ZEISS

OBJECTIVES
AND
EYEPIECES
FOR
MICROSCOPES

CARL ZEISS
JENA

30575/125

Mikro 367 e.
RM
Edition 1936

ZEISS

Objectives and Eyepieces for Microscopes

a) Respecting Objectives in General

All objectives are furnished with the so-called **English standard screw** and may therefore be used with a stand of any make, provided the tube has the standard screw-thread. Attention should, however, in such case be paid to the proper tube length and that our eye-pieces are used.

The **Mounts** of our object lenses are no longer screwed together; the lenses are instead mounted in small cylinders and then superimposed over each other in a larger tube. This arrangement precludes of the centring errors apt to arise with screw mounts due to the frequent fitting and removing of the individual lenses when adjusting the objectives.

Objectives with lenses thus superimposed should not be taken to pieces.

Cleaning should be limited to the lower surface of the front lens and to the top of the rear lens. With high power objectives, the latter is usually sunk fairly deeply within the mount. Furthermore, never attempt to clean the lens by means of a cloth introduced by pliers or a wire, as the top is thus apt to be injured. Only a suitable stick of soft wood should be used for introducing the cloth [1]); better still, use a perfectly clean paint-brush with soft hair for cleaning the lens. Provided the microscope is moreover carefully treated (instrument to be kept under hood, not to be left with eyepiece off while objectives are screwed on), cleaning of the top lens should be necessary only very rarely, i. e. after prolonged use.

[1]) If desired, a suitable stick with leather pad can be supplied.

On the other hand the front lenses of immersion systems should be carefully cleaned each time after being used. First of all remove adhering oil by dabbing with a linen cloth or blotting paper, moisten the front lens well with benzine or benzole and then carefully rub down same as well as its mount with very soft linen or Japanese rice paper. Do not use methylated spirit for cleaning, as otherwise the shellack seal of the front lens will be impaired.

If cleaning of front and rear lenses does not restore the image the objective should be returned to us for dismantling, because the necessary equipment and skilled labour are available only here at the works. Moreover, indistinct and blurred pictures are not only caused by dirt but also by using wrong cover-glasses.

In order as far as possible to minimise the risk of dust entering the objectives, we have changed the manner of inserting and removing the lenses in the capsules. Whereas formerly the objectives were dropped from above, with the front lens downwards, into the long sleeve of the capsule, so that dust was bound to fall on the objective, the objective should now be placed with the front lens upwards in the cover of the capsule, which is shaped accordingly. The long sleeve is then passed over the objective and screwed home in the cover which forms the base. The main marking of the objectives is therefore no longer engraved upon the cover, which, is now intended to form the base, but upon the smaller (upper) face of the capsule.

The **Magnification** of the microscope is the product of the scale ratio of the real intermediate image thrown by the objective alone near the upper end of the tube, and the simple lens magnification of the eyepiece. These figures are marked upon the mounts.

If an optical system be interposed between the objective and eyepiece, which varies the scale ratio of the image thrown by the objective, the product should further be multiplied by the modifying factor engraved upon the system.

The performance of the objectives depends upon the quality of technical design and on the extent to which it is possible by calculation to remedy picture errors peculiar to optical reproduction by lenses, by means of the special design of the objective. The means available to such end are: the the number of lenses, the variety of materials from which produced and the

manner of linking them together. Accordingly, three types of objectives may be distinguished: **Achromatic** Objectives, **Fluorite** Objectives and **Apochromatic** Objectives. The latter give by far the greatest number of correction facilities. Thus for instance the apochromatic oil-immersion objective comprises ten lenses as against the 6 lenses of the corresponding fluorite oil-immersion objective. The apochromatic lenses will therefore furnish pictures in which the errors are corrected for all colours with the exception of a very small residue. For such purpose, however, it will be necessary for them to be used in conjunction with compensated eye-pieces; for it is only in conjunction with the latter that a certain error — viz. the difference in magnification of the images in the individual colours, which go to make up the white light — which cannot be avoided altogether with the objectives alone, will be eliminated. The smallest number of correcting means is available in achromatic objectives; these, therefore, are the cheapest lenses. But in these also the picture errors are corrected, at least for the brightest centre portion of the spectrum, and they should therefore largely answer the requirements of a good image.

An intermediate position between the achromatic and apochromatic objectives is taken by fluorite objectives, the number of lenses in which tallies with that for the achromates. However, owing to fluor spar lenses being incorporated therein, they provide appreciably better colour correction than the achromatic objectives; in contradistinction to the apochromates, however, they are lacking in correction for curvature for different colours.

As natural fluor spar is never completely free from inclusions, minute, dark specks will readily be perceived when looking into the objectives fitted with fluor spar lenses. These are unavoidable but will not impair the power of the objective.

The images of flat bodies thrown by microscope objectives are not equally flat, but curved. The picture of the side portions of the object is closer to the objective than the centre portion. The centre and margin of the field of view will therefore not be defined with equal sharpness at the same time and they should be focused sharply in succession. The curvature of the image increases as the power of the objective; on the whole, it is greater with the achromatic type than with the corresponding apochromatic. An image free from field curvature is the one obtained by the objective "Mikrotar 7" in conjunction with the special eyepiece 6 ×.

(fig. 3). These objectives may be adjusted for cover-glass thicknesses of 0.1—0.2 mm. by moving the correcting ring.

The **cover-glass thickness** is measured with a **cover-glass gauge** (fig. 4).

No. 12 65 01. Cover-glass gauge

RM **27.—** Code: *Middeling* 1.110 kg

A spindle with a ½ mm. pitch thread is fitted with a drum divided into 50 graduations; by turning the latter, the spindle is moved sideways to-and-fro. Thicknesses up to $^1/_{100}$ mm. may thus be read direct. Excessive screw pressure is obviated by a ratchet device.

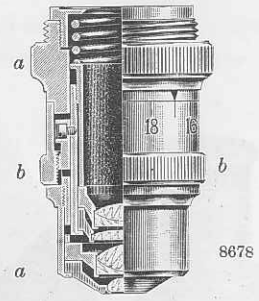


Fig. 3, natural size
Objective with correction mount.
By means of the correcting ring *bb* the distance between the two upper double lenses and the two lower lenses firmly connected with the mount *aa* may be varied.

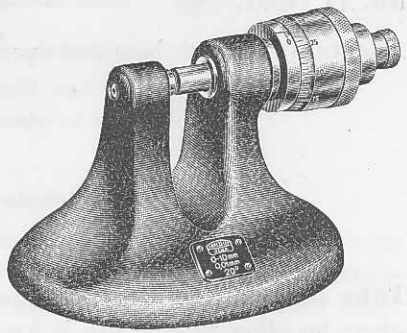


Fig. 4, $^1/_2$ natural size 13796
Cover-glass gauge

The **oil - Immersion** objectives should be used with the cedarwood oil supplied — $n_D = 1.515$. After use, the oil should be carefully removed by pure benzine or benzol and the lens dried with a clean and soft linen cloth. Oil of other origin or substitutes should not be used unless at all events tested for refraction and dispersion. For this purpose we supply:

No. 12 01 65. Oil testing device,
comprising a semi-circular glass plate, the test plate, with a refractive index of $n_D = 1.515$, and a slit diaphragm of 3 mm. width for placing in the diaphragm carrier of ABBE's illuminating apparatus.

RM **1.50** Code: *Minaretol* 0.003 kg

For further particulares see pamphlet: "Mikro 371".

Even in such case there remains a risk of such oil affecting the glass, cement or metal parts of the objective in the long run.

No. 11 30 05. Double Bottle
for cedar-wood oil and benzol (fig. 5)

RM **1.20** Code: *Miabais* 0.090 kg

For further particulars see pamphlet: "Mikro 352".

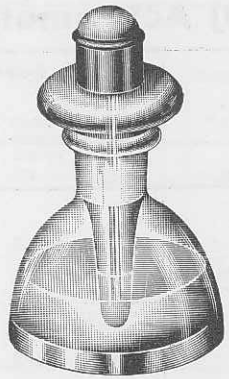
No. 11 30 15. Cedar-wood oil in bottles, 10 g

RM **—.45** Code: *Milicia* 0.030 kg

No. 11 30 22. Cedar-wood oil in bottles, 100 g

RM **3.50** Code: *Kagir* 0.195 kg

For **water-immersion** lenses, distilled water should invariably be used.



8649
Fig. 5, approx. $^1/_2$ nat. size

Dark ground observation demands a sharp discrimination of the respective numerical apertures of the illuminating pencil (the condenser) and the viewing objective; the ranges of these two apertures may not overlap. The object should accordingly be illuminated by rays ranging from a certain aperture upward, while it should be viewed with an objective of a smaller aperture. The image will then be produced exclusively by rays which have their origin in diffraction within the preparation, the direct illuminating rays being rendered ineffective. The background in the field of view of the microscope remains dark, whereas the image of the object appears brightly illuminated on the dark background. The distinctness of the visible details increase in a measure as the contrast is intensified.

An unimpeachable dark ground for illumination is achieved with the aid of specially devised dark ground condensers (as described in "Mikro 230, 365 and 407").

The **Objectives** which are **specially devised** for **dark ground observation** include the achromatic homogeneous oil-immersion objective 50, N. A. 0.85 ($^1/_7$) for use with the paraboloid condenser and change-over condenser, and the apochromatic homogeneous oil-immersion objectives 35 N. A. 0. 85 and 60, N. A. 1.0 (X) with iris-diaphragm for use with these condensers and the Cardioid condenser. Both objectives are likewise available for use in bright-field observation and, when so used, constitute immersion lenses with long free working distances. Of the other immersion objectives the achromatic homogeneous oil-immersion objective 90 N. A. 1.25 ($^1/_{12}$) with iris-diaphragm is alone adapted for use with the above condensers. With a bright-field condenser, on the other hand, all objectives up a numerical aperture of 1.3 may be used without further precaution.

b) Achromatic Objectives

	No.	Notation: Primary magnification	Notation: Numerical aperture	Focal length mm	Free[1]) working distance mm	Old[2]) notation	Remarks	ℳ	Code word	Weight kg
	11 10 01	**1-1.5**		55	64/47	a_0	Lens may be raised and lowered within conical mount, thus varying initial magnification continuously within limits stated. These objectives cannot be used on revolving nosepieces excepting in position of greatest magnification.	**20.—**	*Migabamos*	0.052
	11 10 02	**1.5-2**		45	32/25	a_1		**16.—**	*Migado*	0.082
	11 10 04	**1.2-2.4**			33/7	a*	Upper member movable in the manner of a correction mount. Primary magnification may thereby be varied in the ratio of 1 : 2.	**48.—**	*Migajaria*	0.110 †)
"Dry" Series	11 10 08	**2**		50	60		Cannot be adjusted to mutual focal agreement on a revolving nosepiece	**14.—**	*Mingote*	0.038
	11 10 03	**3**		36	29	a_2		**12.—**	*Migaja*	0.038
	11 10 05	**5**		25	12	a_3		**12.—**	*Migajada*	0.038
	11 10 06	**6**	0.17	23.5	9	aa	Adjusted to mutual focal agreement with the higher "dry" lenses on the revolving nosepiece.	**24.—**	*Migajaron*	0.047
	11 11 08	**8**	0.20	18	9	A		**18.—**	*Mileon*	0.043
	11 11 10	**10**	0.30	15.6	7.5	AA		**36.—**	*Migalha*	0.047
	11 11 20	**20**	0.40	8.3	1.6	C		**38.—**	*Migalhada*	0.047
	11 10 40	**40**	0.65	4.4	0.55	D	"Dry" lens of highest power which is not appreciably affected by variations in the thickness of the coverglass within the usual limits.	**38.—**	*Migalhamos*	0.067

[1]) The free working distance is the distance between the upper surface of the coverglass and the lower rim of the lens mount when an objective is sharply focused upon a preparation covered with a glass of a thickness of 0.17 mm.

[2]) The objectives of the old notation are not strictly identical to the new objectives enumerated on the same line. They merely specify those earlier patterns which come nearest to the present ones.

*) On the whole, the objectives are supplied in a bakelite capsule.
Case alone . . . . . 0.015 kg

†) Objectives marked by an asterisk include a metal capsule until further order.
Metal capsule alone: . . 0.045 kg

	No.	Notation: Primary magnification	Notation: Numerical aperture	Focal-length mm	Free[1]) working distance mm	Old[2]) notation	Remarks	ℳ	Code word	Weight kg
"Dry" Series	11 21 51	**7 Mikrotar**	0.15	20	15		Special objective with large working distance and flat field of view.	**70.—**	*Kiato*	0.050
	11 11 23	**20 Epi**	0.40	8.3	1.6		For "Epi" lamp 8 and "Epi" mirror; for uncovered objects only.	**50.—**	*Mipoux*	0.075
	11 11 40	**40 Epi**	0.65	4.3	0.53			**55.—**	*Mippi*	0.080
Water-immersions	11 11 07	**6*)**	0.11	24.7	36	Pl	For examining objects under water. Long working distance. A tall glass cell required for use with object 6*)	**36.—**	*Migardes*	0.076 †)
	11 11 47	**40*)**	0.75	4.3	1.9	D*		**77.—**	*Migaremos*	0.052
	11 10 91	**90**	1.18	2.0	0.07	I	With correction collar for cover-glass variations between 0.1 and 0.2 mm.	**108.—**	*Migarmosa*	0.080
Glycerin-Immersion	11 11 60	**60**	1.0	3.0	0.12	V	With Iris diaphragm. Only for use with quartz covers 0.75 mm thick.	**140.—**	*Minianda*	0.105 †)
Homogeneous-Oil-Immersions	11 10 50	**50**	0.85	3.5	0.40	1/7	For dark-ground observation, particularly with paraboloid and change-over condensers; also for bacteriological work.	**65.—**	*Milesa*	0.065
	11 10 92	**90**	1.25	2.0	0.11	1/12	Working lens for students' courses and usual requirements: only when furnished with iris diaphragm available for dark-ground observations.	**60.—**	*Migaveis*	0.064
	11 10 93	**90** with iris-diaphr.	1.25	2.0	0.16	1/12		**70.—**	*Mindinha*	0.075
	12 87 20	†) glass vessel for water immersion 6, N. A. 0.11 (for stands F, G, H, X.)						**3.50**	*Miagolammo*	0.058

[1]) [2]) See page 8, Notes 1 and 2.

*) The water immersions 6 and 40 may be fitted on request with a protecting sleeve of stainless steel.

No. 11 11 07/1	Protecting sleeve for water immersion **6**, N.A. 0.11	**16.—**	*Kaglu* 0.015
No. 11 11 47/1	,, ,, ,, ,, ,, **40**, N.A. 0.75	**16.—**	*Kagox* 0.015

†) See p. 8.

c) Fluorite Objectives [3]

(for use with compensating eyepieces)

	No.	Notation: Primary magnification	Notation: Numerical aperture	Focal length mm	Free[1] working distance mm	Old[2] notation	Remarks	ℳ	Code word	Weight kg
"Dry" Series	11 10 48	**40**	0.85	4.4	0.32	DD	Considerably affected by slight variations (± 0.01 mm) in the cover-glass thickness. Correct cover-glass thickness (0.17 mm) and material should therefore be adhered to. Preferably use: **Objectives with correction mounts** so that the objectives may be adjusted to the thickness of the cover-glass in question.	**63.—**	*Migalhando*	0.058
	11 10 60	**60**	0.90	2.9	0.12	E		**76.—**	*Migalharas*	0.096 †
	11 10 45	**40** with corr.	0.85	4.4	0.32	DD		**79.—**	*Migamos*	0.083
	11 10 65	**60** with corr.	0.90	2.9	0.12	E		**100.—**	*Migarais*	0.083
	11 10 95	**90** with corr.	0.90	2.0	0.09	F		**100.—**	*Migaran*	0.110 †
Homogeneous-Oil-immersion	11 10 99	**100**	1.30	1.8	0.10	1/12 Fl.	High power oil immersion with particularly good chromatic correction.	**117.—**	*Migdal*	0.065

[1] [2] See p. 8, Notes 1 and 2.

[3] The natural fluorite contained in these objectives produces exceptionally favourable conditions for obtaining an excellent chromatic correction. It is, unfortunately, not entirely free from included impurities, and hence small dark spots will be seen by an eye looking into the objective mount from the back. These spots, however, do not affect the optical performance of the objectives.

†) See p. 8.

d) Apochromatic Objectives

(for use with compensating eyepieces only)

	No.	Notation: Primary magnification	Notation: Numerical aperture	Focal-length mm	Free[1] working distance mm	Remarks	ℳ	Code word	Weight kg
"Dry" Series	11 01 06	**6**	0.15	25.5	7.3	Cannot be adjusted to mutual focal agreement with the higher "dry" lenses on revolving nosepiece.	**85.—**	*Miniaria*	0.069
	11 01 10	**10**	0.3	16.2	5	Adjusted to mutual focal agreement with the higher "dry" lenses on revolving nosepiece.	**65.—**	*Migma*	0.047
	11 01 20	**20**	0.65	8.3	0.7		**97.—**	*Migmata*	0.067
	11 01 40	**40**	0.95	4.3	0.12	With correction collar, by rotating its correcting ring the objective may be accurately corrected for the thickness of the cover-glass within the limits of 0.12 and 0.2 mm. Before mounting, the cover-glass should be measured with a cover-glass gauge (p. 5).	**130.—**	*Migmatis*	0.085
	11 01 60	**60**	0.95	2.9	0.07		**140.—**	*Migmatum*	0.115 †
Water-Immersion	11 01 70	**70**	1.25	2.5	0.11		**173.—**	*Mignard*	0.082
Homogeneous-Oil-Immersions	11 01 35	**35**[2]	0.85	5	0.25	Special objectives for observations in dark ground and microphotography.	**135.—**	*Minuritior*	0.070
	11 01 62	**60** w. iris-diaphr.	1.0	2.9	0.22		**126.—**	*Mingled*	0.085
	11 01 63	**60**	1.3	2.9	0.15	Objectives with small primary magnification, affording a wide range of magnifications by a change of eyepieces.	**173.—**	*Mignardant*	0.070
	11 01 64	**60**	1.4	2.9	0.13		**270.—**	*Mignarder*	0.068
	11 01 93	**90**	1.3	2	0.11	Working objective.	**173.—**	*Mignata*	0.068
	11 01 94	**90**	1.4	2	0.05	Special objective for research work requiring high magnifications and the highest available degree of resolving power. Front lens very delicately mounted. (must not touch preparation).	**270.—**	*Mignella*	0.068
	11 01 99	**120**	1.3	1.5	0.08	Special objective with exceptional high primary magnification, for measuring, counting or drawing under a high magnification.	**238.—**	*Mignellir*	0.067

[1] See page 8, Note 1.

[2] Special features: Wide field of view and great brilliancy of pictures.

†) See p. 8.

e) Objectives in Short Mounts

for tube lengths of 190 mm
for use with vertical illuminator on uncovered objects.

1) Achromatic Objectives.

	No.	Notation: Primary magnification	Notation: Numerical aperture	Focal length mm	Free[1]) working distance mm	Remarks	RM	Code word	Weight kg
"Dry" Series	11 12 03	**4**		36	29	Available also for covered objects. The same optical data when fitted on intermediate collar of 30 mm.	**13.—**	*Milesiase*	0.037
	11 12 06	**6**		25	19		**13.—**	*Milesienne*	0.040
	11 12 07	**7.3**	0.17	23.5	11		**27.—**	*Miniona*	0.073 †)
	11 12 08	**9**	0.20	18	9		**20.—**	*Milesima*	0.033
	11 12 10	**12**	0.30	15.6	7.5		**38.—**	*Milesimos*	0.074 †)
	11 12 21	**21**	0.40	8.3	1.6		**38.—**	*Milesimum*	0.039
	11 12 40	**40**	0.65	4.4	0.6	Not available for viewing covered objects.	**45.—**	*Milesiora*	0.037
Homogeneous Oil immersions	11 12 53	**53**	0.90	3.5	0.57	With intermediate collar available also for covered objects.	**65.—**	*Milesium*	0.038
	11 12 95	**95**	1.25	2.0	0.28		**85.—**	*Miletum*	0.067 †)

2) Fluorite Objectives.

(for use with compensating eyepieces)

	No.	Notation: Primary magnification	Notation: Numerical aperture	Focal length mm	Free[1]) working distance mm	Remarks	RM	Code word	Weight kg
"Dry" Series	11 12 48	**40**	0.85	4.4	0.32	Not available for viewing covered preparations.	**72.—**	*Milesioris*	0.079 †)
	11 12 60	**60**	0.90	2.9	0.12		**85.—**	*Milestone*	0.067 †)
Homogeneous Oil Immersion	11 12 99	**100**	1.30	1.8	0.27	With intermediate collar available *) also for covered objects.	**117.—**	*Miletuser*	0.037
*) 12 04 55 Intermediate collar, 30 mm deep							**1.50**	*Minuritis*	0.025

[1]) The free working distance is in this case the gap obtaining between the surface of an uncovered object and the lower rim of the objective mount when object is sharply focused.
†) See page 8.

3) Apochromatic Objectives.

(for use with compensating eyepieces only)

	No.	Notation: Primary magnification	Notation: Numerical aperture	Focal length mm	Free[1]) working distance mm	Remarks	RM	Code word	Weight kg
"Dry" Series	11 03 10	**10**	0.30	16.2	5	With appropiate intermediate collar*) also available for covered objects.	**65.—**	*Milanionem*	0.050
	11 03 22	**22**	0.65	8.3	0.7	Not available for viewing covered objects	**97.—**	*Milanionis*	0.041
	11 03 40	**40**	0.95	4.3	0.12		**130.—**	*Milax*	0.068 †)
	11 03 60	**62**	0.95	2.9	0.04		**140.—**	*Milcorus*	0.068 †)
Water-Immersion	11 03 70	**74**	1.25	2.5	0.11		**173.—**	*Mildete*	0.070 †)
Homogeneous-Oil-Immersions	11 03 63	**64**	1.30	2.9	0.30	With intermediate collar*) available also for covered objects.	**173.—**	*Milden*	0.068 †)
	11 03 64	**64**	1.40	2.9	0.30		**270.—**	*Mildened*	0.040
	11 03 93	**94**	1.30	2	0.28		**173.—**	*Mildewed*	0.030
*) 12 04 55 **Intermediate collar,** 30 mm deep							**1.50**	*Minuritis*	0.020

4) Special Objectives.

a) Special objectives, which cannot be used for ordinary observations, are required when using the EPI-condenser W. These objectives are enumerated in the pamphlet "Mikro 476".

b) Objectives for preparations without cover-glass in narrow mount (for loop galvanometer) as also objectives in narrow mount corrected for infinity (for metallographic microscopes) are enumerated in a special list. Similarly also the Water Immersions for the luminescence microscope after Ellinger-Hirt.

5) Monobromnaphthalene Immersion.

No.	Notation: Primary magnification	Notation: Numerical aperture	Focal length mm	Free[1]) working distance mm	Remarks	RM	Code word	Weight kg.
11 04 74	**74**	1.60	2.5	0.07	System with particularly high aperture. Not available for viewing covered objects.	**864.—**	*Minnow*	0.040

[1]) See page 8, Note 1.
*) See page 8.

f) The Eyepieces.

Eyepieces of the HUYGEN's type are used as a rule in conjunction with achromatic objectives, and alternatively orthoscopic eyepieces for very high eyepiece powers in conjunction with the objectives up to 40, N. A. 0.65 (D); these eyepieces give a very wide field of view. Achromatic objectives of higher numerical aperture are preferably used in conjunction with the compensating eyepieces.

The apochromatics are only used with compensated eyepieces. As apochromatic objectives give a higher degree of definition than the achromates, high power eyepieces may more readily be used in conjunction with them than with the latter.

The eyepiece notation conforms to the simple-lens magnification. Compensating eyepieces are designated by a letter "K" preceding the simple-lens magnification, whereas orthoscopic eyepieces are denoted by the word "orthoskop" preceding the magnification factor.

A special eyepiece is the eyepiece 6 ×; it can reproduce a flat surface very well and is therefore primarily intended for use in conjunction with the objective 7 (Mikrotar, p. 9); both will give fairly flat images of flat objects with a very wide field of view. With other objectives, the field of view is more or less indistinct near the margin. A specially wide tube is required for this eyepiece.

A further special eyepiece is the compensating eyepiece 15 × for monobromnaphthalene immersion (p. 12).

HUYGENS and Orthoscopic Eyepieces.

	HUYGENS Eyepieces (= H.)					Orthoscopic Eyepieces (with large field of view)		
Notation and component (primary) magnification	**4×**	**5×**	**7×**	**10×**	**15×**	**12.5×**	**17×**	**28×**
Focal length in mm . .	63	50	36	25	17	20	15	9
Field-of-view number . .	24	23	18	14	8	16	13	6.5
No.	11 35 04	11 35 05	11 35 07	11 35 10	11 35 15	11 35 12	11 35 17	11 35 28
RM	**6.—**	**6.—**	**6.—**	**6.—**	**6.—**	**14.—**	**14.—**	**18.—**
Code word .	*Migeam*	*Miglia*	*Migliare*	*Migliarina*	*Migliarol*	*Migliora*	*Migliorato*	*Migliorom*
Weight: kg.	0.056	0.053	0.042	0.043	0.028	0.045	0.045	0.038

No. 11 36 15. **Eyepiece 6 ×** with extended field of view, field-of-view number 28 for 30 mm tube,
RM **31.—** Code word: *Minuiren* 0.080 kg.

Compensating Eyepieces (= K.)

Notation and primary magnification	**3×**	**5×**	**7×**	**10×**	**15×**	**20×**	**30×**
Focal length in mm . . .	83	50	36	25	17	12.5	8.4
Field-of-view number . .	23	23	18	13	11	8	5.7
No.	11 31 03	11 31 05	11 31 07	11 31 10	11 31 15	11 31 20	11 31 30
RM . .	**15.—**	**15.—**	**15.—**	**22.—**	**22.—**	**22.—**	**27.—**
Code word . .	*Mignol*	*Mignolano*	*Mignolare*	*Mignolassi*	*Mignolato*	*Mignolia*	*Minionette*
Weight, kg. .	0.060	0.070	0.057	0.050	0.047	0.042	0.027

No. 11 31 16. **Compensating eyepiece 15 ×**
for the Monobromnaphthalene Immersion
field-of-view number 9.2,

RM **55.—** Code word: *Minoratius* 0.045 kg

The **Total magnification** of the microscope will be obtained by multiplying the simple-lens magnification (designation) of the eyepiece by the scale of reproduction of the intermediate image (factorial primary magnification) of the objective. The values indicated are maintained in manufacture within a few per cent.

Field of view: The field-of-view number, divided by the factorial magnification (designation) of an objective, will give the diameter in millimetres of that part of the object plane which is seen with the particular objective and eyepiece at correct tube length.

Homals

The eyepieces referred to above are primarily intended for direct observation, although they are equally used for photo-micrography and projection with the microscope. When thus used; it should be remembered that the pictures furnished by the microscope are spherical (cf. p. 3). In order to obtain a flat picture of a flat object on the plane of the photographic plate, this curvature of the field of view may be attenuated by a special lens construction. Such lenses are the **Homals** (print "Mikro" 390), which in conjunction with apochromatic objectives reproduce a flat object almost in a plane again such as the photographic plate. For direct observation, however, the **Homal** lenses cannot be used, because their back lens is sunk deep inside the microscope tube.

We shall be pleased to provide, for the illustration of scientific publications, electros of figures contained in this booklet, or reduced replicas of these as far as they may be available.

Descriptions of the instruments are provided free of charge, on application. Directions for using them are supplied only with purchased instruments.

The illustrations do not necessarily conform in every detail to the current models of the instruments.

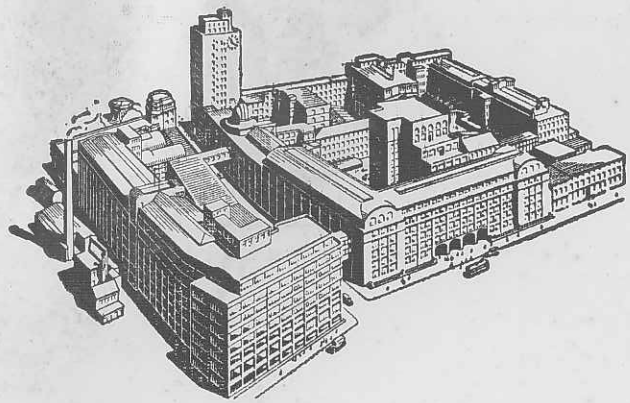
Approximate weights are stated.

Prices are net cash, and are exclusive of the cost of packing.

1 RM = $^1/_{2790}$ kg fine gold.

All goods shipped at consignee's charge and risk.

Place of delivery and payment is Jena.



CARL ZEISS JENA

Telegraphic Address: ZEISSWERK JENA

Berlin / Hamburg / Cologne / Vienna / Brussels / Buenos Aires / Rio de Janeiro / São Paulo / Tokyo

London W. 1: Carl Zeiss (London) Ltd., Mortimer House, 37—41, Mortimer Street / **New York:** Carl Zeiss, Inc., 485, Fifth Avenue and at **Los Angeles,** Cal., 728 So. Hill Street

Montreal: The Hughes Owens Co. Ltd., 1440 Mc Gill College Avenue, also at Ottawa, Toronto, Winnipeg / **Calcutta:** Adair, Dutt & Co. Ltd., Dalhousie Square (East) / **Bombay:** Embassy House, Sir Phirozshaw Mehta Road also at **Madras,** Khaleel Mansions, Mount Road / **Singapore:** The Scientific Instrument Company, 2, Finlayson Green / **Melbourne:** E. C. Heyne Pty. Ltd., Union Building, 100 Flinders Street, also at Sydney / **Manila:** The Philippine American Drug Co. / **Bangkok:** B. Grimm & Co. / **Cairo, Haifa:** Kodak / **Johannesburg:** B. Owen Jones, Ltd., Commercial Exchange Buildgs, 83, Main Street / **Stockholm / Amsterdam / Paris / Milan / Madrid/ Shanghai etc.**

ZEISS

OPTICAL INSTRUMENTS

Microscopes / Photomicrographic Apparatus / Microprojection Apparatus / Ophthalmological and Endoscopic Instruments / Medical Illuminating and Radiating Appliances / Punktal Spectacle Lenses / Cataract Lenses / Telescopic Spectacles / Magnifiers / Photographic Objectives / Stereoscopes / Astronomical and Observation Telescopes / Optical Measuring Instruments / Field Glasses / Opera Glasses / Telescopic Sights for Sporting Rifles / Special Projector Lights / Surveying Instruments / Photogrammetric Instruments / Micrometer Gauge Tools

Catalogues will be sent free to applicants naming the instruments in which they are interested.

Printed in Germany

P. I. 37