

SERVICE MANUAL

APOLLO 16mm SOUND PROJECTOR

Model: QL-100 Series

Apollo 16mm proj

APOLLO AUDIO-VISUAL

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## P R E F A C E

Small size and light weight 16mm sound motion picture projector is designed under three principle, that is, "No film damaging", "Trouble-free" and "Easy operation". To sustain these provisions perfectly for a long period, good knowledge and good maintenance of the projector is indispensable.

This manual covers the detailed procedures for disassembly, checking, assembling, adjustment, etc., required for mainly overhaul.

Separate Part List is also prepared for perfect maintenance.

For further questions that these papers do not cover, please consult with the following:

APOLLO AUDIO-VISUAL  
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## CONTENTS

PREFACE	...	...	...	...	...	...	1
CHART FOR DISASSEMBLING	...	...	...	...	...	...	2
COMPOSITION & SPECIFICATIONS	...	...	...	...	...	...	3
CAUTION ON WORKING	...	...	...	...	...	...	4
1. OPTICAL SYSTEM	...	...	...	...	...	...	5
1.1 GENERAL DESCRIPTIONS	...	...	...	...	...	...	5
1.2 PROJECTION LAMP	...	...	...	...	...	...	5
1.3 GUIDE RAIL ASSY	...	...	...	...	...	...	6
1.4 LENS HOLDER	...	...	...	...	...	...	6
1.5 TROUBLE SHOOTING	...	...	...	...	...	...	7
1.6 DISASSEMBLY	...	...	...	...	...	...	8
1.7 CHECKINGS	...	...	...	...	...	...	8
1.8 ASSEMBLING AND ADJUSTMENT	...	...	...	...	...	...	9
1.9 MISCELLANEOUS	...	...	...	...	...	...	9
2. DRIVING SYSTEM	...	...	...	...	...	...	10
2.1 GENERAL	...	...	...	...	...	...	10
2.2 MOTOR	...	...	...	...	...	...	11
2.3 MOTOR CONTROL ASSY	...	...	...	...	...	...	14
2.4 PULL-DOWN MECHANISM	...	...	...	...	...	...	15
2.5 SPROCKET DRIVING MECHANISM	...	...	...	...	...	...	21
2.6 REEL ARMS	...	...	...	...	...	...	24

3. LINK AND CONCERNED MECHANISM	...	...	...	...	27
3.1 GENERAL DESCRIPTION	...	...	...	...	27
3.2 HORIZONTAL LINK	...	...	...	...	28
3.3 VERTICAL LINK	...	...	...	...	28
3.4 LEVER FOR TENTION ROLLER	...	...	...	...	28
3.5 CONTROL SWITCH	...	...	...	...	29
3.6 LOWER LOOP RESTORER	...	...	...	...	29
3.7 TROUBLE SHOOTING	...	...	...	...	30
3.8 DISASSEMBLY	...	...	...	...	30
3.9 CHECKINGS	...	...	...	...	31
3.10 ASSEMBLING AND ADJUSTMENT	...	...	...	...	31
4. SOUND SYSTEM	...	...	...	...	31
4.1 GENERAL DESCRIPTION	...	...	...	...	31
4.2 OPTICAL REPRODUCTION ASSY	...	...	...	...	32
4.3 STABILIZER, FRICTION ROLLER AND DAMPING ROLLER...	...	...	...	...	34
4.4 MAGNETIC SOUND REPRODUCTION ASSY	...	...	...	...	36
4.5 AMPLIFIER	...	...	...	...	38

## COMPOSITION

Component	QL-100 / QL-100M	QL-100S / QL-100MS
Projector unit	1 ea.	1 ea.
Front cover	1 ea.	1 ea. (with 2 medium-size speaker)
Power cord, 3-meter long	1 ea.	1 ea.
Reel, for 480-meter	1 ea.	1 ea.
Accessories	1 set	1 set
Speaker cord	-	1 ea. (20-meter long)

### OPTIONAL ACCESSORIES

- Large diameter zoom converter
- Large diameter anamorphic lens with holder
- Recording adapter
- Large size external speaker (with 30-meter cord), 8Ω

## SPECIFICATIONS

Power requirements: 100V-130V / 200V-250V, AC 50Hz / 60Hz,  
Power consumption 350 VA

Projection Lamp: Halogen quartz lamp 24V-250W with cold mirror (ELC)

Projection lens: F 1.2, f=50mm, Hard-coated, tube diameter 42.5 φ  
Large diameter zoom converter is applicable to this lens.

Film threading: Roll-loading easy threading system

Film speed: 24 frames per sec.

Rewinding: Even the film threaded for projection can be rewound.

Reel capacity: 15-meter to 600-meter

Motor: Capacitor motor., output 35W

Sound reproduction: QL-100 and QL-100M for optical sound reproduction,  
QL-100M and QL-100MS for optical and magnetic sound reproduction.

Exciter lamp: 6V-1A (Type KEO70), lit on DC.

Sound lens: Cylindrical lens (slitless)

Photo-electric transducer: Solar cell

Amplifier: All IC solid-state, two power supply system

Sound output: 25W max., 8 $\Omega$ , DIN type 2P plug.  
Line out: 0 dB, 600 $\Omega$  unbalanced, DIN type 5P plug.  
Built-in speaker: Elliptical, 16  $\Omega$ .  
External speaker: For QL-100S and QL-100MS, a speaker, 134mm dia., 8 $\Omega$ .

#### CAUTIONS ON WORKING

- \* Put a cover on the part where there is the possibility of spoiling or damaging by disassembly, repair or checking. In case when it is necessary to lay the projector on its front or back, be careful not to damage the part by it.
- \* Disassembly should be limited as small part as possible. Be careful not to lose or to mix the part with that of other unit. Employ the specified part.
- \* Be sure to disconnect the power supply before the work. Keep the safety first principle.
- \* Use special tool properly where it is required.
- \* The front and back cover is made of ABS resin, never apply lacquer thinner or the like. Clean the cover with water or soap water. Gasoline is not recommendable to clean it.

## 1. OPTICAL SYSTEM

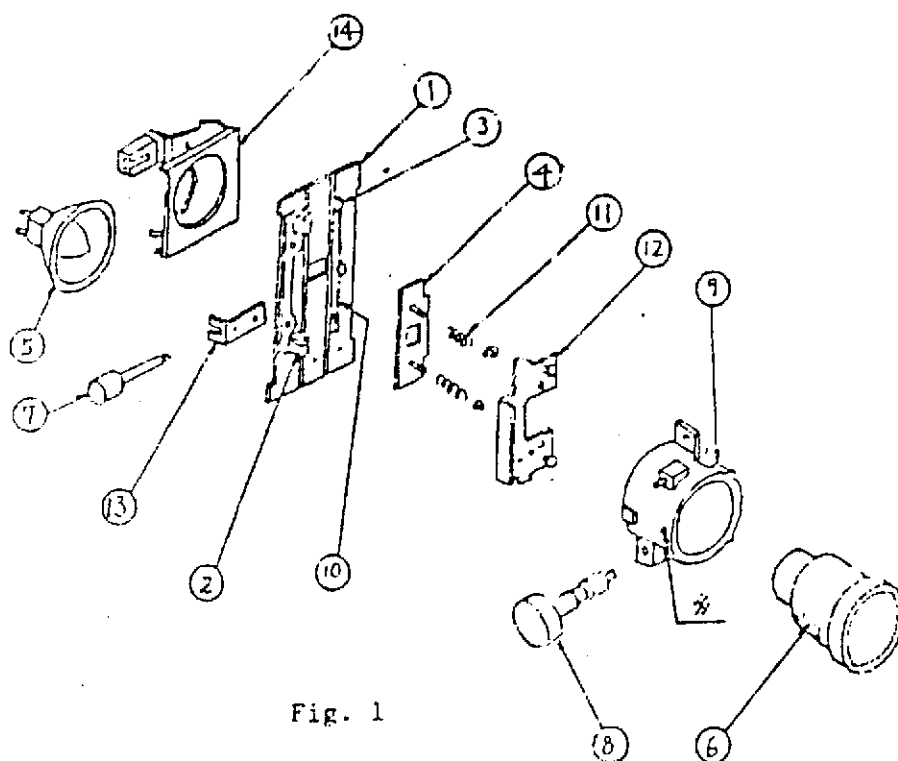


Fig. 1

### 1.1 General Description

Aperture plate ① has side plate ② and side presser ③ to hold the film laterally. Pressure plate ④ presses the film flatly onto the aperture plate. The light beam from halogen tungsten lamp ⑤ illuminates the film, and the image on the film is projected on a screen through projection lens ⑥. Framer knob ⑦ corrects the position of picture frame, and focusing knob ⑧ adjust the lens position finely.

### 1.2 Projection Lamp

The lamp used is halogen tungsten quartz lamp with dichroic coated mirror, rated 24V-250W (ELC of ANSI code), colour temperature 3400K, lamp life 50 hours at the rated voltage.

This projector is provided with a switch that permits the lamp to operate at about 21.5V in the LOW position for long lamp life, and about 23.5V in the HIGH position for brighter screen image. By this method, the lamp life will be prolonged to about 3 times as rated, in the LOW position; and to about 1.2 times as rated, in the HIGH position.

Fig 2. - 1

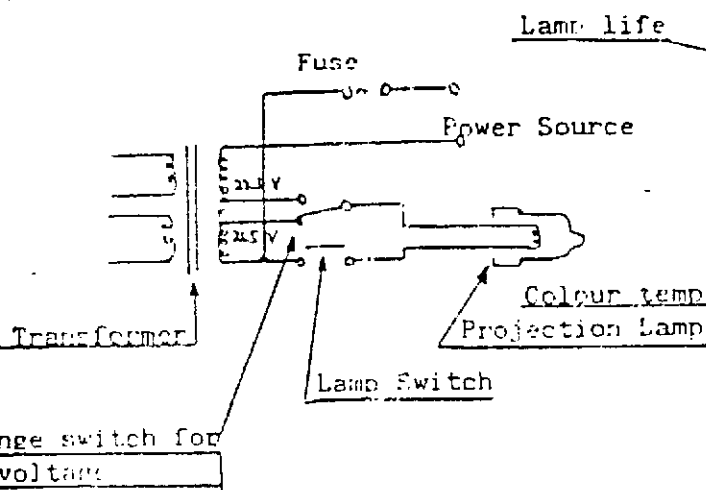
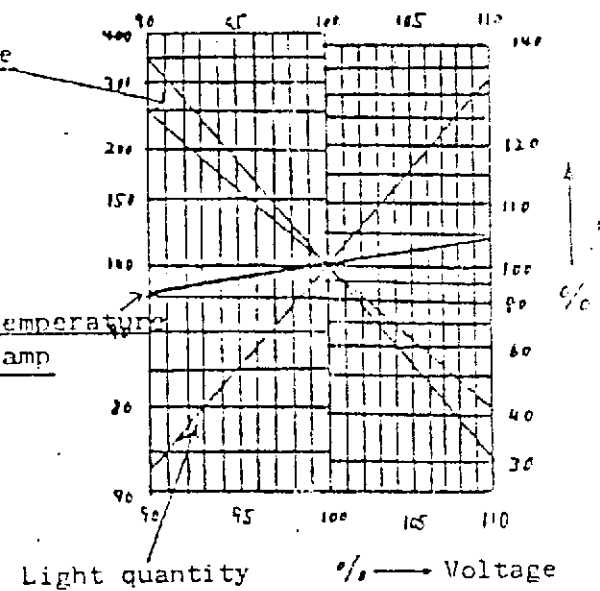


Fig 2. -2



### 1.3 Guide Rail Assy

As described in 1.1, this assy determines the film registration. Special precise machining is performed on the aperture plate and pressure plate, with the careful consideration for flatness, smoothness, durability, spring tension, etc.

Aperture plate is adjustable vertically a little by means of framer knob. The pressure plate can be opened toward the projection lens when threading, and can be removed easily. This makes the checkings and cleaning of film contacting plates accessible, and the projector can be kept in the best condition always.

### 1.4 Lens Holder

Projection lens must be held in a correct right angle against film surface. The hole with \* mark in Fig. 1 is screw threaded for a setting screw, with which the lens is fastened to prevent it from taken away during the storage of the projector.



## 1.5 Trouble-shooting

Trouble and cause	Remedy
<p>1 Inoperative lamp</p> <p>(1) Defective lamp</p> <p>(2) Blown fuse FSL</p> <p>(3) Defective lamp socket</p> <p>(4) Defective transformer</p> <p>(5) Faulty wiring or connection</p> <p>(6) Defective control switch</p>	<p>Replace lamp. Check the lamp terminal voltage and cooling fan in the case of short lamp life.</p> <p>Replace the fuse after the cause of trouble is removed.</p> <p>Replace the socket.</p> <p>Replace the transformer.</p> <p>Check and correct.</p> <p>Replace the switch.</p>
<p>2 Flickering light</p> <p>(1) Refer to 1 (1) and (3) to (6).</p>	<p>Replace or remedy</p>
<p>3 Dark projected image</p> <p>(1) Defective lamp</p> <p>(2) Very low power supply voltage</p> <p>(3) Stray light around screen</p>	<p>Replace the lamp.</p> <p>Correct the voltage.</p> <p>Improve the shading.</p>
<p>4 Dull focusing</p> <p>(1) Faulty projection lens</p> <p>(2) Improperly pressed pressure plate</p>	<p>Clean or replace the lens.</p> <p>Adjust the pressure of pressure plate after film loop checked.</p>
<p>5 Bad contour of image masking</p> <p>(1) Deformed or damaged mask of aperture plate</p> <p>(2) Improperly positioned pressure plate (Right or left of contour is out of focus)</p> <p>(3) Removal of anti-reflection coating on aperture plate or pressure plate</p>	<p>Replace the aperture plate.</p> <p>Correct the position.</p> <p>Replace the part.</p>
<p>6 Inclined image contour</p> <p>(1) Defective aperture plate or improperly mounted aperture plate</p> <p>(2) Worn or defective rubber leg</p> <p>(3) Deformed base plate for rubber leg</p>	<p>Replace or remedy.</p> <p>Replace the leg.</p> <p>Replace.</p>

Trouble and cause	remedy
<p>7 Remarkable lateral weaving of picture</p> <p>(1) Sluggish side presser</p> <p>(2) Insufficient pressure of side presser</p> <p>(3) Insufficient pressure of pressure plate</p> <p>(4) Defective cam case</p>	<p>Adjust or replace side presser.</p> <p>Replace or repair spring ⑩ .</p> <p>Replace coil spring ⑪ .</p> <p>Lubricate slightly on the sliding part.</p> <p>See 2.4.2.</p>
<p>8 Faulty focus adjuster or unstable focus</p> <p>(1) Worn rubber surface of focusing knob</p> <p>(2) Loose fitting between lens and lens holder</p>	<p>Replace knob ⑧ .</p> <p>Replace holder or knob ⑧ .</p>

### 1.6 Disassembly

- 1) Remove lens holder cover and lamp house cover (with the internal shield).
- 2) Remove projection lens ⑥ .
- 3) Remove pressure plate assy ④ , ⑪ and ⑫ .
- 4) Remove projection lamp ⑤ .

Above procedures are for daily check and cleaning.

The following procedures should be performed only when it is necessary for repair or replacement of parts.

- 5) Remove lens holder ⑨ together with ⑧ .
- 6) Remove aperture plate ① together with ② , ③ and ⑩ .

To remove aperture plate ① , loosen the screws above and below the framer knob ⑦ , and remove guide plate ① in Fig. 6, and remove ② by loosening the screw at the inner place.

This disassembly should be done with the pull-down claw in its withdrawn position.

### 1.7 Checkings

- 1) There should be no scar or wear on the pressure plate and aperture plate. If any defect is found on these parts, the part should be replaced. The dirt should be removed carefully.
- 2) If any remarkable deformation is found on spring ⑪ for pressure plate, or spring ⑩ for side presser, the part should be replaced. The pressure of pressure plate should be determined by the film tension placed between pressure plate and aperture plate. The recommendable film tension is 80g to 120g.
- 3) Too loose or too tight rotation of focusing knob can be repaired by replacing part ⑧ in many cases.

- 4) When the rotation of framer knob is not smooth, replace part ⑦ or ⑬.
- 5) If the unstable position of pressure plate assy ④ ⑪ and ⑫ is detected, replace spring ③ in Fig. 6.
- 6) If damage or wear is found on the film contacting surface of side presser ③ or side plate ②, the part shall be replaced.

### 1.8 Assembling and Adjustment

The assembling is performed in the reverse order of disassembly.

Remember the following:

Parts especially pressure plate, aperture plate and lens should be handled with care not to scratch or peel the surface. Do not damage the anti-reflection black coating.

The movement of pressure plate against plate ⑫ must be smooth.

When the framer knob is rotated, the aperture plate must be moved up and down smoothly without a remarkable backlash. It must be able to stay at any point. When pressure plate is set on aperture plate, the proper compression of spring ⑪ is about 1 mm.

### 1.9 Miscellaneous

- 1) The dimensions of projected picture is given by the following formula:

$$D = \frac{F (S+A)^2}{SA}$$

or

$$D = \frac{SF}{A} + 2F$$

Where D: Distance between image and film

F: Focus length of lens

S: Dimensions of projected picture

A: Dimensions of image on film (7.2H x 9.65W)

- 2) Film damaging test should be performed as follows:

Thread a looped raw film on projector, and run the loop more than five turns through the projector, then check the film. If any harmful scratch is detected, trace the cause and remove the trouble.

- 3) Anamorphic lens holder

The displacement of optical axis of anamorphic lens against projection lens is recommended to be within 1 mm. (Refer to the instruction manual).

## 2 DRIVING SYSTEM

### 2.1 General Description

Cooling fan, pull-down mechanism, sprocket shaft, reel shaft, etc. are all driven by a same motor. The name of parts and rotational speed are shown in Fig.3 and Table 1.

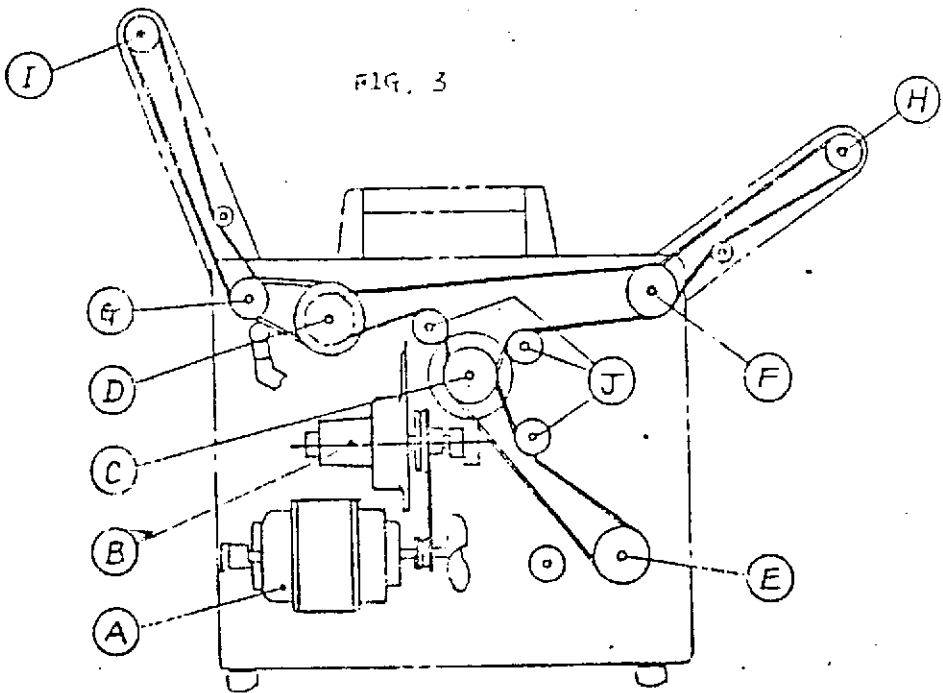


Table 1

	Name of part	Rotational speed (rpm)	Remarks(Without film threaded)
A	Motor	2890 at 50Hz 3480 at 60Hz	Both for forward and rewind
B	Main shaft(Pull-down shaft)	1440	
C	Worm wheel shaft	120	
D	Upper sprocket shaft	120	
E	Lower sprocket shaft	120	
F	Fulcrum shaft of take-up reel arm -	120	Pulley rotates always Shaft rotates only for forward
G	Fulcrum shaft of feed reel	246 approx.	Pulley rotates always

	Name of part	Rotational speed (rpm)	Remarks (With film threaded)
H	Take-up reel spindle	120	Rotates only when forward
I	Feed reel spindle	255 approx.	Rotates only when rewind
J	Tension roller	180 approx.	Rotates both for forward and rewind

## 2.2 Motor

### 2.2-1 General Description

The driving system consists of a capacitor motor of output power 35W, cooling fan for projection lamp (with pulley), fan case, inching knob, etc. The current through the phase splitting coil of this motor runs only when the motor is starting, by means of a relay. The normal current of the motor (of main coil) for AC 100V rated is 1A to 1.2A. The starting current is (3) to (4) times normal current. The current relay (RL3), phase splitting capacitor (C3, 50uF AC 125<sup>V</sup>), etc. are installed within the motor control assy which is under the motor. The start and stop of the motor is controlled by the control switch. The reverse run of the motor is achieved by the action of relay (RL1) through switching the circuit of control switch.

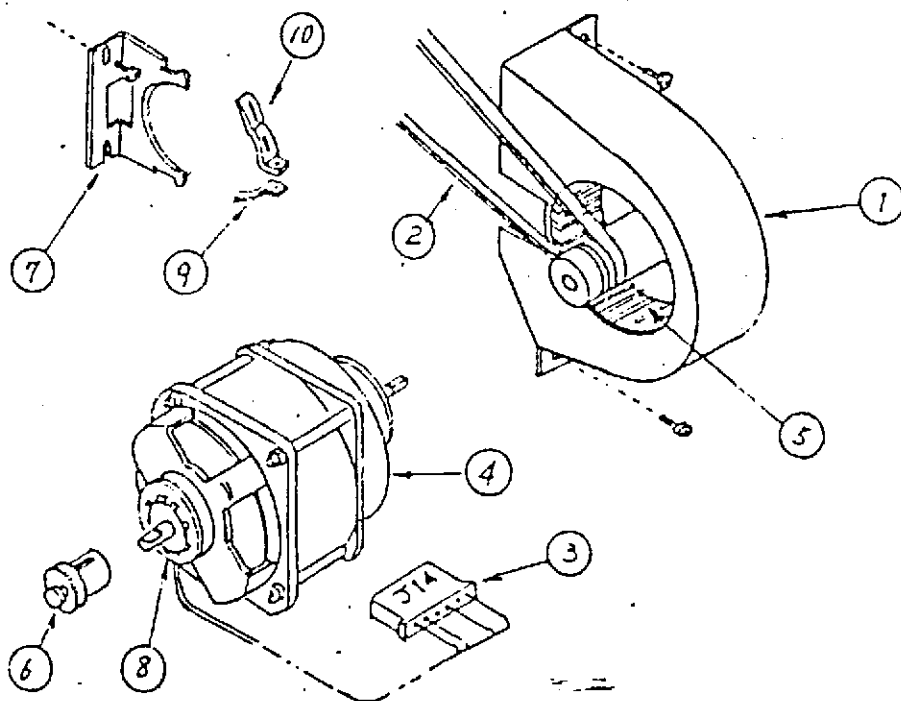


FIG 4.

Trouble and cause	Remedy
1. Inoperative motor	
(1) Faulty power supply	Check the built-in transformer. Check AC input voltage.
(2) Defective motor	Replace motor. Major of trouble are caused by over-voltage and current relay (RL3).
(3) Faulty motor circuit	Check for faulty or broken wiring.
Out of contact of connector	Check the connector (J12 - J14).
Defective phase splitting capacitor	Replace it.
Defective current relay (RL3)	Replace it.
Defective control switch (SW2)	Replace it.
2. Remarkable noise of motor	
(1) Contacting fan and fan case	Correct the position of fan case. Replace deformed fan or case.
(2) Damaged motor bearing	Replace the motor.
(3) Contacting motor frame against other matter	Correct the position of motor or other matter.
(4) Deteriorated shock-absorbing rubber cushion	Replace it.
(5) Loosened motor fixing screw	Tighten the screw.
(6) Over or under tension of V-belt	Readjust for proper tension.
3. Over-heat of motor	
(1) Defective motor	Replace it.
(2) Defective current relay (keeps ON even under normal running.)	Replace it.
(3) Over-voltage	Improve the power supply (Change the tap of built-in transformer, or employ a step-down transformer)
4. Broken belt	Replace it.

## 2.2-3 Disassembly .

Before the disassembly, be sure to separate the power cord from power outlet.

- (1) Unloosen the upper and lower screws to remove fan case ① .

Note 1: To replace belt ② , after this step, loosen four fastening screws and remove the worm of cam case shaft.

- (2) Pull out connector J14 ③ .

- (3) Loosen four screws, and remove motor assy ③ - ⑩ .

- (4) If necessary, proceed further disassembly.

Note 2: Do not attempt to disassemble the motor unit.

## 2.2-4 Checkings

- (1) There should be no damaged part, remarkable vibration, remarkable noise, over-heating on the motor. If any of them is detected, the motor should be replaced. Broken or deteriorated shock-absorbing cushion should be replaced.
- (2) Deformed, damaged fan, or damaged or worn V-groove pulley should be replaced.
- (3) Fan case should be free from deformation.
- (4) Worn belt should be replaced.

## 2.2-5 Assembling and Adjustment

The assembling should be proceeded in the reverse sequence of disassembly.

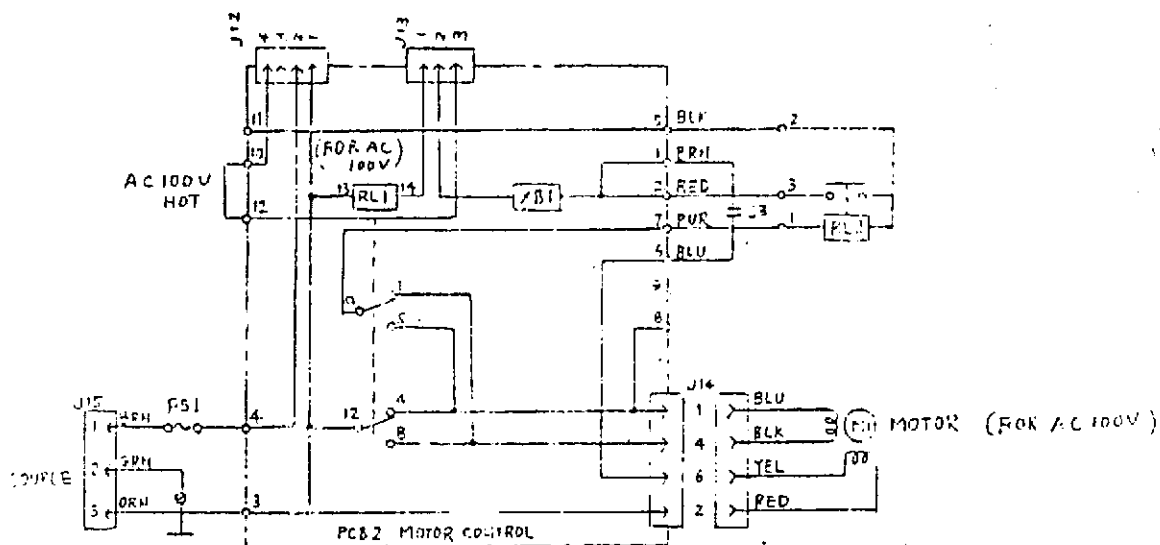
Remember the following:

- (1) Place the fan so that the V-groove of cam case pulley and the V-groove of fan pulley are aligned.
- (2) Place the motor so that the proper tension is given in the belt, and the motor shaft is at a right angle against the belt. (Oblique running of belt will result in shorter life of belt.) The recommendable tension of the belt is that when the middle part of belt is pushed by your finger, the slack about 1.5 - 3mm is observed. Be not too loose.
- (3) Be sure to keep the V-groove free from oil.
- (4) Fan case should be fixed in the place so that it never touch the fan. Ascertain that they do not contact each other during by means of inching knob.

## 2.3 Motor Control Assy

### 2.3-1 General Description

The assy is placed under motor assy. It consists of the component parts concerning motor control, and connectors for power transformer, control switch, etc.



The main component parts and descriptions

- J15      Receptacle for power supply.
- FS1      Power fuse 5A (for 100V - 130V AC) or 3A (for 200V - 250V AC).
- RL1      Operates when control switch is placed in OPEN or REWIND position.
- RL3      For motor starting (current relay).
- XB1      CR unit (0.1μF + 120Ω), for spark killer.
- C3      Phase splitter capacitor for motor, 50μF for 125V AC.
- J12      To supply AC power to transformer.
- J13      To control switch assy.
- J14      To connect to motor.



### 2.3-2 Trouble-shooting

Trouble and cause	Remedy
1. No power is supplied to the projector. (1) Blown fuse FS1  (2) Defective receptacle J15 or faulty soldering of it.  (3) Defective power cord	Replace the fuse after the cause is removed.  Replace or repair the soldering.  Check and if required, replace it.
2. Inoperative reverse run of motor (1) Defective relay RL1 (2) Defective relay (RL1) circuit (Connector J13, control switch, etc.)	Replace it.  Replace it, if required.

### 2.3-3 Disassembly

Pull out the connectors on the upper side. Loosen two screws which fastening the motor and connector. Then the assy can be disassembled easily. Further disassembly should be proceeded as required.

### 2.3-4 Checkings

- (1) Ascertain that the proper fuse is employed. (5A for 100V - 130V AC supply, and 3A for 200V - 250V AC supply).
- (2) No abnormality should be detected in the printed board, connectors and lead wires.
- (3) Ascertain that in any position of control switch, each operation is performed properly.

### 2.3-5 Assembly and Adjustment

- (1) The action of current relay for motor is affected by the direction of gravity. Place the relay in the correct position.
- (2) Be careful not to impose the force on lead wires (tension or breaking force) by cover or other matters.

## 2.4 Pull-down Mechanism

### 2.4-1 General Description

This important mechanism is driven by motor and transmits the rotation to every mechanism. Its main shaft rotates at the speed of 1440 rpm, and one revolution of it transports one frame of film.

Bracket ④ contains framer knob, aperture plate and pressure plate (see 1.1 and 1.2) as a part of mechanism assy. These are pre-adjusted properly as a unit. It is convenient to make maintenance (disassembly, checking, replacement, etc.). This mechanism transports film intermittently at the rate of 24 frames per second. The pull-down claw ⑤, at the lowest end of its pull-down stroke, retires into the aperture plate, and rises up to the top of its stroke (during this period, film is left still). Then, it projects from aperture plate to engage the adjacent film perforation, and pulls down the film by one frame. Triangular cam ⑥ controls the up-and-down motion of claw, and face cam ⑦ controls in-and-out motion. During the film is left still, the light passes the open section of shutter to illuminate the film, and the image on the film is projected on a screen through projection lens.

Note: For the projector with still projection provision, refer to 2.4-6 and 2.4-7 also.

## 2.4-2 Trouble-shooting

Trouble and cause	Remedy
1 Travel ghost (1) Improperly positioned shutter (Improper synchronization) (2) Remarkable wear of triangular cam	Readjust the shutter position.  Replace the cam.
2. Upper loop grows bigger, and loop restorer works continuously. (The causes concerning with this assy will be listed) (1) Too small projection of claw, displaced position of claw, or damaged claw (2) Worn or damaged spring ⑨ for frame cam (3) Worn or damaged spring ⑩ for frame cam (4) Worn cushion ⑪ of frame cam fulcrum (5) Improper pressing action of pressure plate. (6) Remarkably large friction against film	Repair or replace the part.  Check the action by pushing the tip of claw and replace the part if required.  Replace it. Replace it. Check and adjust.  Sometimes happens on new and humid prints.
3 Remarkably unsteady picture (1) any of (1) - (6) above 2 (2) Worn or improperly positioned triangular cam. (3) Too soft pressure of spring ⑨ of frame cam.	Refer to the above. Check that the screw is fastened tightly. Replace worn cam. Replace.

Trouble and cause	Remedy
(5) Defective motor (Remarkable vibration)	Replace or remove the cause of Vibration.
(6) Insufficient film loop	Readjust.
4 Inoperative mechanism with running motor	
(1) Insufficient tension of V-belt	Readjust.
(2) Improperly set V-groove pulley	Readjust.
(3) Damaged V-belt	Replace.
(4) Worn or damaged worm or worm wheel	Replace.
5 Remarkable mechanical noise	
(1) Refer to (1) - (6) of ③.	Refer to (1) - (6) of ②
(2) Deformed shutter	Replace or repair.
(3) Out of oil within case	Lubricate.
(4) Too much projection of claw ⑤	Readjust.
(5) Improperly intermeshed gear or worm	Readjust or replace.

#### 2.4-3 Disassembly

The replacement of belt can be done by removing worm ⑬.

To remove this assy from frame, proceed as follows:

- (1) At first, pull out pressure plate assy ④, ⑪, ⑫ in Fig.1  
Then, remove back cover, and loosen four motor setting screws a little.
- (2) To remove the whole mechanism, loosen two screws which fix the bracket at upper and lower point.
- (3) Loosen fixing screws, and remove worm ⑬ from shaft.
- (4) Loosen two setting screws, and remove pulley ⑭ from shaft.
- (5) Remove four screws to remove cover ⑮.
- (6) Loosen screw ⑯ at fulcrum point, to remove frame cam (lever sub-assy) ⑰.  
Note: Remember the assembling sequence and position of slider ⑪, spring ⑩ etc.
- (7) Loosen collar ⑱ at the back of bracket, and remove shaft assy (face cam ⑦, triangular cam ⑥, shaft ⑧, etc.) from bracket ④.
- (8) As for the aperture plate, framer knob, etc., see 1.6.
- (9) Remove other parts as required.

#### 2.4-4 Checkings

- (1) Damaged, worn or deformed claw should be replaced.
- (2) Check the bearing by holding its inner race and rotate the outer race.

(3) Worn or damaged gear should be replaced. Gears with remarkable backlash should be replaced. Both of worm and wheel should be replaced. (Recommendable backlash is 0.02 - 0.1mm)

(4) Worn slider (11), triangle cam or phase cam should be replaced.

Note: The position of triangular cam against the shaft affects remarkably to the stroke of claw tip. It also affects to the noise and certainly for film transportation. Therefore, to make the assembling work perfect, it is recommendable to employ a special assembling jig with stroke measuring tool to obtain specified stroke. When it is difficult, order the work to a skilled workman, and carefully check and adjust the film transportation, with raw film and test films. It is recommendable to use the complete assy prepared by the factory.

(5) Worn sliding pin (19), fixed on frame cam, should be replaced.

(6) Dirty grease should be removed and new grease should be lubricated.

(See 2-4, 5 (5))

(7) Worn or deformed spring (3), for fixing pressure plate assy, should be replaced

(8) Deteriorated spring (20) should be replaced.

(9) As for aperture plate and other related parts, refer to 1.7.

#### 2.4-5 Assembling and Adjustment

The assembling is proceeded in the reverse order of disassembly.

The followings should be observed.

(1) To assembling triangular cam on the shaft, refer to Note in 2.4-4 (4).

(2) When assembling the shaft to bracket (4), feed grease of good quality to bearing (2), (the same as fed to cam case), and on the end of shaft, a shield bearing should be used.

(3) The rotation of shaft assy must be smooth, and the thrust backlash must be minimized.

(4) Assemble the claw to the frame cam so that the ruby side (in case of ruby lined claw) is placed downward, and the claw must be projected from aperture plate by 0.8 - 0.9mm, for both of the upper and lower position. (Jig should be used for correct setting.)

On the completion of assembling, place framer knob in the middle point of adjustable range. Then applying SMPTE's picture steadiness test film, check that the picture frame is in the correct position approximately.

20

The adjustment can be achieved by correcting the position of claw or aperture plate, or by the setting position of the plate (13 of Fig.1) which is connected with frame knob shaft at the back side of aperture plate.

Within cam case, especially the contacting part of triangular cam should be filled with 20 cc of grease (Shell Albania EP #1 Extra with special addition agent.) The felt pad attached to the frame cam should be infiltrated with viscous oil (for example Multi-way #150).

Note: Excessive oiling is not good because the leaked oil may wet the back side of aperture plate or other parts. Be sure to make test running and check for oil leakage. Wipe off the leaked oil. Piece of felt (23) is oil stopper, and never attempt to lubricate it.

ascertain that there is no bend in the shutter. Bind the shutter in the position so that it does not touch any other surrounding matter. Determine its rotational position so that the minimum ghost can be obtained.

When the assy is fixed to the frame, pay attention to the proper backlash between worm and worm wheel, and grease the two parts. Pay attention to the tension of belt, and fix the motor tightly. (See 2.2-5)

After the pressure plate is mounted, thread a film and inspect the result of the assembling.

#### Still Projection Mechanism

The projector with the provision of still projection includes the parts shown in Fig.7 instead of the parts shown in Fig.6. In this type, the mechanism is driven by motor through V-belt, and a conical friction clutch (2) is inserted between pulley and main shaft (8). The change lever (3) moves metal screen and heat absorbing filter (4), for still projection.

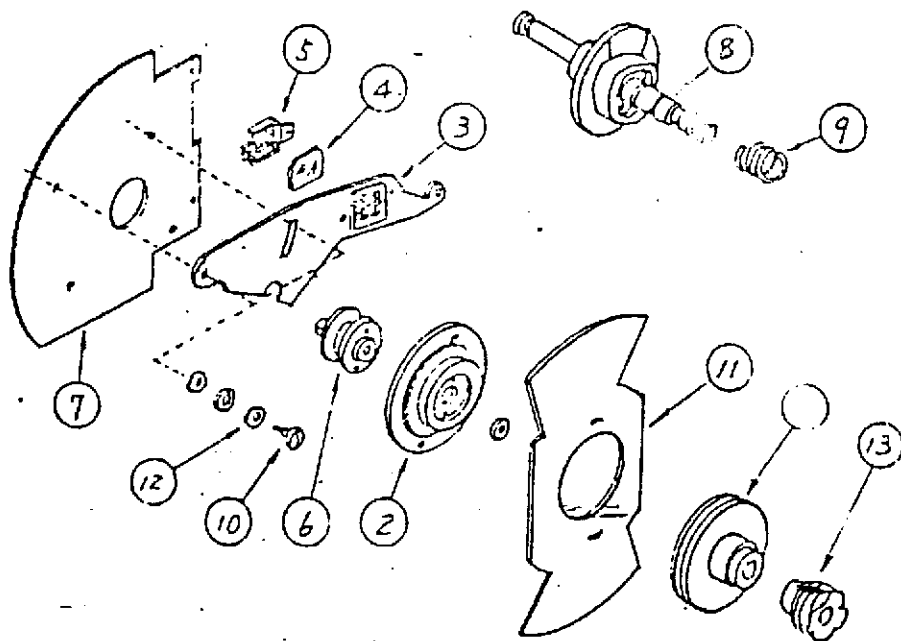


FIG. 7

## 2.4-7 Trouble-shooting (For only still projection components)

Trouble and cause	Remedy
<p>1. Inoperative film transportation in RUN position.</p> <p>(1) Poor coupling of clutch</p> <p>(a) Worn clutch surface or oil-coated surface (1) (2)</p> <p>(b) Worn or damaged compression spring (9)</p> <p>(c) Improperly assembled clutch, such as unsmooth coupling (6)</p> <p>(2) Insufficient tension of motor belt</p> <p>(3) Improper transmitting system</p>	<p>Replace or clean the surface.</p> <p>Replace.</p> <p>Replace the part. Ream or polish the surface.</p> <p>Readjust the tension.</p> <p>Check and adjust.</p>
<p>2. Film is burnt or deformed in STILL position. (Still projection longer than 30 second may cause deformation or discoloration)</p> <p>(1) Broken heat filter (4)</p>	<p>Replace.</p>
<p>3. Non-stop in STILL position</p> <p>(1) Worn clutch (1) (2)</p> <p>(2) Worn or deformed lever (3)</p> <p>(3) Loose screw for lever fulcrum or loose screw for stopper (10)</p> <p>(4) Lever is not placed at STILL position correctly. (Operational mistake)</p>	<p>Replace.</p> <p>Replace.</p> <p>Tighten the screw.</p> <p>Move the lever to the lowest position correctly.</p>

## 2.5 Sprocket Driving Mechanism

### 2.5-1 General

As shown in Fig.3, the lower sprocket shaft, take-up reel arm fulcrum, and upper sprocket shaft are driven by two belts on toothed pulley of worm wheel shaft. At the time of threading, sprocket rotation is free on its shaft, and at the time of projection, they are connected. For this purpose, the sprocket shaft has claw clutch which is controlled by the control switch through a lever mechanism.

Fig.8 shows the schematic drawing of the mechanism.

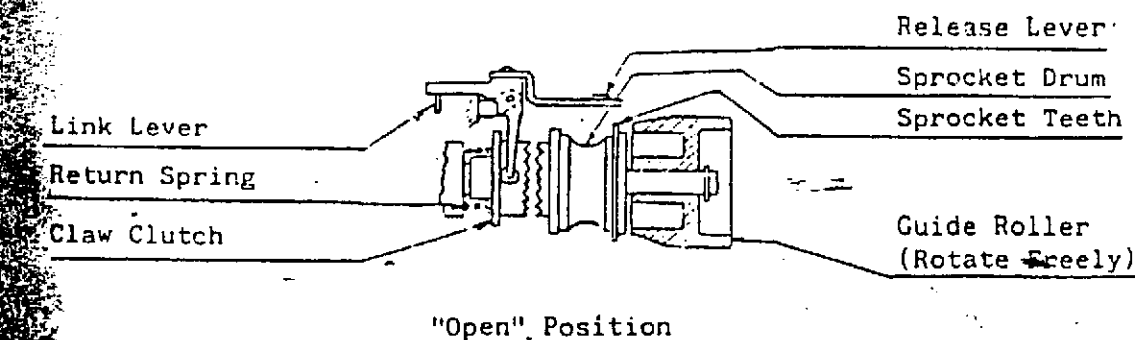
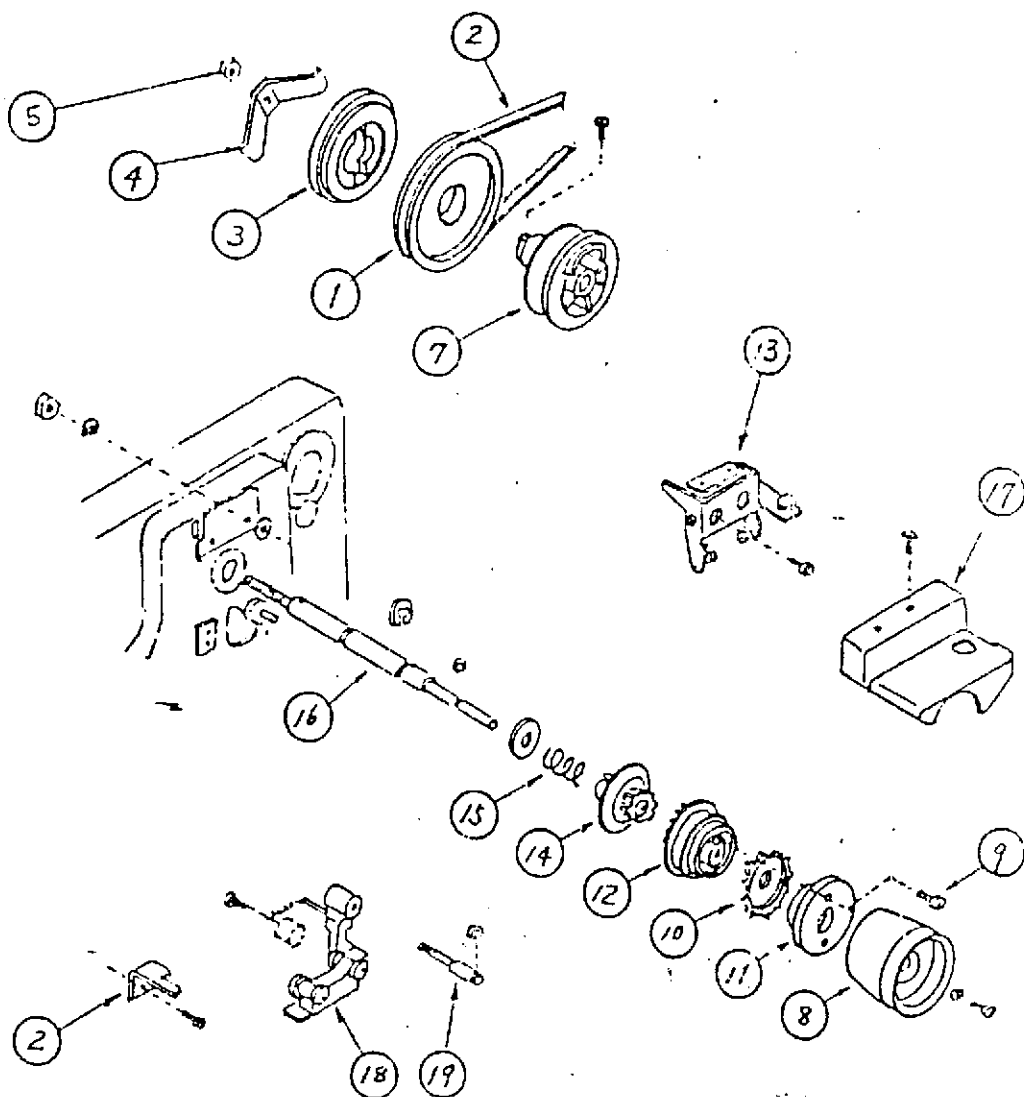


FIG. 9 (Upper)



Pulley ① shown in Fig.9 can be slipped-against the upper sprocket shaft when the over load is imposed on the shaft. This slip mechanism prevents the "skipping" of toothed belt against toothed pulley due to the temporal over load which may be encountered in the start of rewinding.

Trouble and cause	Remedy
Faulty transmission mechanism	
1) Improper tension of toothed belt	Adjust the tension by means of tension roller.
2) Worn toothed belt	Replace.
3) Worn or damaged toothed pulley or tension pulley	Replace.
4) Worn worm wheel or worm	Replace.
	(Be careful to keep grease in it.)
2. Sprocket does not transport film.	
1) Caused by above 1.	See above 1.
2) Improper position of stopper of sprocket shoe.	Readjust. (The clearance between sprocket shoe roller and sprocket drum should be twice film thick.
3) Loose sprocket teeth holder	Tighten the screws.
4) Improper coupling of clutch	Check the coupling of movable part of clutch.
	Readjust or replace as required.
3. Insufficient take-up tension	
1) Loose tension of V-belt ②	Readjust. Tension should be minimized as required.
2) Oil clinged cork of slip plate ③	Clean both of the cork surface and pulley side, to remove oil.
3) Weak setting of adjust spring ④	Readjust to strengthen it as required.
4. At the start of rewinding, skipping of toothed pulley occurrence.	
(The start with large diameter take-up roll is liable to the skipping. When a large take-up roll is to be started, assist the start of take-up reel with your hand.)	

## 2.5-3 Disassembly

To disassemble the back side of frame, proceeds as follows:

- (1) Loosen the setting screw of tension roller assy, and loosen the tension of toothed belt. (See Fig.3)
- (2) Remove C-washer at the shaft end, and remove tension roller or worm wheel. (See Fig.3)
- (3) For the upper sprocket shaft, loosen nut ⑤ to remove spring ④ and slip plate ③.  
Then, loosen the setting screw to remove pulley ① and toothed pulley ⑦.
- (4) For the lower sprocket shaft, loosen the setting screw to remove toothed pulley.



For the upper and lower sprocket on the operation side of frame, after the cover removed, proceed as follow.

- (5) Loosen the screw on the shaft to remove guide roller (8) for threading.
- (6) Loosen two screws (9), to remove sprocket teeth (10) and its holder (11).
- (7) Pull out C-washer to remove sprocket drum (12).
- (8) Loosen two screws, to remove clutch release lever assy (13). Thus, claw clutch (14), release spring (15), shaft (16), etc. can be removed.

#### 5-4 Checkings

- (1) Check the tension of belt, degree of wear, surface condition of toothed pulley and its degree of dirt, the condition of tension roller, etc. (Be careful not to let run out of grease on worm and worm wheel.)  
If any evidence of abnormality is detected, disassemble and check, and replace the remarkably worn part.
- (2) Check the cork part for slip action, if any abnormality is detected, disassemble and check part. If required, clean it.
- (3) Check for the smooth connection and separation of clutch.
- (4) Check for the clearance between sprocket drum and sprocket shoe roller, and if required, readjust it.

#### 5-5 Assembling and adjustment

Assembling should be proceeded in the reverse order of disassembly.

Remember the following:

- (1) Assemble the parts conforming to the description in "Checkings".
- (2) Lubricate every rotational part before assembling. Lubricate one or two drop of good machine oil for tension roller, and coat grease on worm wheel and sprocket shaft.
- (3) Lubricate one or two drops of good machine oil for the movable clutch assy, threading guide roller, etc., before the assembling. Excessive oiling is not good. Excessive oil should be wiped off.
- (4) Don't lubricate for slip cork assy, V-belt and its pulley. Oil or grease on these parts should be removed completely by wiping or cleaning.
- (5) No lubrication is needed on the outside of toothed pulley and toothed belt.
- (6) On completion of assembling, ascertain that the screws are fastened tightly, C-washer is correctly inserted and other parts are properly assembled.

#### 2.6 Reel Arms

##### 2.6-1 General

As shown in Fig.3, the reel spindles are driven through each of pulley (at fulcrum shaft where it is installed) and roller clutch. The take-up reel shaft is driven

only in time of FORWARD, and feed reel shaft is driven only in time of REWIND, by motor.

The take-up reel shaft has a slip mechanism which controls the transmitting power according to the weight of reel with film, thus the film take-up tension is kept in a constant value approximately.

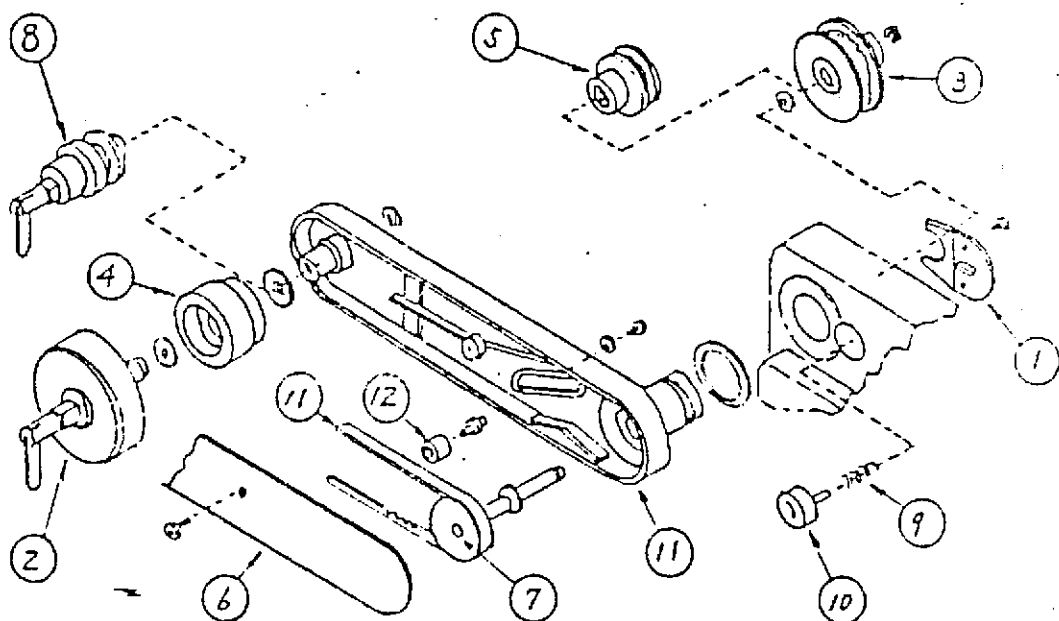


FIG. 10

## 2.6-2 Trouble-shooting

Trouble and cause	Remedy
1. Arm drops by its weight when push button is released.	Replace it.
(1) Worn leaf spring ①.	
2. Insufficient take-up tension of projected film	
(1) Worn slip plate or excessive oiling	Clean the inside of outer ring or replace reel spindle ②.
(2) Insufficient tension of belt within take-up reel arm	Readjust.
(3) Defective roller clutch	Replace toothed pulley ③.
3. Excessive take-up tension of projected film	Lubricate one drop of oil to i or repalce pulley ④.
(1) Run out lubricant of inner ring	
(2) Damaged slip plate	
	Replace reel spindle ②. Replace slip plate for tempora remedy..

#### 4. Insufficient tension of rewinding film

- (1) Insufficient tension of belt within feed reel arm.
- (2) Insufficient tension of V-belt within back cover
- (3) Oil wetted V-belt within back cover
- (4) Run out of oil in reel spindle

Readjust. (Be not excessive.)

Readjust. (See Fig.9.)

Clean the pulley and belt.

Lubricate slightly from C-washer of back side.

#### 2.6-3 Disassembly

- (1) After the tension of toothed belt and V-belt are noted, loosen the tension roller for toothed belt.
- (2) Remove C-washer from the fulcrum of arm, to remove toothed pulley (3) or V-pulley (5) from each shaft.
- (3) Remove C-washer from the shaft end of each reel arm.
- (4) Remove cover (6) from each arm.
- (5) Remove take-up reel sprindle (2).
- (6) Remove pulley (4), pulley shaft (7), feed reel spindle (8) from each shaft.

To remove arm itself, instead of the procedure (3) to (6), proceed as follows:

- (7) Loosen two screws to remove leaf spring (1), spring (9), and push button (10).
- (8) Remove reel arms (11) from frame.

#### 2.6-4 Checkings

- (1) Check rotational parts for wear, breakage, crack, etc. If any defect is found, replace the part.
- (2) Check belt for no crack and deterioration, if any defect is found, replace part.
- (3) The cork (slip plate of take-up reel spindle) with remarkable wear, peeled surface, dirt or damage should be replaced together with shaft.  
(In this projector, the cork is stucked inside of the outer ring and reformed to obtain precise inner diameter. Therefore, replacing cork itself only is not recommendable, excepting temporal remedy because there is little hope of perfect function.)
- (4) Check the lubrication of feed reel spindle and the fulcrum of feed reel arm. If required, lubricate it with grease ( or good machine oil).

Assembling should be proceeded in the reverse order of disassembly.

Remember the following:

- (1) The tension of belt within reel arm should be proper. Excessive tension should be avoided.

Notice: Each of toothed pulley and V-grooved pulley has needle bearing and roller clutch pressed in. If roller clutch is inserted in the wrong direction, the result will be the wrong direction of locking against shaft. When the pulley is replaced, check this point also.

- (2) Cover must not be touched with pulley.

- (3) The tension of V-belt of the upper sprocket shaft should be as loose as permissible. Tight tension gives sufficient and stable rewinding tension of film. But, when a small size reel (for example 50m reel) is used, the heavy feeding tension of film may cause difficulty in threading. The tight belt tension, however, gives no other problem.

### 3. Link and Concerned Mechanism

#### 3.1 General Description

Three stepped cam which is provided at the end of control switch, through link and lever, controls each component to take proper position, and to achieve respective performance for threading, projection and rewinding.

Fig. 11 shows construction.

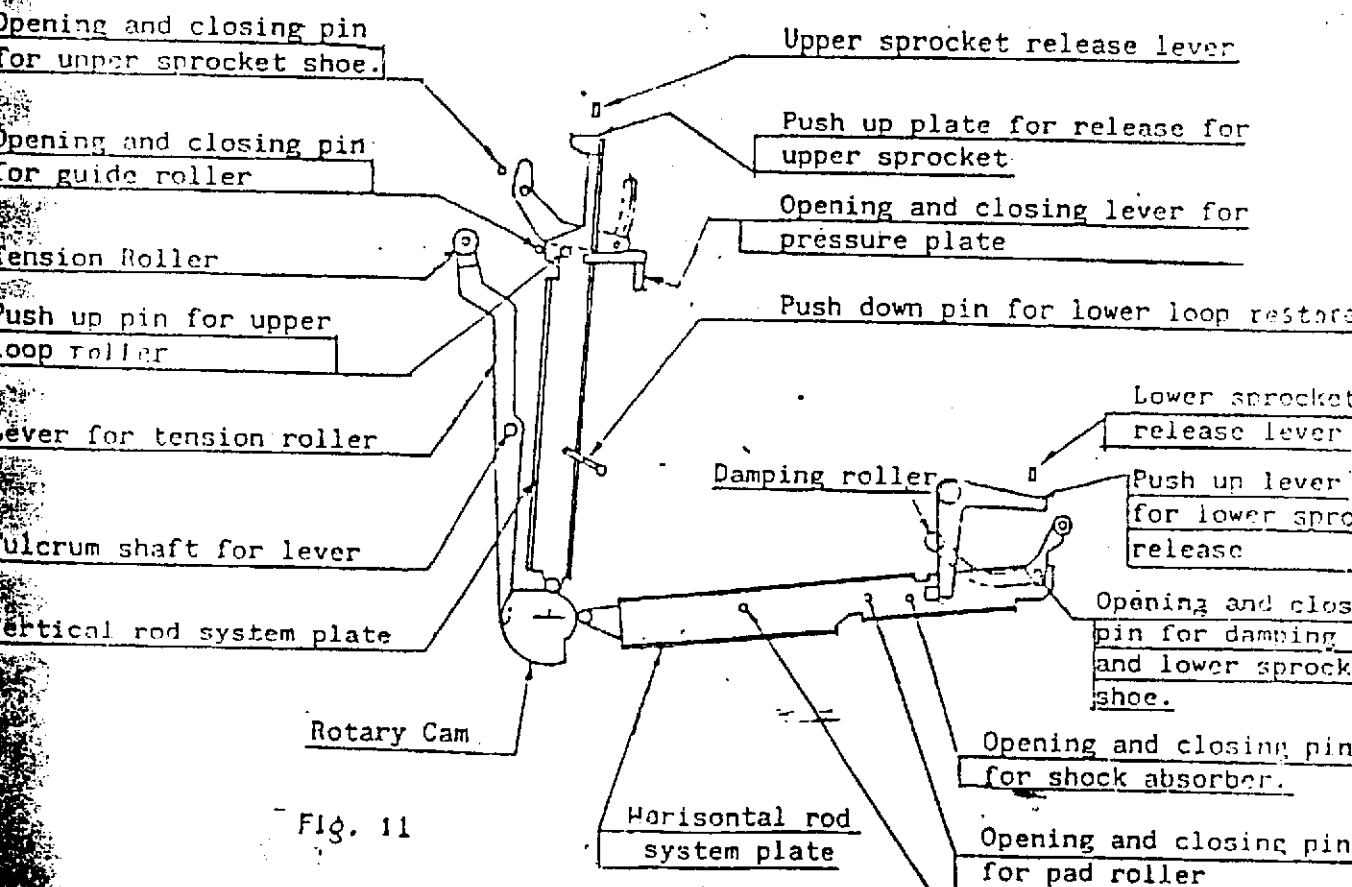


Fig. 11

## 2. Horizontal Link

In the OPEN position of control switch, the arms for friction roller, pad roller, shock absorber, damping roller and lower sprocket shoe, which are connected to the horizontal link, will open; and the lower sprocket drum is separated from driving system, to be acceptable to film threading.

In the SET position of control switch, the arms excepting the arm shown in Fig.12, are placed in the position for projection. Only the pad roller shown in the figure is retained at the place 1mm apart from sound drum.

In the FOR position of control switch, it contacts with sound drum.

In the REW position of control switch, the arms will be placed at the same position as in the OPEN position.

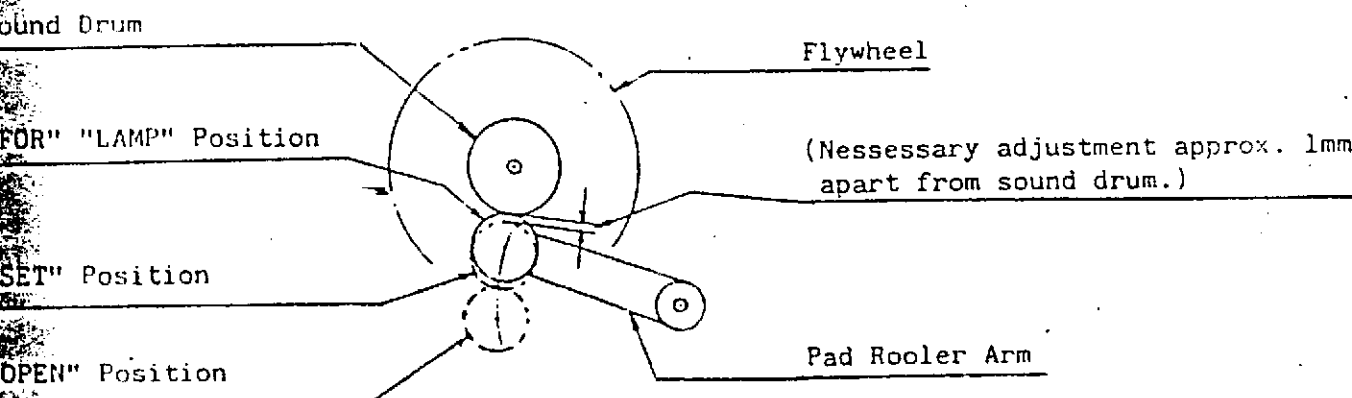


Fig.12

## 3. Vertical Link

In the OPEN position of control switch, the lower loop restorer is pushed down, the pressure plate is opened, the upper sprocket shoe is opened, its drum is separated from driving system, and the guide roller at the entrance to sprocket assembly is pushed to open.

Until the control switch approaches to FOR position through SET position, each of the above parts returns to the position for projection.

In the REW position of control switch, all is same as in the OPEN position.

## 3.4 Lever for Tension Roller

Only in the REW position of control switch, this lever moves to give the necessary tension of V-belt between the upper sprocket shaft and feed reel arm fulcrum shaft. Thus, no excessive tension is required to pull out the film, and required take-up tension for rewinding is ensured.

### Control Switch

Important switch controls motor circuit and lamp circuit, and also actuates sets of linkages and one set of levers.

switch has a three stage cam at the end of shaft, and it is connected to the mentioned link and lever. The mechanical relations (that is, setting position between them) is important. Improper setting may cause improper displacement of link lever, or may cause sluggish turning action of knob.

### Lower Loop restorer

the OPEN position of control switch, the lower loop restorer arm is pulled in to the position for threading. At the time of projection, it takes the position inside of film path and remote from film.

the projection, if the film loop of this part is shorted to touch the adjacent detecting roller, it will displace the roller slightly, then the rotation of the sprocket shaft will move the lower loop restorer arm through the internal link mechanism, thus the lost film loop will be restored.

the arm is displaced to its lowest position, the link connection is released, all parts will be automatically reset.

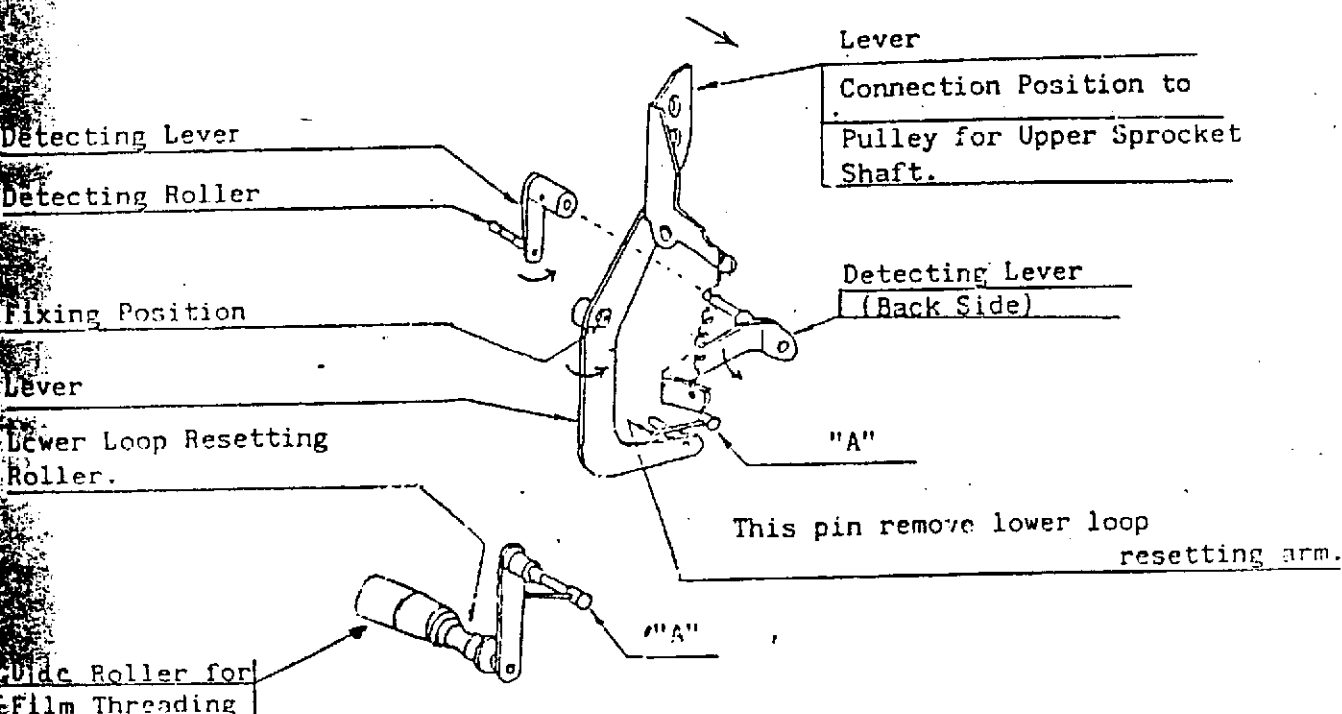


Fig.13

Trouble and cause	Remedy
<p>1. Sluggish control switch</p> <p>(1) Improperly positioned switch</p> <p>(2) Run out of lubricant on switch cam surface</p> <p>(3) Worn or damaged spring of switch</p> <p>(4) Run out of lubricant on movable part (link lever, etc.)</p> <p>(5) Foreign matter, such as screw or others, touching the movable part</p>	<p>Correct the position. If required adjust it applying jig. Tampering with it may result worse regul</p> <p>Grease the surface of cam, after t control panel removed.</p> <p>Replace the spring.</p> <p>Lubricate.</p> <p>Check and remove the cause.</p>
<p>2. Insufficient movement of link lever or arm</p> <p>(1) Improperly positioned switch</p> <p>(2) Loose link-fastening screw</p> <p>(3) Loose fastening-screw for switch-shaft cam</p>	<p>See above 1-(1).</p> <p>Tighten the screw.</p> <p>Tighten the screw.</p>
<p>3. Too small clearance between sound drum and pad roller in the SET position.</p>	<p>Adjust the clearance about 1mm as a standard. Adjust the position of stopper plate for pin on the horizontal link.</p>
<p>4. Inoperative loop restorer</p> <p>(1) Poor sensitive detector</p> <p>(2) Loop restorer works, but normal loop is not obtainable.</p> <p>(3) Faulty pull down mechanism</p>	<p>Check the cause and improve the faulty point. (Position of detecting roller, smoothness of bearing, stopper position, spring condition, etc.)</p> <p>See 2.4-2-2.</p>

## 8 Disassembly

1. Don't remove control switch excepting when it is just required, for the reason described in 3.5 and 3.7.1.
2. Prior to remove horizontal link, remove flywheel, fan case, motor control assy, etc. previously.
3. Prior to remove the lever for tension roller and vertical link, remove internal speaker, motor, pull down mechanism, etc. previously.
4. After the obstacles are taken away, links and levers can be removed easily. Be sure to note that how they are constructed, and the important points should be recorded. Disassembly should be limited within small part as required.

### 3.9 Checkings

- 1) Turn the control switch to ascertain that the arms and rollers are properly displaced and reset as controlled.
- 2) Remarkably worn roller should be replaced. Clean the surface dirt.
- 3) Ascertain that the clearance between sound drum and pad roller is about 1mm in the SET position. If it is measured less than 0.5mm, readjust it.
- 4) Lubricate sluggish roller. If required, replace it.
- 5) Cam surface of control switch must be lubricated with grease. If required, lubricate it.
- 6) The setting of cam on control switch must be fastened tightly.
- 7) If run out of oil is detected at sliding or rotating part such as link lever etc., lubricate it.

### 3.10 Assembling and adjustment

- 1) For the notices for setting position of control switch, refer to 3.7.1.
- 2) To assemble link or lever to the frame, be careful for the relation to the concerned parts. After the assembling, ascertain that arms and concerned parts are properly moved by operating control switch.

## 4 SOUND SYSTEM

### 4.1 General Description

Model QL-100 is for optical sound reproduction only. Model QL-100M is for both of optical and magnetic sound reproduction, and either of optical or magnetic can be selected easily by selector knob.

#### 4.1-1 Optical Sound Reproduction

The sound signal recorded on film by means of variable area type or variable density type recording, is scanned by the light beam originated from exciter lamp. The variation of transmitted light is picked up as the variation of electric Current by a solar cell, and amplified by amplifier to operate speaker.

The exciter lamp is lit on DC in order to prevent hum noise and the light beam is condensed by cylindrical lens. The sound scanning point is at the 26th frame ahead from the corresponding picture aperture.

The S/N of optical sound reproduction depends upon not only amplifier itself but upon the grain of emulsion, dirt, uniformity of scanning beam, displacement of scanning beam, etc. The proper adjustment of scanning beam is very important.



are required.

- 1) 400Hz, 7000Hz signal level test film, and 3000Hz (or 3150Hz) flutter test
- 2) Buzz track test film
- 3) Level meter and oscilloscope
- 4) Distortion meter
- 5) Flutter meter
- 6) Multi-frequency test film

#### 4.1-2 Magnetic Sound Reproduction

Sound signal magnetically recorded on film is picked up as the variation of electric current, which is fed to amplifier and reproduced as sound by loudspeaker. The magnetic sound head touches the film at the point separated from picture aperture by 28 frames on film. A roller presses the film from back side toward magnetic head, to keep good contact.

The magnetic sound reproduction is sensible to the magnetic flux induced by motor transformer and electrical wirings, so that they are carefully positioned and shielded. And a backing coil is placed close to the head and connected in series with the winding of magnetic head. By adjusting the direction of backing coil, the stray flux around can be cancelled to obtain the best S/N.

The relation between magnetic <sup>head</sup> and film is very important, and requires more minute adjustment than for optical sound reproduction.

The materials required for the adjustment are same as that for optical sound reproduction, excepting test films are recorded magnetically.

#### 4.2 Optical Reproduction Assy

##### 4.2-1 General Description

The light beam from exciter lamp is focussed on the sound track of running film. The variation of light beam is received by solar cell and transduced as the variation of electric current. In the figure, ① is exciter lamp (Type KE070, Rating 6V -1A), ② is sound lens, ⑦ is solar cell, ④ and ⑤ are pin and screw for sound lens setting.

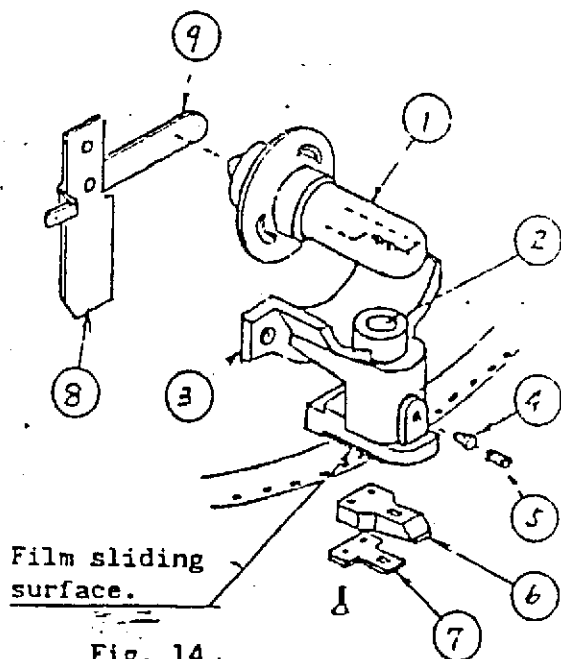


Fig. 14

Trouble and cause	Remedy
1. No sound (1) Defective exciter lamp (2) Defective solar cell (3) Broken wiring (4) Poor contact of contactor ⑨ (5) Faulty exciter lamp circuit, faulty amplifier or defective speaker.	Replace. Replace. Check and repair. Correct. Refer to "Amplifier".
2. Low level of sound (1) Improperly positioned scanning sound track (2) Defective exciter lamp (3) Dirty sound lens top (4) Out-focussed or improperly positioned sound lens. (5) Defective solar cell (6) Defective amplifier (7) Remarkably low line voltage	Adjust the position of friction roller. Replace. Clean it with air brushing. Correct it. Replace. See the notes for amplifier. Improve the power supply, e.g. use a step up auto-transformer.

## 4.2-3 Disassembly

- (1) Sound lens ② and its holder ③ should not be removed, as a rule. Solar cell can be replaced by removing pad roller arm. (For QL-100M, O-M select switch must be removed also.)
- (2) When sound lens ② or sound lens holder ③ is removed, focussing of sound lens is required after the assembling (See 4.2-5).

## 4.2-4 Checkings

- (1) Inspect the film sliding surface for dirt. If required, clean it.
- (2) Clean the sound lens top and the face of solar cell with air brush.
- (3) For other trouble remedy it referring to 4.2-2.

## 4.2-5 Assembling and Adjustment

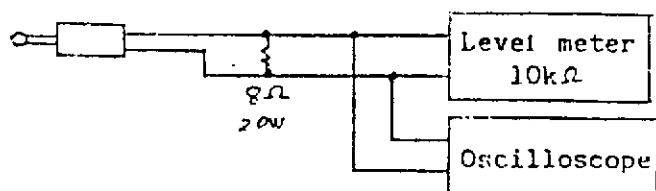
Sound lens should not be readjusted. When if the adjustment is indispensable proceed as follows:

- (1) Employ 7000 Hz signal level test film, thread it so that the film base faces toward the sound lens. (Refer to the note below.)

Connect 8 $\Omega$  Dummy, level meter (10k $\Omega$  terminal) and oscilloscope, all in parallel, at the speaker terminal.

Place the volume control about middle, and treble tone control at maximum. Loosen the setting screw so that the sound lens can be moved. Start the film and move the lens back and forth, and rotate it, to obtain the maximum output level. Fasten the lens setting screw tightly. In this process, be careful not to let the output level down by fastening the setting screw.

(The lens should be moved applying special tool engaged with the lens. The tool other than specified if engaged, may cause the damage of lens.)



#### Stabilizer, Friction Roller and Damping Roller

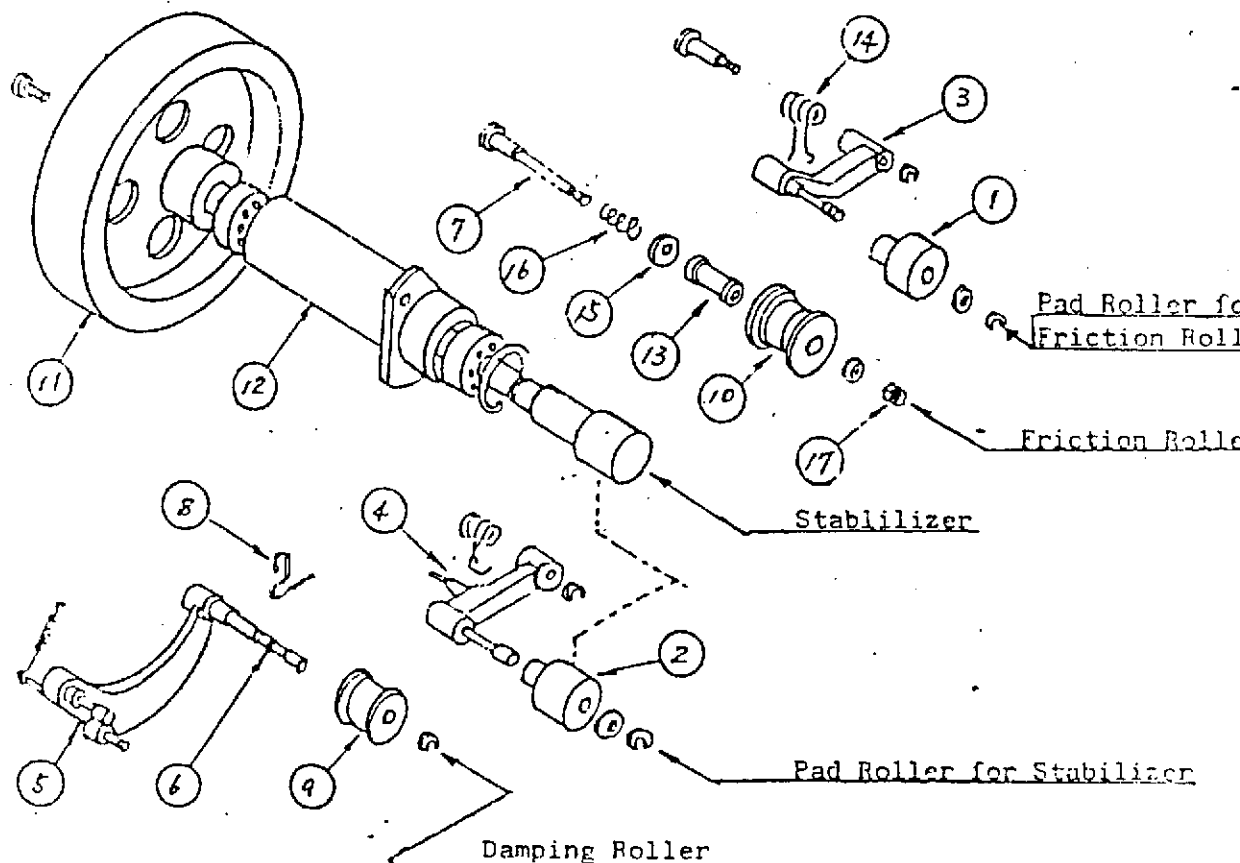


Fig. 15

#### 4.3-1 General Description

Intermittent motion is required for picture projection, but for the film passing through the sound scanning part, absolute uniformity of speed is required. And it is specified that the sound is displaced from the corresponding picture by 26 frames ahead (in case of optical sound), or 28 frames ahead (in case of magnetic sound) in the film travel.

This assy is designed to prevent the non-uniform motion because of the intermittent mechanism and sprocket, and the absolutely constant speed of film assures the sound reproduction free from wow and flutter.

#### 4.3-2 Trouble-shooting

Trouble and cause	Remedy
1. Zig-zag travel (or lateral waving) of film	
(1) Non-parallel contact of pad roller	Check for the following.
• Defective or worn pad roller ① or ②	Replace it.
• Deformed pad roller arm ③ or ④, or deformed damping roller arm ⑤	Replace it.
• Bent roller shaft ⑥, ⑦, etc.	Replace it.
(2) Excessive pressure of pad roller	Correct the pressure.
(3) Dirty roller surface.	
2. Remarkable flutter	
(1) Improperly positioned setting spring ⑧ of damping roller, or worn or damaged spring ⑧	Correct or replace.
(2) Deformed or eccentric stabilizer drum, or non-smooth rotation of shaft	Replace.
(3) Foreign matter contacting flywheel	Remove the cause.
(4) Worn roller ①, ②, ⑨ or ⑩, or non-smooth rotation, or dirty surface of them	Check and clean, lubricate or replace.
(5) Remarkable vibration	Replace rubber leg, or locate and remove the cause of trouble.
3. Improperly adjusted lateral position	
(1) Improperly positioned roller ⑩	Readjust. (See 4.3-5(1))
4. Improperly connection with control switch	
(1) Improper connection to link (Improper assembling)	Check and correct.

#### 4.3-3 Disassembly

- (1) Remove pad rollers (1) and (2), and damping roller (9) from the control side.
- (2) Remove pad roller arms (3) and (4).
- (3) Don't remove friction roller (10) carelessly. When it is disassembled, the lateral adjustment to determine the position of roller (10) is required after assembling (See 4.3-5 (1)).
- (4) Remove flywheel (11) from the back side.
- (5) If required, remove stabilizer (12).
- (6) Before the removal of damping roller arm, remove horizontal link (See Fig.

#### 4.3-4 Checkings (Refer to 3.2 and Fig. 11)

- (1) Check for the movement of rollers by transferring control switch.
- (2) After a film is threaded, remove lamp house cover, and place the control switch in the FOR position, and check the movement of film and the rotation of rollers.
- (3) If non-smooth roller rotation is detected, lubricate it, or replace it as required.
- (4) Clean the dirt of roller. Oil or grease on the surface should be wiped off completely.
- (5) Remarkably worn roller should be replaced.
- (6) Broken or worn spring should be replaced.

## Assembling and Adjustment

to "Checkings" of parts.

ral adjustment should be proceeded as follows: .

energize the projector. Set the volume control a little up from the middle point, and tone control at the middle point.

Thread a buzz track test film, and start the projector to run the film.

Adjust the friction roller setting nut, to adjust the roller position so as to either of 300Hz or 1000Hz is not reproduced.

Lock the nut with locking paint.

## Magnetic Sound Reproduction Assy

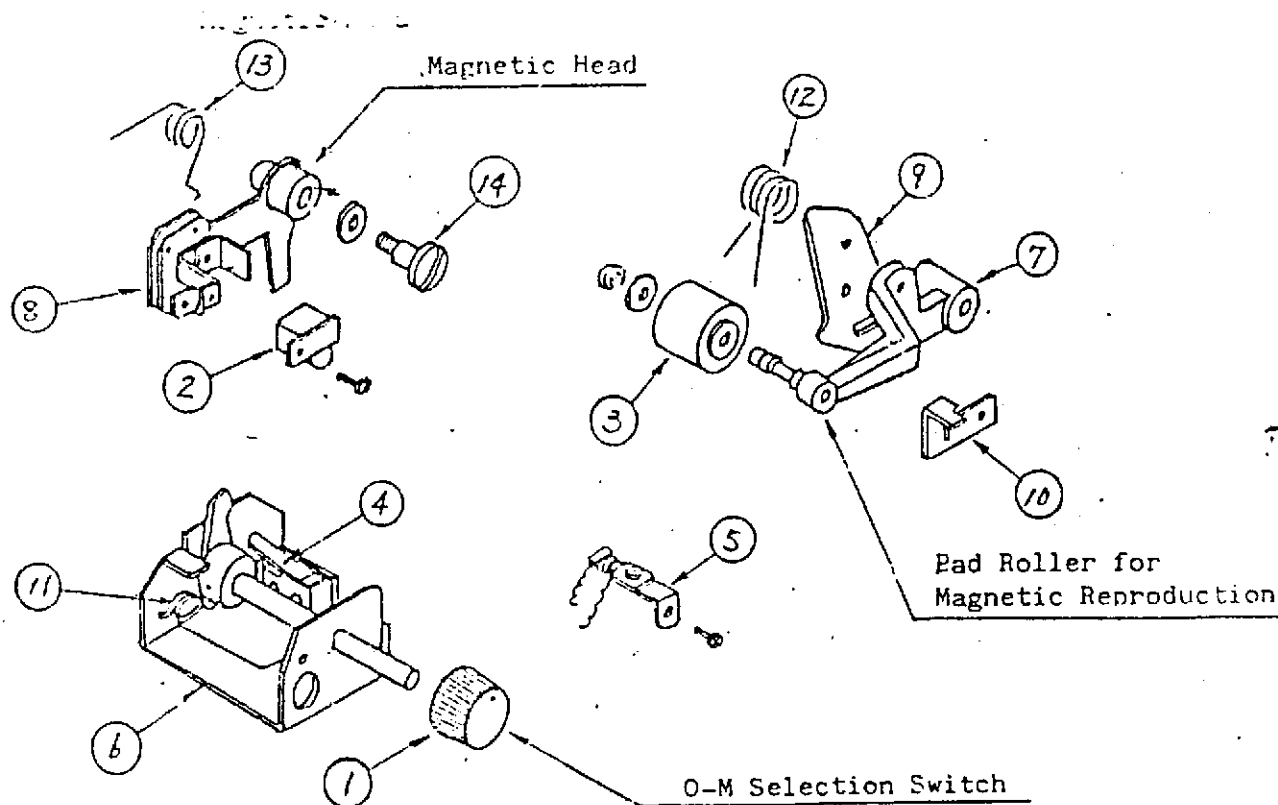


FIG. 16

The selection for optical sound reproduction or magnetic sound reproduction is performed by O-M selector (1). When the selector is turned to MAG, the film will be squeezed between magnetic head (2) and pad roller (3), and at the same time, micro-switch (4) changes the amplifier circuit, in the SET - LAMP positions. The pressure of magnetic head is set at the value as small as required. High precision is required for the relative position of magnetic head against sound track. Especially, the angle of head gap against the guide edge of film is very important. Backing coil (5) is on the left of O-M selector knob, and it is adjusted and locked at position where the least hum noise is reproduced.

## 4-2 Trouble-shooting

Trouble and cause	Remedy
1. No sound (In magnetic sound reproduction)	
1) Improper position of O-M selector knob	Correct the position of selector.
2) Defective magnetic head i.e., broken head	Replace it.
3) Poor connection of circuit	Check and repair.
4) Remarkably improper adjustment of sound arm	Readjust.
2. Remarkable wow and flutter	
1) Improper stopping position of pad roller arm	Correct the position.
2) Defective pad roller	Replace it.
3. Remarkable Hum	
1) Displaced position of backing coil	Adjust S/N with measuring instruments employed.
4. Bad sound quality (Lack of treble tone)	
1) Worn magnetic head	Replace and readjust.
2) Improperly adjusted magnetic head	Readjust. (With great care).

## 4-3 Disassembly (Refer to 4.4-5)

- 1) Remove pad roller arm, and then, remove pad roller.
- 2) Remove O-M selector (6), and if required, remove micro-switch (4), spring (11) etc.
- 3) When magnetic head is to be replaced, remove it.
- 4) Head carrying plate (8) should not be removed unless it is indispensably required. If it is required, remove (3) in Fig.14 before the removal of (8).

#### 4.4-4 Checkings

- (1) Checking the movement of parts by turning the control switch and O-M selector.
- (2) When non-smooth rotation of pad roller detected, lubricate or replace it, if required.
- (3) Dirt on pad roller should be cleaned. Oil coat on roller surface should be removed completely.
- (4) Broken or worn spring should be replaced.

#### 4.4-5 Assembling and Adjustment

Disassembly, replacement and adjustment of magnetic sound head should be performed with great care. Never attempt to make these work without measuring instruments and plenty time required to accomplish the work.

- (1) The magnetic sound head should not be tampered. The adjustment of it affects the frequency response.
- (2) Never tamper with the backing coil unless absolutely necessary, to keep good S/N and minimum hum.

#### 5 Amplifier

##### 4.5-1 General Description

The amplifier magnifies the signal of sound track and feeds it to speaker.

To obtain the sound of good quality, the exciter lamp is lit on pure DC power with ripple removed.

The amplifier is energized by double power supply system for simplification.

Large IC-employed amplifier is trouble free, stabilized, and of good frequency response. IC-Q1 is composed of two amplifier circuit systems, and either of them is selected by O-M selector for optical or magnetic sound reproduction.

The tone can be separately controlled for bass and treble. The amplifier output is 25W maximum.

IC-Q1	Equalizer voltage amplifier	VR1	Bass control
IC-Q2	Voltage amplifier	VR2	Treble control
IC-Q3	Power amplifier	VR3	Volume control
Tr-Q4	Stabilizer	VR4	Volume control

##### 5-2 Trouble-shooting (Refer to 4.2-2, 4.3-2 and 4.4-2)

Trouble and cause	Remedy
(1) Inoperative exciter lamp (Microphone is operative.)	Replace (Average life is 300 hr.) Correct the earth
(1) Broken exciter lamp	
(2) Non-grounded exciter lamp	



(3) Broken fuse FS3 (Refer to Note 1.)	replace it after the exciter lamp circuit is checked for no short circuit.
(4) Broken Q4	Replace it.
(5) Broken diode (D7)	Replace it.
(6) Poor contact of socket	Repair.
2. Inoperative exciter lamp (Microphone is not operative also.)	
(1) Non-grounded amplifier	Repair.
(2) Defective power transformer	Replace it.
(3) Defective connector of amplifier power transformer.	Repair.
3. No sound reproduction (Microphone is operative.)	
(1) Improperly positioned O-M selector	Correct the position.
(2) Inoperative exciter lamp	Refer to above 1.
(3) Defective solar cell	Replace it.
(4) Defective magnetic sound head	Refer to 4.4-2.
(5) Defective Q1 for magnetic sound reproduction	Replace it.
4. No sound reproduction (Microphone is inoperative, and exciter lamp is working.)	
(1) Broken FS2	Replace after the power supply circuit is checked for short circuit.)
(2) Defective Q1 for optical sound (Refer to Note 2.)	Replace it.
(3) Defective Q2 or Q3.	Replace (Check the voltage of each part.)
(4) Faulty operation of O-M selector	Adjust, or replace the switch.
5. Remarkable distortion of sound	
(1) Improper voltage of each part	Check and repair.
(2) Defective Q1 or Q2 (Voltage of each part is normal.)	Replace it.
6. Lack of treble range of sound	
(1) Improperly positioned sound lens	Readjust. (Refer to 4.2-5.)
(2) Foreign matter accumulated on magnetic head	Clean the head.

Worn magnetic head

Defective part within VR2 tone control circuit

Low sound level

Low power supply voltage

Defective speaker

Defective Q1, Q2, or Q3

Dropped exciter lamp voltage

Displaced sound lens.

Foreign matter stuck on sound lens

Bad sound quality (with hum noise)

Lost lower film loop

Remarkable AC ripple in power supply

Defective capacitor C25, C26 or C16 within power circuit.

Defective capacitor C23 within exciter circuit

Remarkable noise

(Volume control VR3 at minimum)

Defective Q3

Defective speaker

Remarkable noise

(Noise can be faded out by VR3)

Defective solar cell

Foreign light hitting solar cell

Defective magnetic head

Replace it.

Replace defective part.

Improve the line voltage after the voltage checked.

Replace it.

Replace it.

Check the exciter lamp circuit.  
(Normal voltage is 4 - 4.5V DC.)

Readjust.

Clean it.

Correct the loop.

Replace part.

Replace it.

Replace it.

The cause is hinder than VR3.

Replace it.

Replace it.

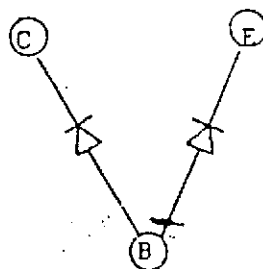
Replace it.

Locate the light and shade it.

Replace it.

Note 1: Easy method of testing transistor

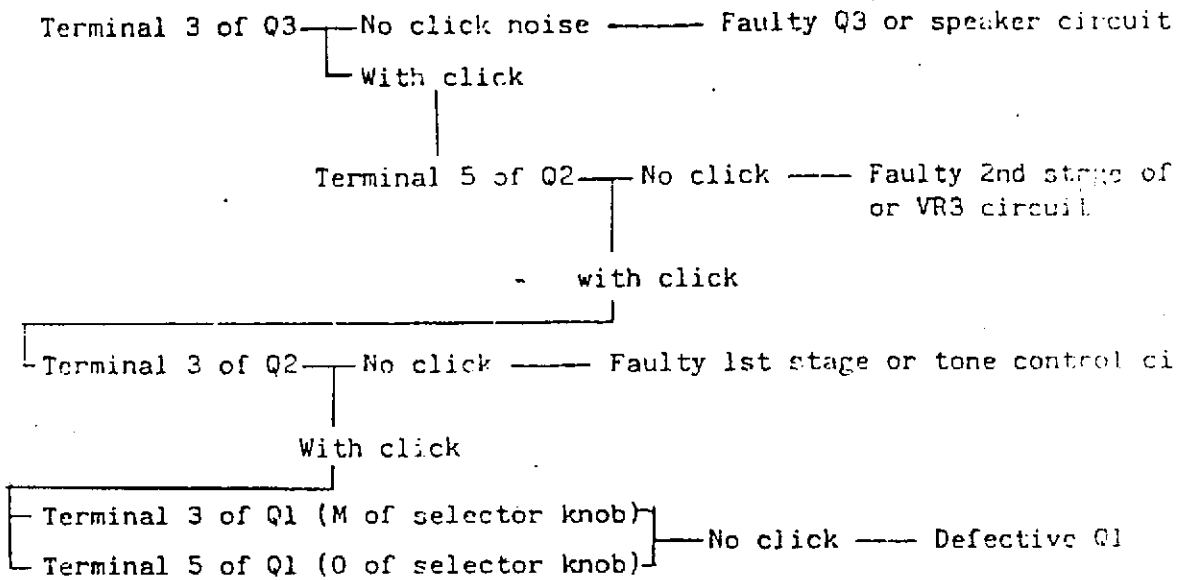
- Make the continuity test of diode characteristics with a circuit tester -



Note 2: Easy method of inspecting IC

- Touch the terminal of IC with a screw driver tip, then the level of click noise produced from speaker represents the operation of IC roughly.

In the connection diagram SC-1A810C237-02,



#### 4.5-3 Disassembly

- (1) Remove the volume control knob and tone control knob at operation side.
- (2) Remove flywheel at the back side.
- (3) Remove all connectors for transformer and amplifier.
- (4) Loosen two screws which fastening the amplifier.
- (5) Remove amplifier.

#### 4.5-4 Checkings

- (1) By removing the cover (control panel) and flywheel, some checkings can be achieved.
- (2) No foreign matter (including screw and washer) shall be dropped or left on the printed board. If found, remove it carefully with a pincette.
- (3) If any abnormality is found in part, check and remedy it.
- (4) Lead wire must be held remotely from rotary part.
- (5) Connector must be connected certainly.

#### 4.5-5 Assembling and Adjustment

- (1) The assembling of parts to projector body should be made in the reverse order of disassembly.

After assembled, ascertain that 4.5-4 is perfectly observed.

- (2) After the knob, cover, etc. are assembled, operate the projector conforming to the projection procedure. Turn VR1 - VR3, and inspect the sound level.

Sound quality and noise, with special cautions on the sound reproduction.

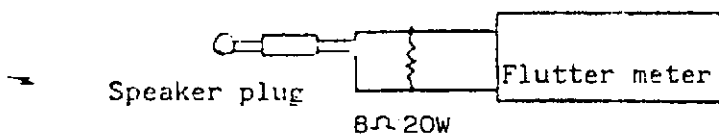
- (3) If required, all or the part of 4.5-6 should be performed, to record the performances of sound system<sup>by</sup> using measuring instruments. And if required, make adjustment to sustain the performances.

#### 4.5-6 Testing Sound System

Sound system should be tested by the following procedure. The explanation is for optical sound reproduction. For magnetic sound, apply it correspondingly.

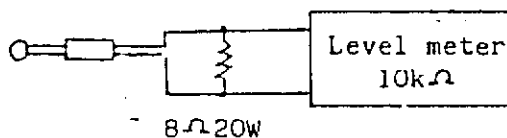
##### (1) Flutter test

- Thread SMPTE flutter test film 3000Hz or 3150Hz on the projector.
- Set the volume control at middle, and both of tone controls at middle also. Set the pointer of flutter meter to CAL line (in red).
- Measure the overall wow and flutter. The measured value shall be 0.5% max.



##### (2) Measuring the maximum output power

- Thread SMPTE 400Hz signal level test film on the projector.
- Set both of tone controls at middle, volume control at the extreme clockwise.
- The read of level meter (high frequency volt meter) shall be 24.3dB (20W) min.



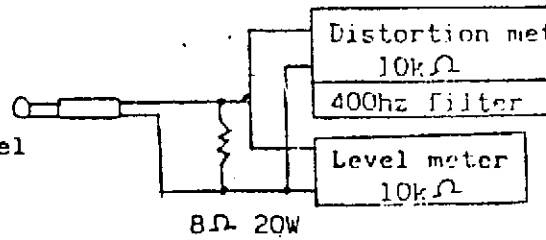
##### (3) S/N test

- Thread SMPTE 400Hz signal level test film.
- Set both of controls at middle, and adjust the volume control so as the level meter indicates +20dB.
- Holding this state, unload the film, and start the projector. The output level of noise shall be -20dB. (The connection diagram is same as above (2)).

Note: During this measurement, be careful not to exposure the solar cell to foreign light, such as room light.

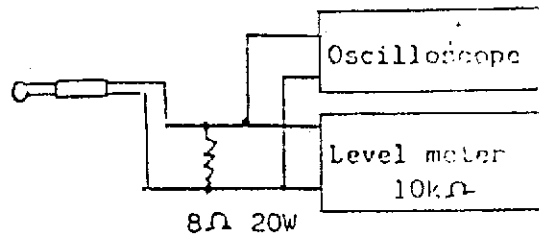
(4) Distortion test

- a) Thread SMPTE 400Hz signal level test film.
- b) Set the tone controls at middle.
- c) Adjust the volume control so as to the level meter points +23dB (15W).
- d) The measured distortion shall be 5% max.



(5) Frequency response test

- a) Thread SMPTE multi-frequency test film.
- b) Set the tone controls at middle.
- c) When the output level of 400Hz is set at +15dB, ...
- d) The deviation of output level of the other frequency against 400Hz shall be -16dB max.



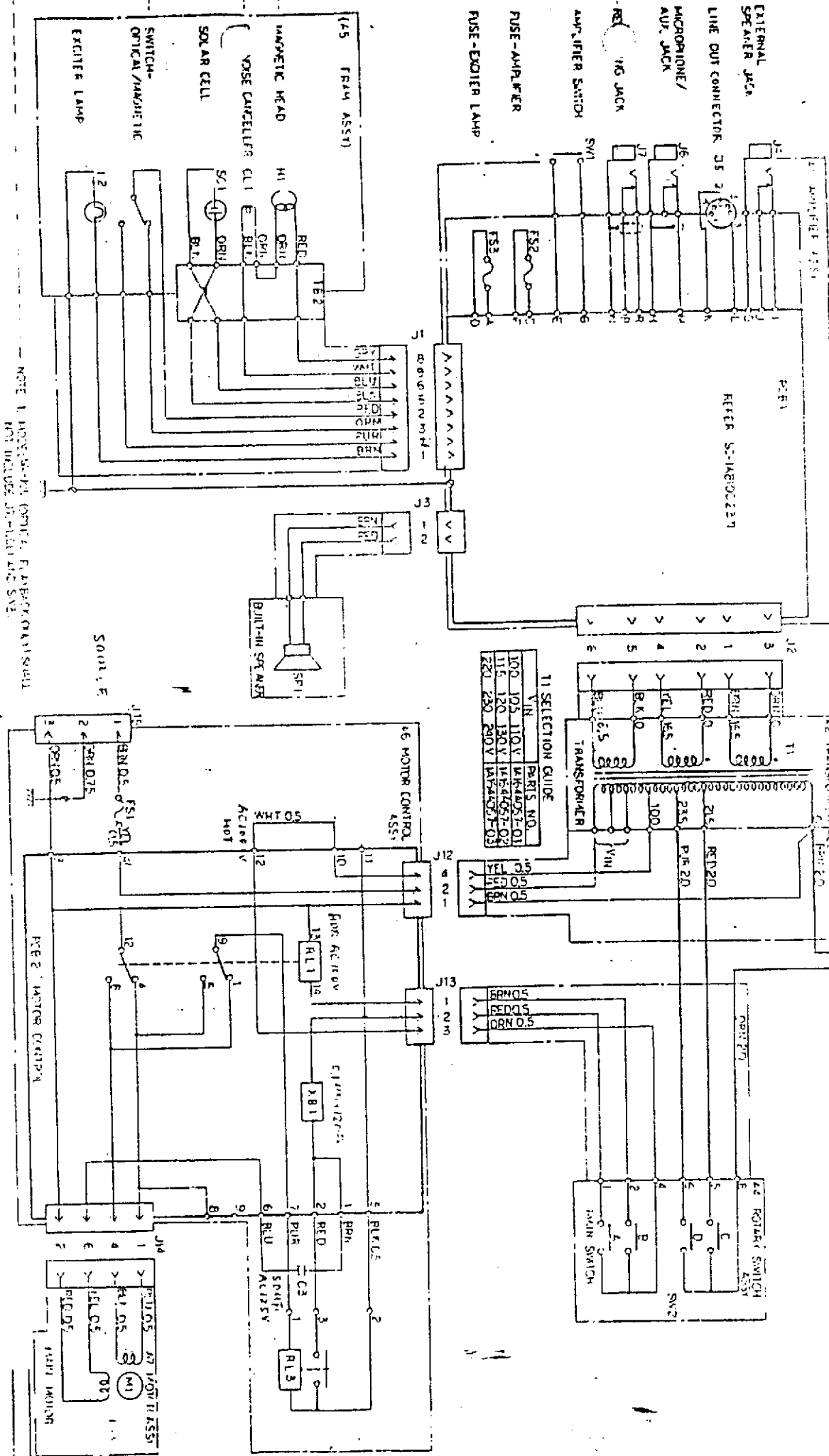
Note: The multi-frequency test film contains the following series of frequencies.

400 - 50 - 100 - 200 - 300 - 500 - 1000 - 2000 -  
3000 - 4000 - 5000 - 6000 - 7000



[illegible]

43 LAMP ASSY  
LI  
PRODUCTION LAMP



NOTE 1. NOTE 5-10 (CONT'D). F. A. BARKER (A) S.W. 11  
NOT DECIDED BY THE ALC S.W.

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