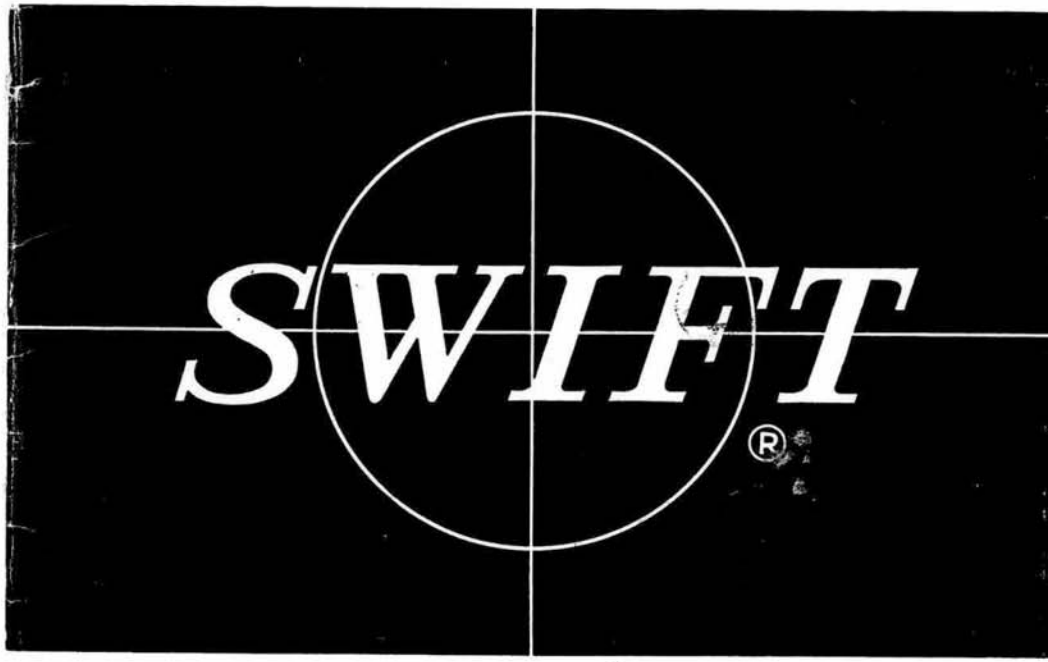
USE AND CARE OF SWIFT SERIES M 2240

MICROSCOPE



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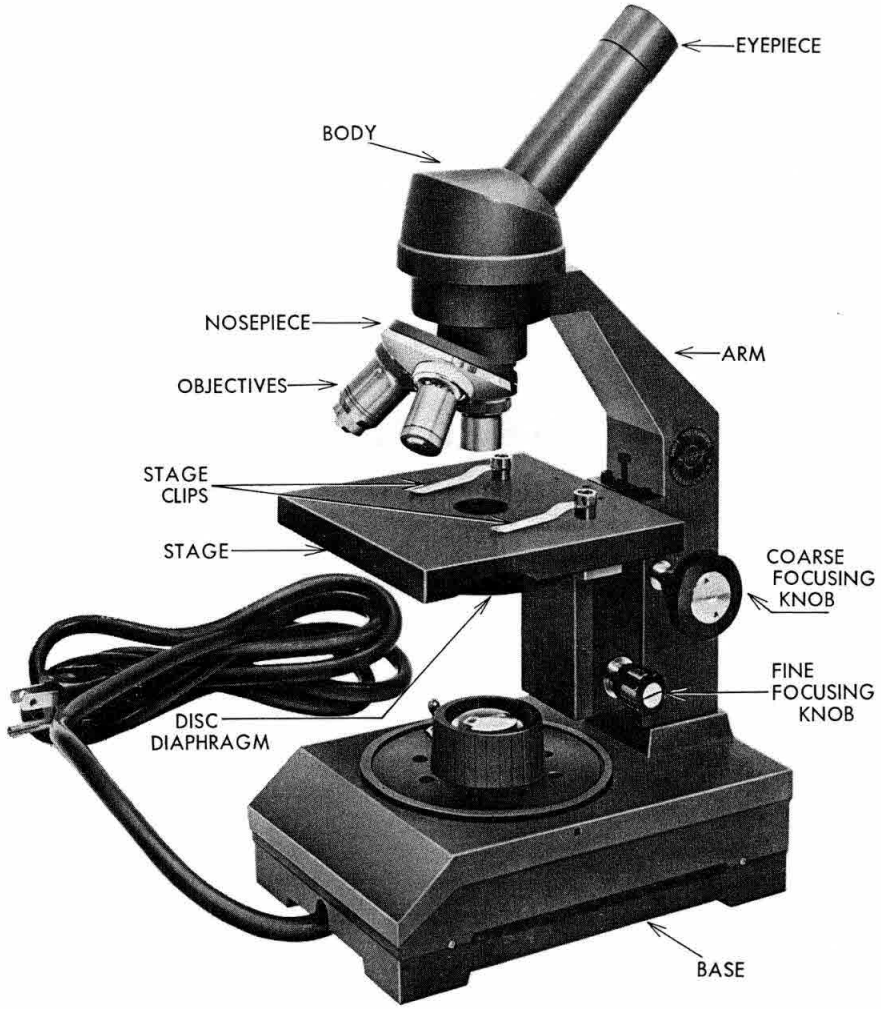

EYEPIECE
BODY
NOSEPIECE
ARM
OBJECTIVES
STAGE CLIPS
STAGE
COARSE FOCUSING KNOB
FINE FOCUSING KNOB
DISC DIAPHRAGM
BASE

PARFOCAL—A term applied to objectives and eyepieces when practically no change in focus has to be made when one power is substituted for another. The objectives on your SWIFT Series M2240 are parfocalized at the factory so that only a slight turn of the fine adjustment is required when a change is made from low to a higher power.

RESOLVING POWER—The ability of a lens to clearly separate fine detail. Resolving power is directly proportional to the numerical aperture of the optical system.

WIDEFIELD EYEPIECE—An ocular with an achromatic doublet for the eyelens and with the plane side of the lower lens nearest the objective. Such a corrected system does not have to be stopped down with a diaphragm, hence a large flat field is insured.

WORKING DISTANCE—The distance between the front lens of the objective and the cover glass when the lens is focused on the specimen.

Inquiries regarding the M2240 Series or other Swift products should be directed to your authorized Swift dealer or:

Swift Instruments Inc.
P.O. Box 562
San Jose, California 95106

Swift Instruments Inc.
952 Dorchester Avenue
Boston, Massachusetts 02125

USE AND CARE OF YOUR M2240 SERIES MICROSCOPE

Your Swift microscope, Series M2240, is an instrument of precision, optically and mechanically, and will perform satisfactorily with minimum maintenance. M2240 is the first microscope combining the ruggedness of teaching microscopes with the design of research instruments.

UNPACKING

If your M2240 was ordered without cabinet, it will be in a molded styrofoam container. Lay the container on its side, remove the tape from its perimeter and carefully lift the top half of the container. The microscope may then be removed from the lower half of the container. The objectives will be found within individual plastic vials.

Install the objectives into the microscope's revolving nosepiece from the lowest magnification to the highest, in a clockwise direction from the rear.

FAMILIARIZE YOURSELF WITH THE COMPONENTS OF THE MICROSCOPE

BASE —This is the rectangular part that houses the illuminator or mirror.

STAGE —The table of the microscope where the slide or specimen is placed.

CONDENSER—The optical element built into the stage.

DIAPHRAGM, DISC —The wheel-shaped device attached to the underside of the stage.

BODY —The component housing the prisms and eyepiece tube.

ARM —The basic frame of the microscope to which the base, body and stage are attached.

NOSEPIECE —The revolver that carries the objectives.

EYEPIECE —The upper optical component, that further magnifies the primary image and brings the light rays to a focus at the eyepoint.

OBJECTIVE —The component that magnifies the image of the specimen to form the " primary image ".

ABOUT THESE COMPONENTS

EYEPIECE—Most models of the M2240 Series are equipped with the 10x widefield eyepiece. Because of the extremely wide field of view and a much higher eyepoint than the 10x Huygenian eyepiece, this eyepiece enables even those with thick eyeglasses to view the specimen with ease. The widefield eyepiece has a built-in pointer, and is designed to accept a variety of measuring and counting accessories. The lenses are highly corrected and coated to reduce glare and reflection.

OBJECTIVES—The objectives are of research type, with large numerical aperture (N. A.) to permit maximum resolution. All objectives are achromatic, color coded and parfocalled to each other. The 40x (high dry) and 100× objective are in a retractable mount to prevent accidental breakage of either the slide or front lens of the objective. All lenses are hardcoated for maximum resolution and produce an excellent, flat field.

DISC DIAPHRAGM—The wheel-shaped disc attached to the underside of the stage. It has circular openings, called apertures, at various points and may be rotated to align any of the apertures with the optical path.

COARSE (RAPID) FOCUS CONTROL—The stage is moved up and down by a diagonally cut rack and pinion. The pinion is of steel and the rack of brass. The movement is actuated by the large knobs on both sides of the arm.

Note: The coarse focus controls have a built-in clutch device activated at either limit of movement. This clutch prevents damage to the precision gears.

FINE FOCUS—The fine focus is of the internal lever type with a fine micrometer screw. It is operated by small knobs found on both sides of the arm.

CONDENSER—The built-in or substage condenser has a numerical aperture (N. A.) matched to the objectives. For good optical results, the condenser must have an N.A. equal to or larger than the N.A. of the objective being used. The purpose of the condenser is to "squeeze" light rays into a bundle and emit them through the specimen at the precise angle to illuminate the field of view.

USING YOUR SWIFT SERIES M2240 MICROSCOPES

After securing the slide into position with the stage clips, turn to

object. By increasing the angular aperture of an objective more light rays from the specimen can be taken in by the lens, hence the resolving power is increased.

APERTURE, NUMERICAL (*N.A.*)—A mathematical formula devised by Ernst Abbe for the direct comparison of dry and all types of immersion objectives for resolving power. Numerical aperture (N.A.) is the sine of half the angular aperture of the objective multiplied by the refractive index of the medium between the front lens and the cover glass. N.A. ranges of the Series M2240 objectives are 0.10 (4x), 0.25 (10x), 0.40 (20×), 0.65 (40×) and 1.25 (100×). These are research type objectives and have a *large* N.A.

CONDENSER—A lens or system of lenses to collect light rays and converge them to a focus. The series M2240 has a condenser built into the stage. The N.A. of the condenser is matched to the highest power objective.

COVER GLASS—Thin glass cut in circles, rectangles or squares, for covering the specimen, usually a thickness of 0.17 to 0.18mm. The majority of specimens should be protected by a cover glass, and must be covered when using 40× or 100× objectives.

DEPTH OF FOCUS—The ability of a lens to furnish a distinct image above and below the focal plane. Depth of focus decreases with the increase of numerical aperture or with the increase of magnification.

EYEPIECE—The lens system near the eye which magnifies the primary image of the objective so as to form a virtual image 10″ away from the eyepoint.

FIELD—The area of the object that is seen when the image is observed. It may range in diameter from several millimeters to less than 0.1mm. Also the size of the diaphragm opening in the eyepiece governs the diameter of the field of view.

FOCAL LENGTH—Parallel rays of light after refraction through a lens will be brought to a focus at the focal point. The distance from the optical center of the lens to the focal point is the focal lengh or focus.

OBJECTIVE—The lens system near the object which forms the primary image.

lens paper immediately. The objectives should never be taken apart except by a qualified Swift serviceman. Should dust be observed on the back lens of the objective, an all-rubber ear syringe or enema tube may be utilized to blow the dust out.

The eyepiece may be cleaned in the same manner as the objectives, except in most cases Xylol will not be required. In most instances breathing on the lens to moisten it, then wiping dry with clean lens tissue will be sufficient to clean the surface.

The finish of the microscope is hard epoxy and is resistant to acids and reagents. Clean this surface with a damp cloth and mild detergent.

Mechanical Parts: Mechanical parts are mostly concealed from the outside. Microscopes should be serviced by a qualified serviceman periodically to remove contaminents from the moving surfaces. These surfaces should then be relubricated using only those lubricants recommended by Swift.

Swift microscopes are covered by the most liberal warranty available and your authorized Swift dealer has all the necessary data to insure fast, efficient service. Swift Instruments, Inc. stand ready to assist you at any time and your inquiries are invited. Your Swift Series M2240 microscope is a highly versatile instrument and many accessories are available to further enhance its use.

You will note the exploded view of M2240 Series in this manual. Each part is numbered and named on the reverse side. If the occasion should arise where it becomes necessary to order a part, specify the model of your microscope, its serial number, the number of the part and its name. Complete parts are available through authorized Swift dealers or direct from the factory.

IMPORTANT MICROSCOPICAL TERMS

COMPOUND MICROSCOPE—A microscope having a primary magnifier (the objective) and a secondary (the eyepiece) to further magnify the image, and bring the light rays to a focal point (the eyes).

ACHROMATIC OBJECTIVE—An optical system corrected for two colors chromatically and one color (yellow-green) spherically.

APERTURE, ANGULAR—The angle (or cone) of light rays capable of entering the front lens of the objective from a point in the

the lowest power objective. The disc diaphragm should be turned to align the largest aperture with the condenser, and the mirror adjusted to direct the light into the optical path.

(Note: The use of a mirror to provide illumination is not efficient. Daylight, especially in the classroom is not easily controlled, therefore the light obtained may vary considerably. On the Series M2240, the built-in substage illuminator is recommended to provide a constant, even dispersion of light to the optical system.)

While looking through the eyepiece, rack the stage up to bring the specimen into focus. The 4x objective has a long working depth so focusing is done with ease at this power. The specimen may be centered to the field at this time, and the nosepiece rotated to the higher magnifying objectives. The objectives are parfocalized so that once the 4x objective is focused, only a slight turn of the fine focus knob is required in changing to the 10x or 40x objective.

Note that should the 40x objective be brought into contact with the slide no damage will result, since the 40x objective is in a retractable mount. It is impossible for the 4x and 10x objectives to contact the slide.

Use of the Diaphragm—The disc or iris diaphragm is not intended to control the brightness of the illumination. The purpose of the diaphragm is to control the angle of the light rays. Smaller apertures increase contrast in the image while larger apertures decrease the contrast. A good procedure in selecting the proper aperture is to start with the largest and reduce until the fine details of the specimen are imaged sharply.

Care must be exercised not to reduce the aperture too much to gain high contrast, as then the fine structure in the image of the specimen will be destroyed. Reducing the aperture does increase contrast and depth of focus but also reduces resolution and introduces diffraction. The proper aperture must be selected for each objective. The aperture for the 10x will not be the same as for the 40x since the angle of the light required is determined by the numerical aperture of the objective. Proper selection of the diaphragm aperture is easily determined after a little experience with the microscope.

SPECIAL INFORMATION ON MODELS M2249 and M2249B

These models are especially designed to aid the user in rapid increase or decrease in magnification where a large working distance

is desirable. Note in the following chart the constant working distance throughout the power range of both 4x and 20x objectives and the large field of view.

Magnification	Working Distance	Field of View
40x	15.2mm	3.1 mm
60x	15.2mm	2.8 mm
80x	15.2mm	2.5 mm
200x	1.4mm	1.18mm
300x	1.4mm	1.05mm
400x	1.4mm	0.95mm

SWIFT QUODLIBET SYSTEM OF PHASE CONTRAST

The Quodlibet system of phase contrast offers techniques in a form simple enough for even the newest science student, yet with phase contrasted results comparable to instruments costing many times more.

The Swift Quodlibet Phase unit may be ordered as a complete microscope or added to your M2240 series microscope that is presently equipped with a disc diaphragm.

HOW TO USE YOUR SWIFT QUODLIBET MICROSCOPE

You will note the 10x and 40x objectives are designated "Phase". This means phase contrast may be achieved with these two objectives, while the 4x objective remains brightfield only.

Look at the disc diaphragm, found attached to the underside of the stage plate. Note the openings (called apertures) in the disc, and the green phase annulus mounted in a green cylindrical mount. Phase contrast is achieved by rotating the disc to position the green annulus under the condensing lens in the stage plate.

With the annulus positioned thus, the 10x and 40x will produce a fine, phase contrast image of the specimen.

Your Swift Quodlibet will also function as a normal, brightfield microscope. Simply rotate the disc diaphragm to any other position, which removes the phase annulus from the path of light, and your 10x and 40x phase objectives will perform as normal brightfield objectives.

Another feature of your Swift Quodlibet is evident when the disc

diaphragm is rotated to position the phase annulus under the condensing lens in the stage, and the low power 4x objective is positioned for viewing. In this manner, the specimen is viewed brightly illuminated against a dark background. This is actually low powered darkfield microscopy.

WHAT IS PHASE CONTRAST?

Phase contrast is literally "optical" staining of the specimen, rather than physical. Phase contrast is achieved by passing light from the illuminator through a phase annulus which is attached to the disc diaphragm of your SWIFT QUODLIBET microscope, which separates the central and outer beams. These light rays consist of undeviated central rays and deviated diffracted rays. The diffracted rays are a quarter wave ($^1/_4\lambda$) behind the central rays. After passing through the phase ring at the back focal plane of the objective the central rays are retarded $^1/_4$ wave ($^1/_4\lambda$) and are reduced in intensity. The central rays are now in phase with the diffracted rays. These rays, when brought to a focus at the eyepiece, produce a well contrasted image of the specimen.

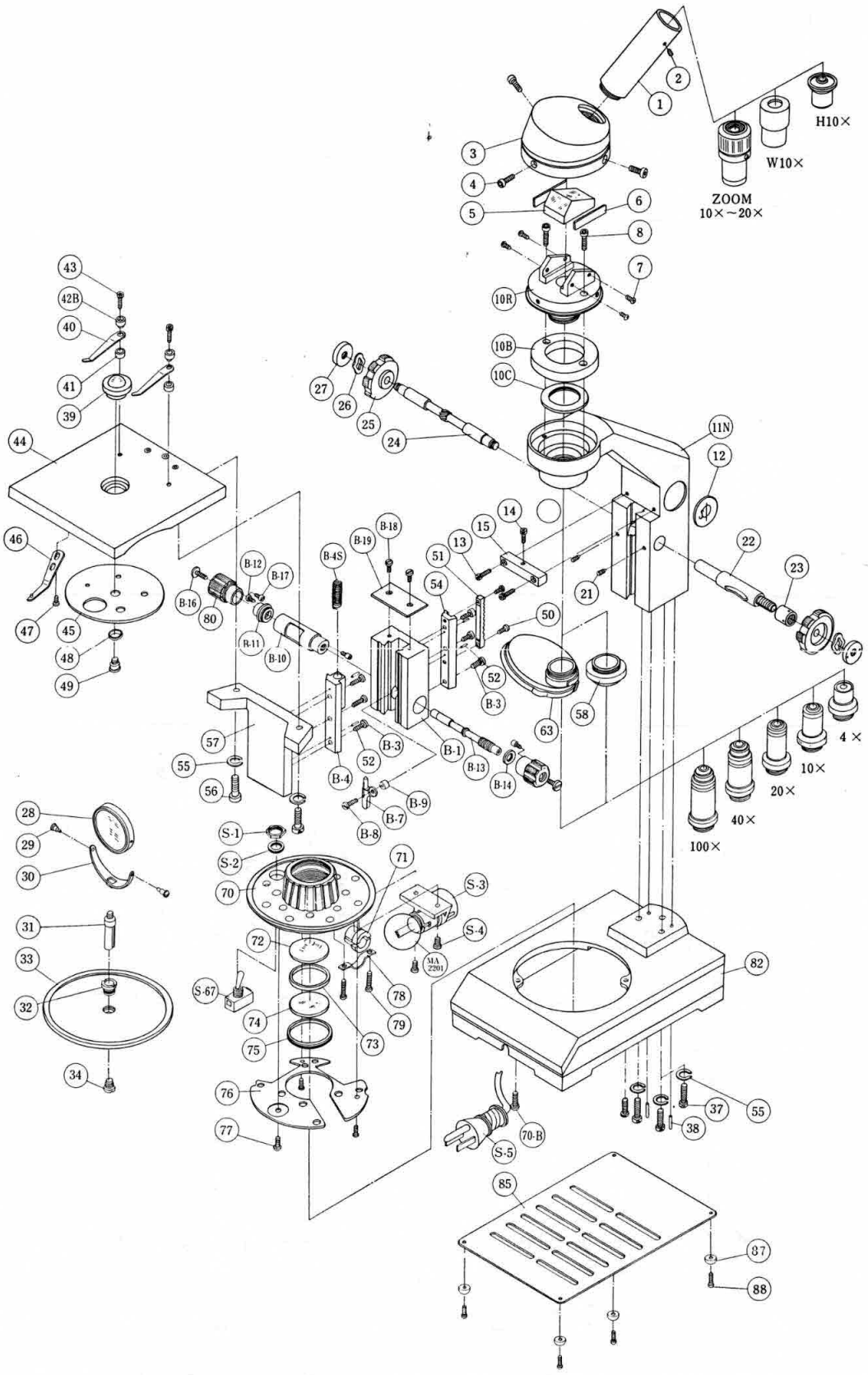
CARE OF THE SWIFT SERIES M2240 MICROSCOPE

The Series M2240 is designed to require only a minimum of maintenance and has many features to prevent accidents common to the "student" microscope. Loss of stage clips is eliminated since these are secured to the stage by allen socket capscrews. Mirrors and forks are also secured in a similar manner. Gear damage is eliminated by internal devices which prevent the rack and pinion from being disengaged. Damage due to overfocusing is prevented by a unique clutch system activated at upper and lower limits of travel.

Tension of the focusing movement is controlled by a tension system found on the pinion metal of the rapid focus control. This is adjusted only by a special tool, Swift Cat. No. MT202. Unauthorized persons are cautioned against tampering with this device.

Cleaning: The front lens of the objectives, particularly the 40x, should be cleaned after using by first brushing with a soft camel-hair brush to remove particles of dust, then wiping gently with soft lens tissue moistened (not soaked) with Xylol C.P., and dried with clean

MODEL M2240 SERIES



PARTS LIST

Parts Number	Description	Parts Number	Description
1	Eyepiece Tube	37	Screw
2	Screw	38	Knock Pin
3	Prism Housing	39	Condenser
4	Screw	40	Stage Clip
5	22°30′ Prism	41	Spacer
6	Prism Adjusting Plate	42B	Spacer
7	Screw	43	Screw
8	Screw	44	Stage
10R	Seat, Prism	45	Disc Diaphragm
10B	Rotatable Ring	46	Spring
10C	Retainer Ring	47	Screw
11N	Arm	48	Dished Washer
12	Marking Plate	49	Screw
13	Screw	50	Screw
14	Screw	51	Rack
15	Rack Stop Block	52	Knock Pin
21	Screw	B-3	Screw
22	Pinion Metal	54	Rack Guide
23	Adjuster, Pinion Tension	55	Lock Washer
		56	Screw
24	Pinion	57	Stage Holder
25	Coarse Adj. Handle	58	Single Nosepiece
26	Washer	63	Revolving Nosepiece
27	Nut	70	Illuminator Plate, Base
28	Mirror	70-B	Screw
29	Screw	71	Grommet
30	Mirror Bow	72	Illuminator Lens
31	Mirror Stud	73	Spacer Ring
32	Bushing	74	Filter-Diffusing
33	Mirror Plate, Base	75	Retaining Ring
34	Screw	76	Heat Dispensing Plate

PARTS LIST

Parts Number	Description	Parts Number	Description
77	Screw	B-7	Fine Adj. Lever
78	Retainer	B-8	Screw
79	Screw	B-9	Fine Adj. Spacer
82	Base	B-10	Pinion Metal
85	Bottom Plate	B-11	Pinion Bushing
S-1	Nut	B-12	Screw
S-2	Washer	B-13	Pinion
S-3	Socket	B-14	Thrust Bearing
S-4	Screw	B-16	Set Screw
S-5	Plug	B-17	Screw
S-67	Switch	B-18	Screw
MA2201	Bulb 20w	B-19	Cover
B-1	Fine Adj. Block	80	Knob
B-3	Screw	87	Rubber shoes
B-4S	Fine Adj. Spring	88	Screw
B-4	Fine Adj. Guide		