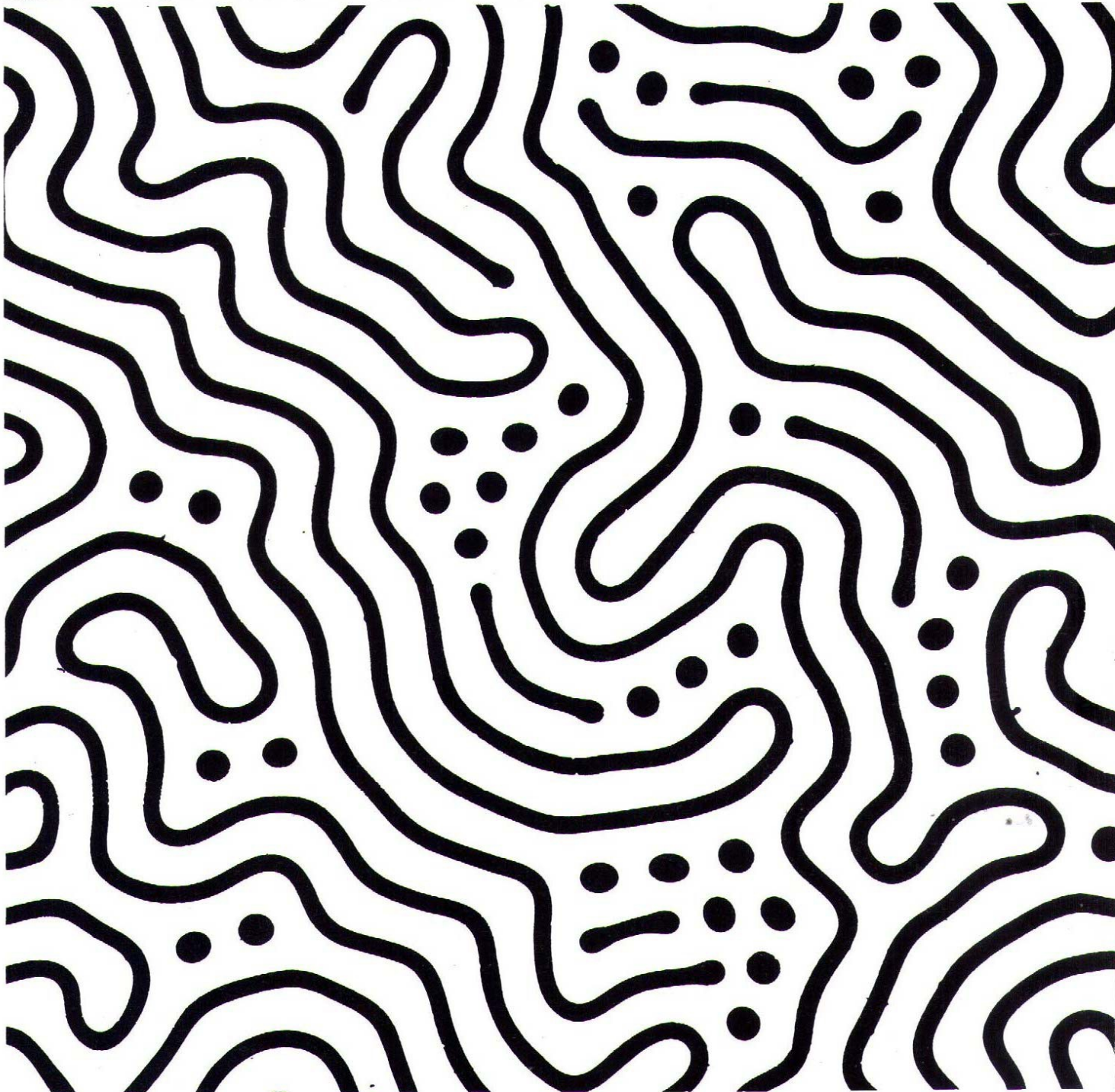
For the polarized transmitted-light investigation of semiconductor elements it is usually enough to add the Pol Condenser No. 702 fvi with filter and pre-polarizer,

Code No. 552 205

to the above-mentioned equipment.

In addition, the LEITZ METALLOPLAN-HL 6 x 6 can be equipped with the appropriate components of the LEITZ ORTHOPLAN POL universal polarizing microscope for other work in polarized incident or transmitted light (see List No. 550-053).

Representation of magnetic domains in polarized light (bubble memory)



Microscope tubes

for binocular observation, photomicrography, projection, television microscopy, and microscope photometry.

The **FSA-GW tube** accepts the GW eyepieces of 30mm diameter and combines the functions of an observation and a phototube.

This means that when observation eyepieces are adjusted to the user's individual interpupillary distance the mechanical tube length does not change. The sharpness of the image is identical in the viewing and film plane for any interpupillary distance and is controlled in the binocular tube also for photography 512 172

This obviates additional focusing in a special focusing telescope for the attachment cameras, LEITZ systems camera, LEITZ COMBIPHOT AUTOMATIC, ORTHOMAT®-W and WILD MPS 50.

A beam splitter built into the tube diverts sufficient light into the eyepieces also during exposure, so that observation is completely uninterrupted even during photography. The beam splitter can be disengaged in critical cases to admit the entire light flux to the eyepieces. For special tasks such as photomicrography of objects of very low reflecting power or for microscope photometric investigation the FSA-GW tube can also be supplied with 100% deflection of the optical path. Depending on requirements the entire light flux is either directed into the observation eyepieces or to the attachment camera or microscope photometer respectively.

The FSA-GW tube with reflection device

Specially designed for photomicrography with the LEITZ VARIO-ORTHOMAT automatic attachment camera (see p. 20) and for microphotometry with the LEITZ MPV Compact.

The built-in triple mirror reflects the images of the light marks for the various photographic formats, so that they are superimposed on the image of the object and can be observed together with it. This obviates the need for the conventional special eyepieces with graticules.

In photometric investigations the reflection system serves for the formation of an image of the measuring diaphragm in the microscopic field of view.

The triple mirror can be disengaged for work without microscope camera or photometer.

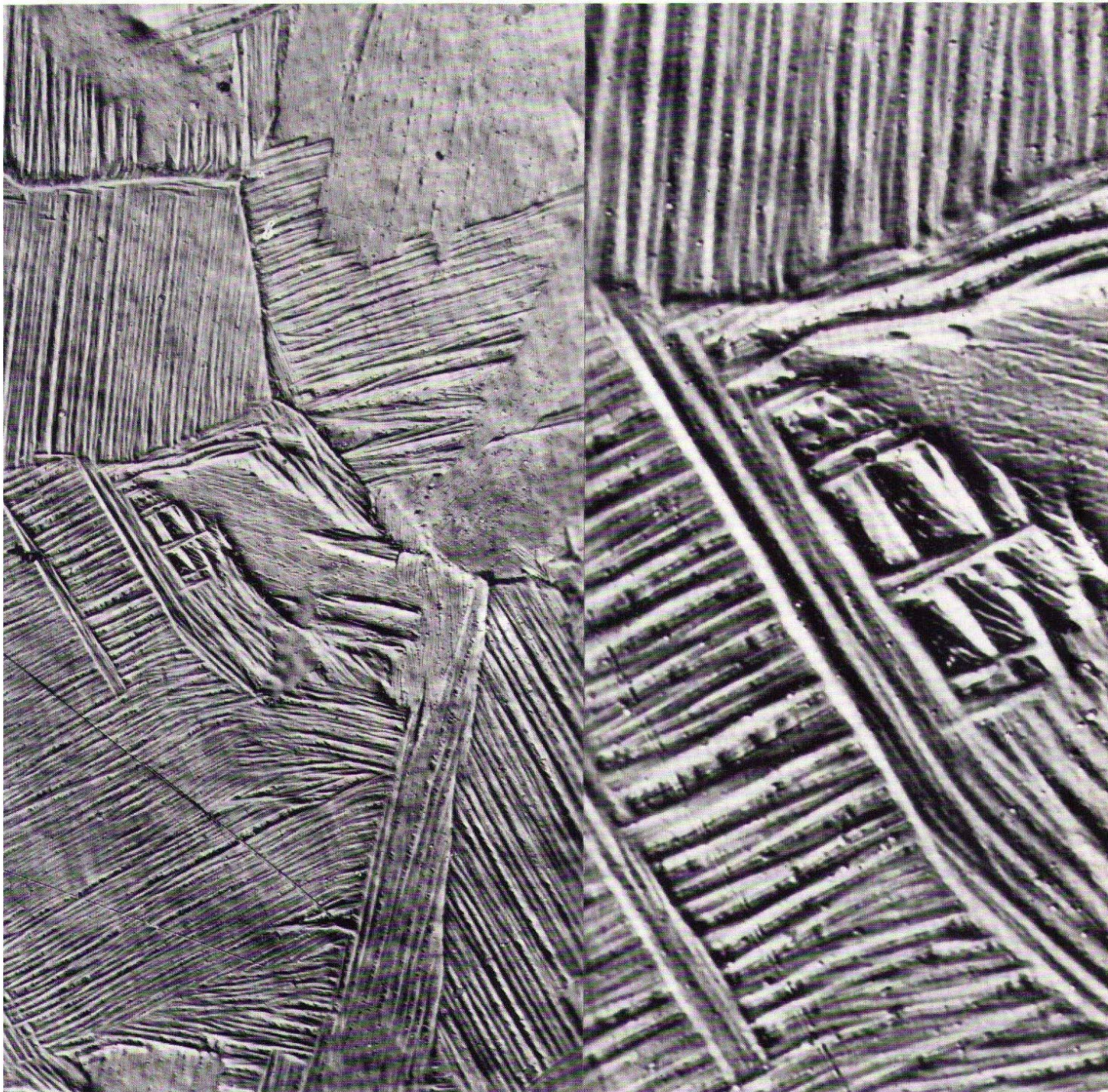
The **discussion tube** serves for simultaneous observation of the microscopic image by three persons. An externally adjustable arrow can be pointed at any area of the field of view 513 452

The device requires two additional observation tubes.
Binocular observation tube S (2x) for eyepieces of field-of-view index 18 512 348
Pair of GF 10x M eyepieces (2x) 519 281

The **vario tube** serves for the continuous variation of the final magnification by factors 1 – 3.2. It can be inserted between the stand and the binocular tube. The lateral setting knob has a scale for reading the magnification factor. The image, once focused, remains in focus throughout the entire zoom range and is right-way-round and upright, which is of particular advantage in semi-conductor control because the position of the structural elements in the image corresponds precisely to that in the object. 512 307

Eyepieces	+ Vario tube	Magnification
PERIPLAN GW 6.3x		6.3x to 20x
PERIPLAN GW 8x	1x to 3.2x	8x to 25x
PERIPLAN GW 10x		10x to 32x

Zirconium in interference contrast, on the left without zoom factor, on the right with zoom factor 3.2



The incident-light microscope interferometer

for the exact check of the microgeometry of surfaces

The incident-light interferometer converts the LEITZ METALLOPLAN into a highly sensitive measuring microscope, whose calibration standard is the wave length of light.

Simply mounted on the stand by horizontal insertion in place of the vertical illuminator and the object stage, it permits the measurement of peak-to-valley heights, etch and scratch depths (surface quality), level differences, structural transitions etc., up to the highest magnification and within a measuring range from $0.003\mu\text{m}$ to $30\mu\text{m}$ 563 329

Measuring principle

Interference arrangement according to Linnik. This ensures contactless measurement of the entire area covered by the objective. Use of white light, essential to the coordination of the interference fringes when interrupted by sharp edges.

Monochromatic light sources:

Sodium lamp Na 10 $\lambda = 589\text{nm}$
Mercury lamp Hg 10 $\lambda =$ depending on the filter
Thallium lamp Ti 10 $\lambda = 550\text{ nm}$
Interchangeable in identical lamp mount and lamp housing and with the same supply unit
Several lamp housings can be simultaneously mounted on the microscope stand by means of a mirror housing for the rapid interchange of light sources.

Sodium lamp Na 10	500 186
Power unit	500 149

Optical outfit:

6 interference-matched paired objectives of the NPL achromat series

Paired objectives	NPL 10x/0.20	569 165
	NPL 20x/0.40	569 166
	LL 20x/0.40	569 170
	NPL 50x/0.85	569 167
	NPL 100x/0.95	569 168

The special pair of LL 20x/0.40 objectives has a working distance of 10mm. It forms images of object areas which because of their arrangement cannot be reached with the other above-mentioned objectives.

Arrangement of object stage and adjustment mechanism:

Sample carrier and optical system are rigidly connected by two columns. This eliminates external affects on the optical path length and ensures perfect steadiness of the fringe system.

Object stage with 10mm x 20mm mechanical adjustment, which ensures rapid and reliable finding of the measuring site even at highest magnifications.

Coarse and fine adjustment of the microscopic image acts directly on the object stage through coaxial controls.

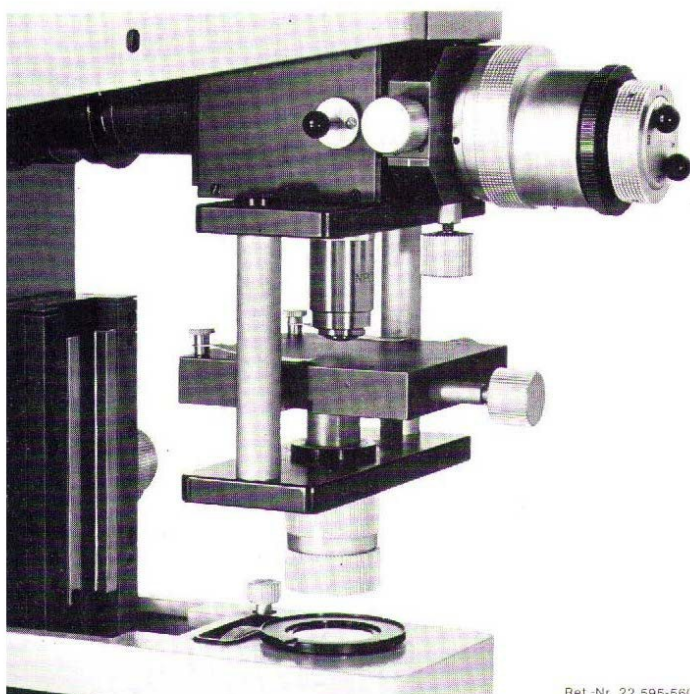
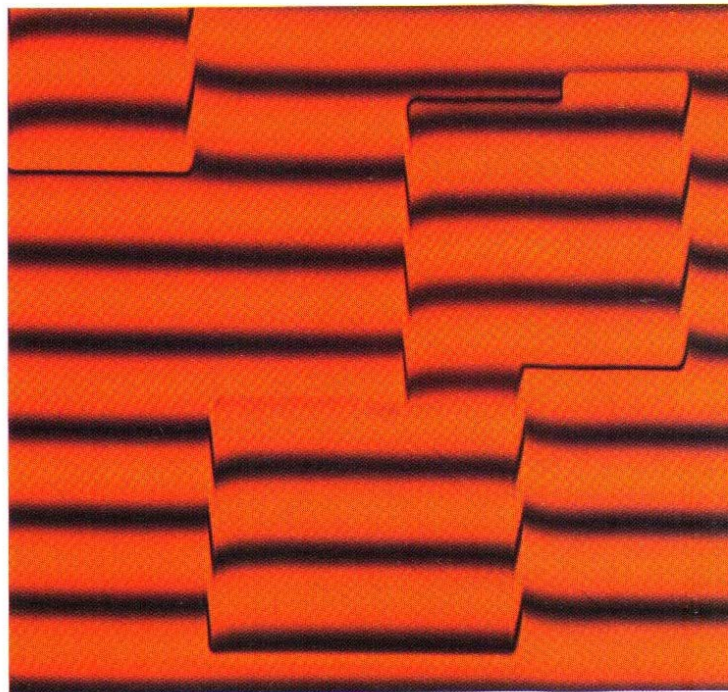
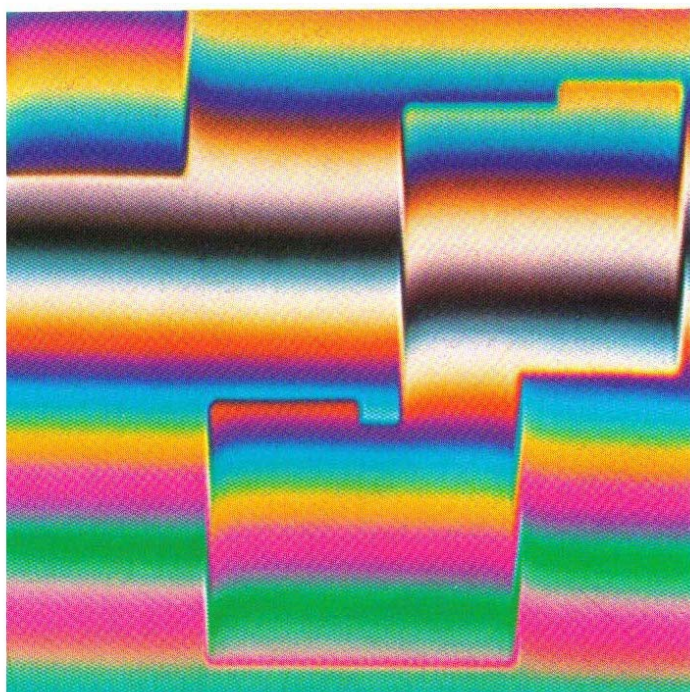
Illustrations of the facing page:

Top left:
Section of an integrated circuit. Interference fringe picture in white light.

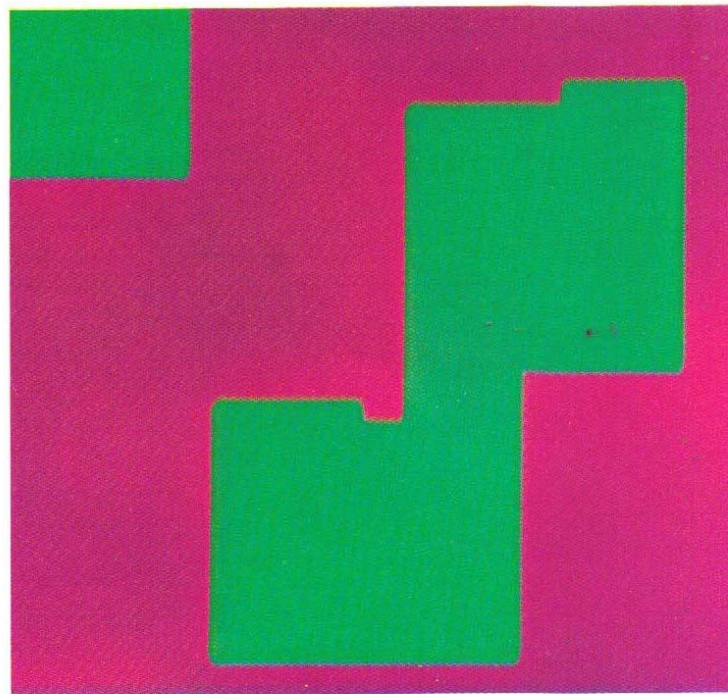
Top right:
As above, but in monochromatic light: $\lambda = 589\text{nm}$

Bottom left:
LEITZ incident-light microscope interferometer

Bottom right:
As above, but in interference contrast, (infinite fringe width)



Ref.-Nr. 22 595-560



Supplementary equipment

for hardness measurement of the finest structural elements

Hardness tests according to Vickers or Knoop can be rapidly and conveniently carried out with the automatic micro-hardness tester on the LEITZ METALLOPLAN-HL 6 x 6.

The indenter replaces an objective in the revolving nose-piece of the vertical illuminator and the monocular tube with micrometer eyepiece is used instead of the binocular phototube FSA.

The tip of the diamond pyramid is adjusted to the optical axis of the focusing objective so accurately that the hardness indentation is precisely in the object detail that has been lined up at 400x magnification.

The diamond is automatically lowered and raised through the pressure transmitter after a preset period of dwell.

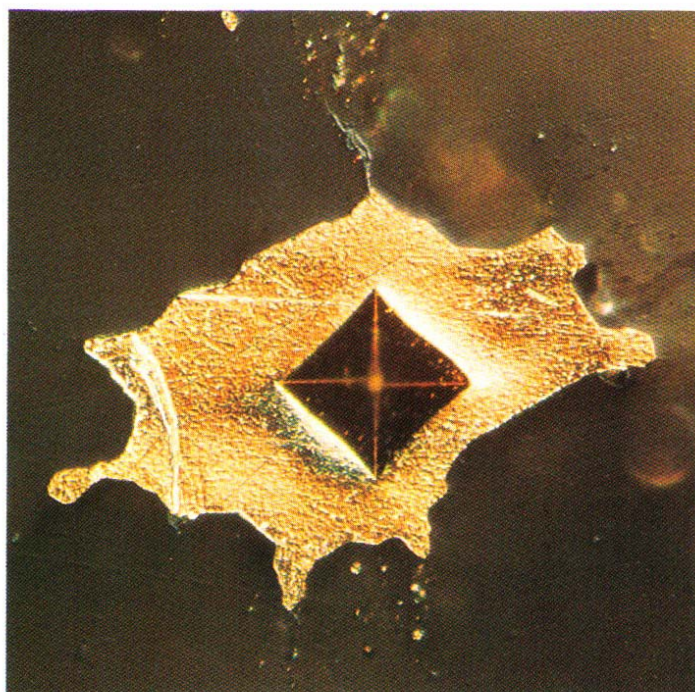
Hardness indentations of diffusely reflecting samples such as enamel, ceramics etc., can be measured only with difficulty in ordinary incident light.

The micro-hardness tester for the LEITZ incident-light microscopes can therefore be supplied also for measurement in interference contrast.

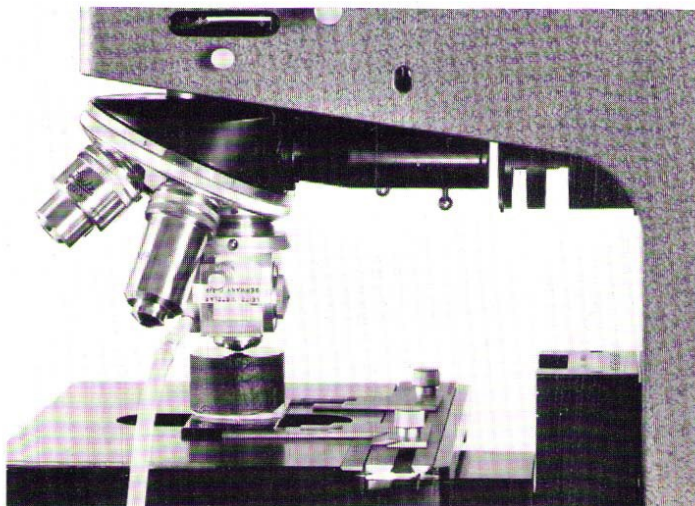
Micro-hardness tester for the LEITZ METALLOPLAN

Complete outfit without diamond	563 209
Complete outfit without diamond for interference contrast	563 244
Complete outfit without diamond for interference contrast, without polarizer*	563 245
Vickers diamond	563 195
Knoop diamond	563 196
Adjustment balance for pressure transmitter	563 334

* The polarizer can be omitted if it is already available from another outfit



Hardness indentation according to Vickers on a gold grain, interference contrast



for material-specific contrasting of solids

The function of this instrument is based on the adsorption of particles (ions, atoms, molecules) in a gas discharge on the surface of polished and plane sections of metals, ores, coal, ceramics and other solids. It produces a colour differentiation between chemically different structural components.

The contrasting device consists of:

Vacuum chamber with gas-discharge-type electron gun,

High-tension unit 2kv

Conventional 2-stage, rotary vacuum pump.

By means of an externally-operated swivelling device the polished section is moved into the particle stream of an electric gas discharge. The gases required for this reaction are introduced into the chamber through needle valves. Bombardement can be interrupted whenever required with the same device and the object moved into the optical path of the microscope for checking the contrasting process. After the cover of the chamber has been exchanged with a top part with the same but obliquely arranged electron gun, the device serves for the microscopic observation of electron luminescence.

A tension of 15kv is necessary for these investigations.

Detailed description: List No. 560-32.

Outfit:

Contrasting device with 2 sample holders, dia. 25.4mm, electron gun (without cathode), special tool, centring key, sealing rings, vacuum switch and vacuum tube

563 317

Plane iron cathode (interchangeable with cathodes of other metals*)

563 289

High-tension supply unit

500 221

Accessories:

Cover for electron luminescence

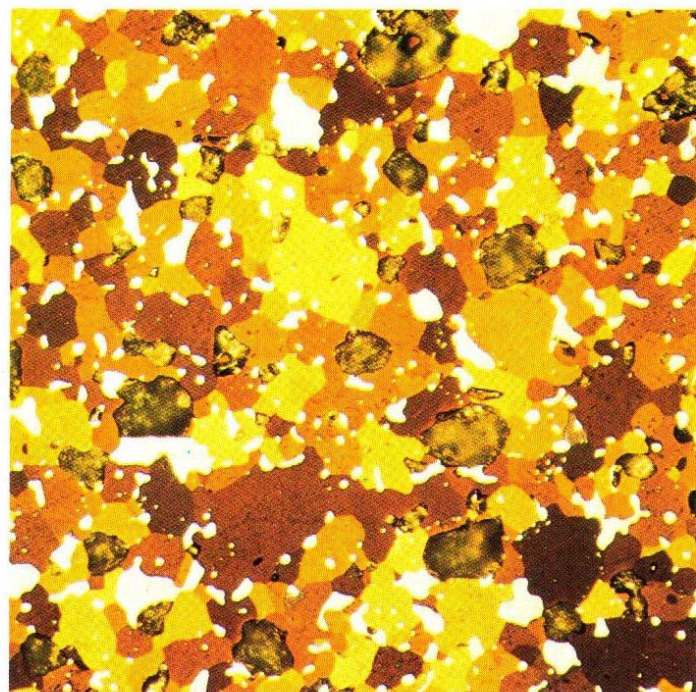
563 266

High-tension supply unit 15kv

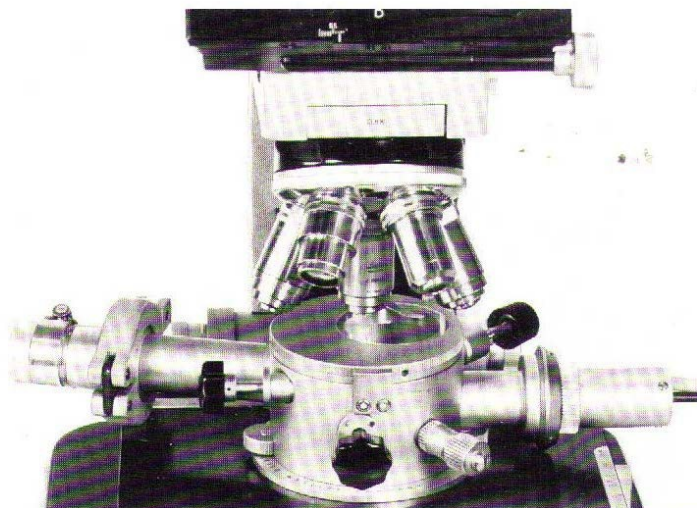
500 233

Aluminium cathode

563 308



Moselite in colour contrast



* For instance for the metallising of objects for scanning electron microscopy.



for photomicrography

The new LEITZ VARIO-ORTHOMAT system of photomicrography can be mounted on the METALLOPLAN-HL 6 x 6 for the recording of details of interest.

Various camera attachments permit the use of all conventional photographic formats from 35mm to 9 x 12cm and POLAROID*.

Depending on the light and contrast conditions of the microscopic image the exposure time can be measured either with the integrating method covering the entire field of the format or with the detail method using a movable measuring spot for any desired object area.

In addition, the following functions of the LEITZ-VARIO-ORTHOMAT are fully automated:

- The measurement of the exposure time
- the shutter

- the transport of 35mm films

- the adaptation of the exposure time to the format used

- the adaptation of the format outline to the magnification of the photographic eyepiece

- the compensation of the reciprocity law failure effect

- the screen against stray light

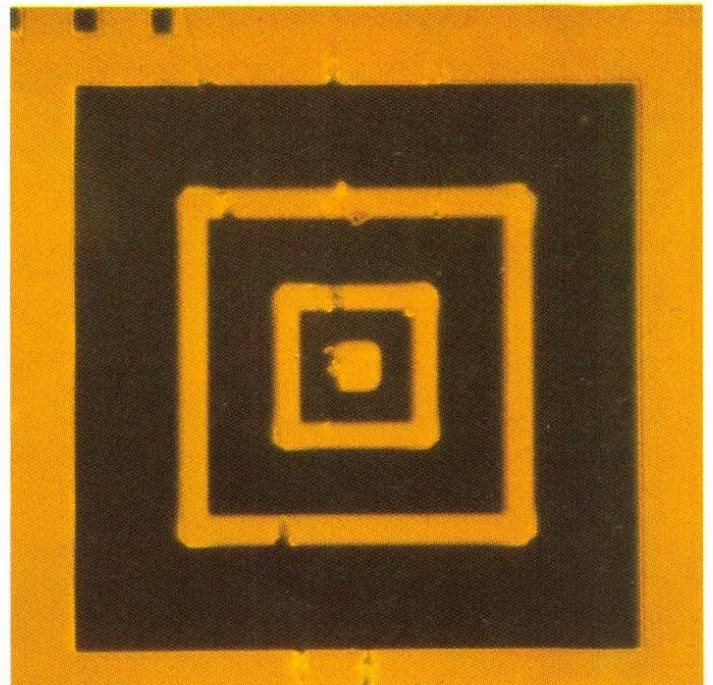
- exposures at preset times intervals.

The image is lined up and focused with a special binocular phototube (FSA-GW) with reflection device for the various format outline marks so that the choice of the picture area and focusing do not interrupt microscopic observation (see also p. 14).

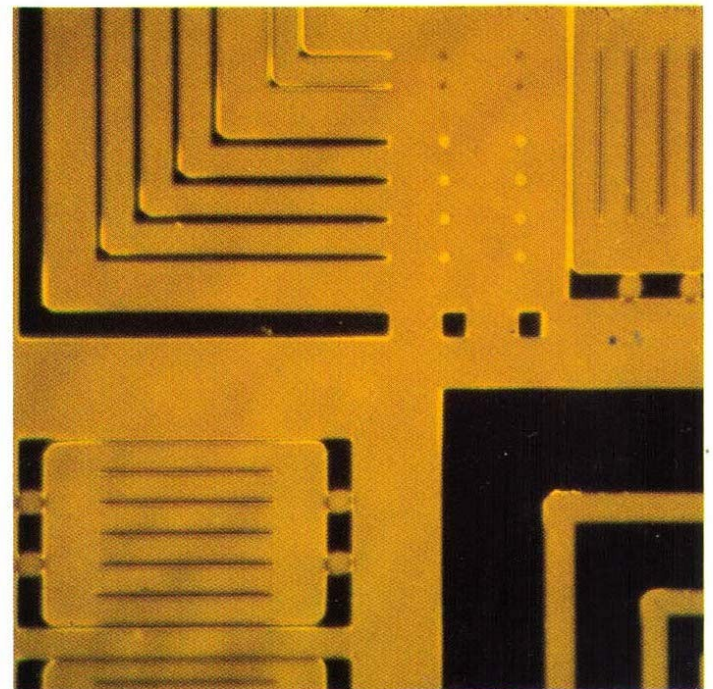
Any film speed between 9 and 38DIN (6 and 5000 ASA) can be set. The photomultiplier, which serves as the measuring element, guarantees exact exposure in difficult lighting conditions, (darkground, fluorescence).

List No. 540-045 contains a detailed description of the LEITZ VARIO-ORTHOMAT.

* The camera attachments of the WILD-MPS system can also be used.



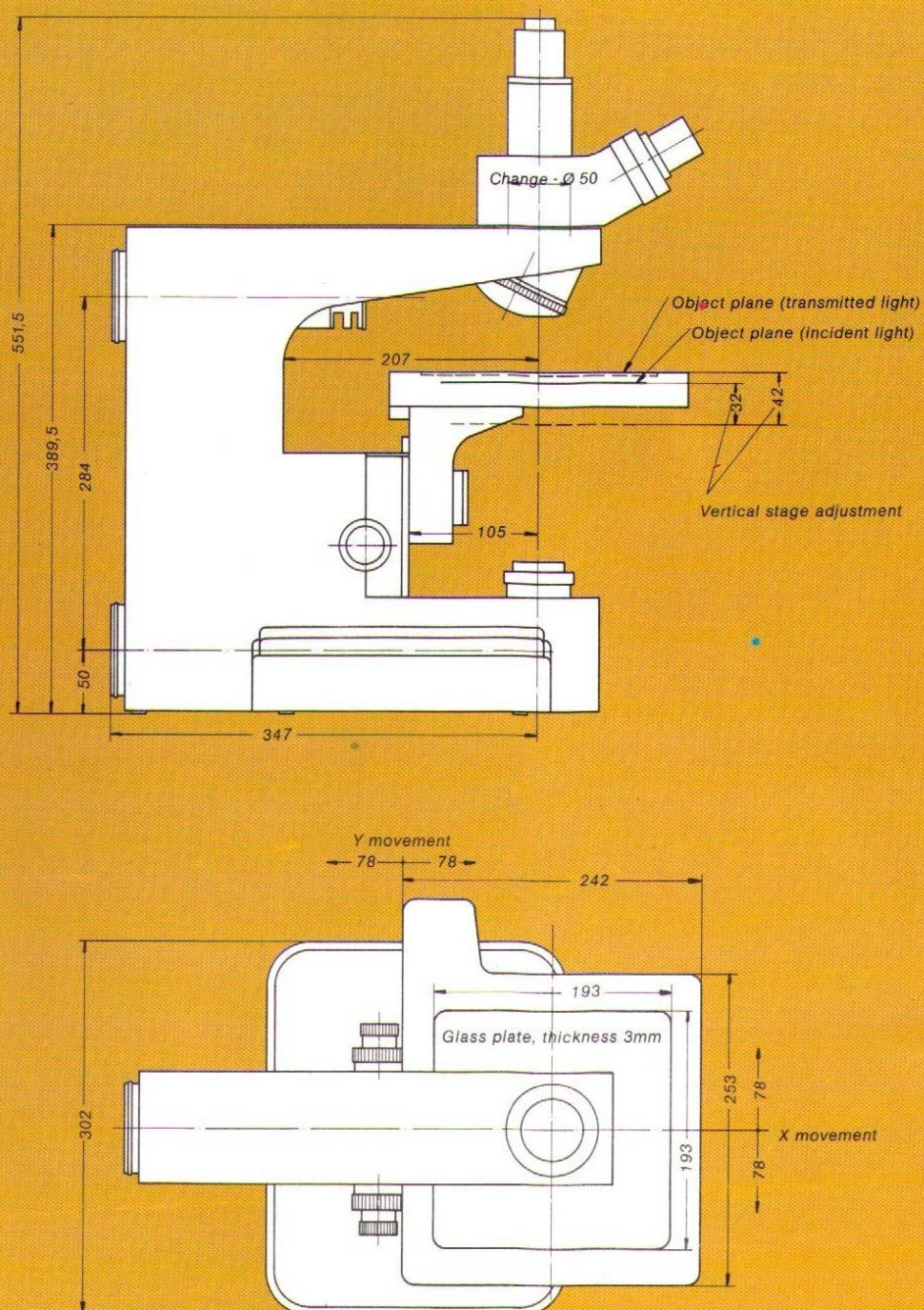
Faults in a photo resist layer, after fluorescence excitation



Right:
Inhomogenous zones in a photo resist layer,
after fluorescence excitation



LEITZ METALLOPLAN-HL 6 x 6, scale drawing
Changing device





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World Wide.**

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

List 121.560-050 a engl. Printed in W-Germany I/80/BX/w.

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macroscopy and microscopy

