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LIST OF ILLUSTRATIONS

INTRODUCTION

This manual provides service instructions for the 2100 Series INSTA-LOAD 16 PROJECTOR. The manual is divided into four sections: Principles of Operation, Operational Check and Troubleshooting, Service Procedures and Illustrated Parts List.

Section I, Principles of Operation, contains a fundamental explanation of the operating principles of the projector. This includes description of the control circuits and the sound system. Section II, Operational Check and Troubleshooting, contains checks to be made while the projector is running, and troubleshooting procedures for determining cause of trouble and corrective action to take. Service Procedures, Section III, contains instructions for repair and adjustment of the projector. The Parts List Sections, Sections IV, V and VI contain a listing of projector parts in disassembly. All parts are keyed to illustrations for quick and easy identification. Wiring diagrams and schematics are included as part of Section VI.

SECTION 1

PRINCIPLES OF OPERATION

A. CONTROL CIRCUITS

The projector is operated by a Master Control Lever and a bank of pushbutton switches. The Master Control Lever selects the operating logic of the projector, while the pushbuttons select direction (forward and reverse) and the (still and off) modes of operation.

For normal operation, the Master Control Lever is set to PROJECT (up) position and the FORWARD pushbutton is activated. This causes the projector to operate with forward motion at normal speed (24 FPS) with the projection lamp and amplifier on. The pushbutton is interlocked mechanically so that either the STOP or STILL pushbutton must be depressed before a direction change can be made. When the REVERSE pushbutton is depressed, the projector operates in the reverse direction and the projection lamp remains on, but sound is cut off.

When the Master Control Lever is set to LOAD FAST MODE (down) and the FORWARD or REVERSE pushbutton is pressed, the projector will operate at fast speed in the direction selected, either with film in path or out. Amplifier and projection lamp are off.

1. 117V 60Hz Circuitry

The projector is used on 120V, 60 Hz. mains only. The three prong molded plug at the end of the main power cord provides the connection to the 120V, 60 Hz. power source. This plug provides a means for grounding all non-current carrying parts of the projector back to the grounded branch circuitry. This grounding method must not be bypassed or defeated in any way. One side of the main through the line cord and plug is common to all functioning electric parts of the projector, except when moving the Master Control Lever which is switched. The other side, which can be designated "HI" is connected through switching to various circuits.

2. Pushbuttons and Master Control Lever

Refer to Index for list of schematic diagrams showing the projector control circuits. Switch S-2 is an assembly of pushbutton switches, including STOP, REVERSE, STILL and FORWARD. Switches S-3, S-4, S-5 and S-6 are mechanically actuated switches which are operated by a cam on the Master Control Lever. When the lever is in PROJECT (up) position, switches S-3, S-4 and S-5 are in the normally closed (NC) position and switch S-6 is in the open (O) position. Switch S-2 (D) is closed in all but the STOP mode, and applies power to: the primary of transformer T-1, to one side of drive motor M-1 and blower motor M-2 and to switches S-2 (C) and S-2 (E) which close simultaneously with the closing of S-2 (D) and remain closed in all but STILL and STOP modes. When switch S-2 (E) is closed, power is applied to the reversing switch S-2 (F, J, G and H) which is shown with the FORWARD pushbutton depressed. The reversing switch will be set in the opposite condition if the REVERSE pushbutton is pressed. Depending upon the position of the reversing switch, power will be applied to operate the drive motor M-1 in one of two directions (forward or reverse). The forward and reverse section of switch S-2 has a memory and cannot change direction without intermediate mechanical change through actuation of the STILL and STOP pushbuttons.

When the Master Control Lever is in the LOAD, FAST MODE (down) position, switch S-6 is closed connecting power from S-2 (C) to relays K-1 and K2. The normally open (NO) contact of switch S-3 is also closed, completing the circuit to energize both relays and the fast mode interlock light L3. Relay K2 is energized by current through resistor R-27 and rectifying diode D-3. Capacitor C-18 connected in parallel with the coil of K2 is charged by this current. Once C-18 is charged, relay K2 is prevented from immediate drop-out when power is removed,

providing a time delay interlock of the Master Control Lever and braking at the termination of a fast operation, to avoid film spilling during braking.

The contacts of K-2 furnish power directly from the line to energize direct drive and interlock solenoid S0-2. This solenoid, when energized, locks the Master Control Lever in the LOAD FAST MODE position and will maintain it locked until K-2 drops out.

Solenoids S0-1 and S0-3, when energized, provide direct-drive and braking for the front and rear spindles respectively. These solenoids are alternately energized depending on the direction and mode of projector operation. The rear spindle solenoid S0-3 is energized for fast forward and brake rewind. The front spindle solenoid S0-1 is energized for reverse, rewind and brake fast forward. A chart showing the condition of switches and solenoids in various modes is provided in the table below.

TABLE 1-1. SWITCH AND SOLENOID OPERATION

COMPONENT	FORWARD	REVERSE	FAST FORWARD	REWIND	BRAKE FAST FORWARD	BRAKE REWIND
Up Control Lever	X	X	O	O	O	O
Down Control Lever	O	O	X	X	X	X
Forward Button	X	O	X	O	O	O
Reverse Button	O	X	O	X	O	O
Still Button	O	O	O	O	X (or)	X (or)
Off Button	O	O	O	O	X	X
Solenoid S0-1	O	X	O	X	X	O
Solenoid S0-2	O	O	X	X	X	X
Solenoid S0-3	O	O	X	O	O	X

B. SOUND SYSTEM

1. General

When the film is driven through the projector, the sound track edge passes between a sound optics cartridge and a photo-sensitive diode. Light from a low power exciter lamp is shaped and focused by the sound optics cartridge into a rectangular beam at the film surface. This beam passes through the sound track to energize a photo diode affixed to the sound drum support. Variations of sound track area, or density, cause corresponding fluctuations in the amount of light transmitted to the photo diode. The resulting photovoltaic action produces a low voltage ac signal proportional to sound track modulation. A solid state electronic amplifier amplifies the signal for loudspeaker reproduction.

2. Operating Principles

The amplifier consists of two major sections: Power Supply and Audio Amplifier. The tone and volume control network also constitutes a separate assembly connected by a shielded cable.

A functional description of each amplifier section follows. Reference is made to the projector schematic.

a. Power Supply Circuit

Projection lamp transformer T-1 supplies 30.0 V AC minimum to bridge rectifier D-1. The 120 cps pulsating dc output is filtered to relatively pure DC by parallel capacitors C-19 and C-20. Resistor R-28 limits peak rectifier surge current. The 42 VDC output operates the power output stage of the amplifier circuit.

NPN Transistor TR-1 together with R-29, C-21 and Zener Diode D-2 comprises a series regulator. The Zener Diode establishes a reference voltage at the base of TR-1. This circuit provides a filtered and stabilized 15.0 VDC source for operation of the pre-amplifier stage of the audio amplifier circuit. Resistor R-30 drops the 15.0 VDC for proper exciter lamp operation.

b. Audio Amplifier Circuit

Photo diode PD-1 is connected in a photovoltaic mode. Control VR-2 is normally factory adjusted to provide a specific level from 400 Hz. test film. This facility compensates for production tolerances of photodiode output and amplifier gain. The sound track signal developed across VR-2 is capacitor coupled through C-2 to the pre-amplifier input. Transistors TR-2 and TR-3 form a cascaded, direct-coupled amplifier having a power gain of approximately +40 db.

The amplifier signal is again capacitor-coupled through C-3 to a tone-volume control network. With the tone control VR-1B set near mid position, a "flat" amplifier frequency response is obtained. Volume control VR-1A controls the signal level applied to succeeding stages. (VR-1B provides bass cut).

A single transistor stage TR-4 having an approximate power gain of 27 db follows the tone-volume control network. This stage makes up for signal loss imposed by the tone-volume network and provides a low impedance drive source for the following power amplifier. Resistor R-13 and Capacitor C-7 provide additional filtering of the power supplied to the pre-amp stage.

Capacitor C-9 provides dc isolation from preamp stage TR-4 while C-14 provides isolation between power output stage and load.

Transistors TR-5 and TR-6 provide a differential input to the power amplifier which maintains the quiescent dc voltage at the junction of resistors R-24, R-25 and R-26 at near 1/2 the nominal 42 VDC power supply voltage. Transistor TR-7 with Resistor R-23 drives the class AB power output stage of Transistors TR-8 and TR-9. Feedback resistors R-21 and R-20 fix the voltage of power amplifier at 27 db.

Loudspeakers LS-1 and LS-2 are each 16 ohms impedance. They are parallel connected to pro vide the appropriate 8 ohm amplifier load. Output jack JS-1 provides connection facility for external speakers. Internal speakers LS-1 and LS-2 are disconnected when an external speaker plug is inserted.

SECTION II

OPERATIONAL CHECK AND TROUBLESHOOTING

A. GENERAL

This section contains an Operational Check and Trouble and Remedy Table.

B. OPERATIONAL CHECK

1. Connect power cord to grounded ac outlet.

2. Swing reel arms up and lock in place.

3. Set Master Control Lever to PROJECT position.

4. Press FORWARD button. Check that sprockets and reels turn properly, that screen is illuminated evenly and blower is operating.

5. Press STILL button (still models only). Check that sprocket and reels stop and that screen illumination is cut down (safety shutter operative).

6. Press REVERSE button. Check that sprockets and reels turn properly.

7. Press STOP button. Projector should stop.

8. Move Master Control Lever to LOAD/FAST MODE.

9. Press FORWARD button (Fast Forward). Check that sprockets and take-up reel operate and the fast mode interlock light comes on after a slight delay.

10. Press STOP button. Projector should stop and fast mode interlock light (Fast Forward) should remain on for approximately five seconds.

11. Press REVERSE button. Check that sprockets and supply reel operate in the fast reverse mode. On Fast Forward models, interlock light will light.

12. Press STOP button. Projector should stop, on Fast Forward models the interlock light should remain on for approximately five seconds.

13. Load projector with SMPTE Jiffy Test Film (refer to operator's manual).

14. Set Master Control Lever to PROJECT position and press FORWARD button to start projecting film at normal speed.

15. Check picture for ghosting, double image and focus.

16. Adjust framing knob so reference frame line shows on screen. Check for picture jump, side movement and centering of aperture to film. Readjust to eliminate frame line before starting to show.

17. Set TONE control to mid-range and adjust VOLUME control to a comfortable listening level. Listen for wow, flutter, microphonics and general clarity of sound.

18. Set TONE and VOLUME controls fully counterclockwise.

19. Move Master Control Lever to LOAD FAST MODE position. Projector lamp should go out and film should advance at fast speed. The Master Control Lever should now be mechanically locked into position. On Fast Forward models the Fast Mode Interlock light should be on.

20. Press STOP button. Projector should stop. On Fast Forward models, the Fast Mode Interlock light should go out after a five second delay.

21. Move the Master Control Lever to PROJECT position.

22. Press REVERSE button. Projector should operate in reverse at normal speed.

23. Move the Master Control Lever to LOAD FAST MODE. Projector should increase to fast speed and on Fast Forward models, the interlock light should go on.

24. Press STOP button. Projector should stop. After approximately five seconds the Fast Mode Interlock light should go off on the Fast Forward models.

C. TROUBLESHOOTING

The purpose of the following table is to list commonly encountered troubles and to indicate corrective repairs and adjustments. Generally, troubles caused by operational error are not listed as it is assumed the repairman is familiar with troubles of this type. Disassemble only as needed for repair. Before disassembly, check for loose or missing screws or parts that are binding because of misalignment or lack of lubrication. Electrical troubleshooting will be facilitated by referring to the wiring and schematic diagrams in Section VI.

The table is divided into four sections. The first section covers control system troubles, the second section covers film handling and picture troubles while the third section covers sound troubles. Miscellaneous troubles are found in section four. Use the schematic diagrams in conjunction with the troubleshooting procedures. The schematic diagram indicates typical ac signal and dc bias voltages for cases requiring more extensive circuit analysis.

A service checklist should be used to verify complete service inspection for each area serviced.

TROUBLE	CAUSE	REMEDY
1. Control System Troubles		
a. Blower Motor does not operate in any mode.	Blower Motor Defective	Replace
b. Projector does not operate when FORWARD button is pressed.	Switch S-2 defective	Replace
c. Projector operates but projection lamp does not illuminate when FORWARD button is pressed	Projection Lamp Defective	Replace
	Transformer T-1 Defective	Replace
	Switch S-2 Defective	Replace
d. Low light level (Safety shutter) on screen during projection	Safety shutter not lifting	Redampen
	Shutter sticking, (Parts interference)	Visually align safety shutter midway between shutter & cam assembly. Safety shutter spring & link must clear shutter cam by 1/8"
e. Film burns in still mode	Safety shutter slow to return	Shutter sticking on bumper pad. Replace. Check alignment.
f. Projector does not operate when REVERSE button is pressed	Switch S-2 defective (no current from terminals H-8)	Replace
g. Fast mode interlock light does not come on with Master Control Lever in LOAD FAST, and FORWARD or REVERSE button is pressed. (Lever mechanically locked in place).	Lamp L-3 defective	Replace
	Capacitor C-18 defective	Replace
h. Fast mode interlock light does not remain on for five seconds after STOP button is pressed	Capacitor C-18 defectice	Replace
	Diode D-3 defective	Replace
	Resistor R-27 defective	Replace
i. Failure to drive in FAST FORWARD or brake in REWIND	Solenoid (S0-3) out of adjustment	Adjust (Sec. III, Par. G. 11. a.)
	F. F. clutch actuator out of adjustment	Adjust (Sec. III, Par G. 11. d.)
	Fast Forward drive belt tension incorrect	Adjust (Sec III, Para. G. 5.)
j. Failure to rewind or brake in FAST FORWARD	Solenoid (S0-1 & S0-2) out of adjustment	Adjust (Sec. III, Para. G. 11)
	Front Clutch Actuator out of adjustment	Adjust (Sec. III Para. G. 11. d.)
k. Stop during REWIND and Film spills (No brake)	Cable off pulley	Reassemble
	Wrong Cable length	Adjust (Sec. III, Para. F. 18. t.)

TROUBLE	CAUSE	REMEDY
k. Stop during REWIND and film spills (No brake)	Pulley (9, Fig. 6-19) worn	Replace
	Spring (13, Fig. 6-19) worn or dirty	Clean or Replace
m. No interlock on main lever	Solenoid (S0-2) out of adjustment	Adjust solenoid when energized, then check link wire (G.10)
	Link (43, Fig. 6-7) is uncoupled or not formed correctly	Reassemble and reform (Sec. III, Para. G.10)
2. Film Handling and Picture Troubles (NOTE: Test Film must be in good condition)		
a. Film slap	Claw protrusion or stroke out of adjustment	Adjust (Sec. III, Para. G. 8)
	Pressure shoe out of adjustment	Adjust (Sec. III, Para. G2)
	Emulsion build up on pressure shoe and aperture plate	Clean (Sec. III, Para. H. 3. c. 3 &4)
b. Film scratch	Aperture Plate (53, Fig. 5-3) or pressure shoe (3, Fig. 6-4) dirty	Clean, with Methyl alcohol or chloro-thene
	Film handling rollers stuck	Clean and lubricate (Sec. III, Para H. 3. c. 5 & Fig. 5-3)
c. Film damage at feed sprocket	Supply arm spindle torque to high	Adjust (Sec. III, Para. F. 7. c.)
	No end play in feed clutch	Adjust (Sec. III, Para. F, 8b)
d. Film spills at supply reel (Reverse operation)	Solenoid (S0-2) out of adjustment	Adjust
e. Loss of lower loop	Claw protrusion or stroke out of adjustment (short)	Adjust (Sec. III, Para. G. 8.)
	Lens housing stop pin, out of adjustment	Adjust (Sec. III, Para. G. 1. b.)
	Pressure shoe not seated properly	Check position of shoe, if necessary, realign (Sec. III, Para. G-2)
	Loop set mechanism not functioning properly	Replace drive belt (31, Fig. 5-7) or replace loop set gear (28), spring (30). CAUTION: DO NOT LUBRICATE GEAR.
f. Clicking noise (film picking)	Teeth of feed sprocket (10, Fig. 5-3) damaged	Replace Feed Sprocket
	Teeth of take-up sprocket (10, Fig. 5-7) damaged	Replace take-up sprocket

TROUBLE	CAUSE	REMEDY
f. Clicking noise (film picking)	Claw arm (13, Fig. 6-22) teeth worn, damaged or missing	Replace claw arm (Sec. III, Para. F-2).
	Pressure shoe out of adjustment	Adjust (Sec. III, Para. G-2)
	Claw arm out of adjustment	Adjust (Sec. III, (Para. G. 8.)
g. Little or no take-up	Reel take-up belt (25, Fig. 5-2) damaged	Replace
	Film tension too low	Adjust (Sec. III, Para. G. 3)
	Liner (16, Fig. 5-8) worn	Replace liner, clean gear & adjust.(Sec. III, Para. G3 & 4
	Take-up clutch lift-off linkage too short	Adjust(Para. G. 3 & 4)
h. Damaged film at take-up sprocket	Take-up film tension too high	Adjust Sec. III Para. G. 3 & 4)
	Bottom idler roller, pressure out of adjustment	Adjust (Sec. III, Para. F. 14. k.
i. Erratic take-up	Brake surface of take-up reel arm pulley (4, Fig. 5-8) dirty	Wipe inner surface of pulley
j. Film spills in FORWARD at Supply reel	Take-up clutch out of adjustment	Adjust (Sec. III. Para. G. 3 & 4)
	Friction drive in clutch assembly (Fig. 3-22)	Clean and adjust (Sec. III, Para. F-9)
k. Rewind stall, partially through reel	Cable off pulley	Reassemble cable
	Brake cable out of adjustment	Adjust cable length (G. 12)
	Pulley (9, Fig. 5-8) drags on bottom of gear and liner	Adjust (Sec. III, Para. G-3)
	Solenoid (S0-1) out of adjustment	Adjust Para. G. 11. b.)
	Excessive F. F. Belt Tension	Adjust (Sec. III, Para. G. 5)
m. Loose rewind	Supply or take-up reel bent	Replace
n. Picture jumps (possible loss of loop)	Claw protrusion, stroke or side clearance out of adjustment	Adjust (Sec. III, Para. G. 8)
	Aperture plate (53, Fig. 5-3) or pressure shoe (3, Fig. 6-4) dirty	Clean with alcohol or chlorothene
	Claw arm (43, Fig. 5-8) damaged (Face of claw arm must be visible parallel to adjacent face of casting)	Replace and adjust (Sec. III, Para. F. 2 & G. 8.)
	Pressure shoe not seated	Align (Sec. III, Para. G-2)
o. Picture motion; side-side	Film edge guide spring not assembled correctly	Reassemble (Fig. 3-24)
p. Picture goes in and out of focus at random	Pressure shoe damaged or out of adjustment	Check carrier (5, Fig. 6-4) for flatness, then adjust (Sec. III, Para. G-2)

TROUBLE	CAUSE	REMEDY
q. Picture "streams" vertically	Pressure shoe not aligned	Align (Sec. III, Para. G-2)
	Film edge guide spring (4, Fig. 6-11) not assembled correctly	Reassemble and lubricate (Sec. III, Para. F-10)
	Short protrusion	Adjust (Sec. III, Para. G. 8)
3. Sound System Troubles		
a. Short exciter lamp life	R-30 shorted	Replace R-30 and check D-2 and C-21
b. Exciter lamp blows	TR-1 shorted	Replace TR-1 and D-1
c. Dead exciter lamp	C-21 shorted	Replace C-21, Check R-29
d. Hum	C-21 open	Replace
e. No sound from film, exciter lamp ok. Speaker hiss increases with volume control	Photo diode (D-1) open	Check continuity and wires at plug terminals
	Shorted or open shielded cable from sound support drum	Repair or replace with spliced section
f. Exciter lamp will not light Speaker hiss increases with Volume control	Resistor R-30 open	Replace
	Exciter lamp socket defective or leads to socket open	Repair or replace
g. No sound from film, exciter lamp ok. Speaker hiss, volume control has no effect	Capacitor C-7 shorted	Replace
	Capacitor C-6 open or shorted	Replace
	Transistor TR-4 defective	Replace
h. No sound, hum or hiss. Exciter lamp ok	Open or loose connection on speaker leads	Repair or replace
i. Excessive hum with sound	Capacitor C-7, C-19 or C-20 defective	Replace defective component
j. Distorted sound. Exciter lamp ok	Transistor TR-2, TR-3, TR-4, TR-5, TR-6, TR-7, TR-8 or TR-9 defective	Replace defective component
	Coupling capacitor C-2, C-3, C-6, C-9 or C-22 defective	Replace defective component
4. Miscellaneous Troubles		
a. Motor runs, drive shaft does not rotate	Belt tension low (slips)	Adjust (Sec. III, Para. G. 4))
	Main shaft pulley loose	Secure screws (14, Fig. 5-9)
	Belt & pulleys dirty	Clean with chlorothene
	Motor pulley pin broken	Replace pin (39091-P001, p/o 11, Fig. 6-12)

SECTION III
SERVICE PROCEDURES

A. GENERAL

This section provides repair, reassembly, adjustments and preventive maintenance instructions.

B. TOOLS AND EQUIPMENT

Servicing of Singer INSTA-LOAD 2100 Series Projectors will be facilitated by tools and equipment described in this section. Some tools are standard and are readily available through local purchase. Special tools have been assigned tool numbers and are available from Singer Education Sytems.

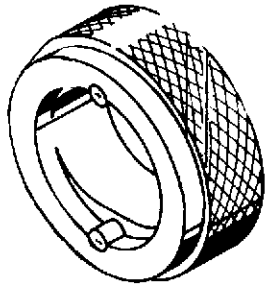
1. Special Tools

Special Tools required for the repair of the projector are listed below. For a description of these tools, refer to the applicable illustration.

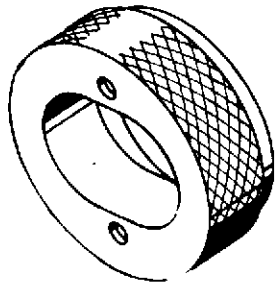
ST-5884	Claw Arm Adjusting Tool (Fig. 3-1)
G10-38000	Claw Arm Protrusion Gage (Fig. 3-2)
T-38000-N	Rollpin-Insert & Extracting Tool (Fig. 3-3)
T-38000-S	Take-Up Film Tension Gage (Fig. 3-4)
ST-5880	Stroke Setting Gage (Fig. 3-5)
T-38001-G	Sound Drum Locating Plug (Fig. 3-6)
SS-305	Retainer Feeler Gage (Fig. 3-7)
T-43411-G1A	Solenoid Holding Clamp (Fig. 3-8)
SS-327	Solenoid Stroke Gage (Fig. 3-9)
T-43680-G1G	Sound Optics Adjusting Tool (Fig. 3-10)

2. Commercial Tools

The commercial tools used in the repair of the projector are listed in the table below. These tools are also available from Singer Education Sytems.



FRONT VIEW

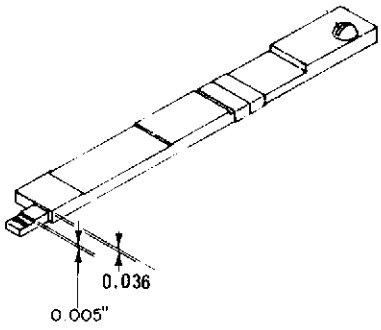


REAR VIEW

Used to adjust claw arm side clearance and pull-down stroke. (This is a handle to turn front pivot, 18, Fig. 6-22).

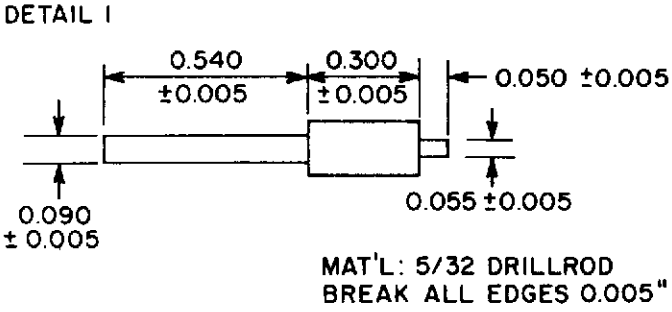
Figure 3-1. CLAW ARM ADJUSTING TOOL No. ST-5884

EDUCATION SYSTEMS NO.	DESCRIPTION	USE
SS-307	Waldes Retaining Ring Applicator M-C 012	To install retaining rings.
T-38000-U	Waldes Tru-Arc No. 1520 Applicator	To remove and install small retaining rings.
T-38000-V	Waldes Tru-Arc No. 1540 Applicator	To remove and install large retaining rings.
T-38000-W	Claw Cam Wrench (Pair)	Claw arm eccentric pivot nuts.
T-38000-X	Waldes Tru-Arc No. CR-0310	To remove and install "C" rings.



Used to set claw pin protrusion.

Figure 3-2. CLAW ARM PROTRUSION GAGE, No. G10-38000



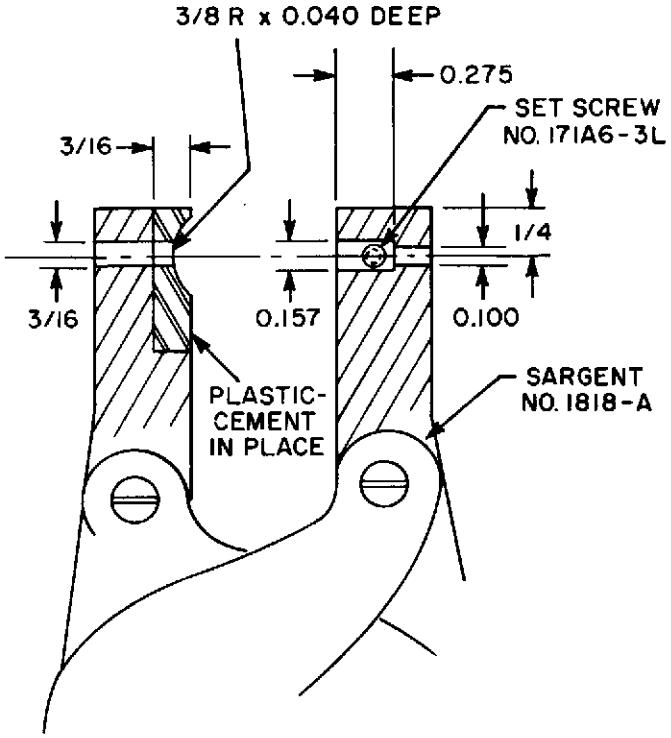
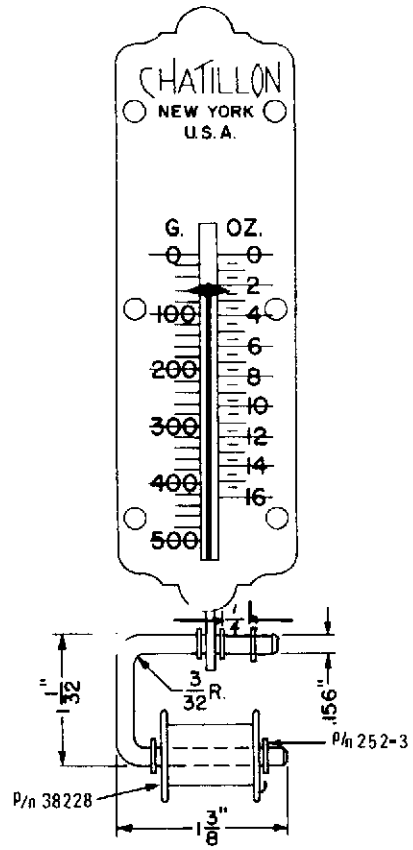
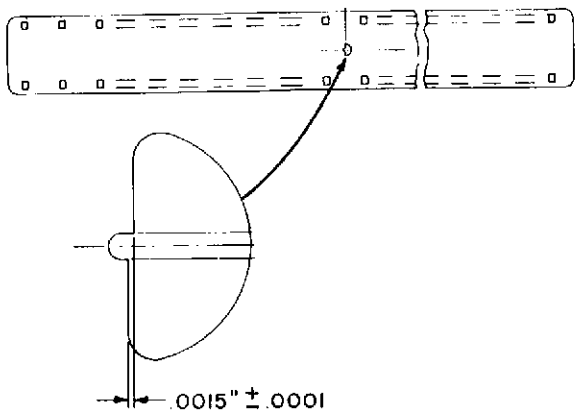


Figure 3-3. ROLLPIN-INSERT & EXTRACTING TOOL, No. T-38000-N



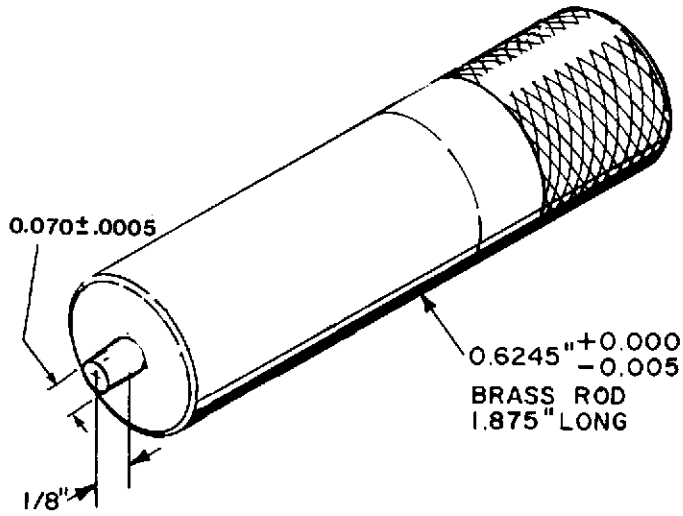
Used to measure film take-up tension, belt tension and fast forward take-up tension. The scale reading is twice the actual film tension.

Figure 3-4. TAKE-UP FILM TENSION GAGE No. T-38000-S



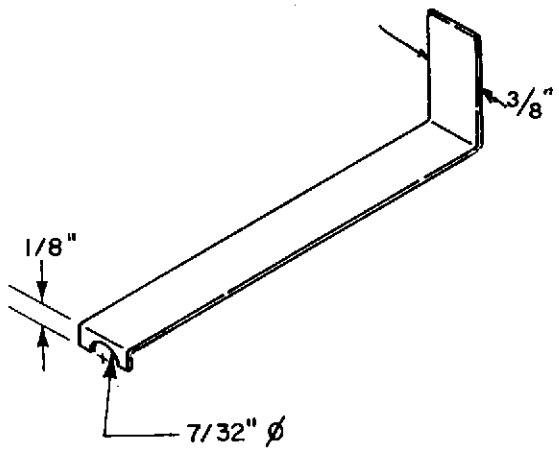
This gage is a piece of stainless steel with perforations exactly like double-perforated 16mm motion picture film. This gage is used to adjust the stroke of the projector. The projector functions as an optical comparator when this tool is used.

Figure 3-5. STROKE SETTING GAGE No. ST-5880



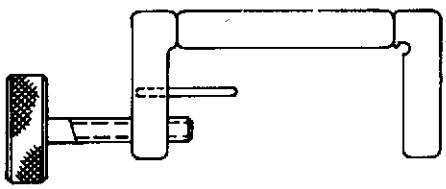
Used to locate the lateral and rotational position of the sound drum.

Figure 3-6. SOUND DRUM LOCATING PLUG, No. T-38001-G



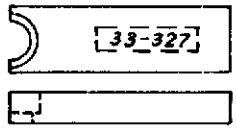
MATERIAL : .025 PHOS. BRONZE OR SPE. BR.

Figure 3-7. RETAINER FEELER GAGE No. SS-305



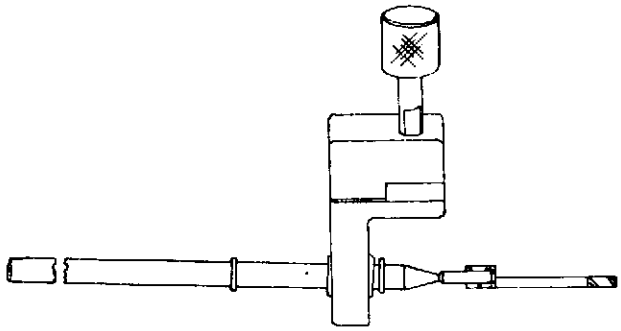
Used to hold solenoid for fine adjustment.

Figure 3-8. SOLENOID HOLDING CLAMP No. T-43411-G1-A



Used to set initial solenoid position

Figure 3-9. SOLENOID STROKE GAGE No. SS-327



Used to set Sound Optics.

Figure 3-10. SOUND OPTICS ADJUSTING TOOL No. T-43680-G1-G

C. MATERIAL

Materials required are listed in the following table. The stock numbers of materials available from Singer Education Systems are given. If there is no number, the product will not be supplied by Singer Education Systems. Only those test films showing our stock numbers can be procured, others must be ordered by PH number from SMPTE.

INSTA-LOAD PROJECTOR
2100 SERIES

STOCK NO.	STOCK PACKAGE	DESCRIPTION
39479-P005	1/2 oz.	DC-200 Silicone Fluid; 200,000 centistroke viscosity (Dow Corning Corp., Midland, Michigan). For sound dampening roller arm.
39479-P013	1/2 oz.	D-200 Silicone Damping Fluid; 200 centistroke viscosity (Dow Corning Corp., Midland, Michigan). For use on Safety Shutter.
39479-P007	1/2 oz.	009 Lubricant (Keystone Carbon Co., St. Mary's, Pennsylvania).
39479-P008	2 oz.	Instrument Oil - Teresstic Oil, No. N-75 (Humble Oil & Refining Co., New York, New York).
39479-P009	2 oz.	DC-44 Light Consistency Silicone Grease (Dow-Corning Corp., Midland, Michigan)
39479-P015	2 oz.	Vischem No. 352 (Ultra-Chem Inc., Wilmington, Delaware)
39479-P004	1/2 oz.	FS-1290 Fluorosilicone Grease (Dow-Corning Corp., Midland, Michigan)
39479-P014	2 oz.	Versilube G-322L (General Electric Co., Schenectady, New York)
39490-P001	3 oz.	7526 Blue Glyptal (General Electric Co., Schenectady, New York)
39479-P016	4 oz.	Extreme Pressure Lube No. 3
39490-P002	3 oz.	1276 Clear Glyptal (General Electric Co., Schenectady, New York)
39484-P002	1/2 oz.	Molycote Z Dry Lubricant (Alpha Molycote Corp., Stamford, Connecticut)
LP	- - - - -	8101-S Silicone Compound (General Cement Electronic Co., Rockford, Illinois)
LP	- - - - -	No. 59 Loctite, Screw Lock (Loctite Corp., Newington, Connecticut)
SS-3	12 ft.	PH 22.57 Buzz Track Film (P16BT)
SS-5	- - - - - -	PH 22.45 400 Cycle Test Film
SS-2	12 ft.	PH 22.42-7 7000 cps Film (P16SFA)
SS-1	12 ft.	PH 22.42-5 5000 cps Film (For Link Model 2120L)
SS-302	12 ft.	16.3 mm. Registration Test Film (Reg. 16)
39490-P004	8 oz.	Glyptal Thinner 1511M
LP	- - - - -	Chlorothene (Dow Chemical Co., Midland, Michigan)
39490-P012	4 oz.	Tan Paint
39490-P014	4 oz.	Brown Paint

D. REPAIR NOTES

1. Semi-Conductor Testing

a. Transistors

An effective but simple transistor test for leakage, amplification and short circuit conditions may be performed using Simpson Model 260/270 Multimeter or equivalent. Connect the transistor under test in the circuit shown and observe the polarity.

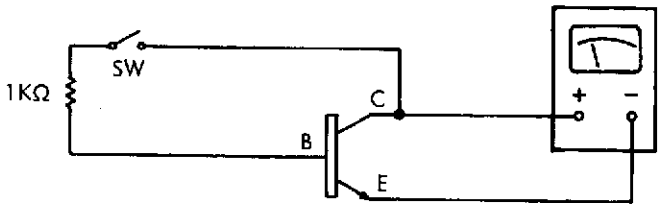


Figure 3-11. TEST CIRCUIT

Use the X100 scale for regular small-signal devices and X10 scale for power types. All readings are referred to the X1 scale.

With base switch open, the reading should be above 200 ohms. A lower reading indicates excessive leakage or a shorted transistor.

With the base switch closed, the reading should be less than 500 ohms. A higher reading indicates low gain and a very high reading indicates an open device.

Polarity is shown for NPN transistors with ohmmeter voltage selector switch on +dc. (PNP types may be checked by reversing VOM polarity). Observe opposite polarity of terminal voltage when using Weston or Triplet instruments.

b. Diodes

Front to back resistance ratio will indicate silicon and germanium diode defects. Using the RX100 multimeter scale, a diode should measure a very low resistance with one lead (test probe) polarity and very high resistance with leads reversed.

c. Zener Diodes

Depending on voltage rating, Zener diodes will exhibit lower reverse resistance than regular diodes but a marked front-to-back ratio should be evident.

2. Amplifier Waveforms

The following brief tests may be performed to check amplifier characteristics.

a. Attach an 8 ohm, 15 watt dummy load in place of the loudspeaker.

b. Connect an audio oscillator through a 40 db pad to test input jacks P-16 and P-11 (P-11 common ground) of board 43477-G001. The audio oscillator ground must be "floating", ie. not common to other test equipment.

c. Connect the ac-coupled vertical sweep (at approximately 10 v/cm range) of an oscilloscope and an ac VTVM across the 8 ohm load.

d. Remove both projection and exciter lamps.

With volume control full counterclockwise and no audio signal input, run the projector in forward mode. The oscilloscope waveform should appear as a straight line having no hum or noise as in Fig. 3-12A. Now start and stop the machine several times. There should be no evidence of high frequency oscillation on the waveform during switching.

Set both volume and tone controls maximum clockwise and repeat above on-off switching. Except for a slight increase in random noise, there should be no oscillation tendency evident.

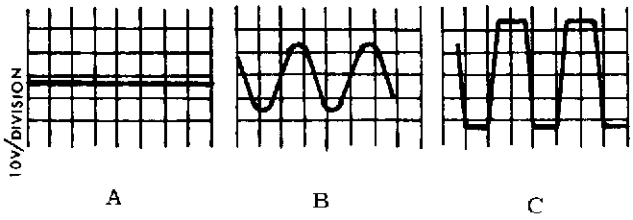


Figure 3-12. WAVEFORMS

Apply a 1000 cps signal from the audio oscillator to the test input terminals P-16 and P-11. Adjust oscillator output to obtain approximately 20mv at this input. With tone control at mid position, increase the projector volume control to obtain a pure sine wave as shown in Figure 3-12B. Increasing volume (CW rotation) further should produce a symmetrically clipped wave as in Figure 3-12C. Reduce signal input to the point where the output signal is just under the level of clipping. It should be possible to obtain 31 volts peak-to-peak(11V RMS) at this level. Severe non-symmetry or high-frequency ringing indicates a circuit problem. NOTE: Operate the amplifier only for short periods under the above test conditions.

3. FOCUS

a. Clean Sound Optics.

b. Set projector up with 400 Hz loop (SMPTE).

c. Check at C-9 (after) with VTVM, should be equal to approximately 1/2 V.

d. Recheck for maximum focus.

e. Recheck and confirm VR-2 voltage.

LINK Model (2120L)

a. Attach jumper between P-19 and P-20 to bypass 5000 Hz filter.

b. Use 5000 Hz film (SS-1) loop. Focus optics for maximum output. Use meter across speaker, or apply an 8 ohm, 10W dummy load in speaker jack. Set volume control at maximum and tone control at maximum treble.

c. Remove jumper.

d. Use 400 Hz loop. Connect meter between ground (P-9) and P-19. Adjust VR-2 to 200 mv.

e. Remove 400 Hz loop. Remove meter.

f. Use 5000 Hz loop. Insert in 5K Hz output jack plug terminated with 10K, 1/2 W resistor.

g. Connect VTVM across 10K resistor.

h. Set VR-3 to 1/2 V AC reading.

j. Set VR-4 for minimum sound through speaker.

k. Start at step 4, recheck to confirm step 8.

E. DISASSEMBLY

Disassembly of the projector and subassemblies thereof should only be performed to the extent necessary to accomplish repair. For convenience however, a complete disassembly sequence for the projector is provided in the exploded view illustrations and parts lists of Section V. Pertinent notes relative to the disassembly of each stage of the projector follow. NOTE: Internal electrical connections may be hot when covers are removed. USE CAUTION

1. Stage I (Fig. 5-2)

a. Remove covers (1, 2, 3 and 7) in the order indicated.

b. Disconnect wires from parts (7 and 22) before removal.

c. Loosen lens retaining screw (19) before attempting to remove projection lens.

d. Use wire cutters to cut retainer (12) and remove arm (11).

2. Stage 2 (Fig. 5-3)

a. Loosen two setscrews that secure control cable to Master Control Lever arm. Pull cable up to feed sprocket.

b. Before removing control unit (3), unhook link wire (43, Fig. 6-7) by reaching through opening above sprocket. It may be necessary to lift wire tip from 90° bend to 45°.

c. Pin (16) is a floating pin, which needs only to be pushed out after removal of clutch spring (14). To remove arbor (15) on Fast Forward mark actuator (6) front and rear for reassembly.

3. Stage 7 (Fig. 5-8)

Remove and discard gear liner (16). DO NOT try to clean or impregnate again with oil, and do not substitute other material or lubricant.

4. Stage 8 (Fig. 5-9)

a. Loosen collar (18) then (30) for easy removal of ring (16).

b. Loosen setscrews securing driveshaft components and press pins (21 & 33) out of worm gears (20 & 32) using tool T-380000-N.

F. REASSEMBLY

1. Shutter and Cam Assembly (Fig. 3-13)

a. Press ring (1) on hub (2a), allowing no end play on cam (2b).

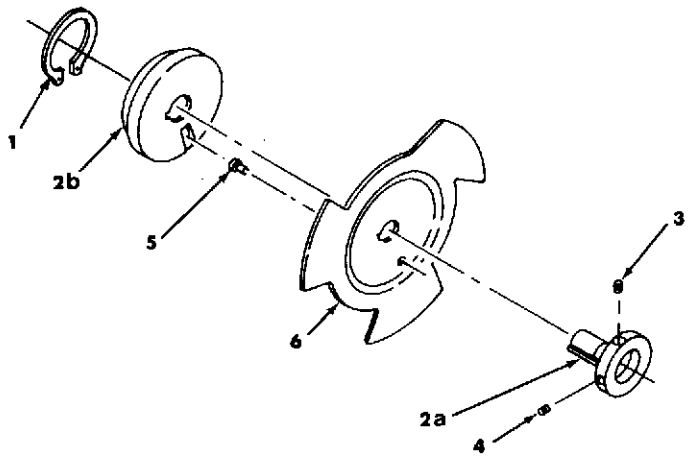


Figure 3-13. SHUTTER AND CAM ASSEMBLY

2. Claw Arm Complete (Fig.3-14)

a. Lubricate periphery of rod (1) and bearing surfaces of washers (5 and 7), ring (6), bracket (2) and spring loop groove of item (12) with DC-44 grease.

b. Lubricate interfaces between claw arm assembly (13) and washer (17) with FS-1290 grease.

c. Adjust nuts (9) to obtain minimum endplay of .001 to permit claw arm to pivot freely with framing arm before spring (15) is assembled.

d. Apply Glyptal 7526 to nuts (9) and washer (10).

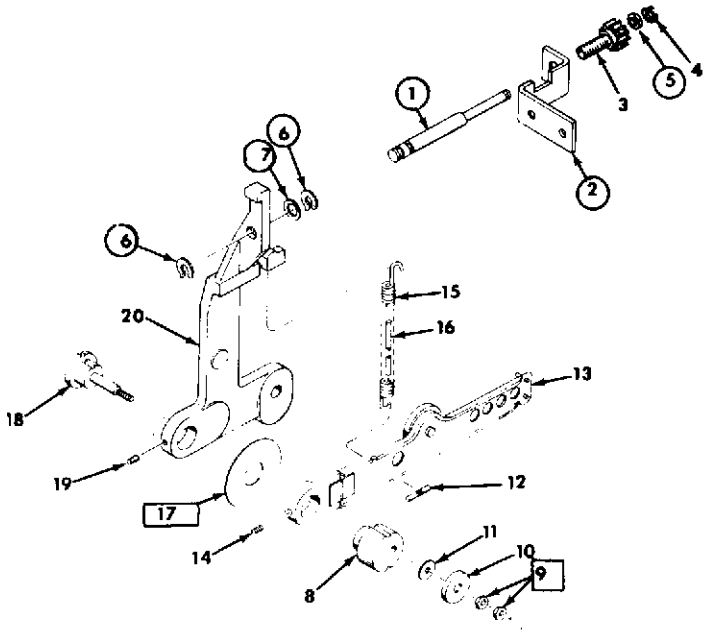


Figure 3-14. CLAW ARM COMPLETE

3. Film Counter Complete (Fig.3-15)

a. Lubricate interfaces of idler gear assembly shaft (7) and bearing (9) with Teresstic N-75 oil.

b. When gear (5) is rotated, entire gear train and counter must operate freely and smoothly.

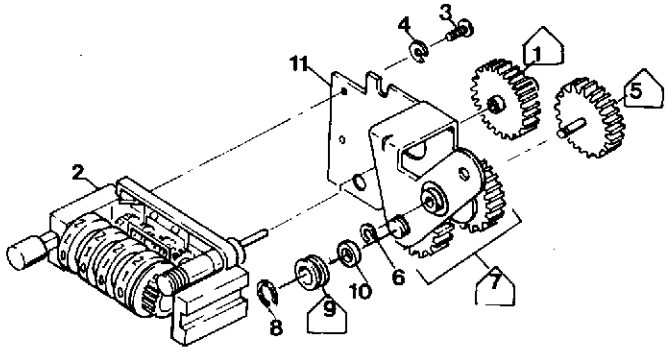


Figure 3-15. FILM COUNTER COMPLETE

4. Threading Control Plate (Fig. 3-16)

a. Apply Silicone DC-200 to face and inside diameter of cap (9).

b. Screw (10) to be tightened with 95 to 105 in. oz. torque.

c. Rotate arm assembly (8) counterclockwise until it is stopped by center shaft. When released, arm must return to original position within 3 to 8 seconds.

d. Apply Vischem No. 352 grease to roller shafts Clean off any grease on roller ends.

e. Roller (1) end play to be .005 to .015.

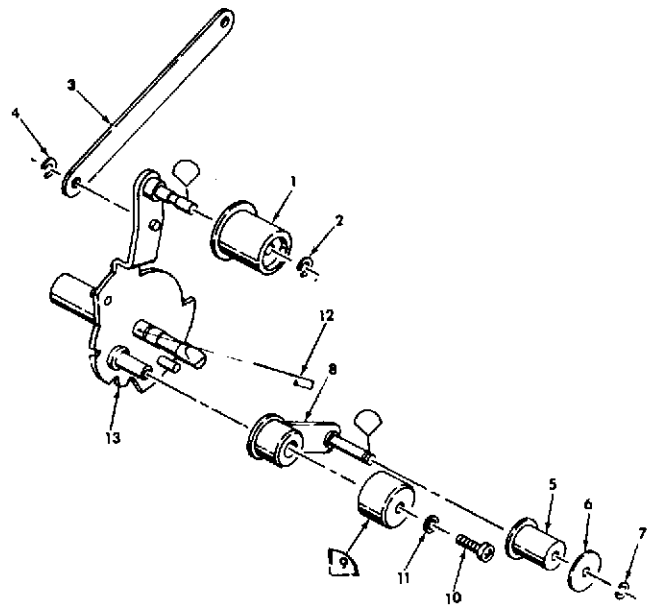


Figure 3-16. THREADING CONTROL PLATE COMPLETE

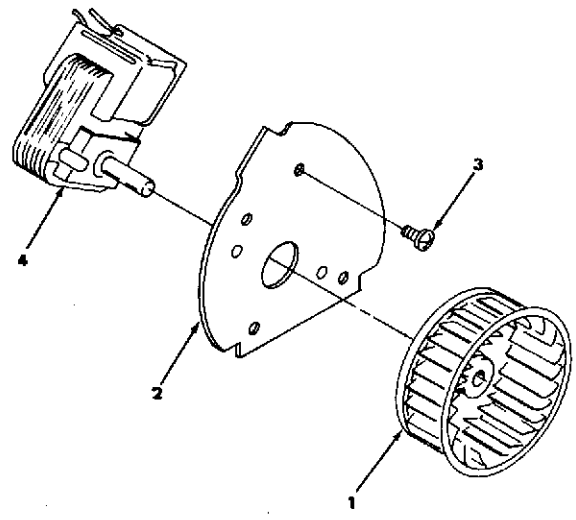


Figure 3-17. MOTOR AND PLATE ASSEMBLY

5. Motor and Plate Assembly (Fig.3-17)

a. Apply Glyptal 7526 to threads and heads of screws (3).

b. With motor shaft play taken-up toward motor, the distance between the wheel (1) and plate (2) must be within .080 to .100. The wheel must also clear screw heads while rotating.

6. Drive Unit Assembly (Fig.3-18)

a. Lubricate inside diameter of spring (9) with Vischem No. 352 grease.

b. Lubricate inside diameter and outside face of bearing (10) with FS-1290 grease.

c. Collar (13) to be adjusted to allow pulley assembly (11) to rotate freely with .004 to .010 end play.

d. Apply Glyptal 7526 to threads of screws (2).

e. Push fan (6) onto shaft (pressure fit).

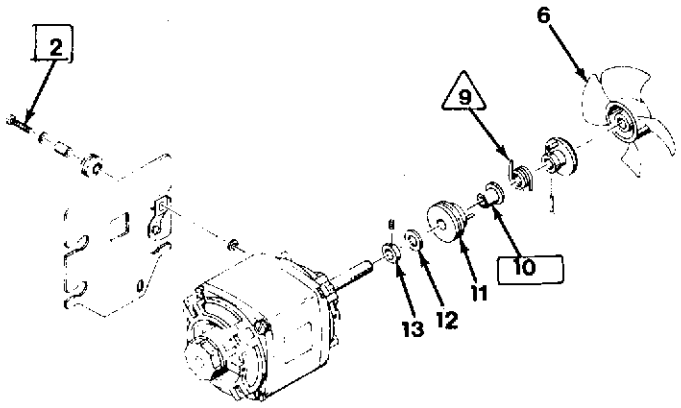


Figure 3-18. DRIVE UNIT ASSEMBLY

7. Arm Complete, Supply & Take-Up (Fig.3-19)

a. Drum assembly (7) or pulley (6) must have .005 to .010 end play after assembly.

b. Clutch (9) must not be nicked during assembly.

c. Spindle (1) must rotate with smooth brake torque of 2.5 to 4.5 in.oz. after assembly. This does not apply to F.F. take-up.

NOTE: Inspect shaft (6 or 7). If scored, replace or polish with crocus cloth on a drill press. Use tool T-38000-N to remove and insert pin (2).

d. Lubricate interface of clutch (9) and drum assembly (7) with Teresstic N-75 oil.

e. Assemble washer (12) as required, to provide .003 to .008 end play between pulley (8), washer (11) and ring (10).

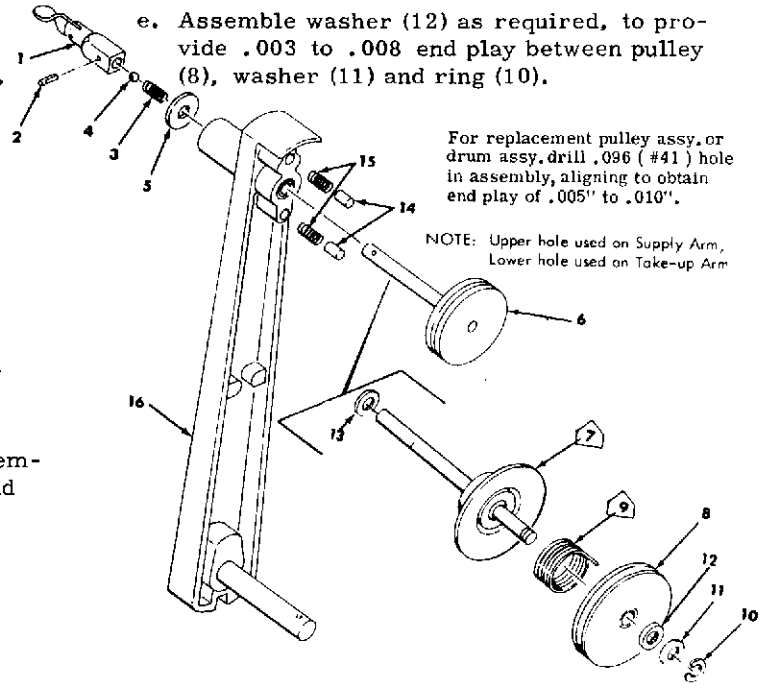


Figure 3-19. SUPPLY AND TAKE-UP REEL ARMS COMPLETE

8. Clutch Complete, Feed Sprocket (Fig.3-20)

a. Lubricate spring (5) with 009 Lubricant.

b. Adjust nut (8) to obtain .002 to .010 end play on gear and hub (3).

c. Lubricate outside diameter of pin (2) with Teresstic N-75 oil.

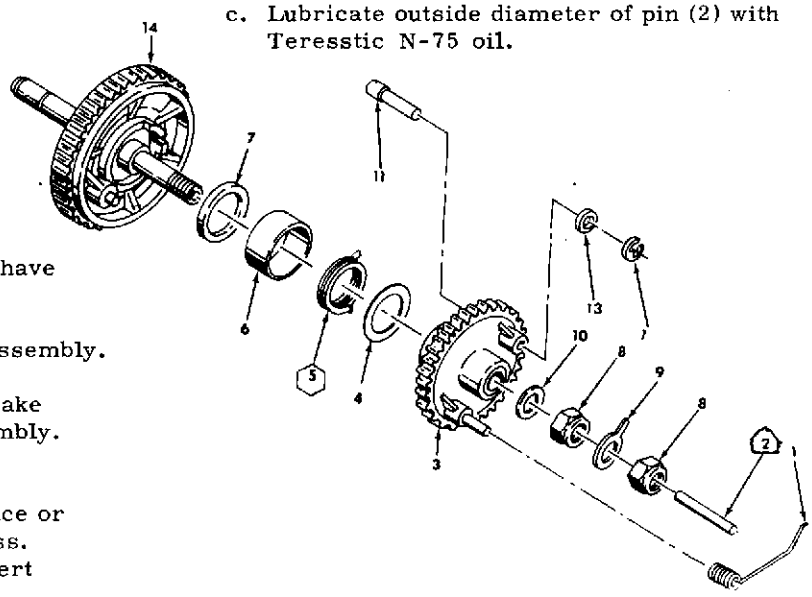


Figure 3-20. FEED SPROCKET CLUTCH COMPLETE

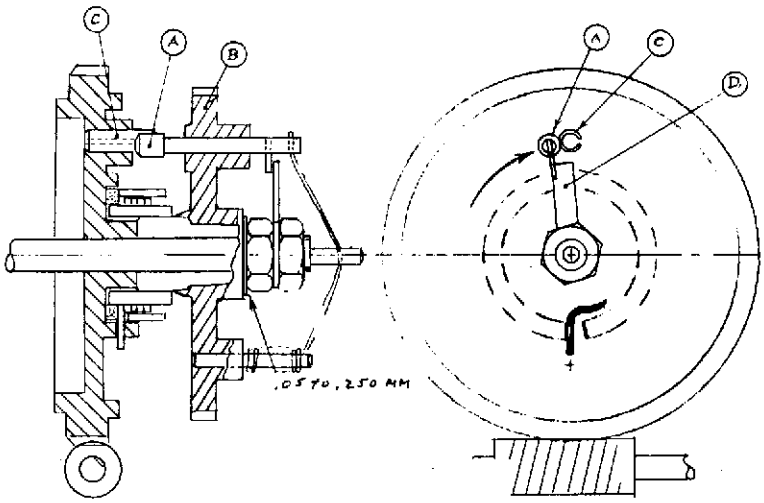


Figure 3-21. FEED SPROCKET CLUTCH SETTING

1. Assembly: Depress pin (A) and turn clutch gear (B) to touch pin (C). Hold gear (B), do not allow to spring back.

2. Position stop (D) so that corner or edge is just over small cross pin of pin (A).

9. Clutch Assembly (Fig. 3-22)

a. Lubricate interfaces of moving parts with Teresstic N-75 oil.

b. Position driven drum (4) to provide .005 to .010 end play.

c. Apply Loctite to threads of setscrew (5) and tighten between 50 and 55 inch ounce torque. Loctite should be removed from outside diameter of driven drum (4).

d. Inner tail of clutch spring (1) must be fully depressed into groove of drum (6). Use screw (2) to hold spring.

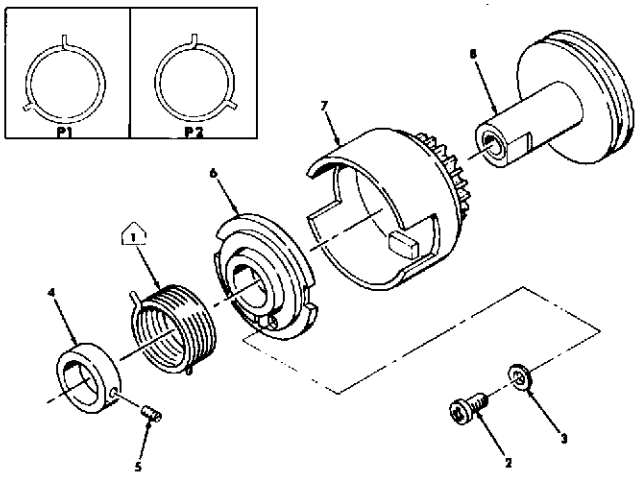


Figure 3-22. CLUTCH ASSEMBLY

10. Aperture Plate (Fig. 3-23)

a. Lubricate interfaces between guide (1), spacer (3) and plate (5) with Molykote Z.

b. The side thrust at the center of each pad should be 1.125 to 1.375 ounces.

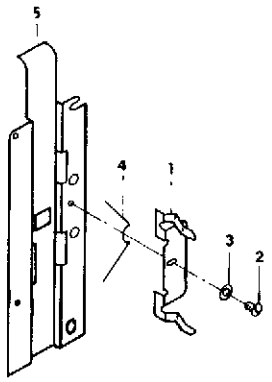


Figure 3-23. APERTURE PLATE

11. Arm Complete (Fig. 3-24)

a. Secure end of brake (13) under head of screw (14).

b. Lubricate brake (13) with Teresstic N-75 oil.

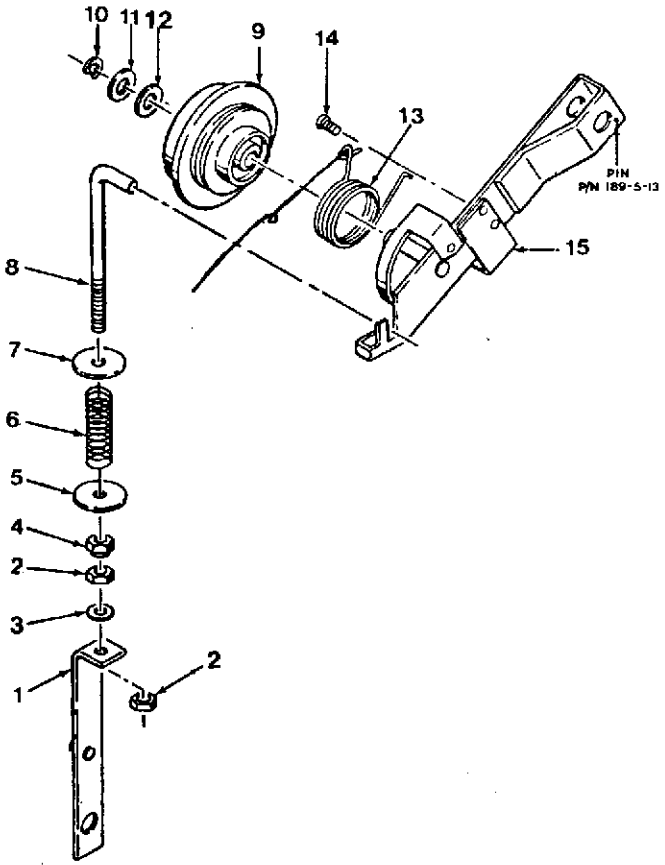


Figure 3-24. ARM COMPLETE, Take-Up Clutch

c. Use washer (11) as required to obtain .001 to .006 end play of pulley assembly (9).

d. Turning pulley against the brake spring, pulley should effectively lock, resisting a minimum torque of at least 10 inch pounds.

NOTE: Inspect brake hub area of pulley (9) for scoring and wear by brake spring. Fast Forward pulley (9) has roller bearings, do not lose while cleaning.

12. Stage 8 Reassembly (Fig. 5-9)

a. Clean all surfaces of shutter and cam, bearings and metal parts with a cloth dampened with chlorothene.

CAUTION:
Hub and cam are permanently impregnated with oil, do not immerse in cleaning solvent.

b. Apply DC-44 grease liberally to outside of bearings (15 and 28), spring washer (17), worm gears (20 and 32), pinion (22) and drive shaft (34).

c. Feed drive shaft assembly through hole in front of projector housing (45), adding parts or assemblies in their proper locations. Dimensions between worm (20) and pinion (22) should be .146 to .156. Assemble "C" ring (16), secure setscrews in collar (18), then secure setscrews in front collar (30) which will draw main shaft forward without end play.

d. Press in pins (21 and 33) flush within .010 on both ends.

e. Lubricate working surface of pin (40) with Teresstic N-75 oil.

f. Apply Glyptal 7526 to interface of screw (11).

13. Stage 7 Reassembly (Fig. 5-8)

a. Position plate (40) to provide approximately equal up and down framing.

b. Apply Glyptal 7526 to interface of limit plate (40) and screws (41) after final adjustment.

c. Apply DC-44 grease to working surface of pivot (44).

d. Lubricate working surface of arm (2) with Teresstic N-75 oil.

e. On cam (21) lubricate outside diameter of shaft entering housing and working surfaces between cam (21) and link assembly (26) with Versilube G-322L. Apply Vischem No. 352 to roller shaft of cam (21).

f. Lubricate working surface of eccentric (28) with Teresstic N-75 oil.

g. Position rings (19) so that rollers (18) have .001 to .005 end play.

h. Install spring (23) by rotating one and one half turns clockwise before inserting tab into slot of shaft.

j. Apply 3 drops of Teresstic N-75 oil into bearing base immediately before assembling gear assembly (17). Apply DC-44 grease to teeth of gear (17).

k. Lubricate interfaces between plunger (7), arm (4) and housing with Versilube G-322L. NOTE: Plunger (7) has narrow key web compared to front plunger.

m. Roll pin (3) may be pressed into the arm shaft with large pliers or channel lock pliers. The top end of pin must extend and bear against bracket of arm (2).

14. Stage 6 Reassembly (Fig. 5-7)

a. Assemble pulley (32) to provide .001 to .007 end play.

b. Lubricate pivot shaft of arm (26) with Versilube G-322L. Do not allow lubricant on gear (28).

c. Lubricate working surface of pin (17) with Versilube G-322L.

d. Lubricate actuator (20) and spring (19) with Teresstic N-75 oil.

e. Secure pad assembly (15) with outside screw (16) and hook under inner screw. Bend pad arm as required to maintain pad contact with both axial and radial cam surfaces. Lubricate pad (15) with 16 drops of Teresstic N-75 oil.

f. Lubricate working surfaces of sprocket assembly (10) and spring (9) with Teresstic N-75 oil.

g. Adjust ring (11) to achieve from .003 to .007 end play in sprocket assembly. Use feeler SS-305 (Fig. 3-7) to simulate grip ring (11) and assemble washers (12) (AR) to fit.

h. Insert stop (7) at an angle when spring is unwound. Wind; pin passes under stop. From maximum tightness, back off sprocket one to one and one half turns. Press stop fully in behind pin.

j. CAUTION: Do not lubricate parts of guide assembly (38).

k. With idlers open (away from sprocket), gage link gap. Close idlers and adjust eccentric (28, Fig. 5-8) so that roller just touches sprocket. Gage link gap again. It must be equal to original open measurement.

15. Stage 5 Reassembly (Fig. 5-6)

a. Apply Teresstic N-75 oil to posts of pulleys (25).

b. Lubricate working surface of lever (22) and housing with Versilube G-322L grease.

c. Lubricate spring (19) and bottom edge of control plate (9) with Extreme Pressure Lube # 3.

d. Lubricate working surface of pressure roller arm (17) and housing with Versilube G-322L grease. Do not allow lubricant on pressure roller (13).

e. Lubricate interface of bearings (12) and threading control plate (9) with DC-44 grease.

16. Stage 4 Reassembly (Fig. 5-5)

a. Apply Glyptal 7526 to thread of screw (54) and interface of screws (42).

b. Insert sound drum locating plug T-38001-G in place of sound optics cartridge (38). Seat plug so tip just clears phototransistor. Center clear area of phototransistor under tip and push sound drum support (8) toward casting until edge of sound drum just touches tip. Tighten screw (9).

c. Apply Glyptal 7526 to interface of screw (19).

d. Adjust or bend film stripper (18) so it does not touch sprocket.

e. Lubricate interfaces of spacer (4) and cam assembly (1) with DC-44 grease.

17. Stage 3 Reassembly (Fig. 5-4)

a. Lubricate working surfaces of pinion (46) and rack (44) with Versilube G-322L grease.

b. Use caution when securing connector (25) to wall (31), excessive torque may crack connector.

c. Apply silicone compound 8101-S to interface of heat dissipator (part of 23) and wall (31).

d. When assembling venturi plate (14) take up all play by urging toward top of the projector before tightening screws (15).

e. Lubricate working surface of washer (7) and gear teeth of flywheel drive assembly (5) with DC-44 grease. Apply grease sparingly.

f. When mounting flywheel drive assembly, the sequence for tightening screws is as follows: (1) Tighten lower left screw, (2) upper left screw, (3) tighten screw on the right.

18. Stage 2 Reassembly (Fig. 5-3)

a. Lubricate shaft surfaces of arm (62) with Versilube G-322L grease.

b. Apply Glyptal 7526 to threads of screw (61).

c. Install spring (58) by rotating one and one half turns clockwise before inserting tab into slot of shaft.

d. The sequence for tightening the aperture plate screws (54 and 55) is as follows: First tighten upper left-corner, then lower right corner, next, the upper right and last, the lower left screw.

e. Assemble shoe (49) with slot on post toward rear of projector.

f. Assemble rollers (47) with wide flange of roller towards shoe.

g. Assemble one or two washers (46) between roller (45) and lensmount (41), as required to obtain .005 to .020 end play of roller (45) and interlock (60). NOTE: Assemble roller (45) with flange toward lens housing.

h. Adjust setscrew (44) to provide .002 to .010 clearance between setscrew and main housing throughout total lens holder travel. Apply Glyptal 7526 to thread of screw (44). NOTE: Do not allow Glyptal in base of lens holder.

j. Lubricate working surface of lens holder (41) with DC-44 grease. Do not get lubricant into lens bore.

k. Apply Glyptal 7526 to thread of post (40).

m. Lubricate shaft of post (40) with Versilube G-322L grease.

n. Apply three drops of Teresstic N-75 oil into bearing bore immediately before assembling clutch (35). Apply DC-44 grease to teeth of (35). NOTE: Clutches (27 and 31) should be positioned and assembled with clutch (35).

o. Assemble washer (21) to obtain .001 to .005 end play of clutch (35).

p. Lubricate working surfaces of actuator (6) with Versilube G-322L grease.

r. Lubricate working surface of roller guide (1) with DC-44 grease.

s. Apply Glyptal 7526 to threads of screws (25) and (26).

t. Reassembly of Control Cables

(1). Place control lever in PROJECT position.

(2). Press the ball of cable (18) into cavity of cable drum (19). Rear cable (shortest) must lay to the right.

(3). Wrap rear cable 1 3/4 turns clockwise, and coming off from the bottom of the cable drum, lay cable over pulleys (rear groove). Secure to control lever when cable drum gear tooth is aligned with the back edge of the bearing slot. (Fig. 3-25a)

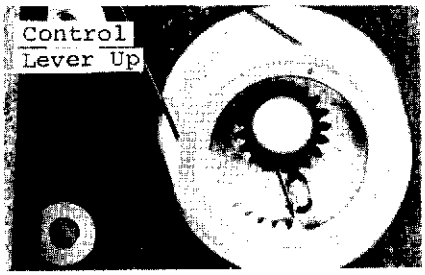


Figure 3-25a

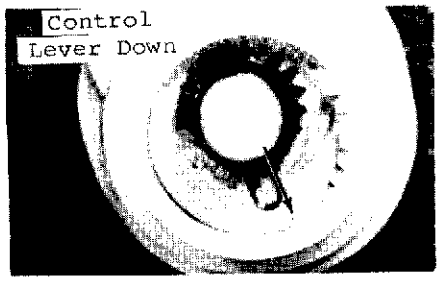


Figure 3-25b

Figure 3-25. CONTROL CABLE WRAP

(4). Wrap front cable (longest) 1 3/4 turns counter-clockwise around cable drum and lay it into the front groove of the pulleys (Fig. 3-26). Secure cable to control lever.

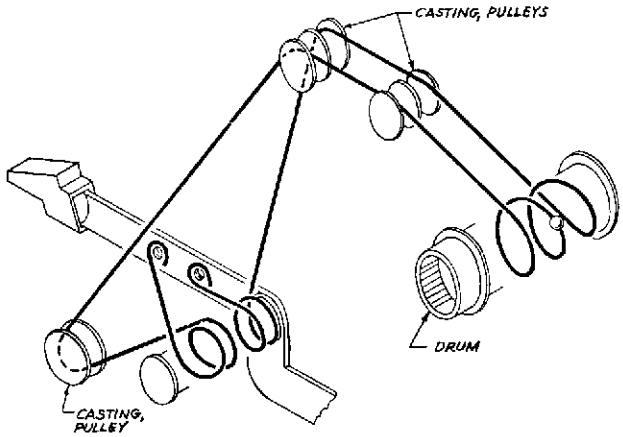
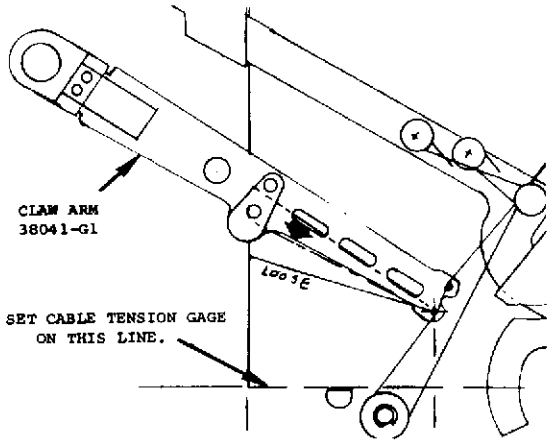


Figure 3-26. CABLE LACING DIAGRAM

(5). Move control lever and check gear tooth relationship with front edge of bearing slot (Fig. 3-25b). Readjust cable length if necessary.

(6). Operate control lever approximately 50 times, then using gage, check cable tension as shown (Fig. 3-27). Readjust as necessary.



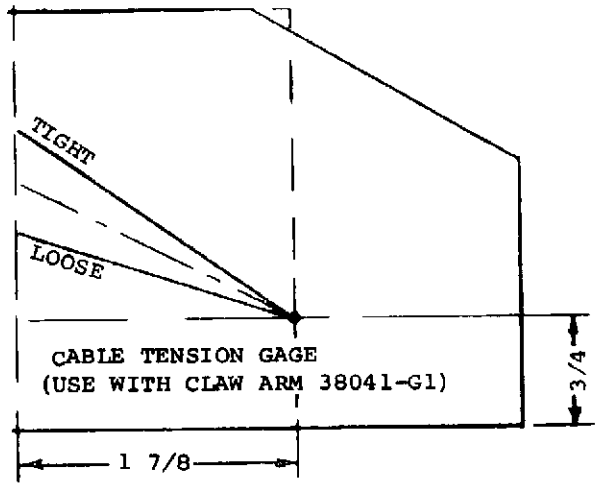


Figure 3-27. CABLE TENSION

u. Apply DC-44 grease to teeth of gear (17).

v. Lubricate working surface of spring (14) and sprocket (10) with Teresstic N-75 oil. Gear (17) must rotate in either direction after clutch spring (14) is assembled.

w. Assemble washer (13) as required to obtain .003 to .007 end play in sprocket (10).

x. Apply Glyptal 7526 to threads of screw (9).

y. Actuator (6) must be assembled so that inside "claw" will press against terminal of clutch spring. If actuator can be pushed in easily to bottom, rotate 180° or adjust "claw" rotation in cap slots. (See adjustments G-11.d.

z. When assembling control unit (3) lay projector on its front so that link wire (43, Fig. 6-7) will hang over top of feed clutch. Assemble screws (4), then hook up link wire by

z. reaching through opening above sprocket.

19. Stage 1 Reassembly (Fig. 5-2)

a. Assemble belt (24) with toothed surface away from pulley.

b. Lubricate working surface of plunger (16) and arm (11) with Versilube G-322L grease.

c. Replace retainer (12). DO NOT REUSE.

G. ADJUSTMENTS

1. Lens Holder Stop Setting

a. Move control lever to "PROJECT" mode.

✱ b. Adjust stop (p/o Lensholder 41, Fig. 5-3) to produce .135 to .141" as shown in Fig. 3-28.

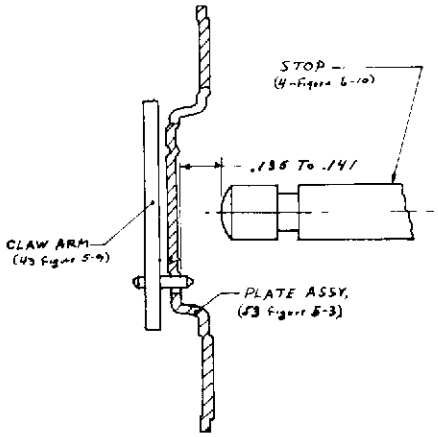


Figure 3-28. LENS HOLDER STOP ADJUSTMENT

c. Secure stop pin into position with setscrew (6, Fig. 6-10).

2. Pressure Plate (Fig. 5-3)

a. Slightly loosen two screws visible through the front of the lens mount (41).

b. Close lens mount slowly by lifting control lever, noting contact between pressure shoe and left edge (viewed from front) of the aperture plate (53).

c. Adjust for .005" clearance along outside edge of aperture plate and tighten the two screws.

3. Film Take-Up Tension (Fig. 3-29)

NOTE: A new gear liner (16, Fig. 5-8) must first be assembled, then proceed as outlined.

a. When operating in forward project, back off the top nut under the spring that controls the film tension and turn up the bottom lift off or drive contact nuts enough to remove hard pressure on the liner, (effectively shortening the arm), but still providing enough contact pressure to turn a 2000' reel of film.

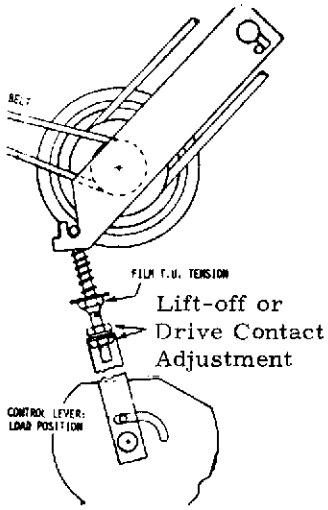


Figure 3-29. FILM TAKE-UP TENSION

b. Mount a 2000' reel with film on the take-up arm and run the projector for 20 minutes, turning this reel to smooth out liner irregularities. Remove the load after 20 minutes or more.

c. Mount an empty 400' reel. Operate the projector, 400' reel should turn. Turn both bottom nuts up together, keeping them snug on the bracket until the reel just stops turning.

d. With a felt tip pen, mark one face of the most bottom nut and turn it down 3 turns. We now have established the fixed length of the push rod and bracket.

✱ e. Film Tension is adjusted with the top nut under the spring using Film Tension Gage (P/N T-38000-S). See Fig. 3-29a.

✱ f. Thread the projector with film and with only 10' to 25' of film on take-up reel, measure film tension by holding spring scale as shown. The scale roller must be directly above the last film path idler as illustrated. Adjust nut so that spring pressure provides film tension on gage scale of 4 to 6 ounces.

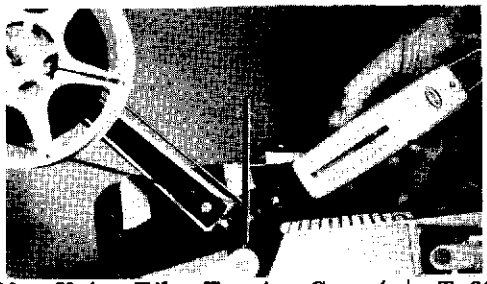


Figure 3-29a. Using Film Tension Gage (p/n T-38000-S)

4. Drive Belt Tension

a. Use spring scale gage T-38000-S.

b. Swing roller down and hook wire about center between pulleys as shown (Fig. 3-30), pull to deflect center of belt equal to belt plus diameter of wire.

c. Scale reading should be 7-10 ounces. I-S)

d. Adjust tension by turning nut (4, Fig. 5-4) under motor plate and locking with stop nut (2, Fig. 5-4).

NOTE: To conveniently turn nut (4), take a 5/16" open end wrench, heat to cherry red and form a 30° bend about $1\frac{1}{2}$" long. Immerse in cold water.

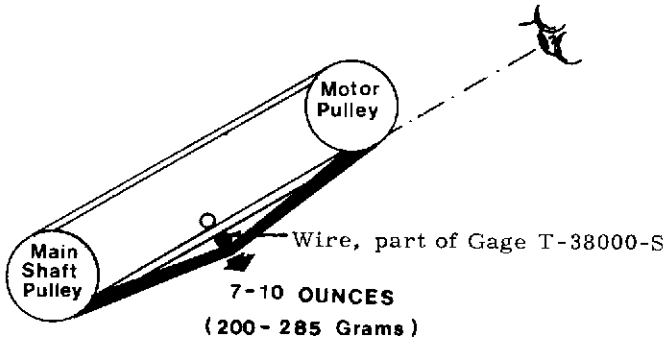


Figure 3-30. MOTOR DRIVE BELT TENSION

5. Fast Forward Drive Tension

a. Use spring scale gage T-38000-S.

NOTE: Using a 400' reel as shown in Fig. 3-31, torque on a 3" radius, using pull scale with a paper clip, will have a reading of 13 to 18 ounces.

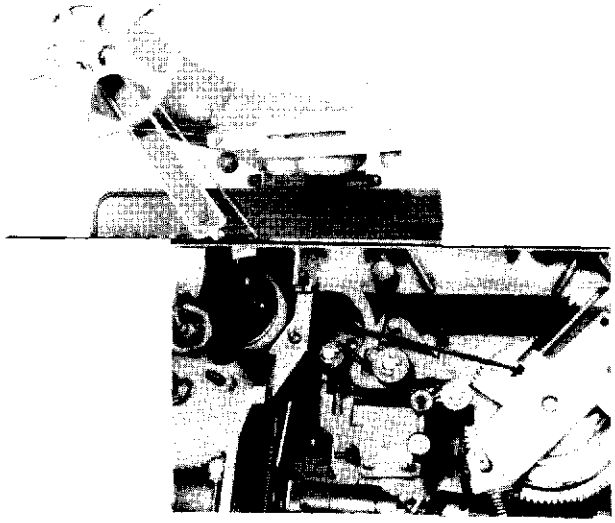


Figure 3-31. FAST FORWARD DRIVE TENSION

b. To adjust loosen screw (6, Fig. 6-20) and move idler (3) on plate assembly (5) . . . . down for more torque and up for less. If this fails to change the torque check solenoid position. Also check the assembly and adjustment of the actuator (6, Fig. 5-3).

6. Switch Adjustments

a. Switches S-3, S-5 and S-6 should be adjusted to actuate in LOAD position and relax in PROJECT position.

b. Switch S-4 should be adjusted to relax in LOAD and PROJECT positions and actuate between positions.

7. Pressure Roller Arm Adjustment (Fig. 5-6)

a. Adjust the pressure roller (13) to lie flat and parallel against the sound drum, when the threading control lever is in the "RUN" position.

b. Adjust spring arm by gradually reforming along its' entire length. Use a bending tool made from a 3/16" rod with a 1/32" saw slot in end . . . slip slot on spring and twist in several places.

8. Claw Arm

a. Pin protrusion should be set at .035 to .040" using protrusion gage G-10-38000, with continuity meter on low voltage battery and lamp. Set protrusion so that the top pin protrudes .035 to .040 throughout the pull-down. Pins must retract to clear film on the upward stroke.

(1). To change pin protrusion, remove screw (27, Fig. 5-9) and loosen screws (3 and 4, Fig. 6-23) in hub assembly.

(2). Insert protrusion gage G-10-38000 in aperture plate. with steel insert just above claw pins. Hold in position with pressure plate by lifting control lever part way. Connect continuity meter, with one lead to the brass screw on the gage and the other to a grounded spot on the projector, ie. lamphouse cover post.

(3). Rotate main shaft until claw arm pins enter and start down.

(4). Find end of gage by pushing claw arm in with finger and slowly push gage down to touch. Release claw arm and observe red reference tape.

(5). Slide gage down $\frac{1}{2}$ width of red tape. If meter shows continuity, protrusion is more than .040" and should be adjusted. If no contact, move gage down width of tape to middle of yellow reference. . . Continuity indicates required protrusion between .035 to .040". If no continuity, protrusion is to short.

(6). Remove jack screw and loosen two other screws as shown (Fig. 3-32). Position gage with bottom (No-Go) step aligned with top pin (protruded and started down). With firm finger grip on shutter, 1/16" allen wrench in setscrew on flat . . . . press shutter forward. Observe meter. When pins make contact, ease off finger grip. When contact breaks, tighten setscrew.

(7). Check "Go" position (step 5) and repeat if necessary.

(8) Tighten and replace all screws when acceptable.

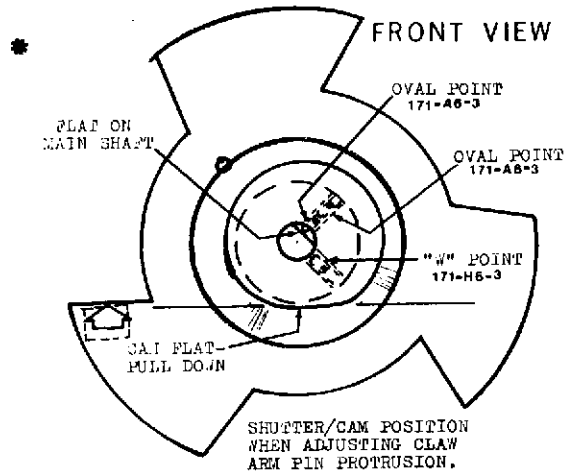


Figure 3-32. SHUTTER & SHAFT ALIGNMENT

b. Side Clearance

Side clearance (Fig. 3-33) should be adjusted to .010 min. when top pin on claw arm just enters into aperture plate. Use shuttle cam adjusting tool (ST-5884) to adjust side clearance. Recheck side clearance after every stroke adjustment. Observe from back of aperture plate.

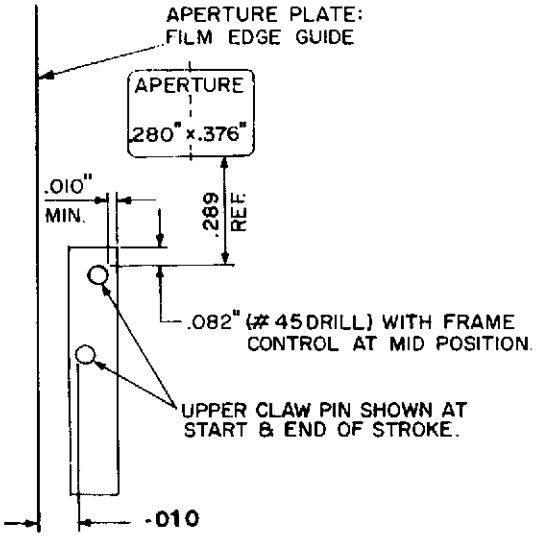


Figure 3-33. SIDE CLEARANCE

c. Claw Pull Down Stroke

(1). Disconnect drive motor leads from capacitor. Do not disconnect blower motor. Move control lever up and check lamp. . . . turn lamp off and remove lamp cover.

(2). Insert gage (ST-5880) so that target hole is just above, but not in, aperture.

(3). Rotate main shaft (shutter blades coming up) until pins enter and pull target into the aperture, to establish the bottom of the stroke.

(4). Continue turning main shaft. Pins will withdraw and raise. Stop turning main shaft when pins re-enter and shutter blade is even with bottom of aperture. NOTE: If you go to far, go back to step (2) and repeat.

(5). Turn on lamp and project image so that it is at least 8" wide. Raise elevation approximately 1 inch and draw reference line full width of target, but on bottom step of target.

(6). Remember that we are gaging clearance under the top pin when it enters.

(7). Lift gage up, target will move down, if upper target step touches reference line, clearance under top pin is .0015" and acceptable.

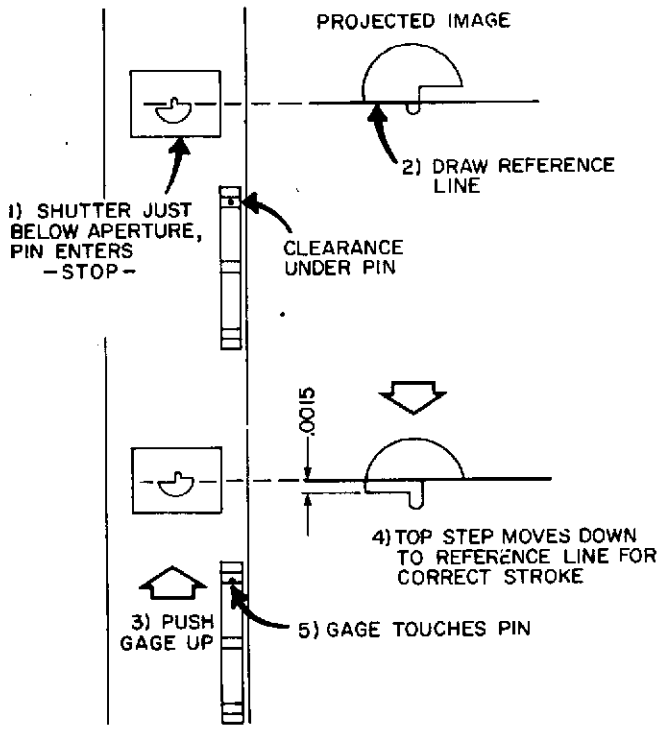


Figure 3-34. CLAW PULL DOWN STROKE

CAUTION: The top pin is made of very hard material to resist wear. DO NOT DAMAGE.

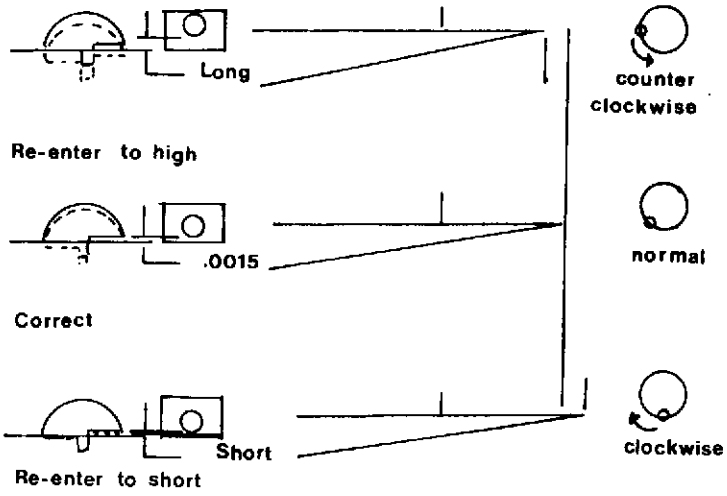


Figure 3-35. PULL DOWN STROKE SETTING

d. Preliminary Pivot Setting

(1). The stud on front pivot, as seen from front, must always lay between 6 and 9 o'clock. Generally, start about 7 o'clock.

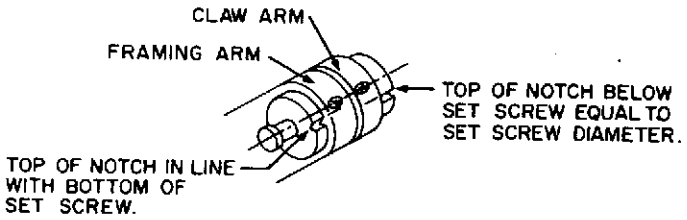


Figure 3-36. PRELIMINARY PIVOT SETTING

NOTE: Recheck side clearance (Para. G6b) after each adjustment.

Theoretically, turning both pivots equally will change pull down length and not change side clearance. However, side clearance should be rechecked.

(It is not advisable to use this as a general practice).

(1). Adjust protrusion and if claw arm has been removed, set pivots as shown in Fig. 3-35.

(2). Make a film loop using 3 feet of 16 mm registration film (SMPTE). Pull into the projector and project onto a suitable surface that can be marked.

(3). Project FORWARD and make a reference line at any number on the vertical scale.

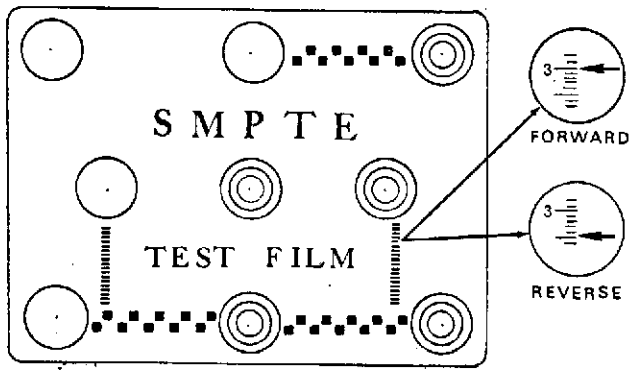


Figure 3-37. SMPTE TEST FILM

(4). Stop and project REVERSE, note scale difference and see the following table for corrections.

STROKE and SCALE CALIBRATIONS

Scale Difference	Stroke	
.003	.303	Too long
.004	.302	Ok
.005	.301	Ok
.006	.300	Too short

9. Sound Head Area

a. Sound Drum Support

Insert sound drum locating plug T-38001-G in place of sound optics cartridge. (Fig. 3-38). Seat plug so phenolic rod just clears phototransistors. Center clear area of phototransistor under rod and push sound drum support toward casting until edge of sound drum just touches rod. Tighten sound drum support retaining screw. Reinstall sound optics cartridge.

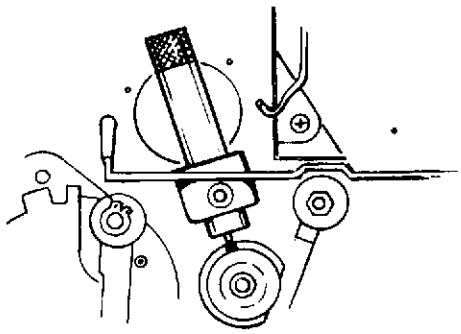


Figure 3-38. SOUND DRUM ADJUSTMENT

b. Focusing Sound Optics Cartridge

Loosen sound optics setscrew, attach ring (p/o focusing tool T-43680-G1-G) to sound optic. Thread projector with 7000 cycle test film (PH 22.42). Set tone control at mid-range. Attach tool T-43680-G1-G to projector and engage point of handle in ring setscrew. Connect voltmeter; set on lowest scale. As an alternative, connect oscilloscope to speaker terminals or at speaker jack, using an 8 ohm, 15 watt dummy load. Focus sound optics by moving focusing handle up or down or rotating until the maximum output is indicated. If voltmeter goes off scale, reduce volume of projector and continue until maximum reading on scale is obtained. Check buzz track. (See Para. G-9).

NOTE:
Setscrew securing sound optics is tightened against a plastic plug. If cartridge does not move freely when screw is loosened, the plastic plug has been wedged in a hole. Plastic plug must then be replaced.

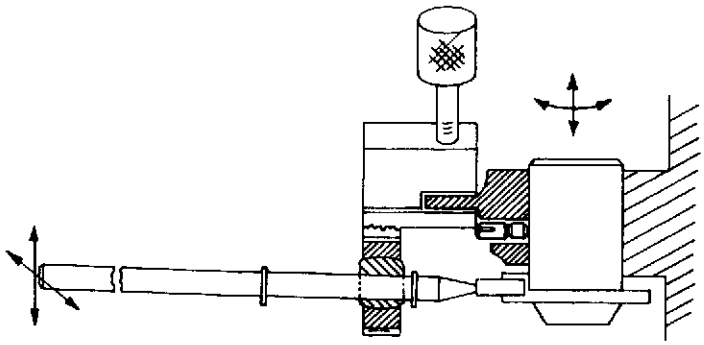


Figure 3-39. FOCUSING SOUND OPTICS CARTRIDGE

c. Cleaning Sound Optics Cartridge

To clean, fold lens tissue over toothpick and clean exposed surfaces of sound optics cartridge. No attempt should be made to remove lens elements. Hold unit in front of bright light and look through it from the end which was adjacent to the exciter lamp. A narrow and sharply defined evenly illuminated beam of light should be seen. If beam is hazy or unevenly illuminated, send cartridge to the nearest Singer Education Systems Service Center.

10. Film Guide Roller (Fig. 5-6)

Thread projector with "buzz track" film (PH-22.57). Adjust film guide roller assembly (13) by tightening or loosening nut (14) until no sound is heard or until high and low frequencies are balanced for equal output.

11. Interlock Solenoid SO-2 (Bottom)

Observe function of the link wire and lever by watching the pin aft of the front sprocket. In operation, solenoid SO-2 energizes, pulling link wire connected to lever which pops interlock pin out, and behind, "Lobster Claw". Thus, it is impossible to close lens mount or lift control lever when the projector is in fast rewind mode.

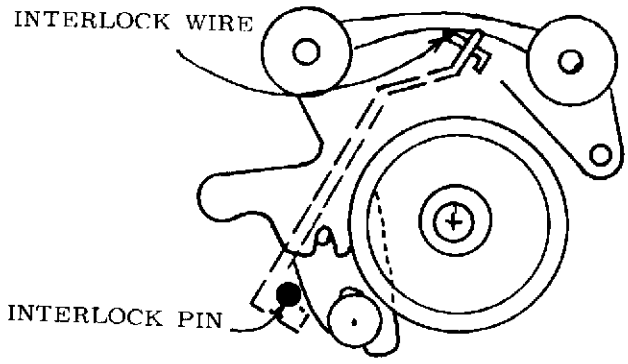


Figure 3-40. SOLENOID INTERLOCK

a. When located correctly, this solenoid will depress feed clutch interlock and also the lens mount interlock. In rewind operation, a 1/8" diameter pin (Fig. 3-40) behind the front lobster claw (front idler bracket) will pop out and the control lever is locked down and the lens mount open.

b. Adjust if interlock pin does not retract, by forming a very slight kink in the link wire. Reach up from the bottom with long nose pliers to form wire.

12. Clutch Adjustment (For simplified control, SO-3 on FF same)

a. Reverse, Project and Rewind solenoid (S0-1). Insert SS-327 in solenoid armature mechanism (Fig. 3-41) to shorten stroke 0.050". When armature is held in and clutch actuator paddle is eyeball vertical, tighten solenoid mounting screws. At this time, clutch will be slightly engaged - you should feel drag when rewind spring belt is pulled. (See Fig. 3-41).

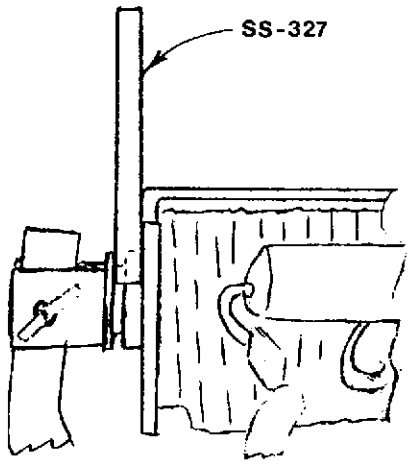


Figure 3-41. SETTING SOLENOID STROKE

b. Operate projector in REWIND. Solenoid S0-1 will energize. Hold rewind arm spindle. Clutch must grab so that spring belt slips on clutch pulley without solenoid buzz. If unit is adjusted correctly, omit the following.

c. Use holding clamp T-43411-G1A (Fig. 3-42) to move solenoid in slightly ($\frac{1}{2}$ to 1 turn), to eliminate buzz, or out slightly for more clutch drive. Also actuator may be rotated (Para. G-11d) slightly for tighter clutch spring warp.

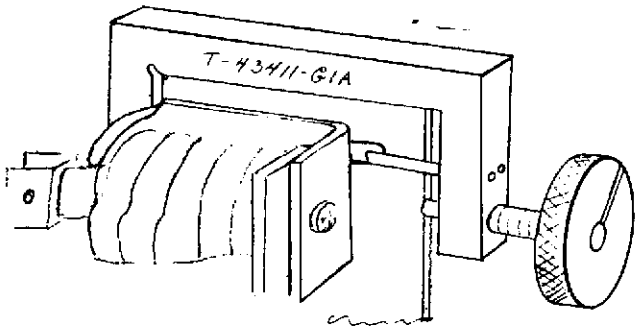


Figure 3-42. HOLDING CLAMP T-43411-G1A

d. Adjusting Actuator Cap

(1). Be sure that claw inside cap presses on clutch spring terminal. If not, turn cap assembly 180°.

(2). The claw inside cap should tighten clutch spring, when cap is pressed 1/16" to 3/32". Adjust claw rotation in cap slots if necessary. If still not satisfactory, check clutch spring for damage or incorrect assembly, or missing washer (30 or 34, Fig. 5-3).

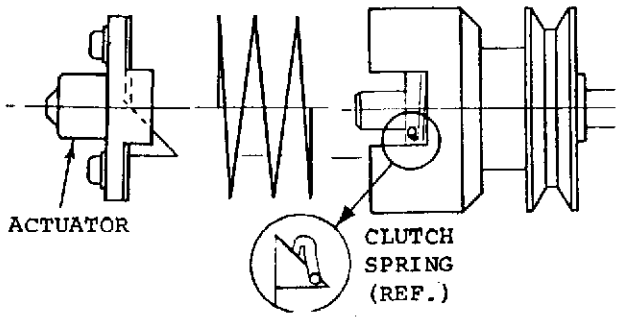


Figure 3-43. ADJUSTING ACTUATOR CAP

13. Brake Cable Adjustment (S.C.) Fig. 3-44

a. Locate solenoid S0-1 (Preceding Para. G-11) then check and adjust brake cable.

b. With power off and Master Control Lever down, take-up spring belt will slip freely in one direction. Pull in solenoid S0-1 armature to release brake . . . . take-up belt should slip freely in either direction.

c. If adjustment is required, be sure cable lays in groove of both pulleys, check return spring (1, Fig. 5-8) for; malformed brake spring (13, Fig. 6-19) and/or possible worn edge of pulley (9, Fig. 6-19) or adjust cable length as terminated in solenoid armature.

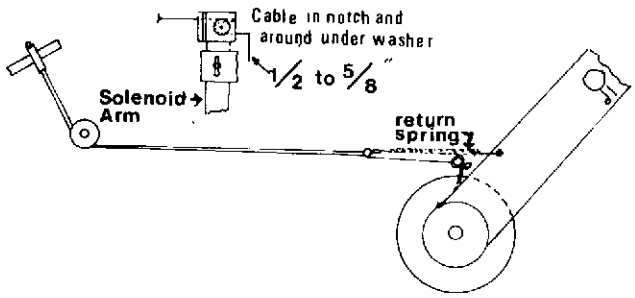


Figure 3-44. BRAKE CABLE ADJUSTMENT

15. Auto Loop Reset Adjustment (Fig.3-45)

a. With projector running in forward mode and level, the torque required to lift and trip the roller shaft should be 10 to 15 grams. (Dynamometer reading). If necessary, adjustment can be made by rotating eccentric.

b. To set endplay clearance of .005" at point "C" turn gear (28, Fig. 5-7) counterclockwise until it latches; using a pair of verniers (extended from inside lamphouse corner down to roller shaft), lift pulley shaft approximately $\frac{1}{4}$ shaft diameter or less. Gear should drop over and latch.

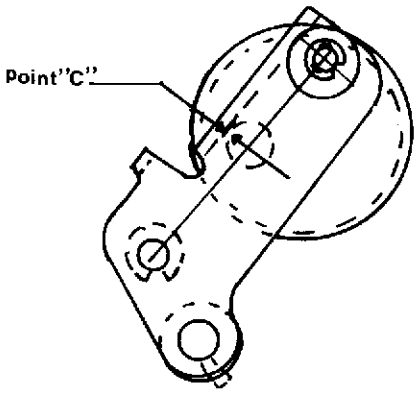


Figure 3-45. AUTO LOOP RESET ADJUSTMENT

H. PREVENTIVE MAINTENANCE

To insure proper operation of the Singer 2100 Series projector, preventive maintenance should be performed every 500 hours or once a year, whichever occurs first. Before starting the maintenance procedures, check the operation of the projector. (Section II)

1. Parts to be Replaced

   a. Take-Up Reel Belt (25, Fig. 5-2)

   b. Supply Reel Belt (10, Fig. 5-2)

   c. Cam Lubricating Pad Assembly (15, Fig. 5-7)

2. Lubricating Points

   a. Lubricate the points shown in Fig. 3-46 with lubricant indicated.

3. Cleaning

Clean the following areas:

a. Brake face of arm pulley (6, Fig. 6-6). Wipe with a dry cloth to remove lubricant.

b. Sound Optics Cartridge (38, Fig. 5-5). Fold lens tissue over toothpick and clean exposed lens surfaces.

c. Projection Lens (18, Fig. 5-2). Remove lens and clean exposed surfaces only. Dampen lens tissue with lens cleaner and wipe surfaces gently.

NOTE:

(1) To remove lens; remove cover (1, Fig. 5-2) and lens retaining screw (19, Fig. 5-2)

(2) Do not apply lens cleaner directly to lens elements. Do not use silicone impregnated lens tissue.

(3) Aperture plate assembly (53, Fig. 5-3), clean with methyl alcohol or chlorothene.

(4) Film pressure shoe (3, Fig. 6-4), clean with methyl alcohol or chlorothene.

(5) Film rollers and sprockets, clean and lube as called for.

4. MISCELLANEOUS

a. Check secureness of all clips on terminals if not tight, crimp with pliers and reconnect.

b. Be sure that wiring is properly dressed to avoid contact with moving parts.

INSTA-LOAD PROJECTOR
2100 SERIES

MODEL_____ SERIAL NO. _____ DATE _____ INVOICE NO. _____

REPORTED PROBLEM _____

OPERATIONAL CHECK

	REC'D	FINAL
Arms-Lock		
Film Handle		
Switch-Forward TU		
-Reverse TU		
-Still		
-Rewind		
-Fast-Fwd.		
Picture & Steady		
Amplifier Sound		
Noise-Mechanical		
Lamps & Blower		
Elevation		
Clean		

NOTE: "O" - No Go
"X" - Ok

LENS HOLDER

Close & Lock
Toggles- Lube
Focus
Lens Retaining Screw
Lens- Clean _____

FRONT SPROCKET

End Play (.002" to .005")
Teeth
Shoe
Stripper
Snubber Action
Idlers (Lube)
Idler Adj.
Set Loop
Clean _____

FILM GATE

Protrusion (.035" to .040")
Stroke (.3015 to .302")
Shoe Side Clearance (.010")
Frame -Up & Down
Press Plate Seat
Film Seat
Claw Arm Pins Tight
Edge Guide Plate Free
Interlock
Quiet Operation
Cam Pad- Replace & Oil _____

SOUND SUPPORT

Optics - Clean
Lamp - Correct & Clean
Focus & Az (7000 Hz Film)
Buzz Track Film Check
Frt. Idler Press (3 to 5 oz.)
Damping Idler (3 to 5 Sec.)
Idlers Square to Drum
Lamp Wires Clear
Flywheel Tight
Flywheel Drive
Level & 15 Elev. (w/o Film)

REAR SPROCKET

Endplay (.002 to .005")
Teeth
Stripper
Snubber Action (or Arm)
Idlers (Lube)
Idler Adj. - Bottom _____

REEL ARMS

Belts - Replace
Pulley - Clean & Lube
Spindle Pin Flush
Plunger - Free & Lock _____

DRIVE MOTOR

Belt - Inspect
Belt - Tension
5-7 oz. Tension
Lube
Wires _____

TAKE-UP

Clean Off Extra Grease
Initial Contact Drive
Film Tension
4-6 oz.
Liner - Check, Replace
Brake Springs (SC)
Inspect Gears & Grease
Fast Forward - 2.5 to 3.5 "/lb. Torque
Rewind Interlock _____

REVERSE & REWIND

Reverse Proj. - smooth
Rewind-2000' Load

ELECTRICAL

Wires Clear
Transformer - Check Taps
Solenoids-Drive & Brake
Relay Arc
Interlock
Speaker Leads
Amplifier
Amplifier Terminals

MISCELLANEOUS

Counter (Fast/Fwd)
Safety Shutter - (Redampen)
Cable Tension:
Control cable on Pulleys
Brake cable on Pulleys
Loop Set Lever
Feet
Elevation
In-Path Idlers-Lube
Belt Idlers-Lube
Lens - Clean
Case- Clean & Wax

Serviced & Checked _____

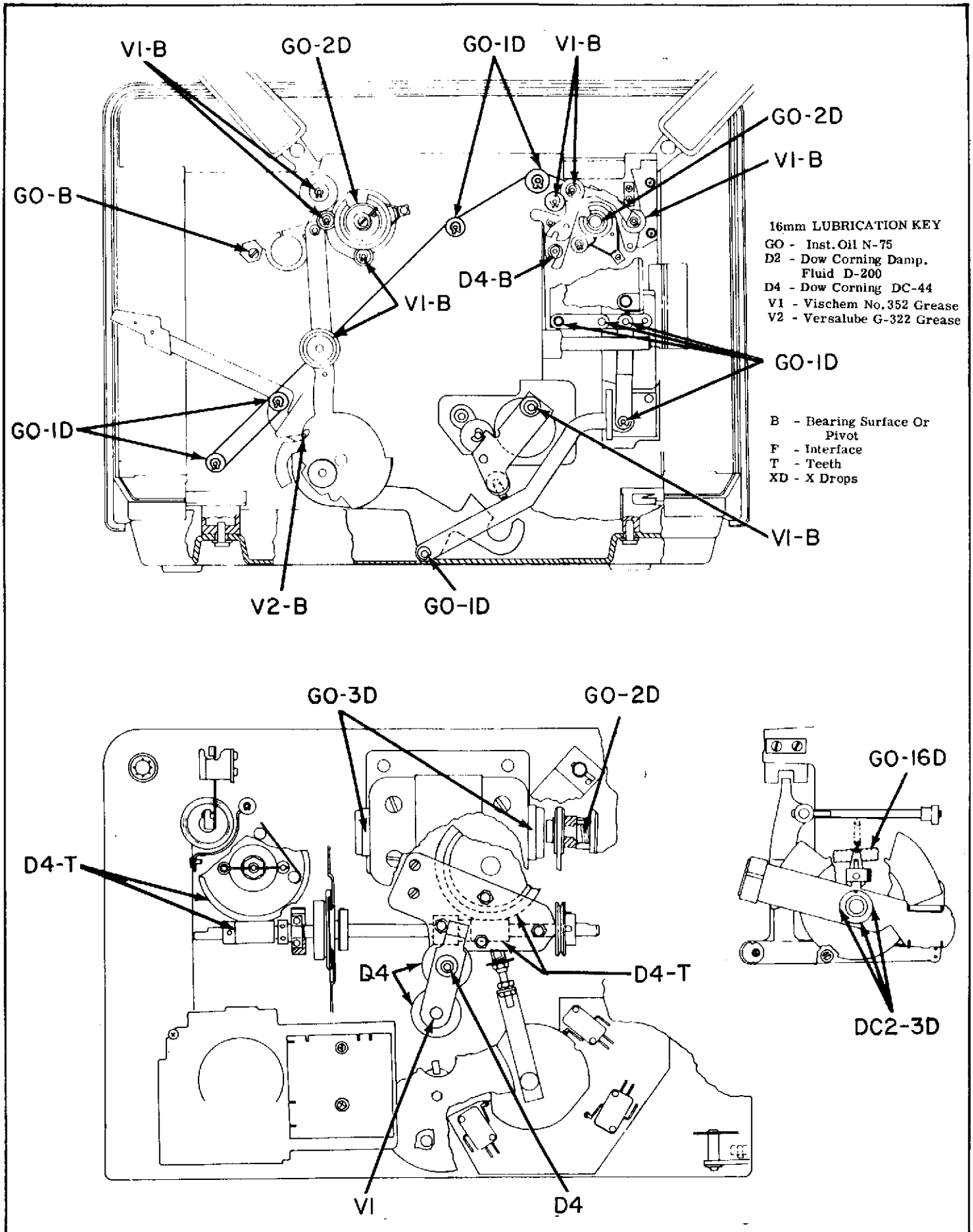


Figure 3-46. PREVENTIVE MAINTENANCE LUBRICATION POINT DIAGRAM

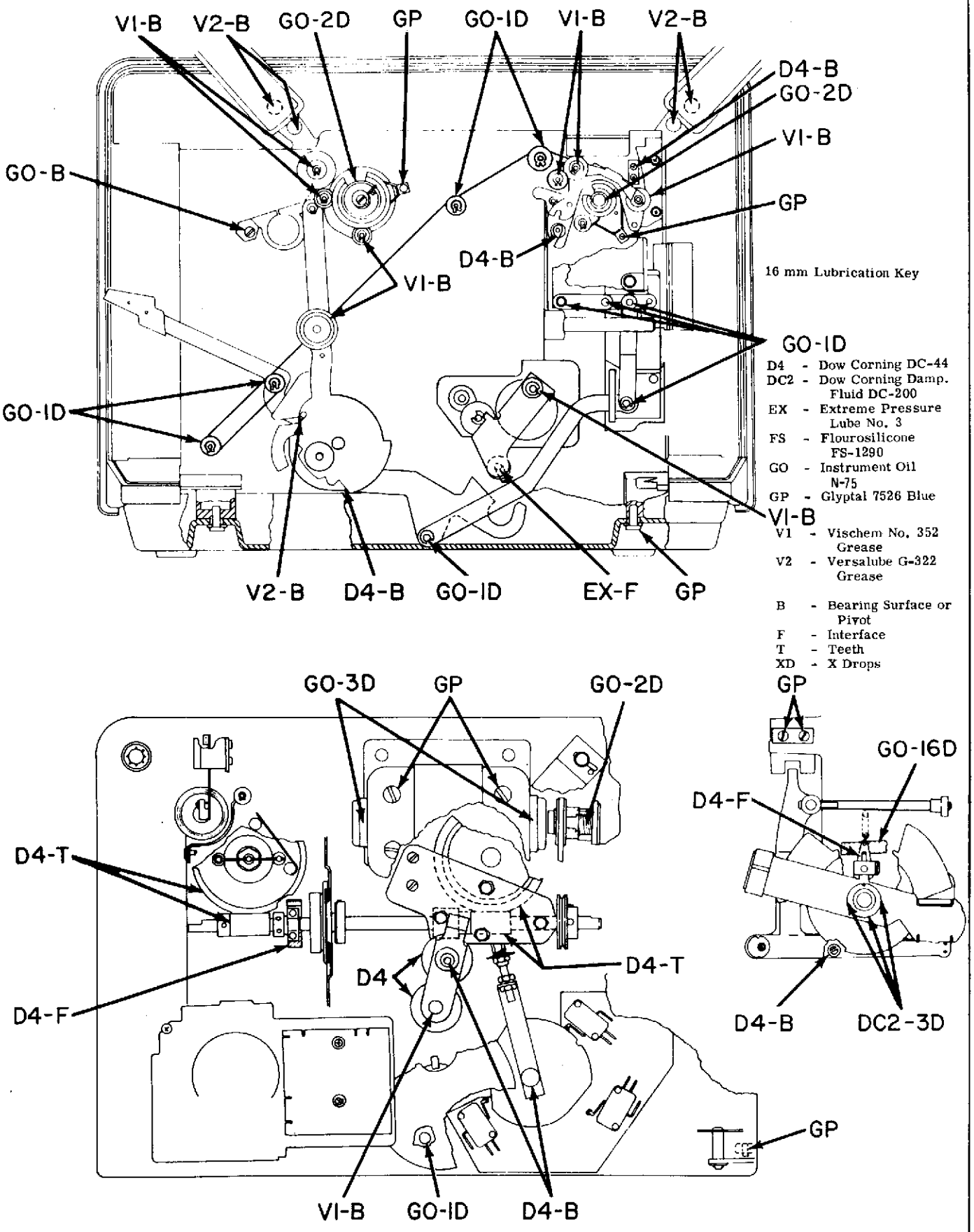


Figure 3-47. OVERHAUL MAINTENANCE LUBRICATION POINT DIAGRAM