Service Manual

For

Kowa Super 66

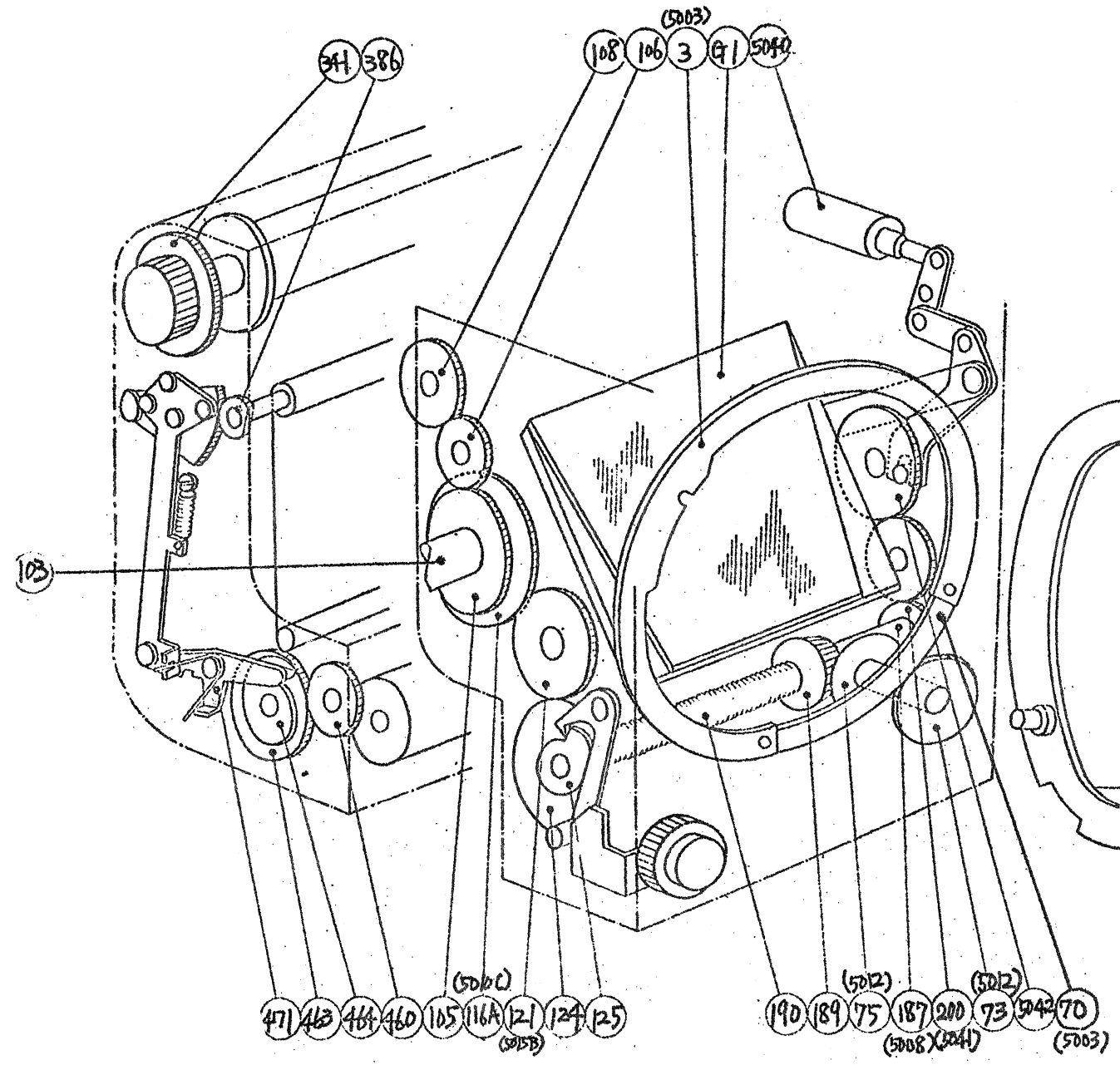
(KIN2C4)

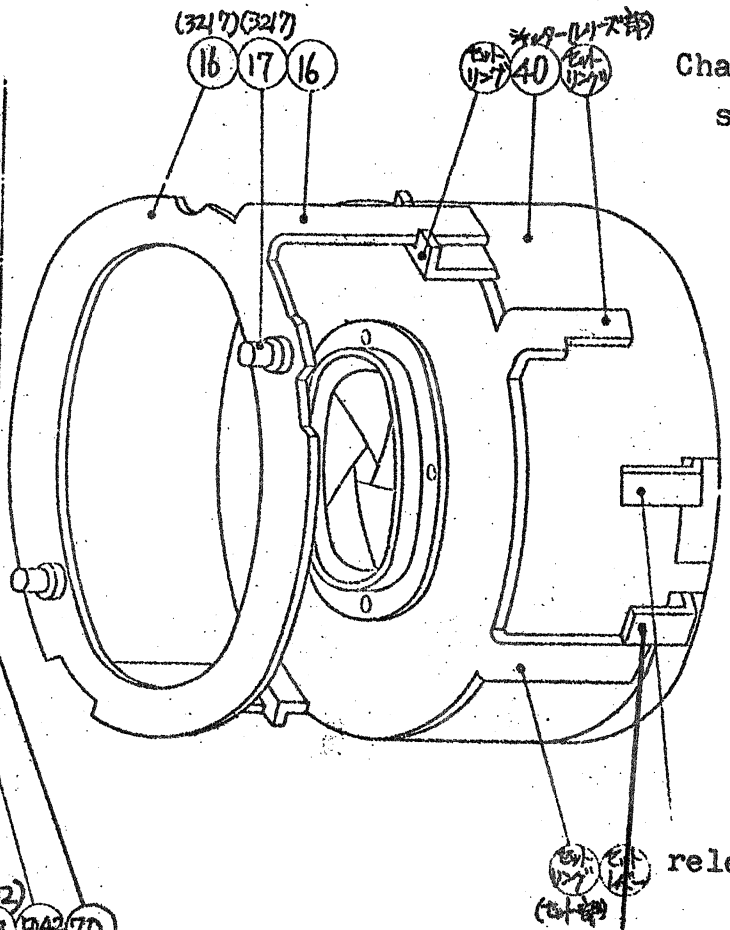
Kowa Company Ltd.

1974.7.20

KOWA SUPER 66SERVICE MANUAL INDEX

Fig 1

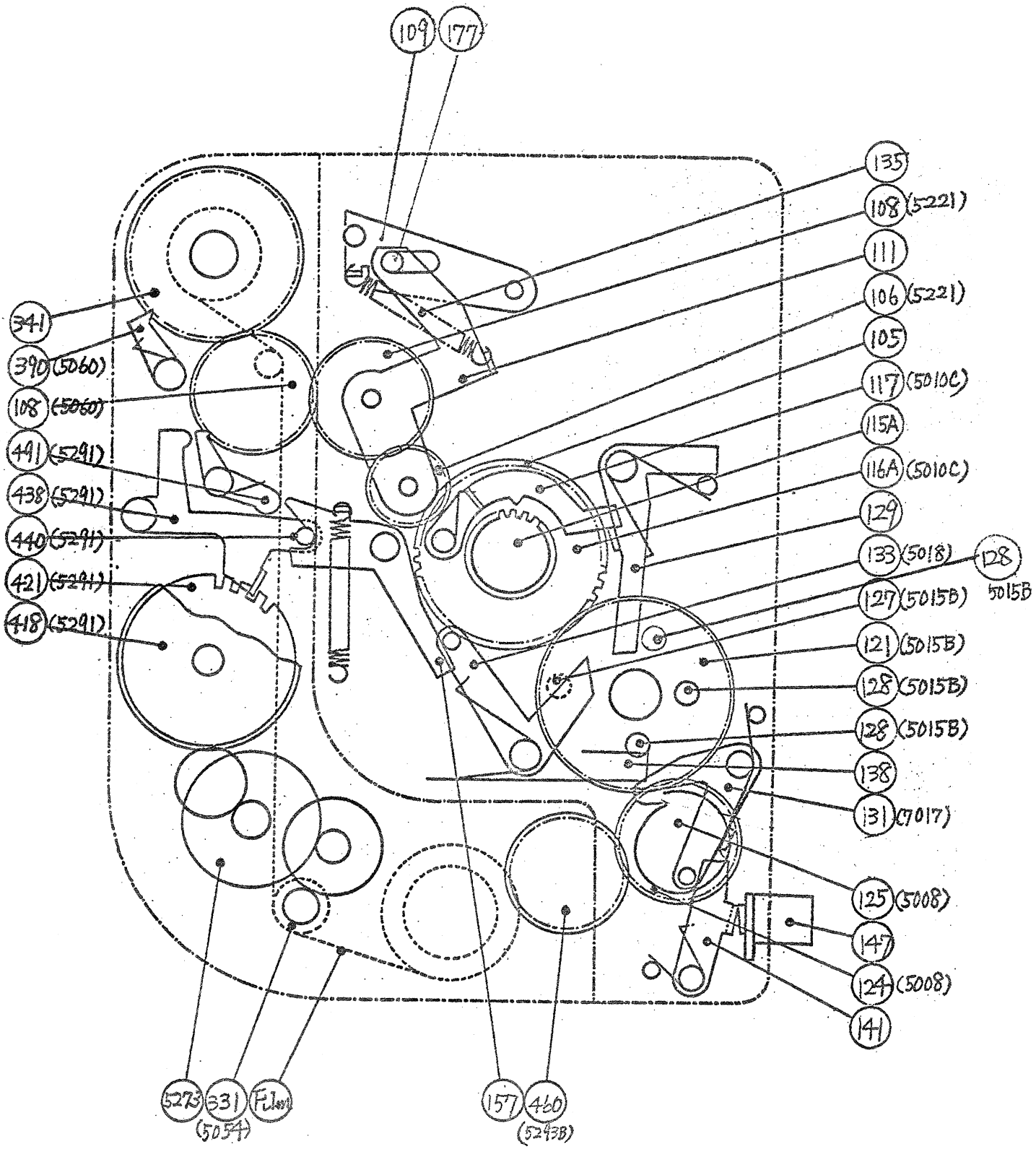




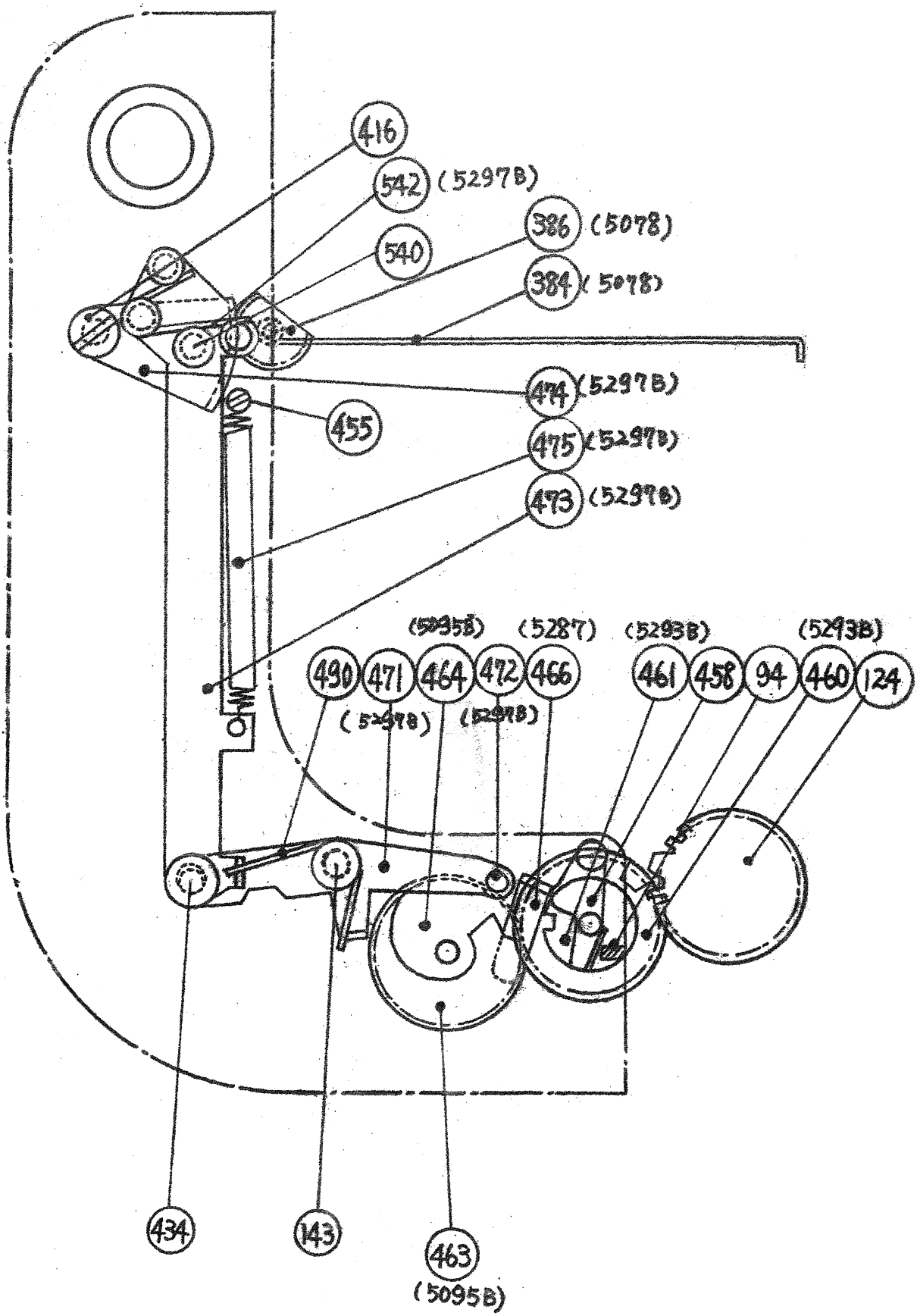
Shutter Unit

(Fig. 1)

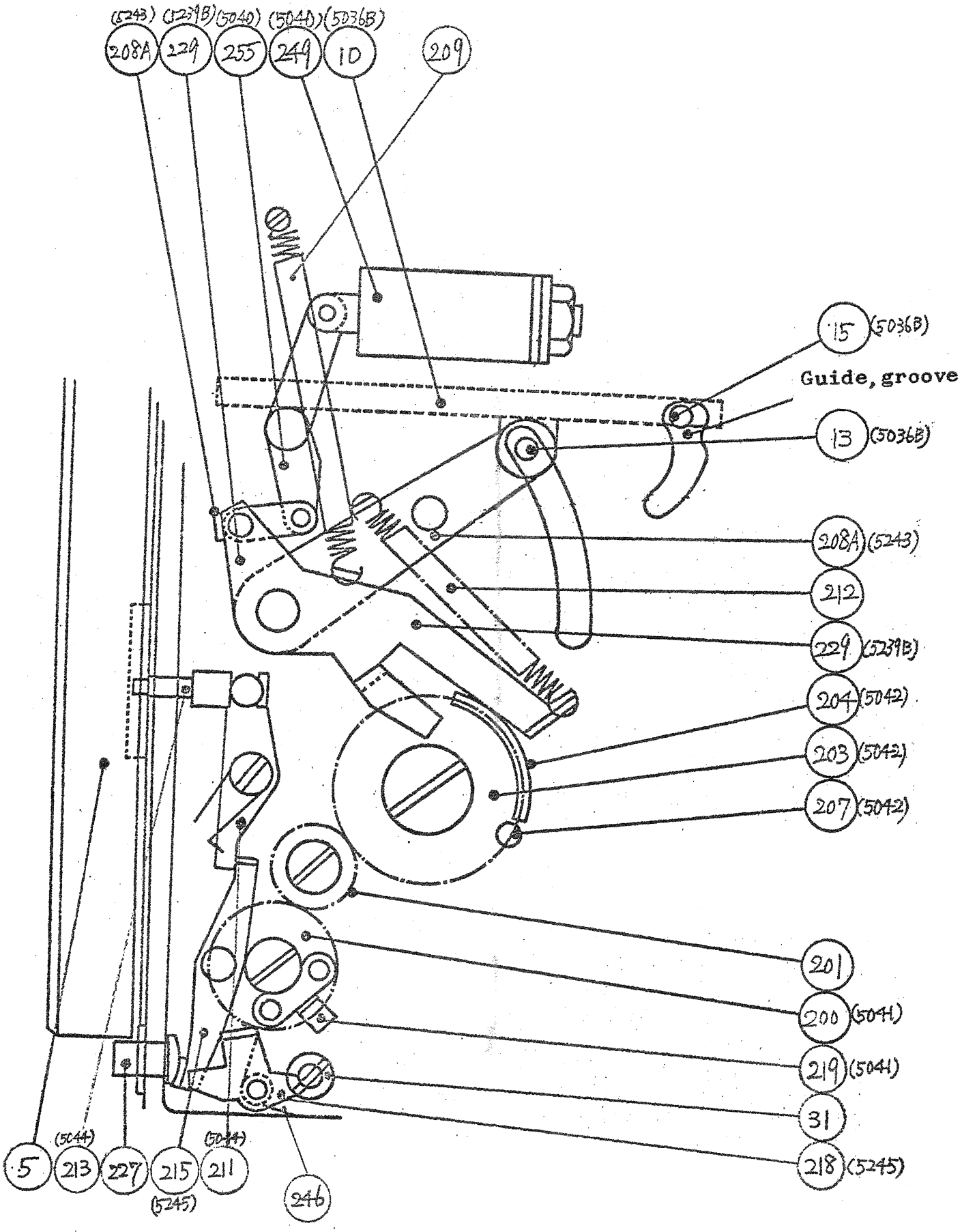
(Fig 2)


109
177
135
108 (5221)
111
106 (5221)
105
117 (5010C)
115A
116A (5010C)
129
133 (5018)
128
5015B
127 (5015B)
121 (5015B)
128 (5015B)
128 (5015B)
138
131 (7017)
125 (5008)
147
124 (5008)
141
341
390 (5060)
108 (5060)
441 (5291)
438 (5291)
440 (5291)
421 (5291)
418 (5291)
527
331
(5054)
Film
157
460
(5293B)

(Fig. 3)


416
542 (5297B)
386 (5078)
540
384 (5078)
474 (5297B)
455
475 (5297B)
473 (5297B)
(5095B)
(5287)
(5293B)
(5293B)
490
471
464
472
466
461
458
94
460
124
(5297B)
(5297B)
434
143
463
(5095B)

(Fig 4)


(5243)
208A
(5239B)
229
(5040)
255
(5044)
244
(5036B)
10
209
15
(5036B)
Guide, groove
13
(5036B)
208A
(5243)
212
229
(5239B)
204
(5042)
203
(5042)
207
(5042)
201
200
(5044)
219
(5044)
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(5245)
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213
227
215
(5245)
(5044)
211
246

(Fig 5)

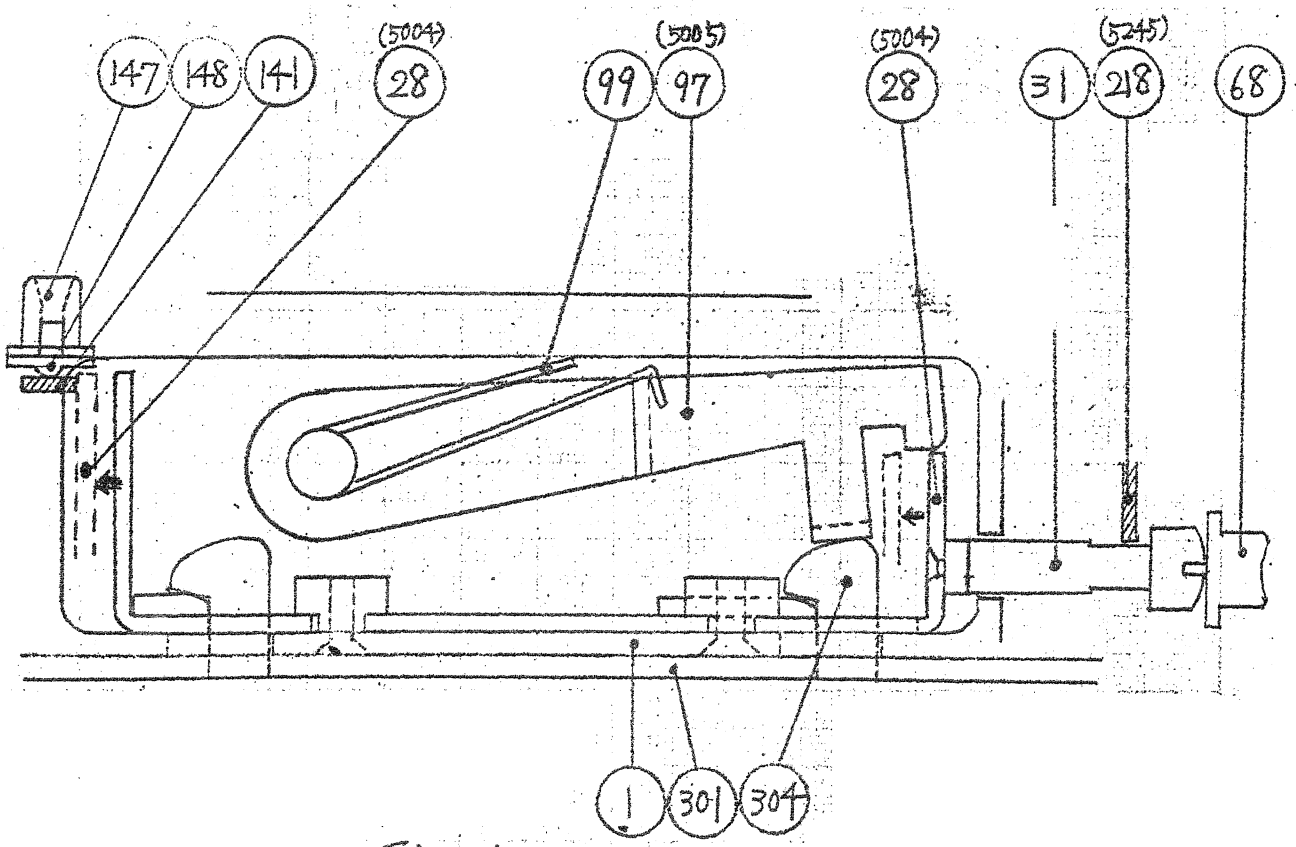
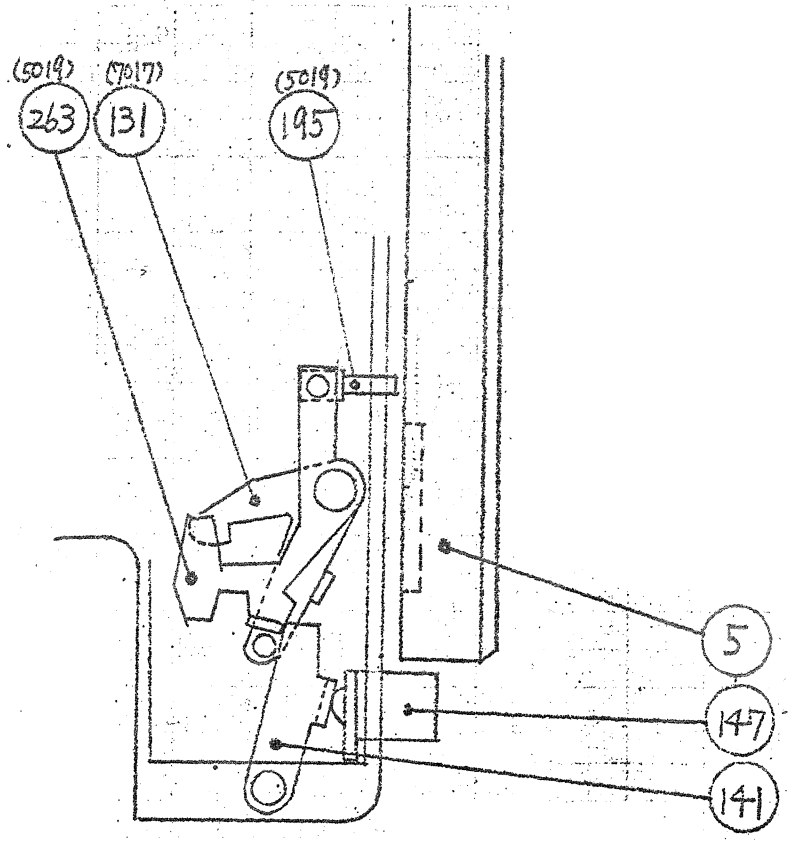

147
148
141
(5004)
28
99
(5005)
97
(5004)
28
31
(5245)
218
68
1
301
304

Fig 6


(5019)
263
(7017)
131
(5019)
195
5
147
141

PART-I EXPLANATION OF PRINCIPAL MECHANISMS

Principal mechanisms of the KOWA SUPER 66 are contained in both sides inside the camera body and film magazine. As shown in Fig.1, two ranges of gears--one which relates film advance, is arranged upward left from 105-gear and the other which relates operations of shutter, reflex mirror, and light shield plate, is arranged downward right from 5010C, all these contained inside the camera body's right side. The shutter cocking unit is contained in the base and front sections of the body. The left side of the body incorporates the mirror functioning mechanism.

Inside the film magazine's right side are three units--one for film wind on its top, the other for film frame spacing/frame-counting at center, and still the other for driving the light shield plate at center and base.

1. Film Advance (fig.2)

Winding the film advance crank/knob clockwise turns 105-and 115A-gears. The 105-gear, through 106 and 108, turns 341-gear, which turns the film take-up spool, and thus film is advanced. (The 341-gear is frictioned and blocked by 390-lever.)

Film advance turns 331-guide roller which contacts with film and moves 418-gear clockwise through 5273-counter-gear sub.assy. Film advance is stopped by engaging 491 with 108 when 438 drops into the grooves of 421 fixed on 418.

2. Shutter, Mirror and Light Shield Plate (Fig.1-4)

As 117-claw interlocks with 115A, the turn of 115A is transfered to 116A through 117. (Fig.1) 116A has a number of teeth enough for cocking the shutter and the extraneous teeth are eliminated. 116A drives 121-mid-gear and then 124-gear. Since 124 is fixed on 187-main-drive-shaft and 189-bevel-gear and 190-main-drive-spring are both fixed on 187-shaft, 187, 125, and 189 altogether turn to set 190-spring. (Fig. 1-2)

189 finally turns clockwise 3-front ring through 75, 73, and 70. As a notch on 3 is interlocked with 17, 16 turns counterclockwise and cocks the shutter. (Fig.1) 463 has 464-cam which is in contact with 476-roller connected to 472-pin on one end of 471-bell-crank.

The other end of 471 links with 473, 474, and 386. The 386-gear and 384-light-shield-plate are fixed on the same axle. When 124-gear turns clockwise, both 463 and 464 turn to the same direction. As 464 turns, its diameter is

lessened gradually. So, pulled by 475-spring, 471 turns clockwise to come in contact with 464 at 472. 471 pushes 473 upward and 474 turns counterclockwise. So, 386 turns clockwise and 384 swings down.

The swing-down completes as 472 comes close to the minimum diameter section of 464 and 384-light-shield-plate is held at this position by 475. While 472-pin passes along the minimum diameter section which ends in a cocentric circle, the reflex mirror swings down as mentioned below. Since 472-pin is interlocked with 464 at the end of 464-cam, the light shield plate is pressed and held onto the down-position. This makes a complete light shield against the external shocks or vibrations upon the camera.(Fig. 3)

The reflex mirror swings down as follows:

As 187-shaft turns by the crank/knob winding, 200-gear fixed on 187 turns 203-gear counterclockwise through 201. As 207 and 204 are fixed on 203, 207 engages with 229 and turns 229 clockwise when the swing-down of the light shield plate ends up. As 208A and 229 are held on the same axle and both are coupled to 212-coil-spring, the clockwise turn of 229 also turns 208A to the same direction. As 208A is coupled to 13-pin fixed on 10-mirror-frame, 10 thus swings downward and is locked at 45° position.(Fig.4)

The shutter blades open toward the end of this action. 187's reverse turn is prevented by 131 interlocked with 125-cam as soon as the shutter is cocked and the reflex mirror swings down. Just after this function completes, 116A reaches the section where teeth are eliminated, and 116A disengages with 121.

As the film wind proceeds and the film diameter on the take-up spool becomes larger, the wind angle of 341 for advancing one frame of film decreases accordingly. Since the wind is stopped when one frame of film is advanced, the shutter cocking should be completed before the film wind by one frame ends up. Thus, this requires a mechanism to keep on the film wind only and not to work the shutter once after the chutter is cocked. Immediately after the shutter cocking completes, 117-claw interlocks with 129-lever and 129 disengages with 115A. By this disengagement 116A stops its turn before it meshes with 121 again. (Fig. 4)

3. Shutter Release (Fig. 1-4)

When 147-shutter-button is pressed, 131-claw is released from 125-cam, and 187-shaft is turned counterclockwise by the work of 190-spring already

charged. Through couplers, this turns 3, 463, 121, and 203 backwards.

The rotation of 3-front-ring turns the set ring of 40-axle and this returns the set lever to its original position, thus stopping down the diaphragm blades and starting the exposure with the shutter blades by kicking the release lever.(Fig. 1)

* For further details of the lens mechanism, see the service manual of KOWA-SIX interchangeable lenses.

As the counterclockwise turn of 187 is transferred to 203-gear and rotates it clockwise, 207-pin pushes 229-lever and turns it counterclockwise. The other end of 229 pushed 208A at its L-shaped tip, and drives 208A counterclockwise. Since 10-mirror-frame is supported by the other end of 208A by 13-pin, 10-mirror-frame flops up along the guide grooves, with a receding movement. This receding movement allow the SUPER 66 to incorporate a reflex mirror longer by 6mm than that of the earlier KOWA-SIX. The longer reflex mirror allows a 95% finder coverage (90% on the KOWA-SIX) and no falling-off of view at the finder edges even when a 500mm telephoto lens is used. (Fig. 4)

As the reflex mirror is connected to the piston of 5040-air-damper through 225-lever, the mirror movement is buffed as the air in 249-cylinder is compressed while the mirror flops up.

As the minimum diameter section, which ends in a cocentric circle, of 464 is in contact with 472, the light shield plate will not swing up until the mirror begins to swing up. As the mirror flops up, 464 pushes 472 to turn 471 counterclockwise. The movement swings up 384-light-shield-plate through 473, 474, and 386. When 472 contacts with the maximum diameter section of 464, the swing-up of the light shield plate stops. Since 464's maximum diameter section ends in a cocentric circle, the light shield plate is suspended in the "up" position and the diaphragm is stopped down and the shutter is released during the suspension. (Fig. 3)

The time lag during the shutter button release, shutter blade pre-closeing, mirror flop-up, light shield plat flop-up, and actual shutter operation is about 90 to 100 milliseconds. The time lag depends both on the strength of 190-spring and buffer power of the air damper. As the speed of 90-100 mS is most recommendable for preventing camera shake and resulting in the highest durability of the whole moving mechanism, you must NOT change the working speed without any special reason. Especially, AVOID by all means the operation of shutter when you disassembly the air damper during your repair work. Also, DONOT work the mechanism at speeds higher

than 80 milliseconds.

The wind-up stop is released as follows:

One of two 128-pins on 121 kicks 133-lever. This movement turns 438-lever counterclockwise and releases it from the notch of 421. At the same time 438 pushes 491 and releases it from 108. Before 121's rotation end up, another 128-pin (lower one in Fig. 2) knocks 129 and frees 129 from 117.

Then, 117 interlocks again with 115A and all the functions are ready for the next winding.

The releasing drive of 187-shaft is stopped by 138 when 127-pin hits 138.

As mentioned previously, one cycle of winding and releasing functions is completed. The sequence of each function, such as the flop-up/down of the mirror and the light shield plate and the cocking and releasing of the shutter blades, is controlled by each ring connected to 187-shaft.

4- Mechanical Coupling of Camera Body and Film Magazine and Safety Devices (Fig. 3-6)

The KOWA SUPER 66 features the unusual light shield plate which plays a role of an automatic dark slide at the time of magazine removal. Since the functional sequences of mirror, light shield plate, and shutter blade movements are strictly controlled, 124-gear on body should mesh accurately with 460-gear on magazine when the magazine is attached.

Thus, the film magazine interchanging can be allowed only when the light shield plate is in the "down" position. Likewise, the lens cannot be detached unless the plate is down. 124-gear, fixed at one end of 187-driving-shaft, has a special double-sized tooth meshed with 460, which has a double-sized notch on the corresponding section. When attaching the film magazine, these two should engage together. When winding has completed, the two gears are engaged at the special tooth. As the magazine is removed, 466 drops into the groove of 461 on 460 to set the correct position of 460 before the tooth disengages from the notch. Meanwhile, the shutter cannot be released when the magazine is detached. (To be explained later.)

On attaching the magazine onto the body, 94-pin pushes 458 and releases 466 from the groove of 461 as the special tooth meshes with the notch. This makes 124 and 460 free from any restriction. (Fig. 3)

Fig. 5 shows the automatic release lock device of the body when the magazine is removed. Pressing 68-button moves 28 leftward through 31 and 304 is released from 28 and the film magazine can now be removed. 97-lock-lever pushed by the tip of 304 is returned by 99-spring, and a hook at the tip of 97 interlocks with 28. The other tip of 28 goes beneath 148 and

Prevents the pressing of 147-release-button.

Fig. 6 shows an automatic release lock device when the lens is removed. When 5-lens-mount-ring is turned counterclockwise for detaching the lens, the grooved section of 5 (shown by the dotted line in Fig.6 This section counterfaces with 195 in the lens attached position.) goes out from its regular position. Thus, 195's rightward movement through 141 and 263 is locked by 5, when 147 is pushed. Therefore, the movement of 147-release-button is locked, as 141 and 131 are locked. Whenever the lens is attached on the body, and 5 is turned clockwise to fasten the lens, the grooved section of 5 counterfaces with 195, thus making possible the release of 147-button.

The automatic lock mechanism with which the lens and the magazine cannot be removed after the shutter is released is explained as follows. As shown in Fig. 4, as 200-gear turns clockwise, 219-signal-post turns together and releases 218 from its hold. 218 returns to its original position by 246 and is held in the position. The other tip of 218 goes into beneath 31 and prevents the movement of 31, thus preventing the film magazine from the detachment. The third tip of 218 interlocks with 215 and holds it in the position, thus locking the 215 movement by the work of 227-button. Since 213 and 227 couple to 215 and 211, the tip of 213 stays in the groove of 5-ring. Thus, the rotation of 5 is limited within the groove. As 5 should be turned farther for detaching the lens, the lens cannot be detached in such a situation as above.

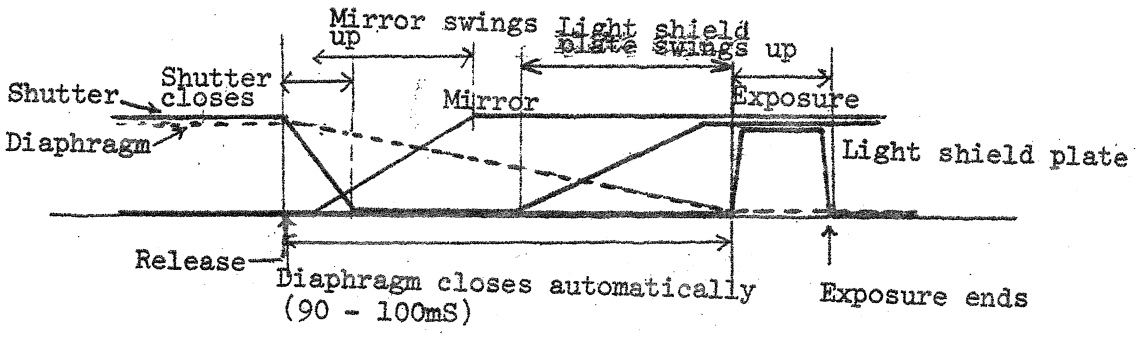
5. Multiple Exposure (Fig. 2)

When you slide the multi-exposure button from "N" to "D", 108-gear on the body turns clockwise on the same axle of 106-gear and frees itself from 108 on the film magazine and is locked in the position. Thus, the winding is not transferred to 341-take-up-spool-gear and the shutter cocking, the mirror and light shield plate functions proceed as usual.

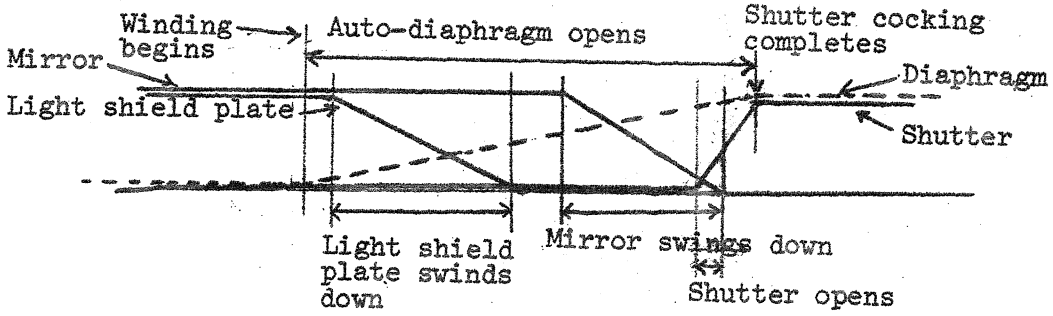
Releasing the multiple exposure can be done only by pushing the lock button-this turns 111-lever counterclockwise by the work of 185, and 108-gear on the body meshes again with 108 on the film magazine.

6. Sequence of Shutter, Diaphragm, Mirror, and Light Shield Functions

1) Releasing



2) Winding



Part-II Adjustments

1. Main Driving Shaft

1-1 Engagement between 124 and 460

The accurate engagement is vital for transferring the driving angle of the main shaft to 460 at the time of winding and shutter release. If the meshing is too tight, the gears cannot turn smoothly, and if it is too loose, not only the movement cannot be transferred but any functional troubles may occur. As the distance between the two gears is apt to be a little large, the following adjustment is recommended.

Fig.A Measurement of the Hole Diameter of 1-Body

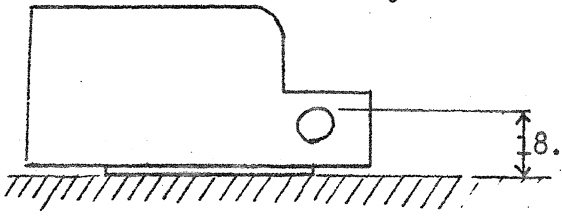
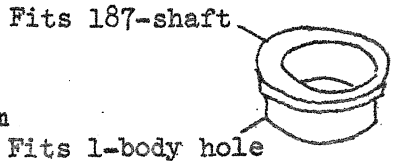


Fig.B 188-Special-Part



1) As shown in Fig. A, place 1-body on a flat plane with 4-bayonette ring facing downward. Insert a 10mmφ steel stick into the hole of 1-body and measure the height that should be more than 18.87mm.

2) If the height is less than 18.87mm, apply 188-special-part into the hole for adjustment, as shown in Fig. B. As 188-Special has an eccentric hole, position and fasten 188 as Fig. C shows. In this position the center of ϕ60 comes to the closest distance to the center of 188. To avoid the rotation of 188 in the hole of 1-body, fix 188 by applying thin wedges upon it from the flange surfaces of the hole as shown in Fig. D. Then, apply bonding agents.

Fig.C Attachment of 188-Special

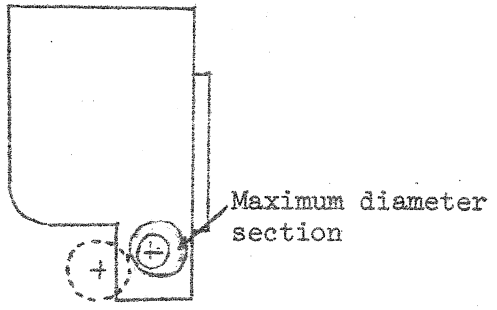
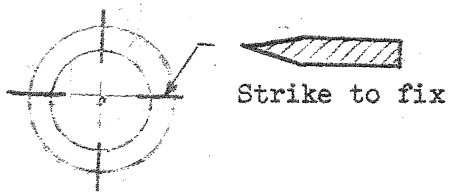


Fig.D Fixing of 188-Special



3) When the gear meshing is too shallow, check if 188 is fixed in the correct position. If so, do the adjustment above.

1-2 Main Drive Shaft Function (Fig. 1 and 7)

Pay your special attention to the meshing between 189 and 75. The correct function of 187 almost entirely depends upon the meshing.

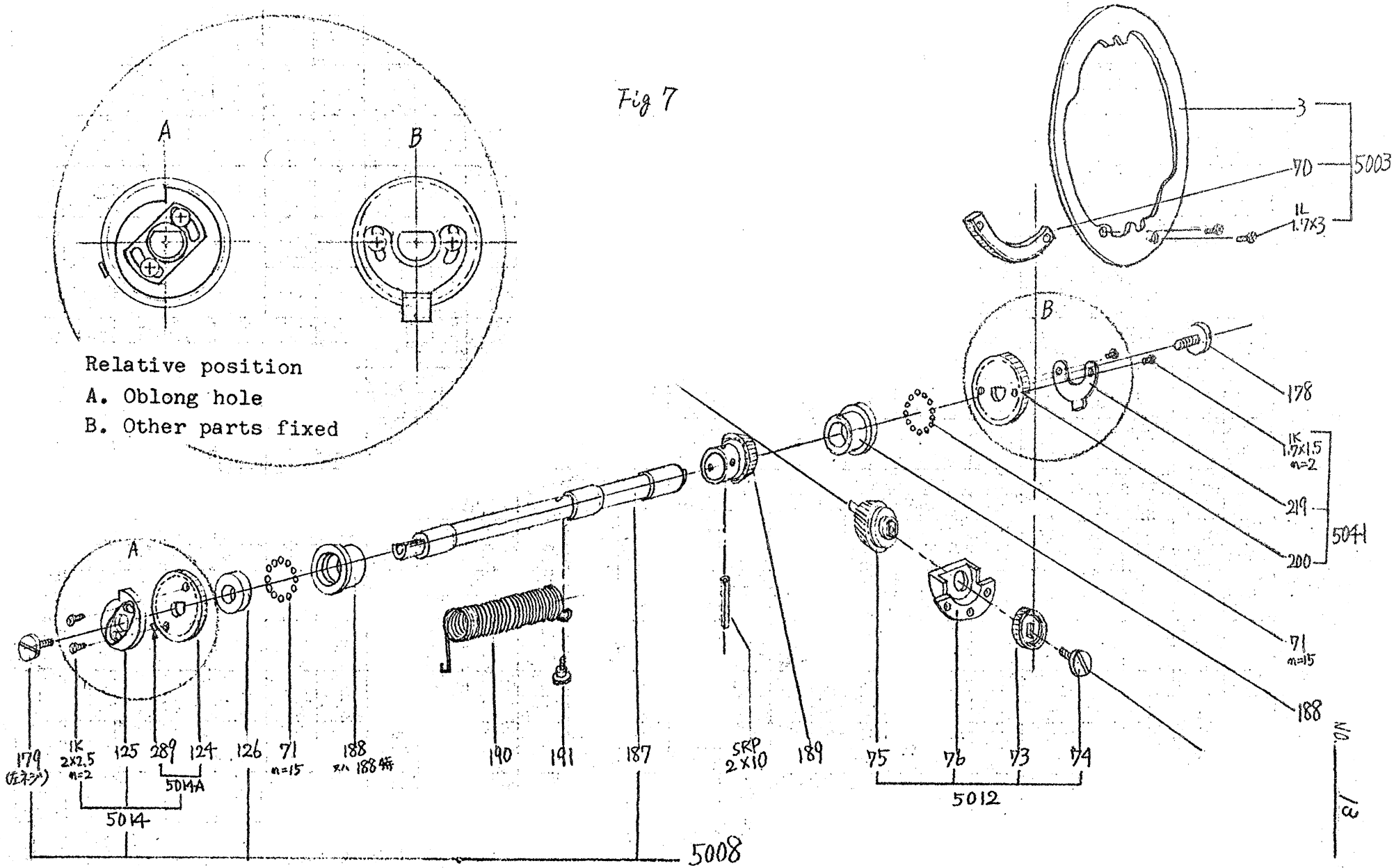
Operation Procedure: 1--188--71--5008--190--189--71--5041--178--
Adjustment-1--Adjustment-2--SRP. 2x10--191

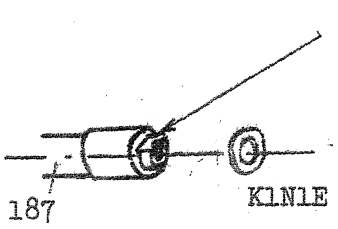
Adjustment-1: Slack of 187

*The slack of 187 to the thrusting direction should be less than 0.1mm.
*If the slack surpasses the limit, insert 123-washer beneath 188 on the left side of the body.
*If the slack is too small, replace 123 with the trimmed KINIE 377-washer. See the figure.

Fig 7

Relative position
A. Oblong hole
B. Other parts fixed





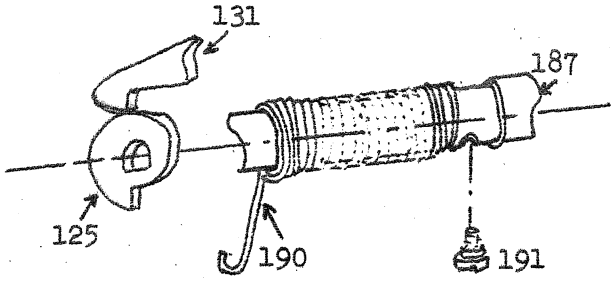
Adjustment-2: Meshing between 189 and 75

Fix tentatively 189 and 75 with two 1K2x3. Then, drill a 2.1mmø hole on 187 for accepting 189. Knock SRP2x10 into it.

*If the meshing is too tight, the unsmooth turn will be resulted. On the contrary, the meshing is too loose, the incorrect-angle transference will be resulted. The clearance of the two gears should be 0.1--0.5mm of pitch circles.

*Set two 1K2x3-screws in the opposite direction. Be careful to set 189 correctly vertical to 187-gear.

*Remove without fail two 1K2x3-screws after knocking SRP2x10.



1-3 Tensioning of 190-Main-Drive-Coil-Spring

1) Hooking of Spring:

As the figure above shows, 125 is to be directed downward to the camera body. Fix 190-spring at the lower side of 187 by using 191.

2) Number of Turns of Spring

The number of turns should be six and a half in the wound-up situation and five and a half turns in the shutter released situation.

1-4 Positioning of 124-Gear and 5010C-Gear-Sub. Assy. (Fig. 2)

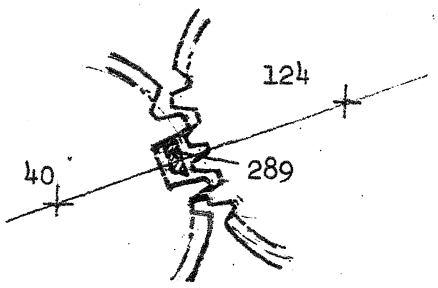
Two thing are important here--one is the timing at which 116A goes out of meshing with 121 after the reverse turn of 125-stop-cam has been prevented by 131 at the end of winding/shutter cocking, and the other is the positioning of the double-sized tooth of 124 when 125 and 131 are engaged.

Operation Procedure: 120--5010C--104--139--3K2x3--7017--132--136A--Adjustment-1--5015B--122--Adjustment-2

Adjustment-1: Positioning of 124

1) Apply the standard film magazine to the body. Match 289 on the two teeth of 124 to the double-sized notch of 460 of the standard film magazine.

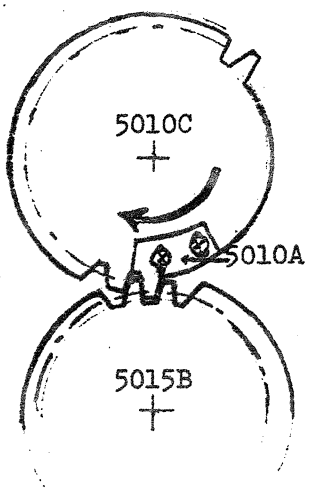
*If the two do not fit well, file the edges of 289 slightly. (See the figure)

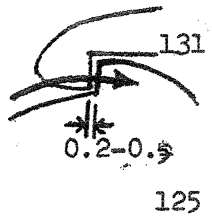


2) Interlock 131 of 7017 with 125.

3) Unscrew two 1K2x2.5-screws of 124 and 125. Place 289 so that 289 is slightly turned clockwise from the notch of 460, by manupilating 124 and 125. Then, screw them at the fixed position. Cement them with boding agents such as polycyano-acrylate chemical.

Adjustment-2: Positioning of 5010C-Gear-Sub. Assy.



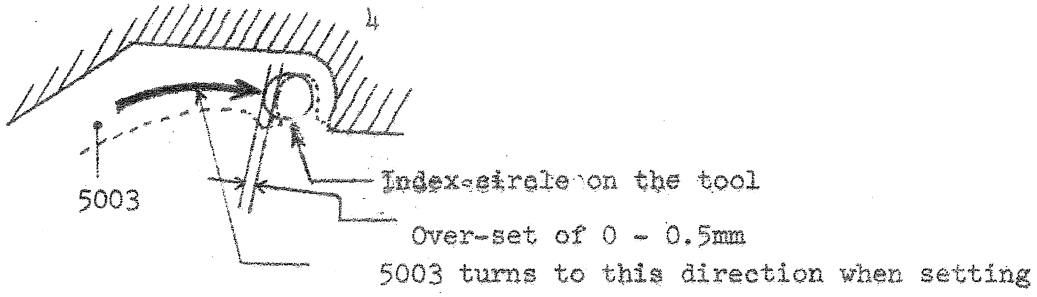


As to explanations see the next page.

1) Adjust 5010A along 5010C so that 131 interlocks with 125 just before 5010A disengages with 5015B at the end of winding. (See Fig. A and B above)
2) The surpassing of 125 over 131 should be within 0.2--0.5mm. (Fig. B)
3) After the correct position is determined, fix 5010A fast with bonding agents.

1-5 Strokes of Shutter Setting and Releasing (Fig. 2 and 7)
(Positioning of 5003)

1) Use a tool to position 5003. The tool, also used for positioning 136, is the same one used for positioning 136 on the earlier KOWA SIX (KINIB).
2) Criteria of Adjustment: Apply the tool to 4 and cock the shutter slowly. As shown in the figure, the coupling part of 5003 should once pass over the index circle of the tool by 0--0.5mm, and when 5003 returns, the coupling section should coincide with the index.



3) Adjustment:

a) As the relative position between 5003 and 70 is slightly unstable because of the setting allowance of 3, the relative position between 70 and the notch section of 3 coupled to 17 also becomes slightly unstable. So, replace 5003 with new one to satisfy the above criteria when 125 and 131 are engaged together.
b) If the adequate 5003 cannot be found or the accidental disengagement of 189 from 75 occurs, it is possible to readjust the set position, if any, as well as to readjust the engagement of 189 and 75.
Remove SRP2x10 to free 189 and cock the shutter. Position 5003 to match the set position and mesh 189 with 75. Fix the situation tentatively with two 1K2x3-screws. Release slowly by applying friction on 5003 with your

fingers and wind up again. If you find the previous criteria are satisfied, drill a 2.1mmø hole and fix 189 by knocking SRP2x10 in it.

Cautions:

1) As to meshing 189 with 75, see 1-2 Adjustment-2.
2) Drilling should be made newly in the place different, say by 45 degree, from the first hole.

4) Criteria for the Released Situation:

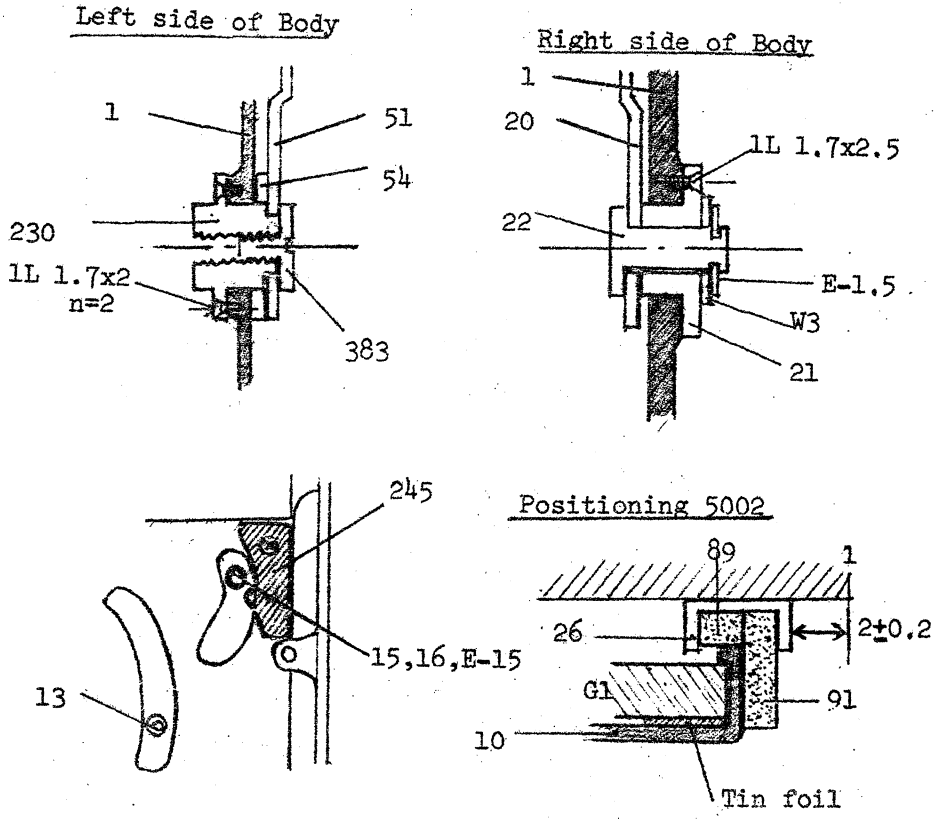
a) When the shutter is released, the coupling part (notch) of 5003 should match the index circle of the tool.

B) The adjustment of the released situation should be made by displacing 138 which works as a stopper to 127 of 5015B. After the suitable position is determined, fix 138 with 3K2x3-screw and place 139 tightly on 148 and fix it with two 3K2x3-screws. Cement the screws with bonding agents.

2. Reflex Mirror (Fig. 4)

2-1 Function of 5036B:

Operational Procedure: 230-1L1.7x2--5036B--54--383-- 21--1L1.7x2.5--22--W3--E-1.5--16-E-1.5--Adjustment-1--5002--Adjustment-2



Adjustment-1: Function of 5036B

*Build 5036B into the body and fix it inobliquely, especially when viewed from behind.

*Then, move 5036B by holding 13 and check if it moves without any friction, especially check if 16 moves smoothly along the groove of 1 and also along 245.

Adjustment-2: Setting of 5002

*Attach 5002-light-shield-plate-frame-sub. assy. inside the body correctly to match 5036B in the up-position. As shown in the figure, be careful to attach the rear end of 26 of 5002 which should be receded by 2mm or so from the rear of the body. It is desirable that 91 of 5002 comes in soft contact with the rear edge of 10 when 5036B is in its up-position.

*After 5002 has been built in, 5036B will get slight frictions because 10 is in contact with 91. During the swing-up, 10 should not run over 91. Instead, 10 should come inside 91 and push 91.

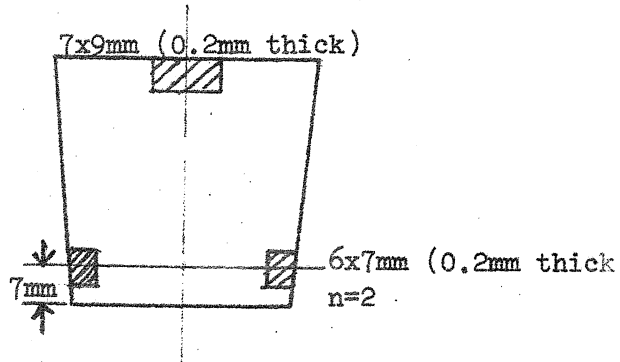
*On cementing 5002, pay your special attention to bond 5002 tightly with the body for eliminating light leak. After bonding, put the body upside down, press 5002 with 5036B by placing a weight upon it, and keep it for more than 12 hours.

2-2 Bonding Reflex Mirror:

Operation Procedure: G1--Tin Foil--18--1R1.4x1.5--19--1R1.4x1.5

1) As shown in the figure at right, paste three tips of tin foil on rear of the reflex mirror. Be careful to match the edges of foil with the mirror edges.

2) Raise the rim of 10 of 5036B not to apply pressure on the mirror too much.



3) Paste bonding agents onto the tin foil tips and place the mirror on 10 of 5036B correctly.

4) Fix 18 and 19 with 1K1.4x1.5-screws, and, if necessary, apply washers

(0.1--0.2mm thick) to get suitable pressure on the mirror.

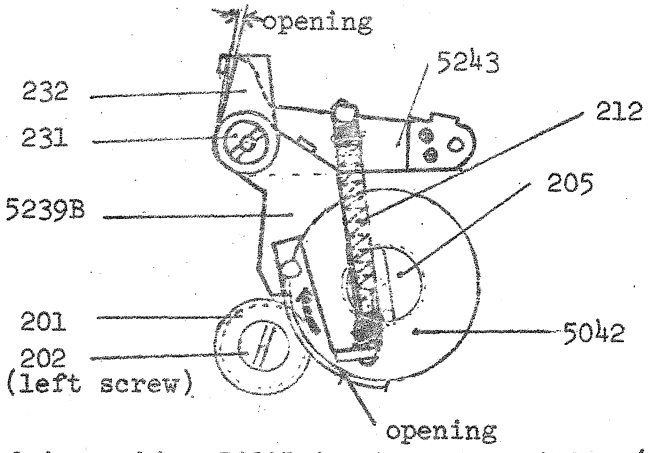
5) Lay it for drying for more than 12 hours.

2-3 Sequence of Reflex Mirror Function (Fig. 4)
(Adjustment of Mirror Movement)

Operation Procedure: 5042--205--5243--232--5239B-231--212--209--201--202--Adjustment-1--Adjustment-2--Adjustment-3

Adjustment-1: Sequence of Mirror Function

See explanations in 1-6. The farther proceeds 5042 in a clockwise turn before the interaction takes place, the more functional interval is allowed between the mirror and light shield plate movements. Therefore, adjust the meshing of 201 and 5042 to satisfy the following conditions and to let 5042 come to its utmost clockwise turn position.



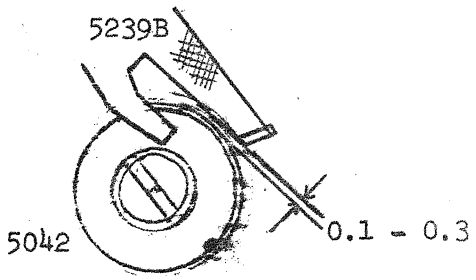
Conditions:

a) Pin of 5042 is pushing 5039B in the set position (when the wind-up is done).

b) 5243 has a slight gap with 5239B at the end of winding because the reflex mirror is stopped by the stopper.

c) The rim (a cam section) of 5042 should not in contract with 5239B.

Adjustment-2: Over-swing of Reflex Mirror



If 5239B is pushed up exceedingly, the rotation of 5042 will be overloaded after the reflex mirror has swung up. To avoid this, there should be a slight gap between 5042 and 5239B. But, if the gap is too big, bend 5239B by beating the section (hatched in the figure at right) with a hammer.

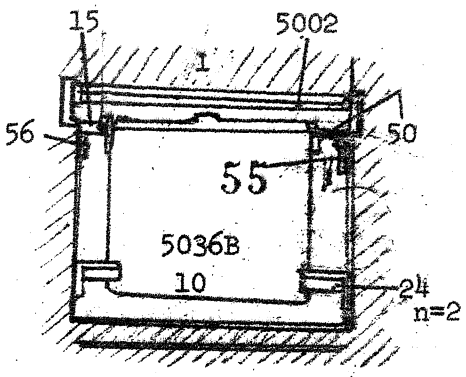
Adjustment-3: Angle of Reflex Mirror

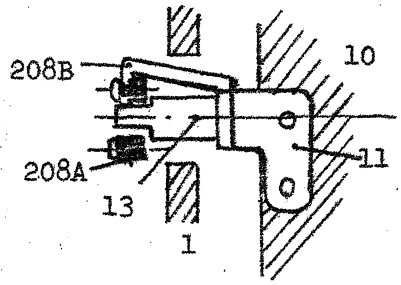
1) Take off 212-spring in the wound-up position of the camera and pull down 5036B at the angle of 45°. Adjust the four mirror receivers, two 24, 55, and 56 to hit the 5036B, maintaining the conditions adjusted in 2-1.

a) The 15 and 50 of 5036B should be rivetted without any declination.

b) The 24 should maintain a 90° angle without any distortion.

c) The angle of 45° should be attained by adjusting 55 and 56. If necessary, 56 may be filed at the part contacting with 15.





2) Let the reflex mirror down by its own weight and make contact with the receivers. Adjust by displacing and bending 11 of 5036B so that the tip of 208B of 5243 softly contacts with 11 of 5036B. Then, hook 212-spring and pull down 5036B slowly by putting your finger of 52 until 5036B is stopped. Check if 208B exerts any hinderance on 5036B's movement.

3) Get a correct angle of 45°. Ascertain that 5036B is set correctly and without any declination. Also confirm that the gap between 5243 and 5239B is adequate.

3. Air Damper

In handling the built-in air damper, pay your utmost attention, as previously mentioned in 1-3.

The camera is adjusted at our factory to get the working speeds for release of:

62--68mS (Body only)

90--100mS (Body with film magazine)

So, if any irregularity of speeds is found after use, it is not allowable to readjust it by screwing 253 for the air damper without any definite reasons.

1) If the releasing speed is too fast:

Check if any screws and axles are loosened in the shutter release and related sections. If no loosening is found, adjust the damping speed by screwing 253.

2) If the releasing speed is too slow or the ~~release work stops~~:

If, after checking the related parts, it is concluded that the air damper causes the trouble, follow the procedure below.

Operation Procedure: '231--5239B-261--258--1[illegible]4

a) Remove the air damper by following the procedure above.
Examine if any burnt or melting is found on 251 and inside 249 of 5040.
b) If the burnt or melting is slight, wipe it out with thinner liquid and polish it several times with a soft cloth with polisher.
c) If the melting and burnt are heavy, replace 5040 with new one.
3) Fixing and Adjustment:

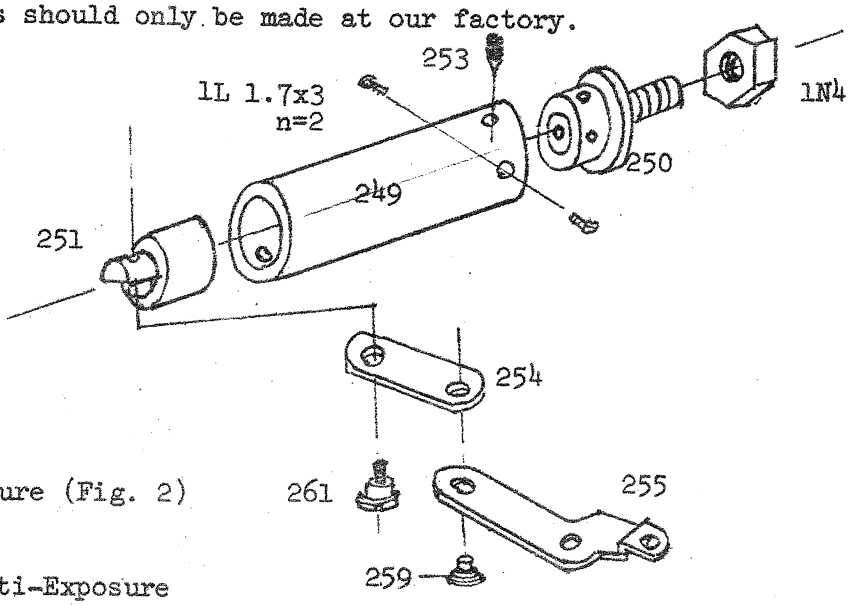
*Cautions for Attaching:

a) Fix 5040 onto 5049 without any declination or separation.
b) 258 should press the cylinder by an appropriate pressure.
c) After attaching, move the piston by working 5038 of 5040 without engaging it with 5239B and check. If there is no friction or unsmoothness, engage it to 5239B.

*Adjustment of Damper Speed:

a) If you have no speed measuring apparatus at hand, use a well-functioning body as a standard for comparison. In this case, judge by sound and feeling.
b) It is recommendable to start adjustment from the most screwed-up potion of 253 and then to loosen the screw gradually. DO NOT release the shutter in the most loosened situation of the air damper, especially when the magazine is attached on the body.
c) Putting bonding agents to 253 should be made prior to the speed adjustment, otherwise bonding agents may permeate into the cylinder and damage the already adjusted piston function. Dry bonding agents before adjusting the damper speed.

4) Caution: DO NOT disassembly the air damper or adjust the damper speed higher than 80mS for using the camera in the coldness or on high mountains. These adjustments should only be made at our factory.



4. Multiple Exposure (Fig. 2)

1) Setting of Multi-Exposure

Pushing 185-button of 5025 disengages 180 from 182 and the lock on 183 is released at the same time. When 183 is slid from "N" to "D" position, 180 interlocks again with 182 and 183 is locked at "D" position. As the tip of 180 catches the left side of 11, 180 moves 108-gear of the body to disengage 108-gear with 108-gear of the film magazine and results in no transaction to 341, though the shutter cocking or other relative functions are made. The switch from "N" to "D" can be done before or after the winding. But switching after the first exposure in the multiple exposure is more desirable for smoother and lighter winding.

2) Releasing of Multi-Exposure

Pushing 185 releases 180 from 182. 108 of the body is returned by 135-spring and meshes with 108-gear of the film magazine. This switch can also be made before or after the winding. However, it is more desirable to push the button after winding because the switching before the wind causes the unnecessary multi-exposure.

3) Adjustment

As the adjustment is rather simple, pay your attention only to the following points.

a) On covering the body with 5025, make sure that 180 is interlocked properly with 177.

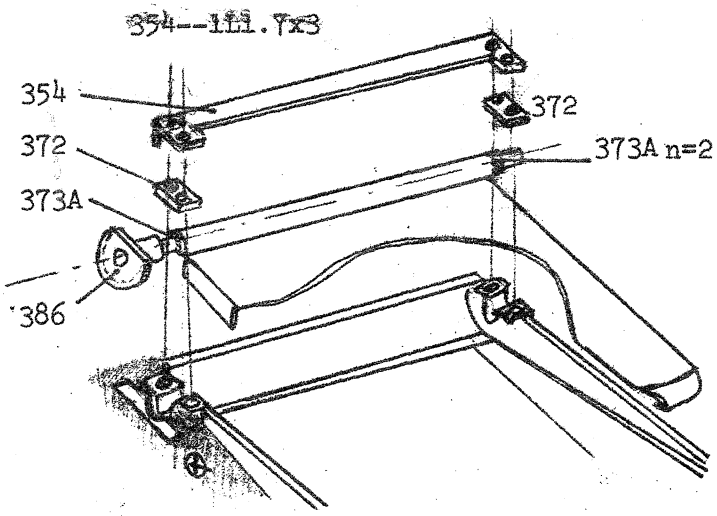
b) In "N" position, two 108-gears should not mesh too tightly. Otherwide, it will not only cause unsmooth turn of gears but also wear out the gears.

c) Check 111-clutch-lever's function. The inproper positioning of 109 may cause no return of 111 by 135-spring.

5. Light Shield Plate (Fig. 3)

5-1 Building-up and adjustment

Operation Procedure: 5078--373A--Adjustment-1--372--Adjustment-2--354--1L1.7x3



Adjustment-1

To give an adequate clearance between 5078 and 5075, the adjustment is made by inserting 373A-washers (0.4mm thick) or 373B-washers (0.2mm thick). 386 should not be in contact with a slit on the body. Insert one 373A-washer at left and two 373A-washers at right of the 5078/5057 gap and check the clearance. If it is inclined to left, take off one 373A-washer from the right side and insert one 373B-washer on each side. It is recommendable to insert a partially-cut washer to the left side.

Adjustment-2: Function of 5078

Place 372 with its round surface facing downward and retain it with 354 and 1L1.7x3. If the bottom face of 5078 does not come in contact with 5057, cut a groove on the right-side 372 at the part of contact for lessening the over-pressure on the axle. Virtually all adjustments of gaps and correct functions can be made in this way. Cutting a groove on 372 on left

side is not recommendable because a slack on this part may result in the malfunctioning of 474. DO NOT use a curved or deformed 5078.

5-2 Meshing between 5293B and 5095B

The angle of meshing between 5293B and 5095B determines the functional sequence of the light shield plate in relation with the functions of the shutter and reflex mirror.

Operation Procedure: 5293B--462--467--534A--5095B--Adjustment

Fig. A

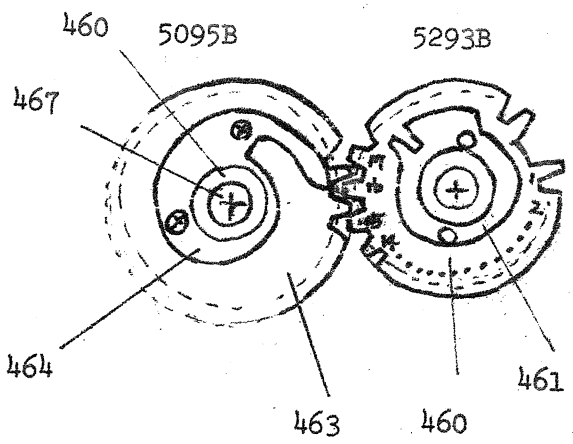
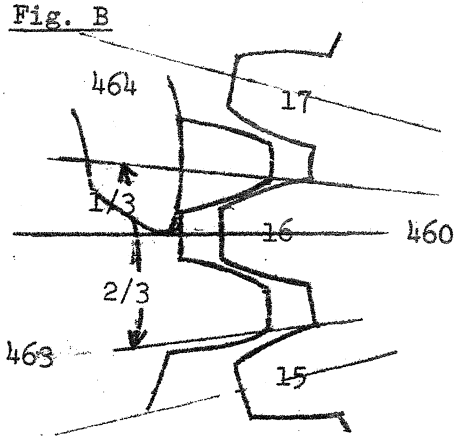


Fig. B



Adjustment

1) Insert 534A-washer (0.3mm thick) into 467 and then engage 5095B. 467 should be slightly higher than the surface of 469. If not, substitute 534A (0.3mm thick) with 534B (0.2mm thick).

2) As shown in Fig. A, the 16th tooth, as counted from the tooth next to the notched section, of 5293B should be in engagement with the end of 464-cam of 5095B. The allowance ranges from one-third of the tooth width toward the side of the 17th tooth to two-third width toward the 15th tooth, as shown in Fig. B.

If the engagement is out the allowance toward the 15th tooth, a collision will take place at the end of winding because 472 of 5297B hits the bottom of the bosom of 464-cam. If the out-of-allowance occurs toward the side of the 17th tooth, the functional sequence of the light shield plate will overlap on that of the reflex mirror, thus resulting

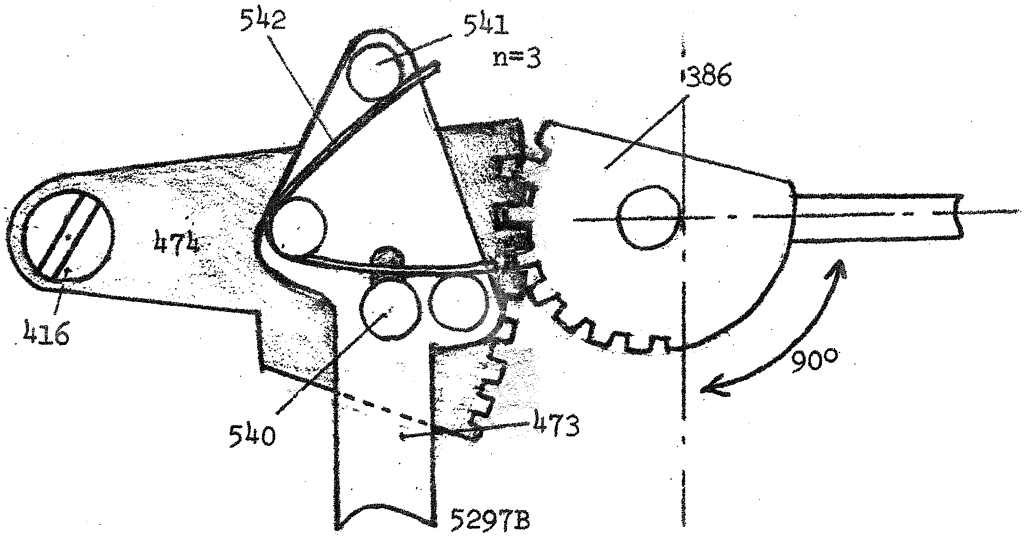
in the light leak.

5-3 Fixing 5297B and Adjusting Light Shield Function (Fig. 3)

Operation Procedure: 455--5297B--143--Adjustment-1--416--490--Adjustment-2

Adjustment-1: Adjusting 542 of 5297B and 386 of 5078

1) Pull down the light shield plate to the picture frame. Engage 476, which is inserted into 472 of 5297B, with the minimum diameter section of 464 of 5095B. While keeping this situation, pull 473 up and intermesh 542 with 386 so that the tip of 473 is almost in contact with the brim of the spool axle hole.
2) If 473 touches the brim, file its edge or the spool axle brim slightly.
3) Make a little gap between 472 and 463. If 472 is pushed too upward, 472 may be out of contact with the cam. So, paste grease on the contact surface of the cam.
4) The section of 434 connected with 471 should have a little space from the boss of the body dicast. If the gap is too large, it may contact tightly with the frame counter. So, the space should be made as small as possible.



Adjustment-2: Adjustment of Angle and Function of Light Shield Plate

473 and 474 are connected with 540-pin at the slit of 473. 540 is pressed to the bottom end of the slit by 542-spring with a little clearance, because of the friction-free movements of 540,542, and 474.

By this buffer action, if the upward movements of the light shield plate is topped by the reflex mirror at the end of the swing-up action, 473 is allowed to return to its original position by leaving behind both 474 and 540 in the up-position.

Likewise, 471 and 473 are connected through a lit of 473 and 434 of 471 is pressed to the bottom end of the slit by 470-pin. When 472 is embraced by 464-cam at the end of winding, 471 is permitted to turn clockwise by pushing 490 after the light shield plate has been stopped by the aperture frame. This device keeps the mechanism from an accidental pressure by hand against the light shield plate in loading film.

1) Positioning of Swing-up Angle

Turn 460-gear until 476 comes in contact with the maximum diameter section of 464. (See Fig. 3) Set the light shield plate horizontal. Be careful not to apply some force on the plate that may cause a deformation. After the adjustment, turn 464 clockwise and swing down the light shield plate. It is desirable that 464 presses down 476 slightly or is in contact with 476 when 476 is embraced by 464. Unless the two conditions above are satisfied at the same time, prefer the horizontal adjustment of the light shield plate.

2) If the light shield plate does not swing up fully with the reflex mirror and 464 does not press down 476, it seems that meshing between 474 and 386 is insufficient, resulting in the insufficient stroke of the light shield plate. In this case, recheck Adjustment-2 of 2-5 1).

3) Function of Light Shield Plate

a) Turn 460-gear clockwise and check if the light shield plate functions smoothly, compared with the standard camera.

b) Turn the body upside down and turn 460 counterclockwise slowly. Check if the light shield plate swings down as the gear turns.

c) If any irregularity is found in the above checks, readjust the items in 1) of 2-5 or in 3) of 2-5.

6. Frame Counter (Fig. 2)

NO. 27

Fig 8

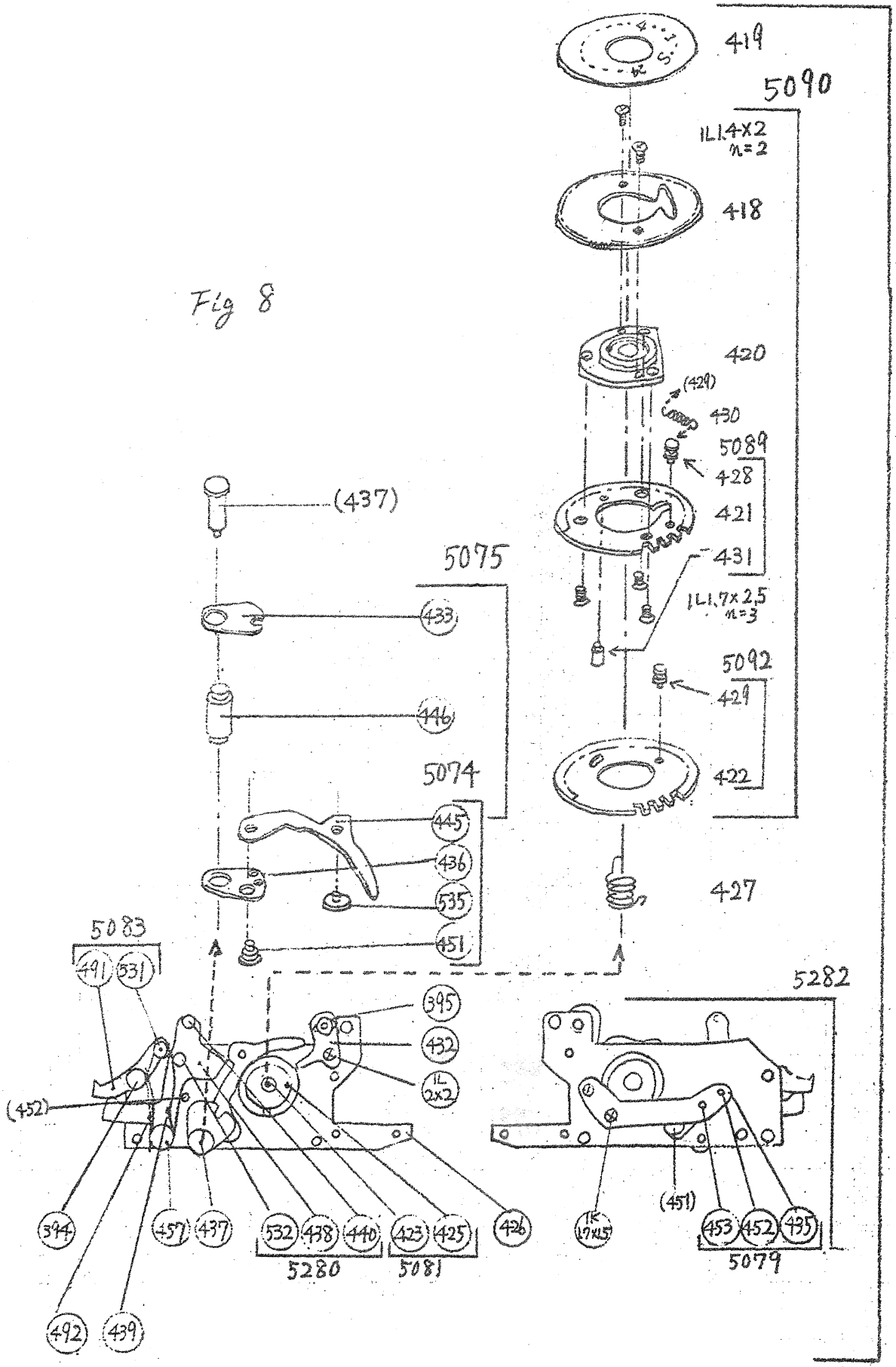
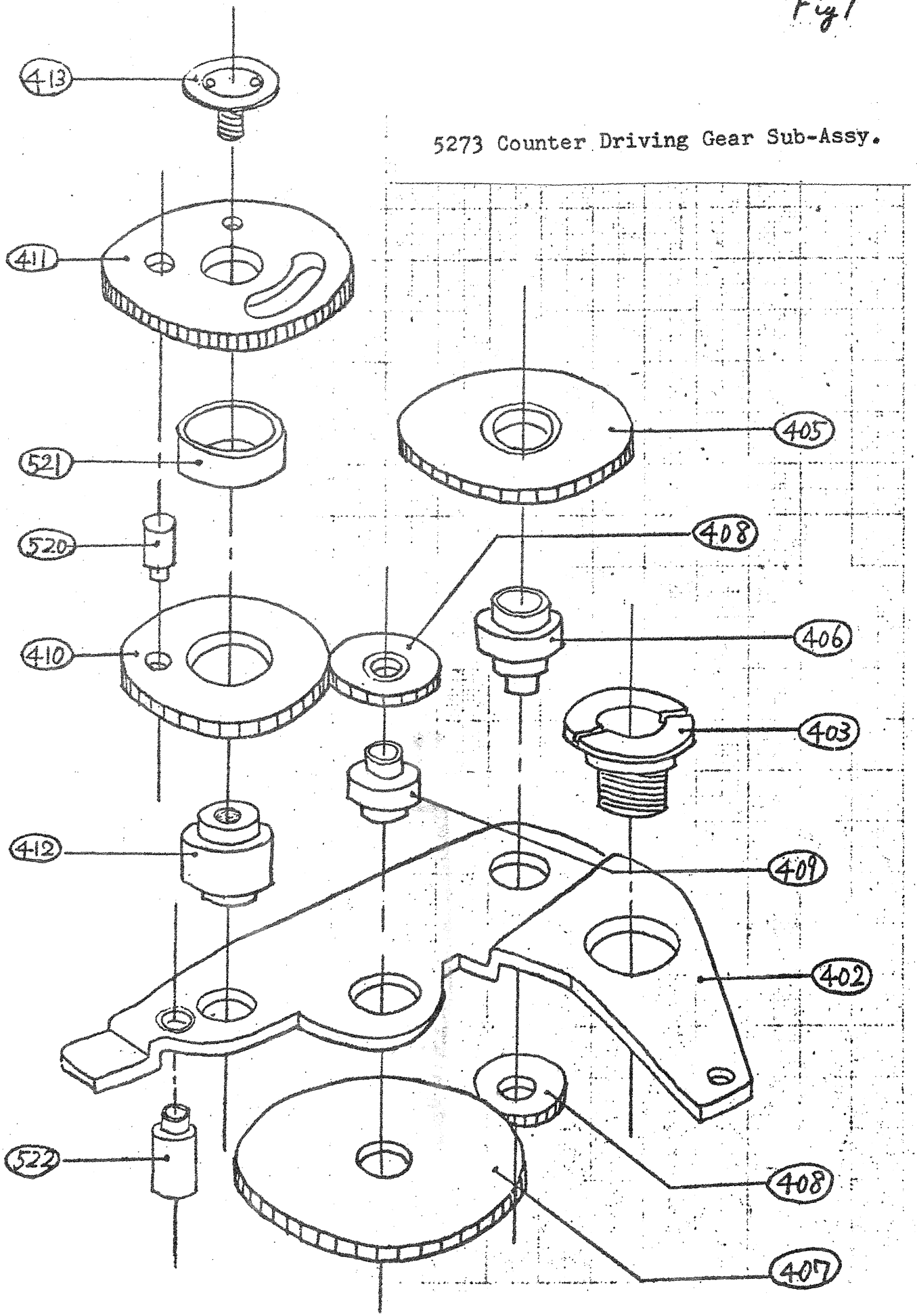

419
5090
IL1.4x2 n=2
418
420
(429)
430
5089
428
421
431
IL1.7x2.5 n=3
5092
429
422
427
5291
(437)
5075
433
446
5074
445
436
535
451
5083
491
531
395
432
IL 2x2
(452)
394
457
437
532
438
440
423
425
426
5280
5081
492
439
5282
IL 1.7x1.5
(451)
453
452
435
5079

Fig 9

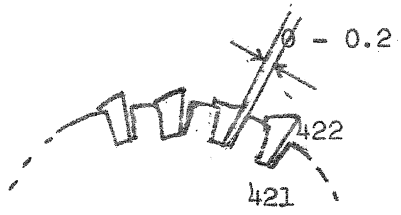
5273 Counter Driving Gear Sub-Assy.



The SUPER 66's frame counter system not only indicates the number of exposures but also regulates the film advance such as the stoppage of winding and film spacing. Thus, the whole mechanism is complicated and you must carefully examine and adjust 5291 and 5273.

6-1 Prechecking and Adjustment

1) Check if 491-claw functions smoothly without any friction.
2) Check if 438-dividing-lever moves smoothly by its own weight and interlocks with the grooves of 421 only by the work of 439-spring. Then, check if 438 does not fluctuate and keeps interlocked with 491 and 445. If any flucturation takes place, insert a small driver (1mmø, minus type) beneath the center of 438 and bend it at the section where 440 is rivetted.
3) Move 433 by pushing 452 to liberate 453 from the click-stop holes beneath 436. Check if the click-stops work accurately with the clicking sound. It is allowable that 439's movement is rather heavy.
4) Rivetting of 433 and 436 should be tight and should not be displaced by a slight force.
5) The movement of 445 should be smooth and it should move by its own weight. Any friction or unsmoothness in moving 422 should be eliminated.
6) The 421 and 422 should be put together in complete flatness. If 422 is turned, it should return correctly to its original position by the force of 430.
7) The allowance of the gap of teeth between 421 and 422 should be 0--0.2mm. If this is not satisfiable, adjust the hole of 422 by filing for accepting 431.



8) The 427-spring should be tensioned until 431 reaches 432 after one full turn. 431 should be surely stopped by 432 and, if 5090 is driven back by 427 after one turn or even if 421 fluctuates during its function, 431 and 432 should not be disengaged.
9) 5090 should be turned smoothly without any friction, unsmoothness, or flucturation when it is liberated from 438

10) Set 453 at the "12-exposure" click-stop of 436 and turn 5090 clockwise, while 438 is pressed against 5090 by 439. Check if 438 interlocks surely with each tooth of 421. At the 13th tooth, 438 should be prevented from interlocking by the work of 445. 438 will resume interlocking with the teeth around the 23th tooth. This is not a trouble.

6-2 5273-Frame-Counter-Gear

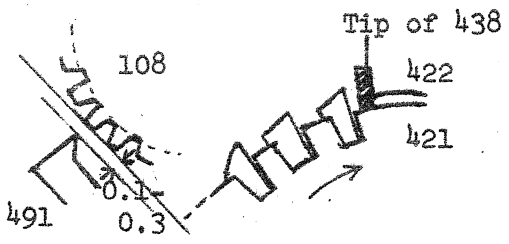
1) Turn 405 and check if the whole system functions well.
2) If 405 fluctuates with 408 of 5270 when 5273 is built in. If so, this may cause a trouble.
3) If 407 fluctuates exceedingly, it may cause a faulty disengagement with 408.

6-3 Assembly and Adjustment of 5291

Operation Procedure : 414--401--415--5291--1L2x3--1L2x2.5--439--492--Adjustment

Adjustment

1) Check if 414 functions well before 415 is hooked.
2) Check if 491 and 438 function well. Especially, 438 should be moved correctly only by the work of 439. 440 should move smoothly without making frictions with a square hole in the body.
3) As to the function suquence of 438 and 491, it is desirable that the edge of the claw of 491 comes close to edges of the teeth of 108 with a gap of 0.1--0.3mm, (see the figure,) when the counter turns clockwise and 438's tip drops into the tooth bottom. If the situation is not satisfying, adjust 5291 within the hole allowance or file the tip of the section of 438 which is in contact with 491.

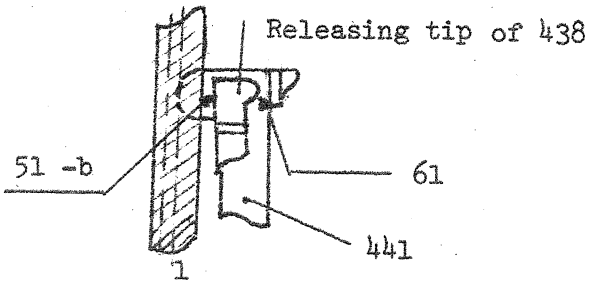


4) Open the back cover and check if the tip of 438 is certainly out of the outer circle of 422. Also, check if it is out of contact with 445 when the counter is set at the "12-exposure" and it goes beyond the 13th exposure.
5) In Fig. 2, the tip of 438 should be free from 422 when you close the back cover and release the shutter. If the gap is insufficient, bend slightly 157 to increase a functional range of 133. In this case, pay your attention to the following items:

a) The contact between 157 and 128 of 133 should be maintained all the time.

b) 157 should be turned freely without collision to the boss of the body which receives 101 of 5221. (This may cause a release error.)

c) The lock releasing part of 438 should not be hindered by 301 of the body. (See the figura at right.)



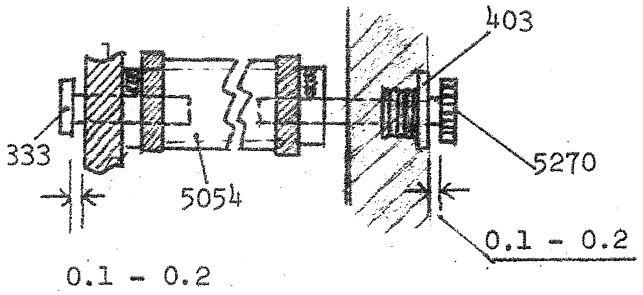
6) When closing the back cover, the tip of 438 drops into the tooth of 421. Check if there is a certain gap between 438 and the risen section of 441 and if 491 surely interlocks with 108-gear.
7) Other: All adjustments of 6-1 should be done completely.

6-4 5273-Frame-Counter-Gear

Operation Procedure: 5273--5054--333--5270--Adjustment-1--454--1K1.7x1.5 --156--Adjustment-2

Screw 403 onto 401 while paying an attention to the interlocking between 422 and 414

Adjustment-1

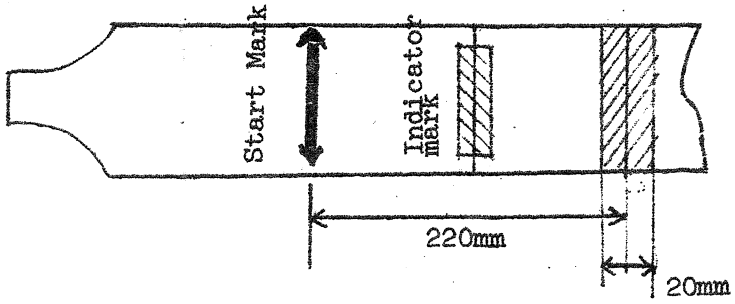


1) Adjust a slack of 5054-guide-roller. It is necessary that 5054 is supported with a clearance of 0.1--0.2mm, as shown in the figure above. Adjust 333 and 5054 for this purpose.
2) The clearance between 403 and 5270 should be 0.1--0.2mm when pressing 5054 to the extreme left.
3) The two previous adjustments are performed by screwing six US2x2-screws so that 5054 rolls well. The checking can be made with a visual inspection.

Adjustment-2

1) Close the back cover and adjust the 454 setting to get a maximum of the good interlocking between 418 and 411. Turn 5270 a little toward the film advance direction. Check if the meshing of 411- and 418-gears is a little shallow. The complete meshing is no good. This standard is only for the film start position. The two gears will intermesh completely after the first exposure. Again, check if 418 meshes with 411 fully until the end of 418's turn.
2) When opening the back cover, check if 411 is sure to be free from 418.

6-5 Film Start Position Adjustment



Prepare a test film and draw an indicator line at the point 220mm apart from the start marks of the film. Load film and align the start marks of film and the camera. Close the back cover and advance film until it stops. Release the shutter, and looking through the body from front, check if the upper section of the picture frame matches with the indicator line. (The allowance is plus/minus 10mm from the 220mm indicator line.) If not, adjust 432.

7. Film Magazine and Camera Body Couplings.

Fig. A

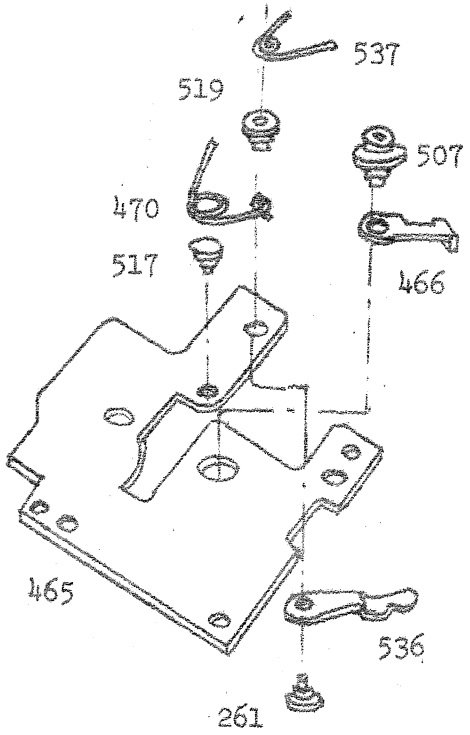


Fig. B

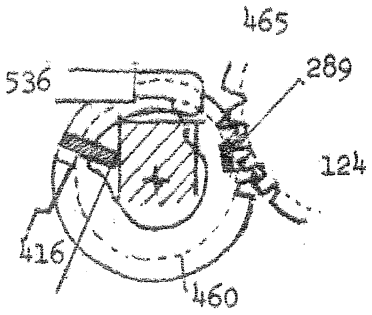
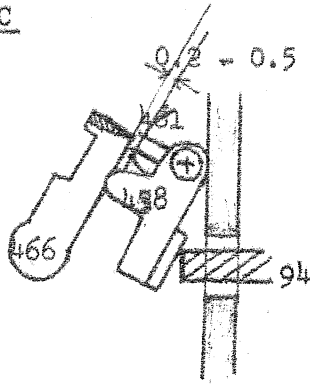


Fig.C



Adjustment

Adjust as follows by applying the standard tools.

1) See Fig. B. (The position of the notched section of 460-gear is set by 466 which drops into a groove of 461.) Adjust the position of the tip of the claw of 466 so that 460 interlocks with both 124 and 289 correctly when the body is connected to the magazine on the arrow direction.

2) When the body is connected completely with the film magazine, 94 on the body pushes 458 and 466 and liberates 466 from the groove of 461. The gap between 466 and 461 should be 0.2mm--0.5mm.

Adjust by bending the tip of 466 as shown in Fig. C. If the gap exceeds this limit, 466 may not interlock with 461 correctly in detaching the body. If so, the previous adjustment has not been performed accurately. If the gap is less than the limit, the shutter release button cannot be pressed down for release.

3) 536-lever has an important function of braking 460 by fixing the edge of the maximum diameter section of 461. Otherwise, the disengagement of 466 before 460 and 124 mesh together or the disengagement of 460 and 124 before 466 and 461 are engaged may cause a malfunction of 460. Bend the

7-1 Positioning and Connecting

On the film magazine attaching, the relaying parts of the magazine and the camera should be in the fixed position. No. special adjustments are required to the relaying parts, if the magazine or the body correctly matches with the standard body or the magazine (measuring tools).

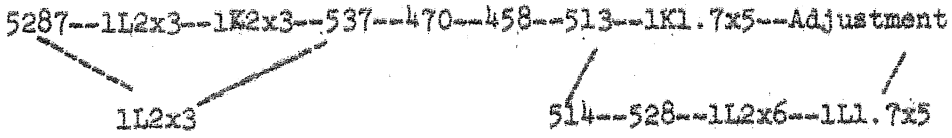
Following parts are provided for connection:

On left side, body.....	5047A(Attached with 1K2x2.5)
On right side, body	5047B(- ditto -)
On left side, magazine	5058A(- ditto -)
On right side, magazine ...	367B(Rivetted to the magazine)

7-2 Intermeshing between 5014A and 5293B (Fig. 3)

1) Attach 124 and 289 onto 5014A and adjust it by following the Adjustment-1 in 1-4.
2) Position 461 of 5293B, which decides the position of 460, by adjusting 5287.

Operation Procedure:

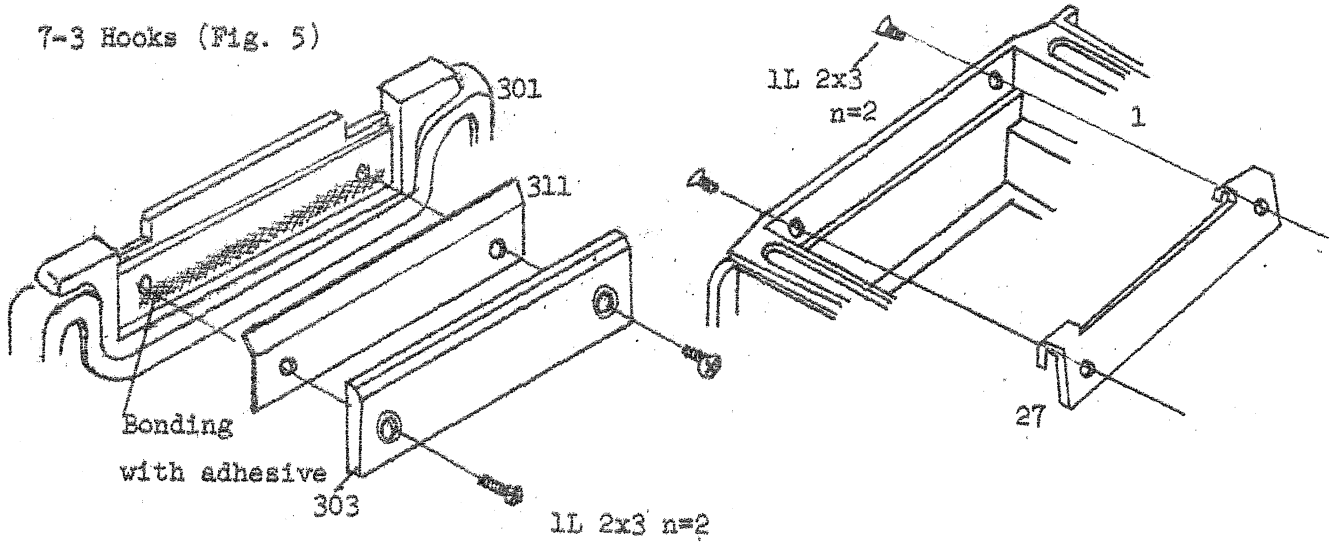


The lower row in the operation procedure diagram indicates the tentative procedure for attaching the standard tools. (1L2x3-screws are replaceable with one 1L2x3-screw and two 1K2x3-screws.)

5258 is partially modified for having large square holes at its right side and base. 550A is used on this modified 5285.

tip of 536, if necessary, and adjust it so that it does not hit the minumum diameter section of 461 and it is stopped correctly by 465. If 536 fluctuates, the disengagement from 361 and the irregular contact with 460 may result.

7-3 Hooks (Fig. 5)



1) 27-Hook-Plate

Fix 27-hook-plate onto the standard body. If the engagement is too tight, widen the loop a little larger. No special adjustments otherwise are necessary here.

2) 5004-Back-Locking-Plate and 304-Hock

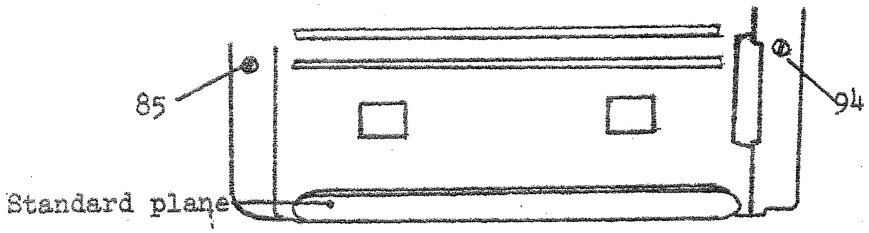
a) 5004-Back-Locking Plate

Attach the standard magazine onto the body. If a slack between 57--58 of 5004 and 304 of the standard magazine is found, insert a 53A-washer (0.1mm thick) or 53B-washer (0.05mm thick) beneath 28. Stick 53A or 53B to the body with bonding agents after checking.

b) 304-Hook

On attaching the magazine on the standard body, 5004 should interlock with the standard body deeply. If necessary, file the lined section shown in the figure at right. Be careful not to file exceedingly.

7-4 85- and 94-Screws



a) 85 is for releasing 5098-safety-lock-pin-sub. assy.
Adjust 85-screw to maintain the height of 2.85--3.10mm from the standard base plane as shown in the figure above. If too high, file the screw tip. If too low, apply a washer (KIE8B 222) with a thickness of 0.1mm

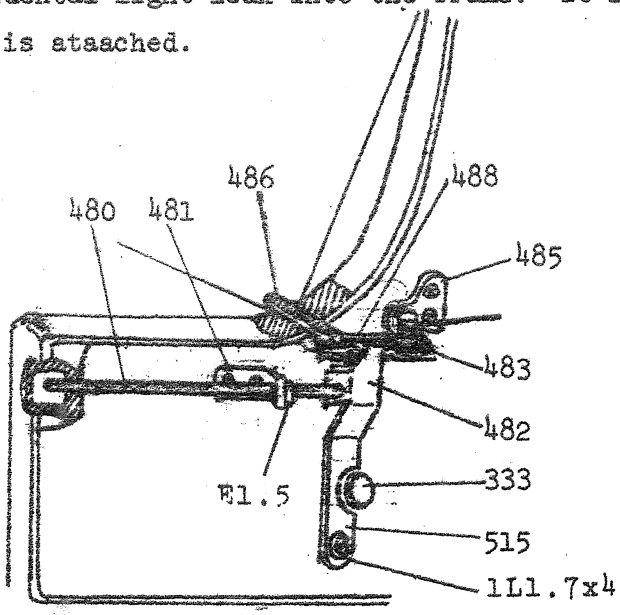
b) 94 serves to release 466 interferred by 458. Adjust 94 to maintain the height of 4.80--4.85mm from the base plane.

7-5 5098-Safety-Lock-Pin-Sub. Assy.

This device serves as a catch on the light shield plate, while the magazine is removed, to avoid an accidental light leak into the frame. It is released by 85 when the magazine is ataached.

Adjustment

1) Install 5098 and adjust the movement of 486 by displacing 485 and smoothening the hole accepting 486. (See Page 59, Parts List.)



2) Attach the magazine onto the standard body and adjust the stroke of 486 according to the projection of 85 of the standard body. If necessary, bend the tip of 482 contacting with 480. Check if 486 does not prevent the function of the light shield palte

3) Check also if E-1.5 does not obstruct 483 and 482 does not obstruct 333 in attaching the film magazine.

7-6 5245-Signal-Lever and 5041-Signal-Plate (Fig 4 and 5)

These devices serve to avoid the accidental magazine removal in the released situation.

Adjustment

1) Install 5245 so that 218 of 5245 goes beneath the head of 31 and 31 is surely prevented by 218 even if 68 is pushed. (Fig. 5)
2) When the film magazine is on the "Wound-up" situation. 218 should be out of 31's stroke. Adjust by displacing 219 of 5041.
3) 304 should be blocked by 28 when 218 is prevented by 31 on the released situation.

7-7 Automatic Safety Lock in Lens Interchanging (Fig. 4)

This device serves as a safety lock to avoid the accidental lens removal in the released situation.

Adjustment

1) By the preceding adjusting in 7-6, 218 prevents 215 of 5245 from being pushed in by 227-button. In this situation, 213 of 5044 should stay in a groove on 5. Thus, if necessary,,bend 215 at the section contacting with 211 for this purpose.
2) 213 has to come out of the groove of 5 even if 227 is pressed down when the lens is correctly attached. If necessary, bend 215.
3) Caution: 213 should stay out of the groove of 5. 211 keeps in contact with 215. 215 does not come in contact with 201.

7-8 Automatic Safety Device for Shutter Release Button (Fig. 5 and 6)

1) Magazine Lock and Release

When the film magazine is removed, 28 of 5004 is prevented by 97 of 5005 and when the magazine is attached to the body, 304 interlocks slightly with 28. 28 serves for the shutter release button prevention when the magazine is detached. (To be explained in detail later.)

Adjustment

a) Move 31 slowly and check if 28 of 5004 slightly passes over the hook of 97 when 304 is released from 5004. (See the hatched lines in Fig.5) 304 can be taken out without any prevention in this situation. If 97 is filed for adjustment, pay your attention not to file exceedingly. Otherwise, 304 will not fit in smoothly.
b) When the magazine is attached to the body, 304 pushes 97 to release 97 from 28. If 97 is bent for adjustment at the part contacting with 304, pay your attention to the adequate release timing.

2) Shutter Release Prevention on Magazine Removal (Fig. 5)

The body in the released situation could be coupled to the magazine in the wound-up situation, if the coupling is made forcibly. But, this should be avoided. So, avoid the shutter release after the magazine is removed, because 31 is blocked by 218 and intermeshing between 124 and 460 is changed.

Adjustment

If 28 is in the hatched-line position in Fig.5, the shutter releasing cannot be made by neither pushing 147 or through using a cable release, because 28 prevents 147. If any adjustment is required, bend 28 so that 28 prevents 148 while 28 is trapped by 97. Overlapping of 28 over 148 is desired to be just the thickness of 28. If it is too deep to touch the wall of the body, 31 will be prevented to slide in completely. This may cause an obstruction in the magazine removal.

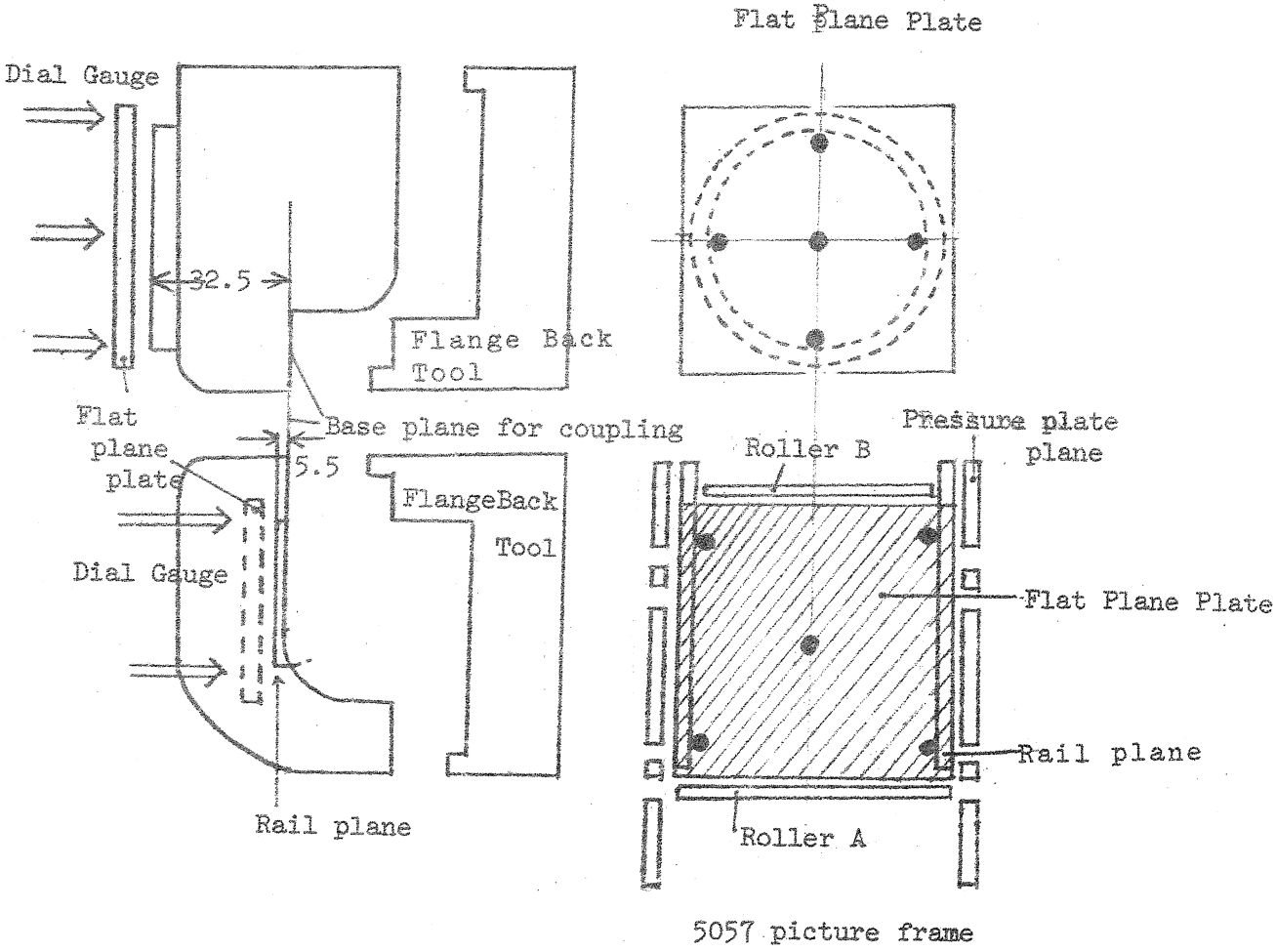
3) Automatic Shutter Release Prevention on the Lens Removal (Fig. 6)

If the lens is mounted on the body after the shutter is released, 17-pins of the lens will not be set at the regular position. Fastening 5-mount-ring in this situation occurs the previously-mentioned locking by 213 , and 5 cannot be loosened again. Thus, the film wind is also made impossible. Therefore, the shutter release after the lens is detached should be avoided.

Turn 5-ring to the lens removal position and push 147. In the disengagement of 131 halfway from 125, 109 of 5019 should hit 5 to prevent 147 from being pressed down. For this purpose, if necessary, bend 263 of 5019 at the section relating to 195. In the complete fastening of 5, the tip of 195 hitting the bottom of the groove of 5 should not block 131 from being released smoothly from 125. 195 should correctly drop into the groove of 5.

8. Flange Back, Film Plane

8-1 Flange Back of Camera



1) Body

Place the camera body on a flange back tool. Put a parallel flat plane plate whose thickness has already been known on 4-ring and measure with a dial gauge at the five pints shown in the figure at upper right. The standard value is 32.5 0.02mm. (See the figure at upper left) In the measurement, pay your attention to any unfinished sections on 4-bayonette ring. If neeessary, place 248-washer (0.02--0.2mm thick) beneath 4 for the minute adjustment.

2) Magazine

Place the film magazine on a flange back measurement tool. Put a parallel flat plane plate of the known thickness on the film plane rails, while paying your attention not to run over the film pressure plane or guide rollers. Measure at the five points as shown in the figure. The standard value is $5.5 \begin{smallmatrix} +0.04 \\ -0 \end{smallmatrix}$mm.
If a slight distortion is found on 5057, adjust it by twisting reversely. If necessary, apply 248-washer beneath 5057 for the minute adjustment.

3) Body and Magazine

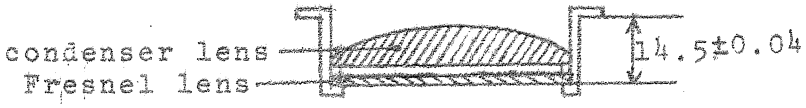
Adjust the distance from the front plane of 4 to the rail plane that should be 79.00 ± 0.03mm.

8-2 Flange Back of Lens

Place the lens on a lens flange back measurement tool and adjust it with an auto-colimeter. The standard value, identical to that of the earlier KOWA SIX, is 79.00 ± 0.04mm. Because of the identity, the complete lens interchangeability is retained.

8-3 Focusing Screen

1) Focusing Screen Frame



Adjust the distance from the plane of 25-screw head (the holding plane of the focusing screen frame) to the lower center of Fresnel lens to 14.5 0.04mm.

2) Focusing Screen

Attach a correctly adjusted standard 85mm lens and a focusing screen. Viewing a colimeter which is adjusted ~~at infinity or at a subject apart by 200~~ meters or farther, adjust 25-screws so as to get the most sharply focused image on the focusing screen. Use of a magnifying glass or a dioptric telescope is desirable. All the heads of 25-screws should be on the same plane for avoiding a slack. The measurement from the front plane of 4 to the image plane of the focusing screen should be $79.00\ ^{+0}_{-0.06}$mm.

8-4 Film Plane and Guide Rollers (Adjustment of Film Plane)

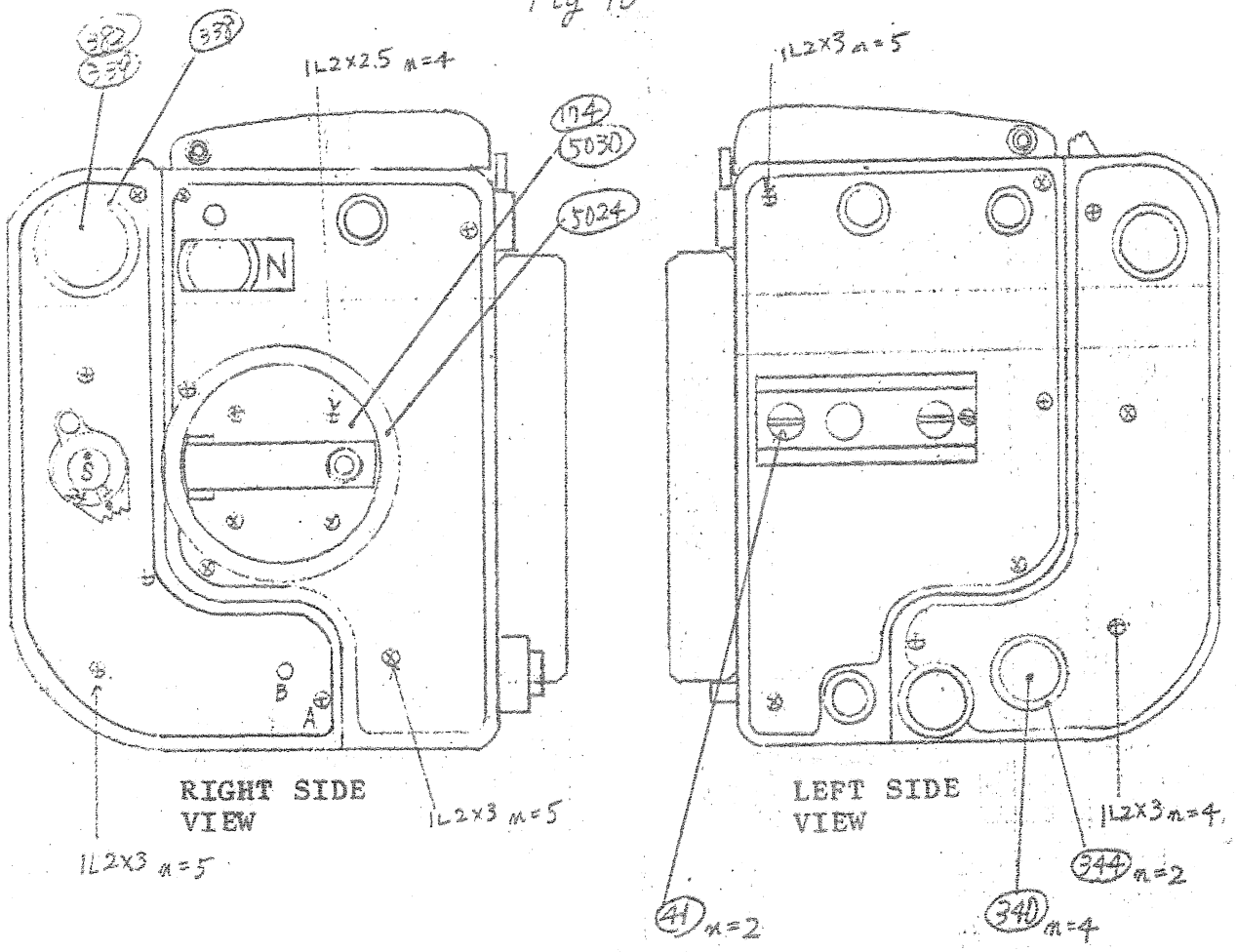
1) 5067A- and 5067B-Rollers

The barrels of 316A and 316B-rollers should be higher by 0.1--0.2mm than the film plane. If necessary, bend the supportingssections of 315A and/or 315B.

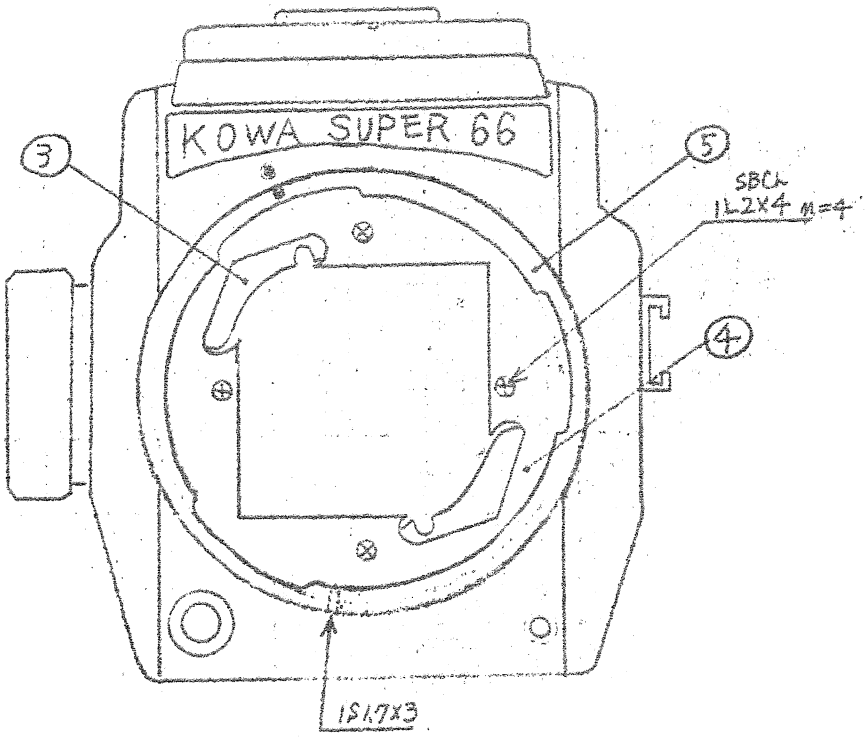
2) 326-Roller

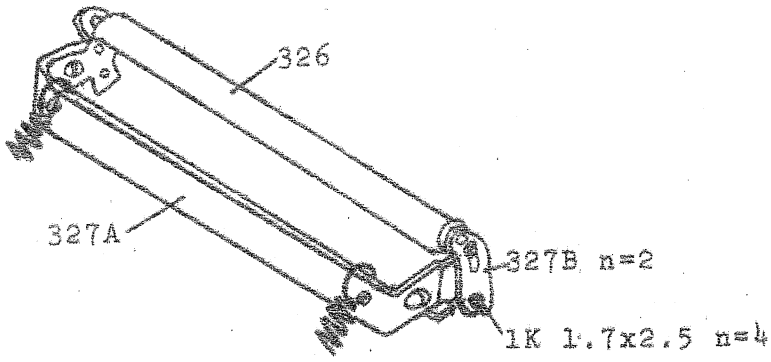
Adjust 326-roller's height by adjusting 327B-roller-arms. Does the following practice of checking: Paste oil ink on the surface of both ends of 326-roller in about 5mm width, load a test film, and close the back cover. If winding is done properly, a printed stripe of almost similar width, say, 1--2mm, will be found on the both sides of film, If not, adjust 327B-arms. After adjustment, cement screws with bonding agents without fail.

Fig 10



FRONT VIEW



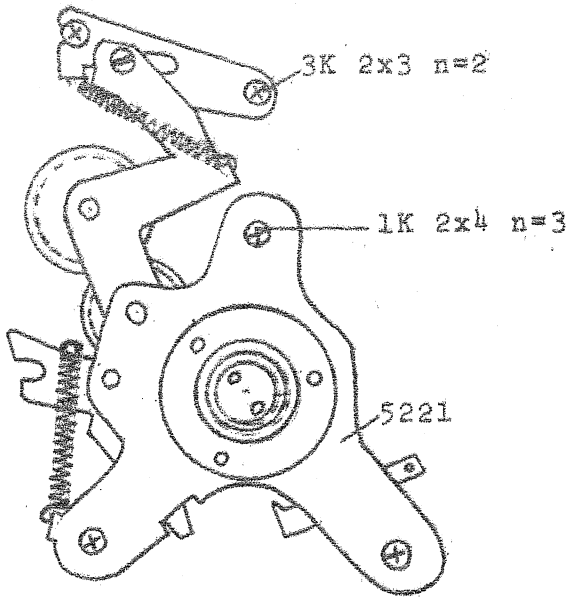


Part-III Disassembly of KOWA SUPER 66

1.Body's Right Side (See Fig. 10)

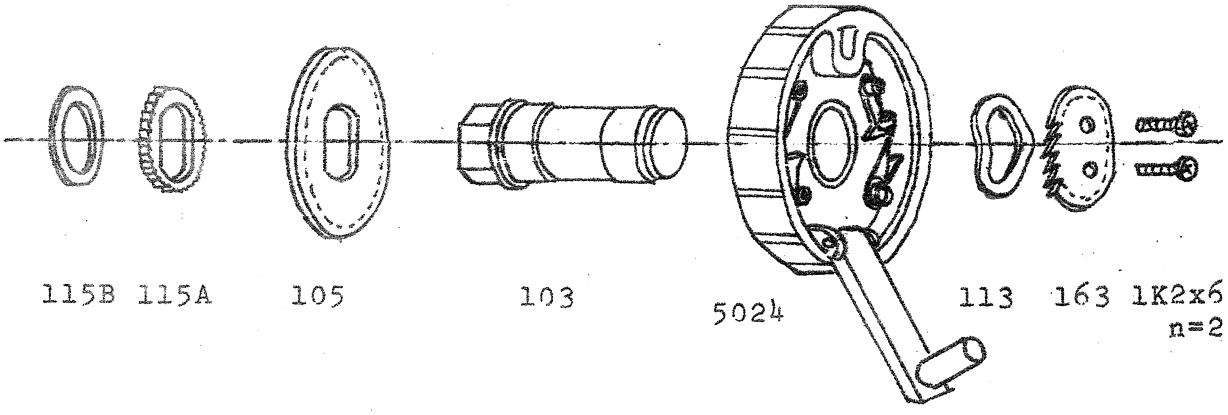
1) Operation Procedure:

174--1L1.7x2.5--5030--1K2x6--163--113--5024--78--1L1.7x3--5025--1K2x4
3K2x3--5221--103--105--115A--115B



2) Cautions:

a) 113-spring-washer should be placed with its convex plane outward.
b) 163-should be fixed as shown in the figure below. Be careful of the direction of the gear teeth.
c) 5221 should be installed to the body after 115B,115A, 105 and 103 are sub-assembled into 5221.



2. Body's Left Side (See Fig.10)

1) Operation Procedure:

41--5037--80--1L1.7x3--5226--1L2x8--US2x3--5228

2) Cautions:

a) Since 5037 is sticked with bonding agents onto the body side panel, remove 5037 together with the side panel after unscrewing four 41-screws.
b) The left side of the body is important for the light tight. If you remove light-insulating strip from the side panel and/or the body, replace them without fail. Otherwise, the light leak will take place.
c) US2x3 serves as a locking screw of 231. Fasten it without fail.

3. Film Magazine's Right Side

1) Operation Procedure:

382--339--383--338--364--1L1.7x3--5285

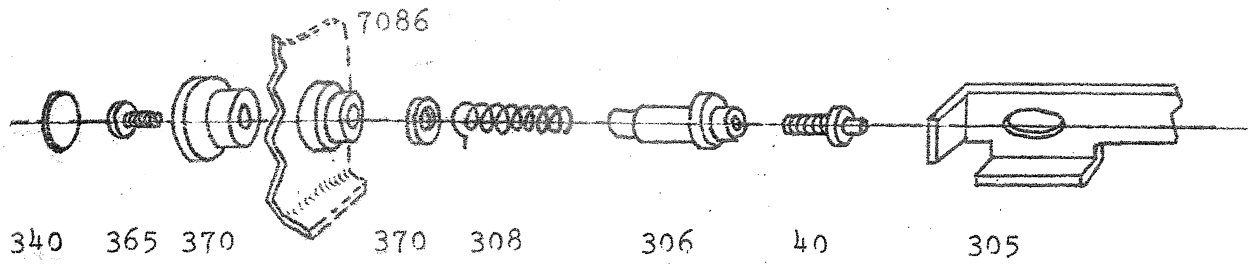
2) Cautions:

a) Disassemble with an upper spool in position and ascertain that 5052 does not drop out when removing 383.
b) Be careful not to disengage 390 with 341 in reassembling.
c) As shown in Fig. 10, the position of the lowermost screw has been changed from "A" to "B" position.
d) Interlockings between 452 of 5291 and 449 of 5285, and between 450 of 5285 and 433 of 5291 should be made correctly when attaching the side panel.
e) Check the following functions--the film advance knob, the switching lever of the frame counter, the click-stops and index positions.

4. Film Magazine's Left Side (See Fig. 10)

1) Operation Procedure:

340--1L1.7x2.5--344--365--307--366--1L1.7x3--7086--370--308



2) Cautions:

a) Removing 365 requires some caution because 378 and 308 may spring out when removing the side panel, unless 306 has been removed first of all
b) When 306 is detached priorily, the side panel can be removed with 365, 307,308, and 306 together on it.
c) When attaching a leather cover, paste bonding agents only around the hem of 307, instead of applying bonding agents all over the area of 365.

5. Body Front

Cautions:

a) Pay attention not to lose 71 and 72 when removing 4, because 4 and 3 are combined by placing 71 and 72 between them.
b) 2 is attached with 1L2x3 and 1L2x2-screws. 1L2x2-screw is used only in the upper right taphole.

Part-IV Fault-Findings and Repairs of KOWA SUPER 66

General Descriptions

As mentioned in the earlier chapters, the fundamental mechanisms of the KOWA SUPER 66 are similar to those of the earlier KOWA SIX, As a matter of course, the interchangeable magazine system make the whole mechanisms more complicated. Therefore, the effective and accurate trouble-findings and repairs with this camera can be acquired through maintaining similar viewpoints when you repair the earlier KOWA SIX. Needless to say, the repairment should be made after you completely understand and become familiar with the working mechanisms.

1 Finding Troubles

If the users get troubles with their cameras, many of them go upset and fumble with the movable parts of these cameras such as the crank/knob or the buttons in seeking the recovery. This may change the trouble situations and cause subsequent troubles. Especially, the wind-up, win-stop, shutter release, and frame counter mechanisms are closely and ingeniously interrelated. Troubles there may sometimes mislead you in identifying the real causes. Thus, special care is required with these devices.

Here are descriptions of main troubles, such as in the wind-up, shutter release, and frame counter. Trivial troubles occuring rarely are omitted here. Most of the troubles caused by the malfunction, shock, weariness of parts, and burnt are also eliminated, except a few cases. We wish you to find the true cause of troubles behind the apparent troubles such as

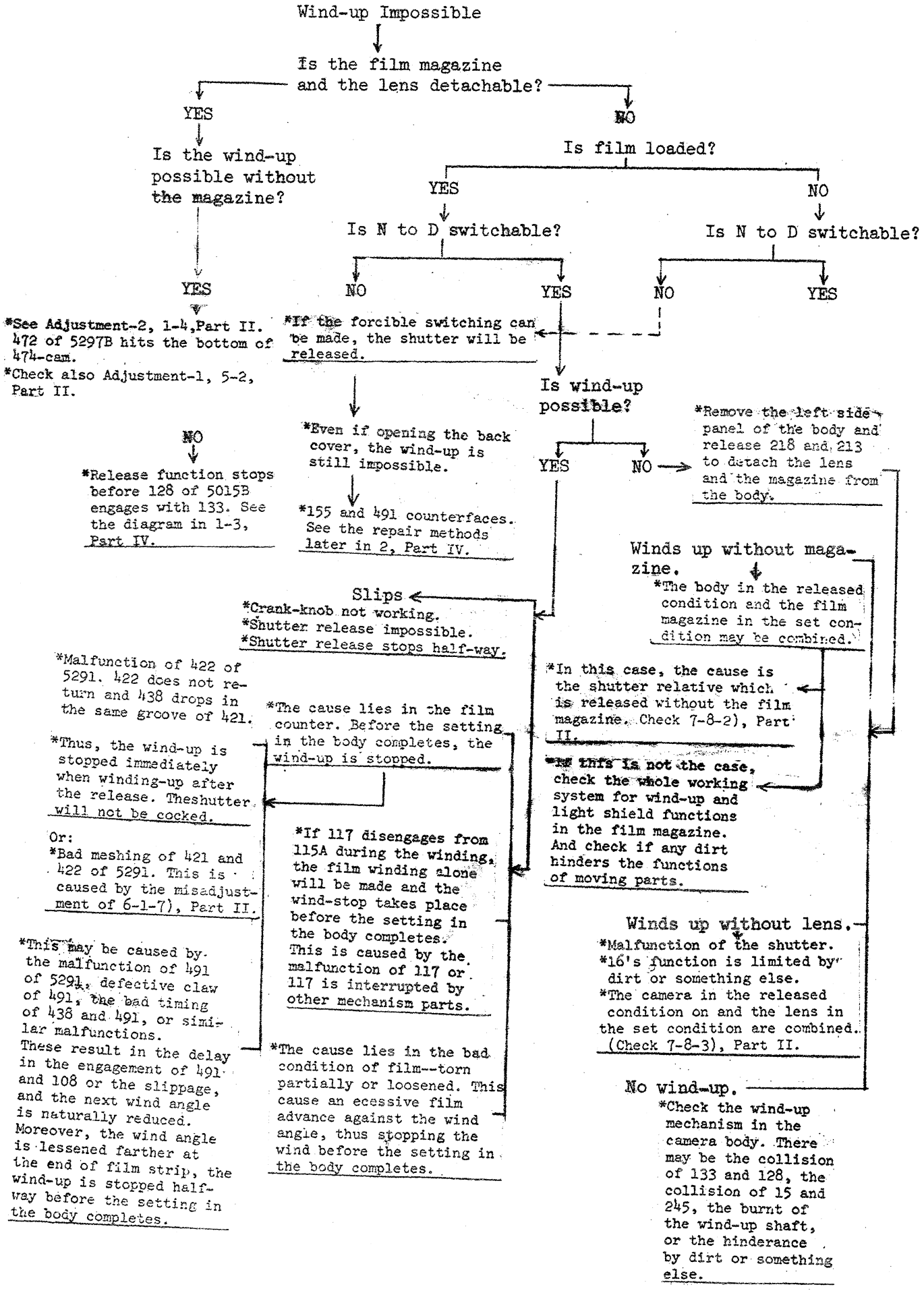
above. When you may be forced to work the body or the film magazine separately, follow the methods below.

1) In Case of the Body alone

a) After detaching the lens, turn 5 counterclockwise, making the shutter button ready for release.
b) Push 97 through the slit provided for 304 and release the shutter button lock device by returning 5004.

2) In Case of the Film Magazine Alone

a) Push and fix 480 to release the lock-pin of the light shield plate.
b) Push 458-lever to disengage 466 from 465.
c) Turn 460 downward to lift up the light shield plate or vice versa.


Wind-up Impossible
Is the film magazine and the lens detachable?
YES
NO
Is the wind-up possible without the magazine?
Is film loaded?
YES
NO
Is N to D switchable?
Is N to D switchable?
YES
NO
NO
YES
NO
YES
*See Adjustment-2, 1-4, Part II. 472 of 5297B hits the bottom of 474-cam.
*Check also Adjustment-1, 5-2, Part II.
*If the forcible switching can be made, the shutter will be released.
Is wind-up possible?
*Even if opening the back cover, the wind-up is still impossible.
*155 and 491 counterfaces. See the repair methods later in 2, Part IV.
*Release function stops before 128 of 5015B engages with 133. See the diagram in 1-3, Part IV.
YES
NO
*Remove the left side panel of the body and release 218 and 213 to detach the lens and the magazine from the body.
Winds up without magazine.
*The body in the released condition and the film magazine in the set condition may be combined.
Slips
*Crank-knob not working.
*Shutter release impossible.
*Shutter release stops half-way.
*Malfunction of 422 of 5291. 422 does not return and 438 drops in the same groove of 421.
*Thus, the wind-up is stopped immediately when winding-up after the release. Theshutter will not be cocked.
Or:
*Bad meshing of 421 and 422 of 5291. This is caused by the misadjustment of 6-1-7), Part II.
*This may be caused by the malfunction of 491 of 5291, defective claw of 491, the bad timing of 438 and 491, or similar malfunctions. These result in the delay in the engagement of 491 and 108 or the slippage, and the next wind angle is naturally reduced. Moreover, the wind angle is lessened farther at the end of film strip, the wind-up is stopped halfway before the setting in the body completes.
*The cause lies in the film counter. Before the setting in the body completes, the wind-up is stopped.
*If 117 disengages from 115A during the winding, the film winding alone will be made and the wind-stop takes place before the setting in the body completes. This is caused by the malfunction of 117 or 117 is interrupted by other mechanism parts.
*The cause lies in the bad condition of film--torn partially or loosened. This cause an ecessive film advance against the wind angle, thus stopping the wind before the setting in the body completes.
*In this case, the cause is the shutter relative which is released without the film magazine. Check 7-8-2), Part II.
*If this is not the case, check the whole working system for wind-up and light shield functions in the film magazine. And check if any dirt hinders the functions of moving parts.
Winds up without lens.
*Malfunction of the shutter.
*16's function is limited by dirt or something else.
*The camera in the released condition on and the lens in the set condition are combined. (Check 7-8-3), Part II.
No wind-up.
*Check the wind-up mechanism in the camera body. There may be the collision of 133 and 128, the collision of 15 and 245, the burnt of the wind-up shaft, or the hinderance by dirt or something else.

1-2 Wind-up Slipping

Wind-up Slipping

*This trouble means that the rotation of the crank-knob turns the film take-up spool alone, and it does not work the mechanisms connected to the main drive axle.

Detach 5030.

*Does 163 engage correctly with 164 of 5024?

Detach 5024 and 5025.

Confirm: 117 is not engaged with 115A.

Is 129 disengaged with 117?

Yes:

1) 117's claw section engaged with 115A is damaged. (This may be caused by the forced winding when the wind-up is made impossible.)
2) The malfunction of 117 causes the disengagement with 115A when 117 is released from 129.
3) 119 is released from 117.

No:

The shutter release stops half-way. See 1-3, Part IV.

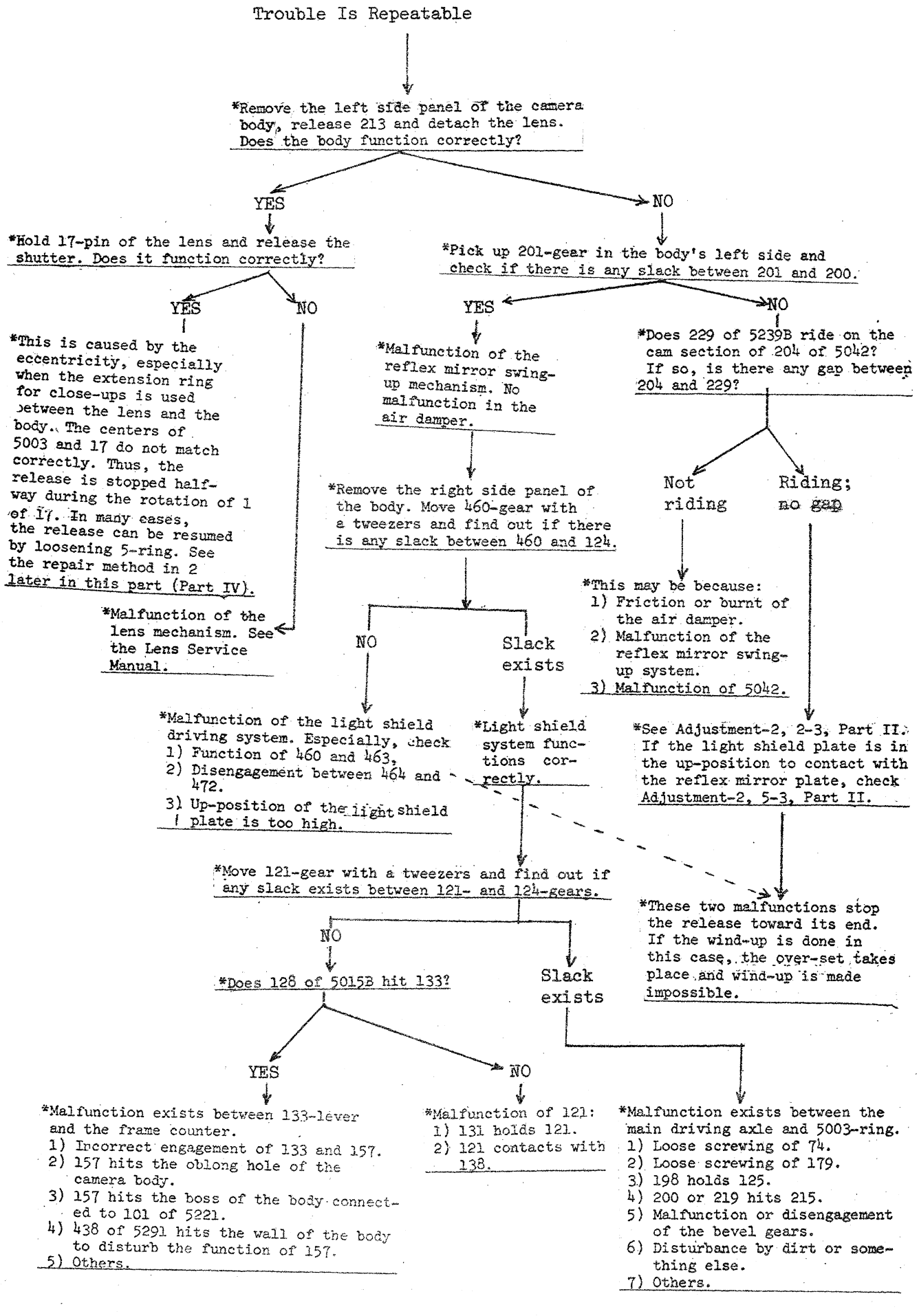
1-3 Shutter Release Stoppage

If the shutter release trouble remains as it is, or the trouble can be repeated by the repairer, it is easy to determine the real cause of this trouble. On the contrary, if the trouble may not occur again or it cannot be repeated again by the repairer, it is difficult to judge the cause. Thus, the two case above are to be explained separately in this section.

128 of 5015B liberates 129 shortly before the shutter release is completed. If 128 hits 129 before 128 comes to the normal position for releasing 129 from 117, the shock liberates 129 from 117 too early. Thus, the release stoppage before the shutter release fully completes causes overset, and this makes the wind-up impossible, if film is once wound.

If the release stops before 129 is released and the camera suffers an external shock, 129 is released from 117. If film is wound up, the over-set will take place. In the over-set situation, repair the over-set first of all and then judge the basic cause after the over-set is repaired.

Except for the above cases, open the back cover and take out film. Then, as the situation will be similar to the film wind slippage in 1-2, follow the instructions in that section.


Trouble Is Repeatable
*Remove the left side panel of the camera body, release 213 and detach the lens. Does the body function correctly?
YES
NO
*Hold 17-pin of the lens and release the shutter. Does it function correctly?
YES
NO
*This is caused by the eccentricity, especially when the extension ring for close-ups is used between the lens and the body. The centers of 5003 and 17 do not match correctly. Thus, the release is stopped halfway during the rotation of 1 of 17. In many cases, the release can be resumed by loosening 5-ring. See the repair method in 2 later in this part (Part IV).
*Malfunction of the lens mechanism. See the Lens Service Manual.
*Pick up 201-gear in the body's left side and check if there is any slack between 201 and 200.
YES
NO
*Malfunction of the reflex mirror swing-up mechanism. No malfunction in the air damper.
*Remove the right side panel of the body. Move 460-gear with a tweezers and find out if there is any slack between 460 and 124.
NO
Slack exists
*Malfunction of the light shield driving system. Especially, check
1) Function of 460 and 463,
2) Disengagement between 464 and 472.
3) Up-position of the light shield plate is too high.
*Light shield system functions correctly.
*Move 121-gear with a tweezers and find out if any slack exists between 121- and 124-gears.
NO
Slack exists
*Does 128 of 5015B hit 133?
YES
NO
*Malfunction exists between 133-lever and the frame counter.
1) Incorrect engagement of 133 and 157.
2) 157 hits the oblong hole of the camera body.
3) 157 hits the boss of the body connected to 101 of 5221.
4) 438 of 5291 hits the wall of the body to disturb the function of 157.
5) Others.
*Malfunction of 121:
1) 131 holds 121.
2) 121 contacts with 138.
*Does 229 of 5239B ride on the cam section of 204 of 5042? If so, is there any gap between 204 and 229?
Not riding
Riding; no gap
*This may be because:
1) Friction or burnt of the air damper.
2) Malfunction of the reflex mirror swing-up system.
3) Malfunction of 5042.
*See Adjustment-2, 2-3, Part II. If the light shield plate is in the up-position to contact with the reflex mirror plate, check Adjustment-2, 5-3, Part II.
*These two malfunctions stop the release toward its end. If the wind-up is done in this case, the over-set takes place and wind-up is made impossible.
*Malfunction exists between the main driving axle and 5003-ring.
1) Loose screwing of 74.
2) Loose screwing of 179.
3) 198 holds 125.
4) 200 or 219 hits 215.
5) Malfunction or disengagement of the bevel gears.
6) Disturbance by dirt or something else.
7) Others.

1-3-2) Trouble Is Not Repeatable.

Insert a rod into the notched section of 5003 (with which 17 is engaged) and, while holding 5003, release the shutter and move 5003 slowly. Does the release stop half-way?

No:

Judging the real cause is difficult Check according to the following instructions.

1) Are there any loosening of screws or axles?
2) a) Right side, body:
   screws 179—125
   Axsles 193—133
   b) Left side, body:
   Screws 178—200
   Axles 202 —201
   Axles 205—5042.
   c) Front, body:
   Axles 74—73
   d) Right side, magazine:
   Axles 143, 416—5297B.
2) Detatch the air damper. Polish the inside of the cylinder and piston. Reassemble the air damper.
3) Are there any fluctuations or bad engagements of levers?
   a) Right side, body: 133 and 157; 157 and the square hole of the body.
   b) Right side, magazine: 438 of 5291 and the square hole of the body; 157 and 438; 464 of 5095 and 472; fluctuation of 471.

Yes:

In many cases when the function is slow or unsmooth, the release stops half-way.

*Maintain the stoppage situation and check according to the instructions in 3-1.

1-4 Frame Counter trouble

If the trouble can be repeated, remove the right-side panel and load film into the film magazine. Repeat windings and releasings over and over again to examine the trouble.

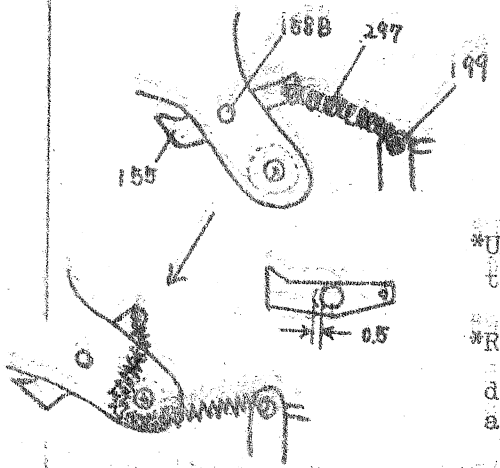
If the trouble occurs intermittently or it is difficult to examine, check attentively the specific sections where the trouble takes place. This may lead you to guess the real cause of the trouble. It is worthwhile to note that most of the trouble in the frame counter system are caused by the malfunction or the mis-positioning of 5273 and 5291. So, check if the standards of adjustments in 6-1 to 6-5, Part II, have been satisfied. See the following descriptions about the trouble and repairs of the frame counter system.

2 Main Troubles and Repair Methods

Troubles	Causes	Repair Methods
Winding Impossible	1. Over-set: When winding is stopped after 128 of 5015B has released 129, a forcible winding changes the meshed position between 121 of 5015B and 116A of 5010C. This results in the overset in the system following 121 as against the working angle of 116A (the working angle is fixed). This overset stroke causes a harmful collision of 5003 against the boss of 4 of 1, stopping the work of the crank/knob.	Liberate 155 while pressing the release button. This releases the shutter. If 121 is still in meshing with 116A, turn 5010C reversely while releasing 155 to disengage 121 from 116A. Turn 121 or 5003 to the direction of releasing until the releasing completes. After this, find the real cause, following the instructions in the release stoppage in 1-3 of Part IV.

2. Stoppage by the Collision of 155 and 491; This trouble occurs when a forcible or too fast winding is performed in winding after the wind is stopped. When 491 engages with 108 to stop the wind-up, a forcible further winding turns 105 by deforming the related parts. During this turn, if 155 drops into the next tooth of 105, the irregular meshing locks 491. Thus, even by the shutter release tork, 491 will not be released and the release function stops halfway and thus the next wind-up is made impossible.

Remove the right side panel and relieve 155 from 105. This releases the shutter. This trouble seldom occurs as the forcible winding causes a bade meshing of 155 and 491 with 105 and 108. However, since the trouble originates in the user's winding manner, it may occur repeatedly. Take the following remedy.

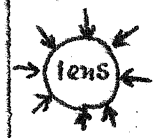


*Unrivet 158B and enlarge the hole of 155 by 0.5mm.

*Rivet 158B again. Hook the doubled 297 at 155 and 199 as shown in the figure here.

3. For other troubles causing the wind-up impossible, see 1-1 in Part IV.

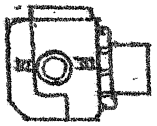
See the instructions contained in 1-1, Part IV and repair accordingly.

Release Stops Halfway	1. Eccentricity: There may be an eccentricity between 4 and 5003 or a malfunction between 16 of 3217 and 17. This cause can be ascertained by selective couplings of several standard cameras and lenses. Attach the lens onto the body and loosen 5. Examine where the release is prevented, while pressing the lens barrel from all directions.  	If the cause is in the body, though it is a rare case, replace 4 or 5003 with new one. If the cause is in the lens, replace 3217 with new one.
	2. For other release stoppages, see 1-2 or 103 in Part IV.	See the instructions in 1-2 or 1-3, Part IV.
Frame Counter Slippage	Slippage in the wind-up stop occurs from the same cause. The following causes may delay or obstruct the engagement of 491 with 108. 1. The gap between 491 and 108 is incorrect. (Adjustment-3, 6-3, Part II) Especially if it is too close and 491 contacts with 108 because of the eccentricity of 108, 491 jumps up and this causes the delay or slippage.	See Adjustment-3, 6-3, Part II and follow the instructions.
	2. The malfunction of 491 or 438, the disengagement of 492 from 439	If necessary, replace 5282 with new one

3. The tip of 438 or 440 at the tip rubs against the hole for 303 on the body.

Bend the tip of 408 for adjustment. Recheck after the side panel is attached because screwing of 344 changes the position of 438's tip.

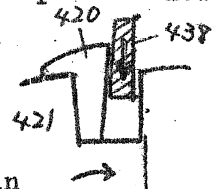
4. 157, which interlocks with 440 on the body, does not move well. Or 157 holds 438 or rubs against the hole for 301, or rubs against the hole of 1. Flip out the crank and press it against the body as shown in the figure and confirm that 157 moves smoothly with a slight safety margin.



Adjust 133 and 157 so as to move well. Lessen fluctuations of 133 and/or 157 to keep away 157 from being caught between 133 and 101. Bend 157 at the part connected with 440 to keep it away from rubbing against the hole and catching on 438.

5. If 438 is not well in contact with 422, 438 may not catch 422 at the right time or smoothly. This may be a result of the unfinished tip of 422 or 438 or the incorrect angle of 438.

File and smoothen the specific sections. If it is difficult, replace 5098 or 5282 with new one.



6. Slippage of Frame-Counter-Gear:
This trouble is inherent from the slippage in anywhere of gears between 5054 and 421.
   a) There is any idle screwing between the guide rollers and 5270

See Adjustment-1 in 6-4, Part II.

Irregular Frame Intervals

b) Slippage between the guide rollers and film may occur because of the unsmooth turn of the guide rollers.

c) Disengagement of 5273 and other gears may be caused by the flucturation of gears such as 405 or 407.

d) Slippage may also be caused by the loose rivetting of 5270 and 5273.

e) Disengagement between 5273 and 411 may be caused by the eccentricity of 418. This may be because of the bad adjustment in Adjustment-2, 6-4, Part II.

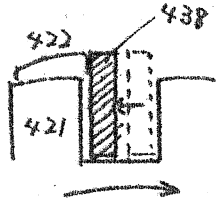
See Adjustment-1, 6-4, Part II. Follow the instructions in the adjustment.

Replace 5273 with new one. For the attachment, see 6-3 and 6-4, Part II.

Replace 5273 or 5270 with new one. For the attachment, see 6-2 and 6-4, Part II. Readjust by following Adjustment-2, 6-4, Part II. If the eccentricity is excessive, replace 5090 with new one.

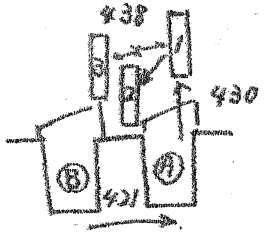
1. Too Large Interval:

The above-mentioned frame counter slippage causes the excessive turn of film, the shift of 421 to the arrow direction, and the shift of 438. In the above case, if the shift is too excessive, the teeth of 421 or 422 may be bent. If the slippage occurs very extremely, the stoppage of the wind-up occurs and advances film all through its end.



2. Too Narrow Interval or Overlapping of Frames:

After film is advanced exceedingly and the interval becomes too large, the next film advance is naturally shorter than normal by the length equivalent to the excessive length in the preceding case, if 438 and 491 work normally. This causes a narrower interval or an overlapping. If the film roll diameter on the spool becomes large toward the end of film, the above-mentioned stoppage trouble of the wind-up may happen as the wind-up stops before the shutter setting ends up.



As shown in the figure, the tip of 438 which stays in tooth-A, is drawn to the position-1 on shutter releasing. 422 returns to its original position by 430-spring Of 422 fit into the groove of 421. As you turn the crank/knob, 133, pushed by 128 of 5015B, becomes apart from 128, and then again returns to be pushed by 128 as 5015B rotates. As this repititious movement of 133 is conveyed to 438 through 157, the tip of 438 drops into position-2 once and is finally drops into tooth-B by compelling 422. Thus, the next shutter release is prepared. If any force works to force the tip into position-3, the tip drops

Malfunction of Frame Counter

into tooth-C, instead of tooth-B, and causes the waste of one frame of film. As film comes to its end, the film on the spool becomes thicker. In this situation, the rotation of 421 increases and 438 comes closer to tooth-B. Thus, 438 may come to position-3.

Main causes of the frame counter skip are;

a) Frame counter slippage causes this trouble onto the next frame.

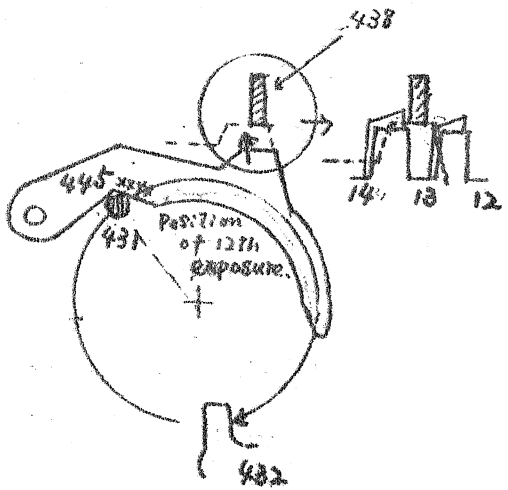
b) Incompleteness in the adjustment of 6-1-7), Part II. 422 conjugates badly with 421.

See the previous section about the frame counter slippage.

File the oblong hole where 431 of 422 engages with 421.

Swell 445 at the part of the X mark in the figure to hasten the timing of 431 pushing 445.

This trouble is the bad working of the film counter while the back paper of roll film is taken up after the 12th exposure. The malfunction of the frame counter in which film advance, wind-up stoppage, and shutter release functions go as usual, will never occur to the KOWA SUPER 66. See the figure above. After the 12th exposure, 431 pushes 455 with the rotation of 421. As 445 pushes 438 to release 438 from the contact with 422 before dropping into the 13th groove, the wind-up stop is also released. If a delay takes place when 431 pushes 445, 438 is not released from the contact with 422 and thus the frame counter stops. This will cause the disengagement between 418 and 411, or bend the tooth of 422, or cause the slippage of the back paper. Thus, the frame counter remains stopped.



Wrong Latching on Magazine Removing	When the film magazine is detached from the body, 5004 is not interlocked by 97 and a wrong return of 5004 occurs. This may be caused by: a) The function of 97 is wrong. Examine if 97 is prevented by the protrusion of 43 of 32. b) The wrong execution of the adjustments in Adjustment-a) in 7-8, Part II.	a) File the protrusion. b) File 97 at the part contacting with 28 to smoothen the interlocking of 28 and 97.
Magazine detachable in released situation	The wrong execution of the adjustments in 7-6, Part II.	See the instruction in 7-6, Part II.
Light shield plate suspends	1. The working speed of the body mechanisms is too fast. 2. The swing-up position of the reflex mirror plate is too low, or the mirror plate slants in the up-position. 3. The function of the light shield plate is dull, because of the malfunction of the system.	1. See 3, Part II, and Adjustment-2, 5-3, Part II. 2. See 2, Part II. 3. See 1-3-1), Part IV.
Unexpected Noises in Winding	1. A big sound like that of a fishing reel is caused by the weakness of 120-spring. The noise is emitted between 117 and 115A because of a wrong function of 117. 2. Two 108-gears intermesh too tightly and do not turn smoothly	Bend 120 to be more effective. Readjust the position of 109 of 5221.

If the timing of 431 pushing 445 becomes further later, the wind-up stop will work at the 13th exposure. If the timing is too early, the wind-up stop will not work at the 12th exposure.

1. When 12-exposure film is rolled up, the frame counter will advance to the 16th exposure of so when film's back paper is wound through. In this case, open the back cover and work 441 to release 438 from 445. Otherwise, 431 is pushed by 445 as 438 pushes 445 and 431 will not return by the work of 427.

2. The trouble is caused by the malfunction of 5090. This may be because of:
   a) 427-spring in wrong turn and may be, for example, entangled.
   b) 5090 is under the excessive pressure because of the excessive thickness of 424.
   c) 431 hits 426.
   d) 422 is caught by a protrusion of 445.

1. If the tip of 438 is prevented by the wall of 301, file 438. See the adjustment in 6-3-4), Part II.
   If 438's movement is restricted by 157, check if 438 is pressed too much by 445. If necessary, file 431 at the section contacting with 445.
   *If the clumsy return of the counter is not improved by exchanging the magazine, there is a doubt that 157 touches the boss of 522 on 1. If necessary, file the boss of 1 or 157.
2. a) Remove 5090 and replace 427 with new one.
   b) Replace the washer with thinner one.
   c) Shorten the tip of 431
   d) Detach 5090 once and file the protrusion.

This deals with the shutter button blockage by other causes than the impossible winding and release stoppage. The troubles come from:

1. The wrong execution of the adjustments in 7-8-3), Part II. 195-pin touches the bottom of the groove of 5 and 131 does not come out from 125.

2. The wrong execution of the adjustments in 7-8-2), Part II.
   a) 97 cannot slip out from 28 and 148 is pressed by 28.
   b) 5004 is in insufficent contact with 304, and 28's return is insufficient. Thus, 28 is not be released from 148.
   d) The wrong execution of the adjustments in 7-8-2), Part II. 28 and 148 are too tightly in contact.

1. Turn 5 fully to its fastening position and bend 263 of 5019 so that 131 slip out from 125 before 195 protrudes into the milled part of 5. If the release prevention does not work after the above repair, beat and swell 263 at the section contacting with 141.

2. a) Bend and adjust 97 at the section of contact with 904 so that 97 can slip out from 28. See 7-8-2), Part II.
   b) Readjust following 7-3-2), Part II.
   c) Follow 7-8-2), Part II.

Clumsy Attaching/Detaching of Film Magazine

This may be caused by the mis-adjustment, mis-operation, and mechanical troubles.

1. The top latch slips in clumsily.
2. The interlocking of the latch is awkward.
3. Disengagement of 124-gear.
4. Didengagement of 360-gear
   a) 466 is not engaged with 461, because of the disengagement of 124-gear.
   b) The misadjustment of 466.
5. The interlocking of 157 with 440 is bad when the back cover is opened up.

1. Bend 27-hook outward, or, if necessary, file inside the hook.
2. See the instructions in the "wrong latching" above.
3. Readjust according to 1-4 Part II.
4. a) Readjust by following 1-4, Part II.
   b) Readjust by following 7-2, Part II.
5. Attach the film magazine with the back cover closed.

Part-V Tool List of KOWA SUPER 66

1. Wrenches

for 136A (old)---slit	*Convert the wrenches for K1N1B 179 or 289 for this purpose.
for 136A (new)--oblong circle	*Use A-6031 (attached to holder of #0 plus-driver)
for 136B	*Convert the old wrenches for K1N1B179 or 289.
for 232 (old)--slit	*Use one for K1N1B 283.
232 (new)--oblong	**Use A-6032 (attached to #0 plus-driver)
for 401	*Use one for K1N1B 162.
for 383 (for installing 5036B)	*2.5mmφ, 90--100mm long, minus-driver.
for 1N4 (for installing 5040)	*Use a wrench for K1N1B 294.

2. Other Tools:
(Tools marked with ° are not supplied.)

°Dial gauge stand
°Dial gauge, 1/100mm
Block gauges; 79mm, 32.5mm, 5.50mm
°Auto-colimeter
A mirror for the auto-colimation (57x57mm)
Tool for positioning 5003-ring.....Use one for positioning K1N1B 136
°Standard body for checking magazine
°Standard magazine for checking body
°Flange back measurement tools
°Parallel flat plane plate

3. General Tools (not supplied)
#0 plus-driver
Watch drivers; 1mm, 2mm, 3mmφ
5 - 6mmφ minus-driver, large size
Pincer, round tip
Pincer, flat tip
Nippers
Tweezers
File
Hammer
Others.