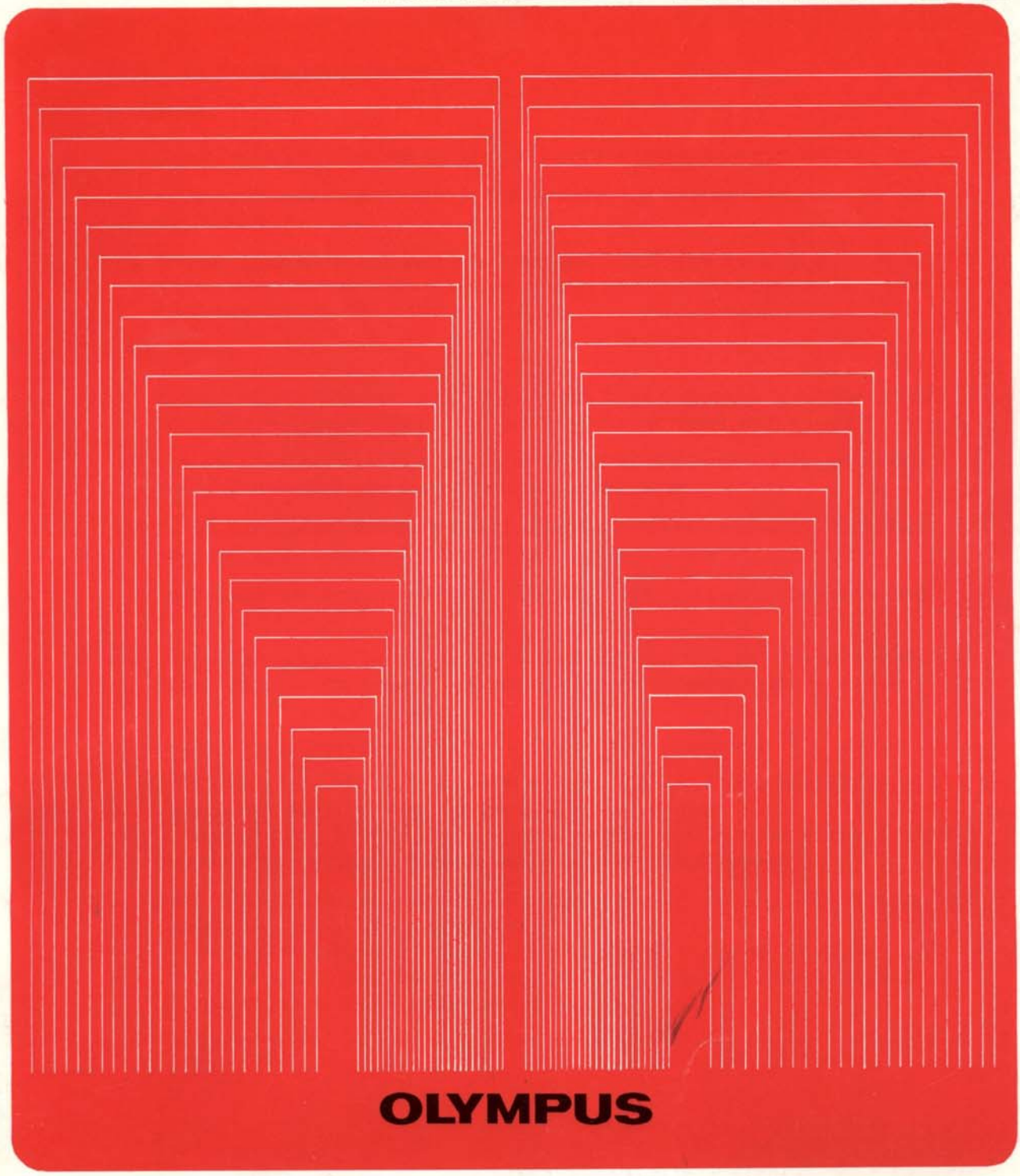
OLYMPUS METALLURGICAL MICROSCOPES

INSTRUCTION MANUAL

MODELS BHMJ& BHMJ-N



OLYMPUS

This instruction manual has been written for the Olympus Metallurgical Microscopes Models BHMJ and BHMJ-N.
The Model BHMJ incorporates a vertical illuminator for brightfield and the Model BHMJ-N incorporates a vertical illuminator for brightfield and darkfield.
It is recommended that you read the manual carefully in order to familiarize yourself fully with your microscope so that you can obtain optimum performance from it.

Observe the following points carefully:

1. **Operation**

   1) Always handle the microscope with the care it deserves, and **avoid abrupt motions.**

   2) **Avoid** exposure of the microscope to **direct sunlight, high temperature** and **humidity, dust** and **vibration.**

   3) **Only use the tension adjustment ring for altering the tension of the coarse adjustment knobs.** (Do not twist the two coarse knobs in opposite directions simultaneously, as this will cause damage.)

2. **Maintenance**

   1) Lenses must always be kept clean. Carefully wipe off oil or fingerprints deposited on the lens surfaces with gauze moistened with a **small** amount of xylene, alcohol or ether.

   ★ **Only use a hand blower** to blow off dust on the half mirror built in the vertical illuminator. If the mirror is still stained, **contact the Olympus repair service.**

   2) Do not use organic solutions to wipe the surface of various components. Plastic parts, especially, should be cleaned with a neutral detergent.

   3) **Never disassemble** the microscope for repair. Only authorized Olympus service personnel should make repairs.

   4) The microscope should be covered with the vinyl dust cover provided. It is recommended to keep objectives and eyepieces in a desiccator, containing desiccants such as silica gel.

◎ For photomicrography, it is preferable to clamp the tension adjustment ring tightly to prevent the microscope body from dropping during operation.
Vibrations caused by the shutter movements will often result in blurred images. To avoid shutter vibrations, shutter speeds as slow as possible are recommended.

◎ The vertical illuminator is recommended to be mounted on the microscope as shown in page 3 from the operational point of view.
If an Olympus halogen lamp housing Model BH-LSHM is mounted on the microscope, make it a point of applying a heat absorbing plate to the bottom of the lamp housing to protect the hands from touching the lamp housing.

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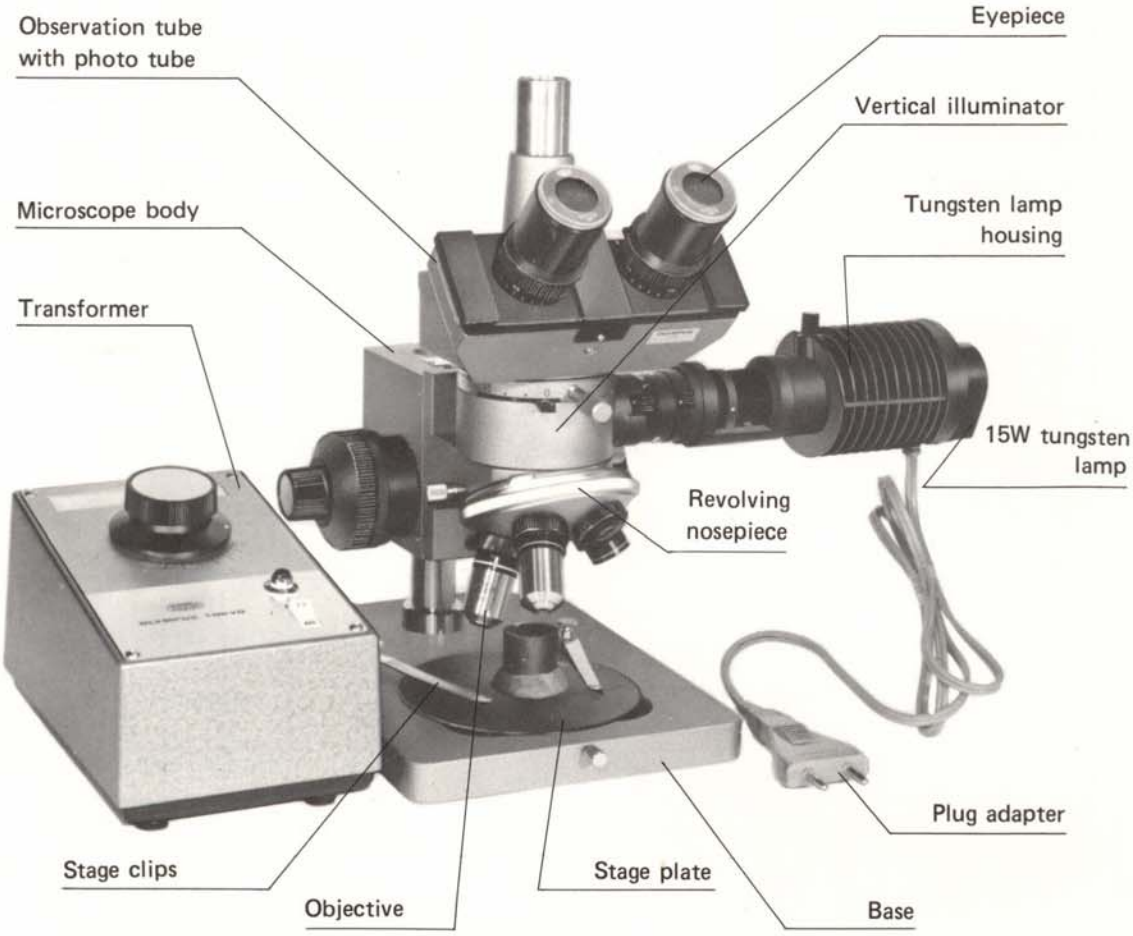
I. STANDARD EQUIPMENT

Module			Quantity	BHMJ-					
				02	22	42	02-N	22-N	42-N
Microscope body (with base)		BHMJ-ST and BHMJ-F	1	O	O	O	O	O	O
Revolving nosepiece		BH-RE	1	O	O	O			
		BH-NRE	1				O	O	O
Vertical illuminator for brightfield		BH-MA	1	O	O	O			
Vertical illuminator for brightfield and darkfield		BH-RLA	1				O	O	O
Observation tubes	Monocular tube	CH-MO45	1	O			O		
	Binocular tube	BH-BI45	1		O			O	
	Binocular tube with photo tube	BH-TR45	1			O			O
Tungsten lamp housing		BH-LHM	1	O	O	O	O	O	O
15W tungsten bulbs		LS15	3	O	O	O	O	O	O
Transformer		TF	1	O	O	O	O	O	O
Objectives	M5X, M10X, M20X, M40X (set of four)		1	O	O	O			
	Neo5X, Neo10X, Neo20X, Neo40X (set of four)		1				O	O	O
Eyepieces	High eyepoint BiWF10X, paired		1		O	O		O	O
	High eyepoint WF10X		1	O			O		
Photo eyepiece	FK3.3X		1			O			O
Stage plate			1	O	O	O	O	O	O
Stage clips			2	O	O	O	O	O	O
Eyepiece caps			2		O	O		O	O
Blue filter	32.5C		1	O	O	O	O	O	O
Vinyl dust cover			1	O	O	O	O	O	O

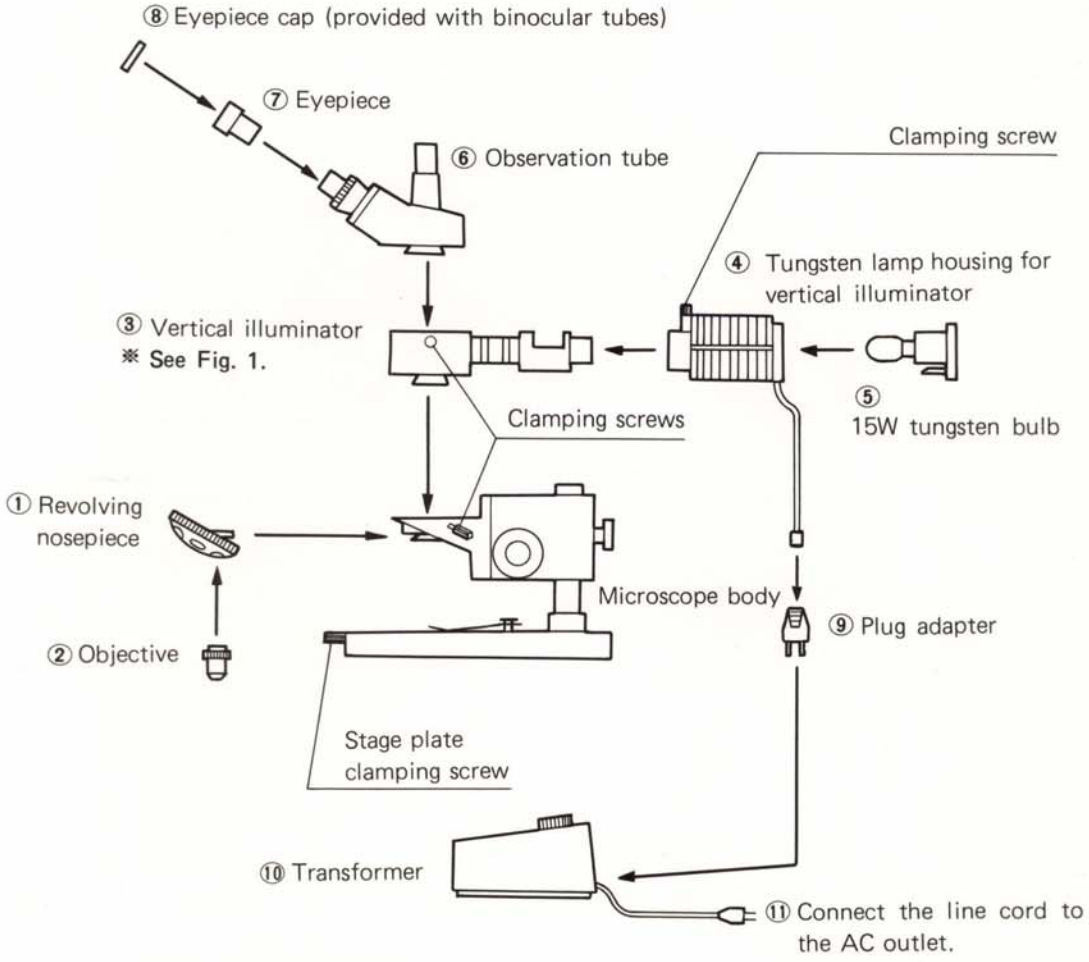
II. NOMENCLATURE

The photo below shows the Model BHMJ-42, which can be converted into the Model BHMJ-42-N by replacement of the vertical illuminator, nosepiece and objectives.



III. ASSEMBLY

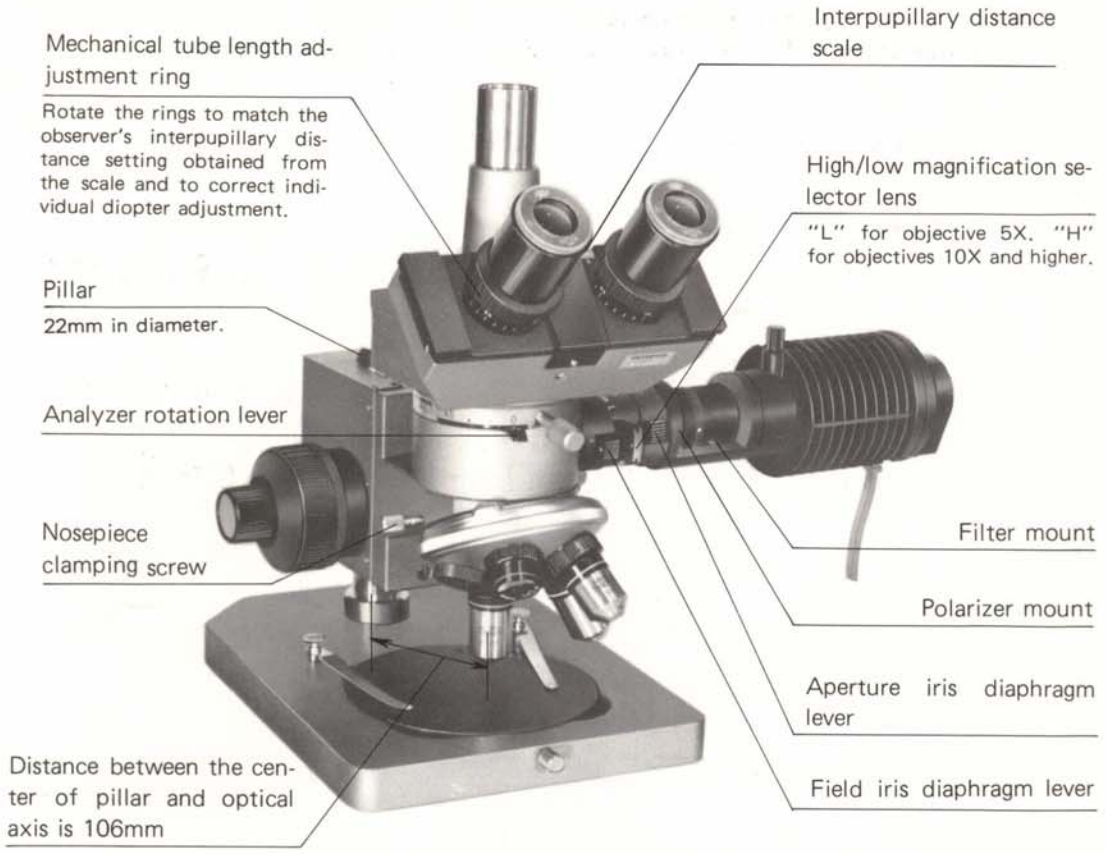
This picture illustrates the sequential procedure of assembly. The numbers indicate the order of assembly of various modules.
Take care to keep all glass surfaces clean, and avoid scratching the lens surfaces.

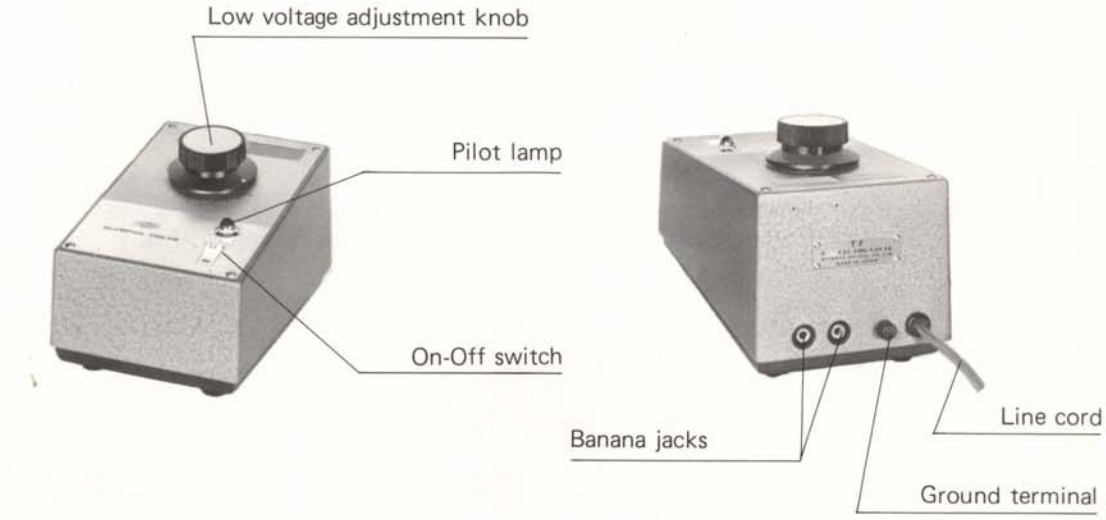


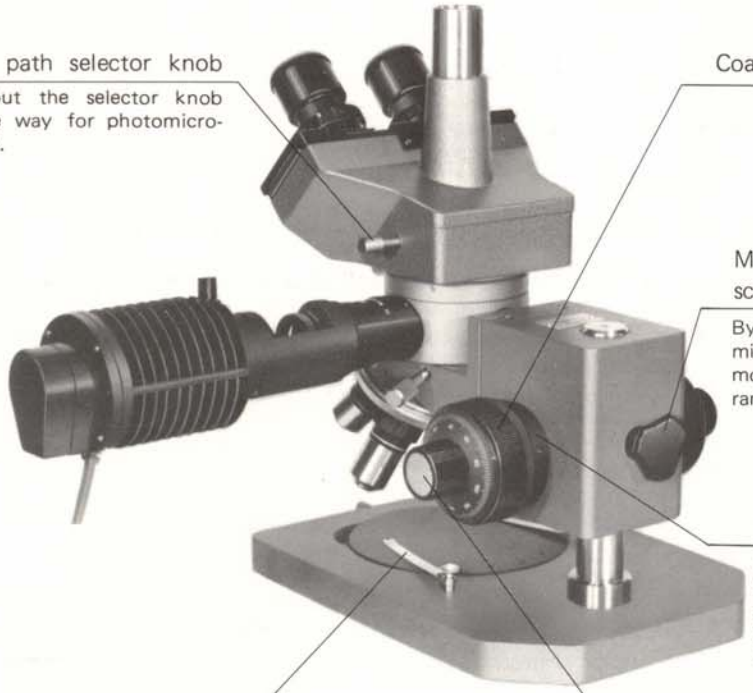
NOTE: It is recommended to mount the vertical illuminator BH-MA or BH-RLA on the microscope body, pointing to the right hand side of the operator. (Fig. 1)

Fig. 1

IV. IDENTIFICATION AND FUNCTION OF VARIOUS COMPONENTS







Light path selector knob

Pull out the selector knob all the way for photomicrography.

Coarse adjustment knob

Max. stroke 30mm.

Microscope body clamping screw

By loosening this screw, the microscope body can be moved vertically within a range of 60mm.

Tension adjustment ring

Insert a small screwdriver into one of the openings on the ring and rotate the ring clockwise to increase coarse adjustment tension.

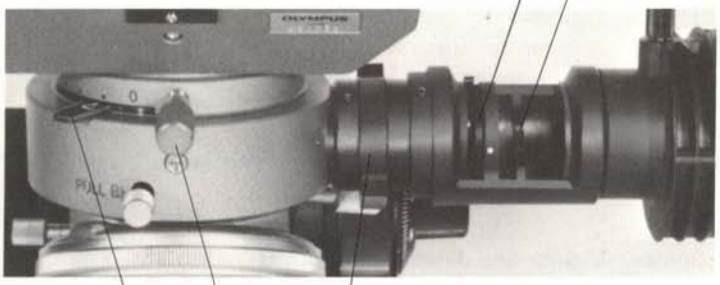
Stage clip

Holds a specimen slide in place.

Fine adjustment ring

Graduated in increments of 2 μ.

Vertical illuminator for brightfield and darkfield



Polarizer mount

Filter mount

Analyzer rotation lever

Brightfield/darkfield selector knob

Pull out the knob all the way for brightfield.

Aperture iris diaphragm lever for brightfield

In case of darkfield observation, open the diaphragm fully.

V. OPERATION

■ **Summary of Putting the Microscope in Operation**

A. Place a specimen on the stage (page 7).

B. Adjust the microscope body height (page 6).

C. In case of the BHMJ-N, choose either brightfield or darkfield (page 6).

① For brightfield, pull out the brightfield/darkfield selector knob all the way.

② For darkfield, open the aperture iris diaphragm fully and push the brightfield/darkfield selector knob all the way in.

D. Switch on the transformer.

E. Coarse focus with the 10X objective.

F. Make interpupillary and diopter adjustments (page 8).

G. Swing in the desired objective.

★ **In case of BHMJ, slide the High/low magnification selector lens to the L position for objective 5X or to the H position for higher power objectives.**

H. Adjust light intensity.

I. Fine focus.

J. Adjust aperture iris diaphragm and field iris diaphragm (for BHMJ only) (page 8).

A. Placement of specimen

1) Put plasticine on a metal slide ① , then place a specimen on the plasticine and press the specimen with a hand press until the specimen surface is properly leveled.

★ **An Olympus hand press, Model HP, is optionally available to level a specimen on a metal slide.**

NOTE: It is suggested to place a piece of tissue paper between the specimen and the plunger of the hand press in order to prevent scratching the polished specimen surface.

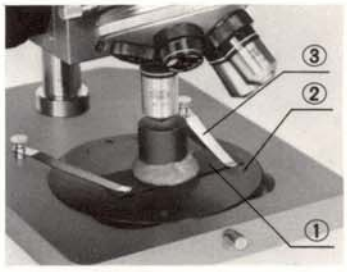


Fig. 2

2) Place the specimen slide on the stage plate ② and fasten it with clips ③ . (Fig. 2)

B. Interpupillary distance and diopter adjustments

1) Hold the knurled dovetail slides ① of the right and left eyepiece tubes with both hands and push the tubes together, or pull them apart laterally, whichever is required, while looking through the eyepieces with both eyes, until perfect binocular vision is obtained.

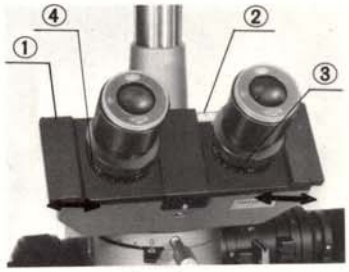


Fig. 3

Read your interpupillary distance as indicated on the scale ②, and rotate the mechanical tube length adjustment ring ③ on the right eyepiece tube until it matches the interpupillary distance reading.

2) Look at the image through the right eyepiece with your right eye and focus on the specimen with coarse and fine adjustment knobs.

3) Next, look at the image through the left eyepiece with your left eye and rotate the tube length adjustment ring ④ to focus on the specimen without using the coarse and fine adjustment knobs.
By taking the steps above, magnification and parfocality of each objective, as well as individual interpupillary distance and diopter adjustments, can be correctly obtained.

C. **Aperture iris diaphragm** (The aperture diaphragm is always kept open for darkfield illumination.)

In order to achieve optimum objective performance, the opening of the aperture iris diaphragm should be matched to the numerical aperture of the objective in use. It is often preferable, however, to stop down the aperture diaphragm slightly more than indicated by the objective N.A. This will result in better image contrast, increased depth of focus and flatter field. After completing focus adjustment, remove one of the eyepieces from the observation tube and look into the eyepiece tube. As you stop down the aperture iris diaphragm, the image of the iris diaphragm can be seen in the objective exit pupil. Adjust the opening of the diaphragm to match the N.A. of the objective in use. If the specimen is low in contrast, it is recommended to stop down to 70 ~ 80% of the objective N.A.

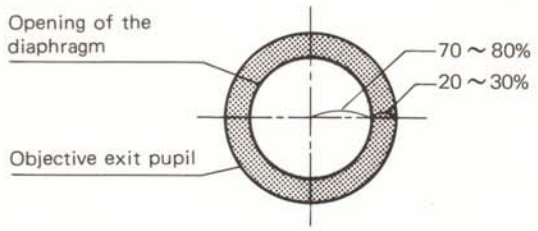


Fig. 4

D. **Field iris diaphragm** (for BHMJ only)

The field iris diaphragm controls the diameter of the ray bundle impinging on the specimen surface and thus increases image definition by excluding stray light. Stop down the field iris diaphragm until it is just outside the field of view. This procedure should be repeated when changing objectives.

E. **Eyepieces**

a) **Eyepiece cap**
The eyepiece cap is recommended for those who wear eyeglasses. It prevents damage to the eyeglasses.

b) **Eyepiece with eye shield**
The eyepieces K5X and WF10X incorporate a sliding eye shield. This eye shield can be pulled out to prevent glare and loss of contrast caused by extraneous light hitting the eye lens.

VI. OPTICAL DATA

Objective / Eyepiece	Type	M (Achromats)				Neo (Achromats)			
	Magnif.	5X	10X	20X	40X	5X	10X	20X	40X
	N.A.	0.10	0.25	0.40	0.65	0.10	0.25	0.40	0.65
	W.D. (mm)	27.00	7.60	2.10	0.50	22.30	7.50	1.70	0.62
	Focal length (mm)	31.46	19.58	10.15	5.39	31.41	19.58	10.15	5.39
	Resolving power (μ)	3.4	1.3	0.84	0.52	3.4	1.3	0.84	0.52
BiK5X (Field number 21)	Total mag.	25X	50X	100X	200X	25X	50X	100X	200X
	Focal depth (μ)	166.0	32.0	10.4	3.3	166.0	32.0	10.4	3.3
	Field of view (mm)	4.2	2.1	1.05	0.53	4.2	2.1	1.05	0.53
BiWF10X (18)	Total mag.	50X	100X	200X	400X	50X	100X	200X	400X
	Focal depth (μ)	98.0	18.4	6.1	2.0	98.0	18.4	6.1	2.0
	Field of view (mm)	3.6	1.8	0.9	0.45	3.6	1.8	0.9	0.45
BiWF15X (12)	Total mag.	75X	150X	300X	600X	75X	150X	300X	600X
	Focal depth (μ)	75.4	13.9	4.7	1.6	75.4	13.9	4.7	1.6
	Field of view (mm)	2.4	1.2	0.6	0.3	2.4	1.2	0.6	0.3

- W.D. (Working distance): The distance between the specimen or cover glass and the nearest point of the objective.
- N.A.(Numerical aperture): The numerical aperture represents a performance number which can be compared to the relative aperture (f-number) of a camera lens. N.A. values can be used for directly comparing the resolving powers of all types of objectives. The larger the N.A., the higher the resolving power.
- Resolving power: The ability of a lens to register small details. The resolving power of a lens is measured by its ability to separate two points.
- Focal depth: The distance between the upper and lower limits of sharpness in the image formed by an optical system. The smaller the opening of the aperture diaphragm or the objective N.A., the larger the focal depth.
- Field number: A number that represents the diameter in mm of the image of the field diaphragm that is formed by the lens in front of it.
- Field of view diameter: The actual size of the field of view in mm.

VII. TROUBLESHOOTING

Troubles	Causes	Remedies
1. Optical system		
a) With the illuminator switched on, the field of view is dark.	(BHMJ) The field iris diaphragm is not opened sufficiently.	Open the field iris diaphragm properly.
	(BHMJ-N) The brightfield/darkfield selector knob is pushed in (darkfield), and the aperture iris diaphragm is stopped down.	Open the aperture iris diaphragm fully.
b) The field of view is cut off or illuminated irregularly.	The nosepiece is not clicked into place.	Slightly rotate the nosepiece until it clicks into place.
	The nosepiece is not correctly mounted.	Insert the nosepiece dovetail into the stand all the way home, then lock.
	(BHMJ) The field iris diaphragm is stopped down excessively.	Open it sufficiently.
	The lamp housing is not correctly mounted.	Insert the lamp housing all the way.
	(BHMJ) The high/low magnification selector lens is not engaged correctly.	Set it to the "L" position for 5X objective or to the "H" position for higher power objectives.
	(BHMJ-N) Brightfield/darkfield selector knob is stopped midway.	Slide the knob in or out completely.
c) Dust or dirt is visible in the field of view.	Bulb is stained.	Clean.
	Dust on half mirror surface.	
	Dirty specimen.	
	Dust on eyepiece and/or objective front lens.	
	Dust on lower surface of observation tube prism.	
d) Excessive image contrast.	Aperture iris diaphragm is stopped down excessively.	Open the diaphragm.
	(BHMJ) High/low magnification selector lens is not correctly engaged.	Move lens to the "L" position for 5X objectives, or to the "H" position for higher power objectives.
	Lamp housing is not correctly mounted.	Push the lamp housing all the way home.

Troubles	Causes	Remedies
e) Resolution problems: • Image is not sharp. • Insufficient contrast.	Nosepiece is not correctly mounted.	Insert the nosepiece dovetail into the stand all the way home, then lock.
	The objective is not correctly positioned in the light path.	Slightly rotate the nosepiece until it clicks into place.
	Dirt on objective front lens.	Clean the objective.
	High/low magnification selector lens is not correctly engaged.	Move lens to the "L" position for 5X objectives, or to the "H" position for higher power objectives.
f) When objectives are changed, they are not parfocal.	Mechanical tube length adjustment rings on observation tube are not correctly adjusted.	Adjust the rings correctly.
g) The field is only partially visible. The image is partly out of focus.	Nosepiece is not correctly mounted.	Insert the nosepiece dovetail into the stand all the way home, then lock.
	The objective is not correctly positioned in the light path.	Slightly rotate the nosepiece until it clicks into place.
	The specimen surface is not at right angles with the optical axis.	Level the specimen surface correctly with a hand press.
	(BHMJ) High/low magnification selector lens is not correctly engaged.	Push the lens mount all the way until it stops.
	(BHMJ-N) Brightfield/darkfield selector knob is stopped midway.	Slide the knob all the way until it stops.
2. Electric system		
a) Lamp flickers and brightness is unstable.	Bulb filament is likely to burn out.	Replace the bulb.
	Loose electric connections.	Check all connections.
b) Pilot lamp lights but illuminator does not.	Bulb is burned out.	Replace the bulb.
	Loose electric connection.	Check all connections.
c) Bulb burns out too often.	Bulb is used on higher voltage.	Use bulb in the black zone as often as possible.
3. Focusing adjustment		
a) Coarse adjustment knobs are too tight.	Tension adjustment ring is tightened too much.	Loosen the ring.
b) Microscope body drops, and the specimen goes out of focus.	Tension adjustment ring is too loose.	Tighten the ring.

Troubles	Causes	Remedies
c) Microscope body cannot be raised to the upper limit.	The microscope body is clamped too low.	Loosen the clamping screw, and after raising the microscope body, reclamp.
d) Microscope body cannot be lowered to the lower limit.	The microscope body is clamped too high.	Loosen the clamping screw, and after lowering the microscope body, reclamp.
4. Observation tube		
a) Incomplete binocular vision.	Interpupillary distance is not correctly adjusted.	Correct the interpupillary distance.
	Diopter difference between both eyes is not correctly adjusted.	Complete the diopter adjustments on both eyes.
	Right and left eyepieces are not matched.	Use a pair of matched eyepieces.
	The user is unaccustomed to binocular vision.	Prior to looking at the image of the specimen, try to look at the entire field of view, or look at a far away object before resuming microscopic observation.

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