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SERVICE MANUAL

GS-1200

ELMO CO., LTD.

Nagoya, Japan

INTRODUCTION

1. Refer to the TROUBLE INDEX on Page 7 in order to find the page to be referred to in accordance with trouble.

2. Refer to the DISASSEMBLY STEPS on Page 4 to reach the defective parts.
For example, when you remove the Amplifier, you should take off the Front Cover (Page 10), Rear Cover (Page 12), Amplifier Cover (Page 14) and Amplifier (Page 116) in order.

Disassembly order in a section in "VI. DISASSEMBLY & REASSEMBLY NOTES" is as follows:

First HOW TO DETACH A UNIT ASSEMBLY FROM THE PROJECTOR
Next HOW TO DISASSEMBLE THE UNIT ASSEMBLY AND SO ON

* Refer to the Parts List for the GS-1200, which will serve you when disassembling the projector.

3. TROUBLESHOOTING is shown in the head part of each article in "VI. DISASSEMBLY & REASSEMBLY NOTES". Please be careful in DISASSEMBLING and REASSEMBLING the parts not to cause other troubles.

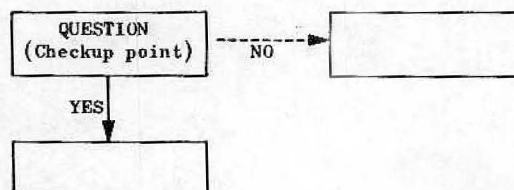
4. The CIRCUIT ANALYSIS is on Page 93, which explicates the logical circuit used in the GS-1200.

5. How to read the troubleshooting flow chart:

ANSWER

YES follow the under box

NO follow the right box

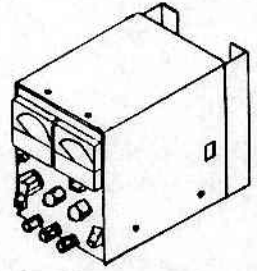
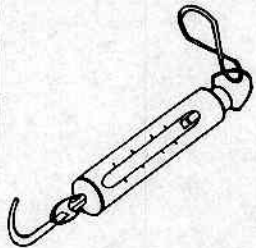
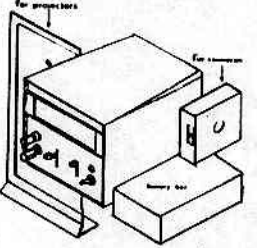
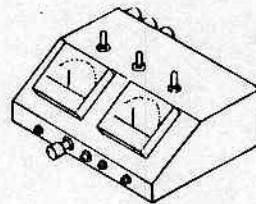
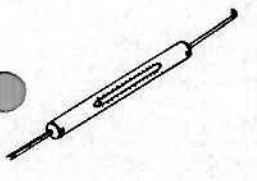
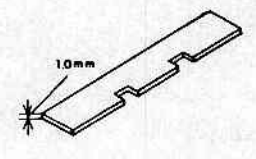


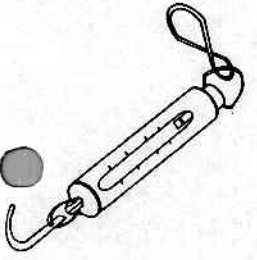
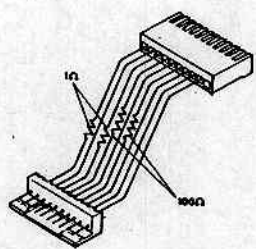
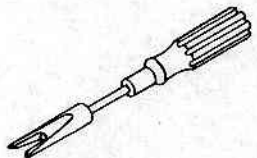
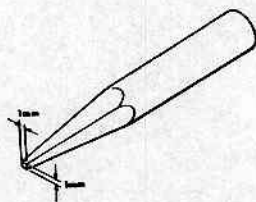
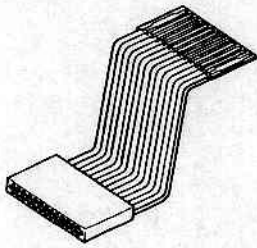
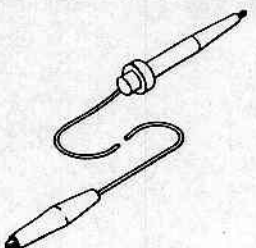
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f. ESS Circuit	109		

I. TOOLS

	Code No. : C004		Code No. : P026
	Name : DC regulated power-supply		Name : Bar spring scale 500g
	Weight : 3.8 kgs.		Weight : 110g
	Dimensions: 105 x 160 x 220mm		Dimensions: 37 dia. x 180mm
	Page : 60, 64		Page : 24, 46
	Code No. : C005		Code No. : P045
	Name : Frequency counter		Name : Resistor box 8 ohms 40W
	Weight : 1.7 kgs.		Weight : 1.1 kgs.
	Dimensions: 130 x 135 x 180mm		Dimensions: 90 x 190 x 200mm
	Page : 86		Page : 49,50,51,52,54,55,56
	Code No. : C043		Code No. : P047
	Name : Bar spring scale 110g		Name : Claw tip length gauge
	Weight : 40g		Weight : 3.7g
	Dimensions: 10 dia. x 280mm		Dimensions: 60 x 8 x 1mm
	Page : 20,24,40,46,60,64		Page : 24


	Code No. : P048		Code No. : P057
	Name : Bar spring scale 1 kg.		Name : Current check cord
	Weight : 110g		Weight : 10g
	Dimensions: 37 dia. x 180mm		Dimensions: 25.5 x 6 x 120mm
	Page : 24		Page : 164
	Code No. : P055		Code No. : P058
	Name : Claw adjust-driver		Name : Trap coil adjust-bar
	Weight : 70g		Weight : 7g
	Dimensions: 23 dia. x 70mm		Dimensions: 8 dia. x 120mm
	Page : 24		Page : 164
	Code No. : P056		Code No. : P059
	Name : Board connection cord		Name : Circuit check cord
	Weight : 85g		Weight : 32g
	Dimensions: 300mm long		Dimensions: 800mm long
	Page : 123-152 Amp. board -- Control board Amp. board(1) -- Amp. board (2)		for connecting and grounding the circuit


II. TEST FILMS & OIL/GREASE

A. Test Films

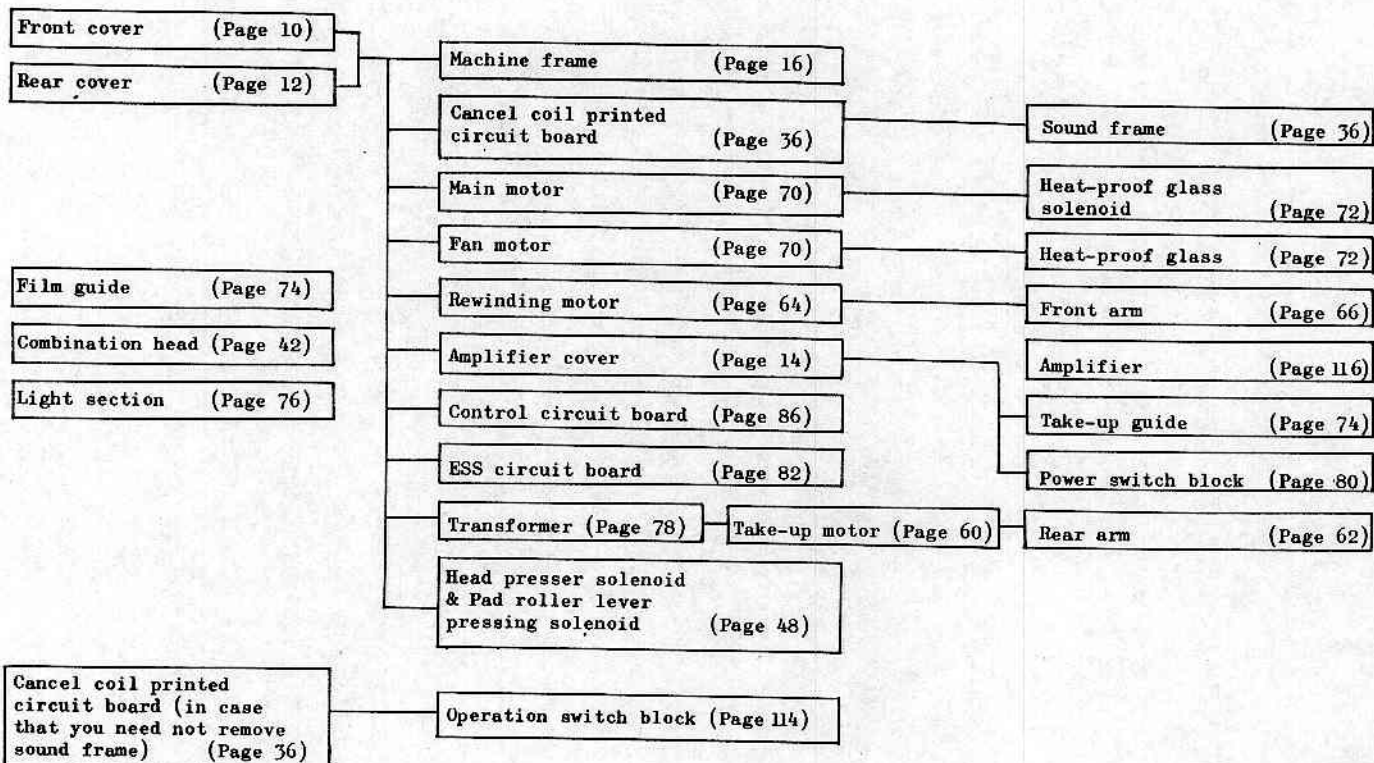
Code No.	Film	Page
P027	Pre-stripped film (4KHz signal recorded at 24 fps)	49
P051	Super-8 optical frequency response film 400Hz	55, 56
P053	Super-8 optical frequency response film 4KHz	54, 56
P054	Resolving power film, Type S	20, 26, 34

B. Oil/Grease

The mark  in disassembly drawing shows you the point to be lubricated. The letters A, B, C, D & E in the mark show you the kind of oil/grease as listed below. Use the regulated oil/grease to keep the projector in the original condition.

Mark	Brand Name
	A DAPHNE 44
	B VEEDLE 20-40
	C ALVANIA GREASE 2
	D ALUMINUM GREASE 1
	E MOLYKOTE EP

III. DISASSEMBLY STEPS



IV. TOLERANCE

Item	Tolerance	Measurement	Page
Spring pressure of pressure plate	60-70g	Hook a scale 110g C043 on a film and hold it up.	33
Spring pressure of side presser	30-35g	Use a tension gauge 50g C063.	19
Tension of claw braking spring	60-70g	Hook a scale C043 on claw and pull it in the turning direction.	23
Tension of claw spring	Shaft direction	Near claw pin. Use a scale 1 kg C026.	23
	Forward direction	Near claw pin. Use a scale 1 kg C048.	23
Claw tip protrudent length	1.0-1.1mm	Length from aperture plate rail. Use a gauge C047.	23
Framing (up and down)	3 lines	Three lines should appear up and down. Use a test film, type S.	25
Unstable picture	Forward	Picture size: 50cm in width. Speed: 24 fps.	
	Reverse		
	Reverse		
18/24 speed	+0.3 fps	With a rating voltage. After 5 minutes running.	87
Speed fine adjustment	24±2 fps		
Take-up tension	40-50g	Use a 800ft reel and a scale C043. At 18 fps.	60
Rewinding tension	200±30g	Use a 800ft reel and a scale C043. At 18 fps.	64
Rewinding speed	150±20 sec	Time for rewinding a 1200ft film.	
Illuminance	Center	over 1450 lx	Picture size: 50cm in width.
	Corner	over 53%	With respect to a center.
	Lumen	over 220 lm	Screen lumen.
Projection lamp voltage	High	23.75V	On transformer terminal. With a rating voltage.
	Low	21.6V	
Projection lamp life	25 hours	Lamp switch knob on High side.	
Dissolving power	20	Left mark should clearly be distinguished. (4 Corners)	
Spring pressure of pad lever	250-300g	On FWD condition. Use a scale 500g C026.	45
Spring pressure of head presser (2)	20-22g	Use a tension gauge 50g C063.	45
Spring pressure of back tension roller	70-80g	Use a tension gauge 200g.	45
Spring pressure of arm	0.9-1.1 kg	Hook a scale 2 kgs. P046 on arm tip.	
Film scratch		Hurtful scratch shouldn't appear after 10 times running of black film.	
Noise	60 phon	Away from aperture plate at 1m in 24 fps projection.	
Tilting angle	over 7°		
Horizontal correcting angle	over +1°	Picture size: 50cm in width. Adjustable over +8mm.	
Insulation resistance	over 10 megohm	Use a 500V megger.	

Item	Tolerance	Measurement	Page
Amp. output	Continuous power	10W	Both tracks 1 & 2 Load an 8 ohms resistor.
	Maximum power	15W	
Frequency response	MAG.	Track 1 18 fps 24 fps	Record signals with 0 VU at 18 fps. Use "Toyo film" when checking at 24 fps.
		Track 2 18 fps 24 fps	
	OPT.		
S/N ratio	MAG.	Track 1 over 50 dB Track 2 over 45 dB	Rating 10W (8 ohms) output thru A.W.N. circuit.
	OPT.	over 45 dB	
Distortion	MAG.	both tracks less than 4%	Rating 10W (8 ohms) output
	OPT.	less than 4%	
Erasing effect	both tracks	less than -40dB	Speed: 18 fps. Input: 0 VU. Rating 10W (8 ohms) output thru A.W.N. circuit.
Noise level	MAG.	both tracks less than 20mV	Set to FWD thru A.W.N. circuit. Maximum volume.
	OPT.	less than 20mV	
Wow/Flutter CCIR	WTD	less than 0.4%	Record at 18 fps. Move a sprocket at 12 teeth.
	LINE	less than 0.7%	
	FUL	less than 0.4%	
Transferring recording	Track 1 to 2 Track 2 to 1	over -6 dB	Transfer at 0 VU a 400Hz signal recorded at -10 VU.
Bias oscillation frequency		60KHz±5K	
Bias current	Track 1	400±15µA	Set both tracks to recording state. Connect a 100 ohms resistor across a ground wire on track 1 side. Measure voltage across it. In case of track 2, connect the resistor on track 2 side.
	Track 2	400±15µA	
Recording signal current	Track 1 400Hz	55µA	Cut a bias power-supply. Measure the current in the same manner as bias measurement.
	Track 2 400Hz	45µA	
Erasing current	Track 1	over 110mA	Set both tracks to recording state. Connect a 1 ohm resistor across a ground wire of track 1 E.H. Measure voltage across it. In case of track 2, connect the resistor on track 2 side.
	Track 2	over 110mA	
Exciter lamp current		0.75±0.01A	Measure with an exciter lamp wire.

Trouble		Page	Trouble		Page	
Film transportation & Auto-threading	Unstable picture	20, 22, 28, 30, 34	Projection Lamp	It doesn't light	76	
	Film flow	22, 28		Uneven illuminance	72, 76	
	Picture inclination	20		Changeover of H-L is defective	80	
	Picture out of position	20		It isn't pre-heated	80	
	Picture flicker	28		Dark picture	72, 76	
	Sometimes out of focus	34		Difficult to replace it	72	
	Uneven focus	34		Unstable lighting	76	
	Film scratch	20, 32, 34, 36, 38, 40, 42, 74		Control Circuit & Others	Control circuit board defective	86-92
	Running noise	22, 28			Motor won't run with FWD key operation	78, 100, 102, 114
	Upper loop is getting shorter in REV	32			Motor won't run with REV key operation	104, 105, 114
	- ditto - in REV at OPT	34			Motor won't stop with STOP key operation	114
	Lower loop isn't formed (OPT)	38			Unable to set to STILL projection	10, 105, 106, 114
	Loop-sensor function is defective	36			ESS sync defective	22, 83, 84, 86
	Unable to set to the auto-threading	30			ESS malfunction	82, 109, 110, 111
	Unable to release the auto-threading	16, 30, 74			Speed of FAST/SLOW isn't adjustable	82
Film is interrupted in auto-threading	30, 42	Unable to record & play back ESS pulse	82			
Difficult to take off the film	38	Solenoids (for head preser & pul roller lever) don't work	48			
Image trails	22	Lamp relay isn't workable	80			
Slow running	22, 28	Unable to shift 18-24 fps	82			
Take-up & Rewind	Take-up is defective	60	Unable to fine adjust speed of 18-24 fps		82	
	Take-up power is weak	60	Main motor revolution is out of regulated number		86	
	Take-up power is too strong	62	No power though power switch is ON		80	
	Rewinding is defective	64	Unable to shift MAG-OPT system	116		
	Rewinding power is weak	64	Unable to shift STEREO-MONO system	116		
Motor	Rewinding power is too strong	64, 66	REC button malfunction	118		
	High speed rewinding is defective	68	Spot recording button malfunction	118		
	Noise from rear arm	62	Volume knob turn isn't proper	118		
	Main motor doesn't run	70, 78	Film damage in still projection (6 fps)	72		
	Noise from main motor	70	Film counter isn't workable	68		
Motor	Slow running of main motor	70, 78	Pilot lamp doesn't light	78		
	Fan motor doesn't run	70, 78	Noise in forwarding	60		
	Noise from fan motor	70	Noise in reversing	64, 66		
	Speed of fan motor isn't changed	70				
	Take-up & rewinding motors don't run	60, 64, 78				

Trouble		Page	Trouble		Page		
Optical	Unable to playback	54, 126	Recording	Unable to record on track 1 or 2	141, 142		
	Poor sound quality	54		Unable to record on both tracks	143		
	Small sound	54		Unable to erase sound on track 1 or 2	40, 144		
	Hum	54, 134		Unable to NORMAL record on track 1 or 2 (DOUBLE recording is OK)	145		
	Unable to playback high frequency range	54		ALC of track 1 or 2 isn't workable	145		
	Oscillation	137, 138		Neither ALC is workable	145		
	Wow/Flutter	38		No deflection of level meter (1) or (2) (Recording itself is OK)	146		
	Quick-sound-start system won't work	16, 38		Unable to DOUBLE record on track 1 or 2 (NORMAL recording is OK)	146		
	Magnetic Playback	Wow/Flutter		16, 28, 32, 36, 38, 40, 42, 46, 48, 58, 86	S O U N D Recording/Playback Shifting Solenoid	Solenoid (1) or (2) doesn't work	147
		Poor sound quality		12, 40		Neither solenoid works	148
High frequency range isn't played back		40, 42	This (1) or (2) won't work though FWD button is pushed together REC button	149			
Unable to playback		12, 78, 118, 123, 124, 125	Both of them won't work through FWD button is pushed together REC button	149			
No sound thru speaker (track 1)		123	Spot recording isn't performed (Other recordings are OK)	149			
No sound thru speaker (track 2)		124	Solenoid terribly vibrates with REC button operation	149			
No sound thru speaker (both tracks)		125	Unable to put spot recording condition back	149			
No deflection of level meter (1) or (2)		127	Once operated, solenoid won't put back though OFF button is pushed	150			
Neither level meter swings		127	As soon as power is applied, solenoid works	151			
Indication of level meter (1) or (2) differs with that in recording		140	Solenoid works with only shifting to READY or M position, without REC button	151			
No signal from AUX OUT (1) or (2)		128	Amplifier fuse burns	152			
Neither AUX OUT line works		128					
No sound from either MONI		129					
No sound from stereo headphone		129					
No sound from EXT. SP (1) or (2)		129					
No sound thru PA system	131						
Stereo system isn't workable	132						
Loud hum from each speaker	133						
Oscillation in magnetic playback	133, 136						
Muting circuit (1) or (2) isn't workable	139						
Neither muting circuit is workable	139						

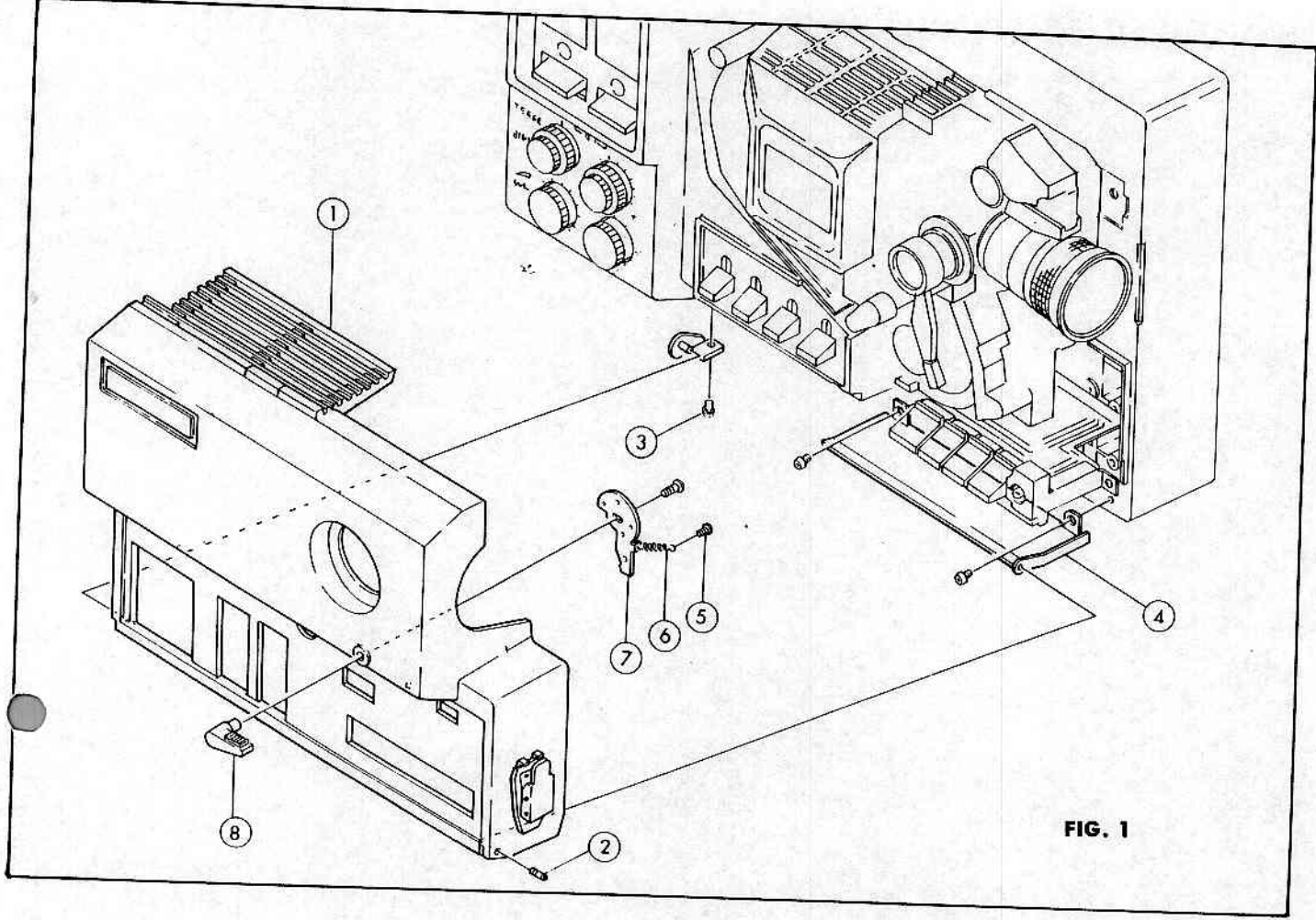


FIG. 1

VI. DISASSEMBLY & REASSEMBLY NOTES

1. APPEARANCE PARTS

A. Front Cover (1)

TROUBLESHOOTING: (Refer to Fig. 1)

Trouble	Cause
Unable to push a STILL button fully	The (4) is fixed incorrectly.

DISASSEMBLY:

1. Unscrew the (2). Loosen the (3) and remove the (1).
2. Go on with disassembly works, referring to Fig. 1.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that the (8) functions smoothly.

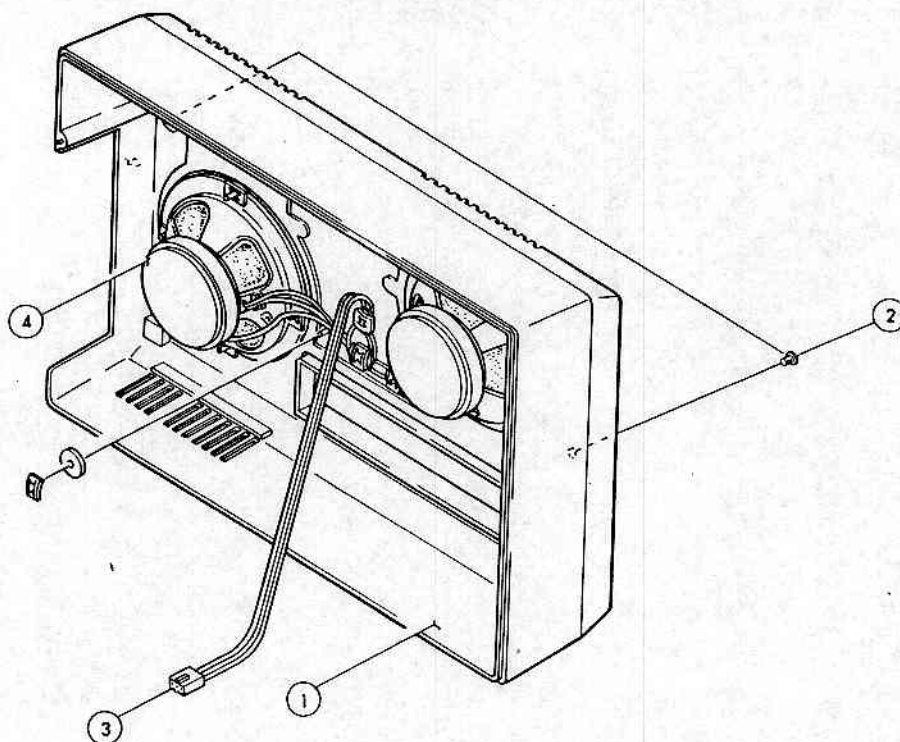


FIG. 2

B. Rear Cover (1)

TROUBLESHOOTING: (Refer to Fig. 2)

Trouble	Cause
No sound from a speaker	The (4) is broken or the (3) is connected loosely.
Bad tone quality	

DISASSEMBLY:

1. Unscrew the (2)x2 and take off the (1) after disconnecting the (3).
2. Go on with disassembly works, referring to Fig. 2.

REASSEMBLY NOTES:

Follow the reverse way of the disassembly steps.

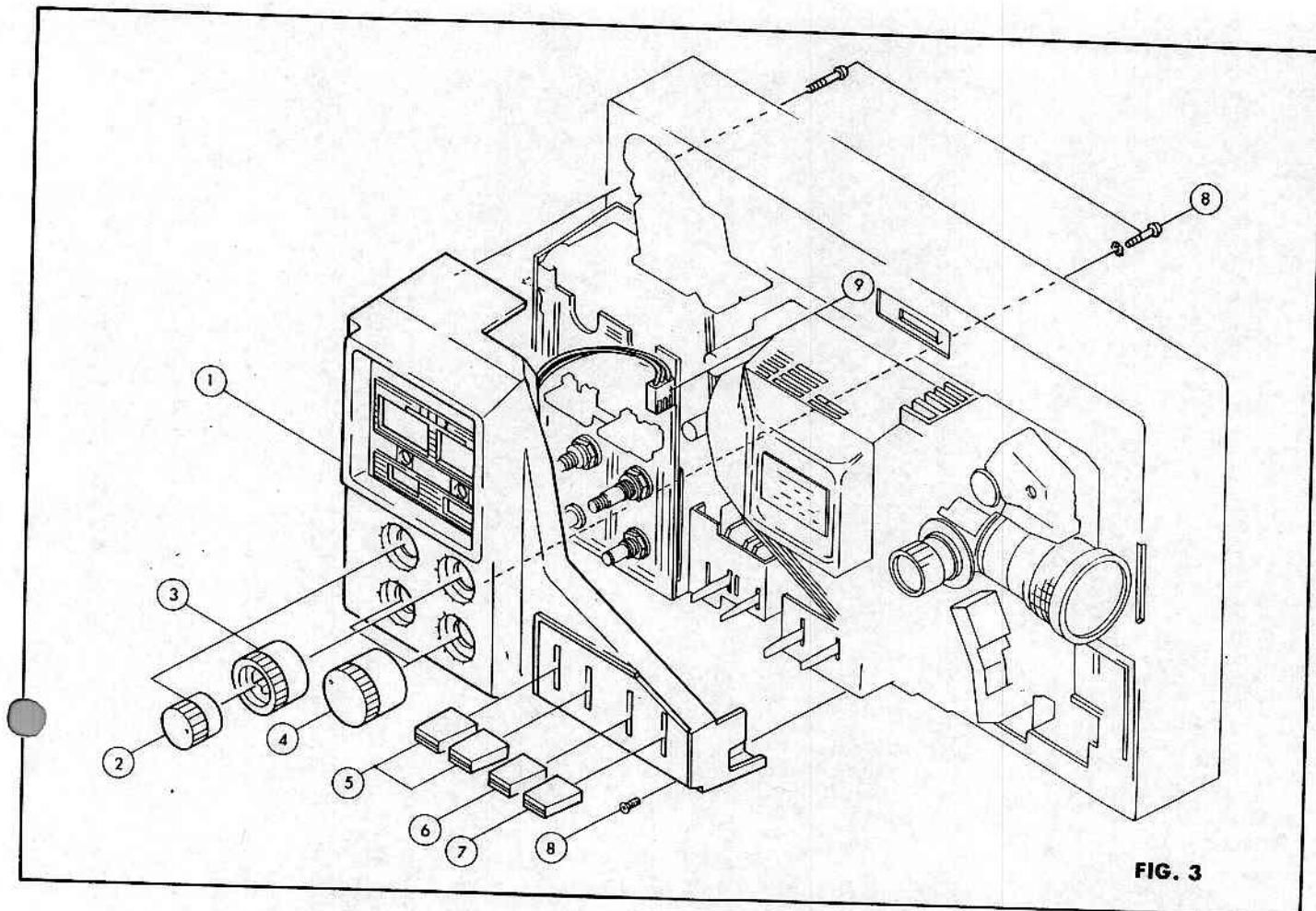


FIG. 3

C. Amplifier Cover (1)

DISASSEMBLY: (Refer to Fig. 3)

1. Pull out the ten knobs: 2 pcs. each of the (2)(3)(4)(5) and 1 pce. each of the (6)(7).

They are inserted rather hard.

2. Unscrew the (8)x3 and take off the (1) after disconnecting the (9).

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Difference in color among knobs is as follows.
 - The (5) is black with a white line.
 - The (6) is silver with a yellow line.
 - The (7) is silver with a red line.

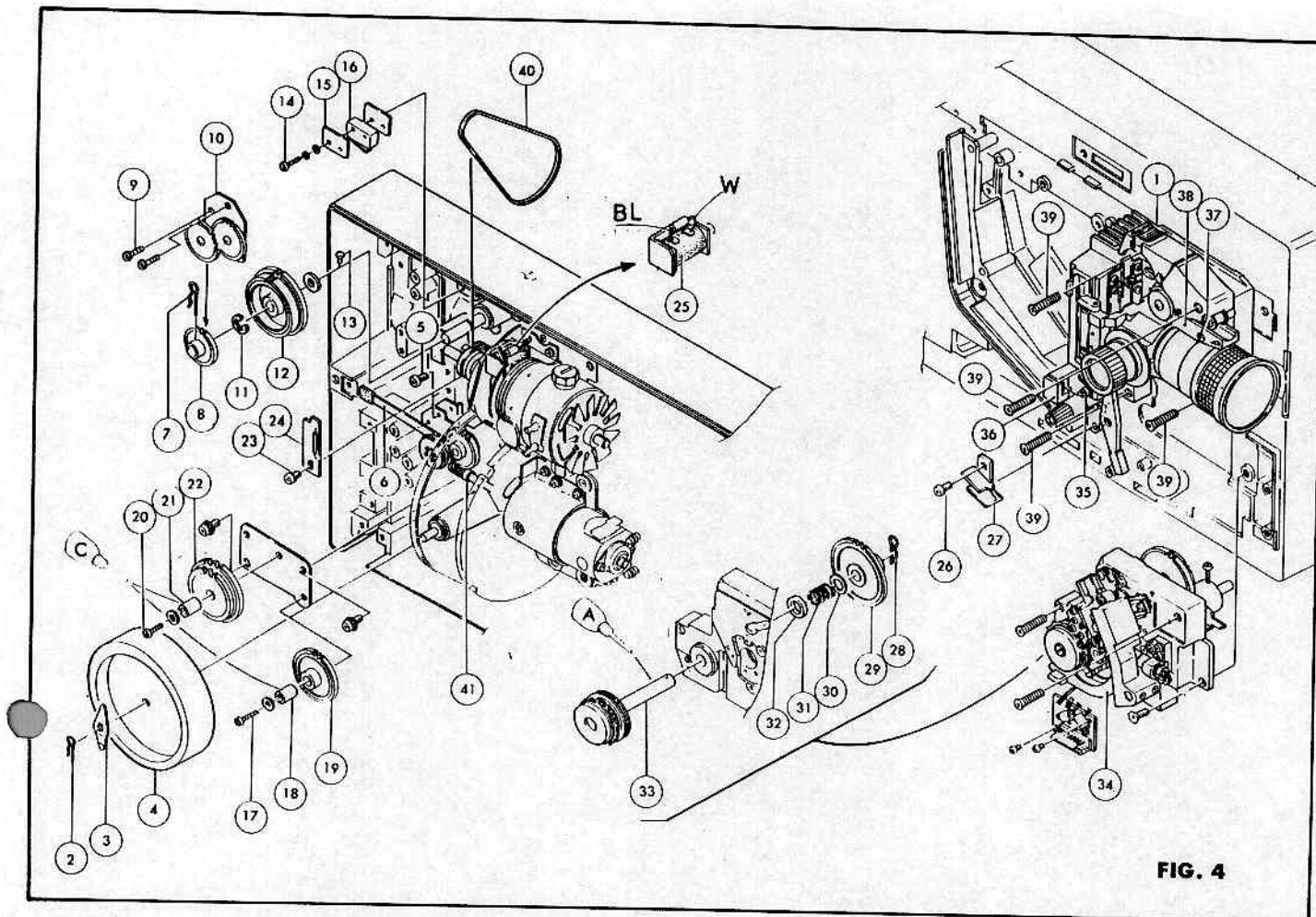


FIG. 4

2. MACHINE FRAME SECTION

A. Machine Frame Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 4)

Trouble	Cause	Reference
Unable to set back auto-threading condition	Defect of the (16) or its electric circuit. The (16) is out of position. Defect of the (25) or its electric circuit.	
Wow/Flutter	The gears (12)(19)(22)(29) have burrs or dust, causing irregular turn. Wash off the dust or replace gears. The (6) is incorrectly positioned	Page 18 REASSEMBLY NOTES No. 2
Time when sound becomes normal is too long	The (6) is out of position.	

DISASSEMBLY:

1. Take off the parts from the (2) to (12). The (13) will fall off.
2. Unsolder the two wires connected to the (16) from the relay board. You, however, may remove the (16) after unscrewing the (14)x2.
3. Take off the (17)(20)(19)(22) respectively. The (18)(21) will fall off.
4. Unscrew the (23) and remove the (24). You need not unsolder the wire connected to the (24).
5. Unsolder the two wires from the (25).
6. Unscrew the (26) and remove the (27).
7. Remove the (28). As holding the (29) and pushing the (34) down, pull out the (33). The (30)(31)(32) will fall off.
8. Unscrew the (35) and remove the (36). You need not unsolder the wire connected to the (36).
9. Unscrew the (37) and remove the (38).
10. Unscrew the (39)x4, take off the (30) and remove the (1).

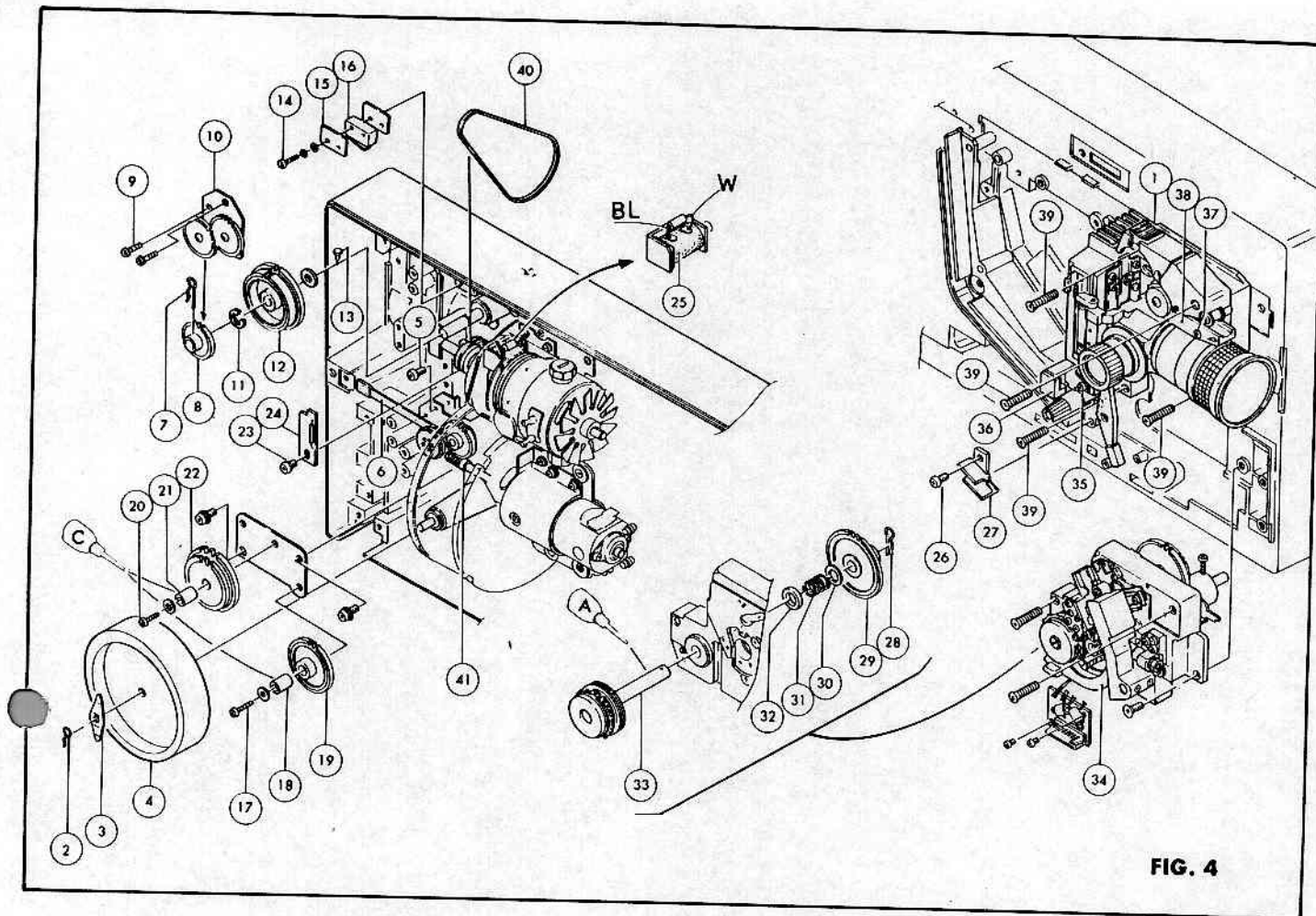


FIG. 4

A. Machine Frame Assembly (1) (Cont'd)

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. After adjusting the engagement of the (6) and (41), tighten them with the (5) temporarily. The (6) is naturally in contact with the (4) and the (4) is able to turn by the (6). Adjust the attaching position of the (6) and fan motor (No.2 on Page 69) so that the (6) can get away from the (4) as soon as FWD button is depressed. After this work, tighten the (6) firmly.
3. Attach the (16) in place where it turns on when an auto-threading button (No.1 on Page 30) is depressed.
4. Attach the (24) in place where the reed switch on it can turn ON in the ratio of 1 time/1 frame. Use a tester for the above checking.
5. After attaching the (29)(28), make sure that "a" surface of the (29) is in contact with the (28) closely. If not, pull the (29) in the arrow direction in Fig. 4-A.
6. Make sure that gears have no crack and no dust prior to the attaching works.
7. Attach gear so that there is a backlash.
8. Don't damage the (36)'s wires. If they short, fuse will burn.

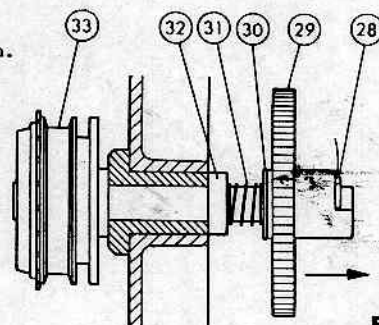


FIG. 4-A

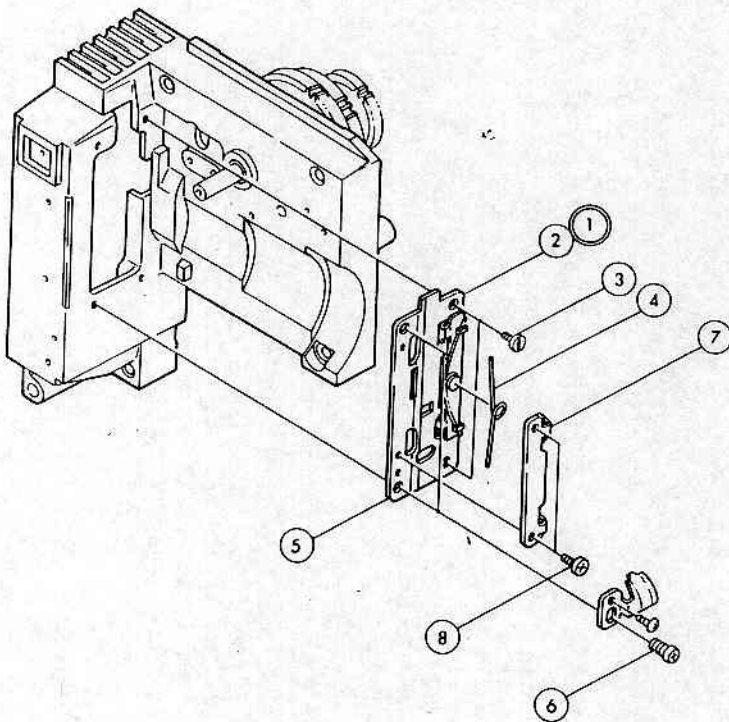


FIG. 5

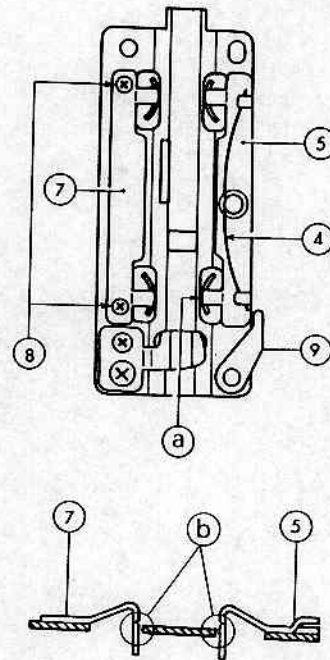


FIG. 5-A

B. Aperture Plate ((1))

TROUBLESHOOTING: (Refer to Fig. 5)

Trouble	Cause
Film scratch	Flaw on the aperture plate rail.
Unstable picture (right/leftward)	The spring pressure of the (4) is improper.
Picture inclination, Unstable picture, Picture out of position (right or left)	The (7) is out of position or worn-out as shown in Fig. 5-A-b.
Unstable picture (new printed film)	The (5)'s position is improper.

DISASSEMBLY:

1. Remove the film insertion entrance, first sprocket shoe, first sprocket and auto-threading button, referring to Page 32.
2. Unscrew the (3), (6)x3 and remove the ((1)).

REASSEMBLY NOTES:

1. Before attaching the ((1)) to the machine frame, make sure that the aperture plate rail has no flaw and that the (5) moves smoothly without burrs or camber.
2. Follow the reverse way of the disassembly steps.
3. When attaching the ((1)) to the machine frame, tighten the screws (3) and (6)x3 in this order.
4. After fixing the (4) to (5), measure of the spring pressure (30-40g) at "a" point in Fig. 5-A. Use a spring scale C043.
5. Attach the (7) with (8)x2 in place where the image can appear fully in every direction without inclination.

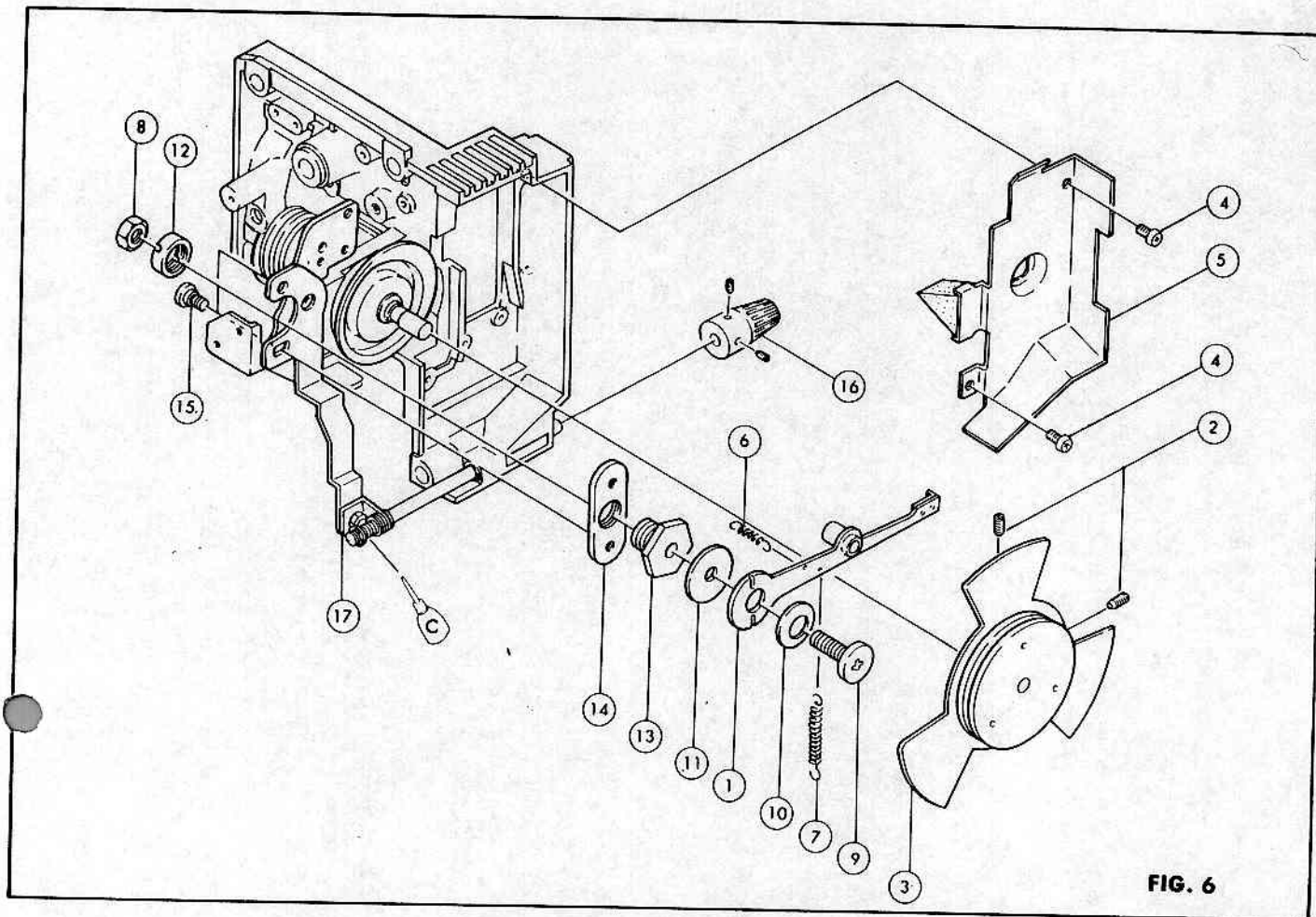


FIG. 6

C. Sending Claw Assembly (1) and Shutter (3)

TROUBLESHOOTING: (Refer to Fig. 6)

Trouble	Cause	Reference
Shutter flows (Picture trails)	The (3) is out of position.	Page 26
Film flows	The claw tip doesn't protrude fully from the aperture place surface (1.0mm is proper).	Page 24
Running noise	The (1) is worn-out. The spring pressure of (6)(7)(10) is improper.	Page 24
Unstable picture (up/downward)	The spring pressure of (6)(7)(10) is improper.	Page 24
Unstable picture (left/rightward)	The (1) is out of position.	Page 24
Unstable picture (sent backward)	the claw tip protrudes excenssively.	Page 24
Slow running	Oil adheres to the pulley of the (3).	

DISASSEMBLY:

1. Take off the (3) after unscrewing the (2)x2.
2. Take off the (5) after unscrewing the (4)x2.
3. Unhook the (6)(7).
4. Take off the (9) after unscrewing the (8) and then remove the (1). The (10)(11) will fall off.
5. For further disassembly, refer to Fig. 6.

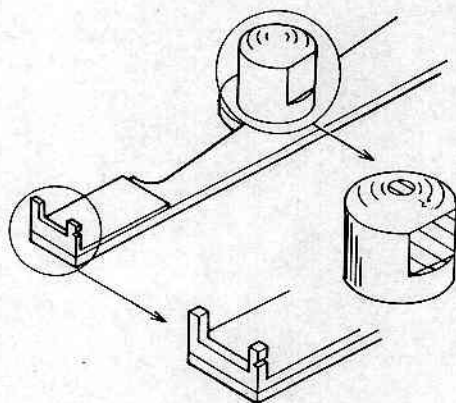


FIG. 7

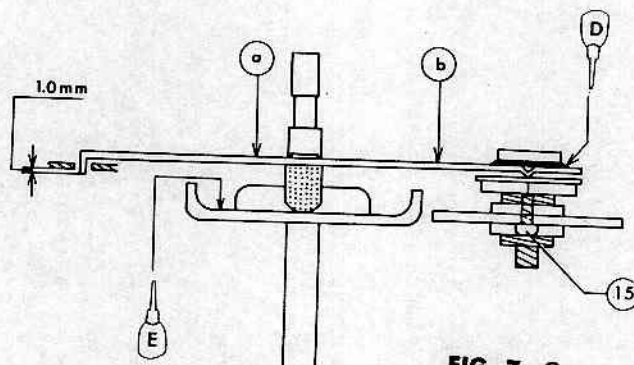


FIG. 7-C

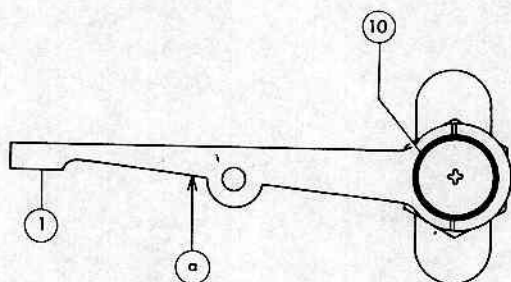


FIG. 7-A

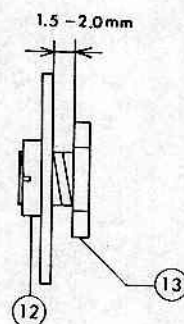


FIG. 7-B

C. Sending Claw Assembly (1) and Shutter (3) (Cont'd)

REASSEMBLY NOTES:

1. Replace the claw or pin if they are worn-out as shown in Fig. 7.
2. Attach the (13) with (12) to (14) in place where there is the clearance (1.5-2.0mm) as shown in Fig. 7-B. Use a tool P055.
3. Attach the claw to the (12)(13)(14) assembly with (11)(10)(9) after checking the claw is straight. Measure the spring pressure of (10) at the (a) point and in the (a) direction, using a scale C043. The proper pressure is at the range of 60 - 70g. If improper, adjust it with use of proper washer.
4. Attach the claw assembly to the machine frame.
5. Adjust the claw tip protrudent length from the aperture plate surface as follows.
 - a. The length is 1.0mm (Fig. 7-C). The 1.0mm length is originally adjusted in assembling line with care, but if not 1.0mm, adjust the length by screwing or unscrewing the (13) in Fig. 7-B, using a gauge P047.
 - b. When the length is 1.0mm, the claw pin contacts close to the bottom of the cam. If opens, bend the (b) point in Fig. 7-C.
 - c. The two pieces of claw tip should protrude into the film perforations simultaneously.
6. Attach the (6)(7) in Fig. 6 and adjust their spring pressure as follows:
 - a. Move the claw downward fully (position where claw ends to send the film) and measure the pressure at the (a) point in Fig. 7-C.
 - b. The (7)'s pressure is within $900 \pm 50g$ when you measuring in the direction that the claw transports the film. Use a scale P048.
 - c. The (6)'s pressure is within $450 \pm 50g$ when you measuring in the direction that the claw goes away from the aperture plate. Use a scale P026.

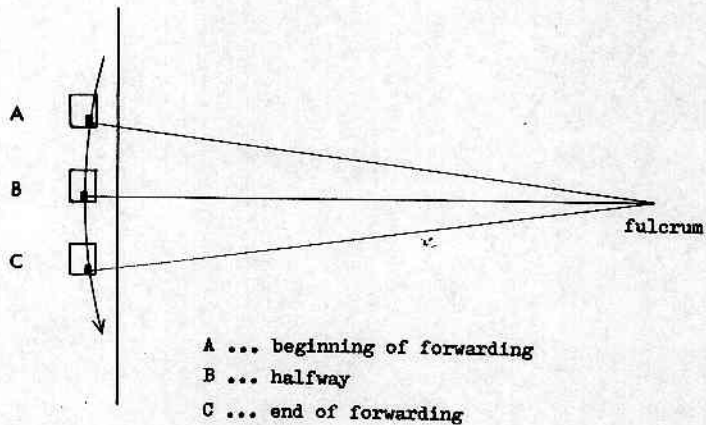


FIG. 8

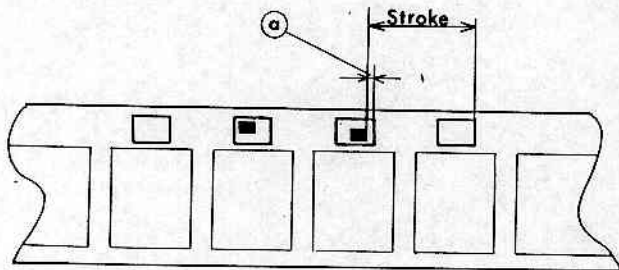


FIG. 9

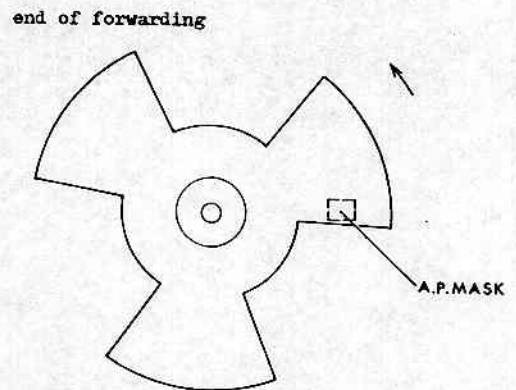
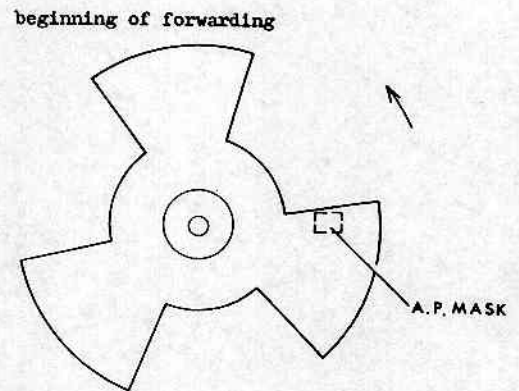


FIG. 10

C. Sending Claw Assembly (1) and Shutter (3) (Cont'd)

REASSEMBLY NOTES (Cont'd)

7. Adjust the claw position as follows:

Set a white leader film on the aperture plate. Whenever the claw tip just protrudes into the perforation, it shouldn't touch the perforation edge regardless a framing knob (Fig. 6-16) position. This is applied to both of forward and reverse projections. For this adjustment, shift the claw position with (15)x2 in Fig. 7-C. Refer to Fig. 8.

8. Check the claw stroke.

As sending the film of one or two frames by hand, make sure that there is a slight clearance (Fig. 9-a) between the claw tip and perforation just before the tip transports the film, and that the claw tip doesn't scratch the perforation edge when putting back.

9. Attach the shutter.

a. Make sure that oil doesn't adhere to the (3)'s pulley in Fig. 6.

b. Adjust the shutter position so that it shades the aperture mask while the claw transports the film of one frame. Refer to Fig. 10.

10. Adjust the framing.

Attach the machine frame to the body. Project the resolving power film (P054). Measure the width between the aperture mask upper line and picture bottom line appearing when the framing knob is turned fully clockwise. Memorize this width. Next measure the width between the mask bottom line and picture upper line appearing when the knob is turned fully counterclockwise. The former width and the later should be in ratio of 6:4. If not, adjust the (17) position in Fig. 6.

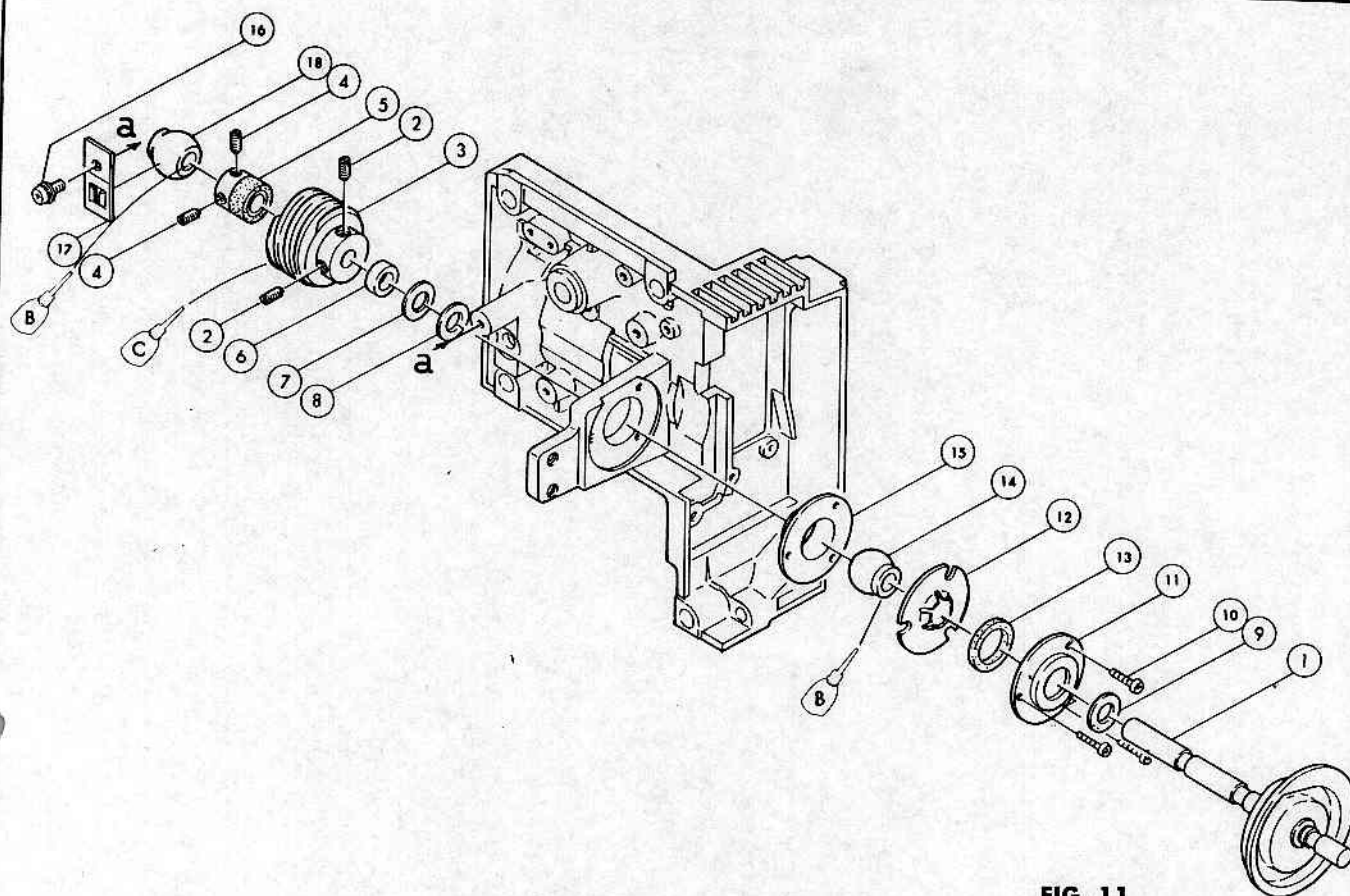


FIG. 11

D. Cam Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 11)

Unstable picture (up/downward)	There is a play among the (1) and (14)(18) owing to abrasion in the direction of its shaft. The (1)'s stroke is insufficient.
Film flow	
Running noise	Flaw on the (1)'s cam surface.
Wow/Flutter	Flaws on the (1)(3). The (1) turns irregularly owing to eccentricity of the (14)(18).
Slow projection speed	Oil, which is lubricated among (1) and (14)(18), becomes insufficient.
ESS sync is defective	The (5) is defective or out of position.

DISASSEMBLY:

1. Pull out the (1) after loosening the (2)x2, (4)x2. The parts from (3) to (9) will fall off. Take care not to mar the (3) with a flaw and not to put oil on.
2. Unscrew the (10)x3 and remove the (11)(12)(13)(14)(15). You, however, had better not take off the (11) because its center gets out of position, except unavoidable case. The (13) of 0.3mm (2 pcs.) or 0.5mm (1 pc.) thick is used.
3. Unscrew the (16) and remove the (17)(18).

REASSEMBLY NOTES:

1. Make sure that the cam surface and its shaft have no flaws.
2. After checking there is no play among the (1) and (14)(18), attach the (14)(18) to the machine frame. Adjust the (1)'s turn by changing the (18) position to see that the (1) can turn smoothly without unevenness.
3. Attach the (1)(9)(8)(7)(6)(3)(5) to the machine frame simultaneously.
4. Adjust the (3)'s position with the (2)x2 so that the (1) can turn smoothly without rattling and unevenness in the direction of the (1)'s shaft.
5. For further assembling works, refer to Page 22.

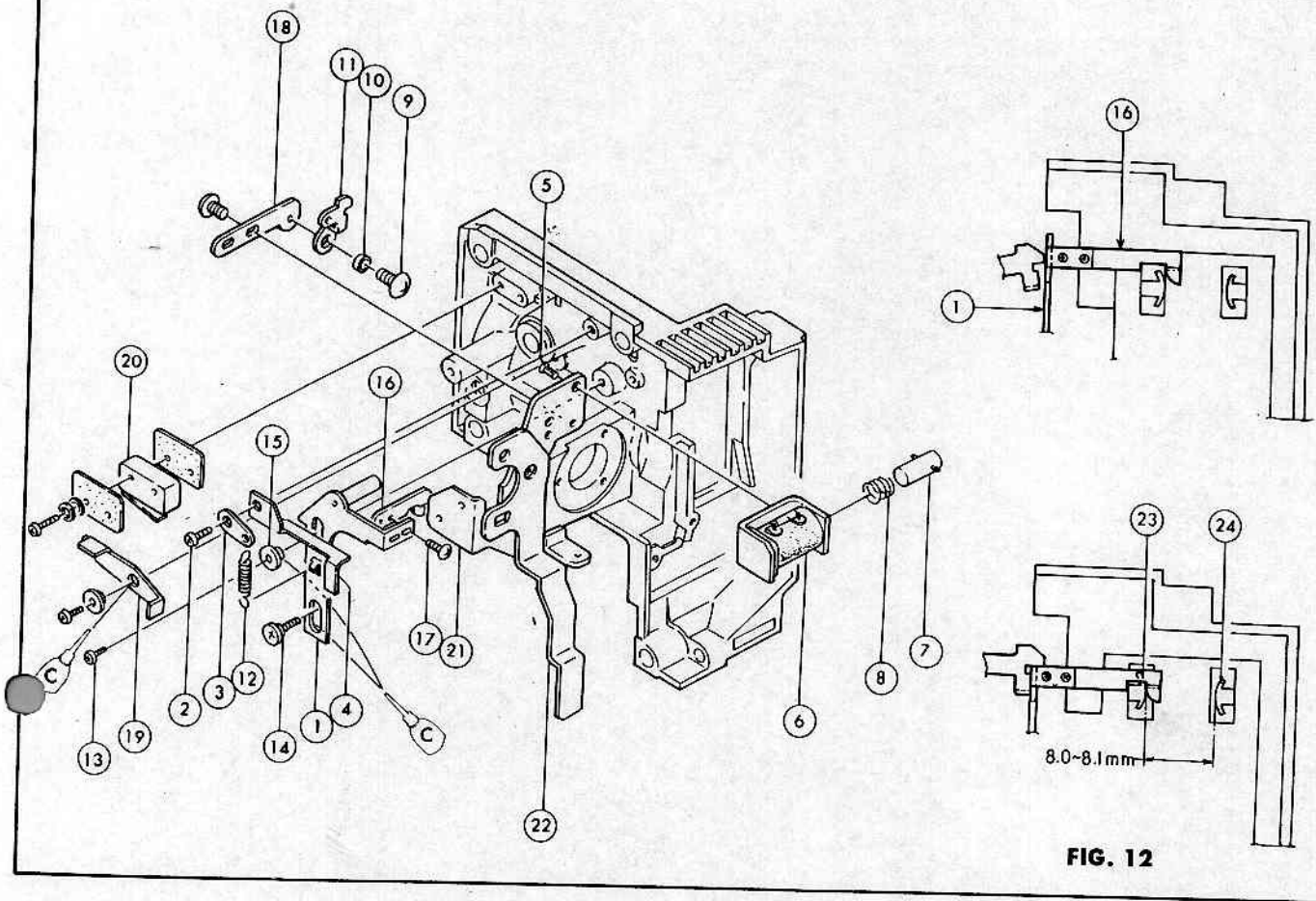


FIG. 12

E. Auto-Threading Mechanism

TROUBLESHOOTING: (Refer to Fig. 12)

Unable to set to auto-threading condition	The (6)'s defective. The (1)(11) are malfunction or out of position.
Unable to set back from auto-threading	The (1)(19) malfunction. The (6)(20) are defective. The (11) is out of position.
Film is interrupted in auto-threading	The (16) is out of position.
Unstable picture (right/leftward)	The (16) malfunctions.

DISASSEMBLY:

1. Take off the (3)(4) after unscrewing the (2). Note that the (12) may fly off.
2. Take off the (6) after unscrewing the (5)x2. The (7)(8) will fall off.
3. Take off the (11) after unscrewing the (9). The (10) will fall off.
4. Take off the (1) after unscrewing the (13)(14). The (15) will fall off.
5. For further disassembly, refer to Fig. 12. You had better not disassemble the (18)(21)(22) because a frame line gets entirely out of order except unavoidable case.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that each lever operates firmly.
3. When you push the (23) down for auto-threading, the (16) pushes the (23) down. Under this condition, the space between the (23) and (24) should be within 8 - 8.1mm as shown in Fig. 12. For this adjustment, change the (16)'s position.

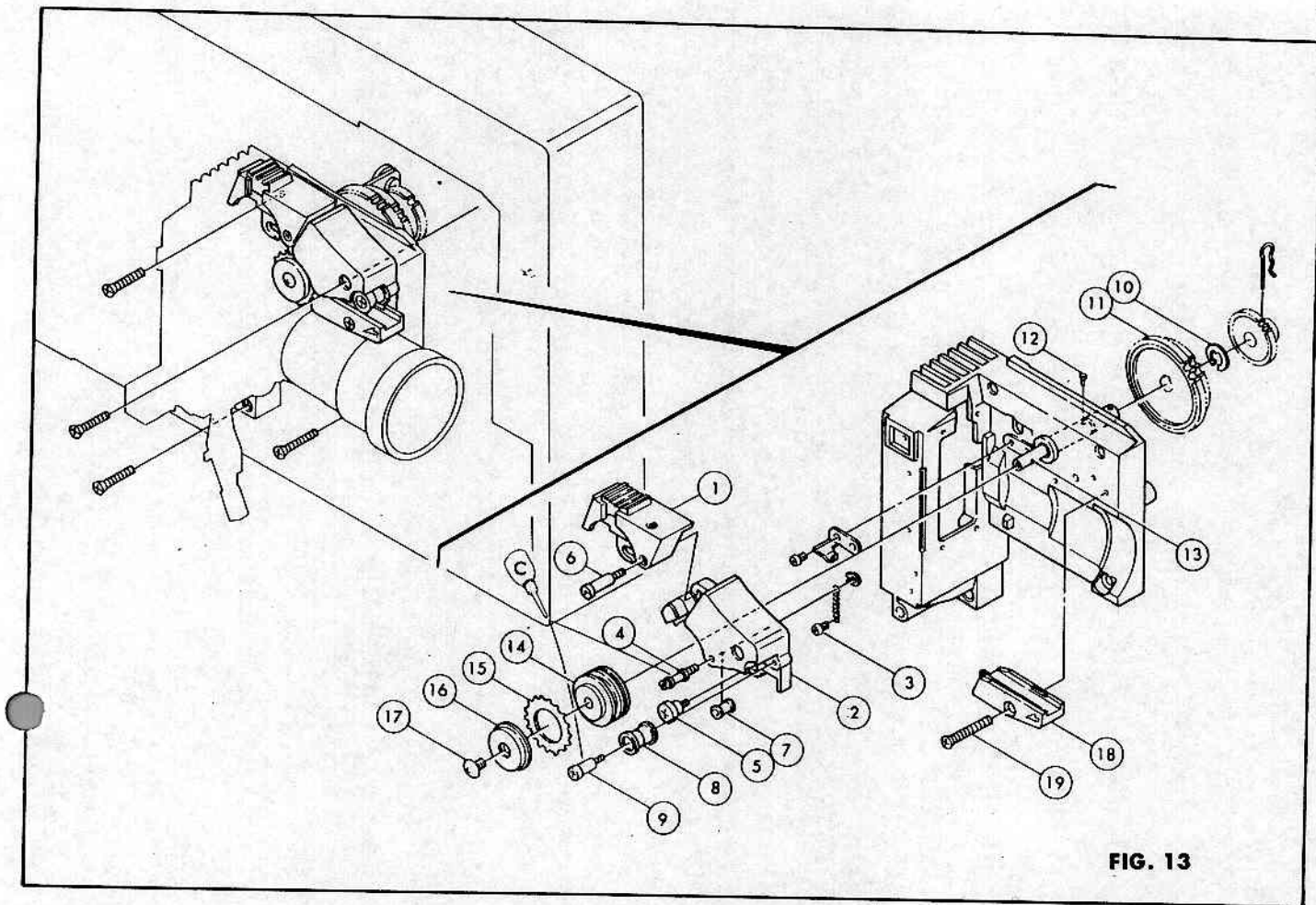


FIG. 13

- F. First Sprocket Shoe (2)
First Sprocket (15)
First Sprocket Gear (11)
Threading Button (1)

TROUBLESHOOTING: (Refer to Fig. 13)

Film scratch	The (15) has flaw or burrs. The (7)(8)(14) have flaw or turn irregularly.
Wow/Flutter	The (11)(15) are defective. The (12) has fallen off.
First sprocket doesn't turn	The (11)'s defective. The (12) has fallen off.
Upper loop decreases in reverse projection	The (2) is not fixed firmly. Stop the (2)'s rattling with use of proper washer.

DISASSEMBLY:

1. Take off the (19)(18)(3)(5)(2) in this order. Don't remove the (6) except unavoidable case.
2. Pull out the (13)(14)(15)(16)(17) as an assembled parts toward you. In an improved machine, however, the (13) is modified and you cannot pull it out. Take off the (14)(15)(16) after unscrewing the (17) and then push the (13) backwards.

REASSEMBLY NOTES:

1. Fix the (14)(15)(16) with (17) to the (13).
2. Fix the (8) with (9) to the (2). Make sure that the (8) turns smoothly and has no flaw and dust.
3. Fix the (7) with (4) to the (2). Make sure that the (7) turns smoothly and has no flaw and dust.
4. Fix the (2)(18) with (5)(19) respectively.

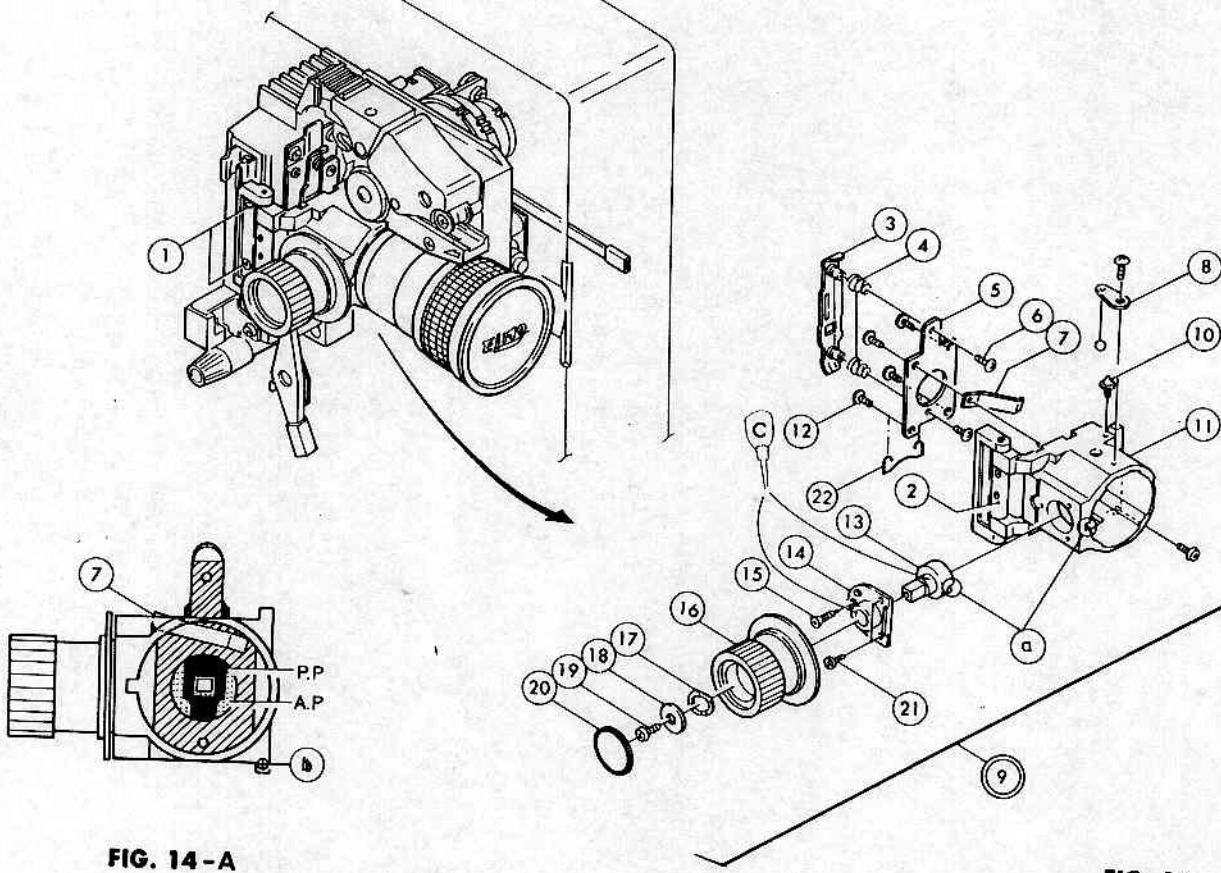


FIG. 14-A

FIG. 14

G. Projection Lens Holder Assembly ((9))

TROUBLESHOOTING: (Refer to Fig. 14)

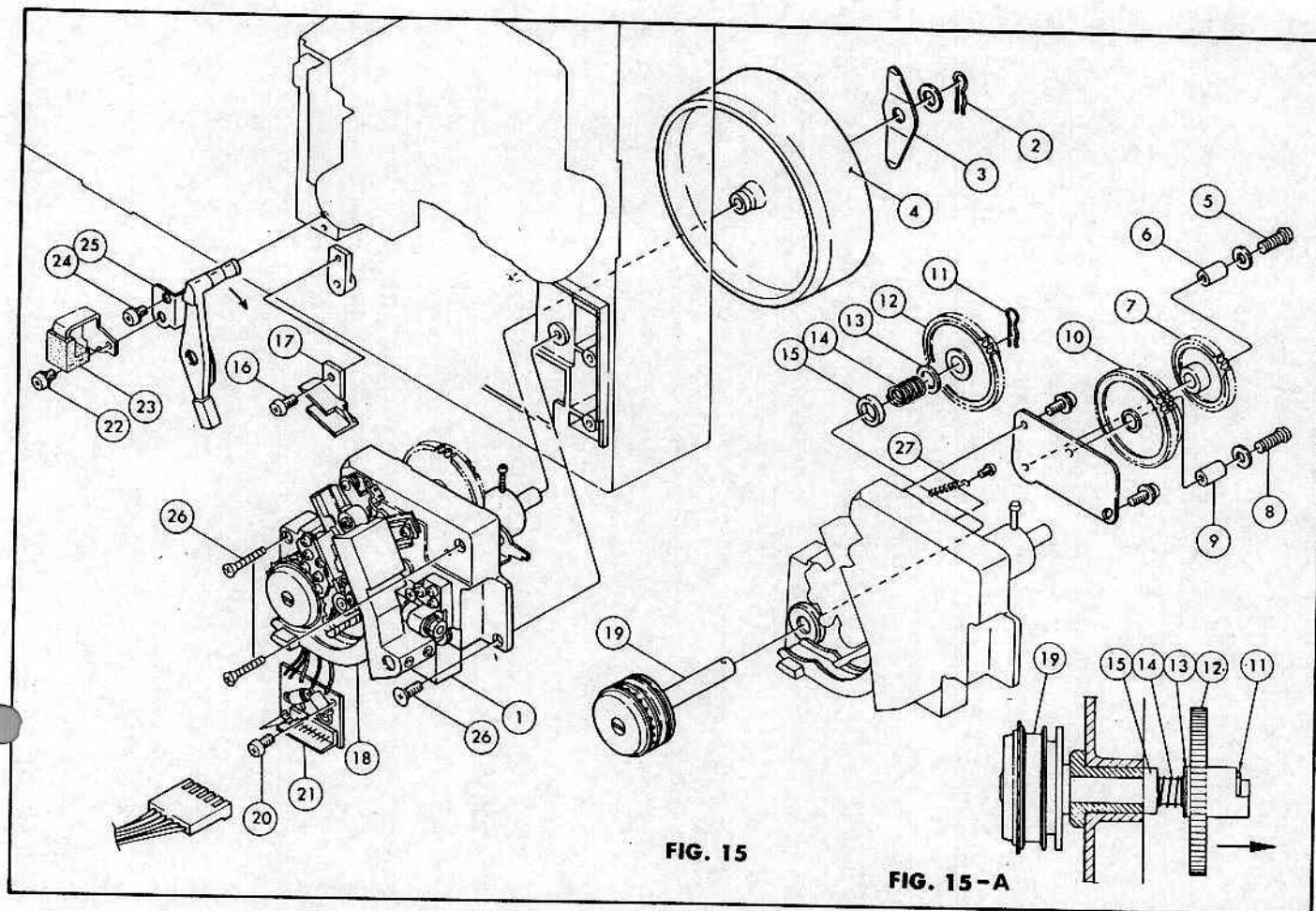
Film scratch	Flaws, burrs or dust on the (13). The (4) pressure is excessive.
Picture sometimes becomes out of focus	The (3) is distortional.
Unstable picture	The (4) pressure is insufficient.
Upper loop is lost during optical film playback in reverse projection	Its proper pressure is within $65 \pm 5g$.
Uneven focus	The ((9)) is out of position.

DISASSEMBLY:

1. Remove the (1)x2 and detach the ((9)) from the machine frame. Don't detach it except unavoidable case.
2. For further disassembly, refer to Fig. 14. The (20) is adhered with double tack tape.

REASSEMBLY NOTES:

1. Attach the (3)(4) to the (5) with (6)x2.
2. Attach the above assembly and the (7) to the (11) with (12)x4 tentatively. Refer to Fig. 14-A to attach the (7).
3. Attach the (14) to the (11) with (21)x2 and (15). Don't misplace the (15) and (21).
4. Attach the (16)(17)(18) to the (13) with (19). Attaching position of the (16) is where the notches (a) of (11)(13) coincides with each other when you turn the (16) fully clockwise.
5. Attach ((9)) to the machine frame with (1)x2. Adjust and tighten the position of the (3)(4)(5)(7) being assembled tentatively so that PP mask can be in the ratio of 4:6 above and below against AP mask. Refer to Fig. 14-A. Adjust it fine by changing the position of the (2).
6. After attaching the machine frame assembly to the base frame, load the resolving power film type S (P054) and run. Make sure the picture is in focus at the all points. If not, adjust it as follows:
 In case upper or lower part is out of focus, adjust it with (1).
 In case right or left part is out of focus, adjust it with (b).



3. SOUND HEAD FRAME SECTION

A. Sound Frame (1)

TROUBLESHOOTING: (Refer to Fig. 15)

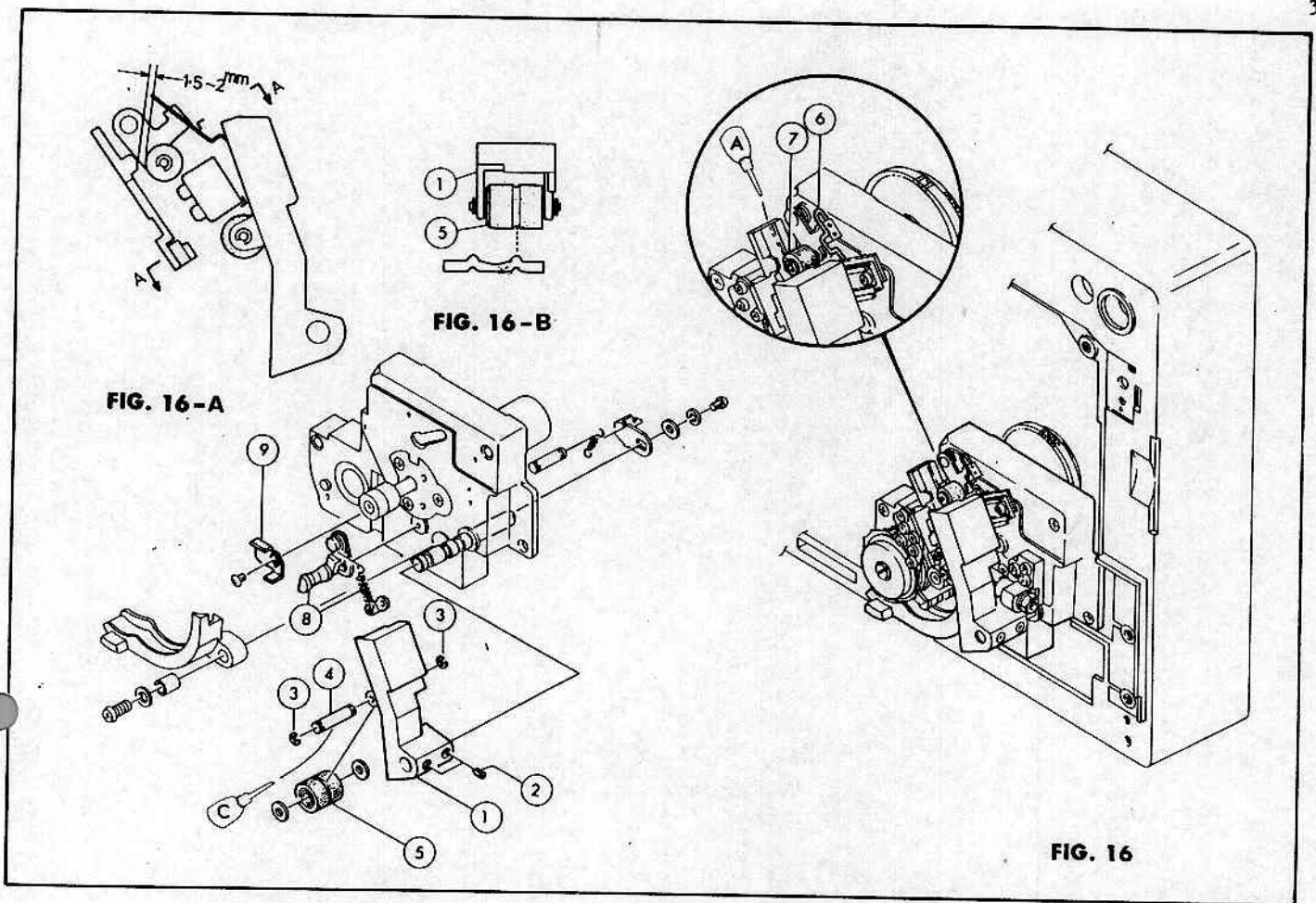
Wow/Flutter	Attaching position of (1)(7)(10)(12) are incorrect. Flaw, deformation or uneven running of (7)(10)(12). Flaw or eccentricity of the (19).
Film scratch	Flaw on the (19).
Malfunction of loop-setter	The (25) is out of position. Attach the (25) while depressing it in the
Front cover doesn't close	arrow direction.

DISASSEMBLY:

1. Remove the exciter lamp. Refer to Page 54 for reattaching it.
2. Remove the drive flywheel spring (Fig. 23-3) from "a" point and 'Solenoid I Spring I' (Fig. 23-7) from b point. Then disassemble the parts by following the order of number in Fig. 15.
3. Remove the (17)(11). Then pull out the (19) while depressing the (18) downward and holding the (13).
4. Don't touch the cancel coil attached to the (21) in disassembling work.
5. Take care for handling of (1)(7)(10)(12)(19).

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that (1)(7)(10)(12)(19) have neither flaw nor dust on their surfaces.
3. Attach the (1) with (26)x3 tentatively. Then fix it after adjusting each backlash of (7)(10)(12).
4. After attaching the (12), pull it in the arrow direction.
5. When detaching sound frame with the above procedures, check spring pressure of the head presser (Fig. 17-10 on Page 40), position of the head presser (Fig. 23-1 on Page 48) and position of switch ON (Fig. 23-A on Page 48).
6. After completing the assembly work, make sure of no hum. For this adjustment, change the position of the cancel coil.



B. Pad Roller Lever (1)

TROUBLESHOOTING: (Refer to Fig. 16)

Wow/Flutter	Flaw or uneven rotation of the (5)(7). The (1) is out of position or its spring pressure is improper. The (6)(8)'s spring pressure are improper.	Page 46
Wow/Flutter during only optical film playback	The (9) is out of position.	
Film removing from film path is not easy	The (1) is out of position.	
Film scratch	The (6)'s spring pressure is excessive.	Page 46
Slow sound picking-up	The (1)(6)'s spring pressure are insufficient.	Page 46
Lower film loop is hardly formed during optical playback		

DISASSEMBLY:

Remove the (1) by unscrewing the (2)x2. For further disassembly, refer to Fig. 16.

REASSEMBLY NOTES:

1. Check the (5)'s surface -- flaw or oil. Attach the (5) to (1). The (5) should turn smoothly. Stop a play in the (5)'s shaft direction within 0.1mm by insertion of proper washer. Fix the E-ring with "Screw-Lock".
2. Attach the (1) in place, making the space (1.5-2.0mm) as shown in Fig. 16-A and coinciding a protrusion of the head guide with the (5)'s groove (Fig. 16-B). The (1)(5) shouldn't contact the sound lens during STILL projection and the (5) shouldn't touch the solar battery during FWD projection.
3. The (7) should rotate smoothly and have no flaw and no oil.
4. The (9) is a stopper used for only optical film playback and has no respect to magnetic playback. The (8) shouldn't work during optical playback. For this adjustment, change the (9) position. Then check wow and flutter with optical test film.

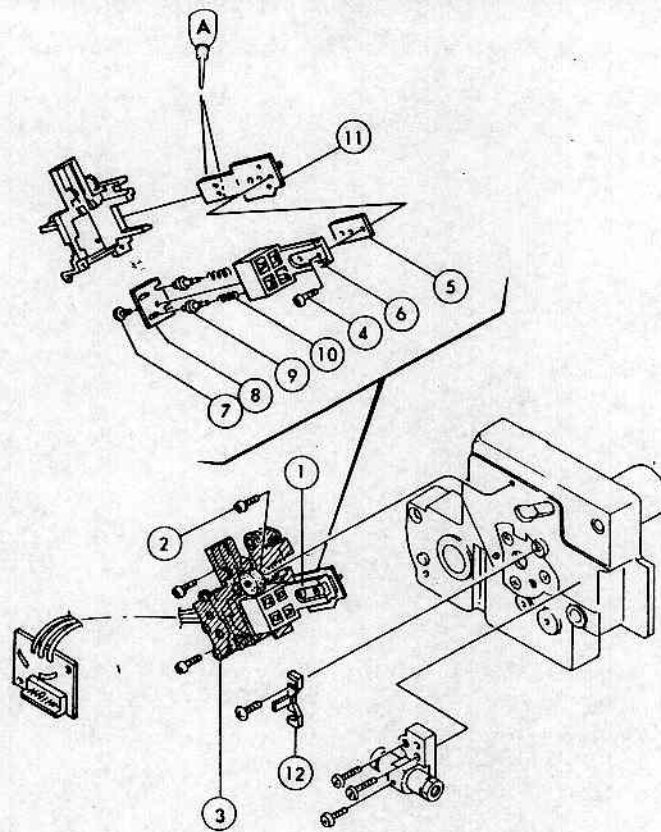


FIG. 17

C. Head Presser Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 17)

Magnetic recording/playback/erasing are faulty.	The (9)'s malfunction.
Film scratch	The (9) are defective.
Poor sound quality on optical playback	The (12) is defective or out of position.
Wow/Flutter, Low output level	The (10)'s pressure are insufficient.

DISASSEMBLY:

1. Detach a pad roller lever (Fig. 16-1).
2. Unscrew the (4)x2 and detach the (6) as an assembled parts. The (5) will fall off. In case of removing the (6) together with the (11), unscrew the (2)x3 and take off the (3) after removing the spring (Fig. 15-27) on back of the (11).
3. For further disassembly, refer to Fig. 17.

REASSEMBLY NOTES:

1. Make sure that the (9)'s have neither flaw nor burrs on film pressing surface.
2. After attaching the parts from the (7) through the (10) to (6), make sure that the (9)'s work smoothly.
3. The (10)'s pressure should be within 20-30g. Use a scale CO43. Refer to Page 45.
4. Make sure that the (1) moves smoothly and that each (9)'s tip contacts with a head surface securely when removing the (3).
5. Depress the (1) in the arrow direction and the (9) will touch to a head surface. Further, depress the (1), and you should observe that the (9)x4 are pushed in by approx. 1mm.
6. Attach the (12) away about 0.1 - 0.2mm from a capstan axis.

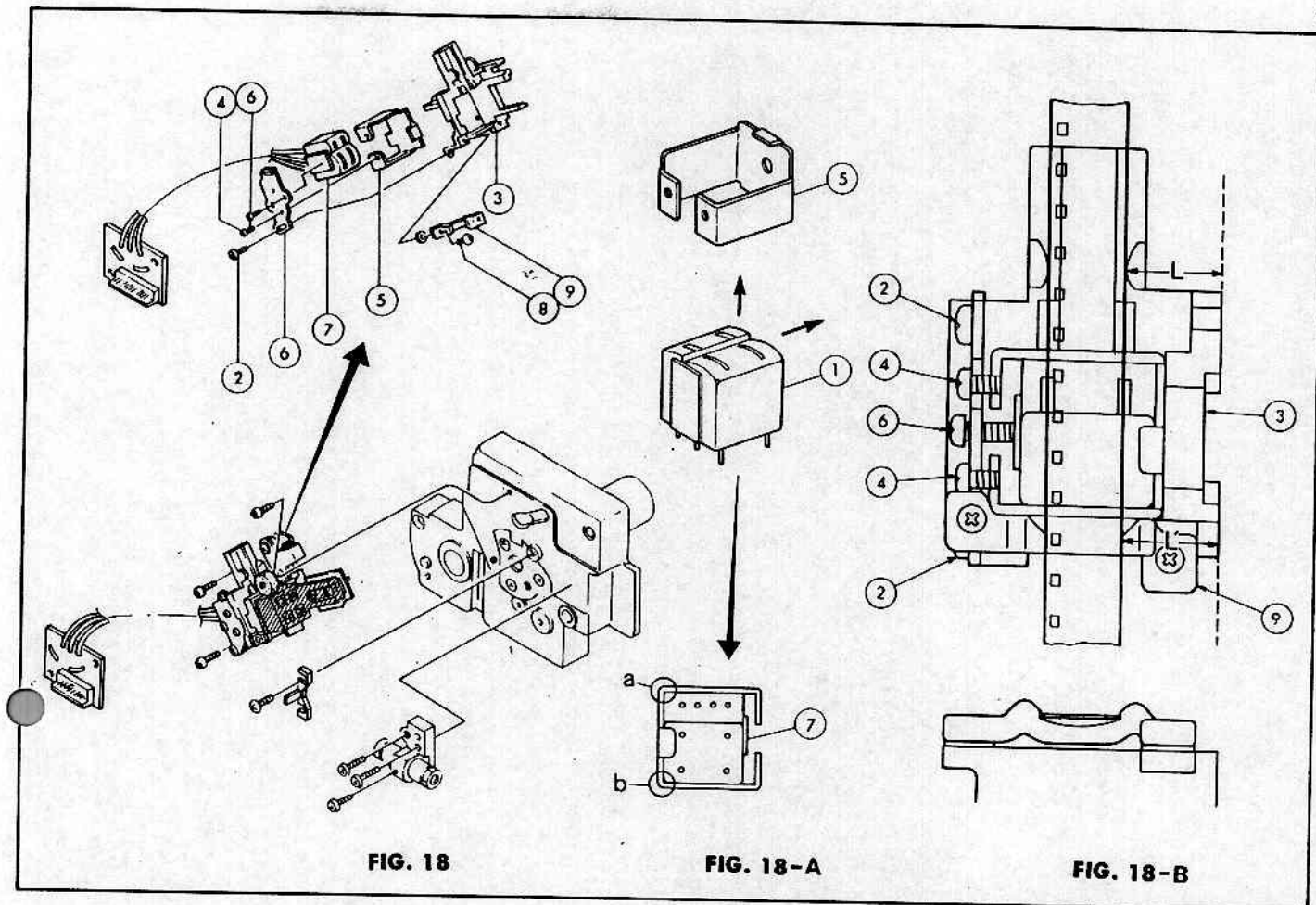


FIG. 18

FIG. 18-A

FIG. 18-B

D. Combination Head (1)

TROUBLESHOOTING: (Refer to Fig. 18)

Magnetic recording/playback/erasing are faulty	The (1) is defective.
Wow/Flutter, Low output level	The (1) is worn-out or out of position. The (9) is out of position.
Film scratch	The (3) is defective. The (9) is out of position.
Film stops in auto-threading	The (9) is out of position.

DISASSEMBLY:

1. Unscrew the (2)x2, (4)x2 and disassemble the (1)(3)(5).
The (1)(5) are assembled with "Cemedine 575".
2. When replacing the (1), unsolder the seven wires from the (1).
Refer to Fig. 19.
3. For further disassembly, refer to Fig. 18.

REASSEMBLY NOTES:

1. Put the (1) in the (5) and fix them by applying "Cemedine 575" to 'a' point and "Alone Alpha" to 'b' point while pushing the (1) in the arrow direction.
2. Attach the (7) to the (1) with "Cemedine 575" as shown in Fig. 18-A.
3. Insert a conventional washer 2.5mm between the (3) & (9) and fix them tentatively. After making sure that distance L equals to L' with a vernier calipers, tighten the (9). Refer to Fig. 18-B.
4. Assemble the parts from (1) through (5) to the (3), and put the film as shown in Fig. 18-B. Adjust the position of the (1) with screws (2)(4)(6), aligning the two head gaps with magnetic stripes. Tighten the (2)(4).

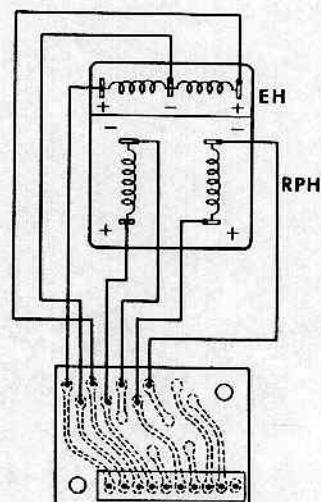


FIG. 19

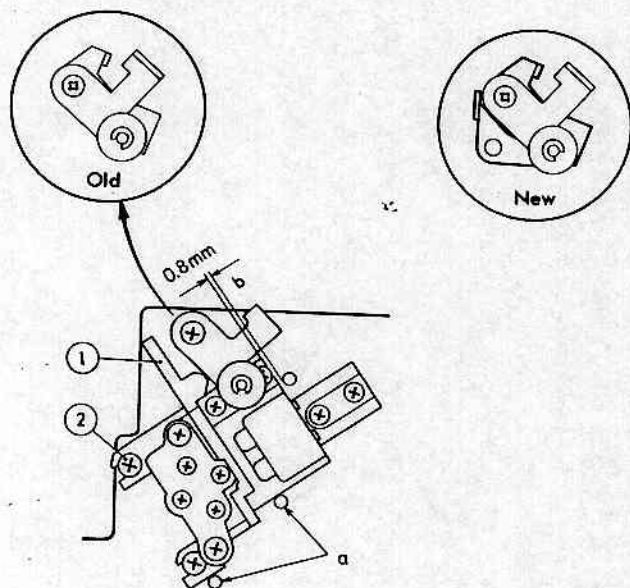


FIG. 20

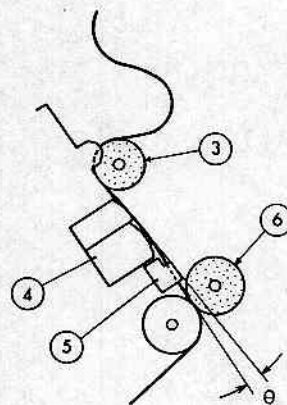


FIG. 21

E. Head Holder (1)

ATTACHING: (Refer to Fig. 20 & 21)

- Put the (1) on the sound frame as shown in Fig. 20. Then fix the (1) tentatively with (2)x3 in place where the (1) not only contacts with 'a' points but is away by 0.8mm from 'b' point.
- Adjust the head position so that the film runs straightly from (3) toward (4).
- Locate the (1) as shown in Fig. 21 and tighten it. Fig. 21 shows the film should pass not along the extension line but away from the line by 0° . The film shouldn't touch the (5) except (5)'s side surface and the (6) shouldn't touch the (5).

IMPROVEMENT INFORMATION

Improvement of Machine Frame Assembly will be performed as under:

Trouble	Countermeasure
If the film is incorrectly spliced with a tape, the spliced part may be doubled when it reaches the place where the loop is to be formed, causing that the film stops on the way or that loop is getting shorter.	The pressure plate fixer (P/No.P413946: (22) on Page 33) is newly applied and the film presser assembly (P/No. 4P8GS0028) is replaced by the new one (P/No.4P8GS0028B). The (25) on Page 35 is attached more closely to the projection lens.
Unstable picture of new printed film	By attaching the film side presser stopper (P/No.P41395: (9) on Page 19), the movement of (5) is limited.

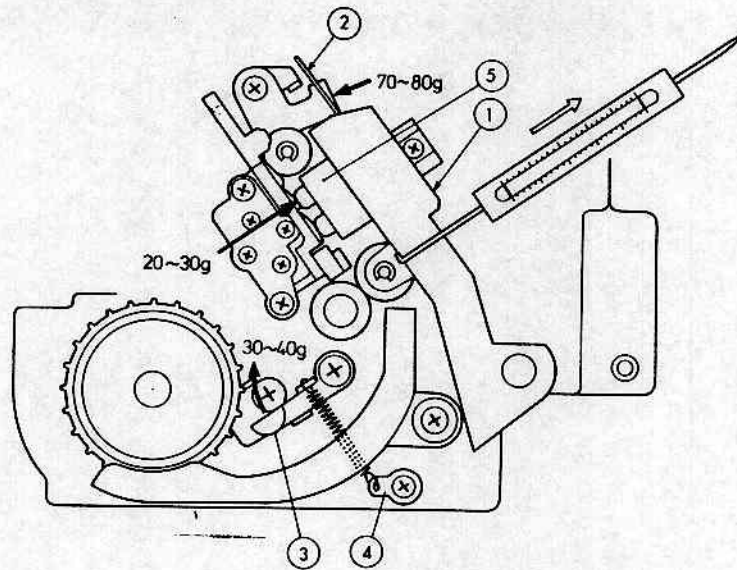


FIG. 22

F. Spring Pressure Adjustment

Adjust each spring pressure of film presser, pad roller and middle tension in order to decrease wow and flutter and to stabilize the optical sound playback.

1. Check the pressure of film presser spring (Fig. 22-2) while pushing it in the arrow direction with a scale C043. The measurement timing is moment the (2) goes just away from the (5). The range of 70-80g is optimum.
For this adjustment, bend the (2). Make sure the (2) is not pushing the (5).
2. Check the pressure of pad roller lever (Fig. 22-1) while pulling it in the arrow direction with a scale P026.
The measurement timing is moment the (1)'s roller goes just away from the capstan.
The range of 250-300g is optimum.
For this adjustment, change the position of the (2) in Fig. 23.
3. Check the pressure of middle tension (Fig. 22-3) while pushing it in the arrow direction with a scale C043.
The range of 30-40g is optimum.
For this adjustment, change the position of (4).

Notes:

1. The adjustment of pressure of film presser is effective for forming loop during optical film playback. The excessive pressure, however, may cause film scratch and wow.
2. The adjustment of pressure of pad roller affects sound picking up during recording or playback.
3. The adjustment of pressure of middle tension is not effective for decreasing large wow.

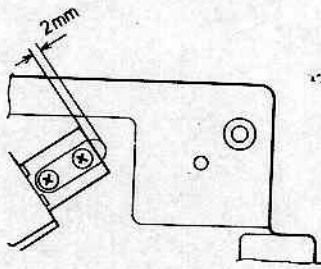


FIG. 23-A

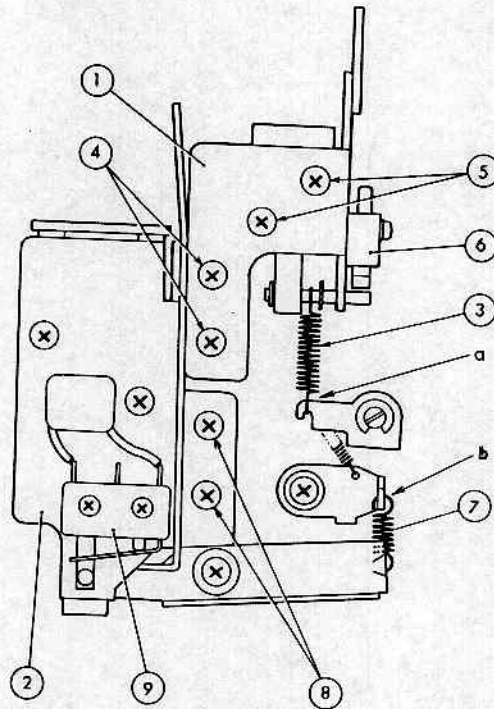


FIG. 23

G. Head Presser Solenoid (1) and Pad Roller Lever Solenoid (2)

TROUBLESHOOTING: (Refer to Fig. 23)

Wow/Flutter	The (1)(2) are out of position. The (3)(7)'s pressure is insufficient.	
Solenoids (1)(2) don't work	The (1)(2) burnt -- (the (6)(9) are out of position or defective). Trouble in the electric circuit.	Page 99

DISASSEMBLY:

1. To remove the (1), unhook the (3) from 'a' point and unscrew the (4)x2.
2. To remove the (2), after removing the (6) in Fig. 4, unhook the (7) from 'b' point and unscrew the (8)x2.

REASSEMBLY NOTES:

1. When attaching the (1), make a clearance of 2mm as shown in Fig. 23-A.
2. Make sure that the (6) can come ON whenever the solenoid (1) works.
3. Attach the (2) in place where the spring pressure of pad roller lever is within 250-300g (Refer to Page 46).
Adjust the (9) position so that the (9) can come ON whenever the solenoid (2) works.
4. The (1)(2) will burn if the (6)(9) are out of position.
5. Take best care when handling the (3)(7).

H. Magnetic Sound Adjustment

1. Head Position Adjustment:

Test film Pre-stripped film recorded a 4KHz signal at 24 fps (P027).
 Instruments Distortion meter and resistor box 8 ohms 40W (P045).

Adjust the position in place where the output obtained from each track is maximum by loosening or tightening the (2)(4)(6).

2. Rated Output (both tracks 1 & 2): 10W (9V)
Maximum Output : 15W (11V)

Test film Pre-stripped film.

Instruments Oscillator, distortion meter and resistor box 8 ohms 40W (P045).

- a. Record a 400Hz signal with 0 VU (controlled by AUX volume knob) at 18 fps.
- b. Play back the signal with maximum volume. The output should be more than 11V. Readjust the head position if less than 11V.

H. Magnetic Sound Adjustment (Cont'd)

3. Distortion Factor (both tracks 1 & 2): less than 4%
S/N ratio (track 1) : less than -50dB) including weighting of -11dB
S/N ratio (track 2) : less than -45dB

Test film Pre-stripped film.

Instruments Oscillator, distortion meter and resistor box 8 ohms 40W (P045).

- a. Record a 400Hz signal with 0 VU (controlled by the AUX volume knob).
 - b. Play back the signal with 9V output (controlled by the main volume knob) and read the indication of the distortion meter set to distortion range. This shows distortion factor.
 - c. Stop the projector and remove the film with care to keep the volume position.
 - d. Run the projector again without film and read the indication of the distortion meter set to level range. This shows S/N ratio.
4. Cancel Coil Fine Adjustment (noise level): less than 20mV (both tracks 1 & 2) including weighting
- Instruments Distortion meter and resistor box 8 ohms 40W (P045).
- a. Run the projector (motor switch ON, lamp switch ON, maximum volume) and adjust the cancel coil position, observing the indication of the meter. When the indication is less than 20mV, the position is OK.
 - b. This adjustment is applicable to both tracks 1 & 2.

H. Magnetic Sound Adjustment (Cont'd)

5. Erasing Effect (both tracks 1 & 2): less than -40dB including weighting of -11dB.

Test Film Pre-stripped film.

Instruments Oscillator, distortion meter and resistor box 8 ohms 40W (P045).

- a. Record a 400Hz signal with 0 VU (controlled by the AUX volume knob). Rewind a part of recorded film and record no signal with minimum volume on the part, i.e. this work is erasing the 400Hz signal.
- b. Play back a 400Hz signal with 9V output (controlled by the main volume knob) and when the part of no signal comes to the sound head, read the indication of the distortion meter set to level range.

6. Difference in output between tracks 1 & 2:

Test Film Pre-stripped film.

Instruments Oscillator, distortion meter and resistor box (P045).

- a. Record a 400Hz signal with 0 VU on each track.
- b. Play back the signal with zero volume on each track. Difference in output between them should be less than 4dB VU. If not, readjust the head position.

H. Magnetic Sound Adjustment (Cont'd)

7. Sound Transfer from one track to another:

Test film Pre-stripped film.

Instrument Oscillator.

- a. Record a 400Hz signal with -6dB VU on track 1. Make sure of no oscillation when transferring the signal to track 2 with less than 0dB VU. Check up track 2 in the same manner as above.
- b. If oscillation occurs while your transferring the signal to another track within 4dB VU, the sound head output is insufficient and therefore, readjust the head position.

8. Frequency Response:

Test film Pre-stripped film.

Instruments Oscillator, distortion meter and resistor box 8 ohms 40W (P045).

- a. Record a 400Hz signal with 0 VU (controlled by AUX volume knob) at 18 fps and record a 2KHz signal without changing the AUX control knob position.
- b. Play back the 400Hz signal with 0dB (controlled by main volume knob, observing the indication of distortion meter). Play back the 2KHz signal without touching the knob and read the indication of the meter. This indication should be between +2dB and -4dB. Refer to the graph concerning other signals' tolerance.

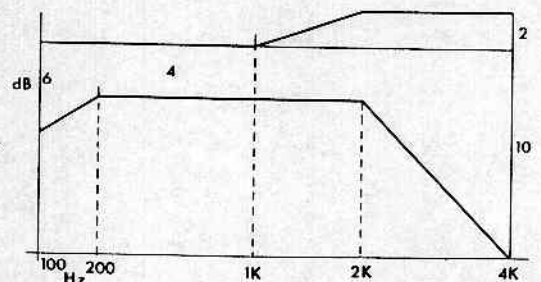


FIG. 24

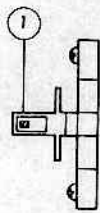


FIG. 25

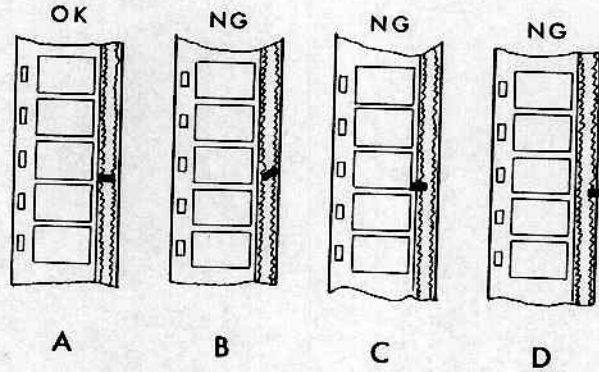


FIG. 26

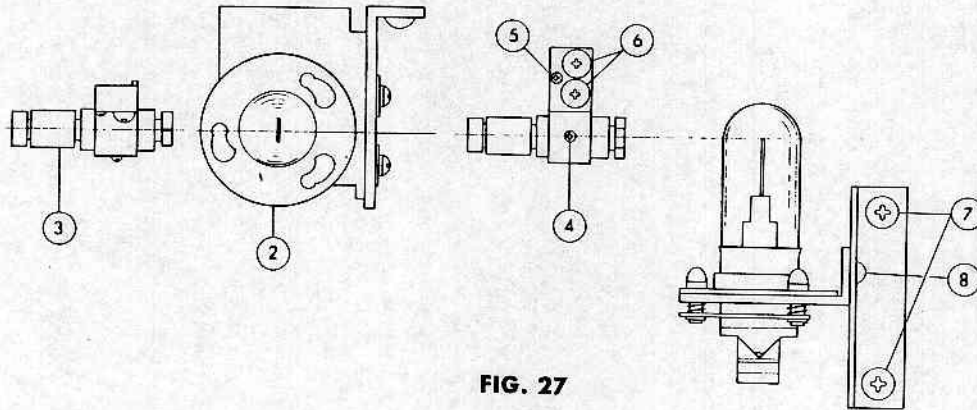


FIG. 27

I. Optical Sound Adjustment

TROUBLESHOOTING: (Refer to Figs. 25, 26 & 27)

Unable to play back optical sound	The (2)'s light does not come correctly to the (1). Defect of (1).
Unable to play back high frequency range	Improper position of the (3) as shown in Fig. 26(B). Stain on (3).
Played back the sound of poor quality	The (3) is out of position as shown in Fig. 26(C)(D).
Insufficient volume during optical playback	
Noise during optical playback	

1. Position Adjustment of Solar Battery, Sound Lens and Exciter Lamp:

Test film Pre-stripped film recorded a 4KHz signal at 24 fps (P053).
Instrument Resistor box 8 ohms 40W (P045)

- a. Turn on the exciter lamp and adjust the position of sound lens tentatively by turning screws (5)(6) in Fig. 27 so as to have the focus of scanning beam on the (1) as shown in Fig. 25. The lens shouldn't touch the capstan.
- b. Adjust the position of the exciter lamp with (7)(8) so that the lamp filament is aligned with light axis of the lens as shown in Fig. 27.
- c. Run the projector with film and play back the signal with maximum volume. To obtain the maximum output, adjust the sound lens position by turning or sliding the lens back or forth after loosening the (4) and by tightening or loosening the (5)(6). Refer to Fig. 26(A).

I. Optical Sound Adjustment (Cont'd)2. Rated Output : 10W (9V)Maximum Output: 15W (11V)

Test film Optical super-8 frequency response film 400Hz (P051).
 Instruments Distortion meter and resistor box 8 ohms 40W (P045).

Play back the signal with the maximum volume at 24 fps.
 Make sure that the output is more than 11V.
 If not, make readjustment on Page 54.

3. Distortion Factor: less than 4%S/N Ratio : less than -45dB

Test film Optical super-8 frequency response film 400Hz (P051).
 Instruments Distortion meter and resistor box 8 ohms 40W (P045).

- a. Play back the signal with 9V (controlled by the main volume knob, observing the indication of the distortion meter) at 24 fps.
 At this time read the indication of the meter set to distortion range.
 This shows distortion factor.
- b. Take off the film from the projector without changing the volume position.
 Run the projector again without film and read the indication of the distortion meter set to lever range. This shows S/N ratio.

I. Optical Sound Adjustment (Cont'd)4. Noise: less than 20mV including weighting

Instrument Distortion meter.

Run the projector without film at 24 fps. With maximum volume read the indication of the distortion meter set to level range. Make sure that the output is less than 20mV.

5. Frequency Response:

Test films Optical super-8 frequency response film 400Hz (P051 and 4KHz (P053)).
 Instrument Distortion meter.

- a. Splice both films. Project the film at 24 fps.
- b. Play back the 400Hz signal with 3V (controlled by main volume knob).
 Play back the 4KHz signal without changing the volume knob position and see the output indicated by the distortion meter.

This output should be within -15dB.

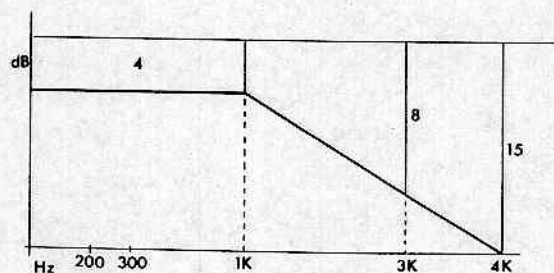


FIG. 28

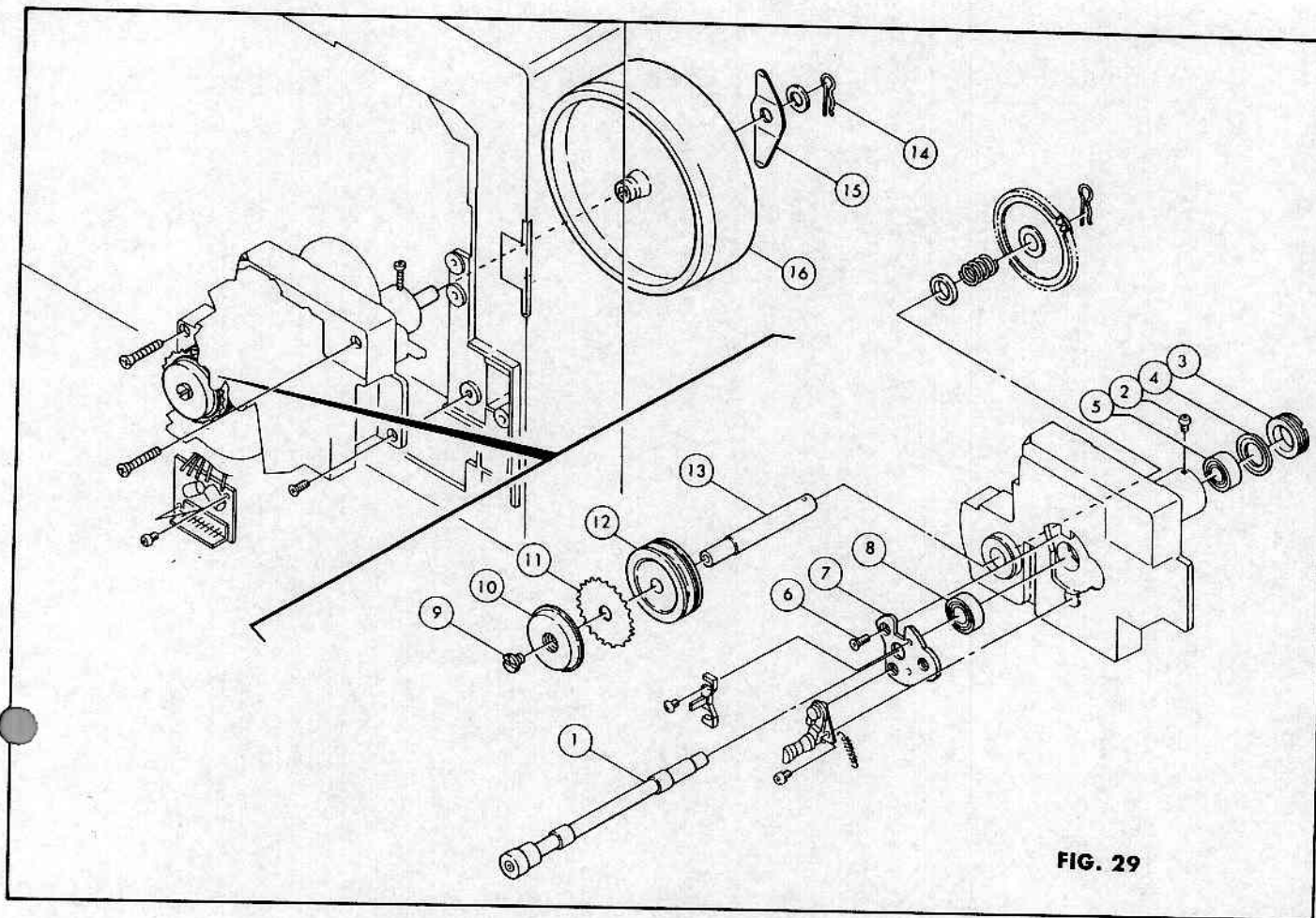


FIG. 29

J. Capstan (1) and Sprocket

TROUBLESHOOTING: (Refer to Fig. 29)

Wow/Flutter	<ul style="list-style-type: none"> Flaw, eccentricity and rattling in the shaft direction of the (1). Defect of the (5)(8). Excessive tightening of the (3). Flaw and eccentricity of the (11)(12)(13). Improper spring pressure of the (15). Improper balance of the (16).
-------------	---

DISASSEMBLY:

1. Remove the sound head holder (3) in Fig. 17.
2. Loosen the (2) and remove the (3) by turning it counterclockwise.
3. For further disassembly, refer to Fig. 29.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that the (1) turns smoothly without unevenness and rattling.

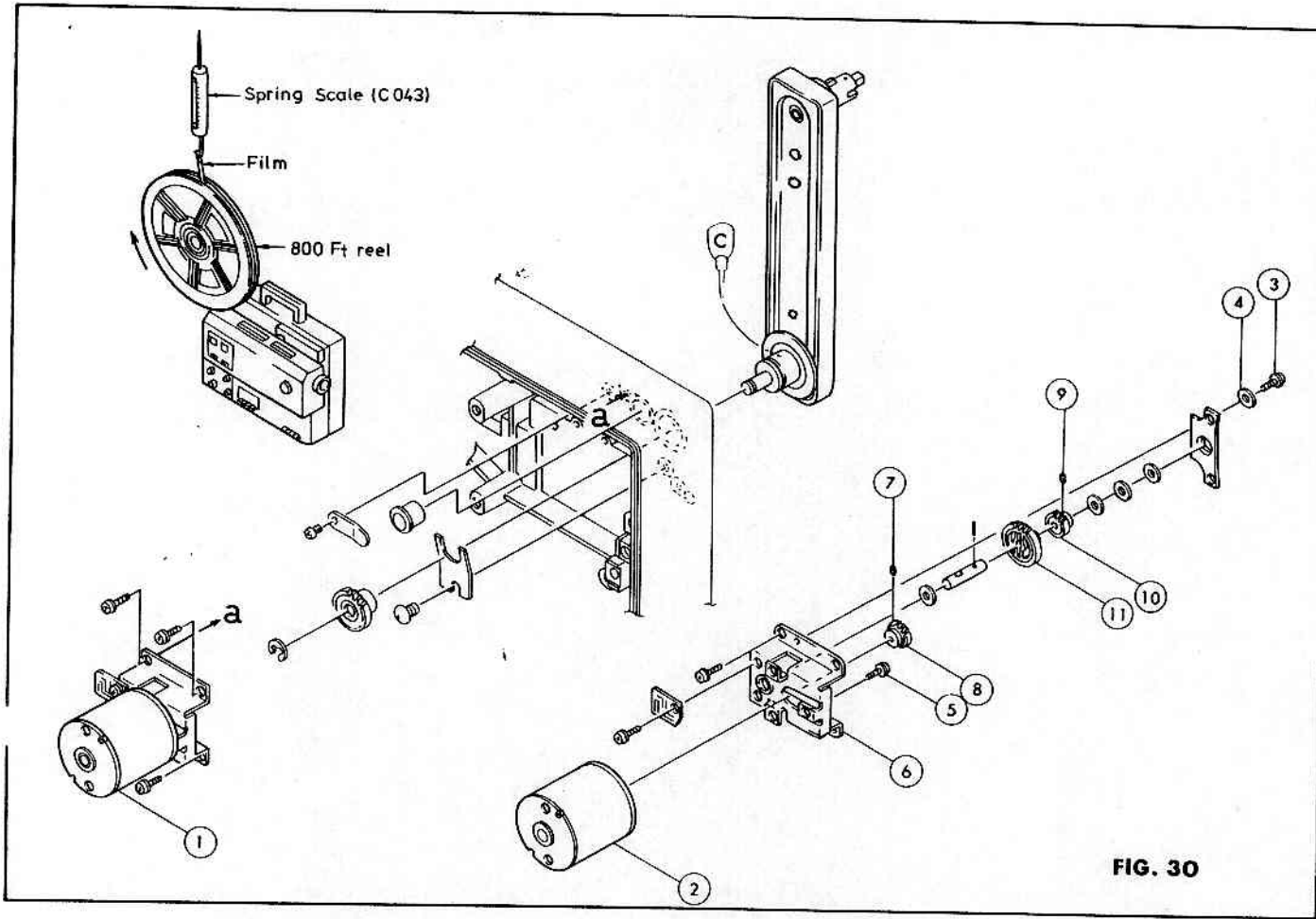


FIG. 30

4. TAKE-UP AND REWINDING SECTION

A. Take-up Motor Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 30)

Improper take-up function	Insufficient torque of the (2). Change the position of wire from 3V to 4V terminal on transformer.	Page 77
Take-up mechanism malfunctions entirely	Defect of the (2) or circuit trouble. Slip of the (8) or defect of gears (10)(11).	
Noise during forward projection	Improper engagement between (8) and (11). Defect of the (1) or its improper position.	

DISASSEMBLY:

Disassemble the parts in accordance with order of the reference number, referring to Fig. 30.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. The (1) should run by DC 4V with consumption current of under 140mA without any load. Use a DC stabilized power-supply C004 for check.
3. The (1) should be attached to the position where it runs by DC 4V with under 300mA current without any noise.
4. When the position of wire on transformer is changed, check and adjustment for rewinding is required. Refer to pages 64 and 66.
5. Take-up tension at 800ft reel core should be within 45 ± 5 kg. Use a bar spring scale C043.
6. Since no slip-mechanism is applied, you adjust the take-up/rewinding power with supply voltage -- from 3V to 4V.

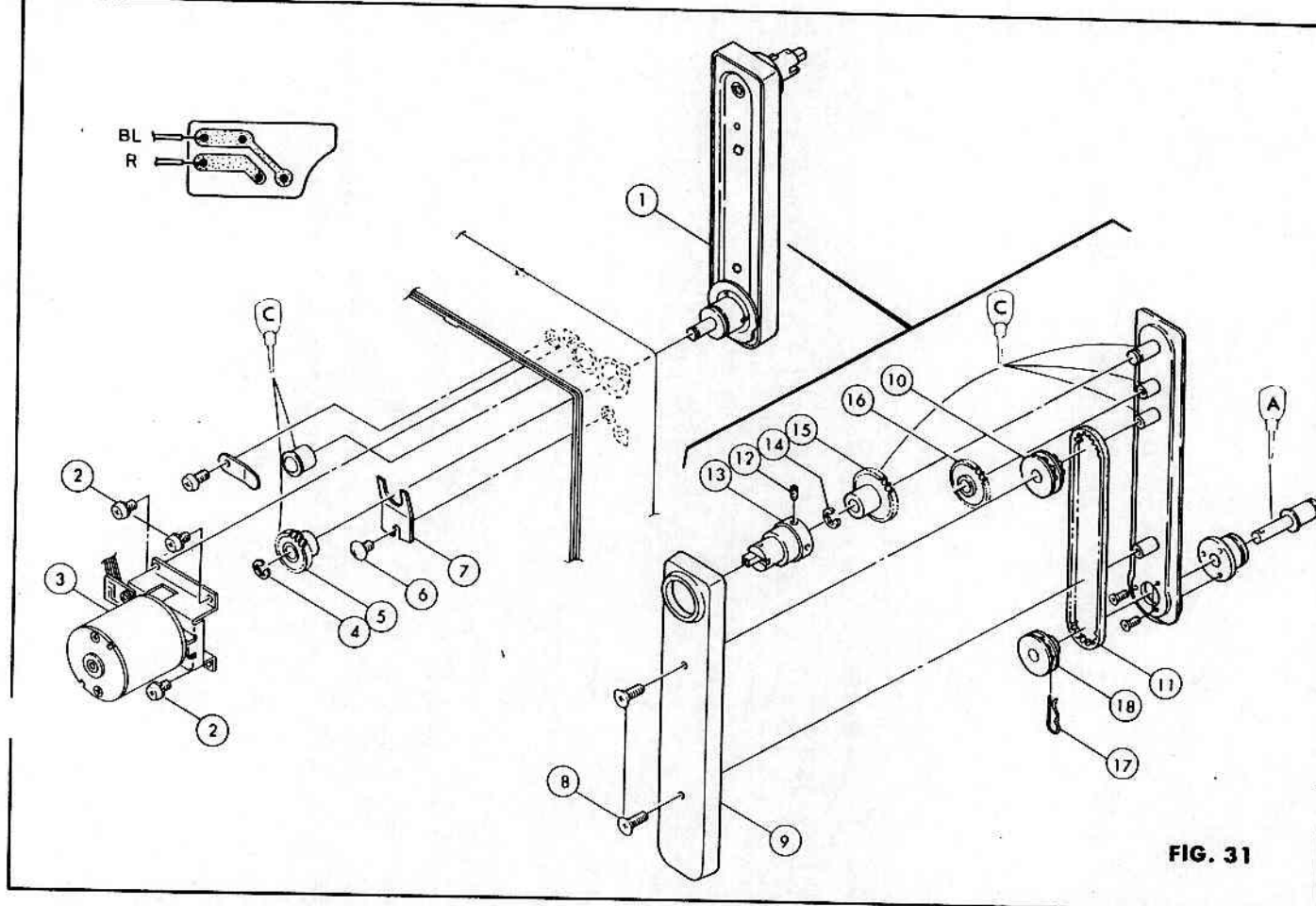


FIG. 31

B. Rear Arm (1)

TROUBLESHOOTING: (Refer to Fig. 31)

Take-up mechanism malfunctions	Defect of the (5)(10)(11)(18).
Noise	Lack of grease at the (10)(15)(16) and their shafts.

DISASSEMBLY:

1. When repairing the inside only of rear arm, unscrew the (8)x2 and remove the (9).
2. When detaching the whole rear arm, take off the transformer. (Refer to Page 78 -- need not unsolder the wires on it).
3. Unsolder the two wires, blue and red.
4. For further disassembly, refer to Fig. 31.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Apply the grease to all gears.
3. When tightening the (12)x2, align the screw holes of (13)(15) with each other.
4. After reassembly of the (1), make sure that it functions smoothly without unevenness.
5. The (5) can rotate in one direction only because the roller clutch is used in it.

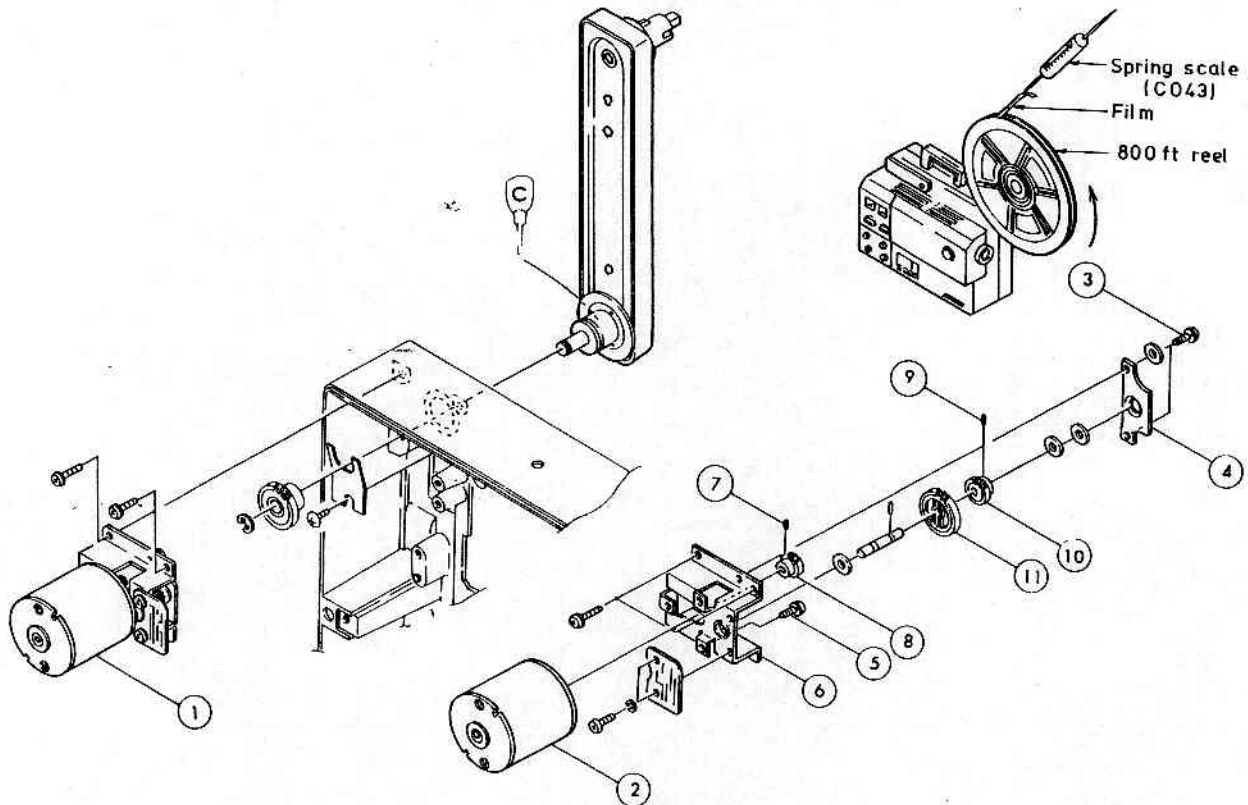


FIG. 32

C. Rewind Motor Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 32)

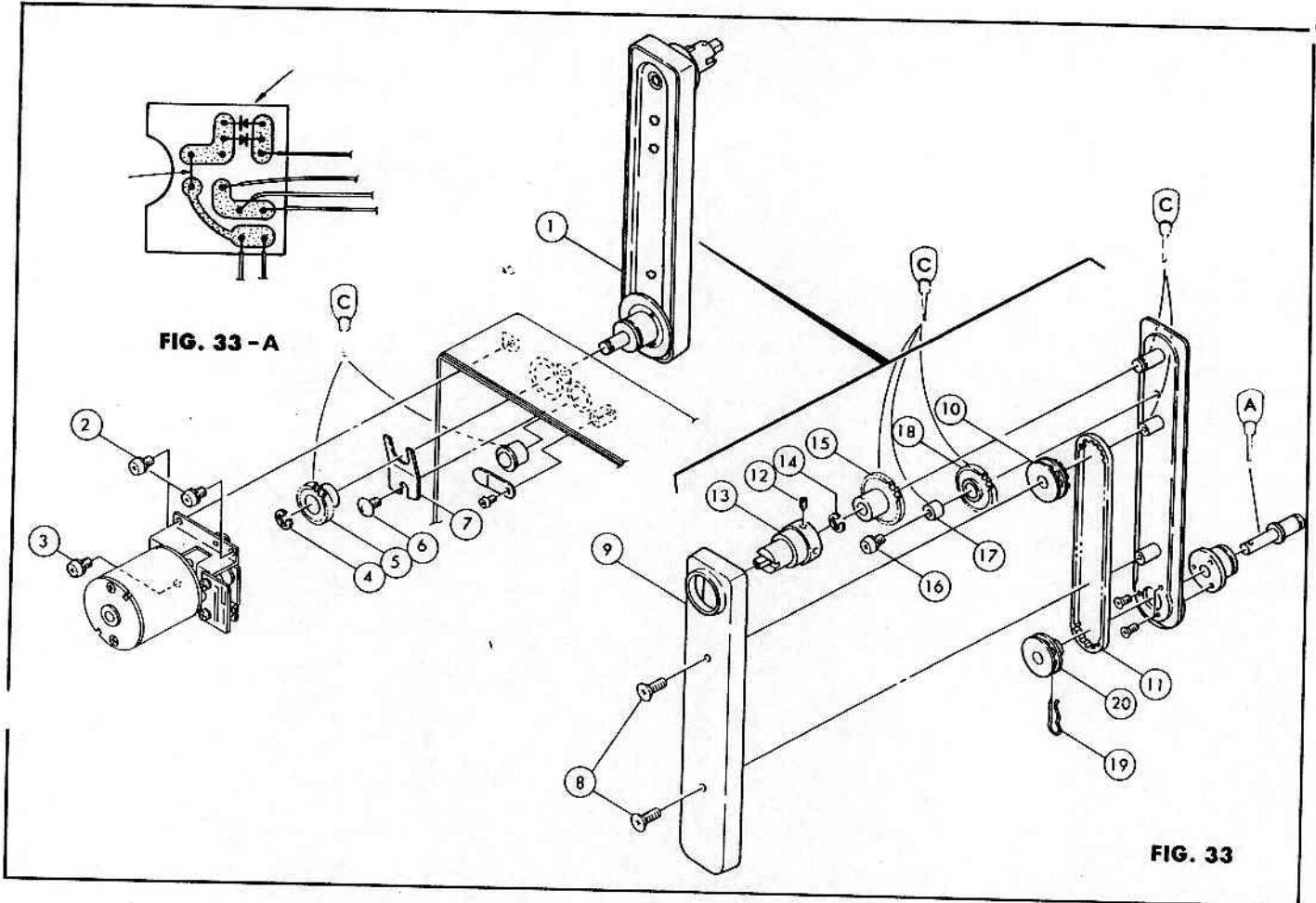
Film is wound loosely into feed reel in REV	The (1)'s torque is insufficient. Change the wire position from 3V to 4V terminal on transformer.
Upper loop is lost during REV projection	Excessive torque of the (1). Tighten the 1st sprocket shoe (Fig. 13-2) firmly. Attach the two diodes 1S1887 as shown in Fig. 33-A in order to lower the supply voltage.
Noise from the 1st sprocket in REV	Improper engagement between (8) and (11). Improper position or defect of the (1).
Noise during reverse projection	Defect of the (2) or circuit trouble. Slip of the (8) or defect of the (10)(11).
Rewinding mechanism malfunctions entirely	Weak torque of the (1). Defect of the (2) or circuit trouble.
Slow rewinding speed	
Rewinding mechanism stops on the way	

DISASSEMBLY:

1. Take off the transformer (Fig. 40-1) without unsoldering the wires.
2. Make disassembly procedures in accordance with order of the reference numbers in Fig. 32.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. The (1) should run by DC 4V with consumption current of under 140mA without any load. Use a DC stabilized power-supply C004 for check.
3. The (1) should be attached to the position where it runs by DC 4V with under 300mA current without any noise.
4. When the wire position on transformer is changed, check and adjustment for take-up is required. Refer to Page 60.
5. Take-up tension at 800ft reel core should be within 45 ± 5 kg. Use a bar spring scale C043.
6. Since no slip-mechanism is applied, you adjust the take-up/rewinding power with supply voltage -- from 3V to 4V.



D. Front Arm (1)

TROUBLESHOOTING: (Refer to Fig. 33)

Unable to rewind the film	Defect of the (5)(10)(11)(20).
Noise	Lack of grease at gears (10)(15)(18) and their shafts.

DISASSEMBLY:

1. When repairing the inside only of front arm, unscrew the (8)x2 and remove the (9).
2. When detaching the whole front arm, unsolder the two wires, blue and red.
3. For further disassembly, refer to Fig. 33.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Apply the grease to all gears.
3. When tightening the (12)x2, align the screw holes of (13)(15) with each other.
4. After reassembly of the (1), make sure that it functions smoothly without unevenness.
5. The (5) can rotate in one direction only because the roller clutch is used in it.

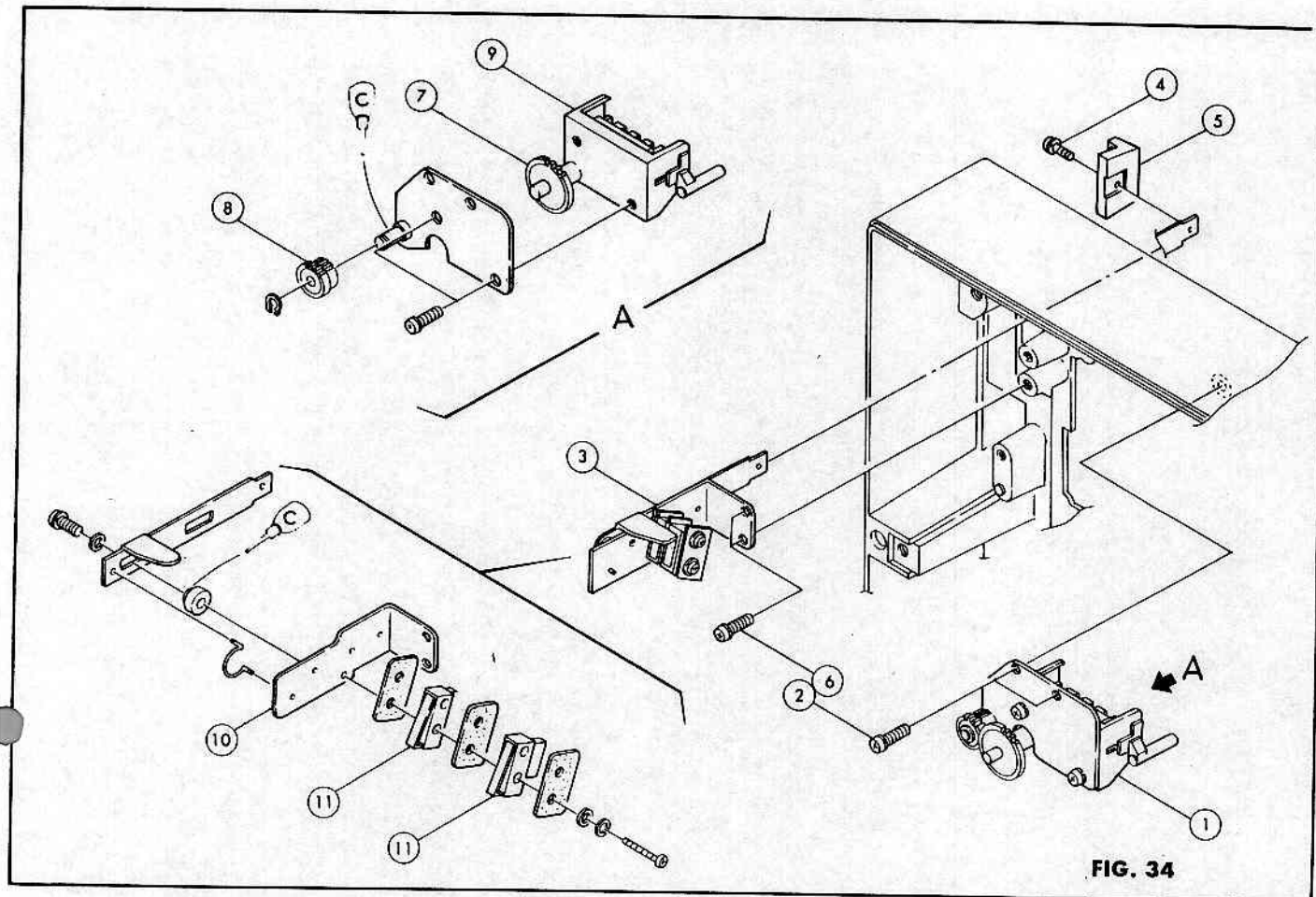


FIG. 34

5. BASE FRAME SECTION

A. Counter Gear (1) and Rewind Switch (3)

TROUBLESHOOTING: (Refer to Fig. 34)

High speed rewinding mechanism isn't workable	Defect of the (11). Improper position of the (10). Trouble in circuit.	Fig. 35
Film counter malfunctions	Slip of the (7) or defect of the (7)(8)(9). Turning of the (7)(8)(9) is interrupted by wires.	

DISASSEMBLY:

1. Unscrew the (2)x2 and take off the (1).
2. Unscrew the (4) and take off the (5).
3. Unscrew the (6) and take off the (3).
4. For further disassembly, refer to Fig. 34.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. When disassembling the (1), reassemble it with backlash between (7) and (8).
3. Make sure that the (11) turns on exactly when the (5) is pulled for high speed rewinding.

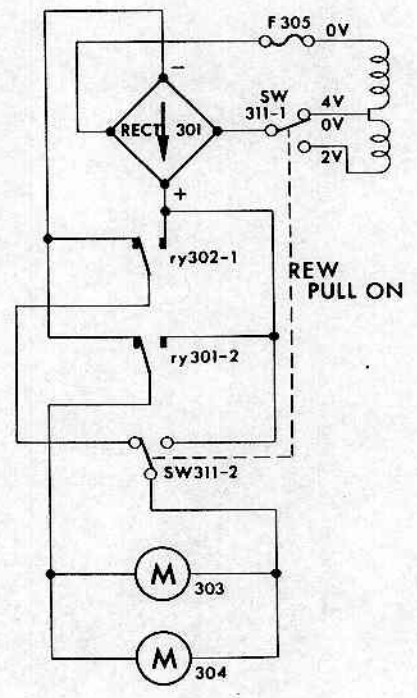


FIG. 35

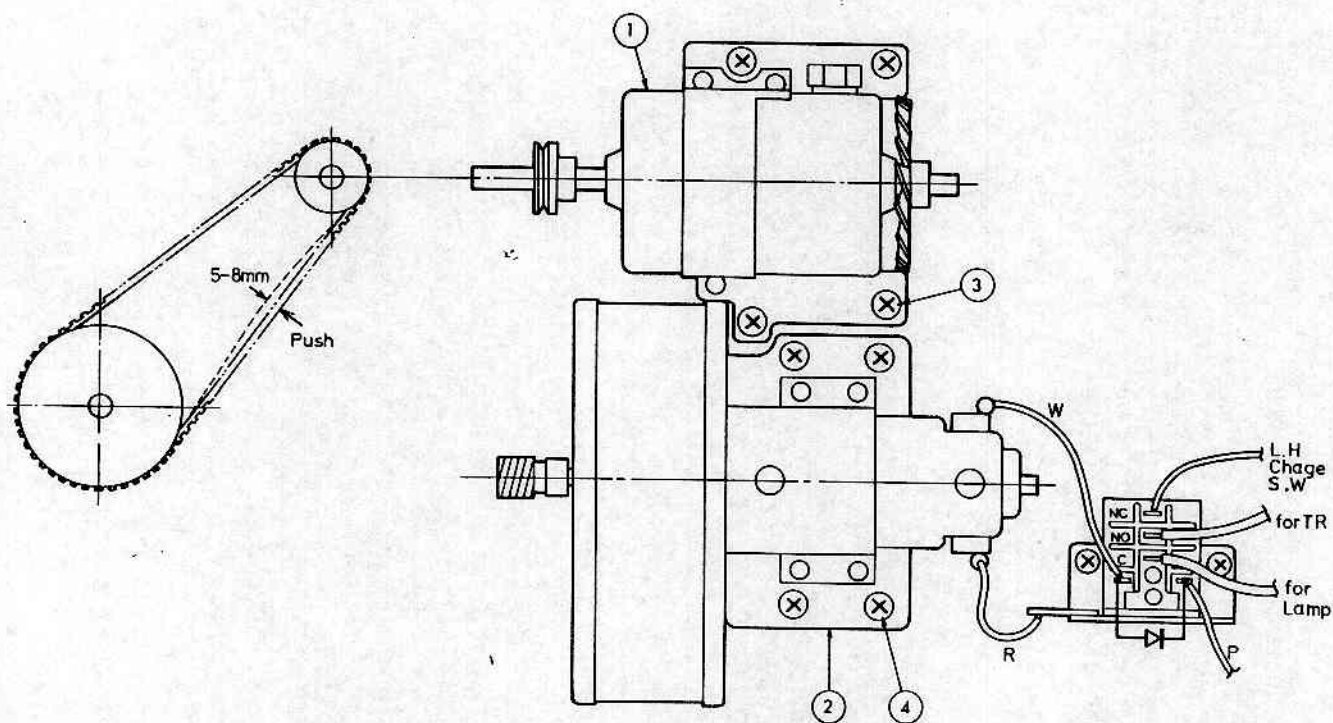


FIG. 36

B. Main Motor (1) and Fan Motor (2)

TROUBLESHOOTING: (Refer to Fig. 36)

No rotation of (1) and/or (2)	Defect of (1)(2). Circuit trouble.	
Noise from (1) and/or (2)	Lack of oil on their shafts. Wipe off oil on contact surface of carbon brushes or replace the (1)(2).	
Slow rotation of main motor	Excessive tension of V belt. Circuit trouble.	Fig. 36-A
Turning of fan motor isn't changeable though FWD button is depressed	Circuit trouble.	

DISASSEMBLY:

Refer to Fig. 36.

REASSEMBLY NOTES:

1. Attach the (1) in place where the tension of V belt becomes as shown in Fig. 36-A.
2. When attaching the (2), refer to the reassembly notes No. 2 on Page 16.

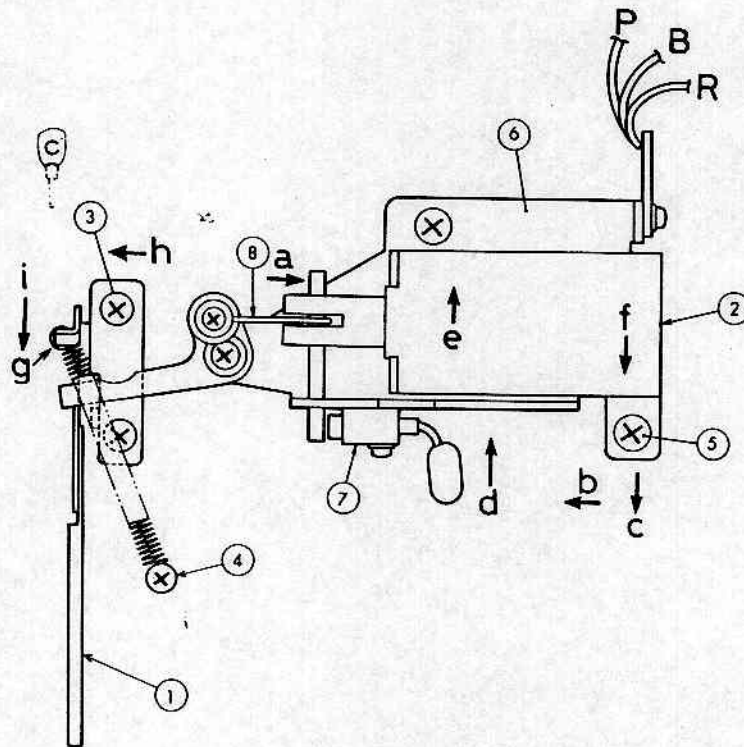


FIG. 37

C. Safety Shutter Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 37)

Uneven illumination by safety shutter Film is damaged by head in STILL projection	Safety shutter doesn't function normally. The (2) is defective or out of position.
--	---

DISASSEMBLY:

1. After removal of the main motor (Refer to Page 70) unscrew the (3)x2 and remove the (1). If necessity of removing the (4), take off the fan motor (Refer to Page 70) in advance.
2. Unscrew the (5)x2 and remove the (6) assembly. Unsolder the three wires on the (6).
3. For further disassembly, refer to Fig. 37.

REASSEMBLY NOTES:

1. The correlation position of the (2)(7) is where the (7) turns on when you push 'a' point of the (2) fully. If the (7) turns on quicker than normal timing, the (1) will stop on the way. If the (7) doesn't turn on at all, the (2) is burnt and becomes defective.
2. Bend the (8) if its movement isn't smooth in the (2)'s core slit owing to deflection of it.
3. When the movement distance of the (2)'s core, readjust the position of (2)(6)(1) as follows:
 - Attach the (2), pushing it in the direction of 'e' and 'f'.
 - Attach the (6), pushing it in the direction of 'b', 'c' and 'd'.
 - Attach the (1), pushing it in the arrow direction.

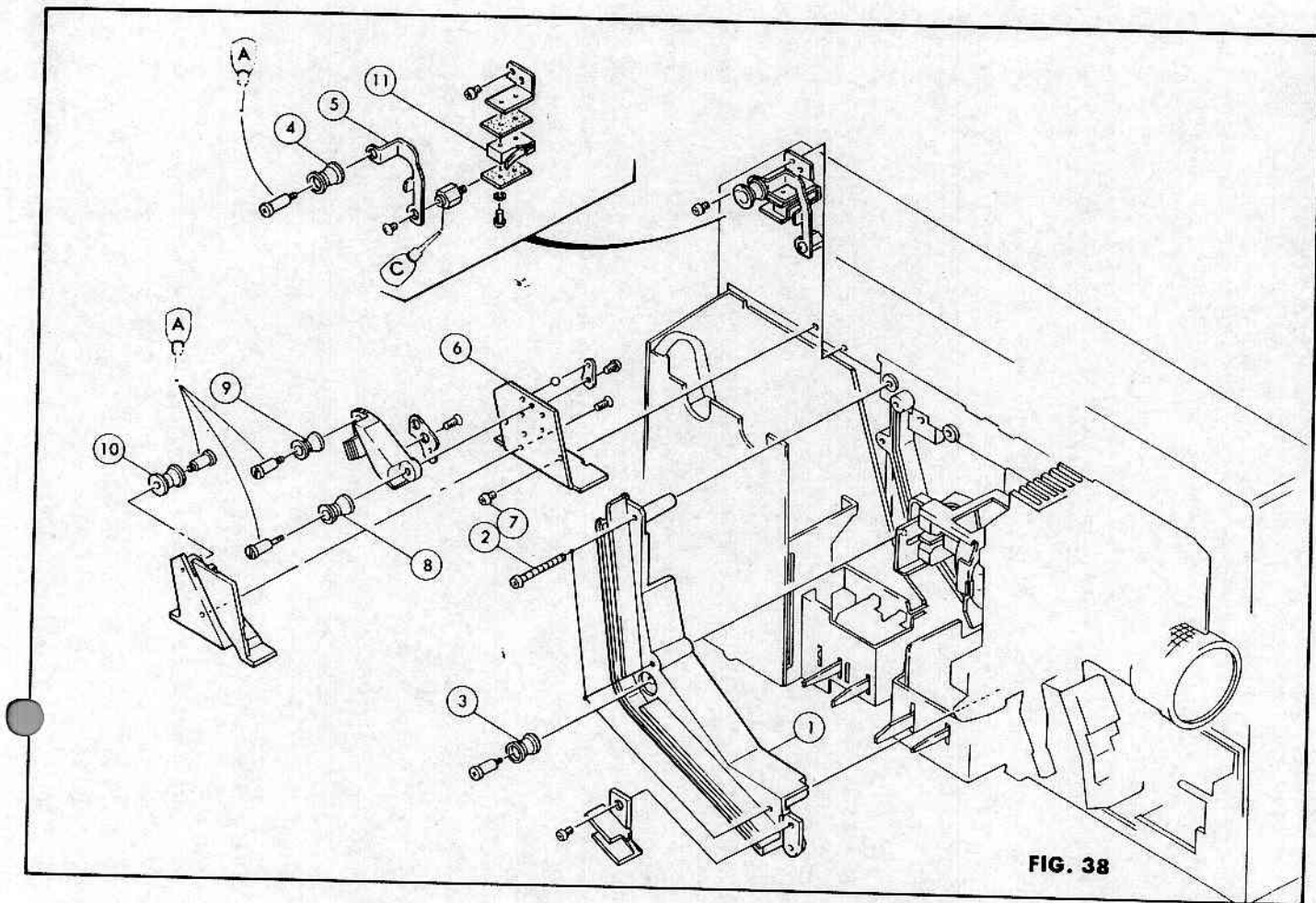


FIG. 38

D. Film Guide Assembly (1) and Take-up Guide Assembly (6)

TROUBLESHOOTING: (Refer to Fig. 38)

Unable to set back the auto-threading condition	The (11) is out of position or defective. The (5) malfunctions.
Film scratch	Flaws or poor turning of the (3)(4)(8)(9)(10).

DISASSEMBLY:

1. Unscrew the (2)x3 and remove the (1).
2. To remove the (6), take off the amplifier cover (Page 14) and unscrew the (7)x2.
3. For further disassembly, refer to Fig. 38.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that each roller rotates smoothly.
3. Make sure that the (5) works perfectly after its reassembly.

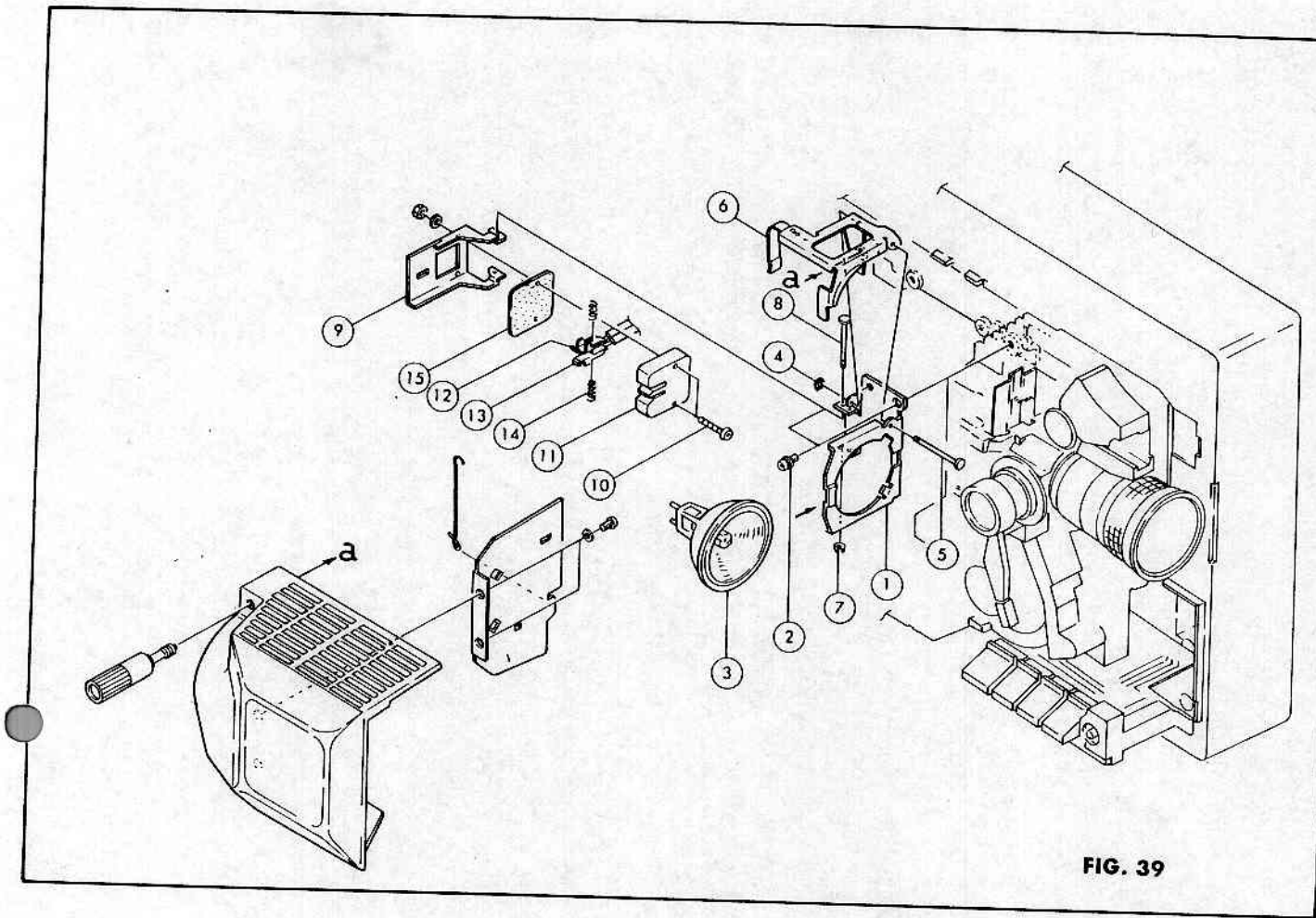


FIG. 39

E. Projection Lamp Socket Assembly

TROUBLESHOOTING: (Refer to Fig. 39)

Unstable lighting	Defect of the (12)(13)(14).
Difficult to replace the lamp	Defect of the (1)(6).
Uneven illumination	The (1) is out of position. The (3) deteriorates.

DISASSEMBLY:

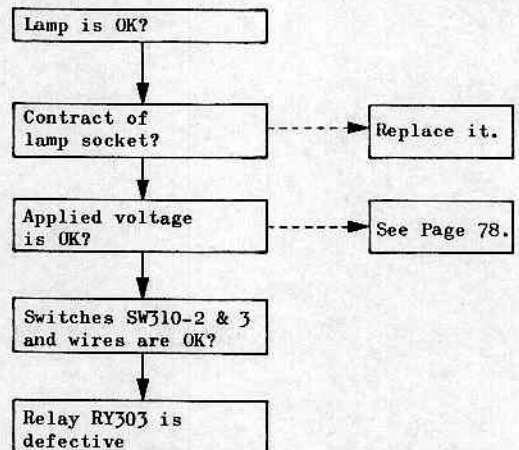
Refer to Fig. 39.

REASSEMBLY NOTES:

Adjust and tighten the (1)'s position with (2)x2 in place where the maximum illumination appears without unevenness.

* ANSWER: YES ↓
NO ---→

THE LAMP DOESN'T LIGHT



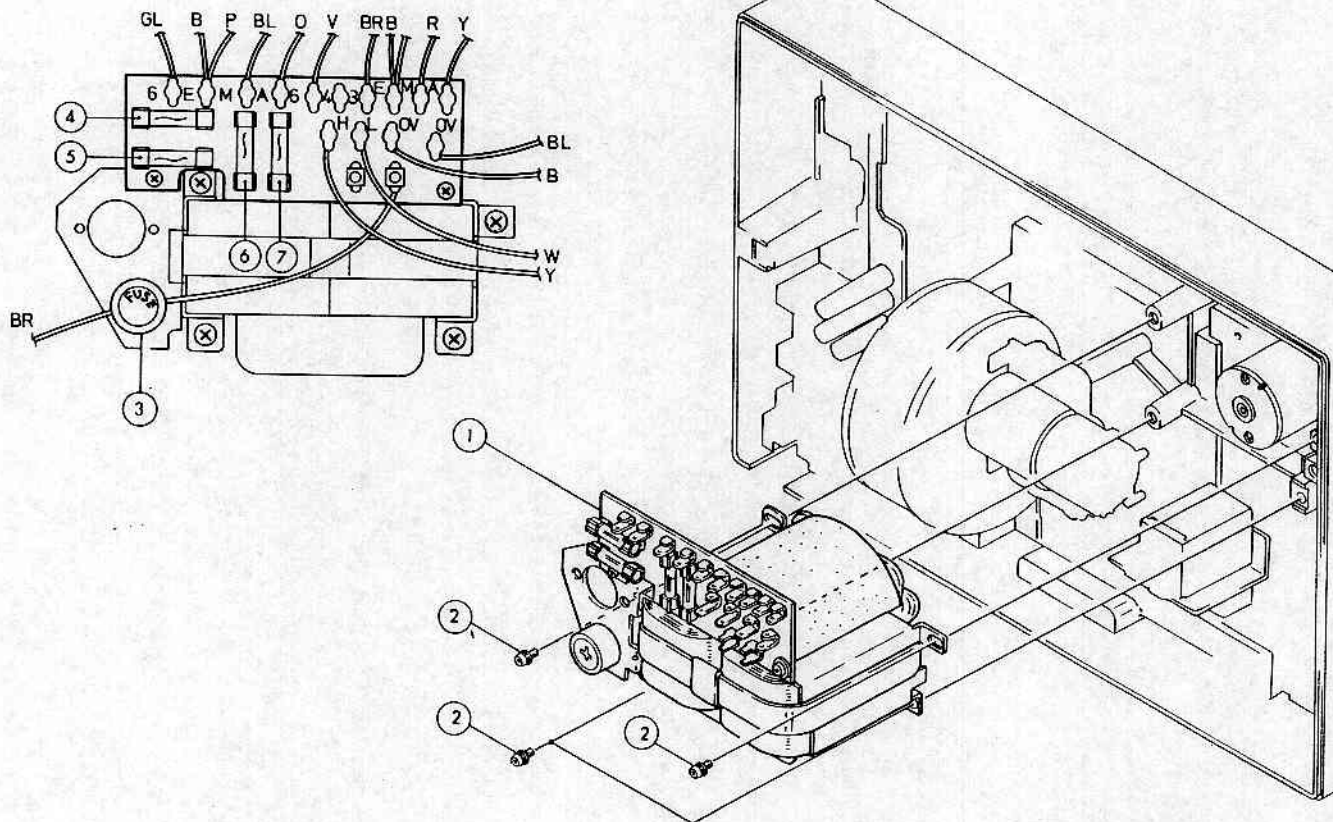


FIG. 40

F. Transformer

TROUBLESHOOTING: (Refer to Fig. 40)

Pilot lamp doesn't light	Defect of the (1) or breaking of the (3).
Main motor doesn't turn	Defect of the (1) or breaking of the (4).
Take-up motor doesn't turn	Defect of the (1) or breaking of the (5).
Fan motor doesn't turn	Defect of the (1) or breaking of the (6).
Main motor turns only slowly	Defect of the (1) or breaking of the (6).
Amplifier isn't workable (but exciter lamp lights)	Defect of the (1) or breaking of the (7).

DISASSEMBLY:

1. Unsolder the sixteen wires from the (1). Note that a brown wire is unsoldered from the (3).
2. Unscrew the (2)x4 and remove the (1).

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that each wire is surely connected in place.
3. Refer to the under list when trouble happens in the take-up/rewind motors.
The combination of the unloaded power-supply voltage for the motors have been changed at two times.

Voltage at 3V terminal	Voltage at 4V terminal	Applied GS-1200
about 3.8V	about 4.6V	initial production
3.4V	4.2V	recent production
3.8V	4.2V	

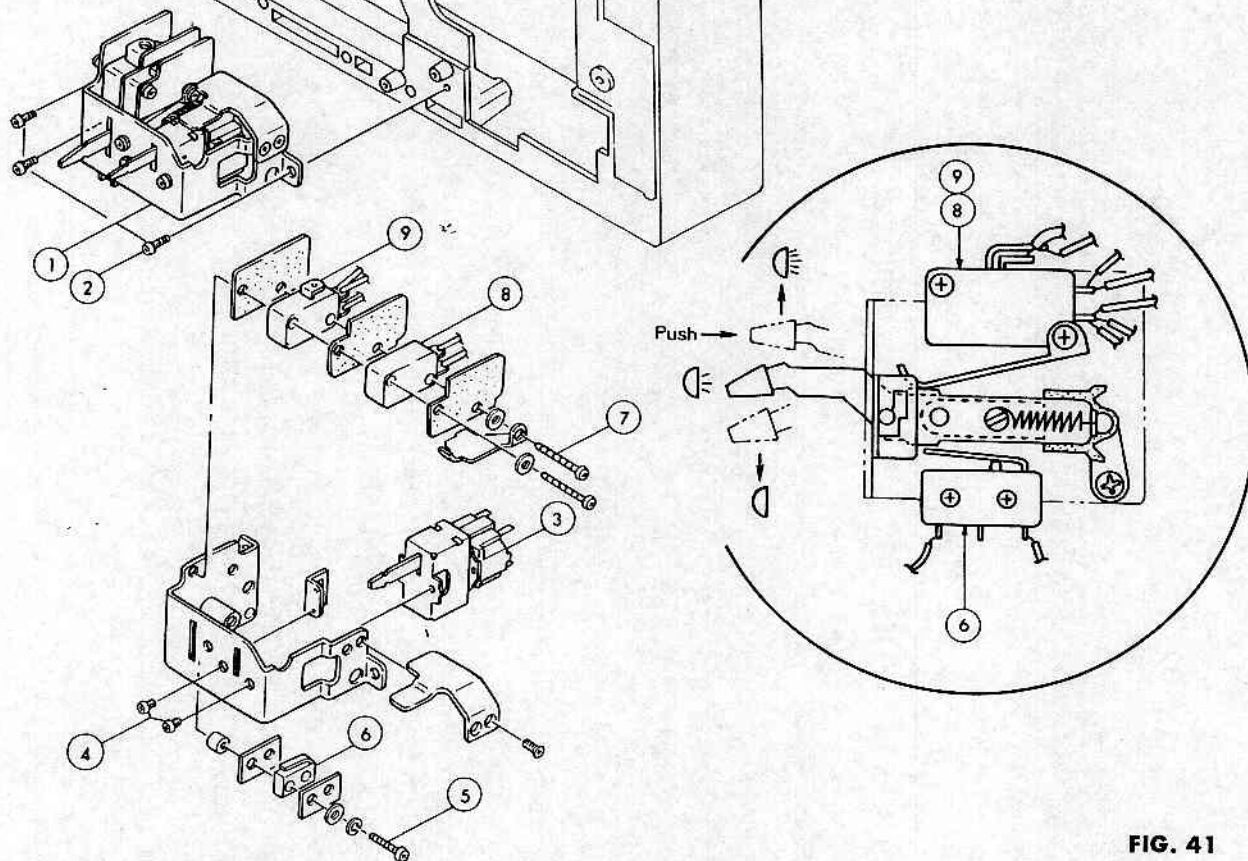


FIG. 41

G. Power and Lamp Switch Unit

TROUBLESHOOTING: (Refer to Fig. 41)

No power though the switch is ON	The (3) is defective.
Projection lamp doesn't light	The (6)(8)(9) are defective.
Relay doesn't work	The (6) is defective.
Unable to shift High-Low illuminance	The (8)(9) are defective.
Projection lamp isn't preheated	The (9) is defective.

DISASSEMBLY:

1. Unscrew the (2)x3 and remove the (1) with wires.
2. For further disassembly, refer to Fig. 41.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure each lever surely works.
3. Make sure each switch surely works.

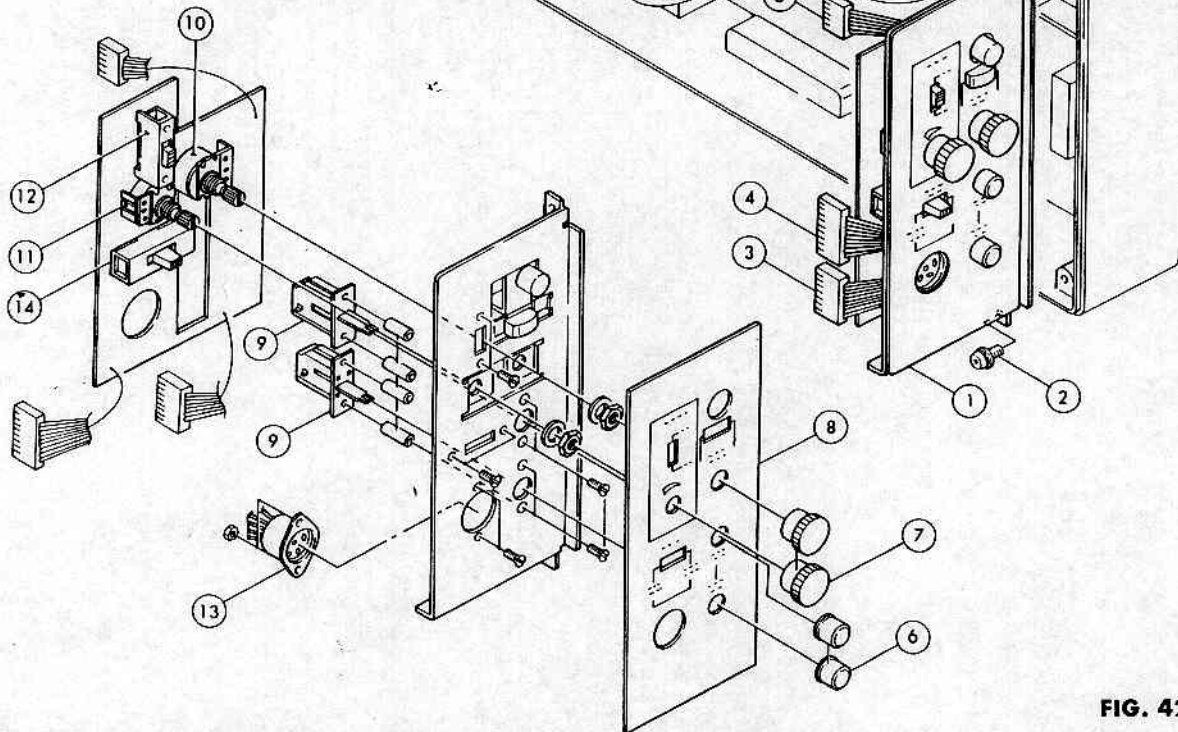


FIG. 42

6. ESS CIRCUIT SECTION

A. ESS Circuit Board Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 42)

Unable to shift speed of 18/24 fps	The (12) is soldered poorly or defective.
Unable to adjust speed of ± 1 fps	The (11) is soldered poorly or defective.
Unable to record/play back ESS pulse	Half-contact of the (15) or defect of the (14).
ESS mechanism doesn't work at all (Refer to Page 83)	The (10) is soldered poorly or defective. Defect of (14).
Unable to adjust speed of SLOW/FAST	The (9) is defective.
Not synchronize with tape recorder (Refer to Page 84)	Short of 2 or 3 pin of (3). The (3) is defective.

DISASSEMBLY:

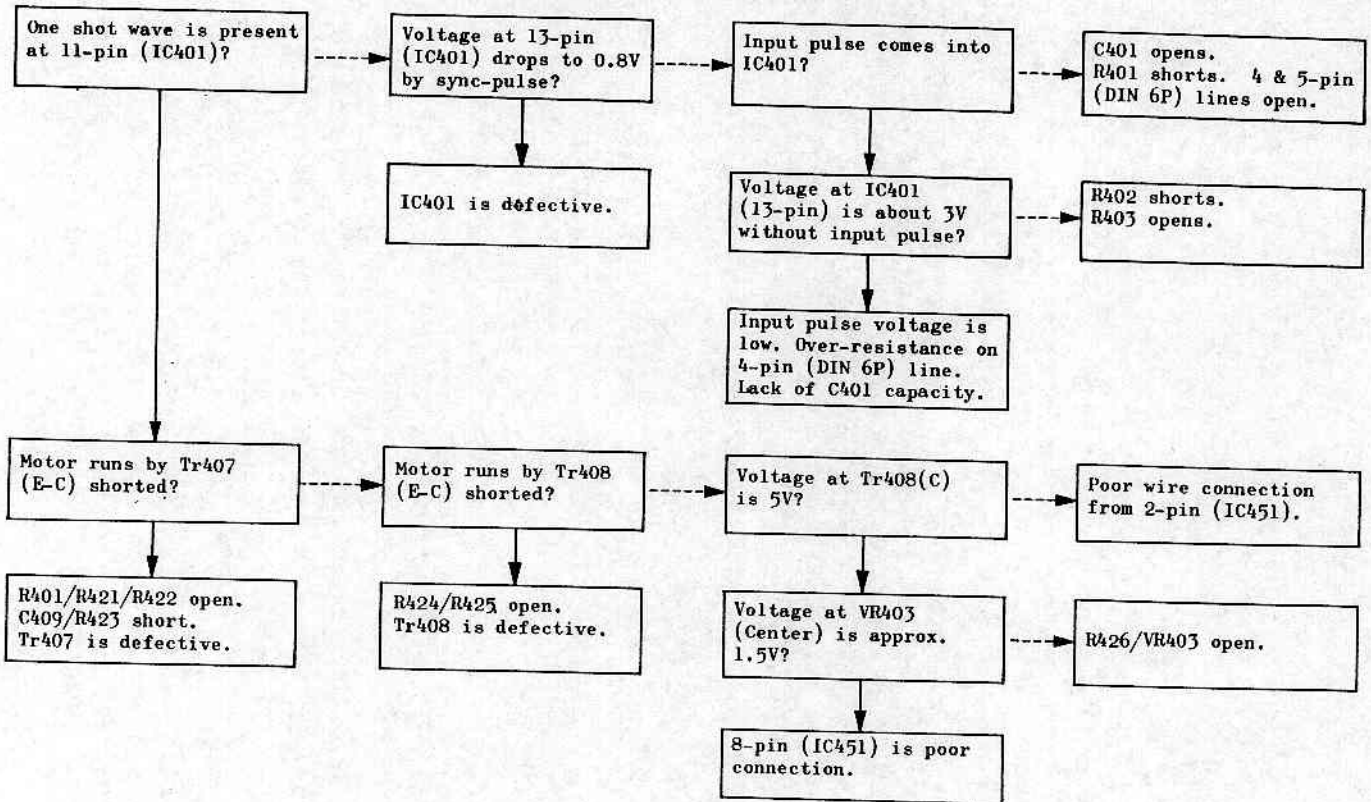
1. Unscrew the (2)x2 and disconnect the (3)(4)(5). Detach the (1) from the projector.
2. Pull out the (6)x2, (7)x2 and peel off the (8).
3. For further disassembly, refer to Fig. 42.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure the (9)(10)(11)(12)(14) are surely soldered on the board as they will take off easily.

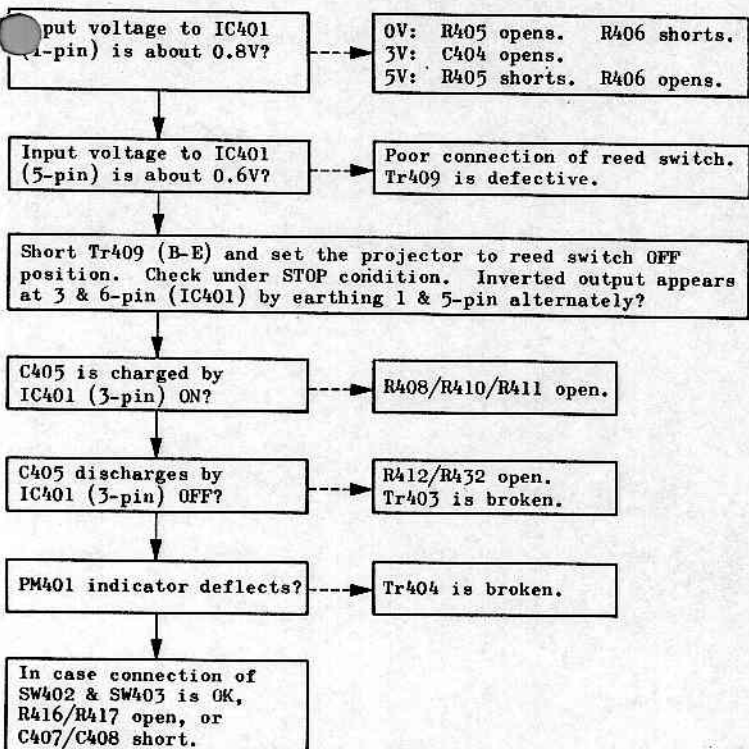
B. Troubleshooting

PROJECTOR DOESN'T START BY SYNC-PULSE

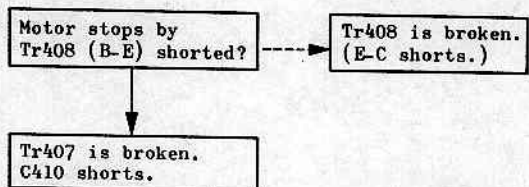


B. Troubleshooting (Cont'd)

PROJECTOR DOESN'T SYNCHRONIZE WITH TAPE RECORDER



MOTOR RUNS SLOWLY WITHOUT INPUT PULSE



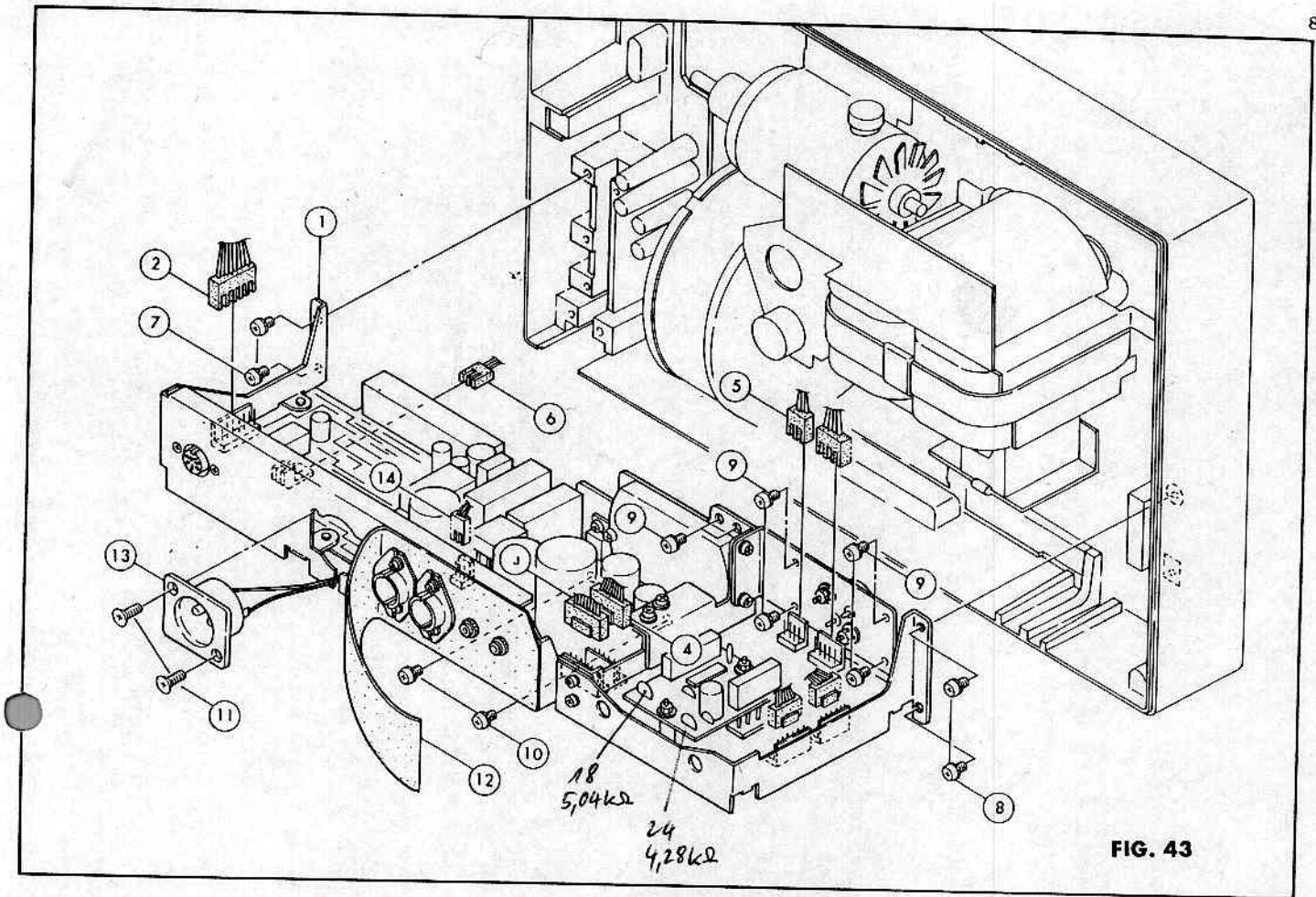


FIG. 43

7. CONTROL CIRCUIT SECTION

A. Control Circuit Board Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 43)

Wow/Flutter	The wires being connected to connectors touch the rotation parts.
Control circuit board is broken	Poor connection of connectors. Circuit trouble (Pages 87-92).
Main motor doesn't run at 6 fps	Adjust it with semi-fixed resistor 'c', using a tool C005.
Main motor doesn't run at 18 fps	Adjust it with semi-fixed resistor 'a', using a tool C005.
Main motor doesn't run at 24 fps	Adjust it with semi-fixed resistor 'b', using a tool C005.
ESS sync-projection isn't well	Adjustable with semi-fixed resistor 'd'.

DISASSEMBLY:

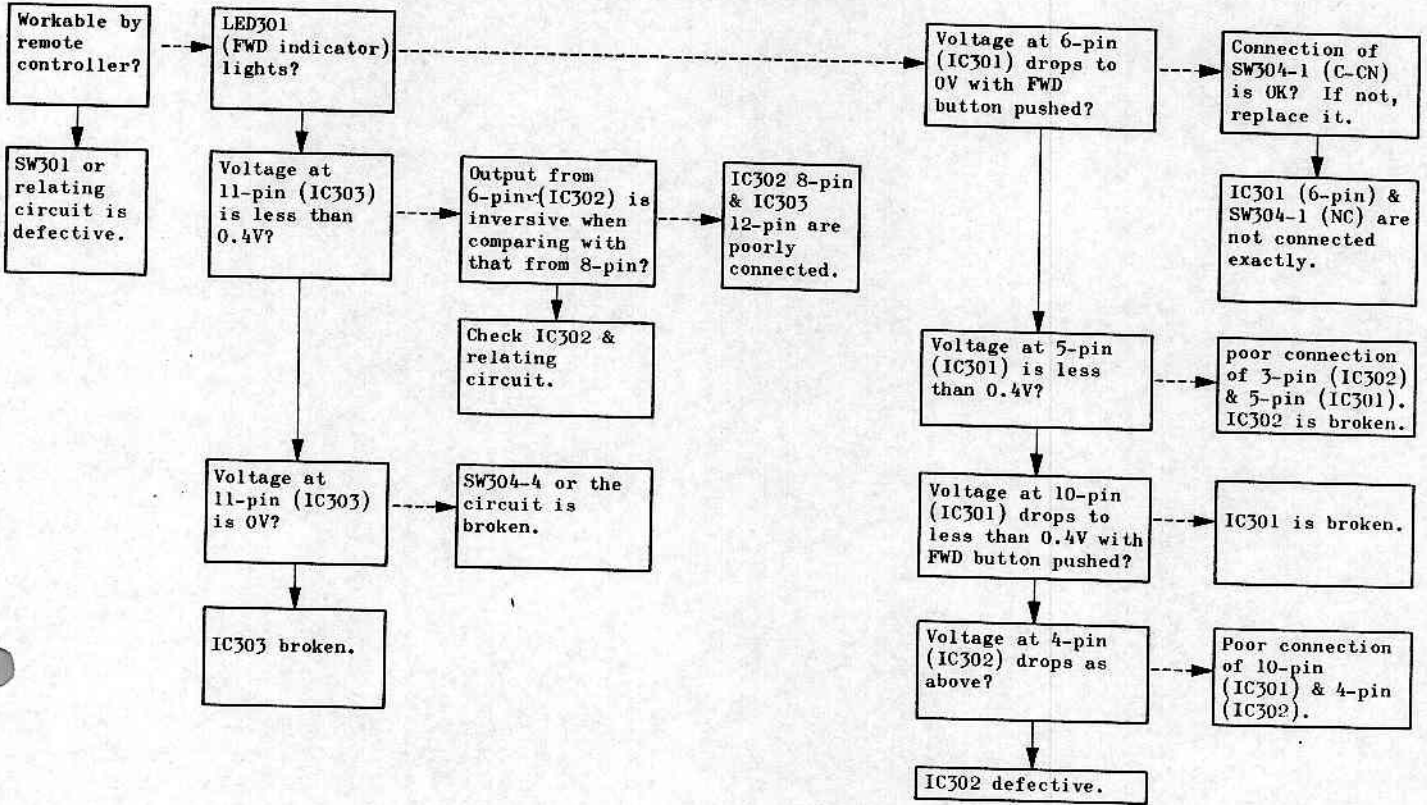
1. Disconnect the (2)(3)(4)(5)(6) with care not to break the wires. Disconnect the connectors indicated by dotted and virtual lines if not disconnected yet.
2. Unscrew the (7), (8)x2, (9)x6 and (10)x2. Unsolder the (13)'s wires along with (1)'s groove. Pull out the (1) toward you somewhat powerfully because it is connected by connector.

REASSEMBLY NOTES:

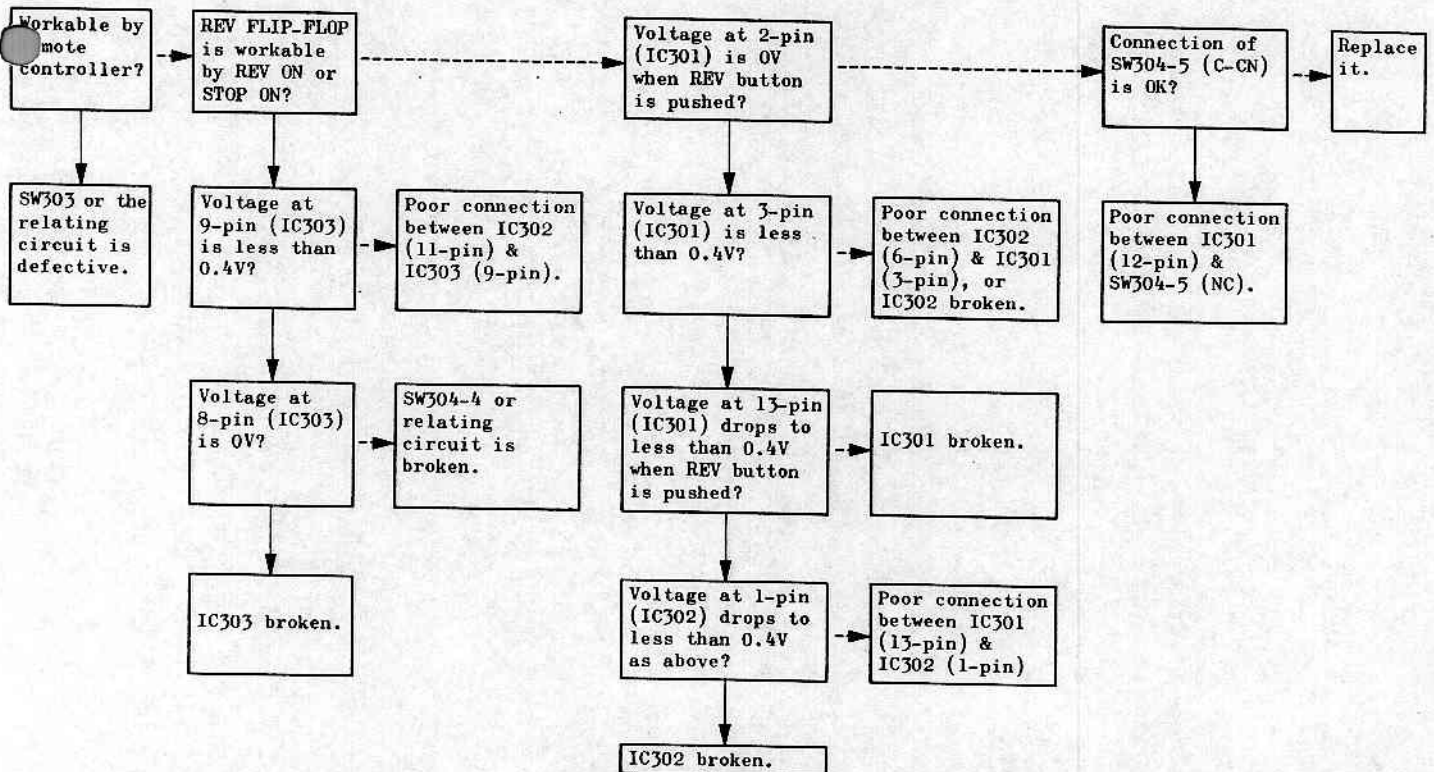
1. Follow the reverse way of the disassembly steps.
2. Connect the (5) after pulling out it from under a lot of wires bound.
3. Let the (14)'s wires come nears transformer and connect it.
4. Be careful not to cut or short-circuit thin wires.

B. Troubleshooting

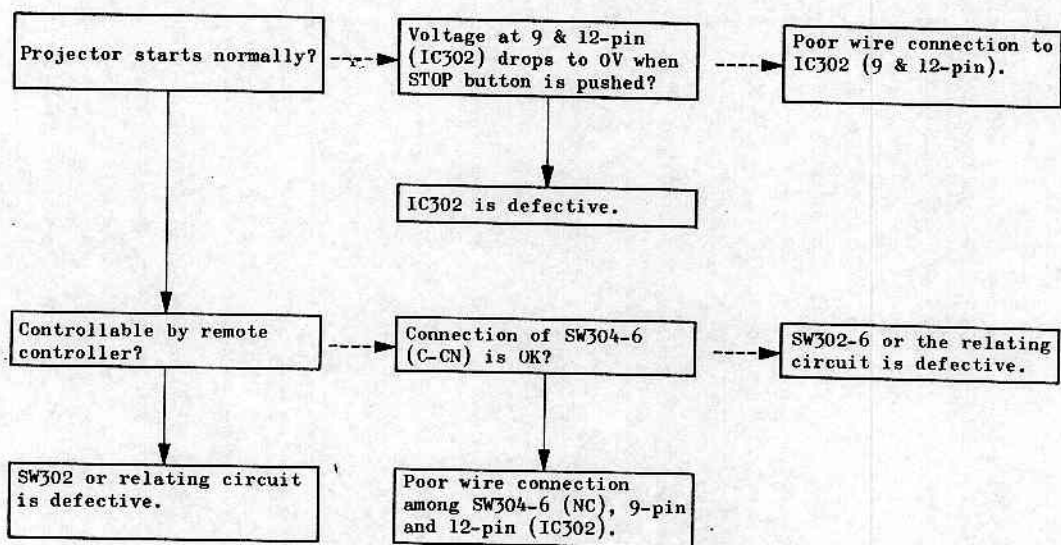
FWD PROJECTION ISN'T WORKABLE



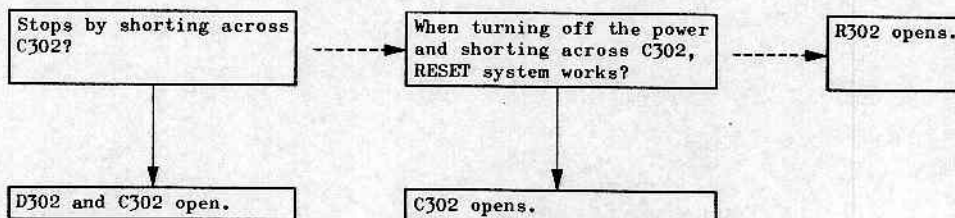
REV PROJECTION ISN'T WORKABLE

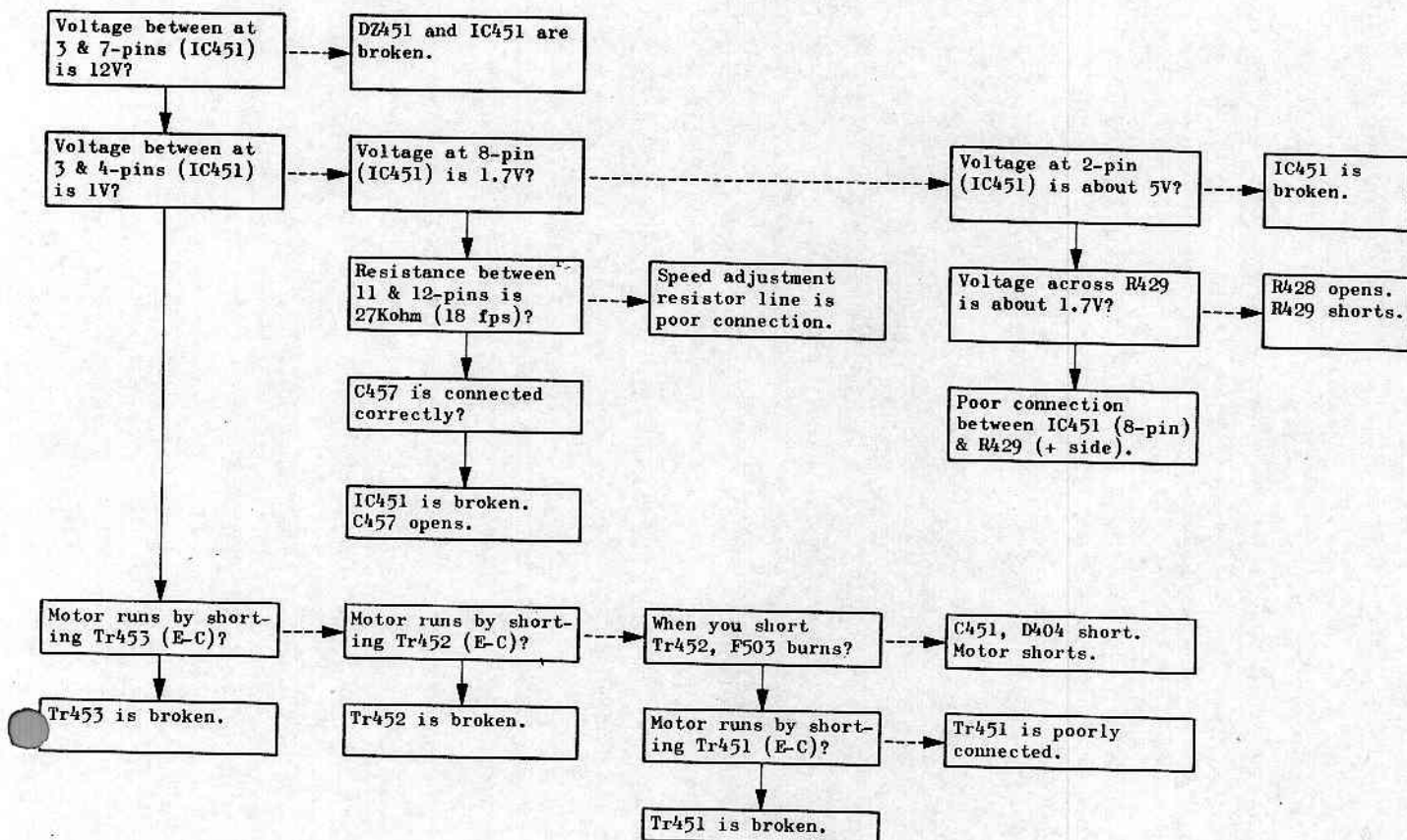


PROJECTOR DOESN'T STOP

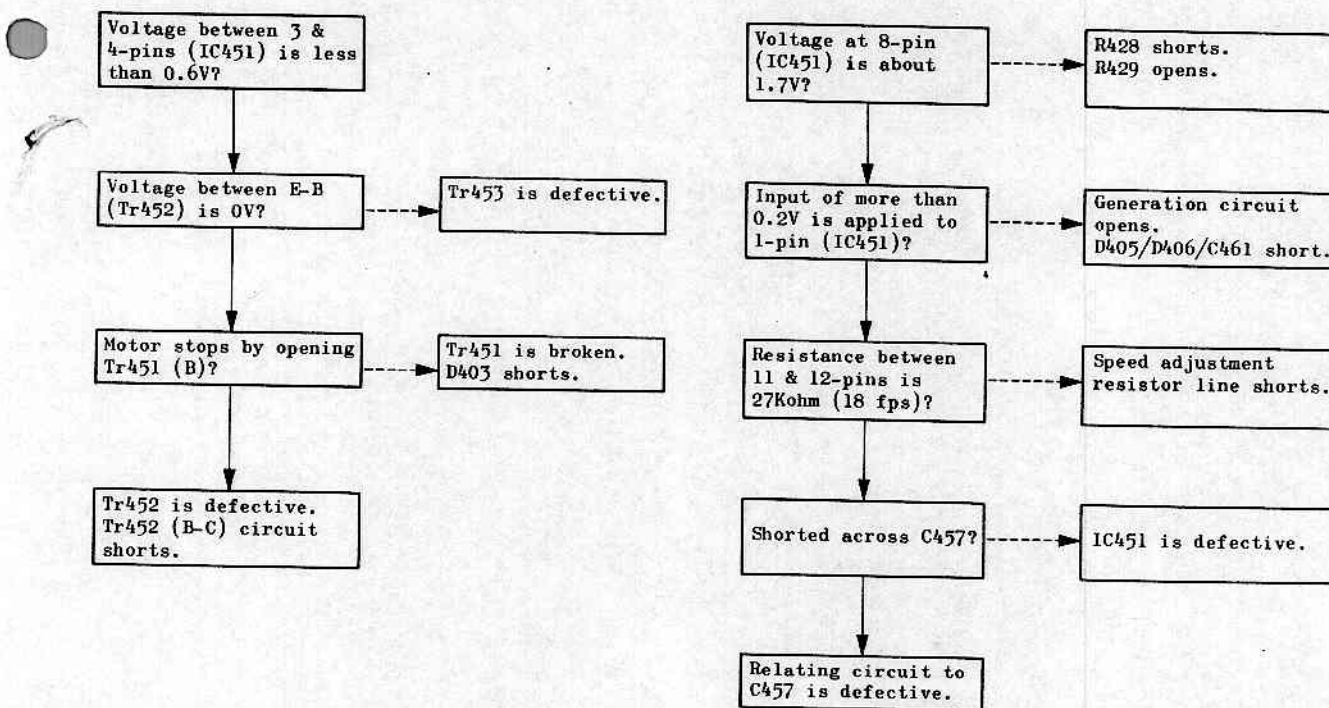


PROJECTOR STARTS AS SOON AS POWER SWITCH IS ON
(Reset system isn't workable)





MOTOR ROTATION IS OUT OF CONTROL



C. Circuit Analysis

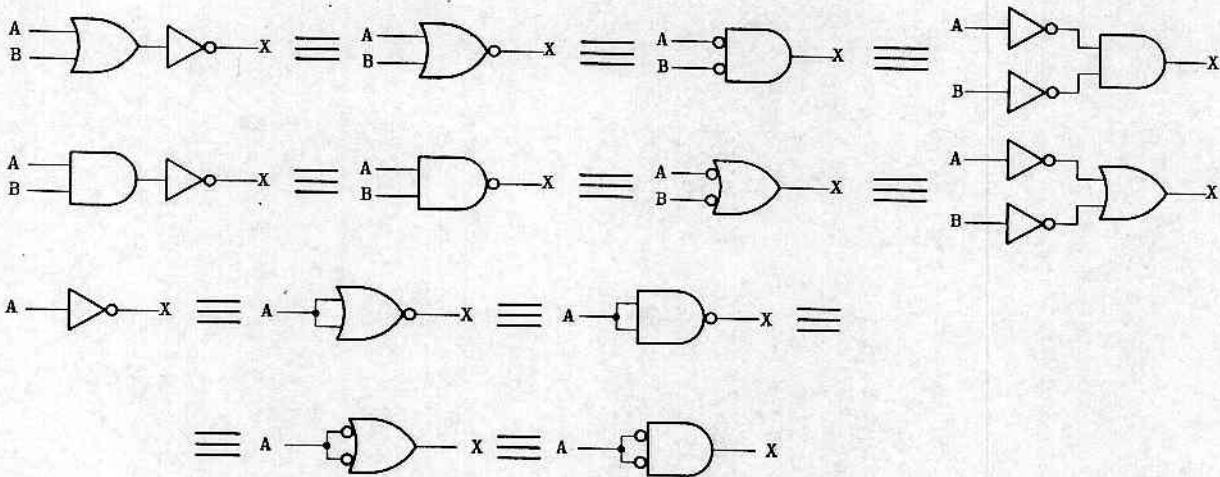
a. Logical Circuit

When a voltage at input/output of the logical circuit gate is high -- Vcc (Supplied voltage), it is called '1' or 'High' and when low (0V), it is called '0' or 'Low'. The symbol 'o' of the gate means the inversion of the signal (Inverter). Inverter means that the inversion of '0' is '1' and vice versa.

GATE:

OR gate		A B X 0 0 0 0 1 1 1 0 1 1 1 1	A + B = X (1 + 1 = 1)	Only in the case both A and B are 0, X=0. When A is 1, X=1 regardless of B.
NOR gate		A B X̄ 0 0 1 0 1 0 1 0 0 1 1 0	A + B = X̄	X̄ is inversion of X of OR gate. When X is 1 at OR gate, X̄ is 0 at this NOR gate and vice versa. When X is 0 at OR gate, X̄ is 1 at this NOR gate.
AND gate		A B X 0 0 0 0 1 0 1 0 0 1 1 1	A x B = X	Only in the case A and B are 1, X=1. When A is 0, X=0 regardless of B.
NAND gate		A B X̄ 0 0 1 0 1 1 1 0 1 1 1 0	A x B = X̄	X̄ is inversion of X of AND gate.
INVERTER		A Ā 0 1 1 0		Ā is inversion of A.

EQUIVALENT GATE:



GATE COMBINATION:

RS Flip-Flop (RS F.F.)

This circuit is workable by the input of only 0 pulae.
 When S is 0, Q will be 1.
 When R is 0, Q will be 0. (\bar{Q} is the inversion of Q.)
 Don't apply input of 0 to both S and R. (Inhibited input)

One Shot

When 0 pulse is given to A, the plus wave continues to come from X for the period of time pre-controlled by C.R.

Transition Chart

Timing Chart

L level of input at NAND gate

a. Logical Circuit (Cont'd)

STATE OF THE PROJECTOR:

Correlation between operation and signal at each point of ICs

Operation Key	FWD	FWD → STILL	FWD/REV → OFF	FWD/REV → STILL → OFF	REV	REV → STILL
Signal Name State in Circuit Diagram	Forwarding	Still in forwarding	Stop	Stop after STILL	Reversing	Still in reversing
FWD	○	○				
FWD			○	○	○	○
REV					○	○
REV	○	○	○	○		
FWD STILL	○					
FWD STILL		○	○	○	○	○
REV STILL						○

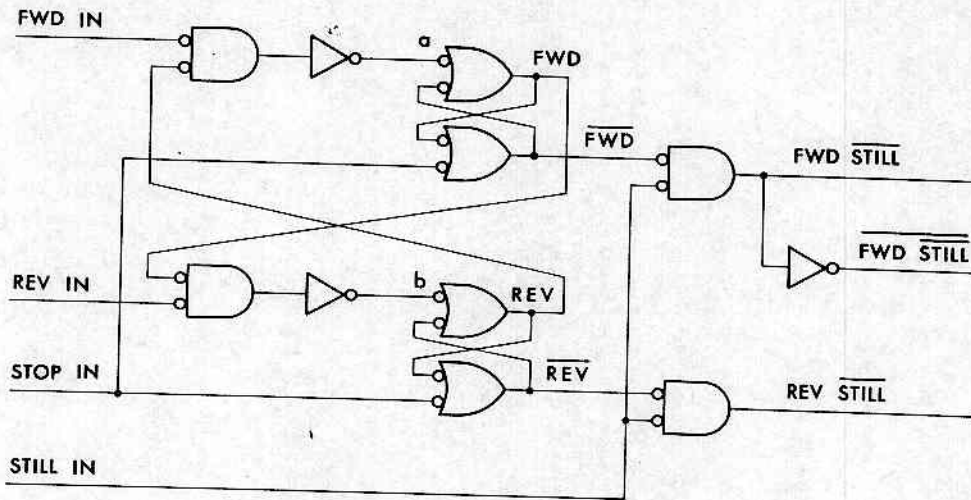
Remark: Should be read the FWD and $\overline{\text{FWD}}$ signal as FWD $\overline{\text{STILL}}$ and $\overline{\text{FWD}} \overline{\text{STILL}}$ respectively, in the control circuit diagram (-- going to Amplifier).

These FWD and $\overline{\text{FWD}}$ are muting power on recording.

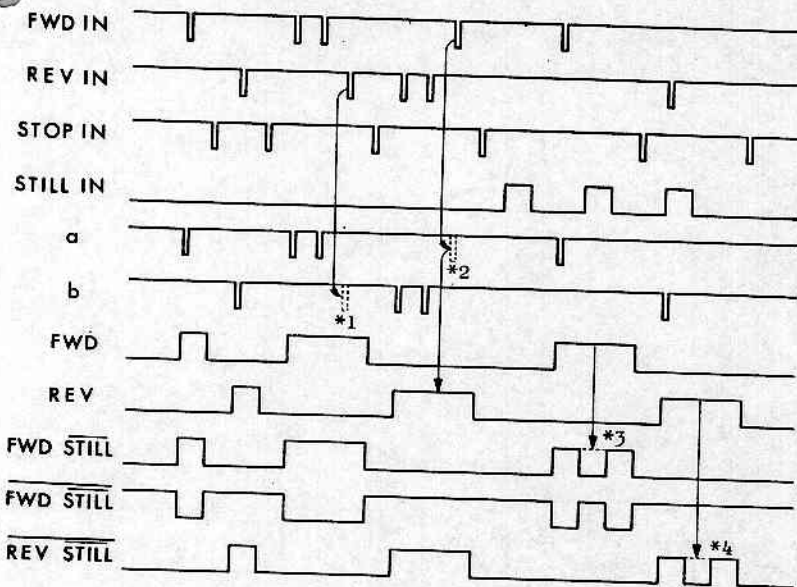
a. Logical Circuit (Cont'd)

GATE CIRCUIT USED IN THE GS-1200:

Control Circuit for FWD and REV



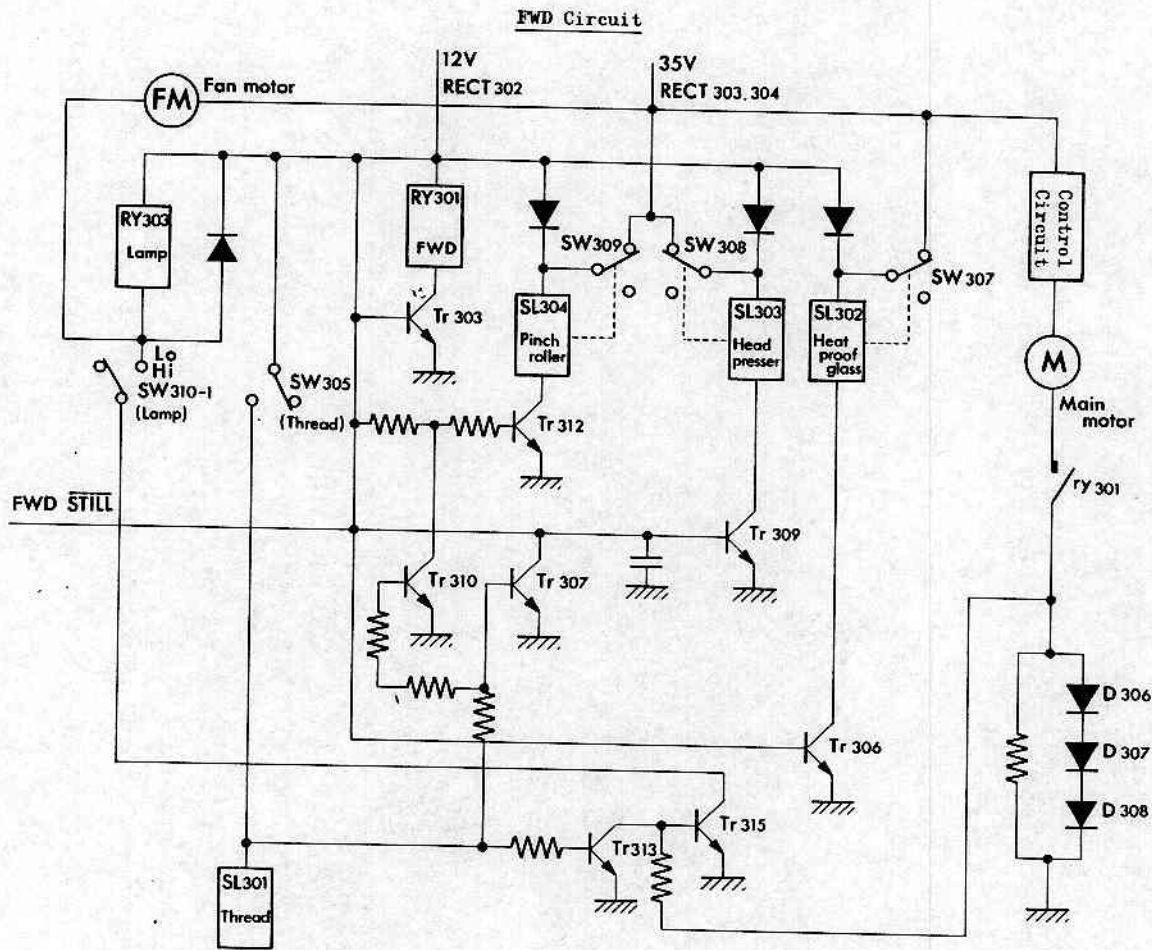
Timing Chart



- *1: REV input is not effective even if REV button is pushed during FWD projection.
- *2: FWD input is not effective even if FWD button is pushed during REV projection.
- *3: The state of FWD F.F. (Flip-Flop) doesn't change even if STILL button is pushed while the FWD F.F. is set, but final output (FWD STILL) is stopped until STILL button is pushed again.
- *4: REV F.F. is the similar function to FWD F.F.

NOTE:

All inputs (FWD, STOP, REV) are raised to High when STILL button is once pushed.



b. FWD Circuit (Refer to Page 99)

FWD PROJECTION:

1. When you turn FWD switch on, the output FWD STILL will be changed to High by operation of FWD starting circuit.
2. Current flows in RY301 and the main motor starts running. SL302 for heat-proof glass works.
3. A bit late, SL304 for pinch roller and SL303 for head presser work.
4. Since Tr307 is ON during optical projection (OPT), the SL303 does not work.

DURING AUTO-THREADING:

1. Since Tr313 is ON, Tr315 does not work and projection lamp does not light. FM (Fan Motor) does not run at high speed.
2. Since Tr310 is ON, neither Tr312 nor SL304 works.
3. Since Tr307 is ON, neither Tr309 nor SL303 works.

FAN MOTOR:

The motor turns slowly by the potential difference between 35V and 12V while the projection lamp is being preheated.

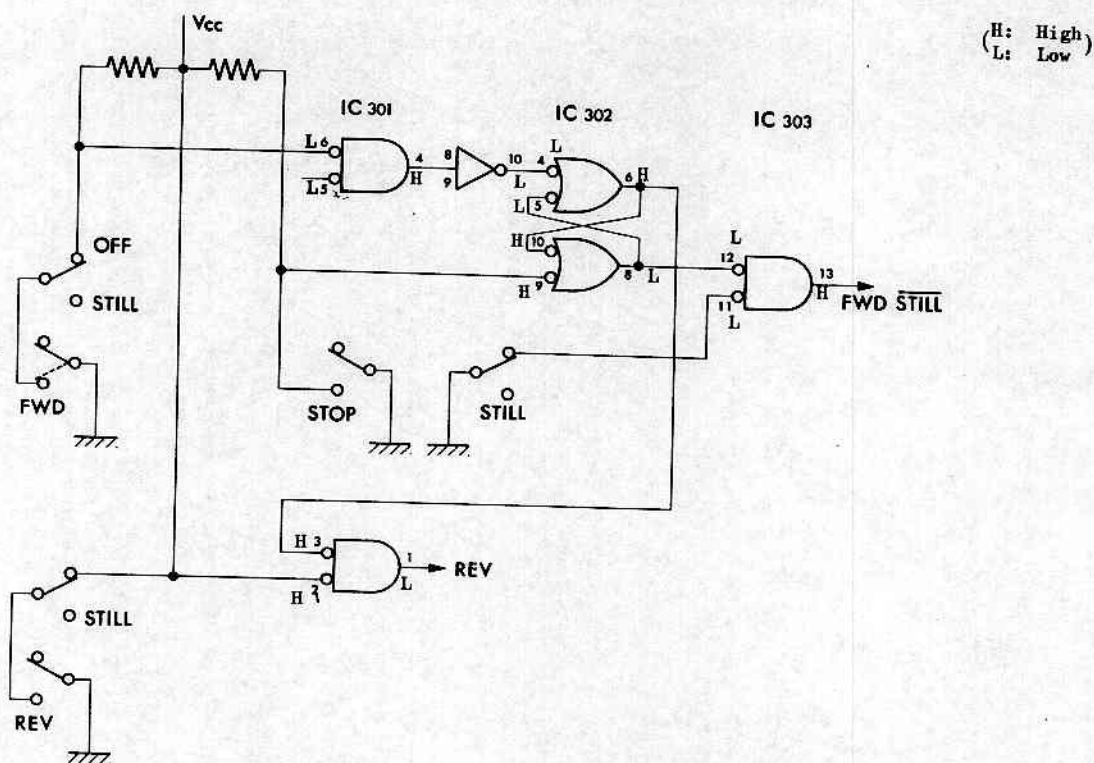
LAMP CIRCUIT:

While the main motor is running, the positive potential is generated by D306, D307 and D308. It turns Tr315 on and RY303 works.

SL CIRCUIT:

For actuating the SL's, current flows from RECT303/304 (35V)/SW307/SW308/SW309 into SL's because their attraction power is insufficient. Once SL's work, they continue working with current supplied from RECT302 (12V). Decreasing the current prevents SL from overheating.

FWD Starting Circuit



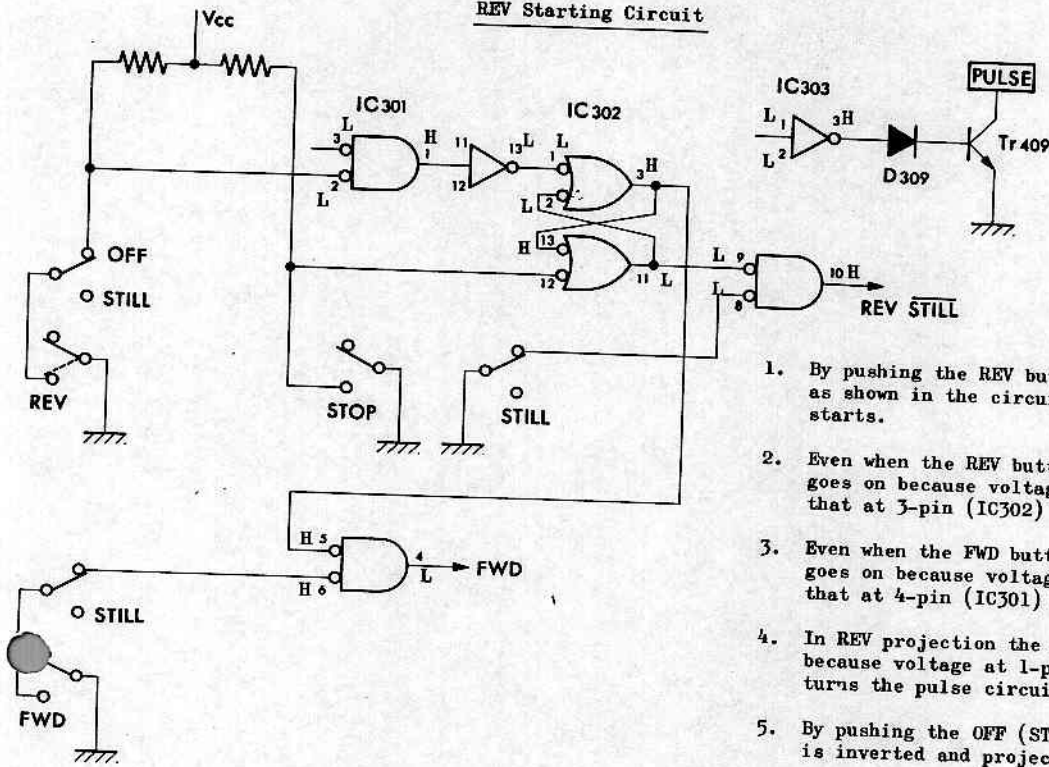
b. FWD Circuit (Cont'd)

FWD STARTING CIRCUIT: (Refer to Page 101)

1. By pushing the FWD button, voltage at each pin changes as shown in the circuit diagram on Page 101 and FWD projection starts.
2. Even when FWD button is released (voltage at 4-pin of IC302 returns to High), FWD projection goes on because voltage at 5-pin (IC302) is Low and that at 6-pin (IC302) keeps High.
3. Even when REV button is pushed (voltage at 2-pin of IC301 changes to Low), FWD projection goes on because voltage at 3-pin (IC301) is High and that at 1-pin (IC301) keeps Low.
4. By pushing the OFF (STOP) button, voltage at each pin is inverted and FWD projection stops accordingly.

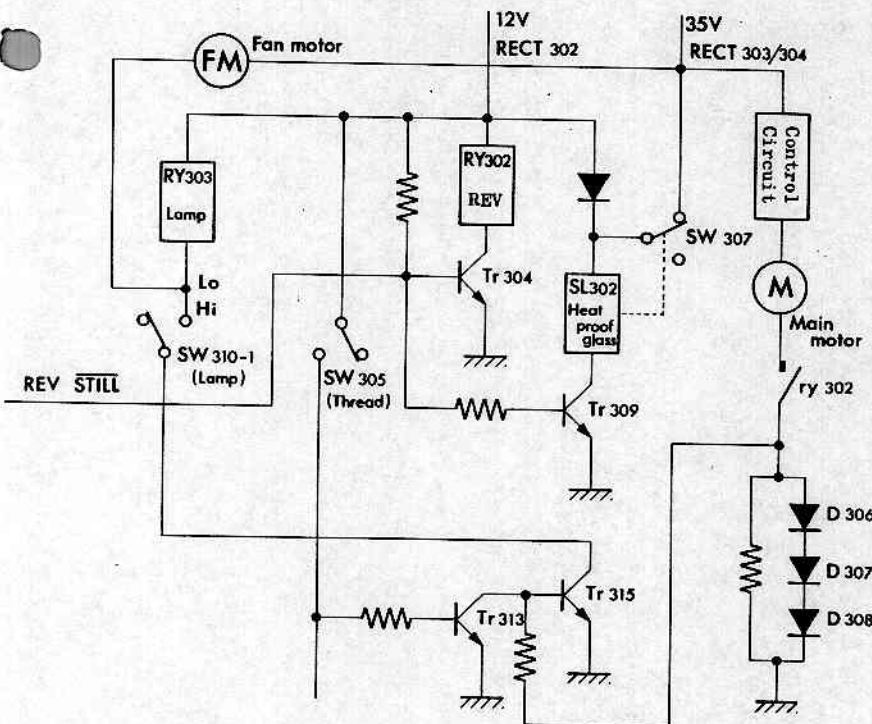
c. REV Starting Circuit

REV Starting Circuit



1. By pushing the REV button, voltage at each pin changes as shown in the circuit diagram and REV projection starts.
2. Even when the REV button is released, REV projection goes on because voltage at 2-pin (IC302) is Low and that at 3-pin (IC302) keeps High.
3. Even when the FWD button is pushed, REV projection goes on because voltage at 5-pin (IC301) is High and that at 4-pin (IC301) keeps Low.
4. In REV projection the pulse circuit does not work because voltage at 1-pin (IC303) is High and Tr409 turns the pulse circuit off.
5. By pushing the OFF (STOP) button, voltage at each pin is inverted and projector stops.

REV Circuit



LAMP CIRCUIT:

While main motor is running, positive potential is generated by D306, D307 and D308.

Then Tr315 turns on and RY303 works.

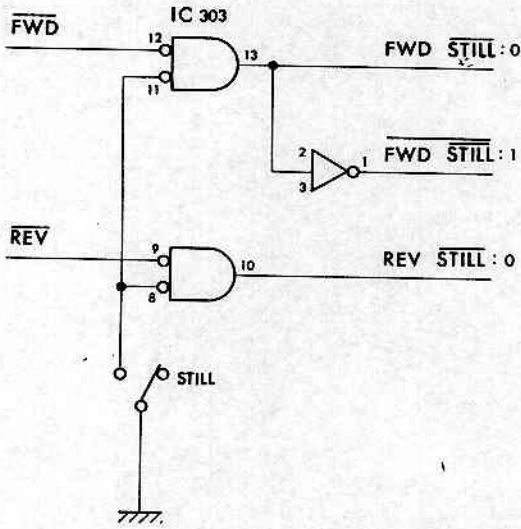
SL CIRCUIT:

Since the output (REV STILL) is High, Tr304 turns on and RY302 works.

Tr306 turns on. SL302 turns the SW307 off and continues to work by the current supplied from RECT302.

d. STILL Function Circuit

STILL Function Circuit

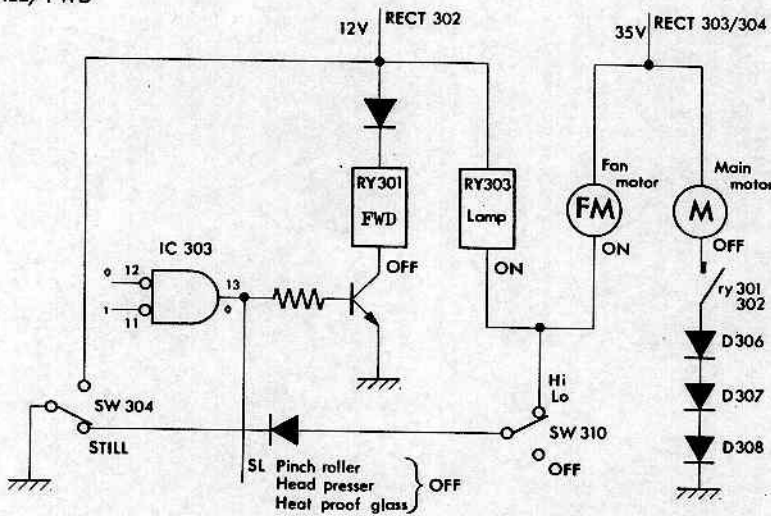


When you push the STILL button, each input of FWD, OFF and REV is cut regardless of their position.

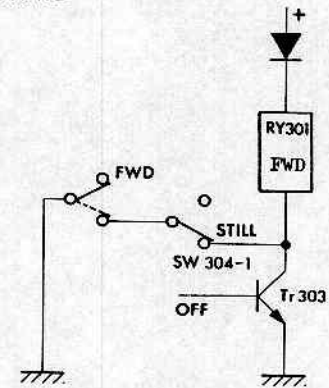
As soon as you push the STILL button, each input and output at pins of IC303 changes as follows.

Pin No.	Voltage
8-pin	High
11-pin	High
13-pin (FWD $\overline{\text{STILL}}$)	Low (regardless of 12-pin voltage)
10-pin (REV $\overline{\text{STILL}}$)	Low (regardless of 9-pin voltage)
1-pin (FWD $\overline{\text{STILL}}$)	High (STILL projection starts)

STILL/FWD

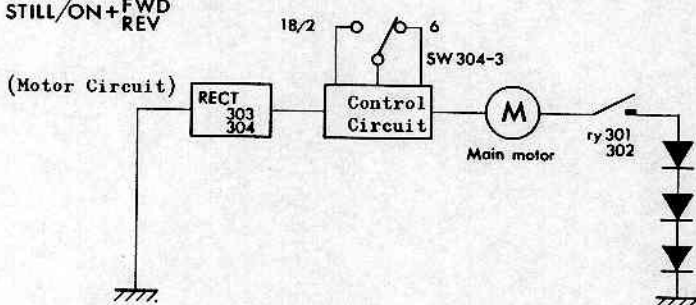


STILL/ON+FWD

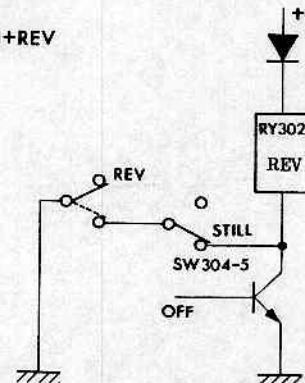


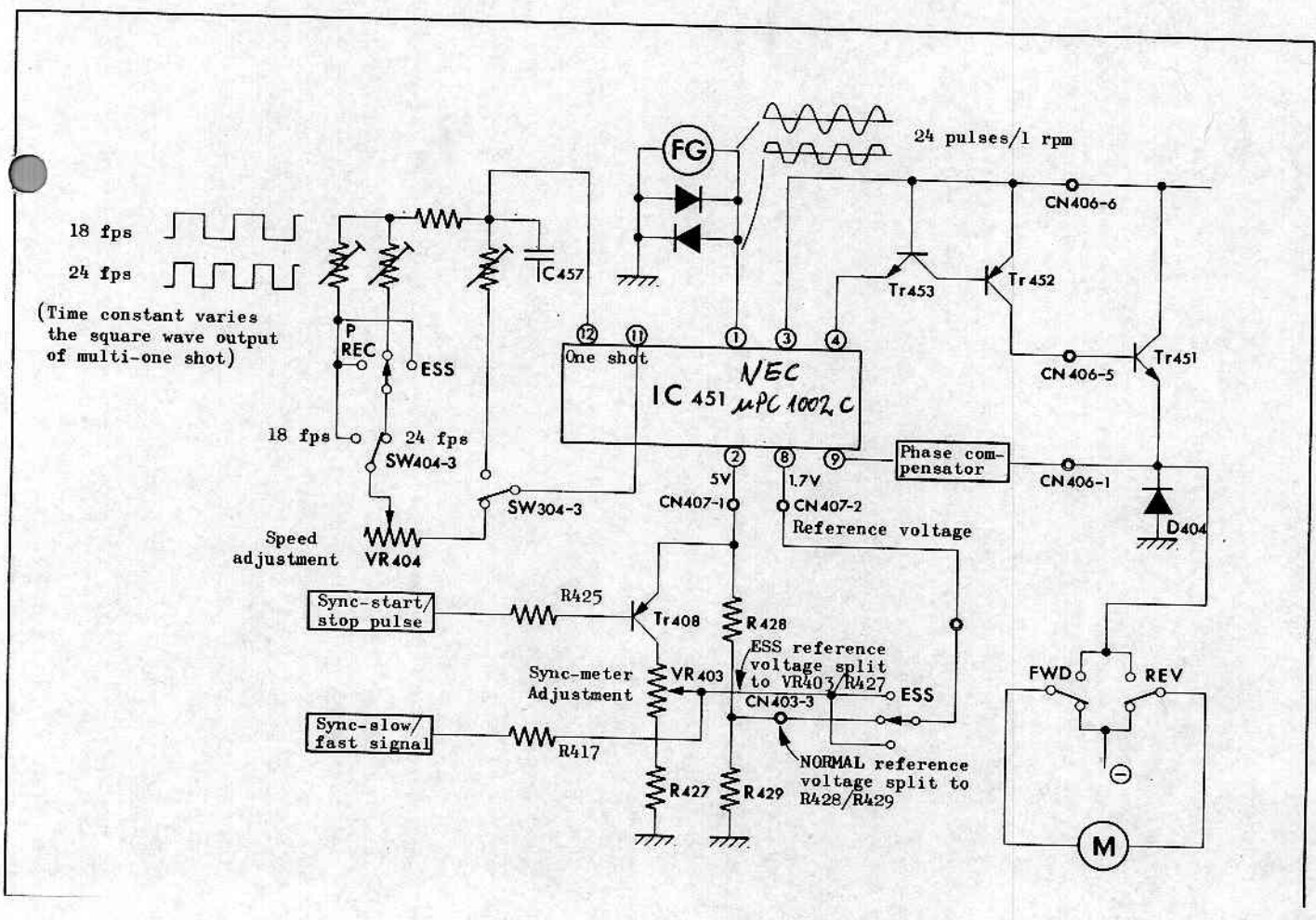
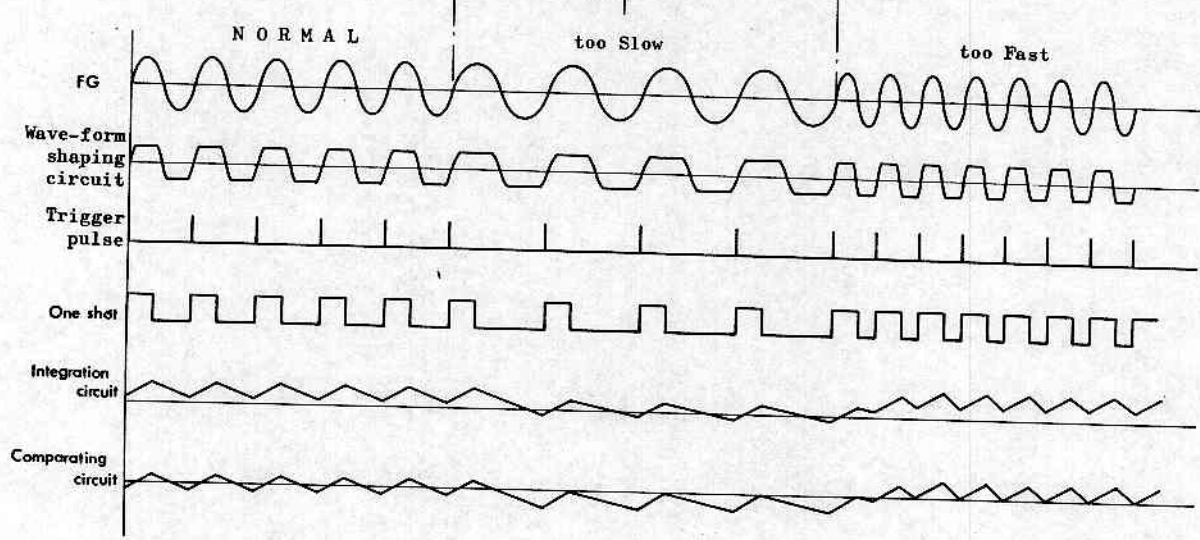
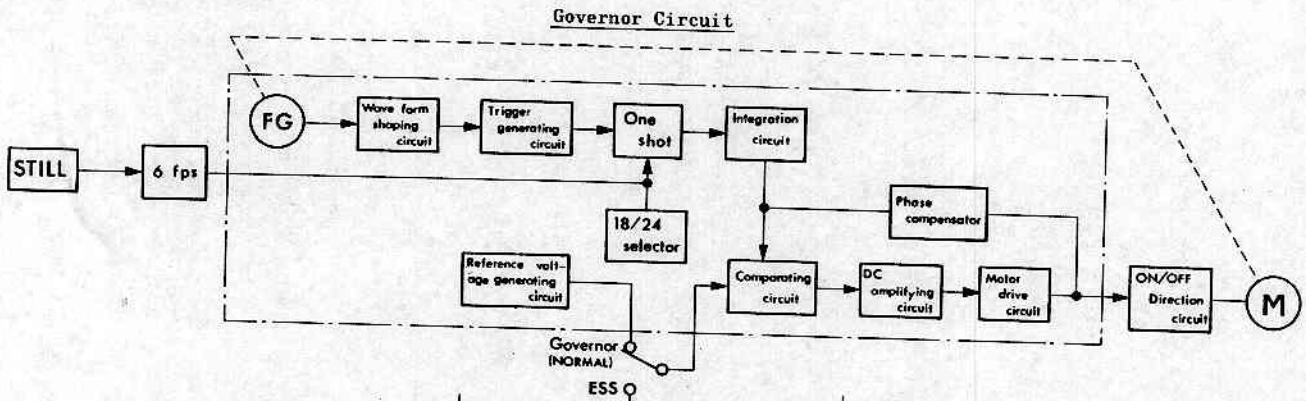
Only while pushing FWD/REV button, slow motion is possible.

STILL/ON+FWD
REV

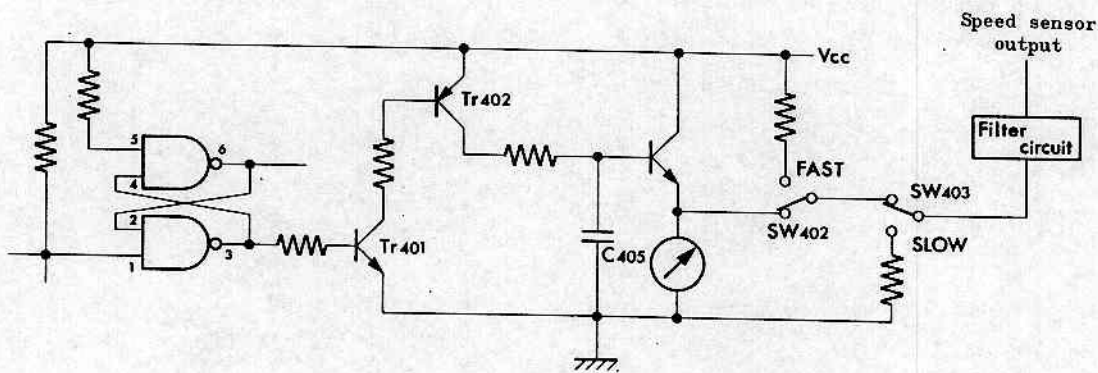
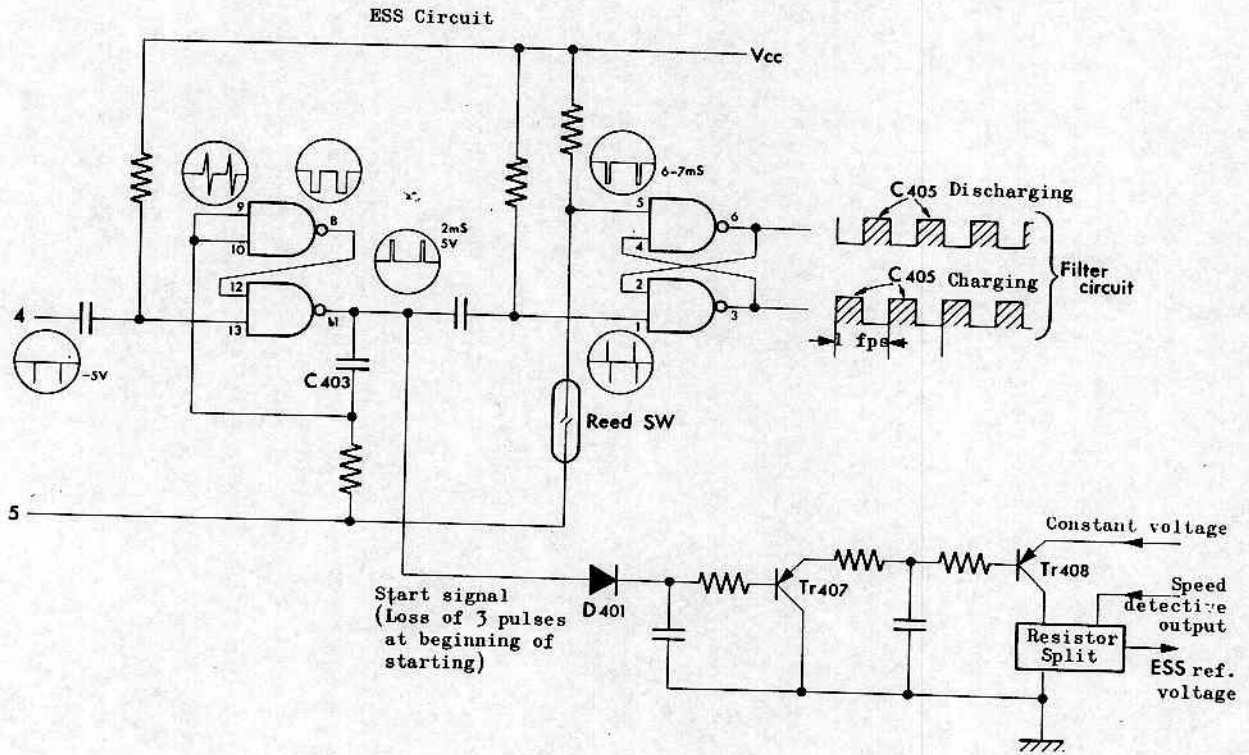


STILL/ON+REV





ESS is the pulse talkie system controlled by the built-in pulse control circuit.



PULSE IN:

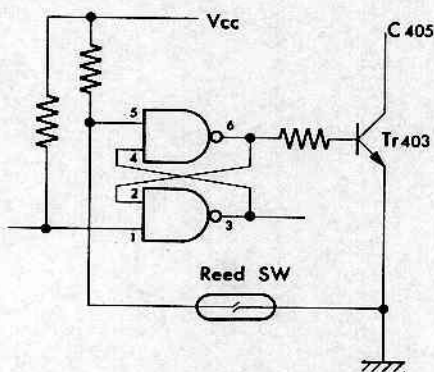
When negative pulse goes into 1-pin, the output at 3-pin changes to 1 and C405 is charged. Since the output at 4-pin changes to 1, that at 6-pin changes to 0 and that at 2-pin becomes 0. Therefore, the output at 3-pin keeps 1.

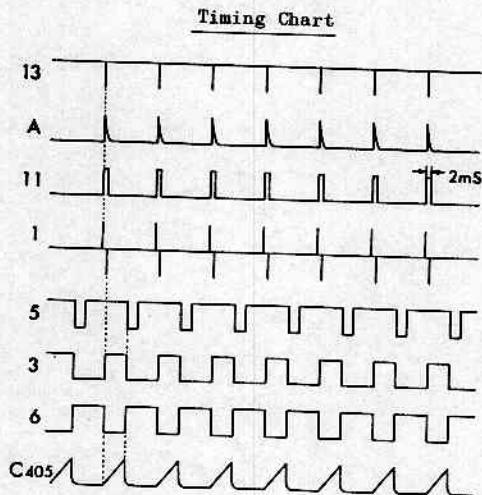
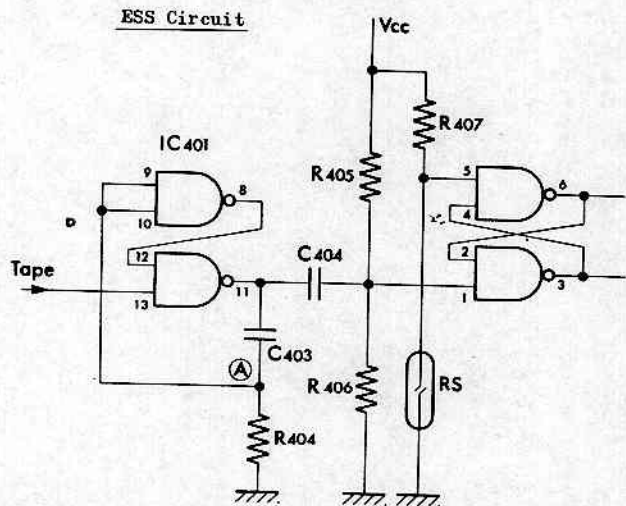
REED SWITCH ON:

When reed switch is ON, output at 5-pin changes to 0 and that at 6-pin changes to 1. Therefore, C405 is discharged. Since the output at 2-pin becomes 1, that at 3-pin changes to 0 and that at 4-pin becomes 0. Therefore, the output at 6-pin keeps 1.

SYNCHRONIZATION:

The residual electric charge in C405 is a control output. If the motor runs fast, the charge of C405 decreases. If the motor runs slowly, the charge of C405 increases. Synthesis electric charge is smoothed and it is led to split circuit of ESS reference voltage.

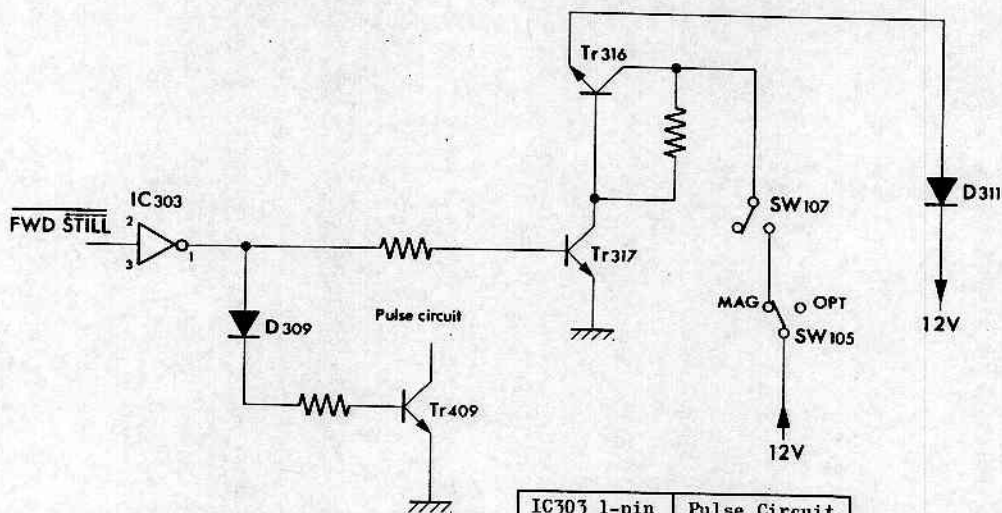




Voltage at each pin:

No pulse from tape (Still condition)		When negative pulse puts into 13-pin from tape		Remarks
(A) -point	Low	13-pin	Low	
9/10-pin	Low	11-pin	High ... *	
8-pin	High	C403	Charged	
12/13-pin	High	(A)-point	High ... **	
11-pin	Low	8-pin	Low	
C403	Discharge	12-pin	Low	

Pulse Recording Power-Supply Circuit



Projection
FWD
REV/STOP

IC303 1-pin	Pulse Circuit
LOW	ON
HIGH	OFF

Tr317	Tr316	D311	Pulse Rec. Power
OFF	ON	12V	ON
ON	OFF	0V	OFF

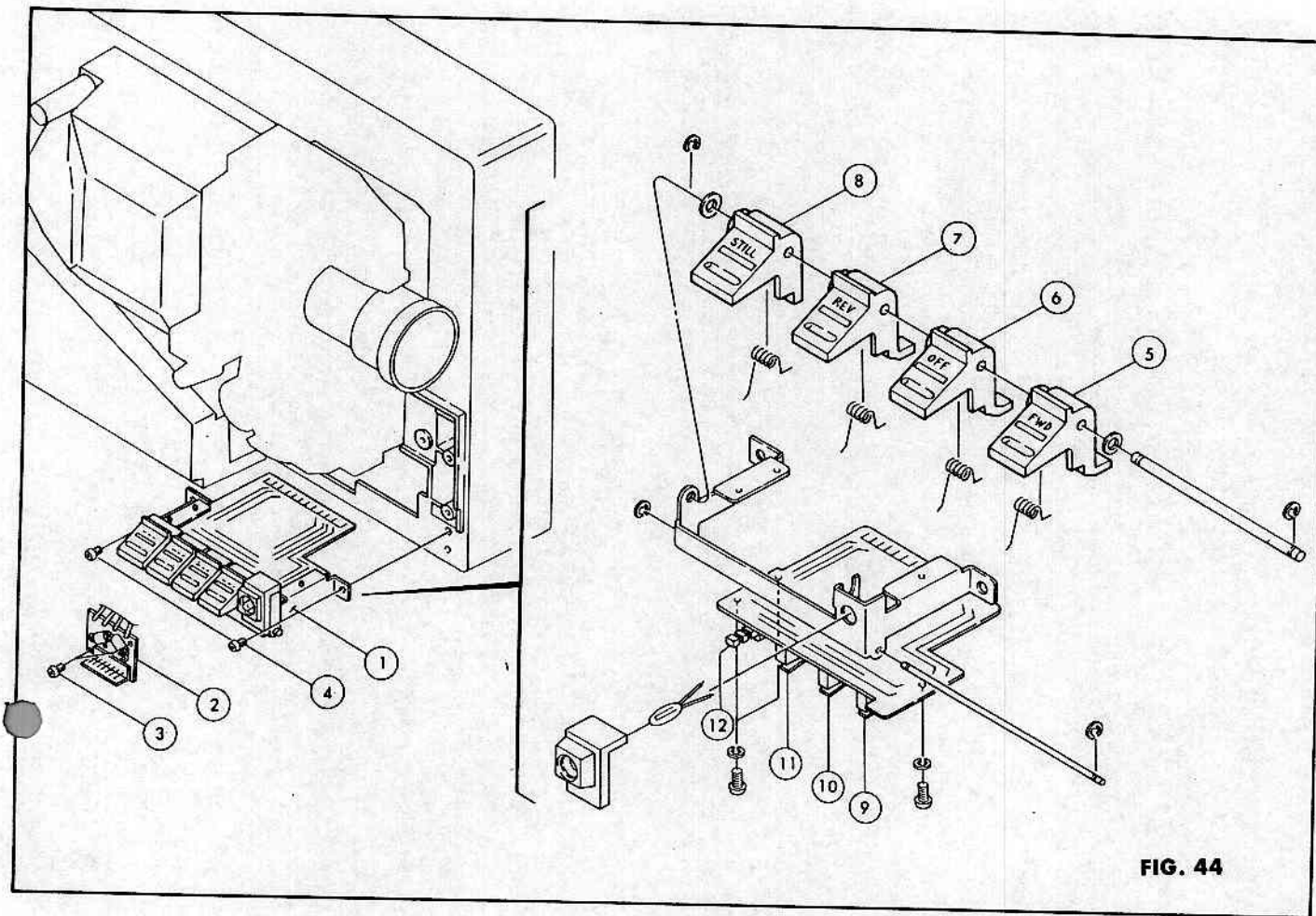


FIG. 44

8. OPERATION SWITCH UNIT (1)

TROUBLESHOOTING: (Refer to Fig. 44)

Unable to lock the STILL button	The (1) is out of position. Attach the (1), pushing it upward.
Motor doesn't run though operator pushed FWD button	The (5)(9) are defective or connectors are half-connected.
Motor doesn't stop though operator pushed OFF button	The (6)(10) are defective or connectors are half-connected.
Motor doesn't run though operator pushed REV button	The (7)(11) are defective or connectors are half-connected.
STILL projection system isn't workable though operator pushed STILL button	The (8)(12) are defective or connectors are half-connected.

DISASSEMBLY:

1. Unscrew the (3)x2 and lift the (2) up slightly. Don't touch the cancel coil on the (2).
2. Unscrew the (4)x2 and remove the (1).
3. For further disassembly, refer to Fig. 44.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that each button and switch functions well.

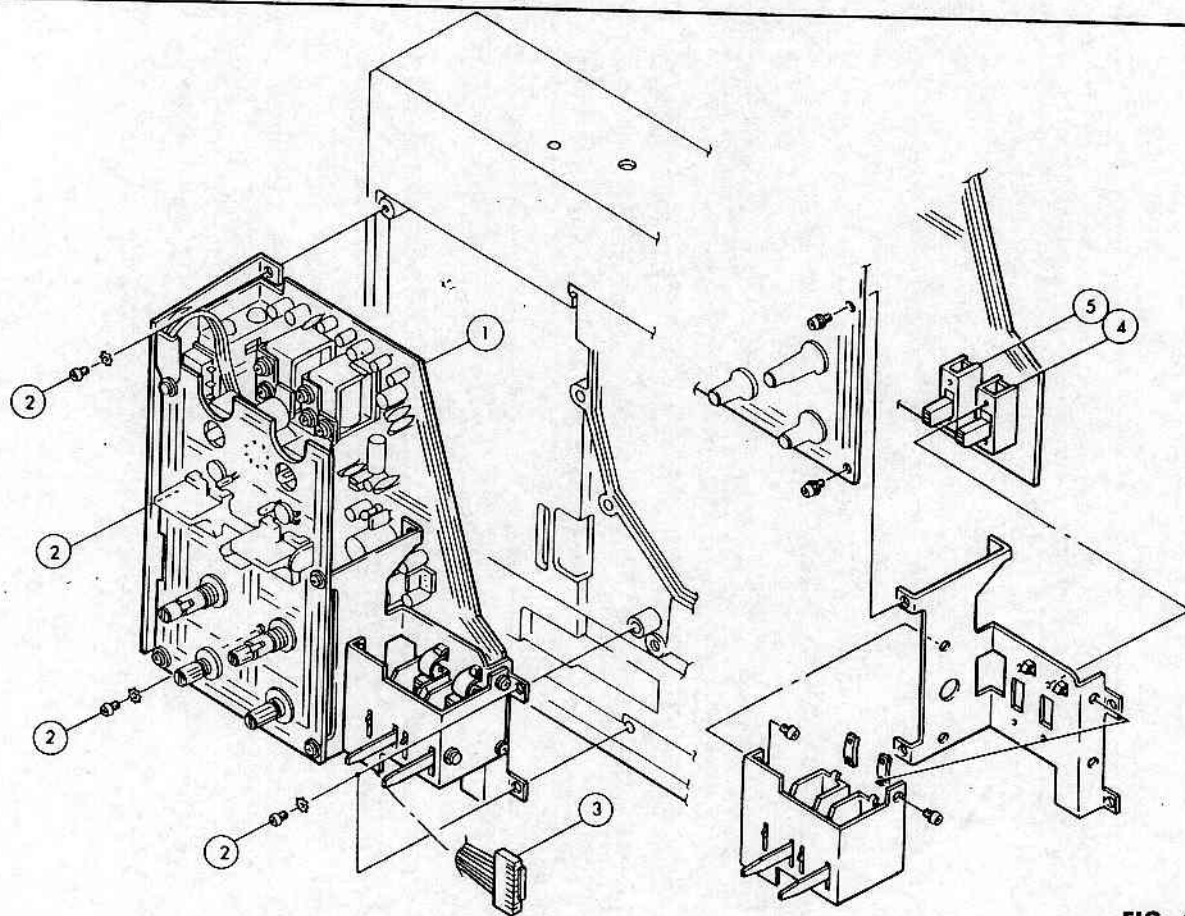


FIG. 45

9. AMPLIFIER SECTION

A. Amplifier Assembly

TROUBLESHOOTING: (Refer to Fig. 45)

Unable to shift MAG-OPT	The (4) is defective.
Unable to shift STEREO-MONO	The (5) is defective.

DISASSEMBLY:

1. Unscrew the (2)x4 and pull out the (3) after cut a beaded binder. The toothed lock washers are used under the (2).
2. Remove the (1), pulling it toward you. Note that the (1) is connected to the projector with connector.
3. For further disassembly, refer to Fig. 45.

REASSEMBLY NOTES:

Follow the reverse way of the disassembly steps.

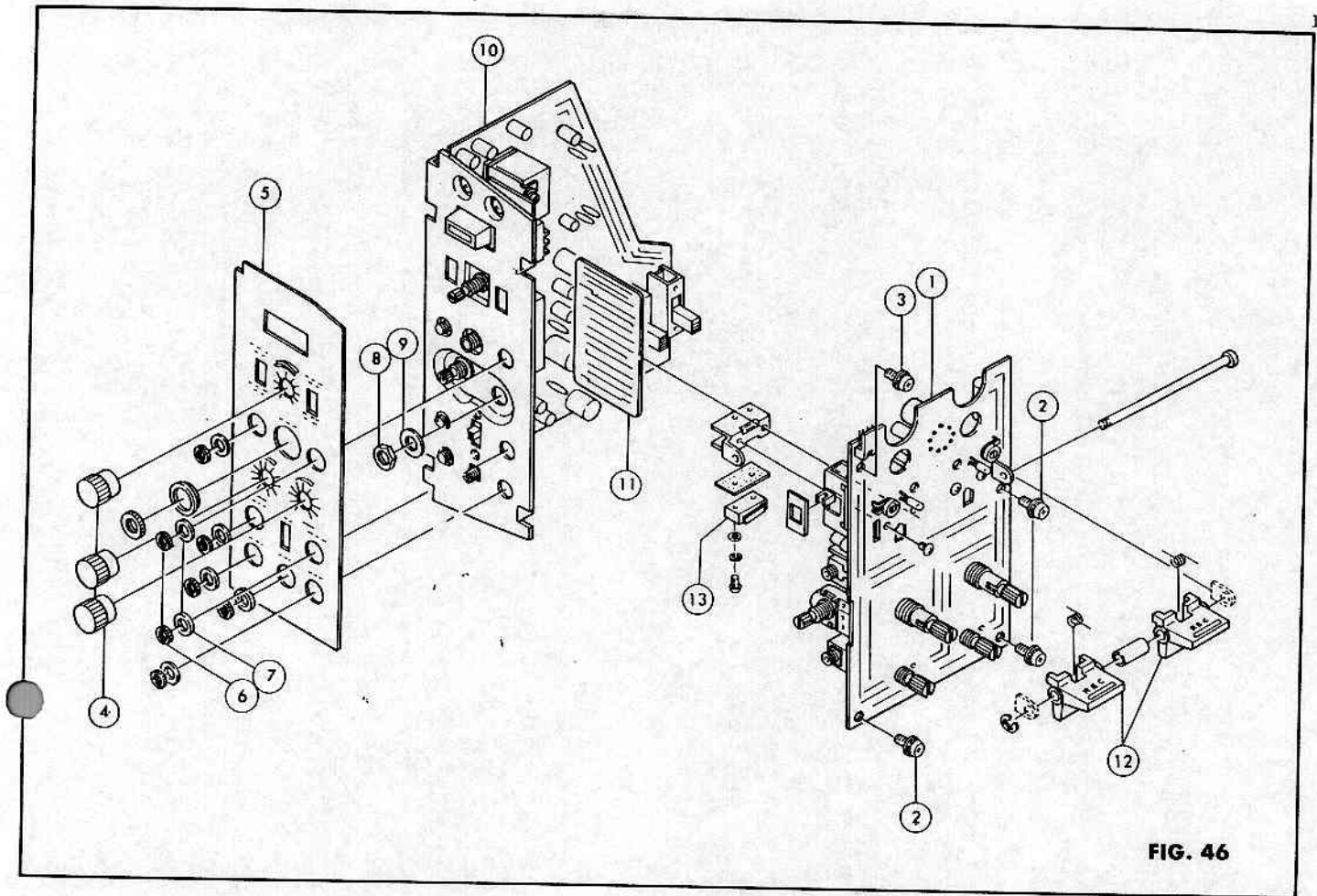


FIG. 46

A. Amplifier Assembly (Cont'd)

How to detach the amplifier board (1) from the amplifier board (10) --

TROUBLESHOOTING: (Refer to Fig. 46)

Spot recording malfunctions	The (3) is too long.	
REC button movement isn't smooth	The (12)(13) are defective.	
Volume knobs don't turn smoothly	Knobs are out of position.	
Defect of amplifier		from Page 123 forth

DISASSEMBLY:

1. Unscrew the (2)x3, & (3). Remove the (4)x3 and peel the (5) off.
2. Unscrew the (6)x2 with (7), and the (8) with (9). Detach the (1) from the (10).
3. For further disassembly, refer to Fig. 46.

REASSEMBLY NOTES:

1. Attach the (11) between the connectors of (1)(10) carefully not to touch resistors, capacitors, etc.
2. Attach the knob to the center of (5)'s hole respectively.
3. Don't forget to insert the isolation washer when tightening the jack.

B. Amplifier Design

1. Stereo Circuit

The GS-1200 uses Track 1 as the left channel and Track 2 as the right channel.

It is possible to operate each channel independently.

The public address (PA) system and optical playback circuit are connected with only the left channel. One piece of bias oscillator is used for both channels.

2. Remote Recording

Solenoids are used for recording-playback changeover, so the operator can operate the changeover by remote controller. With use of remote controller, the pulse operation is easy and the microphone will not catch any projector running noise. Refer to Page 160.

3. Level Meter of Constant Level

There is an exclusive amplification circuit (not affected by volume/tone position) for the AUX OUT/Level Meter system added to the amplification circuit for the speaker system.

The level meter can indicate the level of recorded sound as it is. With this facility, it is easy for operator to add other sound with equal level. Refer to Pages 156 and 157.

4. Muting Circuit

a. For playback:

To reduce or eliminate the noise (click noise on switch ON/OFF operation and other noise), control signal for muting flows into the overload transistors (Tr101, Tr201) which are used for the ALC circuit on recording.

The muting system works on STOP/REV/STILL/AUTO-THREADING, but it does not work when the PA switch is ON. Refer to Page 158.

b. For recording:

Photo coupler is used in order to mute the recording current.

This photo coupler turns ON (muting is released) when not only the REC button but also FWD button is pushed.

Therefore, when only the REC button is pushed, recording current doesn't flow into sound head. Refer to Page 161.

5. Bias Control

To reduce click noise on recording, the bias oscillator works when not only the REC button but also the FWD button is pushed.

6. Recording Amplifier (Tr102, Tr202)

To avoid the tone control on recording, there is an exclusive amplifier for recording.

To compensate the phase shift between each input/output terminal for stereo performance, this amplifier is designed as an inverted amplifier. The phase, which is once inverted by the head switching circuit, will be compensated. And the operator can transfer the sound on one track to another track without phase shift. Refer to Page 159.

7. For superb sound performance, the tone control for Bass is also provided.

8. High-Cut Filter for Transferring Sound

To allow the sound transfer between tracks, a high-cut filter is connected to the playback circuit. When you set the Track 2 side to the recording condition, the Track 1 filter will function because of a crossover connection as shown in Fig. 47. Refer to Page 157.

9. Transistor Switch

To reduce the number of switch and wire, transistor is used as switch (Tr105, Tr106, Tr107, Tr108, Tr111, Tr205, Tr206 & Tr207).

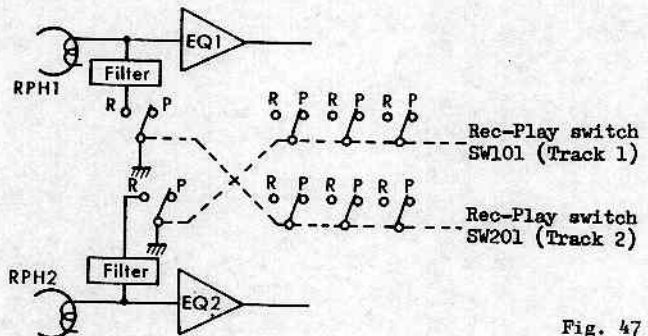
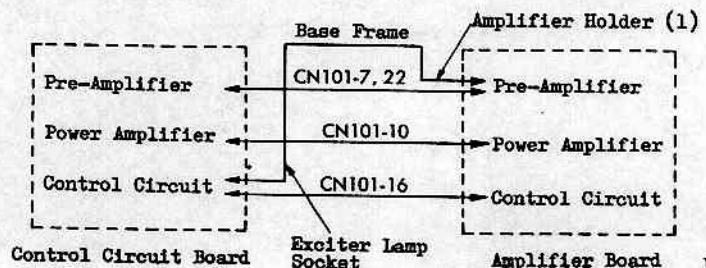


Fig. 47

10. Earth

To prevent noise and oscillation, the earth circuit on the amplifier printed board is divided into three units -- Pre-amplifier unit, Power amplifier unit and Control unit -- and is respectively connected to the control circuit printed board as shown in the schema. Each point is not affected.



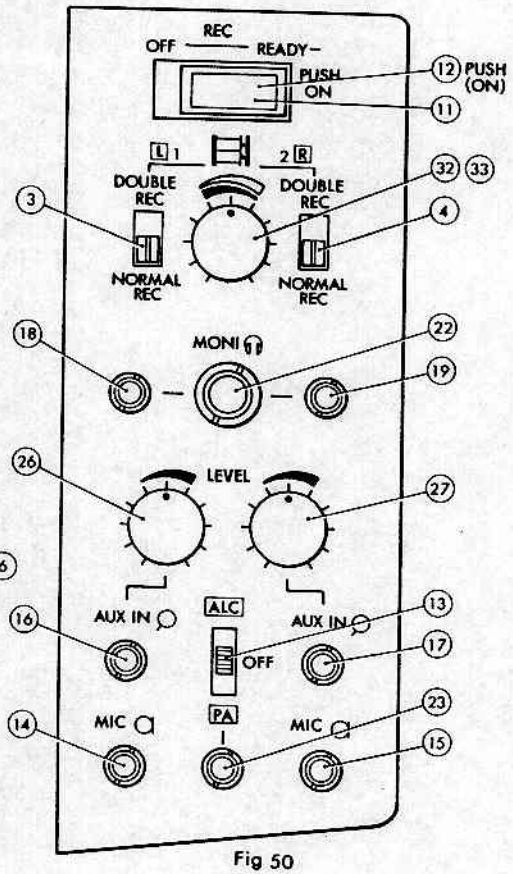
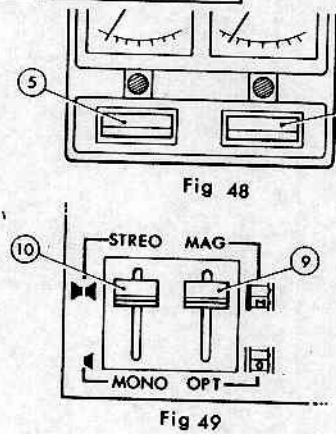
C. Switches, Jacks, Variable Resistors and Connectors in Amplifier Circuit

SWITCHES:

SW No.	Switching	Track	Fig.	Remarks
1	SW101	REC-PLAY	1	Workable by solenoid
2	SW201	"	2	
3	SW102	NOR.-DOUBLE REC	1	50
4	SW202	"	2	50
5	SW103	for REC	1	48
6	SW203	"	2	48
7	SW104	Voltage	1	for solenoid
8	SW204	"	2	
9	SW105	MAG-OPT		49
10	SW106	STEREO-MONO		49
11	SW107	READY-OFF		50
12	SW108	for SPOT REC		50
13	SW109	ALC-OFF-PA		50

JACKS:

Jack No.	Purpose	Track	Fig.
14	J101	MIC	1
15	J201	"	2
16	J102	AUX IN	1
17	J202	"	2
18	J103	Monitor	1
19	J203	"	2
20	J104	AUX OUT	1
21	J204	"	2
22	J105	Headphone	1
23	J106	PA MIC	1



VARIABLE RESISTORS:

VR No.	Purpose	Track	Fig.
24	VR101	Volume control	1
25	VR201	"	2
26	VR102	AUX IN level	1
27	VR202	"	2
28	VR103-1	TREBLE	1
29	VR103-2	BASS	1
30	VR203-1	TREBLE	2
31	VR203-2	BASS	2
32	VR104-1	DOUBLE REC (linked)	1
33	VR104-2		2
34	VR105	Bias adjustment	1
35	VR205	"	2
36	VR154	AUX OUT level meter adjustment	1
37	VR254	"	2

CONNECTORS:

CN No.	Connection	Fig.
38	CN101 (30P) Amp-board (1)	51
39	CN102 (30P) " (1)	51
40	CN103 (30P) " (2)	52
41	CN104 (3P) " (1)	51
42	CN105 (3P) " (2)	51, 52
43	CN106 (10P) " (1)	51
44	CN107 (3P) Built-in SP	51
45	CN108 (2P) (DIN)	54
46	CN208 (2P) (DIN)	54

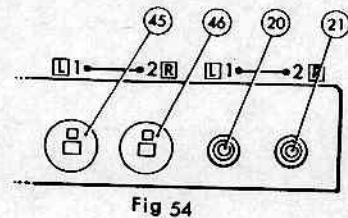
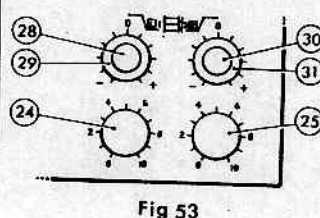
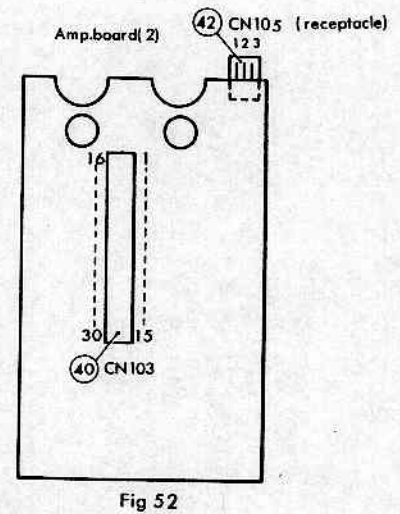
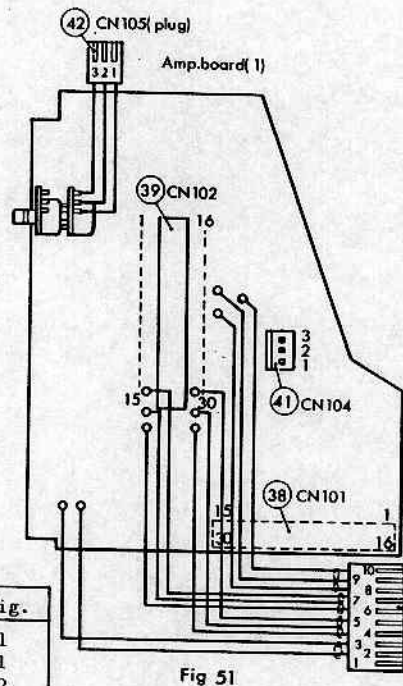
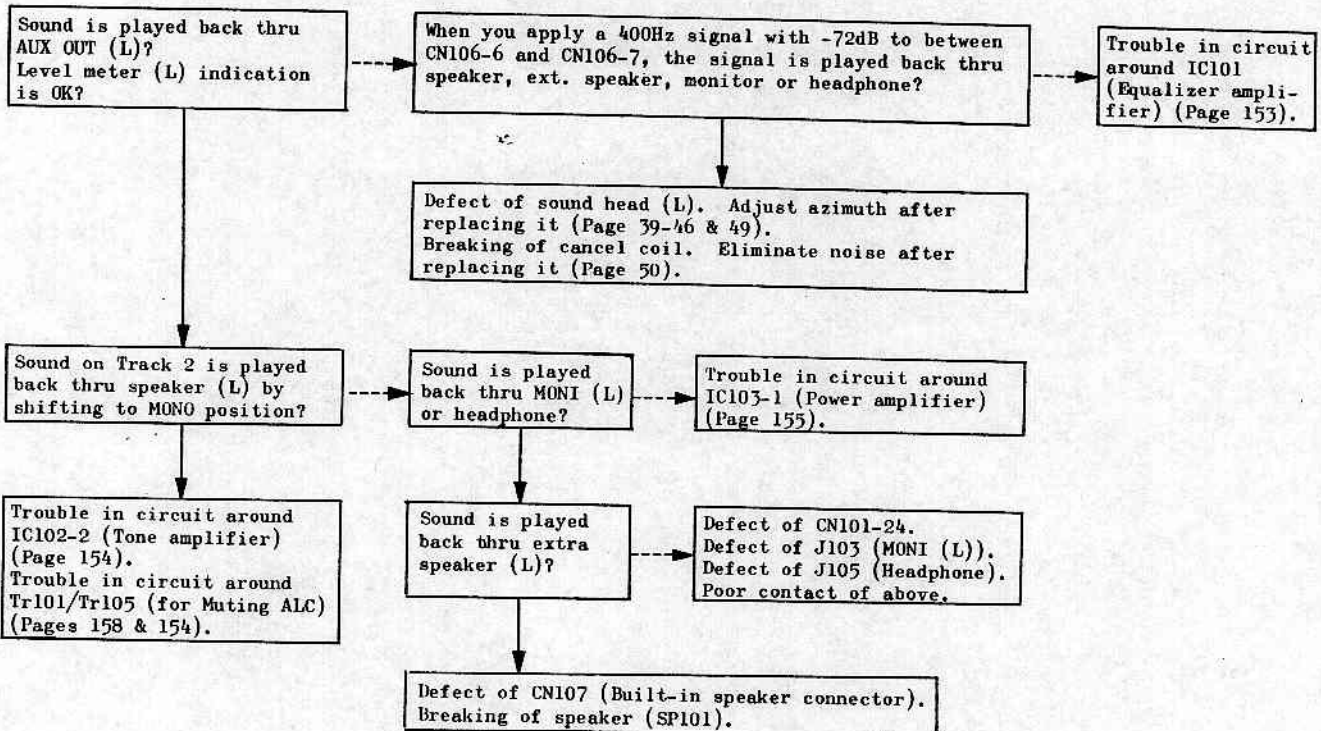


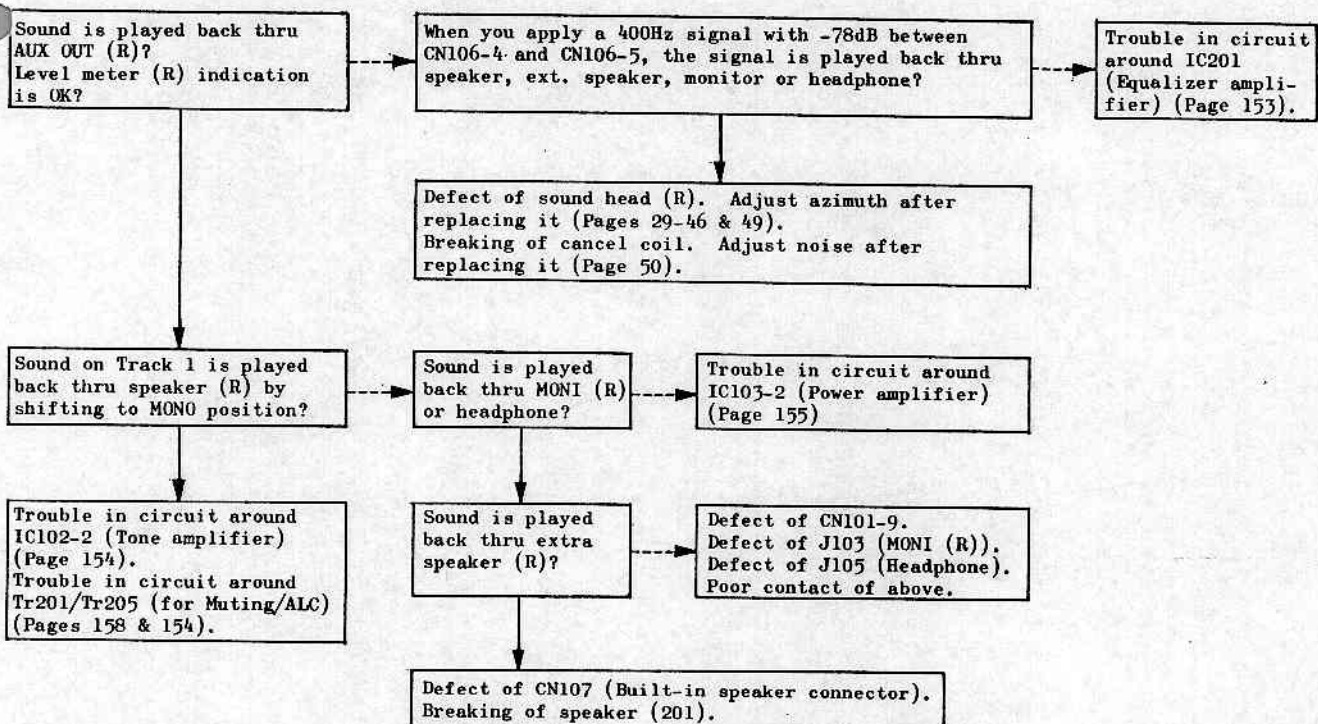
Fig 53

Fig 54

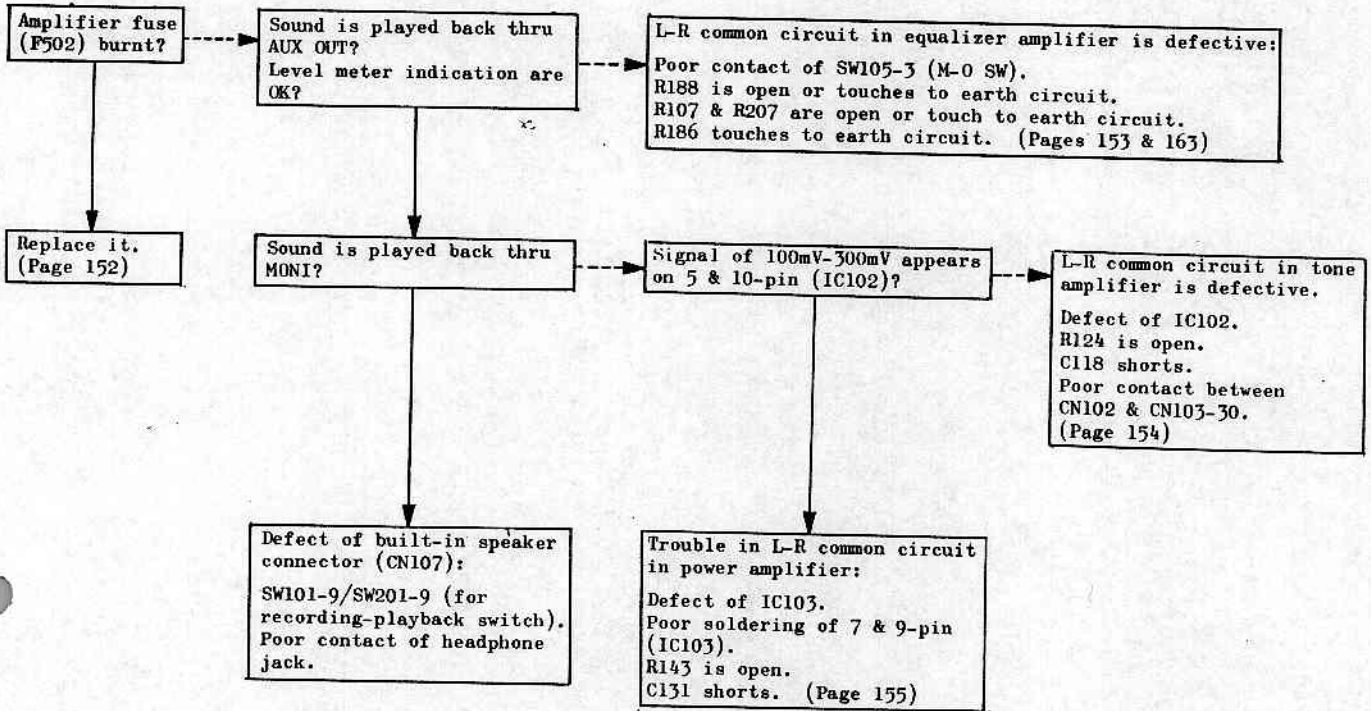
D. Troubleshooting

SOUND ISN'T PLAYED BACK THRU SPEAKER OF L-CHANNELSOUND ISN'T PLAYED BACK THRU SPEAKER OF R-CHANNEL

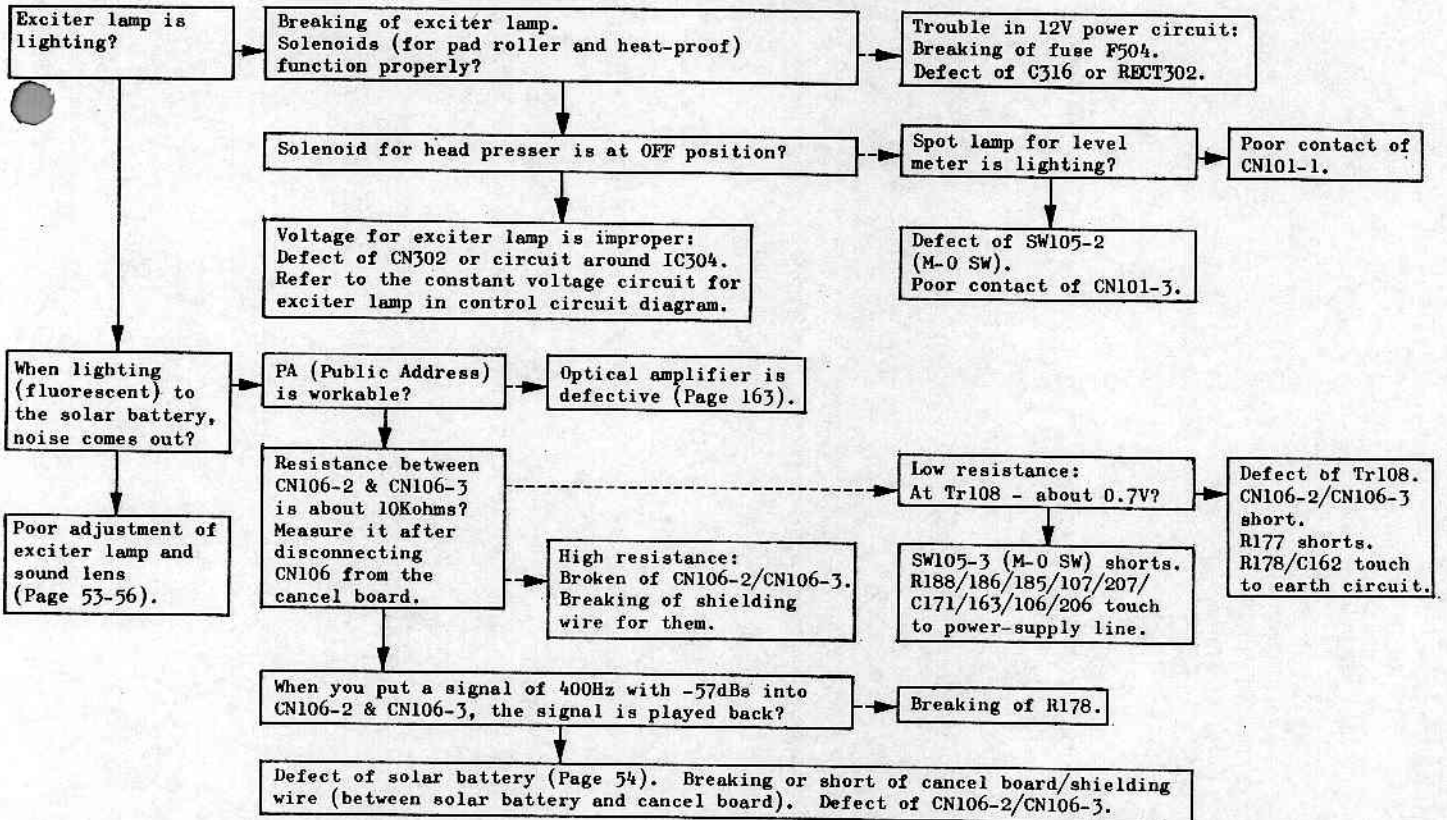
(Refer to R-Channel Circuit corresponding to the reference page in the box)



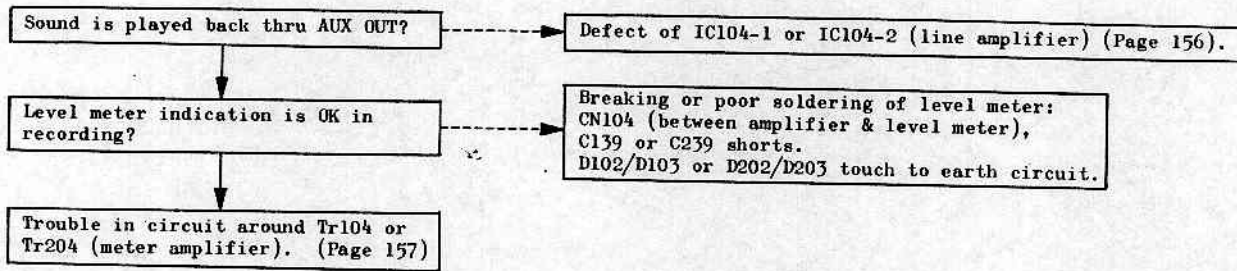
SOUND ON BOTH TRACKS ISN'T PLAYED BACK THRU SPEAKER



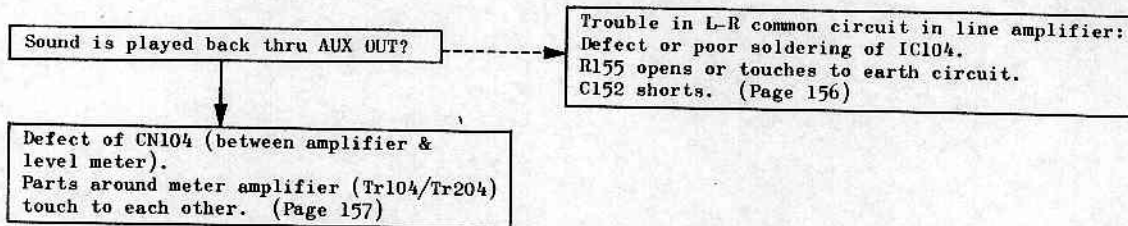
NOT PLAYED BACK OPTICAL SOUND



LEVEL METER (L) OR (R) SHOWS NO INDICATION IN PLAYBACK
(though Sound can be played back thru Speaker)

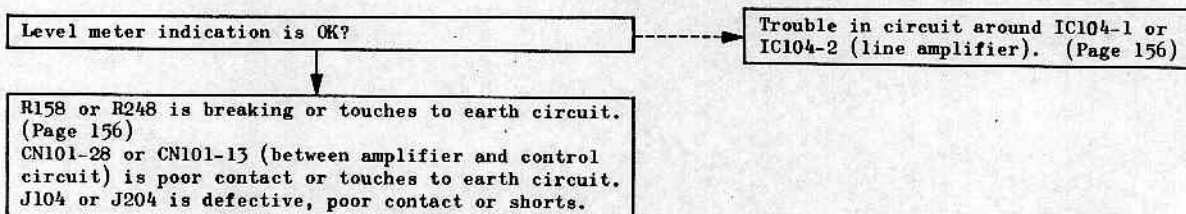


BOTH LEVEL METERS SHOW NO INDICATION IN PLAYBACK
(though Sound can be played back thru Speaker)

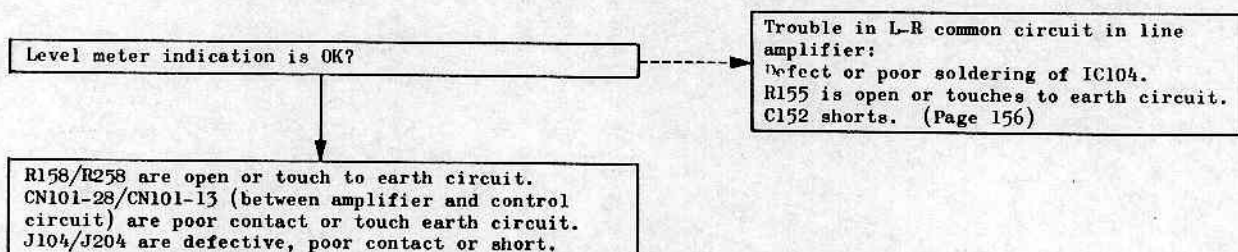


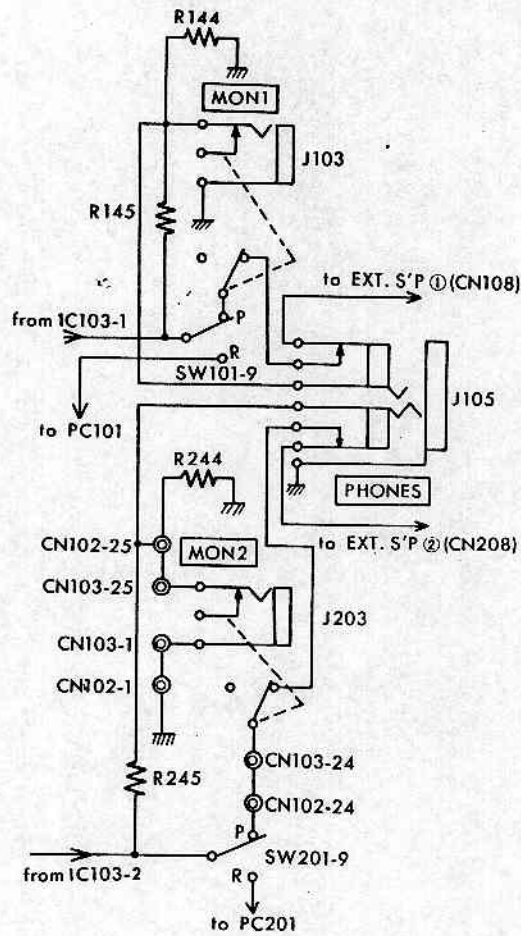
IC104 (1/2 LA3122) of line amplifier is of composite type, so at first check the applied voltage (+20V at 8-pin) circuit when both level meter indicators do not swing.

SOUND ISN'T PLAYED BACK THRU AUX OUT (L) OR (R)
(though it can be played back thru the Speaker)

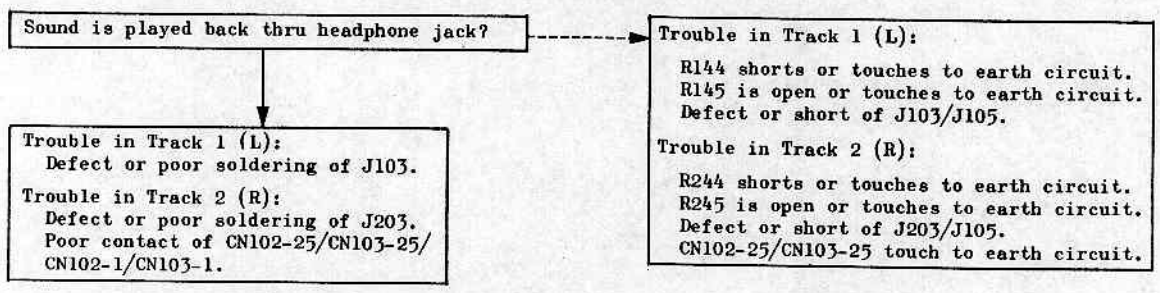


SOUND ISN'T PLAYED BACK THRU BOTH AUX OUT
(though it can be played back thru the Speaker)





SOUND ISN'T PLAYED BACK THRU MONITOR (L) OR (R)
 (though it can be played back thru Built-in Speaker)



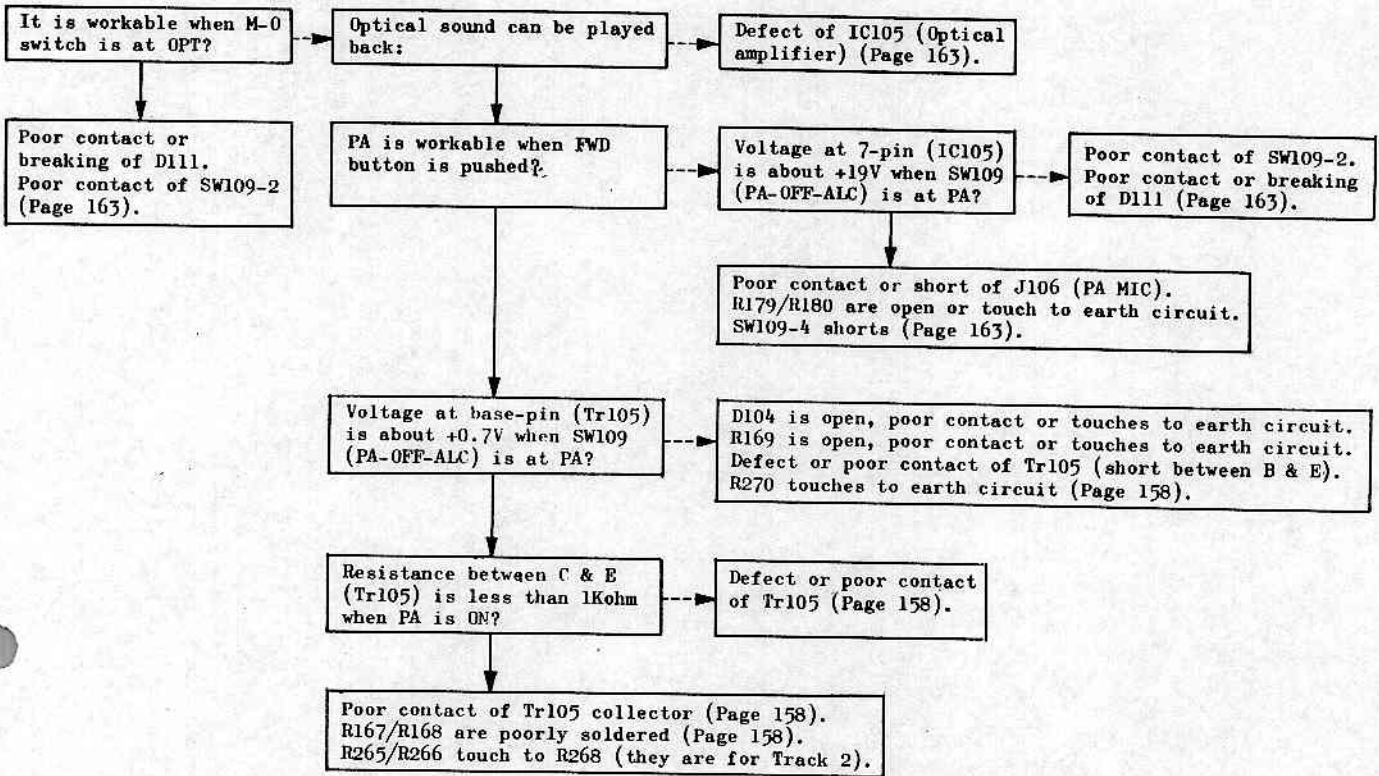
SOUND ISN'T PLAYED BACK THRU HEADPHONE JACK
 (It is OK thru Speaker)

Poor contact or defect of J105 (Headphone Jack)

SOUND ISN'T PLAYED BACK THRU EXTRA SPEAKER
 (It is OK thru Built-in Speaker)

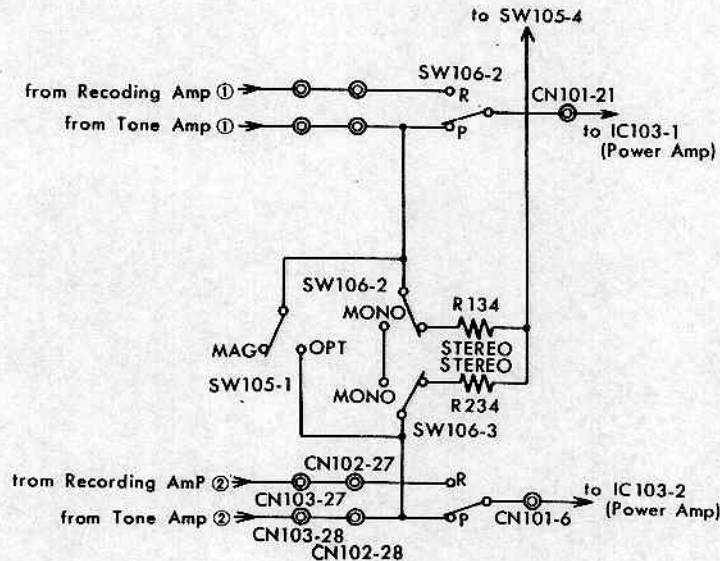
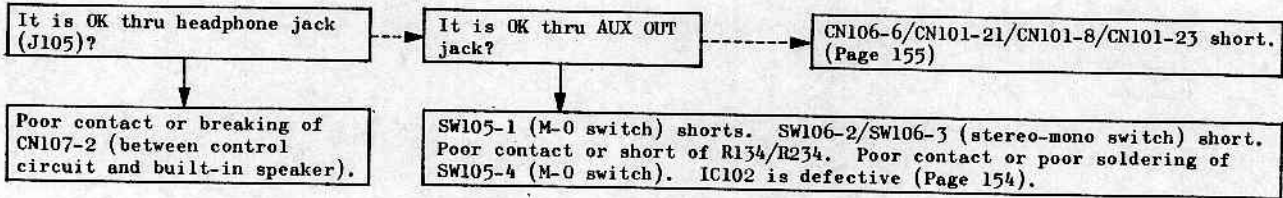
Track 1: Poor contact or defect of CN108.
 Track 2: Poor contact or defect of CN208.

PA (PUBLIC ADDRESS) SYSTEM ISN'T WORKABLE



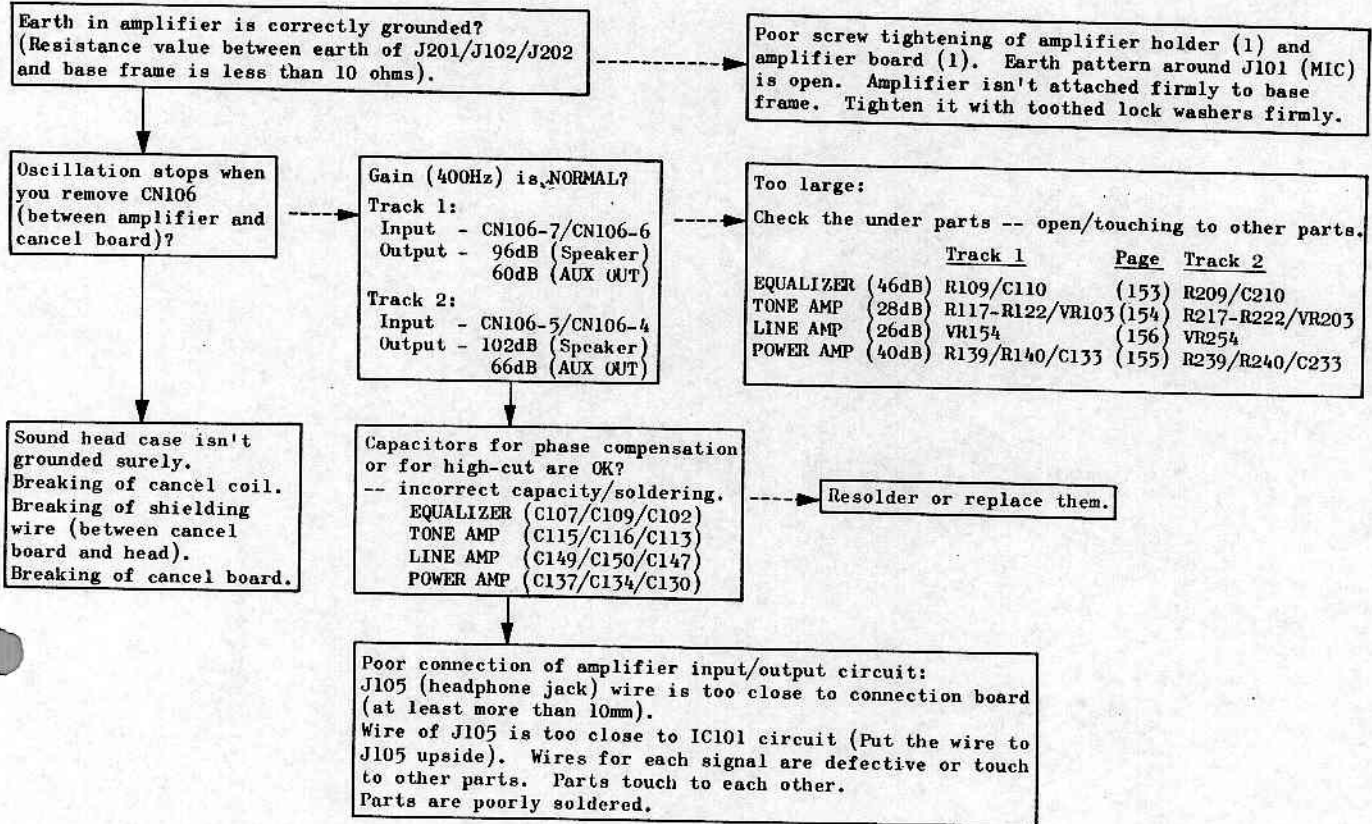
SOUND ISN'T PLAYED BACK IN STEREO

(though Stereo-Mono Selector (SW106) is set at STEREO)

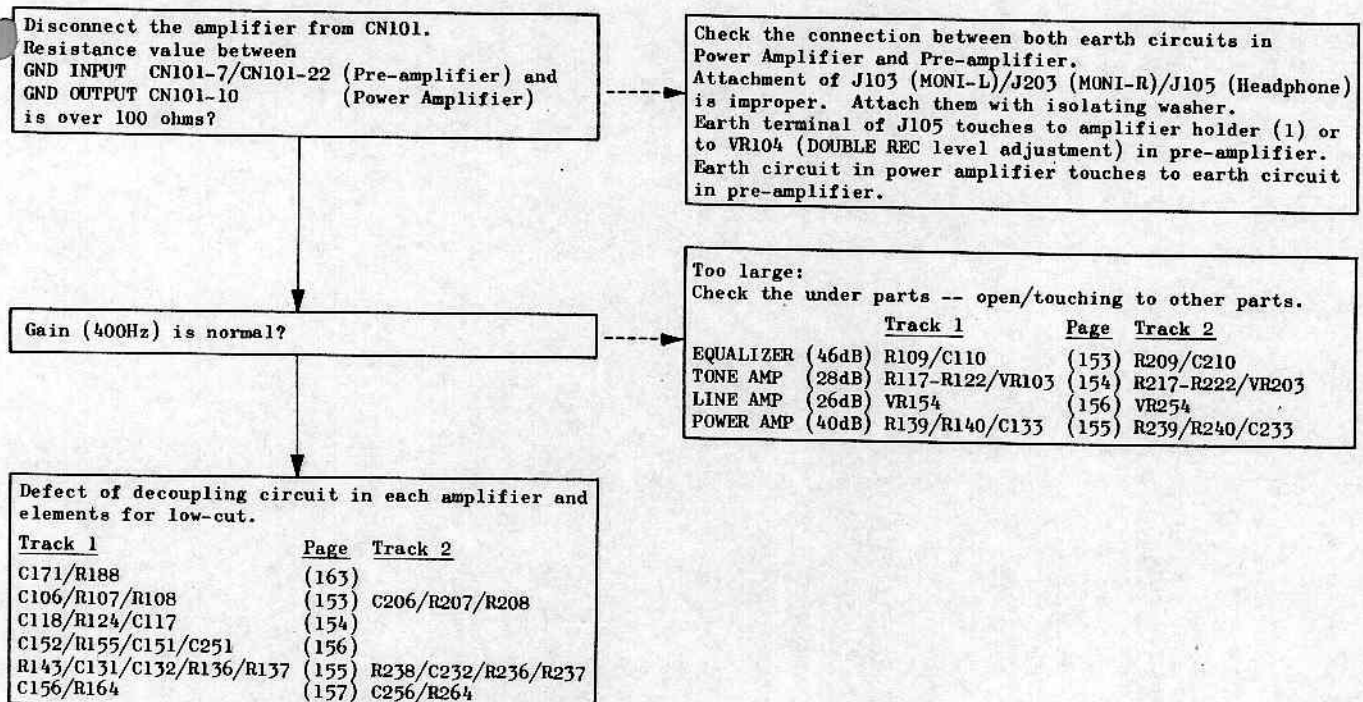


OSCILLATION DURING MAGNETIC PLAYBACK

Oscillation at high frequency range:

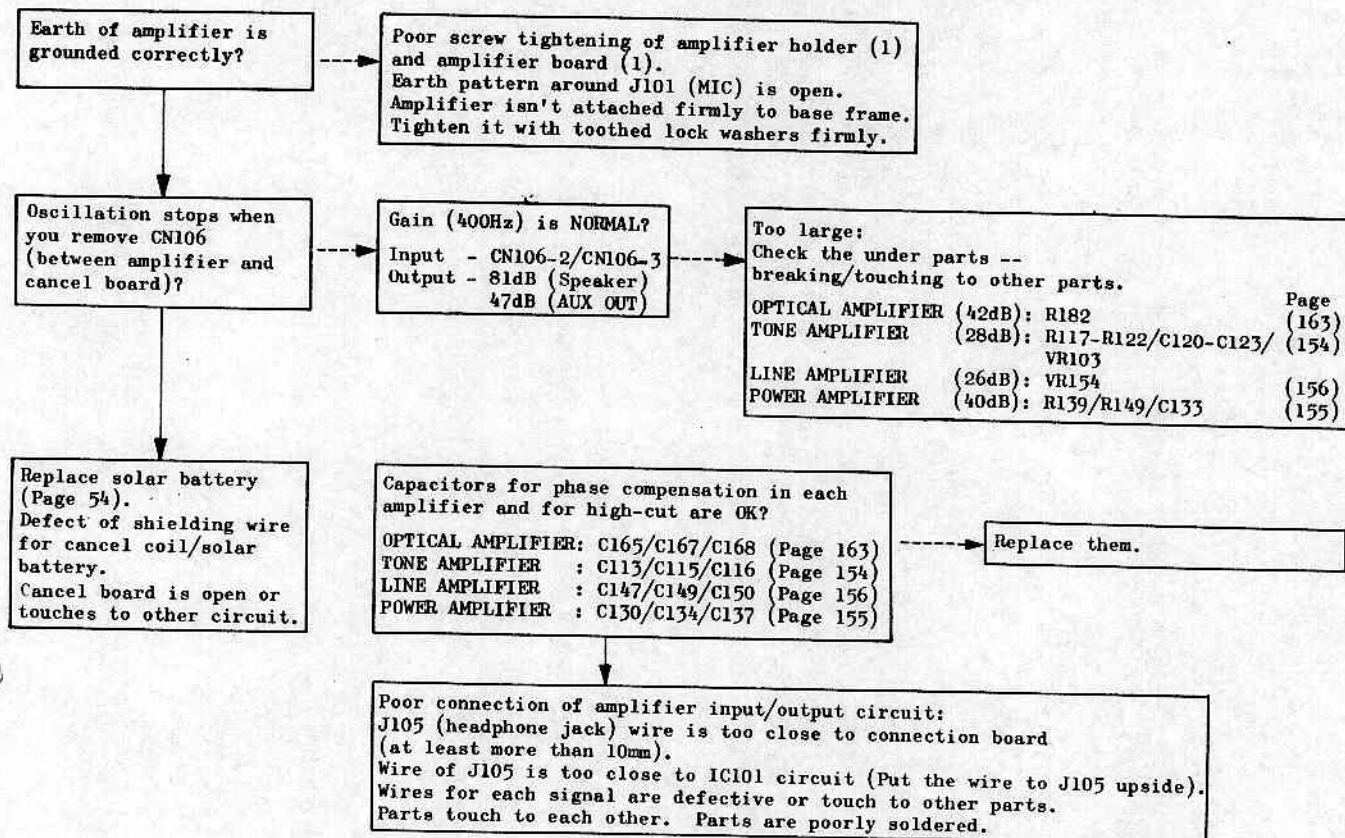


Oscillation at low frequency range:

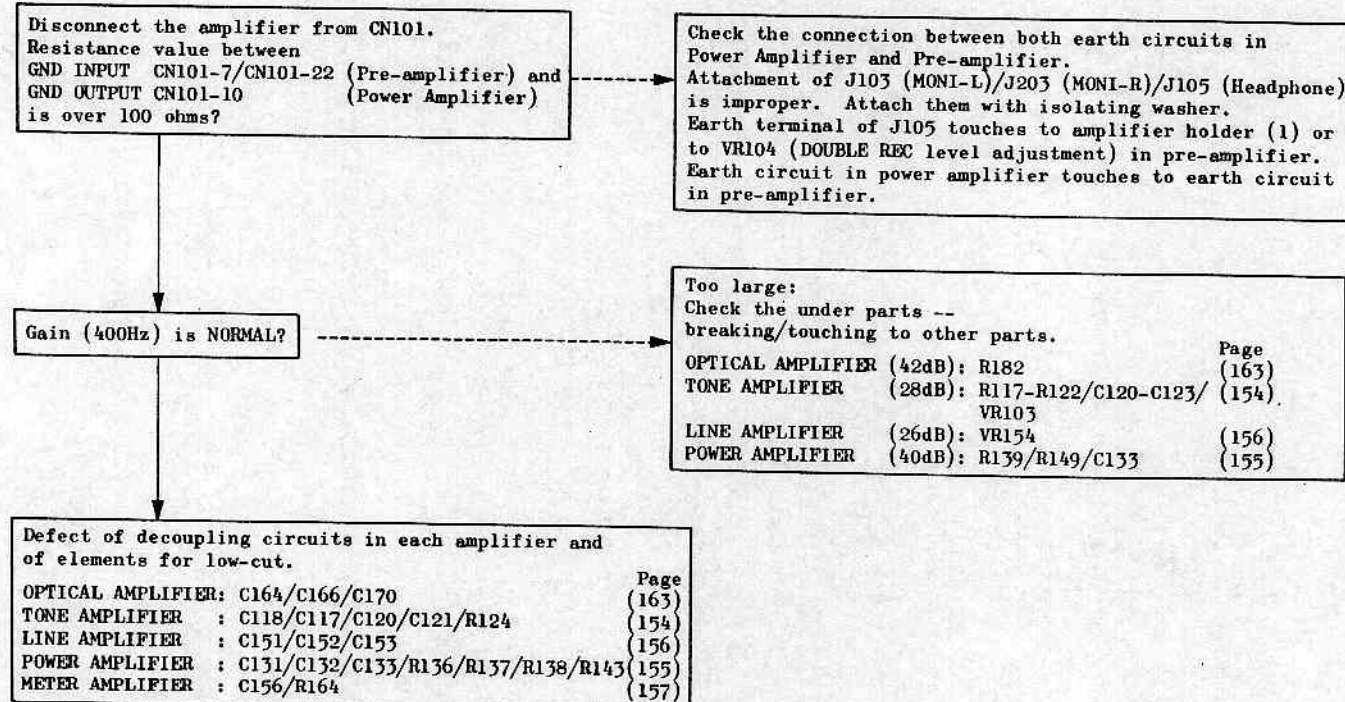


OSCILLATION DURING OPTICAL PLAYBACK

Oscillation at high frequency range:



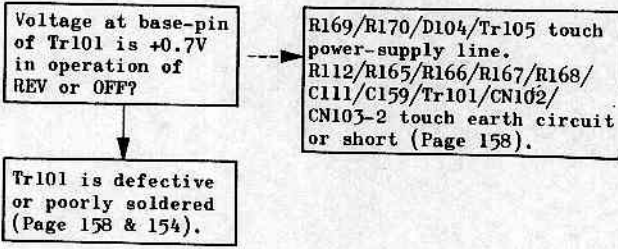
Oscillation at low frequency range:



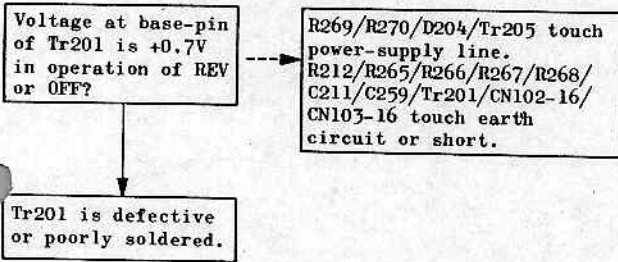
MUTING DOESN'T WORK IN PLAYBACK

SW109 (PA-OFF-ALC Switch) is at correct position? ----- Shift the switch to OFF/ALC.

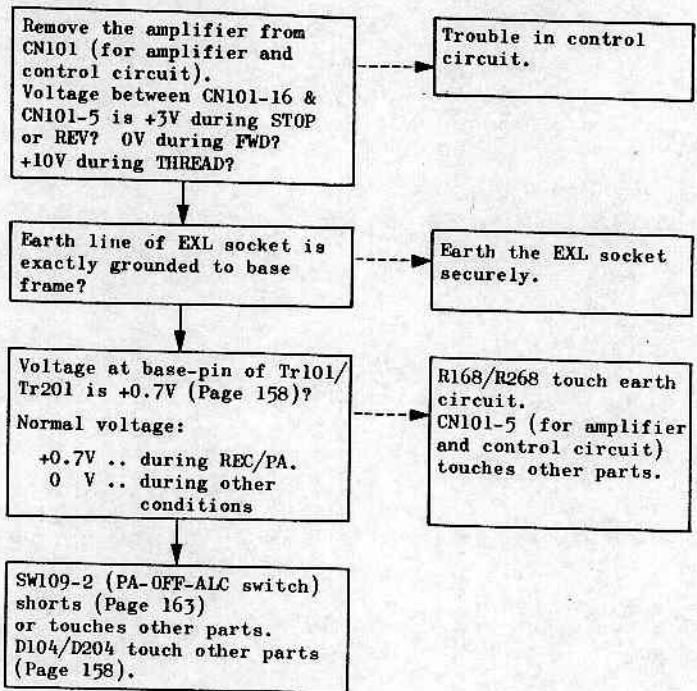
TROUBLE IN TRACK 1:



TROUBLE IN TRACK 2:

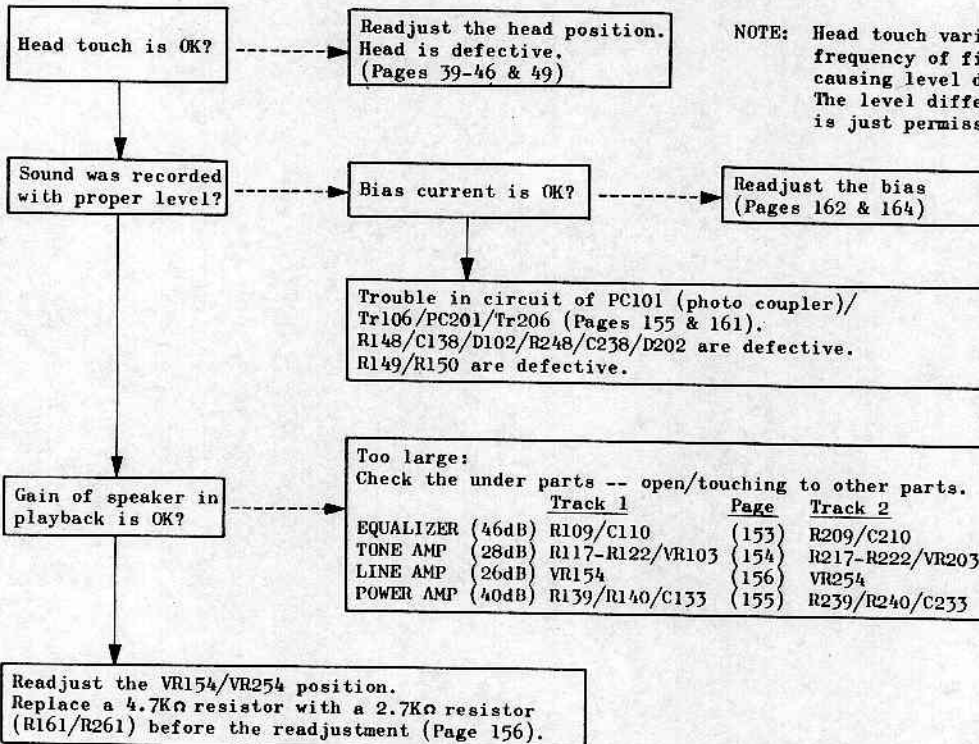


TROUBLE IN BOTH TRACKS:



DIFFERENCE (OVER ±3dB) OF LEVEL METER INDICATIONS

- on Recording & on Playing Back -



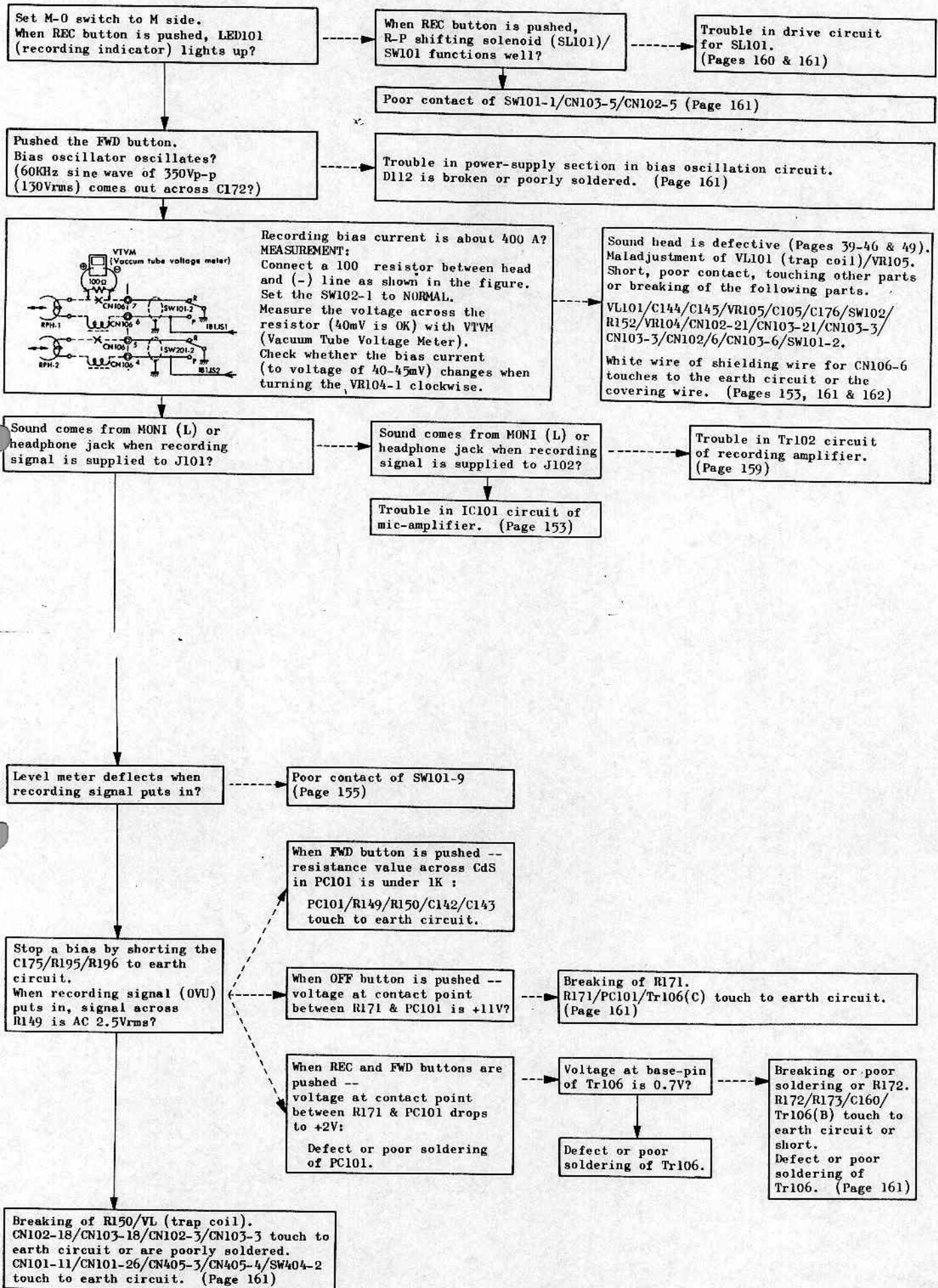
NOTE: Head touch varies with kinds of films, usage frequency of films or curling of films, causing level difference in the meter. The level difference within ±3dB, however, is just permissible.

Too large:
Check the under parts -- open/touching to other parts.

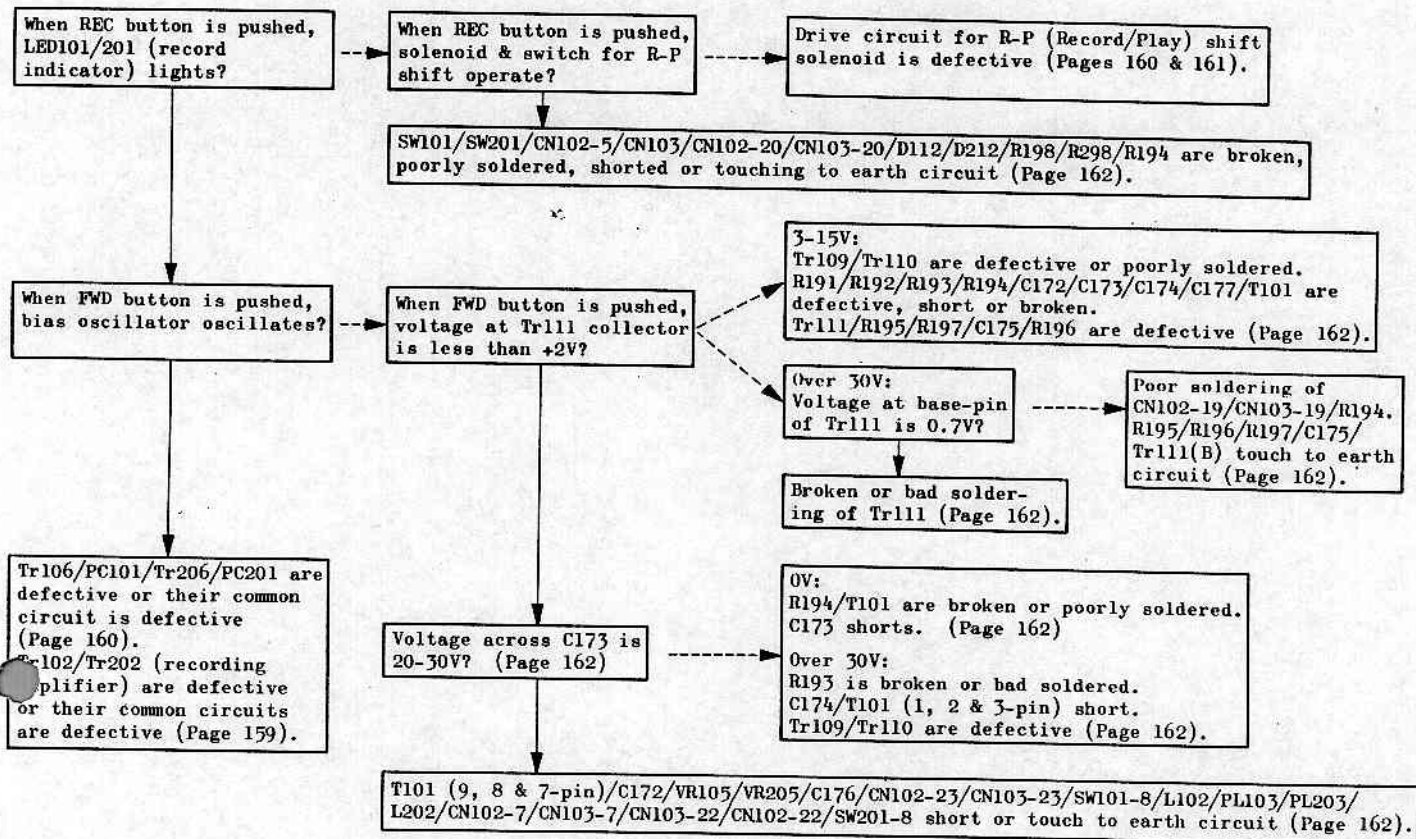
	Track 1	Page	Track 2
EQUALIZER (46dB)	R109/C110	(153)	R209/C210
TONE AMP (28dB)	R117-R122/VR103	(154)	R217-R222/VR203
LINE AMP (26dB)	VR154	(156)	VR254
POWER AMP (40dB)	R139/R140/C133	(155)	R239/R240/C233

UNABLE TO RECORD ON TRACK 1 OR 2

Track 1. * (Track 2: Refer to Track 2 Circuit)



RECORDING IS IMPOSSIBLE ON EITHER TRACK 1 OR 2



NORMAL RECORDING IS IMPOSSIBLE

(DOUBLE Recording is OK)

Trouble in Track 1:

SW102-3 touches to other circuits.
Erasing head shorts (Pages 40, 42 & 44).
Cancel board/CN106-10/CN106-8 short.
Shielding wire (between amplifier and cancel board/CN106-10/CN106-9/CN106-8) shorts or touches to the earth circuit.
Shielding wire (between erase head and cancel board) shorts or touches to the earth circuit.

Trouble in Track 2:

Check the similar points to the above, referring to the Track 2 Circuit.

ALC IS IMPOSSIBLE

Trouble in Track 1:

Muting on playing back is OK?

Refer to Page 139.

R146/R166/D101 are broken or touching to other parts.
R147/C140/C141 short or touch to other parts.
SW109-3 is poorly soldered. (Pages 155 & 158)

Trouble in Track 2:

Check the similar points to the above, referring to the Track 2 Circuit.

Trouble in both Tracks 1 & 2:

C141/C241/D101/D201 short or touch to the earth circuit.
SW106 touches to other circuits.
SW109-3/SW109-1 touch to other circuits.
(Pages 155 & 158)

LEVEL METER DOES NOT WORK ON RECORDING

(Recording is OK)

Trouble in Track 1:

The meter shows indication on playing back?

The meter is defective or broken.
CN104/its wires short or are bad contact.
C139 shorts.
D102/D103 touch to the earth circuit. (Page 157)

R148/D102 touch to the earth circuit or broken.
C138 shorts. (Page 155)

Trouble in Track 2:

Check the similar points to the above, referring to the Track 2 Circuit.

DOUBLE RECORDING IS IMPOSSIBLE

(NORMAL Recording is OK)

Trouble in Track 1:

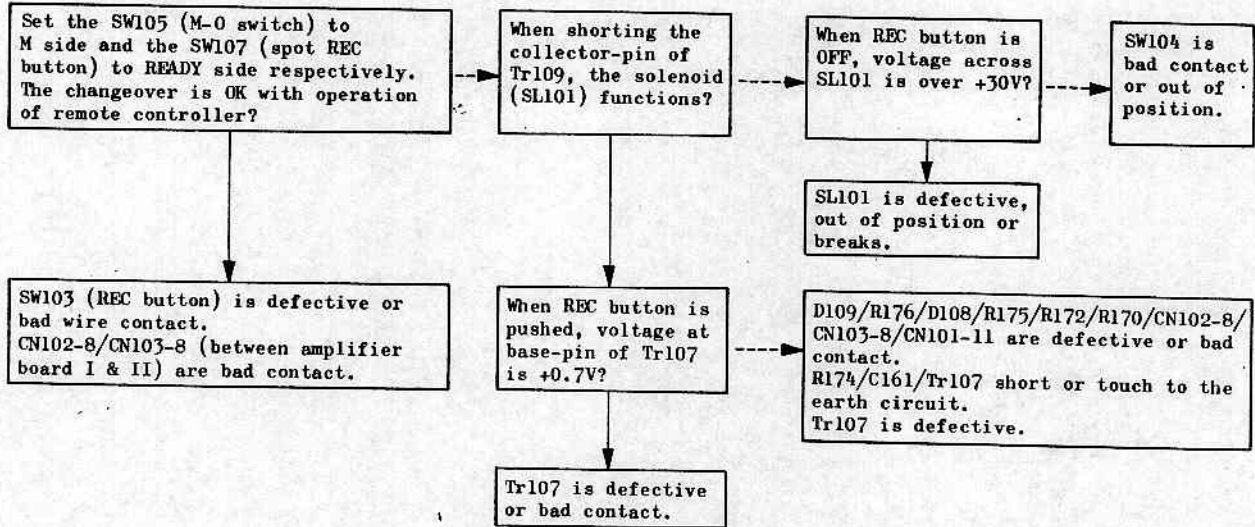
SW102/CN102-21/CN103-21/C176 touch to the earth circuit.
VR104-1 is bad soldering or touches to other parts.
Bad contact of amplifier board I and VR104-1.
L102/SW102-2/SW108 short or touch to the earth circuit. (Page 162)

Trouble in Track 2:

Check the similar points to the above, referring to the Track 2 Circuit.

R-P (RECORD-PLAY) SOLENOID DOES NOT WORK

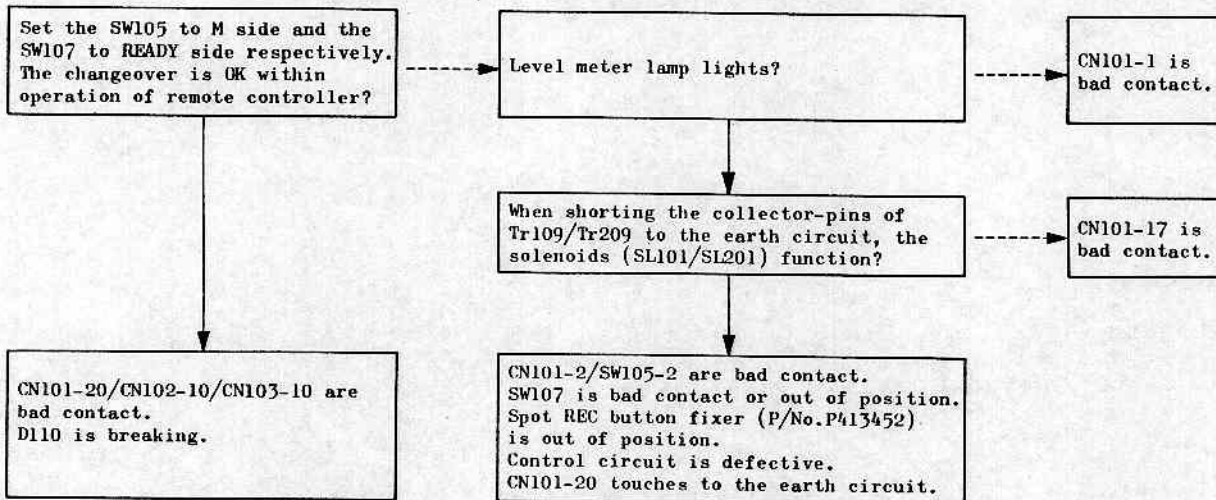
Trouble in Track 1: (Refer to Pages 160 & 161)



Trouble in Track 2:

Check the similar points to the above, referring to the Track 2 Circuit.

Trouble in both Tracks 1 & 2:



HOLDING (R-P SOLENOID) IS IMPOSSIBLE

Trouble in Track 1:

SW101-7 is broken or bad contact.
D107 is breaking.
(Pages 160 & 161)

Trouble in Track 2:

Check the similar points to the above,
referring to the Track 2 Circuit.

Trouble in both Tracks 1 & 2:

SW108/D107/D207/SW101-7/SW201-7/R171/R271/R197/
CN102-19/CN103-7 touch to the other parts.
CN101-19 is bad contact or touches to the other
parts.
Control circuit (periphery of Tr316/Tr319) is
defective.

R-P SOLENOID VIBRATES
WHEN REC BUTTON (SW103) IS PUSHED

Trouble in Track 1:

D105 is defective, breaking or bad contact.
Tr107/R107 are bad contact.
SL101 is bad contact or out of position.
SW104 is out of position.
(Pages 160 & 161)

Trouble in Track 2:

Check the similar points to the above,
referring to the Track 2 Circuit.

SPOT RECORDING IS IMPOSSIBLE
(NORMAL / DOUBLE Recordings are OK)

Trouble in both Tracks 1 & 2:

SW108 is defective, bad contact or out of
position. (Pages 160 & 161)

RECORDING STATE IS KEPT ON EVEN WHEN
OFF BUTTON IS PUSHED

Trouble in Track 1:

SW108 (SPOT REC switch) shorts or out of position.
CN101-19/CN101-20/Remote connector short.
Wires of D110/SW108 touch to other parts.
Control circuit (periphery of Tr316-Tr319) is
defective.
D107/R171/SW101-7 (R-P switch) touch to the
other circuits.
(Pages 160 & 161)

Trouble in Track 2:

Check the similar points to the above,
referring the Track 2 Circuit.

CHANGEOVER FROM SPOT REC TO FWD PROJECTION IS
IMPOSSIBLE EVEN BY TURNING SPOT REC BUTTON TO
OFF POSITION

(It is possible by operation of OFF button)

Trouble in Track 1:

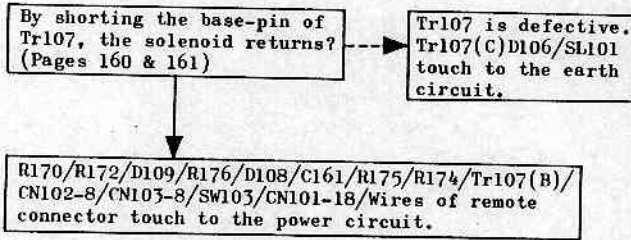
SW107 (READY-OFF switch) shorts.
CN101 touches to the other parts.
Wiring of remote connector is bad.
Control circuit (periphery of Tr316-Tr319) is
defective.
D107/R171/SW101-7 touch to the other circuits.
(Pages 160 & 161)

Trouble in Track 2:

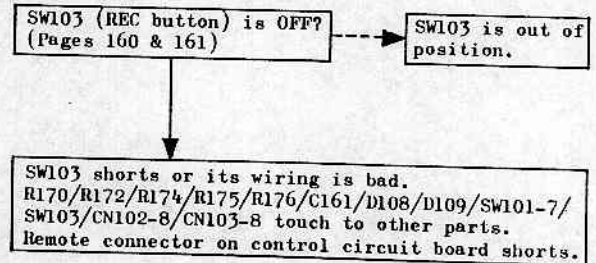
Check the similar points to the above,
referring to the Track 2 Circuit.

R-P SOLENOID WORKS AS SOON AS POWER SWITCH TURNS ONR-P SOLENOID WORKS AS SOON AS SW107 IS SET TO "READY" OR SW105 IS SET TO "M" POSITION

Trouble in Track 1:



Trouble in Track 1:

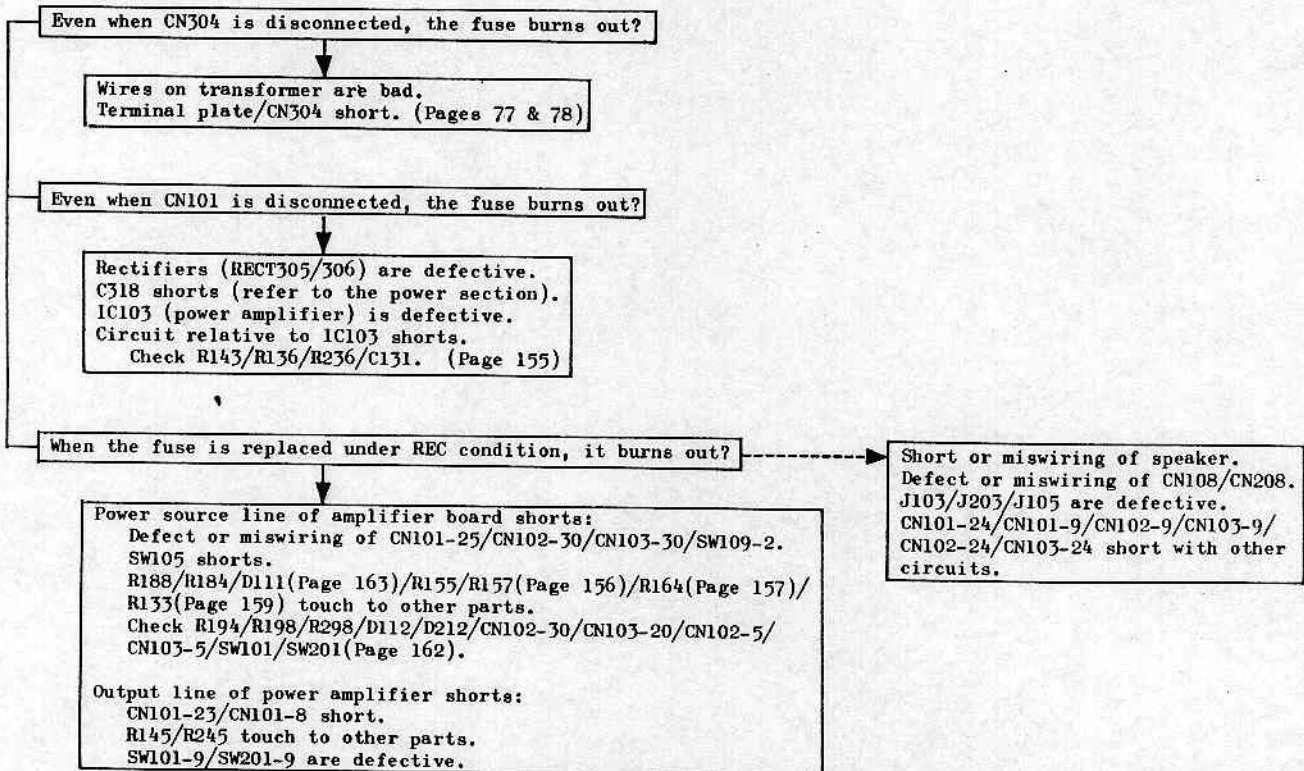


Trouble in Track 2:

Check the similar points to the above, referring to the Track 2 Circuit.

Trouble in Track 2:

Check the similar points to the above, referring to the Track 2 Circuit.

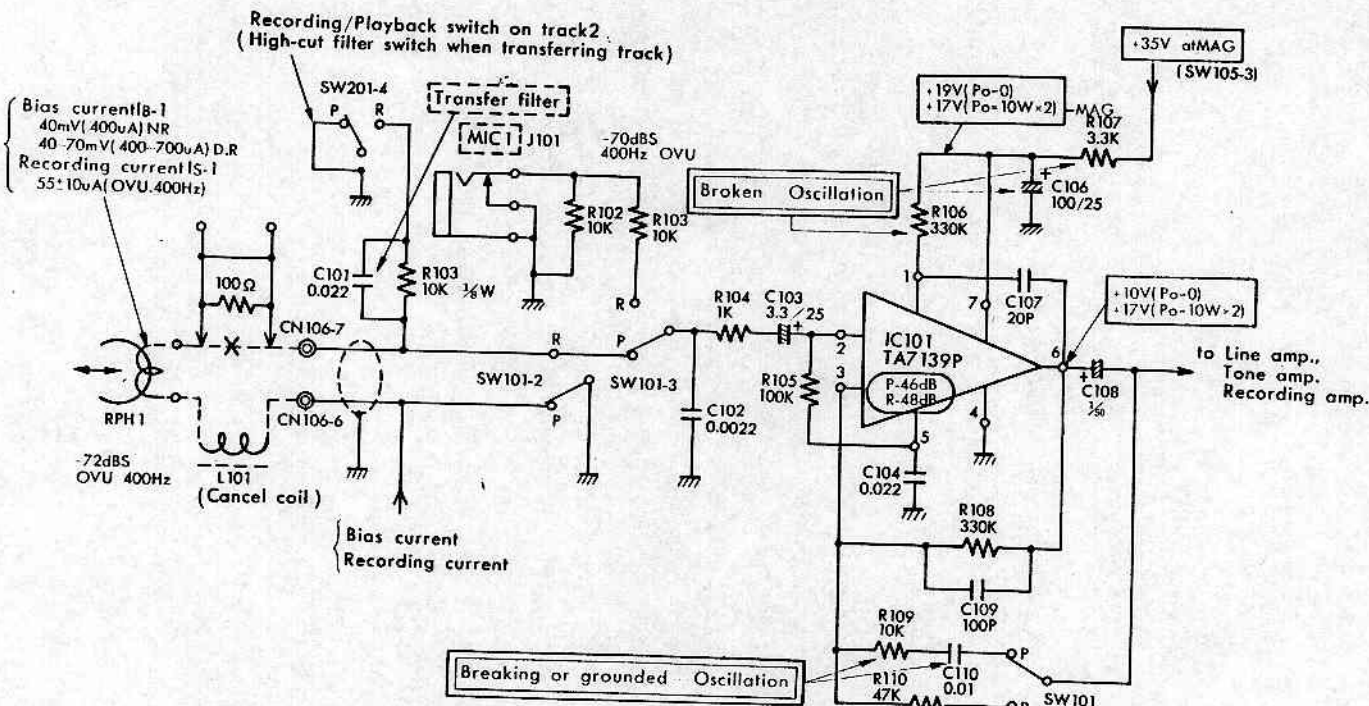
AMPLIFIER FUSE (F502) BURNS OUT

E. Circuit Analysis

CIRCUIT RELATIVE TO IC101 (TA7139P)

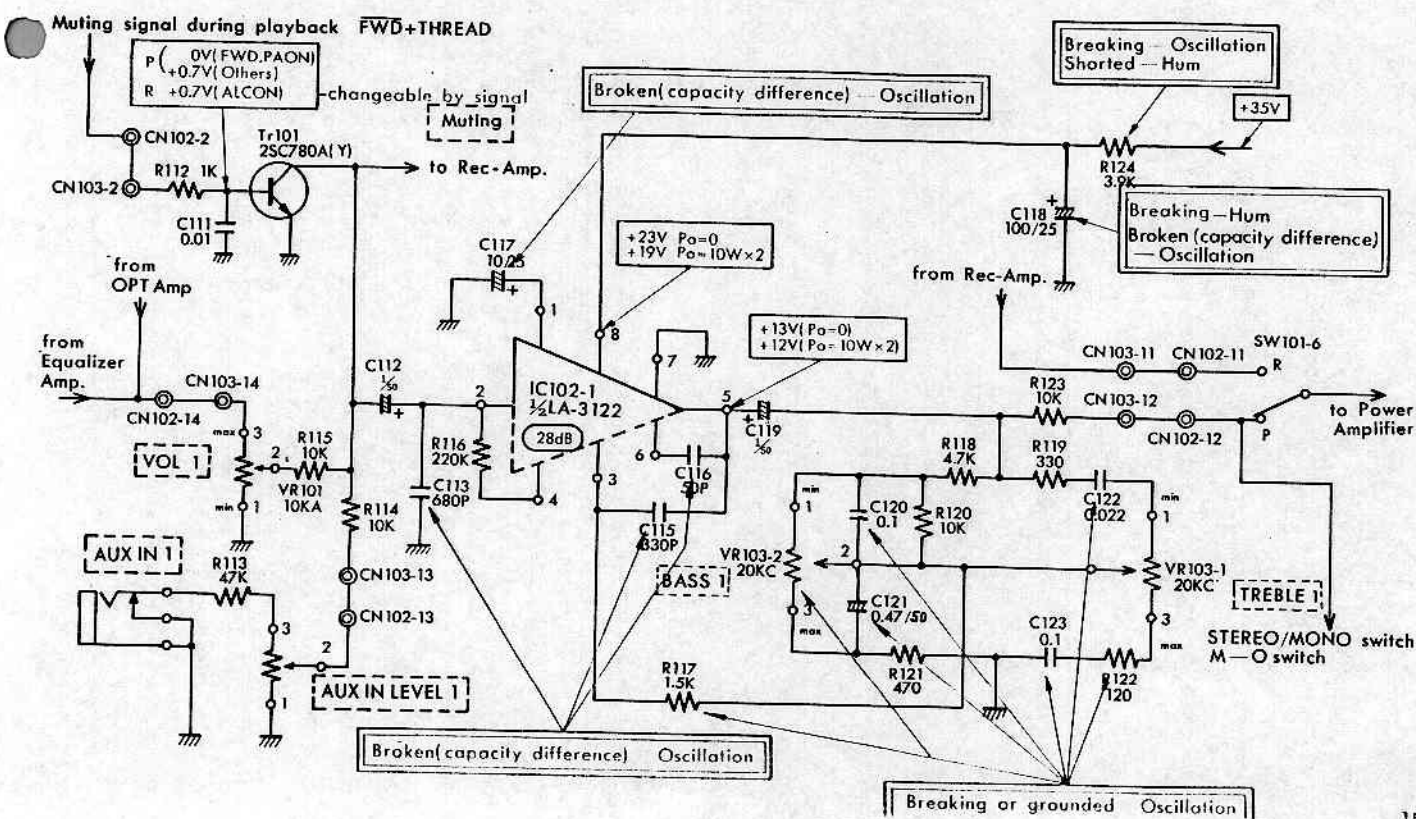
(Equalizer Amplifier for Track 1)

(Playback : Equalizer Amplifier)
Recording: Mic Amplifier

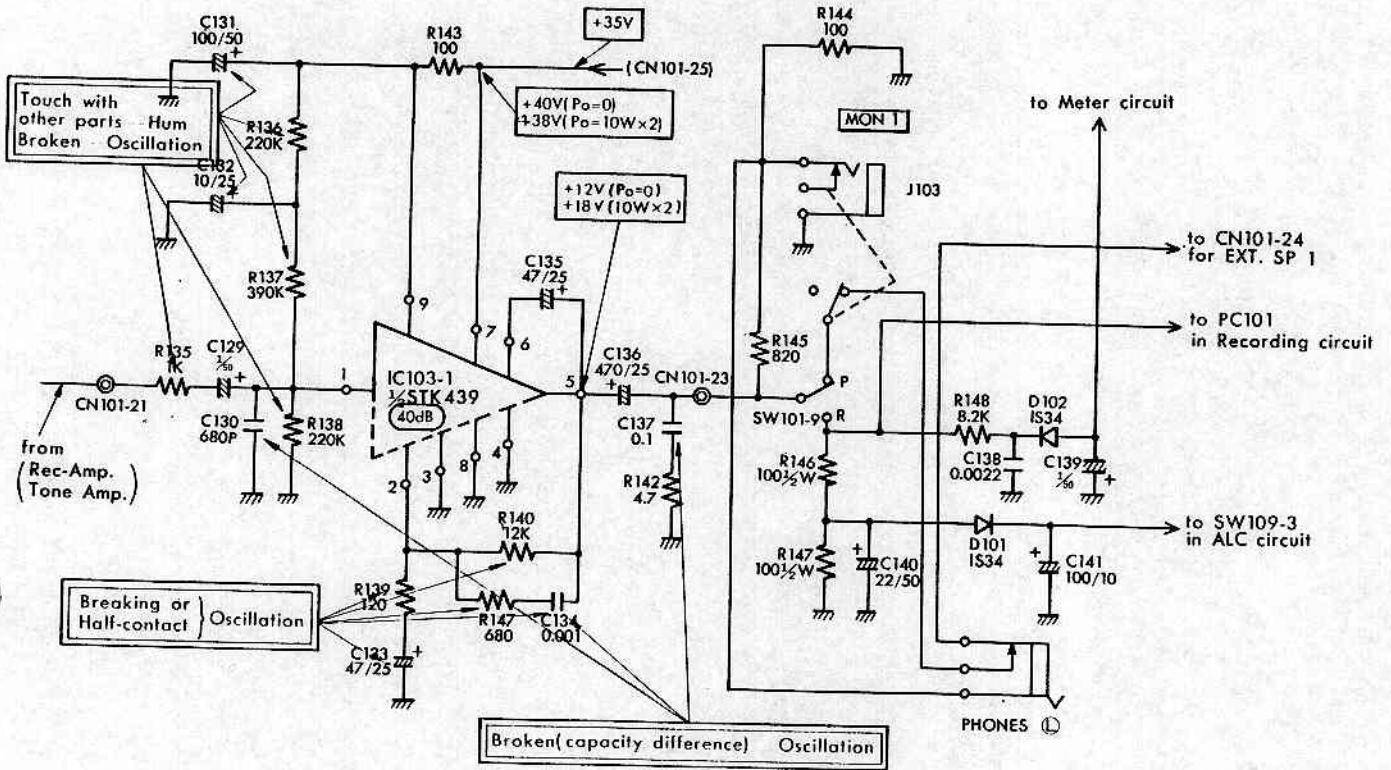


CIRCUIT RELATIVE TO IC102-1 (1/2 LA3122)

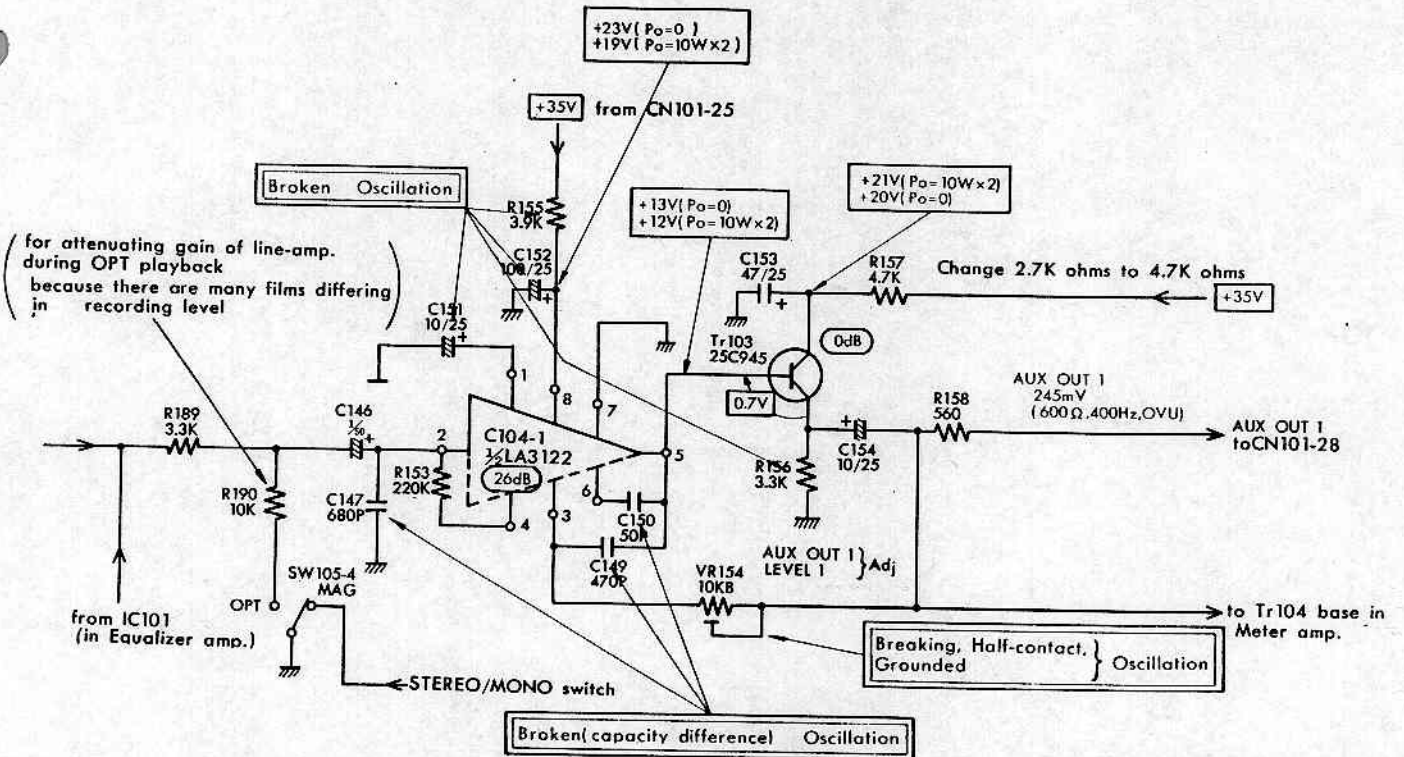
(Tone Amplifier for Track 1)



CIRCUIT RELATIVE TO IC103 (1/2 STK439)
(Power Amplifier for Track 1)

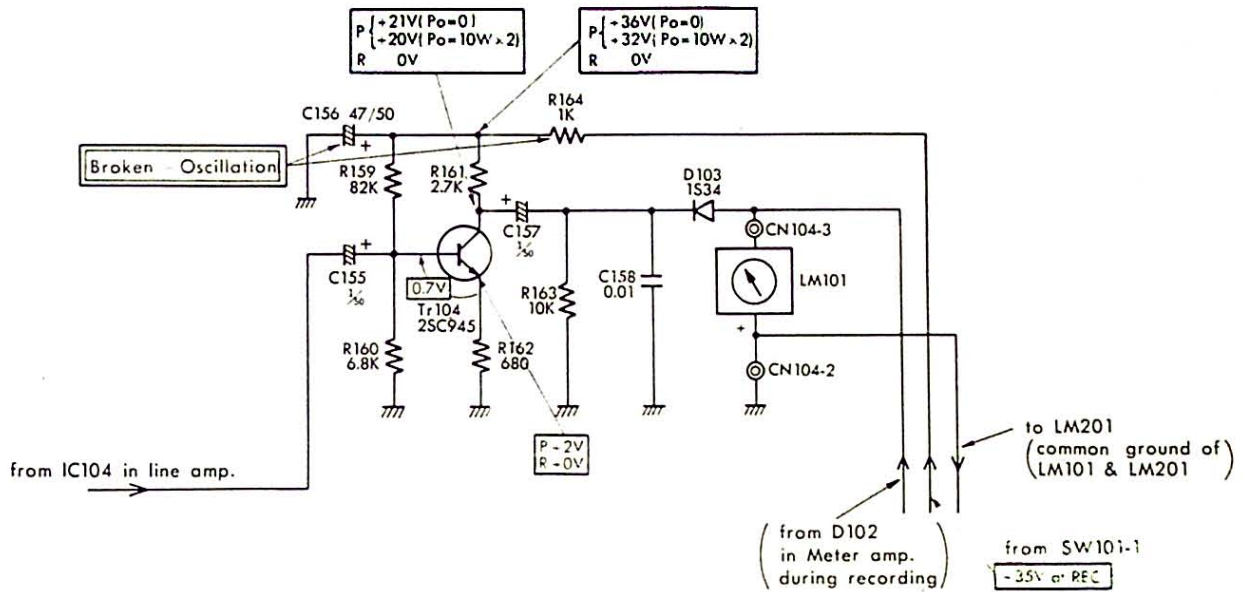


CIRCUIT RELATIVE TO IC104 (1/2 LA3122)
(Line Amplifier for Track 1)

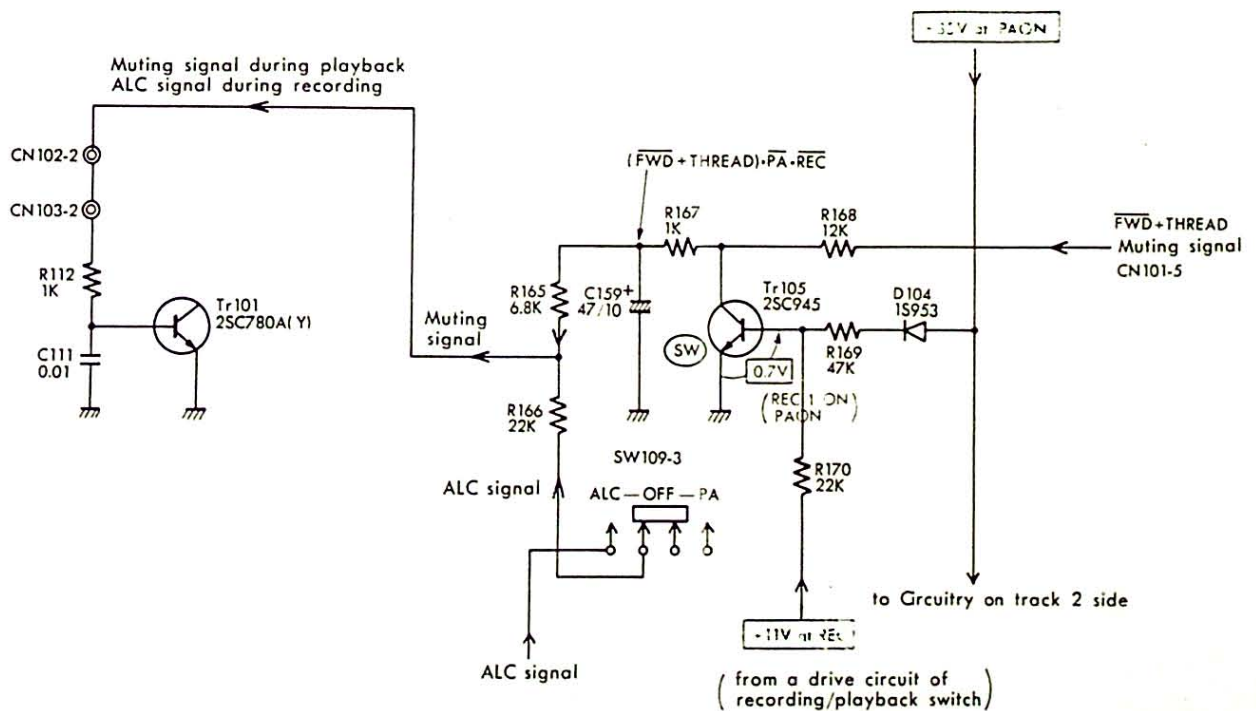


CIRCUIT RELATIVE TO TR104 (2SC945)

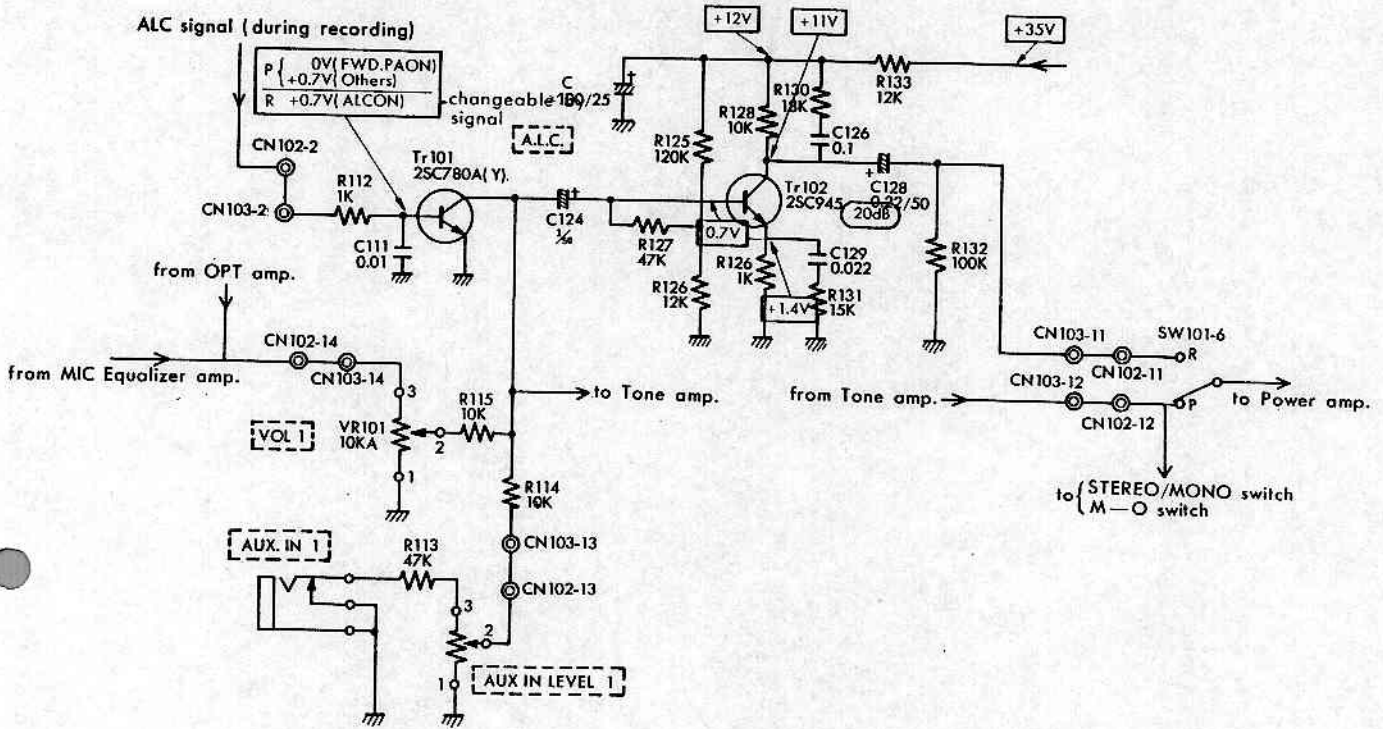
(Meter Amplifier for Track 1)



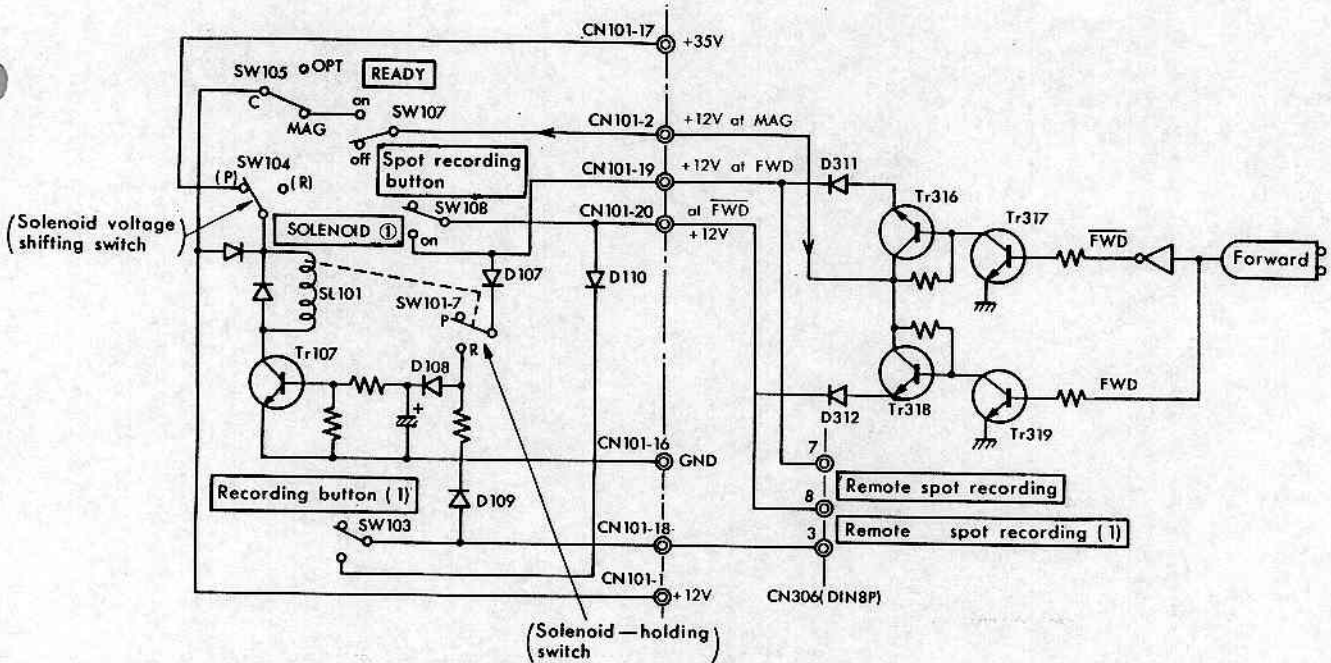
MUTING SIGNAL CONTROL CIRCUIT



CIRCUIT RELATIVE TO TR102
(Recording Amplifier for Track 1)

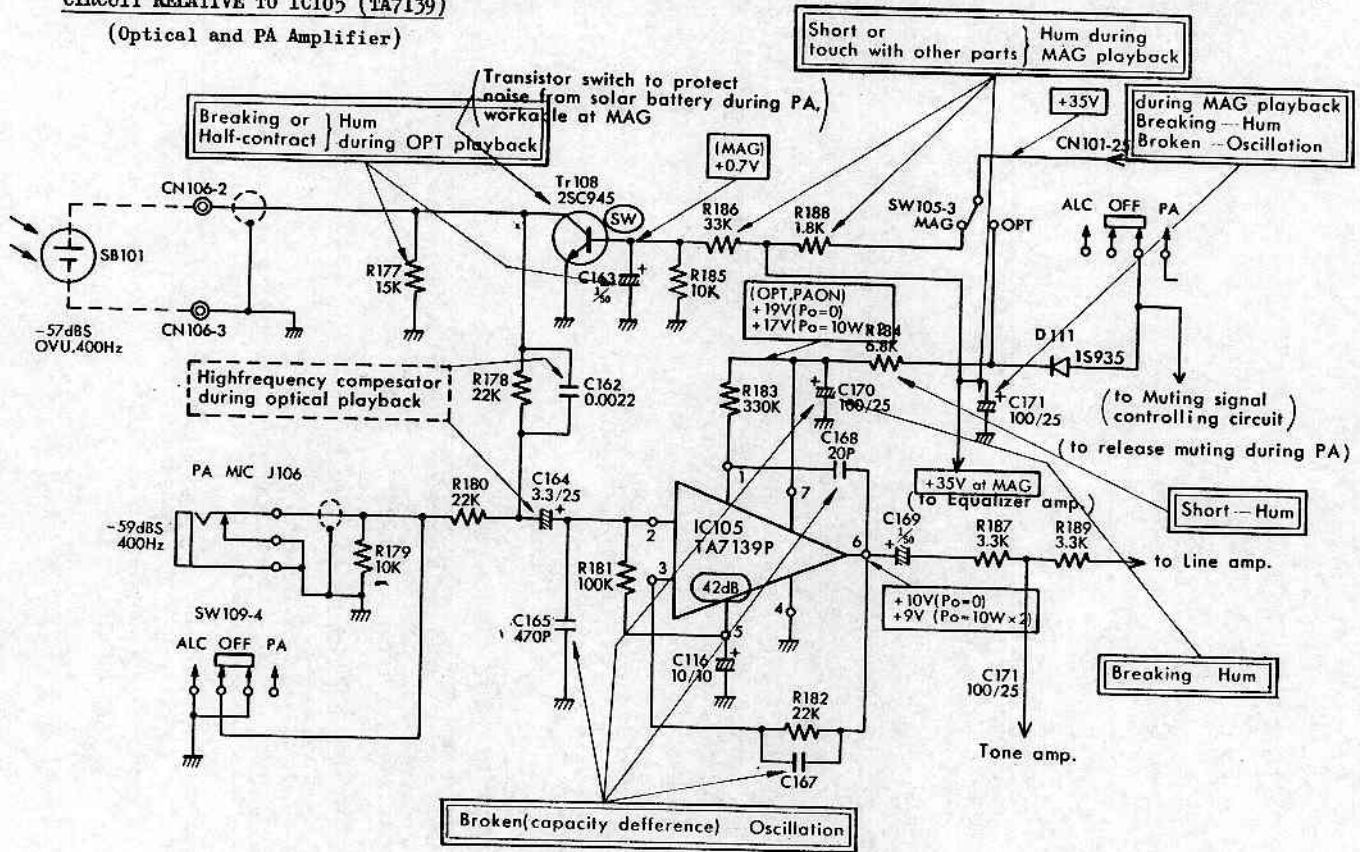


R-P SOLENOID DRIVE CIRCUIT
(for Normal/Double/Remote/Spot Recording)



Button	Tr318	Tr316	D312	D311	SW108	D110	SW103	D107	D109	SW101-7	D108	Tr107	SL101	SW101-7	SW104
1. OFF/REC : ON	ON	-	ON	-	-	ON	ON	-	ON	-	ON	ON	ON	-	R
2. FWD: ON, REC: OFF	OFF	ON	OFF	ON	-	OFF	OFF	ON	OFF	R	"	"	ON	"	R
1. SPOT REC/REC : ON	-	ON	-	ON	ON	ON	ON	-	ON	-	"	"	"	"	"
2. SPOT REC/REC : OFF	-	"	-	"	OFF	OFF	OFF	ON	OFF	R	"	"	"	"	"

CIRCUIT RELATIVE TO IC105 (TA7139)
(Optical and PA Amplifier)



F. Recording Bias Current Adjustment

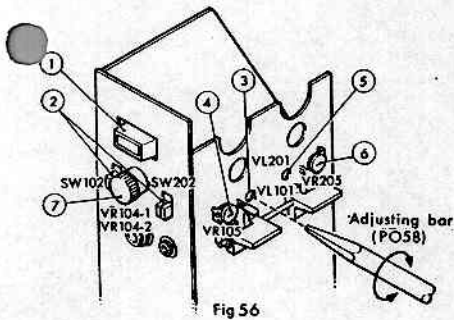


Fig 56

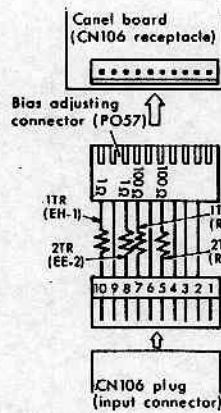


Fig 57

1. Disconnect the CN106 and connect a bias adjustment connector (PO57). Fig. 57
2. Slide the spot REC button to READY.
3. Slide the DOUBLE/NORMAL selectors to NORMAL (both tracks).
4. Set the projector to the recording condition (both tracks).
5. Connect a VTVM (Vacuum Tube Voltage Meter) across a 100Ω resistor (7-pin of PO57). Turn the trap coil (VL101) until the voltage on VTVM is maximum as shown in Fig. 56.
6. Turn the VR105 until the voltage on VTVM is 40mV (400μA).
7. Adjust the bias current on the track 2 in the same manner as above.
8. Slide the DOUBLE/NORMAL selectors to DOUBLE (both tracks). By turning the double recording control knob clockwise, check that the voltage varies from 0 to 50mV.
9. Check the erase current. For checking, measure voltage across a 1Ω resistor: 10-pin of PO57 (Track 1), 8-pin (Track 2). It should be 110-170mV.

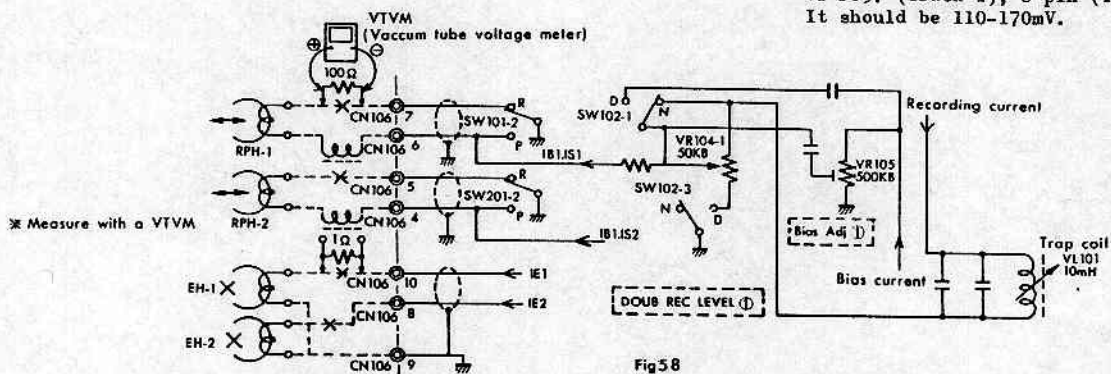
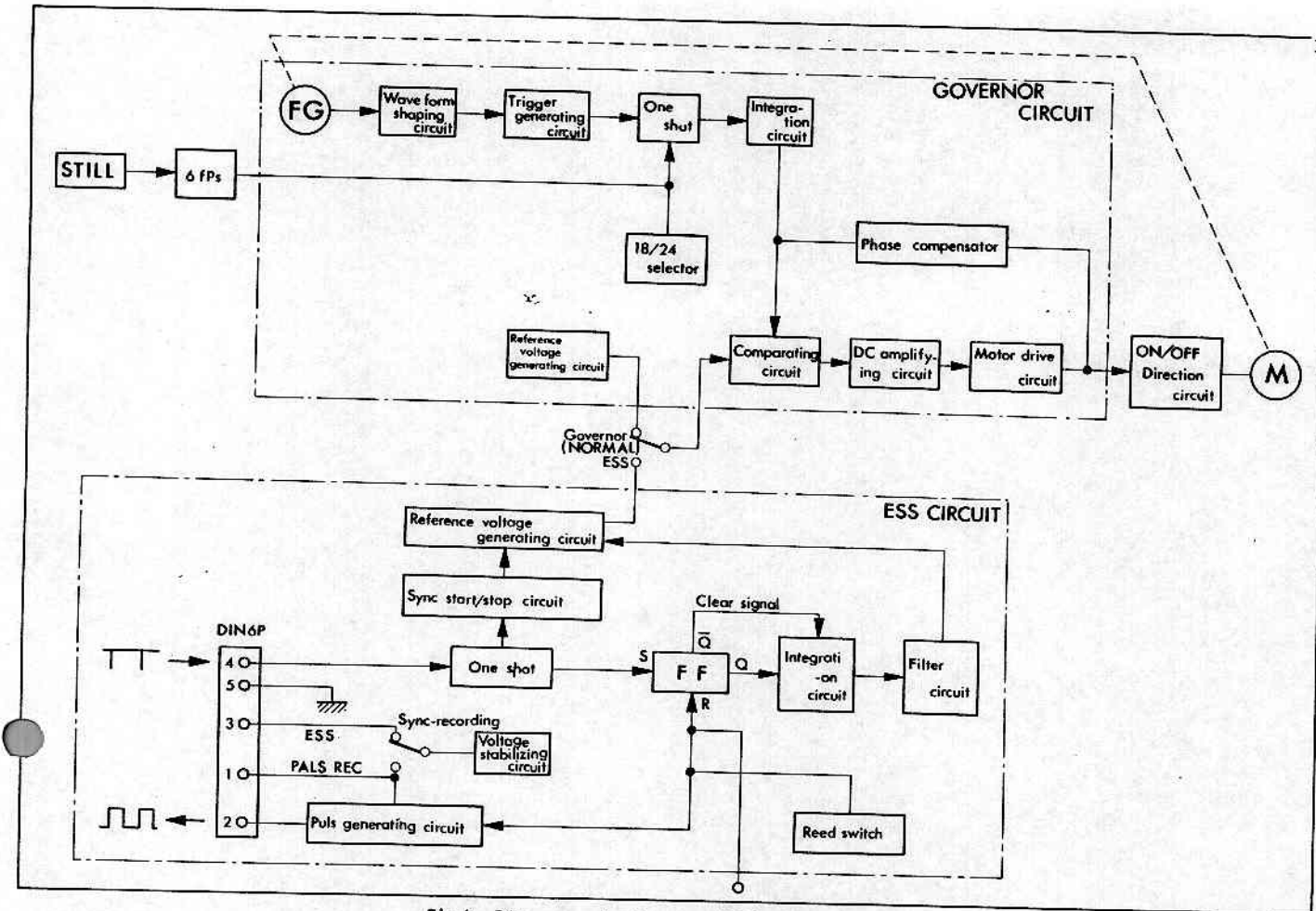
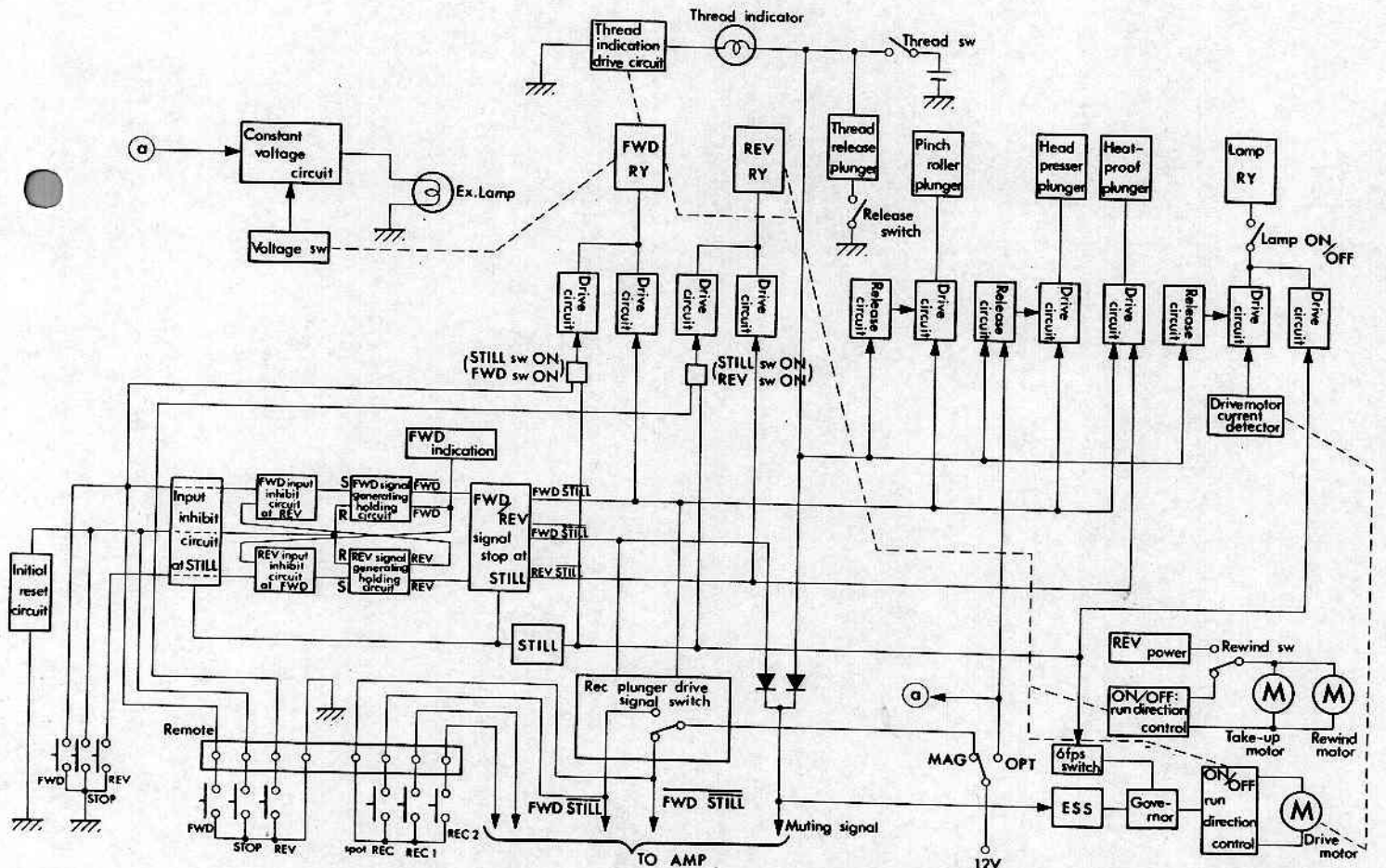


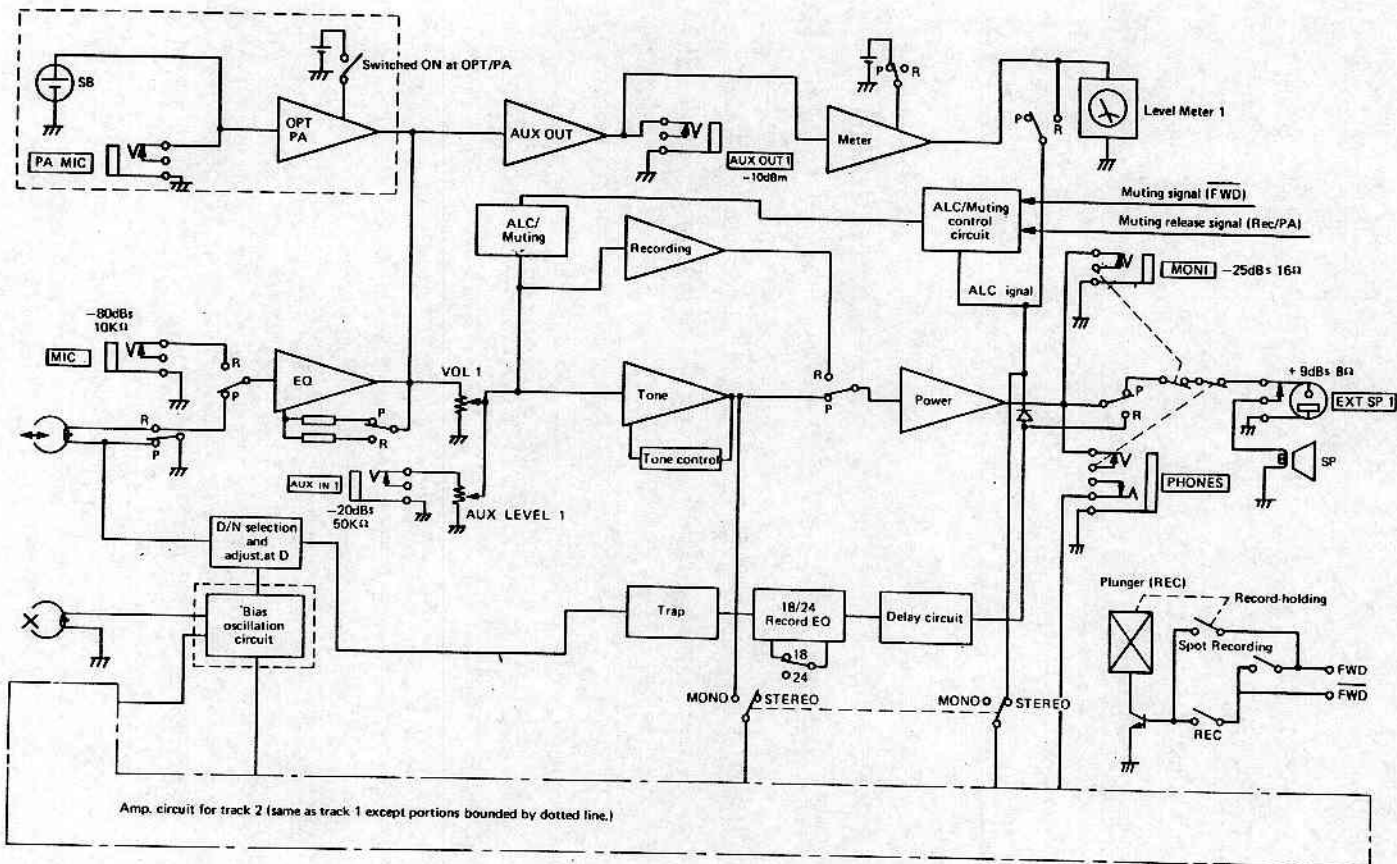
Fig 58



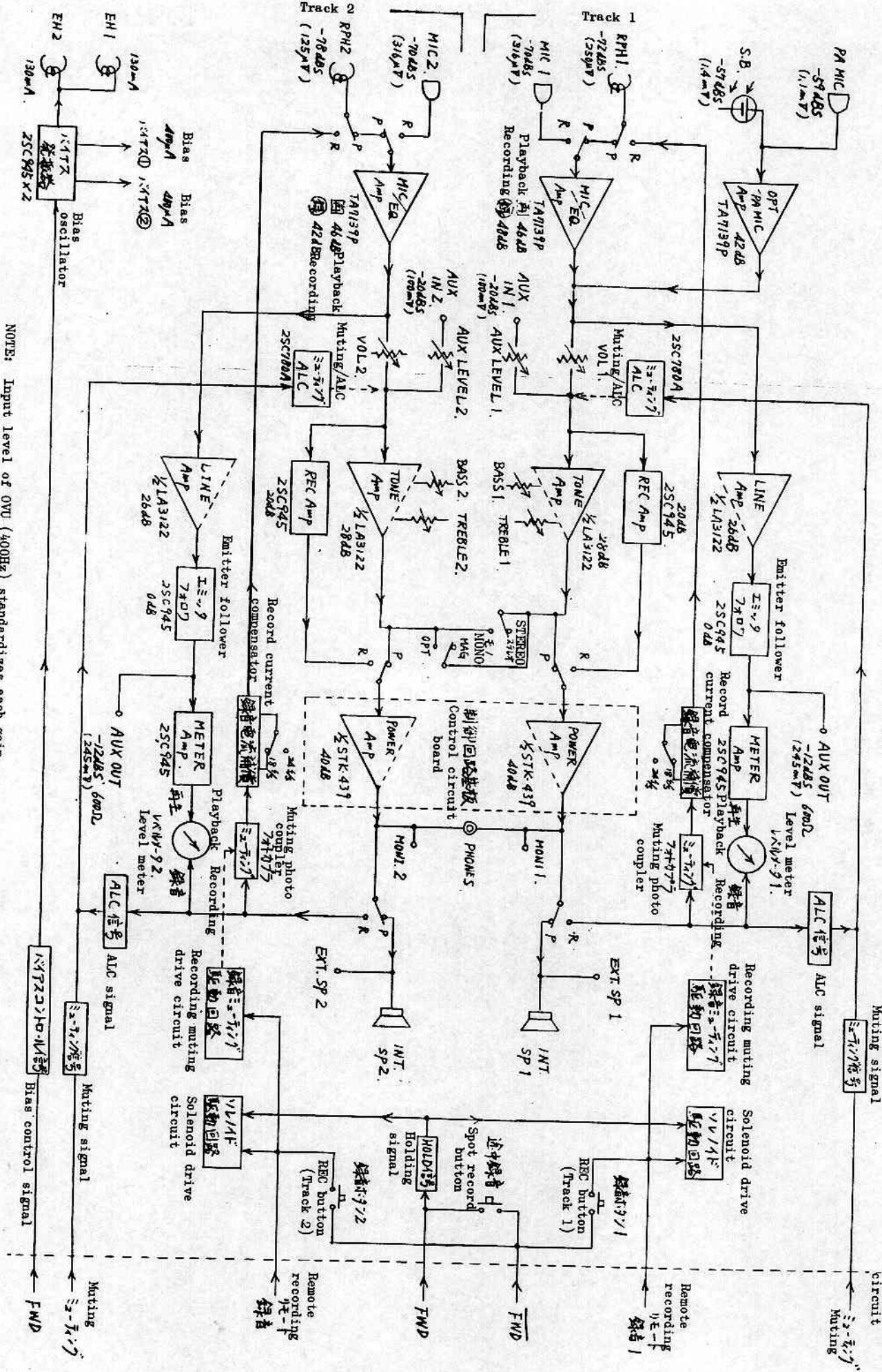
Block Diagram of Governor/ESS Circuit.



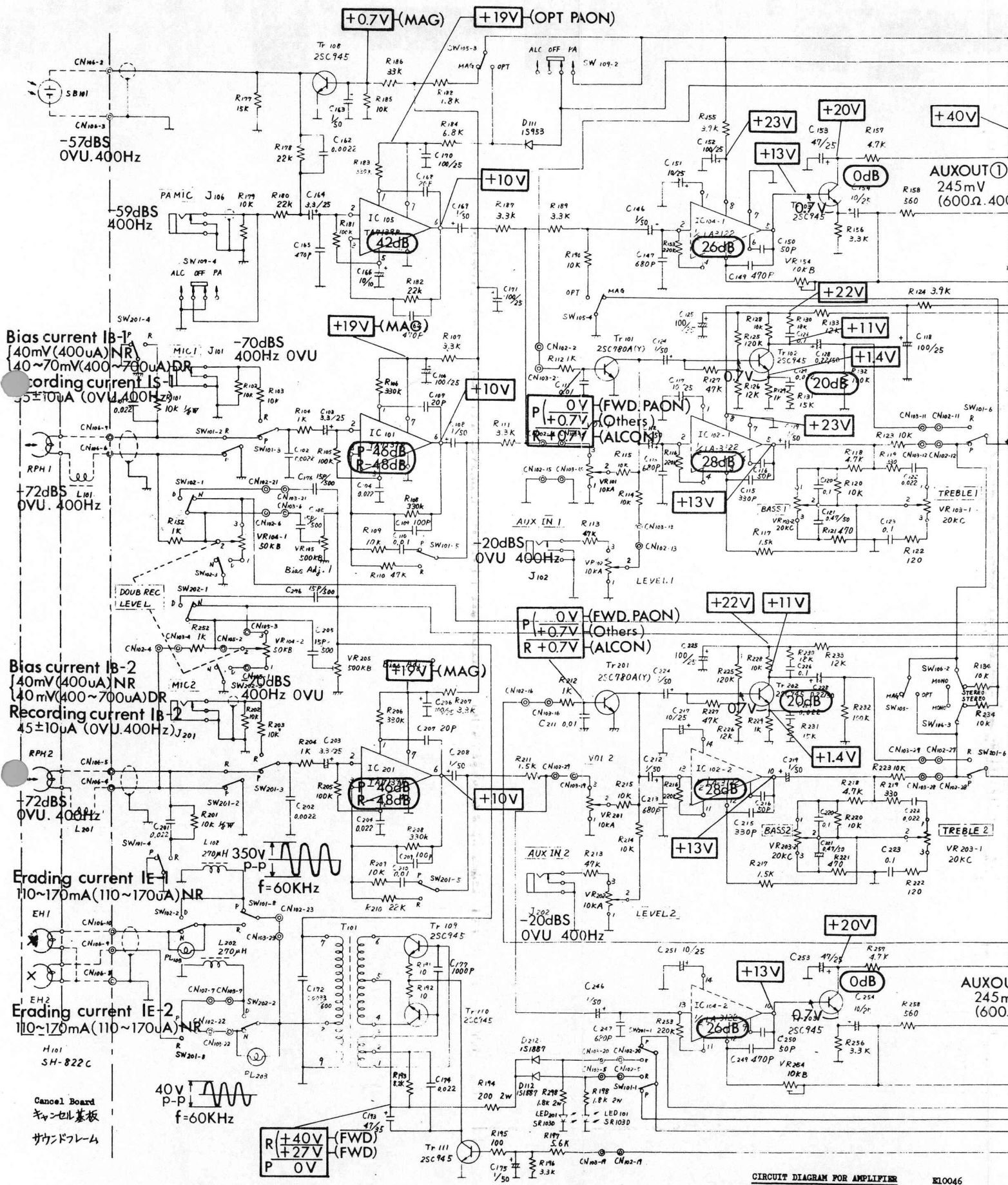
Control Circuit Block Diagram



AMPLIFIER BLOCK DIAGRAM



NOTE: Input level of OVT (400Hz) standardizes each gain.



Bias current IB-1
 40mV (400uA) NR
 40~70mV (400~700uA) DR
 Recording current IS-1
 45±10uA (OVU, 400Hz)

Bias current IB-2
 40mV (400uA) NR
 40mV (400~700uA) DR
 Recording current IS-2
 45±10uA (OVU, 400Hz)

Erasing current IE-1
 110~170mA (110~170uA) NR
 f=60KHz

Erasing current IE-2
 110~170mA (110~170uA) NR
 f=60KHz

Cancel Board
 キャンセル基板
 サウンドフレーム

Note: The Japanese Words show as follows.

低モレ (low-leakage type capacitor)

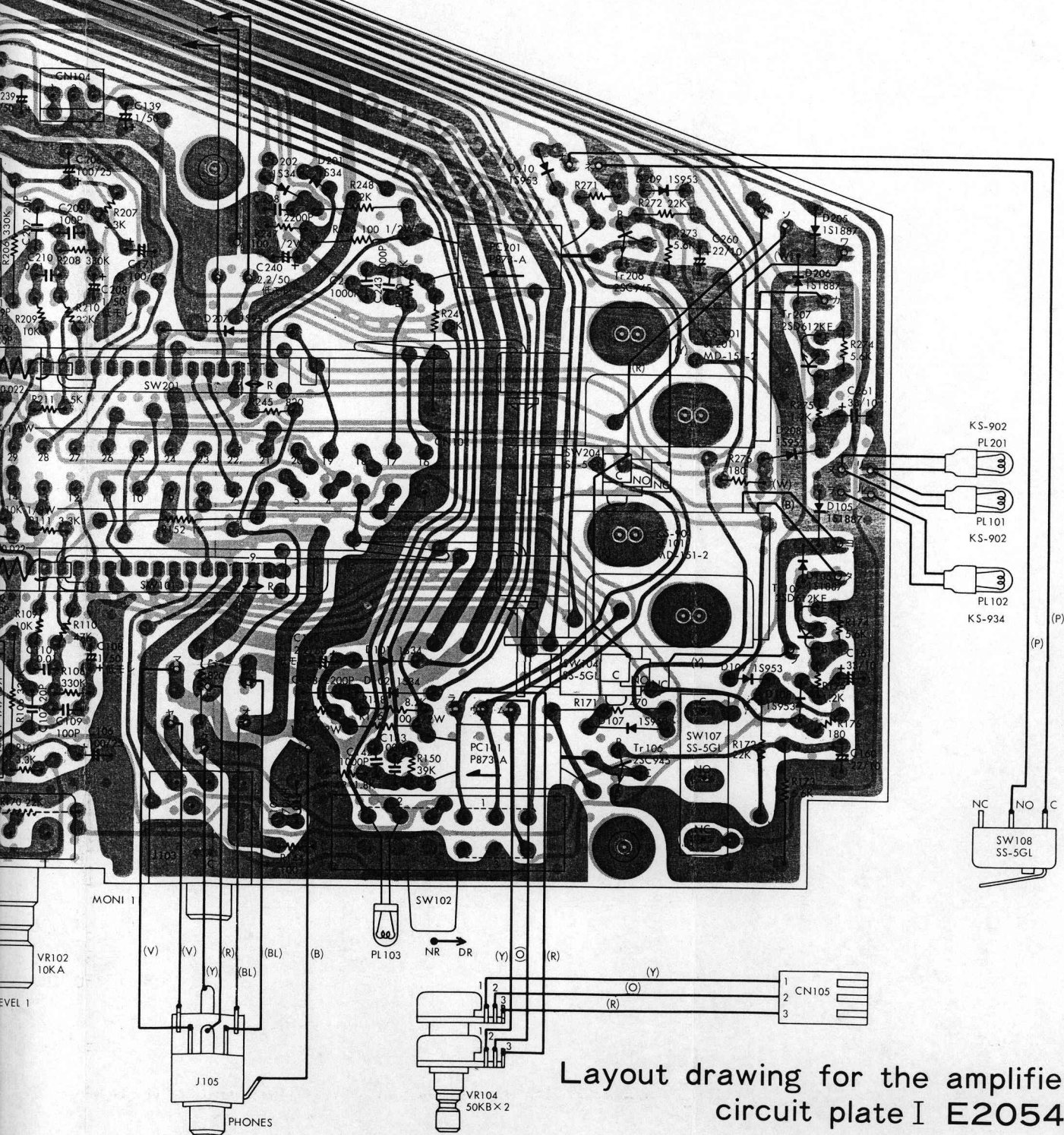
リ,ヌ,ル,ヲ,ワ,カ,ヨ,タ,レ,ソ,ツ,ネ,ナ,ラ,ム,ウ
キ,ノ,オ,ク,ヤ,マ,ケ,フ,コ,エ,テ,ア,サ,キ,ユ

(points to solder the wires at)

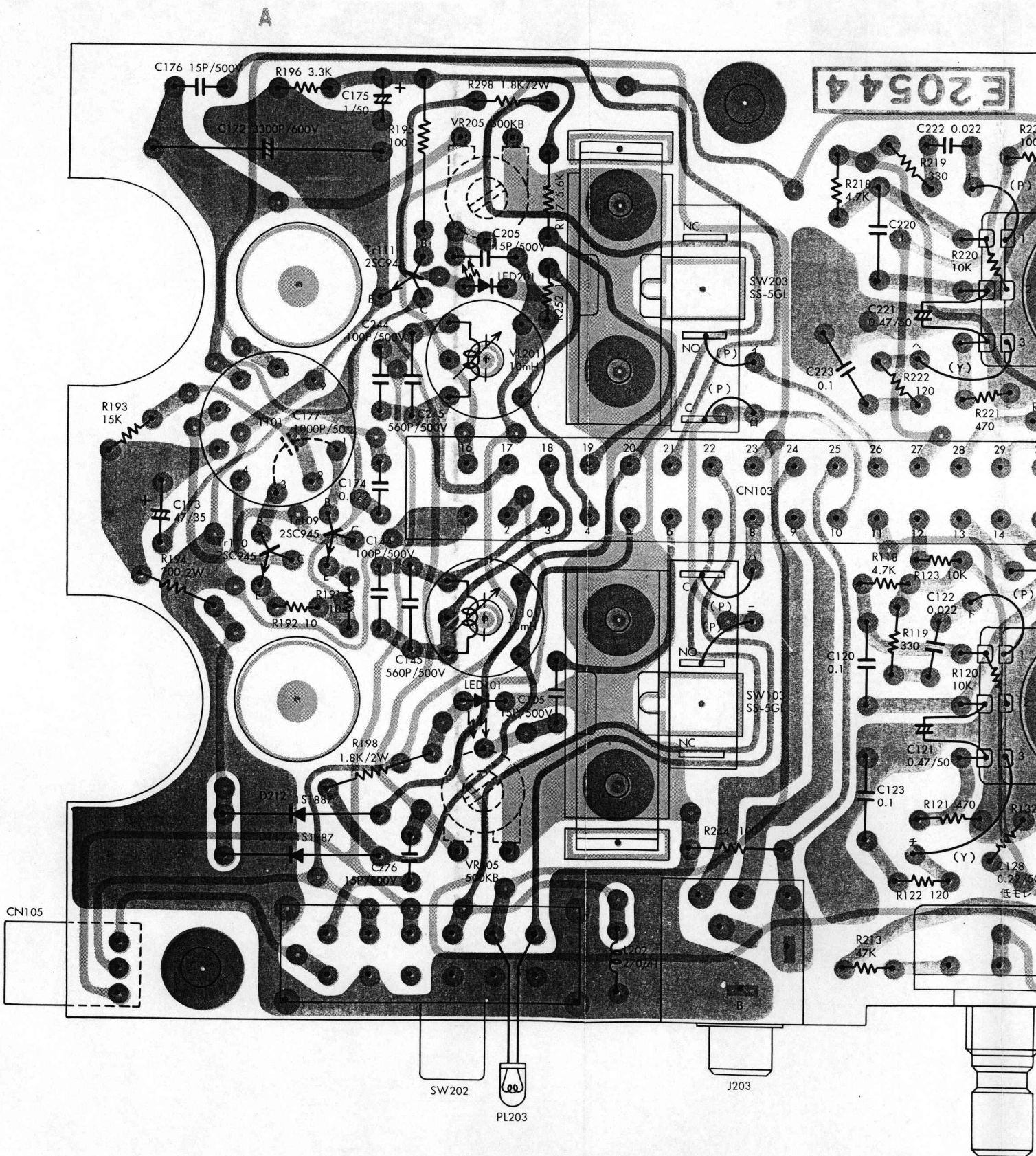
黒 (black wire) 赤 (red) 黄 (yellow) 橙 (orange)

青 (blue) 紫 (violet) 桃 (pink) 灰 (gray) 茶 (brown)

シールド線 (shield wire)

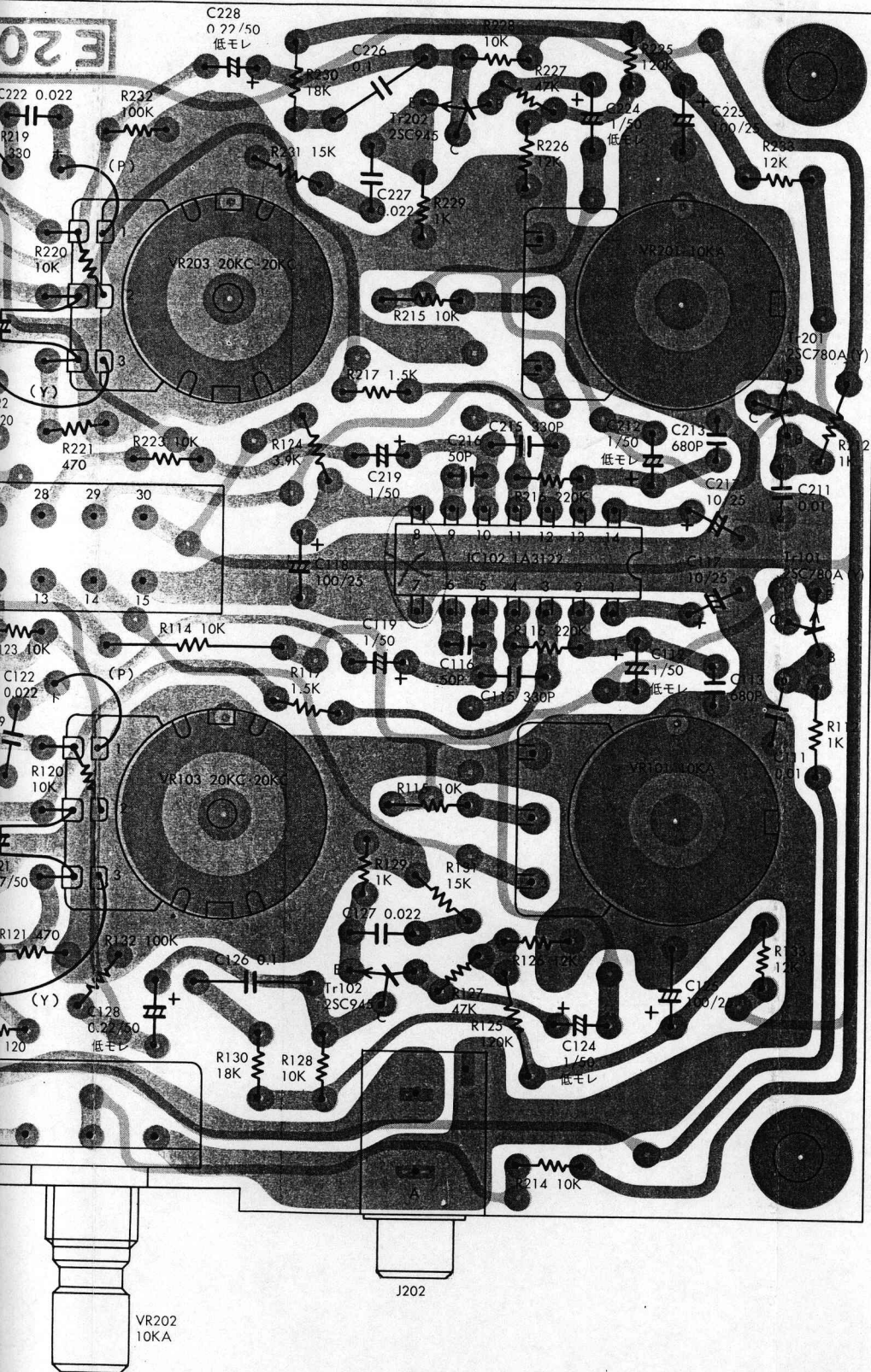


Layout drawing for the amplifier circuit plate I E20547



Layout drawing for the amplifier circuit p

B



注1)

1. D112, D212, R194ハ
プリント基板ニ密着サセルコト。

Notes:

1. Attach D112, D212 and
R194 Closely to the
circuit board.

2. The Japanese words
show as follows.

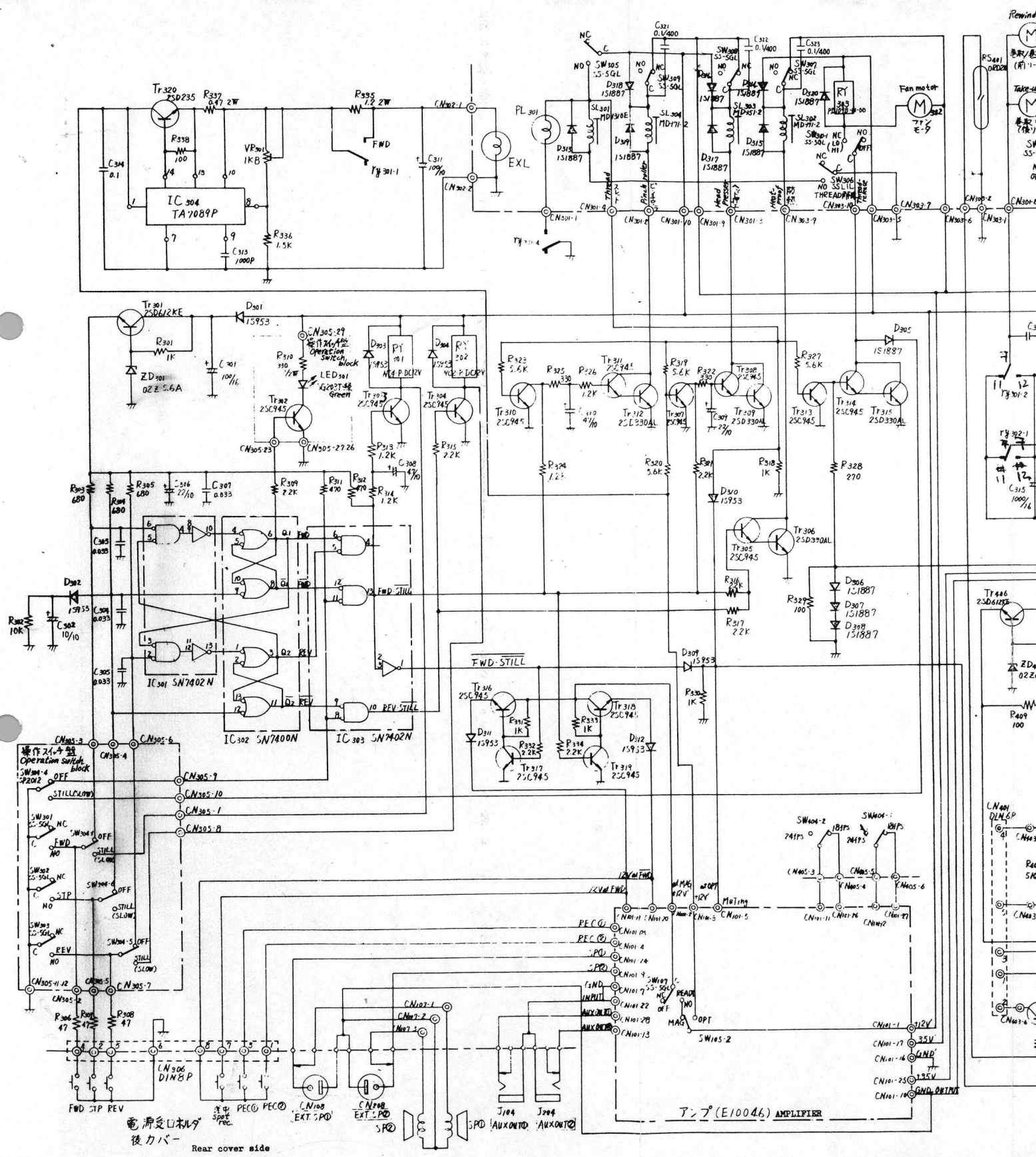
低モレ...low-leakage type
capacitor

Y.....yellow wire

P.....pink wire

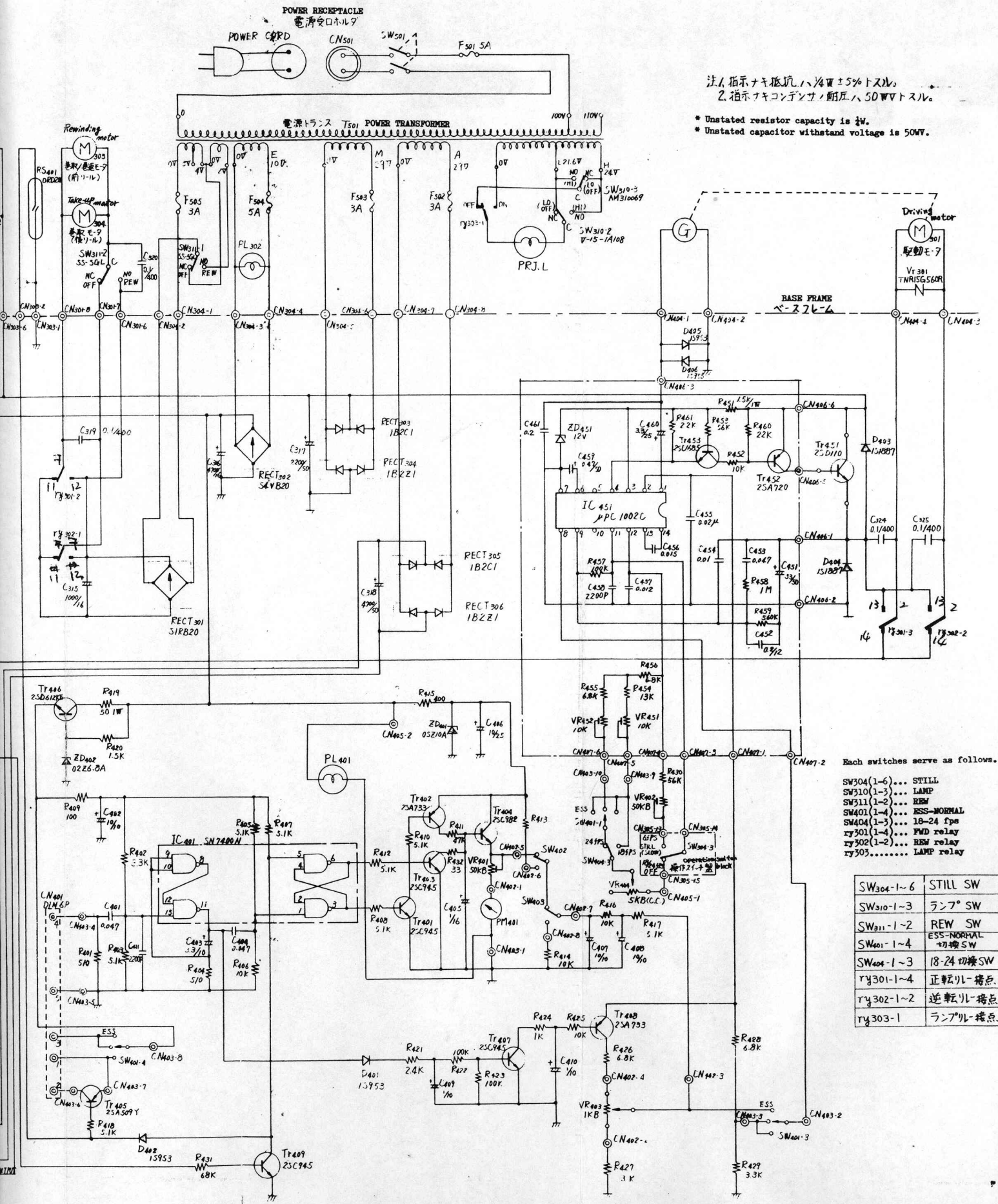
イ, ロ, ハ, ニ, ホ, ヘ, ト, チ
points to solder
the wires at

circuit plate II E31224



電源受口機
後カバー
Rear cover side

CIRCUIT DIAGRAM FOR THE GS-



法人指示ナキ抵抗ハ1/4W±5%トスル
 乙指示ナキコンデンサノ耐圧ハ50VVトスル。

* Unstated resistor capacity is 1/4W.
 * Unstated capacitor withstand voltage is 50WV.

Each switches serve as follows.

- SW304(1-6)... STILL
- SW310(1-3)... LAMP
- SW311(1-2)... REW
- SW401(1-4)... ESS-NORMAL
- SW404(1-3)... 18-24 fps
- ry301(1-4)... FWD relay
- ry302(1-2)... REW relay
- ry303..... LAMP relay

SW304-1~6	STILL SW
SW310-1~3	ランプ SW
SW311-1~2	REW SW
SW401-1~4	ESS-NORMAL 切替SW
SW404-1~3	18-24切替SW
ry301-1~4	正転リレ-接点
ry302-1~2	逆転リレ-接点
ry303-1	ランプリレ-接点

