Film-Tech

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These manuals are designed to facilitate the exchange of information related to cinema projection and film handling, with no warranties nor obligations from the authors, for qualified field service engineers.

If you are not a qualified technician, please make no adjustments to anything you may read about in these Adobe manual downloads.

www.film-tech.com

16m/m SOUND PROJECTOR

MS-860 SERIES

861-862-863

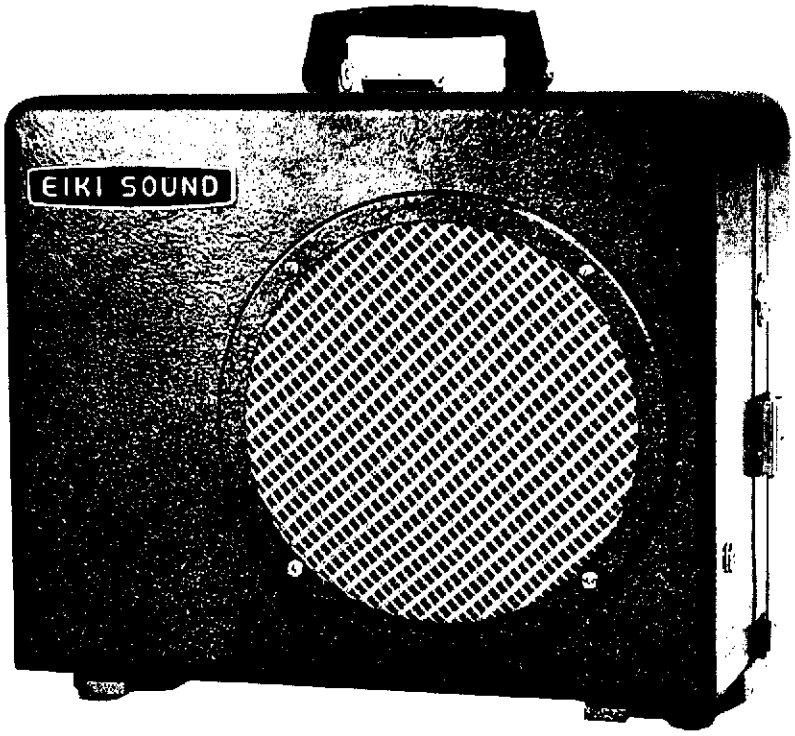
INSTRUCTION BOOK

EIKI INTERNATIONAL, INC.
30251 Esperanza
Rancho Santa Margarita, Calif. 92688-2132
Phone: 1-800-242-3454
Fax: 1-800-457-3454
Email: usa@eiki.com
URL: www.eiki.com

MANUFACTURED BY

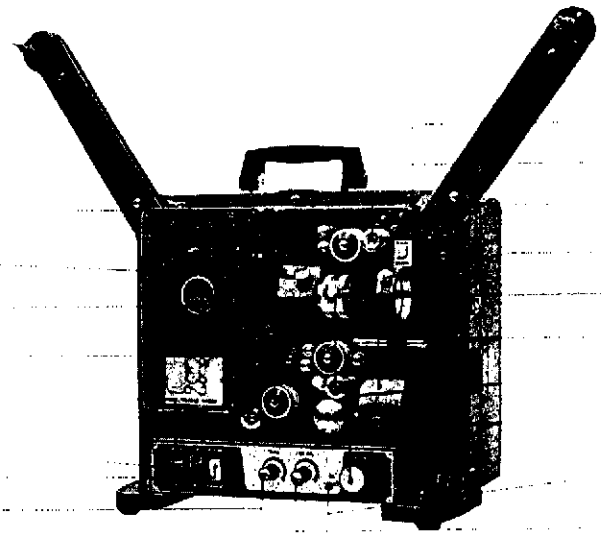
EIKI INDUSTRIAL CO., LTD.

OSAKA, JAPAN.



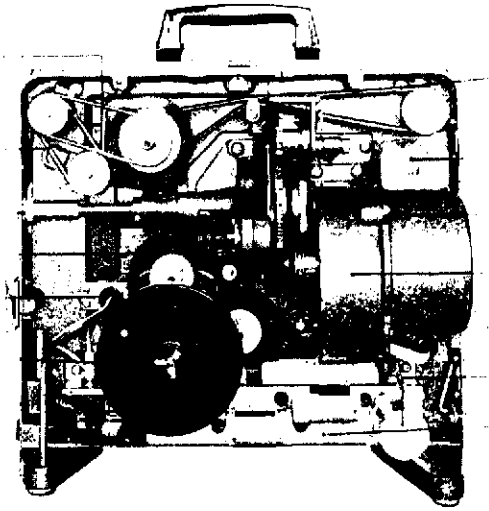
GENERAL

Model	MS-860	MS-861	MS-862	MS-863
Carrying case		Single case		
Sound system		Optical play-back	Optical & Magnetic play-back	Optical & magnetic play-back, magnetic recording
Power source		100V-250V, AC. 50 or 60 cycle fitted to your local power		
Projection lamp		750w-1,000w lamp		
Exciter lamp		4V-0.75A		
Optical sound lens		Coated cylindrical lens		
Sound pick-up		Solar cell		
Amplifier		Printed circuit. All transistorized amplifier		
Output			12W undistorted	
Transistor	8	8	8	10
Diode	8	8	8	9
Loud speaker	12×20cm Speaker in rear lid	8 inch (20 cm) built-in front cover of projector		
Projection lens		50mm (2 inch) f : 1.5 amber hard coated (standard)		
Motor		Output power 35W induction motor with condenser 1 20HP		
Film speed		24 and 16 frames per second		
Reel capacity		2,000 ft. maximum		
Size and weight		13½×9×12 inch (34×24×31 cm 30 lbs (14kgs)		



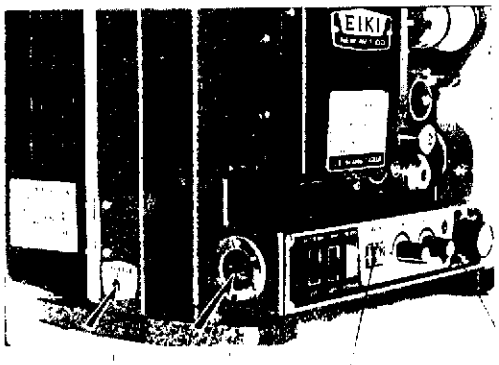
Still pcture clutch
Masking lever
Loop setter
Third sprocket
Motor switch
Lamp switch
Forward Reverse switch
Tone control

Reel lock
Front arm
Arm lock
Rewind lever
Threading knob
Anamorphic lens holder
Tension roller
Exciter lamp
OPT. MAG. switch
Tilting knob
MIC P.U
Amp switch & Volume control

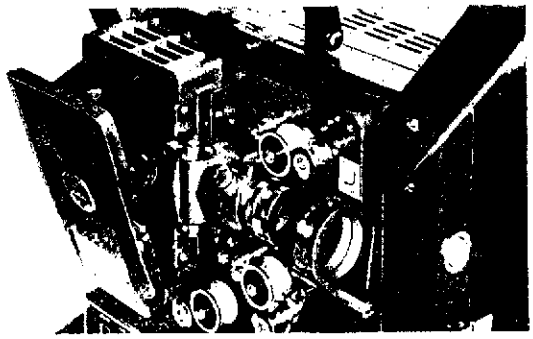


Reverse belt
Rewind spring belt
Threading knob
Cam tank
Solar cell cord
Flywheel

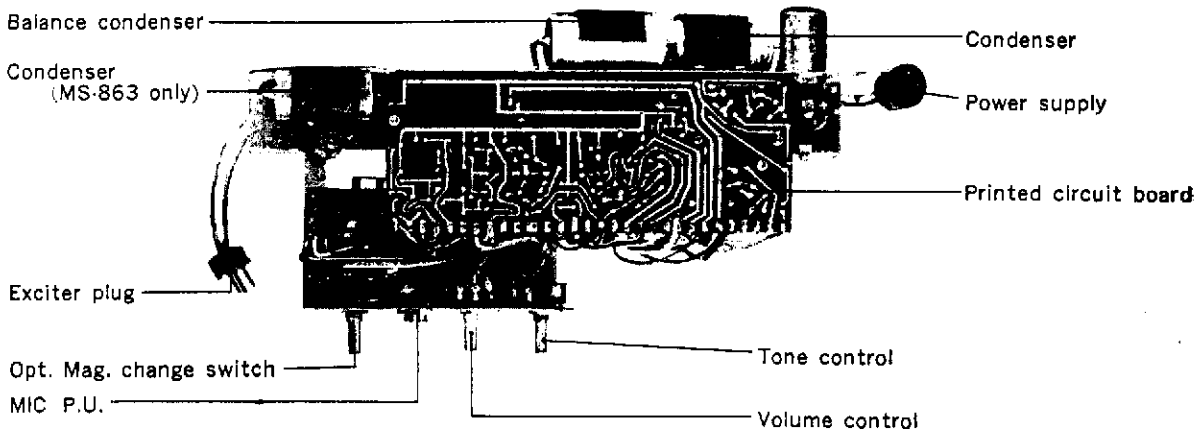
Take-up belt
Motor condenser
Motor
Fan cover
Amplifier fuse (1A
Condenser
Amprifier

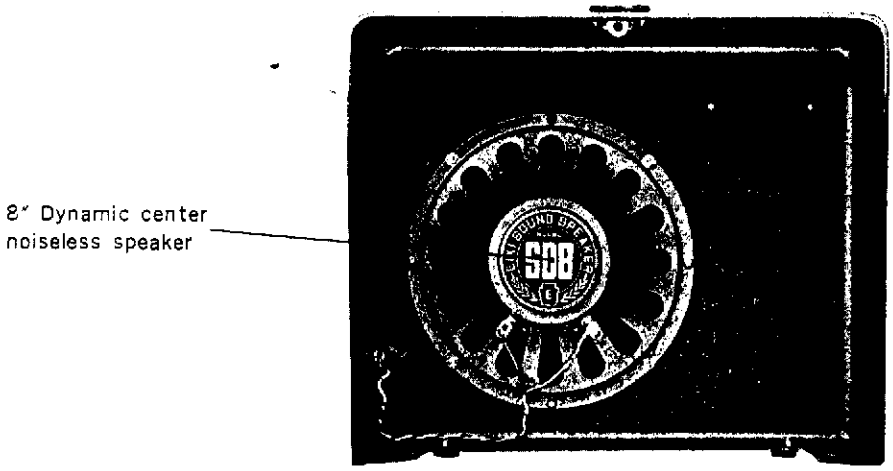


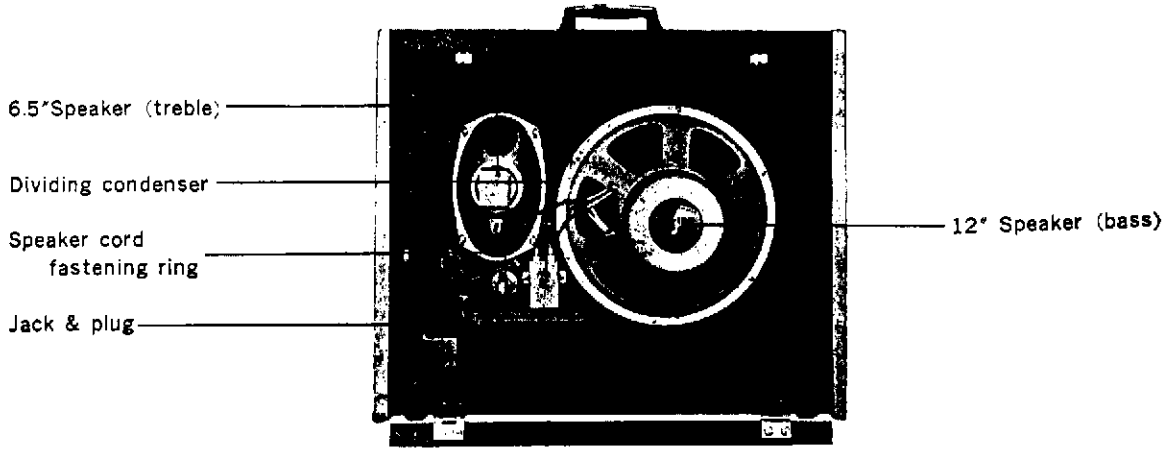
Speaker Jack Power supply Level indicator (MS-863)



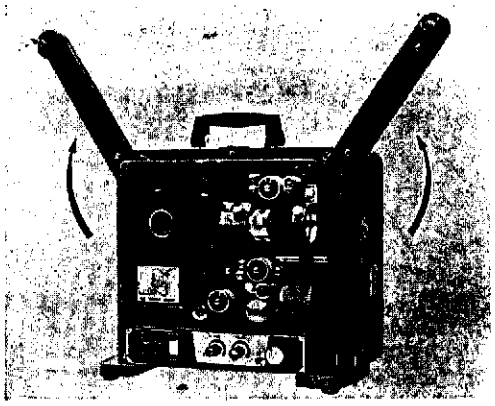
Safety lock for recording (MS-863)







<2 way speaker system (optional)



No. 1

Preparation for Projection

1. Setting up

A) Place the projector on a table or stand and remove the front cover. (Photo No. 1)

B) Raise the front and rear arm to a position where the safety lock snaps over the pin. (Photo No. 1)

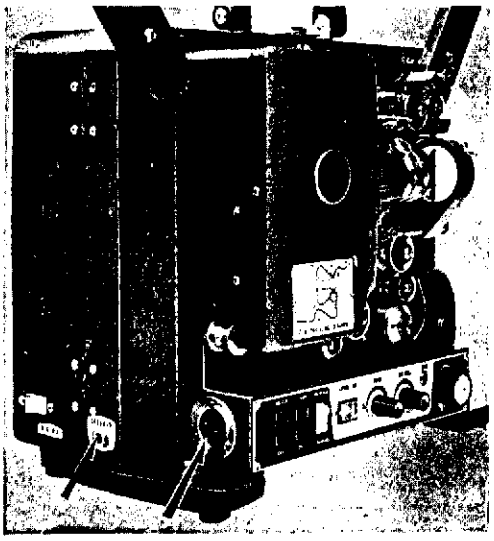
C) Set a Speaker beside the screen at an optimum height at least 2 feet above the heads of the audience.

D) For projection distances and sizes of picture and lens, refer to following table.
if used with an anamorphic lens, the width of picture will be increased nearly 2 times of the width indicated in the chart.

SCREEN SIZE CHARTS

APERTURE WIDTH - 380"

LENS FOCAL LENGTH	Projection Distance in Feet	SCREEN WIDTH																
		40'	50'	60'	70'	84'	8'	9'	10'	12'	14'	16'	18'	20'	22'	24'	26'	28'	30'
1½"		13.2	16.4	19.7	23.0	27.6	31.6	35.8	39.5	47.4	55.3	63.2	71.1	78.9	86.8	94.7	102.6	110.5	118.4
2"		17.5	21.9	26.3	30.7	36.8	42.1	47.4	52.6	63.2	73.7	84.2	94.7	105.3	115.8	126.3	136.8	147.4	157.9
2½"		21.9	27.4	32.9	38.4	46.1	52.6	59.2	65.8	78.9	92.1	105.3	118.4	131.6	144.7	157.9	171.1	184.2	197.4
3"		26.3	32.9	39.5	46.1	55.3	63.2	71.1	78.9	94.7	110.5	126.3	142.1	157.9	173.7	189.5	205.3	221.1	236.8
4"		35.1	43.9	52.6	61.4	73.7	84.2	94.7	105.3	126.3	147.4	168.4	189.5	210.5	231.6	252.6	273.7	294.7	315.8



No 2

Speaker Power Supply

2. Connection of cords

A) Speaker cord
Insert the plug at each end of the speaker cord into the jack on the projector and on the speaker. (Poto No. 2)

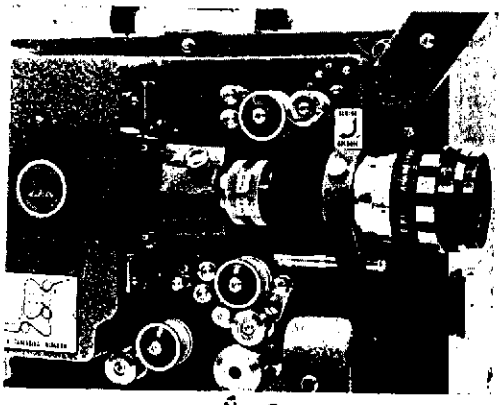
B) Power supply cord
First ascertain that the motor, amplifier, and projection lamp switch are all in the "OFF" position.
(When removimg the cord from the projector, be sure to depress the safety locking pin on the jack which is attached to the power cord.)
(Photo No. 2)

3. Checking

A) Forward and Reverse switch
For forward projection, be sure that this switch is depressed on the forward or lower side of the switch.

B) Motor and lamp switch
1) The motor switch must be "ON" for amptifier operation. After switching the motor switch to the "ON" position, you may switch the amplifier "ON" by rotating the volume control to the right.
2) Turn lamp switch "ON" for projection.

C) Adjustment of projection angle
Use the elevator gear knob located on the front of the projector to project the picture at the proper position on the screen.



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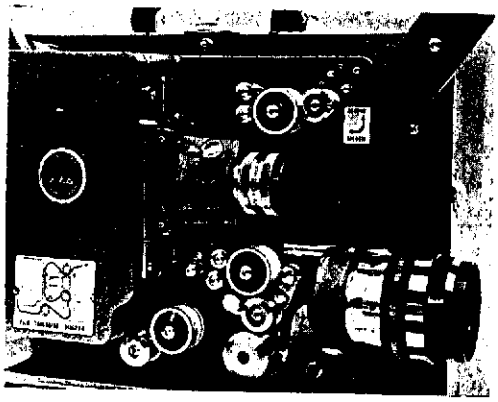

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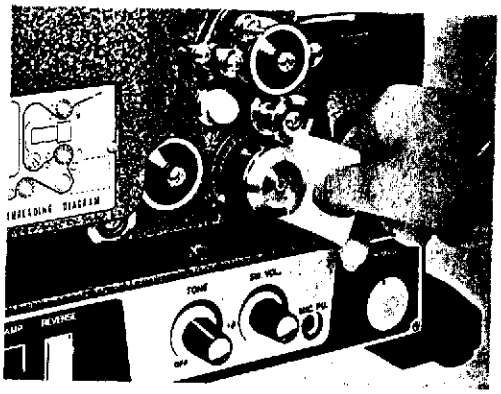


No. 5

D) Focusing

Turn the lens as necessary to focus the picture on the screen.

It may be necessary to refocus the lens slightly after the film has been threaded in a projector.

E) Adjustment of Anamorphic lens

After focusing with the master lens, attach anamorphic lens as in the photo No. 3. It is necessary to adjust the anamorphice lens so that the figure appearing on the lens corresponds to the projection distance. When using the anamorphic lens, the width of the picture will be approximately 2 times the height of the picture. The height of the picture will not change between anamorphic lens and standard lens. (Photo No. 4)

F) Testing the amplifier (Optical sound)

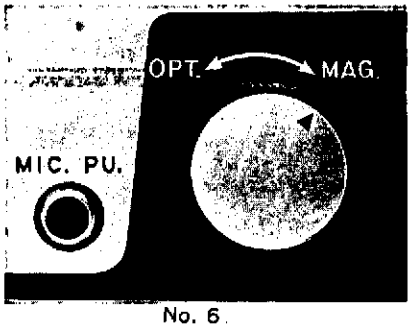
After the motor and amplifier switch are turned "ON", the exciter lamp will light. Insert a piece of paper between the sound lens and the sound drum so that it interferes with the light beam. By moving the paper so that the light beam is broken, you will hear popping noises in the speaker. Adjust the volume control for a better indication of this test. (Photo No. 5)

G) Rotate tone control as nesessary, while listening for the change and pitch of the sound coming from the speaker.

H) When a silent film is projected, the amplifier should de turned "Off" in order to save any undue wear on the amplifier and causing noises during projection.

Width and Height of Picture in Meters

Lens		3m	5	10	15	20	25	30	40
2"	H	0.4	0.7	1.4	2.1	2.8	3.5	4.2	5.5
	W	0.6	1.0	1.9	2.8	3.8	4.7	5.7	7.6
2.5"	〃	0.3	0.6	1.1	1.7	2.3	2.9	3.4	4.6
	〃	0.5	0.8	1.5	2.3	3.1	3.9	4.6	6.2
3"	〃	0.3	0.5	1.0	1.7	1.9	2.4	2.9	3.8
	〃	0.4	0.6	1.3	1.9	2.6	3.2	3.6	5.1



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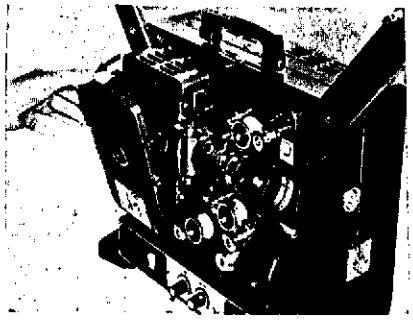
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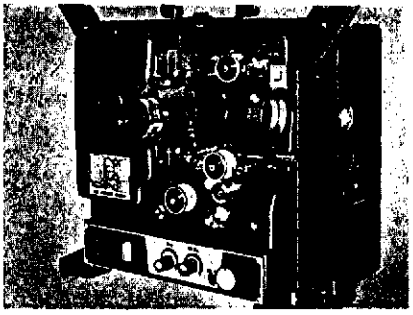
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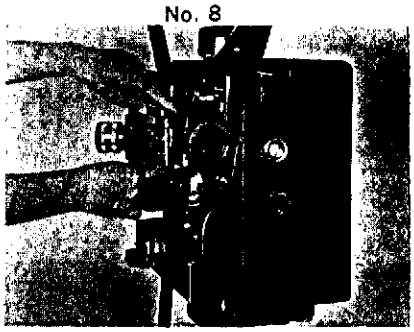
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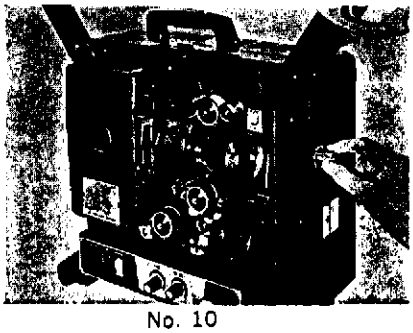

No. 10

I) Magnetic playback
For use with magnetic striped film turn OPT-MAG knob to the "MAG" position, the exciter lamp should go out when the switch is in the "MAG" position. (Photo No. 6)

J) After all tests have been completed, be sure to return all switches to the "Off" position.

K) Open the lamp house cover and examine the following places for unnecessary stains or dirt: (Photo No. 7)
* Reflector mirror * Projection lamp
* Condenser lens * Gate and aperture
* Claw

L) Turn threading knob by hand and check the motion of the claw and sprocket drums. (Photo No.10)

4. Threading the film

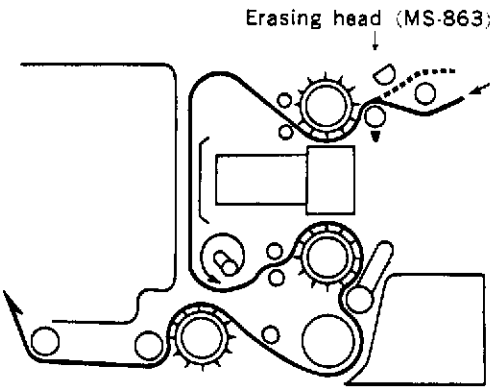
A) Thread the film on the sprockets and through the gate as shown on the attached threading diagram.

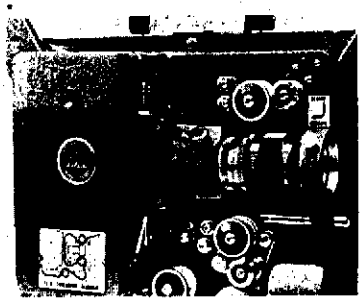
B) Release the sprocket shoes which are beside the sprocket drums before trying to insert the film After the film is placed over the sprockets, the sprocket shoes should be closed.

C) Swing lens holder out to install film in gate area. Be sure that film is pressed on film channel before closing the lens holder. (Photo No.8 No.9)

D) After completing the threading, turn the threading knob by hand to be sure that the film transport is opearating properly. (Photo No.10)

FILM THREADING DIAGRAM





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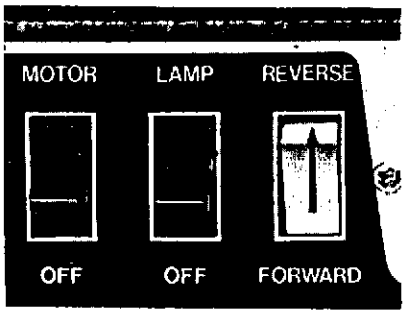

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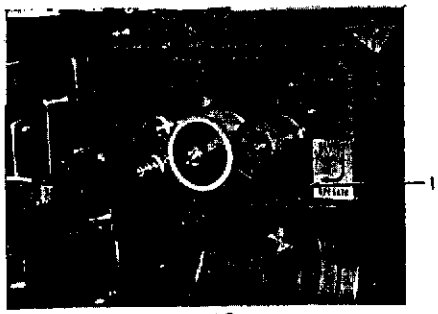

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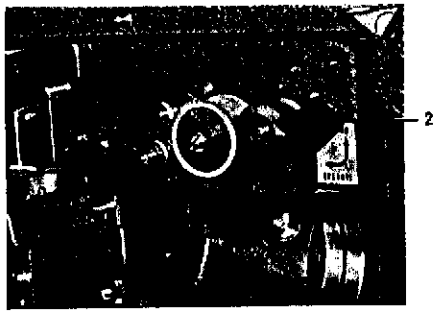


No. 14

5. Projection

1) To start projection

A. Switch "ON" motor and lamp

B. Focus as necessary. After focusing, fasten the screw to prevent lens from rotating.

C. Check the framing lever and be sure that only one frame appeares on the screen. (Photo No. 11)

D. Adjust volume as necessary for the auditorium. Also adjust the Tone Control for pleasant listening sound.

2) Still projection

For single frame projection, depress the STOP lever completely.

3) Reverse projection

Push the Reverse-Forward switch into REVERSE position. (Photo No. 12)

6.End of projection

After the projection is completed, turn the lamp switch "OFF" first.

CAUTION: The motor and cooling fan should be left on for a minute or two in order to cool the lamp. The first 30 seconds after lamp is turned off are the most liable to cause lamp damage.

7. Rewinding

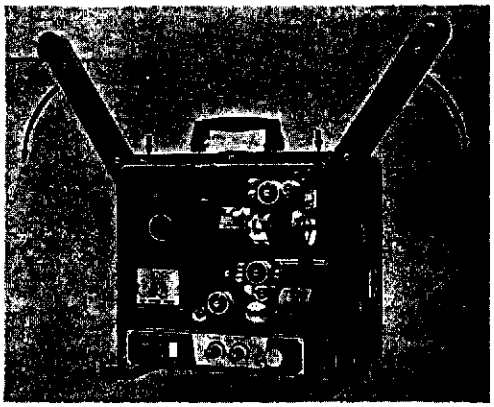
A) Without changing reels, thread the tail end of the film back into the empty feed reel under the hub.

B) Raise the Rewind lever to the "REWIND" position. (Photo No. 13, 14)

C) Turn motor switch "ON" and the film will be rewound automatically.

D) When rewound, please return the Rewind lever to the "Operate" position, ready for the next projection.

CAUTION: Be sure that Rewind-Operate lever is in the "Operate" position when projecting or threading the film.



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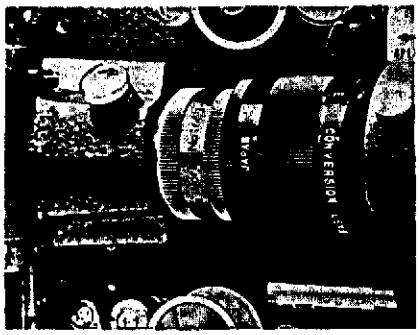


No. 16

Conversion lens

Remove master lens hood, and mount Conversion Lens into tne projection lens.

Cleaning

The following parts should be cleaned after each projection.

Use a brush to clean aperture plate, pressure plate, and sprocket as necessary. For the projection lens, use the silicon treated chamois skin or equivalent for best lens care. The condenser lens and reflecting mirror should be cleaned with a soft cloth as necessary.

8. Dismantling projector

Release arms by depressing safety locks, before folding into position. Remove power cord and speaker cord as necessary.

Replace the cover as provided.

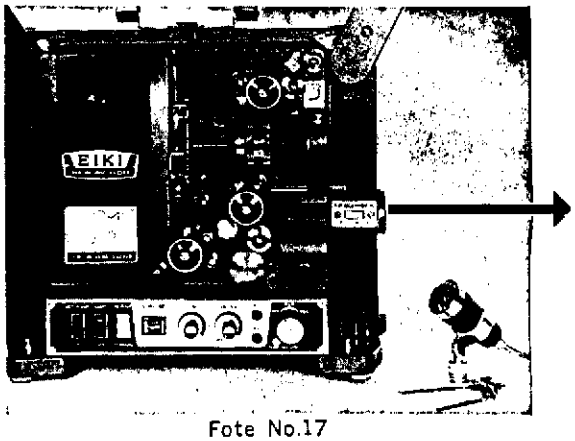
(Photo No.15)

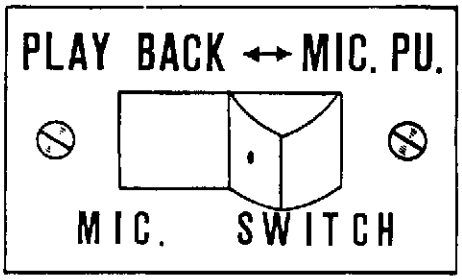
9. Use of microphone or recording pick-up.

1) It is necessary to have the motor running which supplies power to the amplifier. Switch amplifier "ON" (Photo No. 17)

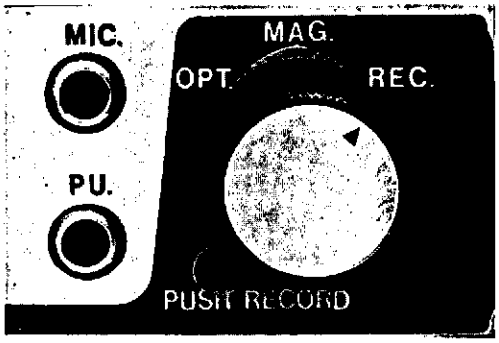
Insert into the MIC jack on front panel. A microphone of crystal or moving coil type is recommended. A carbon microphone should not be used. Phonograph pick up may be either magnetic or crystal type.

On the projector with the magnetic recording facility it is necessary to put PLAY BACK MIC. PU switch in "MIC" position.





Fote No.17



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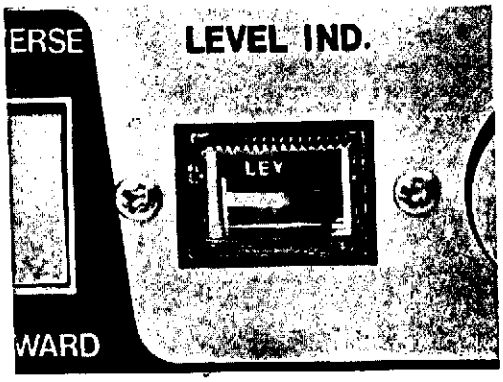


No. 19

≪MS-863≫

Recording on magnetic film.

1. Film threading
   A) Refere to threading diagram on page 6.
   B) Be sure that film comes in contact with the erase head before attempting a recording if previous signal is to be erased.
   C) If you wish to record sound, thread the film under the first Idler roller so that it does not come in contact with the erase head. This way the previous recording will not be erased, but the new recording will be mixed with previous recording.
2. Use "MIC" or "PU" jack as necessary depending on which input is required. "MIC" for microphone and "PU" for phonograph pick-up or other high level signal. (Photo No. 18)
3. Rotate knob to REC. position by depressing safety button. (Photo No. 18)
4. With microphone in place, amplifier on and motor running, set volume control so that the level indicator will deflect the proper amount. (Photo No. 19)
   A normal level is such that the needle does not reflect into the dark area, except on very high peaks. Too high a recording level will cause distortion.
5. Record as necessary, watching the signal level indicator and also the screen if you are doing your own commentary.
6. Playback
   Disconnect microphone or other imputs and rotate knob to "MAG" position. Now, it is safe to move the film by the running the projector in reverse or byre-threading.

PLAY BACK-MIC P.U. switch must be in "PLAY BACK" position.

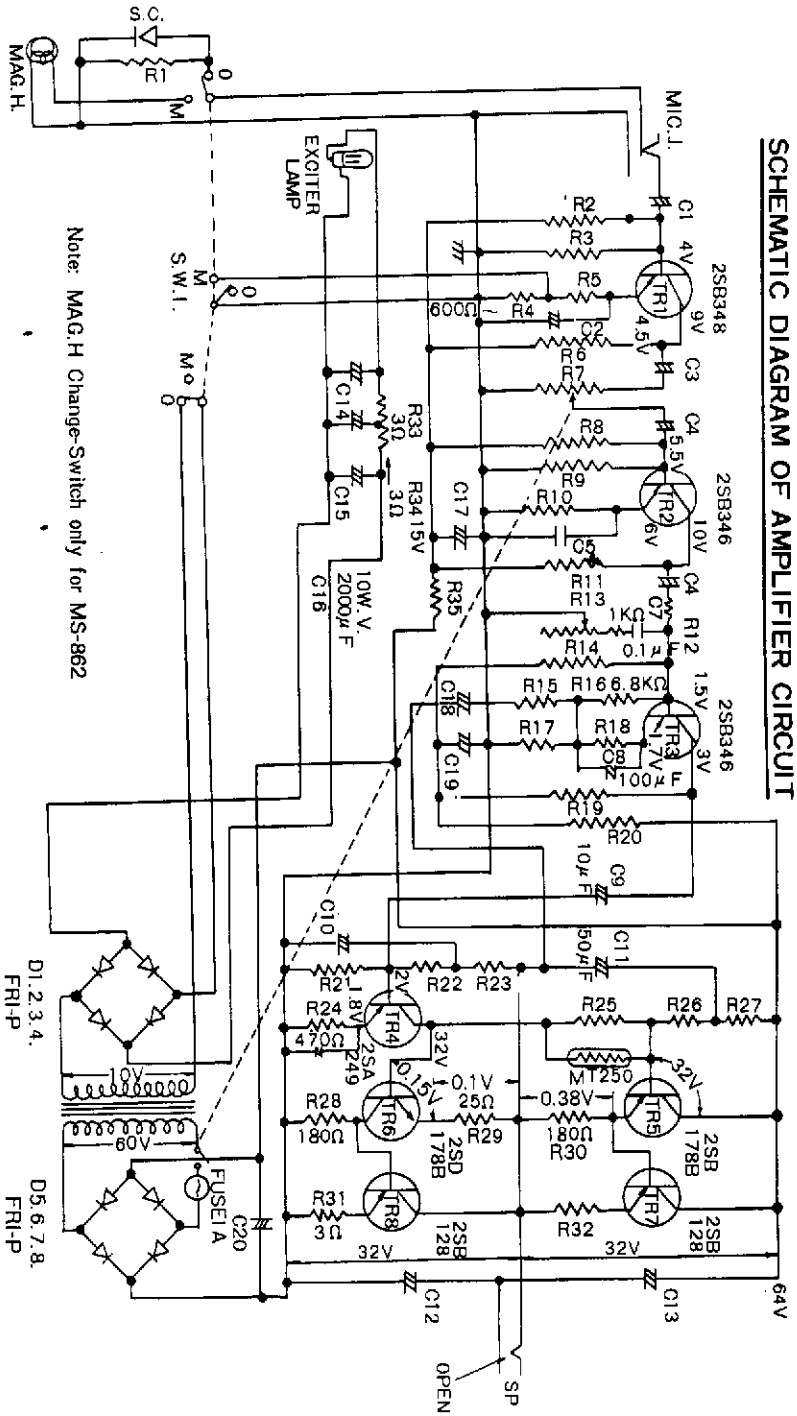
CAUTION: Do not run film through projector with switch in "RECORD" position if you wish to keep the recording on the film. If you wish to erase the recording, thread in the normal way, making sure that the film comes in contact with the erase head and run the film through the projector. In this case, it is necessary to remove the microphone, turn the volume all the way down, but be sure the amplifier is operating.

TROUBLE SHOOTING CHART

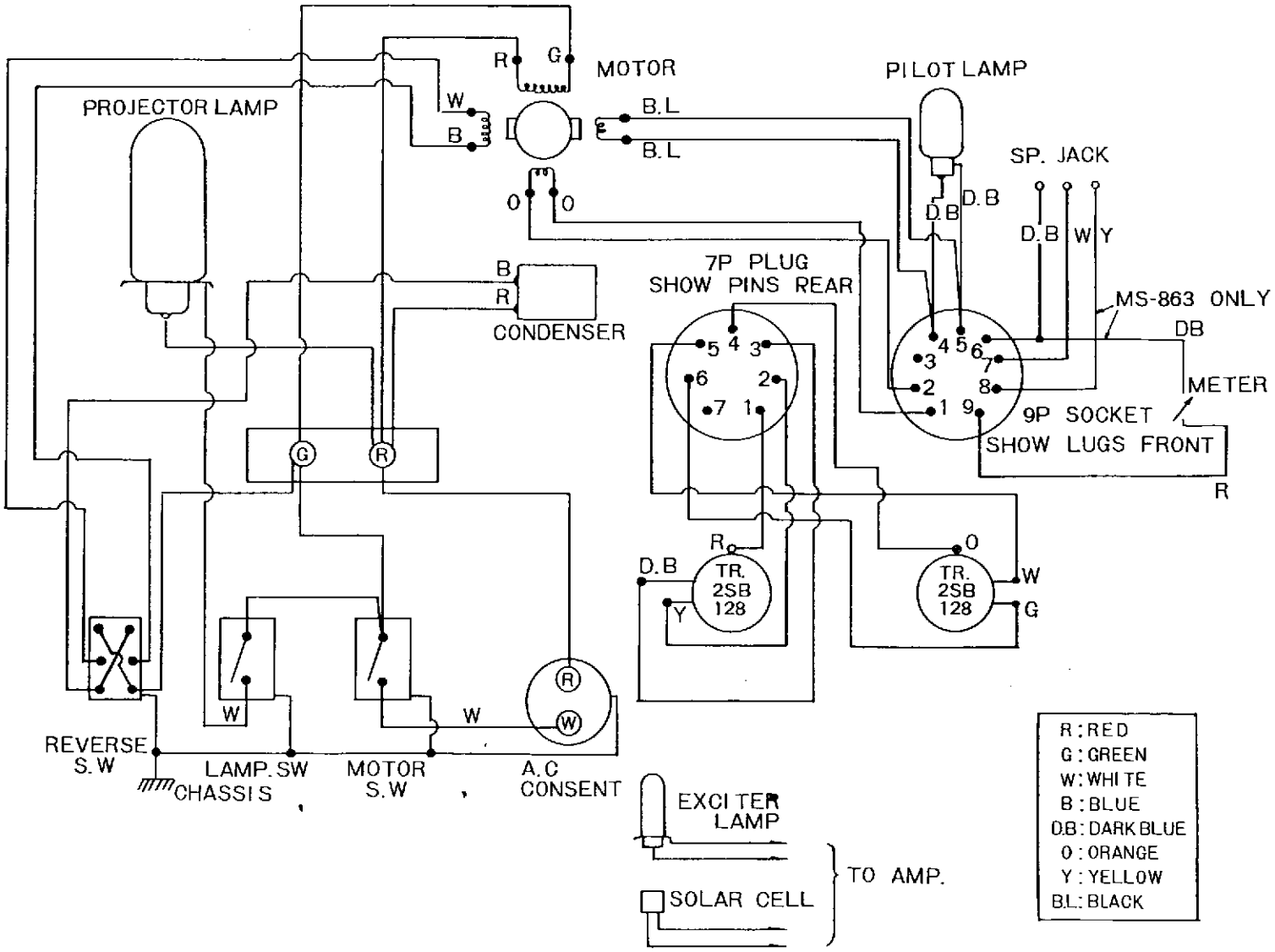
SYMPTOM	PROBABLE CAUSE	REMEDY
No power to motor or lamp	1. No mains power. 2. Poor connection on power cord	1. Check fuse or multi breaker. 2. Check and repair.
Projection does not light- motor runs.	1. Burned out lamp.	1. Replace
Film does not run-motor runs lamp lights.	1. Stop lever depressed. 2. Motor belt broken 3. Rewind lever in "Rewind".	1. Raise to operate 2. Replace. 3. Move to "Operate"
No sound	1. Exciter lamp defective. 2. OPT-MAG switch in MAG position. (In some projectors) 3. Speaker not plugged in. 4. Speaker cable or speaker defective 5. Amplifier defective.	1. Replace. 2. Change to OPT. 3. Remedy. 4. Repair or replace 5. Replace
Poor sound.	1. Dirty sound lens. 2. Film too loose over sound drum 3. Exciter lamp defective. 4. poor recording. 5. Sound lens out of focus.	1. Clean. 2. Thread properly. 3. Replace. 4. Replace. 5. Adjust only with test film.
Poor picture.	1. Defective lamp 2. Dirty mirror,condensor lens,projector lens. 3. Dirty gate aperture 4. Low line voltage. 5. Cracked or broken condensor lens. 6. Out of focus. 7. Poor film.	1. Replace. 2. Clean with soft tissue. 3. Clean. 4. Check. 5. Replace. 6. Refocus. 7. Replace.
Picture unsteady	1. Improper threading. 2. Film striking loopsetter. 3. Dirty gate, claw or film shoe.	1. Check. 2. Make loopsetter rotate 3. Clean

NOTE : If you are unable to remedy the faults described, please refer to a qualified technician.

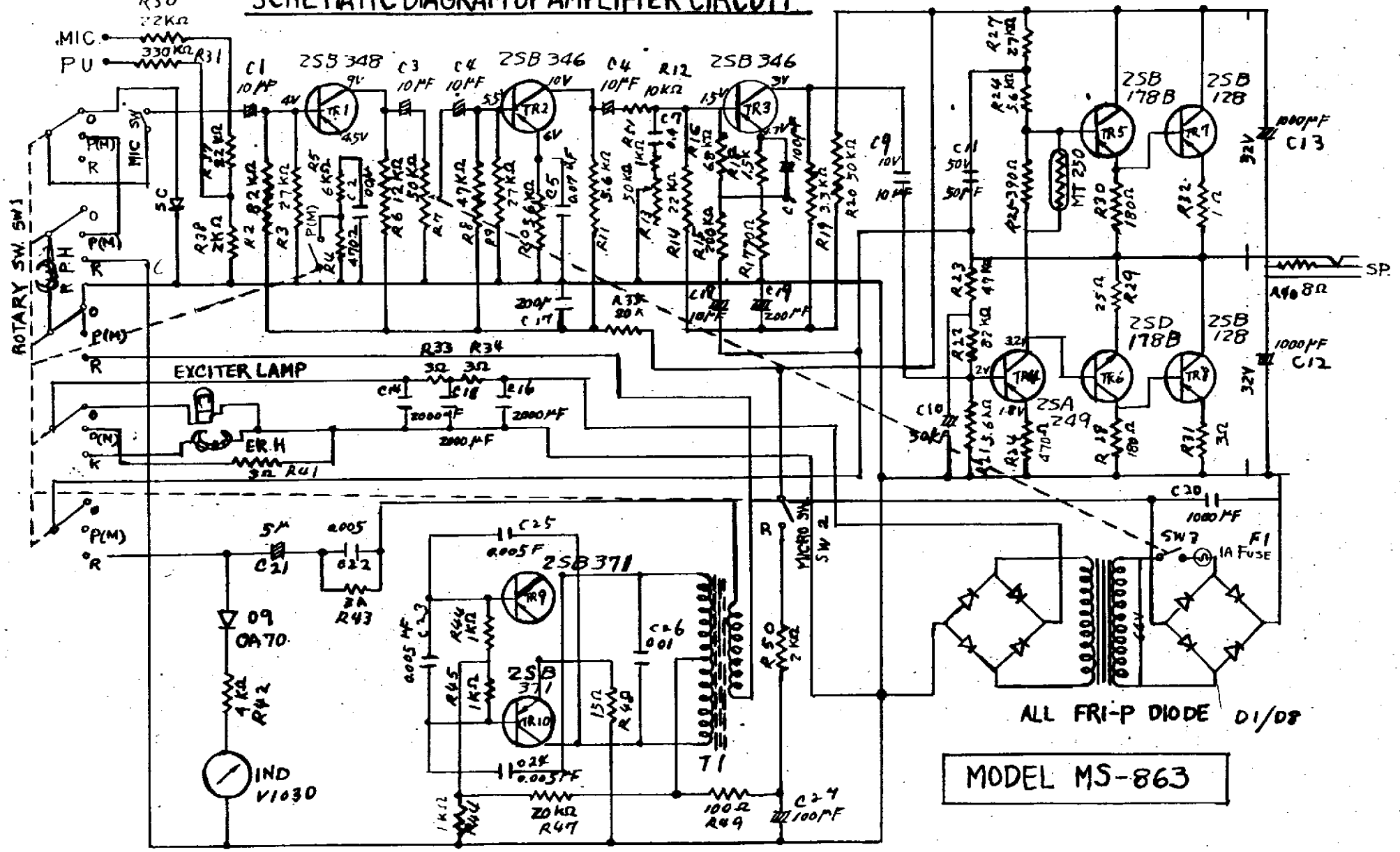
〈MS-861/2〉
SCHEMATIC DIAGRAM OF AMPLIFIER CIRCUIT



〈MS-861~3〉
MECHANISM DIAGRAM



SCHEMATIC DIAGRAM OF AMPLIFIER CIRCUIT

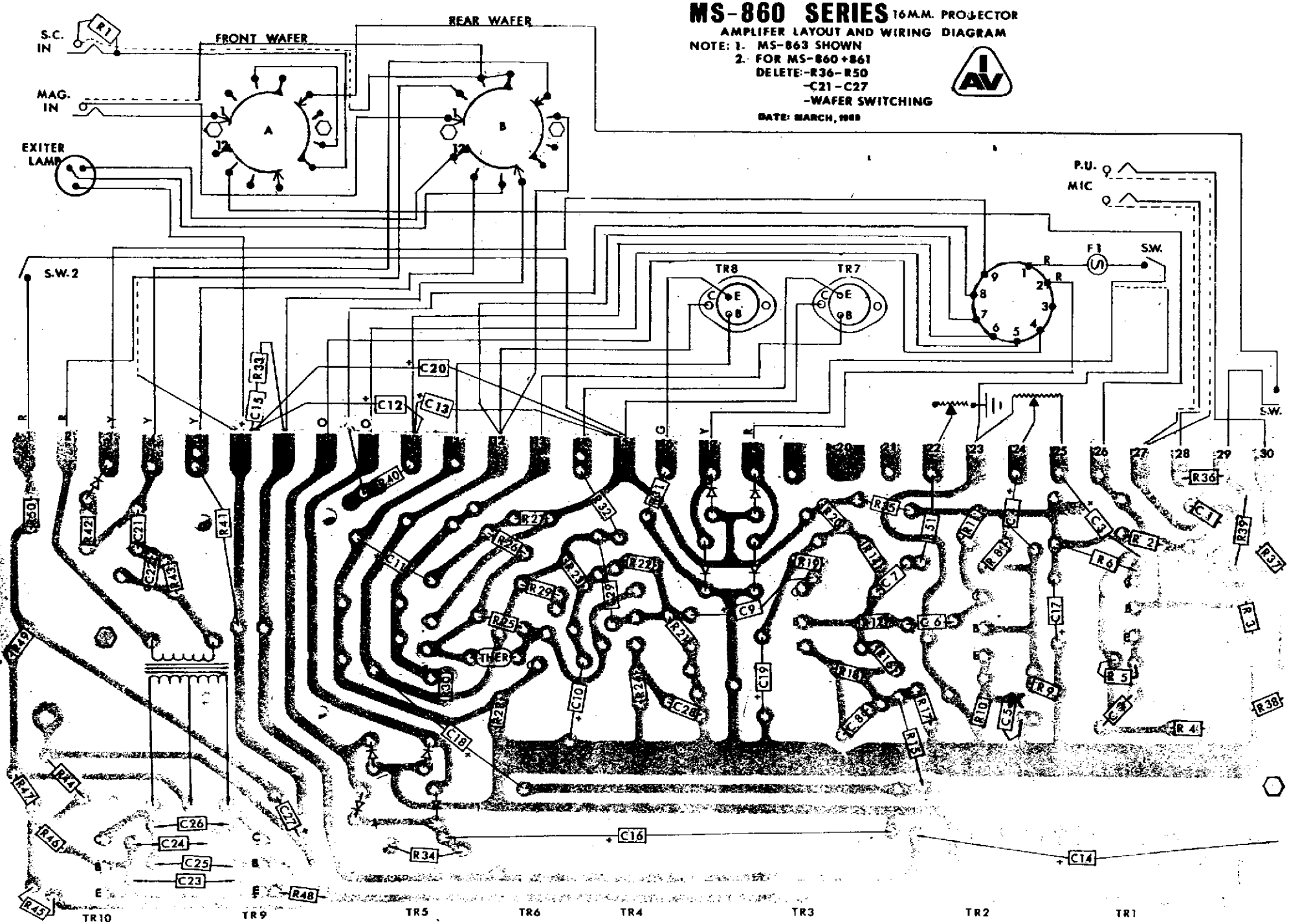


MS-860 SERIES 16M.M. PROJECTOR

AMPLIFER LAYOUT AND WIRING DIAGRAM

NOTE: 1. MS-863 SHOWN
2. FOR MS-860+861
DELETE:-R36-R50
-C21-C27
-WAFER SWITCHING

DATE: MARCH, 1968



SERVICE INSTRUCTIONS FOR MS-860, 1, 2, 3.

Specifications:

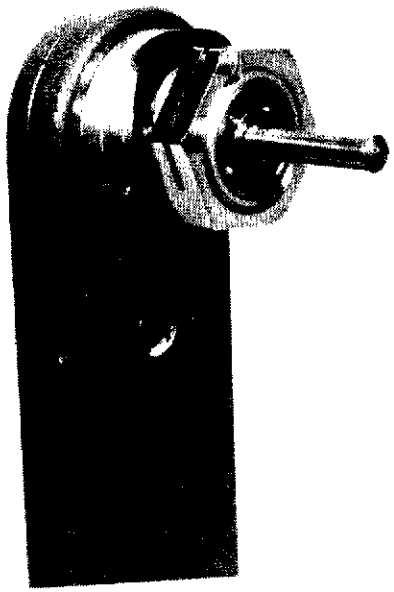
Power Requirements	-	115 volts AC 60c, 1200 watts
Optional	-	115 volts AC 50c
	-	230 volts AC 60c
	-	230 volts AC 50c
Projection lamp	-	750 watt DDB
	-	1000 watt DFT or DFD
Exciter lamp	-	4v. - 0.75 amp. KE-04 (original)
Sound pickup	-	Solar Cell (optical)
	-	Magnetic record/playback head (MS-862,863 only)
Sound Recording	-	MS-863 only
Amplifier	-	Printed Circuit
	-	8 transistors, 4 diodes (amplifier)
	-	4 diodes (exciter lamp)
Output	-	15 watts
Loudspeaker	-	Built in rear cover (MS-860 only)
	-	8" heavy duty built in front cover (MS-861 862, 863)
Projection lens	-	50mm (2"), f.1.5 amber hard coated (standard)
Motor	-	35W condenser motor; 1/20 H.P.
Film speed	-	24 and 16 frames/sec. belt change
Film capacity	-	2200' max. reel size
Dimensions	-	13 1/2" x 9 1/2" x 12"
Weight	-	MS-860 30 lbs.
	-	MS-861, 2, 3. 33 lbs.

1. BELTS

1.1 All plastic urathane belts must be kept clean and free from oil. Use denatured alcohol, triclorethylene or equivalent. The length of a belt in its natural unstretched position should be at least 10% shorter than its length when placed in operating position.

1.2 A stretched belt will tend to slip and should be replaced.

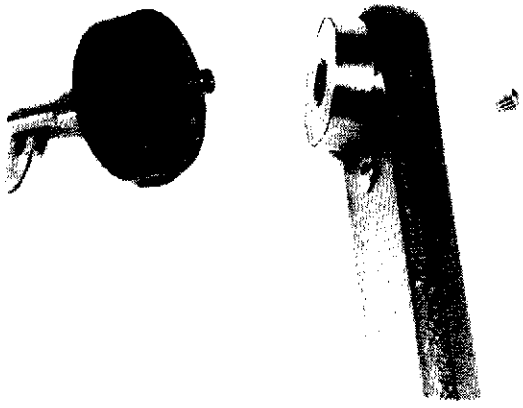
2. REEL ARMS



2.1 Front (Supply) - Arm is mounted on chassis and held in place with a special locking nut. The small screw through the split side of the locking nut must be released before attempting to turn the nut. When mounting the arm, tighten the locking nut to provide the proper tension on the arm and then secure the locking nut by tightening the locking screw.

2.2 Rear (take-up) - Mounting-same as front arm.

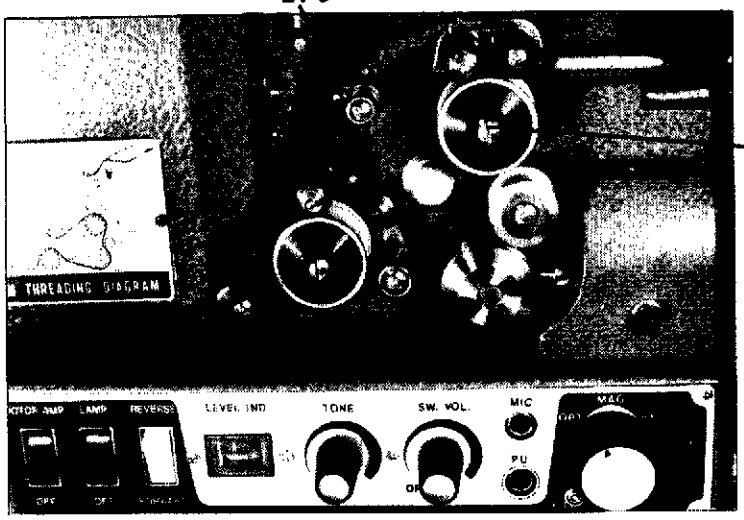
2.3 Slip clutch - The cork liner in the clutch drum provides the friction necessary for the film take-up. To check for proper clearance, cut a length of 16mm film to fit inside the cork liner completely covering the cork but not overlapping on the ends. This should provide a moderately snug fit over the steel drum. If necessary, due to expansion, use sandpaper to remove some of the cork until the proper clearance is attained. If the cork is dry, use a small amount of fine oil over the entire cork area. Wipe off any excess.



3 DRIVE GEARS & FILM SPROCKETS

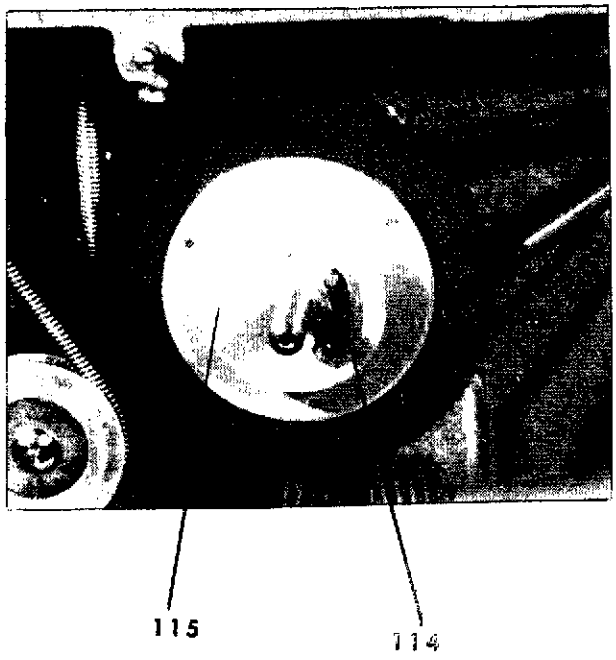
3.1 When assembling the sprocket shaft and fibre gears, care should be taken to allow .003" end play. Use a fine lubricating oil SPARINGLY on the bronze bushings and shaft. Observe the flat spots on the shaft for the purpose of tightening the gears, collars, etc. The shaft should be "rocked" back and forth before the final turn of the tightening screw. Be sure the screw is perpendicular to the flat spot on the shaft.

3.2 Sprocket tooth position is adjusted by loosening screw #86-122 in end of shaft, thus releasing the pressure of the plastic face plate against the sprocket plate. Observe position of film in relation to loop restorer roller #86-276. If film tends to strike roller during projection, rotate #2 sprocket plate #86-120 counter-clockwise 1/3 - 1/2 frame. Tighten screw. Perpendicular film movement midway between sound drum and #3 sprocket should be approximately 3/16". Adjust #3 sprocket if necessary.

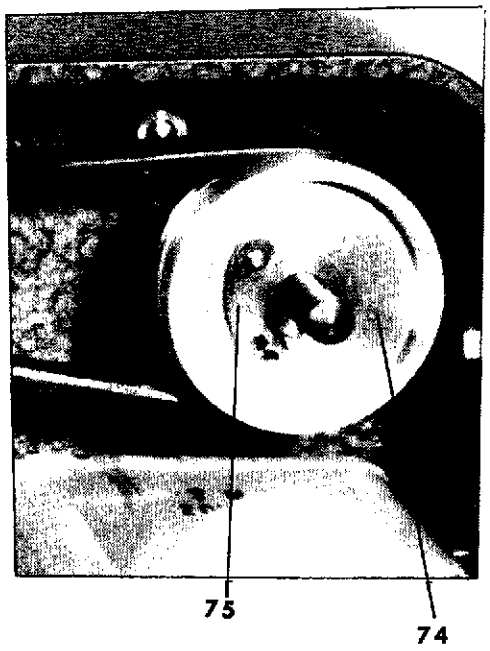


4. CAM CLUTCH

4.1 Reverse: This clutch is part of the top, #1 sprocket and gear shaft assembly. See illustration. This clutch engages when the film direction is in REVERSE. This is necessary to rewind the film on the supply reel. When assembling, turn or position the gear 86-115, so that the protruding pin in the hub of the gear is in the "1;30 o'clock" position. Hang the curved cam 86-114 on the pin. Place clutch pulley 86-113 on shaft. Install retaining collar 86-112 fastening the screw on the flat spot of the shaft. Be sure to allow a slight amount of "end play" on the shaft, approximately .003".

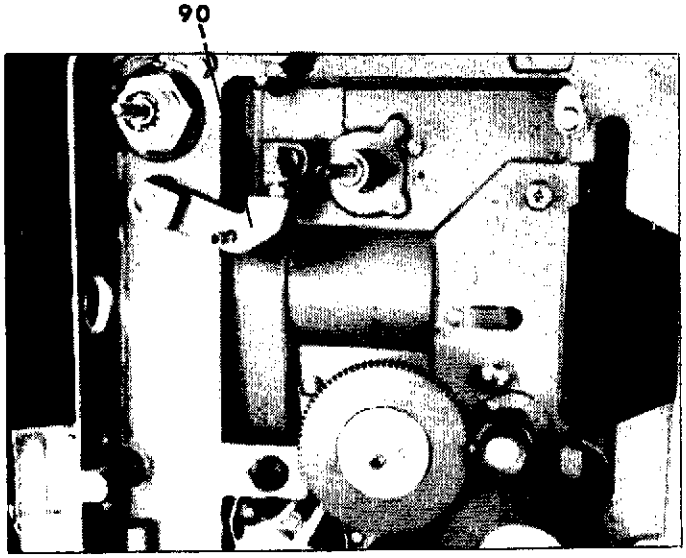


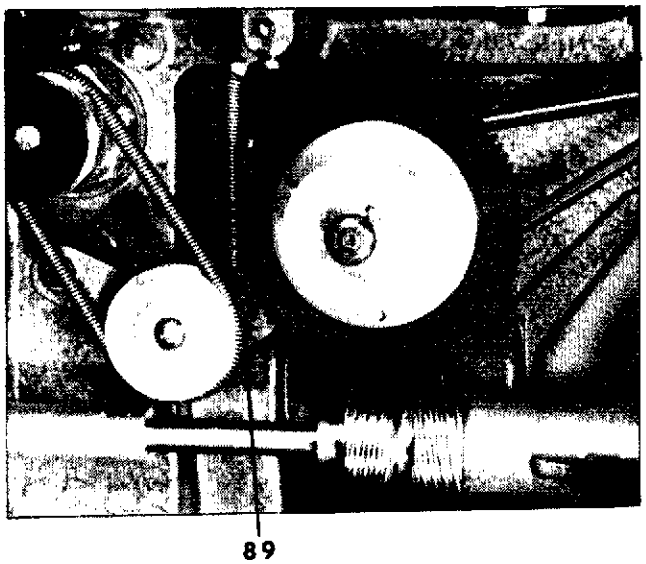
4.2 Forward: This clutch is on the drive shaft of the rear take-up arm. FORWARD direction of film engages this clutch. This drives the take-up spindle. When assembling this clutch, turn the belt pulley 86-74 so that the protruding pin is in the "10:30 o'clock" position. Hang the curved cam 86-75 on the pin. Install clutch collar, 86-73, fastening screw on flat spot of the shaft. Be sure belt pulley is free to turn without binding.



5. REWIND

5.1 Rewind is accomplished by placing "Operate-Rewind" lever 86-85 in "rewind" position. The flat part of the shaft allows the fibre rewind gear 86-89, to engage with the #1 sprocket drive gear. The supply arm spindle is driven in reverse via the steel spring belt between the supply arm drive shaft and the fibre rewind gear pulley. The film direction switch 86-177 on control panel must be in FORWARD position. The cap-screw lock-nut on the rewind gear bracket 86-90 allows adjustment of rewind gear position. When engaged the fibre gears should mesh completely with a slight amount of "play" to avoid undue wear caused by excess pressure. The strong vertical spring between chassis and rewind gear bracket assures positive action. With lever in "operate" position, gears must disengage completely with approximately 1/32" clearance.





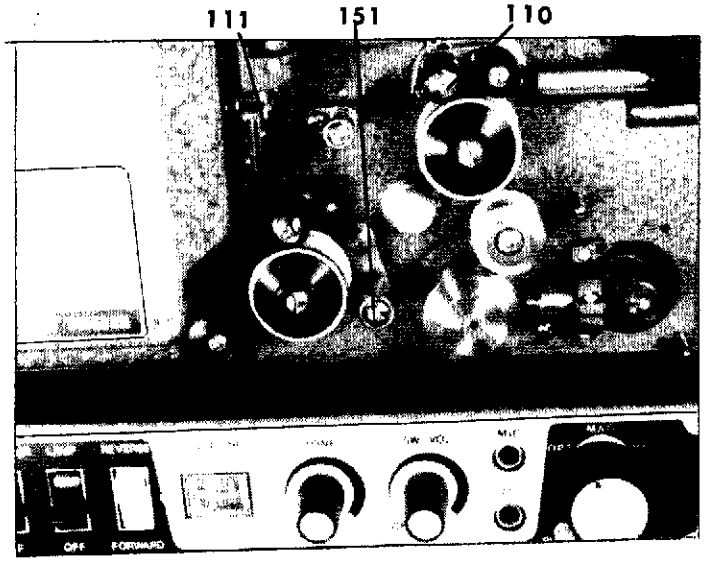
6. SPROCKET SHOES:

6.1 The sprocket shoes prevent the film from skipping over the sprocket. The oversize holes in the shoe mounting bracket allow for proper positioning of the shoe in relation to the sprocket. The stationary roller should clear the sprocket by approximately .015" - .020". This will allow the film to be threaded easily without damage. The moveable roller should be as close as possible to the sprocket (without a film), and yet be free to turn.

7. IDLER ROLLERS:

7.1 Idler rollers must turn freely. Use oil SPARINGLY.

8. TENSION ROLLER



8.1 This roller, 86-151 is between the sound drum and the #3 sprocket. The tension at the roller should be approximately 2 1/2 oz .

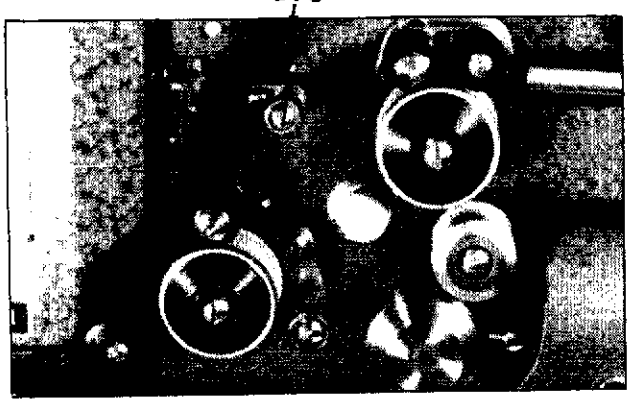
8.2 Remove flywheel and #2 fibre gears to provide access to spring tension adjustment.

8.3 To adjust, loosen spring bracket, on rear of shaft and move as necessary to achieve the correct spring tension. Tighten screw securely.

9. AUTOMATIC LOOP SETTER

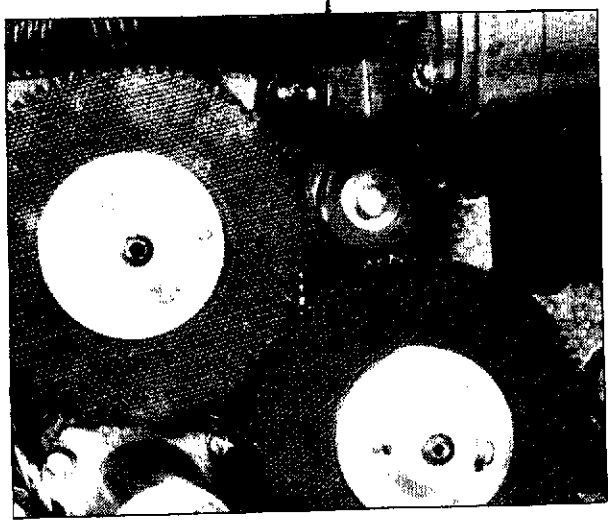
9.1 This device maintains the correct lower loop size. As the loop is lost the film applies pressure to the sensing roller #86-276. This causes it to begin a counter-clockwise revolution. The rubber tire #86-273 at the rear of the shaft then engages the #2 fibre gear causing the loop setter to make a complete revolution. The flat spot on the rubber tire is cleared by the fibre gear. The position of the sensing roller in relation to the flat spot on the rubber tire may be adjusted by releasing the screw holding the sensing roller bracket to the shaft.

276



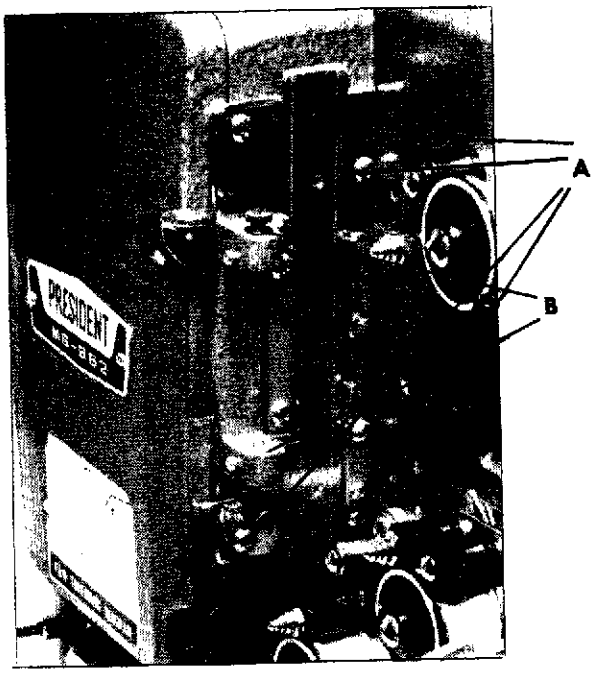
9.2 The tension spring between the rubber wheel and case holds the loop setter in neutral position. If loop-setter does not stay in neutral, and keeps rotating, adjust by sliding rubber wheel closer to case, thus increasing the spring tension.

273

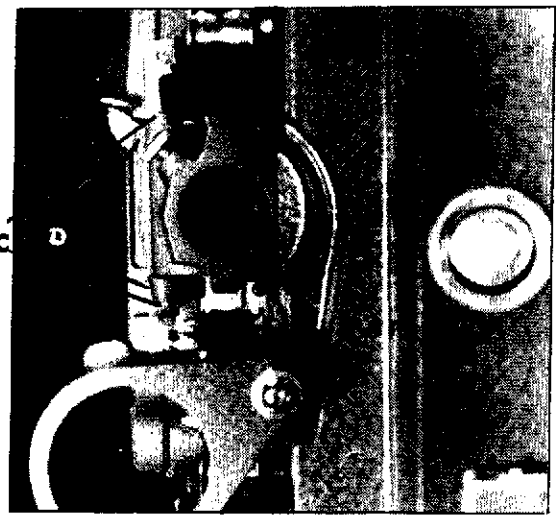


10. FILM GATE LENS HOLDER AND FILM SHOE

10.1 The film gate is secured to the chassis by 4 screws (marked "A"). When mounting to chassis the inner edge should be snug against the face of chassis casting. The lens holder bracket is mounted on the gate plate with 2 screws (marked "B"). The elongated holes in the bracket allow for horizontal adjustment. The flat face of the lens holder should be flat against the flat face of the chassis.



10.2 The 2 screws marked "C" allow vertical adjustment of lens holder. To adjust, remove lens and sight through open end with lens holder in operating position. Move the film channel with framing lever. The hole in the film shoe should be centered over the hole in film channel. Locking screws "D" must be loosened for any adjustment of screws "C".



10.3 After adjustment, screws "D" must be snug against screws "C". Do NOT over-tighten, threads may be damaged.

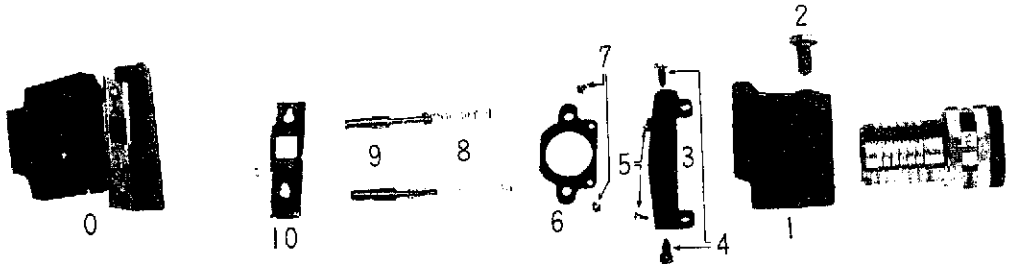
10.4 Outer guide rail, #86-31, is adjustable, Loosen screws just enough to free the rail. Install a short length of film into the gate, adjust guide rail so that film edge is parallel to edge of gate. Be sure that preforations of film are centered over claw aperture. Tighten guide rail screws.

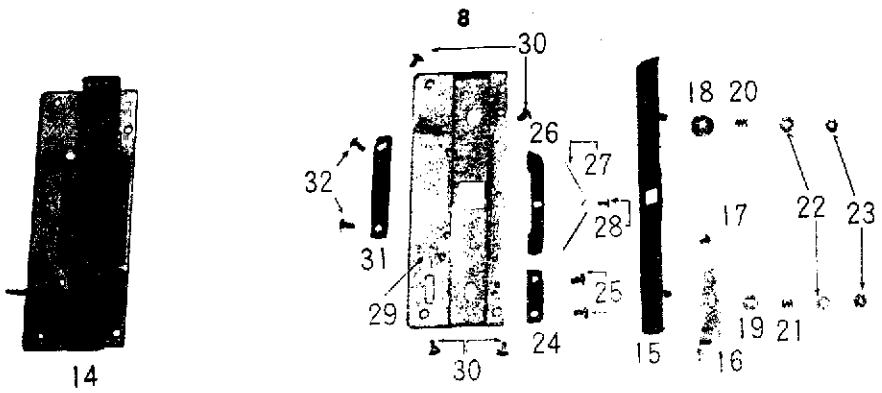
10.5 Film Shoe #86-10 is kept in place on the supporting pins by a curved lever on the lower end of shoe. Pins are held in lens holder by metal plate #86-6. The mounting holes of this plate are elongated or oversize allowing for a horizontal adjustment of film shoe. With lens holder in operating position, clearance between outer film guide and edge of film shoe should be .006" (thickness of 16mm film).

10.6 The pressure applied to the film by the shoe should be uniform. To check spring tension of shoe mounting pins #86-9 remove shoe. Make sure pins move smoothly and easily. A pressure of 80-100 grams applied to each pin is required to depress pin 1/8". If adjustment is necessary, remove plate and adjust or replace springs.

10.7 The inner (sound track side) film guide 86-26 is spring loaded. The tension required to depress one end should be approximately 15-20 grams. To much side pressure here will tend to buckle the film. The guide should have free travel.

10.8 Lower film guide, 86-24, should be close to inner, sound-track edge of film. adjust as necessary.



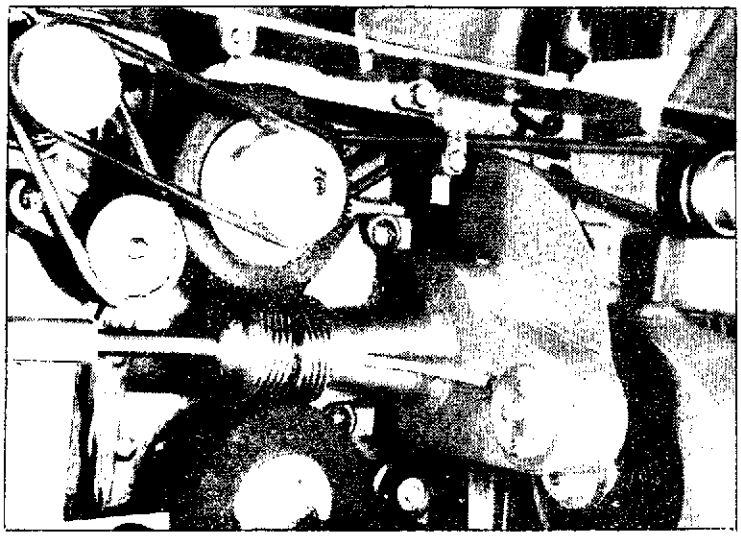


Gate assembly and view of parts

11. SHUTTER, CLAW AND CLUTCH ASSEMBLY

11.1 This assembly is held in place with 2 screws. The knurled hand knob protruding through the front chassis frame should be centred in the hole. Turn shaft so that claw is in maximum retracted position. This is necessary for it to clear aperture.

11.2 To remove assembly, remove hand knob first. Remove the 2 screws holding the assembly to the chassis frame. Remove motor belt. Open lamp house cover to clear the clutch lever. A slight pressure on clutch lever toward the rear of the machine will help to remove complete assembly.



11.3 Screw #86-185, in end of shaft holds belt pulley clutch and shuttle blade on shaft. To remove claw assembly cover, move still picture clutch lever #86-194, part way down exposing all 4 screws. See diagram for parts recognition and location.

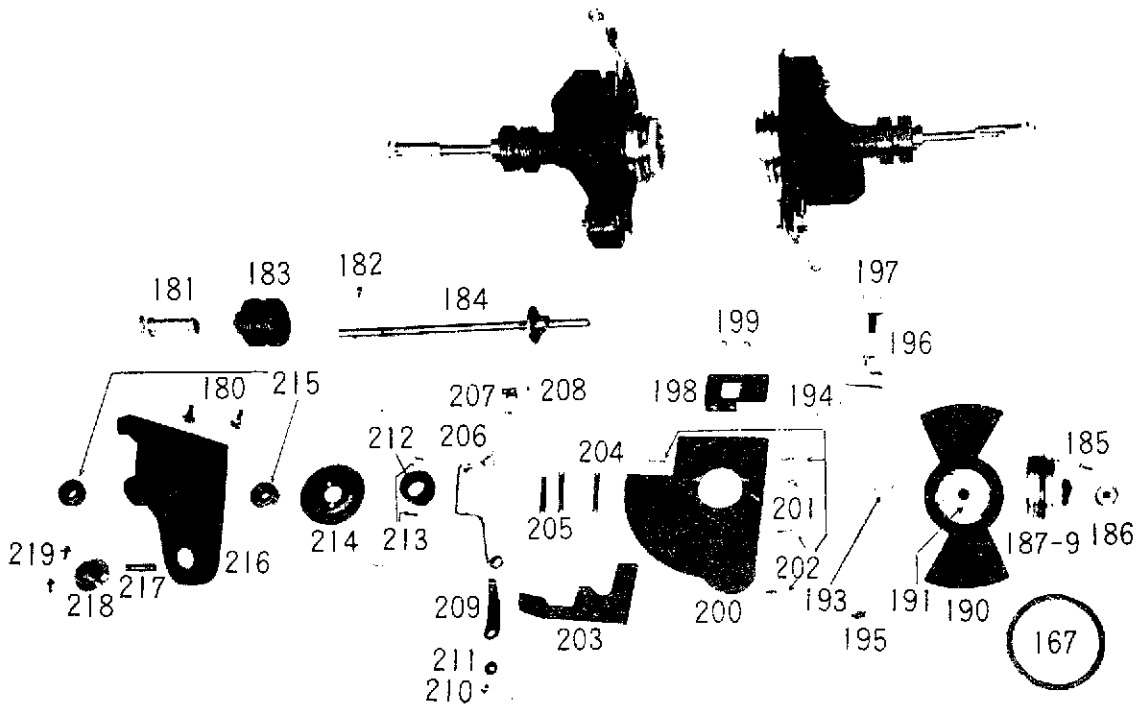
11.4 Observe location of cam springs. The curved shock absorber spring, #86-205, is first from the top of the claw lever #86-206. This is the "belly" of the lever. Next to the curved spring is a straight spring, #86-204, used for a bearing surface. The fibre cam, #86-212, rides between this and its counterpart,#86-204, on the bottom of the claw lever.

11.5 The timing of shutter blade and claw movement is important. Note position of hub #86-191, in relation to shutter blade, #86-190. The semi-circular raised flange is in a position that is in line with the centre hole and the centre line of one blade.

11.6 Further timing is predetermined by the cam mounting screws placed in an "off center" position.

11.7 When installing worm gear, #86-183, be sure that the set screw is seated properly on the flat part of the shaft and that it is tightened securely.

11.8 Lubrication of shutter mechanism is important for long life. Use only silicon compound or a high quality fibre grease.



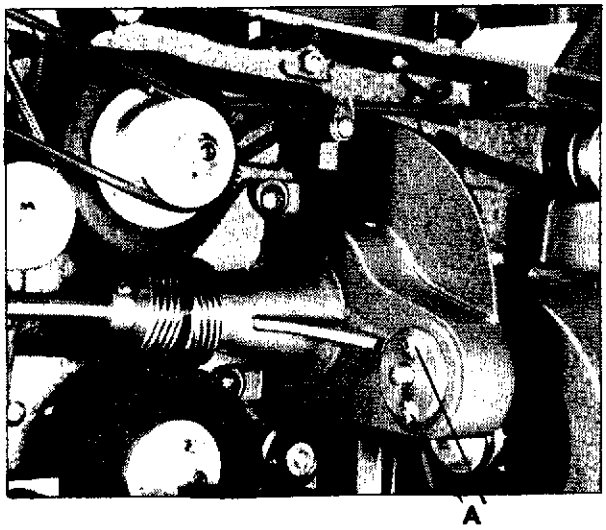
Shutter assembly and view of parts

11.9 Claw Travel and Position is adjusted with assembly in machine.

Loosen 2 screws "A". in illustration. This is the fulcrum of the claw lever. The holes in the collar of this fulcrum are oversize allowing complete relative adjustment. The vertical, horizontal or a combination of both may be necessary. To determine correct claw position swing lens holder out. Cut a 2" - 3" length of film and place it in position in film gate. Set framing lever in midway position. Turn knurled hand knob on shutter shaft in clockwise direction. Observe entry of claw into sprocket holes of film. Entry should be in the centre of the hole. Film position over aperture is important. After claw has left film, one frame of film should be centred over hole. Adjust fulcrum collar as necessary. Tighten screws securely.

11.10 Claw Protrusion should be .035" (6 thickness of 16mm film). Adjust as necessary by bending claw lever. Be sure claw clears aperture before attempting this adjustment. If re-adjustment of claw position is necessary, proceed as outlined in previous paragraph.

11.11 Install motor belt over shutter pulley BEFORE securing complete assembly to chassis frame.

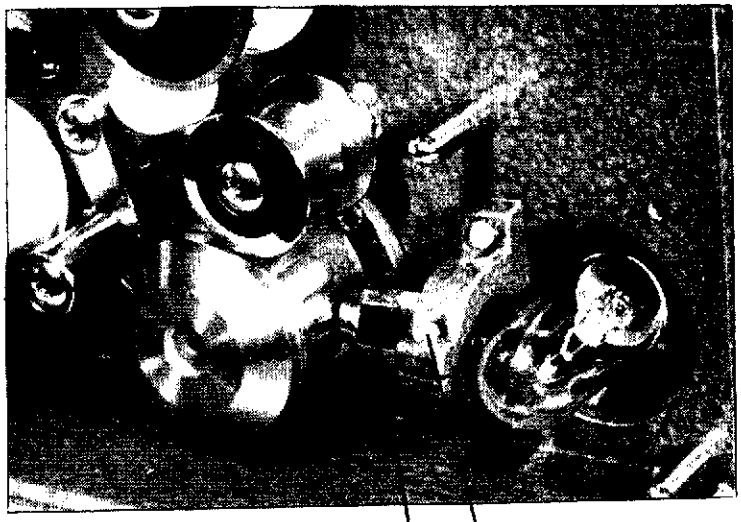


12. LIGHT DIFFUSION:

12.1 When the still picture clutch #86-194 is fully depressed, a light diffusion unit 86-196 is placed in front of the aperture. Undiffused light will burn the film. Adjust this diffusion unit as necessary to completely cover the aperture.

13 EXCITER LAMP AND LENS

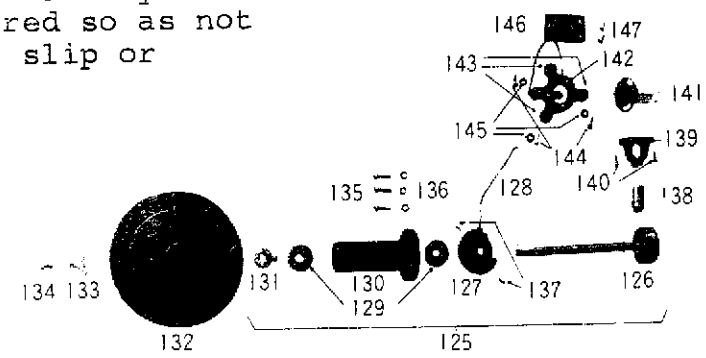
13.1 The focus and azimuth of the optical sound lens are very critical and are adjusted simultaneously. Note position of filament of exciter lamp. It must be in centre line of optical lens. The scanning beam must be a sharp thin line focused on the film sound track. The scanning beam must also strike the centre of the sound track. In this position it will clear the edge of the sound drum and strike the solar cell.



13.2 To adjust the optical lens, 86-138, loosen setscrew in lens bracket 86-139, just enough to allow the lens to be moved. A loop of 5000 cycle test film, SMPTE PH22,42-5000, is threaded in machine. Clip the leads of a low reading A.C. voltmeter across speaker wires at speaker. Set projector controls to operate, volume at reasonable level, treble control fully clockwise. Set voltmeter for convenient reading. Carefully slide the lens for maximum reading. Rotate lens for maximum reading. After obtaining maximum reading on both focus and azimuth, carefully tighten bracket setscrew, checking meter. Output should not drop. Seal set screw with paint or sealing wax.

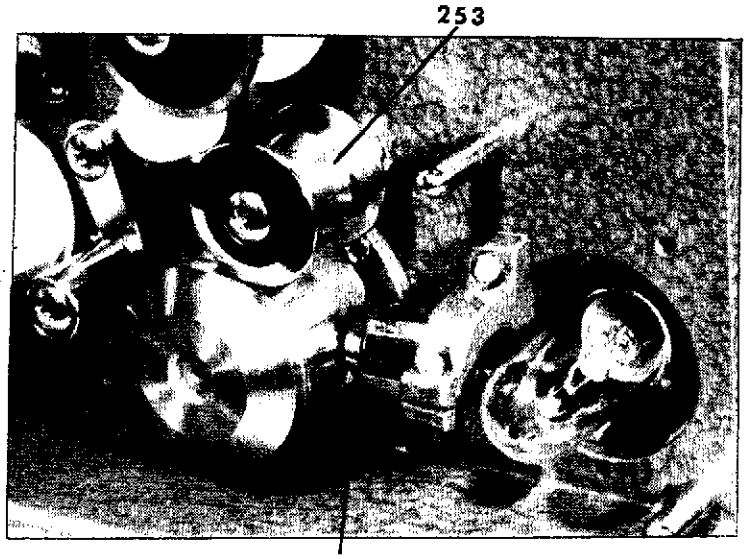
14. SOUND DRUM AND FLYWHEEL ASSEMBLY

14.1 The sound drum shaft is mounted in the shaft housing 86-130, with ball bearings 86-129. The retaining collar 86-131 should be installed with .002" clearance. Shaft must not bind in rotation. Flywheel should be secured so as not to allow it to slip or loosen.



14.2 The solar cell is located in the casting collar 86-127, just under the edge of the sound drum. Remove the leads from the terminal strip before removing the housing. After the housing is replaced, be sure that solar cell is in line with the optical lens. The Scanning beam must fall on the cell. Be sure that the edge of the sound drum does not interfere with the light beam.

14.3 The guide roller 86-253, just above the sound drum is adjustable horizontally to guide the film so that the scanning beam strikes the sound track properly. A test film is available from the Society of Motion Picture Engineers to assure proper alignment. (SMPTE Buzz Track PH22.57).



15. MOTOR AND COOLING FAN

15.1 When mounting motor and fan observe the clearance on either side of cooling fan. Tighten set screw securely.

15.2 Be sure to install belt pulley with set screw toward motor before mounting motor and fan housing to projector chassis. After securing motor mounting, align the motor belt pulley with the shutter pulley. Tighten set screw to flat spot on motor shaft.

16. SPEED CHANGE

16.1 Sound speed (24 frames per sec.) is obtained by placing the belt on the large size motor pulley and the corresponding shutter shaft pulley.

16.2 For silent (16 frames per sec.) place the belt on the other pulley.

17. LAMPHOUSE

17.1 The top of the lamphouse door swings out for ready access to projection lamp. The spring loaded stop arm may be lifted off the pin to allow the door to be opened right out.

17.2 The knob in the upper front centre of the door is used to adjust the projection lamp position. Adjust for maximum uniform brightness on the screen without a film in the projector.

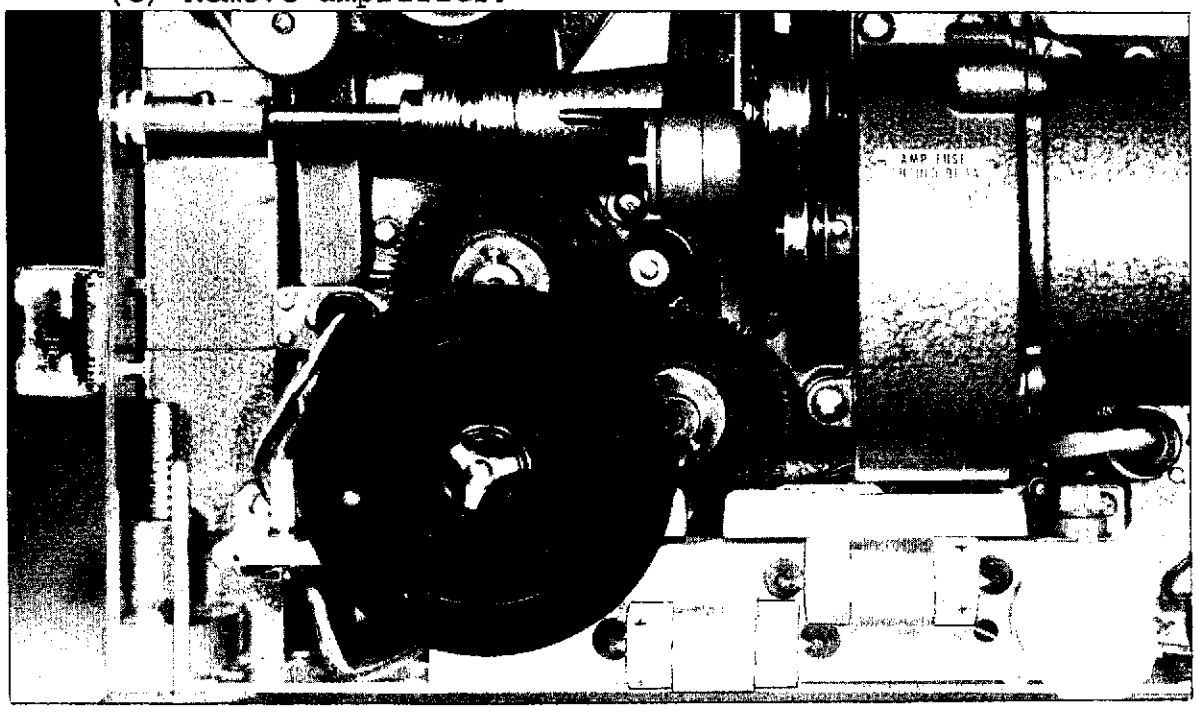
17.3 If knob is turned counter-clockwise too much, the inner lamp cover, 86-44, will touch the motor belt. Observe and adjust accordingly.

18. AMPLIFIER

18.1 Removal and replacement of the amplifier is very simple:

(a) Disconnect power supply
(b) Loosen set screws in control knobs on front panel and remove knobs.
(c) Unplug electrical leads.
(d) Remove one screw at each end of amplifier chassis with Phillips screw driver.
(e) Remove amplifier.

18.2 To replace, simply follow above procedure in reverse order.

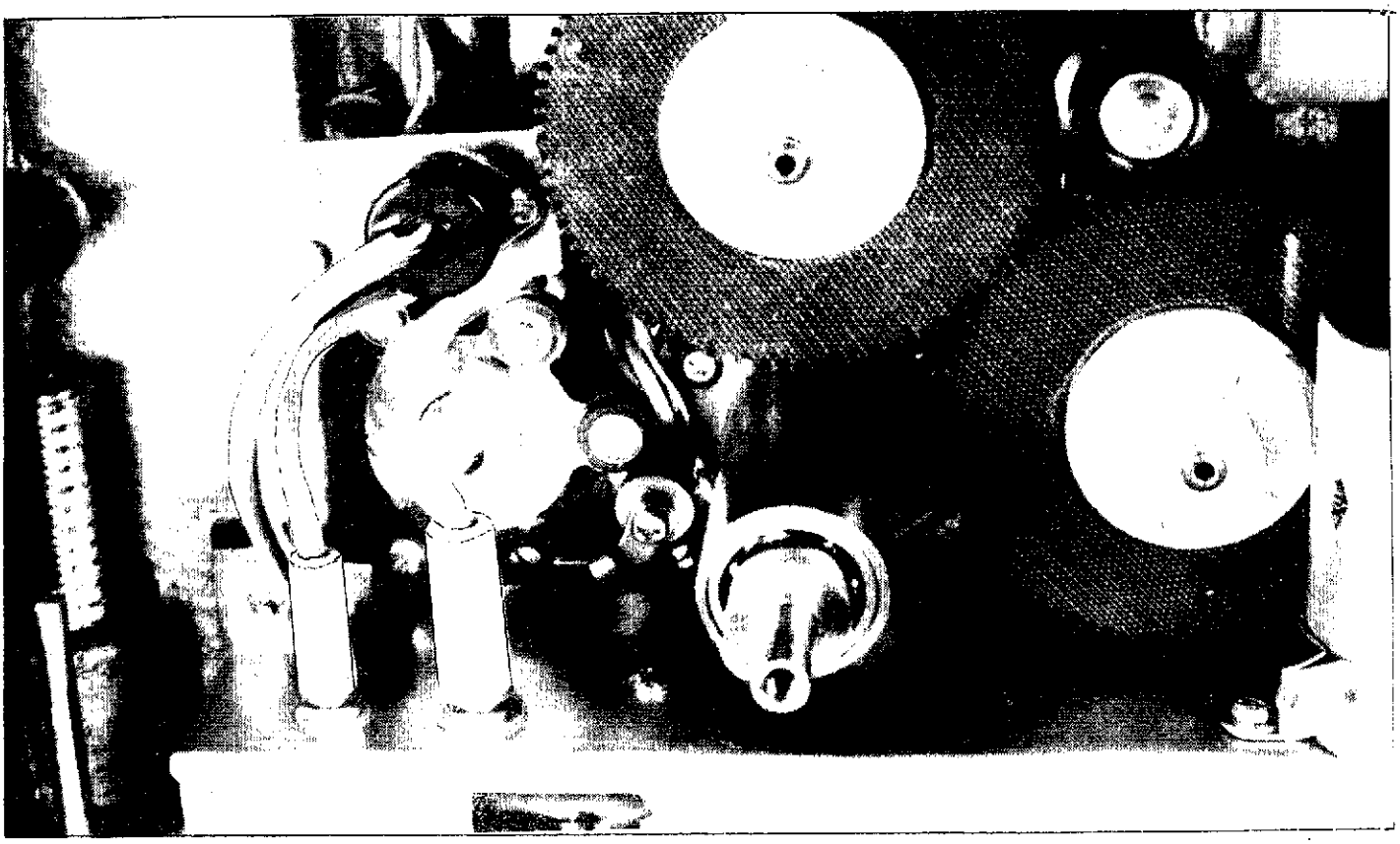


19 MS-862

19.1 This projector has a magnetic head and associated switch and circuit for magnetic playback. In the OPT position, the wafer contacts connect the solar cell circuit and exciter lamp circuit to the amplifier. The magnetic sound head is lifted off the film by the action of the lever attached to the end of the switch shaft. The sound head is directly behind the sound drum. The bracket and shaft assembly is spring loaded so that when the selector switch is in the MAG. position, the spring pulls the magnetic sound head down in contact with the magnetic sound strip on the film. In the OPT position, the switch lever strikes the sound head shaft bracket, lifting it up.

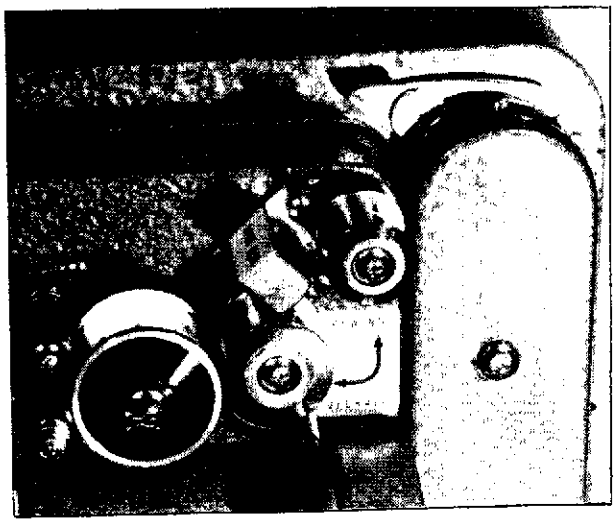
19.2 Observe this action and adjust the position of the switch lever if necessary. This is done by releasing the set screw in the end of the switch shaft. Wafer contacts must make full contact in either selector switch position.

19.3 NOTE: Selector switch should be in MAG. position when removing and replacing amplifier. This is to help avoid bending switch lever shaft.



20 MS-863

20.1 The erase head located between the first two idler rollers at top front of projector : REC. position with safety switch added to selector switch on front panel: recording level indicator: MIC. and high level pick-up jacks on front panel: rocker selector switch on rear lid of machine. The necessary bias oscillator circuit is built into the amplifier.



20.2 NOTE: The threading path must be OVER both idler rollers to provide erasure of previous recording. For sound-on-sound, thread film under first roller and over second. This keeps the film away from the erase head.

21. AMPLIFIER EXCHANGE

21.1 Projectors prior to S/N 38564 have the output transistors mounted under the fan housing which acts as a heat sink. From S/N 38564, these transistors are mounted on amplifier chassis with appropriate heat sinks.

21.2 If it is necessary to install the new style amplifier in earlier model projectors, be sure to provide enough clearance between the heat sink and the fan housing. The heat sinks are connected to the collector of their respective transistors. Care must be taken so that the heat sinks do not touch any other part of the projector.

TROUBLE SHOOTING CHART, MS-860 "PRESIDENT" SERIES

SYMPTOM	PROBABLE CAUSE	REMEDY
No power for motor or lamp.	1. No power at the socket	1. Check fuse or multi breaker or power circuit
	2. Poor connection on cord contacts	2. Repair power cord. Spread pins of AC receptacle of projector.
	3. Faulty motor switch	3. Replace switch.
Lamp will not light - motor runs.	1. Burned out lamp.	1. Replace lamp.
	2. Faulty lamp switch.	2. Replace switch.
Film sprockets not turning, motor runs, lamp lights.	1. Stop lever depressed	1. Raise lever.
	2. Motor belt broken	2. Replace belt. See Sec. 11.1, 11.2.
No sound.	1. Amplifier switch not turned on	1. Turn volume control switch
(Optical)	2. Exciter lamp faulty	2. Replace
	3. Fuse in amplifier blown (Indicates defective output transistors.)	3. Replace
	4. Cable connections in amplifier loose or out.	4. Replace
	5. Solar cell out of position	5. Reposition.
(Magnetic)	6. Speaker faulty.	6. Replace.
	7. Speaker cable faulty	7. Repair or replace.
	8. Amplifier defective	8. Repair or replace.
	9. Magnetic head defective.	9. Replace.
Weak sound.	1. Dust or foreign object on optic lens or solar cell.	1. Clean
	2. Solar cell out of position.	2. Reposition.
	3. Low voltage to exciter lamp.	3. Repair Exciter lamp circuit of amplifier.
	4. Optic lens out of focus.	4. Adjust, see Sec. 13.
	5. Amplifier defective	5. Repair.
	6. Magnetic head dirty	6. Clean.
	7. Magnetic head defective.	7. Replace.

SYMPTOM	PROBABLE CAUSE	REMEDY
Distorted sound.	1. Dirty optic lens or solar cell	1. Clean.
	2. Optic lens out of adjustment.	2. Adjust. See Sec. 13
	3. Amplifier defective	3. Repair or replace.
	4. Poor recording. (Magnetic)	4. Re-record
	5. Film too loose over sound drum.	5. Re-thread or adjust. See Sec. 3.2.
	6. Film not threaded properly over sound.	6. Adjust. See Sec. 3.2.
	7. Film sound track not centered over optical scanning beam.	7. Adjust. See Sec. 14.3.
	8. Sound drum not turning freely.	8. Repair or replace bearings. See Sec. 14.1.
	9. Flywheel loose on shaft	9. Tighten screw.
Loses upper loop.	1. Sprocket shoe on No. 1 sprocket drum not in place or out of adjustment.	1. Correct. See Sec. 6.1.
Loses lower loop.	1. Torn sprocket holes in film	1. Automatic loop restorer corrects this fault.
	2. Film too tight in gate.	2. Adjust. See sec. 10.
	3. Claw not engaging film properly	3. Adjust. See Sec. 11/9, 11.10.
Loop restorer keeps rotating.	1. Rubber wheel too close to fibre gear.	1. Trim flat spot with sharp knife or replace. See Sec. 9.1.
	2. Spring tension too loose	2. Adjust. See Sec. 9.2.
Take-up defective. (Forward)	1. Broken rear arm belt.	1. Replace.
	2. Broken take-up drive belt.	2. Replace
	3. Belts slipping.	3. Clean or replace. See Sec. 1.
	4. Forward clutch cam not engaging.	4. Adjust, clean or replace. See Sec. 4.2.
(Reverse)	5. Reverse drive belt broken or slipping.	5. Replace or clean.
	6. Reverse cam clutch not engaging.	6. Adjust, clean or replace. See Sec. 4.1.
	7. Broken or oily supply arm.	7. Replace or clean. See Sec. 1.

SYMPTOM	PROBABLE CAUSE	REMEDY
Rewind defective	1. Steel rewind belt broken	1. Replace
	2. Supply arm belt slipping.	2. Clean or replace. See Sec. 1.
	3. Take-up slip clutch cork too tight or dry.	3. See Sec. 2.3. for repairs.
	4. Rewind gear defective.	4. Replace. See Sec. 5.
Film noise in gate	1. Film shoe binding	1. Adjust. See Sec. 10.4, 10.5, 10.6.
	2. Film guides out of adjustment.	2. Adjust. See Sec. 10.4, 10.7, 10.8.
	3. Claw not entering film perforations properly.	3. Adjust. See Sec. 11.95, 11.10.
	4. Claw travel incorrect.	4. Replace fibre cam. See Sec. 11.4.
	5. Curved shock absorber spring broken.	5. Replace. See Sec. 11.4.
Picture unsteady.	1. Claw dirty or defective.	1. Clean or replace.
	2. Dirty film path in gate.	2. Clean.
	3. Film guides out of adjustment.	3. Adjust. See Sec. 10.4, 10.7, 10.8.
	4. Film shoe misadjusted.	4. Adjust. See Sec. 10.5, 10.6.
	5. Defective film.	5. Check.
Picture illumination poor.	1. Dirty mirror, condensor lens or projector lens.	1. Clean with soft cloth or lens tissue.
	2. Projector lamp defective.	2. Replace.
	3. Low line voltage.	3. Check and remedy if possible.
Film scratched.	1. Film channel or shoe dirty or damaged.	1. Clean or replace.
	2. Emulsion deposits on gate or shoe.	2. Clean.
	3. Guide rollers dirty or dragging.	3. Clean and lubricate.