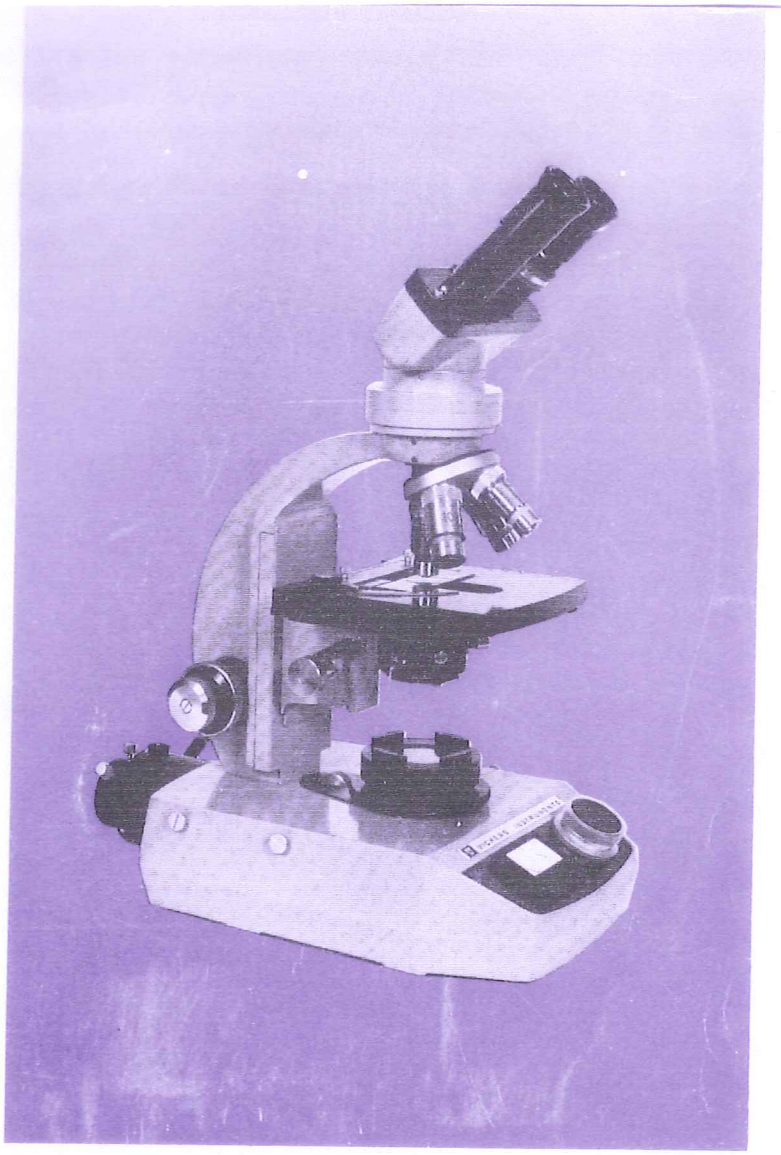


M15c MICROSCOPE
INSTRUCTIONS

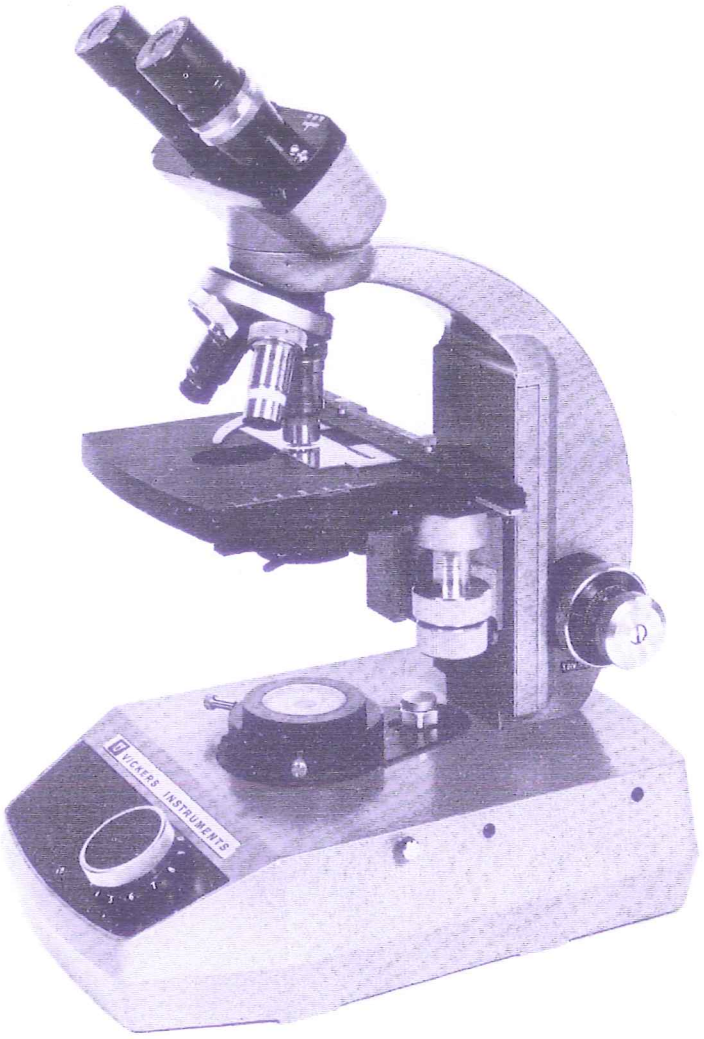
VICKERS LTD.
VICKERS INSTRUMENTS

(June 2002)
Dr copy

M15c MICROSCOPE

INDEX

In the book - there wasn't a page 2.!



Unpacking

The M15c Microscope will arrive packed in a fitted wood cabinet or in an expanded polystyrene container.

The microscope is secured in the cabinet by a large screw which passes through the bottom of the cabinet.

The stage bracket will be supported by a polystyrene block which can be removed from between the substage and microscope base after raising the stage with the coarse movement—(see Fig. 4 for direction of rotation).

A. ASSEMBLY

Fitting the stage

If the stage (simple or mechanical) is supplied detached, it must be fitted to the stage bracket by the four securing screws using the short screwdriver provided. Correct alignment ensuring that the stage movements are truly East-West, North-South can be made after the microscope is set up. When the screws are just lightly tightened the stage can be rotated very slightly side to side to align the axes before finally tightening them up.

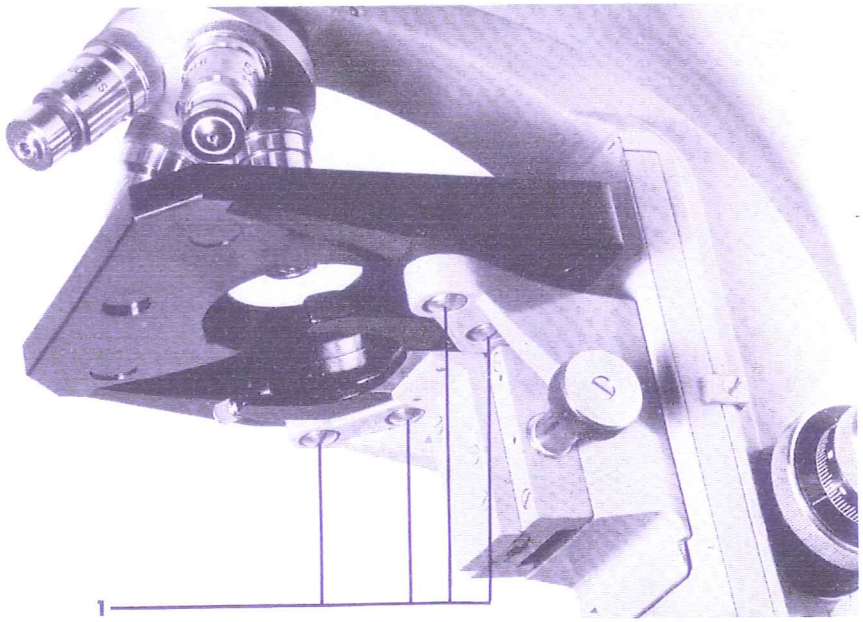


Fig. 2
1. Stage securing screws.

Fitting the viewing head or magnification changer

The viewing heads are each attached to the microscope limb on a cone fitting clamped firmly in position by the side-facing knurled screw. The magnification or barrier filter unit is attached in a similar manner between the limb and viewing head.

Fitting the illuminator

The illuminator, including the mirror in gimbal for external lamps and the internal mirror supplied with the camera base and tungsten halogen base illuminators, plug directly into the microscope base key-hole shaped aperture. The lamp units are clamped in place by the knurled screw to the right of the microscope base. The lead from the mains lamp, wide field illuminator or low-voltage illuminator is fitted with a plug which fits into the small electrical socket inside the microscope base.

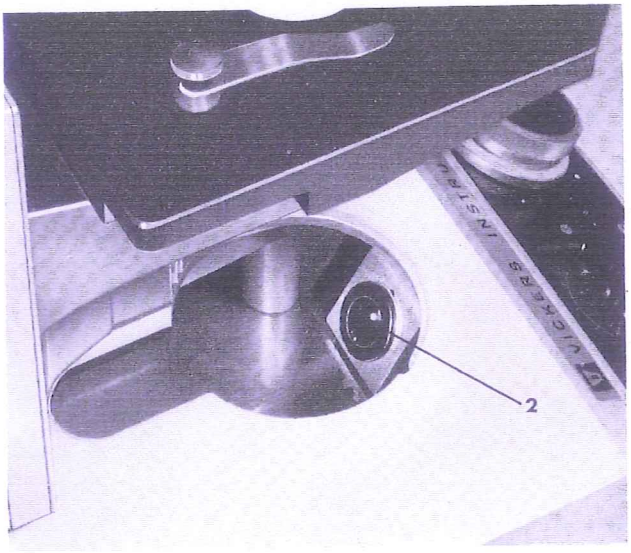


Fig. 3
2. Socket for illuminator plug.

The mains lead is provided with a three pin plug which fits into the socket at the outside rear of the microscope base. The lead is colour coded as follows:—

Green and yellow — Earth
Brown — Live
Blue — Neutral

The correct mains voltage is printed on the microscope base bottom cover.

Fitting the condenser and objectives

The condenser is inserted from beneath into the substage ring-mount whilst ensuring that the shoulder bears fully against the mount. The condenser is clamped by the side facing knurled screws. Essential controls should point towards the operator.

The objectives should be mounted into the objective changer anti-clockwise from above in ascending order of power starting at the marked aperture. Parfocality and parcentricity within tolerances can only be maintained if the objective threads and objective changer bearing face are clean before insertion. Objectives should always be retained in their original apertures.

Fitting the arm-rests

The black perspex arm-rests are fitted to the side of the microscope by being placed gently onto the appropriate two studs before being allowed to slide into place. Equal care should be taken when removing the arm-rests.

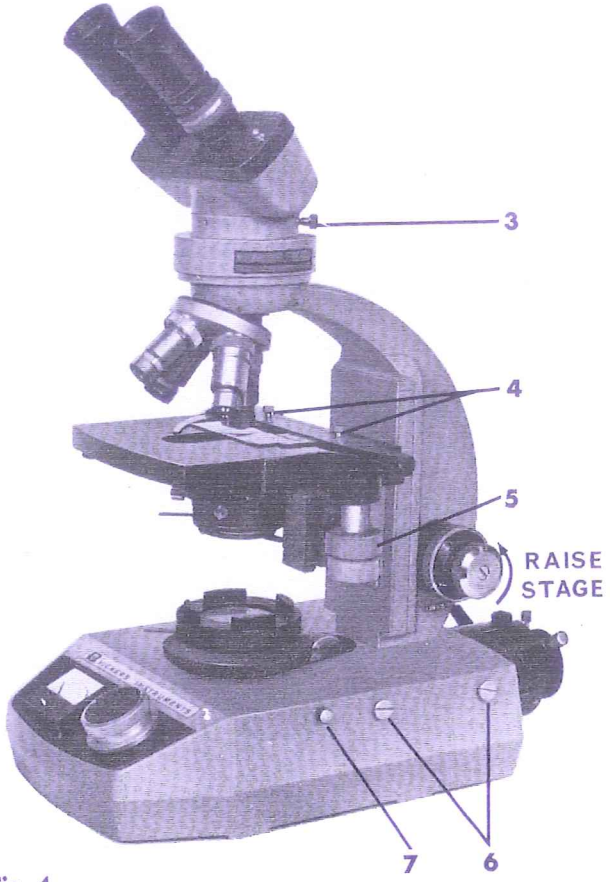


Fig. 4

3. Clamp screw, magnification changer/viewing head.
4. Slide carrier fastening screws.
5. Stage traverse controls.
6. Arm-rest attachment studs.
7. Illuminator fixing screw.

B. MICROSCOPE COMPONENTS

Focusing movements and substage

The coarse and fine movements are coaxial, the inner, fine knob being calibrated to approximately 2μ on one spindle. The coarse motion has a total movement of 35 mm and the fine motion has a total movement of 1·9 mm. Both movements operate directly on the stage. An internal friction clutch prevents damage to the mechanism on overrun of the controls.

The rack and pinion condenser focusing control has a total range of 25 mm and is fitted with a range stop accessible from the left hand side directly beneath the stage. The stop, which is secured by a grub screw, limits the upper movement of the condenser carrier to prevent the condenser crashing into the microscope slide.

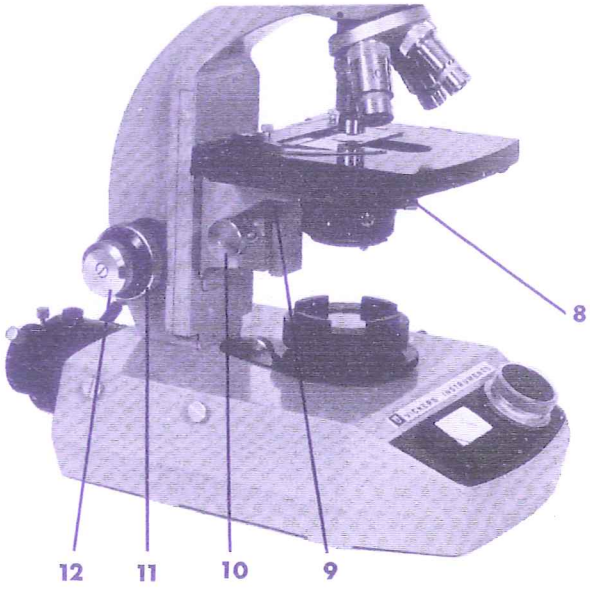


Fig. 5

8. **Condenser clamp.**
9. **Condenser substage height stop.**
10. **Substage focusing.**
11. **Coarse focusing knob.**
12. **Fine focusing knob.**

Mechanical stage

The square mechanical stage fitted for right handed use has a very large working surface. The stage controls have a cross movement of 50 × 75 mm read from verniers to 0·1 mm, the slide carrier itself being removable. The two small knurled screws should be removed whereupon the carrier can be lifted free. Any small spacer washers must be replaced when refitting the carrier.

Viewing heads

The binocular viewing head is provided with one fixed and one focusing eyepiece tube together with a scale in millimetres for the interocular setting. In use, after the interocular distance has been correctly set, the fixed tube (left-hand) should be used with the appropriate eye (left-hand) the other tube should then be rotated until the image is also in focus for that eye. The correct setting of interocular distance may be recognised when the operator can comfortably fuse the two images.

The binocular phototube and the high efficiency binocular head are each fitted with two focusing eyetubes. The reading obtained for interocular separation should be transferred to each of the scroll tubes. Any residual focusing difference between the two tubes should then be removed by rotating one preferred eyepiece scroll tube whilst maintaining focus with the other.

The binocular phototube splits the light permanently in the ratio 50 : 50 between the eyepiece and monocular tube. The unit has a magnification factor of 1·3x approx. The binocular phototube with trip-out mirror directs all the illumination to either the eyepiece or to the monocular tube, depending on the lever position. Up—to monocular tube. Angled—to eyepiece. The unit has a magnification factor of 1·3× approx. The standard binocular head has a 1× factor.

Insertion of Eyepiece Graticules

The graticule should first be examined with a hand magnifier in a good light. On one side it will be seen that the engraved scale has a second, darker image of itself, slightly displaced in one direction. This is formed by a reflection off the back, chromed surface of the graticule and it is this double-image side which should be put next to the stop in the eyepiece, irrespective of whether the graticule is inserted from above or below.

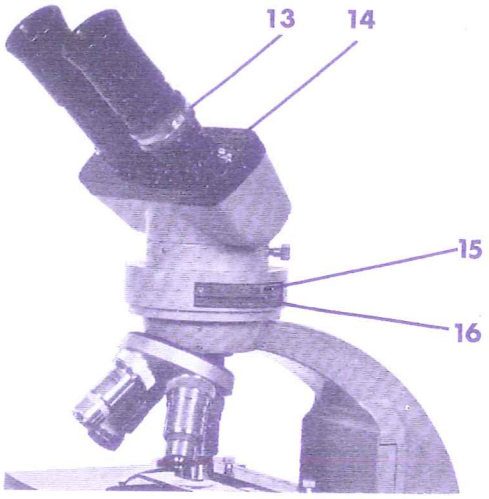


Fig. 6
13. Focusing eyepiece tube.
14. Interocular setting scale.
15. Magnification change ring.
16. Bertrand lens focusing.

Magnification changer

The magnification changer fits between the microscope limb and the viewing head.

Rotation of the upper milled ring will bring three different magnification systems of powers, 1×, 1·5× and 2·25× successively into the light path.

The fourth position contains a Bertrand lens 'B' which, together with the eyepieces can be used to view an image of the objective back aperture. The lower knurled ring when turned, will focus the Bertrand lens to suit the back aperture of different objectives.

Alternatively the back aperture may be viewed simply by removing an eyepiece or by temporarily replacing one eyepiece with a focusable auxiliary telescope.

Objective systems

Each objective is engraved with the type, power, numerical aperture and where applicable, the permitted cover slip thickness. A black ring on the objective mount in addition to the engraved markings indicate a fluorite, and a white ring an apochromat. A colour ring on the objective mount denotes the power of the objective.

All objectives are corrected for a tube length of 160 mm and where necessary a standardised 0·18 mm cover slip thickness; corresponding approximately to size 1·5.

The objectives should always be used under the range of conditions for which they were designed. The maximum overall microscope magnification should lie between 500 and 1,000 times the objective numerical aperture. Any magnification over this range supplies no additional information about the microscope image and is therefore referred to as empty magnification. Careful attention to eyepiece and instrument magnification factors and to objective powers will help to avoid this common error. Higher magnifications are however of assistance in many fields of application. Where necessary because of short working distances the higher power objectives are provided with spring mounts to avoid collision damage either to the specimen or to the objective front components.

Oil immersion objectives should be used with standard non-drying ALP1 immersion oil, a little being applied between the slide and objective front lens. After use any oil should be wiped from the objective with a lens tissue lightly moistened with industrial alcohol. Oil should not be allowed to remain for extended periods on the stage.

Condenser systems

Three bright field condensers are currently available.

The achromatic 1·25 N.A. condenser which can be oiled for high power work and which is fitted with an auxiliary field lens is intended basically for all round use particularly with the 6-volt 30-watt illumination base.

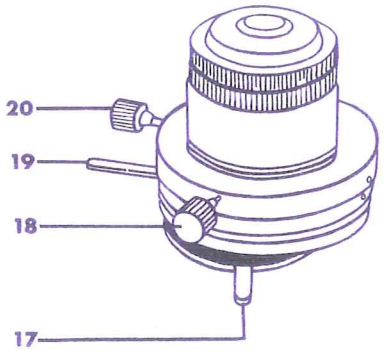


Fig. 7
17. Auxiliary lens.
18. Condenser centring.
19. Aperture diaphragm.
20. Condenser centring.

The Abbe condenser which should not be oiled is a suitable inexpensive system for student and routine use. The centrable version has a high light transmission making it highly suitable for fluorescence application.

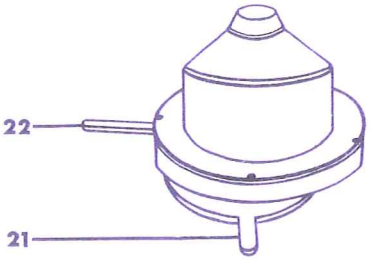


Fig. 8
21. Filter tray.
22. Aperture diaphragm.

The swing-out top lens condenser is a better corrected system for student and routine use but is of limited application for the 6-volt 30-watt base or for fluorescence.

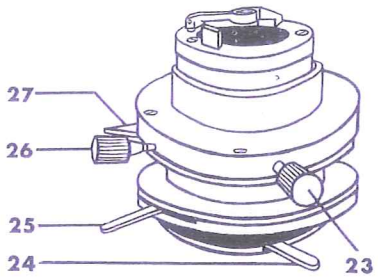


Fig. 9

23. Condenser centring.
24. Filter tray.
25. Aperture diaphragm.
26. Condenser centring.
27. Swing out lever.

Eyepiece systems

Compensating eyepieces should always be used for high power objectives and for fluorite and apochromatic objectives. Certain eyepieces are fitted with a collar beneath the field lens which can be removed for the insertion of graticules.

C. ILLUMINATION SYSTEMS AND MICROSCOPE ADJUSTMENT

With all systems of illumination the whole field of view should be evenly illuminated and the back aperture of the objective should be filled to at least 7/10 by area. The back aperture can be observed either with the magnification changer Bertrand lens or with a separate auxiliary telescope. Simple removal of an eyepiece will permit an overall view of the back aperture.

The best starting position for all illumination adjustment is with the condenser racked fully up, with a low power objective (10X) in position and with a well stained specimen.

The aperture diaphragm is intended only for aperture control, any brightness control should be achieved by dimming the lamp or by employing suitable filters.

When a centrable condenser is employed it should be so adjusted that the image of the aperture diaphragm in the objective back aperture closes concentrically with the back aperture.

C1. MAINS VOLTAGE ILLUMINATOR

Basic description

Non-centring condensers should be used with this unit.

The mains voltage bulb has a bayonet fitting and should be adjusted to the lamp condenser after replacement. The bulb should be orientated with its holder to present the maximum amount of filament to the condenser. When adjusting the bulb after fitting the illuminator into the microscope base, the diffuser should be removed from the clip and be held beneath the substage condenser. The lamp can then be centred with the bulb centring control until the illuminated patch of light is well adjusted. The diffuser is then replaced. When working with the Abbe condenser and 3X objectives a diffuser should be placed in the condenser filter tray.

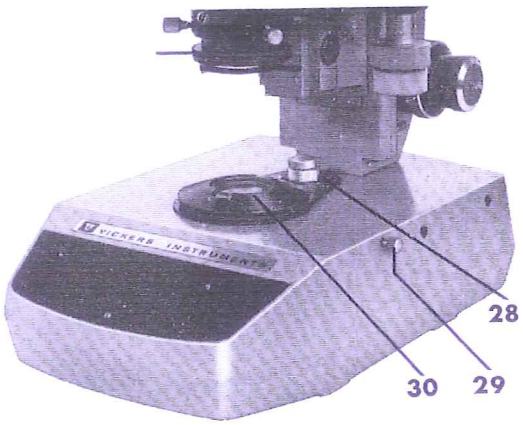


Fig. 10

28. Bulb centring control.
29. Illuminator centring screw.
30. Diffuser clip.

Condenser adjustment

1. Rack the condenser to upper limit.
2. Select low power objective (10X) and focus the specimen.
3. Observe the objective back aperture and adjust condenser aperture diaphragm to fill 7/10th of back aperture.

4. If the back aperture cannot also be filled with illumination drop the condenser a little until just filled.
5. Revert to normal viewing.

	Abbe	Swing-out
3X	Diffuser on Condenser	Diffuser on Lamp
5X	Diffuser on Lamp	Diffuser on Lamp Top lens swung out
10X	Diffuser on Lamp	Diffuser on Lamp Top lens swung in
20X	Diffuser on Lamp	Diffuser on Lamp Top lens swung in
40X	Diffuser on Lamp	Diffuser on Lamp Top lens swung in
100X	Diffuser on Lamp	Diffuser on Lamp Top lens swung in

Spare bulbs: 240 volt M006015 Pack of 10
25 watt 110 volt M006016 Pack of 10

C2. LOW VOLTAGE ILLUMINATOR

Basic description

Non-centring condensers should be used with this unit.

The low voltage 6 volt 18 watt illuminator has a bayonet fitting and is externally pearl-frosted.

Bulb centring should be achieved after the unit has been adjusted to centre and the field diaphragm focused in the field of view. When working with all condensers with a 3X objective a diffuser should be used in the substage condenser filter tray.

The lamp is switched on and the intensity is adjusted by the rheostat knob. The maximum recommended setting is 8 on the knob which position corresponds to about 6 volts. The life of the bulb will be considerably reduced if this setting is exceeded or if the lamp is turned up too rapidly to maximum intensity.

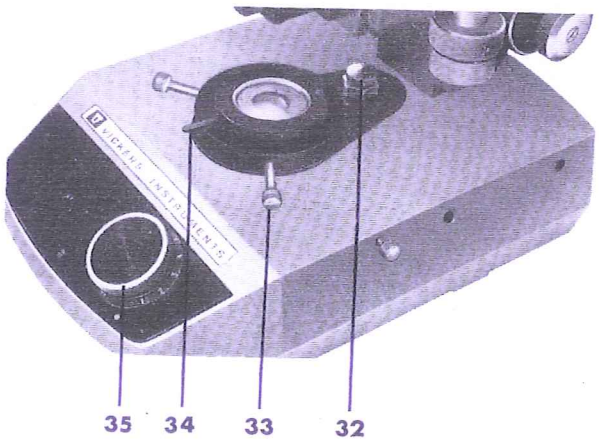


Fig. 11
31. Illuminator fixing screws.
32. Bulb centring control.
33. Field diaphragm centring.
34. Field iris.
35. Rheostat.

Condenser adjustment

1. Rack the condenser to upper limit.
2. Select low power objective (10X) and focus the specimen.
3. Close the field diaphragm and focus it in the field of view with the condenser focusing controls.
4. Centre the field diaphragm in the field of view with the iris centring controls and open it to fill the field of view.
5. Observe the objective back aperture and adjust the condenser aperture diaphragm to fill 7/10ths of back aperture.
6. Revert to normal viewing and operate the bulb centring control until the field of view is evenly illuminated.

	Abbe	Swing-out
3X	Diffuser on Condenser	Diffuser on Condenser Top lens swung out
5X	No Diffuser	No Diffuser Top lens swung out
10X	No Diffuser	No Diffuser Top lens swung in
20X	No Diffuser	No Diffuser Top lens swung in
40X	No Diffuser	No Diffuser Top lens swung in
100X	No Diffuser	No Diffuser Top lens swung in

Spare bulbs: 6 volt 18 watt M006035 Pack of 10

Fitting the bulb

When fitting the bulb into the brass bayonet mount it is essential to ensure that the bulb filament is correctly aligned. The bulb already fitted will be so aligned in the factory.

With the lamp unit removed from the instrument base but with the small internal plug still inserted the lamp should be switched on so that when a bulb is fitted it is possible to see the position of the lamp filament through the pearl frosting. The filament should be so aligned that the top of the bulb facing the condenser lens system is brighter than the sides of the bulb facing east and west (shadows of the filament mount will be seen east and west). If the positioning is not correct the bayonet mount should be loosened on its holder by unscrewing one of the brass clamp rings and the bulb suitably rotated before reclamping.

C3. 6 VOLT 30 WATT ILLUMINATOR

Basic description

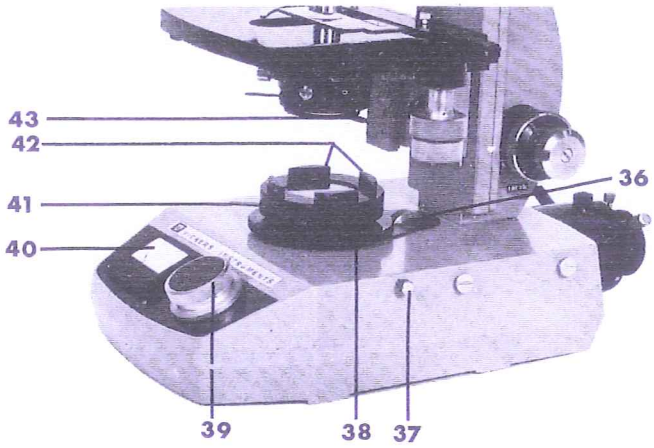


Fig. 12

36. Field lens control wheel.
37. Illuminator fixing screw.
38. Centring clamp for iris unit.
39. Rheostat.
40. Voltmeter.
41. Field iris.
42. Filter trays.
43. Substage auxiliary lens.

The full field and aperture illumination ranges of the wide field base are only completely exploited with the achromatic condenser 1·25 N.A. Other condensers in the range may be used but these lead to a limitation of field coverage with the very low power objectives.

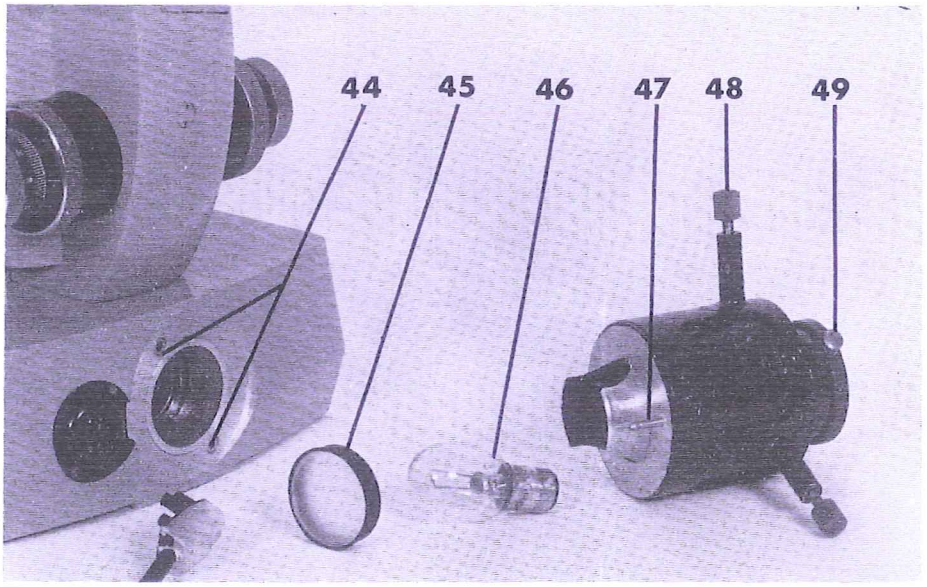


Fig. 13

44. Lamp supply sockets.
45. Lamp diffuser.
46. Bulb.
47. Lamp supply pins.
48. Lamp centring screws.
49. Lamp rotation and focusing clamp.

The centrable 6 volt 30 watt tungsten lamp is contained in a plug-in lamp housing. The bulb is inserted on a simple bayonet mount and twisted clockwise to fasten it in place. The lamp brightness is controlled by a rheostat fitted with an on/off switch, the voltage being indicated on a meter. The normal running voltage is 6 volts, the red area on the meter scale indicating overload between 6 and 8 volts. A plug-in diffuser is fitted into the open end of the lamphousing before it is attached to the base.

The field iris is mounted in a centrable unit which may be clamped on rotating the large knurled ring clockwise. The forward facing lever operates the field iris. To the right closed, to the left open.

A wheel immediately behind the iris unit controls a variable position field lens. When the wheel is rotated towards the rear the illuminator is suited to the higher aperture objectives and when towards the front, to low power objectives.

2″ × 2″ filters may be placed in the illuminator filter tray.

Mode of operation:

1. Rack the condenser to upper limit.
2. Select low power objective (10X) and focus the specimen.
3. Observe the objective back aperture. Centre the aperture diaphragm in the back aperture with the condenser centring controls. Open the aperture diaphragm to fill 7/10ths of the back aperture.
4. Revert to normal viewing, close the field diaphragm and centre it in the field of view by moving the iris unit bodily after releasing the lamp clamp ring (rotate anti-clockwise). Re-clamp when centred.
5. Open the field diaphragm to fill the field of view.
6. After removing the diffuser from the lamp, centre the filament image (visible in the field of view on turning the field lens wheel to the rear) with the lamp centring screws.

   Defocus the filament image by shifting the lampholder after unclamping the fixing screw. Slight rotation of the holder between the 90° stops will eliminate any residual filament detail. Re-clamp after completion.

   For low power work (3X objective) the diffuser must be employed and the sub-stage auxiliary lens must be swung into the light path.

   For convenience in operation the diffuser may be left in place when using higher power objectives. For normal usage the lamp has sufficient light reserve to cope with the resulting loss in illumination. The diffuser must be removed if a pro-jection head is to be used.

Achromatic Condenser 1·25				
	Auxiliary Lens	Base Iris	Condenser Iris	Field Lens Wheel
3X	In	Open	Open	Turn to front until filled
5X	Out	Field Iris	Open	Turn to front until filled
10X	Out	Field Iris	Aperture Iris	Turn to front until filled
20X	Out	Field Iris	Aperture Iris	Turn to rear
40X	Out	Field Iris	Aperture Iris	Turn to rear
100X	Out	Field Iris	Aperture Iris	Turn to rear

Colour Temperature of 6 volt 30 watt lamp

2950°K
3050°K
3200°K
3200°K

Voltage	Filter
6	none
7·5	none
6	82A
7·5	82

2″ × 2″ glass filters may be placed in the filter tray.

C4. MIRROR IN GIMBAL

A suitable external source of illumination is required for use with the mirror in gimbal. Instructions for use are provided with the Vickers external illuminators.

An external source should be positioned about 8 inches from the mirror. The illuminator should be directed to strike the centre of the mirror which should then be tilted to direct the beam vertically up to the underside of the substage condenser. If the lamp is focusable the filament image should be focused in the plane of the condenser aperture diaphragm.

D. TECHNIQUES AND ACCESSORIES

D1. Dark Ground

The dark ground condenser operates by illuminating the specimen with a hollow cone of illumination whose smaller illuminating angle is greater than the aperture angle of the objective in use. This means that no direct light from the condenser will enter the aperture and therefore the background will appear dark. If a specimen is in the beam of light it will scatter the light and alter its direction so that it enters the objective and so the specimen will appear light against a dark background.

Well adjusted dark ground illumination can be achieved using the oil immersion condenser with slide thickness adjustment.

Best results will be achieved with the more sophisticated lamp units—6 volt 30 watt and tungsten halogen illuminators.

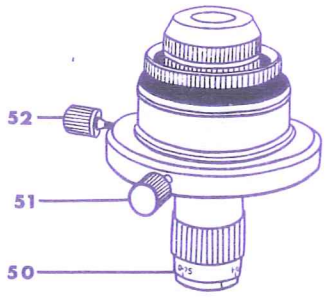


Fig. 14
50. Slide thickness adjustment.
51. Condenser centring.
52. Condenser centring.

Condenser adjustment

Assuming the lamp to be well adjusted—

1. Turn the lamp well up and fully open the field iris.
2. Select a low power objective (10X) and oil the condenser with immersion oil ALP1.
3. Rack the condenser into contact with the slide and turn the condenser centring screws to about the middle of their run.
4. Looking down the eyepiece, a halo or spot of light should be visible. Focus to a small bright spot using the condenser slide thickness adjuster (with 10X objective about 1/10th field will be illuminated).
5. Centre spot accurately, again using the condenser centring screws.
6. Switch to final objective.

All oil immersion objectives for use with the dark ground condenser should either be of the type fitted with an iris diaphragm or a funnel stop should be inserted to reduce the aperture to below 1·0. With an iris fitted the collar should be adjusted to give maximum contrast.

Screw in funnel stops

Screw out the back coma stop from the objective and screw the funnel stop into its place in the objective mount.

Plug in funnel stops

Drop the funnel stop directly into the back of the objective mount. With a funnel stop the aperture is reduced to about 0·95 N.A.

A condenser height stop adjustment screw is positioned just beneath the stage on the left hand side of the substage unit. It may be necessary to alter the stop to focus the dark ground condenser. After releasing the small side mounted clamp grub screw the vertical height screw may be adjusted. Set the screw so that the condenser just contacts the slide when the condenser focusing is racked to the stop.

D2. Phase contrast

The phase contrast condenser may be used with a full range of both negative and positive contrast objectives. The objectives will be clearly marked with a + positive or — negative sign, depending on their contrast type.

The unit is fitted with two condenser centring screws which face towards the front. The two push-in annulus centring pins face towards the rear. The phase annuli are contained in a selector drum accessible from the front. A number 0–4 on the front of the drum corresponds to the number engraved on the objective mount.

0 is for bright field.

1–3 are for progressively higher powered objectives, Ph. 1, Ph. 2, Ph. 3.

4 is for further accessories.

The unit is also provided with an aperture iris for use with bright field in position 0.

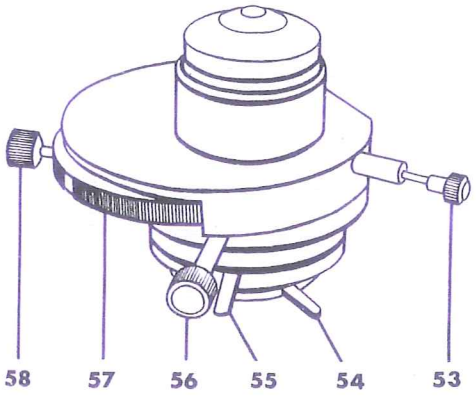


Fig. 15

53. Annulus centring.
54. Auxiliary lens.
55. Aperture diaphragm.
56. Condenser centring.
57. Annulus drum.
58. Condenser centring.

Condenser adjustment

1. Set up and adjust bright field illumination as detailed in the bright field section (in position 0).
2. Turn the condenser selector drum until the number corresponding to the phase number marked on the objective is visible at the front of the condenser. The drum locates accurately into click stops.
3. Either insert a phase telescope in place of one eyepiece or insert the Bertrand lens in the magnification changer. Focus the annulus and phase ring now visible with the telescope or Bertrand lens.
4. Push in the adjustment pins and rotate them until the annulus and phase ring are in exact coincidence. Release the pins which will then be removed from the ring carrier under spring pressure. The pins are captive.
5. Change to normal viewing. The phase image will now be in correct adjustment. The use of a green filter will help to enhance the contrast.

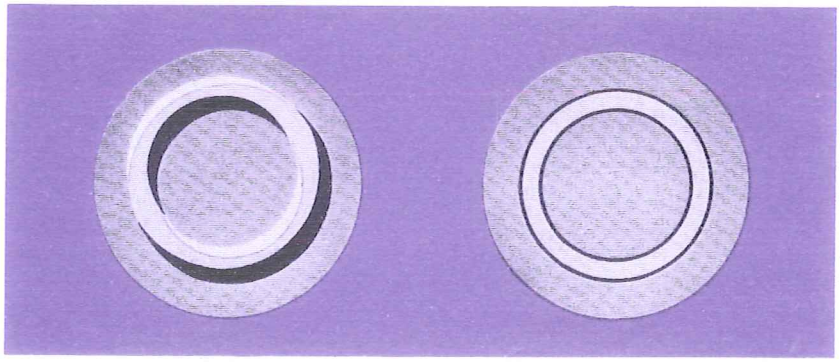


Fig. 16

(a) Annuli unmatched. (b) Annuli matched.

Long-working distance phase

The long working distance phase contrast condenser has a working distance of about 15 mm and is suitable for use with 10X, 20X or 40X phase contrast objectives.

The annuli drum is provided with annuli for Ph. 1 and Ph. 2 objectives in the normal position but cannot be used for Ph. 3

Adjustment is precisely similar to the standard condenser.

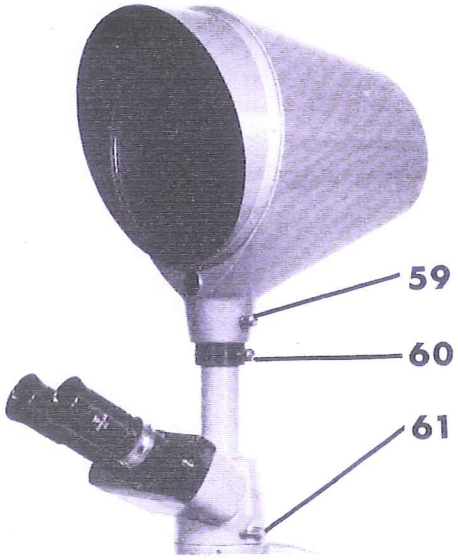


Fig. 17

59. Projection head screw.
60. Adaptor collar clamp screw.
61. Binocular phototube trip mirror lever.

D3. Projection head

The projection head incorporates a "micro-crystalline" wax screen which gives a clear bright image with the tungsten halogen 12 volt 100 watt illuminator. The 30 watt illuminator or 18 watt illuminator can be used under subdued lighting conditions.

The projection screen and collar fits a straight monocular head or the straight tube of a photo visual head. The adaptor collar first fits over the straight tube into which is then placed an 8X or 10X eyepiece. The projection head then slides directly over the tube where it is clamped firmly in place.

E. CARE OF THE MICROSCOPE

Cleaning the optics

It is essential that the optical surfaces of the microscope are kept scrupulously clean. Dust should be removed with a clean camel hair brush. Smeared surfaces should have dust particles removed in the same manner before wiping with a suitable material, such as Goddard's Lens Cloth, well washed fine linen or lens tissues, *lightly* moistened with industrial alcohol.

While the use of industrial alcohol is recommended for cleaning Vickers Instruments optics, it may not be suitable for use with other manufacturers equipment.

Cleaning the paint surfaces

The paint surfaces can be cleaned with a soft cloth lightly moistened with industrial alcohol and afterwards polished with a dry cloth. The microscope is finished with an epoxy resin paint which is extremely durable, but any injurious chemicals which may accidentally come into contact with it should be removed as quickly as possible.

Servicing

The mechanical movements have been lubricated before leaving the factory and should only require attention after prolonged use. If servicing is necessary, the user should contact Vickers Instruments or their agents.

An annual servicing contract placed with Vickers Instruments or their Agents is a wise insurance.

Bright Field

Rack the condenser as high as possible. Fully open the aperture diaphragm and open the field iris. Ensure that any movable items such as filter changers do not obstruct the light path.

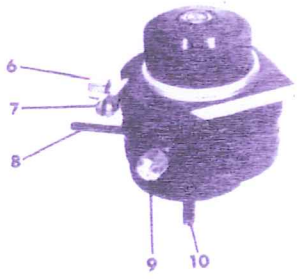
1. Switch on the illumination.
2. Pull out the viewing head beam splitter slide rod to the stop. All the available light will now be transmitted to the viewing head.
3. Adjust the interocular distance on the viewing head. The tube length compensator will automatically maintain a standard 160 mm. tube length.
4. Observe the specimen with a lower power objective (10x) through the binocular head and focus it with the stage focusing controls. The fixed left hand tube should be used at this stage—with the left eye!
5. Turn the right hand draw tube to focus both eyes equally.
6. Close the field iris and focus it in the field of view with the condenser focusing control.
7. Centre the field iris image in the field of view with the condenser centring controls and open the iris to fill the field of view.
8. Insert the Bertrand lens or auxiliary telescope, close the aperture diaphragm and focus it in the back focal plane with the Bertrand lens focusing control. Open the aperture diaphragm to fill 7/10 of the back focal plane by area.
9. Swing out the lamp diffuser disc. With the filament centring and focusing knobs, centre and focus the filament image conjugate with the diaphragm image.

   Revert to normal viewing.

The aperture size filling 7/10 of the back focal plane by area is chosen so as to give the best compromise between resolution and contrast. Reducing the aperture too much will reduce the high objective correction. Opening the aperture iris wider than the objective aperture will possibly introduce scattered light. Judicious use of the aperture iris will give useful control over the image contrast.

If any filament image is visible in the field of view this may be removed by inserting the diffuser screen or by defocusing the lamp condenser.

10. On selection of the desired objective optimum performance is ensured by repeating steps 6 to 10. The condenser should be oiled for use with high power objectives. See chart for details of field lenses and other variables.



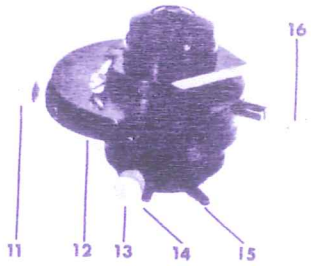
6. Condenser centring
7. Condenser/carrier clamp
8. Aperture iris lever
9. Condenser centring
10. Auxiliary lens

Phase contrast

The phase contrast condenser for the M41 may be used with a full range of both negative and positive contrast objectives. The objectives will be clearly marked with a + positive or — negative sign depending on their contrast type.

Adjust the illumination as for bright field up to and including Step 10.

11. Turn the condenser selector drum until the number corresponding to the phase number marked on the objective is visible at the front of the condenser. The drum locates accurately into click stops.



11. Condenser centring
12. Annuli disc
13. Condenser centring
14. Aperture iris lever
15. Auxiliary lens
16. Annulus centring

12. Either insert a phase telescope in place of one eyepiece or insert the carrier bracket Bertrand lens (if fitted). Focus the annulus and phase ring now visible with the Bertrand lens.

    (To insert the Bertrand lens pull the slider to the left and turn the knob at the right hand end of the slider to focus)

13. Push in the two phase adjustment pins on the condenser and rotate them until the annulus and phase ring are in exact coincidence. Release the pins which will then be removed from the ring carrier under spring pressure. The pins are captive.

14. Change to normal viewing. The phase image will now be in correct adjustment. The use of a green filter will help to enhance the contrast.

Position 0 may be used for bright field work with the aperture diaphragm.
Position 4 which is also centrable is kept clear for further accessories.