VI. ACCESSORIES

1. Sénarmont Compensator

To be inserted into the compensator slot of the intermediate tube "P" in place of the 1/4 λ & tint plate to measure the retardation with the accuracy of the λ unit. (Fig. 33)

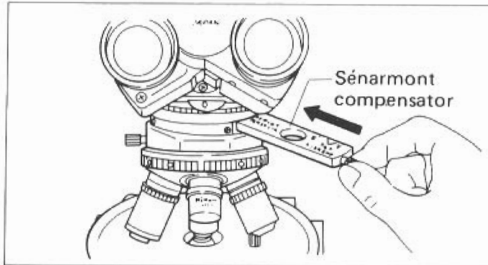

Fig. 33

1) Detecting of extinction position

Rotate the stage with the specimen under the crossed Nicols to find out the direction where the specimen part for measurement appears darkest.

2) Detecting of subtraction position

Rotate the stage 45° to bring it to the diagonal position from the extinction position and confirm that the interference color of the specimen part for measurement changes toward the lower order side by inserting **the 1/4 λ & tint plate** into the optical path. If the color changes toward higher order side, rotate the stage further by 90°.

3) Measurement

Inserting the filter GIF into the filter receptacle, **replace the 1/4 λ & tint plate by the compensator.**

Rotate the analyzer so as the specimen part for measurement becomes as dark as possible.

Let the angle of the above analyzer rotation be $\theta°$ then the retardation R (nm) will be obtained as follows:

$$R = \frac{\theta}{180}\lambda$$

where λ : wave length of the light used for the measurement

When the filter GIF is used: λ = 546nm

2. Quartz Wedge

The quartz wedge is used instead of the 1/4 λ & tint plate that is in the compensator slot of the intermediate tube "P". (Fig. 34)

With this wedge the retardation **in the range of 1 λ ~ 6 λ** can roughly be measured.

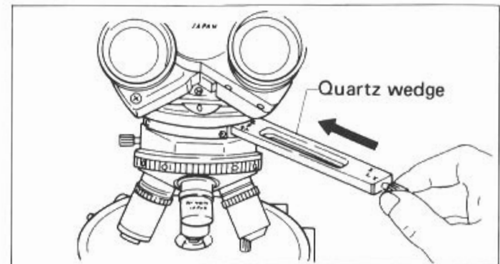

Fig. 34

1) Detecting of extinction position

Detect the position where the specimen part for measurement becomes darkest by rotating the stage under the crossed Nicols.

2) Detecting of subtraction position

Rotate the stage 45° to bring it to the diagonal position from the extinction position and confirm that the interference color of the specimen part for measurement changes toward the lower order side by inserting **the quartz wedge** into the optical path.

If the color changes toward the higher order side, rotate the stage further by 90°.

3) Measurement

By sliding the quartz wedge along the slot, the interference color changes consequently.

The wedge sliding is to be stopped when the specimen part for measurement comes under the dark stripe, then compare the interference color of the view field beyond the specimen but under the same dark stripe with the Interference Color Chart to assume the amount of retardation.

If the view field is entirely filled with the specimen around the part to be measured, restrict the illumination of the view field except around the part for measurement by means of the field diaphragm, remove the specimen away the optical path and then compare the interference color with the chart.

3. Monocular Eyepiece Tube "AP"

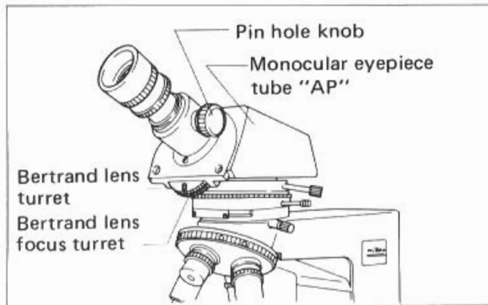

Fig. 35

1) Bertrand lens

The Bertrand lens is brought in and out of the optical path by turning the Bertrand lens turret.

The lens is in the optical path when the indication on the turret is B.

The Bertrand lens can be focused by turning the focus turret located under the Bertrand lens turret.

2) Pin hole knob

The pin hold can be put in or out of the optical path by operating the pin hole knob located right-hand side of the eyepiece sleeve.

By means of the pin hole, the conoscopic observation of the specimen area within 10μmφ (when a 100× objective is used) is possible.

4. Universal epi-illuminator

Used for episcopic polarizing microscopy, mounted between the X-POL stand and the intermediate tube "P".

1) Nomenclature

- Referring to Fig. 36, assemble in the order given.

① Remove the eyepiece tube and the intermediate tube "P" from the X-POL stand.

② Mount the universal epi-illuminator on the microscope arm, positioning the illuminator nearly parallel to the arm. Clamp the screw.

③ After releasing sufficiently the clamp screw on the lamp housing, to which the lamp bulb (12V−50W Halogen lamp) and socket is attached, insert the lamp housing into the universal epi-illuminator and clamp the screw.

④ Connect the lamp cord to the transformer.

⑤ Remove the accessory ND32 filter slider from the illuminator. Push in the polarizer slider until it clicks twice.

⑥ Place the filters.

⑦ Mount the intermediate tube "P" on the illuminator, fitting the notch of the circular dovetail on the end of the clamp screw. Fasten the clamp screw.

⑧ Referring to p.7, mount the eyepiece tube on the intermediate tube "P".

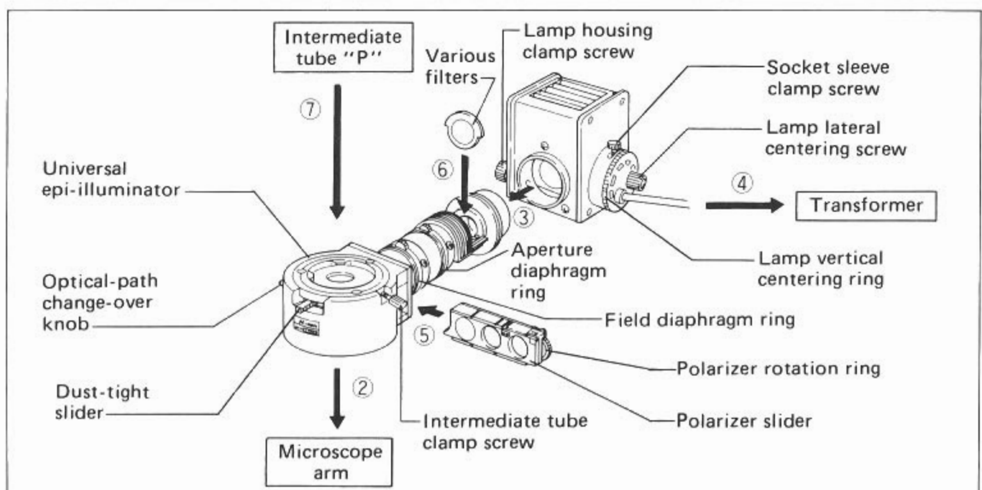

Fig. 36

2) Preparation

(1) Centering the lamp

① Make certain that the optical-path change-over knob is pushed to the limit.

② Turn ON the power switch on the transformer, set the voltage to 6V.

③ If the L900C filter is in the optical-path, remove this.

④ Fully open the aperture diaphragm.

⑤ Place the ND filter on the stage and focus on it using objective 10×.

⑥ Remove the eyepiece from the sleeve, looking into the exit pupil of objective, move the lamp housing back and forth to form a sharp image of the lamp filament on the diffuser of exit pupil.

⑦ Manipulate the lamp centering screws to center the filament image on the exit pupil.

⑧ Place the L900C filter.
If the image is found too dark with an objective of 40× or higher, remove the L900C filter.

(2) Orientation of polarizer (intermediate tube "P")

① Nearly focus on the ND filter on the stage using objective 40×.

② Set the polarizer graduation to "0".

③ Remove one eyepiece from the observation tubes.
Looking into the exit pupil of the objective, rotate the polarizer rotation ring to form the dark cross image on the exit pupil.
(Refer to Fig. 37)

Note : Take care not to touch the polarizer rotation ring while observing the specimen, or the orientation of the polarizer will get out of order.
If it is touched by mistake, readjust the orientation.

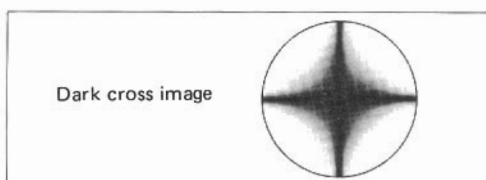

Fig. 37

3) Objectives

Use the objectives CF M Plan Achromat P series (Strain-free, 210/45).

4) For manipulation and microscopy, refer to diascopic polarizing microscopy.

5. Attachable Mechanical Stage Type "E"

To attach the attachable stage on the graduated stage, fit the two positioning pins on the rear side of the attachable stage into the two pin holes on the graduated stage surface, and clamp the screw using a driver or a coin.

Attachable mechanical stage is equipped with point counters, whose pitch is 0.2mm or 0.3mm. The counter can be replaced by releasing the head of the point counter by means of a coin and removing the milled part of the counter.

To release the click-stop of the point counter, release the click spring nut. (Fig.38)

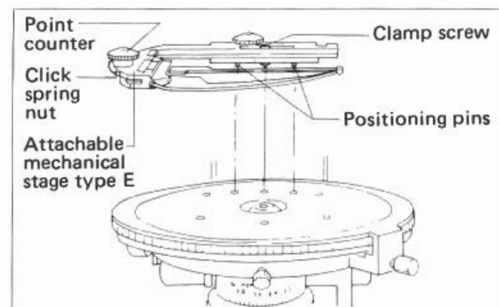

Fig. 38

6. Universal Stage

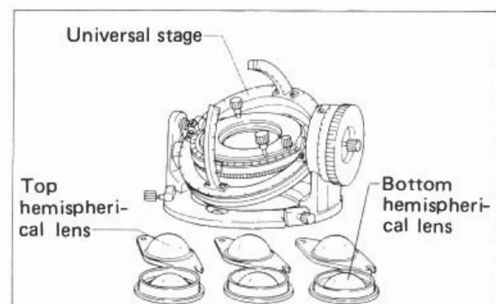

Fig. 39

When using the universal stage, lower the substage beforehand to face the white dot ● with the mark ◄ T on the microscope stand, referring to P. 15 12).

For using the universal stage, refer to the separate instructions on "Universal Stage".

VII. TROUBLE SHOOTING TABLE

Although nowhere you can find any disorder or derangement in the instrument, if you encounter some difficulty or dissatisfaction, recheck the use, referring to the table below:

1. Optical

Failures	Causes ——→	Actions
Darkness at the periphery or uneven brightness of viewfield (No appearance of viewfiedl)	● Optical path in trinocular tube not fully changed-over ——→	Changing-over to the limit (Refer to P. 9)
	● Centering nosepiece not in click-stop position (Objective not centered in optical path) ——→	Revolve it to click-stop position
	● Lamp bulb not centered ——→	Centering (Refer to P. 8)
	● Condenser not centered ——→	Centering by using field diaphragm (Refer to P. 10)
	● Field diaphragm too much closed ——→	Open it properly
	● Dirt or dust on the lens (Condenser, objective, eyepiece, slide) ——→	Cleaning
	● Improper use of condenser ——→	Correct use (Refer to P. 11)
	● Diffuser not set in or incorrectly positioned ——→	Correct positioning (Refer to P. 8)
	● Revolving nosepiece not correctly attached ——→	Correct attaching (Refer to P. 6)
	● Bertrand lens in the optical path ——→	Flip out (Refer to P. 13 & 19)
	● Pin hole in the optical path (in monocular eyepiece tube "AP") ——→	Swing out (Refer to P. 19)
	● Top lens of condenser incorrectly positioned ——→	Swing in to the limit
	● 1/4 λ & tint plate, compensator or quartz wedge incorrectly positioned ——→	Correct setting
Dirt or dust in the viewfield	● Dirt or dust on the lens (Condenser, objective, eyepiece, field lens) ——→	Cleaning
	● Dirt or dust on the slide ——→	Cleaning
	● Too low position of condenser ——→	Correct positioning (Refer to P. 10)
No good image obtained (low resolution or contrast)	● No coverglass attached to slide or NCG objective used with coverglass ——→	Correct use (Refer to P. 13)
	● Too thick or thin coverglass ——→	Use specified thickness (0.17mm) coverglass (Refer to P. 13)
	● Immersion oil soils the top of dry system objective (especially 40×) ——→	Cleaning
	● Dirt or dust on the lens (condenser, objective, eyepiece, slide) ——→	Cleaning
	● No immersion oil used on immersion system objective ——→	Use immersion oil (Refer to P. 13)
	● Air bubbles in immersion oil ——→	Remove bubbles
	● Not specified immersion oil used ——→	Use Nikon immersion oil

Failures	Causes →	Actions
	● Incorrect illumination →	Correct the illumination (Refer to P. 8)
	● Dirt or dust on the entrance lens →	Cleaning
Image quality deteriorated	● Condenser aperture too much closed →	Open properly (Refer to P. 12)
	● Too low position of condenser →	Bring it up to coincidence with field diaphragm image (Refer to P. 10)
	● Diffuser not inserted →	Insert it in correct position (Refer to P. 8)
Oneside dimness of image	● Centering nosepiece not in click-stop position →	Revolve it to click-stop position
	● Centering nosepiece not correctly attached. →	Insert it to the limit and clamp it firmly
	● Centering nosepiece not clamped →	Clamp tightly
Image moves while being focused	● Specimen rises from stage surface →	Place it stable
	● Centering nosepiece not in click-stop position →	Revolve it to click-stop position
	● Centering nosepiece not clamped →	Clamp tightly
	● Condenser not correctly centered →	Correct centering (Refer to P. 10)
	● Lamp bulb not correctly centered →	Correct centering (Refer to P. 8)
	● Optical path in trinocular tube not fully changed-over →	Changing-over to the limit (Refer to P. 9)
Image tinged yellow	● NCB 10 filter not used →	Use NCB 10 filter
	● Too low power source voltage →	Raise the voltage over 6 on the indicator
Too bright image	● ND filter not used →	Use ND filter

2. Manipulation

Failures	Causes →	Actions
No focused image obtained with high power objectives	● Upside down of slide →	Turn over the slide
	● Too thick coverglass →	Use specified thickness (0.17mm) coverglass (Refer to P. 13)
High power objective touches the slide, when changed-over from low power	● Upside down of slide →	Turn over the slide
	● Too thick coverglass →	Use specified thickness (0.17mm) coverglass (Refer to P. 13)
	● Eyepiece diopter not adjusted (Especially when changing-over low power objective 2×) →	Diopter adjustment (Refer to P. 9)

Failures	Causes →	Actions
Insufficient parfocality of objective(when changed-over)	● Eyepiece diopter not adjusted →	Diopter adjustment (Refer to P. 9)
Movement of image not smooth by moving the slide	● Attachable mechanical stage not tightly fixed →	Fix it tightly
No fusion of binocular images	● Interpupillary distance not adjusted →	Adjustment (Refer to P. 9)
Fatigue of observing eyes	● Incorrect diopter adjustment → ● Inadequate brightness of illumination →	Correct adjustment (Refer to P. 9) Use ND filter or change power voltage

3. Electrical

Failures	Causes →	Actions
Lamp does not light even though switched ON	● No electricity obtained → ● No lamp bulb attached → ● Lamp bulb blown → ● Fuse blown →	Connect the cord to socket Attaching Replacement Replacement
Unstable brightness of illumination	● Input voltage not adjusted to house current voltage → ● House current voltage fluctuates too much → ● Lowest voltage adjustment not made →	Turn the change-over switch on the microscope bottom Use transformer or the like (for adequate voltage) Make adjustment (Refer to P. 7)
Strong glare even at lowest voltage, when using low power objective	● Lowest voltage adjustment not made →	Make adjustment (Refer to P. 7)
Lamp bulb promptly blown	● Not specified lamp bulb used → ● Too high voltage of house current →	Use 12V–50W specified lamp bulb: (Halogen bulb: OSRAM 64610 or PHILIPS 7027) Use transformer for adjustment

Failures	Causes ——→	Actions
Insufficient brightness of illumination	● Lamp bulb not centered ——→	Centering (Refer to P. 8)
	● Condenser not centered ——→	Centering (Refer to P. 10)
	● Condenser aperture too much closed ——→	Open it properly (Refer to P. 12)
	● Too low position of condenser ——→	Correct positioning (Refer to P. 10)
	● Not specified lamp bulb used ——→	Use 12V-50W specified Halogen bulb
	● Dirt on lens (condenser, objective, eyepiece, field lens, filter) ——→	Cleaning
	● Too low voltage ——→	Raise the voltage
Fuse blown	● Not specified fuse used ——→	Use 1A/250V or 0.75A/250V
Flickering or unstable brightness of lamp bulb	● Lamp bulb going to be blown ——→	Replacement
	● Connector not connected securely ——→	Secure connection
	● Fuse holder not firmly fastened ——→	Firm fastening
	● Irregular change of house current voltage ——→	Use stabilizer
	● Lamp bulb insufficiently inserted into the socket ——→	Positive connection