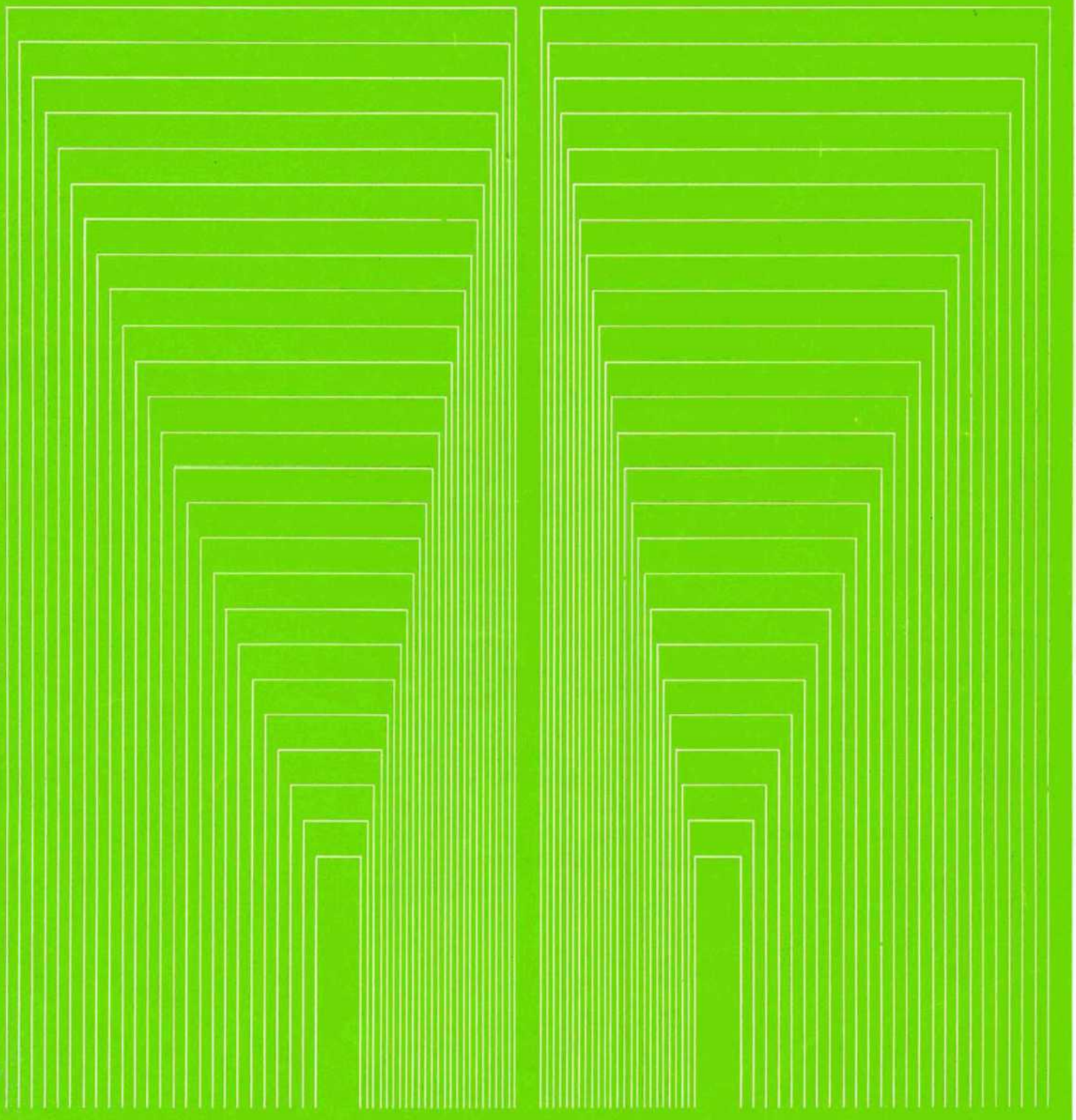
OLYMPUS UNIVERSAL RESEARCH MICROSCOPE

MODEL **VANOX**

INSTRUCTION MANUAL



OLYMPUS

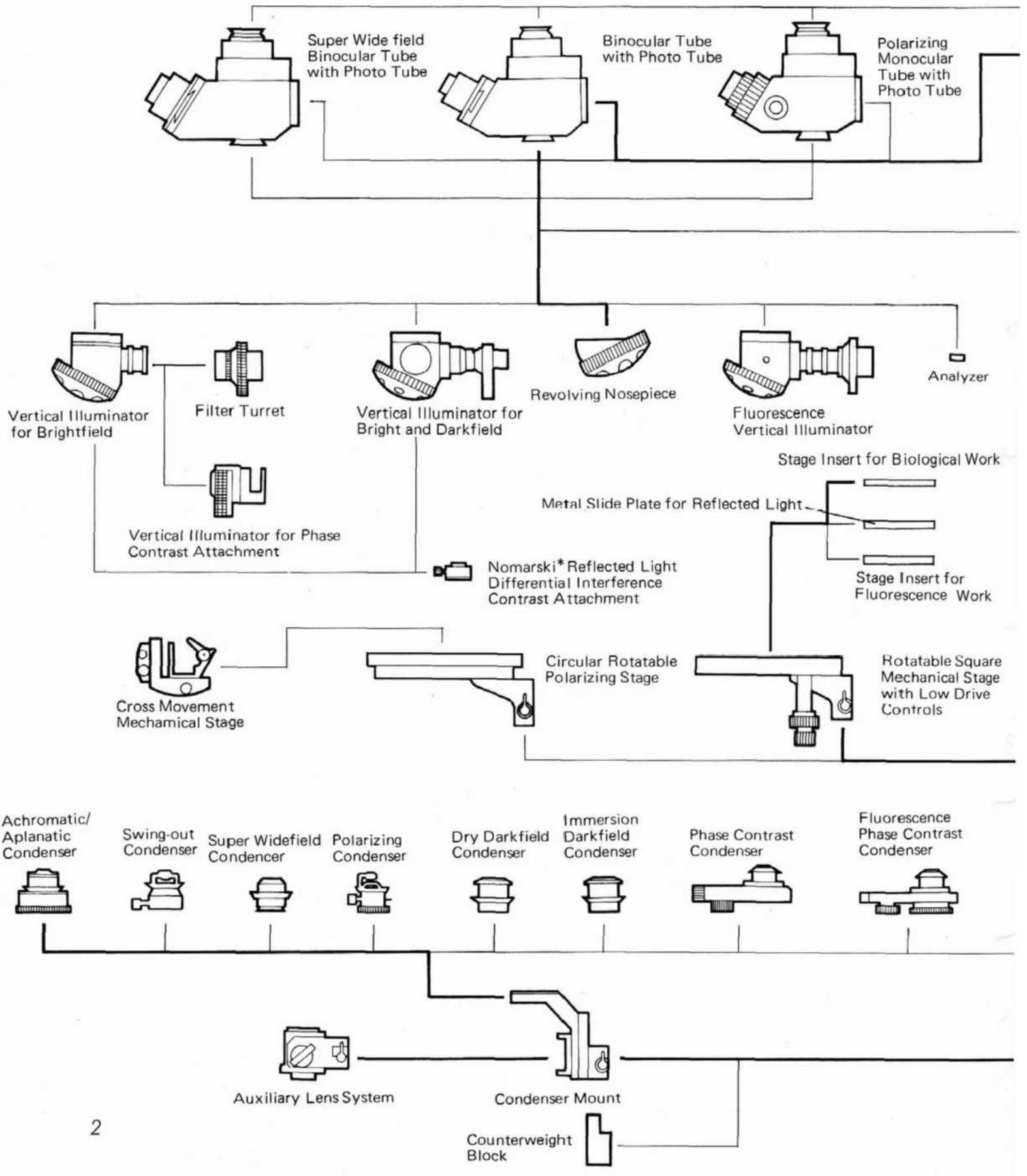
Olympus Universal Research Microscope

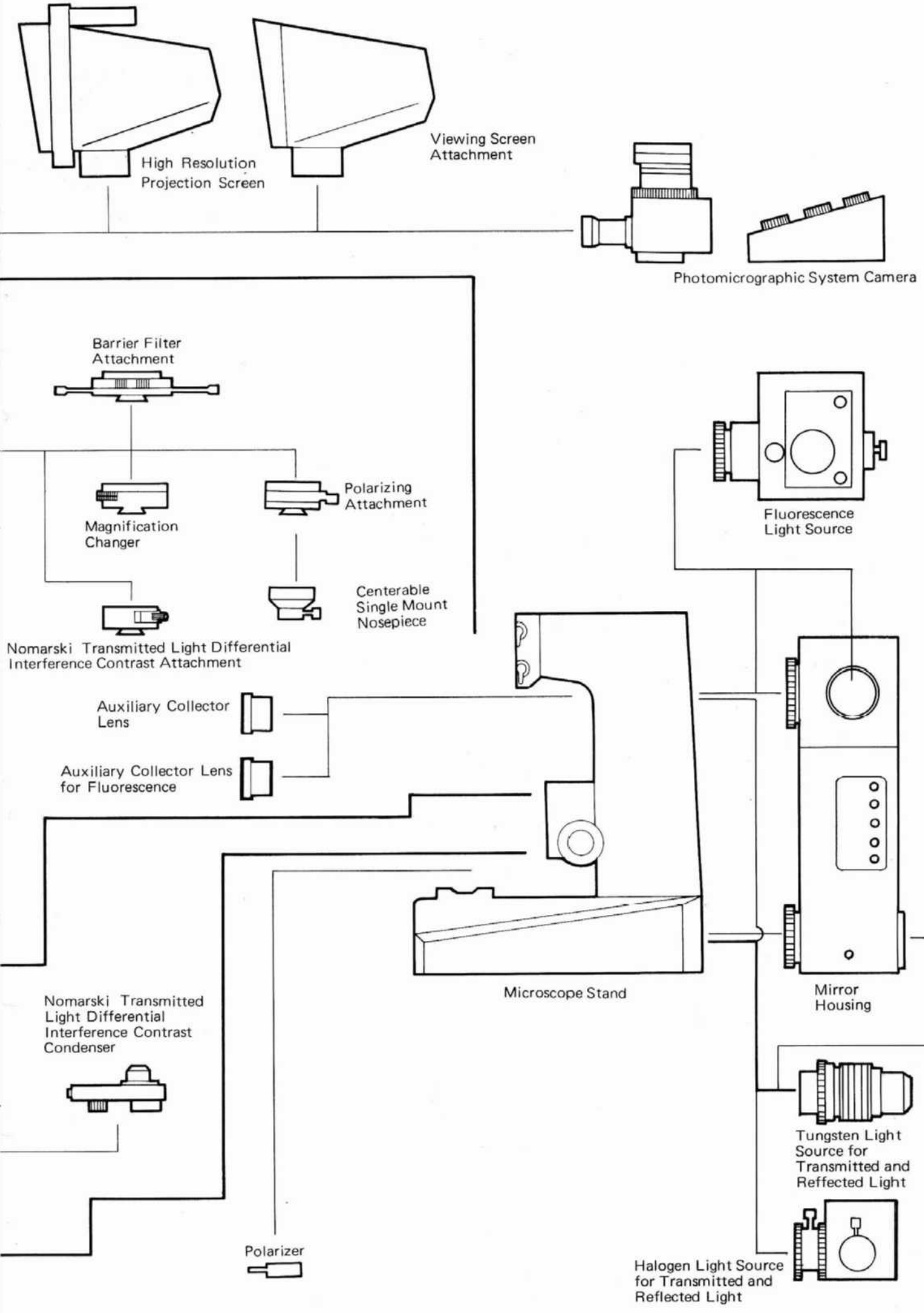
Model VANOX

Table of Contents

I. System Chart of Various Units

The various units in the chart below are based on the modular building-block system of interchangeable accessories for a wide range of applications. The standard components are linked by bold lines. The optional accessories are linked by fine lines.





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II. Standard Equipment

Before assembly, please check your standard outfit, which comprises the following items:

Microscope Stand			1
Binocular Tube with Photo Tube			1
Revolving Nosepiece			1
Rotatable Square Mechanical Stage with Low Drive Controls			1
Condenser Mount			1
Auxiliary Lens System			1
Tungsten Lamp House			1
Lamp Socket			1
Collector (transmitted light)			1
Achromatic/Aplanatic Condenser			1
Centering Frosted Glass			1
Objectives:	Plan 4X		1
	Plan 10X		1
	Plan 20X		1
	Plan 40X		1
	Plan 100X		1
Eyepieces:	BiWF 10X, paired		1
Orthochromatic Filters:	G-533	(Green)	1
	Y-48	(Yellow)	1
	C	(Cobalt)	1

Bulb (6V 5A)	3
Immersion oil (bottled)	1
Dust Cover	1

Optional Accessories

1. Phase Contrast Attachment Model A-PC
2. Fluorescence Illuminator Attachment Model A-FL-2
3. Fluorescence Phase Contrast Attachment Model A-FLPC
4. Polarizing Attachments for Transmitted Light Models A-P-1 & A-P-2
5. Vertical Illuminator Model A-M
6. Incident Phase Contrast Attachment Model A-MPC
7. Vertical Illuminator for Bright and Darkfield Model A-RLB
8. Halogen Light Source for Transmitted Light Model A-LSH
9. Halogen Light Source for Reflected Light Model A-M-LSH
10. Nomarski* Reflected Light Differential Interference Contrast Attachment Model A-M-NIC
11. Magnification Changer for Transmitted Light Model A-CA
12. Low Power Condenser N.A. 0.06 Model A-ULC
13. Dry Darkfield Condenser N.A. 0.8/0.92 Model A-DCD
14. Immersion Darkfield Condenser N.A. 1.4/1.2 Model A-DCW
15. Swing-out Condenser N.A. 0.85 Model A-SC
16. Super Widefield Attachment Model A-SW
17. Fluoresence Vertical Illuminator Attachment Model A-RFL
18. Nomarski Transmitted Light Differential Interference Contrast Attachment Model A-NIC

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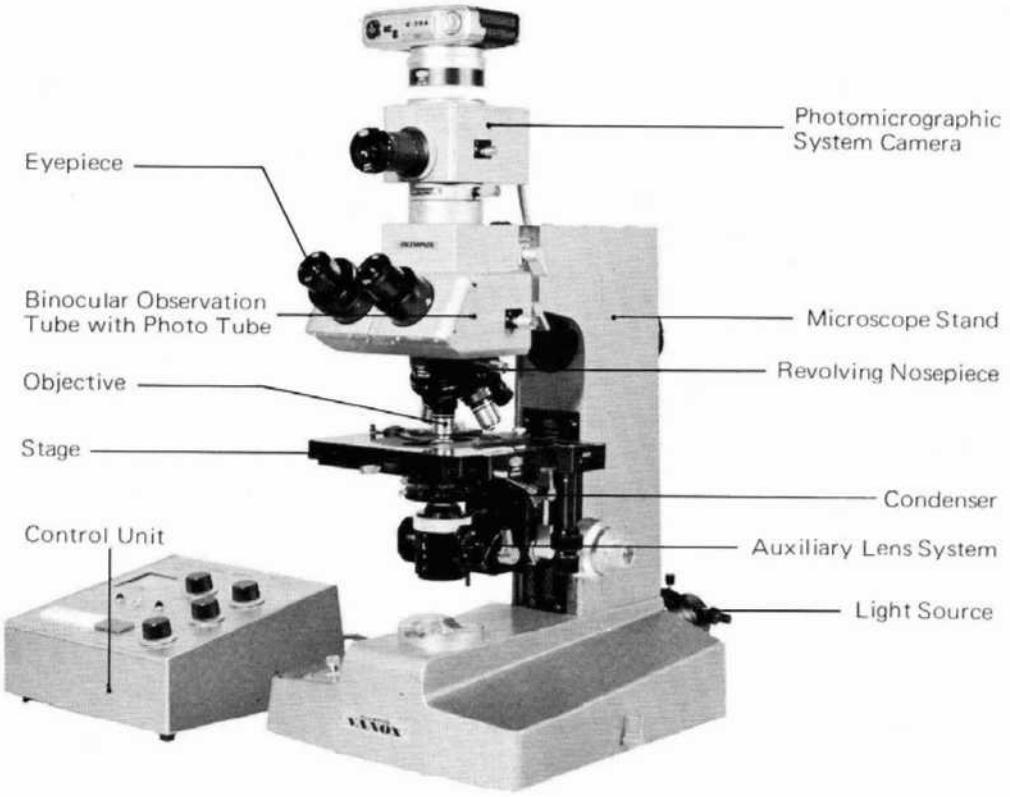
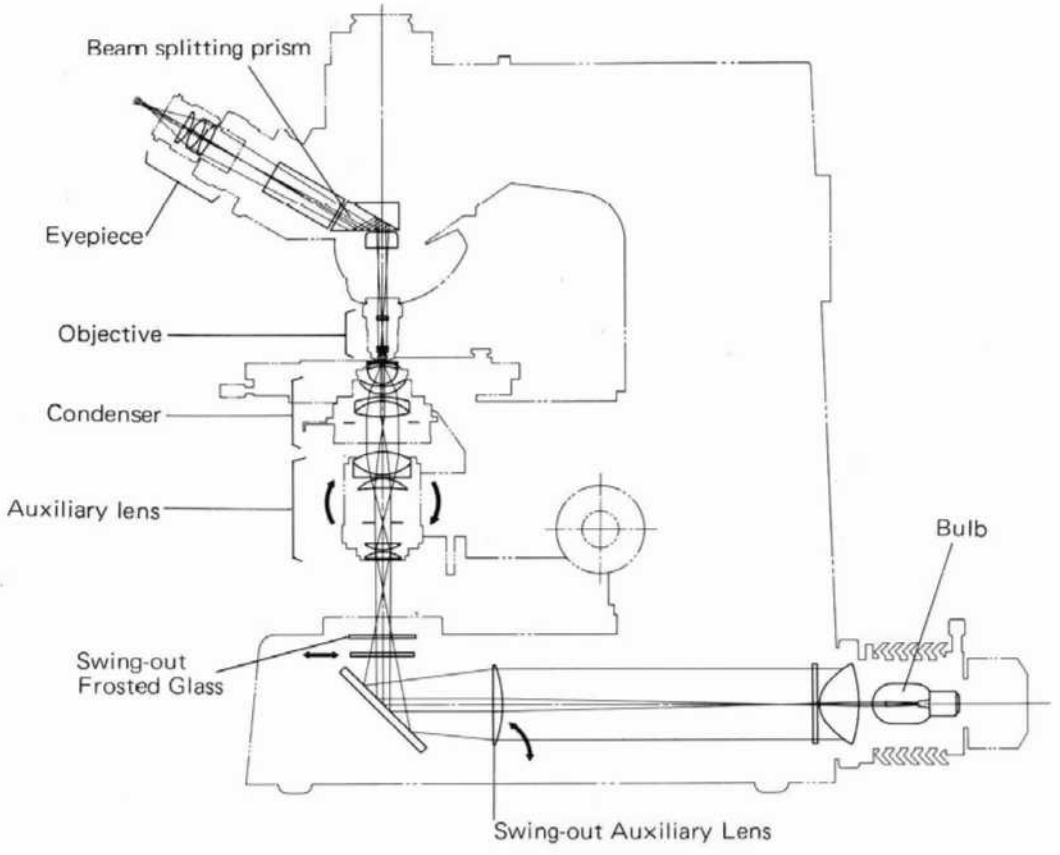
III. Specifications

Microscope Stand:	Height position of observation tubes is variable. Various types of light sources are attachable. Focusing: Vertical stage movement. Coaxial coarse and fine adjustment knobs, with automatic pre-focusing lever. Coarse Adjustment: Dovetail slideways, rack-and-pinion type; adjustment range 49mm. Fine Adjustment: Roller guide, gear train type; adjustment range 2.3mm, graduated in increments of 1 micron.
Standard Observation Tube:	Binocular observation tube with photo tube, with constant tube length adjustment. Tube inclination 30°. Three-position light path selector lever. A choice of intermediate adapters for special methods of observation is available. Interpupillary adjustment: 54–74mm. Field of view eyepieces for photomicrography are available.
Revolving Nosepiece:	Quintuple, on ball bearings.
Mechanical Stage:	Square stage (170 X 172mm), with low positioned coaxial control knobs. Rotatable. Rack-and-pinion drive. Movements on ball races, for both vertical and horizontal excursions. Working range : vertical 52mm, horizontal 76mm. Vernier scales reading to 0.1mm. Adjustable and removable specimen holder; interchangeable stage inserts.
Condenser:	Aplanatic/achromatic condenser, N. A. 1.40, with decenterable aperture iris diaphragm and graduated scale.
Condenser Mount:	With condenser centering device and rack-and-pinion height adjustment. Height displacement 30mm.
Light Source:	Tungsten lamp, 6V, 5A, with bulb centering device. Built-in collector, heat absorbing filter and transformer, variable 0–9.5V. Slot for insertion of light filters.
Auxiliary Lens System:	Flip-over type. Fitted with field iris diaphragm. For optimum illumination from low power to oil immersion objectives. Flips 180°. Knurled ring for operation of field iris diaphragm.

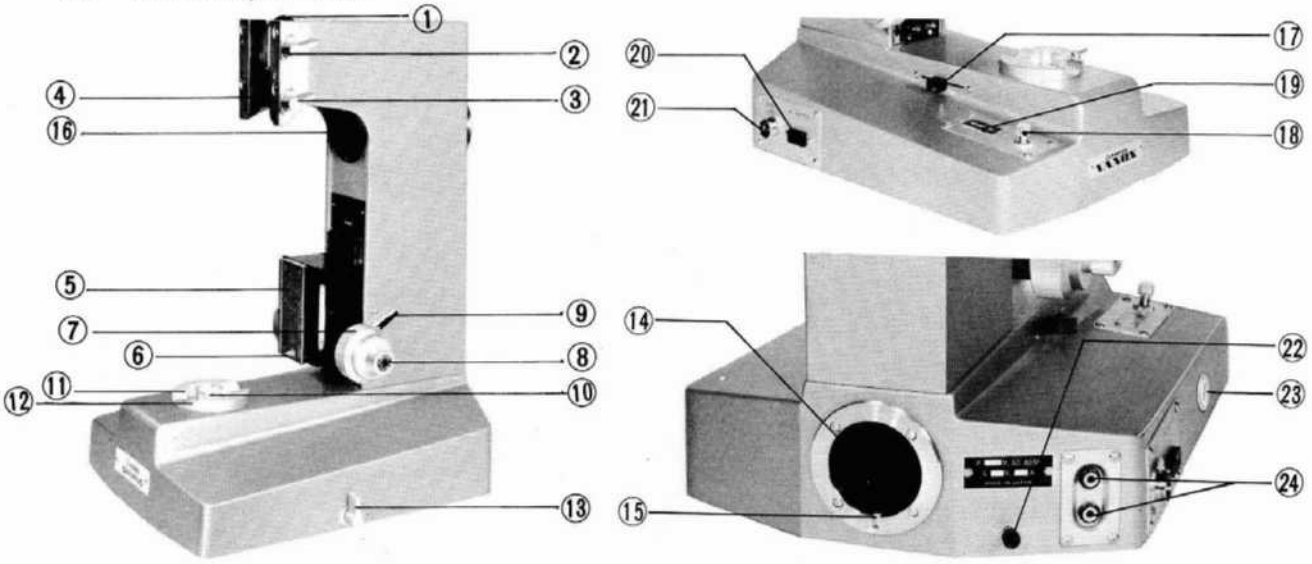
IV. Principal Components and Light Path Diagram





V. Identification of Microscope Components

A. Microscope Stand



① Selector Turret for height adjustment of observation tube. This turret ensures correct height positioning of the observation tube. It permits vertical tube adjustment in 3 positions and can be engaged in 3 positions, depending on the choice of accessories, as listed below.

Selector Turret ①	Application	Clamping Lever to be Used
S	Standard Microscopy	③
M. P	Metallurgical and polarized light microscopy	②
F. C	Fluorescent light microscopy, Magnification changer	

② ③ Tube Clamping Levers. Use lever ③ when the selector turret is in position "S", and lever ② when the turret is in position "M. P" or "F. C".

④ Tube Dovetail Mount. The mount accepts various types of observation tubes.

⑤ Stage and Condenser Mount Clamping Block: This block accepts various types of stages and the condenser mount.

⑥ Positioning Pin for Condenser Mount.

⑦ Coarse Adjustment Knob. Coarse adjustment range: 49mm.

⑧ Fine Adjustment Knob. Fine adjustment range: 2.3mm, graduated in increments of 1μ.

⑨ Automatic Pre-Focusing Lever. This lever prevents accidental damage to specimen or objective front lens. (See page 20.)

⑩ Light Exit.

⑪ Filter Mount. The mount accepts various types of filters, auxiliary lenses, centering frosted glass, etc.

⑫ Lever for Swing-out Frosted Glass.

⑬ Lever for Swing-out Auxiliary lens. Inserted into light path (pos. "UL") only when using very low magnification objectives (Pl 1.3 x and Pl 2 x).

⑭ Screw Mount for Transmitted Light Lamp House: The mount accepts tungsten, fluorescent, and other light sources.

⑮ Positioning Groove. To correctly orient the lamp house.

⑯ Opening for Incident Light Source.

⑰ Voltage Adjustment Knob. As sliding the knob toward the microscope arm along the slit, voltage rises.

* The knob must be set at the nearer end to you, when you turn on or off the main switch.

⑱ Main Switch (with built-in pilot lamp)

⑲ Voltmeter

⑳ Output Socket (to supply 500VAC to extra electric appliances)

* Power frequency selection between 50Hz and 60Hz is provided inside the base behind the 500VAC output socket. When the instrument is transferred from the 50Hz area to the 60Hz area or vice versa, change the freq. selection accordingly.)

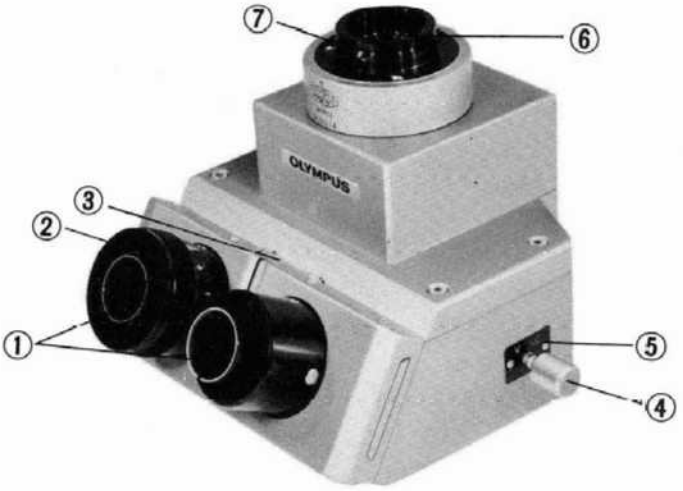
㉑ Line Cord Socket

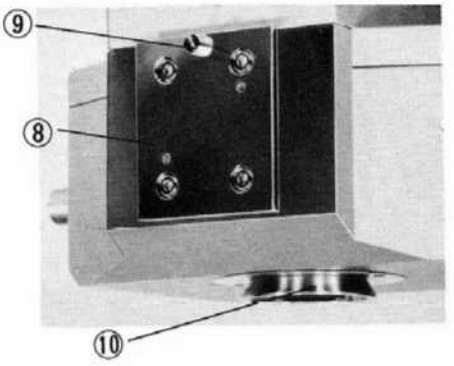
㉒ Grounding Terminal

㉓ Line Voltage Adjustment Screw

㉔ Low Voltage Outlet

B. Binocular Observation Tube with Photo Tube





① Eyepiece Tubes.

② Diopter Adjustment.

③ Interpupillary Distance Scale.

④ Light Path Selector Knob.

⑤ Indicator Plate for Light Path Selector. (See page 22.).

⑥ Eyepiece Tube for Photo Eyepieces. Accepts FK photo eyepieces, designed exclusively for photomicrography.

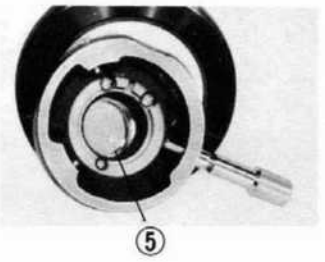
⑦ Camera Ring Dovetail Mount. Accepts the Photographic Equipment Model PM-10-A.

⑧ Dovetail Slide.

⑨ Positioning Pin.

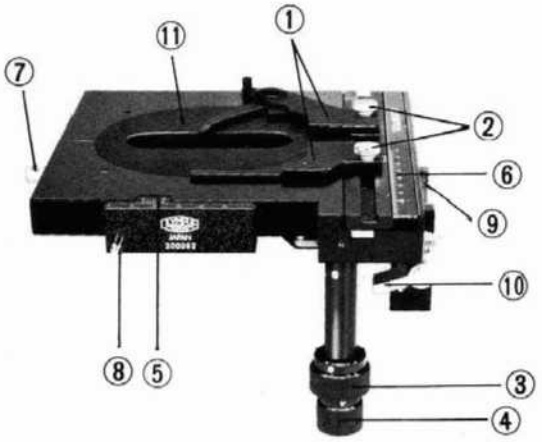
⑩ Nosepiece Dovetail Mount. Accepts various types of revolving nosepieces or intermediate adapters.

C. Revolving Nosepiece



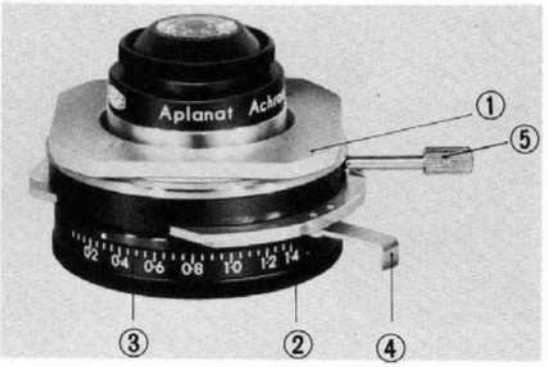
① Clamping Screw.
② Threaded Hole for Objective.
③ Knurled Ring.
④ Engravings. The engravings, coded A to E, are a guide for mounting the objectives in ascending order of magnification.
⑤ Opening for Analyzer.

D. Square Mechanical Stage with Low Drive Controls



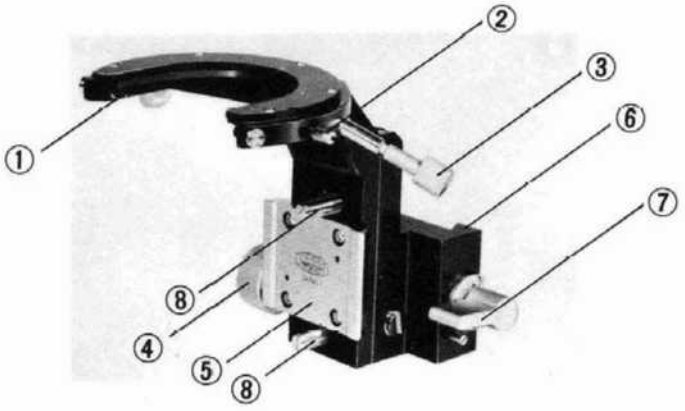
① Specimen Holder. By loosening the clamping screws ②, the distance between the holders can be adjusted or the entire holder can be removed. Adjustment is made according to the size of the specimen slide.
② Clamping Screws for Specimen Holder.
③ North-South Movement Knob. Range 52mm.
④ East-West Movement Knob. Range 76mm.
⑤ Graduated Scale for North-South Movement. With vernier reading to 0.1mm.
⑥ Graduated Scale for East-West Movement. With vernier reading to 0.1mm.
⑦ Clamping Screw for Stage Rotation.
⑧ Pin for Stage Rotation.
⑨ Dovetail Mount.
⑩ Clamping Lever.
⑪ Stage Insert. In addition to the standard insert (with longitudinal slot), inserts for metallurgical, fluorescent and polarized light observations are available.

E. Achromatic/ Aplanatic Condenser



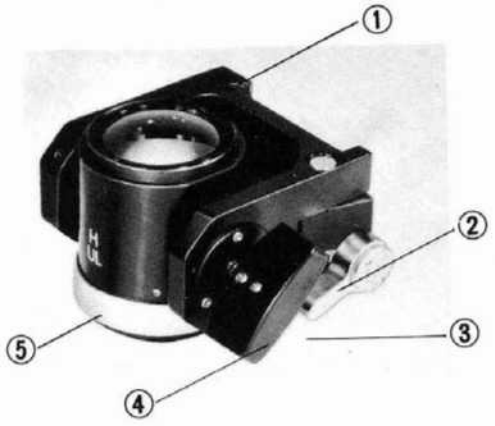
① Dovetail Slide.
② Knurled Ring. Permits adjustment of the aperture iris diaphragm.
③ Graduated Aperture Scale. The scale, engraved twice symmetrically, indicates numerical aperture values corresponding to the opening of the aperture iris diaphragm.
④ Slide Lever. This lever allows the center of the aperture iris diaphragm to be moved off the optical axis and rotated through 150°, thus obtaining oblique illumination. (See page 19.)
⑤ Clamping Screw. Permits simultaneous locking of slide and rotation.

F. Condenser Mount



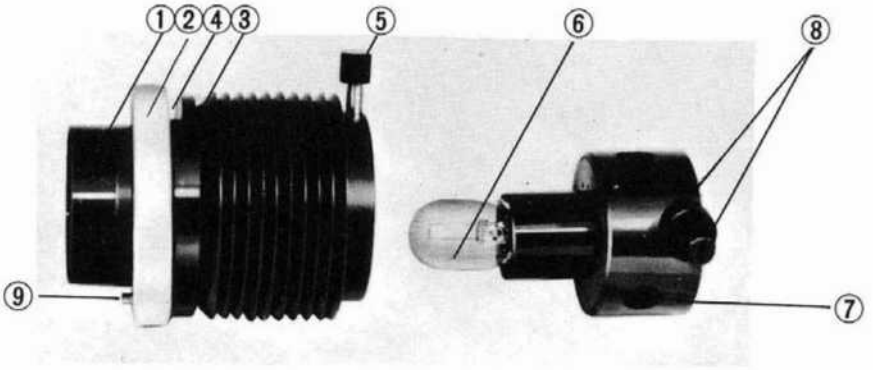
① Dovetail for Condenser Slide.
② Condenser Clamping Screw.
③ Condenser Centering Knobs.
④ Condenser Height Adjustment Knob.
⑤ Dovetail Mount for Auxiliary Lens System.
⑥ Mounting Bracket.
⑦ Clamping Lever.
⑧ Stop Pin for Auxiliary Lens System.

G. Auxiliary Lens System

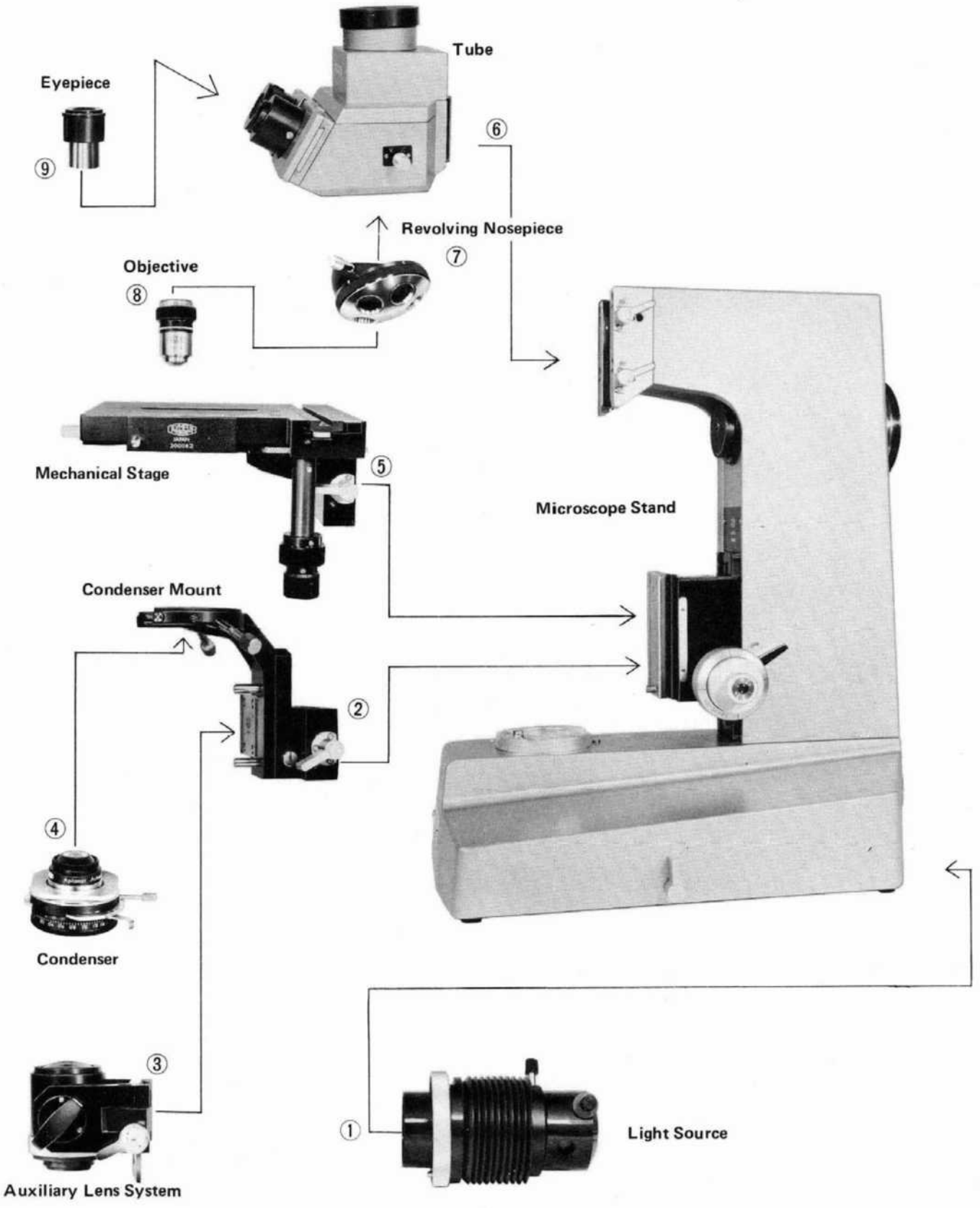


① Mounting Dovetail.
② Clamping Lever.
③ Stop Pin. (Provided beneath the dovetail)
④ Lens Rotating Knob. The knob is used to reverse the auxiliary lens system according to the objective magnification in use.
⑤ Knurled Ring. To adjust the field iris diaphragm.

H. Light Source



① Collector. Attached to lamp house by screw threads.
② Knurled Ring. To attach lamp house to the microscope stand.
③ Lamp House.
④ Filter Slot.
⑤ Lamp Socket Clamping Screw.
⑥ Low Voltage Bulb, 6V 5A. (See page 17.)
⑦ Lamp Socket.
⑧ Lamp Centering Knobs. Coaxial knob arrangement for bulb centration. (See page 17.)
⑨ Positioning Pin. The pin correctly orients the lamp house to the microscope stand.


Tube
Eyepiece
⑨
⑥
Revolving Nosepiece
⑦
Objective
⑧
Mechanical Stage
⑤
Microscope Stand
Condenser Mount
②
④
Condenser
③
Auxiliary Lens System
①
Light Source

Remove dust caps before mounting various components.
All clamping levers have arrows indicating their clamping direction.

1. Attachment of Light Source (Fig. 2)
   Insert the light source into the flange of the opening provided on the microscope stand, aligning positioning groove and positioning pin,and lock by turning the knurled clamping ring.
2. Attach the Condenser Mount.(Fig. 3)
   First loosen clamping lever ① , then fit the mounting bracket ③ of the condenser mount correctly into the clamping block ② of the stand from above, slide the condenser mount down all the way and lock with the clamping lever.
   The arrow mark on the clamping lever shows the locking direction.
3. Attach the Auxiliary Lens System.(Fig. 4)
   Loosen clamping lever ① of the lens system, press the unit onto the dovetail slide ② of the condenser mount, left side first and lock with clamping lever ①.

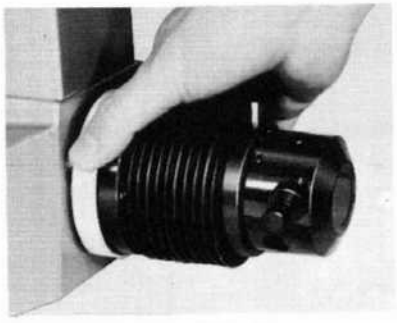


Fig. 2

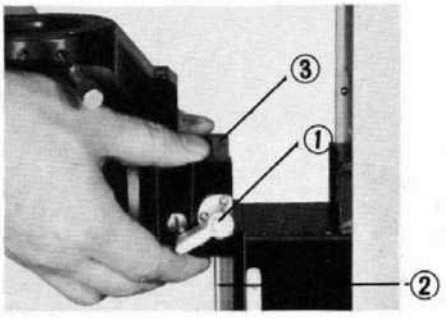


Fig. 3

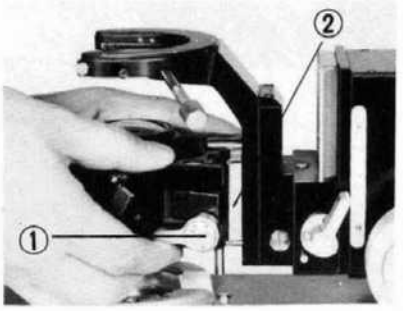


Fig. 4

4. Insert the Condenser.(Fig. 5)
   Turn the arrow mark ① on top of the condenser slide towards the condenser mount ③, slide the condenser into the dovetail and lock with clamping screw ②.

☆ The condenser can also be inserted or removed with the mechanical stage in place. In that case, lower the condenser with the condenser height adjustment until it can easily be removed without hitting the stage.

5. Mount the Mechanical Stage.
   Insert the stage into the mounting block of the microscope stand in the same manner as the condenser mount, slide down the stage all the way, and lock with clamping lever (Fig. 6). Stage insert and specimen holder are packed separately from the mechanical stage; therefore, attach the insert by aligning the positioning pin and groove, the holder by inserting into the slide provided on the stage.(Fig. 7.8)

☆ If the mechanical stage is intended to be used as a plain stage, the specimen holder need not be mounted.

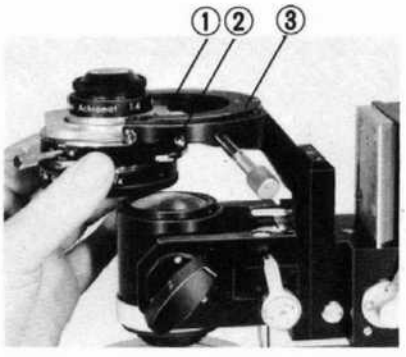


Fig. 5

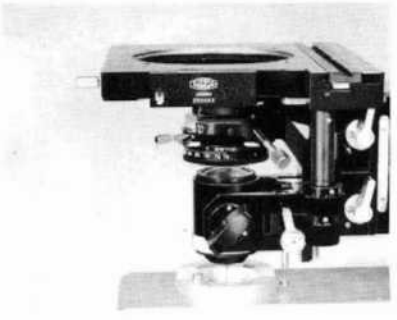


Fig. 6

6. Attach the Observation Tube.
   1) First turn the selector turret on top of the microscope stand to position "S".
   2) Check that the two clamping levers on the right hand side of the dovetail mount are unclamped (levers pointing upwards).
   3) Insert the tube dovetail slide into the dovetail mount on the microscope stand and lower the tube as far as possible.
   4) Lock the tube with the lower clamping lever. (Fig. 9)
   ☆ If the tube is used in standard position (selector turret at position "S"), be sure to clamp the lower clamping lever only.

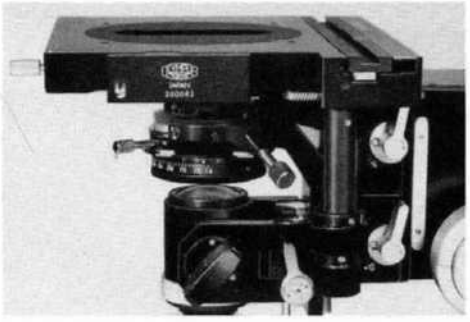


Fig. 7

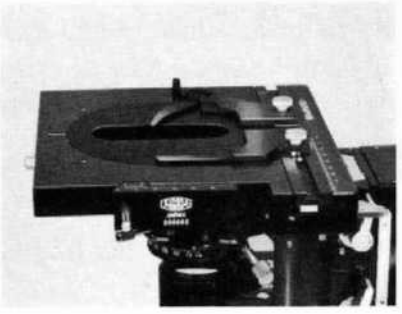


Fig. 8

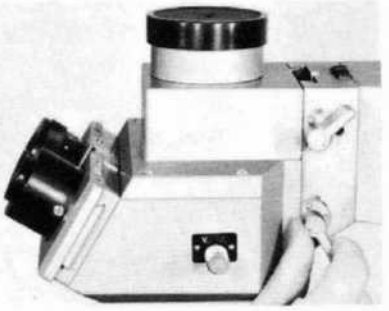


Fig. 9

7. Insert Revolving Nosepiece
   1) Lower the stage as far as possible.
   2) Unscrew the clamping screw ① of the nosepiece until it clears the thread ②. Pull spring-loaded clamping screw. This will cause the locating pin ③ to withdraw. (Fig. 10)
   3) With clamping screw ① pulled out, insert the nosepiece into the ring dovetail ④ on the tube, aligning locating pin ③ with the locating groove ⑤ on ring dovetail. Release clamping screw ① slowly and the locating pin will drive home into the locating groove. Tighten clamping screw ① (Fig. 11)
   ☆ Locating groove ⑤ and pin ③ are in alignment if the nosepiece carrier stays in place when slightly moved to the right and left before tightening knob.

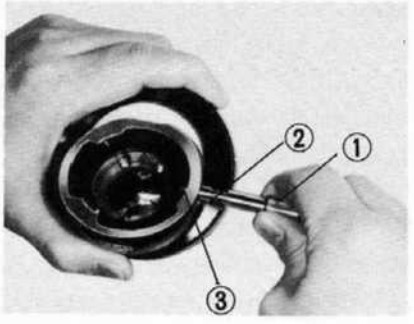


Fig. 10

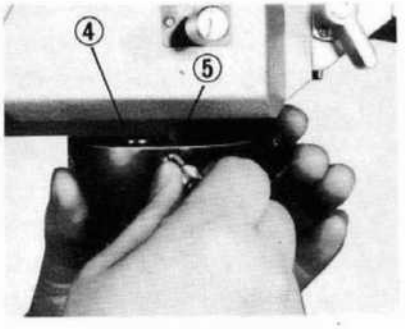


Fig. 11

8. Mount the Objectives.
   The objectives are mounted in ascending order of magnification according to the engravings A to E on the nosepiece.
9. Insert the Eyepieces.
   Insert a pair of WF10X eyepieces into the eyepiece tubes of the binocular observation tube.
   Use the field of view eyepiece for photomicrography only. (See page 24.)

It is good policy to keep the microscope immaculately clean. Remove visible spots, specks of dirt, dust or grease from all exposed glass surfaces.
A blower brush is a handy aid for this purpose.
How to put the microscope in operation:

1. Switch on tungsten light source.
2. Center the light bulb. (See page 17.)
3. Place a specimen slide on the mechanical stage.
4. Push in the light path selector knob on the binocular tube all the way (white band; 100% of the light is directed towards the eyepieces).
5. Make interpupillary and dioptric adjustments. (See page 22.)
6. Swing in the desired objective.
7. Select the auxiliary lens system according to the objective in use. (See page 18.)
8. Coarse focus with the coarse adjustment knobs.
9. Fine focus with the fine adjustment knobs.
10. Center the condenser. (See page 17.)
11. Adjust aperture iris diaphragm and field iris diaphragm. (See page 21.)
12. Adjust light intensity.

A. Electrical Connection

1) Insert the two plugs of the lamp cord into the low voltage outlet.
2) Insert the plug of the line cord into the line cord socket.
3) Make sure that the voltage adjustment knob is set at the nearer end to you (low voltage), then push the main switch to supply AC power to the instrument. When power is on, power pilot lamp lights.
   * As you push the main switch again, the light is off, and all power is cut off.
4) By raising the voltage progressively, you can ascertain that the bulb is on. Adjust light intensity to suit your requirement.

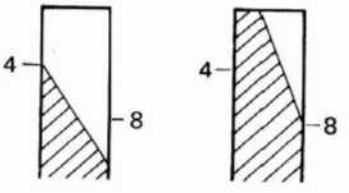
o Line Voltage Adjustment

1) Voltage Selector Switch
   At the bottom of the base is a voltage selector switch, which can be turned with a coin, to correspond with the voltage of main supply (110V, 120V, 220V or 240V).
2) Line Voltage Adjustment Screw
   The minimum voltage required for light source can be varied by means of the line voltage adjustment screw provided at the side of microscope base (on your left-hand side), since a silicon controlled rectifier (SCR) is adopted in the dimmer circuitry.
   If the bulb is dimmly lit upon switching on light source, the line voltage is proper, and you have only to manipulate the voltage adjustment knob in order to obtain optimum light intensity. However, in case the bulb does not light at all or does light up bright immediately after switching on, rotate gradually the line voltage adjustment screw with a coin, until the bulb dims.

   NOTE: For low voltage adjustment (0–9.5V) after dimming the bulb, use the voltage adjustment knob.

Voltmeter Reading

As the voltage adjustment knob is moved along the slit, the red zone shifts as shown schematically. The left-side picture indicates 4V, and the right-side picture 8V. Avoid prolonged use of the light source at readings in the red zone.



B. Center the Light Bulb

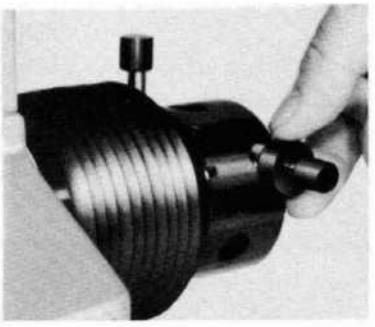
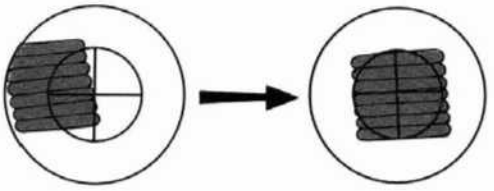


Fig. 12

1) First, make sure that the swing-out frosted glass at the light exit on the microscope base is disengaged, and that the swing-out auxiliary lens inside the base is in the light path (lever in vertical position).
2) Insert the centering frosted glass into the filter mount at the light exit.
3) Loosen the clamping screw of the lamp socket and move the socket back and forth to focus the bulb filament on the frosted glass. Adjust the light intensity, so that the filament can be easily recognized. Clamp the lamp socket.
4) Center the filament image with the two coaxial centering knobs on the lamp socket. (Fig. 12)
5) Remove centering frosted glass. Repeat the above procedure after installation of a replacement bulb.



Bulb Replacement Procedure:

1) Loosen the socket clamping screw and slide out the socket.
2) Remove the bulb by slightly depressing it against the seat and then rotating it in a counterclockwise direction.
3) Insert replacement bulb in reversed order.
   * Before use, wipe off thoroughly any fingerprints or stains on the bulb.

Fuse Replacement:

At the back of the 500VAC output socket, a fuse holder is positioned. When the fuse is burned, slide the microscope to the desk edge on which the microscope is placed, until there is an opening at the bottom of the microscope base enough to replace the burned fuse with a new one from beneath the base. Or lay down the microscope.

* Remove the observation tube, stage, etc, prior to replacement of the fuse.

C. Center the Condenser

1) The frosted glass at the light exit should be swung out of the light path and the swing-out auxiliary lens should be engaged (lever in vertical position).
2) Push in the light path selector knob on the binocular tube all the way (white band).
3) Place a specimen on the mechanical stage and use the objective 10X to bring the specimen in focus.
4) Raise the condenser all the way with the condenser height adjustment knob.
5) Swing the auxiliary lens system to position L and stop down the field iris diaphragm with the knurled ring. A slightly blurred image of the field diaphragm can now be seen in the eyepiece.
6) Move the condenser up and down to focus on the image of the field iris diaphragm.
7) While widening the diameter of the field progressively, use the condenser centering knobs to bring the diaphragm image into the center of the field of view. If the polygonal image of the iris diaphragm becomes inscribed in the field it means that the field diaphragm is centered. Slightly increase diameter of field iris diaphragm until it is just outside the field of view.

D. Operation of the Auxiliary Lens System

The auxiliary lens system helps in achieving perfect Koehler illumination at all magnifications by manipulation of the auxiliary lens system ① , the frosted glass ② , and the swing-out auxiliary lens ③ , respectively. Lens manipulation is achieved by means of levers or knobs as shown in the photograph. (Fig. 13) The correct lens positions for various objective powers are summarized in the following:

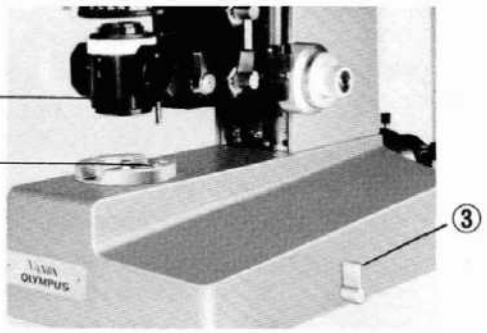


Fig. 13

Objective Magnification	Condenser		Auxiliary Lens System	Frosted Glass (Insertion into or removal from Light Path)	Lever Position of Swing-out Auxiliary Lens
	Achromatic/-Aplanatic N.A. 1.4	Low Power			
* 1.3X		O	H, UL	IN	UL
* 2X					
4X	O		L		VERTICAL
10X					
20X				OUT	
40X			H, UL		
100X					

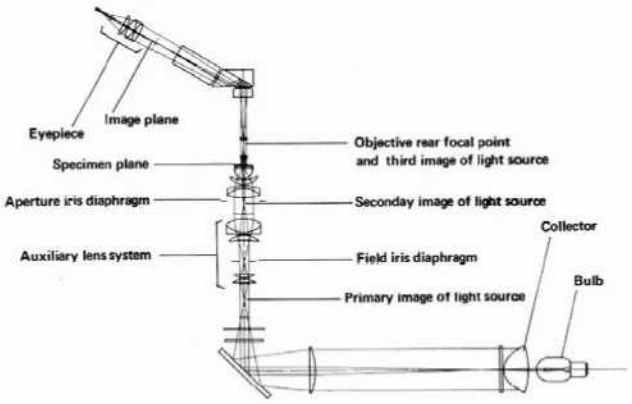
* The objectives 1.3X and 2X and the low power condenser are optional accessories.

Principle of Koehler Illumination

Koehler illumination may be described as follows: "If an image of a light source is conjugate with the rear focal plane of an objective and the field iris diaphragm of the light source is conjugate with the field of view of the objective/eyepiece combination, maximum light intensity of the light source is obtained and the field of view is free from 'illumination irregularities', irrespective of the shape of the light source." As shown in the drawing below, the filament of the light source (6 V, 5A) forms, through the collector, an image at the aperture iris diaphragm. This image, located at about the same place as the front focal point of the condenser, is projected by the objective to the rear focal point of the objective, that is, in the exit pupil of the objective. Since this image is then projected into the observer's pupil, it is completely invisible to the observer, hence, illumination free from 'irregularities' is obtained.

The field iris diaphragm, as will be noted from the drawing, freely controls, by its opening and closing, the diameter of the cone of light entering the condenser from the light source.

Correct Koehler illumination with the VANOX can be obtained by appropriate positioning of the auxiliary lens system and adjustment of aperture and field iris diaphragms.



E. Condenser

Achromatic/Aplanatic Condenser (N. A. 1.40)

EXCELLENT RESOLVING POWER

* Has extremely high resolving power and will give the operator satisfactory results even when used dry.
* Proves best its excellence when oil-immersed.
* When using objectives 100 X, the condenser should be immersed. The condenser can be used with all objectives from 4 X and up. Oblique illumination will further improve resolving power.

1. Oblique Illumination

Resolving power can be doubled.

As against the normal (central) illumination where the light beams are parallel to the optical axis of the microscope, oblique illumination provides light bundles at an angle to the optical axis.

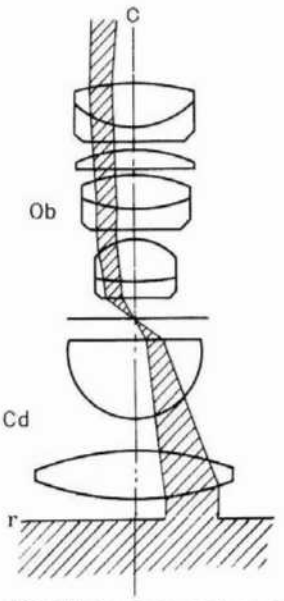
The illuminating light proceeds from below with an inclination to the specimen, which will cause not only the normal transmitted beam but also the refracted light to enter the objective. This will double the resolving power as compared with central illumination.

The drawing on the right hand side illustrates oblique illumination system.

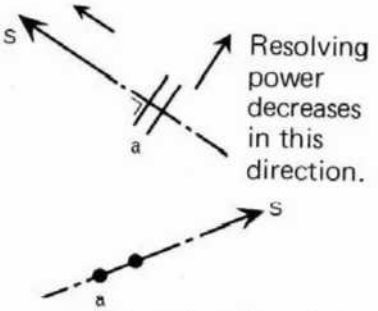
The cross hatched area represents the cone of light.

C: Optical axis Cd: Condenser

Ob: Objective r: Iris diaphragm



Resolving power increases in this direction.



a: Article to be identified

s: Sliding direction of iris

2. Procedure

1) Stop down the aperture iris diaphragm.
2) Loosen the clamping screw and pull out the aperture diaphragm with the slide lever. The direction of diaphragm displacement should be at right angles to the specimen detail to be observed.
   For example, if it is desired to identify two parallel details very close to each other as two separate lines, the aperture diaphragm is moved at right angle to the details. If identification of two points is desired, the diaphragm is moved parallel to the straight line connecting the two points.
3) Adjustment of the diaphragm slide and diaphragm diameter while looking through the eyepiece resolves the two lines or points and permits very detailed observation of the structure.

3. Observation of Overall Area Possible

Oblique illumination is effective only when the illuminating light is directed at right angles to the specimen.

In order to identify individual specimen details, therefore, it is necessary to adapt the direction of diaphragm displacement perpendicular to the direction of the specimen detail to be observed.

Diaphragm rotation through 150° is possible with the achromatic/aplanatic condenser. Stage rotation provides further possibility of directional adaptation.

F. Focusing Procedure

Both coarse and fine focusing adjustments affect vertical stage displacement.
Since all objectives are parfocal only a minimum of fine adjustment motion is required when changing objective powers.

1. Standard Focusing Procedure
   1) Operate the fine adjustment knob to bring the fine adjustment indicator line to the center of the fine adjustment range. (Fig. 14)
   2) Please the objective 10X in position.
   3) Bring the specimen close to the objective with the coarse adjustment knob.
   4) While looking through the eyepiece, lower the stage slowly and focus on the specimen.
   5) Turn the revolving nosepiece to bring the objective to be used into the light path.
   6) Set the auxiliary lens system according to the magnification of the objective.
   7) Adjust aperture iris diaphragm and field iris diaphragm. (See page 21.)
   8) Focus accurately with the fine adjustment knob.
   * Be sure to rotate the nosepiece only by its knurled ring.

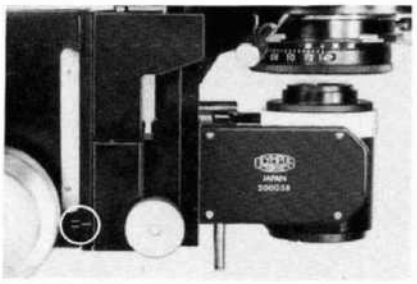


Fig. 14

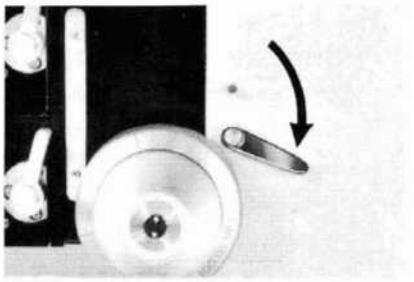


Fig. 15

2. Automatic Pre-Focusing Lever (Fig. 15)
   This lever is provided to prevent possible contact between specimen and objective as well as to simplify coarse focusing.
   The lever is locked after coarse focus has been accomplished. This prevents further upward travel of the stage and automatically provides a limiting stop if the stage is lowered and then raised again.
   The automatic pre-focusing lever does not restrict fine focusing.
3. Tension Adjustment of Coarse Adjustment Knobs
   While the coarse adjustment motion is normally stiff and heavy, it is freely adjustable for either heavy or light movement depending on the observer's preference. To adjust the tension hold the two coarse adjustment knobs with your both hands and rotate them in the opposite direction at the same time. (Fig. 16)

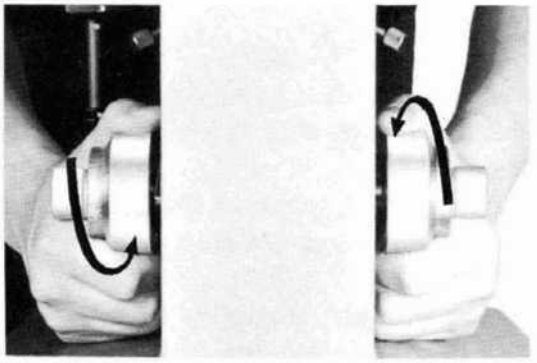


Fig. 16

G. Use of Iris Diaphragms

Aperture iris diaphragm as well as field iris diaphragm are provided on the microscope. The aperture iris diaphragm is part of the condenser and the field iris diaphragm is built into the auxiliary lens system. When ultra low magnification objectives are used, the function of the diaphragms is reversed.

Iris Diaphragm / Objective	Condenser Diaphragm	Auxiliary Lens System Diaphragm
Ultra Low Power (UL)	Field Iris Diaphragms	Aperture Iris Diaphragm
Low Power (L)	Aperture Iris Diaphragm	Field Iris Diaphragm
High Power (H)	Aperture Iris Diaphragm	Field Iris Diaphragm

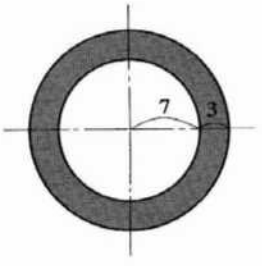
1. Aperture Iris Diaphragm

An aperture diaphragm opened too wide impairs image contrast due to internal reflections and related factors. On the other hand, if the diaphragm is stopped down excessively, resolution is unduly reduced. It is therefore suggested to match the opening of the aperture iris diaphragm to the numerical aperture of the objective in use, in order to achieve maximum objective performance.

For that purpose simply set the numerical aperture scale on the condenser to the numerical aperture (N. A.) of the objective in use.

However, since microscopic specimens generally are low in contrast, their image lacks contrast if the objective is used with its full numerical aperture. Therefore, it is occasionally preferable to stop down the aperture diaphragm slightly more than indicated by the objective N. A. This will result in increased image contrast, larger depth of focus and a flatter field. On the other hand, stopping down too much impairs resolution. An aperture setting of 0.7 X the N. A. of the objective is recommended.

If the numerical aperture of the objective is 1, for instance, you can set the scale to 0.7.



2. Field Iris Diaphragm

The field iris diaphragm controls the diameter of the ray bundle impinging on the specimen surface and thus increases image definition.

Stop down the field diaphragm while looking through the eyepiece. An image of an iris diaphragm will appear within the field. Now open the filed diaphragm until its diameter is just slightly larger than the diameter of the field of view.

H. Operation of the Binocular Observation Tube with Photo Tube

1. Select the Light Path.
   Operation of the light path selector knob located on the right side of the tube deflects the light in three directions as explained in the following chart: (Fig. 17)
   The knob shaft has color bands to identify the three settings and click stops to engage the light path selector in each position.

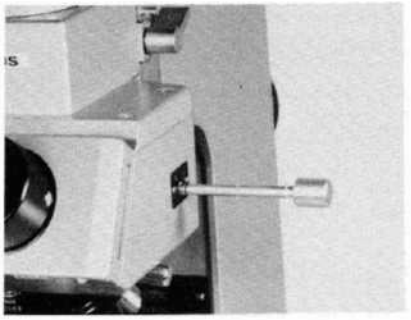


Fig. 17

	Position of Knob	Color on Knob Shaft (Indicator Plate)	Amount of Light
Observation Tube	Pushed in all the way	White (V)	100% into binocular tube
Observation Tube/ Photo Tube	Pulled out halfway	Yellow Green (CV)	20% into binocular tube, 80% into photo tube
Photo Tube	Pulled out all the way	Red (C)	100% into photo tube

The indicator plate summarizing the usage of the above table is provided at the knob port; it can be consulted before operating the knob.

V: Viewer (white letters) C: Camera (red letters)

CV: Camera & Viewer (yellow-green letters)

The colors of the letters correspond with the color bands on the knob shaft.

2. Diopter Correction
   Differences in eye acuity are often present in the same person so that long time microscopic observation would put considerable strain on the observer's eyes. Therefore, diopter adjustment of both eyes is a very useful aid.
   To adjust for your correct diopter setting: (Fig. 18)
   1) Look through the right eyepiece with your right eye and focus on the specimen.
   2) Next, look through the left eyepiece with your left eye and turn the diopter adjustment ring on the eyepiece tube to focus on the specimen.

Fig. 18

3. Interpupillary Adjustment
   Because of the constant tube length adjustment built into the observation tube, the mechanical tube length does not change at all if the interpupillary distance of the eyepiece tubes is varied. Hold the right and left eyepiece tubes with both hands and push the tubes together, or pull them apart, whichever is required, while looking through the eyepieces with both eyes, until perfect binocular vision is obtained. (Fig. 19)
   It is good practice to memorize the individual interpupillary distance setting.
   A scale is provided for this purpose, located between the eyepiece tubes.

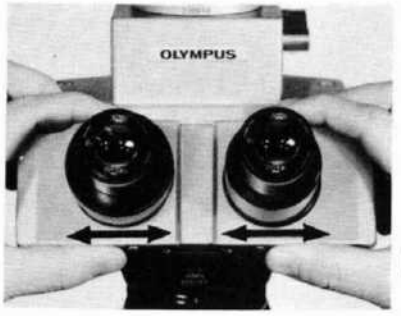


Fig. 19

I. Use of Immersion Optical Components

1. Immersion objectives:
   1) Focus on the specimen with a low-power objective.
   2) Put a drop of immersion oil on both the specimen and the objective front lens.
   3) Turn the revolving nosepiece to bring the immersion objective into the light path, and focus with the fine adjustment knob.
2. Immersion condensers:
   1) Remove the specimen from the mechanical stage and place a drop of immersion oil on the front lens of the condenser.
   2) Place the specimen on the mechanical stage and slowly raise the condenser until firm contact with the underside of the specimen slide is made. Care should be taken to prevent oil bubbles from forming in the oil film between condenser and specimen slide.
3. After use:
   Carefully wipe off the immersion oil deposited on the lens surfaces with gauze moistened with xylene.
   Never leave oil on the lens surfaces after use as oil remnants will seriously impair the performance of the lens systems.

VIII. Photomicrography

The Olympus Photomicrographic Equipment Model PM-10 is uniquely qualified to be used with the Research Microscope "VANOX" for routine and advanced photomicrography. A separate, detailed instruction manual is available for the PM-10 camera system. For quick reference, however, you may want to refer to the following pointers when using the PM-10.

1. Photographic Eyepiece
   Use only FK photo eyepieces for photomicrography.
   They are especially computed for this very purpose. Insert the eyepiece into the eyepiece tube of the photo tube.
2. Mounting the Photographic Unit
   Slip the body of the photographic unit over the eyepiece tube of the photo tube. Align the dots on photo tube and the PM-10 unit and clamp the camera unit to the photo tube. (Fig. 20)
   **When changing the photographic eyepiece, remove* the camera unit, exchange the eyepiece and re-mount the camera and then replace.

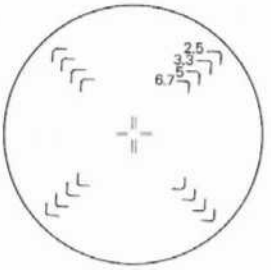
Fig. 20

3. Setting the Light Path Selector
   Refer to section H. 1., page 22,
   When photomicrography is performed on a constant basis it is recommended to keep the light path selector in position "CV" (camera/viewing) and to use position "V" (viewing) only for the observation of weakly illuminated specimens (fluorescence, polarization, for example). In this case and for work with short shutter speeds, the path selector is moved to position "C" (camera) for photography.

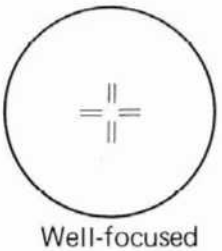
4. Focusing Procedure

Use the field of view eyepieces for focusing on the film plane. Each field of view eyepiece has a focusing front lens and a reticle with 4 frames, each frame indicating the area covered by a specific power FK photo eyepiece. Several type field of view eyepieces are available, according to the film size employed.

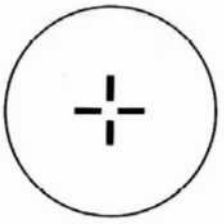
Attachment Camera	Field of View Eyepiece
35mm Back	[35] WF 10 X
3 1/4" X 4 1/4" Polaroid Back	[P] WF 10 X
4" X 5" Holder	[4.5] WF 10 X
120 Roll Film	[MH] WF 10 X



1) Select the field of view eyepiece matching the camera back in use and insert it into the right eyepiece tube of the binocular observation tube, aligning locating groove and locating pin.
2) While looking through the field of view eyepiece, turn the front lens in screw mount to focus on the double cross lines in the field.
3) Bring the specimen detail to be photographed within the frame corresponding to the power of the FK eyepiece in use and focus on the specimen with the microscope fine adjustment knobs. Make sure the light path selector knob on the observation tube is either on the white (V) or yellow-green (CV) band. (See page 22.)



Well-focused



Out of focus

5. Use of Filters

When using photographic filters, place them into the filter holder at the light exit in the microscope base.

For photography with black-and-white film:

G-533 (green) : This filter is most recommended, since it aids in obtaining photomicrographs of highest resolution and maximum contrast.

Y-48 (yellow) : Recommended as contrast filter when it is desirable to emphasize the blue color in the stained portion of a specimen.

C (cobalt) : Not generally recommended for photomicrographic purposes since it reduces both resolution and contrast. Use it for specific applications only when it is desirable to emphasize yellow in the stained portion of a specimen.

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