



INSTRUCTION

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FOR

OLYMPUS

METALLURGICAL

MICROSCOPE

MODEL MF



OLYMPUS OPTICAL CO., LTD.

Tokyo

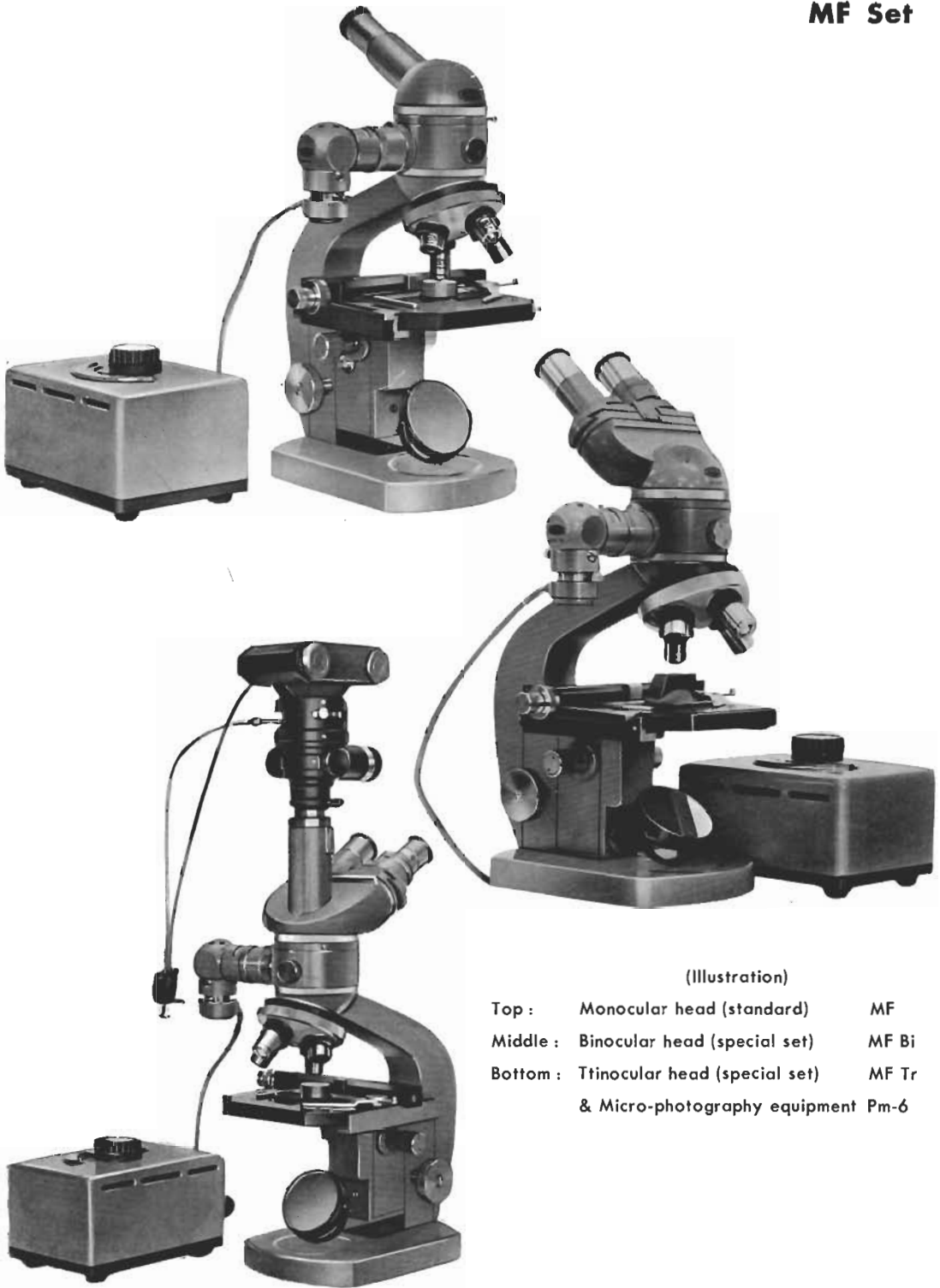
FEATURES

- (1) **Focusing:** Focusing is performed by raising and lowering the stage. Coarse and fine adjustment handles are at the lower part of the microscope for convenience in operation.
- (2) **Microscopic photography (microphotography):** The microscopic body is fixed on the arm, which prevents outfocusing when taking a picture that is usually caused by unintentional sliding of the body.
- (3) **Easy Observation:** The head with an inclination of 45° and rotative through 360° will put the observer free of fatigue and enable the user to observe from any side of the microscope.
- (4) **Interchangeable Head:** Also available are a binocular head for an easy observation and a trinocular head for an immediate microscopic photography while making binocular observation.
- (5) **Nosepiece:** The objective nosepiece is of ball-bearing mechanism and revolves lightly with positive click stops.
- (6) **Illumination Unit:** Includes a compensation lens for low power objective lenses.

Standard Set

1. Body with an inclined monocular head (45° from horizontal), rotative. (Also including a straight tube for microphotography, an illuminator, and a mechanical stage).....	1 set
2. Eyepieces, P7 \times , P10 \times , P15 \times	3 pcs.
3. Objectives, M6 \times , M10 \times , M40 \times , M100 \times (oil-immersion)	4 pcs.
4. Illumination bulb 6V 2A (2 each of clear & smoked bulbs)	4 pcs.
5. Transformer, 6V 5A.....	1 set
6. Filters, yellow & green, 1 each.....	2 pcs.
7. Metal slides	5 pcs.
8. Reflector for trans-illumination for low magnification observation.....	1 set
9. Cedar Oil.....	1 btl.
10. S-shaped Spanner.....	1 pc.
11. Cabinet and plastic cover	1 set
12. Instructions and guarantee card	1 set

MF Set



(Illustration)

Top : Monocular head (standard) MF
Middle : Binocular head (special set) MF Bi
Bottom : Trinocular head (special set) MF Tr
& Micro-photography equipment Pm-6

Special Sets

A. Inclined binocular head, MF Bi (with a separate straight tube for microphotography) :

Eyepieces	1 pair each of binocular P7×, WF10×, P15×
Objectives	M6×, M10×, M40×, M100× (oil immersion)
Magnification	42× to 1,500×

B. Trinocular Head, MF Tr

Eyepieces	1 pair each of binocular P7×, WF10×, P15× & 1 each of microphotography P7×, P10×, P15×
Objectives	M6×, M10×, M40×, M100× (oil immersion)
Magnification	42× to 1,500×

SPECIFICATION

Weight : Approx. 15.5kg (body 6.6kg, transformer 2kg, cabinet 7kg.)

Height : Approx. 350mm

Head : Standard Set : Monocular inclined head (45° from horizontal, rotative through 360°) with a separate straight tube for microphotography.

Special Set : Binocular head (other features same as above)
Trinocular head

Optical Equipment :

(Mechanical Tube Length 200mm)

Objectives : M6×, M10×, M40×, M100 (oil immersion) 1 each

Eyepieces :

Inclined Monocular Head P7×, P10×, P15× 1 each

Inclined Binocular Head P7×, WF10×, P15× 1 pr. ea.

Inclined Trinocular Head P7×, WF10×, P15× 1 pr. ea.

Microphotography P7×, P10×, P15× 1 each

Nosepiece : for 4 objectives, ball-bearing mechanism with position indicator for each objective

Magnifications : 42× - 1,500×

Illumination Unit :

Light Bulb : 6V 2A clear and smoked glasses

Illuminator : Radiating, capable of centering the filament, including a compensation lens for low magnification illumination.

Transformer : Graded voltage, 6V 5A.

Focusing : Raising and lowering of the stage by the coarse and fine adjustment knobs.

Coarse Adjustment-Rack & pinion.

Fine Adjustment-Lever & microscrew, vertically movable approximately 2mm with graduated scales of 0.005mm.

Stage : Square, with a mechanical stage for cross-movement of the specimen, 72mm east-west and 50mm north-south.

Reflector : For transillumination for low magnification observation.

Filter : 1 each of yellow and green.

OPTICAL SYSTEM

1. Lens

Optical System Characteristics

Objectives	Numerical Aperture	Eyepieces	Total Magnif.	True Fld. of View	Wkg. Dist.	Depth of fld.	Focal length
M 6 ×	0.12	P 7 ×	42 ×	2.90mm	13.80	131.7 μ	27.4
		P 10 ×	60 ×	2.14		100.9	
		P 15 ×	90 ×	1.54		77.0	
M 10 ×	0.25	P 7 ×	70 ×	1.8	6.50	36.4	18.5
		P 10 ×	100 ×	1.3		27.6	
		P 15 ×	150 ×	0.95		20.9	
M 40 ×	0.65	P 7 ×	280 ×	0.45	0.68	4.14	5.0
		P 10 ×	400 ×	0.33		3.22	
		P 15 ×	600 ×	0.24		2.50	
M 100 × (oil immersion)	1.30	P 7 ×	700 ×	0.18	0.35	0.961	2.1
		P 10 ×	1,000 ×	0.13		0.760	
		P 15 ×	1,500 ×	0.095		0.604	



2. Eyepieces :

The eyepiece further enlarges the specimen image which has already been enlarged by the objective. The upper lens of the eyepiece is called an eye-lens and the lower one a field lens. In between those two lenses is the field stop which is used in conjunction with an eye-piece micrometer when measuring the specimen. The extent of the view field depends upon the eyepiece, and is provided for by the number of field of view. (See Eyepiece characteristic table, below) The following relationship exists between the number of field of view and the extent of the view field :

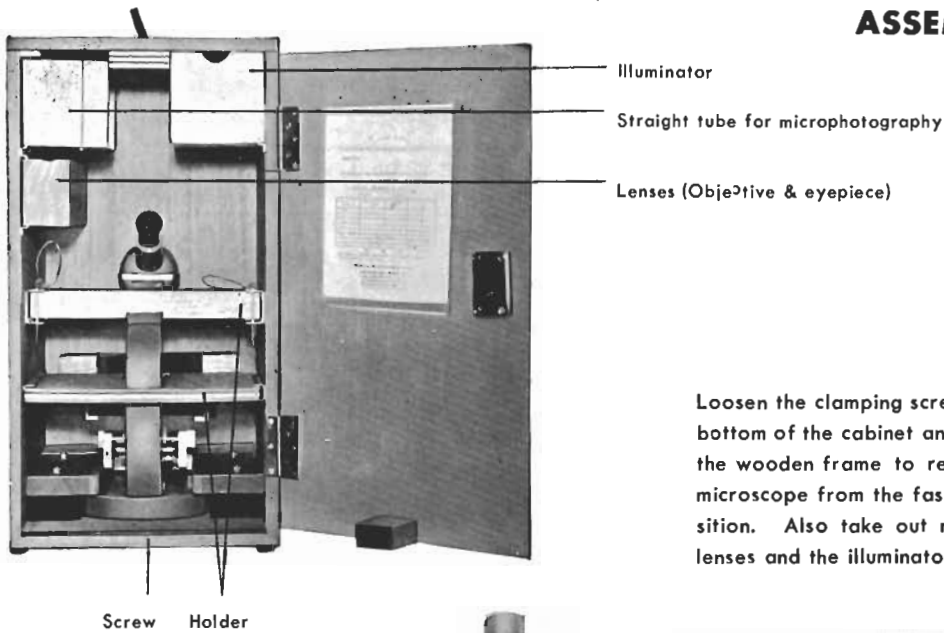
$$\frac{\text{Number of field of view}}{\text{Magnification of Objective}} = \text{Microscopic diameter of the view field (mm)}$$

The letter "P" (as in P7 ×, etc.) engraved on each eyepiece indicates the type of the eyepiece which compensates spherical and chromatic aberrations. 7 ×, 10 × and 15 × show the individual magnification.

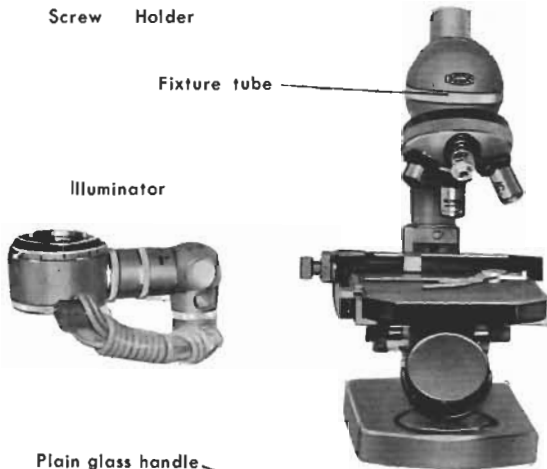
Eyepiece Characterisations

Eyepiece	Individual Magnification	No. of Fld. of View	Focal Length
P 7 ×	7	18	36mm
P 10 ×	10	13	25
P 15 ×	15	9.5	17

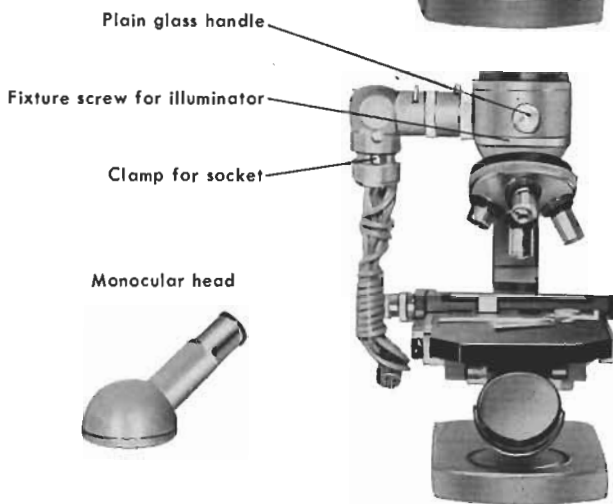
ASSEMBLY



Loosen the clamping screw at the bottom of the cabinet and remove the wooden frame to release the microscope from the fastened position. Also take out necessary lenses and the illuminator.



Screw off the head from the body. Attach the illuminator and fasten it by the provided ring. By loosening the socket clamp and releasing the bulb socket, the illuminator becomes rotative through 360° horizontally. After mounting the illuminator, put the head back on.



Attach objectives M6×, M10×, M40× and M100× at the positions A, B, C, and D on the nose-piece respectively. This will enable the user to easily confirm the magnification of the objective used without changing his posture of observation.

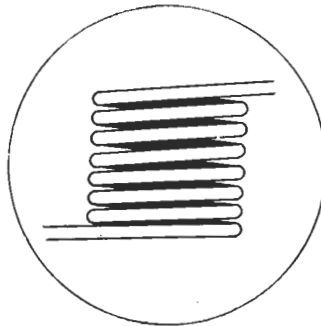
OBSERVATION

(1) Bright Field Observation :

a. Specimen : Place some oil-clay on the metal slide and the specimen on top of it. Press them by the handpress so that the specimen will be right-angled toward the optical axis. Fix the specimen on the stage using mechanical stage clips. Two slides may be placed on the stage and their locations may be adjusted crosswise by the knob on the right hand side.



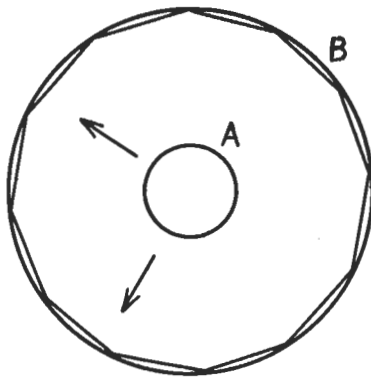
b. Filament Centering : Put the clear bulb in the illuminator socket. Keep the power low. Turn the plain glass knob to match the dot and the indicator line. Set the stopper when the filament is centered in the lamp house. i. e., looking into the tube (without an eyepiece) insert the socket and set the stopper when the filament image comes to the vision. Further, the filament image in the plain glass will become more clear-cut, by turning the centering knob, and look like a worm in the centre of the field of view.



OBSERVATION

c. Regulation of the Field Diaphragm: First attach an appropriate type bulb in the illuminator, attach the eyepiece, then roughly focus on the specimen using M10 \times objective by means of the coarse adjustment mechanism. (See item (e) Focusing, below). When the diaphragm ring with an F marking on the illuminator is rotated to the fullest extent of MIN, the image of the diaphragm will appear in the field of view. If this image may not be in the center of the view field, adjust its location by the plain glass knob. When the image is centered, gradually open the diaphragm as far as the rim of the field. (If the magnification of the eyepiece is changed, the diaphragm must be re-adjusted because of different ratio between the diaphragm area and the view field.)

d. Adjustment of Aperture Diaphragm: Remove the eyepiece first. Looking into the head, stop down the aperture ring with A marking. However, if it is closed down more than the N. A. of the objective, the diaphragm image will appear at the rim. The area of the diaphragm image differs according to the objective used. Therefore, it must be adjusted so that the diaphragm image will not be inside of the rim. When the eyepiece is inserted, you will see the view field darkened at a certain point while closing down the diaphragm. Immediately before that point is the correct position of opening. Only in case the user desires a very contrasty image, the diaphragm may be stopped down further than the above position.



NOTE: Field and aperture diaphragms must be correctly adjusted (regulated) otherwise it would cause over-reflection or scattered light on the specimen thus lowering the resolving power of the objective and the view field contrast. The image of diaphragm appears almost in circle at the center of the view field. Open up the diaphragm until the image A becomes polygonal as Image B, and further step up until the image reaches almost outside of the rim.

(Remarks: The above instructions on adjustments of filament position, field diaphragm and aperture diaphragm are based on the assumption that the face of the specimen to be observed is set right-angled to the optical axis.)

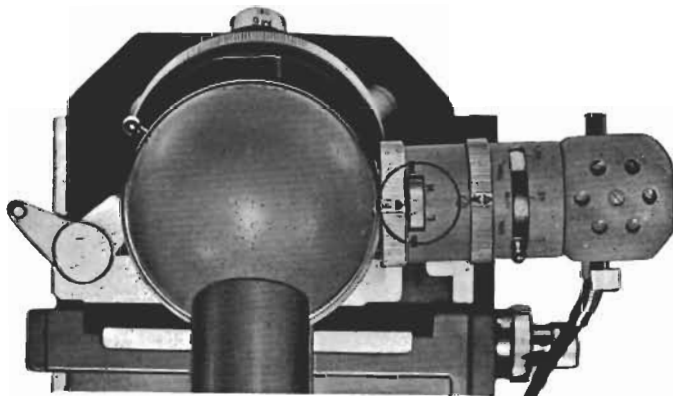
e. Focusing: After regulation of the illuminator, focusing will be performed. If this is done by raising and lowering the stage while user looks into the microscope, the objective may be thrust into the specimen. Therefore, first use M10 \times objective and, looking from the side, raise the stage by coarse adjustment knob until the top of the specimen comes very close to the tip of the objective. Then looking into the eyepiece, lower the stage gradually for rough focusing. Turn the nosepiece to the desired high-power objective. Then use the fine adjustment knob for precise focusing. The crosswise movement knob will be used in centering the desired portion of the specimen in the view field.

OBSERVATION

f. Oil Immersion Objective-M100 \times : Oil immersion objective M100 \times is marked with letters "HI" and a black line at the lower part. "HI" stands for "homogeneous immersion" and indicates the oil immersion lens, together with the black line. When using this lens, first focus roughly on the specimen using M10 \times , then drip a drop of cedar oil (or anisole which is of the same refractive index as cedar oil but of higher volatility) on top of the specimen. Turn the objective nosepiece to M100 \times . Raise the stage so that the tip of the objective touches the cedar oil and make fine adjustment looking through the microscope.

(Note : Application of some cedar oil at the tip of M100 \times , before turning it into position, will prevent for some air to be left in between the lens and the specimen. After its use, the cedar oil on the objective must be wiped off with clean gauze and xylol, then again with dry gauze. The objective should not be left with cedar oil applied. If anisole is used, simply wipe it with clean gauze.)

g. Objective MGK : When using this type objective, let the compensation lens, included in the illuminator, position in the illumination optical path. This is accomplished by moving the compensation lens handle to L (Low). The compensation lens handle is located near the field aperture ring on the illuminator. For other type objectives, move the handle to H (High) to remove the compensation lens from the path.

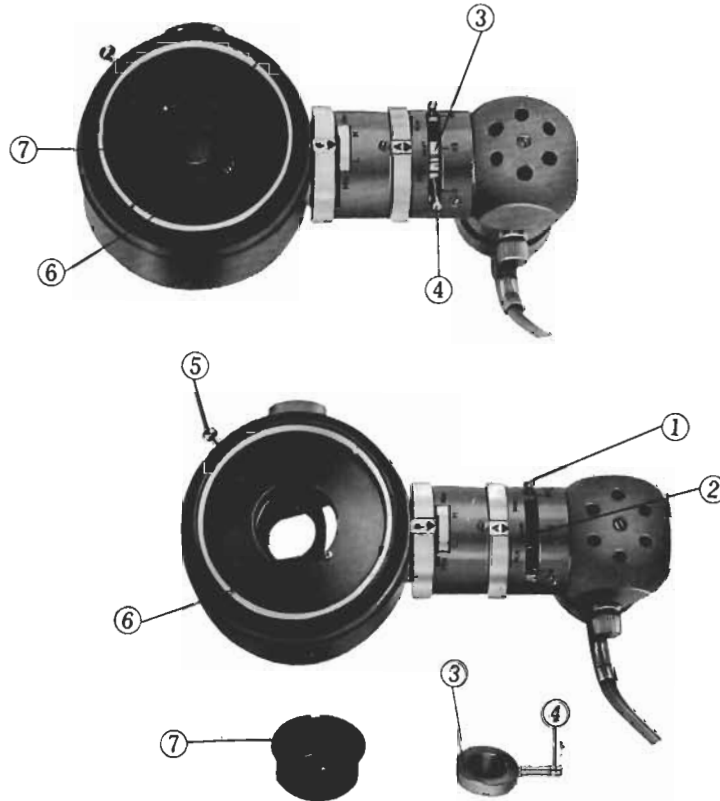


h. Coarse Focusing Knob : The coarse focusing knob is usually heavy and tight. This can of course be adjusted to the user's preference. Hold right and left knobs and turn them clock-wise at the same time to make it tighter and heavier, and counter-clockwise for lighter movement. Ordinarily it is kept rather tight.

OBSERVATION

(2) Polarizing Observation :

For polarizing observation, the special polarizing unit composed of a polarizer and an analyzer will be employed. This type of observation can be applied for determination of crystal direction or identification of non-metallic inclusions.



1. Remove the head (monocular, binocular or trinocular).
2. Insert the polarizer (3) into the filter opening (2) at this time, the letter "P" engraved on the frame will be turned toward the word "FILTER" engraved on the illuminator.
3. Put the analyzer (7) above the plane glass. Let the analyzer greeve fit the screw (6). (Letter A on the frame stands for Analyzer).
4. The polarizer can be turned by the knurl (4) and the analyzer by the knurl (5).
5. Parallel and crossed nicols are attained as follows :

		Polarizer Scale	Analyzer Scale
Crossed	1	0°	0°
	2	90°	90°
Parallel	1	45°	45°
	2	0°	90°
	3	90°	0°

(Note : When a polarizer or a filter is not used, turn the knurl (1) and close the filter opening.)

OBSERVATION

(3) Transilluminated Observation :

The Metallurgical Microscope MF is originally designed for observation of non-transparent specimen by reflected light. However, it can be used for transilluminated observation only in case of low magnification, i. e., using objectives $M6\times$ or $M10\times$. In such a case, reflect the light beam on the mirror under the stage. The mechanical tube length without illuminator is 160mm, and can therefore be used as a biological microscope in which case a better result may be obtained by employment of an objective for biological microscope.



APPLICATION

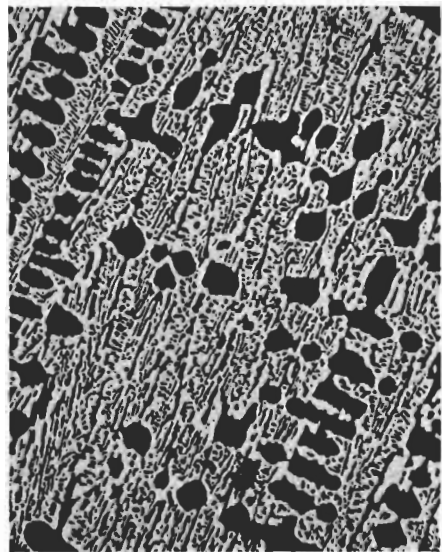
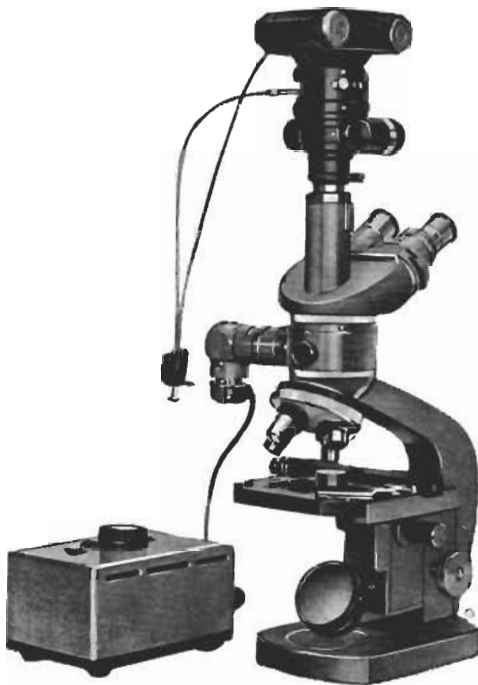
Microphotography :

If a monocular or binocular head is used, remove it and attach a straight tube for microphotography. In case of a trinocular head, simply use the straight tube included in it. Focusing on MF model metallurgical microscope is performed by raising and lowering the stage. Microscopic body, including objective, is secured firmly to the arm and it is only the stage which makes coarse and fine movements vertically. Therefore, absolutely no fear should be borne as to outfocusing due to slippage of the body caused by the weight of the photographic equipment. Furthermore, the arm is of such a design that is very secure from the dynamical standpoint, and would not transmit, any vibration, caused by shutter release, to the specimen nor to the objective.

All illumination factors, the most important for photo taking, are all taken care of by the new illuminator which will provide every necessary lighting condition and an even and efficient lighting, completely free of ununiformity of illumination.

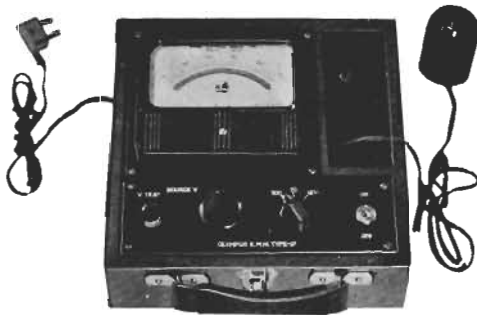
For 35mm micro-photographing, the Olympus micro-photographic unit PM-6 is most suitable. Magnification on the film surface of PM-6 is approximately 1/3 of the total magnification of the microscope.

When a PM-6 is employed, the Olympus micro-photo exposure meter, EMM-IV, can be attached at the exposure window. This will help user finding out appropriate exposure time. Please refer to our catalogue for exposure meters.

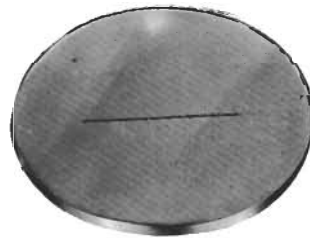


SPECIAL ACCESSORIES

1. Small microphotographic equipment, PM-6.
2. Polarizing unit for MF
3. Microphotographic exposure meter EMM IV (for general use)
4. Metallurgical objective micrometer (scale 1mm 1 : 100)
5. Eyepiece micrometer (scale 10mm 10: 100)
6. Filar micrometer eye-piece OSM
7. Handpress (for specimen)
8. Special eyepiece for identification of non-metallic inclusion in steel and determination of crystal grain degree of austenite.



Microphotographic exposuremeter Model EMM-IV



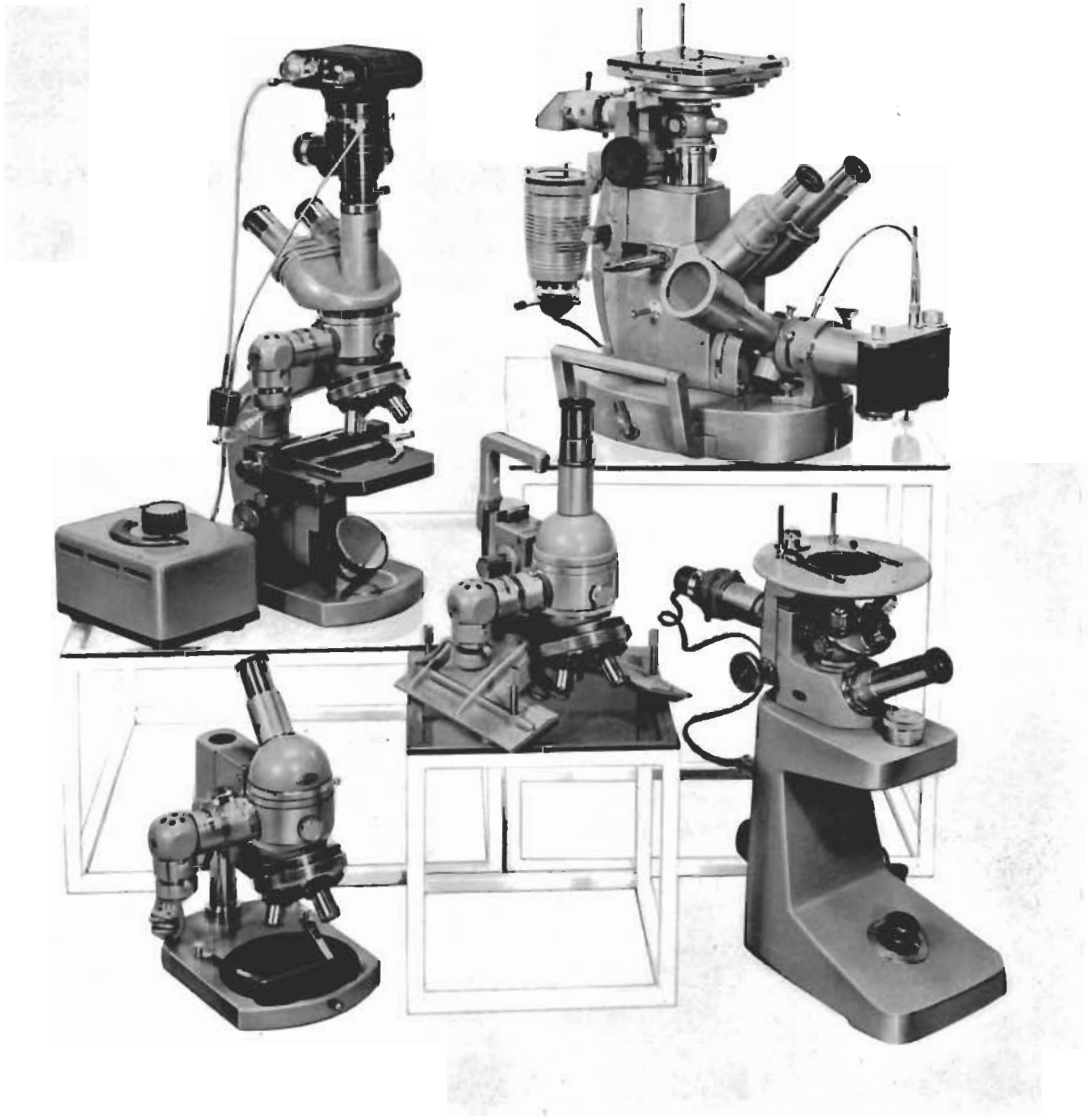
Eye-piece micrometer



Metallurgical objective micrometer

Ocular screw micrometer
OSM





Metallurgical Microscopes

1. Universal microscope model PMF
2. Model MF Tr with PM-6
3. Roll-microscope model MR
4. Junior type model MJ
5. Inverted type model ME

REMARKS

Maintenance Instruction :

Special care must be taken to avoid dampness and dust when storing the microscope. A laboratory, where the microscope is mostly used, is often under unsatisfactory conditions as far as those two factors are concerned. It preferred that immediately after the use, the microscope be stored in the cabinet. If, because of constant research requirements, such storing would cause any inconvenience, be sure to use the provided plastic cover.

Objectives and eyepieces can best be stored in a dessicator. It is also a desirable practice to keep some dessicant in the cabinet.

When the eyepiece is removed from the microscope, be sure to put on the provided cap. It must be absolutely prohibited to disassemble the mechanical parts of the microscope for repair or for any other reasons. It must be done by the professional engineers. In cleaning parts of the microscope, one must be very cautious —dusts at the minute part may be blown away by use of a rubber ball or may be removed by a soft brush.

