SERVICE MANUAL

16 mm Projector Series 1000

Service Instructions

TELEX®

TELEX COMMUNICATIONS, INC.

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16 mm PROJECTORS
1000 SERIES

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

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1000 SERIES

TABLE OF CONTENTS

SECTION I.
PRINCIPLES OF OPERATION

All Singer 16mm projectors may be divided into six (6) basic functions:

1. The Main Drive System
2. The Feed & Rewind System
3. The Gate & Lens Mount
4. The Sound Drum and Optic
5. The Take-up System
6. The Electrical System

A thorough understanding of each function and its relationship with the other functions will be a great assistance in servicing these projectors.

THE MAIN DRIVE SYSTEM

All functions are driven from a single drive shaft which is turned by a reversible motor through a drive belt (Figure 1-1). Two worm gears (drive gears), pinned to the shaft, drive the Take-Up Clutch gear and the Film Feed Clutch gear. The Shutter and Safety Shutter (in models which have the still feature) are also mounted on this same drive shaft. Forward and Reverse operation of the projector is produced by changing the direction of rotation of the drive shaft by changing the direction of rotation of the drive motor. (See Power Supply and Motor Drive Circuits).

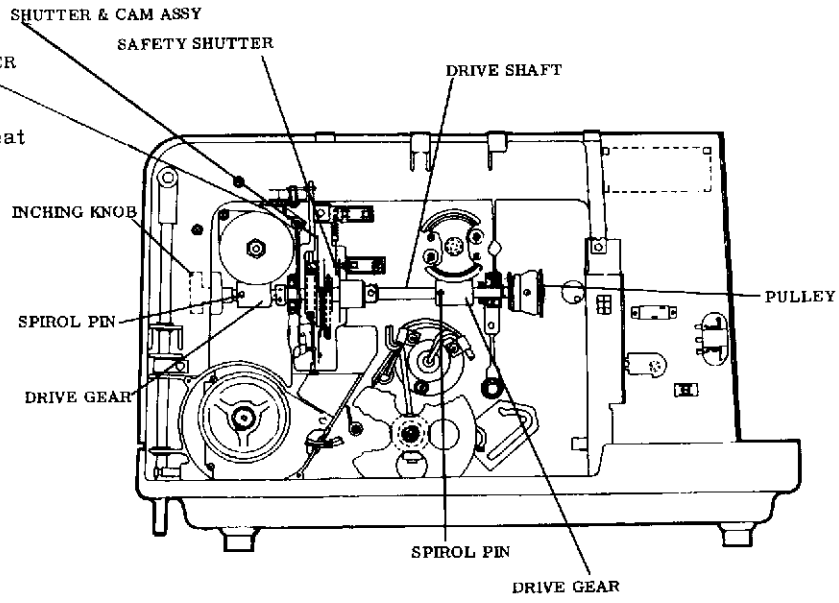


Figure 1-1. MAIN DRIVE SYSTEM

FEED AND REWIND SYSTEM

The Film Feed Clutch gear is driven by the front worm gear on the main drive shaft (Figure 1-1). The Feed Clutch gear is moulded permanently on a shaft, one end of which fits through a bearing in the main casting and supports the Film Feed Sprocket (Figure 1-2). The other end of the shaft supports the entire clutch mechanism which produces the clutching action and the direct drive for retrieving film on the supply reel when the projector is run in the Reverse or Rewind modes. (Figure 1-3). The Feed Clutch Pulley drives the supply reel in Reverse and Rewind by means of the supply reel arm belt (Figure 1-2). The pulley is clutched in the Reverse mode, driven directly in the Rewind mode and not driven in the Forward mode.

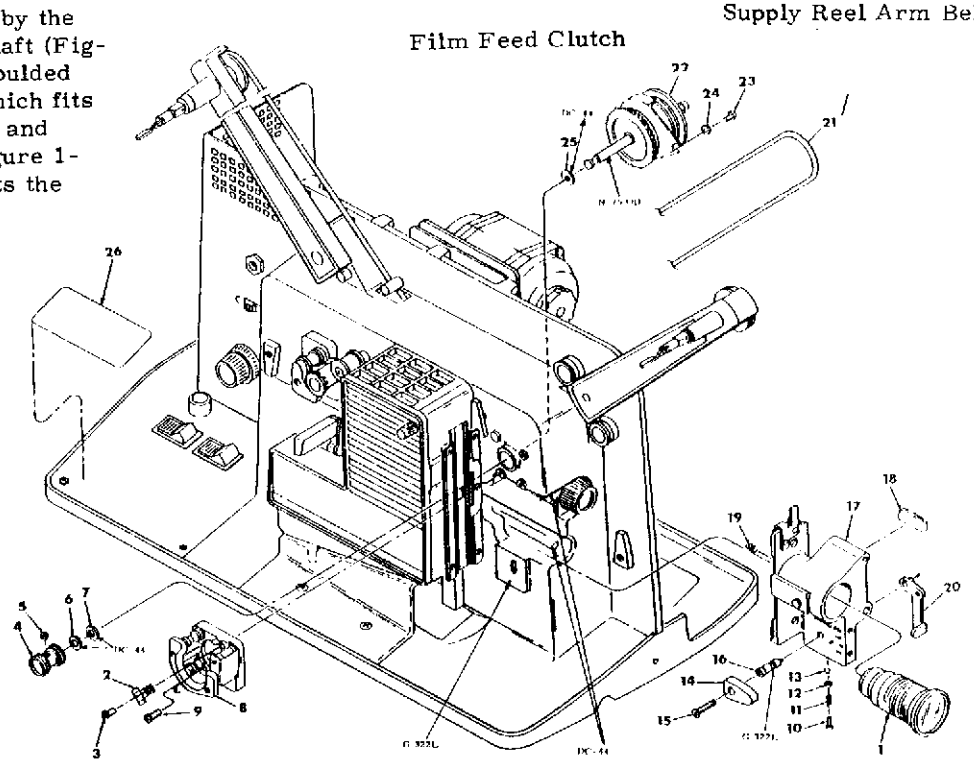
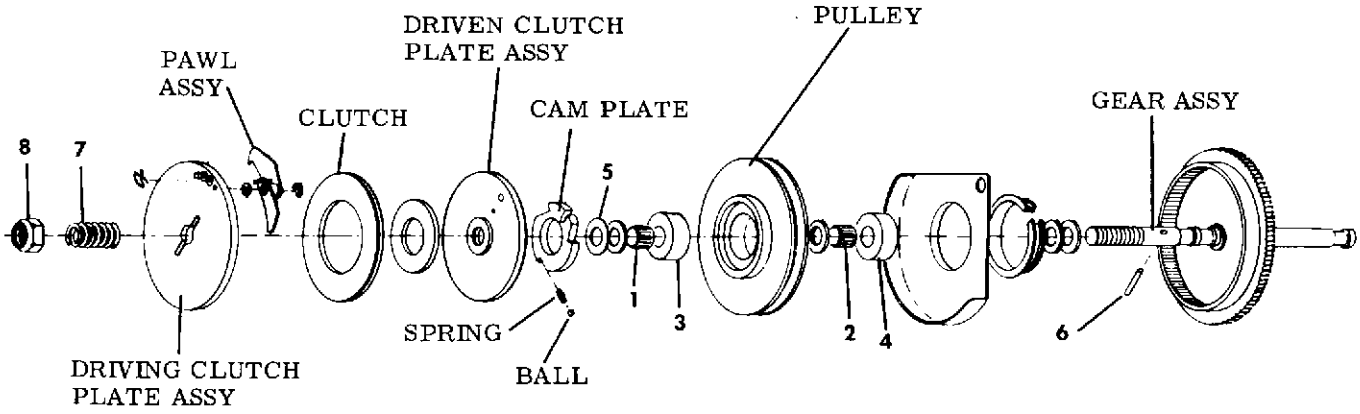


Figure 1-2. FILM FEED CLUTCH ASSEMBLY



(Figure 1-3). FILM FEED CLUTCH ASSEMBLY

The action of the Balls, Springs and Cam Plate (Fig 1-3 & 1-4), determines whether the pulley is driven or not. The action of the Nut (8), Spring (7), Driving Clutch Plate, Pawl Assembly, Clutch and Driven Clutch Plate determines whether the driving force delivered to the pulley is clutched or connected directly to the pulley.

FORWARD

The Cam Plate rotates counterclockwise (Figure 1-4). pushing the Balls down the ramp of the Cam, compressing the Springs. The Cam turns freely inside the recess of the pulley and the pulley is not driven.

REWIND

The Cam Plate rotates clockwise, forcing the Balls up the ramp (these also now being pushed by the Springs) causing them to lodge between the Cam Plate and the wall of the recess in the pulley. This locks the Cam Plate together with the pulley and causes the pulley to rotate when the Cam Plate rotates.

The Cam Plate rotates when the Driven Clutch Plate rotates because the two are connected together by a pin protruding from the Driven Clutch Plate into the notch in the Cam Plate.

The Driven Clutch Plate rotates because it is connected directly to the Driving Clutch Plate by the Pawl Assembly, the hooked end of which has been pushed down by the Rewind Lever (Figure 1-1) to engage the outer pin of the Driven Clutch Plate.

The Driving Clutch Plate rotates because it is pinned to the shaft of the Gear Assembly by pin (6).

Thus the driving force from the Feed Gear is coupled directly to the pulley in the Rewind mode.

REVERSE

The Cam Plate and Driven Clutch Plate function identically in Reverse as they do in Rewind. However, the driving force supplied to the pulley is now clutched rather than direct.

The position of the rewind lever is moved to cause the hooked end of the Pawl Assembly to raise up and disengage from the pin on the Driven Clutch Plate. Drive is now transmitted from the Driving Clutch Plate to the Driven Clutch Plate by the Clutch. The amount of drive supplied by the clutch is determined by the pressure exerted against the Driving Clutch Plate by the Spring (7) which can be compressed or relaxed by adjusting Nut (8).

A clutched mechanism is necessary in reverse since the film is fed to the supply reel by the feed sprocket at a constant rate, but the supply reel will try to take up film at a progressively faster rate as film builds up on it and increases its diameter.

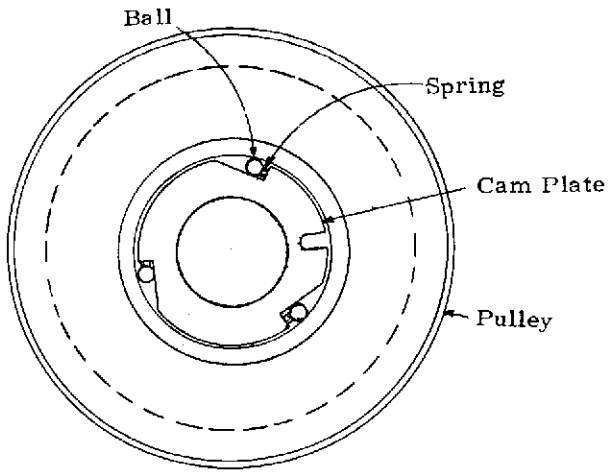


Figure 1-4. FEED CLUTCH CAM PLATE

GATE AND LENS MOUNT

The film is held securely in place against the aperture plate by the film pressure shoe (Figure 1-5). It is fed into this channel from the feed sprocket which is just above the lens mount. The pins on the claw arm enter the sprocket holes from behind the aperture plate and pull the film down through the channel one frame at a time (Figure 1-6).When the framing adjustment is properly made, each picture frame will line up exactly in front of the hole in the aperture plate through which the projection lamp shines. The light shines through the film and the image is projected onto a screen and focused by means of the projection lens.

The film is moved through the film gate at a rate of 24 frames/second. This is accomplished by moving the claw arm first into the sprocket holes, then down, then back out of the sprocket holes and up again to start the cycle over. While the film is being pulled through the gate area by the claw arm, a shutter moves between the lamp and film to prevent light from passing through the film and projecting an image on the screen. As soon as the claw arm has moved the film into position in front of the hole in the aperture plate, the shutter moves out of the way and the light is again allowed to pass through the film. The momentary interruption of the light by the shutter is necessary to prevent what would appear to be a streaming of the picture. However, the interruption of the light is at such a rapid rate that only a small amount of flicker is discernible by the human eye. The claw arm and shutter are synchonized by a cam which is part of the shutter assembly and turns at the same rate of speed as the main shaft.

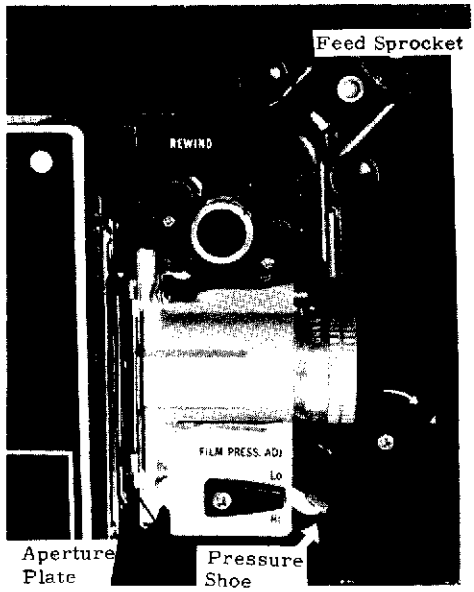


Figure 1-5. GATE AND LENS MOUNT

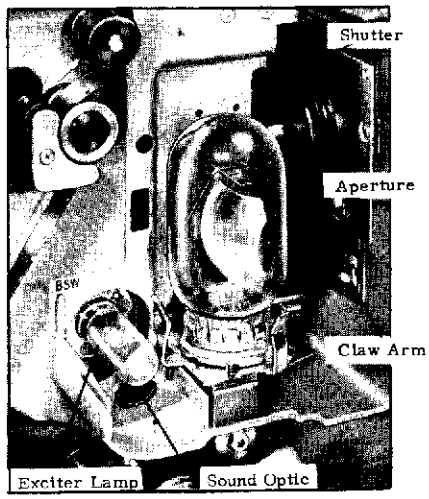


Figure 1-6. CLAW ARM AND SHUTTER

SOUND DRUM AND OPTIC

After leaving the gate and lens mount area, the film passes over the sound drum. It is here that the sound information recorded on the sound track portion of the film is detected.

Sound information is recorded on the film by causing an audio signal to vary the intensity of a beam of light which is focused on the sound track portion of the film. The varying intensity of the light exposes the film in varying degrees corresponding to the frequency and amplitude of the audio signal itself.

To replay the audio track a beam of light from an exciter lamp is passed through this exposed part of the film and onto a light sensitive device which transforms it into electrical energy (Figure 1-7). The electrical energy will then vary at the same rate and with the same amplitude as the exposed portions on the film sound track. These electrical variations are fed into the audio amplifier where they are amplified and eventually drive the speakers to reproduce the original sound.

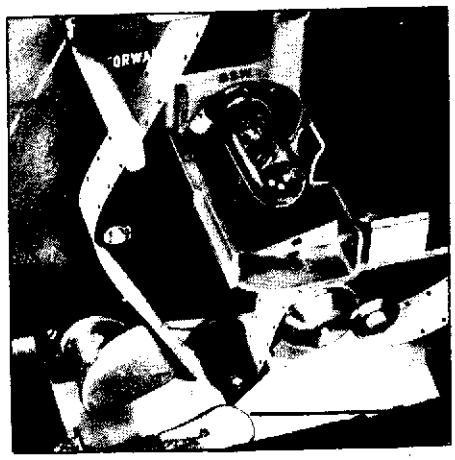


Figure 1-7. SOUND DRUM AND OPTIC

A pressure roller in front of the sound drum holds the film firmly against the sound drum and a dampening roller behind the sound drum maintains a constant film speed over the sound drum for maximum fidelity of sound reproduction.

The movement of film over the sound drum causes the sound drum to rotate. A balanced flywheel mounted on the end of the sound drum shaft, maintains a constant rotational speed of the sound drum which also insures maximum fidelity of sound reproduction.

TAKE UP SYSTEM

Film is drawn through the sound drum portion of the projector by the take-up sprocket, then passes over the reel tension arm pulley and is gathered on the take-up reel (Figure 1-8). The take-up sprocket turns at a constant rate of speed since it is attached to the shaft of the take-up gear which is driven by the rear worm gear on the main drive shaft. Film is

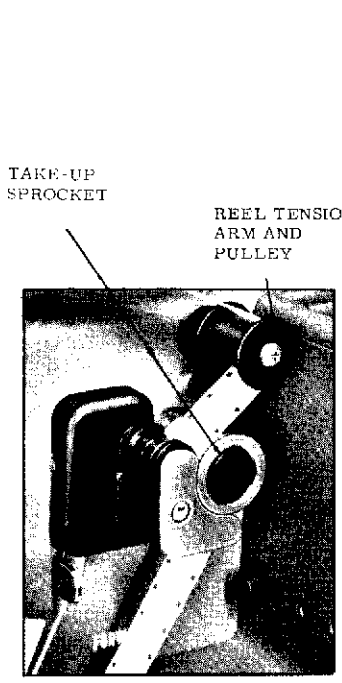


Figure 1-8. TAKE UP SPROCKET AND TENSION ROLLER

thus fed to the take-up reel at a constant rate of speed. However, the take up reel must be able to turn at a variable speed since the diameter of its take-up surface varies continuously as film is gathered on it. The drive mechanism which drives the take-up reel with the reel arm belt is, therefore, continuously clutched and self-adjusting to compensate for the increased diameter and weight of the take-up reel.

The clutching action is provided by the interaction of the take-up clutch arm and pulley (20), the take-up clutch liner (31), and the take-up clutch gear (29), (Figure 1-9). The liner fits snugly inside the gear and the pulley fits inside the liner.

The clutch is adjusted so the top part of the pulley contacts the liner when the projector is run in the forward mode. The gear is driven by the worm gear on the main shaft and rotates continuously while the machine is running. The liner rotates along with the gear and turns the pulley. The pulley drives the reel arm pulley by means of the reel arm belt. The surface of the clutch pulley is polished and can slip on the liner if necessary.

The system is designed so the take-up reel is capable of taking the film much faster than the film is fed to it by the take-up sprocket, so film will not be spilled when the clutch is working properly. Since the take-up reel tries to take up film faster than the film is being fed to it, the

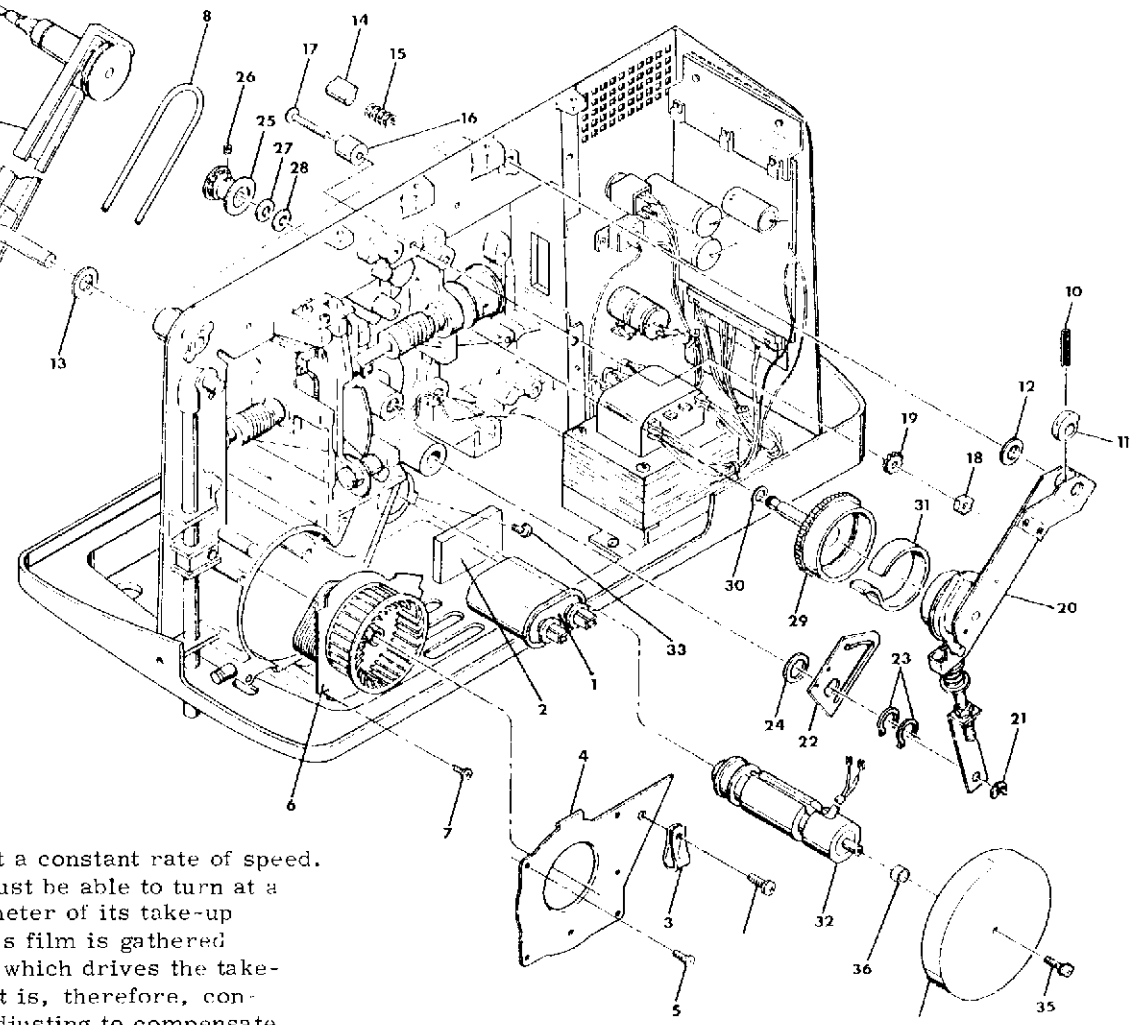


Figure 1-9. TAKE-UP CLUTCH

mechanism which drives it must provide a sufficient amount of drive while at the same time being able to slip to prevent film from being pulled through the take-up sprocket. The fact that the take-up clutch pulley can slip inside the take-up clutch liner allows for this to happen.

The mechanism is self-adjusting during the entire take-up cycle of any given film because of the way the take-up reel arm (9) is attached to the take-up clutch arm (20). (Figure 1-9). The shaft of the take-up reel arm passes through a hole in the upper portion of the take-up clutch arm. A roll pin(10)is inserted in a hole in the reel arm shaft and pushes down on the upper end of the clutch arm when the reel arm is allowed to rest in its normal upright position. Since the roll pin pushes down on the upper portion of the clutch arm, it causes the clutch arm to pivot and push up on the lower portion. This means that the lower portion or the pulley is forced up against the liner which is inside the clutch gear. The more weight placed on the reel arm, the more downward pressure is exerted on the roll pin and upper portion of the clutch arm, resulting in more upward pressure on the clutch pulley forcing it to press harder against the liner. This results in more friction between the clutch liner and the pulley producting a greater amount of drive. Thus, when the film take-up reel gets heavier because it is taking on more film, it forces the clutch pulley against the clutch liner producing the increased torque needed to drive the heavier reel. (Figure 1-10).

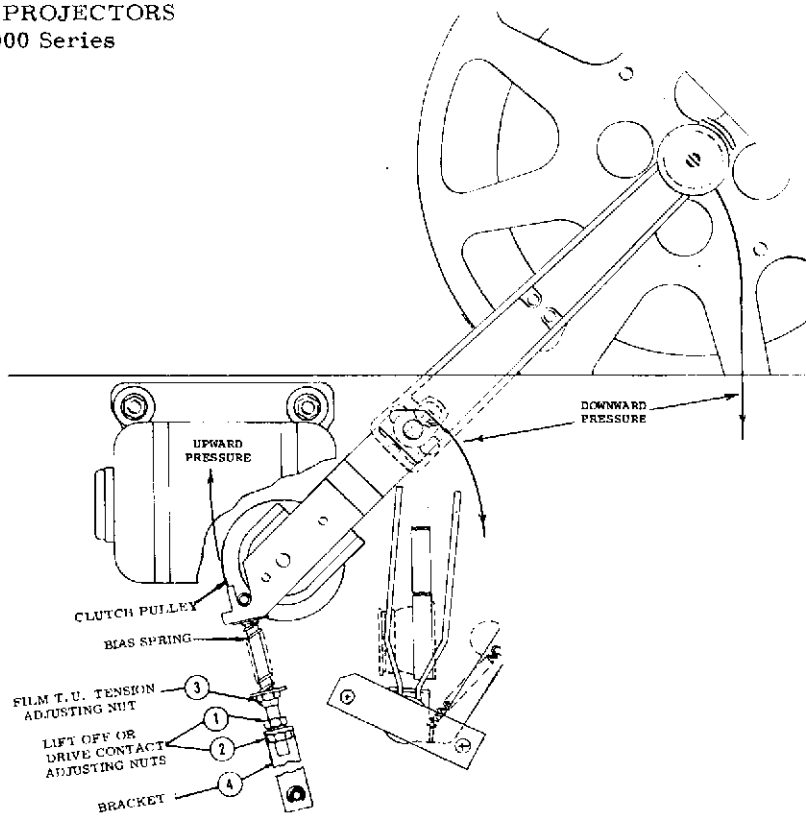


Figure 1-10. TAKE-UP CLUTCH WEIGHT COMPENSATION.

ELECTRICAL AND ELECTRONIC CIRCUITS

The electrical and electronic circuits in the 1000 Series projectors are divided into two sections.

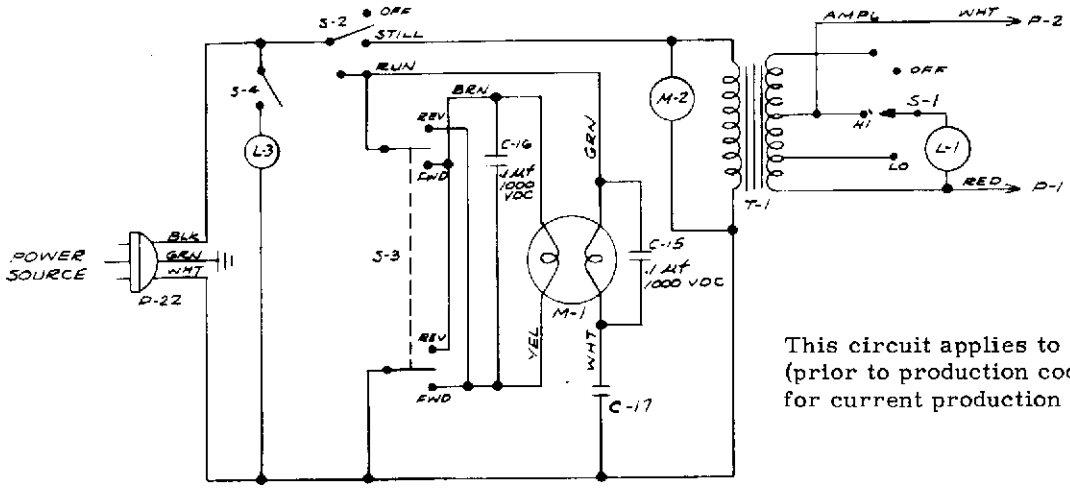
1. Power Supply and Motor Drive Circuits
2. Audio Amplifier and Miscellaneous Circuits.

POWER SUPPLY AND MOTOR DRIVE CIRCUITS

are basically the same in all machines. For the purpose of discussion, we will use the circuit for the Model 1020 shown in Figure 1-11.

SWITCH (S2) This switch supplies power to all functions of the machine with the exception of the threading lamp. In the Still position, power is supplied to the blower motor (M2) and the step down transformer (T1). In the Run position, power continues to be supplied to the blower motor and the step-down transformer, and in addition to the start winding of the main drive motor (M1) as well as the Forward/ Reverse switch (S3).

When the main function lever is in the Thread position, no power is supplied to the run winding (brown-yellow) of the main drive motor. Moving the function lever to the Forward position applies power to the brown wire which is in phase with the power applied to the green wire of the start winding. The motor now runs in the direction to move film forward through the machine.



This circuit applies to early production projectors (prior to production code L4). Refer to Figure 6-7 for current production schematics.

Figure 1-11. POWER SUPPLY AND MOTOR DRIVE CIRCUIT - Model 1020

When the main function lever is moved to the Reverse position, power is supplied to the yellow lead of the run winding in phase with power on the green wire of the start winding. In this condition, the motor runs in a direction to move film through the projector in reverse. Thus forward and reverse operation are achieved by changing the input voltage phase relationship between the start winding and the run winding of the main drive motor.

BLOWER MOTOR (M2). The blower motor's function is to provide a constant flow of air over the projection lamp (L1) to prevent the lamp from overheating.

TRANSFORMER (T1). This transformer takes the line voltage applied to its primary and steps it down to 21.75v for use by the amplifier and the high intensity setting for the projection lamp. A 17.5v tap is provided for low intensity operation of the projection lamp.

SWITCH (S1). This switch is used to select either high or low intensity for the projection lamp (L1). It applies the 21.75v from the secondary of transformer (T1) to the lamp when it is in the high position, and the 17.5v when it is in the low position.

SWITCH (S4). This switch supplies power for the threading lamp.

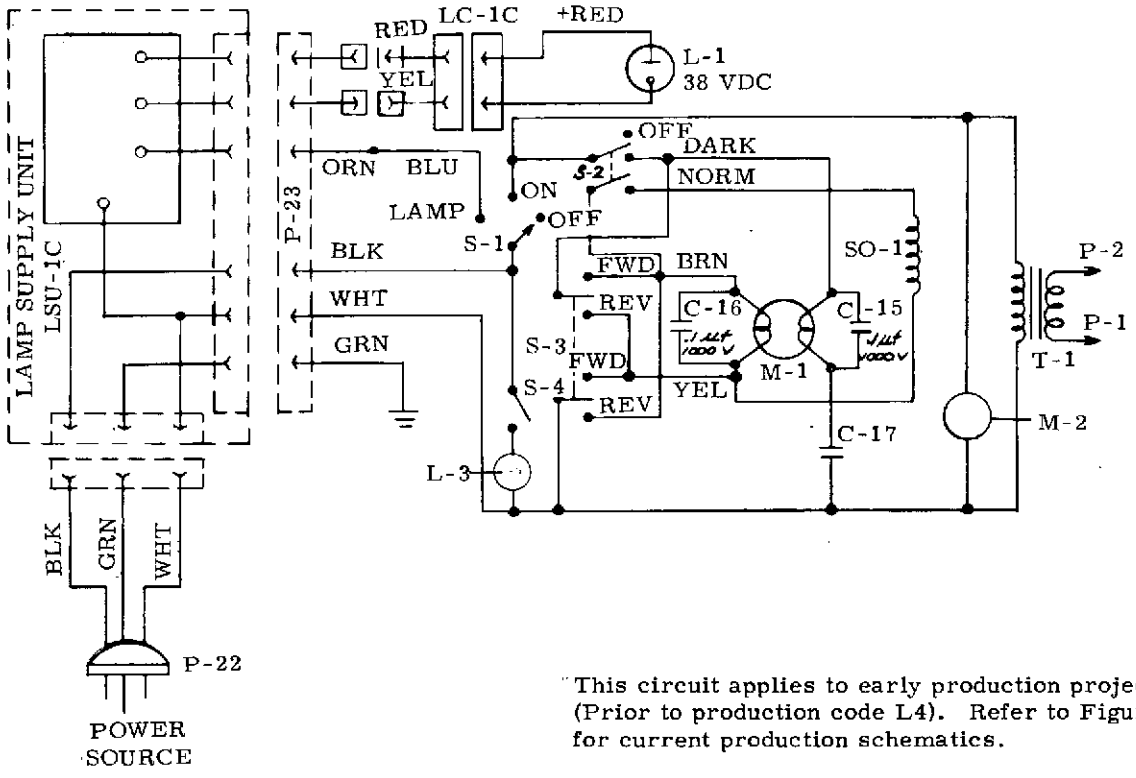
POWER SUPPLY AND MOTOR DRIVE CIRCUITS—MODEL 1040. When the projector is plugged into the lamp power supply by means of (P23), AC line voltage is supplied to the projector on the black wire of the interconnecting cable (Figure 1-12).

SWITCH (S1). This switch is the OFF-ON-LAMP switch. In the On position it applies power to the blower motor (M2), the transformer (T1), and the Off-Dark-Normal switch (S2). The blower motor will run continuously when the switch is in this position, and the transformer will step the line voltage down to the correct voltage for the audio amplifier. When (S1) is in the lamp position, it continues to supply power to the previously mentioned circuits, and it also supplies power back through the orange wire in the interconnecting cable to the lamp supply itself.

SWITCH (S2). In the Dark position, this switch supplies power for the start winding of the main drive motor (M1), and the Forward/Reverse switch (S3). In the Normal position, this switch continues to supply power to the above-mentioned circuits, and in addition, it connects the dowser solenoid (SO1) to the Forward/Reverse switch (S3).

SWITCH (S3). This is the Forward/Reverse switch which supplies power to the run winding of the main drive motor (M1) and through the contacts on switch (S2), to the dowser solenoid (SO1). The function of the motor circuit is identical to that described above for the Model 1020 projector.

SWITCH (S4). This switch applies power to the threading lamp.



This circuit applies to early production projectors (Prior to production code L4). Refer to Figure 6-7 for current production schematics.

Figure 1-12. POWER SUPPLY AND MOTOR DRIVE CIRCUIT - Model 1040

POWER SUPPLY AND MOTOR CIRCUITS—MODEL 1030N Figure 1-13).

SWITCH (S1). This switch applies power to the threading lamp (L1).

SWITCH (S2). This switch applies power to one side of the start winding of the main drive motor (M1), one side of the blower motor (M2), the forward/reverse switch (S3), and the Site/Normal switch (S5).

SWITCH (S3). This Forward/Reverse switch performs the same function as the Forward/Reverse switch previously described under POWER SUPPLY AND MOTOR DRIVE CIRCUITS - MODEL 1020.

RELAY (K1). This relay is added to the circuit to remove AC power from the start winding of the main drive motor (M1) when the main function lever is moved from either Forward or Reverse to the Thread position. This is necessary because the synchronous motor in the 1030N will sustain itself if power is maintained on its start winding after power is removed from its run winding.

The relay winding is in series with the run winding of the main drive motor and its contacts are in series with the start winding. With switch (S2) in the Run position, placing the Forward/Reverse switch (S3) in either Forward or Reverse applies power to the run winding of the main drive motor through the relay coil. The relay operates and its contacts close to complete the other half of the start winding circuit.

When the main fuction lever is moved to Thread, power is removed from the run winding and the relay coil. The relay releases and its contacts open to remove power from the start winding.

SWITCH (S4). This switch supplies power to the projection lamp (L2). It must be turned on for the lamp to light when the machine is operated with the Site/Normal switch (S5) in either position.

SWITCH (S5). This is the Site/Normal switch which determines the source of power supplied to the primary of transformer (T1) as well as to the amplifier. In the Normal position, this switch supplies power from within the machine to these circuits. In the Site position, power must be supplied to these circuits through the remote socket (J5).

REMOTE SOCKET (J5). This socket provides remote access to all circuits except the threading lamp circuit.

Connecting one set of contacts of a double pole, single throw switch to pins 2 and 9 and the other set of contacts to pins 7 and 8 simulates the Off/Run switch.

Connecting a single pole, single throw switch to pins 5 and 7 (with the Site/Normal switch in the Site position) permits control of power to the primary of the transformer (T1). This allows for simultaneous control of the Projection Lamp and Amplifier from the remote position.

Connecting a single pole, single throw switch to pins 1 and 10 (with the Site/Normal switch in the Site position) permits control of power to the Amplifier independent from the Projection Lamp. (Pins 5 and 7 must

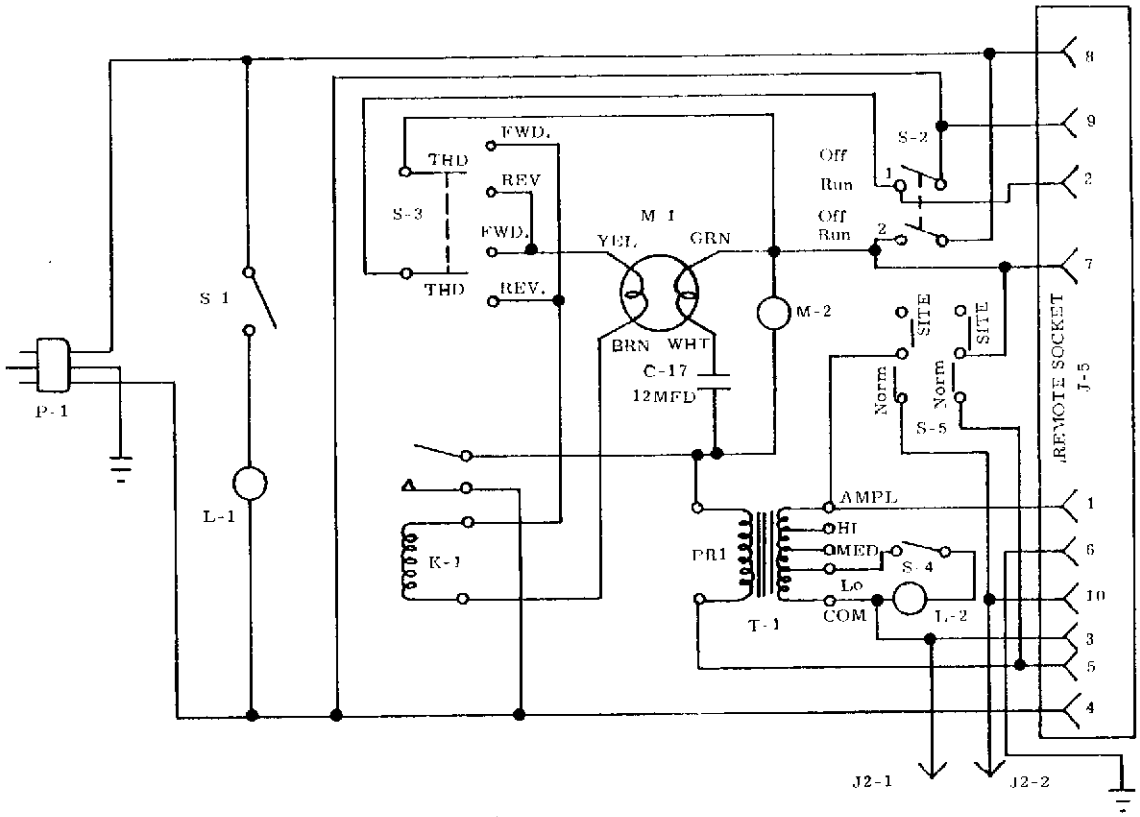


Figure 1-13. POWER SUPPLY AND MOTOR DRIVE CIRCUIT - Model 1030N

be connected together to provide the source of power for the Amplifier.)

Connecting a 250 Watt rheostat or standard 250 Watt dimmer control to pins 5 and 7 provides a continuously variable control of projection lamp intensity. (If this option is exercised, an auxiliary power source should be supplied for amplifier operation - see discussion below.)

With the Site/Normal switch in the Site position, power may also be supplied to the Amplifier by connecting an auxiliary 24 Volt AC supply to pins 3 and 10. Pins 5 and 7 do not need to be connected together for amplifier operation in this configuration.

AUDIO AMPLIFIERS. The audio amplifiers used in all 1000 Series projectors are basic audio amplifiers and need very little explanation. For the purpose of our brief discussion, we will refer to the 43477G6 amplifier. (Figure 1-14).

The variations of light intensity produced by the exciter lamp shining through the sound track on the film are picked up by a photo-sensitive diode (PD-1) and converted to electrical variations. These electrical variations are fed into the preamplifier portion of the audio amplifier (TR-2) and (TR-3) where they are amplified and fed to the volume/tone control (VR-1A) and (VR-1B). From there they pass into the voltage amplifier (TR-4) and then into the output amplifier (TR5-9). The output amplifier then drives the speakers mounted in the projector. A standard 1/4" audio jack (JS-1) is provided for connecting an external apeaker to the projector. The external speaker plug opens the normally closed contacts of this jack and removes the internal speakers (LS-1) and (LS-2) from the circuit.

AMPLIFIER POWER SUPPLY. All amplifiers are supplied DC power from a full wave bridge rectifier (D-1) which is connected to the secondary of the lamp-amplifier transformer. The bridge supplies an unregulated DC voltage which powers the output stages of the audio amplifier and a voltage regulating circuit.

The voltage regulator supplies a regulated voltage for the preamplifier as well as the exciter lamp circuit. The zener diode (D2) holds the base of the transistor (TR-1) at a constant voltage. The

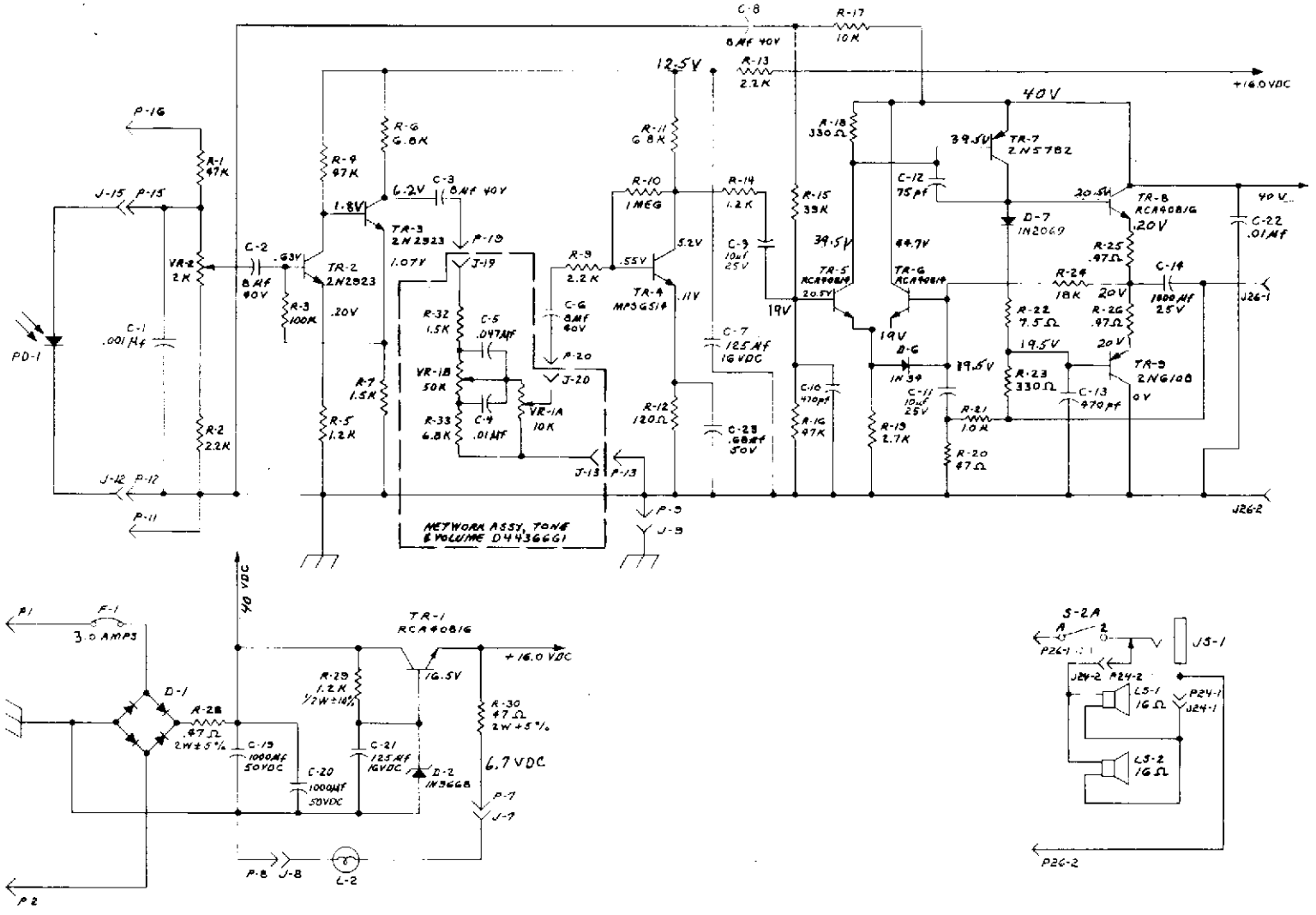


Figure 1-14. AMPLIFIER SCHEMATIC DIAGRAM

capacitor across the zener diode (C21) helps to stabilize this regulated voltage. Resistor (R29) in series with the diode/capacitor circuit is a voltage dropping resistor which develops the remaining DC unregulated voltage supplied to the voltage regulating circuit.

Transistor (TR1) does the regulating in this circuit. When the DC voltage to the circuit increases because of a line voltage increase, the DC output voltage from the emitter of the transistor tries to increase. However, since the base is held at a constant voltage by the zener diode, an increase in emitter voltage will be recognized as an increase in reverse bias and the transistor conducts less to maintain a constant voltage at the emitter. When the input DC voltage drops due to a drop in line voltage, the voltage at the emitter tries to drop. With the base still held at a constant voltage by the zener diode, this drop in voltage at the emitter causes greater forward bias, the transistor conducts more, and the output at its emitter will remain the same.

The regulated voltage output from the transistor is supplied to the pre-amplifier to improve the signal to noise ratio of the amplifier. It is used in the exciter lamp circuit to prevent any variations in sound which would occur if the brightness of the exciter lamp were to vary. Resistor (R30) is in series with the exciter lamp (L2) to reduce the 16 volt regulated supply to 6.7 volts for the exciter lamp. When the exciter lamp is removed from the circuit, the voltage measured between P7 and P8 will be 16V. This is an open circuit voltage since no current is flowing in the circuit with the exciter lamp removed.

0 dbm CIRCUIT. The 0 dbm circuit is supplied as a standard part of the 1030N projector and can be added to any 1000 Series Projector (Figure 1-15). It provides for a balanced 600 ohm output, adjustable for 0 dbm.

When the projector is not being used in the 0 dbm mode, the output signal from the pre-amplifier is fed through a normally closed set of contacts on the 0 dbm jack to the volume control and through the remaining portion of the amplifier to the speakers. Inserting a standard 1/4" phone plug into the 0 dbm jack (J7) opens the normally closed set of contacts and closes the normally open set of contacts so the signal from the pre-amplifier is fed into the 0 dbm circuit. Transistor (TR10) amplifies the signal and delivers it through C24 to transformer (T2). The transformer couples the signal to the 0 dbm jack. Potentiometer (VR3) is used to adjust the output at this jack for 0 dbm. The jack must be terminated with 600 ohms when making this adjustment.

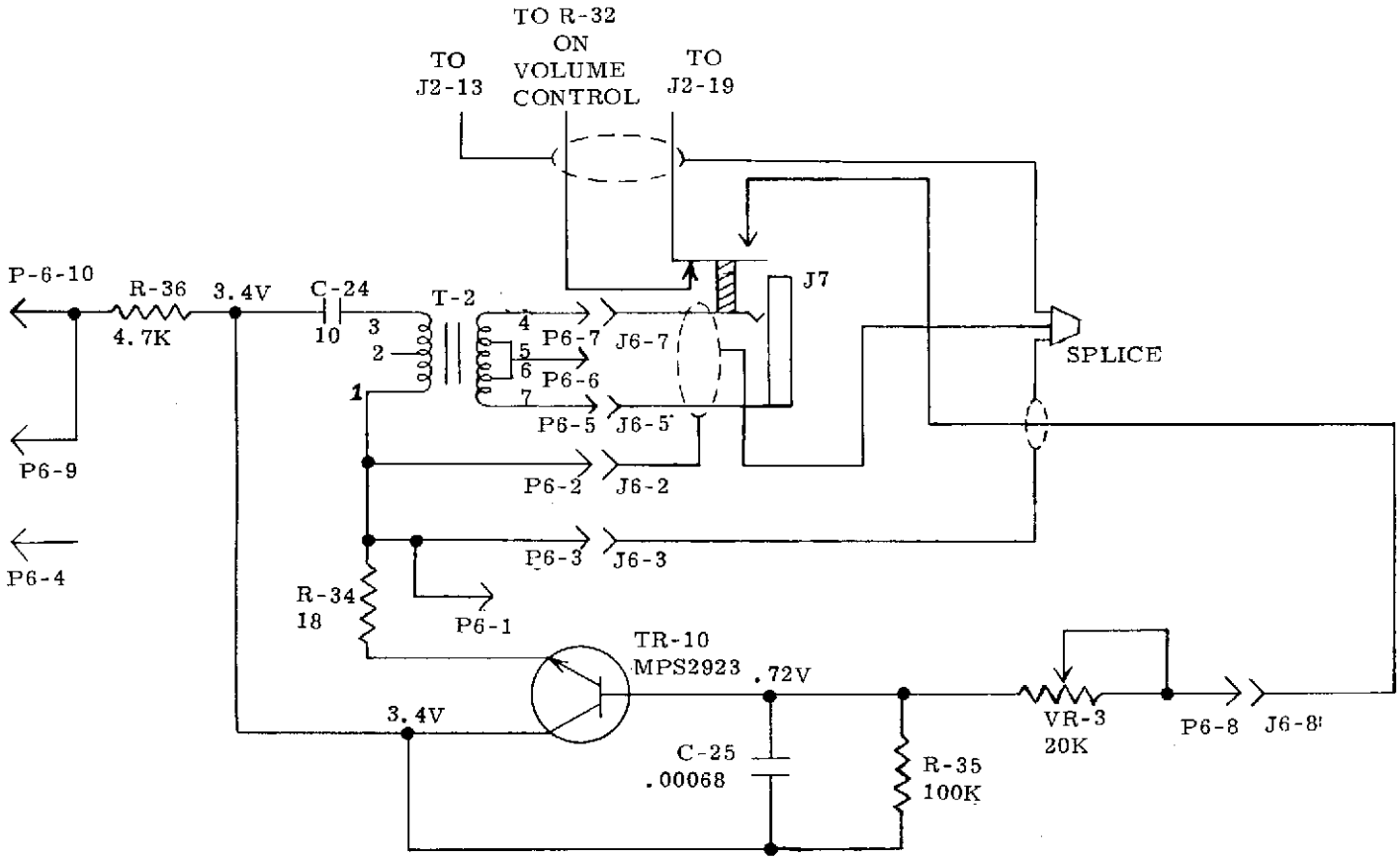


Figure 1-15. 0-dbm Circuit Diagram

ADHESIVES

39490-P2	Glyptal No. 1276; Clear (General Electric Co., Schenectady, New York) 3 oz.
39490-P1	Glyptal No. 7526; Blue (General Electric Co., Schenectady, New York) 3 oz.
LP	A-963-B Cement (W. J. Ruscoe Co., Akron, Ohio)
LP	Hysol R9-2039 Resin (Hysol Corp., Olean, New York)
LP	Hysol H2-3404 Hardener (Hysol Corp., Olean, New York)

LUBRICANTS

39479-P4	FS-1290 Fluorosilicone Grease (Dow-Corning Corp., Midland, Michigan) 1/2 oz.
39479-P5	DC-200 Silicone Fluid; 200,000 Centistroke Viscosity (Dow-Corning Corp., Midland, Michigan) - 1/2 oz.
39479-P6	DC-550R Silicone Fluid; 115 Centistroke Viscosity (Dow-Corning Corp., Midland, Michigan) - 1/2 oz.
39479-P7	009 Lubricant (Keystone Carbon Co., St. Mary's, Pa.) - 1/2 oz.
39479-P8	Instrument Oil N-75 - 2 oz.
39479-P9	DC-44 Silicone Grease; Light Consistency (Dow-Corning Corp., Midland, Michigan) - 2 oz.
39479-P15	Vischem #352 (Ultra Chem Inc., Wilmington, Del.) - 2 oz.

MISCELLANEOUS

39490-P12	Tan Touch-up Paint - 4 oz.
39490-P13	Brown Touch-up Paint - 4 oz.
39490-P4	Glyptal Thinner 1511M, - 8 oz.
LP	8101-S Silicone Compound (General Cement, Rockford, Ill.)
LP	Chlorothene (Dow Chemical Co., Midland, Michigan)
LP	Methyl Alcohol

TEST FILMS

* 40478-P3	TV16AS 16mm Television Test Film (Alignment & Resolution) 40" Loop
* 45191-G2	P16-SF-A 7000 Hz Film (PH 22.42-7) - 12'
* 45191-G3	P16-B.T. Buzz Track Film (PH 22.57) - 12'
* 45191-G6	16-RT 16mm Registration Test Film - 12'
* 45191-G7	P16-SL, Signal Level Test Film, Optical 400 Hz, -12'
**	P16-PP SMPTE Jiffy Test Film

* Available in 100' Roll from: Test Film Dept.
Society of Motion Picture and Television Engineers
862 Scarsdale Ave., Scarsdale, NY 10583

** Also available through above source.

TOOLS

G8-38000	FILM PRESSURE ADJUSTING GAUGE
G10-38000	CLAW ARM PROTRUSION GAUGE
G17-38000	SUPPLY REEL SPINDLE TORQUE GAUGE
ST-5880	STROKE SETTING GAUGE
ST-5884	SHUTTLE CAM ADJUSTING TOOL
T-38000-N	ROLLPIN-INSERTING AND EXTRACTING TOOL
T-38000-N1	REPLACEMENT PIN
T-38000-S	FILM TENSION GAUGE
T-38000-U	WALDES TRU-ARC NO. 52 APPLICATOR
T-38000-V	WALDES TRU-ARC NO. 54 APPLICATOR
T-38000-X	WALDES TRU-ARC NO. CR-31 APPLICATOR
T-38001-G	SOUND DRUM LOCATING PLUG

SPECIFICATIONS

Feature	Model Number									
	1000	1015	1016	1020	1021	1022	1030N	1040	1042	1050
Single Switch										x
Double Switch	x	x	x	x	x	x	x	x	x	
Speed Control	x	x	x	x	x	x				
Still Control				x	x	x				
Automatic Shutter (2-3 Blade)				x	x	x				
Standard Shutter (3 Blade)	x	x	x							x
5 Blade Shutter							x			
2 Blade Shutter								x	x	
Threading Lamp	x	x	x	x	x	x	x	x	x	
117V, 60Hz	x	x		x			x	x		x
117V, 50Hz						x			x	
230V, 50Hz			x		x					
LAMP, DLR Or DKM	x	x	x	x	x	x	x *			x
LAMP, DJP							x *			
LAMP, Marc 300								x	x	

*Generally, the DKM lamp is used in multiplex applications while the DJP lamp is used in uniplex applications.

Height: 14" (356mm) Width: 20¼" (514mm) Depth: 11" (279mm)

Weight: 40lb (18.1 Kg) Marc 300 Power Pack: 15lb (6.8 Kg) Optics: 2" (50mm) f/1.6)

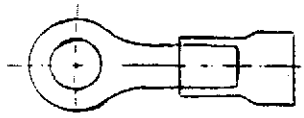
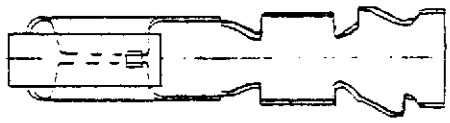
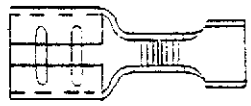
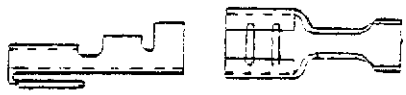
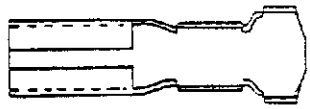
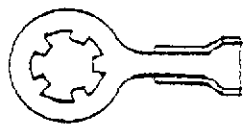
Amplifier: Early Models - 10 Watts; Current Production - 15 Watts

Speakers: Two 3" x 5" Oval 16Ohm Connected In Parallel

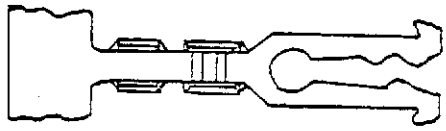
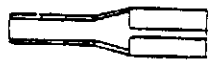
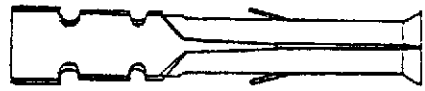
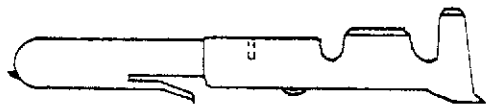
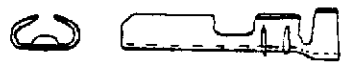
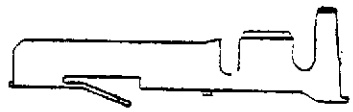
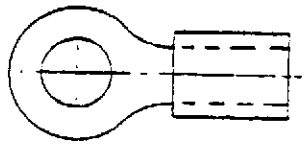
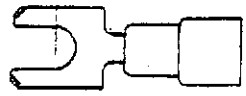
Film Speed:Sound 24 Frames/Second; Silent 18 Frames/Second

Accessories	Catalog Number
Extension Speaker	3220
Dust Cover	3737
Lift-off cover speaker	3722-1
Aperture Cleaning Brush	3694
Lenses: 5/8", f/2.0	3610
1", f/1.9	3602
1½", f/1.6	3603
2", f/1.6	3604
2½", f/1.8	3605
3", f/2.0	3606
3½", f/2.5	3607
4", f/2.8	3608
Zoom Lens f/1.5	3601
Microphone Set	41087G1
16C Anamorphic Lens	19-503
16D Anamorphic Lens	19-521
16C Lens Bracket for Anamorphic Lens	19-531
16D Lens Bracket for Anamorphic Lens	19-526
Buhl Rear Projection Lens Bracket	19-505
Rear Projection Mirror	19-506

TERMINALS

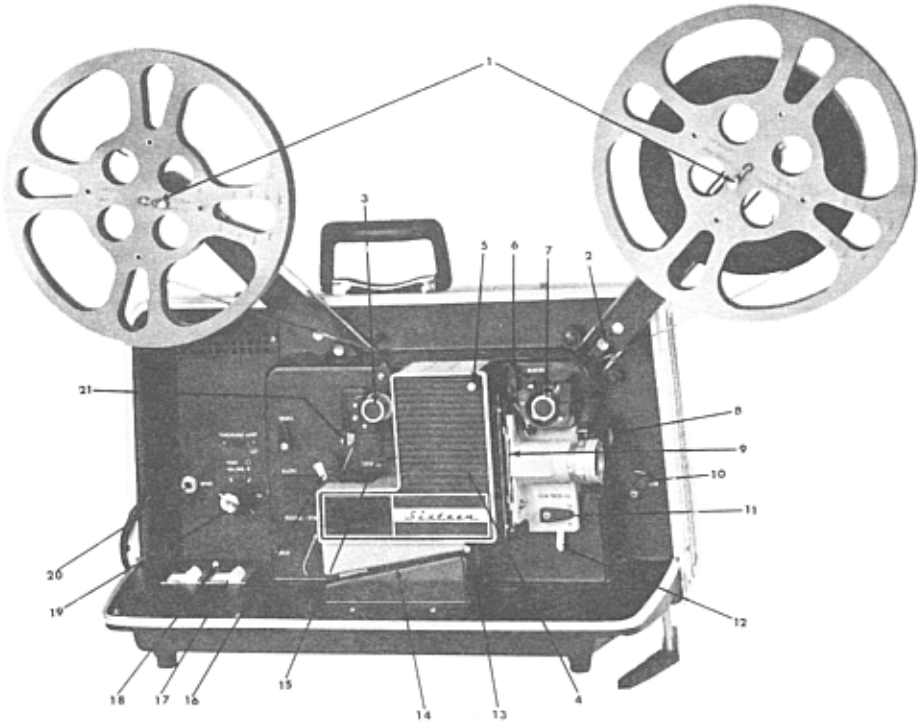
PART NUMBER	WIRE SIZE	INSULATION	STRIPPING	TAB SIZE	ILLUSTRATION
				SCREW	
39338	16-22 AWG	140 max	.155-.215	#8	
41004	16-22 AWG	140 max	.155-.215	#6	
38298	18-22 AWG	.050-.115	.125-.185		
39321	20-24 AWG	.048-.071	1/8"		
38998	18-22 AWG	.90-.132	1/4"	.250	
42423	20-22 AWG	.075 max	.125-.185		
42752	20-24 AWG	.016 max	.125-.155		
43042	14-18 AWG	.120-.170	.210-.240	.250	
42717	18-22 AWG	.060-.100	.195-.225	.250	
44513	22-30 AWG	.062 max	.100-.125		
43457	18-24 AWG	.100 max	.125-.155		
41338	18-20 AWG	.080-.120	.156-.219	.103	
43965P1	14-18 AWG	.105-.145	.220-.280		

16 mm PROJECTORS
1000 SERIES

PART NUMBER	WIRE SIZE	INSULATION	STRIPPING	TAB SIZE	ILLUSTRATION
45144P1	20-26 AWG	.035-.060	.125-.185		
44549P1	20-22 AWG	.060-.100	.155-.185	.100	
41098P1	18-22 AWG	.060-.100	.155-.185	.110	
38994P1	16-20 AWG	.090-.130	.125-.185	.187	
44508P1	24-30 AWG		.100-.125		
44360P1	18-24 AWG	.060-.120	.125-.155		
44360P2	18-24 AWG	.060-.120	.125-.155		
41438	14-18 AWG	.100-.130	.140-.170		
43225	20-22 AWG	.080-.100	.125-.185		
41440	14-18 AWG	.100-.130	.140-.170		
37593	16-22 AWG		7/32	#3 or #4 Screw	
43497	18-22	.136 max	.250-.280	#6 Screw	

SECTION II. PREVENTIVE MAINTENANCE

To insure proper operation of Singer Model 1000 Projectors, preventive maintenance should be performed every 500 hours or once a year, whichever occurs first. The Projector should be thoroughly cleaned and then checked for proper operation before any parts replacement or adjustments are attempted.



Reference Guide

1. Reel Spindle Lock Lever
2. Reel Arm Lock
3. Take-up Sprocket
4. Lamphouse Cover
5. Framing Knob
6. Rewind Control
7. Feed Sprocket
8. Manual Advance Knob
9. Film Pressure Shoe
10. Elevation Lock Lever
11. Film Pressure Adjustment Lever
12. Film Gate Lever
13. Sound Loop Synchronizer
14. Soundhead (loading) slot
15. Lamphouse Cover Release
16. Master Control Lever
17. Master Control Switch
18. Fuse Reset Button
19. On-Off Volume Control
20. Speaker Jack
21. Take-up Sprocket Shoe Lever

Figure 2-1. CLEANING REFERENCE GUIDE

Cleaning

1. All dust and grime should be removed from external surfaces of covers, main casting, etc. Any good household detergent should be sufficient.

2. Projection lens - Remove lens. Remove dust from front and rear exposed lens surfaces by brushing gently with a soft brush. Then wipe lens gently with a clean lens tissue (slightly moistened with lens cleaner if necessary).

   CAUTION: Never pour lens cleaner or other solvents on the lens elements. DO NOT use silicone impregnated lens tissue.

3. Projection Lamp and Exciter Lamp. Remove dust by brushing gently with a soft brush. Then wipe gently with a clean lens tissue (slightly moistened with lens cleaner if necessary).

4. Aperture Plate and Film Pressure Shoe - Swing the Film Gate Lever forward to open the film channel. Turn the lens forward. Insert the Aperture Brush (Cat. 3694) into the top of the channel and move it vigorously up and down. Use care to keep the shaft of the brush away from the pressure shoe or the film track. If necessary, dampen the brush with solvent to loosen and remove any hardened substance.

5. Claw Arm - Remove all lint and dirt from pins on Claw Arm with a soft bristled brush. Examine pins for looseness or grooves cut in them by film. (Solvents may be used for this cleaning).

6. Film Rollers - For proper cleaning, Rollers should be removed and wiped thoroughly with clean, dry rag. Remove stubborn dirt from plastic Rollers with detergent and warm water. Dry thoroughly. Shaft holes may be cleaned with cotton swabs or a pipe cleaner moistened with instrument oil N-75. Roller end play should be .005" to .015".

7. Sprockets - Wipe with clean, dry cloth. (Cloth may be moistened with alcohol or chlorothene if necessary.)

8. Reel Arm Pulleys - Clean grooves with cotton swabs moistened with alcohol or chlorothene. Wipe flat surfaces with clean rag moistened with alcohol or chlorothene.

9. Sound Drum - Clean grease and dirt from general area with alcohol. Moisten cotton swab with alcohol and clean Photo-diode and back edge of Sound Drum.

10. Sound Optic - Moisten cotton swab with lens cleaner or alcohol and clean upper and lower lenses.

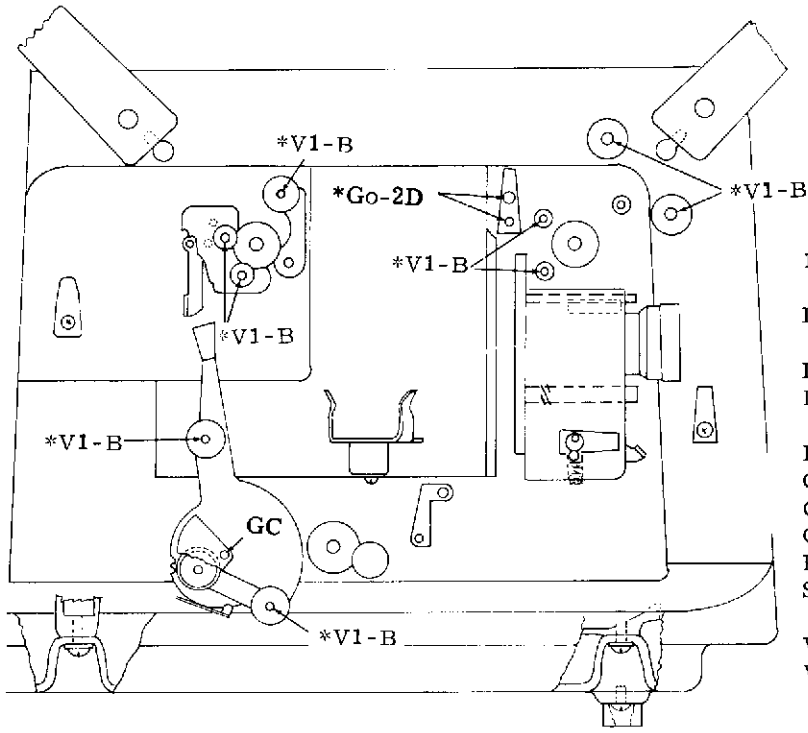
11. Motor Pulley and Main Shaft Pulley - Clean drive surfaces with clean rag moistened with alcohol or chlorothene.

12. Shutter - Wipe all visible surfaces of Shutter and Cam Assembly using a cloth dampened with chlorothene or alcohol.

13. Safety Shutter - Wipe all visible surfaces of Safety Shutter using a cloth dampened with chlorothene or alcohol.

14. Lexan Gears - (Main Drive Shaft Worm Gears, Film Feed Clutch Gear and Takeup Clutch Gear) - DO NOT clean Lexan Gears with ANY solvent. Wipe clean with clean, dry cloth or remove excess, dirty grease with toothbrush.

LUBRICATION POINTS



16 mm LUBRICATION KEY

D2	-	Dow Corning Damp. Fluid DC-200
D4	-	DC44 Grease
D5	-	Dow Corning Damp. Fluid DC-550R
FS	-	Fluorosilicone FS-1290
GC	-	Glyptal Clear (1276)
GO	-	Inst. Oil N-75
GP	-	Glyptal Blue (7256)
KA	-	Keystone 009 Oil
S	-	8101 Silicone Heat Sink Jell
V1	-	Vischem #352 Grease
V2	-	Versilube G322L Grease

AREA TREATMENT

B	-	Bearing Surface of Pivot
F	-	Interface
T	-	Teeth of Gears
XD	-	X Drops

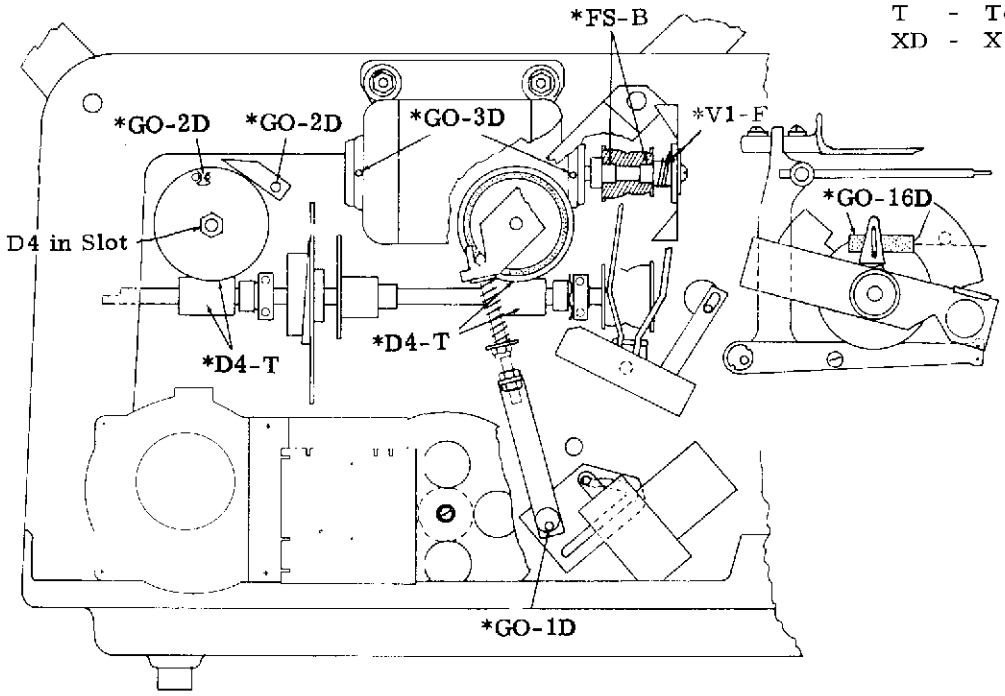
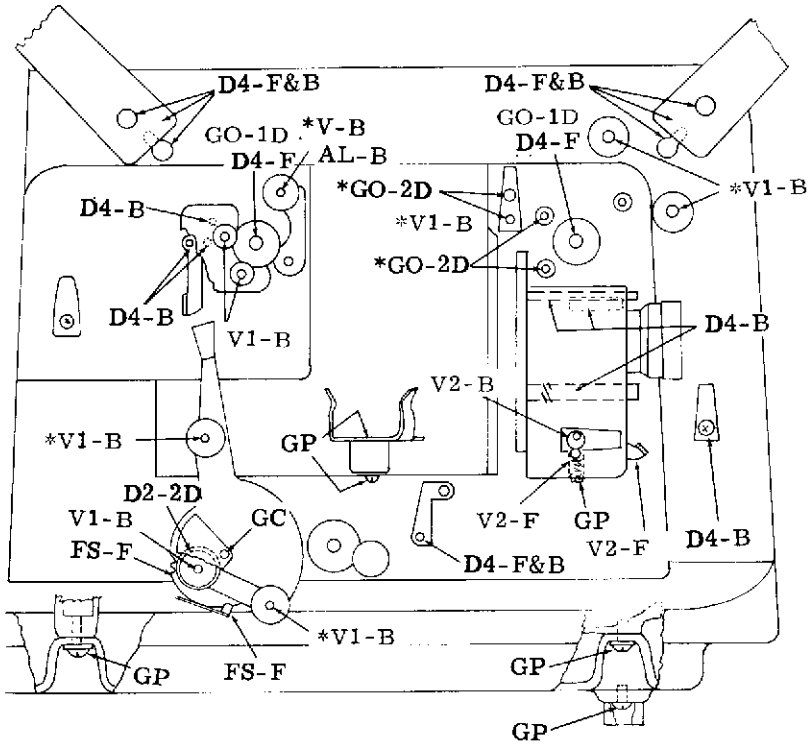


Figure 2-2. PREVENTIVE MAINTENANCE LUBRICATION, POINT DIAGRAM



16 mm LUBRICATION KEY

D2	-	Dow Corning Damp. Fluid DC-200
D4	-	DC44 Grease
D5	-	Dow Corning Damp. Fluid DC-550R
FS	-	Fluorosilicone FS-1290
GC	-	Glyptal Clear (1276)
GO	-	Inst. Oil N-75
GP	-	Glyptal Blue (7256)
KA	-	Keystone 009 Oil
S	-	8101 Silicone Heat Sink Jell
V1	-	Vischem #352 Grease
V2	-	Versilube G322L Grease

AREA TREATMENT

B	-	Bearing Surface of Pivot
F	-	Interface
T	-	Teeth of Gears
XD	-	X Drops

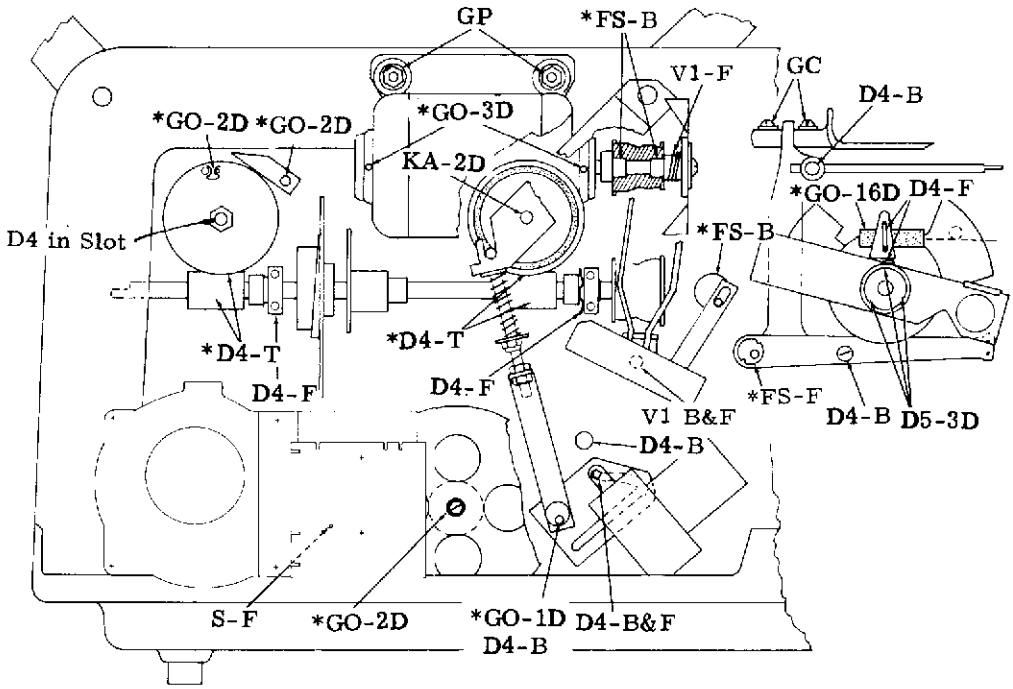


Figure 2-3. OVERHAUL MAINTENANCE LUBRICATION, POINT DIAGRAM

OPERATIONAL CHECK

It is recommended an old film be used for the initial part of this check. This will prevent damage to a valuable test film in case the projector is malfunctioning to the extent that it damages film. An SMPTE jiffy test film No. P16-PP should be used for the latter portion of this check.

1. Connect power cord to AC receptacle supplying correct line voltage and frequency. Swing reel arms up until they lock.
2. Press run button and check to see that sprockets and reel pulleys turn properly. Listen for unusual noises.
3. Press Lamp Norm button and check for screen illumination and even distribution of light. Press High button (on models having this feature); screen illumination should increase.
4. Press Still button (if projector has this feature). Illumination should decrease and motion of sprockets and reel pulleys should stop. (Screen may be partially or totally dark. If so, rotate inching knob slightly to move shutter blade away from aperture.)
5. Press Off button.
6. Turn amplifier and threading lamp switches on.
7. Move master control lever to thread position and thread an old film into projector.
8. Turn threading lamp switch off.
9. Move master control lever to Forward position.
10. Check for proper threading by manually rotating the inching knob and checking the film movement through the projector.
11. Press Run button and observe that film moves smoothly through the projector and is gathered on take-up reel. Set volume and tone controls for comfortable listening.
12. Check for proper film handling in film gate area by rotating film pressure adjustment lever from low to high. Film should run best when noise is at its lowest level.
13. Check picture for focus, double image or ghosting.
14. Adjust framing knob maximum clockwise and then maximum counterclockwise. Observe that the frame line moves an equal distance into the top and bottom of the projected image. Check for picture jump, side shake or weave, and mechanical noise at both extremities of framing.
15. Readjust framing knob to eliminate frame line from projected image.
16. Rotate speed control to silent position (sound/silent projectors only). Projector should slow down to 18 frames/sec. Shutter should shift from two-blade position to 3-blade position on automatic shutter models. Safety Shutter (on machines having Still feature) must remain up.
17. Return speed control to sound position. Projector should return to 24 frames/sec. Shutter should shift back to 2-blade position.
18. Move master control lever to Reverse position.
19. Observe that the film moves smoothly through the projector and is gathered on the supply reel. Note: At this point, the balance of the old film may be run through the projector and then rewound, or unthreaded from the projector and rewound immediately at the operator's discretion.
20. Press Off button. Move master control lever to Thread position. Thread jiffy test film into projector.
21. Move master control lever to Forward position.
22. Check for proper threading by manually rotating the inching knob and checking the film movement through the projector.
23. Press run button and observe that film moves smoothly through the projector and is gathered on take-up reel.
24. Rotate tone control and listen for change in pitch.
25. Advance volume control momentarily to a loud listening level. Check for case rattle or buzz.
26. Follow directions on jiffy test film.
27. Rewind jiffy test film when test is complete.
28. Check Elevation Lock.
29. Check Loop Restorer.

Parts Replacement

1. Takeup Reel Belt - Refer to Section IV.
2. Supply Reel Belt - Refer to Section IV.
3. Motor Drive Belt - Replace if worn or stretched. Refer to Sections III and IV.
4. Spirol Pin (Motor Fan and Hub Assembly) - Refer to Sections III and IV.

5. Cam Lubricator Pad - Refer to Section III.
6. Takeup Clutch Liner - Replace if worn or if Takeup Clutch Liftoff or Takeup Tension requirements cannot be met. Refer to Sections III and IV.

Adjustments

Be sure to check following areas and adjust if necessary.

1. Claw Arm operation - See Section IV.
2. Pressure Shoe seating - See Section IV.
3. Film Pressure - See Section IV.
4. Takeup Clutch Lift-off Linkage - See Section IV.
5. Takeup Clutch Film Tension - See Section IV.
6. Reverse Drive Film Tension - See Section IV.
7. Rewind Engagement - See Section IV.
8. Adjustments deemed necessary as a result of Operational Check above.

Miscellaneous

1. Check all clip-on terminals. If not tight, carefully crimp with pliers and reconnect.
2. Be sure that wiring is sufficient distance from moving parts to avoid entanglement.
3. Main Drive Shaft Speed - With projector operating at Sound Speed, Main Drive Shaft should rotate at minimum speed of 1420RPM. If above 1460RPM, major repair may be necessary (defective motor, etc.). If below 1400 RPM, Main Shaft may be binding due to insufficient lubrication or Motor Drive Belt may be slipping.

Miscellaneous End Play and Clearance Requirements

1. Claw Arm Pivot - Maximum clearance of 0.002". (Equivalent to 0.001" end play when claw has complete freedom.)
2. Threading Control Arm Rollers - 0.005" to 0.015" end play.
3. Drive Unit Assembly Pulley - 0.005" to 0.010" end play.
4. Reel Tension Arm Pivot - 0.005" maximum end play.
5. Takeup Shoe Pivot - 0.005" maximum end play.
6. Threading Control Arm Pivot - 0.005" maximum end play.
7. Pressure Roller Arm Assembly Pivot - 0.005" maximum end play.
8. Sprockets - 0.003" to 0.005" end play.

SECTION III. DISASSEMBLY AND REASSEMBLY PROCEDURES

Where disassembly and reassembly seems straightforward and self explanatory, no procedures are given in this service manual. However, where certain steps may not be obvious or where a definite order of steps should be followed, we would like to pass on a few tips or tricks we've learned to make your job a little easier and cut repair time.

Always clean parts thoroughly before any relubrication or reassembly is attempted. See cleaning suggestions under Preventive Maintenance, Section II.

Removal of Feed and Rewind Clutch (Figures 3-1)

1. Remove Feed Arm Drive Belt (21).
2. Remove Screw (3) and Film Stripper (2).
3. Remove three Screws (9) and remove Feed Sprocket Shoe (8).
4. Loosen Screw (5) and remove Feed Sprocket (4).
5. Remove Screw (23) and remove Feed and Rewind Clutch (22). (See cleaning instructions for Lexan Gear in Section II, Preventive Maintenance).

Reassembly of Feed and Rewind Clutch to Projector (Figure 3-1)

1. Apply DC44 lubricant to:
   a. Both sides of washers (6), (7) and (25).
   b. Gear of Feed and Rewind Clutch (22).
2. Apply one drop of Teresso Oil N-75 to shaft of Gear.
3. Assemble Feed and Rewind Clutch (22) to projector with Screw (23) and Washer (24).
4. Assemble Washers (6) and (7) and Sprocket (4) to shaft of Clutch. Hold Clutch firmly against main casting, insert a .004 shim between Washer (7) and main casting and push Sprocket (4) firmly against main casting with this shim in place. Tighten Screw (5) and remove .004 shim. End play of sprocket should be .003 to .005.
5. Assemble Feed Sprocket Shoe (8) to projector.
6. Assemble Film Stripper (2) and Screw (3) to Feed Sprocket Shoe (8).

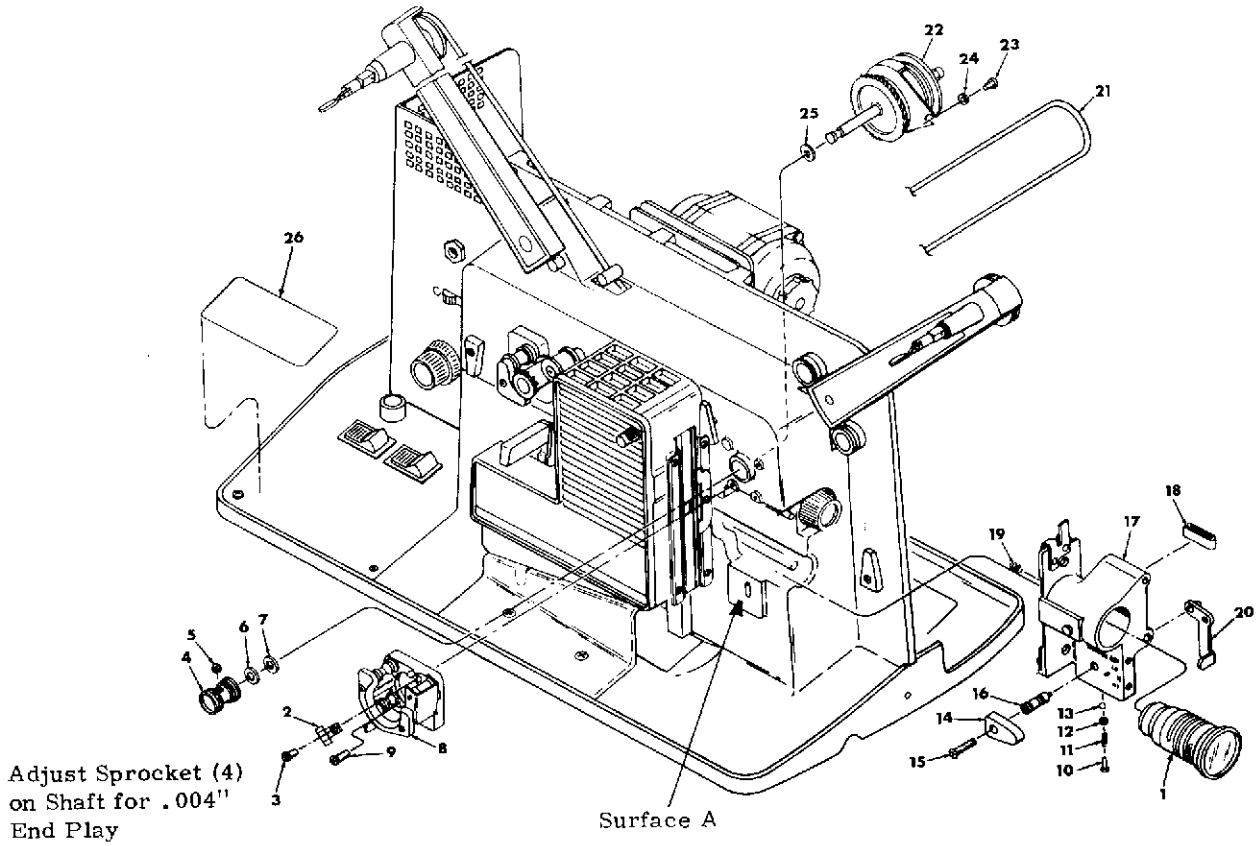


Figure 3-1. DISASSEMBLY AND REASSEMBLY FEED AND REWIND CLUTCH

Removal of Lens Holder (Figure 3-1)

1. Remove Feed and Rewind Clutch (see procedure).
2. Remove Lens (1) and store in a safe place.
3. Back out Allen Head Set Screw (10) until Film Pressure Adjustment Lever Assembly (14), (15) and (16) can be pulled out of hole. DO NOT remove the Allen Head Screw (10) from the Lens Holder (17) (care should be taken not to lose the small Spring (11), Washer (12) and Ball (13).
4. Make sure Film Gate Lever (20) is down, and slide Lens Holder (17) off of its mounting rods. Take care not to lose upper nylon Lens Holder Spring (18) and Lower Spring (19).

Reassembly of Lens Holder to Projector (Figure 3-1)

1. Apply DC44 lubricant to:
   a. Upper nylon Lens Holder Spring (18).
   b. Lens Holder mounting rods.
2. Apply Versilube G322L lubricant to:
   a. Film Gate Lever (20) pin, hole and interfacing surfaces.
   b. Slot and Surface A of main casting.
   c. Ball (13).
3. Insert pin of Film Gate Lever (20) into slot in surface A.
4. Hold upper nylon Lens Holder Spring (18) in place against Lens Holder (17) and slide Lens Holder onto mounting rods.
5. Position hole in Film Gate Lever (20) so the eccentric pin on the end of Gate Lever Eccentric (16) drops into the hole when the Film Pressure Adjustment Lever Assembly (14), (15) and (16) is inserted into its mounting hole in the Lens Holder (17). (Make sure the Spring (11), Washer (12) and Ball (13) are in place before replacing the Film Pressure Adjustment Lever Assembly.)
6. Tighten the Allen Head Set Screw (10) so the Film Pressure Adjustment Lever (14) can be moved but is snug enough that it cannot move of its own accord or by exerting pressure on the Lens Holder (17). (See MECHANICAL ADJUSTMENTS AND SPECIFICATIONS, Section IV, for remaining adjustments to Lens Holder).

Removal of Takeup Clutch (Figure 3-2)

1. Remove Main Drive Motor being careful to observe the number and position of the spacers on the mounting shafts. (It is not necessary to remove Motor wires. Simply dismount Motor and lay it in Base.)

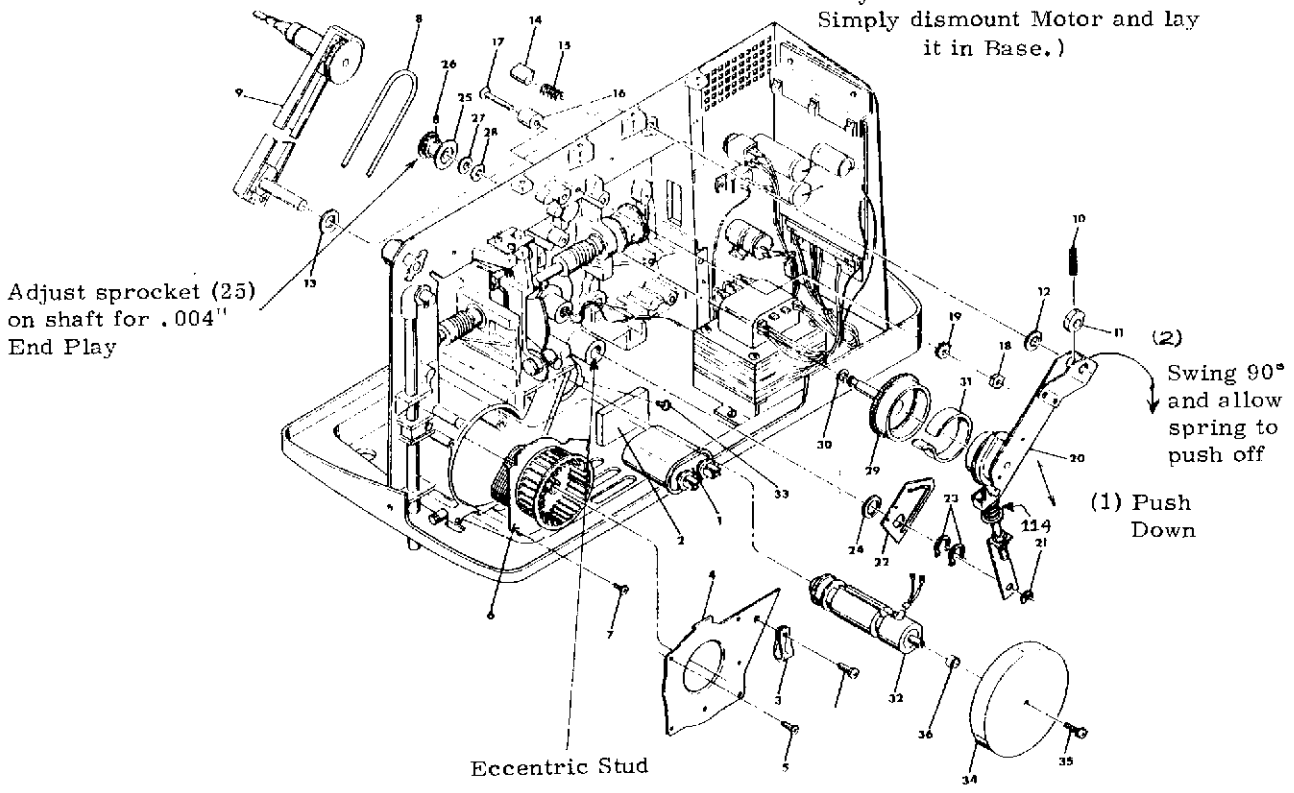


Figure 3-2. DISASSEMBLY AND REASSEMBLY TAKE-UP CLUTCH

2. Remove Main Drive Motor Plate.

3. Remove take-up reel arm Belt (8).

4. Remove Roll Pin (10). (A large pair of diagonal cutters or vise-grips generally serve well in gripping this pin sufficiently to pry it out. It may also be driven out with a 3/32" drive punch.)

5. Remove Reel Arm (9) being careful not to lose washers (12) and (13), Reel Arm Lock (14) and spring (15). (Older machines use a guide plate in place of Washer 13).

6. Pull Take-up Clutch Arm (20) away from main casting so the pulley comes out of the Take-up Gear (29) and Liner (31).

7. Push down on Take-up Clutch Arm (20) to compress the spring (114) on the adjusting rod and allow the hook on the rod to move up out of the notch in the Take-up Clutch Arm (20). Now swing the upper part of the Takeup Clutch Arm (20) toward you 90° and allow the spring (114) on the adjusting rod to push the Takeup Clutch Arm up off the rod.

Reassembly of Takeup Clutch to Projector (Figure 3-2)

1. Apply DC44 lubricant to:
   a. Reel Arm Lock (14) and Spring (15).
   b. Rod of Reel Arm (9).
   c. Washers (12 and 13).

2. Assemble Reel Arm Lock (14) and Spring (15) and hold in place while assembling Reel Arm (9).

3. Hold Take-up Clutch Arm (20) so it can be pushed down over the nook in the end of the adjusting rod. (This is the same position it was in when it was removed from the adjusting rod.)

4. Push Take-up Clutch Arm (20) down to compress the Spring (114) until the hook in the Adjusting Rod comes up over the top of the notch in the Takeup Clutch Arm (20).

5. Rotate the Take-up Clutch Arm (20) 90° back toward the main casting until the end of the hook lines up with the notch in the arm. Now allow the Spring (114) to push the arm up so the hook seats in the notch.

6. Push Take-up Clutch Arm (20) onto the Reel Arm Shaft and seat the pulley inside the takeup clutch Liner (31).

7. Install a new Roll Pin (10) making sure it is pushed far enough into hole of Reel Arm shaft to be secure and yet protrudes up above the upper end of the Takeup Clutch Arm.

Note: For the 1030N, the Roll Pin (10) should be installed so the bottom end is flush with the outside circumference of the bottom of Takeup Arm Stop Bushing (11).

8. Apply small amount of DC44 lubricant to eccentric stud (located on Master Control Lever pivot).

Removal of Takeup Gear (Figure 3-2)

1. Remove Takeup Clutch (See Procedure).

2. Open Takeup Sprocket Shoe Arm (10), Figure 3-3.

3. Loosen Screw (26) and hold Takeup Sprocket (25) while removing Takeup Gear (29).

4. See cleaning instructions for Lexan Gear.

Reassembly of Takeup Gear to Projector (Figure 3-2)

1. Apply DC44 lubricant to:
   a. Washers (27), (28) and (30).
   b. Takeup Gear (29) teeth.

2. Apply one drop of Teresso Oil N-75 to shaft of Gear (29).

3. Press Washers (27) and (28) onto Sprocket (25) (Lubricant will hold them in place).

4. Hold Sprocket (25) in place in front of main casting bearing and slide shaft of Takeup Gear (29) through bearing and into Sprocket (25).

5. Hold Takeup Gear firmly against main casting, insert a .004 shim between Washer (28) and main casting and push Sprocket (25) firmly against main casting with this shim in place. Tighten Screw (26) and remove .004 shim. End play of sprocket should be .003 to .005.

Removal of Reel Tension Arm (Figure 3-3)

1. Remove Lamphouse Cover and Projection Lamp.

2. Remove Main Drive Motor being careful to observe the number and position of the spacers on the mounting shafts.

3. Remove Takeup Clutch and Takeup Gear. (See Procedures)

4. Hold Reel Tension Arm Assembly (3), (4), (5) and (6) firmly in place and move two Grip Rings (7) out toward end of shaft as far as they will go without removing Spring (2).

5. Pull Reel Tension Arm out until it clears the molded stop on the main casting or the end of the roll pin pressed into the main casting just below the molded stop. (If necessary, remove the roll pin.)

6. Gently allow the Reel Tension Arm to rotate clockwise to release its spring tension.

7. Remove Screw (1) and Spring (2).

8. Remove two Grip Rings (7) and slide Reel Tension arm out of main casting.

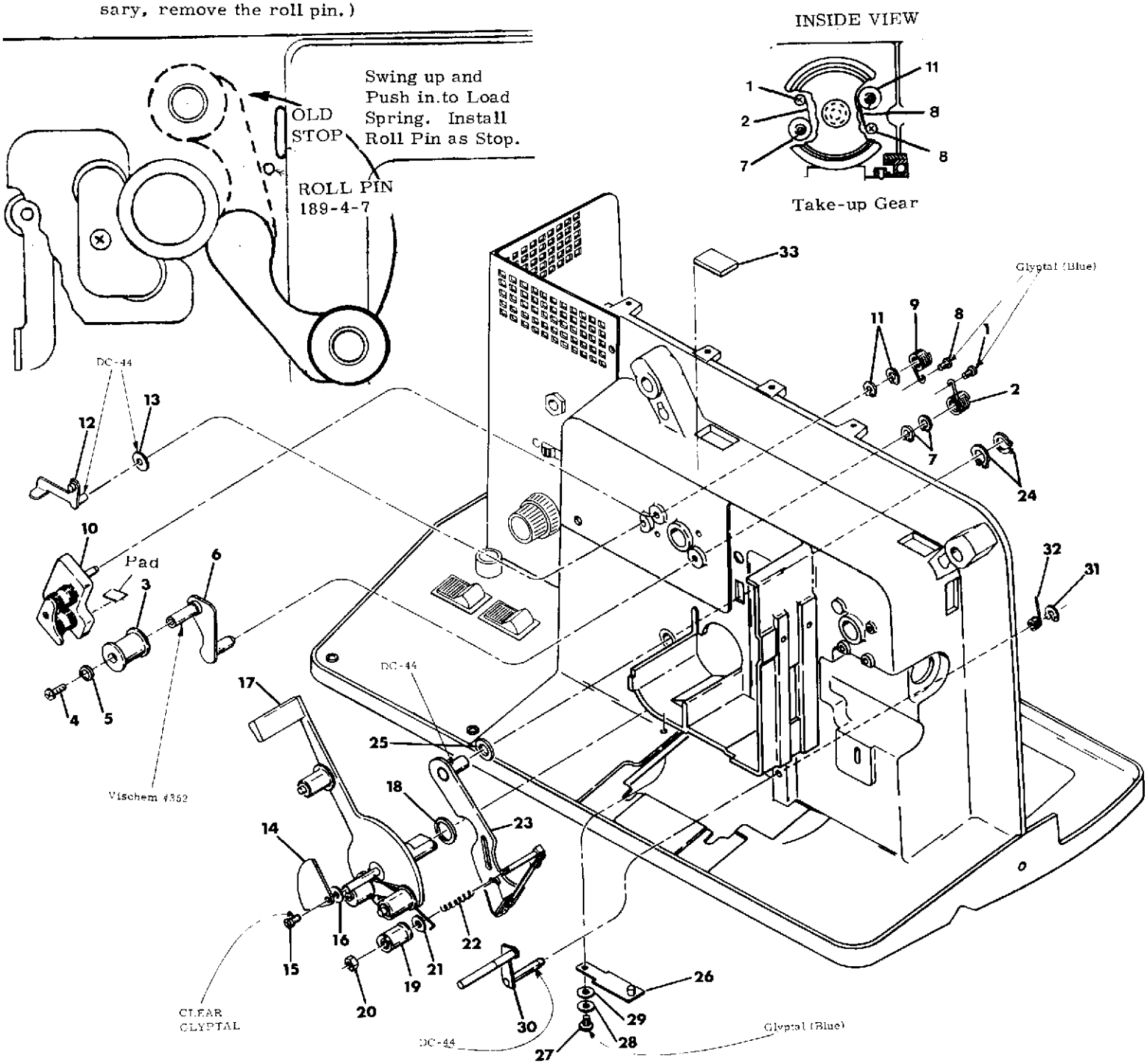


Figure 3-3. DISASSEMBLY AND REASSEMBLY REAL TENSION ARM.

Reassembly of Reel Tension Arm to Projector (Figure 3-3)

1. If the Projector is not equipped with a Roll Pin stop for the Reel Tension Arm, perform steps (a) and (b) below. Otherwise, proceed with Step 2.

   a. Use a prick punch to locate a hole just below and slightly behind the reel tension arm Stop molded as part of the main casting (note position in Figure 3-3)

   b. Drill the hole using either a 3/32" or #41 drill. DO NOT insert the roll pin at this time.

2. Apply Vischem 352 lubricant to roller shaft of Reel Tension Arm and assemble Roller (3) to arm.

3. Apply DC44 lubricant to shaft of arm which fits into main casting.

4. Assemble Reel Tension Arm to projector - allow it to hang down as shown in (Figure 3-3)

5. Assemble two new Grip Rings (7) to shaft, pushing them just past bottom of slot in end of shaft.

6. Assemble Spring (2) to main casting with Screw (1). Do not tighten screw completely.

7. Push tail of Spring (2) into slot in shaft by moving Reel Tension Arm to align slot with tail.

8. Rotate Reel Tension Arm counterclockwise to load spring.

9. Push Reel Tension Arm snugly against main casting and push Grip Rings (7) up against inside of main casting. End play of Reel Tension Arm should be about .005". (If provision was made in Step 1 for a Roll Pin Stop or if an existing Roll Pin had to be removed during this procedure, a new roll pin should be installed at this point. Hold the Reel Tension Arm back and insert a 189-4-7 Roll Pin, allowing it to protrude from front surface of casting about 5/32".)

10. Tighten Screw (1) and apply a coating of Glyptal 7526 to its head.

Reassembly of Takeup Sprocket Shoe Arm to Projector (Figure 3-3)

1. Apply Vischem 352 lubricant to roller shafts of Takeup Sprocket Shoe Arm (10) and assemble rollers.

2. Attach pad to Arm Assembly (10) with A-963-B adhesive.

3. Apply DC44 lubricant to shaft of arm which fits into main casting and to Shoe Lever (12) (both pivots) as well as slot in back side of Shoe Arm (10).

4. Assemble Shoe Lever (12) and Shoe Arm (10) to Projector, pushing shoe arm snugly against main casting.

5. Assemble two new Grip Rings (11) to shaft, pushing them snugly against inside of main casting to allow for about .005" end play.

6. Assemble Spring (9) to Projector with Screw (8).

7. Place the Shoe Arm (10) in its open position and allow the tail of the Spring (9) to drop into the slot in the shaft end. (Do not pre-load spring.)

8. Apply Glyptal 7526 to the head of Screw (8).

Removal of Main Drive Shaft (Figure 3-4)

1. Loosen both Set Screws (3) in pulley (2) so pulley will rotate freely on Main Drive Shaft (22). (The visible screws may be jam screws. If loosening them will not allow the pulley to turn, remove them and loosen the set screws under them until the pulley turns on the shaft.)

2. Loosen both Set Screws (9) in Rear Collar (8) so collar will rotate freely on Main Drive Shaft (22).

Warning:

From this point on, EXTREME CARE should be taken to insure that the pins on Claw Arm (58) are not allowed to hit the Aperture Plate or any other part of Projector, causing damage to them.

3. Remove oval point Jam Screw (#3 in Shutter and Shaft Alignment insert of Figure 3-4) and loosen remaining two Set Screws (#1 and #2 in insert) in Shutter and Cam Assembly (14) so cam assembly will rotate freely on Main Drive Shaft (22).

4. Loosen both Set Screws (19) in Front Collar (18) enough to allow Main Drive Shaft (22) to visibly move toward the rear of Projector but NOT enough to allow Collar (18) to rotate freely on Main Drive Shaft (22).

5. Loosen Set Screw (13) in Safety Shutter (12) so collar of Safety Shutter rotates freely on Main Drive Shaft (22). Unhook link (23) from Safety Shutter (12) and allow Spring (24) to pull Link (23) against pin on bracket (41). (Disregard for machines having no Safety Shutter.)

6. Exert a firm downward pressure on the Claw Arm (58) and slide the Shutter and Cam Assembly (14) toward the rear of the Projector until the cam follower on the Claw Arm no longer engages the cam surface.

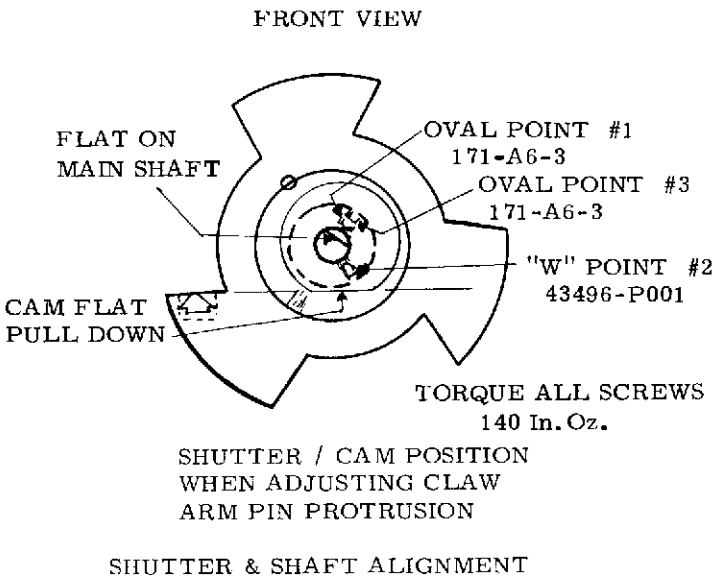
NOTE: When the Claw Arm cam follower clears the cam, gradually allow the Claw Arm Spring to pull the Claw Arm up. DO NOT let the Arm snap up or allow the Arm pins to hit the top of the aperture plate slot. Otherwise damage will result.

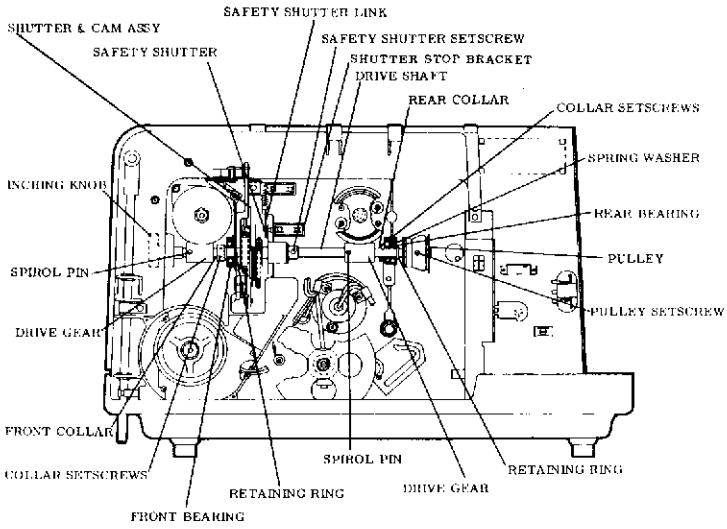
7. Tuck a cleaning cloth under the Rear Bearing (6).

8. Remove Inching Knob (1) and push Main Drive Shaft toward rear of projector as far as it will go.

9. Remove "C" Ring (5).

10. GENTLY tap out Spirol Pin (11) from Rear Worm Gear (10) with a 3/32" drive punch being very careful not to hit punch hard enough to bend Main Drive Shaft (22). Tap Pin (11) out only part way and then rotate Main Drive Shaft (22) so end of Pin (11) may be grasped with pliers and pulled out.





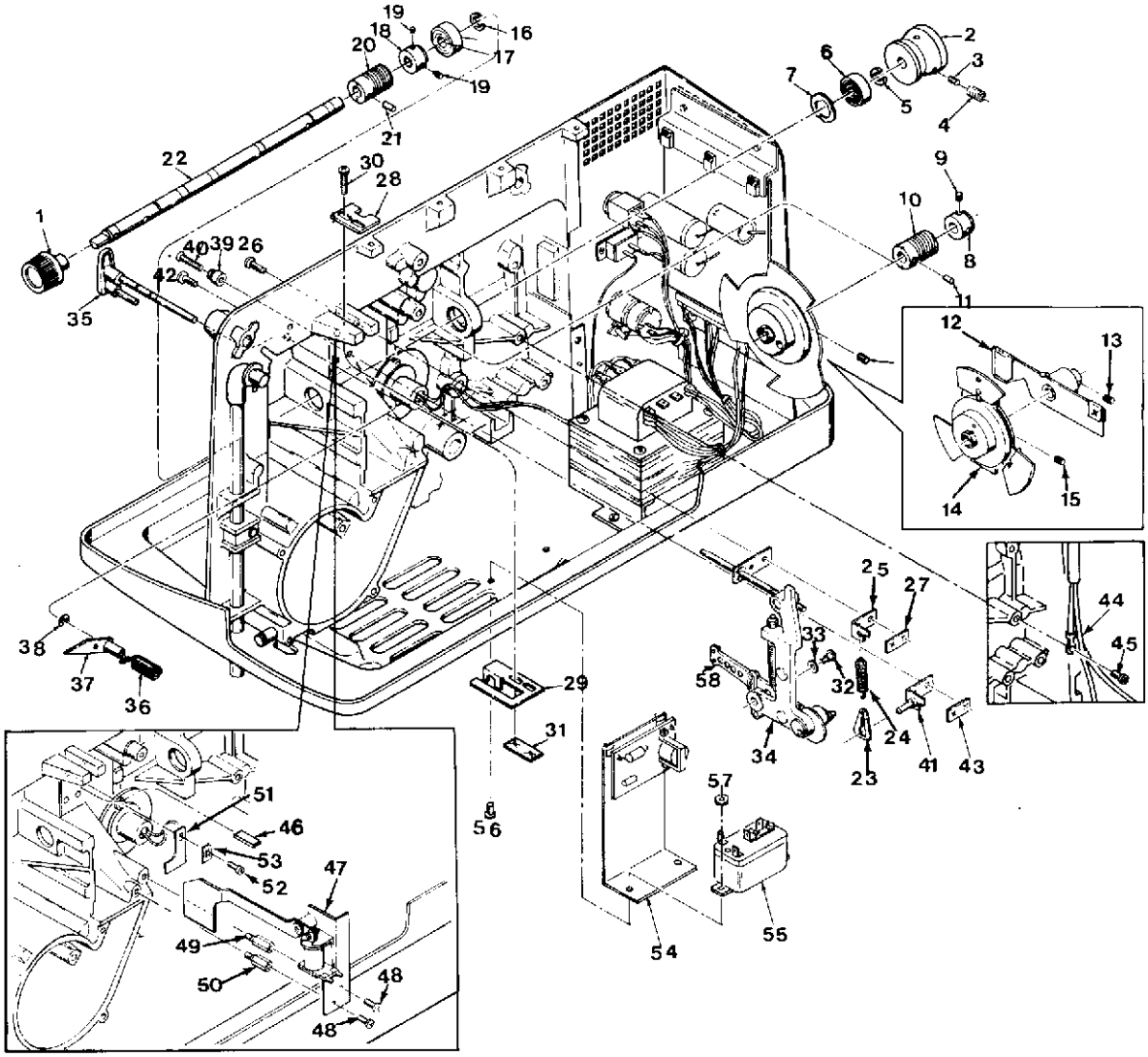


Figure 3-4. DISASSEMBLY AND REASSEMBLY
MAIN DRIVE SHAFT.

11. Replace Inching Knob (1) and pull Main Drive Shaft toward front of Projector, removing Pulley (2) and other parts in order until Shutter and Cam Assembly (14) can be removed.

    NOTE: Watch the Claw (58) and protect the pins!

12. Remove the cam lubricating pad.

13. If Front Bearing (17) is to be replaced, loosen Set Screws (19) in Front Collar (18) so Collar will rotate freely on Main Drive Shaft (22). GENTLY tap out Roll Pin (21) from Front Worm Gear (20) with 3/32" drive punch and remove Inching Knob (1), Worm Gear (20) and Bearing (21). It is not necessary to remove "C" Ring (16).

Reassembly of Main Drive Shaft to Projector (Figure 3-4)

1. Wipe all visible surfaces of Shutter and Cam Assembly, (14) Bearings, (6)and(17) and metal parts using a cloth dampened with chlorothene. Hub and cam of Shutter and Cam Assembly (14) are permanently impregnated with oil; do not immerse in cleaning solvent.

   CAUTION

   Do not use a chlorine-base solvent on plastic parts as it will cause crazing or cracking.

   Note: If Front Bearing (17) was removed from Main Drive Shaft (22) during disassembly, install new bearing. Install Collar (18) and align Set Screws (19) over recesses in Main Drive Shaft. Tighten Set Screws (19) into recesses just enough to prevent Collar (18) from rotating on Main Drive Shaft (22). Install Front Worm Gear (20) and pin to Main Drive Shaft (22) with NEW Spirol Pin (21). Install Inching Knob (1).

2. Check Pin (10) (Figure 3-5) to be sure it is in position under edge of Claw Arm (58) with its groove at the spring (Lubricate Pin (10) with DC44).

   WARNING

   From this point on, EXTREME CARE should be taken to insure that the pins on Claw Arm (58) are not allowed to hit the Aperture Plate or any other part of Projector, causing damage to them.

3. Apply DC44 lubricant on Spring Washer (7) and outside circumference of Bearings (6) and (17).

4. Start Main Drive Shaft (22) through front bearing hole in Main Casting. Hold Shutter and Cam Assembly (14) in place and push Main Drive Shaft through its center hole. Hold Safety Shutter (12) in place (if used) and push Main Drive Shaft through its hole. Slide Rear Worm Gear (10) and Rear Collar (8) onto Main Drive Shaft and push Shaft through rear bearing hole in Main Casting. Push Spring Washer (7) into bearing hole and assemble Bearing (6) and Pulley (2). Push Main Drive Shaft as far back as it will go and install NEW "C" Ring (5) with Waldes retaining ring applicator CR-310 (Singer P/N T38000X).

5. When tightening Screws (19) in Front Collar (18), be sure the points of the screws seat properly in the recesses in the Main Drive Shaft (22). Otherwise the Shaft will be burred and will not be positioned properly in Projector. It is best to tighten each one a little bit at a time and alternately with the other one until they cannot be tightened further. The Main Drive Shaft (22) should visibly move forward during the tightening process. Manually pushing the Main Drive Shaft (22) forward, while starting to tighten these screws, will help insure they are seated properly.

6. Caution should be exercised in tightening Set Screws (9) in the Rear Collar (8) as above. The Main Drive Shaft (22) will not move forward when these screws are tightened.

   WARNING

   From this point on, EXTREME CARE should be taken to insure that the pins on Claw Arm (58) are not allowed to hit the Aperture Plate or any other part of Projector, causing damage to them.

7. Rotate Main Drive Shaft (22) until flat on Shaft just behind Front Bearing (17) is at about 2 o'clock (See Shutter and Shaft Alignment insert on Figure 3-4). Rotate Shutter and Cam Assembly (14) until Set Screw (#1 in insert) lines up with flat on Shaft (22). Gently push Shutter and Cam Assembly (14) Forward while pushing down on Claw Arm (58) until cam follower on Claw Arm (58) slides under Cam. Tighten Set Screw (#1 in insert) on flat of Shaft (22). Make sure Claw Arm (58) is not hitting Aperture Plate.

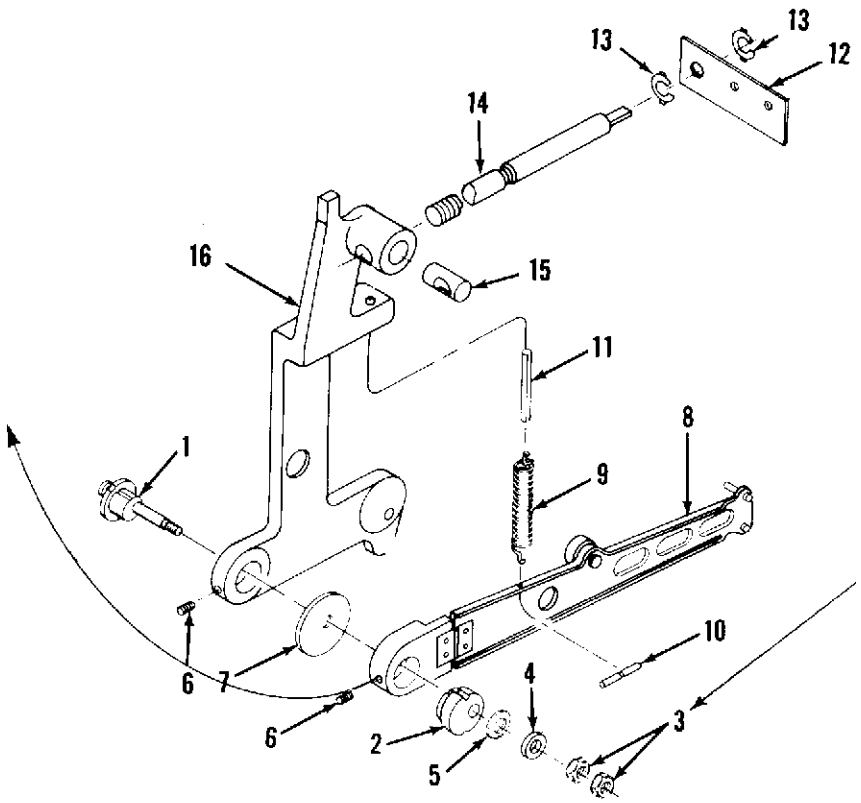


Figure 3-5. DISASSEMBLY AND REASSEMBLY CLAW ARM WITH SIDE CLEARANCE REQUIREMENT.

8. Be sure to use a new Spirol Pin (11) when reassembling Gear (10) to Main Drive Shaft (22).

9. Be sure to install a new lubricating pad (discard the old pad). Apply 16 drops of Teresso Oil N-75 to new pad.

10. Position Safety Shutter (12) to avoid striking either the Shutter and Cam Assembly (14) or the Chimney. Secure Safety Shutter in position with Set Screw (13). Hook safety shutter Link (23) under tab on Safety Shutter assembly.

Removal of Claw Arm (Figure 3-5)

WARNING

From this point on EXTREME CARE should be taken to insure that the pins on Claw Arm (8) are not allowed to hit the Aperture Plate or any other part of Projector, causing damage to them.

1. Remove oval point Jam Screw (#3 in Shutter and Shaft Alignment insert on Figure 3-4) and loosen remaining two Set Screws (#1 and #2 in insert in Shutter and Cam Assembly (14) Figure 3-4) so it can be moved back on Main Drive Shaft to make clearance for removal of Claw Arm (8). DO NOT move Shutter and Cam so far back that cam follower on Claw Arm slips off Cam surface with resulting damage to Claw Arm Pins.

2. Remove two Nuts (3) and Washers (4) and (5).

3. Loosen two Set Screws (6) and remove Bushing (2), Washer (7) and Pivot (1).

   NOTE: Wipe Pivot (1) and Bushing (2) with clean, dry rag. DO NOT clean these two parts with solvent.

4. Grasp Claw Arm (8) and pull it toward you while at the same time swinging it up in an arc-like motion (Extreme care should be taken not to damage the pins.)

5. Grasp Spring (9) and Claw Arm (8) and unhook Claw from Spring being careful not to lose Pin (10).

Reassembly of Claw Arm to Projector (Figure 3-5)

WARNING

From this point on EXTREME CARE should be taken to insure that the pins on Claw Arm (8) are not allowed to hit the Aperture Plate or any other part of Projector, causing damage to them.

1. Apply DC44 lubricant to Pin (10) and stick pin in place on the Claw Arm making sure notch lines up with hole.

2. Apply DC44 to Rod (14) threads and retaining ring notch.

3. Grasp Spring (9) and pull it back so Claw Arm (8) can be hooked onto it.

4. Position Claw Arm (8) so it may be easily hooked onto Spring (9) (usually in a vertical position) making sure Pin (10) is trapped in place by Spring (9).

5. Start pin end of Claw Arm (8) into slot between Framing Arm (16) and Shutter and Cam Assembly, and insert Claw Arm by reversing the arc-like movement described in step 4 of removal instructions.

6. Lubricate both sides of Washer (7) with FS-1290 lubricant.

7. Assemble Pivot (1), Washer (7), Claw Arm (8), Bushing (2), Washers (5) and (4) and Nuts (3).

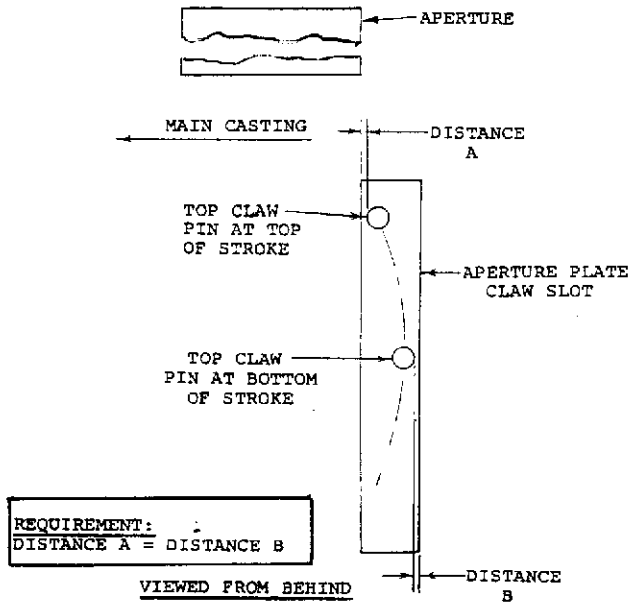
8. Tighten Nuts (3) for .001" end play and coat nuts with Blue Glyptal 7526.

9. Gently push Shutter and Cam Assembly forward while pushing down on Claw Arm (8) making sure cam follower on Claw Arm (8) slides under Cam. Tighten Set Screw (#1 in Shutter and Shaft Alignment insert of Figure 3-4) on flat of Main Drive Shaft (see step 7 under Reassembly of Main Drive Shaft to Projector). Make sure Claw Arm (8) is not hitting Aperture Plate.

10. Rotate Pivot (1) so eccentric pin is between 6 and 7 o'clock when viewed from front of machine. Tighten Pivot Set Screw (6).

11. Rotate Bushing (2) so its circumference lines up with circumference of the Pivot (1) and the groove in its side is slightly below the groove in the side of the Pivot. Tighten Claw Arm Set Screw (6).

12. Manually rotate the inching knob to make sure the Claw Arm Pins do not strike the side of the Aperture Plate Claw Slot. At the top of the Claw Arm Stroke, the Top Claw Arm Pin will be nearer the inside edge of the Aperture Plate Slot (sketch below) At the bottom of its travel, this Pin will be nearer to the outside edge of The Aperture Plate Slot. Loosen Screw (5) and adjust Bushing (8) (Figure 4-8) so these two distances are equal. (Removing Lamphouse Cover and viewing Pins from behind the Aperture Plate aids in this adjustment.)



Disassembly of Supply and Take-up Reel Arms (Figure 3-6)

1. Mark one flat side of Spindle (3) with a felt marker and then mark Pulley (9) in line with the marked flat side of Spindle. (This will allow proper realignment of these parts at time of reassembly if both parts are to be reused.)

2. Press Roll Pin (4) out with Roll Pin Inserting and Extracting Tool T-38000-N. If this tool is not available, Roll Pin (4) may be removed by GENTLY tapping it out with a 1/16" drive punch. BE SURE TO SUPPORT END OF PULLEY IF ROLL PIN (4) IS DRIVEN OUT WITH DRIVE PUNCH. Otherwise, Pulley Shaft may be bent.

3. Clean Pulley (9) with Chlorothene or Alcohol. Clean Oilite Bearings in Arm (12) with a cotton swab or pipe cleaner moistened with Instrument Oil N-75 (P/N 39479-P8).

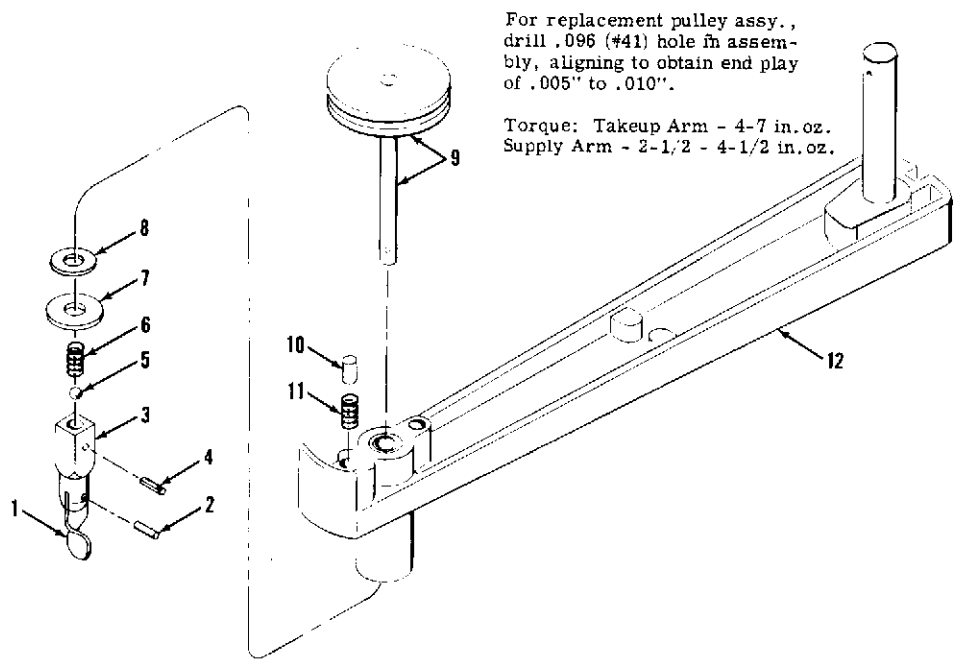


Figure 3-6. DISASSEMBLY AND REASSEMBLY OF SUPPLY AND TAKE-UP REEL ARMS COMPLETE

Assembly of New Reel Arm Pulley to Reel Arm (Figure 3-6)

Due to accumulated tolerances in machining of parts used in Reel Arms, Pulleys and Spindles are drilled at time of assembly.

1. Assemble Pulley (9) to Arm (12) making sure to hold Spring(s) (11) and Brake(s) (10)in place until Pulley is seated.
2. Assemble Spindle (3), Collar (7) (for Takeup Arm only), Washer (8) and a Washer (35473-72) (this washer is used to achieve proper end play and will be removed in step 4) to end of Pulley shaft.
3. Hold Pulley (9) and Spindle (3) firmly together and drill a .096 hole (#41 drill or 3/32" drill) in Pulley shaft using hole in Spindle (3) as a locator.
4. Remove Spindle (3) and washer (35473-72) installed in step 2.
5. Make sure Ball (5) and Spring (6) are in place inside Spindle (3) and assemble Spindle to shaft of Pulley (9).
6. Press Roll Pin (4) into hole making sure that both ends are either flush with or slightly below the surface of the Spindle.

Disassembly of Film Feed Clutch (Figure 3-7)

1. Remove Nut (1) and Spring (2) and slide Driven Clutch Plate Assembly (7) (including 3-6) off shaft.
2. Remove Clutch (8). This part may stick to either the Driving Plate (7) or the Driven Plate (11) because of a thin film of oil. Simply remove the Clutch (8) and wipe it off with a clean, dry rag. DO NOT clean with solvent.
3. Remove Pin (9) and VERY GENTLY lift Driven Plate (11) trying not to disturb the Cam (12), Balls (13) and Springs (14).
4. CAREFULLY remove Balls (13) and Springs (14) and then Cam (12) and Washers (15) and (16).
5. Grasp Pulley (19) and tap threaded end of shaft with a rubber or fiber hammer to remove Pulley (19) and Bearing (18).
6. Grasp Bearing (24) with padded pliers and tap threaded end of shaft as above to remove Bearing (24).
7. DO NOT clean Bearings (18) and (24) or Clutch (8) with solvent. Use clean, dry rag. All other metal parts may be cleaned with chlorothene. See cleaning instruction for Lexan Gear (26) in Section II, Preventive Maintenance.

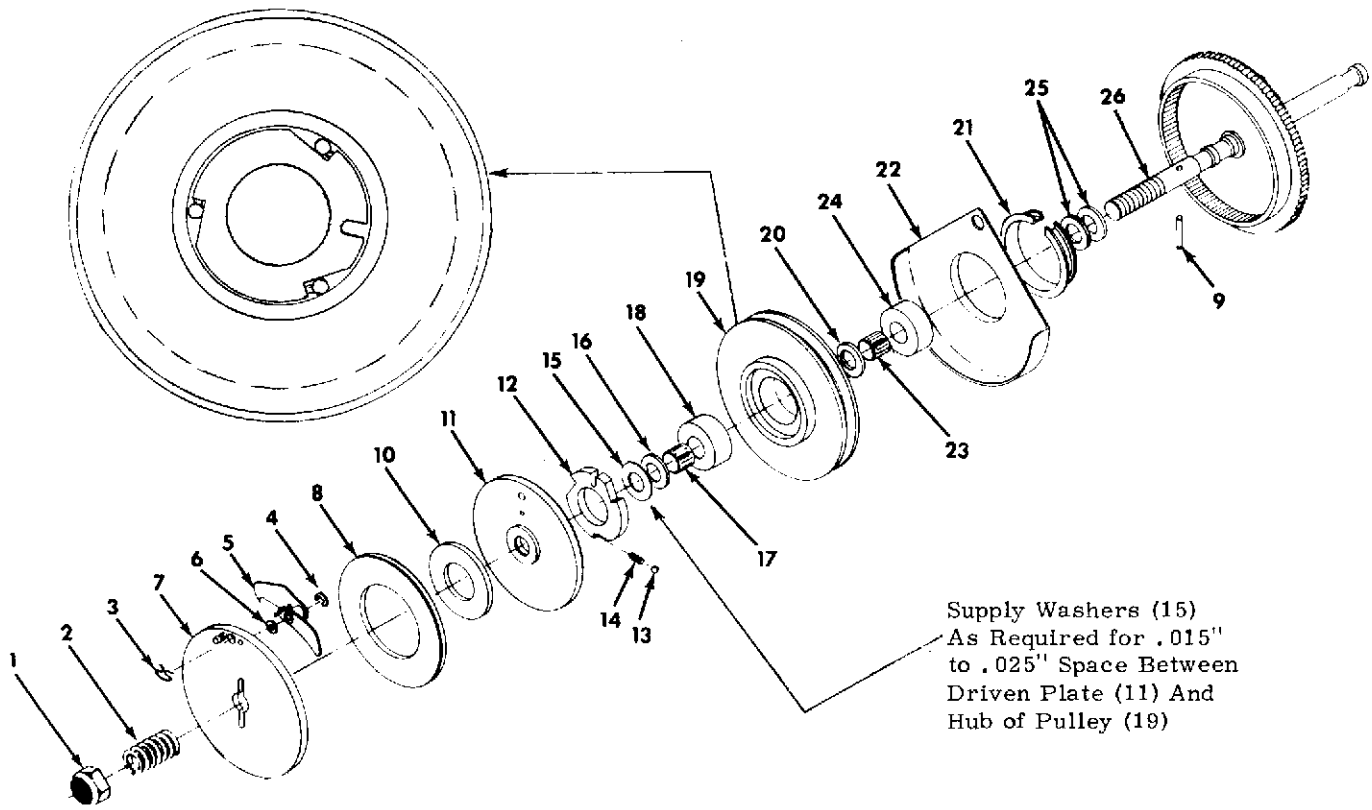


Figure 3-7. DISASSEMBLY AND REASSEMBLY OF FILM FEED CLUTCH ASSEMBLY

Reassembly of Film Feed Clutch (Figure 3-7)

1. Apply one drop of Teresso Oil N-75 to Bearings (18) and (24) and mounting post for Pawl (5) and Toggle Spring (3).

2. Apply a very thin coat of DC44 lubricant to the slot in Driving Clutch Plate (7). DO NOT get this lubricant on the surface of the Plate.

3. Make sure Cam (12), Balls (13), Springs (14) and Pulley (19) are clean and free from dirt or grease. DO NOT lubricate these parts.

4. Assemble parts in reverse order of disassembly. (See insert on Figure 3-7 for orientation of Cam (12), Balls (13) and Springs (14). See note below.)

   NOTE: A very thin, sharp, non-magnetic tool such as a dental pick is very useful in assembling Cam (12), Balls (13) and Springs (14). Assemble first Spring and Ball and rotate Cam (12) slightly counterclockwise while pushing Cam (12) toward the inside wall of hub at point where Ball is. This pushes Ball up ramp to allow maximum room for assembling next Spring and Ball.

   If the second Ball does not drop right in place, gently depress spring with sharp tool and Ball will drop.

   Use same counterclockwise motion described above to force both Balls up ramps and place third Spring and Ball in position. Gently depress spring with tool and Ball will drop.

5. Supply Washer (15) as required to achieve spacing of .015" to .025" between Driven Clutch Plate (11) and rim of hub on Pulley (19).

6. Inner pin on Driven Clutch Plate (11) must engage slot in Cam (12).

7. Apply DC44 lubricant to teeth of Gear (26).

Disassembly of Motor Drive Unit Components (Figure 3-8)

1. Remove Drive Belt by manually rotating Inching Knob while forcing Belt off back edge of Main Shaft Pulley. (Place Sound/Silent lever in Silent position if Projector has this feature.)
2. Remove Fan and Hub Assembly (1) through (6) by supporting Motor shaft and gently tapping out Spirol Pin (7).
3. Remove Pulley (9) and Bearings (8) and (10).
4. Clean Pulley (9) with Chlorothene. Wipe Motor shaft and Bearings (8) and (10) with clean, dry cloth.

Reassembly of Motor Drive Unit Components (Figure 3-8)

1. Apply FS-1290 to Motor Shaft, inside diameters and outside faces of Bearings (8) and (10), and inside diameter of Pulley (9).
2. Assemble Bearings (8) and (10) to Pulley (9) and install (Pulley (9) on Motor Shaft.
3. Apply Vischem 352 lubricant to inside diameter of Spring (6) (Between Spring (6) and Hub (5)) and install Hub Assembly (1) through (6), lining up hole in Hub Assembly with hole in Motor Shaft.
4. Support Motor shaft and gently tap NEW Spirol Pin (7) into hole.
5. Examine Drive Belt and replace if worn or stretched.
6. Make sure no lubricants are on Drive Belt or driving surfaces of Pulley (9).
7. Adjust Collar (11) for .005" to .010" end play of Pulley (9).

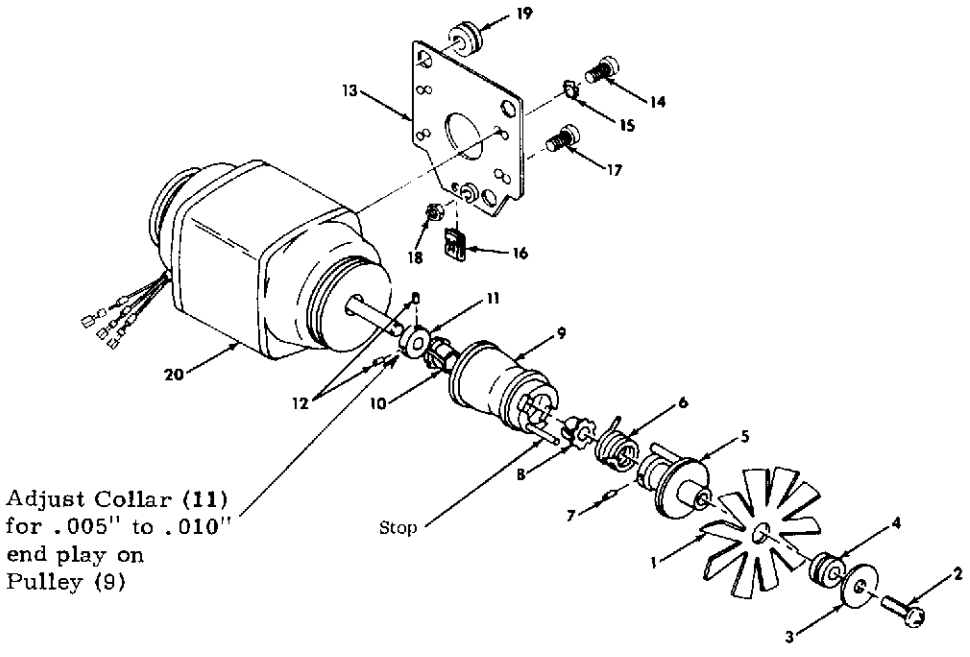


Figure 3-8. DISASSEMBLY AND REASSEMBLY OF DRIVE UNIT ASSEMBLY.

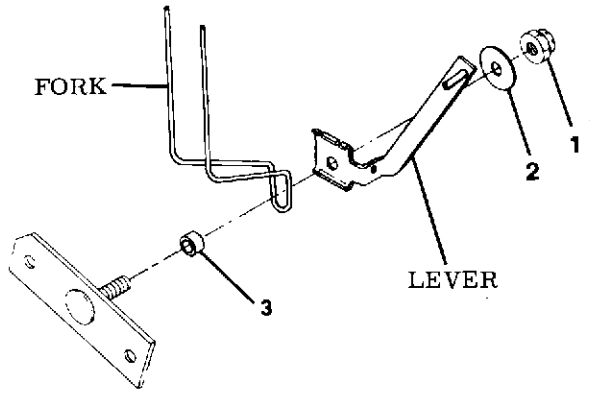


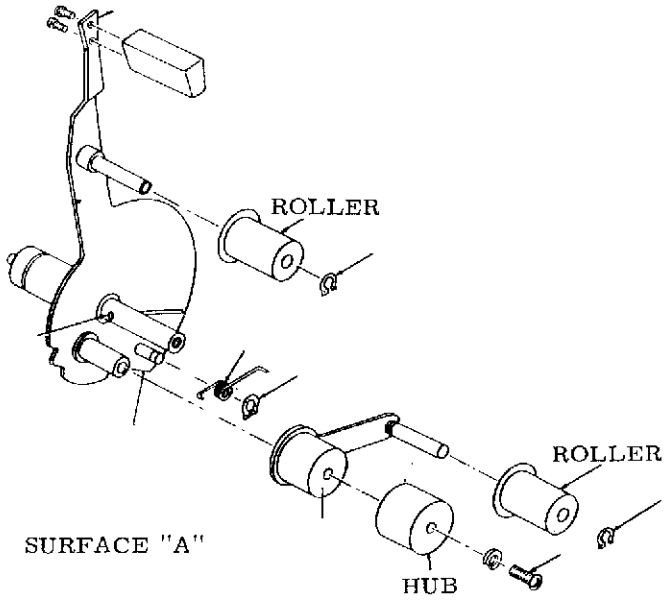
Figure 3-9. REASSEMBLY OF DRIVE BELT SHIFT FORK ASSEMBLY

Reassembly of Drive Belt Shift Fork Assembly (Figure 3-9)

1. Lubricate Spacer (3), working surfaces of Lever, and Washer (2) with Vischem 352 lubricant.
2. Tighten Nut (1) until Fork and Lever rotate freely with no perceptible end play.
3. Ring (2) must be assembled with throat parallel to bottom edge of control arm (surface "A") and facing closest edge of control arm. Spring (5) must rotate feely without end play.
4. Apply DC-200 to surface of Stud (3) and to face and inside diameter of Hub.
5. Tighten Screw (4) to 95-105 inch ounces of torque.

NOTE: When installed properly, Spring (5) hangs loose when Threading Control Arm is in Forward or Reverse position and is under tension to hold Film Tension Arm up when Threading Control Arm is in Thread position.

THREADING CONTROL ARM



FILM TENSION ARM

Figure 3-10. REASSEMBLY OF THREADING CONTROL ARM

Reassembly of Threading Control Arm (Figure 3-10)

1. Apply Vischem 352 lubricant to Roller Shafts. Clean lubricant off Roller ends.
2. Adjust Rings (1) to obtain end play of 0.005" to 0.015 between Rings (1) and Rollers.

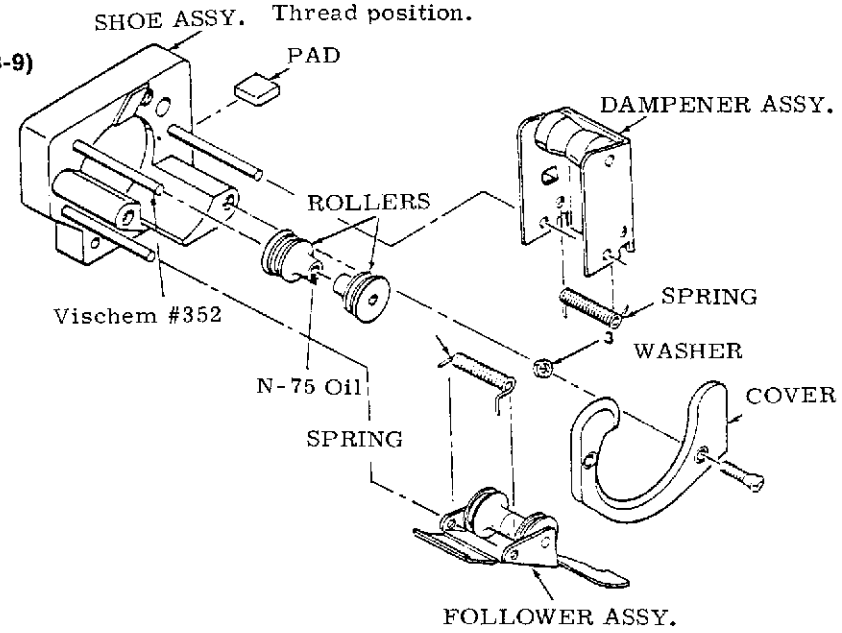


Figure 3-11. FEED SPROCKET SHOE COMPLETE

Feed Sprocket Shoe Complete (Figure 3-11)

1. Wash all parts in methyl alcohol. Inspect Rollers for wear. Apply Vischem 352 lubricant to studs on Shoe Assembly. Apply one drop of Singer Instrument Oil Teresso N-75 between halves of Roller on Follower Assembly.
2. When reassembling, load Springs with one full turn of pre-tension. Add washer(s) under cover as required to permit Follower Assembly and Dampener Assembly to be returned smoothly by spring action without binding. Wipe excess lubricant from rollers and supporting parts.
3. Fasten pad in position using A-963-B adhesive.

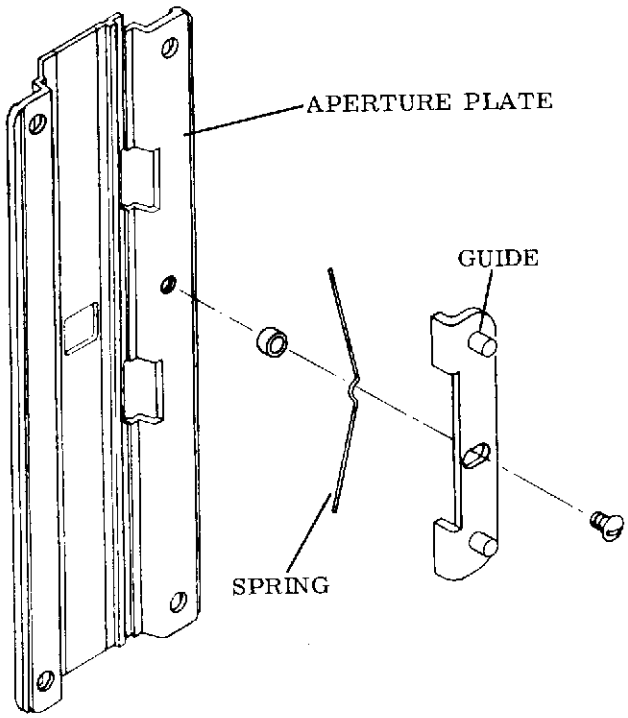


Figure 3-12. APERTURE PLATE ASSEMBLY

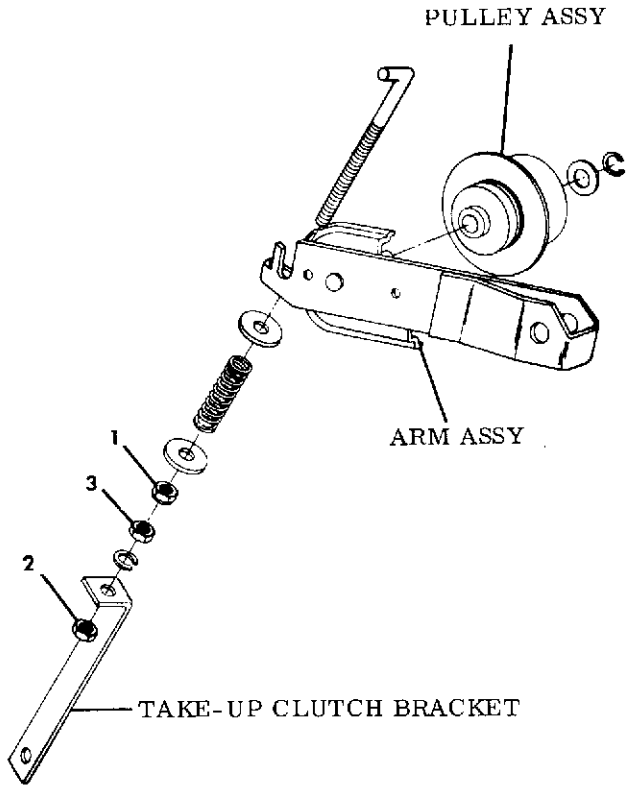


Figure 3-13. TAKE-UP CLUTCH ARM COMPLETE

Aperture Plate Assembly (Figure 3-12)

1. Clean Guide and Aperture plate using a cloth dampened with chlorothene. Use a toothpick or brush to remove deposits of dirt and emulsion. Inspect all parts for wear and damage.

NOTE: Examine Aperture Plate around claw pin slot and on narrow raised rib along other side of aperture. If chrome plating is worn off. Aperture Plate, it will appear very dull in these areas (stainless steel showing through). Replace Aperture Plate if plating is worn off.

2. When assembled, film edge Guide must move freely, smoothly, and be returned by action of the spring.

3. If Guide pressure is not within tolerance, reshape Spring to maintain 1.250 ±0.125 oz. at each pad.

4. Measure Guide pressure with Push-Pull Gage No. 516-500 or equivalent (16 oz. x $\frac{1}{4}$ oz. increment). This tool will not be supplied by Singer Education Systems, but should be ordered from John Chatillon & Son, 85 Cliff Street, New York, New York 10038

Take-up Clutch Arm Complete (Figure 3-13)

1. Wipe Pulley Assembly with cloth dampened with chlorothene. Other components of the take-up arm can be washed in chlorothene if cleaning is required.

2. Lubricate stud on Arm Assembly with 00-9 Keystone lubricant before assembling Pulley.

Cleaning of 2-3 Blade Shutter

1. Push clean, dry cloth under Shutter and flush between blades of Shutter with alcohol, manually moving Shutter from 2 to 3 blade position while flushing. Be sure to prevent alcohol from getting on Shutter Cam.

2. Run Projector and move Sound/Silent lever between its two positions. Shutter should shift freely from 2 to 3 blade position when moved from Sound to Silent and vice versa.

3. The 2-3 Blade Shutter needs no lubrication. A VERY SMALL amount of molybdenum disulfide (molycote Z) may be used if desired.

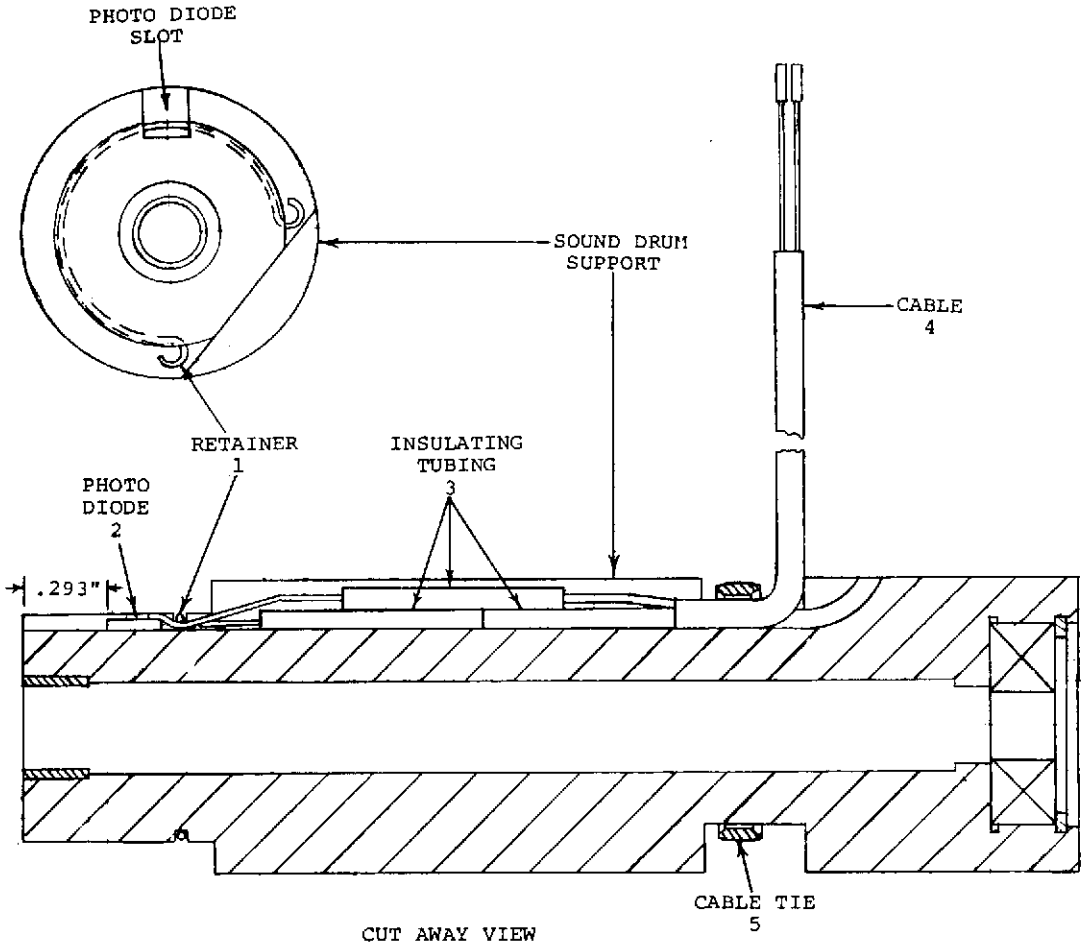


Figure 3-14. REPLACING PHOTO DIODE CHIP IN SOUND DRUM SUPPORT

Replacing Photo Diode Chip in Sound Drum Support (Figure 3-14)

1. Mark body of Sound Drum Support at outer end of Photo Diode (this establishes proper orientation for installation of new Diode).

2. Remove Retainer (1) Photo Diode (2) out of slot. Clip leads and discard Diode.

3. Remove Insulating Tubing (3) and unsolder remaining portion of Diode leads.

4. Clean residual epoxy cement from Photo Diode Slot.

5. Position new Photo Diode into Slot with shiny, black surface up (red wire) and end aligned with mark made in Step 1. Assemble Retainer (1) to hold Photo Diode in place, orienting Retainer as shown in Figure 3-14. Make sure Photo Diode is perfectly flat in slot. (End of Photo Diode should be .293"--about 9/32"--from end of Sound Drum Support.) PHOTO DIODE IS VERY FRAGILE. BE VERY CAREFUL NOT TO BREAK IT!

6. Mix 100 parts of Hysol R9-2039 Resin to 11 parts of Hysol H2-3404 Hardener (by weight). Dip a toothpick or paper clip in cement mixture and apply cement to Slot, contacting front edge of Photo Diode so cement will run under Diode. DO NOT allow cement to get on top surface of Diode. Allow cement to dry thoroughly (over night) before proceeding.

7. Slide Insulating Tubing on leads of Photo Diode and make sure that the third piece of Insulating Tubing is on Shield of Cable (4). Solder Black lead of Photo Diode to Shield of Cable and Red lead to Center Conductor of Cable. Slide tubing over solder connections (It may be helpful to cut Cable Tie (5) so Cable can be lifted out of Slot for soldering). Dress wires into Slot and replace Cable Tie if cut.

8. Measure resistance between Shield and Sound Drum Support with Ohmmeter. Resistance must be 5 Megohms MINIMUM.

Motor Run Capacitors

Motor Run Capacitors (C15) and (C16) have been eliminated from all Projectors manufactured after L4 Code. If these Capacitors go bad in other machines, it is not necessary to replace them. Simply remove them both. See Figures 6-3 and 6-7.