

Technical Manual

SERVICING THE **ELMO SUPER 104** MOVIE CAMERA



Honeywell

PHOTOGRAPHIC PRODUCTS DIVISION

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Technical Manual

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DISASSEMBLY AND INSPECTION LOCATIONS

Outlined in their respective sequence are disassembly, inspection, adjustment, removal, and reassembly.

1. Removal of Top Cover

a. Method:

- a-1. Remove the four screws shown in Fig. 1 (1 and 2) and Fig. 2 (1 and 2).
- a-2. Take off the top cover.

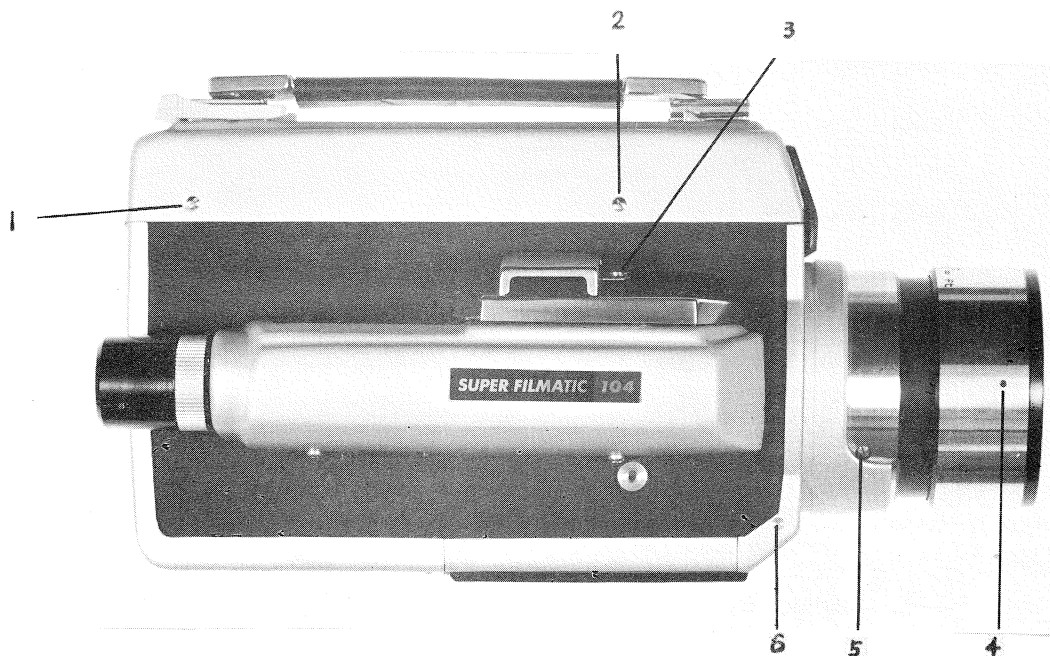


Fig 1.

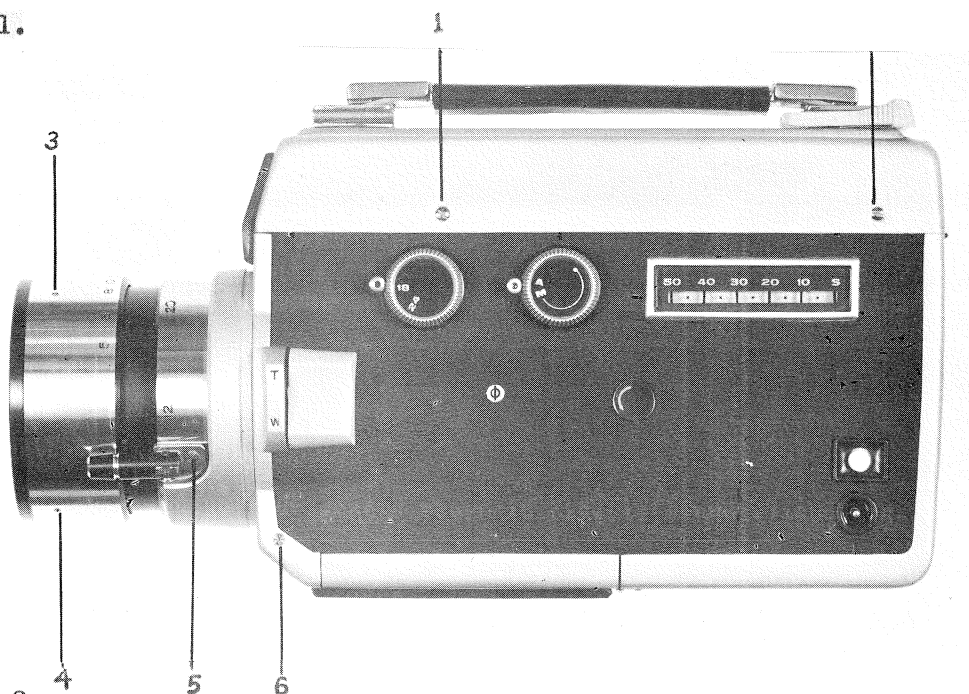


Fig. 2.

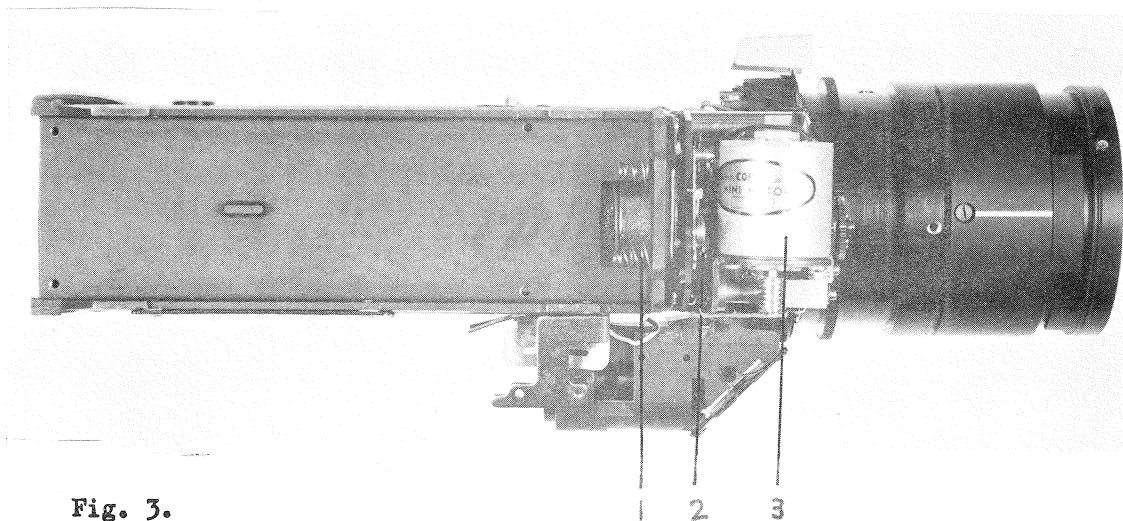


Fig. 3.

b. Inspection locations:

- b-1. Inspect, remove and replace battery case contact spring (1 in Fig. 3).
- b-2. Inspect zooming motor (3 in Fig. 3).
- b-3. Inspect and adjust 85 filter operation (2 in Fig. 3).
- b-4. Inspect, adjust, remove and replace battery case cover lock.

2. Removal of Finder Cover

a. Method:

- a-1. The start button is removed by peeling back the leather of the start button (2 in Fig. 5) and removing the two fixing screws.
- a-2. Remove the screws shown in Fig. 4 (5 and 6), Fig. 5 (1), and Fig. 1 (3), and take off the finder cover from the rear by lifting upwards.

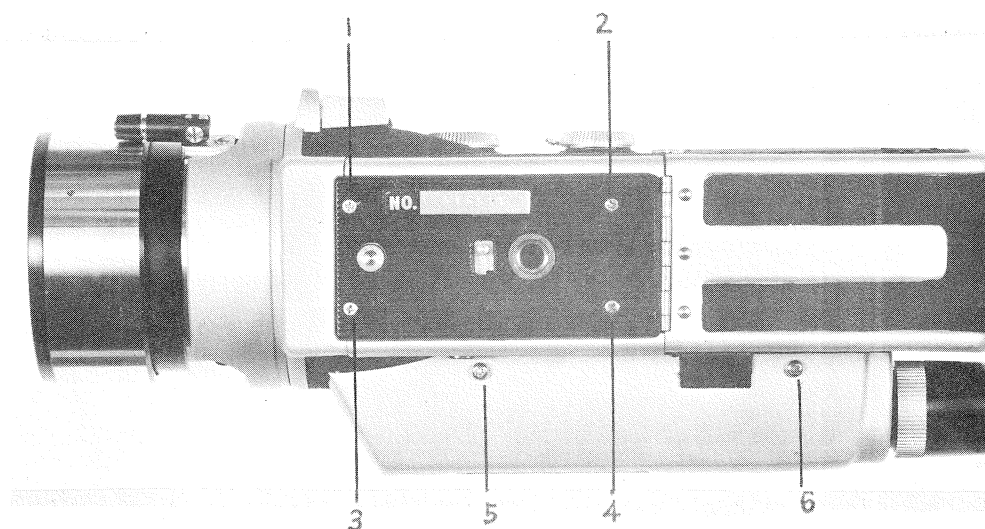


Fig. 4.

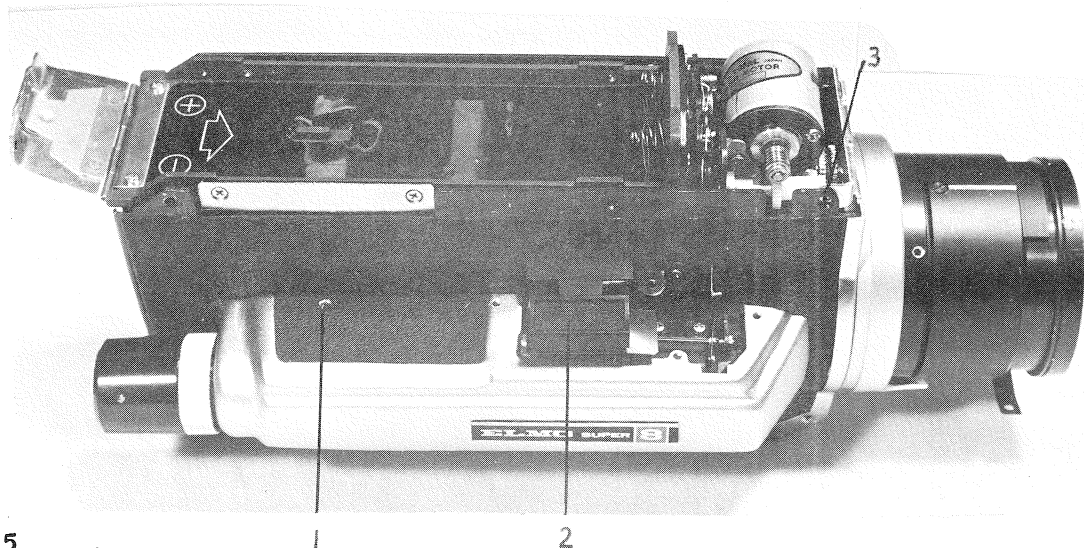


Fig. 5

b. Inspection locations:

- b-1. Inspect and adjust joint operation of the finder exposure indicator needle (1 in Fig. 6) and aperture blade. Remove and reinstall these parts.
- b-2. The operation of the contact part of the sensitivity selector can be checked if the common joint cover (4 in Fig. 6) for the eyepiece (3 in Fig. 6) and mask lens (8 in Fig. 6) is removed.
- b-3. Remove and replace the finder mask and eyepiece.
- b-4. Clean the filter and adjust focus.
- b-5. Inspect and adjust contact of start button main switch contact point.
- b-6. Parallax adjustment. Parallax is adjusted by the mounting screw (2 in Fig. 6). This screw, however, is mainly for adjustment in the horizontal direction even though adjustment to some extent is possible in the vertical direction. Other adjusting location (for vertical adjustment) produces better results. (See b-5 in 5.)
- b-7. Inspect resistance of the sensitivity selector and remove and replace it (8 in Fig. 9).

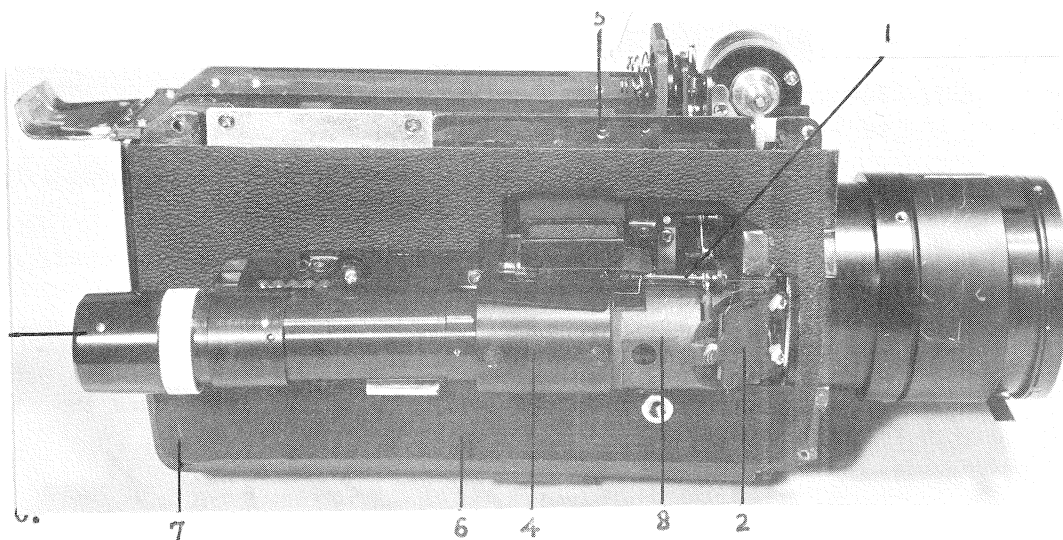


Fig. 6

3. Removal of Bottom and Rear Covers (unrelated to that in 1 and 2).

a. Method:

- a-1. If the four screws (1, 2, 3, and 4) shown in Fig. 4, are removed, the state will be as that shown in Fig. 7 and the rear cover can be removed by removing the three remaining screws (1, 2, and 3 in Fig. 7).

b. Inspection locations:

- b-1. Adjust governor speed

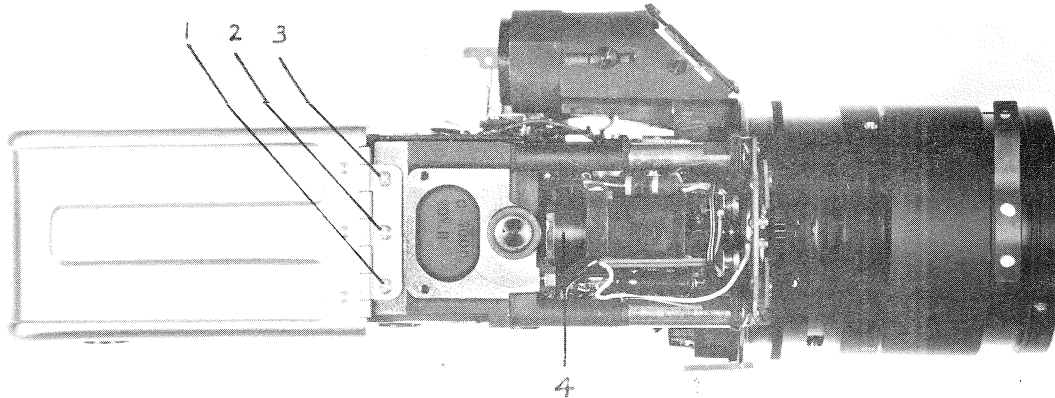


Fig. 7

4. Removal of Front Cover

a. Method:

- a-1. After disassembly operations 1 and 3, loosen the zoom lens front frame mounting screws (4 in Fig. 1; 3 & 4 in Fig. 2), and remove the front frame.
- a-2. Remove the three zoom lens ring retaining screws (5 in Figs. 1 & 2) and take out the zooming ring.
- a-3. Remove the two retaining screws (3 in Fig. 5) on the upper portion of the front cover and the two retaining screws (6 in Figs. 1 & 2) on the lower portion of the front cover and take off the front cover (from the front).

b. Inspection Locations:

- b-1. Inspect, adjust, remove, and replace the power zoom switch (2 in Fig. 8)
- b-2. Inspect, adjust, remove, and replace the power zoom mechanism (1 in Fig. 8)
- b-3. The governor slip ring can be inspected, adjusted, removed, and replaced if the power zoom switch base plate is removed.
- b-4. The motor can be removed and replaced as a continuation of operation b-3. The motor mounting screws (4 and 5 in Fig. 18), appear protruding from the lower end of the frame when the rear cover is removed.

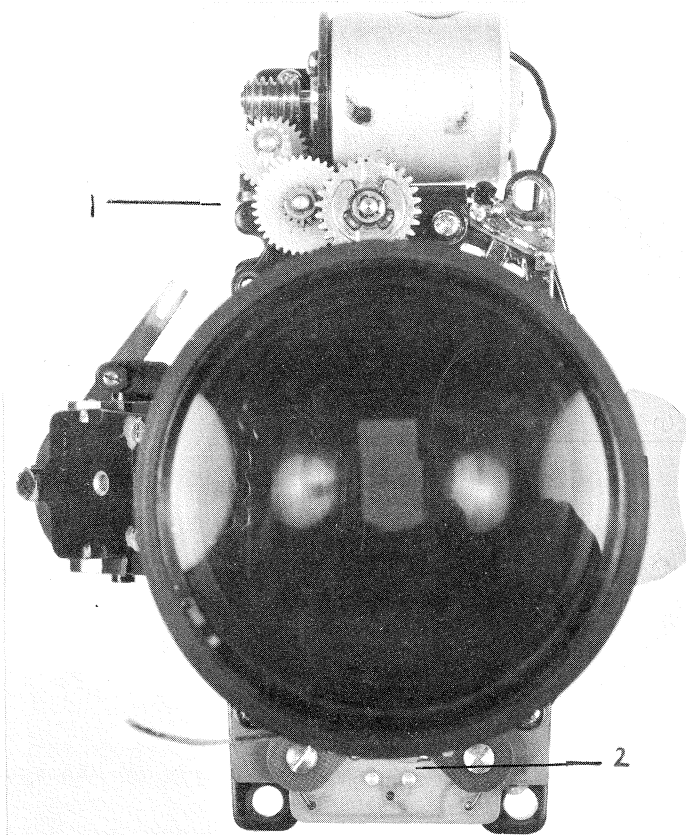


Fig. 8

5. Removal of Side Plate on Finder Side

a.- Method:

- a-1. Remove the mounting screw (5 in Fig. 6) on the upper portion of the side plate.
- a-2. The side plate mounting screws are located at positions 6 and 7 in Fig. 6. Peel back the leather to remove these screws.

b. - Inspection Locations:

- b-1. Inspect and adjust cassette side pressure (2 and 4 in Fig. 9).
- b-2. Inspect, adjust, remove, and replace the sensitivity selector lever (3 in Fig. 9).
- b-3. Inspect 85 filter operation (5 in Fig. 9)
- b-4. Inspect operation of the grip start connecting lever (7 in Fig. 9).
- b-5. Adjust vertical parallax (6 in Fig. 9).
- b-6. Adjust focus of master lens (5 in Fig. 11).

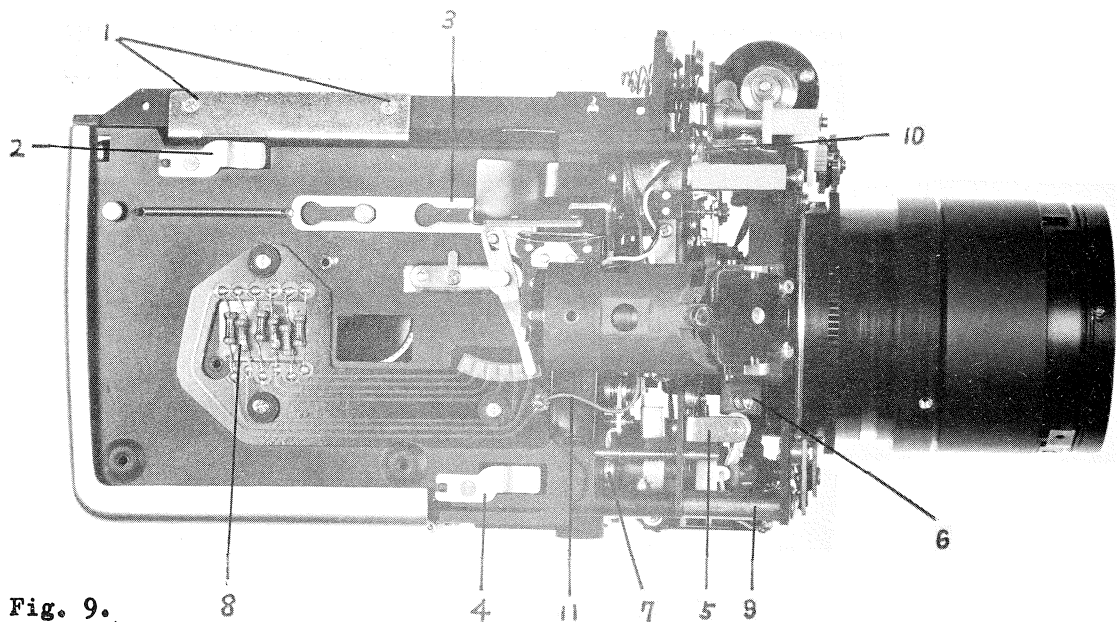
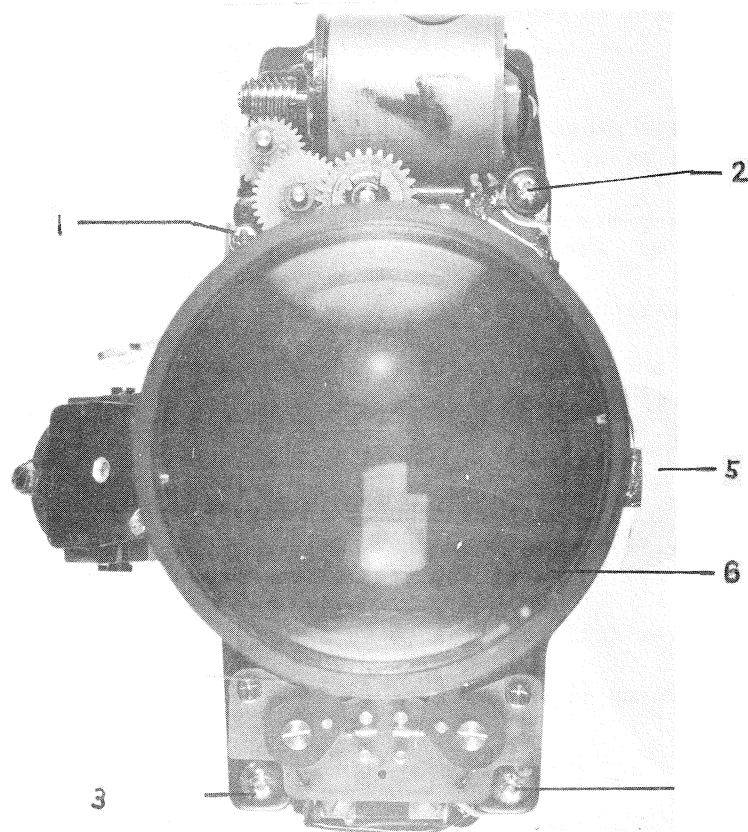


Fig. 9.

6. Removal of Zoom Lens Holder

a. Method:

- a-1. Remove the red lead of CdS circuit connected on the frame side.
- a-2. Remove the yellow lead connected to the power zoom switch base plate.
- a-3. Remove screws 1, 2, 3, and 4 shown in Fig. 10.



b. Inspection Location:

- b-1. Inspect, adjust, remove, and replace the aperture blade (4 in Fig. 11).
- b-2. Inspect, adjust, remove, and replace the meter (3 in Fig. 11).
- b-3. Inspect, adjust, remove, and replace 85 filter (2 in Fig. 11).
- b-4. Inspect, adjust, remove, and replace speed/sensitivity selector filter (6 in Fig. 11).
- b-5. Inspect, adjust, remove, and replace the aperture indicator connecting plate (1 in Fig. 11).
- b-6. Inspect, clean, remove, and replace the half prism (1 in Fig. 13).
- b-7. Remove and replace the zoom lens (6 in Fig. 10).
- b-8. Inspect and adjust zoom lever operation. Remove and replace the zoom lever (5 in Fig. 10).
- b-9. Adjust focus of master lens. Remove and replace the master lens (5 in Fig. 11).

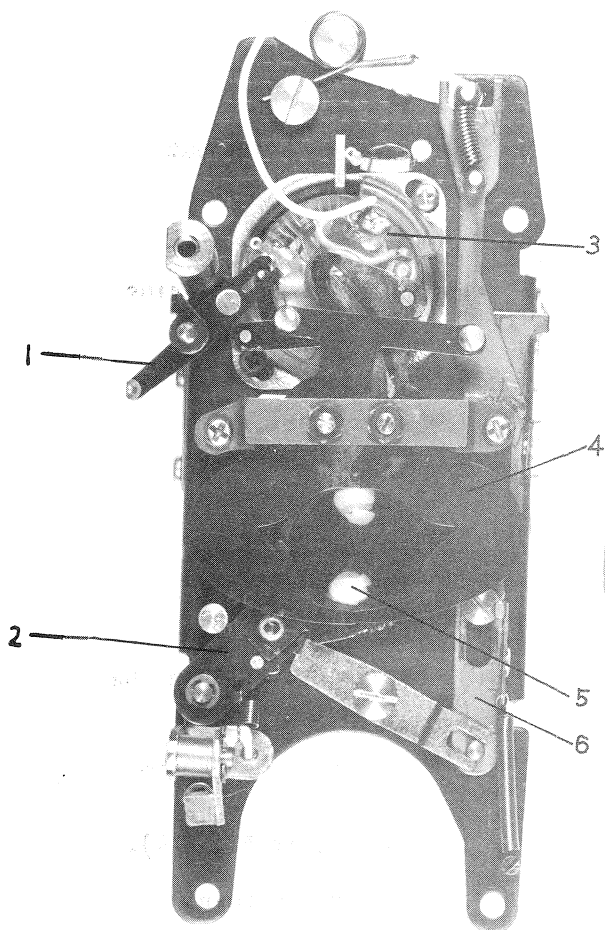


Fig. 11

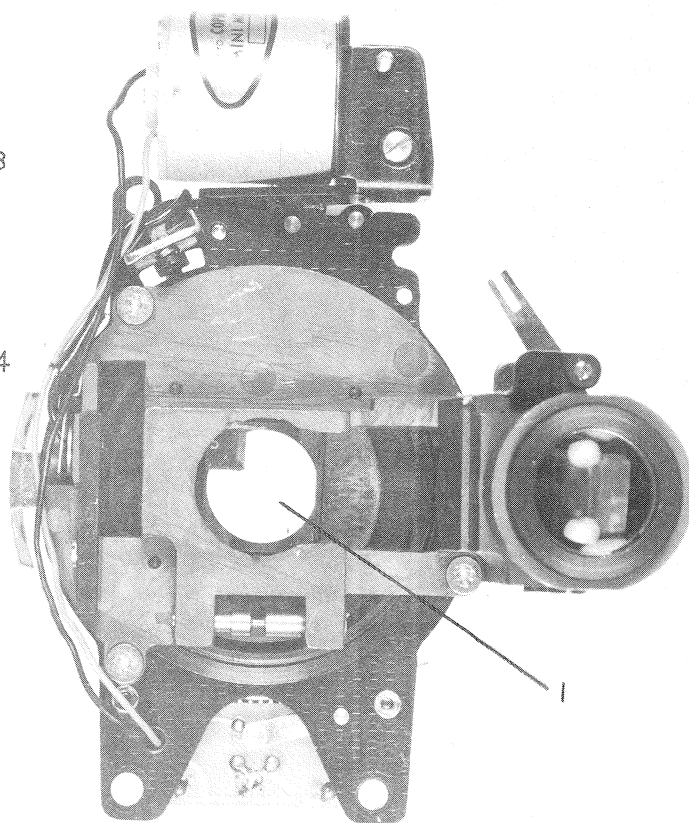


Fig. 13

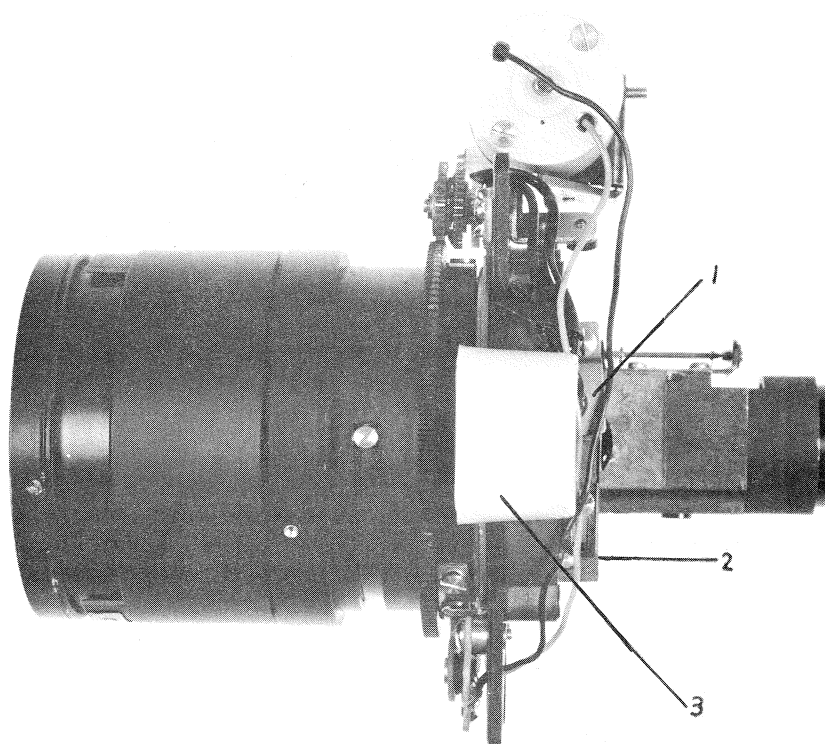


Fig. 12

7. Removal of Side Plate on Footage Counter Side (can be performed without work 6).
 - a. Method:
 - a-1. Remove the two retaining screws at the upper portion of the side plate.
 - a-2. Remove the screw at the lower portion of the side plate.
 - a-3. Remove the screw at the rear portion of the side plate.
 - b. Inspection Locations:
 - b-1. Inspect, adjust, remove, and replace the footage counter (6 in Fig. 14).
 - b-2. Inspect and adjust the shutter contact point (3 in Fig. 14).
 - b-3. Inspect and adjust the loading indicator. Remove and replace the lever (4 in Fig. 14).
 - b-4. Inspect, adjust, remove, and replace the take-up gear mechanism (5 in Fig. 14).
 - b-5. Inspect, remove, and replace the remote terminal (7 in Fig. 14).
 - b-6. Inspect, remove, and replace the mercury battery compartment (2 in Fig. 14).
 - b-7. Inspect, adjust, remove, and replace the printed circuit board (1 in Fig. 14).

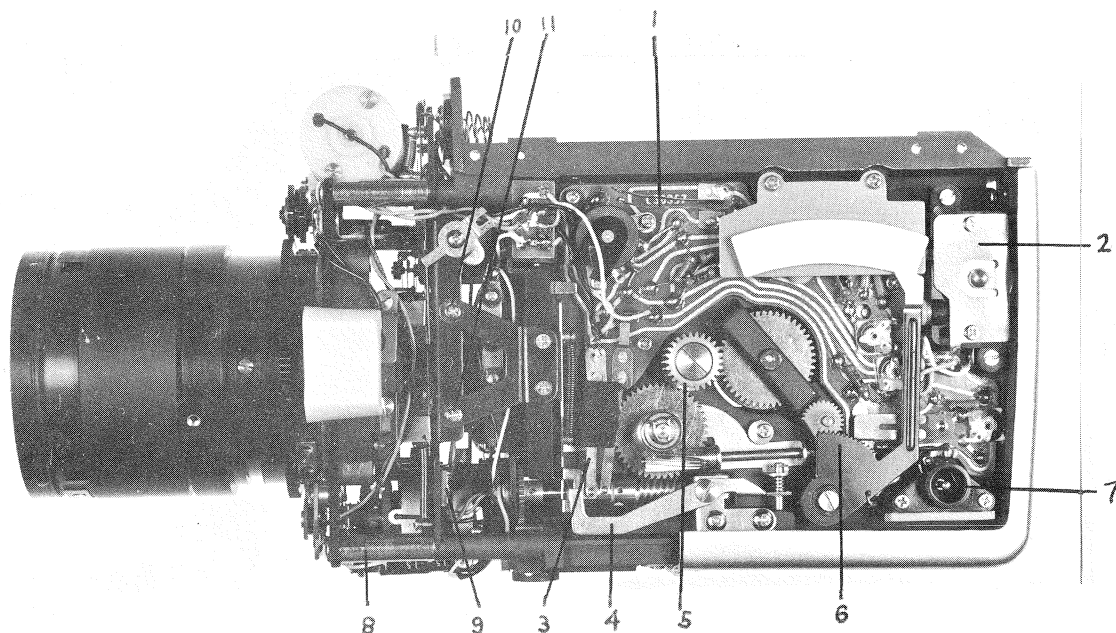


Fig. 14

8. Removal of Master Lens Holder

a. Method:

- a-1. Remove the studs shown in Fig. 9 (9) & Fig. 14 (7 & 8).
- a-2. Remove the master lens holder retaining screw, shown in Fig. 9 (10).
- a-3. Remove the white lead connected to the meter.
- a-4. Remove the two leads (green & blue) on the motor circuit relay base plate (9 in Fig. 14).
- a-5. Remove the master lens holder support plate screws (10 & 11 in Fig. 14). Also, remove the support plate screws on the opposite side.

b. Inspection Locations:

- b-1. Inspect, adjust, remove, and replace the starting mechanism and switch (1 & 2 in Fig. 15).
- b-2. Inspect, adjust, remove, and replace the 18/24 speed changing switch (1 in Fig. 16).
- b-3. Remove and replace the shutter stopper (3 in Fig. 15).

9. Removal of Motor Mounting Plate

a. Method:

- a-1. Remove the four screws located at positions 4, 5, 6 & 7 in Fig. 15.
- a-2. Remove the two leads (green & black) shown in Fig. 15 (8).
- a-3. Turn the motor governor by hand, and turn the shutter 180° from the specified stop position and remove it, insuring while doing so that it is not caught by the light intercepting plate on the start button side.

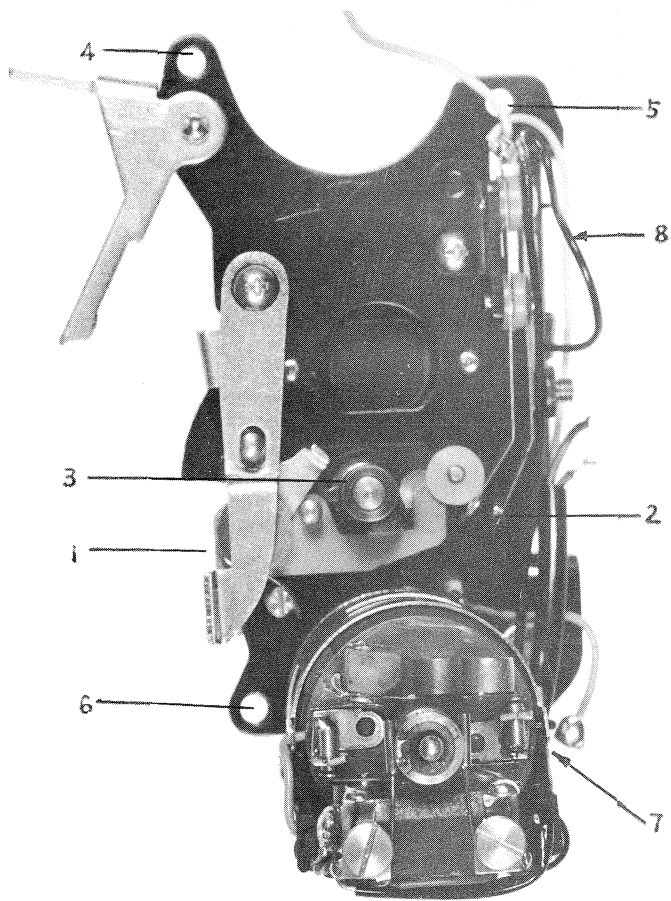


Fig. 15

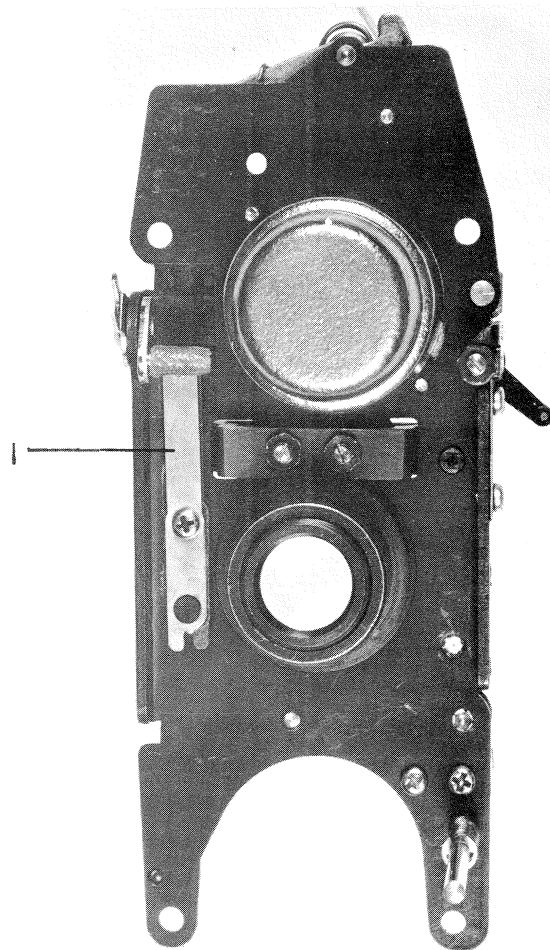


Fig. 16

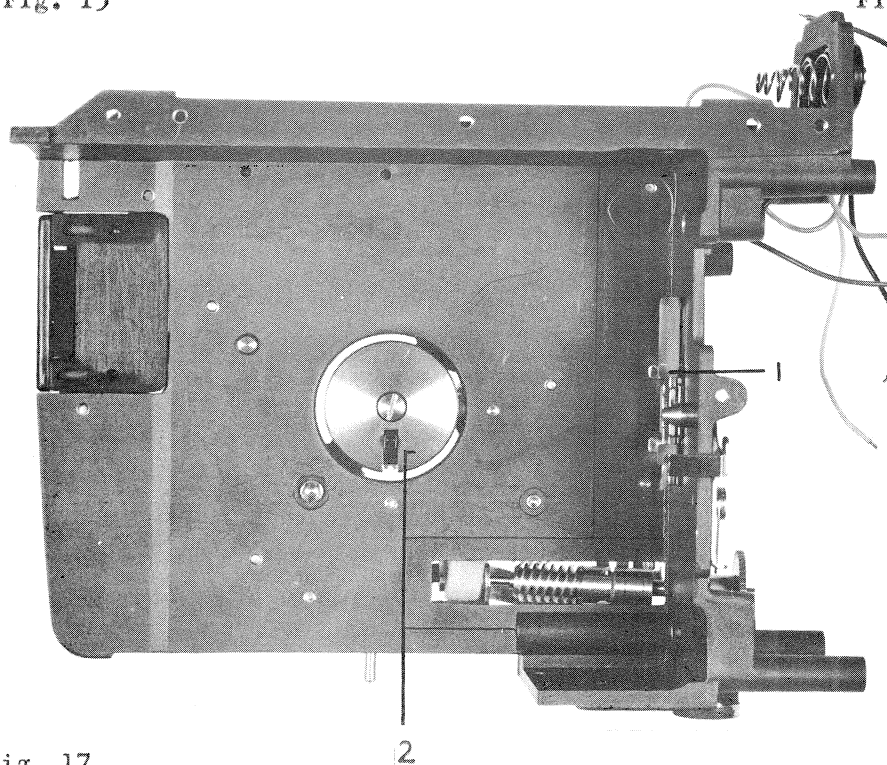


Fig. 17

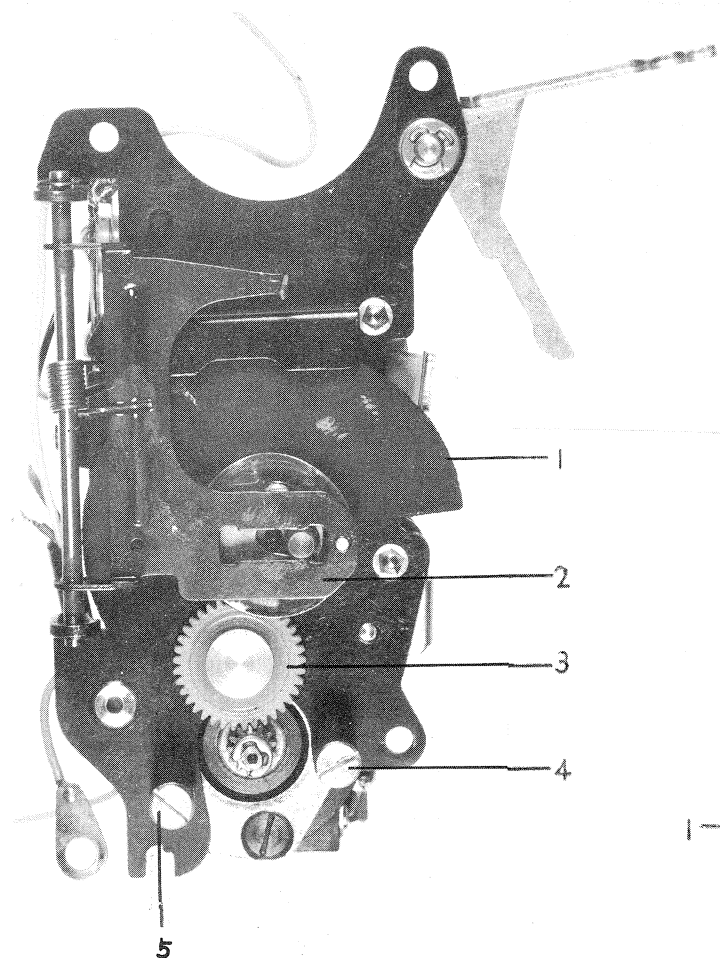


Fig. 18

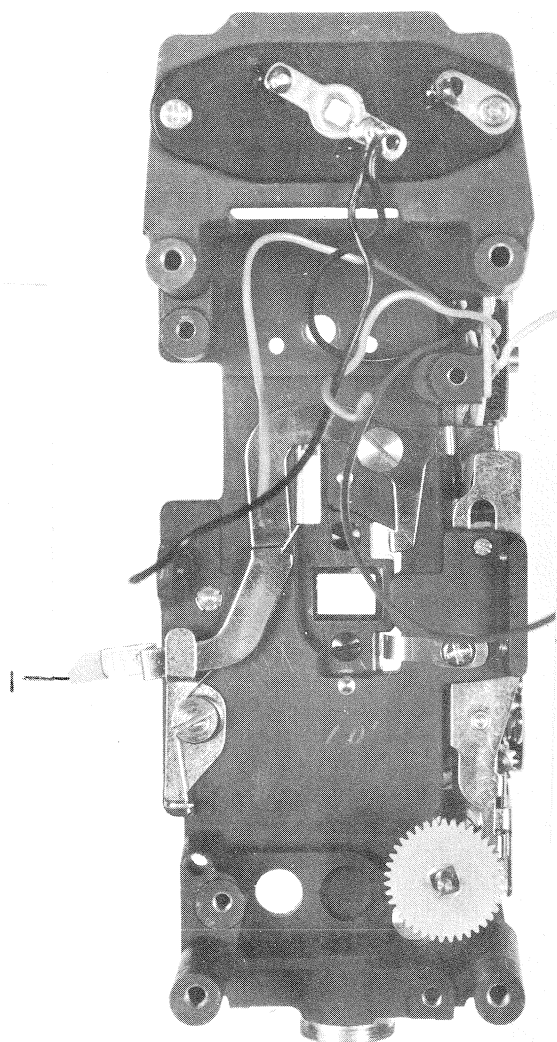


Fig. 19

b. Inspection Locations:

- b-1. Inspect, adjust, remove, and replace the sending claw and shutter (1 & 2 in Fig. 18).
- b-2. Inspect, adjust, remove, and replace the shutter intermediate gear and take-up intermediate gear (3, in Fig. 18).
- b-3. Inspect, adjust, remove, and replace the loading lever (1 in Fig. 19).
- b-4. Remove and replace the light intercepting plate.

10. Removal of Reinforcing Plate for Side Plate

a. Method:

- a-1. Remove the two mounting screws (1 in Fig. 9).
- a-2. Remove the green lead (11 in Fig. 9).
- a-3. Remove the two screws at the bottom.

b. Inspection Locations:

- b-1. Inspect, adjust, remove, and replace the aperture plate (1 in Fig. 17).
- b-2. Inspect, adjust, remove, and replace the take-up shaft (2 in Fig. 17).

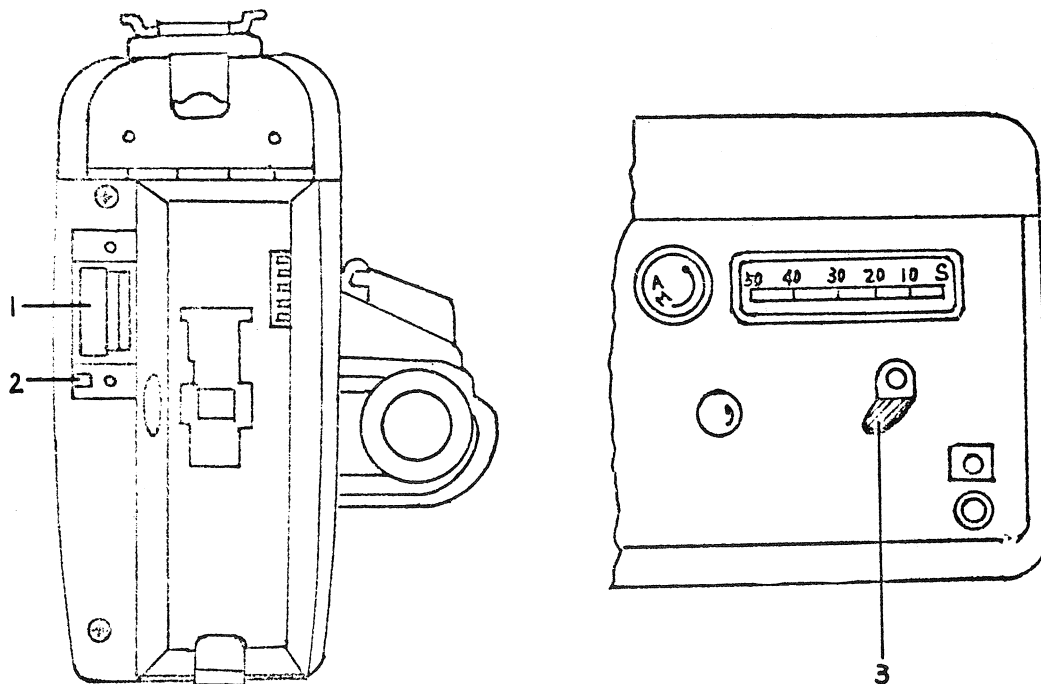


Fig. 20

11. Check Voltage of Auto Eye Constant Voltage Power Supply

- a-1. If the cover of the dry mercury battery compartment (1 in Fig. 20) is removed the point shown in Fig. 20 (2) can be seen. Inspect constant voltage at this point. Constant voltage is determined by measuring voltage between the body and point at the (-) terminal.
- a-2. The voltage adjusting point window, shown in Fig. 20 (3), is employed when constant voltage deviates markedly from the specified voltage of 3V. Constant voltage is set by inserting a screw-driver into this part and adjusting the variable resistor, directly below.

ADJUSTMENT

1. Construction and Adjustment of Auto Eye Circuit

- 1-1. The motor power supply of 6V is also used for the auto eye circuit.
- 1-2. The voltage of 3V is necessary to operate the auto eye and it is supplied by the two-transistor constant voltage circuit.
- 1-3. Constant voltage circuit maintains a voltage of 3V if power supply voltage (ordinary 6V) is above 4.5V.
- 1-4. Adjustment of auto eye meter sensitivity is performed with variable resistor VR2.
- 1-5. Meter sensitivity for power supply voltage check is adjusted with variable resistor VR4.
- 1-6. Constant voltage (3V) adjustment is performed with VR1.
- 1-7. VR3 is the variable resistor used for the manual aperture, which is provided with an auto (A) / manual (M) selector switch.

2. Measuring Auto Eye

Necessary instruments:

Brightness plate (used for 8TL, C200/300), brightness meter, master body, auto eye measuring cassette with CdS, and ohm meter (Sanwa Tester JP-5, 1 M.0hm range).

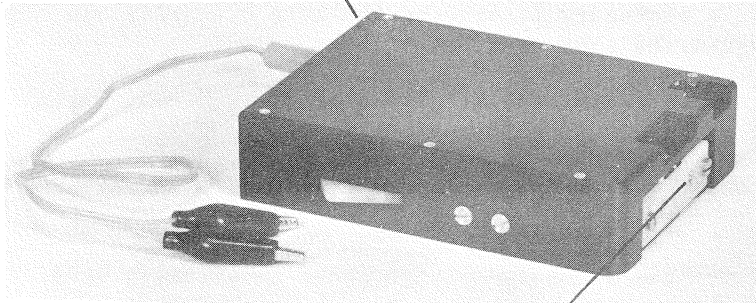
Measuring

- 2-1. Set the aperture of master body at F/5.6 and insert the CdS cassette into the master body.
- 2-2. Connect an ohm meter to the lead terminal of the CdS cassette.

Note: Set the ohm meter beforehand to the 1 M.0hm range and accurately adjust the zero point.
- 2-3. Set the brightness of the brightness plate to F/5.6 (1140 Cd/m²).
- 2-4. Bring the master body into contact with the brightness plate. Switch on the master body, and record the value indicated by the ohm meter when the shutter turns.
- 2-5. Next, set the master aperture of the master body to F/11 and F/2.8, and record the values indicated by the direct reading resistance meter as explained in 2-4. Keep the brightness of the brightness plate at a constant 1140 Cd/m².
- 2-6. The resistance values of F/11, F/5.6, and F/2.8 are very important for determining the standard value and allowable error ranges in auto eye measurement.

Auto Eye Measuring Instruments

Auto Eye measuring Cassette

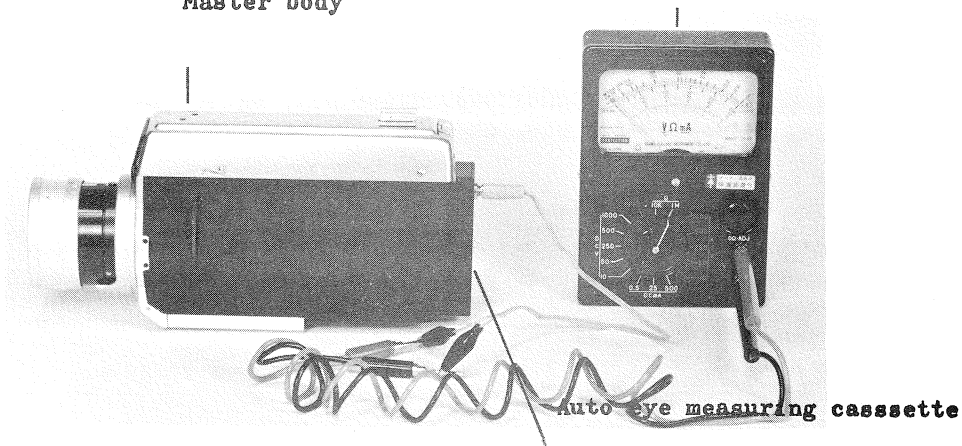


This cassette is so designed as to set the ASA sensitivity to 25 and release the filter 85 automatically when it is inserted into the camera.

CdS light receiving part

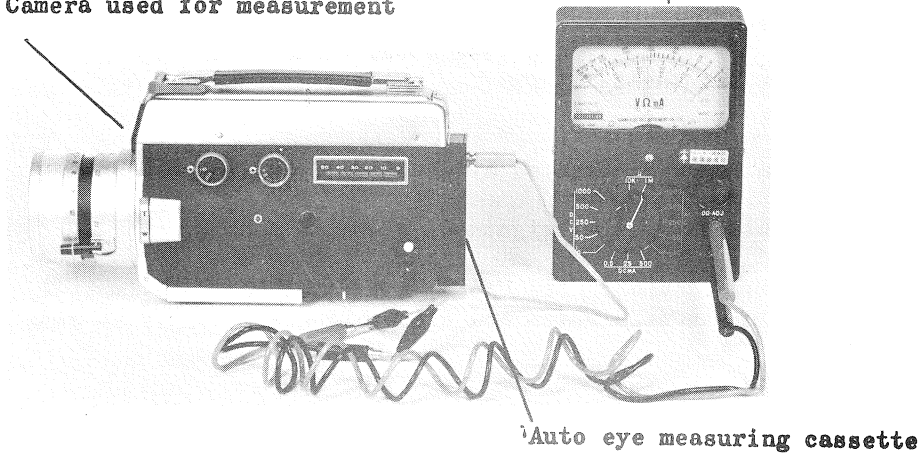
Direct reading resistance meter
(1 M.0hm range)

Master body

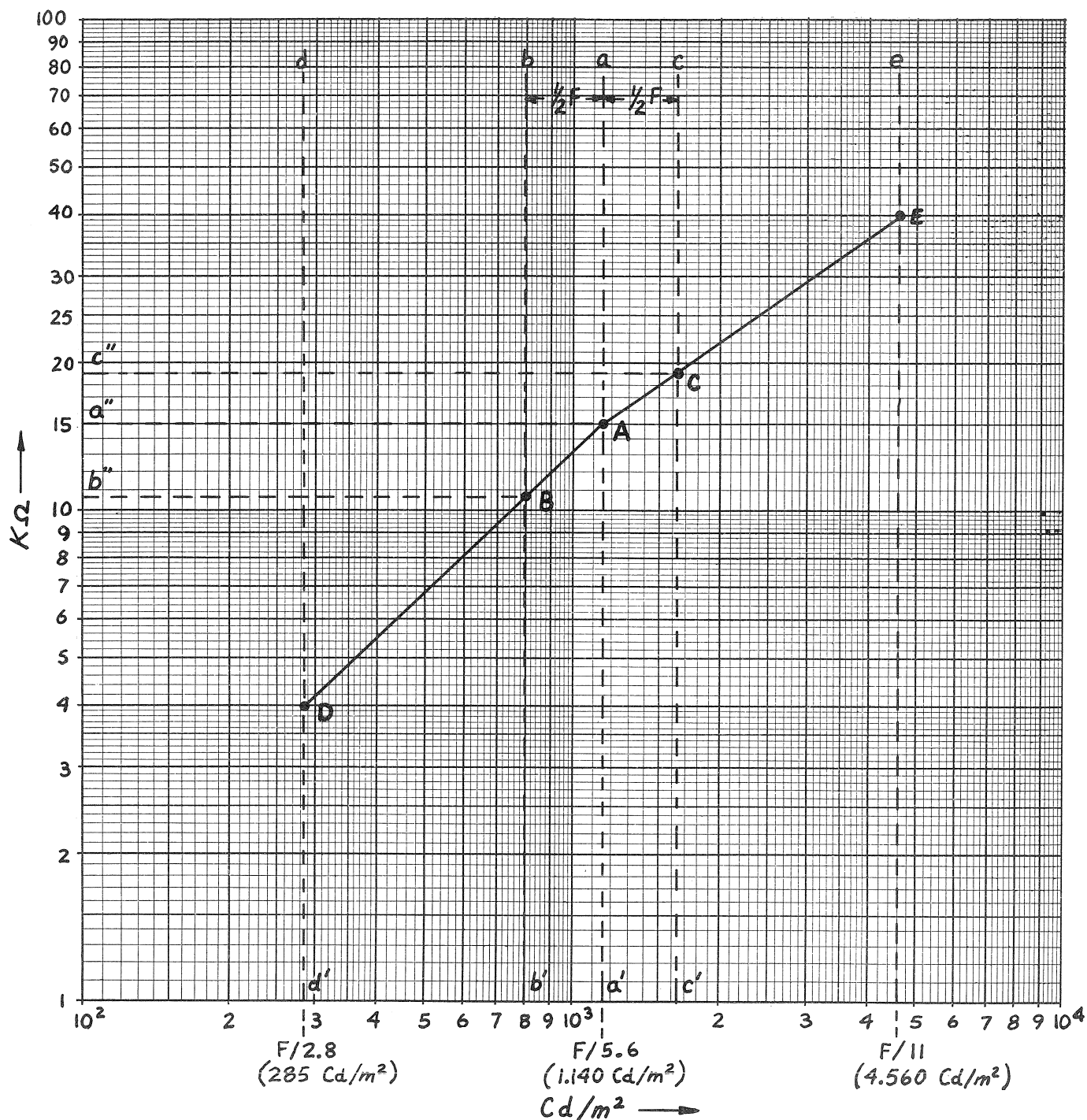


Camera used for measurement

Direct reading resistance meter
(1 M.0hm range)



- 2-7. Dot the values determined with the master body on the vertical lines of brightness values at $F/2.8$, $F/5.6$, and $F/11$. Draw straight lines through these points as shown in Fig. 21.



- 2-8. The figure above shows the graph plotted with the values ($F/2.8$ - 4 K. Ohm, $F/5.6$ - 15 K. Ohm, and $F/11$ - 40 K. Ohm) obtained with the master body.

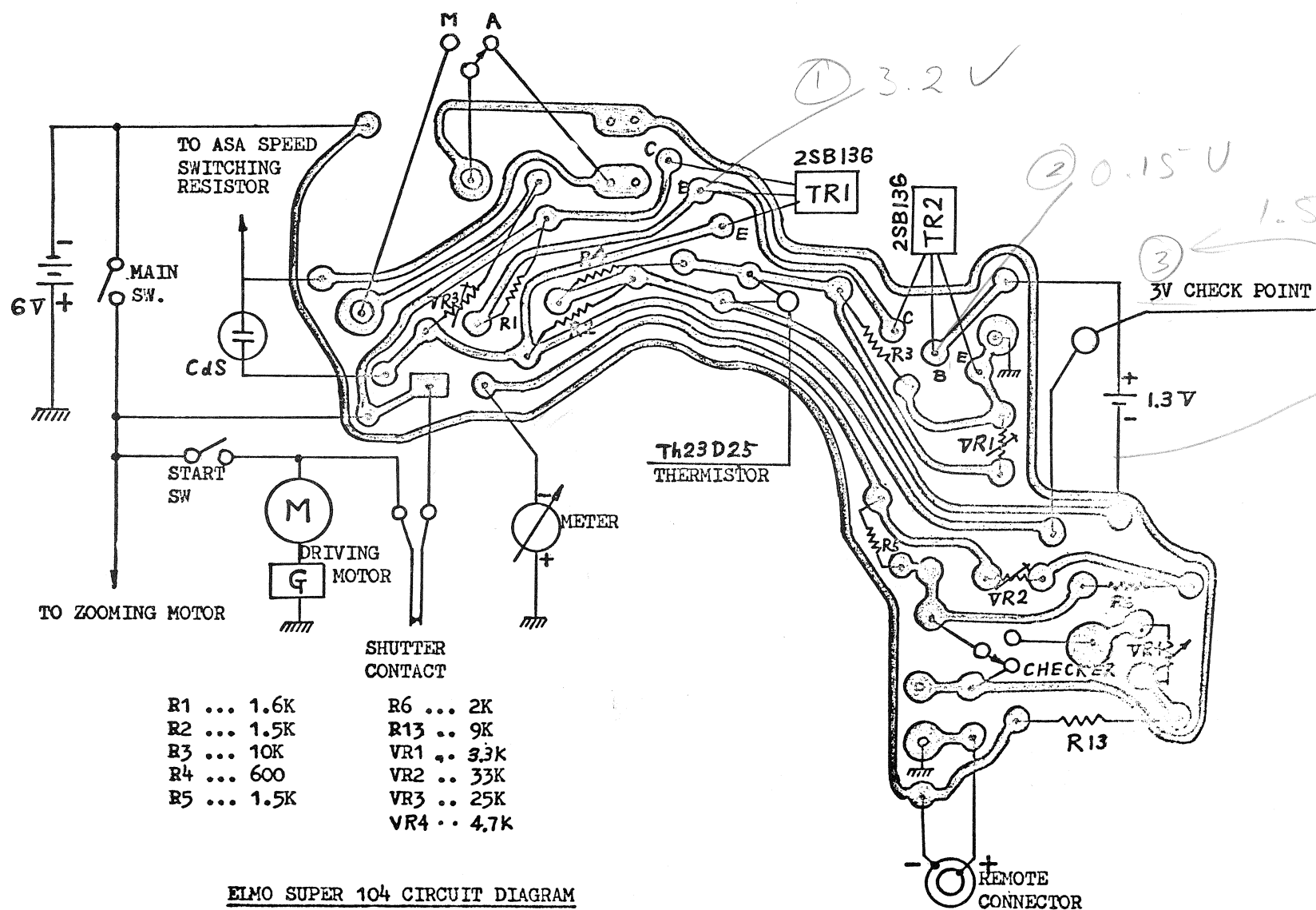
Note: Values of A, D, and E change according to CdS sensitivity characteristic of the cassette used in measurement. Since values A, D, and E change if CdS sensitivity change in time, they must be checked at each time of measurement.

- 2-9. Vertical lines bb' and cc' and $1/2$ aperture limiting lines basing on aa' .
B and C are $1/2$ aperture limiting points on straight lines AD and AE, respectively. b'' and c'' on the Y axis show the values at the limits denoted by K.Ohm. These values are used as standard values for judging the state of the camera auto eye measured.
- 2-10. Make the measurements as given in the following after making a graph based on the measurement with the master body as given above.
- 2-11. Set the zoom lens to the focal length (34mm) and the distance scale to infinity.
- 2-12. Set the A-M knob to A.
- 2-13. Set the speed knob to 18 fps.
- 2-14. Insert the CdS measuring cassette into the camera and connect the ohm meter to the cassette terminal.
- 2-15. Set brightness plate to F/5.6 (1140 Cd/m^2), bring the camera into contact with the brightness plate, push the start button, and record the value indicated on the ohm meter turning the shutter.
- 2-16. Next, set the brightness at F/2.8 (285 Cd/m^2) and F/11 (4560 Cd/m^2) and measure and record the respective values.
- 2-17. If the measured values fall within the limits of the graph plotted for the master body then the auto eye is normal; but if they fall outside of the limits the auto eye is defective.
- 2-18. Explaining this using the graph above, if the values of F/2.8, F/5.6, and F/11 fall within b'' c'' (within 11 K.Ohm 19 K.Ohm), the auto eye is normal while on the other hand, if they are below 11 K.Ohm or above 19 K.Ohm, the auto eye is defective.
- 2-19. Since error of the master body is within an aperture of $\pm 1/10$, the values obtained with the master body can be considered true values.
- 2-20. To operate the auto eye, raise the shutter button and turn on the main switch. But as the shutter contact functions to close the shutter when the switch is turned on, turn the shutter, otherwise aperture cannot be measured. The master body has a shutter also.

[illegible]

ELMO SUPER 104 CIRCUIT DIAGRAM

Fig 23



3. Auto Eye Adjustment I

When the camera exposure is found to be incorrect, inspect as outlined below before making adjustment.

3-1. Inspection

- a. Check whether aperture indicator operation is correct.
- b. Check the power supply voltage of the battery
- c. Remove the rear cover of the dry mercury battery case and check the voltage (3.0) of the auto eye power supply battery.
When the above inspections result in no abnormalities, remove both side covers and inspect in the following manner (camera is disassembled as shown in Fig. 14).
- d. Insert a Super Cassette and inspect operation of the ASA sensitivity selector. While doing this, check whether the selector lever is in correct contact on the point indicated by the cassette.

3-2. Adjustment

a. Sticking of Auto Eye Mechanism

When sticking occurs in operation of the aperture indicator, the fault can be considered to lie in the aperture blade, aperture indicator, or the coupling of these parts. To determine the exact cause, remove the meter, aperture, and aperture blade, part by part, and check the operation of each. Follow this with connection of the couplings sequentially, and check for sticking in the couplings.

- a-1. When sticking occurs in the meter, the cause most likely lies in the contact of the movable wire wheel and yoke; there is the possibility that dirt has collected between the wire wheel and yoke or that the bearing pivot has been overtightened.
- a-2. Sticking in the aperture blade is due to sticking in the connecting pin coupling the two blades and the pin groove, or overtightening of the bearing pivot.
- a-3. Sticking in the couplings of the aperture blade and the aperture indicator is due to non-perpendicularity of groove and pin or to protrusions in the sliding surface of the groove. The latter being the case, sticking can be eliminated by lapping the groove using a sharpened pencil point or a match stick with molycoat (carbon powder).
- b. Voltage drop due to Consumption of Power Supply Batteries
 - b-1. If the power supply batteries are not used for periods as long as three months, voltage drops due to self-discharge.
 - b-2. Consumption may also be due to shorting of camera circuit or defective insulation. Consequently, V and mA must be checked and the current determined before new batteries are installed.
 - b-3. The circuit should in particular be checked for abnormality when the batteries are leaking.

c. Abnormality of Auto Eye Power Supply Batteries

- c-1. Adjust VR_1 and set the voltage to 3.0V. Determine the voltage between the check point at the rear of the mercury battery case and the body. (See Disassembly, 11.)
- c-2. The constant voltage circuit is defective when the specified voltage of 3V is not obtainable even on adjusting VR_1 .
- c-3. The constant voltage circuit is explained.

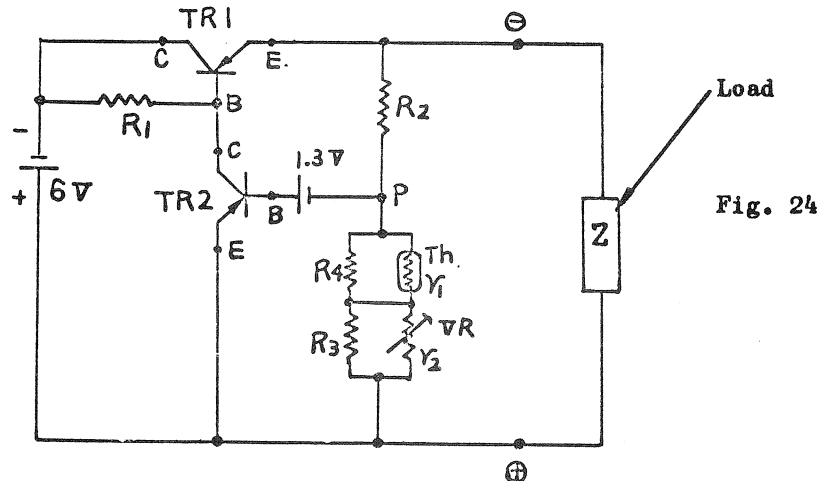


Fig. 24

- c-3-1. In Fig. 24, it is assumed that the specified 3V is added to the load and that a constant current flows. When the output voltage on the load drops, the voltage of point P will also drop.

Note: If point P is taken as the voltage determination point, then the voltage V_p is expressed thus

$$V_p = \frac{R}{R + R} \cdot V$$

where V = output voltage

$$\text{and } R = \frac{R_3 r_2}{R_3 + r_2} + \frac{R_4 r_1}{R_4 + r_1}$$

As the voltage of point P drops, the voltage drop at R_1 becomes smaller due to decrease in TR2 collector current.

Consequently the TR1 base current increases as well as TR1 collector current.

Increase in this collector current results in decrease of voltage which is absorbed between the TR1 collector and emitter, and the output voltage V increases. To put it another way, TR1 is automatically controlled by TR2 to work as the variable resistor and keeps the output voltage constant always.

Since the output voltage V is determined by the voltage of point P, changes in V_{R1} would result in R changing.

$$V = \frac{R_2 + R_0}{R_0} \cdot V_P$$

$$\therefore V = \left(1 + \frac{R_2}{R_0}\right) V_P$$

V_P and V_0 change until the above formula is satisfied. Consequently, if V_0 and R_0 are plotted on a graph, Fig. 25 will be the result.

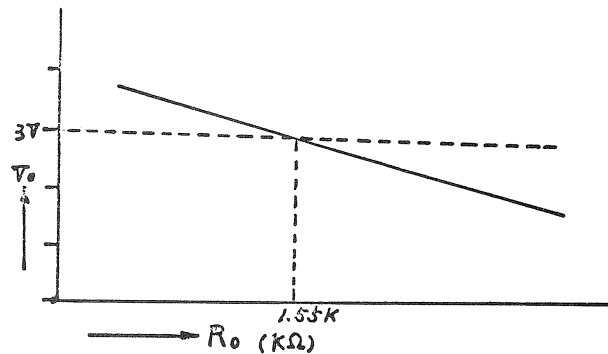


Fig. 25

- c-3-2. Concerning the thermistor (Th23Dr25) in the constant voltage circuit: This thermistor compensates for changes in R due to the surrounding temperature. Changes in the constant voltage affect the auto eye and the values calculated for 1/2 aperture changes are --

ASA 160 $\pm 0.1V$

ASA 25 $\pm 0.2V$

Since the thermistor temperature correction for a temperature range of $-10^{\circ}C$ to $+40^{\circ}C$ is $+0.06V$ to $-0.03V$, the purpose of the thermistor is amply satisfied.

- c-3-3. Purpose of R_4 and R_3 ,

R_4 - Compensates for the thermistor temperature characteristic.

R_3 - Enhances V_{R1} adjustments.

- c-3-4. Dry mercury battery (1.3V) :

The dry mercury battery connected to the TR2 base is charged by the TR2 base current. Thus, it is semi-permanent provided so far as there is no leakage or shorting.

c-4. Constant Voltage Circuit -- Troubleshooting

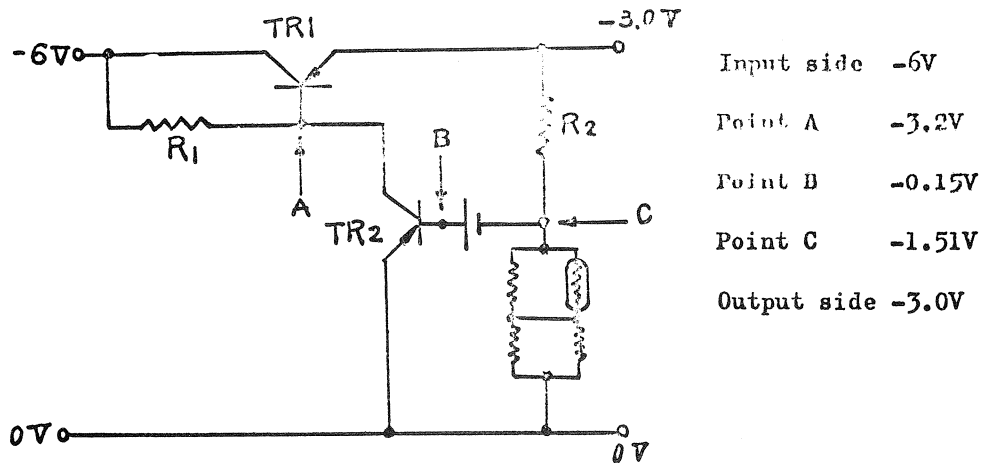


Fig. 26

c-4-1. Check points in Fig. 26 are the input and output terminals and points A, B, and C. Troubleshooting is given below.

c-4-2. When the output voltage is abnormally high (near .6V).

- (1) TR1 is defective when voltage of point A is -3.2V.
Corrective action: Replace TR1.
- (2) When voltage of point A varies widely from -3.2V, TR2 is defective.
Corrective action: Replace TR2.
- (3) If the circuit does not return to normal after replacing TR2 as in b, replace TR1 as well.

c-4-3. When there is no voltage on the output side.

- (1) When voltage of point A is above -3.2V, TR1 is defective.
Corrective action: Replace TR1.
- (2) When voltage of point A varies widely from -3.2V, TR2 is defective.
Corrective action: Replace TR2.

c-4-4. When the voltage on the output side is near 3V but cannot be adjusted to 3.0V.

- (1) Defective dry mercury battery Replace
- (2) Defective VRL - Defective contact of movable terminal Replace.

d. Positional Slipping of ASA Sensitivity Selector Lever

- d-1. The ASA sensitivity lever must be in correct contact with the contact point (2 in Fig. 27) fixed by the cassette.
- d-2. When the ASA sensitivity lever is positioned over the adjacent contact point, exposure would be bad or non-uniform.
- d-3. There are two causes for defective the ASA sensitivity positions:
 - d-3-1. Incorrect positioning of ASA selector printed base plate (4 in Fig. 27).
 - d-3-2. The cassette may not be fully inserted because the pressure of the rear cover cassette holder is weak. This may also cause bad focusing and defective film feeding, etc. The force of the cassette is about 2 kgs.
 - d-3-3. In the case of d-3-1, loosen the screw shown in Fig. 27 (1) and adjust the position of the ASA selector printed base plate.
 - d-3-4. In the case of d-3-2, replace the spring attached to the rear cover cassette holder ((1) in Fig. 28).

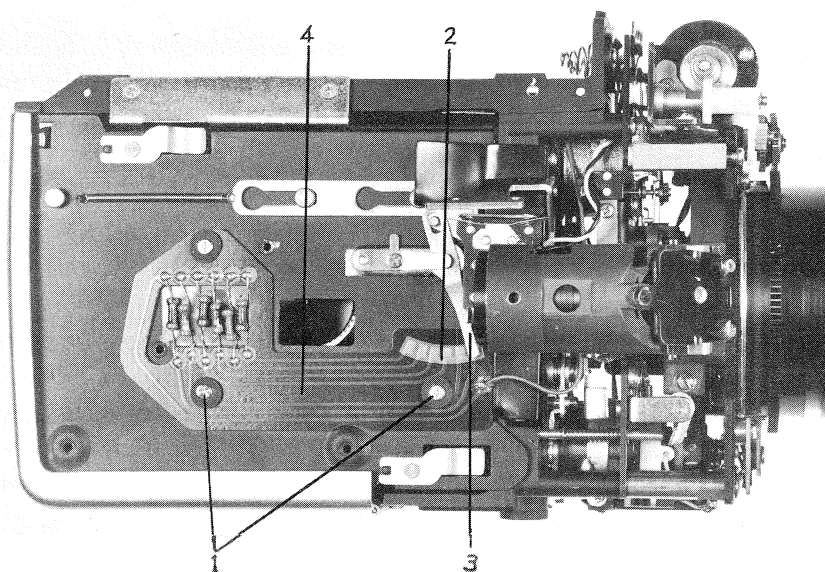


Fig. 27

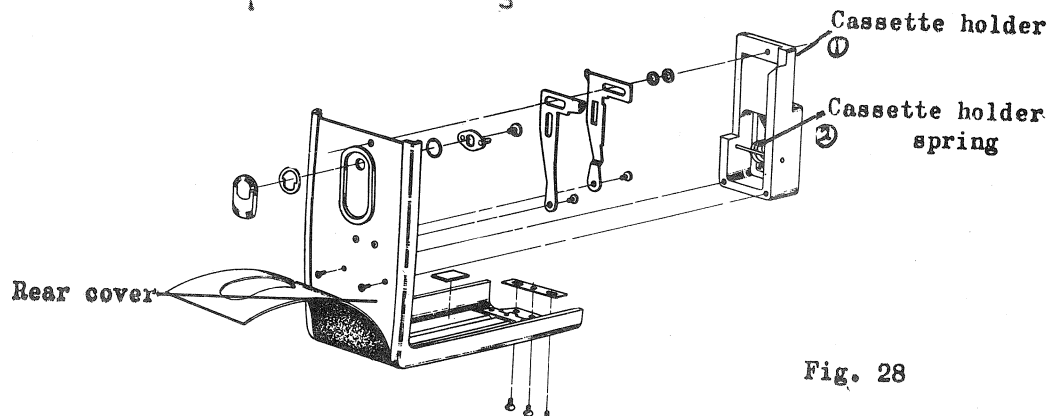


Fig. 28

4. Auto Eye Adjustment II

When no abnormality can be found by inspection from a. to d. of 3-1, adjustments are performed as given below.

4-1. Adjustment of meter sensitivity.

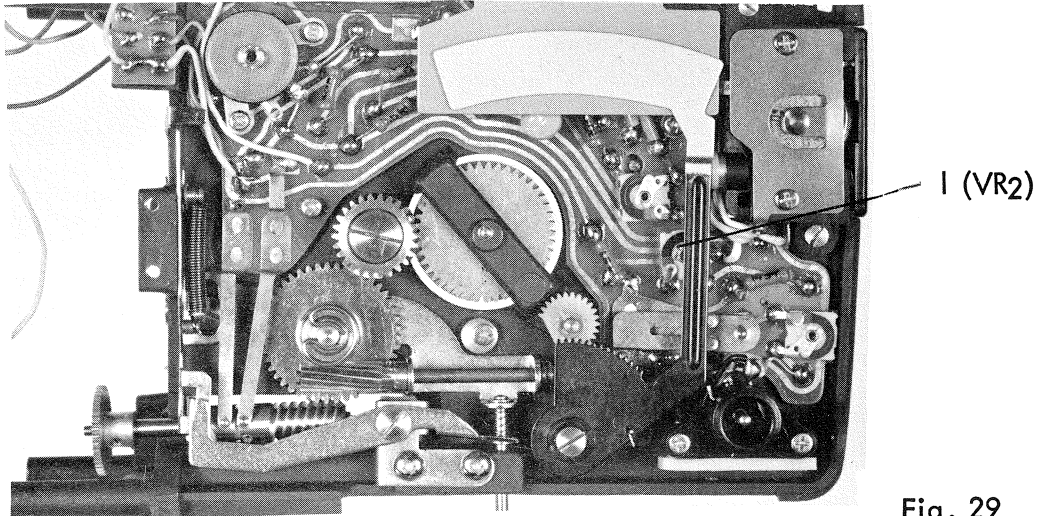


Fig. 29

- 4-1-1. Remove side plate (1) on the feet meter side and insert an auto eye measuring cassette.
- 4-1-2. Set the brightness of the brightness plate to $F/5.6$ (1140 Cd/m^2) and correctly set the camera in relation to the brightness plate.
- 4-1-3. While looking at the ohm meter, adjust VR_2 (1 in Fig. 29) to obtain the correct exposure.

4-2. Adjustment of CdS Sensitivity

- 4-2-1. When the correct exposure cannot be obtained by adjusting the meter sensitivity as in 4-1, slide the sensitivity adjusting plate (1 in Fig. 30) attached to the front surface of CdS upward and downward, and adjust the amount of light incident upon CdS. The sensitivity adjusting plate is adjusted as given in 4-1, while observing the auto eye.
- 4-2-2. Replace CdS when its sensitivity cannot be adjusted to within the adjustment range.
- 4-2-3. The CdS characteristic curve needs to be corrected when there is over exposure for low brightness and under exposure for high brightness or vice versa. The curve is corrected with VR_2 . Changes in meter sensitivity due to VR_2 changes are adjusted by correcting the CdS sensitivity with the CdS sensitivity and adjusting plate. The optimum point can be obtained by adjusting VR_2 and the CdS sensitivity adjusting plate alternately.

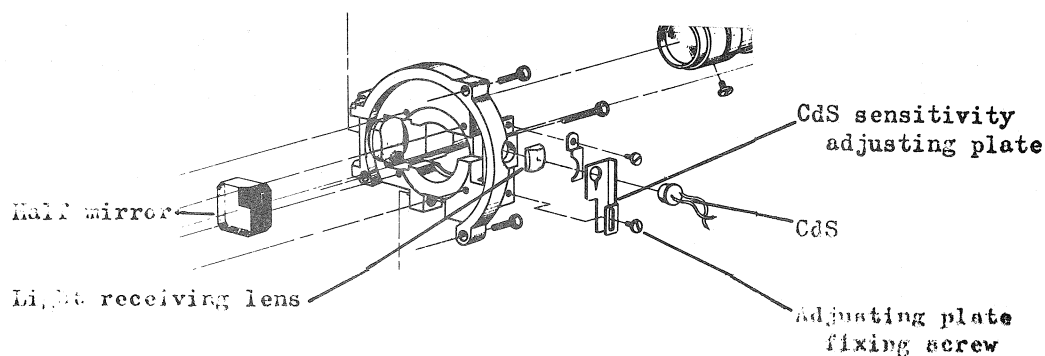


Fig. 30

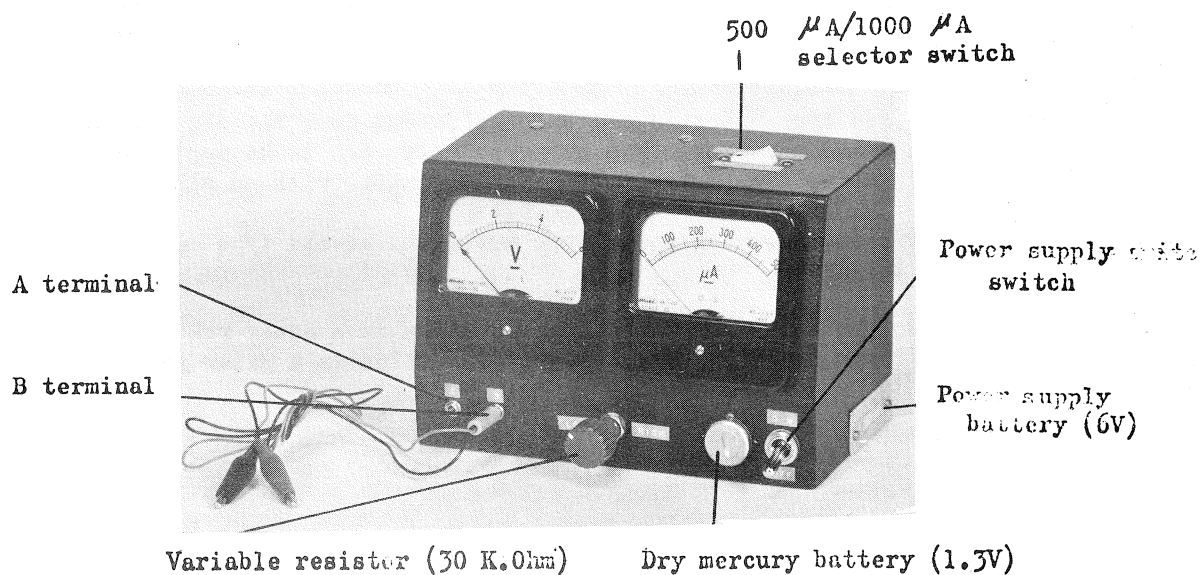
4-3. Adjustment of Relative Positions of Meter and Aperture Blade

When either the meter or aperture blade is disassembled, adjustment of their relative positions on re-installation is necessary. Although the incorrect relative position of the aperture blade on re-installation is very little due to its construction, in the case of the meter, the fixing position has a great influence on the setting of the auto eye.

The method of adjustment is given below.

Instruments used:

- Constant voltage power supply equipment (Voltage stabilizer)
- Aperture blade gauges: F/2.8 and F/11.
- Meter setting gauge.



Constant Voltage Power Supply Equipment

Fig. 31

- 4-3-1. Remove the meter wiring cord (white) from the relay base plate, connect it to the (-) side of the B terminal of the constant voltage power supply equipment and connect the body to the (+) side of this equipment.
- 4-3-2. Switch on the constant voltage power supply and turn the variable resistor knob in the clockwise direction and then the meter current will gradually increase.
- 4-3-3. Adjust the variable resistor until the constant voltage equipment ammeter gives a reading of $214\mu\text{A}$.
- 4-3-4. At this time, the camera meter swings and the aperture blade operates. Measure the major diameter of the aperture formed by the aperture blade using an F/2.8 aperture blade gauge.
- 4-3-5. Next, turn the variable resistor knob and adjust the meter current to $558\mu\text{A}$. The ammeter scale should be changed to the full scale of $1000\mu\text{A}$ before the current is increased, otherwise the indicator may go over the scale and the ammeter may become damaged.

The aperture blade will open at F/11 when $558\mu\text{A}$ flows through the meter. Measure the major diameter of the aperture using an F/11 aperture blade gauge at this time.

- 4-3-6. If the major aperture diameters of the aperture blade for F/2.8 and F/11 are in agreement (or near agreement) with the respective gauges, then the relative positions of the meter and aperture blade are correct.
- 4-3-7. When the major diameter does not agree with the aperture blade gauge, adjust the position of the meter in accordance with the order stated in 18 part of how to use the meter setting gauge.
- 4-3-8. There are two kinds of the meter, one is a new type meter and the other is an old one. They are a little different each other in being set but there is no difference in adjusting them.
- 4-3-9. The new type meter is a little different from the old one in shape and consequently a new type meter has to be replaced with a new type meter. The old type meter with an old one.
- 4-3-10. Difference between a new type meter and an old type one are as follows:

New type meter ... There is graduation in a meter yoke.
Old type meter ... There is no graduation in a meter yoke.

4-3-11. Relationship between meter current and aperture stop.

The meter current and the aperture stop formed by the aperture blade are related in the following manner:

<u>Meter Current</u> (μ A)	<u>Aperture Stop</u>	<u>Remarks</u>
103	-- Meter zero point
128	F/1.8	
214	F/2.8 Adjusting point
386	F/5.6	
558	F/11 Adjusting point
644	F/16	
730	F/22	

Note: The meter current of 86μ A gives one aperture stop.

4-3-12. When deflecting the meter, return the variable resistor knob of the constant voltage power supply equipment to the start position turning it in the counterclockwise direction.

4-3-13. Since the A terminal of the constant voltage power supply equipment gives a current of 3V, it can be used as the auto eye power supply.

4-4. Adjustment of Aperture Indicator

4-4-1. When, although the exposure is in normal, the indication of the aperture indicator is not in agreement with the aperture stop, set the brightness of the brightness plate to 1140 Cd/m^2 , bring the camera into contact with the brightness plate, and then the auto eye operates which deflects the exposure indicator needle. The position of the exposure indicator needle at this time is adjusted to coincide with F/5.6 on the finder scale.

4-4-2. If the auto eye cannot be operated under disassembly of the camera, make the meter deflect by flowing a current of 386μ A to the meter and adjust the indicator to F/5.6.

4-4-3. The exposure indicator needle, must be adjusted when the meter and the aperture blade are replaced or disassembled and re-installed.

4-4-4. Adjustment of deflection width and incline of the exposure indicator needle.

(1) When the aperture width of the exposure indicator needle is too large or too small.

(2) When the exposure indicator needle tends to some position.

The deflection width of the exposure indicator needle can be adjusted in the case of (1) by adjusting the height of the exposure indicator needle coupling plate with a washer.

In the case of (2), the fault may lie in the bent of the indicator needle or be due to the fact that the fixing position of the indicator holder is not adjusted to the mask lens central line.

4-4-5. The indication error of the exposure indicator needle must be within $\pm 1/2$ aperture for the aperture stop in question.

4-4-6. When the aperture indicator is adjusted, the battery check must be re-adjusted.

4-5. Other Breakdowns related Auto Eye

4-5-1. Meter disconnection.

4-5-2. Defective main switch for start button.

4-5-3. Defective A-M selector switch.

4-5-4. Shorting or disconnection in meter circuit.

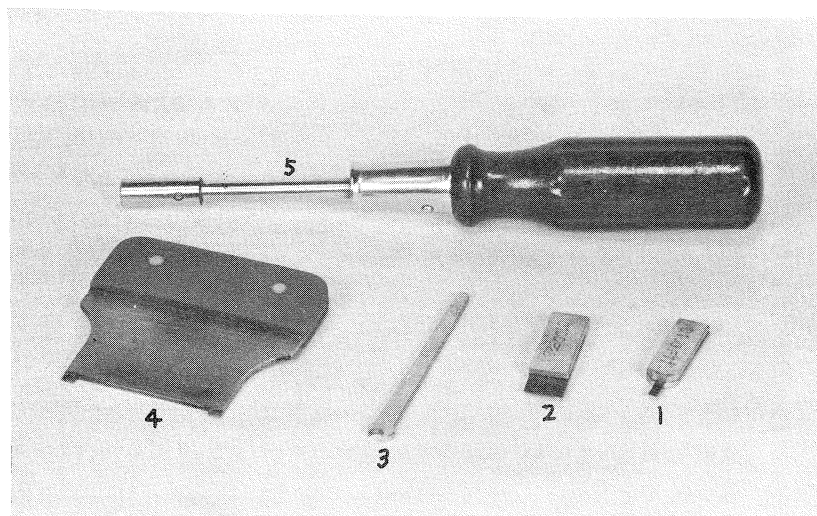
Note: The auto eye would not operate in any of the above breakdowns. Motor, zooming, manual aperture also would not work in case of 4-5-2 breakdown.

4-5-5. Defective ASA sensitivity selector.

Resistor disconnection, circuit shorting and defective contact of selector lever, etc. are the causes of a defective ASA sensitivity selector.

When the sensitivity selector does not operate in proportion to the ASA sensitivity, it means that the resistance value of the constant resistor has changed.

Aperture Blade Gauges and Special Tools for Assembly and Disassembly



<u>Name</u>	<u>Application</u>
1 ... F/11 aperture blade gauge	For meter setting
2 ... F/2.8 aperture blade gauge	- " -
3 ... Special wrench	For removal and fixing of special screw used for fixing the motor fixing plate
4 ... Zoom lens screwdriver	For zoom lens removal and installation
5 ... Zoom lens holder fixing stud box screwdriver	For stud removal and fixing

5. Focusing Adjustment

Tools: Auto Collimator
Focus detecting mirror cassette

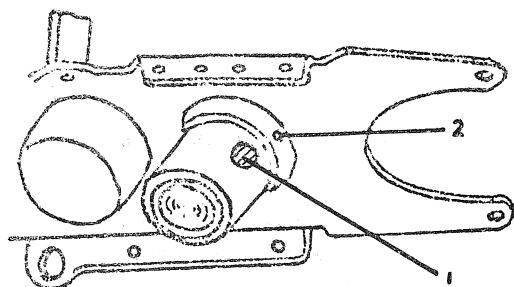
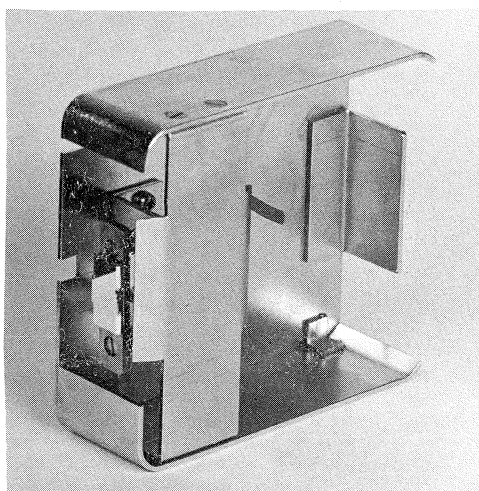


Fig. 32



Focus detecting mirror cassette

5-1. Focus Detection

5-1-1. Set the zoom lens to ∞ and $f/34$ mm.

5-1-2. Remove the bottom plate and open the shutter by turning the governor.

5-1-3. Insert the mirror cassette into the camera and lock the rear cover. Then detect the focus with the collimator.

5-1-4. Detect the finder focus as well.

5-2. Tolerable focusing values: Tele -0.02 -0.06mm
(when measured with mirror cassette)

5-3. Focusing adjustment

5-3-1. Remove the side plate on the finder side.

5-3-2. Loosen the master lens holder screw. This holder screw can be loosened with a screwdriver from the bottom of the finder mask lens.

5-3-3. The master lens is moved by pushing the saw-like part shown in Fig. 32 (1) with a driver. (The master lens is moved forward or backward by turning.)

5-3-4. Since the master lens is a right hand screw, it approaches the film when turned to the right and moves away from the film when turned to the left.

5-3-5. Turn the master lens to the left when the results obtained by measuring with the collimator are on the (-) side of the tolerable value.
Turn the master lens when the results are on the (+) side.

5-3-6. When adjusting, the desired value for the mirror cassette is -0.04 mm.

5-3-7. Turn the master lens and tighten the holder screw as the desired value is approached. Again, detect the focus after tightening the holder screw, because the focus may have moved, although it may be little, when the holder screw is properly tightened.

5-4. Focusing Adjustment of Finder

- 5-4-1. Remove the finder cover and loosen the finder mask lens fixing screw (1 in Fig. 33).
- 5-4-2. Set the camera to the collimator and adjust the zero point of the collimator.
- 5-4-3. Set the zoom lens to ∞ and $f = 34\text{mm}$.
- 5-4-4. The focus can be adjusted by moving the finder mask lens forward and backward while viewing the finder.
- 5-4-5. When an auto collimator is not used, focus on an object at a distance of more than 300 m away.
- 5-4-6. When moving the finder mask lens forward and backward, do not move too much back as the exposure indicator needle may get bent. Be very careful of this when adjusting.

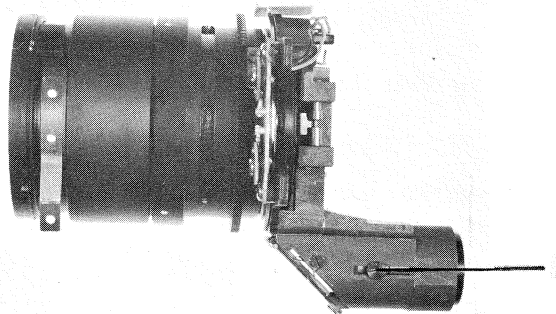


Fig. 33

6. Detection and Adjustment of Parallax

6-1. Detection of Parallax

Instruments: Parallax detecting light source equipment
(can be used for C-200, 300 also)

Frame stand (also used for C-200, 300)

Parallax detector (used for 8TL, C-200, and 300)

Parallax detecting light source equipment

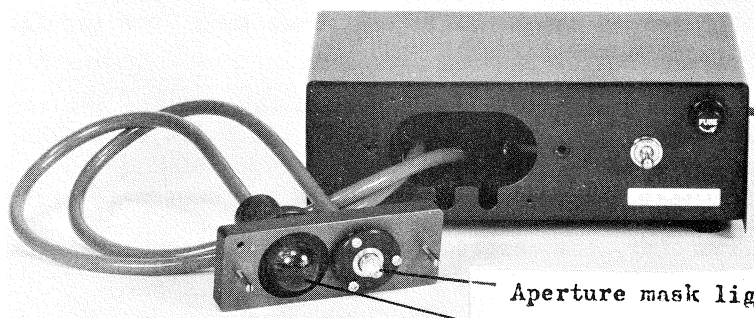


Fig. 34

Aperture mask light source lamp (2.2V)

Finder mask light source lamp (6V 3A)

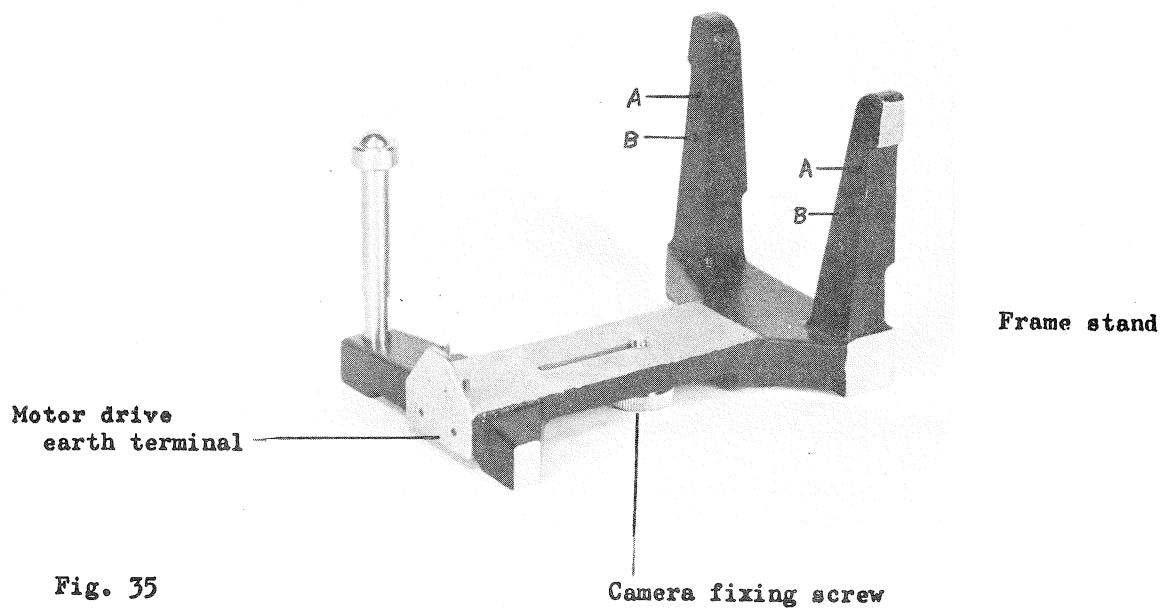


Fig. 35

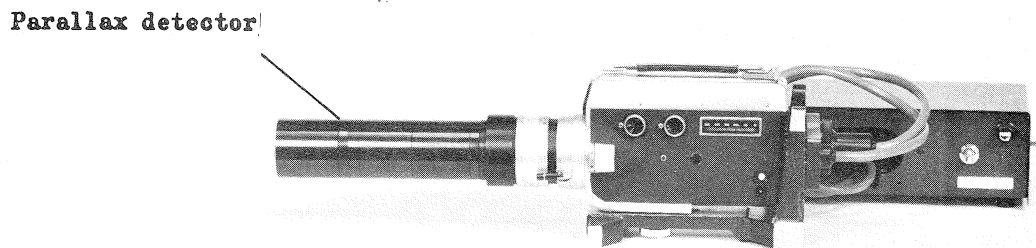


Fig. 36

Setting the parallax detector

- 6-1-1. Remove the camera rear cover.
- 6-1-2. Open the camera shutter. To open the shutter, push the start button and take out the power supply battery while the shutter is running, and then the shutter will stop at its option. Repeating this two or three times will open the shutter.
- 6-1-3. Fix the camera to the frame stand.
- 6-1-4. Fix the parallax detector to the zoom lens.
- 6-1-5. Fix the light source lamp for the parallax detecting to the frame stand. The lamp is fixed to the lower holes (B in Fig. 35) in the frame stand. The upper holes (A in Fig. 35) are used for MG-8.
- 6-1-6. Light up the lamp and observe the image on the detector. The inside of the detector image is the finder mask image while the outside is the aperture mask image.

6-1-7. The limits of parallax should be as follow that the finder mask image is in contact with the outline of the aperture mask image and the finder mask image is not on slant.

6-2. Adjustment of Parallax

6-2-1. Parallax adjustment is divided into vertical and horizontal adjustments. The adjust locations differ.

6-2-2. Horizontal adjustment of parallax.

- (1) Remove the finder cover.
- (2) Parallax can be adjusted horizontally by changing the angle of the mirror. The mirror angle is changed by tightening or loosening the three finder mirror screws (1, 2, and 3 in Fig. 37).
- (3) There is some change in the vertical direction when the finder mirror is adjusted. Consequently, horizontal adjustments should be performed before vertical adjustment.

6-2-3. Vertical adjustment of parallax

- (1) Remove the side plate on the finder side.
- (2) Vertical adjustment is performed by turning the adjusting screw shown in Fig. 38 (1). Although this screw adjusts the slanting of the half mirror prism, the auto eye sensitivity is also affected when parallax is vertically adjusted as a reflector for reflecting light incident in the CdS direction is attached to the half mirror prism. Consequently, the auto eye must be checked when vertical adjustments are made.

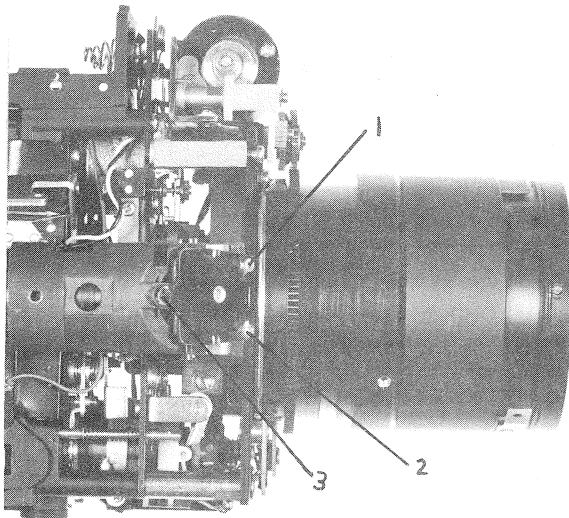


Fig. 37

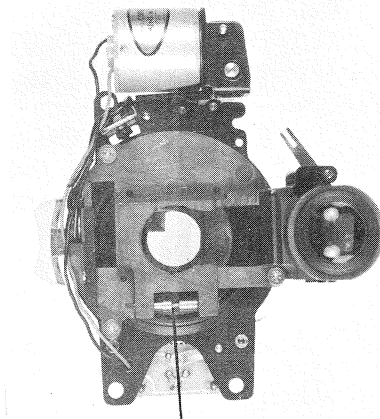


Fig. 38

7. Inspection and Adjustment of Zooming Device

7-1. Inspection

- 7-1-1. Inspect the auto zooming speed (irregular and otherwise) and noise.
- 7-1-2. Connect an ammeter (mA) and determine the current value for zooming.
- 7-1-3. Inspect if the manual zooming operation is smooth.

7-2. Zooming (Troubleshooting)

*Defects

- 7-2-1. Slow auto zooming speed.
- 7-2-2. Auto zooming stops halfway.
- 7-2-3. There is irregularity in auto zooming speed.
- 7-2-4. Auto zooming operates only on the T side or the W side.
- 7-2-5. Auto zooming does not operate at neither T or W side.
- 7-2-6. Auto zooming operation is slow while film is running.
- 7-2-7. Manual zooming extremely tight.

*Cause and Correction

- 7-2-8. The main cause for 7-2-1 through 7-2-3 is distorted zooming rings (Fig 39-1) and hard zoom lens helicoids. Since adjustment is extremely difficult, it is advisable to replace the lens.
- 7-2-9. If the gears of the gear mechanism are too deeply engaged, zooming may become tight.
- 7-2-10. Wrong position of auto-stopper may cause zooming to stop before reaching 34mm and 8.5mm. It will be corrected by moving forward or backward the auto-stopper illustrated in 2 of Fig. 39.
- 7-2-11. In addition to causes of the trouble in 7-2-8, eccentric gears, distorted gear shaft, motor shaft, and other troubles can cause zooming speed irregularity. Effective parts should be replaced in this case.
- 7-2-12. When auto zooming operates only on the T side or the W side, the zooming switch contact point is not in good contact.
- 7-2-13. When there is no operation for both the T and W side:
 - (1) Disconnection of motor or motor circuitry
 - (2) Defective zooming switch
 - (3) Operation of zooming mechanism is too tight.

7-2-14. When film speed falls as zooming is operated during film running, or when zooming time is lengthened, the power supply battery may be worn out or the film drive motor current may be excessive, etc.

7-2-15. Manual zooming may be too tight when the slip spring is too strong.

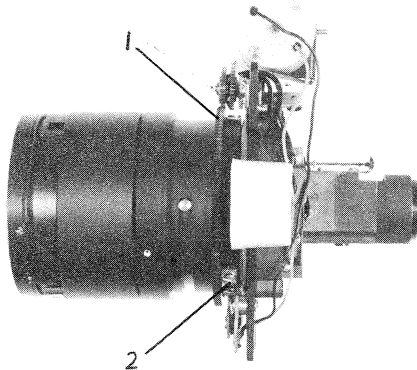


Fig. 39

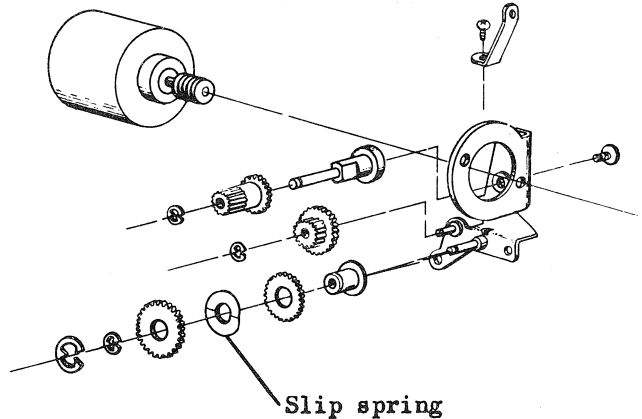


Fig. 40

8. Adjustment of Film Speed

8-1. Standard values:

24 frames $24 + \frac{3}{2}$ frames/Sec.
 18 frames $18 + \frac{2}{2}$ frames/Sec.

8-2. As shown in Fig. 41, the governor can be adjusted when the bottom cover is removed.

8-3. The causes of slow rotation.

8-3-1. The earth brush in contact with the motor shaft is floating.

8-3-2. Disconnection of governor circuit, or poor contact of governor brush.

8-4. When the rotation is too fast and the speed cannot be decreased even when the governor is adjusted.

8-4-1. Shorting of governor circuit.

8-4-2. The governor contact point is in contact and cannot be separated.

8-5. After the governor is adjusted, the speed adjusting screw must be secured with coating material. Do not, however, use too much coating material as the balance of the governor may be affected. The coating material may also adhere to the governor contact point, causing defective operation.

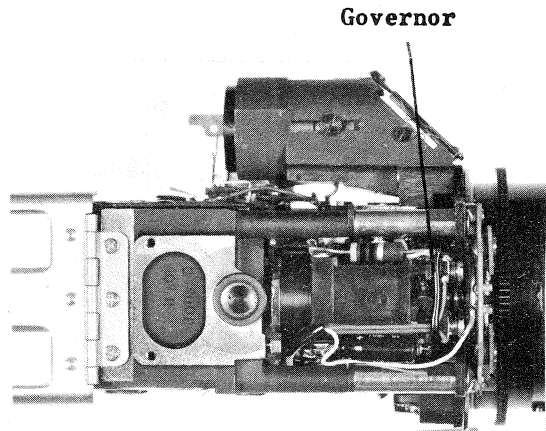


Fig. 41

9. Adjustment of Motor Current

9-1. Standard values for motor current

No-load current Below 170 mA for 24 frames/sec.

9-2. Causes of excessive motor current

- 9-2-1. No oil in the shutter shaft, intermediate gear shaft, winding intermediate gear shaft, and other rotating parts.
- 9-2-2. Motor gear and intermediate gear engagement too deep.
- 9-2-3. Excessive pressure of feeling pawl spring.
- 9-2-4. Eccentricity of winding intermediate gear shaft bearing.
- 9-2-5. Defective motor (insufficient torque).

9-3. Decreasing the motor current

- 9-3-1. Wash the gear and gear shaft with toluene ($C_6H_5OH_3$). Toluene is sprayed onto the gear and shaft by means of an injector and the motor is rotated. The current will drop when this is repeated from two to three times. Lubricate after cleaning.

Note: Should any optical part be sprayed with toluene during washing, the sprayed optical parts must be properly cleaned.

- 9-3-2. Adjustment of motor gear and intermediate gear engagement: loosen the motor mounting screw shown in Fig. 42 (4), connect the ammeter, rotate the motor. It is important that the screw be loosened just enough to allow motor repositioning.

Observe the ammeter, and secure the motor position at the point where current is minimum.

Be especially careful when performing this adjustment as the intermediate gear may be damaged if the gear engagement is insufficient.

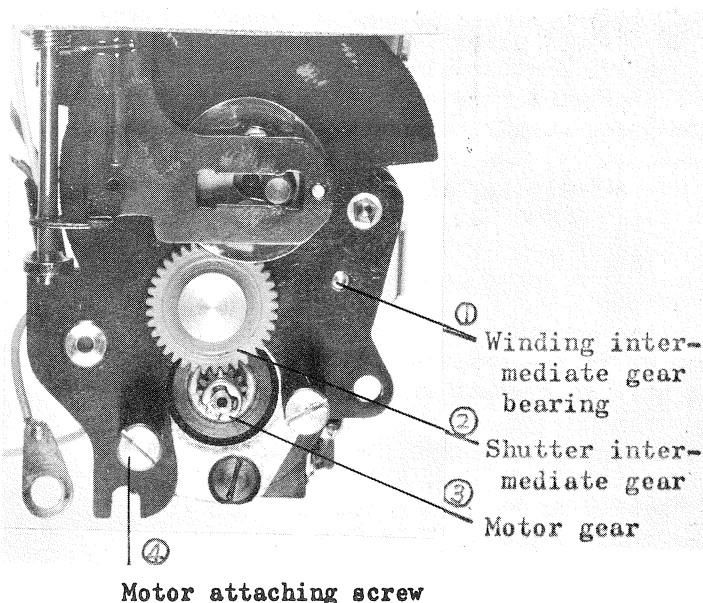


Fig. 42

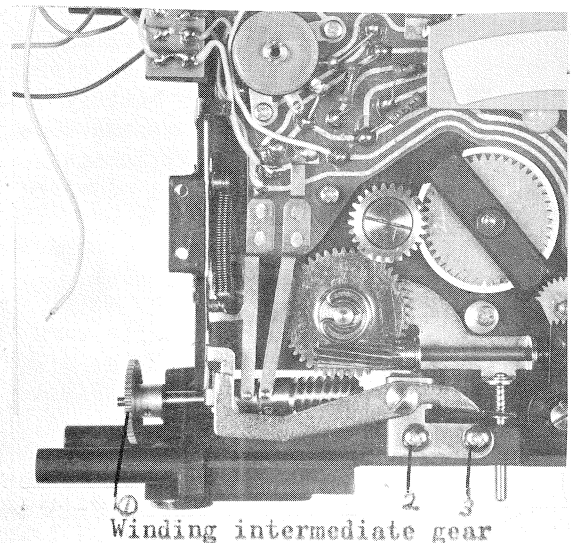


Fig. 43

9-3-3. Adjustment of winding intermediate shaft

This adjustment must be made when the disassembled motor mounting plate is reinstalled.

First, fit the motor mounting plate on the frame with four screws (1, 2, 3 & 4 in Fig. 44). Connect the volt/milliampere meter with the motor.

Next, loosen the two screws (2 & 3 in Fig. 43).

Keeping watch over the current to operate the motor, adjust the winding intermediate shaft receptacle to which the loading indicating lever is attached, and fix this receptacle at the position where the current for motor is minimum.

When the motor mounting plate is reinstalled, it should not be forgotten to adjust the shutter stopper stated in the next part.

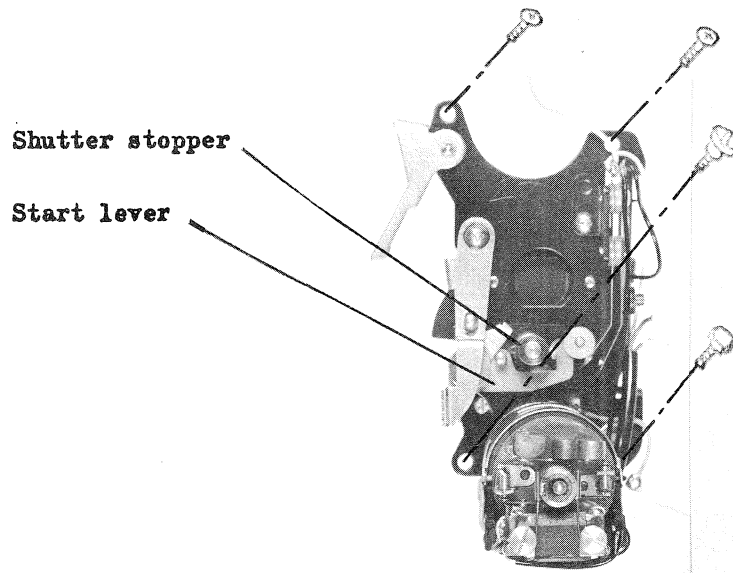


Fig. 44

10. Adjustment of Shutter Contact Point

If the position at which the shutter contact point comes to a halt, current will flow into the motor circuit when the shutter stops and the service life of the power supply battery will be shortened. If the camera is left under this condition for a long time, the power supply battery will leak and the camera will be badly damaged. Consequently, the position of the shutter contact point must be adjusted on re-installation of the motor mounting plate or motor.

10-1. Adjusting sequence

- 10-1-1. Manually turn the motor governor in Fig. 44 in the anti-clockwise direction up to the position where the shutter stopper comes to a halt in contact with the shutter lever.
- 10-1-2. Adjust in such a manner that the insulated cut portion of the shutter contact point (2 in Fig. 45) on the winding intermediate shaft gear will be at a position where it is in contact with the contact plate (1 in Fig. 45).

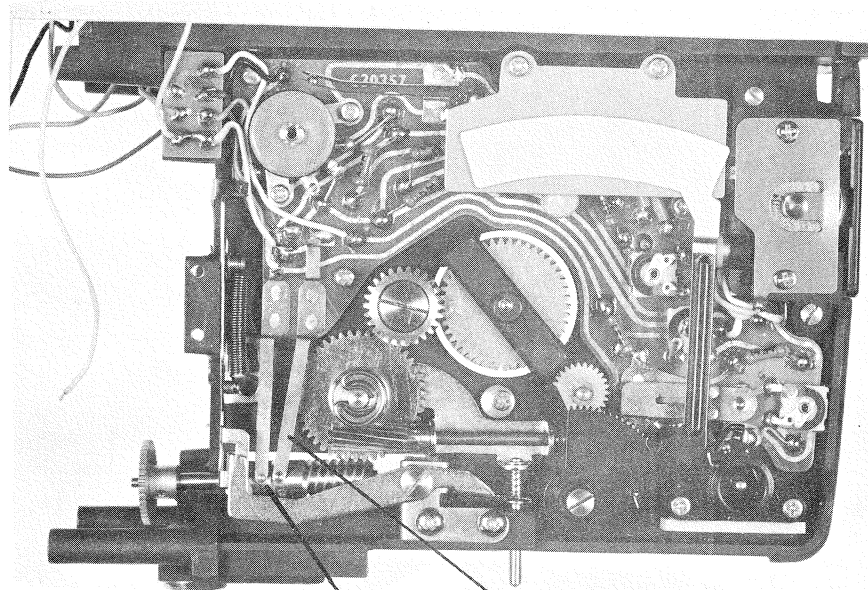


Fig. 45

- 10-1-3. Taking care not to move both the shutter and the winding intermediate gear shaft, engage the winding intermediate gear and shutter intermediate gear.
- 10-1-4. When engaging these gears, the shutter and the intermediate gear shaft must not be moved even by the slightest degree.
- 10-1-5. After tightening the motor retaining or mounting plate screw, determine motor current.
- 10-1-6. If the relation of the shutter contact point and stopping position of the shutter is bad, an excessively large current will flow even when the motor is stopped. When this happens, re-adjustment must be made.

11. Adjustment of Starting Device

Sometimes, on gently pressing the start button while the camera is not in operation a peculiar noise may be produced for a short while before the camera comes to a stop. This is due to the bad cut-off timing of the start switch.

Adjustment

- 11-1. Adjust in such a manner that the protruding portion of the shutter stopper shown in Fig. 46 (1) pushes up against part A of the start lever (Fig. 46 (2)). (Adjust as shown in the figure below.)

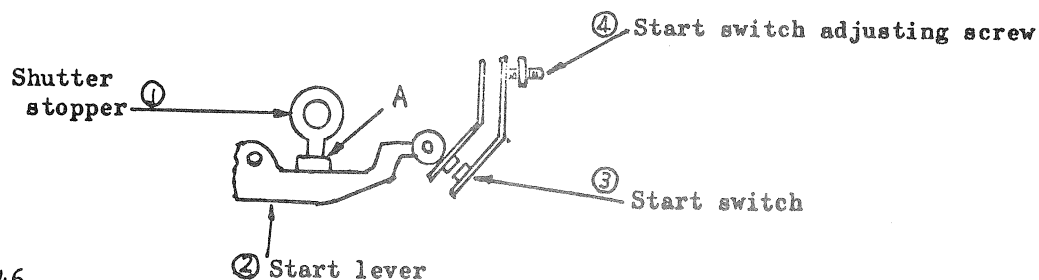


Fig. 46

- 11-2. Adjust the start switch adjusting screw shown in Fig. 47 (1) so that the start switch contact point is off and such that the contact point has a space of 0.2 to 0.3 mm.
- 11-3. Start the motor and inspect the start lever operation. The start switch should go off before the start lever comes into contact with the shutter stopper.
- 11-4. Sometimes, when the motor current is measured, the ammeter indicator may go over the scale. This occurs only during the short interval when the start button is pressed and is due to an excessive current flow. A surplus current may also flow when the camera is stopped as in the figure above. All these defects are the result of bad cut-off timing of the start switch in relation to start-lever operation.

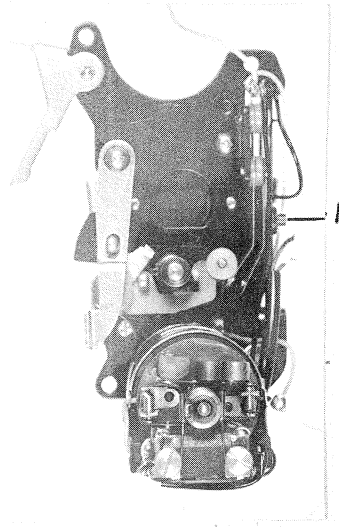


Fig. 47

12. Adjustment of Footage Counter

If the engaging position of the footage counter (Fig. 48 (1)) and the footage counter double gear is bad then the footage counter would be defective.

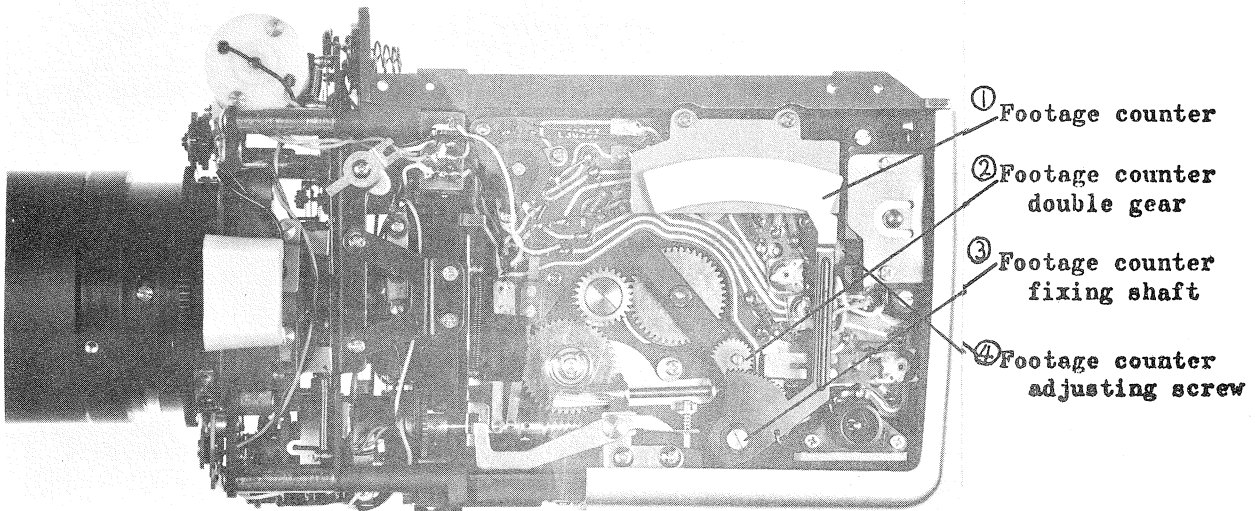


Fig. 48

- 12-1. Before fixing the footage counter with the shaft, position the footage counter double gear as shown in Fig. 49.
- 12-2. Close the rear cover, push the footage counter worm gear upward and place the footage counter onto the shaft without moving the positioned footage counter double gear.

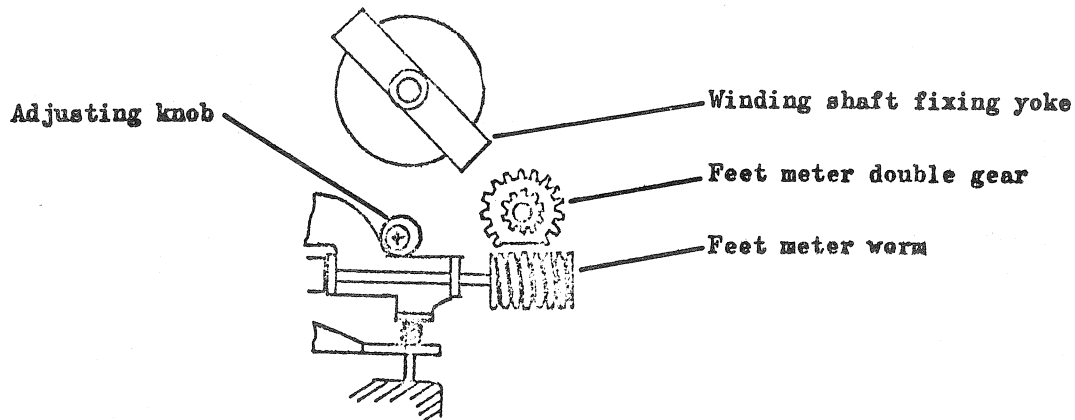


Fig. 49

12-3. Tighten the footage counter shaft properly, engage the double gear with the tooth profile of the footage counter making sure that the footage counter arm is positioned parallel to the side surface of the winding shaft mounting yoke and tighten the counter shaft.

12-4. When the rear cover is opened, the footage counter should return to the start position.

12-5. Stopping position of footage counter.

The stopping position of the footage counter worm gear can be adjusted by turning the adjusting knob shown in Fig. 49 (1). The best stopping position for the footage counter worm gear is for the worm gear tooth top to be as close as possible to the tooth bottom of the double gear without touching. If too close, the worm gear tooth top would touch the double gear top bottom and frictional losses would be great. If too far apart the worm gear may be pushed back and the feet meter indicator would not operate.

12-6. How to adjust the start position of the footage counter.

Start position of the footage counter is adjusted with the adjusting screw which is illustrated in 4 of Fig. 48. This screw can be adjusted when the 1.3V mercury battery is taken off.

13. Adjustment of Film Feeding

13-1. Causes due to insufficient film feeding adjustments.

13-1-1. Worn out feeding pawl.

13-1-2. Bad positioning of pawl top in relation to aperture plate.

13-1-3. Over or under jutting of pawl top in relation to aperture plate surface.

13-1-4. Worn out feeding pawl sliding pin.

13-2. Adjustment

13-2-1. Should the pawl top position tend to one side, either left or right, in relation to the aperture plate, the side plate (2) and the reinforcing plate are first removed.

- 13-2-2. If the aperture is brought into contact with the film side and the motor shaft turned manually, the feeding pawl would turn slowly.
- 13-2-3. At this time, the pawl top is observed to enter the film perforation.
- 13-2-4. When the pawl top goes into and out of the perforation, the pawl top must come into contact with the perforation side surface.
- 13-2-5. If the frame surface is agitated and the pawl top position is separated from the perforation center as the pawl top comes into contact with the perforation side surface, film feeding would become impossible.
- 13-2-6. When adjusting the pawl top position, utilize the play of the fixing hole to move the whole motor fixing plate and adjust the pawl top position in relation to the aperture plate.
- 13-2-7. The aperture plate must not be removed from the frame.

This is because the frame side surface is used as a standard to fix the cassette position and position the aperture plate securely with a precision gauge in relation to this standard surface. Moreover, the aperture window is made to coincide with the master lens center and since this position is fixed, it cannot be correctly set if the aperture plate is removed.

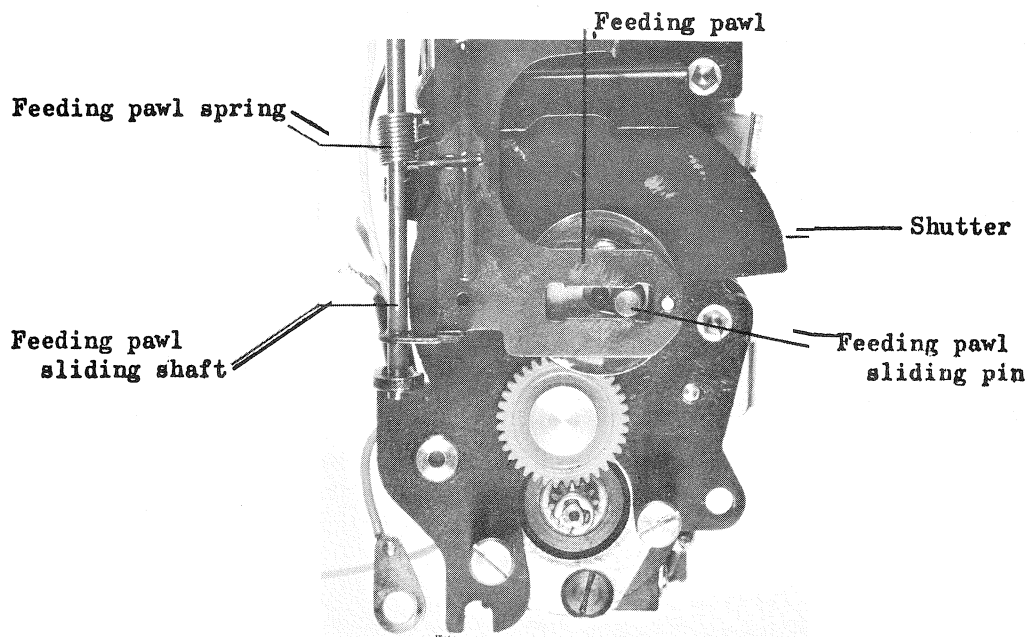


Fig. 50

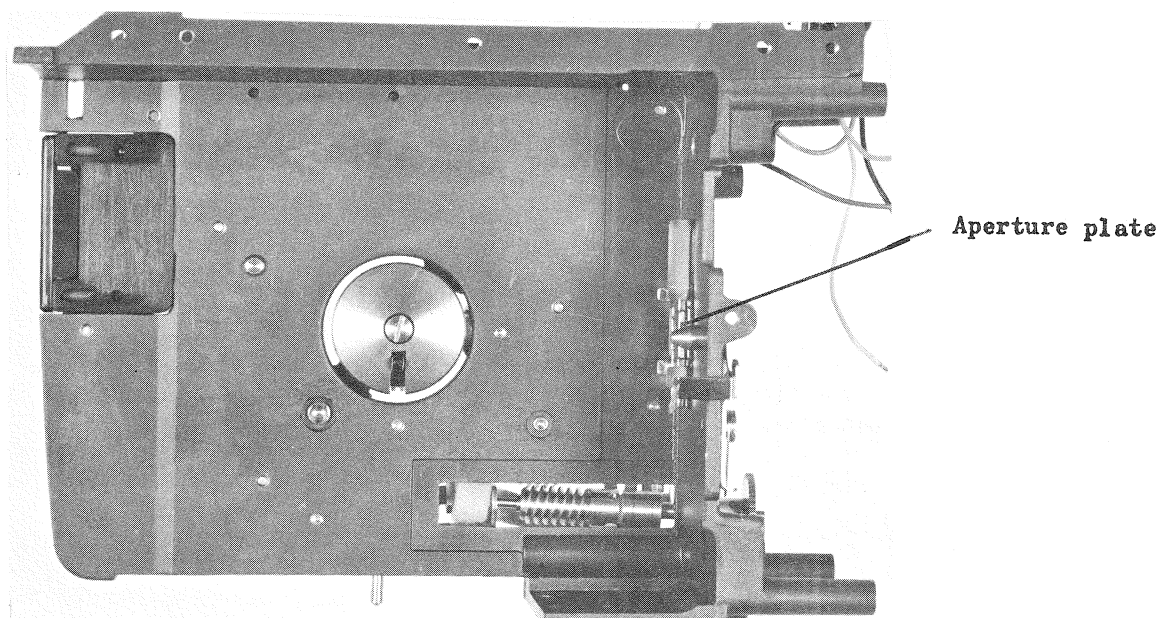


Fig. 51

14. Adjustment of Battery Voltage Checker

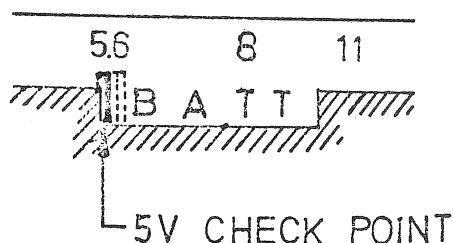


Fig. 52

The position exposure indicator needle by the arrow in the above figure is the 5V position. Thus, when the voltage is checked, the constant voltage can be considered to be 5V if the exposure indicator needle is at this position. The exposure indicator needle is obviously defective if the exposure indicator needle is at a position to the left of this or is deflected to the neighborhood of F/11 when checking is performed with new batteries.

14-1. Adjustment

- 14-1-1. Connect the camera to volt/milliampere checker meter, run the motor and adjust the voltage to 5V.
- 14-1-2. Push the check button and observe the deflection of the exposure indicator needle. The exposure indicator needle should be at the 5V point shown in the above figure. It is tolerable if the exposure indicator needle is 2-indicator needle widths to the right of the 5V point and a half width of the needle to the left.
- 14-1-3. When the exposure indicator needle is deflected from the 5V point, remove the side plate on the footage counter side, adjust VR4 and make the exposure indicator needle coincide with the 5V point.

14-1-4. Since voltage check indication is influenced by VR2 adjustment performed when the auto eye is adjusted, the voltage check must be adjusted whenever VR2 is adjusted and whenever the disassembled meter and exposure indicator, needle, etc. are re-installed.

15. Speed Selector and Auto Eye Related Parts

15-1. Since the amount of incident light in unit time decreases when the film speed is changed from 18 frames to 24 frames, the auto eye must be corrected. For this reason, the camera is constructed with a correcting filter interlocked with the speed selector knob in front of the CdS.

16. 85 Filter and Auto Eye Related Parts

16-1. The installed 85 filter should be released when a tungsten type film is used for shooting in tungsten light. The 85 filter is released by putting the filter key into the front of carrying handle strap mount. This work also releases CdS sensitivity correcting filter to correct the sensitivity relation between film (ASA 40) and auto eye.

The CdS sensitivity correcting filter related to the 85 filter is operated only by a filter key. When the filter key is not used, the CdS sensitivity correcting filter is always in front of CdS.

16-2. Since CdS sensitivity correcting filters for the speed selector and 85 filter are provided in front of the CdS, care must be taken when the zoom lens holder is removed or re-installed. Otherwise, these correcting filters may be damaged.

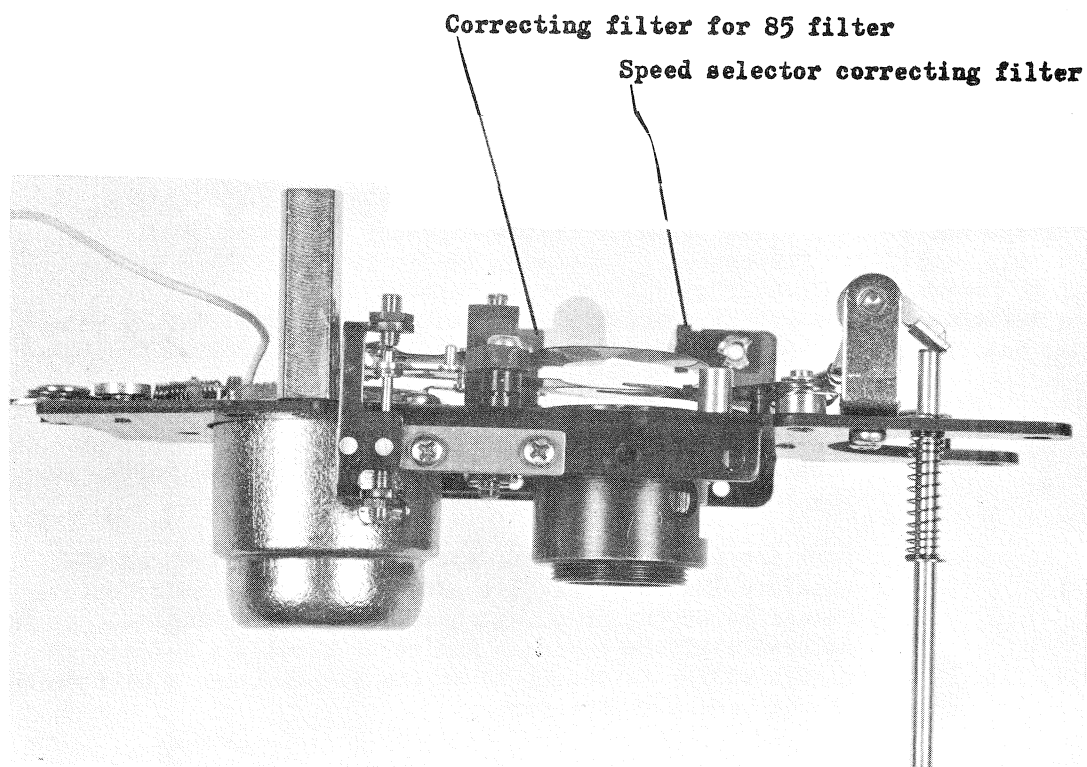


Fig. 53

17. Adjustment of Film Take-up Tension

17-1. Film take-up tension standards

17-1-1. 24 - 47 g cm Desired value 36 g cm

17-1-2. When measuring cassette is used 12 - 24 g

17-2. Two slip springs are located between the slip gears shown in Fig. 54 (1). The film take-up tension is determined by these slip springs.

17-3. Film take-up would not be smooth if Molycoat inside the slip gear is soaked with oil and hardened. Correct this defect by injecting a little oil.

17-4. Film take-up is weakened if the springs are permanently set. Replace the springs if this happens.

17-5. Measuring the film take-up tension

Tools used Film take-up tension measuring cassette
Tension spring 50 g
(fan shaped spring)

17-5-1. Insert the cassette into the camera and start the motor.

17-5-2. Attach the front end of the fan shaped spring to the front end of the plate fixed to the cassette shaft.

17-5-3. The spring reading should be within the standard values given above when the cassette shaft comes to a stop.

17-5-4. The front end of the fan shaped spring should be parallel to the plate attached to the cassette shaft when the measurement is made; otherwise, there will be a large error. That is, care must be taken to insure that the tension is always in the direction perpendicular to the front end of the spring.

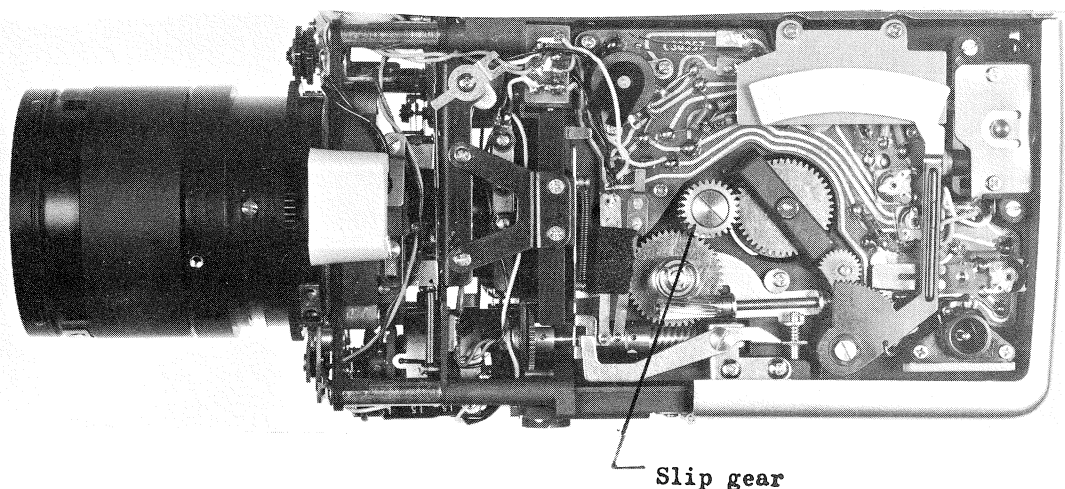
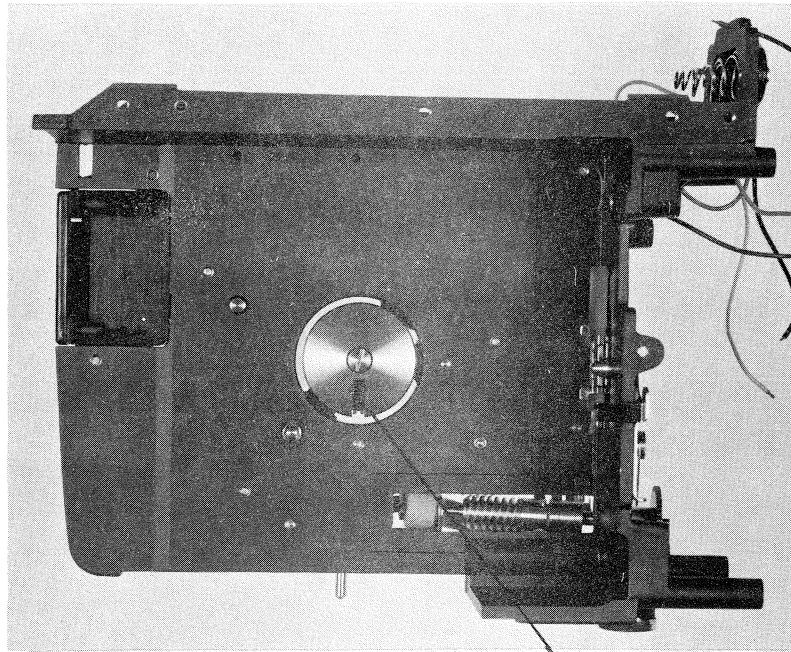
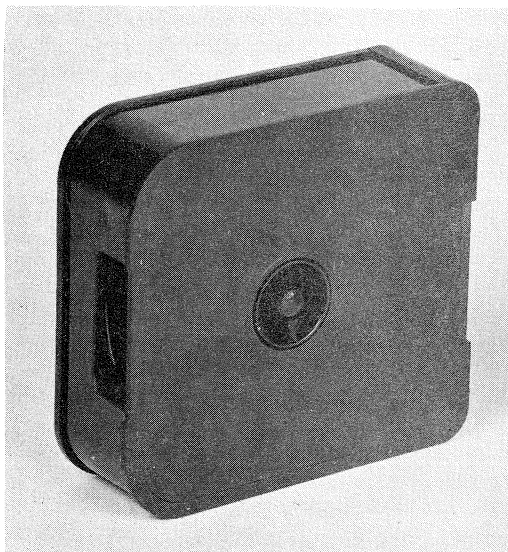


Fig. 54



Winding gear

Fig. 55



Film take-up tension
measuring cassette

Fig. 56

How to use the meter setting gauge for Super 104

1. Put the meter on the master lens attaching plate.
2. Set the meter setting gauge to the attaching stad for the aperture blade.
3. Move the meter to the position where the pointer (1) at the side of meter aperture blade can smoothly move in the ditch of the gauge.
4. Turning the meter, fix it at the position where the pointer (1) indicates third red mark (3 in Fig. A) while flowing F5.6 basic current of $386\mu\text{A}$ to the meter.

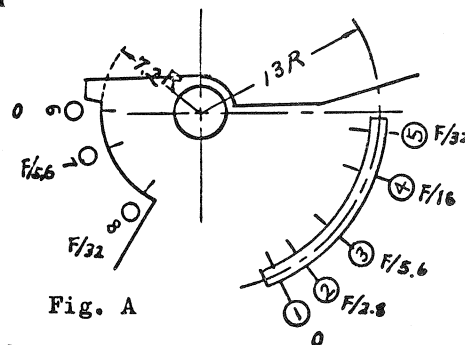


Fig. A

The allowance error of the pointer (1) is as shown below:

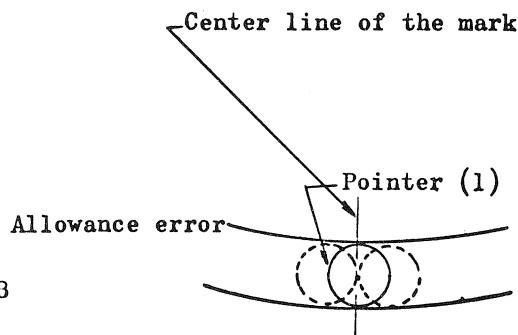
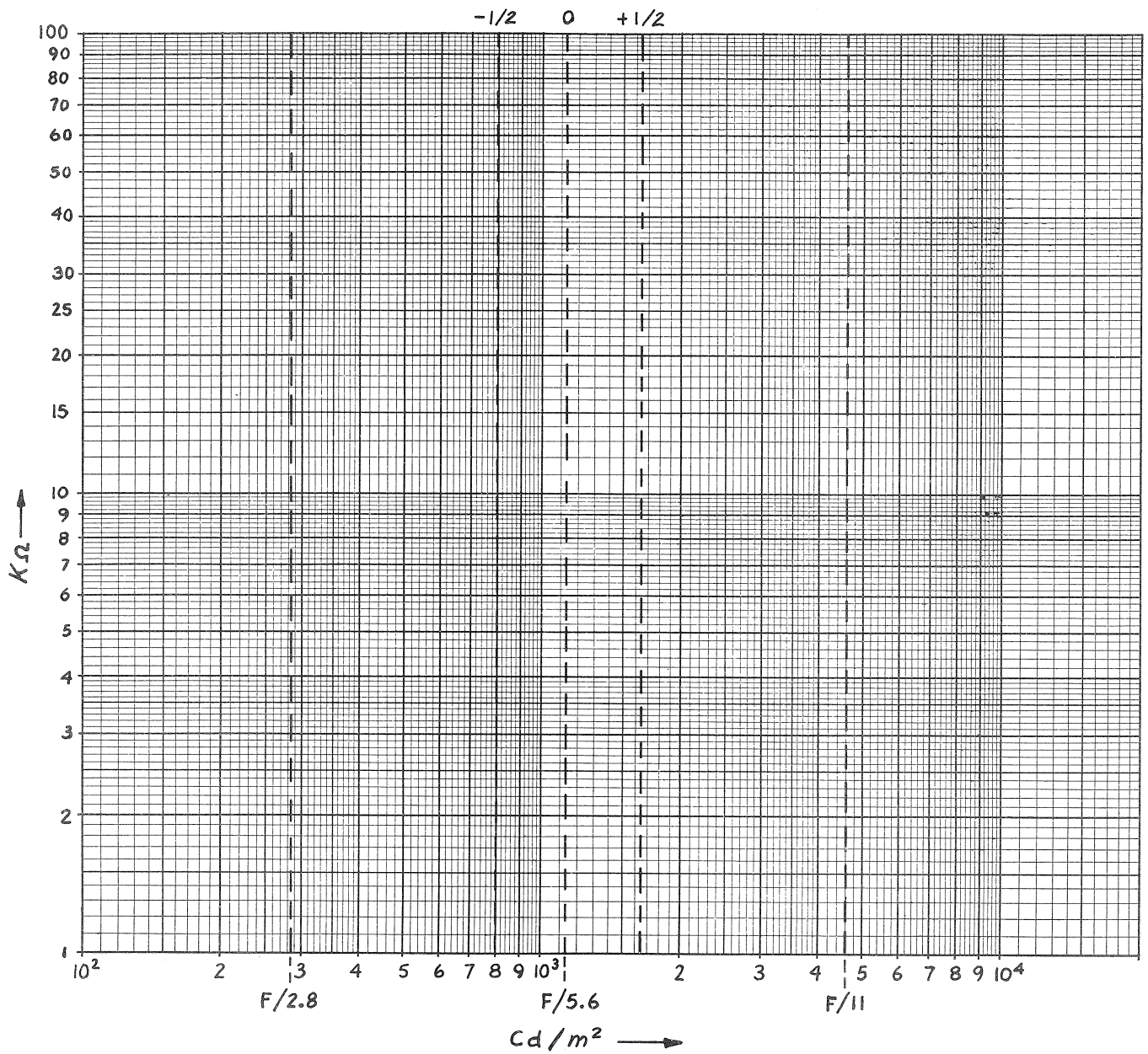


Fig. B

6. The position of the pointer (2) at the side of aperture indication needle should be as follows in figure A.
When the pointer (1) is at the first white mark, the pointer (2) should be at the opposite side of sixth white mark. When the pointer (1) is at third the pointer (2) should be the seventh and the pointer (1) is at the fifth, the pointer (2) should be at the eighth.
7. The length (radius) of the pointer (2) should be arranged so that it does not touch the gauge wall of $7.2R$.
8. Put the stopper on 0 and F32 in order to stop the pointer (1) at the first and fifth white mark.
9. After setting the meter is completed, remove the gauge and fix the aperture blade. Then inspect the condition of the aperture blade with aperture blade gauge on F2.8 basic current of $214\mu\text{A}$ and F11 basic current of $558\mu\text{A}$.
10. Adjustment of the opening of the aperture blade is made by moving the aperture blade assembly up and down.



AUTO-EYE SETTING SHEET FOR SUPER 104