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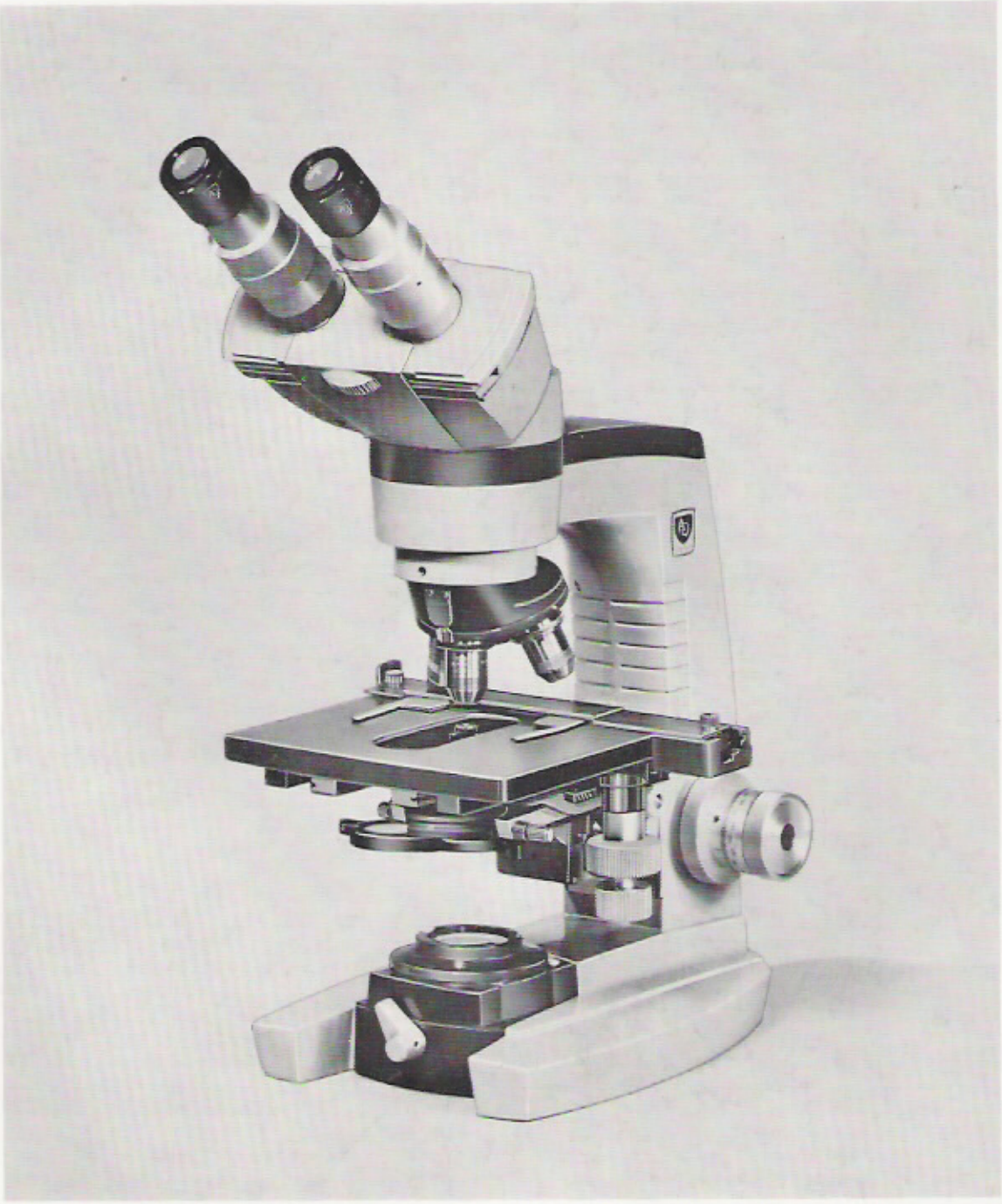
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REFERENCE MANUAL

Series 10 MICROSTAR

Advanced Laboratory Microscopes



AMERICAN OPTICAL COMPANY
INSTRUMENT DIVISION • BUFFALO, NEW YORK 14215

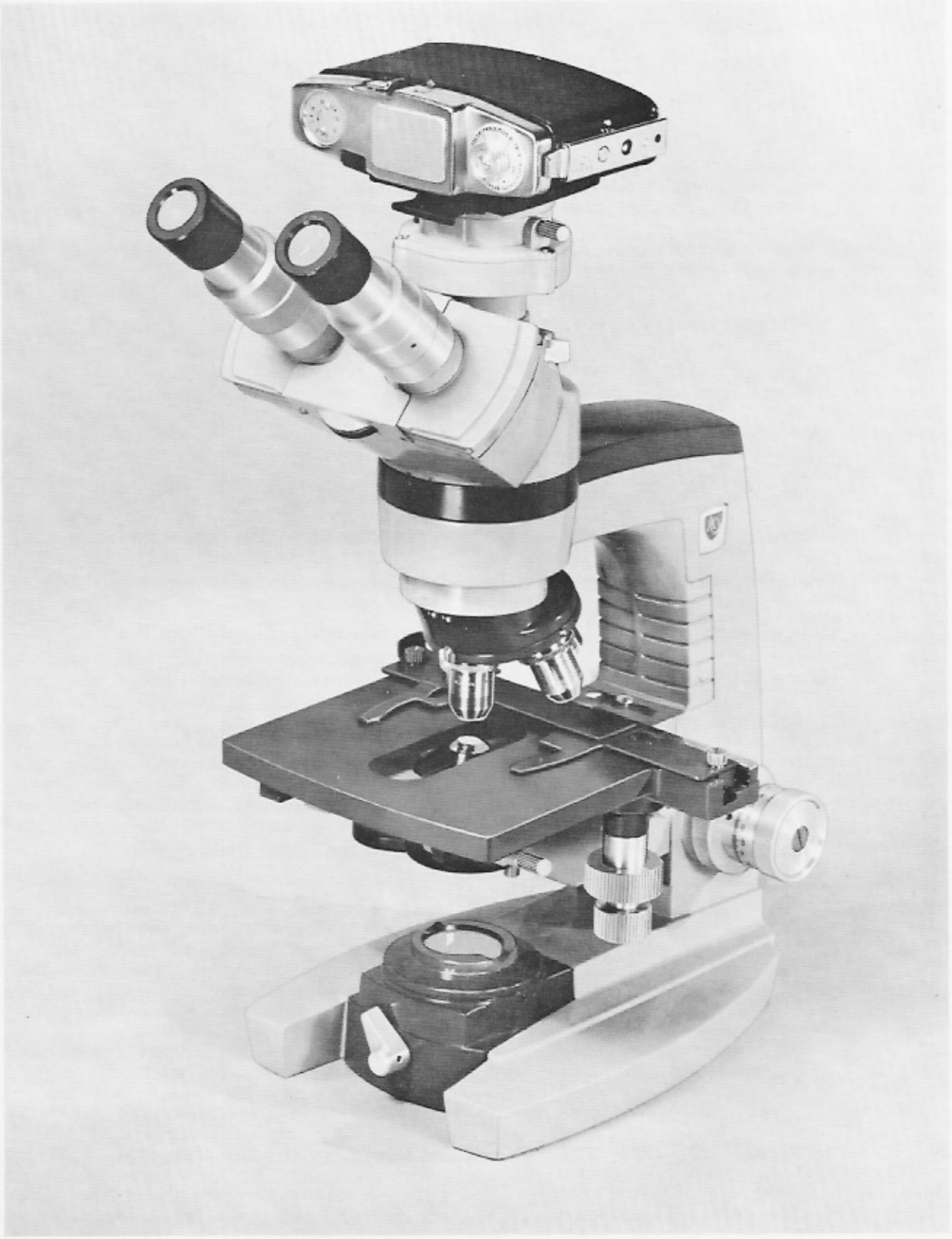
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MICROSTAR Series 10 Microscope

IMPORTANT

As a safeguard your AO Microstar has been equipped with the following feature. Should the downward excursion of the coarse and fine adjustment be limited to an extent which prevents focussing on a slide of normal thickness, it may easily be released. Simply turn the coarse adjustment knob in the direction which raises the objectives to the positive stop at the top of the coarse adjustment excursion.

This adjustment is not to be confused with improper adjustment of stage height. The stage should be raised to the upper limit permitted by the autofocus stop (See pages 2, 3, & 4, Figures 3 & 4).

AO MICROSTAR SERIES 10 MICROSCOPE

I INTRODUCTION

The AO-Spencer Microstar represents the finest and most advanced laboratory microscope ever produced; the latest in a long series of fine microscopes produced over a span of 115 years. With proper care, it will give a lifetime of satisfactory, dependable use.

This Reference Manual is written on the assumption that it is to be used by advanced students and experienced microscopists. No attempt has been made to include fundamentals and basic principles of microscopy. It is condensed to cover the essential functional adjustments and controls specific to the AO Microstar Series 10, together with a complete listing of parts with exploded drawings. It also covers routine maintenance requirements. If the reader is interested in a more complete treatise on fundamentals and principles of the microscope, AO will be pleased to forward, at no charge, our booklet entitled "Effective Use and Proper Care of the Microscope".

II GUARANTEE

The AO-Spencer Microstar is guaranteed unconditionally against defects in material or workmanship. With care and a minimum of maintenance, it will provide a lifetime of satisfactory, dependable service. This guarantee cannot be extended to cover damage in transit or damage caused by carelessness, misuse, or conditions beyond our control. Please note carefully the conditions relating to damage in transit in the paragraph immediately following.

III DAMAGE IN TRANSIT

Modern and effective methods of packaging have been carefully considered to ensure that the Microstar arrives in "factory new" condition. Each microscope is thoroughly inspected before leaving the factory, and with careful handling during shipment, delivery of the microscope in good condition is assured.

The transportation company, when it accepts the shipment, becomes the cosignee's agent and is responsible for safe delivery. If, upon delivery, the outside of the packing case shows evidence of rough handling or damage, the transportation company's agent should be requested to make a "Received in Bad Order" notation on the delivery receipt. If there is no exterior evidence of rough handling upon delivery but concealed damage is evident on unpacking the shipment, the transportation company should, within 48 hours of delivery, be requested to make out a "Bad Order" report. This procedure is necessary in order to maintain the right of recovery from the carrier.

If it should be necessary after consultation with the transportation agent to ultimately return any material to us, it is requested that you communicate with us before actually returning any goods. After arrangements have been made for the return, the material should be plainly tagged with the sender's name and address, carefully packed and shipped prepaid. Please indicate the date and number of the packing list in a letter to us.

IV UNPACKING AND ASSEMBLY

The method of packaging the new Microstar takes advantage of modern packaging materials and techniques plus the quick and easy interchange of component assemblies which has been engineered into the design of this modern microscope. Each microscope is fully assembled and thoroughly inspected at the factory. The subsequent removal of component assemblies for convenience and safety in transit in no way impairs the ultimate performance of the microscope. Precise functional alignment is assured by manufacturing techniques and design. Simply follow these instructions for quick assembly of the instrument. If it is desired, the AO dealer or AO representative will be pleased to assist with the assembly of the microscope.

Note

Contents of inner carton are clearly marked including accessories such as body, objectives, eyepieces, mirror and fork assembly (if ordered without illuminator), transformer for "In-Base" illuminator (if so ordered), blue glass filter (where supplied), immersion oil, plastic cover, reference manual, and two Allen wrenches.

1. Unpacking

Unpack the microscope as follows:

a. Stand carton upright and open from top.

b. Lift out the inner carton by means of the two finger holes provided.

c. Remove separators in the inner carton, and lift stand from lower carton.

d. Remove material used to restrain movement of the mechanical stage, and remove the foam pads from under the stage support, and under the nosepiece assembly.

Note

The plastic bag used for protection in handling and shipping can be discarded since a permanent, heavy duty plastic cover is included with the microscope.

2. Attaching Body to Stand

Attach body to stand by backing off knurled screw, inserting dovetail in body support and tightening the knurled screw firmly without forcing. See figure 1. The body is thus precisely located on the optical axis of the microscope, regardless of the orientation selected. The AO Microstar may be used in either of two positions; arm toward the observer, or arm away from the observer. It is assumed that microscopes with attached or built-in illuminators will be used with the arm away from the observer.

3. Assembling Objectives to Nosepiece

Screw objectives into the nosepiece openings. It is customary to arrange the sequence of magnification from lowest magnification to next highest by rotating the nosepiece clockwise. It makes no difference which hole is selected for the first objective. Precision tolerances held in the manufacture of AO objectives make random selection possible without affecting centration or parfocality. Be sure that the objectives are seated firmly against the shoulder of the nosepiece by tightening snugly. Do not force.

4. Connection of Illuminator

The illuminator may now be connected to its power supply. Illuminators, Cat. No. 1034 and No. 1037, plug directly into 115 volt AC outlet. Cat. No. 1036



Figure 1. Attaching Binocular Body to Stand

Illuminator connects through a variable transformer to the 115 volt AC outlet.

If the microscope is ordered with a mirror for use with an external light source, the mirror fork assembly, packed in the accessory box, should be inserted firmly into the hole provided in the base.

V FOCUSING

1. AO's New Focusing Concept

The AO Microstar incorporates a new focusing concept of unprecedented convenience and effectiveness in which only the nosepiece moves in focusing. The basic construction is shown in figure 2. The nosepiece is raised and lowered by the concentric coarse and fine adjustment knobs. The entire internal focusing mechanism is totally enclosed and sealed against entry of dirt. Movement of the nosepiece on a ball-bearing slideway, ensures smooth, positive action, free of backlash.

2. Coarse Adjustment

Positive stops are provided for both the upper and lower position of the coarse adjustment control knob. Excursion provided is ample for slides or chambers. For use with tissue culture bottles, etc., where greater clearance is required, the stage can be immediately lowered and locked to the desired position. Maximum clearance thus provided is 1-5/8". Relubrication and tension readjustment of coarse adjustment are rarely required.

3. Fine Adjustment

A micrometer screw, graduated in microns for fine adjustment, has a total excursion of 2 mm. or 10 complete revolutions. Each revolution represents a movement of 200 microns. It will be extremely helpful to learn to recognize when the fine adjustment is midway in its operating range. See figure 3. This midway position is the correct setting to provide the necessary operating range to effectively use AO's unique autofocus stop.

The fine adjustment mechanism moves on the same ball bearing slideway as the coarse adjustment. Relubrication and tension readjustment are rarely required.

4. Autofocus Stop

Autofocus is an indispensible aid to microscopy. This concept, pioneered by AO over 15 years ago, is a tremendous time saver in using the coarse adjustment, particularly with the oil immersion objective.

The autofocus stop is pre-set at the factory. It is the stop which limits the height of the stage (see figure 4). This setting is valid for slides anywhere from 0.50 to 2.5 mm. in thickness. Because of the highly precise tolerances held in the manufacture of the objectives (affecting both parcentration and parfocality), it is possible to search the slide with 10X or 45X objectives, find the field required for study under oil

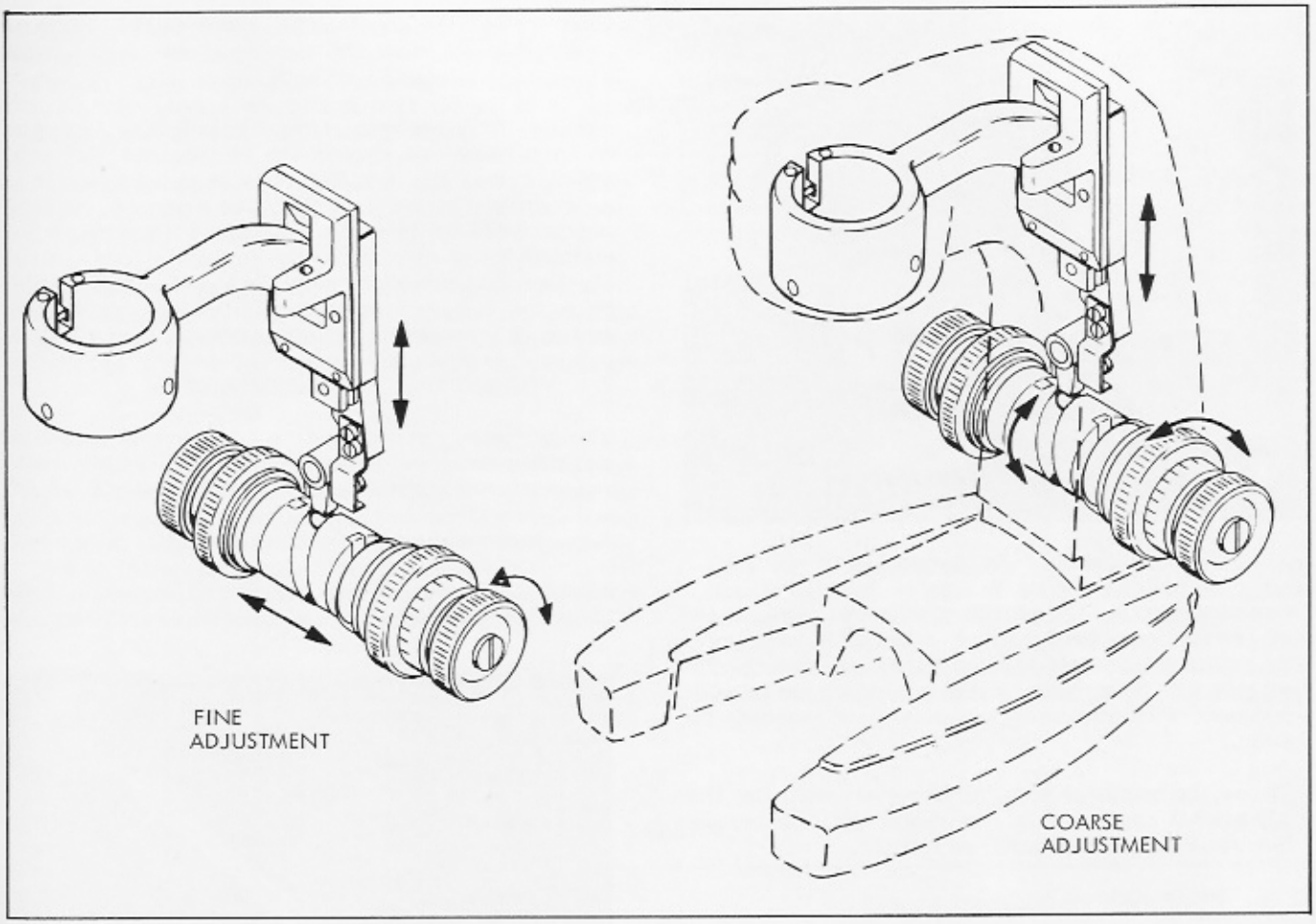


Figure 2. Focusing System

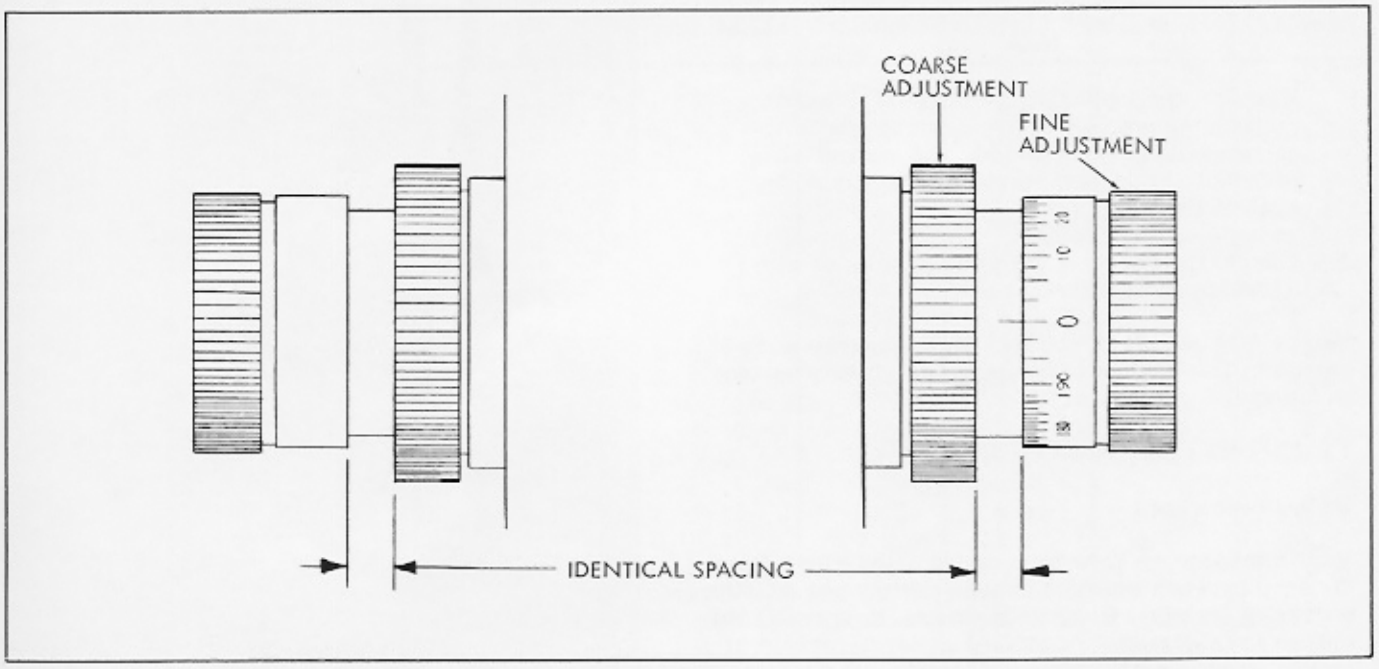


Figure 3. Fine Adjustment

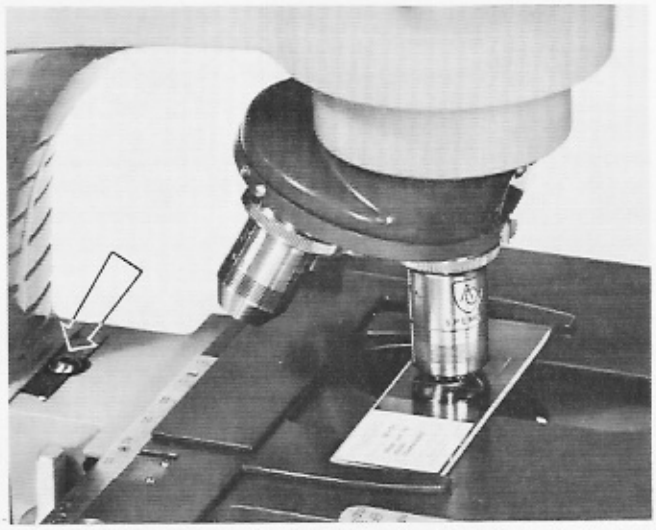


Figure 4. Autofocus Stop

immersion, raise the coarse adjustment, swing to the oil immersion objective, apply oil to slide, and lower the coarse adjustment rapidly to its positive stop. The subject will be in focus within a touch of the fine adjustment with absolutely no danger of touching the slide.

To use the autofocus stop, always start with the fine adjustment approximately in center of its excursion (see figure 3), and proceed as follows:

a. Place slide on stage.

b. Rotate nosepiece to 10X objective.

c. Lower the nosepiece with coarse adjustment to its lowest limit.

Note

Whether the objective is actually lowered through the position of focus, or the position of focus is never reached, the coarse adjustment should be lowered all the way down against the stop.

d. Bring the image of the slide into focus with the fine adjustment control knob.

Repeat this simple procedure each time the slide is changed. This method of focusing will quickly become an automatic procedure.

VI INFINITY CORRECTED OBJECTIVES

1. Description

Most microscopes have been constructed with a fixed distance between eyepiece and objective. The infinity corrected system (figure 5) makes it possible to change the objective to eyepiece distance without affecting optical performance. The new AO concept in infinity corrected objectives makes possible a new breakthrough in optical performance and, at the same time, simplifies the focusing mechanism. This is achieved by focusing the nosepiece only, and not the heavy stage assembly or body tube.

Parallel light emerging from the objective is picked up by a telescope lens in the microscope body tube which brings the parallel rays thus intercepted to focus at the correct position in the eyepiece. Optical performance is in no way impaired by varying the distance from objective to the telescope lens assembly since this merely extends the length of the parallel beam but the addition of the telescope lens system makes it possible to improve optical performance.

2. Table of Objective Characteristics

The pertinent characteristics of this new series of infinity corrected objectives, in combination with recommended eyepieces, are given in Table I.

3. Parfocality and Parcentration

All AO objectives in this series are parfocal. This means that the subject is essentially in focus when the

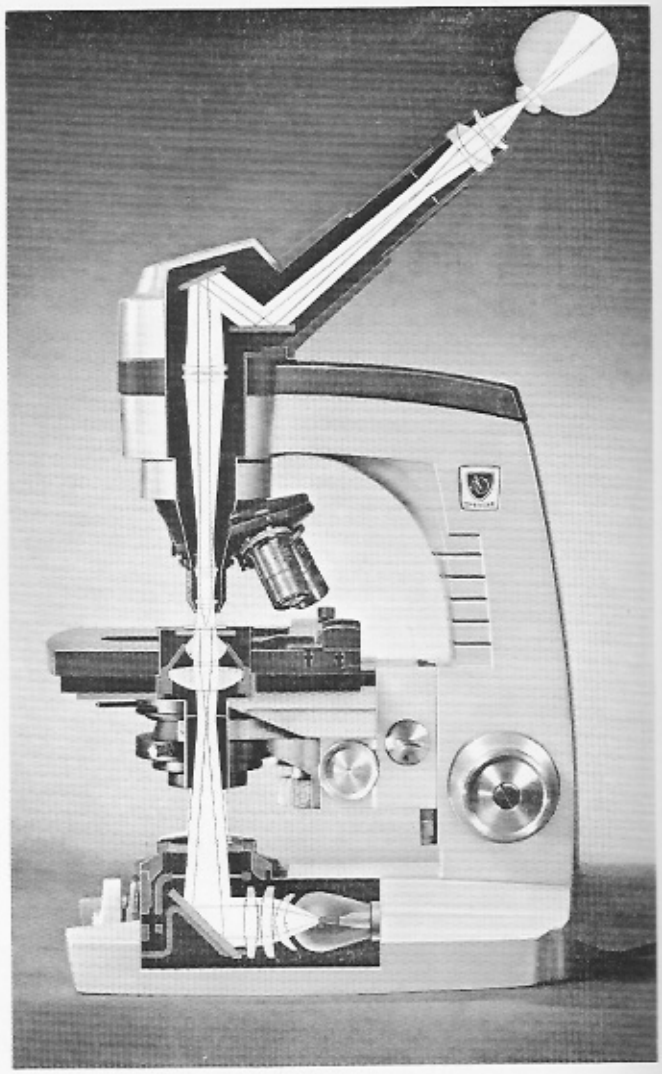


Figure 5. Infinity Corrected System

nosepiece is rotated to change from one magnification to another. With stained slides of normal density, it should always be possible to see an image when going to the next highest power and it is normal to expect a slight touch-up with the fine adjustment.

Parfocality will not be adversely affected by any random selection or arrangement of objectives on the nosepiece.

This new series of objectives is also parcentered. When an area is selected in the center of the field for a given magnification, it will remain well within the field of view for the next highest magnification.

4. Immersion Oil

In addition to a suitable refractive index and dispersion, a satisfactory immersion oil must possess the following physical properties: It should be chemically inert; it should be free from a tendency to spread or creep; it should remain fluid and not harden rapidly when exposed to air; and its optical properties should be stable and not change with age.

Immersion fluids recommended for use with AO objectives are: Cedarwood Oil, Crown Oil or Shillaber's Oil available from AO and most scientific supply houses. Oils of low viscosity, such as mineral oil, will cause damage by seeping up around the mount and into the lens.

VII EYEPIECES

AO Microstar microscopes furnished with achromatic objectives are supplied with either Huygenian or wide field eyepieces.

1. Huygenian Eyepieces

The Huygenian eyepiece is the simplest in construction. As shown in Table I, it has smaller field size and less eye relief than the wide field type. For this reason, it is not recommended for use by observers wearing eyeglasses.

A cross section of the 10X Huygenian eyepiece is shown in figure 6.

Both the 5X eyepiece Cat. No. 133 and the 10X Cat. No. 177 accept reticles of AO 400 series; 21 mm. in diameter. To install a reticle in the Huygenian eyepiece, the reticle must be inserted in the eyepiece from the top with the etched side of the reticle facing down, and secured with a circular spring retainer.

TABLE I

OBJECTIVES					EYEPIECES				
					1. Field of view 2. Eye relief in MM. **				
Catalog Number	Initial Magnification	Focal Length in MM.	Numerical Aperture N. A.	Working * Distance in MM.	5X Huygenian Cat.No.133	10X Huygenian Cat.No.177	10X Wide Field Cat.No.176	15X Wide Field Cat.No.147	20X Wide Field Cat.No.157
1075	4X	46.0	0.12	7.2	1. 4.7 2. 9.5	3.7 8.1	4.6 21.0	4.2 14.0	3.1 10.0
1076	10X	18.0	0.25	9.1	1. 1.9 2. 8.6	1.5 7.9	1.9 21.0	1.7 14.0	1.2 10.0
1077	20X	9.1	0.50	0.8	1. 0.95 2. 7.9	0.74 7.7	0.92 21.0	0.84 14.0	0.61 10.0
1078	45X	4.0	0.66	0.3***	1. 0.42 2. 7.7	0.33 7.6	0.41 21.0	0.37 14.0	0.27 10.0
1079	100X	1.8	1.25	0.1	1. 0.19 2. 7.0	0.15 7.5	0.18 21.0	0.17 14.0	0.12 10.0
1116	45X	4.0	0.66	0.7	1. 0.42 2. 7.7	0.33 7.6	0.41 21.0	0.37 14.0	0.27 10.0

NOTES:
* All working distances in air above a 0.18 MM Coverglass.
** Eye relief is distance from exit pupil (ideal position of eye) to top of eyepiece lens.
*** Working distance of 0.3 in air + 0.18 coverglass, equivalent to 0.63 in glass. Ample clearance for 0.4 MM thick coverglass used with Hemacytometer.

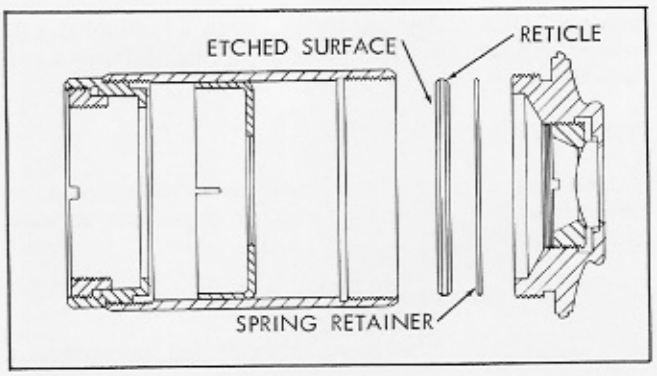


Figure 6. 10X Huygenian Eyepiece

2. Wide Field Eyepieces

This eyepiece is of greater complexity and provides an increased field of view. It will be noted from Table I that the 10X wide field has essentially the same field of view as the 5X Huygenian eyepiece. It also provides a higher eyepoint, that is, for this reason, definitely recommended for observers wearing eyeglasses.

The series is available in three different magnifications:

10X wide field - Cat. No. 176
15X wide field - Cat. No. 147
20X wide field - Cat. No. 157

Figure 7 shows a cross section of the wide field eyepiece. To insert a reticle into the eyepiece, place the reticle into the reticle mount with the etched side facing outward, and slide the mounted reticle into the eyepiece tube with the etched side of the reticle upwards until the reticle seats against the field diaphragm.

3. Calibration of Micrometer Disc

The projected values of reticle graduations vary with the optical combination used, and consequently, should be pre-calibrated before accurate measurements can be made. To calibrate, focus on a stage micrometer and move it until one of the graduations corresponds exactly with one of the divisions of the eyepiece micrometer. (See figure 8.) The true distance (X) seen on the stage micrometer, which corresponds to the number of divisions (Y) of the eyepiece micrometer disc, is then read and dividing this true distance by the number of divisions of the eyepiece micrometer, it is possible to find the distance each division subtends (C = X/Y). The number of divisions covered by the specimen multiplied by the calibration constant (C) gives the length of the specimen.

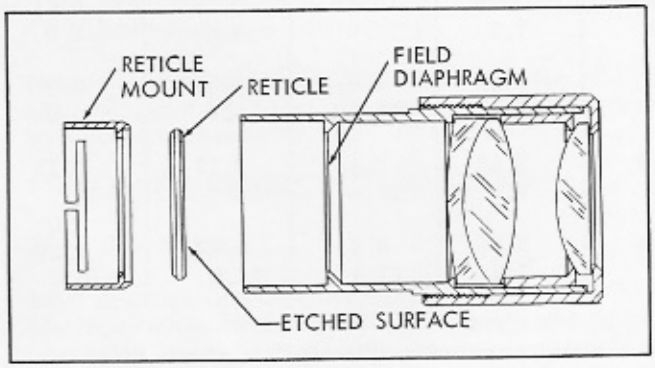


Figure 7. Wide Field Eyepiece

VIII STAGES

1. Types and Construction

There are two basic groups of stages furnished for use with the Series 10 Microstar. One group incorporates the simple bakelite stage, Micro-Glide stage, or rotating stage. See figures 9 and 10. This two-piece constructed stage, illustrated in figure 10, consists of the top portion (simple, glide, or rotating) which is supported in a ring mount and bracket. The top portion is identical to and interchangeable with stages furnished on previous Series 2 and Series 4 Microstar microscopes.

The stage is attached to the stand by means of a dovetail slide. In use, the stage assembly is locked at a fixed position on the slide, the height determined by position of the autofocus stop. Adjustment on the slide is made only when one wishes to accommodate unusually thick vessels such as tissue culture bottles or wet mounts.

The other group consists of the graduated or un-graduated mechanical stage. See figures 11 and 13. The mechanical stage is a one-piece construction and attaches to the stand in exactly the same manner as the two-piece constructed stage.

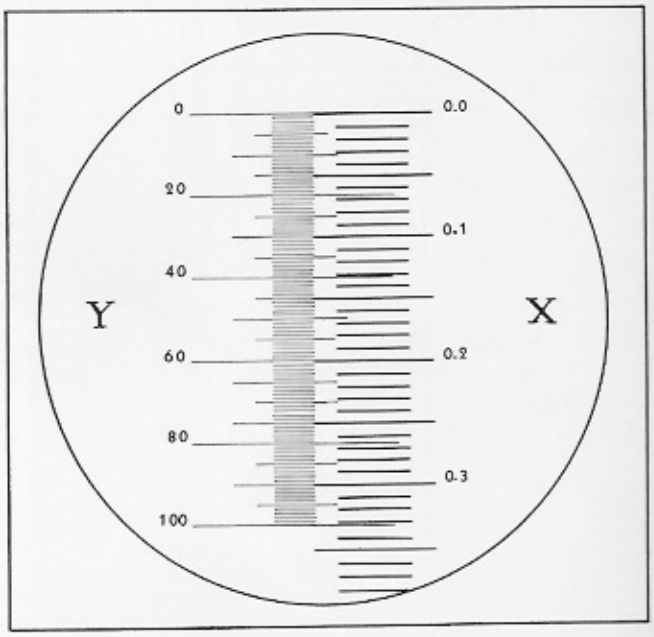


Figure 8. Calibration of Micrometer Discs

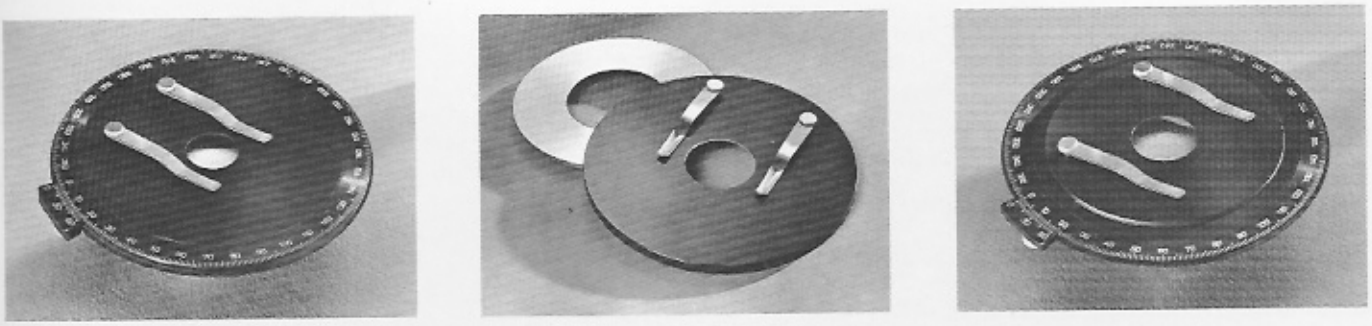


Figure 9. Stages

Both groups of stages are adjustable in height and locked at the desired position by means of the locking lever. With slides of normal thickness the stage is raised to its uppermost position, against the preset autofocus stop. This stop is set at the factory for a slide thickness of approximately 1.5 mm. and provides, with the 2 mm. excursion of the fine adjustment, satisfactory use of the autofocus stop with any slide of thickness from 0.5 mm. to 2.5 mm.

2. Changing Stages

Remove the stage assembly as follows (see figure 12):

a. Remove autofocus stop screw (figure 4).

b. Remove all objectives from nosepiece.

c. Raise nosepiece to upper limit with coarse adjustment.

d. With mechanical stages, center the elongated hole in the top stage plate to the hub of the nosepiece by moving the stage top in a north-south direction.

e. While supporting the stage in one hand, unlock locking lever and raise the entire assembly from the dovetail slide, tilting it forward at the top of the slide to clear the nosepiece.

Replace the stage assembly as follows (see figure 13):

a. Make sure the top stage plate is centered to the hub in a north-south direction so that the nosepiece hub will not interfere.

b. Make sure the locking plate will not interfere.

c. Tilt the stage assembly forward to carefully engage the slide, and lower to correct position.

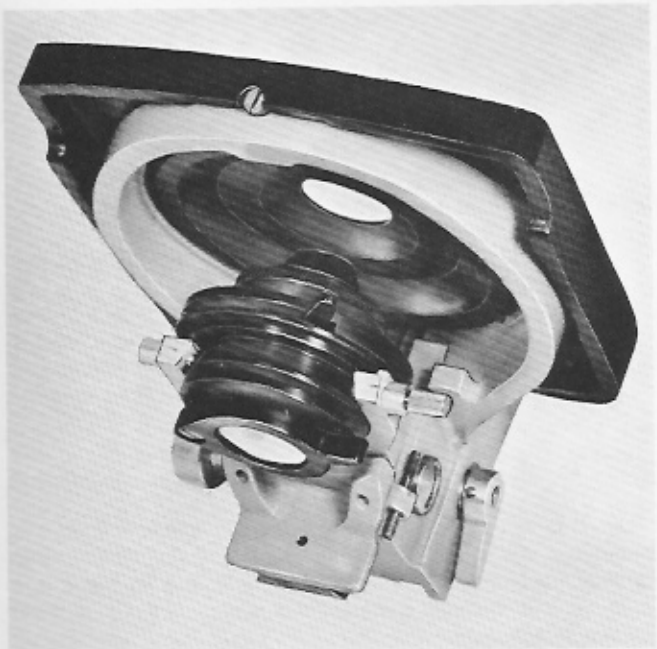


Figure 10. Plain Stage

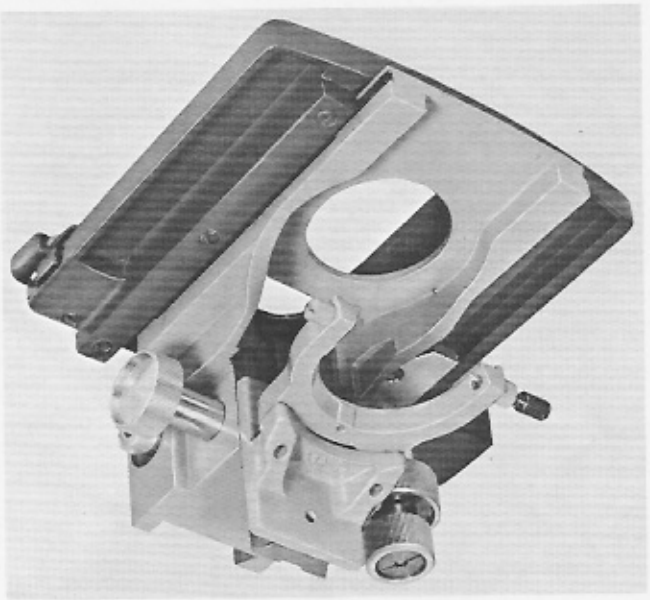


Figure 11. Mechanical Stages



Figure 12. Removal of Stage Assembly

d. Replace objectives on nosepiece.

e. Lock the locking lever.

f. Insert autofocus screw with Allen wrench and adjust for correct autofocus stop setting as follows:

(1) Use slide of normal thickness (approximately 1.25 mm).

(2) With 10X objective, lower nosepiece all the way to its stop with the coarse adjustment.

(3) Set fine adjustment approximately in the center of its range.

(4) Raise stage until image is in focus. Lock with locking lever.

(5) Advance autofocus screw downward until it contacts the top of the dovetail slide and becomes a stop which limits further upward movement of the stage.

3. Mechanical Stage

The slide carrier assembly is easily removed by unscrewing the two knurled screws. See figure 13. The lateral movement of the finger, actuated by the pinch grip, should be free and respond instantly to the spring action which causes the finger to hold the slide firmly in place. If clean, it should require no lubrication.

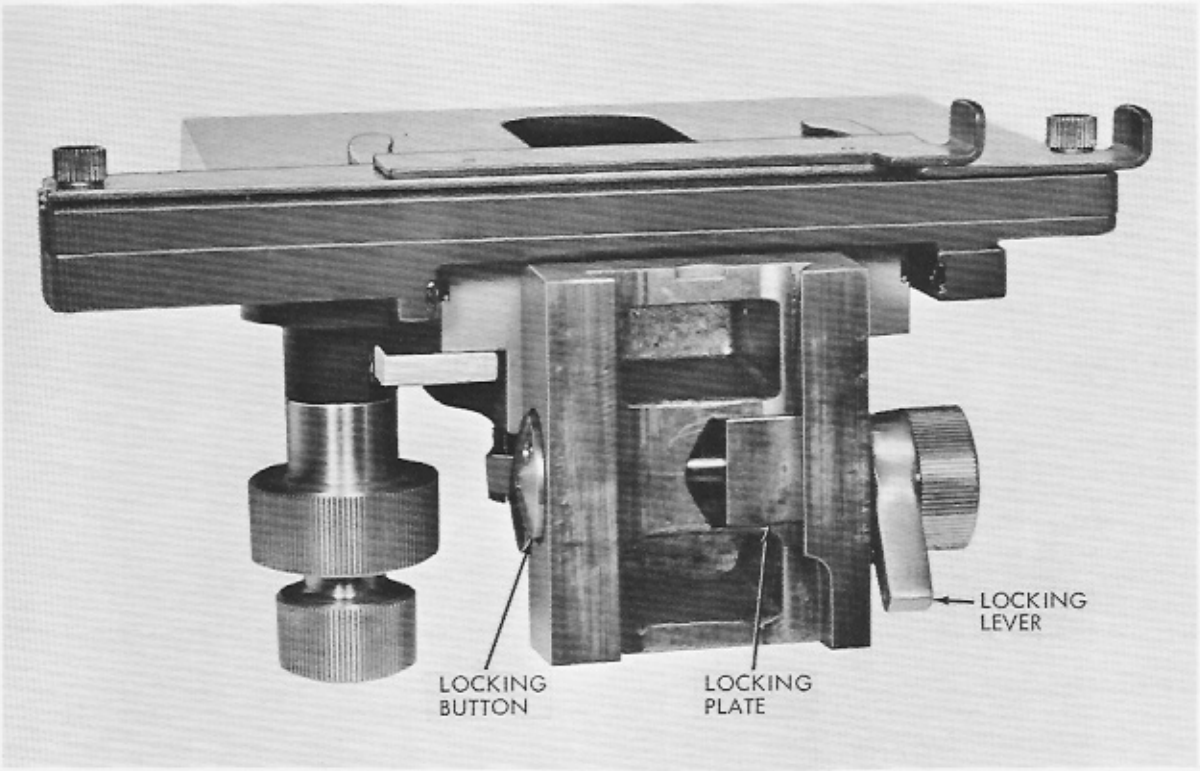


Figure 13. Rear View of Stage Assembly Slide

The forward and lateral motions of the stage are on prelubricated bearing ways.

4. Simple Stage

The simple bakelite stage is easily installed or removed from its support ring. See figure 14. When installing the simple stage, make sure the lock screw is backed off far enough for the stage to seat properly. Tighten the lock screw snugly but do not force.

5. Micro-Glide Stage

The Micro-Glide stage depends for successful operation on a film of lubricant of proper viscosity applied uniformly on the inner sliding surfaces. It requires periodic maintenance in relubricating these surfaces. Frequency of relubrication required depends on the environmental conditions and frequency of use. To relubricate, separate the upper plate from the lower plate by forcing apart. Completely remove all the old grease with a solvent such as xylene or alcohol, and relubricate using the lubricant supplied with the stage. Use sparingly and spread in a thin film over both plates with finger or a cloth. Reassembly and work in by moving the top plate around for a few seconds.

6. Rotating Stage

Two types of rotating stages are provided; one plain, Cat. No. 1536, and one with Micro-Glide top, Cat. No. 1537. The rotating action is on a prelubricated ball bearing.

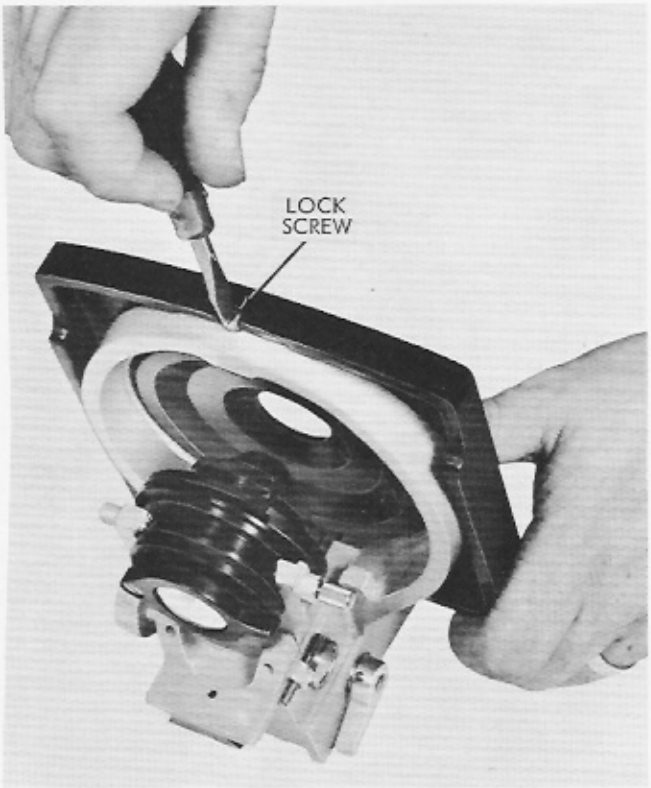


Figure 14. Removal of Simple Stage

IX SUBSTAGE EQUIPMENT

1. Rack and Pinion Focus

On the new Microstar Series 10 models, the fork mount which supports the substage condenser is actuated by rack and pinion. The maximum height of the condenser has been properly adjusted at the factory to just below stage level. If it becomes necessary to readjust the height of the condenser, proceed as illustrated in figure 15, advancing or retracting the Allen head stop screw as necessary.

2. Fork Mount

The condenser assembly is easily removed from the fork mount by backing off the thumb screw and pulling the entire condenser assembly forward. See figure 16. To reassemble the condenser to the fork mount, be sure that the slot in the back of the condenser mount seats into the pin in the fork mount. See figure 17. Insert the condenser mount all the way into the fork and then rotate until the pin engages the slot.

3. Focusing Tension

Adjust the focusing tension by turning knob while holding slotted nut on the opposite side stationary with a screwdriver or coin. (See figure 18.)

4. Condenser Mount

Two types of condenser mounts are provided; (1) fixed mount, Cat. No. 1093, and (2) centerable mount, Cat. No. 1095. The fixed mount is pre-centered at the factory and requires no further adjustment.

The centerable mount provides the ultimate in centration and is usually necessary only for advanced techniques. Centration is best accomplished by removing the eyepiece and observing the image of the aperture diaphragm with a pinhole eyepiece or centering telescope. This adjustment should be made when the objective is properly focused on a slide and the condenser is in correct operating position.

Both condenser mounts are furnished with an iris diaphragm which controls the effective numerical aperture of the objective.

A filter slot is incorporated at the lower side of the condenser mount. This slot accepts filters of 33 mm. diameter such as blue daylight filters or ground glass filters, special colored filters, simple dark-field stop, polaroid disc, etc.

5. Condensers

a. Abbe Condenser, N.A. 1.25, Cat. No. 1088. This condenser is recommended for advanced

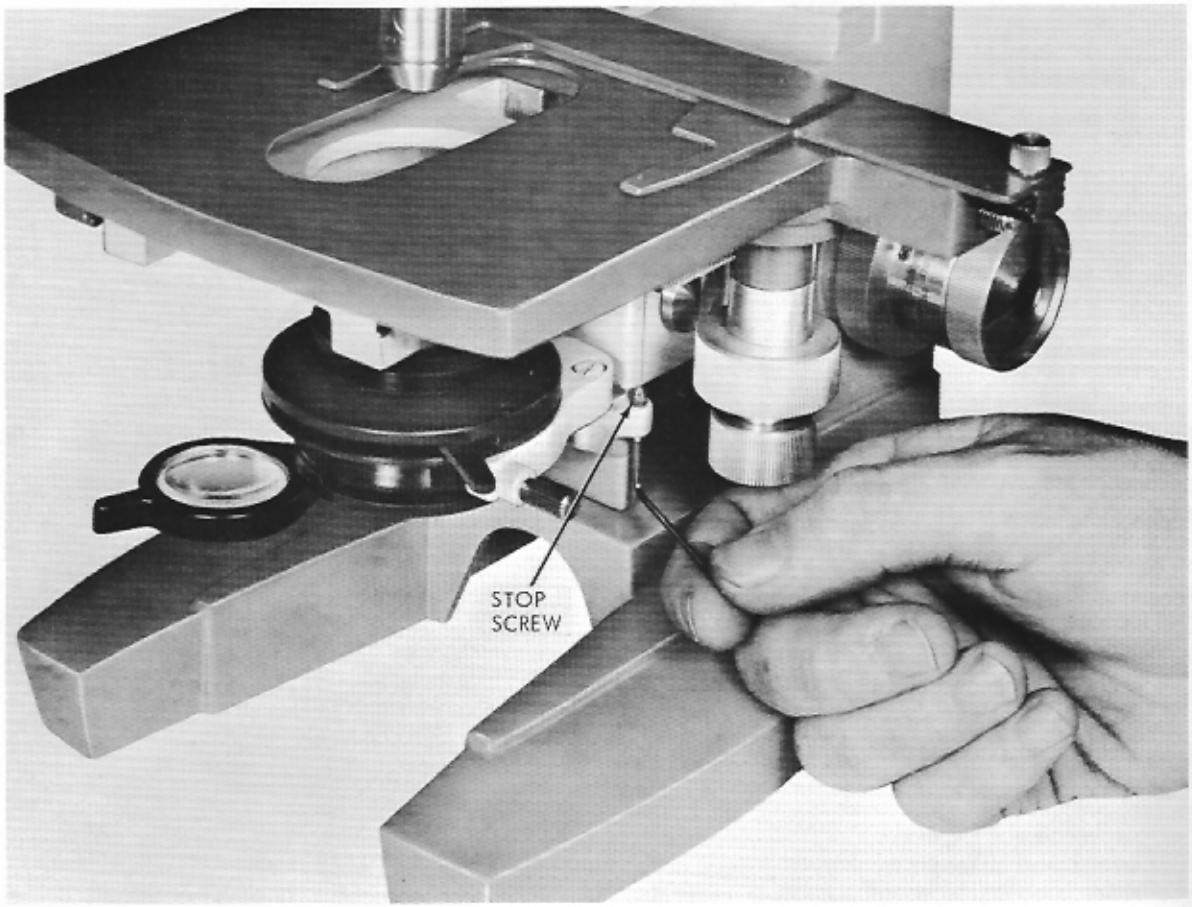


Figure 15. Adjusting Condenser Heights

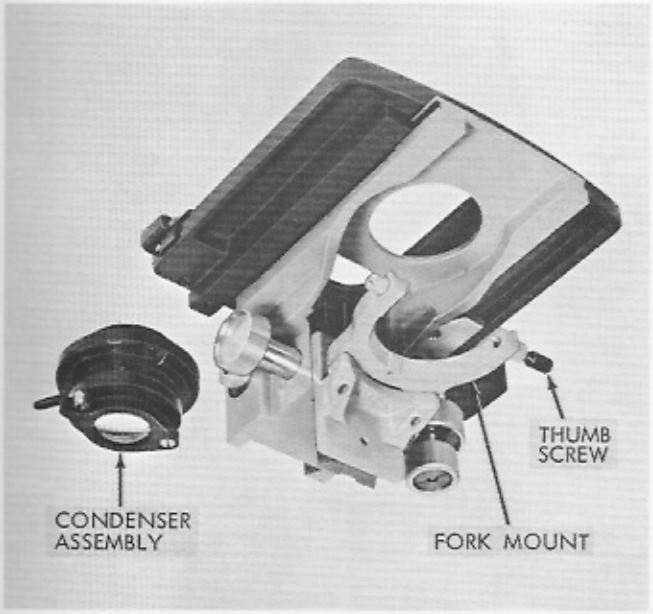


Figure 16. Removal of Condenser Assembly

laboratory use and is essential for microscopes equipped with oil immersion objectives.

b. Abbe Condenser, N.A. 0.66, Cat. No. 1089. This condenser is adequate for microscopes equipped with dry objectives.

c. Auxiliary Swing-in Condenser, Cat. No. 1090. This condenser (figure 19) permits filling the entire field of the 4X scanning objective when using the No. 1036 in-base illuminator, or when using external illuminators with the plano mirror. It is not required when the microscope is equipped with on-base illuminators, Cat. No. 1034 and No. 1037.

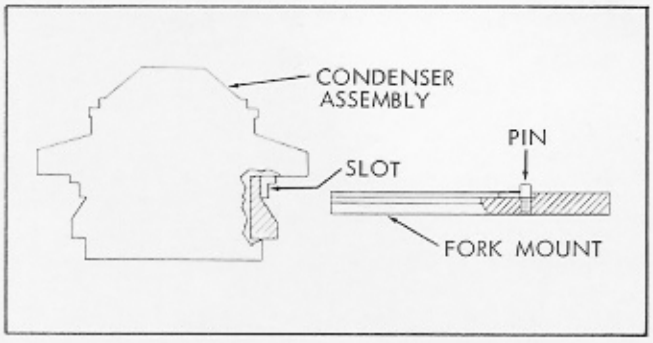


Figure 17. Fork Mount

If ordered later, the auxiliary swing-in condenser and stop pin can be readily attached to the bottom of the condenser mount in the threaded holes provided. The stop pin is provided with an eccentric mounting hole. This makes it possible to adjust the position of the stop pin to ensure that the auxiliary swing-in condenser is centered properly when swung into position.

For instructions on the use of darkfield condenser or phase condenser, see reference manuals furnished with these units.

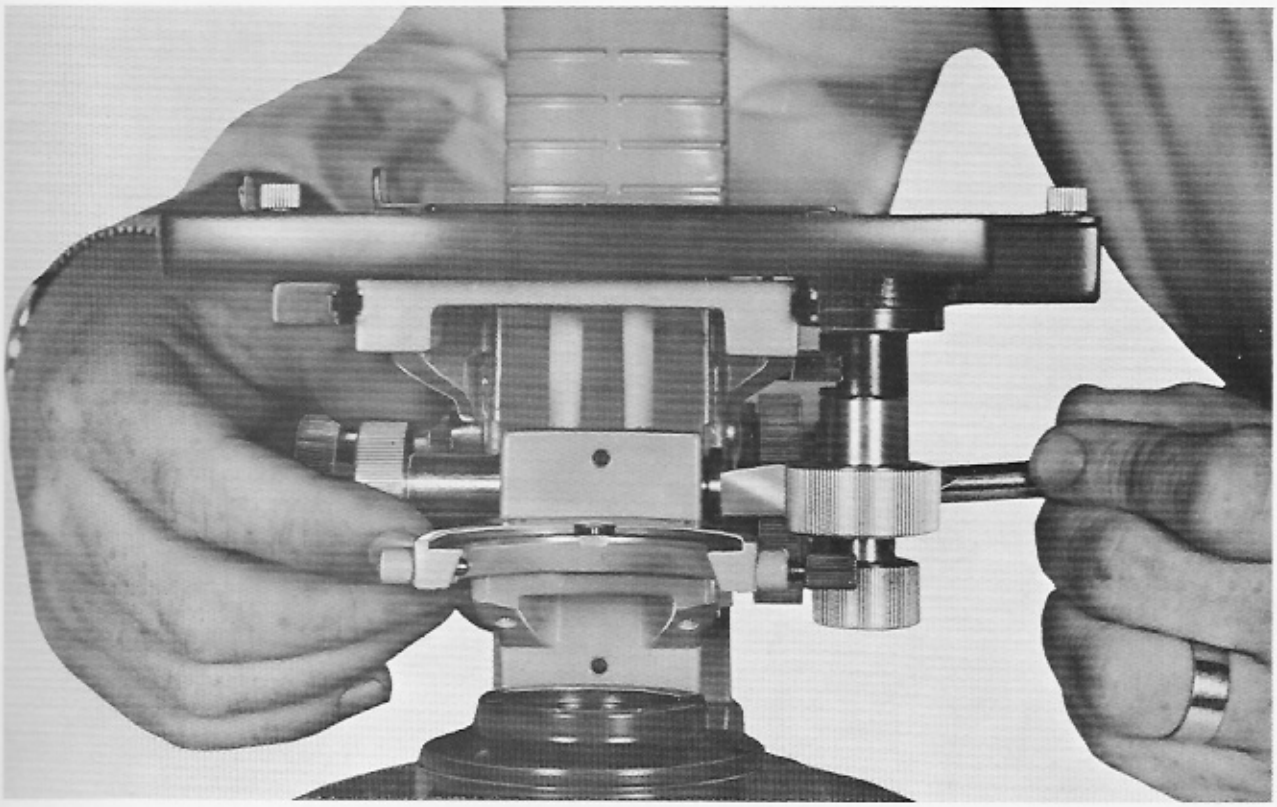


Figure 18. Adjustment of Focusing Tension

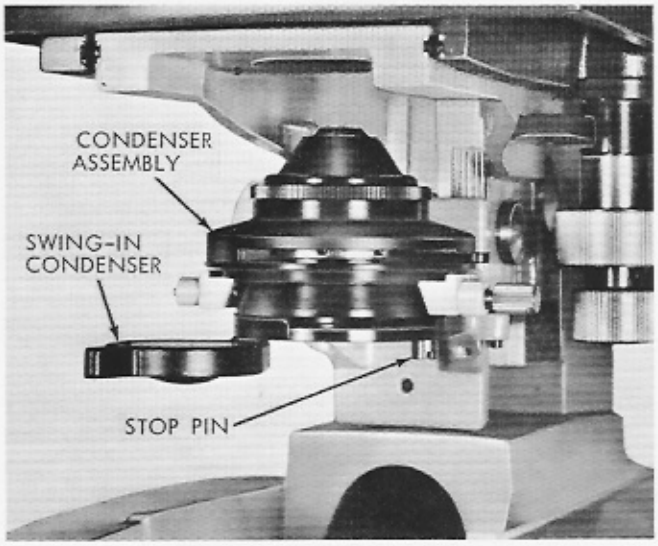


Figure 19. Auxiliary Swing-in Condenser

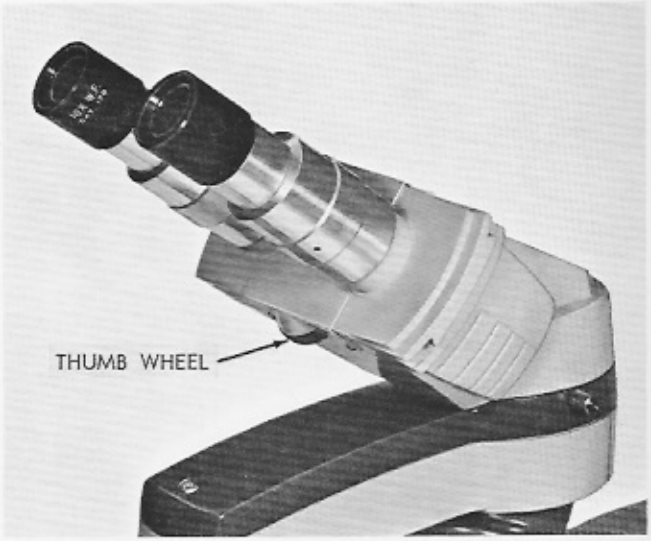


Figure 20. Interpupillary Distance Adjustment

X BODIES

1. Attaching and Removing Body

All bodies attach interchangeably to the upper arm support. See figure 1. The dovetail is accurately located by firmly tightening the knurled screw. Rotation of 180° does not impair centration. All bodies incorporate a telescope lens system designed specifically for the AO Microstar infinity corrected objective. All air-glass surfaces have a low reflection coating (Americote) for maximum light transmission and image contrast.

2. Monocular Bodies

Two types of monocular bodies are available; (1) Inclined for maximum viewing comfort, Cat. No. 1041; and (2) Vertical for photographic use, Cat. No. 1040.

3. Binocular Body, Cat. No. 1042

AO's unique construction automatically maintains constant tube length by linking the telescope lens assembly to the interpupillary change mechanism (figure 20). This means that a change of interpupillary distance does not affect parfocality, magnification, or calibrations which depend on magnification.

Interpupillary distance is changed by means of the thumb wheel provided. Always use the thumb screw for this adjustment instead of trying to pull the tubes apart. Return to correct interpupillary setting is instantly accomplished by means of the scale provided.

The left eyepiece tube is focusable to compensate for refraction differences of the eyes. The correct procedure is to focus on the specimen through the right eyepiece only, using the fine adjustment of the microscope, while covering the left eyepiece. Then focus the specimen through the left eyepiece by turning the eyepiece while covering the right eyepiece and without disturbing the fine adjustment. This is better practice than alternately opening and closing the eyes.

4. Trinocular Body, Cat. No. 1043

Construction of the trinocular body (figure 21) is very similar to that of the binocular. Instead of a fixed reflecting prism, this component is in a swing-out mount actuated by an external lever. With the prism swung out, all of the light goes to the third tube for photography or screen viewing. The photographic eyepiece tube is easily removable for use with integral cameras or for use with the viewing screen as illustrated in figure 22. The dust cap should always be installed when the photographic eyepiece or integral camera are not in use.

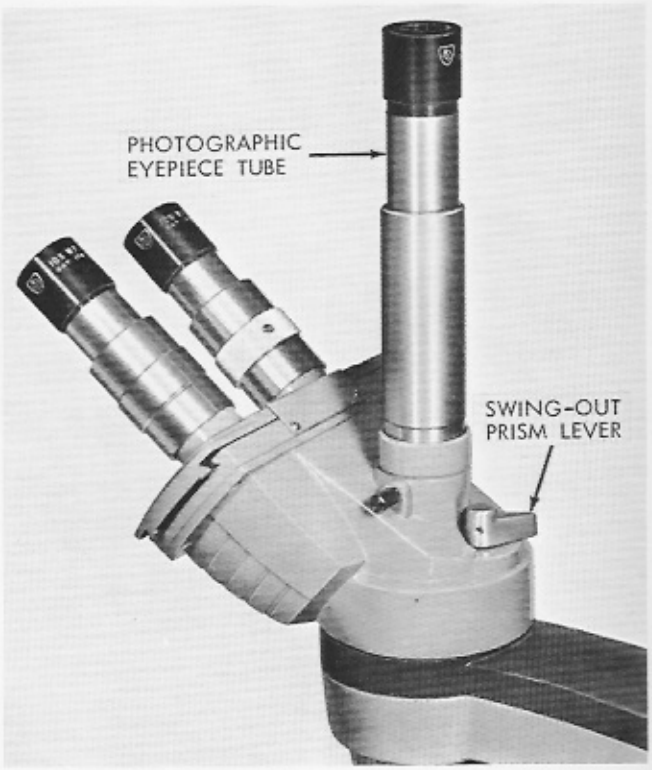


Figure 21. Trinocular Body

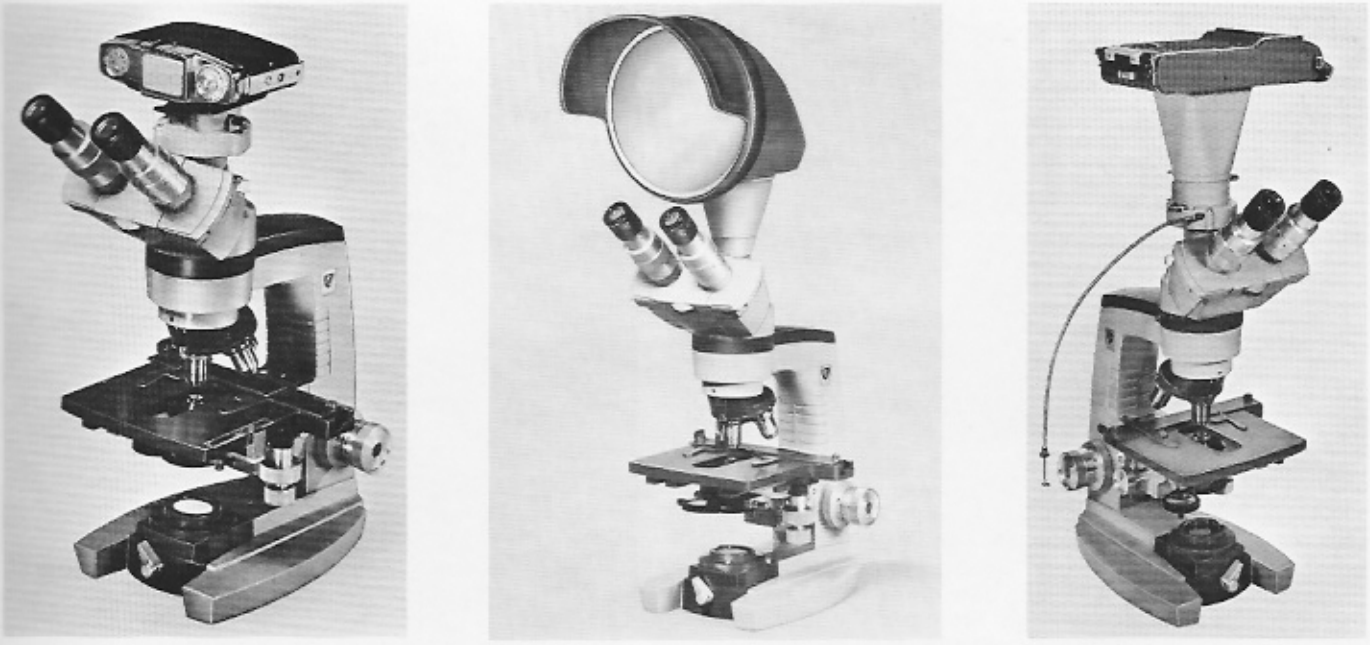


Figure 22. Trinocular Body with Integral Cameras and Viewing Screen

XI ILLUMINATORS

1. "On-Base" Type

   a. Cat. No. 1034. This illuminator (figure 23) is designed specifically for monocular models. If ordered with the microscope, it comes attached to the base. If ordered separately, it is easily attached by means of the two screws on the under side of the base. It utilizes a 15 watt medium screw base, 115 volt lamp, and plugs directly into a 115 volt AC outlet. A convenient on-off switch is located at the top of the illuminator. The illuminator contains a reflector, blue glass, and spherical condensing lens. It will fill the numerical aperture of all objectives and provide full field illumination of all magnifications, including the 4X scanning lens.

   b. Cat. No. 1037. This illuminator is designed specifically for binocular models, Similar in appearance and construction to Cat. No. 1034 except that it contains a more highly corrected aspheric condenser yielding greater intensity.

   c. Changing Lamp. To change lamp in Cat. No. 1034 or No. 1037 illuminators, refer to figure 24. The top half of the illuminator is removable from the lower half by unlocking the slide catch on the under side of the illuminator. Tilt the microscope on its side for ready access. When this catch in unlocked, the top half lifts off the lower half. Be sure that the top half is located properly before replacing.

   d. Lamp Specification, Cat. No. 611. Manufacturer's designation 15S11/102. Wattage 15, voltage 115, filament C-7A. Base medium screw. Rated hours 400.

2. "In-Base" Type

   a. Cat. No. 1036. Recommended for binocular and trinocular use and for photomicrography or screen viewing. When ordered with the microscope, it comes attached to the base. It is operated through the 5-step variable transformer, Cat. No. 1051, utilizing 6.5 volt lamp.

      (1) Transformer Setting - For visual observation, operate the transformer at any voltage setting most comfortable. A separate,

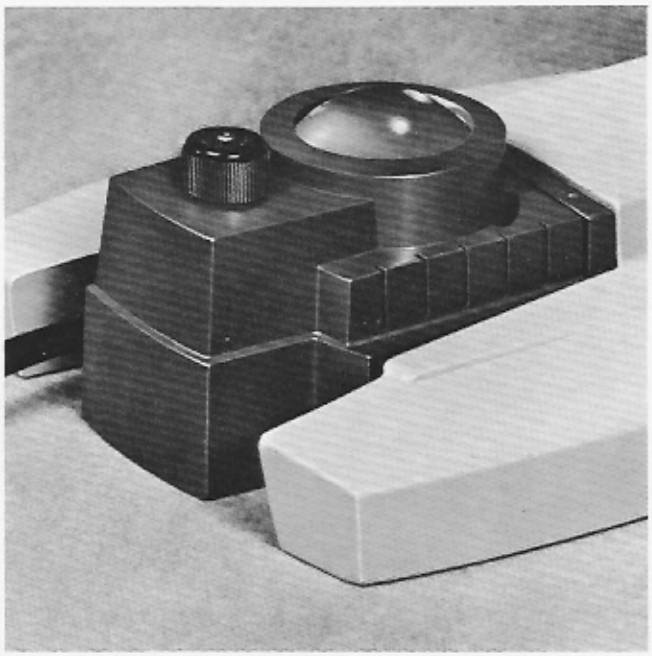


Figure 23. Cat. No. 1034 Illuminator

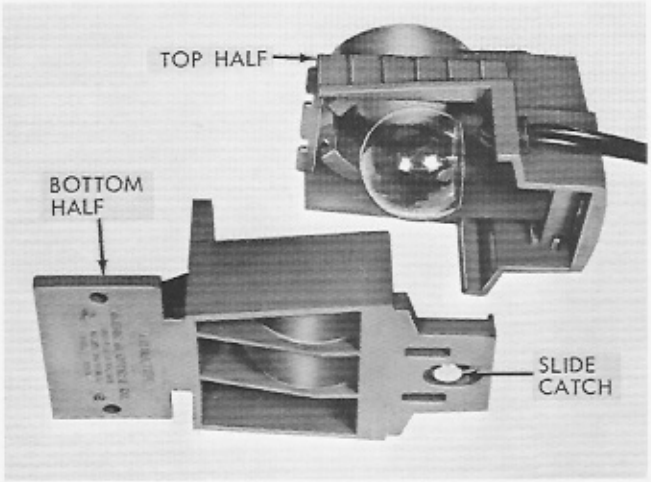


Figure 24. Changing Lamp in "On-Base" Illuminator

33 mm. diameter, blue glass filter is supplied which fits into the top of the illuminator. For visual observation, it gives a quality of light approximating daylight in color temperature and will be preferred for most uses.

(2) Neutral Density Filter. A integral neutral density filter is incorporated as standard equipment in the Cat. No. 1036 illuminator (figure 25). It has a transmission of approximately 10% and is controlled by a lever in the front of the illuminator. Because of the high intensity provided with this illuminator, for ordinary bright field work it will probably be more comfortable to use the neutral density filter.

For phase microscopy, darkfield, and for use with the viewing screen, maximum illumination is desirable, and the neutral density filter should not be used.

Lamp life decreases very rapidly with increased voltage. From this standpoint, it is better to reduce the voltage setting on the transformer in order to reduce intensity, rather than using the neutral density filter at a higher voltage setting. However, reducing voltage makes the light more red; increasing it makes the light bluer. So even for visual observation, some observers will be willing to sacrifice lamp life by setting the transformer at a higher setting, and, if necessary, use the neutral density filter to achieve comfortable intensity.

b. Changing Lamp (See figure 26). The lamp is easily replaced by tilting the microscope over on its side, swinging the lamp socket out on its pivot as illustrated. The lamp is of the prefocus type and is removed by pushing down and turning slightly counterclockwise to disengage the slots from the pins. A special tool, AO #1036-856, consisting of a fiber tube with a rubber insert, is provided with the microscope for removing the lamp.

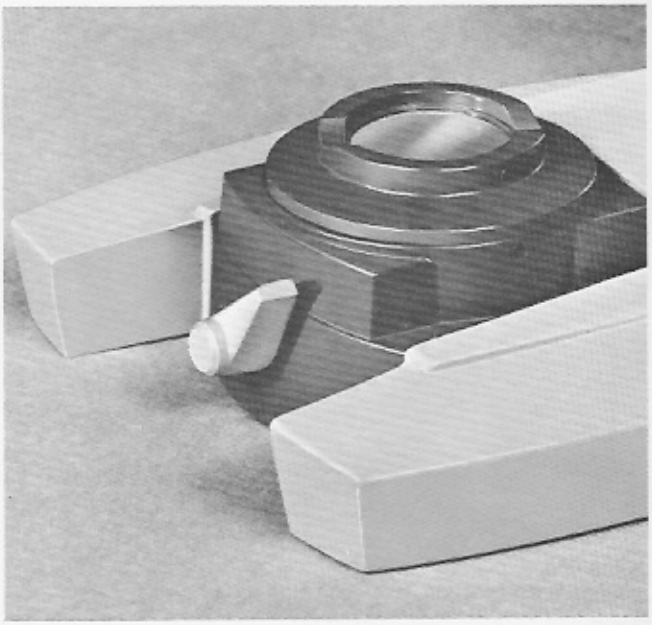


Figure 25. Cat. No. 1036 Illuminator

XII CARE OF THE MICROSCOPE

1. General

Cleanness of all optical components of the microscope is important for good optical performance. Therefore, the microscope, when not in use, should always be covered with the plastic cover provided. If any optical surface becomes badly coated with dust or dirt, all such loose dust or dirt should be blown off with a syringe or removed with a camel's hair brush before attempting to wipe the surface clean.

Optical surfaces should be cleaned with a lint-free cloth, lens tissue, or a Q tip moistened with xylene or alcohol. It is very important to avoid the use of excessive solvent. The cloth, lens tissue, or Q tip

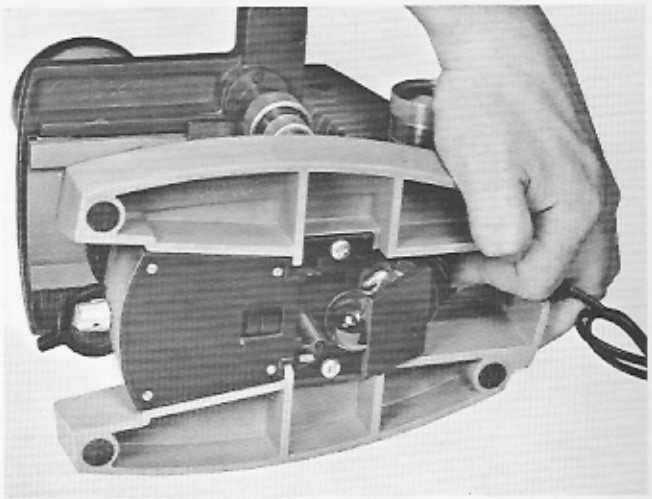


Figure 26. Changing Lamp in "In-Base" Illuminator

should be just moistened with solvent, and not wet enough for the solvent to run down in around the lens with the resultant danger of loosening cement on interior surfaces.

2. Cleaning Objectives

No part of the microscope is quite so vulnerable to lack of complete cleanness as the front lens of the objective. Fingerprints and oil smears on the front lens will greatly impair the performance of a fine objective. Whenever lack of contrast, cloudiness, or poor definition is encountered, carefully check the condition of the front lens with a magnifier. Subtle loss of contrast and definition due to a slight smear on the front lens is often overlooked and can be avoided with routine inspection and cleaning.

The 4X, 10X, and 20X objectives with fairly large plano front lenses can be cleaned with a cloth or lens tissue wrapped around the finger and moistened with xylene or alcohol. The 45X and 100X oil immersion objectives require a little more care, and examination with a magnifier is recommended; the 10X wide field eyepiece, reversed, is an excellent magnifier for this purpose. See figure 27.

To achieve the high degree of flatness obtained with the new #1078 45X infinity corrected objective, it was necessary to utilize a small concave front lens of fairly short radius of curvature. The surface of this front lens can be readily cleaned as illustrated in figure 28 with a toothpick covered with cotton at the tip, or with a small Q tip. Moisten the cotton with xylene

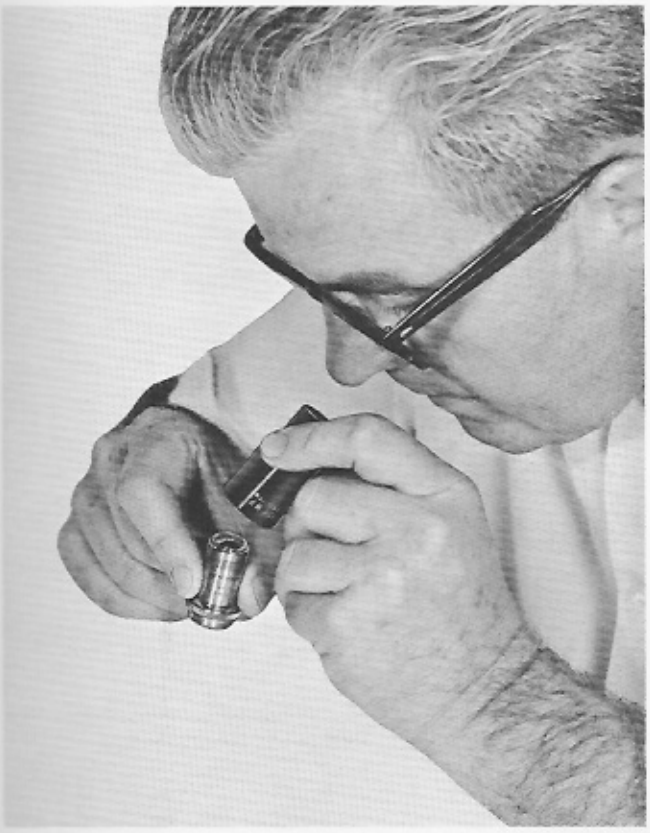


Figure 27. Checking for Cleanness

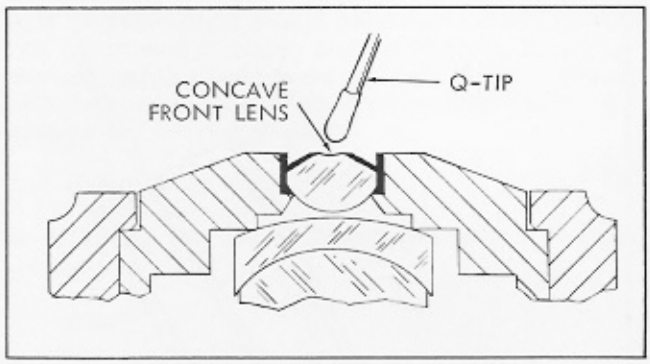


Figure 28. Cleaning Front Lens of #1078 45X Objective

or alcohol, and squeeze almost dry. Wipe the front lens lightly without applying any undue force or scrubbing action. Make sure that the cotton tip contacts the concave lens surface. Check with the magnifier after cleaning.

3. Cleaning Monocular Bodies

The reflecting mirrors within the inclined monocular body are protected from loose dust and dirt by the telescope lens assembly at the bottom of the body and by a protective window at the bottom of the eyepiece tube. Remove and clean the protective window as illustrated in figures 29 and 30. Before removing the two small Allen screws, mark with a pencil the position of the eyepiece tube with respect to the body assembly so that it can be reinstalled at the same height. If the eyepiece tube is removed without marking, it can be returned to the proper height as follows:

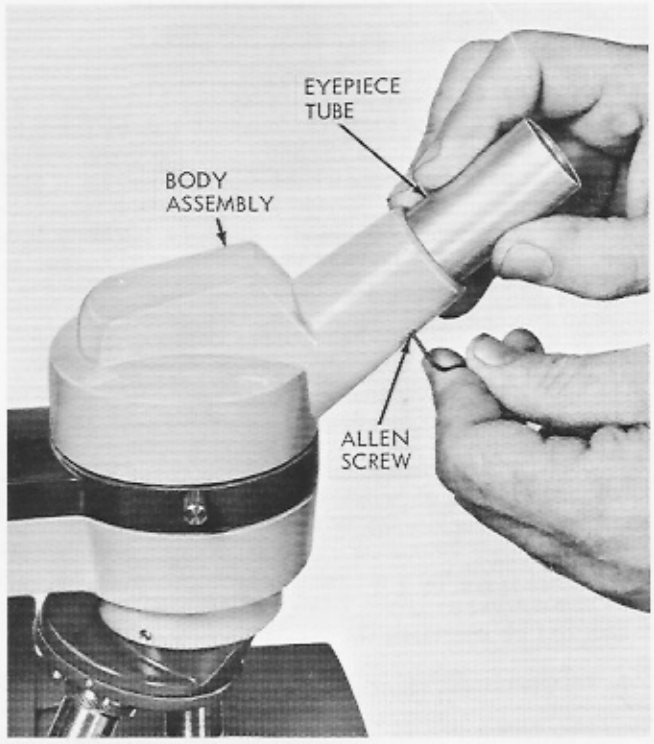


Figure 29. Removing Eyepiece Tube

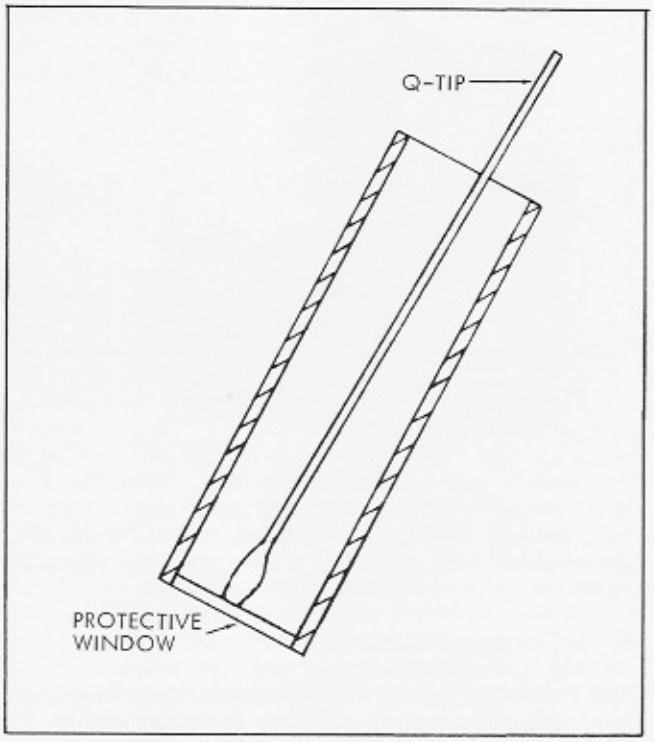


Figure 30. Cleaning Protective Window

Remove the body assembly, insert an eyepiece in the eyepiece tube, and insert the eyepiece tube in body assembly. View a distant object through this assembly, and focus by adjusting the height of the eyepiece tube. When the distant object is in sharp focus, the height of the eyepiece tube is correct. Lock the eyepiece tube in this position with the two Allen screws.

4. Cleaning Binocular Body

The internal optical surfaces of the binocular body are sealed against entry of dust and dirt by the telescope lens assembly at the bottom of the body, and by the plano parallel glass windows at the bottom of each eyepiece tube. The external surface of the telescope lens assembly seldom needs cleaning because it is protected when the body is in place.

CAUTION

When removing the binocular body, be careful not to get fingerprints on the lower lens surface.

The eyepiece tube windows are most easily cleaned with a Q tip moistened with a mild soap solution, or, if necessary, xylene or alcohol. If the eyepieces are removed from the microscope during storage, be sure to protect the eyepiece tubes against the entry of dust and dirt by inserting the plastic eyecups.

5. Cleaning Trinocular Body

The procedure used for cleaning the binocular body also applies for cleaning the trinocular body except that one additional surface may require cleaning. This surface is the swing-out prism which may collect dust and dirt when the vertical tube, cameras, or viewing screen are removed. The prism can be cleaned with a moistened Q tip. Always keep the protective cap over the third tube opening when accessories are not attached. When the photographic tube is attached, always keep either an eyepiece or the plastic eyecup in place.

6. Mechanical Maintenance

Faithful use of the dust cover is also advantageous in keeping the microscope in good mechanical condition and appearance.

The AO Microstar is finished in a durable finish which is impervious to most commonly used laboratory reagents. It may be cleaned with a cloth dampened with a mild soap solution or xylene. The same precaution of not using too much solvent should also be followed; because such solvent, running down into bearings, can remove necessary lubricant and cause malfunction.

There is very little in the way of re-lubrication or routine-maintenance required on the AO Microstar microscope. As pointed out previously, the focusing mechanism does not require lubrication, nor does the mechanical stage. The only slide which should require periodic lubrication and cleaning is the substage condenser slide. This should be kept clean by wiping away old lubricant with xylene and re-lubricating with Vaseline or a light grease.

7. Removing Nosepiece

To remove the nosepiece (see figure 31), lower the nosepiece with the coarse adjustment until the front allen screw (A) becomes accessible. Back off the allen screw, and remove the nosepiece. Do not alter the position of the two allen screws on the sides of the arm, these are a factory set adjustment.

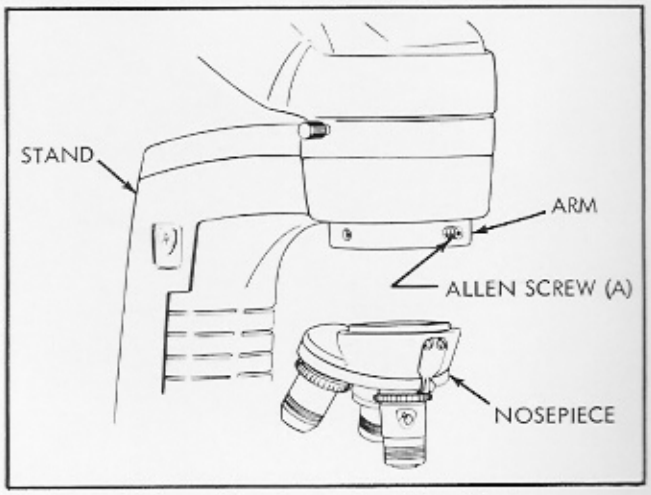


Figure 31. Removing Nosepiece

Complete repair facilities are always available at AO's Instrument Division plant at Buffalo, N.Y., and at many of AO's authorized dealers.

XIII PARTS LIST

1. General

This section contains a listing of parts and illustrations for the AO Microstar Microscope.

The illustrations are used to identify and locate parts of the microscope, and are keyed to the parts lists by the use of index numbers. To order a part, identify and locate the part by using the illustrations. Note the index number for the part and cross-reference it to the parts list. The part number, description, and quantity required will be found opposite the index number.

In certain cases, it may be desirable to replace a complete assembly instead of overhauling or rebuilding with detail parts. Where complete assemblies are available, they are indicated by a note in the description column to show which parts they include. Detail parts of these assemblies are also available separately.

Parts or assemblies should be ordered directly from AO's Instrument Division plant at Buffalo, N.Y., or from any of AO's authorized dealers. When ordering parts, be sure to include a complete description, part number, and correct quantity.

2. Contents

The following is a list of assemblies broken down in this section:

Stand

Monocular Assembly

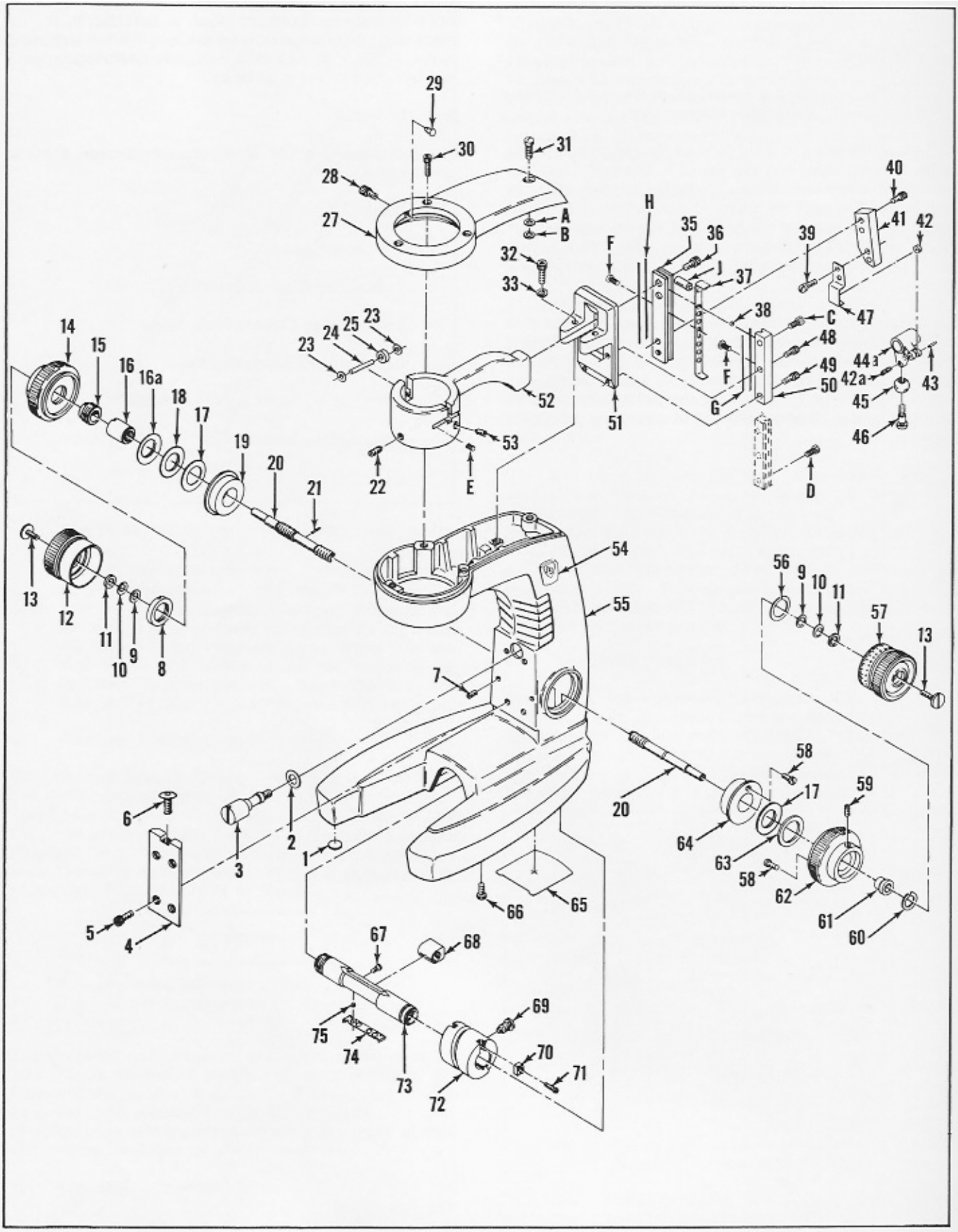
Trinocular (two illustrations)

Ungraduated Conventional Stage

Transformer Assembly

Illuminator, Models 1034 and 1037

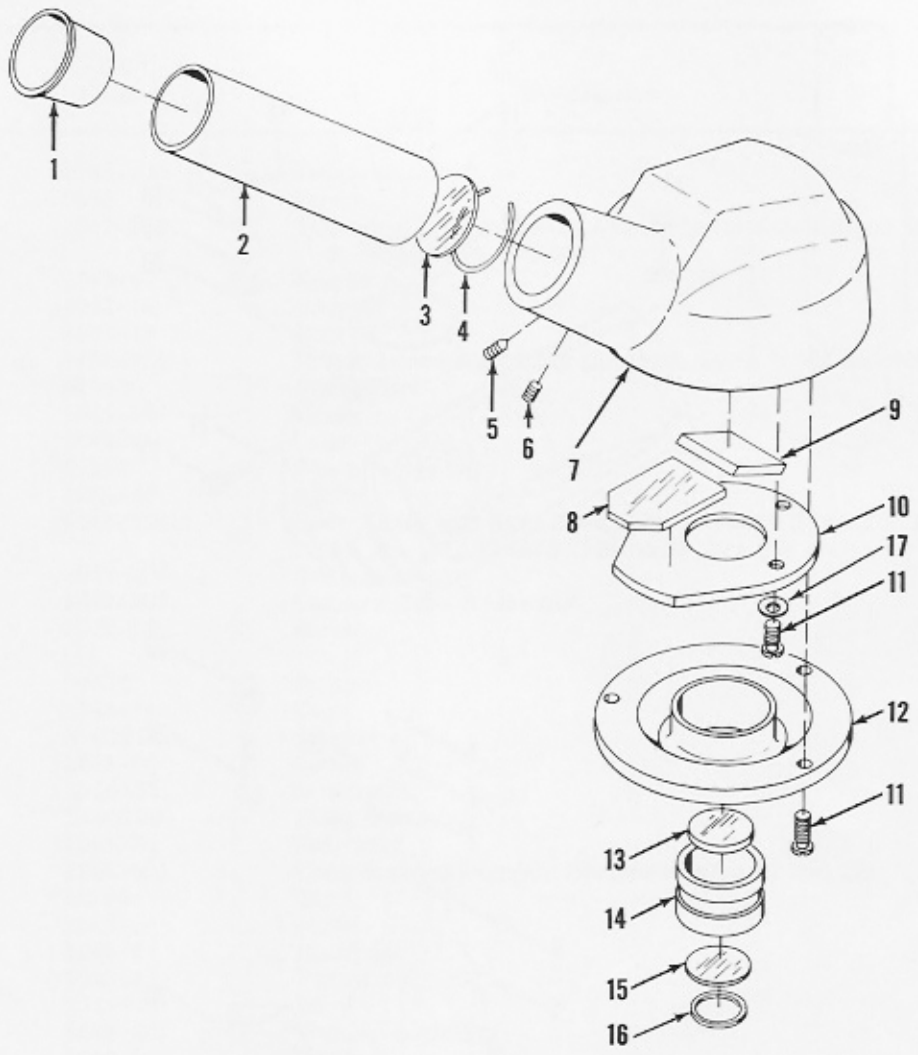
Illuminator, Model 1036


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16a
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Stand

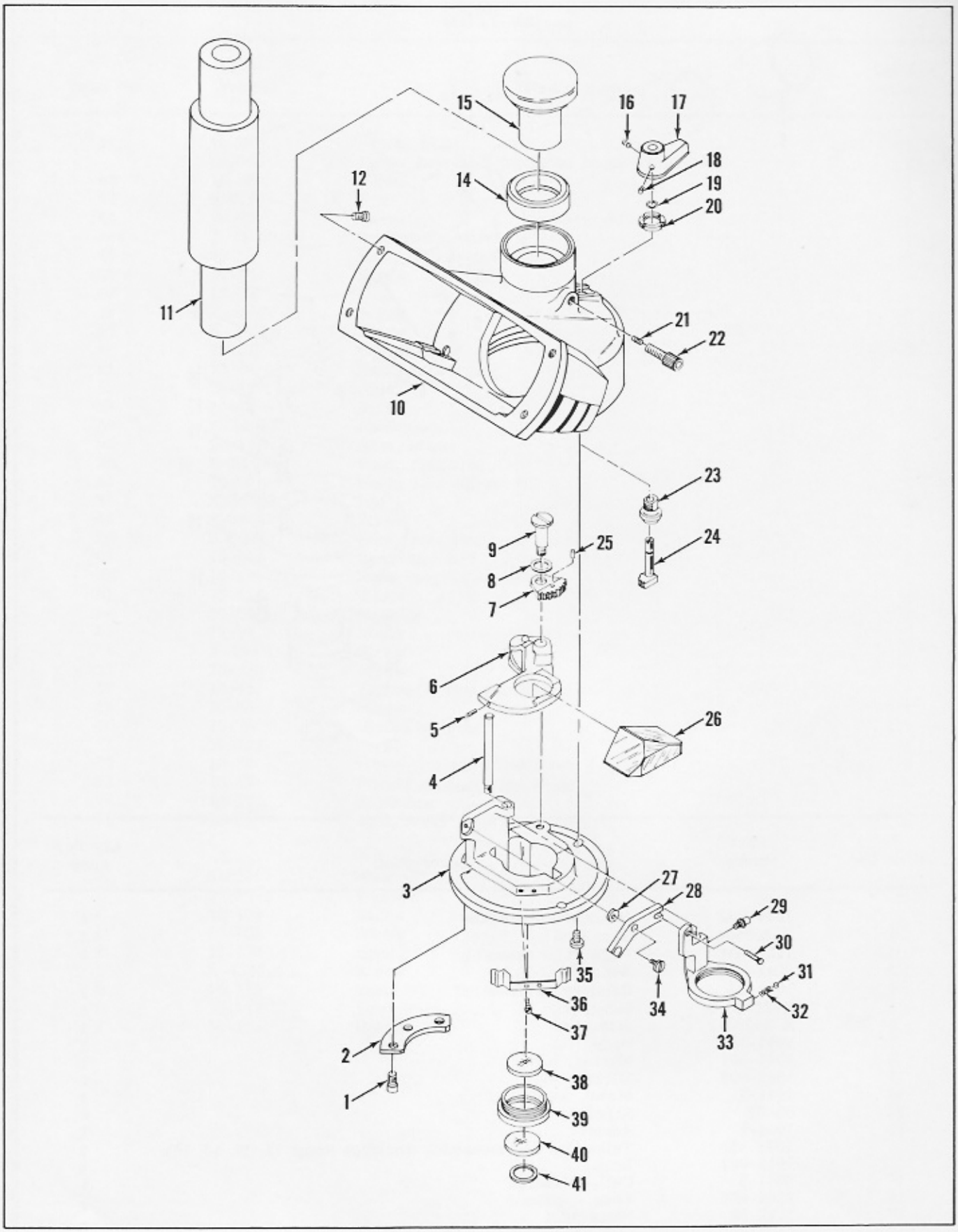
Index No.	Part Number	Description	Qty Per Assy
	10-800	Stand	1
1	2-52	Foot, base	4
2	10-88	Washer	1
3	10-87	Screw	1
4	10-22	Slide, stage	1
5	X-19448	Screw	4
6	X-51607-22	Screw, Allen	1
7	X-20648	Setscrew	2
8	10-68	Nut	1
9	10-75	Washer	2
10	X-50491	Washer, spring	2
11	10-62	Washer	2
12	10-91	Knob, plain, fine adjustment	1
13	10-61	Screw	2
14	10-90	Knob, plain, coarse adjustment	1
	10-852	Fine and Coarse Adjustment Assembly (includes items 15, 16, 20, 21, 61, and 67 thru 75)	1
15	10-66	Retainer	1
	10-501	Fine Adjustment Screw Assembly (includes items 16, 20, and 68)	1
16	10-65	Bushing, adjustable	1
16a	X-50864	Washer, spring	1
17	10-133	Washer, flat steel	2
18	10-76	Washer, thin fiber	1
19	10-92	Bushing	1
20	10-63	Shaft	1
21	01588	Pin	2
22	10-93	Screw	1
23	10-18	Washer	4
24	10-17	Pin	2
25	10-21	Bearing, ball	2
27	10-7	Cover	1
	10-853	Lock Screw Assembly (includes items 28 and 29)	1
28	10-10	Screw	1
29	10-95	Tip, lock screw	1
30	X-19406-58	Screw	3
31	X-27453-11	Screw	1
32	X-19466	Screw	2
33	01257-2	Washer	2
	10-855	Arm and Slide Assembly (includes items 34 and 41, and 48 thru 52)	1
34	X-50786	Pin	1
35	10-116	Slide, bearing	1
36	X-19454	Screw	2
37	10-97	Retainer, ball	2
38	B35-14	Ball, steel	10
39	X-798-1	Screw	2
40	X-19400	Screw	2

Index No.	Part Number	Description	Qty Per Assy
41	10-28	Block, slide	1
	10-854	Lever Assembly (includes items 42 thru 46)	1
42	10-86	Wheel	1
43	01521	Pin	1
44	10-83	Lever	1
44a	X-25750-58	Setscrew, Allen	1
45	10-84	Ball, adjustment lever	1
46	10-85	Screw	1
47	10-99	Clip	1
48	X-20078	Screw	2
49	X-20072	Screw	1
50	10-115	Gib, bearing	2
51	10-25	Bracket, bearing	1
52	10-117	Arm	1
53	10-98	Screw	2
54	X-50963	Nameplate	2
55	10-119	Arm, stand	1
56	X-51180	Ring, retaining	1
57	10-60	Knob, fine adjustment	1
58	X-51603	Pin	2
59	X-36848	Screw	2
60	X-50953	Ring, retaining	1
61	10-64	Bearing, shaft	1
62	10-129	Knob, coarse adjustment	1
63	10-134	Washer, fiber	1
64	10-131	Bushing	1
65	10-96	Cover	1
66	X-29067-2	Screw	2
67	10-135	Screw	1
68	10-81	Follower, fine adjustment	1
69	10-80	Screw	1
70	10-79	Block, bearing	2
71	10-122	Screw	2
72	10-78	Worm, coarse adjustment	1
73	10-67	Barrel	1
74	10-82	Separator	2
75	10-6	Ball, steel	6
A	01068	Washer	1
B	01030-1	Washer	1
C	10-104	Screw	2
D	10-103	Screw	1
E	10-110	Spring	2
F	X-1390-1	Screw	4
G	10-113	Short Wire Track	4
H	10-112	Long Wire Track	4
J	10-102	Roller	1



Monocular Assembly

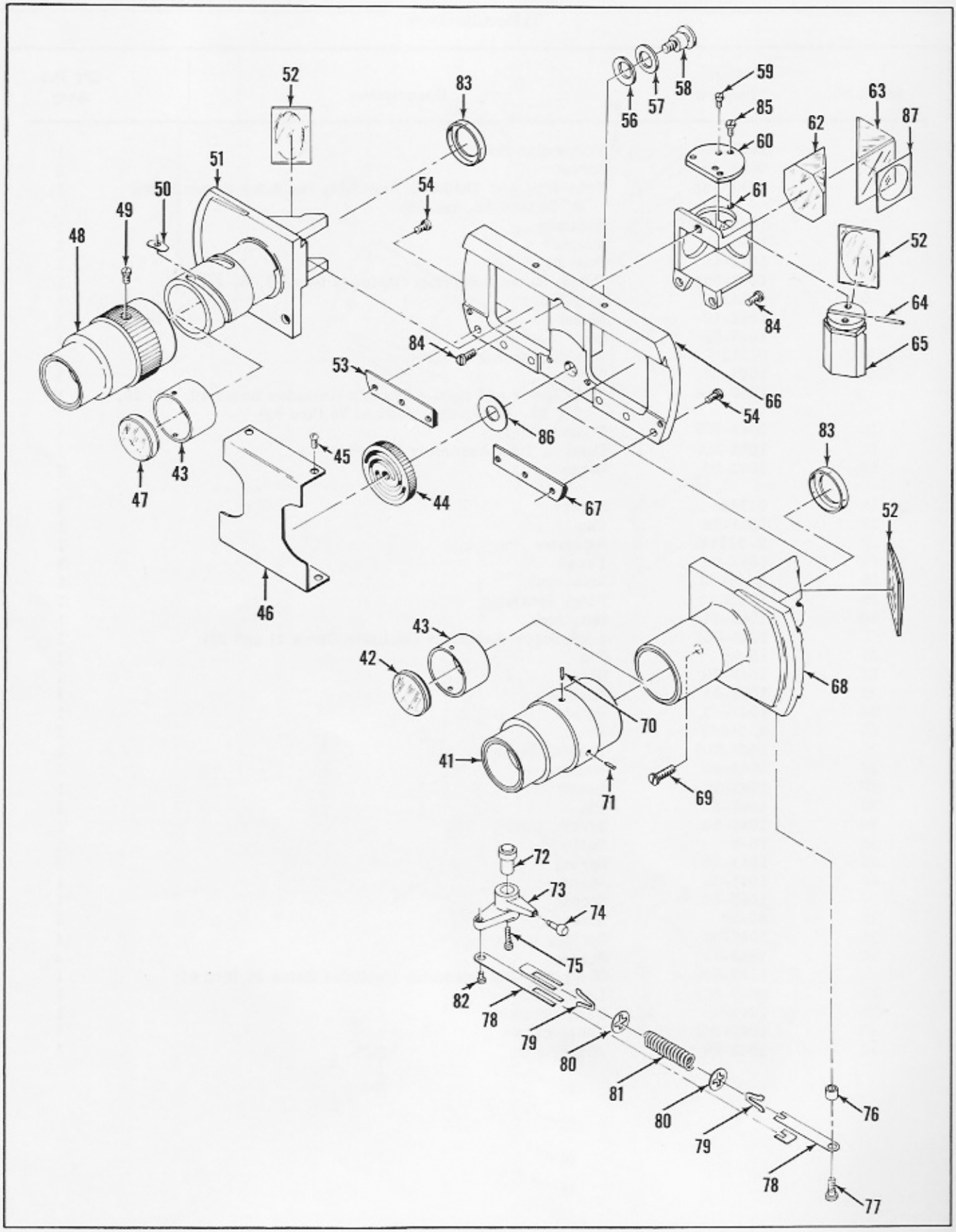
Index No.	Part Number	Description	Qty Per Assy
	1041-800	Monocular Assembly	1
1	X-50550	Cap, dust	1
2	1041-501	Draw Tube Assembly	1
3	1042-607	Window	1
4	1041-11	Retainer, window	1
5	X-21336-3	Setscrew	1
6	X-25100-3	Setscrew	1
7	1041-3	Body	1
8	1041-601	Mirror, lower	1
9	1041-602	Mirror, top	1
10	1041-7	Mount, lower mirror	1
11	60-57	Screw	6
12	1041-4	Adapter	1
	1041-851	Telescope Cell Assembly (includes items 13, 14, 15, 16)	1
13	1042-602	Lens	1
14	1041-5	Cell, telescope	1
15	1042-601	Lens	1
16	1042-59	Diaphragm	1
17	01091-3	Cup Washer	3



Trinocular (Sheet 1 of 2)

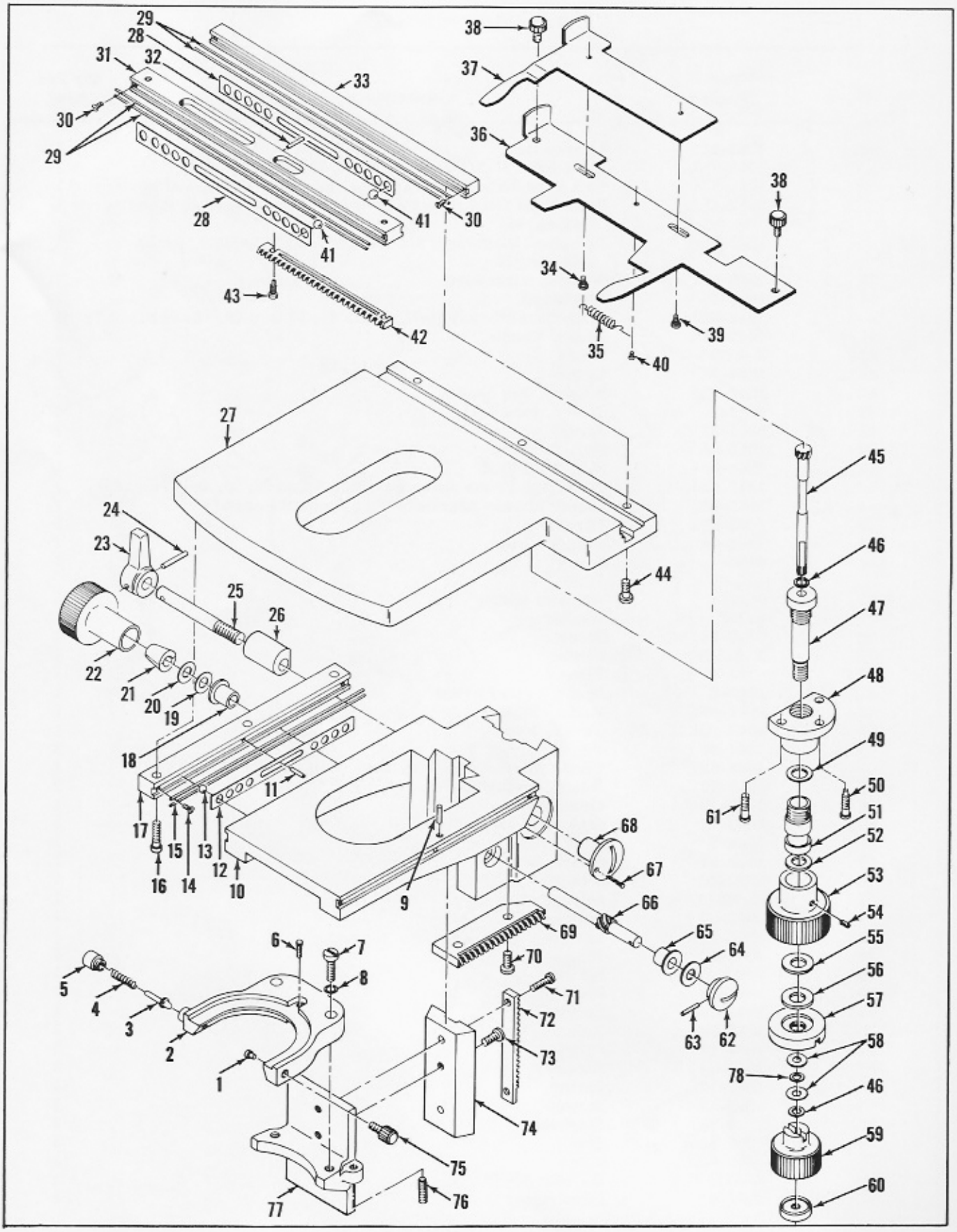
Trinocular Body

Index No.	Part Number	Description	Qty Per Assy
	1043-800	Trinocular Body	1
1	0458	Screw	2
	1043-852	Telescope and Throw-In Assembly (includes items 2 thru 9, 25 thru 34, and 36)	1
2	1042-47	Retainer	1
3	1043-14	Adapter	1
4	1042-41	Post	1
	1043-851	Prism Mount Assembly (includes items 5, 6, and 26)	1
5	01541	Pin, Index	1
6	1043-16	Mount	1
7	1043-61	Gear	1
8	01235	Washer, spring	1
9	1043-68	Screw	1
	1043-854	Body Lever and Arm Assembly (includes items 10, 13, 19, 20, 23, 24, 72 thru 75, and 78 thru 82)	1
10	1043-502	Body Assembly	1
11	1043-501	Camera Tube Assembly	1
12	1042-52	Screw	7
14	01374	Spacer	1
15	1043-74	Cap	1
16	X-21336	Setscrew	1
17	1043-66	Lever	1
18	X-25100	Setscrew	1
19	X-50820	Ring, retaining	1
20	1043-64	Nut, lock	1
	1043-853	Lock Screw Assembly (includes items 21 and 22)	1
21	10-95	Tip	1
22	1043-76	Screw	1
23	1043-63	Bushing	1
24	1043-62	Pinion	1
25	X-50763	Pin	1
26	1043-603	Prism, deviating	1
27	1042-39	Washer	1
28	1042-38	Lever	1
29	1043-67	Pin	1
30	1042-50	Screw, pilot	1
31	10-6	Ball	1
32	1042-46	Spring	1
33	1043-25	Mount	1
34	1042-40	Screw	1
35	60-57	Screw	3
36	1043-29	Spring, index	1
37	1042-52	Screw	2
	1042-851	Objective Cell Assembly (includes items 38 thru 41)	1
38	1042-602	Lens, flint	1
39	1042-42	Cell, objective	1
40	1042-601	Lens, crown	1
41	1042-59	Diaphragm	1



Trinocular (Sheet 2 of 2)

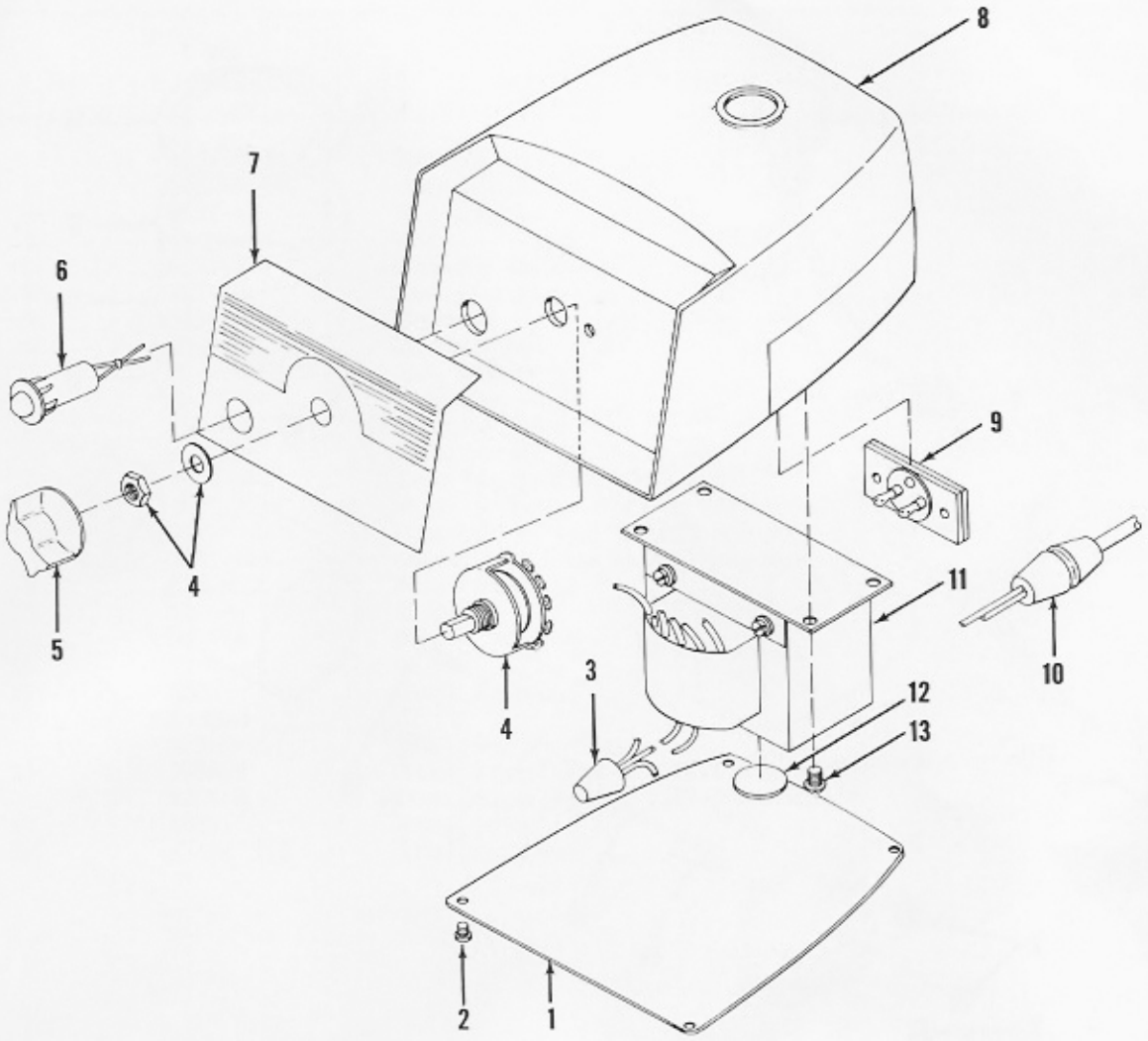
Index No.	Part Number	Description	Qty Per Assy
41	1042-18	Sleeve, fixed	1
	1042-853	Right Hand Slide Assembly (incl. items 43, 47, 51, and 52)	1
	1042-854	Left Hand Slide Assembly (incl. items 42, 43, 52, and 68)	1
	1042-857	Right Hand Diaphragm and Window Assembly (incl. items 42 and 43)	1
	1042-858	Left Hand Diaphragm and Window Assembly (incl. items 43 and 47)	1
42	1042-607	Window, right hand	1
43	1042-45	Diaphragm	2
	1042-859	Slideway Assembly (incl. items 44, 53 thru 58, 66 and 67)	1
44	1042-26	Wheel, thumb	1
45	X-34585	Screw	4
46	1042-3	Cover	1
47	1042-608	Window, left hand	1
48	1042-20	Sleeve, focusing	1
49	0281-22	Screw	1
50	1042-43	Key, focusing	1
51	1042-9	Slide, left hand	1
	1042-856	Mount and Prism Assembly (incl. items 52, 54, and 61 thru 65)	1
	1042-852	Center Mirror Assembly (incl. items 52 and 65)	1
52	1042-606	Mirror	3
53	1042-48	Gib, left hand	1
54	0458	Screw	8
56	01163	Washer, spring	1
57	01293	Washer	1
58	0142-54	Screw	1
59	X-32524	Screw	2
60	0142-55	Plate	1
61	1042-5	Mount, center prism	1
62	1042-605	Prism, upper	1
63	1042-604	Prism, lower	1
64	1042-56	Pin	1
	1042-852	Center Mirror Assembly (incl. items 52 and 65)	1
65	1042-28	Mount, center mirror	1
66	1042-10	Slideway	1
67	1042-49	Gib, right hand	1
68	1042-7	Slide, right hand	1
69	1042-51	Screw, pilot	2
70	X-51403	Setscrew	1
71	X-25749	Setscrew	1
72	1042-37	Bushing	1
73	1042-35	Lever	1
74	1042-36	Pin, ball	1
75	X-32402-22	Screw	1
76	1043-30	Spacer	1
77	1042-30	Screw	1
78	1043-69	Arm	2
79	1043-72	Clip	2
80	1043-71	Retainer, spring	2
81	1043-70	Spring	1
82	1042-33	Screw	1
83	1042-58	Diaphragm	2
84	1042-52	Screw	3
85	1042-62	Screw	3
86	X-51368	Washer	1
87	1042-61	Diaphragm	3



Ungraduated Mechanical Stage

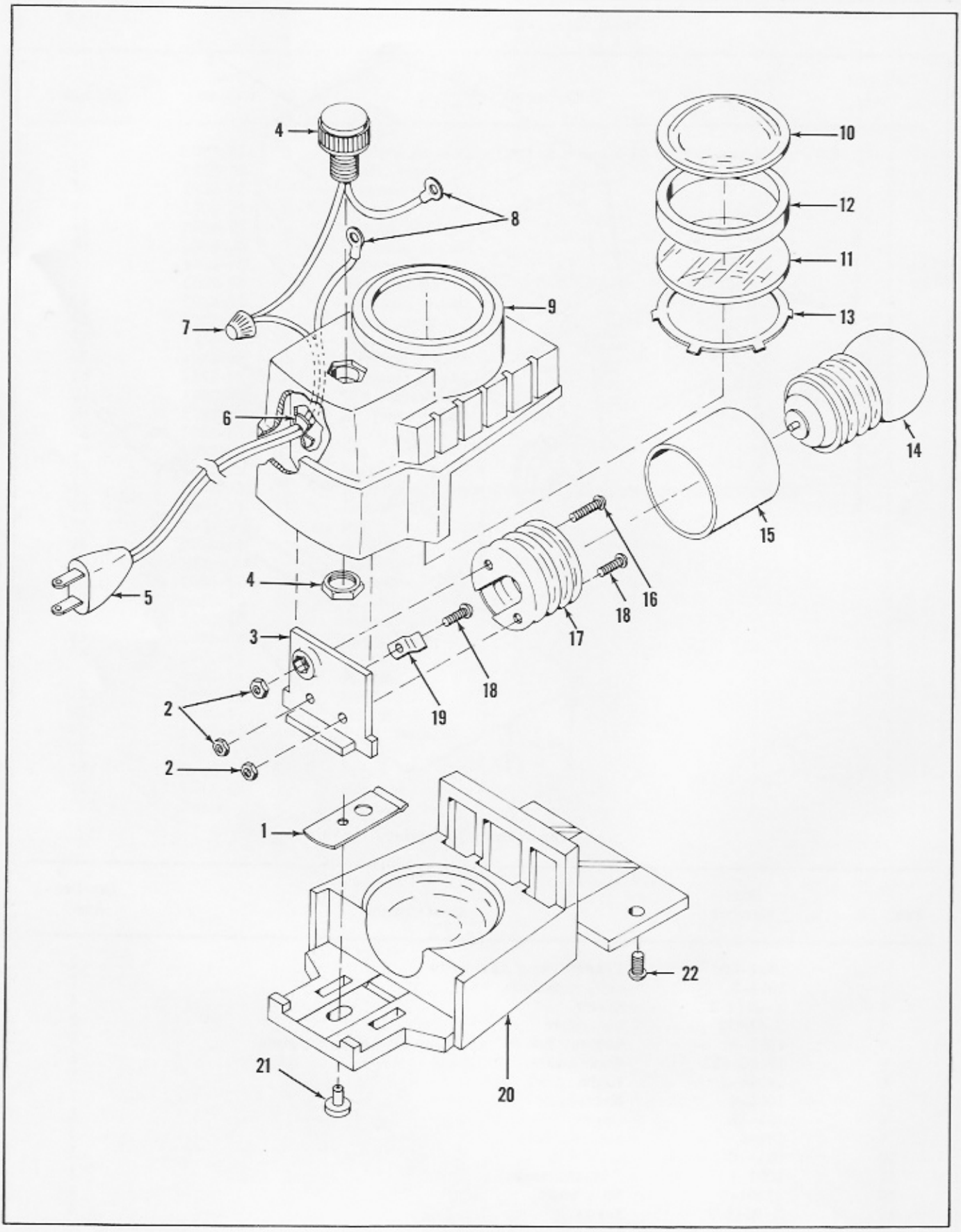
Index No.	Part Number	Description	Qty Per Assy
	1062-800	Ungraduated Mechanical Stage	1
	10-853	Lock Screw (includes items 1 and 75)	1
1	10-95	Tip	1
2	10-49	Holder, condenser	1
3	35-38	Plunger	1
4	B35-40	Spring	1
5	1062-50	Cap, plunger	1
6	B35-79	Index, condenser	1
7	0865-40	Screw	2
8	01025-1	Washer	2
9	X-50468	Pin	1
10	1062-4	Base, stage	1
11	X-50947	Pin	2
12	1062-18	Separator, short	2
13	18020-348	Ball	16
14	X-1390-1	Screw	8
15	1062-19	Track, short	8
16	1062-54	Screw	3
17	1062-20	Guide, short	1
18	B35-47	Bearing	1
19	01186-1	Washer	1
20	1062-60	Washer	1
21	35-48	Bearing, thrust	2
22	1062-38	Knob	1
	1062-853	Lock Shaft and Lever Assembly (includes items 23 thru 25)	1
23	1062-35	Lever	1
24	X-15086	Pin	1
25	1062-39	Shaft	1
26	1062-41	Lock, slide	1
27	1062-2	Stage	1
28	1062-8	Separator, long	2
29	1062-21	Track, long	8
30	0128-1	Screw	8
31	1062-7	Slide, cross	1
32	X-50707	Pin	1
33	1062-51	Guide, long	1
	1062-852	Slide Holder Assembly (includes items 34 thru 40)	1
34	1062-12	Screw	1
35	B33-79	Spring	1
36	1062-10	Finger, fixed	1
37	1062-11	Finger, sliding	1
38	1062-14	Knob	2
39	1062-13	Screw	1
40	0866-1	Screw	1
41	11330-90	Ball	20
42	1062-9	Rack, long	1
43	0861-1	Screw	2
44	1062-53	Screw	3

Index No.	Part Number	Description	Qty Per Assy
	1062-851	Control Assembly (includes items 45 thru 49 and 51 thru 60)	1
45	1062-22	Shaft, inner	1
46	1062-58	Washer	2
47	1062-24	Sleeve	1
48	1062-23	Mount, sleeve	1
49	1062-26	Bearing, thrust	1
50	1062-15	Screw, stop	1
51	1062-25	Shaft, outer	1
52	1062-32	Bearing, thrust	1
53	1062-28	Knob, large	1
54	X-36845	Setscrew	1
55	1062-27	Washer, thrust	1
56	1062-59	Washer, thrust	1
57	1062-29	Nut, adjustable	1
58	1062-30	Bearing, thrust	2
59	1062-31	Knob, small	1
60	1062-16	Nut	1
61	1062-42	Screw	2
	1062-854	Adjustable Pinion Assembly (includes items 62 thru 66)	1
62	1062-37	Button, slide	1
63	X-15084	Pin	1
64	01183-1	Washer	1
65	B35-47	Bearing	1
66	1062-36	Pinion	1
67	1062-61	Screw	1
68	1062-40	Button, locking	1
69	1062-17	Rack, short	1
70	1062-45	Screw	2
71	0862-1	Screw	2
72	1062-57	Rack	1
73	0863-1	Screw	1
74	1062-46	Slide, bracket	1
75	10-10	Screw	1
76	X-36702	Screw	1
77	1062-48	Bracket	1
78	01219	Washer	1



Transformer Assembly

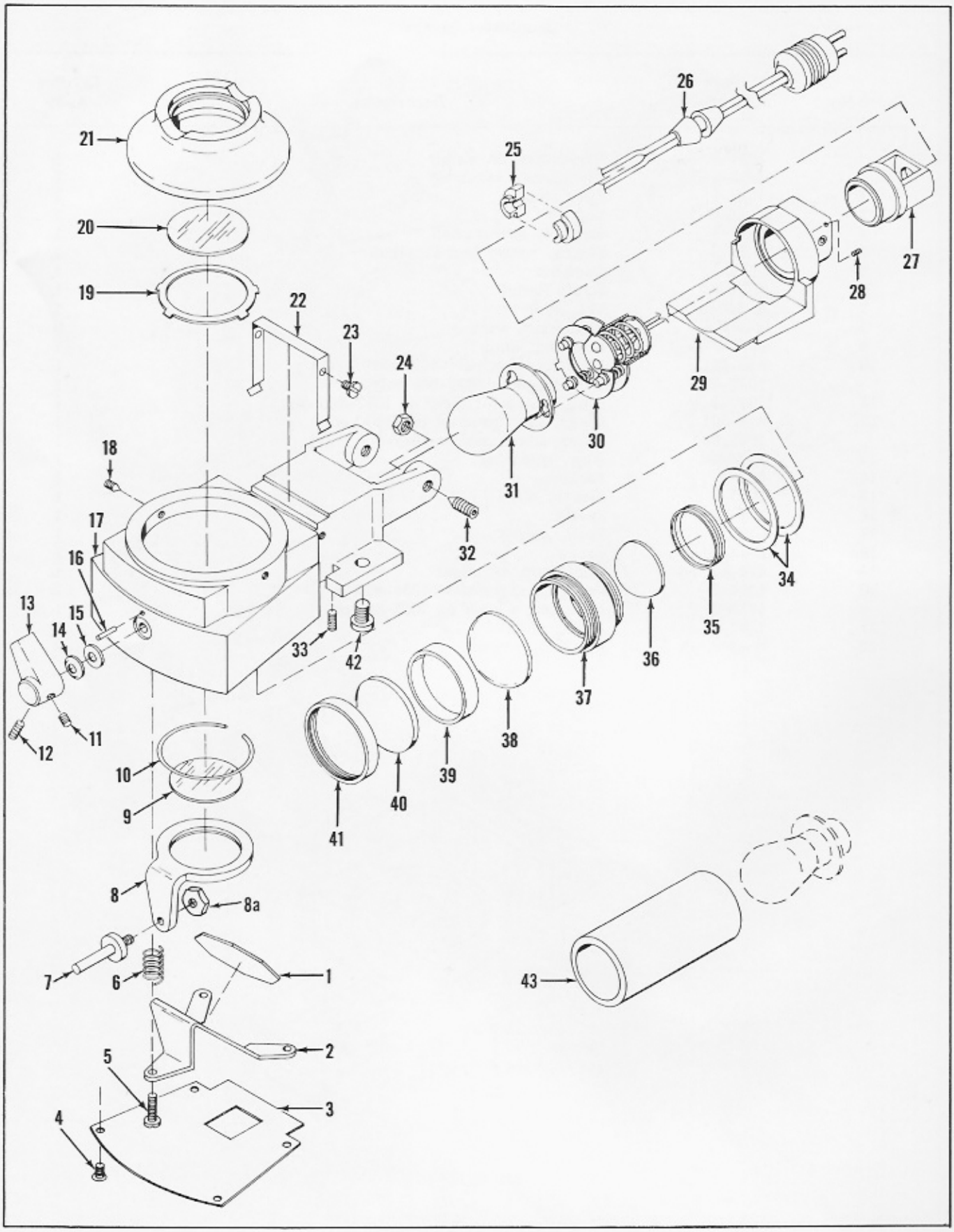
Index No.	Part Number	Description	Qty Per Assy
	1051-800	Transformer Assembly	1
1	1051-3	Cover, bottom	1
2	X-9542-2	Screw	4
3	X-50282	Nut, wire	2
4	1051-2	Switch, rotary (nut and lockwasher supplied)	1
5	10500-851	Knob Assembly, switch	1
6	11144-7	Light, pilot	1
7	1051-4	Nameplate	1
8	651-15	Cover, case	1
9	651-5	Receptacle	1
10	651-10	Cord Set	1
11	1051-1	Transformer	1
12	11201-77	Pad, base	1
13	X-9548-2	Screw	4



Illuminator, Models 1034 and 1037

Illuminator Assembly

Index No.	Part Number	Description	Qty Per Assy
	1034-800	Illuminator Assembly	1
	1037-800	Illuminator Assembly	1
1	1037-4	Slide, lock	1
2	X-8000-1	Nut	3
3	1037-5	Support, socket shell	1
4	1037-8	Switch, rotary (nut supplied)	1
5	1037-10	Cord Set	1
6	X-36442	Strain Relief	1
7	X-50060	Nut, wire	1
8	X-50039	Connector, wire	2
9	1037-2	Housing, lamp	1
10	610-601	Lens (used on 1034-800 only)	1
	1037-602	Lens (used on 1037-800 only)	1
11	1037-3	Ring, separator (used on 1037-800 only)	1
12	614-601	Glass, blue (used on 1034-800 only)	1
	1037-601	Glass, blue (used on 1037-800 only)	1
13	X-50882	Ring, retaining	1
14	611-1	Lamp	1
15	1037-6	Sleeve, shell	1
16	X-80-1	Screw	1
17	610-7	Shell, socket	1
18	X-68-1	Screw	2
19	610-9	Connector, terminal	1
20	1034-2	Base, lamp (used on 1034-800 only)	1
	1037-9	Base, lamp (used on 1037-800 only)	1
21	1037-7	Rivet, slide	1
22	X-29067-2	Attaching Screw	2



Illuminator, Model 1036

Illuminator Assembly

Index No.	Part Number	Description	Qty Per Assy
	1036-800	Illuminator Assembly	1
	1036-858	Mirror and Bracket Assembly (includes items 1 and 2)	1
1	1036-604	Mirror	1
2	1036-39	Mount, mirror	1
3	1036-5	Cover	1
4	X-1396	Screw	4
5	0306-1	Screw	3
6	1036-16	Spring	3
7	1036-34	Shaft	1
8	1036-33	Bracket	1
8a	X-8010-2	Nut, hexagonal	1
9	1036-608	Filter, neutral density	1
10	1036-35	Ring, retaining	1
11	X-25100	Setscrew	1
12	X-21336	Setscrew	1
13	1036-15	Lever	1
14	01228-2	Washer, spring	1
15	01112	Washer	1
16	X-50947	Pin	1
17	1036-31	Housing, lamp	1
18	X-20745	Setscrew	2
	1036-852	Window and Mount Assembly (includes items 19 thru 21)	1
19	X-51327	Ring, retaining	1
20	1036-606	Window	1
21	1036-40	Mount, window	1
22	1036-10	Clip, spring	1
23	0143	Screw	2
24	X-51326	Nut	2
	1036-855	Cord Socket and Housing Assembly (includes items 25 thru 31)	1
25	X-36441	Strain Relief	1
26	1036-18	Cord Set	1
27	1036-22	Adapter	1
28	X-20631	Setscrew	1
29	1036-4	Housing, socket	1
30	1036-20	Socket	1
31	1033	Lamp	1
32	X-25484	Setscrew	2
33	X-36687	Setscrew	1
34	01294	Spacer	AR
	1036-853	Lens Assembly (includes items 35 thru 41)	1
35	1036-7	Ring, retaining	1
36	1036-601	Lens, first	1
37	1036-6	Cell, lens	1
38	1036-602	Lens, second	1
39	1036-8	Spacer	1
40	1036-603	Lens, third	1
41	1036-9	Ring, retaining	1
42	X-29067-2	Screw	2
43	1036-856	Bulb Remover Tube	1

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