

SZH10
ZOOM STEREO
MICROSCOPE SYSTEM

REPAIR MANUAL

OLYMPUS

SZH10
ZOOM STEREO MICROSCOPE SYSTEM
REPAIR MANUAL

OLYMPUS

SZH10

INTRODUCTION

This manual describes how to repair the SZH10 which is the minor-changed version of the previous SZH zoom stereo microscope system. Note the following items when using this manual.

1. This manual is written for the service persons who can repair the SZH, therefore, it is necessary to understand the basic mechanism of the SZH before repairing the SZH10. This does not apply to the persons who are trained for repairing the SZH10 together with the SZH.
2. Assembly and disassembly of the zoom section are common to the SZH and SZH10. For the repairing of this section, refer to the SZH repair manual.

CONTENTS

| | |
|--|-----|
| A. OUTLINE OF PRODUCT | |
| 1. DIFFERENCE BETWEEN SZH10 AND SZH | A-2 |
| 2. USING CONDITIONS | A-3 |
| 3. SPECIFICATIONS | A-3 |
| 4. SYSTEM CHART | A-4 |
| B. INSPECTION STANDARDS | |
| 1. REQUIRED JIGS AND TOOLS | B-2 |
| 2. HOW TO MOUNT JIGS AND TOOLS | B-2 |
| 3. INSPECTION STANDARDS | B-3 |
| C. DISASSEMBLY PROCEDURE | |
| 1. REMOVAL OF FOCUSING-GUIDE UNIT (S-F010) | C-2 |
| 2. DISASSEMBLY OF FOCUSING-GUIDE UNIT (S-F010) | C-3 |
| 2-1 DISASSEMBLY OF COARSE/FINE FOCUSING KNOB | C-3 |
| 2-2 DISASSEMBLY OF GUIDE UNIT | C-4 |
| D. ASSEMBLY/ADJUSTMENT PROCEDURE | |
| 1. ASSEMBLY/ADJUSTMENT OF FOCUSING-GUIDE UNIT (S-F010) | D-2 |
| 1-1 ASSEMBLY/ADJUSTMENT OF GUIDE UNIT | D-2 |
| 1-2 ASSEMBLY/ADJUSTMENT OF COARSE/FINE FOCUSING KNOB | D-4 |
| 2. ATTACHMENT OF FOCUSING-GUIDE UNIT (S-F010) | D-7 |

E. REPAIR PROCEDURE

1. CLEANING OF OPTICS OF ZOOM MICROSCOPE BODY (SZH-ZB10) ----- E-2
2. ADJUSTMENT OF OPTICS OF ZOOM MICROSCOPE BODY (SZH-ZB10) ----- E-3
 - 2-1 PREPARATION FOR ADJUSTMENT ----- E-3
 - 2-2 CHECKING THE OPTICAL AXIS AND PARFOCALITY ----- E-3
 - 2-3 STRIP THE ADHESIVE BEFORE ADJUSTMENT ----- E-4
 - 2-4 PARFOCALITY ADJUSTMENT ----- E-4
 - 2-5 BONDING THE PARFOCALITY ADJUSTMENT PART ----- E-4
 - 2-6 OPTICAL AXIS ADJUSTMENT ----- E-5
3. REPAIR OF OBSERVATION TUBE (SZH-BI45N) ----- E-6
 - 3-1 ASSEMBLY PROCEDURE ----- E-6
 - 3-2 ADJUSTMENT PROCEDURE ----- E-8

F. LUBRICANTS AND CHEMICALS

1. LIST OF LUBRICANTS AND CHEMICALS ----- F-2

G. JIGS AND TOOLS

1. LIST OF JIGS AND TOOLS ----- G-2
2. EXPLANATION OF JIGS AND TOOLS ----- G-3

H. DESCRIPTION OF MECHANISM

1. ZOOM MICROSCOPE BODY (SZH-ZB10) ----- H-2
 - 1-1 LIGHT PATH DIAGRAM ----- H-2
 - 1-2 PREVENTION OF PARTIAL DEFOCUSING ----- H-2
 - 1-3 COMPONENTS OF ZOOMING OPTICS ----- H-3
 - 1-4 BALANCING SPRING ----- H-4
2. FOCUSING-GUIDE UNIT ----- H-5
 - 2-1 COARSE/FINE FOCUSING KNOB ----- H-5
 - 2-2 COUNTERBALANCING MECHANISM ----- H-6

CONTENTS

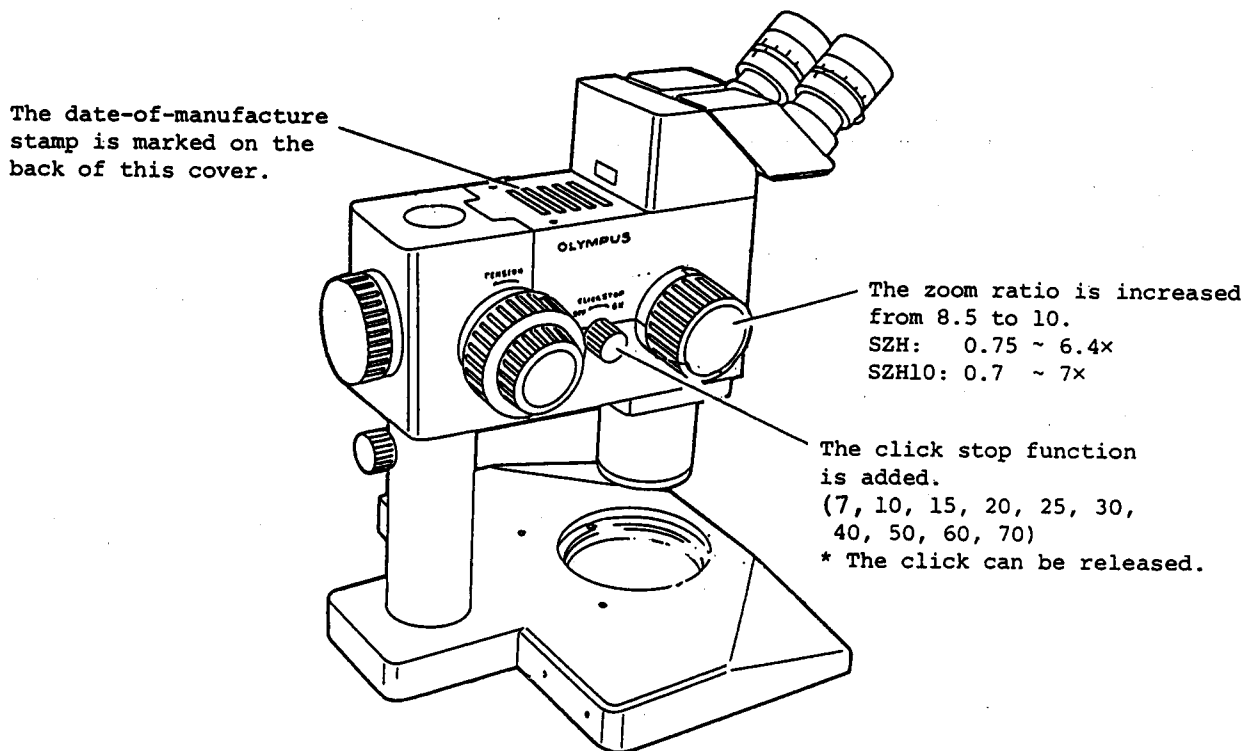
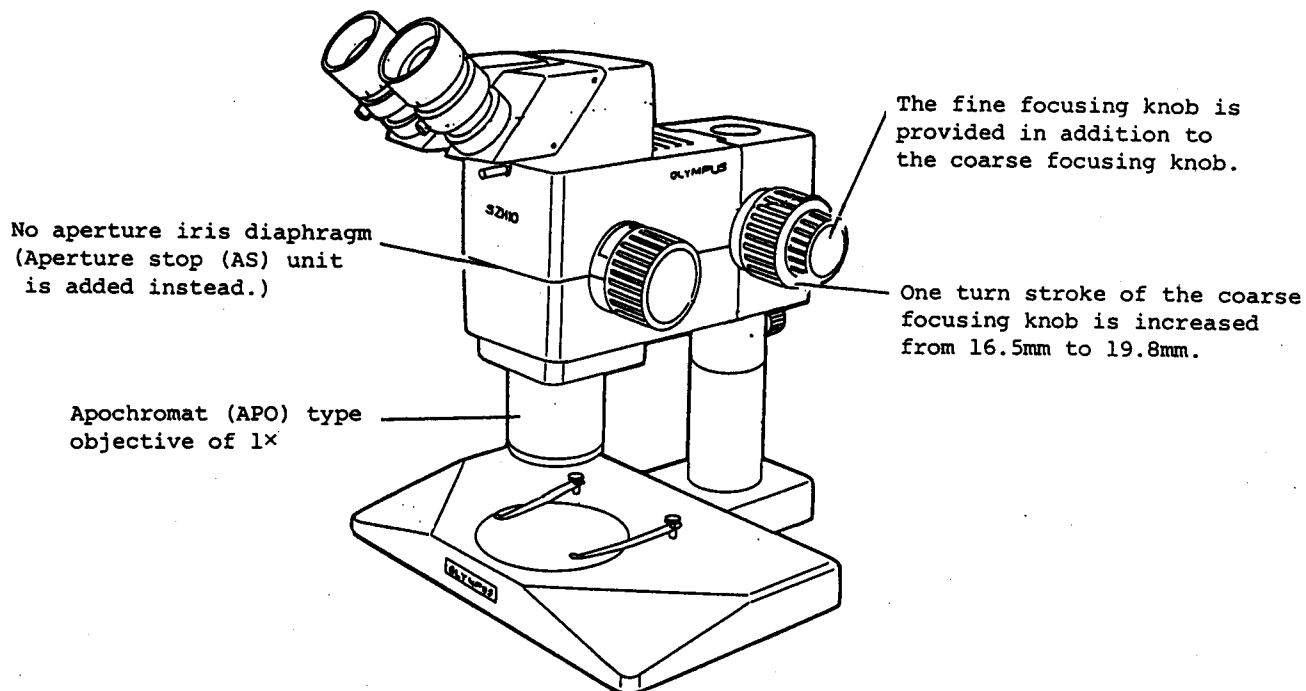
1. DIFFERENCE BETWEEN SZH10 AND SZH ----- A-2

2. USING CONDITIONS ----- A-3

3. SPECIFICATIONS ----- A-3

4. SYSTEM CHART ----- A-4

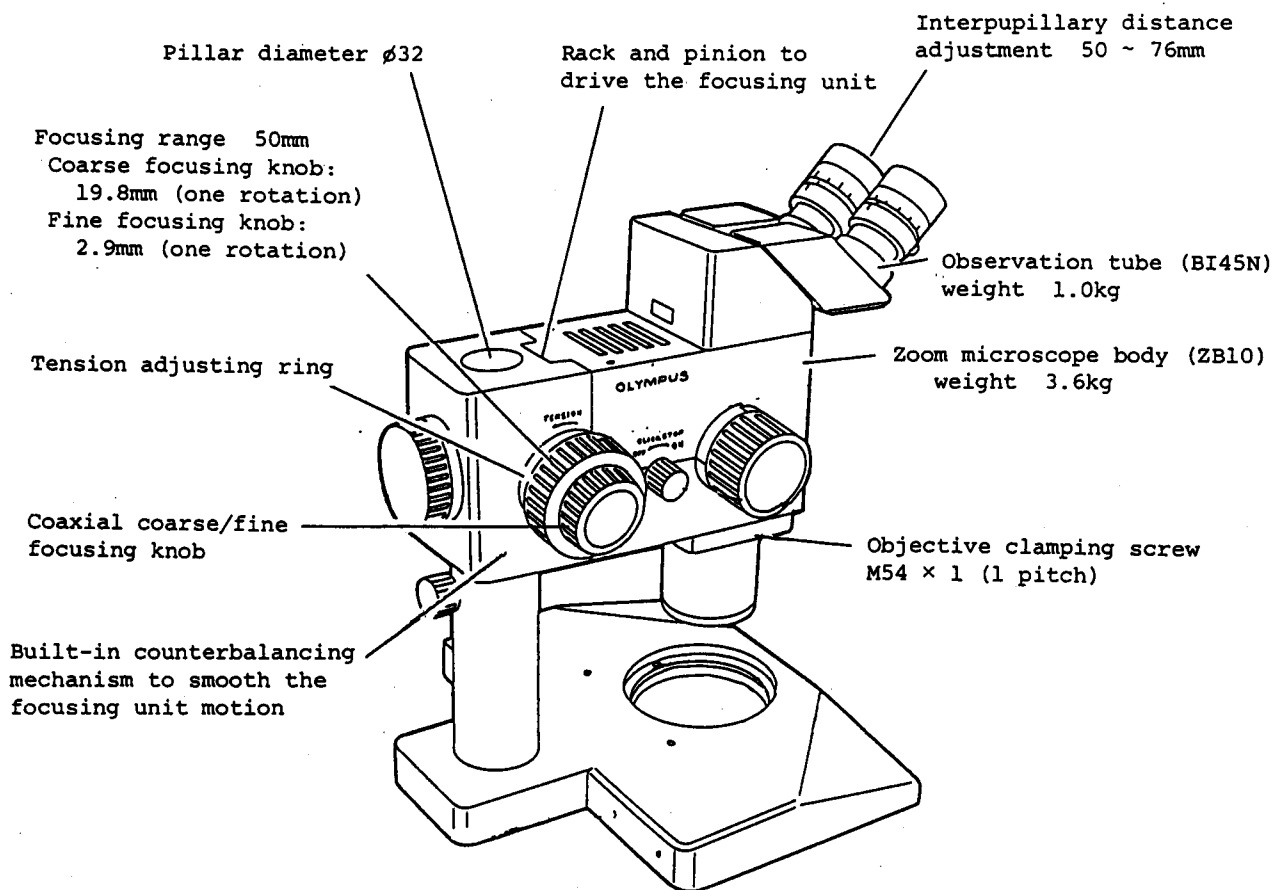
1. DIFFERENCE BETWEEN SZH10 AND SZH



2. USING CONDITIONS

- (1) The conventional motor drive unit (MDU) can not be mounted.
- (2) Maximum two intermediate attachments can be mounted. (The aperture stop unit can be added in addition to two intermediate attachments.)
- (3) The maximum load of the focusing unit is 2.7kg except for the zoom microscope body.

3. SPECIFICATIONS



CONTENTS

1. REQUIRED JIGS AND TOOLS ----- B-2

2. HOW TO MOUNT JIGS AND TOOLS ----- B-2

3. INSPECTION STANDARDS----- B-3

1. REQUIRED JIGS AND TOOLS

<SZH-BI45N>

| No. | Name | Remark |
|----------|-----------------------------|--|
| KN0048 | Universal standard eyepiece | Replaceable with KN0024 (optical axis only). |
| SZHKC002 | Standard objective | |
| SZHKC003 | Standard zooming body | |

<SZH-ZB10>

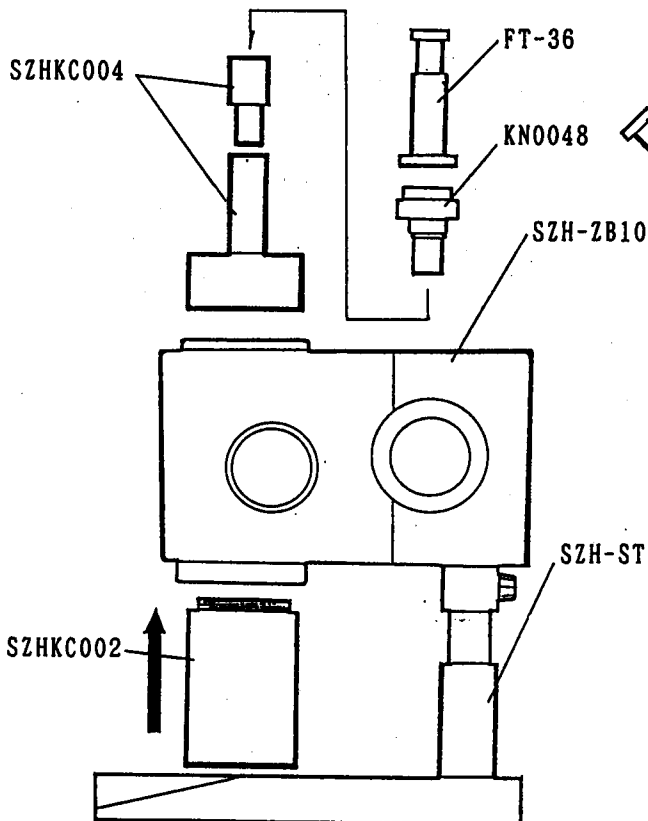
| No. | Name | Remark |
|----------|-----------------------------|---|
| KN0048 | Universal standard eyepiece | Replaceable with KN0028 (optical axis only) |
| SZHKC002 | Standard objective | |
| SZHKC004 | Standard BI-head | |

<General purpose jigs and tools>

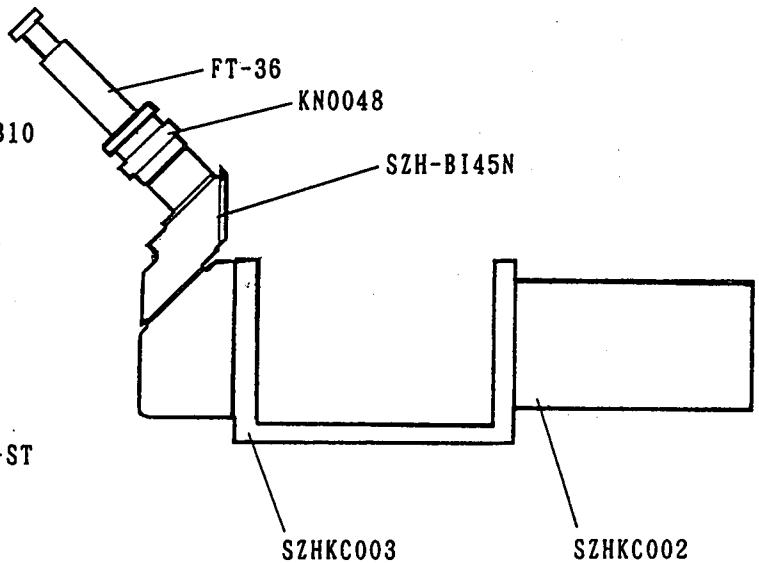
| No. | Name | Remark |
|--------|---------------|--------|
| OT1068 | Tension gauge | (3kg) |
| — | FT-36 | |

2. HOW TO MOUNT JIGS AND TOOLS

<SZH-ZB10>



<SZH-BI45N>



3. INSPECTION STANDARDS

<SZH-BI45N>

| Item | Characteristic | Standard | Check method |
|-------------------------------------|---|--|--|
| Inter-pupillary distance adjustment | Working force | 400 ~ 1500g (Difference between left and right sleeves is 500g maximum.) | Measure at the position of eyepiece (OC) sleeve end with a tension gauge. |
| | Adjustment range | 50mm or less at minimum 76mm or more at maximum | Measure the light interval at the eyepoint of GWH10X-D (the position where the spot light projected to a thin paper becomes minimum). |
| | Displacement of optical axis caused by interpupillary distance adjustment | Movement of image (locus) 0.3 graduation max. (KN0048 or KN0024) | Measure the displacement of optical axis caused by interpupillary distance adjustment with the combination of KN0048(KN0024), SZHKC002 and SZHKC003. |
| Focus | Focal position | 13 ± 0.25 mm from the eyepiece (OC) mounting surface (Within ± 2.5 graduations of KN0048) | Read the focal difference between the cross hairs of KN0048 and the specimen of SZHKC002 on the helicoid ring scale of KN0048 with the combination of KN0048, SZHKC002 and SZHKC003. |
| Displacement of optical axis | Optical axis | 0.6 graduation max. (KN0048 or KN0024) | Measure the displacement of optical axis between centers of KN0048 and SZHKC002 with the combination of KN0048, SZHKC002 and SZHKC003. |
| | Left/right optical axis difference | 0.6 graduation max. (KN0048 or KN0024) | Measure the optical axis difference between the left and right sleeves with the combination of KN0048, SZHKC002 and SZHKC003. |
| Sleeve | Difference between left and right tube length | 1mm max. | Put a flat plate across the tubes and measure the difference. |

<SZH-ZB10>

| Item | Characteristic | Standard | Check method |
|---------------|--------------------|-------------------------------|---|
| Focusing knob | Tension adjustment | Should not ascend naturally. | Check by setting the tension free with BI + OC mounted. |
| | | Should not descend naturally. | Check by setting the tension tight with BI + OC + ILLC + PT (including PM-CP) + PT35 mounted. |

< SZH-ZB10 >

| Item | Characteristic | Standard | Check method |
|------------------------------|---|---|--|
| Zoom magnification change | Working force | Low → high magnification 60 ~ 200g High → low magnification 70 ~ 400g | Measure at the knob periphery with a tension gauge. |
| | Magnification (including magnification change with click) | ±8% (KN0048 or KN0028) | Mount OBLX, SZHKC004 and KN0048. Read the difference between the scales of KN0048 and stage micrometer, and compare with the theoretical values at each magnification. |
| Click | Click force | Click removing force Knob rotating force with click off plus 150 ~ 300g | Measure at the zoom magnification knob periphery with a tension gauge. |
| | Stop position | Displacement between the index line and the center of magnification indication. Character height ±1/4 max. | Visual inspection and scale |
| Displacement of optical axis | Optical axis | Up/down/outward: 1.3 graduation max. Inward: 2 graduations max. (KN0048 or KN0028) | Measure the displacement of optical axis between the centers of KN0048 and SZHKC002 with the combination of KN0048, SZHKC002 and SZHKC004. |
| | Left/right optical axis difference | Up/down/outward: 1.3 graduation max. Inward: 2 graduations max. (KN0048 or KN0028) | Measure the optical axis difference between the left and right sleeves with the combination of KN0048, SZHKC002 and SZHKC004. |
| | Movement of image caused by magnification change | Shift 1.5 graduation max. (KN0048 or KN0028) | Measure the displacement of optical axis by magnification change with the combination of KN0048, SZHKC002 and SZHKC004. |
| | | Shake 1.5 graduation max. (KN0048 or KN0028) | Measure the displacement of optical axis by magnification change with the combination of KN0048, SZHKC002 and SZHKC004. |
| | | Jump 1.5 graduation max. (KN0048 or KN0028) | Measure the displacement of optical axis by magnification change with the combination of KN0048, SZHKC002 and SZHKC004. |

<SZH-ZB10>

| Item | Characteristic | Standard | Check method |
|--------------|-----------------------------------|---|--|
| Parfocal-ity | Parfocality | 7×: ±3 graduations max. 15×: ±6 graduations max. 25×: ±8 graduations max. 40×: ±13 graduations max. 70×: ±17 graduations max. | Read the focal difference between the cross hairs of KN0048 and the specimen of SZHKC002 on the helicoid ring scale of KN0048 with the combination of KN0048, SZHKC002, SZHKC004 and FT36. |
| | Left/right parfocality difference | 7×: ±3 graduations max. 15×: ±6 graduations max. 25×: ±8 graduations max. 40×: ±13 graduations max. 70×: ±17 graduations max. | Read the focal difference between left and right sleeves on the helicoid ring scale of KN0048 with the combination of KN0048, SZHKC002, SZHKC004 and FT36. |

<SZH10 combination> — GWH10X-D, SZH-DFPLANAPOLX, SZH-ST, SZH-ZB10, SZH-BI45N

| Item | Characteristic | Standard | Check method |
|-------------------------------|--|--|---|
| Magnifi-cation change | Displacement of image | Shift 1.5 graduation max. Shake 0.5 graduation max. (2 times) Jump 0.5 graduation max. | Replace the eyepiece with KN0048 and read on the scale of KN0048. |
| | Zoom parfocality | Taking 70× as a reference 40×: ±2.5 diopter 25×: ±2 diopter 15×: ±1.5 diopter 7×: ±1 diopter | Focus precisely on the specimen at the highest magnification and change the zoom magnification. Read the focal difference on the diopter scale of the eyepiece. |
| | Left/right parfocality difference | 70×: ±3 diopter 40×: ±2.5 diopter 25×: ±2 diopter 15×: ±1.3 diopter 7×: ±1 diopter | Read the focal difference between left and right sleeves at each magnification on the diopter scale of the eyepiece. |
| Displace-ment of optical axis | Left/right optical axis difference (all magnification) | Upward: 1.8 graduation max. Outward: 1.8 graduation max. Inward: 3 graduations max. | Replace the eyepiece with KN0048 and read the displacement of optical axis between left and right sleeves on the scale of KN0048. |

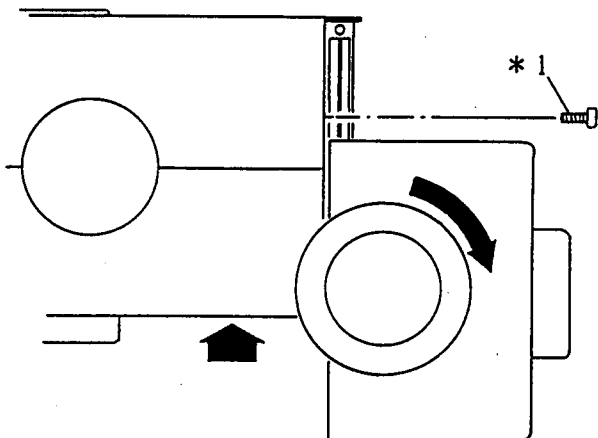
CONTENTS

1. REMOVAL OF FOCUSING-GUIDE UNIT (S-F010)----- C-2

2. DISASSEMBLY OF FOCUSING-GUIDE UNIT (S-F010) ----- C-3

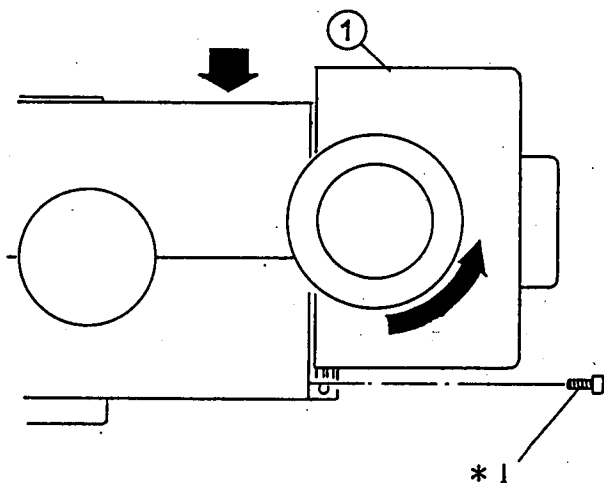
 2-1 DISASSEMBLY OF COARSE/FINE FOCUSING KNOB ----- C-3

 2-2 DISASSEMBLY OF GUIDE UNIT ----- C-4

1. REMOVAL OF FOCUSING-GUIDE UNIT (S-F010)

- (1) Turn the coarse/fine focusing knob to the stop position (up direction) and remove the two screws on the back of the zoom microscope body.

Screw AB4x10SA 2 pcs. (*1)

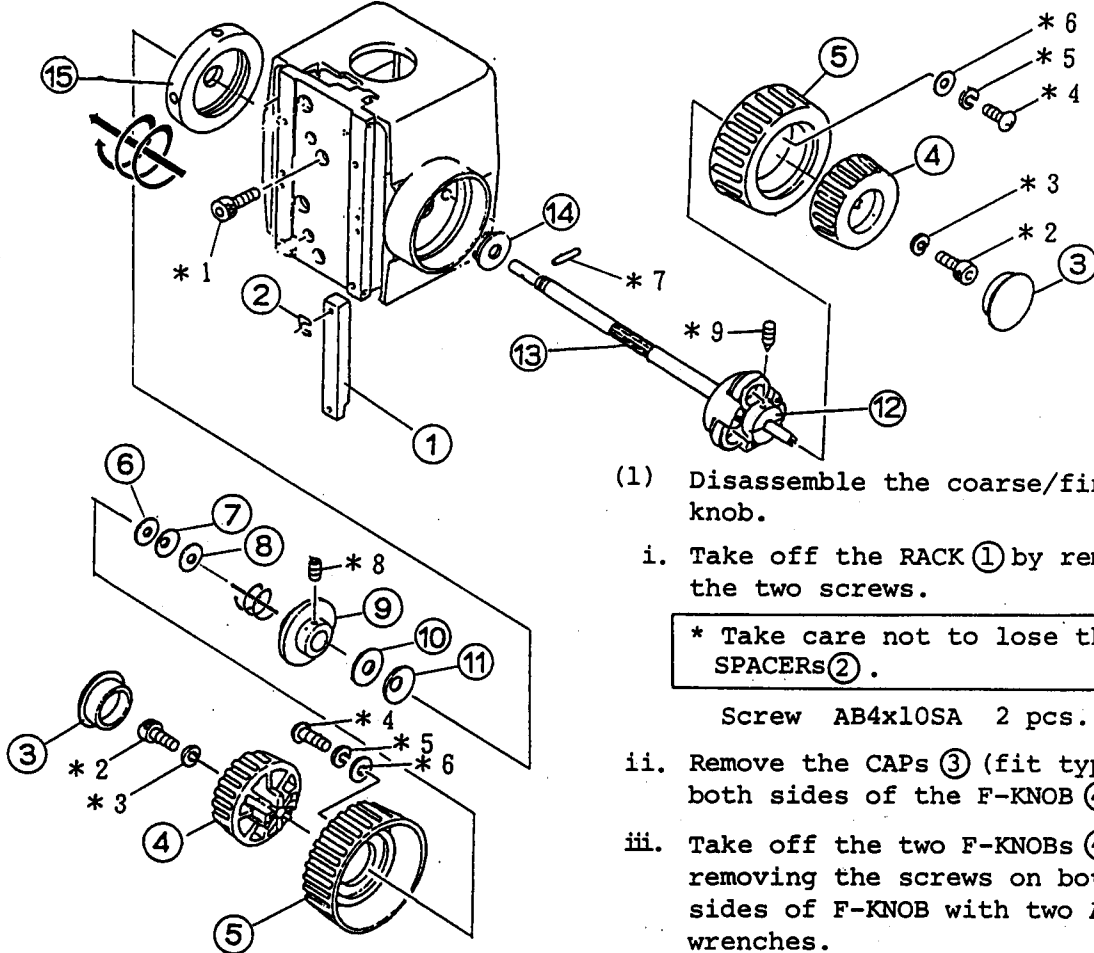


- (2) Turn the coarse/fine focusing knob to the stop position (down direction) and remove the two screws on the back of the zoom microscope body. The FOCUSING-GUIDE UNIT (S-F010) ① will now come off.

Screw AB4x10SA 2 pcs. (*1)

2. DISASSEMBLY OF FOCUSING-GUIDE UNIT (S-F010)

2-1 DISASSEMBLY OF COARSE/FINE FOCUSING KNOB



(1) Disassemble the coarse/fine focusing knob.

- i. Take off the RACK (1) by removing the two screws.

* Take care not to lose the SPACERS (2).

Screw AB4x10SA 2 pcs. (*1)

- ii. Remove the CAPS (3) (fit type) on both sides of the F-KNOB (4).

- iii. Take off the two F-KNOBS (4) by removing the screws on both sides of F-KNOB with two Allen wrenches.

Screw AB3x8SA 2 pcs. (*2)

Washer SW3SA 2 pcs. (*3)

- iv. Take off the two C-KNOBS (5) by removing the three screws.

Screw CUK3x8SA 6 pcs. (*4)

Washer SW3SA 6 pcs. (*5)

Washer KNW3SA 6 pcs. (*6)

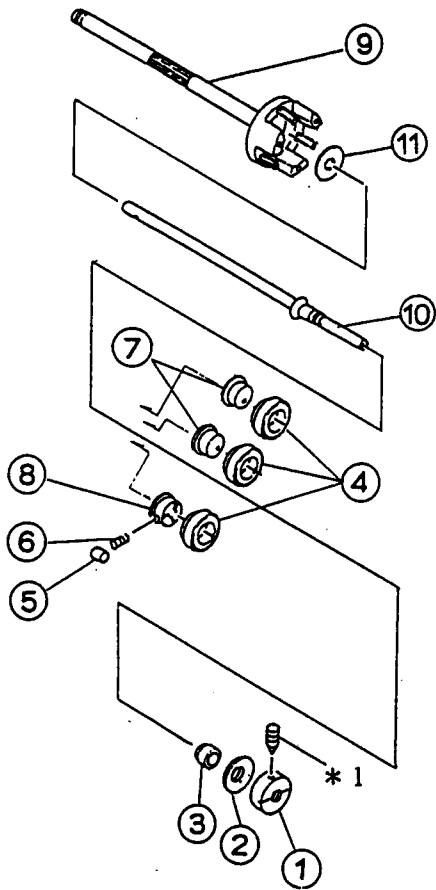
- v. Take off the WASHER (6), the SPRING WASHER (7) and the WASHER (8) by removing the two PINS.

Pin NP2x14UO 2 pcs. (*7)

- vi. Remove the CONNECTING RING (9) by loosening the two screws. The WASHER (10) and the SPRING WASHER (11) come off.

Screw ACU3x6SA 2 pcs. (*8)

C. DISASSEMBLY PROCEDURE



vii. Loosen the NUT (12) by loosening the screw.

Screw ANU2.6x6SA 1 pc. (*9)

viii. Pull out the PINION (13) together with the WASHER (14).

ix. Remove the RING (15) by turning it counterclockwise. (See page C-3)

(2) Disassemble the pinion.

i. Remove the NUT (1) by loosening the screw, then remove the SPRING WASHER (2) and the RING (3).

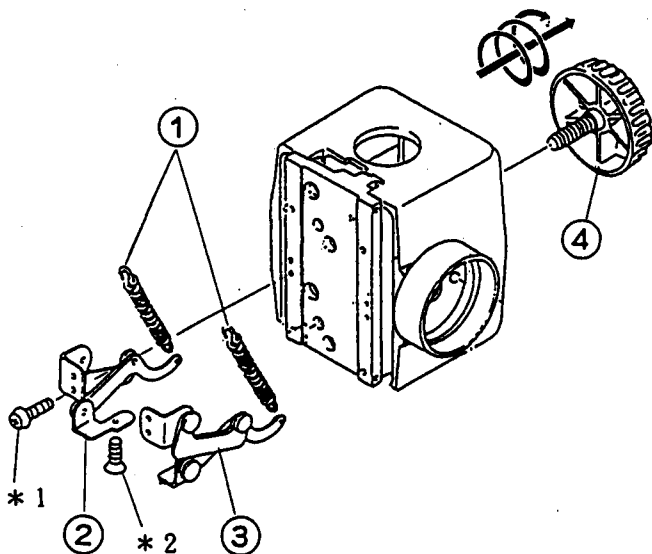
Screw ANU2.6x6SA 1 pc. (*1)

ii. Remove the three RINGS (4), then remove the three ROLLERS (5) and three SPRINGS (6).

iii. Remove the two BUSHINGS (7) and one ROLLER BUSHING (8).

iv. Pull out the SHAFT (10) from the PINION (9), then remove the WASHER (11).

2-2 DISASSEMBLY OF GUIDE UNIT



(1) Disassemble the counterbalancing mechanism.

i. Remove the two SPRINGS (1).

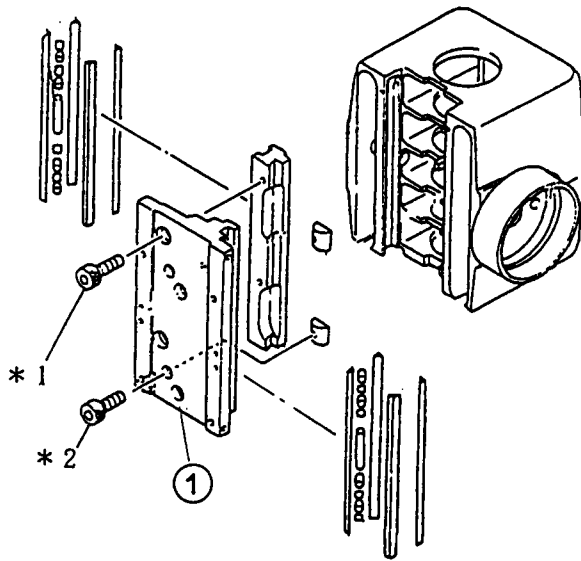
ii. Remove the L-LINK (2) and R-LINK (3) by removing the three screws respectively.

Screw CUK4x8SA 4 pcs. (*1)

Screw CSK4x8SA 2 pcs. (*2)

iii. Remove the KNOB (4) by turning it counterclockwise.

C. DISASSEMBLY PROCEDURE



- (2) Take off the INNER ROLLER GUIDE ① by removing the four screws. The guide unit comes off as shown on the left.

Screw AB4x10SA 2 pcs. (*1)
Screw AB3x10SA 2 pcs. (*2)

CONTENTS

1. ASSEMBLY/ADJUSTMENT OF FOCUSING-GUIDE UNIT
(S-F010) ----- D-2

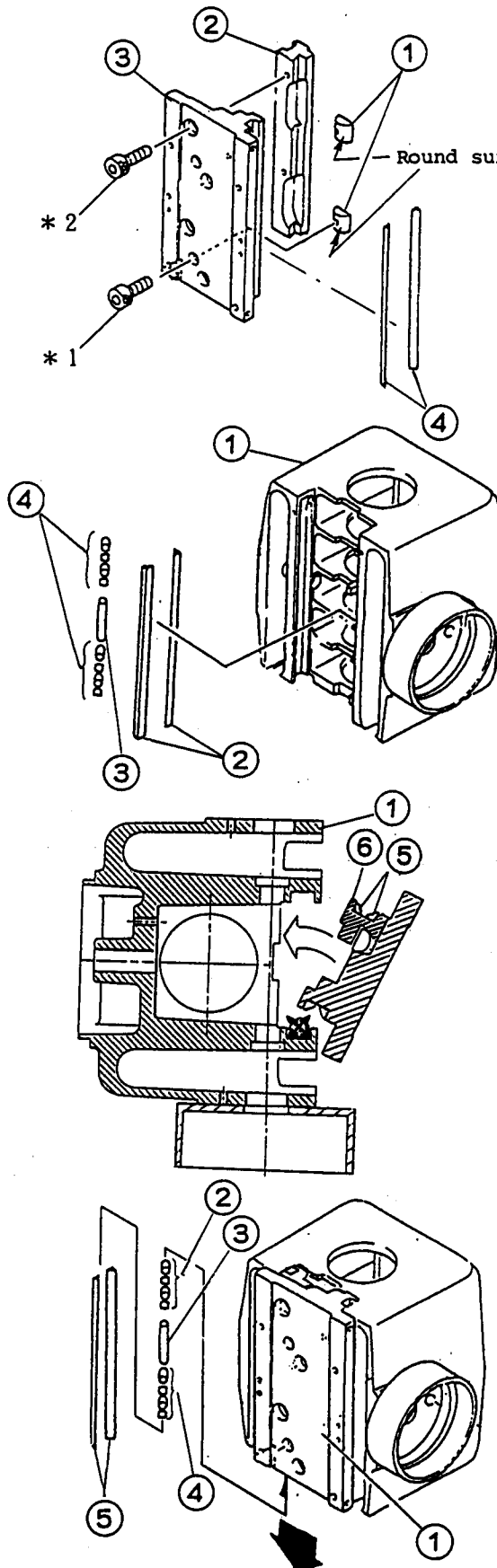
1-1 ASSEMBLY/ADJUSTMENT OF GUIDE UNIT ----- D-2

1-2 ASSEMBLY/ADJUSTMENT OF COARSE/FINE
FOCUSING KNOB ----- D-4

2. ATTACHMENT OF FOCUSING-GUIDE UNIT (S-F010)----- D-7

1. ASSEMBLY/ADJUSTMENT OF FOCUSING-GUIDE UNIT (S-F010)

1-1 ASSEMBLY/ADJUSTMENT OF GUIDE UNIT



(1) Assemble the guide unit on the moving side.

- i. Fit the two WIRE FIXING PIECES ① (coat grease on the round surface) in the notches of the ROLLER GUIDE ②, attach it to the INNER ROLLER GUIDE ③, and tighten the screws slightly.

Grease Los72515 (OT2008)

Screw AB3x10SA 2 pcs. (*1)

Screw AB4x10SA 2 pcs. (*2)

- ii. Stick the two WIRES ④ to the groove of the INNER ROLLER GUIDE ③ with grease (so the wires are closely stuck to the groove).

Grease Los72515 (OT2008)

(2) Assemble the guide unit on the main body side.

- i. Put the two WIRES ② on the groove of the BODY ① (so the wires are closely attached to the groove).
- ii. Put the SPACER ③ coated with grease at the middle of the WIRE ②.

Grease Los72515 (OT2008)

- iii. Arrange the eight ROLLERS ④ coated with grease alternately on both sides of the spacer ③, so that the direction of roller top changes one another by 90°. (so rollers rotate in the guide advancing direction).

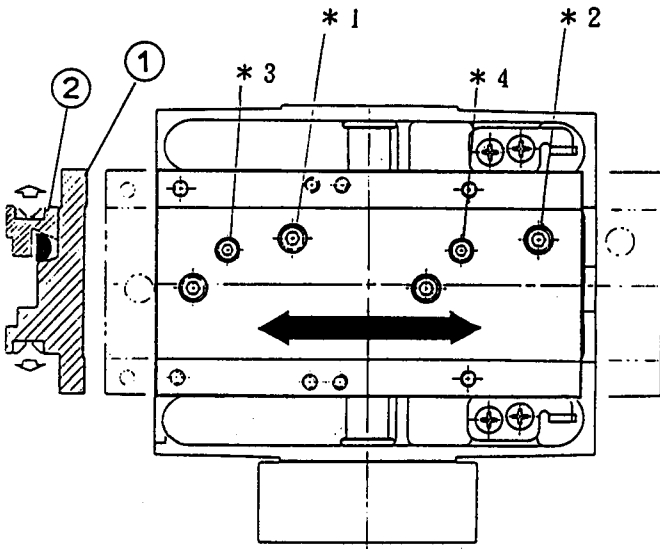
Grease Los72515 (OT2008)

(3) Put the two WIRES ⑤ on the groove of the ROLLER GUIDE ⑥, and mount the GUIDE unit gently in the BODY ①.

* Hold the GUIDE unit by hand till the next step. Otherwise, the GUIDE unit will fall.

(4) Move the GUIDE UNIT ① in the direction of the arrow. Arrange the four ROLLERS ②, the SPACER ③ and the four ROLLERS ④ on the wires of the ROLLER GUIDE ⑥. After this, insert the two wires ⑤ into the groove of the BODY.

* The ROLLERS should be arranged alternately. (the same as (2)iii)
* Apply the grease to the ROLLERS and SPACER beforehand.



(5) Adjust the guide working force.

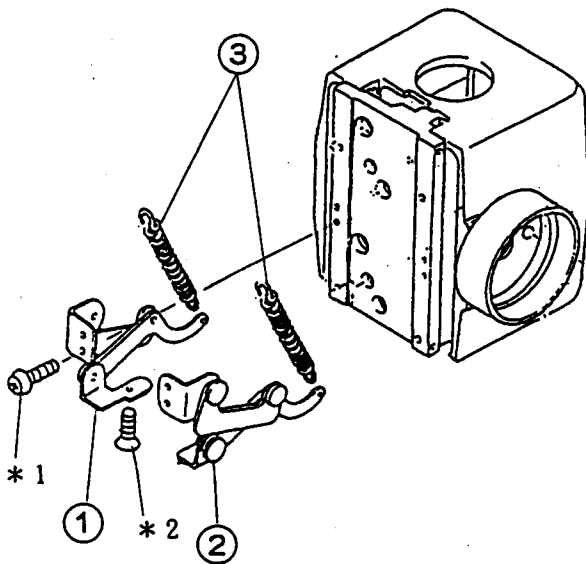
- i. Make the endface even between the INNER ROLLER GUIDE ① and the ROLLER GUIDE ② (oblique lines part on the left), and tighten the screws *1 and *2 slightly (to the extent that the ROLLER GUIDE ② moves).
- ii. Tighten the screws *3 and *4 gradually by the same force.
- iii. When the play of the ROLLER GUIDE is eliminated, apply a tension gauge to the ROLLER GUIDE and measure the working force in the going and returning direction.

Standard:

Guide working force 175g±20g

- iv. Repeat adjustment (ii ~ iii) until the standard is met. If the standard is met, tighten the screws *1 and *2 firmly. After checking the working force again, apply adhesive to the screw heads to prevent looseness.

Adhesive Shellac (OT1131)



(6) Assemble the counterbalancing mechanism.

- i. Hook the SPRINGS ③ on to L-LINK ① and R-LINK ②, then mount the unit in the BODY with the screws coated with adhesive

Screw CUK4x8SA 4 pcs. (*1)

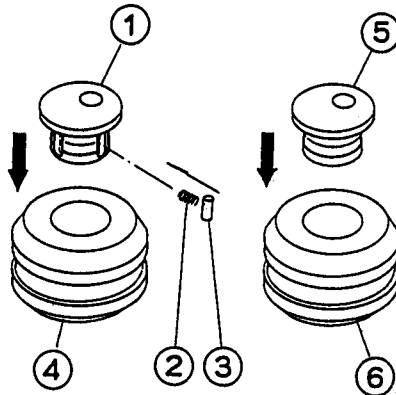
Screw CSK4x8SA 2 pcs. (*2)

* When mounting the LINKS, direct the end of the SPRINGS ③ to the spring hook side in the body so that it can be hooked smoothly.

Adhesive Perma lock MM (OT1126)

- ii. Hook the SPRINGS ③ on to spring hooks in the BODY.

1-2 ASSEMBLY/ADJUSTMENT OF COARSE/FINE FOCUSING KNOB



(1) Assemble the RING.

- i. Insert three SPRINGS ② and three ROLLERS ③ into the ROLLER BUSHING ①, and hold with the RING ④. (Apply grease all around the ROLLER BUSHING, SPRINGS and ROLLERS.)

Grease Los72515 (OT2008)

- ii. Assemble the two BUSHINGS ⑤ and two RINGS ⑥. (Apply grease all around the BUSHINGS.)

Grease Los72515 (OT2008)

* The shape of RINGS ④ and ⑥ are the same on both sides.

- iii. Wipe off the oil remained all around the RING with the cleaning mixture.

(2) Assemble the coarse/fine focusing knob.

- i. Apply grease to the thread of the RING ② and screw all the way to the connecting mount of the BODY ①.

Grease Los72515 (OT2008)

- ii. Insert the PINION ④ with the WASHER ③ (ø21 plastic) into the BODY ①. (Apply grease to the WASHER and the sliding part of the PINION)

Grease Los72515 (OT2008)

- iii. Insert the SHAFT ⑥ with the WASHER ⑤ (ø14 plastic) into the PINION ④. (Apply a small amount of grease around the SHAFT and the WASHER.)

Grease Los72515 (OT2008)

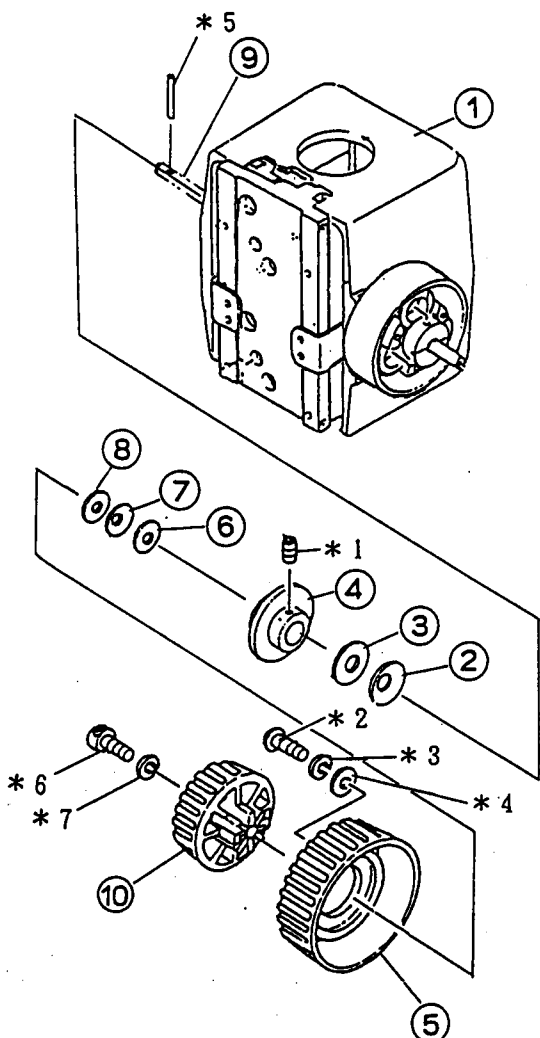
- iv. Fit the RINGS ⑦ (assembled in (1), i and ii above) on the PINS (*1) as shown on the left. (Apply grease to the contacting surface between the RING and the SHAFT.)

Grease Los72515 (OT2008)

* Any RINGS ⑦ can be mounted on any pin.

- v. Insert the RING ⑧ and the SPRING WASHER ⑨ with the convex side set forth on the SHAFT ⑥, screw the NUT ⑩ to the position which stops lightly by hand. (Apply grease to the SPRING WASHER and the round part of the RING.)

Grease Los72515 (OT2008)



(3) Assemble the coarse/fine focusing knob.

- i. Insert the SPRING WASHER (2) ($\phi 20$, with the concave side set forth) and the WASHER (3) ($\phi 21$) on the SHAFT (9), screw the CONNECTING RING (4), then tighten the two screws. (Apply grease to the SPRING WASHER and the WASHER.)

Grease Los72515 (OT2008).

Screw ACU3x6SA 2 pcs. (*1)

- ii. Insert the WASHER (6) ($\phi 14$ transparent), the SPRING WASHER (7) (with the concave side set forth) and the WASHER (8) ($\phi 14$ plastic) on the SHAFT (9) in this order. (Apply grease to the WASHERS.)

Grease Los72515 (OT2008)

- iii. Insert the PIN (*5) into the SHAFT (9).

Pin NP2x14UO 1 pc. (*5)

- iv. Secure the C-KNOB (5) to the CONNECTING RING (4) with three screws.

Screw CUK3x8SA 3 pcs. (*2)

Washer SW3SA 3 pcs. (*3)

Washer KNW3SA 3 pcs. (*4)

- v. Insert the F-KNOB (10) on the shaft and fix it with a screw.

Screw AB3x8SA 1 pc. (*6)

Washer SW3SA 1 pc. (*7)

(4) Adjust the contacting force of the RING.

- i. Tighten the NUT (1).

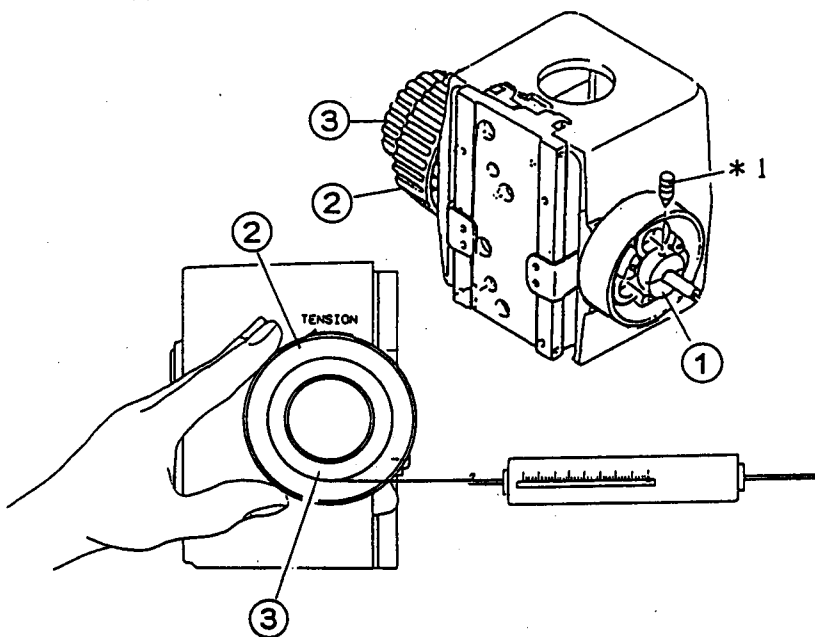
- ii. Adjust the contacting force (sliding force) to the standard(*) while tightening the NUT (1) gradually.

* Standard:
Sliding force 1.0 ~ 1.1kg

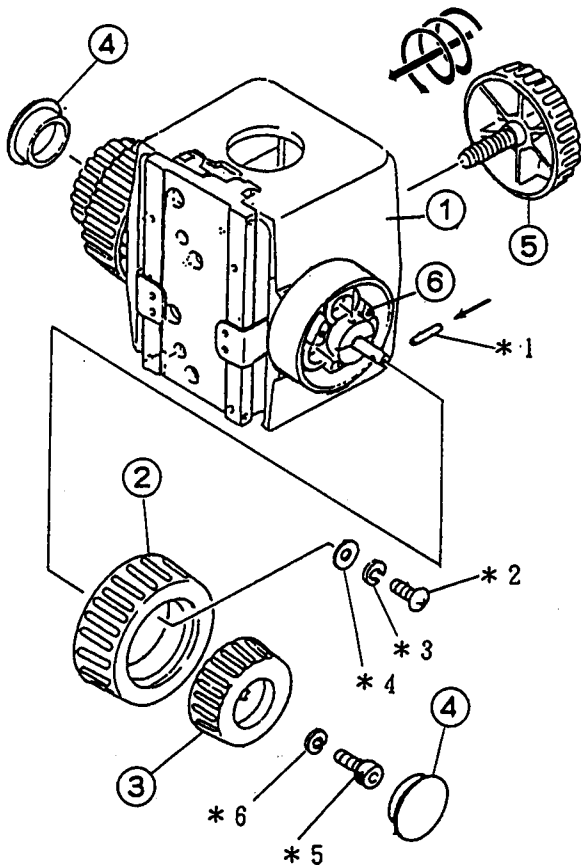
* How to measure the sliding force
a. Hold the C-KNOB (2) by hand.
b. Wind a string around the periphery of F-KNOB (3) as shown on the left, and pull it with a tension gauge to measure the sliding force.

- iii. Secure the NUT (1) by tightening the screw.

Screw ANU2.6x6SA 1 pc. (*1)



D. ASSEMBLY/ADJUSTMENT PROCEDURE



(5) Assemble the coarse/fine focusing knob.

i. Insert the PIN into the SHAFT of the BODY ①.

Pin NP2x14UO 1 pc. (*1)

ii. Secure the C-KNOB ② to the KNOB MOUNT ⑥ of the BODY ① with three screws.

Screw CUK3x8SA 3 pcs. (*2)

Washer SW3SA 3 pcs. (*3)

Washer KNW3SA 3 pcs. (*4)

iii. Insert the F-KNOB ③ on the shaft of the BODY ① and fix it with a screw.

Screw AB3x8SA 1 pc. (*5)

Washer SW3SA 1 pc. (*6)

iv. Fit the CAPS ④ on both ends of the F-KNOB ③.

v. Screw the KNOB ⑤ by turning it clockwise.

(6) Perform the assembly/adjustment of the RACK.

i. Insert the RACK ① from the bottom side of the BODY, engage with the pinion, adjust the screw holes to rack holes by turning the coarse/fine focusing knob, and secure tentatively with two screws.

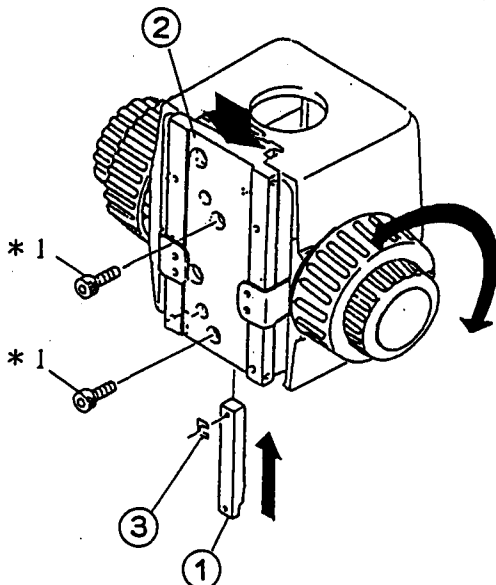
Screw AB4x10SA 2 pcs. (*1)

ii. Hold the coarse/fine focusing knob by hand and check if it has no play when the GUIDE UNIT ② is jiggled.

iii. Check if it has any unevenness by turning the coarse/fine focusing knob.

iv. Check if the working force is uniform by turning the coarse/fine focusing knob in working range.

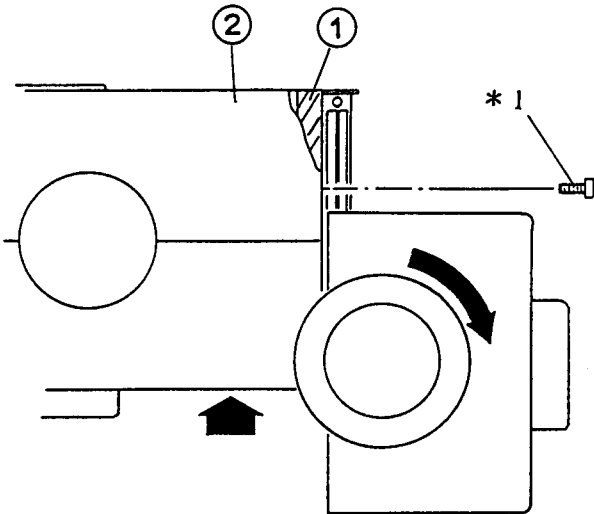
v. If the GUIDE UNIT has play in the check ii above, insert the WASHER ③ (0.02 ~ 0.1 thickness) under the rack at two positions. If the coarse/fine focusing knob rotation has unevenness in the check iii above, decrease the number of the washers or replace the rack. If the coarse/fine focusing knob working force is not uniform in the check iv above, decrease the number of the washers used under the rack position at which working force becomes heavier, or replace the rack.



vi. Repeat the checks ii ~ v.

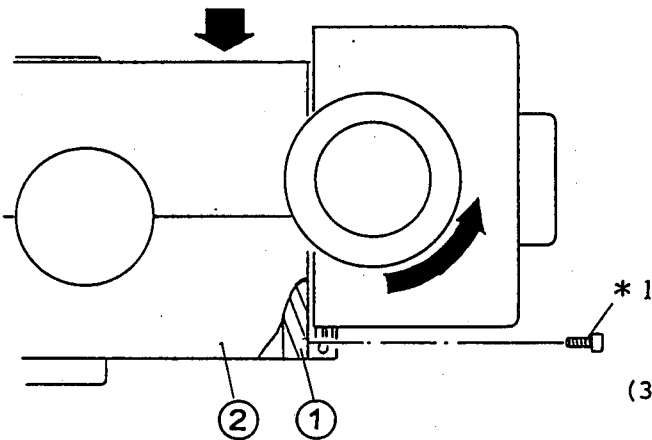
(7) Check according to B-3, "Focusing knob" in B. INSPECTION STANDARDS.

2. ATTACHMENT OF FOCUSING-GUIDE UNIT (S-F010)



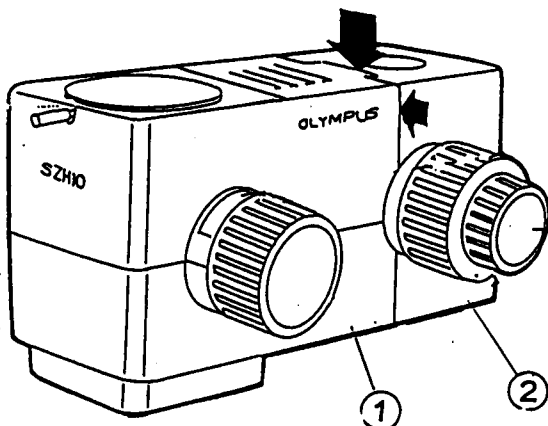
(1) Turn the coarse/fine focusing knob to the stop position (up direction) and secure the INNER ROLLER GUIDE ① tentatively to the ZOOM MICROSCOPE BODY ② with two screws.

Screw AB4x10SA 2 pcs. (*1)



(2) Turn the coarse/fine focusing knob to the stop position (down direction) and secure the INNER ROLLER GUIDE ① tentatively to the ZOOM MICROSCOPE BODY ② with two screws.

Screw AB4x10SA 2 pcs. (*1)



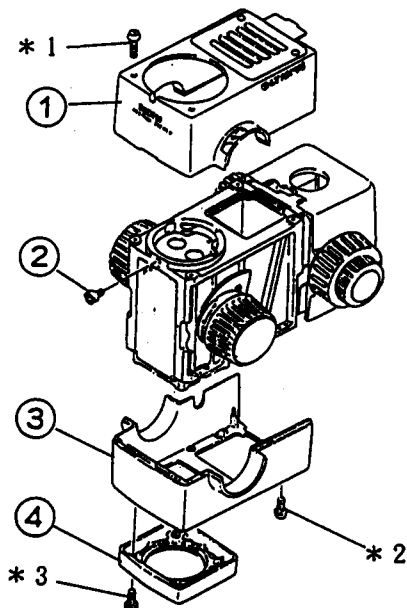
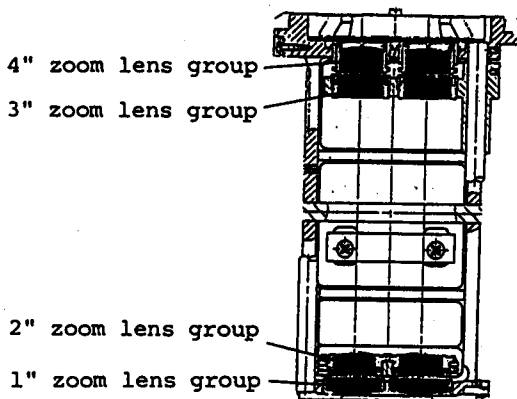
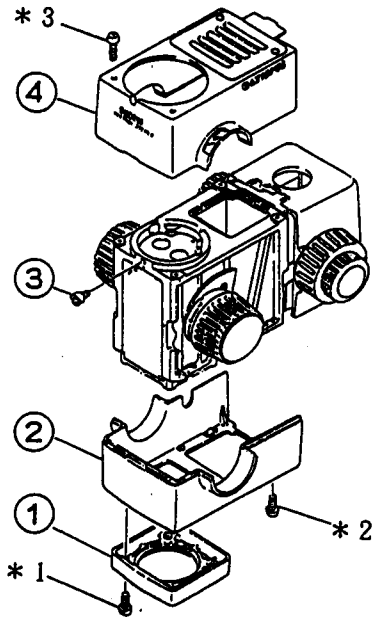
(3) Make the surfaces (shown by the arrows) even between ZOOM MICROSCOPE BODY ① (S-ZB10) and the FOCUSING GUIDE UNIT (S-F010) ②, then tighten the screws securely. Apply adhesive to the screw head.

Adhesive Shellac (OT1131)

CONTENTS

| | |
|---|-----|
| 1. CLEANING OF OPTICS OF ZOOM MICROSCOPE BODY (SZH-ZB10) ----- | E-2 |
| 2. ADJUSTMENT OF OPTICS OF ZOOM MICROSCOPE BODY (SZH-ZB10) ----- | E-3 |
| 2-1 Preparation for adjustment ----- | E-3 |
| 2-2 Checking the optical axis and parfocality ----- | E-3 |
| 2-3 Strip the adhesive before adjustment ----- | E-4 |
| 2-4 Parfocality adjustment ----- | E-4 |
| 2-5 Bonding the parfocality adjustment part ----- | E-4 |
| 2-6 Optical axis adjustment ----- | E-5 |
| 3. REPAIR OF OBSERVATION TUBE (SZH-BI45N) ----- | E-6 |
| 3-1 Assembly procedure ----- | E-6 |
| 3-2 Adjustment procedure ----- | E-8 |

1. CLEANING OF OPTICS OF ZOOM MICROSCOPE BODY (SZH-ZB10)



- (1) Disassemble the BODY for cleaning the optics.
 - i. Take off the OB MOUNT ① by removing the four screws.

Screw AB4x8SA 4 pcs. (*1)
 - ii. Take off the LOWER COVER ② by removing the four screws.

Screw CUK3x6SA 4 pcs. (*2)
 - iii. Take off the UPPER COVER ④ by removing the FEMALE SCREW ③ and four screws.

Screw CUK3x6SA 4 pcs. (*3)

* Since the FEMALE SCREW ③ has been bonded with adhesive, it is difficult to remove. Apply cleaning mixture or heat with a soldering iron.

- (2) All the lenses of the 1" ~ 4" zoom lens groups can be seen. Clean each lens completely.

* The lenses are shown shaded in the drawing on the left. Clean the upper and lower surfaces by changing the zoom magnification.

- (3) Reassemble the BODY.
 - i. Mount the UPPER COVER ① taking care not to interfere with the ZOOM MAGNIFICATION KNOB, then secure with four screws.

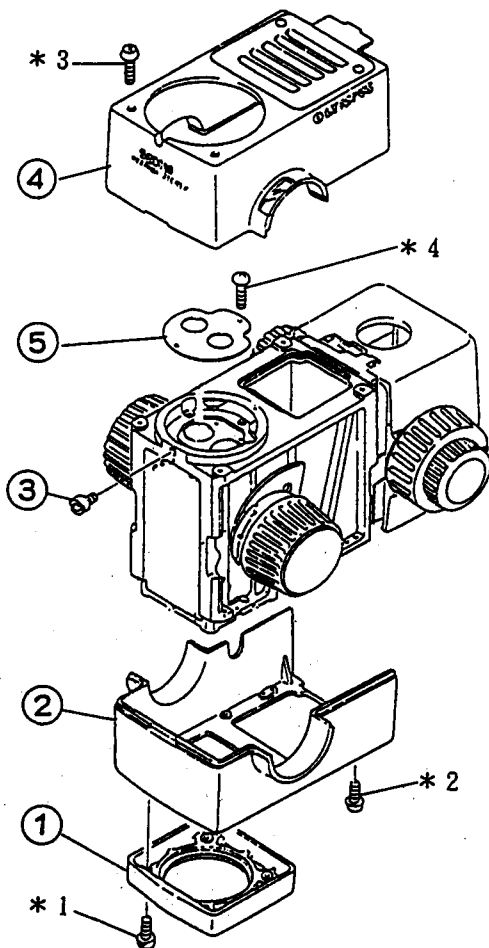
Screw CUK3x6SA 4 pcs. (*1)
 - ii. Tighten the FEMALE SCREW ②, then loosen slightly, apply adhesive to the clearance, then tighten the screw. Wipe off the exuded adhesive.

Adhesive Three bond 1401 (OT1378)
 - iii. Mount the LOWER COVER ③ taking care not to interfere with the ZOOM MAGNIFICATION KNOB and line up between the UPPER COVER ① and LOWER COVER ③, then secure with four screws.

Screw CUK3x6SA 4 pcs. (*2)
 - iv. Mount the OB MOUNT ④ and secure it in the middle of the play with four screws.

Screw AB4x8SA 4 pcs. (*3)

2. ADJUSTMENT OF OPTICS OF ZOOM MICROSCOPE BODY (SZH-ZB10)



2-1 Preparation for adjustment

- i. Take off the OB MOUNT ① by removing the four screws.

Screw AB4x8SA 4 pcs. (*1)

- ii. Take off the LOWER COVER ② by removing the four screws.

Screw CUK3x6SA 4 pcs. (*2)

- iii. Take off the UPPER COVER ④ by removing the FEMALE SCREW ③ and four screws.

Screw CUK3x6SA 4 pcs. (*3)

* Since the FEMALE SCREW ③ has been bonded with adhesive, it is difficult to remove. Apply cleaning mixture or heat with a soldering iron.

- iv. Tighten the FEMALE SCREW ③.

- v. Mount the OB MOUNT ① and secure it in the middle of the play with four screws.

Screw AB4x8SA 4 pcs. (*1)

- vi. Take off the COVER ⑤ by removing the two screws.

Screw PSK2x6SA 2 pcs. (*4)

2-2 Checking the optical axis and parfocality

- i. Set the jigs.

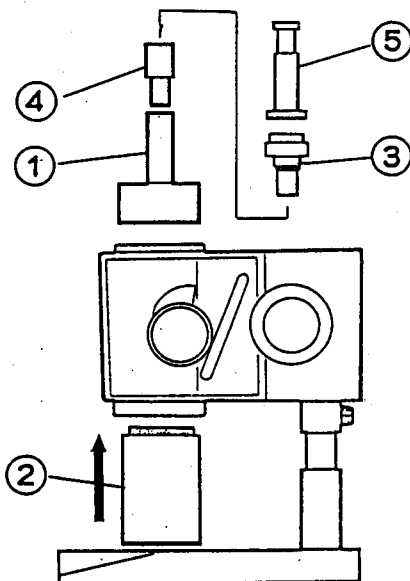
- Standard BI-head ① (SZHKC004)
- Standard objective ② (SZHKC002)
- Universal standard eyepiece ③ (KN0048)
- Eyepiece adapter ④ (included in SZHKC004)
- FT-36 ⑤

- ii. Check the optical axis.

Refer to B-4, "displacement of optical axis" in B. INSPECTION STANDARDS.

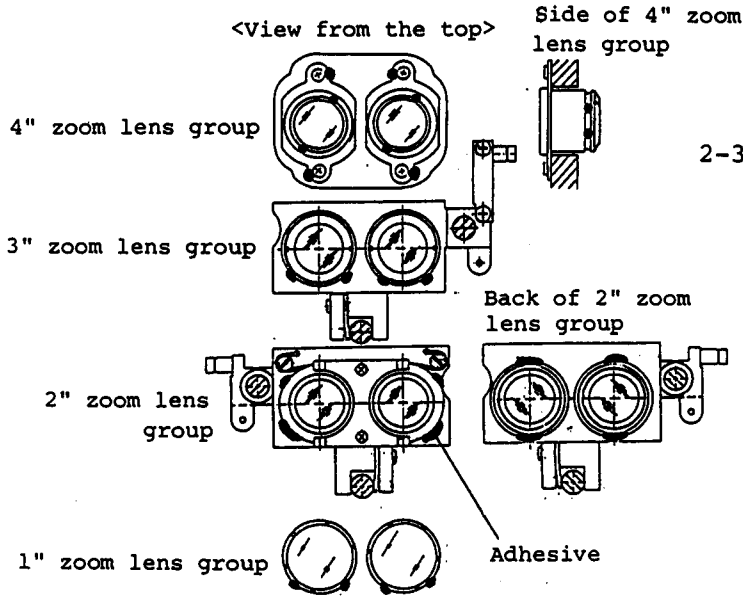
- iii. Check the parfocality.

Refer to B-5, "parfocality" in B. INSPECTION STANDARDS.



E. REPAIR PROCEDURE

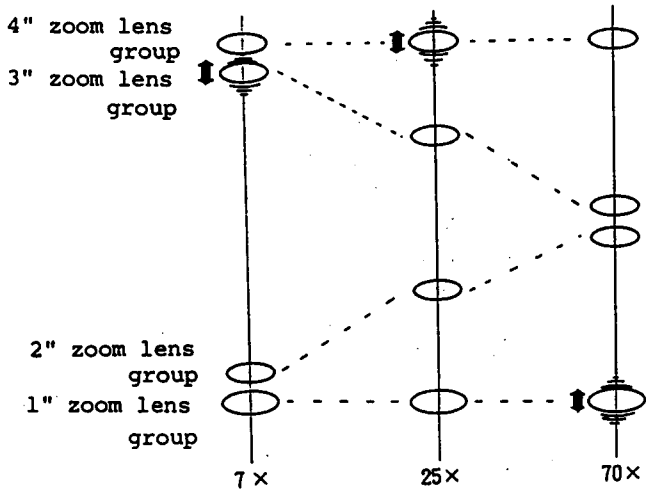
* If the optical axis or parfocality is out of the standard, perform the following adjustment.



2-3 Strip the adhesive before adjustment

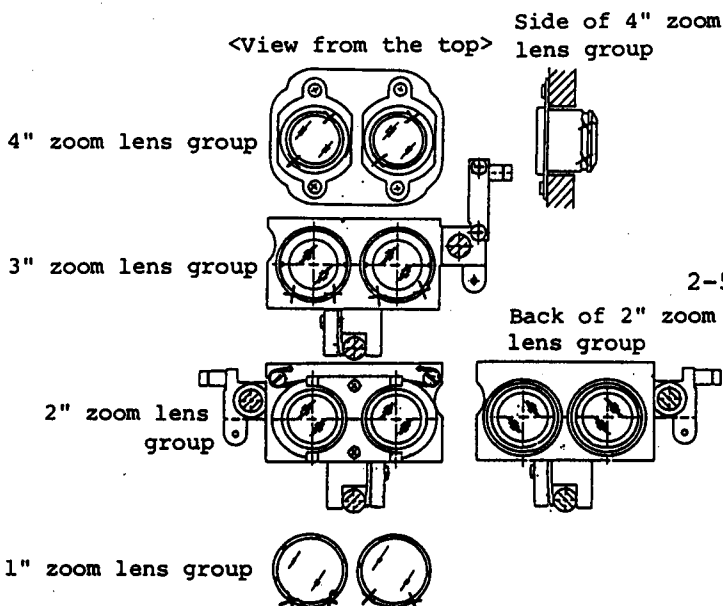
There are three adjustment patterns depending on the displacement of the optical axis and parfocality.

- i. If only the optical axis or the left/right optical axis difference is slightly out of standard, strip the adhesive by the screws of only the 4" zoom lens group.
- ii. If the shift by magnification change is out of standard, strip the adhesive from the edges of the frames of the 4" and 2" zoom lens groups.
- iii. If the parfocality is out of standard, strip the adhesive from the frame screws of the 1", 3" and 4" zoom lens groups. (The adjustable spanner (KKAB3900) is available for turning the frame of 1" zoom lens group.



2-4 Parfocality adjustment.

- i. Set ON the click.
- ii. Set the same jigs as those used in 2-2, "Checking the optical axis and parfocality".
- iii. Set the magnification to 25x and adjust the focus by turning the frame of 4" zoom lens group.
- iv. Set the magnification to 7x and adjust the focus by turning the frame of 3" zoom lens group.
- v. Set the magnification to 70x and adjust the focus by turning the frame of 1" zoom lens group.
- vi. Return to iii and repeat iii ~ v.



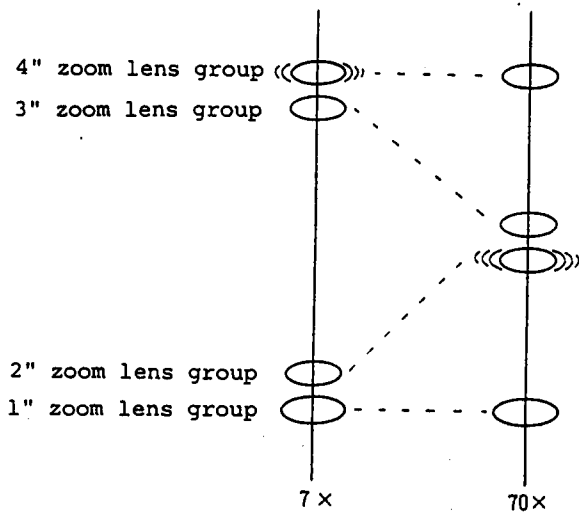
2-5 Bonding the parfocality adjustment part

- i. Apply a small amount of adhesive to the specified points of 1", 3" and 4" zoom lens groups (marked by "x" in the drawing on the left).

Adhesive Araldite rapid (OT1315)

E. REPAIR PROCEDURE

2-6 Optical axis adjustment



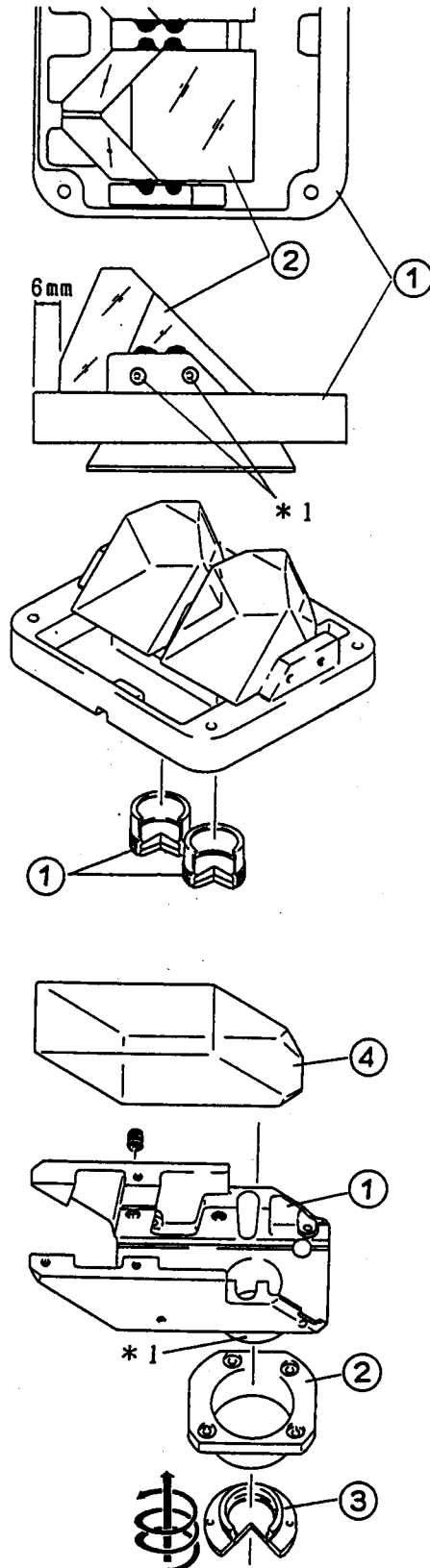
- i. Set ON the click.
- ii. Set the same jigs as those used in 2-2, "Checking the optical axis and parfocality".
- iii. Set the magnification to 7 \times and align the cross hairs center of the eyepiece with the center of the specimen by moving gradually the frame of 4" zoom lens group in the horizontal direction (change frame position by pushing from the side of the frame with the fixing screws semi-fixed.)

* The optical axis and left/right optical axis difference can be adjusted, but the shift by magnification change will be slightly displaced.

* If the shift by magnification change meets the standard, the adjustment is completed.

- iv. Set the magnification to 70 \times and align the cross hairs center of the eyepiece with the center of the specimen by moving gradually the frame of 2" zoom lens groups in the horizontal direction (change frame position by adjusting the side screws).
- v. Return to iii and repeat iii ~ iv.

3. REPAIR OF OBSERVATION TUBE (SZH-BI45N)



3-1 Assembly procedure

(1) Assemble the BASE (1).

- i. Put the PRISM (2) on the BASE (1) as shown on the left and secure it with the screws.

* It is recommended that the endface of the PRISM be about 6mm inside from the endface of the BASE.

Screw AHU3x4SA 2 pcs. (*1)

- ii. Apply adhesive at two positions on the border between the PRISM and the BASE.

Adhesive Araldite rapid (OT1315)

(2) Mount the LENS ASS'Y (1).

* Set the LENS ASS'Y at the position of about 2mm inside from the bottom surface of the BASE.

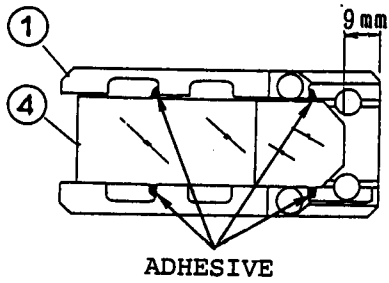
(3) Assemble the PRISM MOUNT (1) (first on the right side).

- i. Apply grease to the sliding surface (*1) of the PRISM MOUNT (1), insert the MOUNT (2), and screw the LENS FRAME (3).

Grease Los1160C (OT2006)

- ii. Check for any play or tightness. If there is any play or tightness, adjust the working force by broadening or narrowing the slit of the LENS FRAME (3).

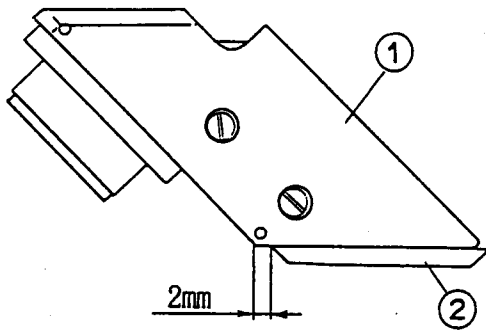
E. REPAIR PROCEDURE



- iii. Put the PRISM (4) on the bottom of the PRISM MOUNT (1) and secure it at the position shown on the left with the screws.

* The endface of the PRISM should be about 9mm inside from the endface of the PRISM MOUNT.

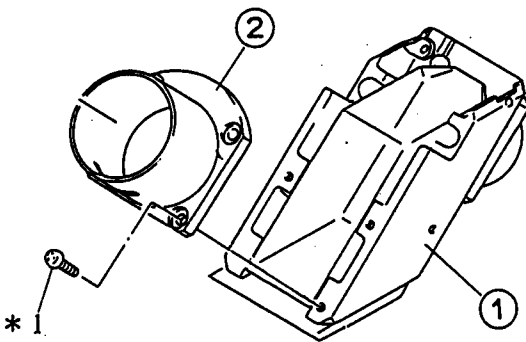
- iv. Apply adhesive at four positions.
Adhesive Araldite rapid (OT1315)



- (4) Stick the COVER (2) to the PRISM MOUNT (1).

Adhesive Sonny bond (OT1024)

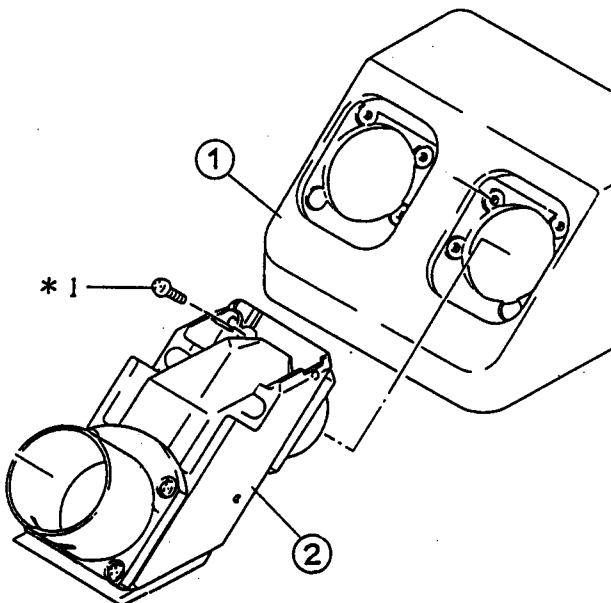
* The COVER should be about 2mm inside from the endface of the PRISM MOUNT.



- (5) Secure the SLEEVE (2) tentatively to the PRISM MOUNT (1) with three screws.

Screw CUK3x4SA 3 pcs. (*1)

* Secure it in the middle of the screw play.



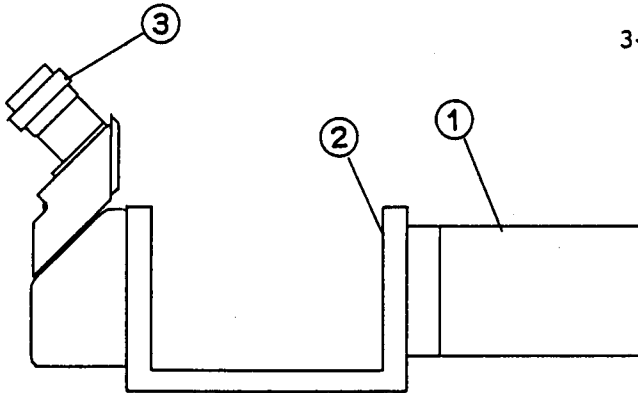
- (6) Secure the PRISM MOUNT (2) tentatively to the BASE (1) with three screws.

Screw CUK3x6SA 3 pcs. (*1)

* Secure it in the middle of the screw play.

- (7) Perform (3) ~ (6) above for the PRISM MOUNT on the left side.

E. REPAIR PROCEDURE

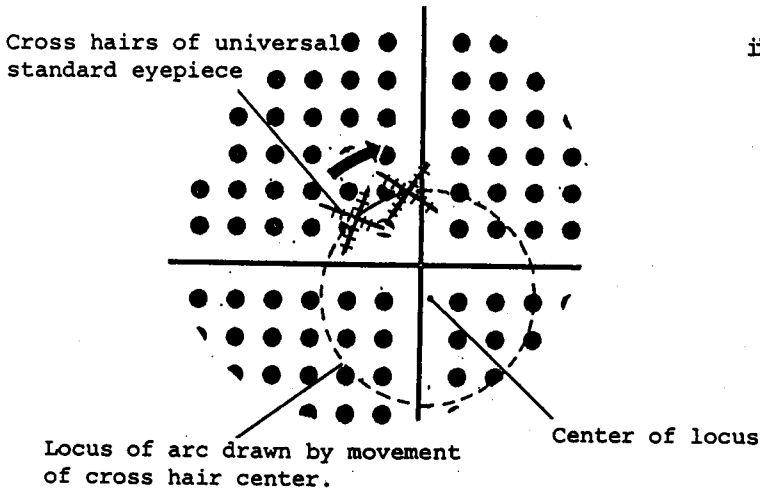


3-2 Adjustment procedure

(1) Adjust the decentration of image by interpupillary distance adjustment.

i. Set the jigs.

- Standard objective ① (SZHKC002)
- Standard zooming body ② (SZHKC003)
- Universal standard eyepiece ③ (KN0048)



ii. Grasp the center of locus.

- a. Set the interpupillary distance to maximum (or minimum), at this time remember the position of the cross hairs center of KN0048 on the right sleeve side.
- b. Set the interpupillary distance to minimum (or maximum) and obtain the center of locus by assuming the locus as shown in dot line from the movement of cross hairs center.

iii. Align the center of locus with the center of sleeve (the cross hairs center of the universal standard eyepiece).

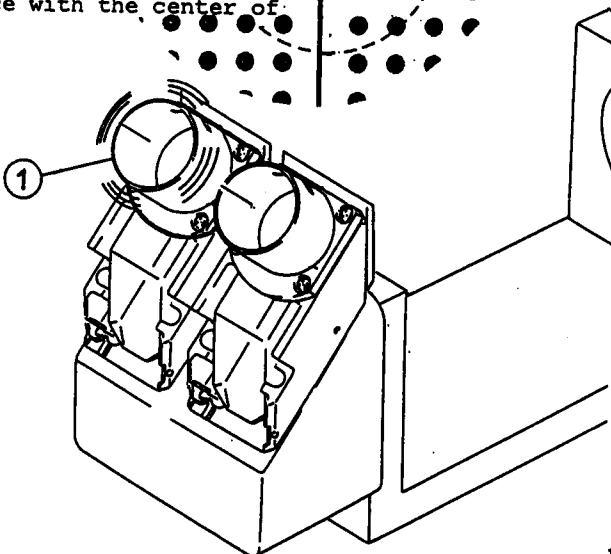
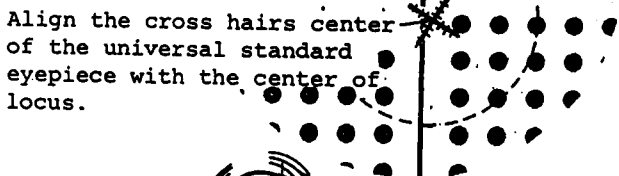
- a. Move the sleeve ① so that the cross hairs center of the universal standard eyepiece aligns with the center of locus.

* In this adjustment, it is not necessary to align the center of locus with the specimen center.

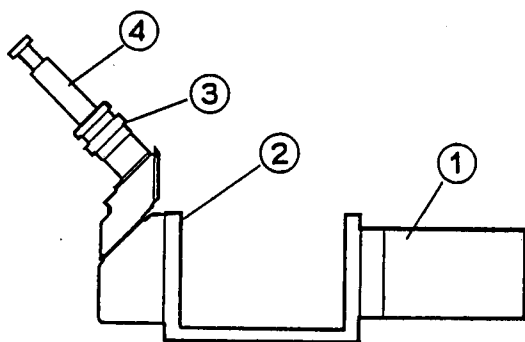
- b. Apply a small amount of adhesive to the screw head.

Standard:
KN0048 1/3 graduation max.

Adhesive Shellac (OT1131)



iv. Perform the same adjustment for the left sleeve.



(2) Adjust the optical tube length.

i. Preparation

a. Set the jigs.

- Standard objective ① (SZHKC002)
- Standard zooming body ② (SZHKC003)
- Universal standard eyepiece ③ (KN0048)
- FT-36 ④

- b. Move the helicoid ring of KN0048 and the inner-sleeve of FT-36 so that the cross hairs of KN0048 on the right sleeve can be clearly seen.

ii. Optical tube length adjustment

- a. Turn the LENS FRAME ① so that the focus is adjusted to the specimen.

Adjustable spanner (KKAB3710)

* If the focus is displaced in the direction of pulling out the helicoid ring, turn the LENS FRAME counterclockwise.

- b. Apply adhesive to the screw of the LENS FRAME ① after the adjustment.

Adhesive Three bond 1401 (OT1378)

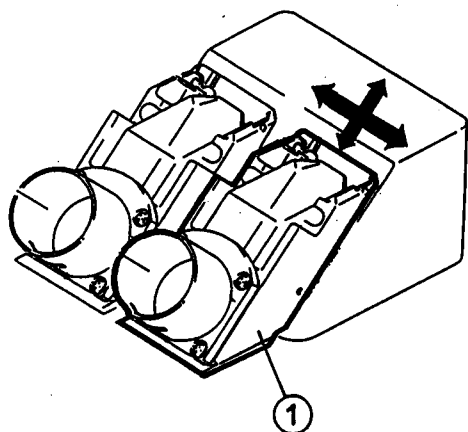
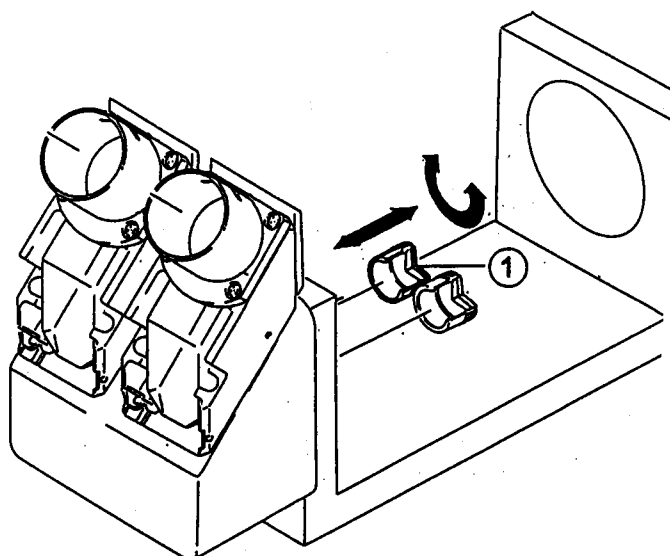
- c. Perform the same adjustment for the left sleeve.

Standard:

Focal difference between cross hairs and specimen: 2.5 graduations
Focal difference between left and right specimen: 2.5 graduations (on the diopter scale of KN0048)

- (3) Adjust the optical axis. (Setting of the jigs is the same as the optical tube length adjustment.)

- a. Move the PRISM MOUNT ① so that the cross hairs center of the universal standard eyepiece aligns with the center of specimen.



E. REPAIR PROCEDURE

Standard:

Displacement between the centers of cross hairs of the universal standard eyepiece and specimen: 0.6 graduation

- b. Perform the same adjustment for the other sleeve.

Standard:

Displacement between the centers of left and right specimen: 0.6 graduation

- c. Apply adhesive to the screws after the adjustment.

Adhesive Shellac (OT1131)

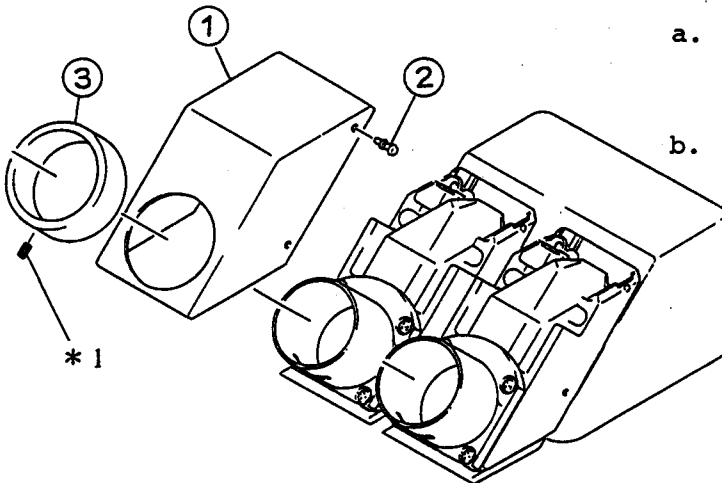
- (4) Check according to B. INSPECTION STANDARDS (Page B-3). If there is any abnormality, readjust that item.

- (5) Mount the cover.

- a. Mount the COVER ① and secure with the RIVETS ② (four for one cover).

- b. Secure the TUBE ③ with a screw.

Screw ACU3x3SA 2 pcs. (*1)



CONTENTS

1. LIST OF LUBRICANTS AND CHEMICALS ----- F-2

SZH10

F. LUBRICANTS AND CHEMICALS

1. LIST OF LUBRICANTS AND CHEMICALS

<SZH-BI45N>

| No. | Name | Remarks |
|--------|---------------------------|---------|
| OT2006 | Grease: LOS1160C | |
| OT1024 | Adhesive: Sony bond | |
| OT1131 | Adhesive: Shellac | |
| OT1315 | Adhesive: Araldite rapid | |
| OT1378 | Adhesive: Three bond 1401 | |

<SZH-ZB10>

| No. | Name | Remarks |
|--------|-------------------------|---------|
| OT2008 | Grease: LOS72515 | |
| OT1126 | Adhesive: Perma lock MM | |
| OT1131 | Adhesive: Shellac | |

CONTENTS

1. LIST OF JIGS AND TOOLS ----- G-2
2. EXPLANATION OF JIGS AND TOOLS ----- G-3

1. LIST OF JIGS AND TOOLS

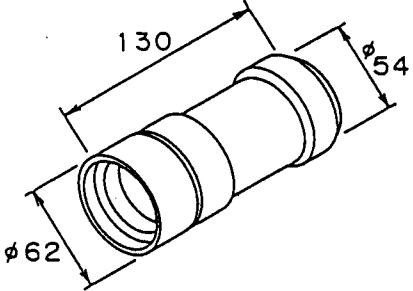
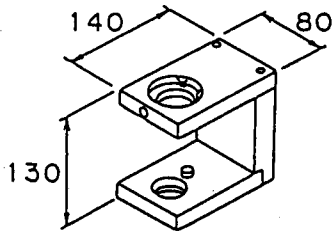
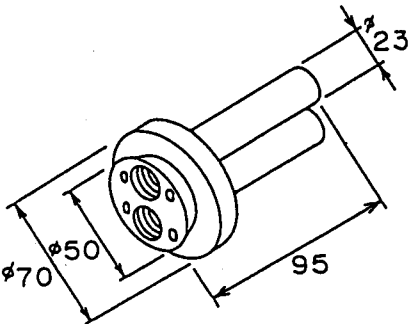
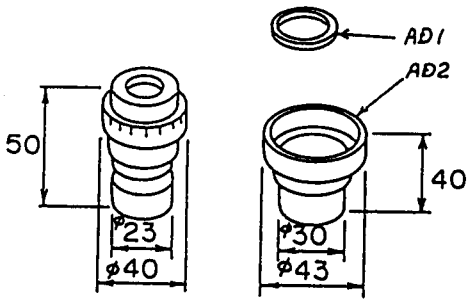
<SZH-BI45N>

| No. | Name | Remarks |
|----------|-----------------------------|------------------------------|
| KN0048 | Universal standard eyepiece | or KN0024(optical axis only) |
| SZHKC002 | Standard objective | |
| SZHKC003 | Standard zooming body | |
| Product | FT-36 | |
| KKAB3710 | Adjustable spanner | |

<SZH-ZB10>

| No. | Name | Remarks |
|----------|-----------------------------|------------------------------|
| KN0048 | Universal standard eyepiece | or KN0028(optical axis only) |
| SZHKC002 | Standard objective | |
| SZHKC004 | Standard BI-head | |
| OT1068 | Tension gauge | (3kg) |
| Product | FT-36 | |
| KKAB3900 | Adjustable spanner | |

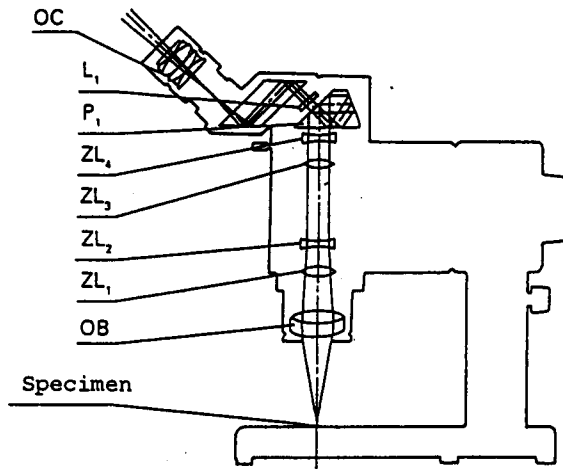
2. EXPLANATION OF JIGS AND TOOLS

| | | |
|---|-------------------|------------------|
| <p>SZHKC002</p>  | <p>① SZHKC002</p> | <p>② SZH-ZB</p> |
| <p>③ Standard objective lens for optical axis and optical tube length. The magnification is 1 time, built-in specimen with cross hair line.</p> | | |
| <p>SZHKC003</p>  | <p>① SZHKC003</p> | <p>② SZH-ZB</p> |
| <p>③ Standard ZB (Zooming Body). It is used to adjust BI-UNIT and OBJECTIVE.</p> | | |
| <p>SZHKC004</p>  | <p>① SZHKC004</p> | <p>② SZH-ZB</p> |
| <p>③ Standard BI-head. It is used with KN0028.</p> | | |
| <p>KN0048</p>  | <p>① KN0048</p> | <p>② GENERAL</p> |
| <p>③ Universal use standard eyepiece for optical axis and tube length. It has two adapter. One is to convert to long barrel, and another one is to convert sleeve diameter d=23.2mm to d=30mm (for stereo).</p> | | |

CONTENTS

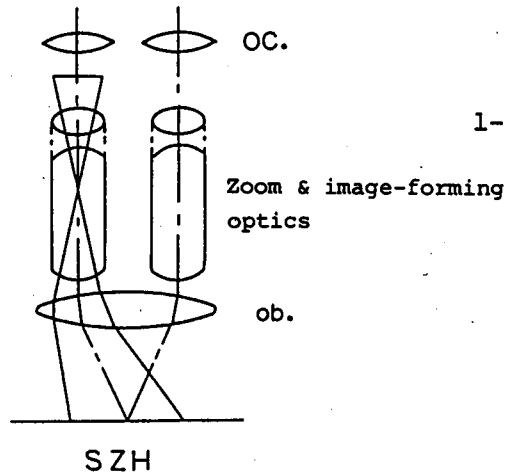
| | |
|--------------------------------------|-----|
| 1. ZOOM MICROSCOPE BODY (SZH-ZB10) | H-2 |
| 1-1 Light path diagram | H-2 |
| 1-2 Prevention of partial defocusing | H-2 |
| 1-3 Components of zooming optics | H-3 |
| 1-4 Balancing spring | H-4 |
| 2. FOCUSING-GUIDE UNIT | H-5 |
| 2-1 Coarse/fine focusing knob | H-5 |
| 2-2 Counterbalancing mechanism | H-6 |

1. ZOOM MICROSCOPE BODY (SZH-ZB10)



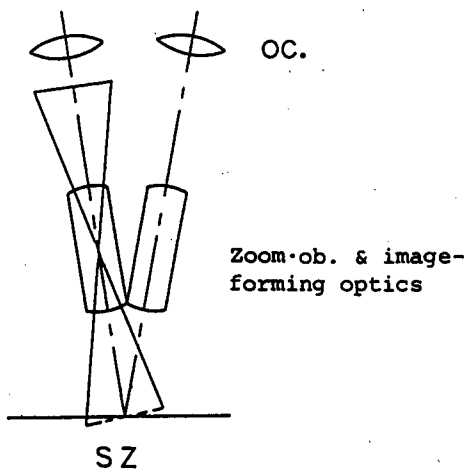
1-1 Light path diagram

- The light beam from the specimen is applied to the zoom lens groups ZL1 ~ ZL4 through the objective (OB), bent 45° by the upright image-forming dach prism P1, forming an image by the image-forming lens L1, and sent to the eyepiece (OC).
- The light beam is parallel rays between the objective (OB) and the zoom lens group ZL1 and between the zoom lens ZL2 and the upright image-forming dach prism P1.

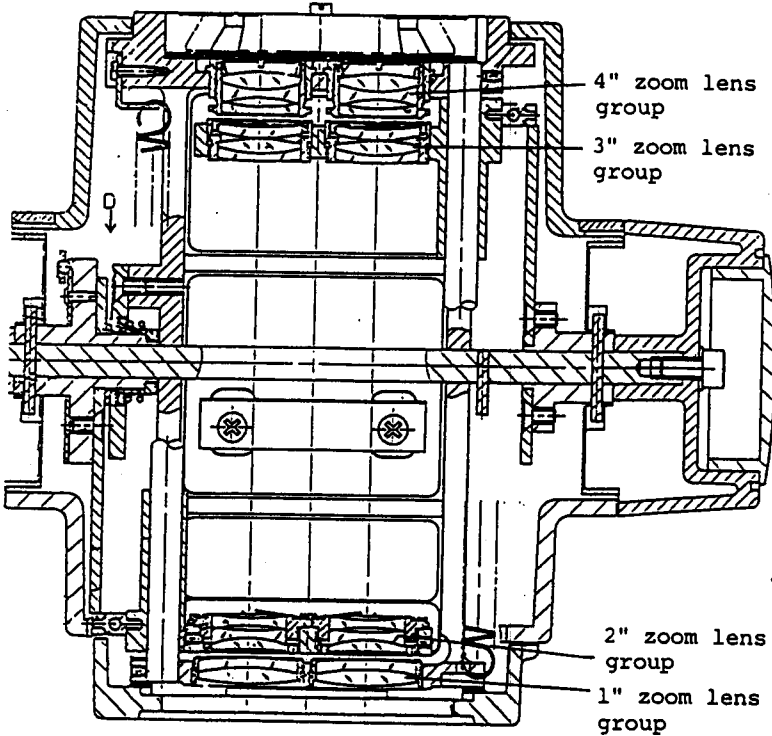


1-2 Prevention of partial defocusing

- The image-forming optics of the SZH has no inward angle, and the image surface is parallel to the specimen surface.



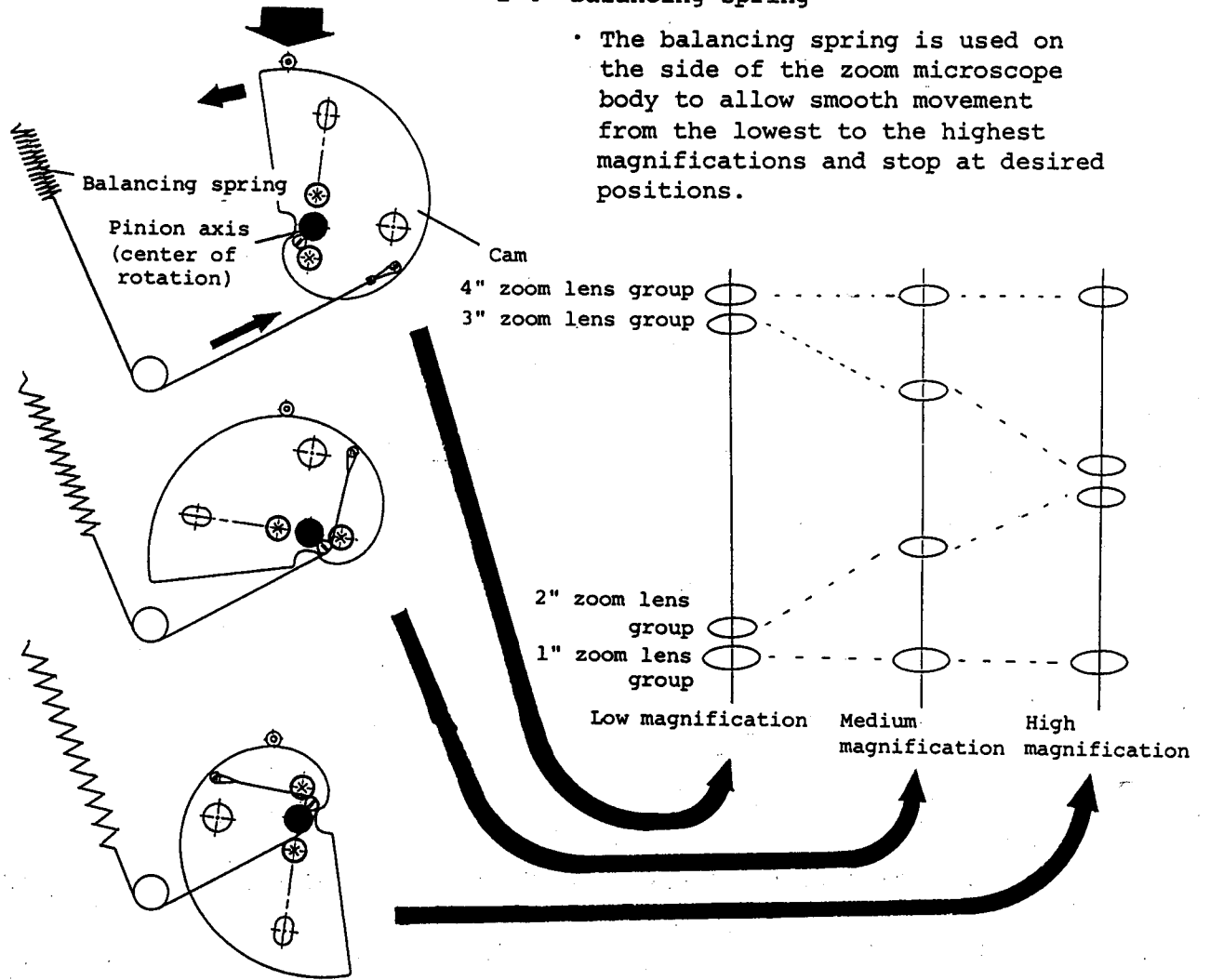
1-3 Components of zooming optics



- The zoom microscope body comprises 1" to 4" zoom lens groups. Desired magnifications can be obtained by moving the 2" and 3" zoom lens groups.
- The zoom lens groups have the following adjustment functions:
 - 1" zoom lens group:
Parfocality adjustment with frame screw
 - 2" zoom lens group:
Optical axis adjustment with screws
 - 3" zoom lens group:
Parfocality adjustment with frame screw
 - 4" zoom lens group:
Parfocality adjustment with frame screw
Optical axis adjustment with screws
- Zoom lens groups related for parfocality adjustment are as follows:
 - Low magnification:
3" zoom lens group
 - Medium magnification:
4" zoom lens group
 - High magnification:
1" zoom lens group
- Zoom lens groups related for optical axis adjustment are as follows:
 - Optical axis in zooming optics (shift by magnification change):
2" zoom lens group
 - Optical axis of whole zooming optics:
4" zoom lens group

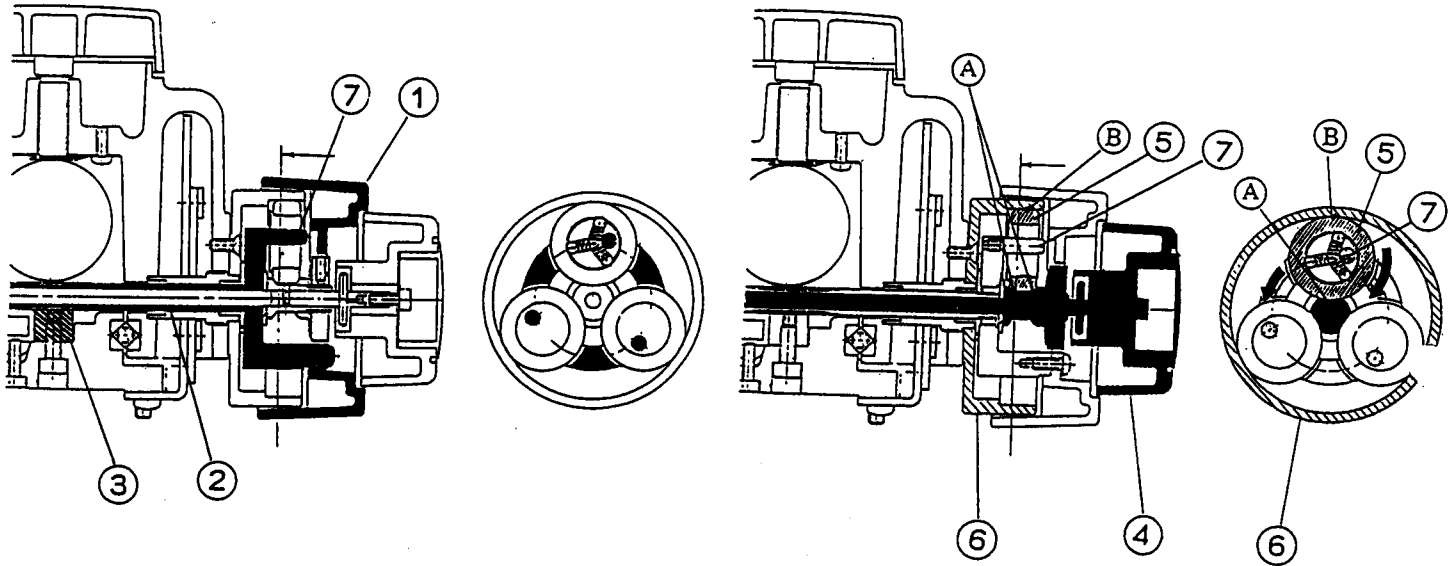
1-4 Balancing spring

- The balancing spring is used on the side of the zoom microscope body to allow smooth movement from the lowest to the highest magnifications and stop at desired positions.



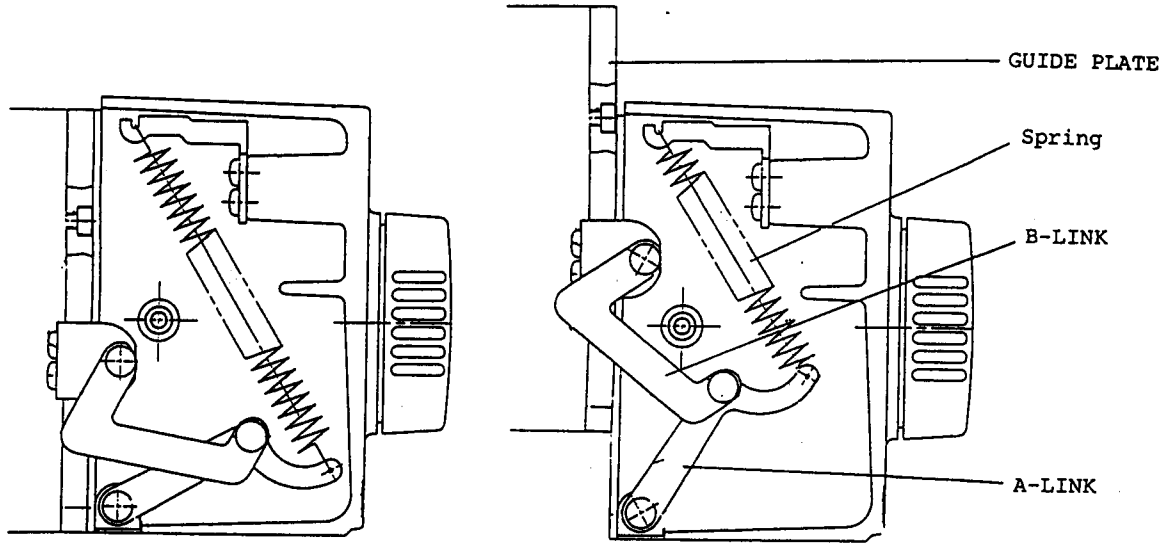
2. FOCUSING-GUIDE UNIT

2-1 Coarse/fine focusing knob



- (1) The COARSE FOCUSING KNOB ① is connected directly to the PINION ② to move the RACK ③ directly.
- (2) When the FINE FOCUSING KNOB ④ is turned, the three RINGS ⑤ are rotated by the friction at the point A.
- (3) The RINGS ⑤ also attempt to rotate the CASE ⑥ by the friction at the point B, but since the CASE ⑥ is originally fixed, the RINGS rotate around inside surface of the CASE with its rotation.
- (4) The three PINS ⑦ of the RINGS ⑤ are connected directly to the PINION ② to move the RACK ③.

2-2 Counterbalancing mechanism



<Construction>

- Principle -

Fig. A and Fig. B show the concept of the counterbalancing mechanism which is constructed as shown above.

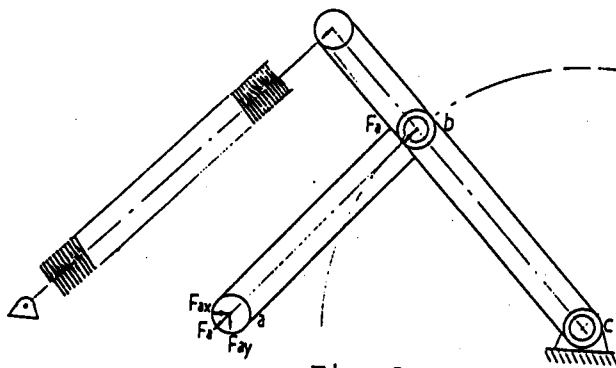


Fig. A

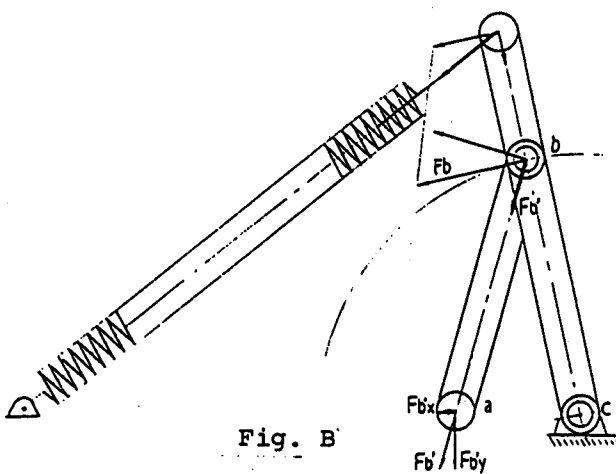


Fig. B

- (1) In Fig. A, the spring is not extended and the force applied to the A-LINK is weak.
- (2) In Fig. B, the spring is extended and the force applied to the A-LINK is strong.
- (3) If the force to move the point "a" of the B-LINK in the X direction is expressed by vector, the spring force to pull the A-LINK (Fa and Fb) become each x component of the force transmitted to the B-LINK (Fa and Fb').
- (4) The spring force to pull the A-LINK (Fa and Fb) is extremely different in Fig. A and Fig. B. The "Fa" is efficiently converted to "Fax" in Fig. A, while Fb is little converted to Fb'x in Fig. B.
- (5) As seen above, the change in force of the spring which extends when the guide moves is canceled by the LINK.

$$Fa < Fb$$

$$Fax \doteq Fb'x$$