

# **SERVICE MANUAL**

## **1100A SERIES 16 mm PROJECTORS**

**TELEX<sup>®</sup>**

TELEX COMMUNICATIONS, INC.

9600 Aldrich Ave. So., Minneapolis, MN 55420 U.S.A.

## TABLE OF CONTENTS

Para.	Title	Page
INTRODUCTION . . . . .		1-1
SECTION I - PRINCIPLES OF OPERATION. . . . .		1-1
A. Control Circuits (Simplified Control Models). . . . .		1-1
1. 117V 60 Hz Circuitry. . . . .		1-1
2. Pushbuttons and Master Control Lever. . . . .		1-1
Control Circuits (Fast Forward Models) . . . . .		1-2
1. 117V 60 Hz circuitry . . . . .		1-2
2. Pushbuttons and Master Control Lever . . . . .		1-2
B. Sound System. . . . .		1-3
1. General. . . . .		1-3
2. Operating Principles (10 watt) . . . . .		1-3
a. Power Supply Circuit . . . . .		1-3
b. Preamplifier Circuit . . . . .		1-4
c. (1) Power Amplifier (42780-G1). . . . .		1-4
c. (2) Power Amplifier (43957-G1). . . . .		1-4
3. Operating Principles (15 watt) . . . . .		1-4
a. Power Supply Circuit. . . . .		1-4
b. Audio Amplifier Circuit . . . . .		1-4
SECTION II - OPERATIONAL CHECK AND TROUBLESHOOTING . . . . .		2-1
A. General . . . . .		2-1
B. Operational Check . . . . .		2-1
C. Troubleshooting . . . . .		2-1
SECTION III - SERVICE PROCEDURES . . . . .		3-1
A. General . . . . .		3-1
B. Tools and Equipment. . . . .		3-1
1. Special Tools . . . . .		3-1
2. Commercial Tools . . . . .		3-1
C. MATERIALS . . . . .		3-3
D. Repair Notes . . . . .		3-5
1. Semi-Conductor Testing. . . . .		3-5
a. Transistors . . . . .		3-5
b. Diodes . . . . .		3-5
c. Zener Diodes . . . . .		3-5
2. Waveforms (10 watt). . . . .		3-5
E. DISASSEMBLY. . . . .		3-6
1. Stage 1 . . . . .		3-6
2. Stage 2 . . . . .		3-6
3. Stage 3 . . . . .		3-6
4. Stage 4. . . . .		3-6
5. Stage 5 . . . . .		3-6
6. Stage 6 . . . . .		3-6
7. Stage 7 . . . . .		3-6
8. Stage 8 . . . . .		3-6
F. REASSEMBLY. . . . .		3-6
1. Shutter and Cam Assembly . . . . .		3-6
2. Claw Arm Complete . . . . .		3-6
3. Film Counter Complete . . . . .		3-3
4. Threading Control Plate. . . . .		3-7
5. Motor and Plate Assembly . . . . .		3-7
6. Drive Unit Assembly . . . . .		3-8
7. Arm Complete, Take-Up Reel. . . . .		3-8
8. Clutch Complete, Feed Sprocket. . . . .		3-8
9. Clutch Assembly. . . . .		3-9
10. Arm Complete Supply Reel. . . . .		3-9
11. Stage 8 Reassembly. . . . .		3-9
12. Stage 7 Reassembly. . . . .		3-9
13. Stage 6 Reassembly. . . . .		3-9
14. Stage 5 Reassembly. . . . .		3-10
15. Stage 4 Reassembly. . . . .		3-10
16. Stage 3 Reassembly. . . . .		3-10
17. Stage 2 Reassembly. . . . .		3-10
18. Stage 1 Reassembly. . . . .		3-10
19. Eccentric Bearing/Single. . . . .		3-11

20. Loop Setting Cable Adjustment . . . . .	3-12
21. Loop Setting Cable Requirement . . . . .	3-12
22. Loop Setting Gear And Arbor Installation . . . . .	3-13
23. Removal of Take-Up Clutch . . . . .	3-13
24. Take-Up Clutch Arm Servicing . . . . .	3-15
25. Installation Of Clutch Liner . . . . .	3-15
26. Take-Up Clutch Reassembly . . . . .	3-15
G. ADJUSTMENTS . . . . .	3-16
1. Lens Holder Adjustment . . . . .	3-16
2. Pressure Plate Adjustment . . . . .	3-16
3. Drive Motor Belt Requirement . . . . .	3-16
4. Drive Motor Belt Adjustment . . . . .	3-16
5. Rewind Brake Requirements . . . . .	3-17
6. Take-Up Adjustment . . . . .	3-17
7. Lift-Off Theory and Adjustment . . . . .	3-18
8. Fast Forward Drive Requirement . . . . .	3-18
9. Fast Forward Drive Belt Adjustment . . . . .	3-18
10. Shutter and Cam Operation . . . . .	3-19
11. Side Clearance Adjustment . . . . .	3-19
12. Claw Pin Protrusion Requirement . . . . .	3-20
13. Claw Pin Protrusion Measurement . . . . .	3-20
14. Claw Pin Protrusion Adjustment . . . . .	3-21
15. Lensholder Stop Pin Theory . . . . .	3-21
16. Lensholder Stop Pin Gage . . . . .	3-21
17. Lensholder Stop Pin Adjustment . . . . .	3-22
18. Pressure Shoe Requirement . . . . .	3-22
19. Pressure Shoe Adjustment . . . . .	3-22
20. Interlock Adjustment . . . . .	3-23
21. Pressure Roller Arm Adjustment . . . . .	3-23
22. Rewind Adjustment . . . . .	3-23
23. Pressure Roller and Sprocket Clearance . . . . .	3-23
24. Switch Adjustment . . . . .	3-23
25. Projection Lamp Adjustment . . . . .	3-23
26. Projection Lens . . . . .	3-24
27. Buzz and Sound Optic Focusing . . . . .	3-24
28. Sound Optic Focusing Adjustment . . . . .	3-24
29. Buzz Adjustment . . . . .	3-26
30. Flywheel Drive Adjustment . . . . .	3-26
31. Flywheel Belt Pop-Off . . . . .	3-26
32. Reassembly of Claw Arm to Projector . . . . .	3-27
33. Claw Arm Adjustments . . . . .	3-27
34. Claw Arm Adjustments ( 1180A) . . . . .	3-30
35. Framing Adjustment . . . . .	3-33
36. Replacing Photodiode Chip in Sound Drum . . . . .	3-33
37. Sound Drum Adjustments . . . . .	3-34
38. Feed Sprocket Clutch . . . . .	3-35
39. Fast Forward and Rewind Clutches . . . . .	3-36
40. Switch Adjustments . . . . .	3-37
41. Film Counter . . . . .	3-37
SECTION IV ILLUSTRATED PARTS LIST INTRODUCTION . . . . .	4-1/5-1
SECTION V PROJECTOR ASSEMBLY PARTS LIST . . . . .	4-1/5-1
SECTION VI PROJECTOR SUBASSEMBLY PARTS LIST . . . . .	6-1
Additional Projectors . . . . .	6-37
1115AN . . . . .	6-37
1120L . . . . .	6-38
1140A . . . . .	6-39

# INTRODUCTION

This manual provides service instructions for the Telex INSTA-LOAD 16 Projectors in the 1100A Series. 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 Systems. Section II, Opera-

tional 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 order. All parts are keyed to illustrations for quick and easy identification. Wiring diagrams and schematics are included as part of Section VI.

## SECTION I

### 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), still, and off modes of operation.

For normal operation, the Master Control Lever is set to the 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 on 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.

#### SIMPLIFIED CONTROL MODELS

When the Master Control Lever is set to LOAD/Fast Mode (down) and the REVERSE pushbutton is pressed, the projector will operate at fast speed either with the film in path or out and amplifier and projection lamp off.

##### 1. 117V 60 Hz Circuitry (Domestic Models)

The projector is used on 117V 60 Hz mains only. The three prong molded plug at end of the main power cord provides the connection to the 117V, 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 electrical 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, and S-7 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-7 are in the normally closed (NC) 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 (A), S-2 (C), and S-2 (E) which close simultaneously with the closing of S-2 (D). Switch S-2 (A) in the speaker circuit remains closed in the FORWARD PROJECT mode only. Switches S-2 (C) and S-2 (E) 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, 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.

Solenoids SO-1 and SO-2, when energized, provide direct-drive and interlock respectively for the front spindle and master control lever. The front spindle solenoid SO-1 is energized for reverse and rewind. When SO-1 is de-energized it mechanically releases a wrap spring brake on the rear spindle which brakes the spindle in rapid rewind. Solenoid SO-2, when energized, locks the master control lever in the LOAD, Fast mode, and also interlocks feed drive and clutch gears for rewind. A chart showing the conditions of switches and solenoids in various modes is provided in the table following.

TABLE 1-1. SWITCH AND SOLENOID OPERATION

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

**FAST FORWARD MODELS**

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 and amplifier and projection lamp off.

1. 117V 60 Hz Circuitry (Domestic Models)

The projector is used on 117V 60 Hz mains only. The three prong molded plug at end of the main power cord provides the connection to the 117V, 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 "HT", 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, 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 K-2. 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 L-3. Relay K-2 is energized by current through resistor R-16 and rectifying diode D-3. Capacitor C-17, connected in parallel with the coil of K-2 is charged by this current. Once C-17 is charged, relay K-2 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.

The contacts of K-2 furnish power directly from the line to energize direct drive and interlock solenoid

SO-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 SO-1 and SO-3, when energized, provide direct-drive and braking for the front and rear spindles, respectively. These solenoids are alternately energized depending upon the direction and

mode of projector operation. The rear spindle solenoid SO-3 is energized for fast forward and brake rewind. The front spindle solenoid SO-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 SO-1	O	X	O	X	X	O
Solenoid SO-2	O	O	X	X	X	X
Solenoid SO-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 (10 Watt)

The amplifier consists of three major sections: Power Supply, Preamplifier, and Power Amplifier. Two printed wiring board modules are used to comprise the total amplifier system. These are interconnected with a three-lead shielded cable. One PC module (42738-G1) contains preamp and Power Supply circuits while the other module (42780-G1 or 43957-G1) contains only Power Amplifier stages.

The tone and volume control network (D42766-G3) also constitutes a separate assembly connected to the preamp/Power Supply module by shielded cable. Frame ground for the entire audio system is made only at this control network to minimize noise and prevent inadvertent oscillation.

A functional description of each amplifier section follows. Reference is made to the Projector and Amplifier Schematics.

#### a. Power Supply Circuit

Projection Lamp Transformer T-1 supplies 24V or 22VAC to full wave bridge rectifier D-1. The 120 cps pulsating dc output is filtered to pure dc by parallel capacitors C-6 and C-9. Resistor R-9 limits peak rectifier surge current. The 33V dc filter section output is supplied only to power amplifier circuitry on assembly 42870-G1 or 43957-G1. NPN transistor TR-1 together with R-10, C-7 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 highly filtered and stabilized 16.5 VDC source for both preamplifier stages and exciter lamp. Resistor R-11 drops the 16.5 VDC to 6.2 VDC (1115A) and 6.7 VDC (1115A $\bar{N}$ ) for proper exciter lamp operation.

## b. Preamplifier Circuit

Photo diode PD-1 is connected in a photovoltaic mode. A slight forward bias is applied through resistor R-2 to improve linearity. Control VR-3 is normally factory adjusted to provide a specific level from reference film. This facility compensates for production tolerances of photo diode output and amplifier gain. The sound track signal developed across VR-3 is capacitor-coupled through C-1 to the preamplifier input. Transistors TR-2 and TR-3 form a cascaded, direct-coupled amplifier having a gain of approximately +40 db.

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

A single transistor stage (TR-4) having an approximate gain of 27 db follows the tone-volume control network. This stage makes up for the signal loss imposed by the tone-volume network and provides a low impedance drive source for the following power amplifier. Resistor R-20 and capacitor C-2 provide additional dc decoupling of the three pre-amp stages and photo diode as supplied from the 16.5 volt regulated source.

### c.1. Power Amplifier Circuit (42780-G1)

The Power Amplifier section is designed around an encapsulated thick film hybrid integrated circuit device (42795-P1). This unit is supplied with 33V dc directly from the bridge rectifier output and must be mounted to a heat sink when energized. It is dc coupled throughout (between pin 3 input and pin 8 output) and therefore requires capacitor dc isolation. Capacitor C-5 provides such isolation from pre-amp stage TR-4 while C-12 provides isolation between power output stage and load. Variable resistor VR-2 provides a bias adjustment means to derive optimum idle current and "crossover" distortion characteristics. This control is factory set and requires adjustment only if IC-2 is replaced. Resistor R-23 provides a bias to minimize "crossover" distortion.

RC network C-13, R-14 and R-15 prevents high frequency oscillation particularly under no-load conditions. Loudspeakers LS-1 and LS-2 are each 16 ohms impedance. They are parallel connected to present the appropriate 8 ohms 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.

### c. (2) Power Amplifier Circuit (43957-G1)

The Power Amplifier section is a discreet component amplifier circuit. This is supplied with 33 VDC from the bridge rectifier output and must be mounted to a heat sink when energized. It is dc coupled between pin 3 input and pin 8 output and therefore requires capacitor dc isolation. Capacitors

C-5 and C-21 provide such isolation from pre-amp stage TR-4 while C-14 provides isolation between power output stage and load.

RC network C-13, R-14 and R-15 prevents high frequency oscillation particularly under no-load conditions. Loudspeakers LS-1 and LS-2 are each 16 ohms impedance. They are parallel connected to present the appropriate 8 ohms 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.

## 3. Operating Principles (15 watt)

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 shielded cable. Frame ground for the entire audio system is made only at this control network to minimize noise and prevent inadvertent oscillation.

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 27.0 VAC 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 33 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 preamplifier 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 reference test film. This facility compensates for production tolerances of photo diode output and amplifier gain. The sound track signal developed across VR-2 is capacitor-coupled through C-2 to the preamplifier 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.

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 preamp 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 33 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 provide the appropriate 8 ohms 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 includes an Operational Check and Trouble and Remedy Table.

#### B. OPERATIONAL CHECK

1. Connect power cord to 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 sprockets and reels stop and that screen illumination is cut down (safety shutter operates). Turn inching knob if necessary to open shutter.
6. Press REVERSE button. Check that sprockets and reels turn properly. Projection lamp should stay on when REVERSE button is pressed.
7. Press STOP button. Projector should stop and be turned off completely.
8. Move Master Control Lever to LOAD-FAST Mode.
9. Press REVERSE button. Check that sprockets and reels operate in the fast reverse mode (On Fast Forward Models, the Fast Mode interlock light should be on) and the Master Control Lever is mechanically locked into position.
10. Press STOP button. Projector should stop and be turned off completely. (On Fast Forward Models, the interlock light should remain on for approximately 5 seconds.
11. Press FORWARD button. (Fast Forward Models). Check that sprockets and reels operate in the fast forward mode. The Master Control Lever should now be mechanically locked into position and the Fast Mode interlock light should be on.
12. Press STOP button. Projector should stop and Fast Mode interlock light should remain on for approximately five seconds.
13. Load projector with SMPTE Jiffy Test Film (refer to operators 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. Check loop and reset with loop reset lever.

16. Adjust framing so frame line shows on screen. Check for picture jump, side movement and centering of aperture to film.

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 counter-clockwise.

19. Press STOP button.

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

21. Move the Master Control Lever to LOAD Fast Mode. Projector should increase to fast speed (On Fast Forward Models, the Fast Mode interlock light should be on) and the Master Control Lever is mechanically locked into position.

22. Press STOP button. Projector should stop and be turned off completely. (On Fast Forward Models, the interlock light should remain on for approximately 5 seconds.

23. Press FORWARD button (Fast Forward Models) Projector should advance film rapidly in a forward direction. The Master Control Lever should be mechanically locked into position and the Fast Mode Interlock Light should be on.

24. Press STOP button. Projector should stop and after approximately five seconds, the Fast Mode Interlock Light should go out.

#### 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 parts. The first part covers control system troubles, the second part covers film handling and picture troubles while the third part covers sound troubles. Miscellaneous troubles are found in part 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.

TROUBLE	PROBABLE CAUSE	REMEDY
<p>1. Control System Troubles</p> <p>a. Blower Motor does not operate in any mode.</p> <p>b. Projector does not operate when FORWARD button is pressed.</p> <p>c. Projector operates but projector lamp does not illuminate when FORWARD button is pressed.</p> <p>d. Screen illumination is not cut down when STILL button is pressed,</p> <p>e. Projector does not operate when REVERSE button is pressed.</p> <p>f. Fast mode interlock light does not come on with Master Control Lever in LOAD FAST and FORWARD or REVERSE button pressed. (Lever is mechanically locked into position. (Fast Forward Models.)</p> <p>g. Fast mode interlock light does not come on with Master Control Lever in LOAD FAST MODE and FORWARD or REVERSE button is pressed (Lever is not mechanically locked into position (Fast Forward Models)</p> <p>h. Fast mode interlock light does not remain on for five seconds after STOP button is pressed. (Fast Forward Models)</p> <p>i. Failure to rewind or brake in fast forward. (Fast Forward Models)</p> <p>j. Failure to drive in fast forward or brake in rewind. (Fast Forward Models)</p> <p>k. No interlock on main lever.</p>	<p>Blower Motor defective</p> <p>Switch S-2 defective</p> <p>Projector Lamp defective Transformer T-1 defective Switch S-2 defective</p> <p>Safety shutter sticking</p> <p>Link (2, fig. 5-9) catching on pin of bracket (3).</p> <p>Switch S-2 defective</p> <p>Lamp L-3 defective</p> <p>Relay R-2 defective Solenoid SO-2 defective Diode D-3 defective Resistor R-16 defective</p> <p>Capacitor C-17 defective Diode D-3 defective Resistor R-16 defective</p> <p>Solenoid (SO-1 and 2) out of adjustment</p> <p>Solenoid (SO-3) out of adjustment</p> <p>Solenoid (SO-2) out of adjustment Solenoid (SO-2) link (14, Fig. 6-4) deformed</p>	<p>Replace</p> <p>Replace</p> <p>Replace Replace Replace</p> <p>Visually align safety shutter midway between shutter and cam assembly. Safety shutter spring and link must clear shutter and cam assembly by 1/8". Adjust by bending safety shutter spring bracket.</p> <p>Adjust bracket to center trip pin to link.</p> <p>Replace</p> <p>Replace</p> <p>Replace Replace Replace</p> <p>Replace Replace Replace</p> <p>Adjust (Sec. III, para. G. 22)</p> <p>Adjust (Sec. III, para. G. 22- Same procedure as for Rewind</p> <p>Adjust (Sec. III, para. G. 12. a.)</p> <p>Adjust (Sec. III, para. G. 12. a.)</p>

TROUBLE	PROBABLE CAUSE	REMEDY
<b>2. Film Handling and Picture Troubles (Note - Test film must be in good condition.)</b>		
a. Film slap	Claw protrusion or stroke out of adjustment Pressure shoe out of adjustment Film Gate not closing properly Flywheel not driving in reverse	Adjust (Sec. III, para. G. 10-14, 33, 34) Adjust (Sec III, para G. 18, 19) Adjust lens holder (Sec. III, para G. 1) Adjust (Sec. III, para G. 30, 31)
b. Film scratch	Aperture plate (41, fig. 5-3) or pressure shoe (3, fig. 6-3) dirty Film handling rollers stuck	Clean Clean and lubricate
c. Film damage at feed sprocket (reverse operation).	Tension on roller pad too high No end play in feed clutch	Adjust (Sec. III, para. F. 8)
d. Film spills at supply reel (reverse operation)	Feed clutch torque too low	Adjust (Sec. III, para. F. 8)
e. Loss of upper loop	Pressure roller misadjusted	Adjust (Sec. III, para. G. 21)
f. Loss of lower loop	Claw protrusion or stroke out of adjustment Pressure shoe not seated properly	Adjust (Sec. III, para G. 10-14, 33, 34) Check position of shoe, if necessary, realign (Sec. III, para. G. 18, 19)
h. Clicking nose (film picking)	Teeth of feed sprocket (14, fig. 5-2) damaged Teeth of take-up sprocket (6, fig. 5-7) damaged Claw arm (14, fig. 6-17) teeth worn or damaged	Replace feed sprocket Replace take-up sprocket Replace claw arm (Sec. III, para. F. 2, G. 10-14, 33, 34)
i. Little or no take-up	Reel take-up belt (1, fig. 5-8) damaged Bias force too low Take-up clutch lift-off linkage too short	Replace Tighten nuts (3 & 4, fig. 6-15) Adjust (Sec. III, para. G. 7)
j. Take-up belt squeal	Take-up film tension too high	Back off nuts (3 & 4, fig. 6-15)
k. Damaged film at take-up sprocket	Take-up film tension too high Worn or dirty film Incorrect threading	Back off nuts (3 & 4, fig. 6-15) Replace Thread correctly and check

TROUBLE	PROBABLE CAUSE	REMEDY
<p>l. Erratic take-up</p> <p>m. Film spills in FORWARD at supply reel</p> <p>n. Rewind stall part way through reel</p> <p>o. Loose rewind</p> <p>p. Picture jumps (possible loss or loop)</p> <p>q. Picture moves from side to side</p> <p>r. Picture goes in and out of focus at random</p> <p>s. Picture "streams" vertically</p> <p>t. Film burns when in STILL mode.</p> <p>u. Film tears in REVERSE</p>	<p>Brake surface of take-up reel arm pulley ( 8 Fig. 5-8 ) dirty</p> <p>Clutch liner (28, fig. 5-8) worn</p> <p>Supply reel drive clutch too tight or improper lubrication</p> <p>Brake on take-up</p> <p>Supply or take-up reel bent</p> <p>Claw protrusion or stroke out of adjustment</p> <p>Aperture plate (41, fig. 5-3) or pressure shoe (3, fig. 6-3) dirty</p> <p>Claw arm (46, fig. 5-8) damaged (face of claw arm must be visibly parallel to adjacent face of casting)</p> <p>Film edge guide spring (40, fig. 5-3) out of tolerance</p> <p>Aperture plate (41, fig. 5-3) or pressure shoe (3, fig. 6-3) damaged</p> <p>Pressure shoe not aligned</p> <p>Film edge guide spring (40, fig. 5-3) out of tolerance</p> <p>Safety shutter (24, fig. 5-9) binding</p> <p>Reverse take-up torque too high</p>	<p>Wipe inner surface of pulley</p> <p>Replace</p> <p>Adjust and/or repair assembly. Seal knurl with glyptal</p> <p>Adjust (Sec. III, para. G. G. 5)</p> <p>Replace</p> <p>Adjust (Sec. III, para G. 10-14, 33, 34)</p> <p>Clean</p> <p>Replace and adjust (Sec. III, para. F.2 and G. 10-14, 33, 34)</p> <p>Readjust (Sec. III, para. F. 17 i.)</p> <p>Replace and adjust (Sec. III, para. G. 18, 19)</p> <p>Align (Sec. III, para G. 18, 19)</p> <p>Readjust and lubricate (Sec. III, para. F. 17 i.)</p> <p>Visually align safety shutter midway between shutter and cam assembly. Safety shutter spring and link must clear shutter and cam assembly by 1/8". Adjust by bending safety shutter spring bracket</p> <p>Adjust ( Sec. III, para. F. 8. b. )</p>
<p>3. Sound System Troubles</p> <p>a. Short exciter lamp life</p> <p>b. No sound from film, exciter lamp OK. Speaker hiss increases with volume control</p>	<p>Transistor TR-1 shorted</p> <p>Diode D-2 and capacitor C-7 (10 Watt) or C-21 (15 Watt) open or shorted</p> <p>Photo diode PD-1 open or shorted</p> <p>Shorted or open shielded cable from sound support drum</p>	<p>Replace defective component</p> <p>Check 16.5 VDC (10 Watt) or 15 VDC (15 Watt) level at TR-1 emitter. Replace defective component.</p> <p>Replace sound support assembly</p> <p>Repair or replace with spliced section</p>

TROUBLE	PROBABLE CAUSE	REMEDY
<p>c. Exciter lamp will not light. Speaker hiss increases with volume control</p>	<p>Capacitor C-8 (10 Watt) or C-1 (15 Watt) shorted</p> <p>Resistor R-11 (10 Watt) or R-30 (15 Watt) open</p> <p>Exciter lamp socket defective or leads to socket open</p>	<p>Replace capacitor</p> <p>Replace resistor</p> <p>Repair or replace</p>
<p>d. No sound from film, exciter lamp OK. Speaker hiss but volume control has no effect</p>	<p>Capacitor C-2 (10 Watt) or C-7 (15 Watt) shorted</p> <p>Capacitor C-4 (10 Watt) or C-6 (15 Watt) open or shorted</p> <p>Transistor TR-4 defective</p>	<p>Replace defective component</p> <p>Replace defective component</p> <p>Replace defective component</p>
<p>e. No sound (hum or hiss). Exciter lamp OK. No excessive component heating</p>	<p>Open or loose connection on shielded interconnection cable on speaker leads</p>	<p>Repair or replace as required</p>
<p>f. Excessive hum with sound</p>	<p>Capacitor C-2, C-6, or C-9 (10 Watt) or C-7, C-19, or C-20 (15 Watt) defective</p> <p>Shielded cable grounded at sound support</p>	<p>Replace defective component</p> <p>Repair cable or replace sound support</p>
<p>g. Distorted sound. Exciter lamp system OK</p>	<p>Transistor TR-2, TR-3, TR-4, or IC-2 (10 Watt) or TR-2, TR-3, TR-4, TR-5, TR-6, TR-7, TR-8, or TR-9 (15 Watt) defective</p> <p>Coupling capacitor C-1, C-3, C-4, C-5, or C-22 (10 Watt) or C-2, C-3, C-6, C-9, or C-22 (15 Watt) leaky or shorted</p> <p>Flywheel driving in forward mode</p>	<p>Replace defective component</p> <p>Replace defective component</p> <p>Adjust (Sec. III, para. G. 30, 31)</p>
<p>h. No sound or exciter lamp</p>	<p>Fuse F-1 blown due to line surge</p>	<p>Replace fuse and check for proper sound system operation</p>
<p>i. Fuses blow immediately upon replacement and power supplied. Resistor R-9 (10 Watt) or R-28 (15 Watt) OK</p>	<p>Shorted diode D-1</p>	<p>Replace component</p>
<p>j. Fuses blow when power is applied. Resistor R-9 (10 Watt) or R-28 (15 Watt) burned</p>	<p>Defective capacitor(s) C-5, C-6, C-9, or C-12 (10 Watt) or C-9, C-14, or C-20 (15 Watt)</p> <p>Defective IC-2 (10 Watt)</p>	<p>Replace defective component</p> <p>Check Diode D-1</p>
<p>4. Miscellaneous Troubles</p> <p>a. Motor runs but drive shaft does not rotate</p>	<p>Pulleys dirty</p> <p>Pulleys out of alignment</p>	<p>Clean</p> <p>Align</p>

TROUBLE	PROBABLE CAUSE	REMEDY
b. Fails to start on low power	<p>Drive belt (1, fig. 5-4) worn, damaged or loose</p> <p>Spring motor pulley on drive unit assembly not functioning properly</p>	<p>Adjust (Sec. III, para. G. 3)</p> <p>Check as follows:</p> <p>(1) Hold pulley without binding motor shaft. Wind spring to full tight position by rotating fan (6, fig. 6-10)</p> <p>(2) Release fan. Spring must throw fan 180°. If less than 180°, clean and lubricate</p>
c. Loss of power and/or speed	<p>Low drive belt tension</p> <p>Bearing for shaft of take-up or for supply sprocket gear assembly dirty</p> <p>Cam lubrication pad dry</p>	<p>Adjust (Sec. III, para. G. 3)</p> <p>Clean and lubricate</p> <p>Lubricate (Sec. III, para. F.13 d.)</p>
d. Failure to set loop	<p>Loop set cables loose or off pulleys</p> <p>Clutch spring (18, fig. 5-2) damaged</p>	<p>Tighten and adjust (Sec. III, para. F. 18 or 20 and 21)</p> <p>Replace</p>
e. Control lever binds when moving from LOAD to PROJECT	<p>Damaged pinion (22, fig. 5-2), gear (21, fig. 5-2), or drum complete (23, fig. 5-2)</p> <p>Improper gate adjustment</p> <p>Inadequate end play in control lever system</p>	<p>Replace defective component</p> <p>Adjust (Sec. III, para. G. 1)</p> <p>Check all end play</p>

## SECTION III

### SERVICE PROCEDURES

#### A. GENERAL

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

#### B. TOOLS AND EQUIPMENT

Servicing Telex INSTA-LOAD 1100A SERIES Projectors will be facilitated by tools and equipment described in this section. Some tools are standard tools. Special tools have been assigned tool numbers and are available from Education Systems.

##### 1. Special Tools

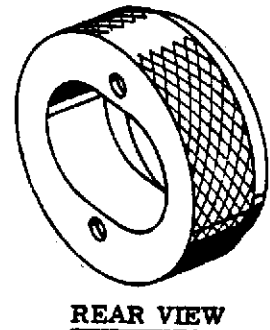
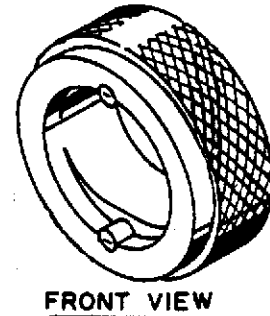
Special tools required in the repair of the projector are listed below. For a description of these tools, refer to the applicable illustration.

ST-5884	Claw Arm Adjusting Tool ( Fig. 3-1 )
G10-38000	Claw Arm Protrusion Gage ( Fig. 3-2 )
T-38000-N	Rollpin - Insert and 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. 3-10 )
T- 43680-G1G	Sound Optics Adjusting Tool ( Fig. 3-11 )

##### 2. Commercial Tools

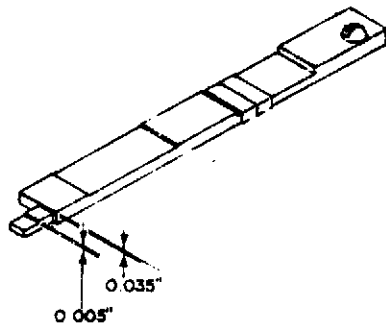
The commercial tools used in the repair of the projector are listed in the table below. These tools are available from Education Systems.

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 adjust claw arm side clearance and pull-down stroke.

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



Used to set claw pin protrusion electrically.

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

DETAIL I

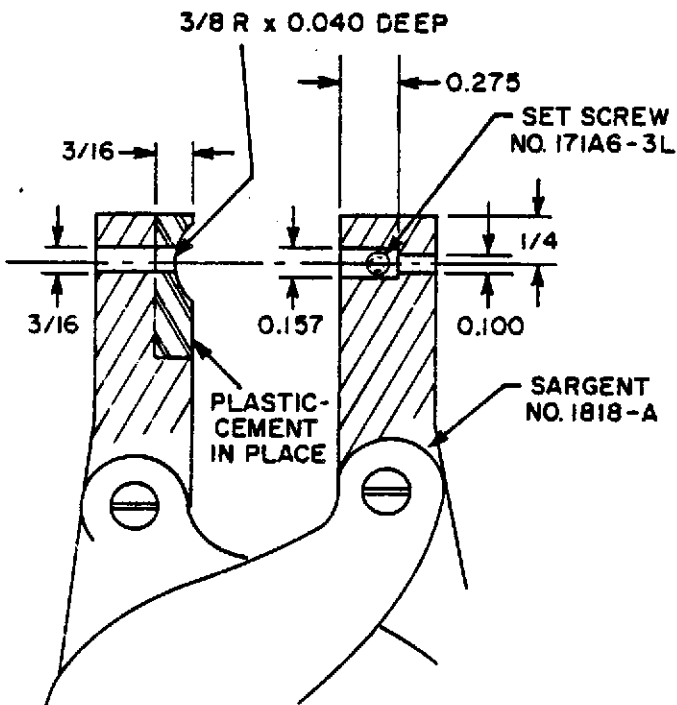
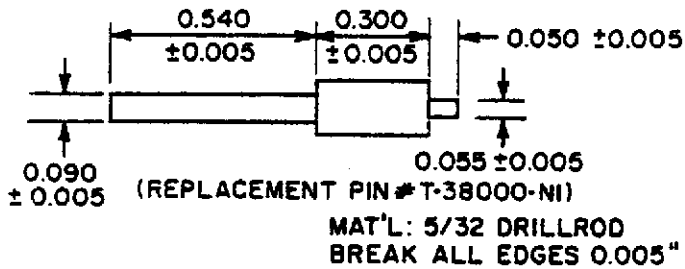
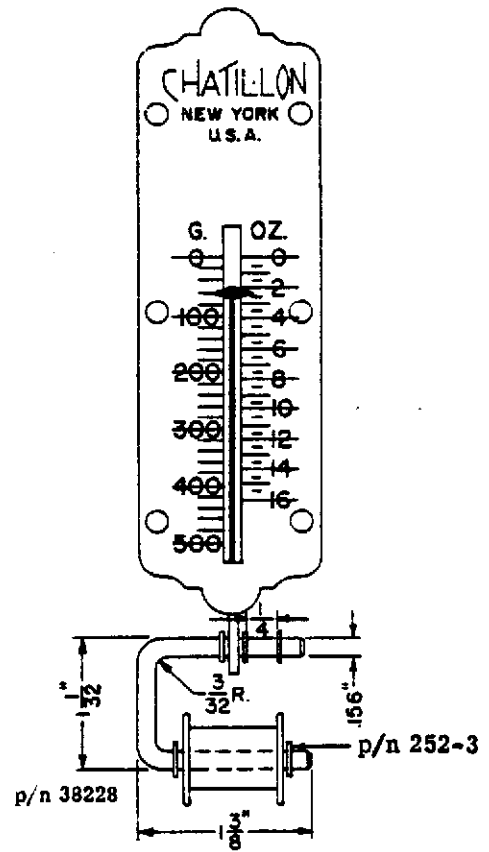
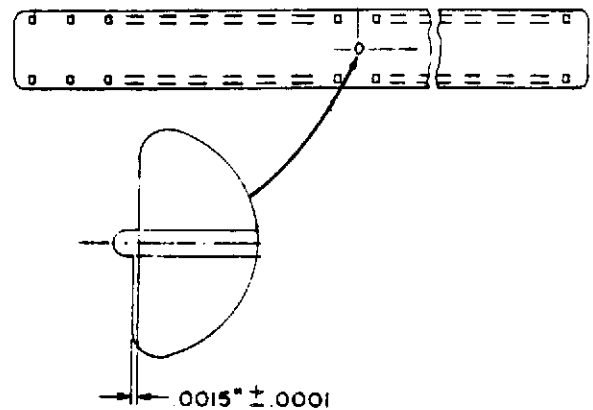


Figure 3-3. ROLLPIN-INSERT AND EXTRACTING TOOL, No. T-38000-N



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

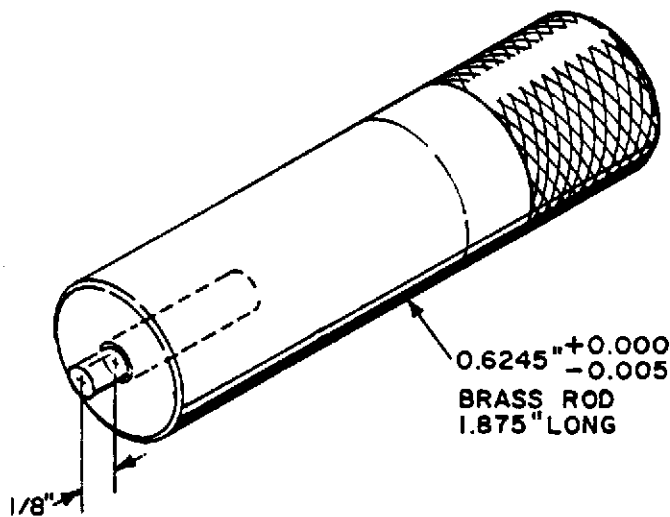
Figure 3-4. TAKE-UP FILM TENSION GAGE No. T-38000-S



This gage is a piece of stainless steel with perforations simulating 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.

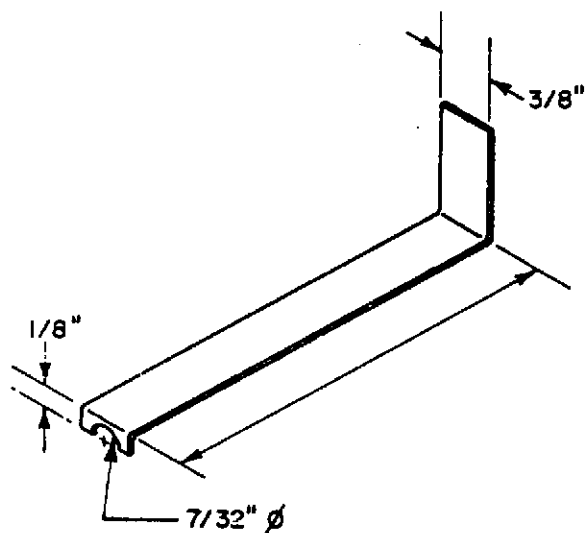
Figure 3-5. STROKE SETTING GAGE, No. ST-5880





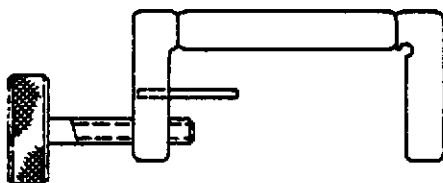
Used to locate the lateral and rotational position of the sound drum.

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



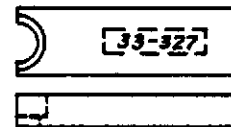
MATERIAL : .025 PHOS. BRONZE  
OR SPE. BR.

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



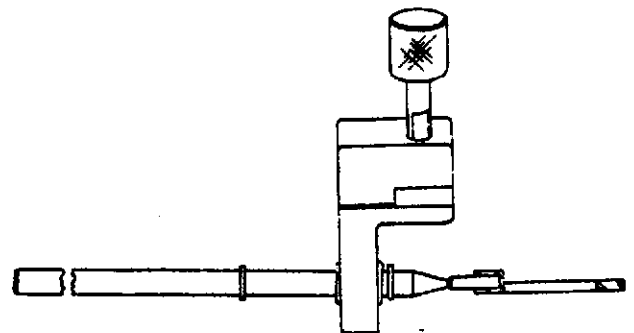
Used to hold solenoid while setting stroke.

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



Used to set solenoid stroke.

Figure 3-10. SOLENOID STROKE GAGE  
No. SS-327



Used to set Sound Optics.

Figure 3-11. SOUND OPTICS ADJUSTING TOOL  
No. T-43680-G1-G

### C. MATERIALS

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

LUBRICANTS AND CEMENTS

STOCK NO.	STOCK PACKAGE	DESCRIPTION
39479P5	1/2 oz.	DC-200 Silicone Fluid; 200,000 centistroke viscosity (Dow-Corning Corp., Midland, Mich.)
39479P13	1/2 oz.	D200 Silicone Damping Fluid, 200 centistroke viscosity (Dow-Corning Corp., Midland, Mich.)
39479P7	1/2 oz.	009 Lubricant (Keystone Carbon Co., St. Mary's, Pa.)
39479P8	2 oz.	Instrument Oil-Teresso Oil, No. N-75 (Humble Oil & Refining Co., New York, N. Y. N.)
39479P9	2 oz.	DC-44 Light Consistency Silicone Grease (Dow-Corning Corp., Midland, Mich.)
39479P15	2 oz.	Vischem No. 352 (Ultra Chem Inc., Wilmington, Del.)
39479P4	1/2 oz.	FS-1290 Fluorosilicone Grease (Dow-Corning Corp., Midland, Mich.)
39479P14	2 oz.	Versalube - G-322L (General Electric)
39490P1	3 oz.	7526 Blue Glyptal (General Electric Co., Schenectady, N. Y.) N-75
39479P16	4 oz.	Extreme Pressure Lube No. 3
39490P2	3 oz.	1276 Clear Glyptal (General Electric Co., Schenectady, N. Y.)
39479-P17	1/2 oz.	DC 350 Dampening Fluid (Used on Insta Load safety shutter P/N 42994-G2 (Replaces 39479-P13, DC 200-200CS)
-----	-----	8101-S Silicone Compound (General Cement Electronic Co., Rockford, Ill.)
-----	-----	No. 59 Loctite, Screw Lock (Loctite Corp., Newington, Conn.)
-----	3 oz.	EC-880 (Minnesota Mining & Manufacturing Co., St. Paul, Minn.)
45191-G3	12 ft.	PH22.57 Buzz Track Film (P16BT)
-----	-----	PH22.43 3000 cps Film
45191-G7	-----	PH22.45 400 Cycle Test Film
45191-G2	12 ft.	PH22.42 7000 cps Film (P16SFA)
45191-G6	12 ft.	16.3 mm Registration Test Film (Reg. 16)
39490P4	8 oz.	Glyptal Thinner 1511M
-----	-----	Chlorothene (Dow Chemical Co., Midland, Mich.)
39490P12	4 oz.	Tan Paint
39490P13	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 Multimeters or equivalent. Connect the transistor under test in the circuit shown observing polarity.

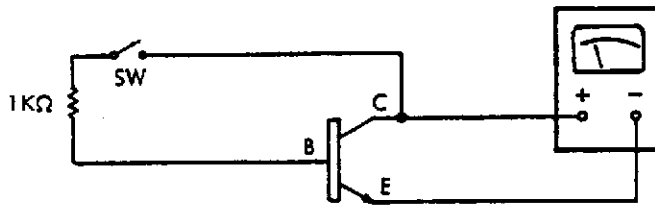


Figure 3-12. TEST CIRCUIT

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 (10 Watt)

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

a. Attach an 8 ohm, 10 watt dummy load in place of the loudspeaker.

b. Connect an audio oscillator through a 40db pad to test input jacks J-7 and J-8 (J-8 common ground) of preamp board 42738. The audio oscillator ground must be "floating" i. e., not common to other test equipment.

c. Connect the ac-coupled vertical sweep 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. 3-13A. 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.

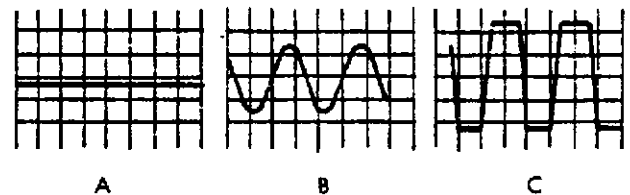


Figure 3-13. WAVEFORMS

Apply a 1000 cps signal from the audio oscillator to the test input terminals J-7 and J-8. 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 3-13B. Increasing volume (CW rotation) further should produce a symmetrically clipped wave as in Figure 3-13C. Reduce signal input to the point where the output signal is just under the level of clipping. It should be possible to obtain 22.5 volts peak-to-peak (8V RMS) at this level. Severe non-symmetry or high-frequency ringing indicates a circuit problem. Operate the amplifier only for short periods under the above test conditions.

## 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. Disassembly sequence of the subassemblies is provided in Section VI. Pertinent notes related to the disassembly of each stage of the projector follow.

### 1. Stage 1 (Figure 5-2)

a. Remove covers (1 and 2) in the order indicated and loosen two screws that secure control cable to Master Control Lever Arm. Pull cable up to feed sprocket pulley.

b. Pin (20) is a rotating pin, which needs only to be pushed out after removal of clutch spring (18) from arbor (19).

c. Disassemble remainder of parts in key order of index numbers.

### 2. Stage 2 (Figure 5-3)

Disassemble in key order of index numbers disconnecting wires from parts (23 and 31) before removal.

### 3. Stage 3 (Figure 5-4)

a. Release all cable ties to free wires of motors (2 and 15) before disassembly.

b. Disassemble in key order of index numbers disconnecting wires from items (8, 10, 15, 18, 23, and 37) prior to removal.

### 4. Stage 4 (Figure 5-5)

Disassemble in key order of index numbers.

### 5. Stage 5 (Figure 5-6)

Disassemble in key order of index numbers.

### 6. Stage 6 (Figure 5-7)

Disassemble in key order of index numbers.

### 7. Stage 7 (Figure 5-8)

Disassemble in key order of index numbers.

### 8. Stage 8 (Figure 5-9)

a. Loosen all setscrews securing drive shaft components and press pins (20 and 38) out of worm gears (19 and 37) using tool T-380000-N.

b. Disassembly in key order of index numbers carefully removing all drive shaft components as the drive shaft is withdrawn through the front of the projector.

## F. REASSEMBLY

### 1. Shutter and Cam Assembly (Figure 3-14)

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

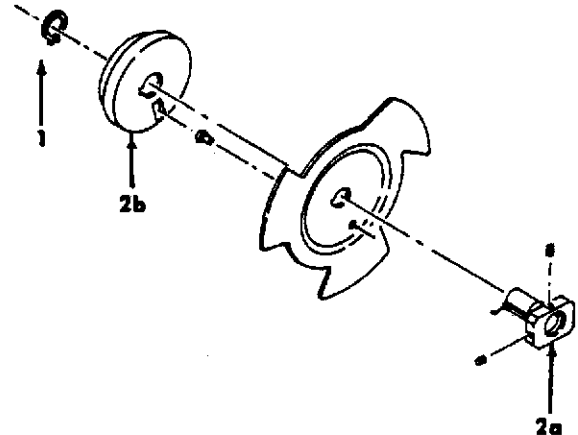


Figure 3-14. SHUTTER AND CAM ASSEMBLY

### 2. Claw Arm Complete (Figure 3-15)

a. Lubricate periphery of rod (2), and bearing surfaces of washers (6 and 8), ring (7) and bracket (3) with DC-44 grease.

b. Lubricate interfaces between claw arm assembly (14) and washer (18) with FS-1290 grease.

c. Adjust nuts (10) to obtain a minimum end play of .001 to permit claw arm assembly to pivot freely with framing arm before spring (16) is assembled.

d. Apply Glyptal 7526 to nuts (10) and washer (11).

### 3. Film Counter Complete (Figure 3-16)

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

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



## 6. Drive Unit Assembly ( Figure 3-19 )

- a. Lubricate inside diameter of spring ( 10 ) with Vischem No. 352 grease.
- b. Lubricate inside diameter and outside face of bearing ( 11 ) with FS-1290 grease.
- c. Collar ( 14 ) to be adjusted to allow pulley assembly ( 12 ) to rotate freely with .001 to .005 end play.
- d. Apply Glyptal 7526 to threads of screws ( 2 ).
- e. Push fan ( 7 ) onto shaft ( pressure fit ).

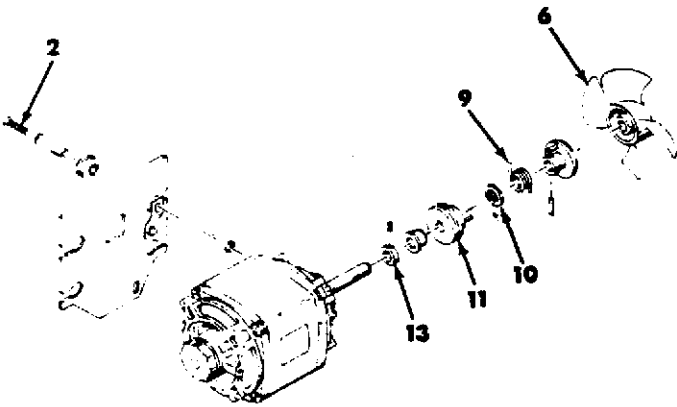


Figure 3-19. DRIVE UNIT ASSEMBLY

## 7. Arm Complete, Supply and Take-up Reel ( Figure 3-20 )

- 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 inch ounces after assembly.
- d. Lubricate interface of clutch ( 9 ) and drum assembly ( 7 ) with Teresso N-75 oil.
- e. Assemble washer ( 12 ) as required to provide .003 to .008 end play between pulley ( 8 ), washer ( 11 ) and ring ( 10 ).

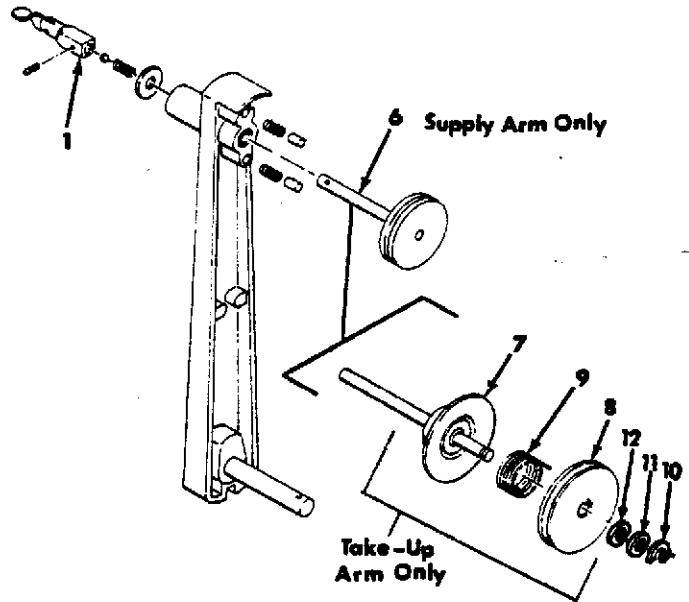


Figure 3-20. SUPPLY AND TAKE-UP REEL ARMS COMPLETE

## 8. Clutch Complete, Feed Sprocket ( Figure 3-21 )

- a. Lubricate spring ( 6 ) with 009 Lubricant.
- b. Adjust nut ( 9 ) to obtain .002 to .010 end play on gear and hub ( 3 ).
- c. Lubricate outside diameter of pin ( 4 ) with Teresso N-75 oil.

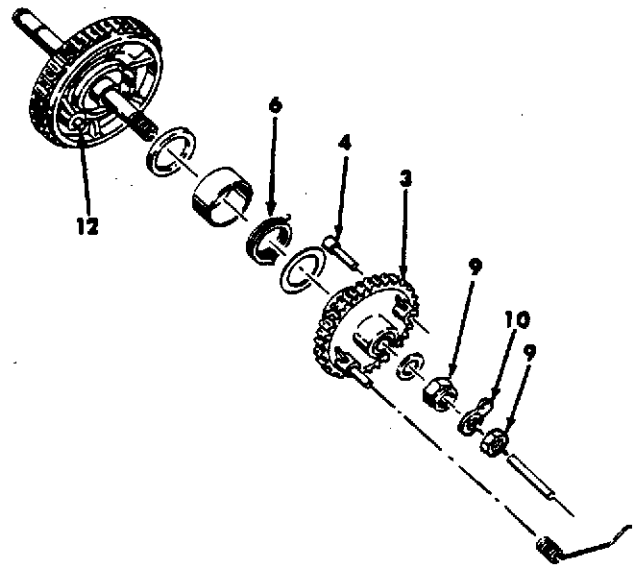


Figure 3-21. FEED SPROCKET CLUTCH COMPLETE

- d. Depress pin ( 4 ) and turn gear ( 3 ) clockwise until pin ( 4 ) and pin of gear ( 12 ) touch. While holding in place position left corner or edge of stop ( 10 ) over stud of pin ( 4 ) and secure in place with nut ( 9 ).

## 9. Clutch Assembly ( Figure 3-22 )

- a. Lubricate interfaces of moving parts with Teresso N-75 oil.
- b. Position driven drum ( 1 ) to provide .005 to .010 end play.
- c. Apply Loctite to threads of setscrew ( 2 ) and tighten using 50-55 in. oz. torque. Loctite should be removed from outside diameter of driven drum ( 1 ).
- d. Inner tail of clutch spring ( 3 ) must be fully depressed into groove of drum ( 4 ).

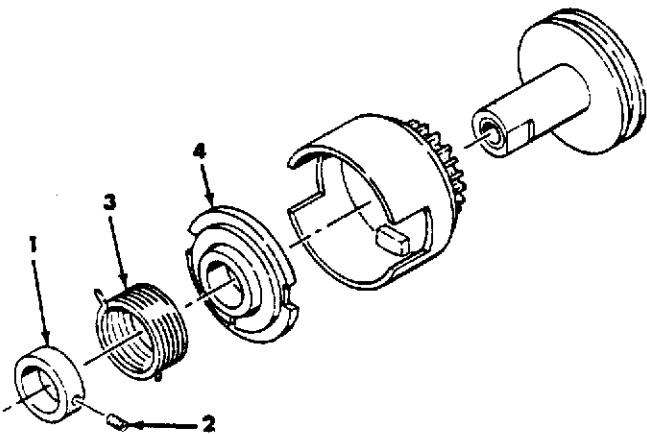


Figure 3-22. CLUTCH ASSEMBLY

## 10. Arm Complete Supply Reel ( Figure 3-20 )

- a. Pulley ( 6 ) when assembled must have .005 to .010 end play.
- b. Pulley ( 6 ) on Supply Reel Arm must rotate with brake torque of 2.5 to 4.5 in. oz.

## 11. Stage 8 Reassembly ( Figure 5-9 )

- a. Apply Teresso N-75 oil to working surfaces of pulleys (44 and 47).
- b. Clean all surfaces of shutter and cam, bearings, and metal parts with a cloth dampened with chloro-thene.

### CAUTION

Hub and cam are permanently impregnated with oil; do not immerse in cleaning solvent.

- c. Apply DC-44 grease moderately to outside of bearings (14 and 33), spring washer (16), worm gears (19 and 37), and link (2).
- d. Feed drive shaft assembly through hole in front of projector housing (50), adding parts or subassemblies in their proper locations. Do not lock collar

( 17 ) to fully assembled shaft, with set screws ( 18 ), until assembled shaft turns smoothly with no end play.

- e. Press in pins (20 and 38) flush within .010 on both ends. Use tool T-38000-N.
- f. Position pulley ( 21 ) so that belt ( 23 ) tracks in a straight line. Orient one setscrew ( 22 ) against flat on drive shaft.
- g. Apply Glyptal 7526 Blue to interface of screw ( 11 ).
- h. Lubricate working surfaces of link ( 2 ) with DC-44 grease.

## 12. Stage 7 Reassembly ( Figure 5-8 )

- a. Position plate ( 41 ) to provide approximately equal up and down framing.
- b. Apply Glyptal 7526 Blue to interface of limit plate (41) and screws (42).
- c. Apply DC-44 grease to working surface of pivot (44).
- d. Lubricate working surfaces of arm ( 2 ) with Teresso N-75 oil.
- e. On cam ( 26 ), lubricate outside diameter of shaft entering housing and the working surfaces between cam ( 26 ) and link assembly ( 15 ) with Versalube G-322L. Apply Vischem No. 352 to roller shaft of cam ( 26 ).
- f. Position rings ( 22 and 24 ) so that rollers ( 21 and 23 ) have .001 to .005 end play. Assemble rings with sharp side out.
- g. Install spring ( 18 ) by rotating one and one-half turns clockwise before inserting tab into slot of shaft.
- h. Apply 3 drops of Teresso N-75 oil into bearing bores immediately before assembly of gear assembly ( 29 ).
- i. Lubricate interfaces between plunger ( 13 ), arm (11) and housing with DC-44 grease.

## 13. Stage 6 Reassembly ( Figure 5-7 )

- a. Lubricate working surfaces of sprocket assembly ( 6 ) and spring ( 5 ) with Teresso N-75 oil.
- b. Assemble ring ( 7 ) to achieve from .003 to .007 end play in sprocket assembly ( 6 ) by using shim washer ( 8 ) as required. Use feeler gage SS-305 in place of ring ( 7 ) while shimming to obtain the specified end play.

c. Wind spring ( 5 ) clockwise until tight, back off to insert stop ( 3 ) so that spring will be about one turn clockwise from being tight.

d. Position pad assembly (11) between heat shield and housing, and install screws (12 ).

#### NOTE

Inner screw must not pinch spring.

Bend pad arm as necessary to maintain pad contact with both axial and radial cam surfaces. Lubricate pad (11) with 16 drops of Teresso N-75 oil.

e. Lubricate working surfaces of link and plate assembly, (27 ), toggle link assembly (26 ) and pawl pivots with Teresso N-75 oil.

f. Lubricate interfaces of link ( 25 ) and housing ( 50, fig 5-9 ) interfaces with DC-44 grease.

g. Assemble ring ( 21 ) so that pawl ( 20 ) has from .001 to .005 end play.

h. Lubricate interfaces between rollpins on eccentrics ( 29 and 33 ) and pawls ( 20 ) with Extreme Pressure Lube No. 3.

#### 14. Stage 5 Reassembly ( Figure 5-6 )

a. Lubricate lever ( 20 ) and lever ( 27 ) with Versalube G-322L grease.

b. Lubricate crank ( 24 ) with Teresso N-75 oil.

c. Lubricate working surface of pressure roller arm ( 18 ) and housing ( 50, fig. 5-9 ) with Versalube G-322L grease.

d. Lubricate interfaces of bearings ( 13 ) and threading control plate (10) with DC-44 grease.

#### 15. Stage 4 Reassembly ( Figure 5-5 )

a. Apply Glyptal 7526 Blue to threads of screw (42 ).

b. Insert sound drum locating plug T-38001-G in place of sound optics cartridge ( 28 ). Seat plug so phenolic rod just clears photovoltaic cell. Center clear area of photovoltaic cell under rod and push sound drum support ( 34 ) toward casting until edge of sound drum just touches rod. Tighten screw ( 30 ).

c. Apply Glyptal 7526 Blue to interface of screw assembly ( 32 ), screws ( 43 ), and screw ( 9 ).

d. Adjust or bend film stripper ( 8 ) so it does not touch sprocket.

#### 16. Stage 3 Reassembly ( Figure 5-4 )

a. When reassembling venturi plate ( 13 ) take up all end play by urging plate toward top of projector before tightening screw ( 14 ).

b. Apply Silicone Compound 8101-S to interface of

integrated circuit ( part of 8 ) and venturi plate ( 13 ) or interface of heat dissipator ( part of 23 ) on current models.

c. Assemble belt ( 1 ) with tooth surface away from pulley, and check for proper tracking.

#### 17. Stage 2 Reassembly ( Figure 5-3 )

a. Lubricate working surface of plunger (17) and arm ( 16 ) with Versalube G-322L grease.

b. Replace retainer ( 22 ). DO NOT REUSE.

c. Apply Glyptal 7526 Blue to threads of screw ( 5 ).

d. Apply Versalube G-322L grease to shaft of arm ( 9 ) that enters housing.

e. Lubricate roller shafts on arm ( 9 ) and eccentric ( 7 ) with Vischem No. 352 grease.

f. Install spring ( 10 ) preloading with one-half turn clockwise.

g. Position rings ( 4 ) with opening toward top or bottom on a parallel to the bend of shoe ( 2 ). Assemble rings with sharp edge out.

h. Lubricate interfaces between guide ( 39 ), plate (41), spacer (38), and screw (37) with Molykote Z.

i. The force required to move the pads of guide ( 39 ) must not exceed 1.625 oz.

j. The sequence for tightening the aperture plate screw ( 34 and 35 ) is as follows:

First, tighten the upper left corner, then the lower right corner, next the upper right corner and finally the lower left corner.

k. Lubricate working surfaces of lens holder ( 25 ) with DC-44 grease.

l. Adjust setscrew ( 28 ) to provide .002 to .010 clearance between setscrew and main housing throughout total lens holder travel . Apply Glyptal to threads of screw ( 28 ). No Glyptal allowed in bore of lens holder.

m. Lubricate shaft of guide roller post ( 15 ) with Vischem No. 352 grease.

n. Apply Glyptal 7526 Blue to the threads of guide roller post ( 15 ). Assemble sharp edge of ring ( 14 ) out.

#### 18. Stage 1 Reassembly ( Figure 5-2 )

a. Lubricate bearing ( 30 ) with Teresso N-75 oil.

b. Apply Glyptal 7526 Blue to threads of screw (38).

c. Lubricate working surface of spring ( 18 ) and sprocket assembly (14 ) with Teresso N-75 oil.



d. End play of feed sprocket ( 14 ) to be .003 to .007. Use washer (17) to achieve this dimension.

e. Apply Glyptal 7526 to the threads of screw (6).

f. Lubricate working surface of roller arm guide (3) with Teresso N-75 oil.

g. Wrap and attach control cables as shown in Figure 3-23 and described below.

(1) Set control lever to "PROJECT". Thread rear cable first one wrap counterclockwise on drum. Pin approximately 0 left of verticle.

(2) Thread front cable. Cables must be snug but not "Music" tight.

(3) Secure cable ends under screw heads on threading control arm.

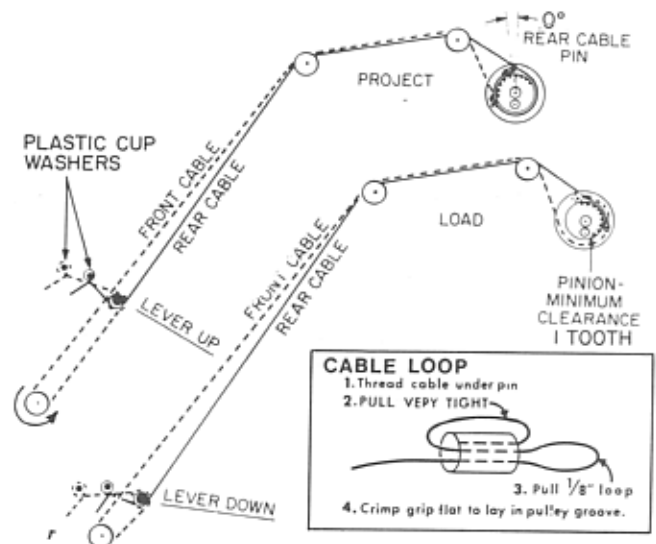


Figure 3-23. CONTROL CABLES

### 19. Eccentric Bearing/Single (Double Loop) Cable

All projectors having Code M4AW (Dec. 16 , 1974 ) and later will have an eccentric front bearing and a single (double loop) cable and a new loop setting gear.

Earlier models can be changed if desired by using kit # 43973-G2 having a modified drum and bearing puller # 43973-P60.

Kit # 43973-P60

- \* 1 - 44367-P1 Loop Set Gear ( Black)
- c 1 - 44368-P1 Cable (45"/1.14m long)
- 1 - 44369-P1 Bearing
- 1 - 44370-P2 Cable Drum (P1 modified)
- 2 - 41846-P6 Washer
- 2 - 43693-P1 Screw (4/40 x .176 long)
- 2- 44259-P1 Washer (Special) Plastic
- \* Do not confuse with 43307-P1
- c Use 44368-P2 for Arc ( 49"/1.24m long)

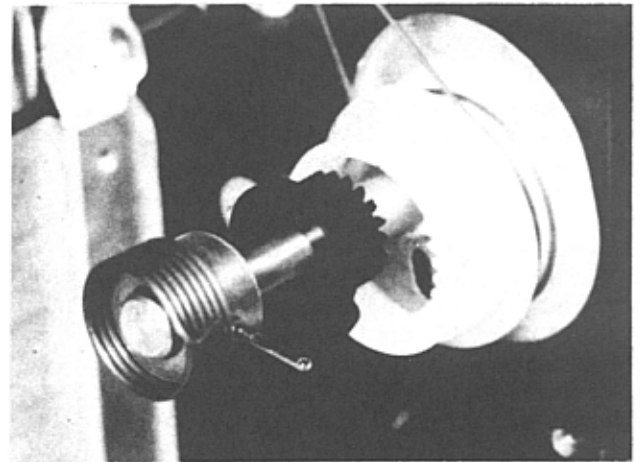


Figure 3-24. ECCENTRIC FRONT BEARING KIT

a. Change over instructions; Prior to Code M4AW

- (1) Remove front sprocket and feed clutch assembly
- (2) Pull old bearing using bearing puller # 43973-P60
- (3) Pull in new bearing #44369-P1, Slot should be as illustrated, down and slightly forward (13 to 17 )
- (4) Hand ream after assembly to 0.2505/2500" (6.363/6.376mm). On metric use adjustable hand reamer set to this dimension.
- (5) Press cable ball into cavity of cable drum, short end of cable must lay to the right. .... this is the rear cable. See diagram.

To hold cables after wrapping and before stringing, use a small heat clip.

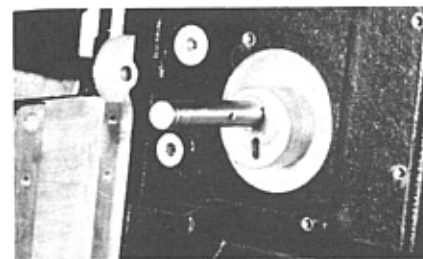


Figure 3-25. ECCENTRIC FRONT BEARING.

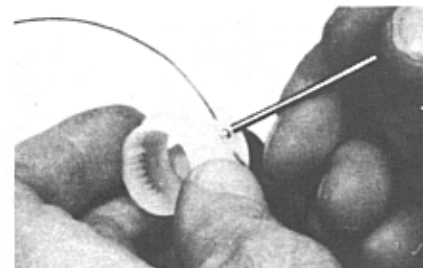


Figure 3-26. CABLE DRUM /CABLE.

## 20. Loop Setting Cable Adjustment.

Position the cable drum with the gear section located between 6 and 9 o'clock.

Align the right edge of the bottom tooth with the back edge of the bearing slot.

Hold the drum in position with a rubber band as illustrated, pull the inside cable (Short end) tight, wrap it counterclockwise, twice around the post on the Master Control Lever and secure it under the front screw and washer.

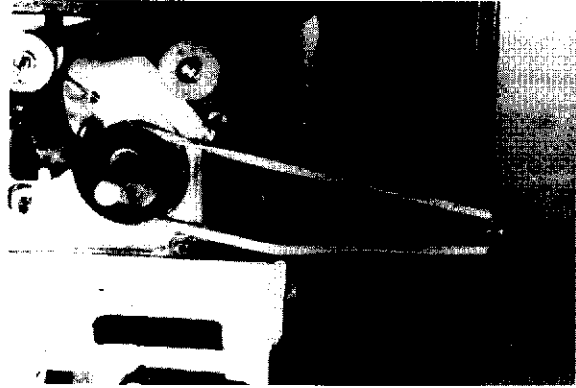


Figure 3-27. CABLE DRUM POSITION

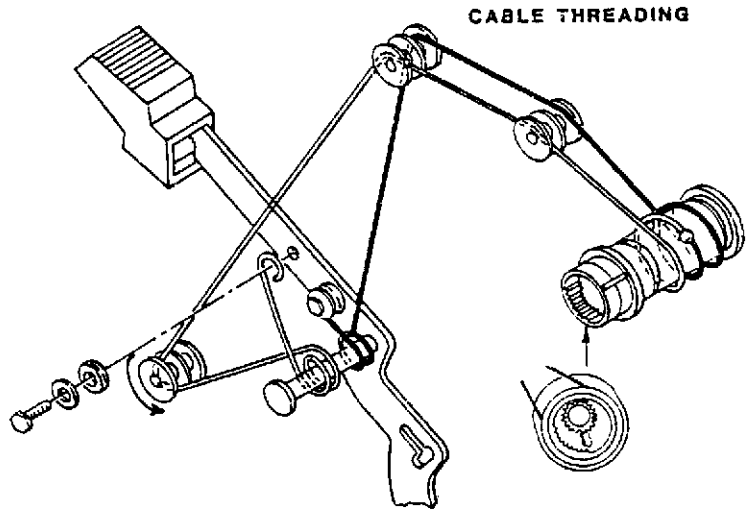
Thread the outside cable (Long end) as illustrated.

Wrap it clockwise, twice around the post on the Master Control Lever and secure it under the rear screw and washer.

Hang a claw arm (38041-G1) on the cable as shown and adjust the cable tension until the top edge of the claw arm is parallel with the bottom edge of the Master Control Lever.

Tighten the screws holding both ends of the cable to the Master Control Lever to 5.5 to 6.5 inch/pounds of torque and recheck the position of the claw arm.

Remove the rubber band from the cable drum and operate the Master Control Lever between the LOAD and PROJECT positions several times. In the LOAD position, the left edge of the bottom tooth of the cable drum gear should align with the front edge of the bearing slot. In the PROJECT position, the right edge of the bottom tooth should align with the back edge of the bearing slot. If not, readjust the cables.



## 21. Loop Setting Cable Requirement.

Hang a claw arm (38041-G1) on the cable as shown. The top edge of the claw arm should be parallel with the bottom edge of the Master Control Lever.

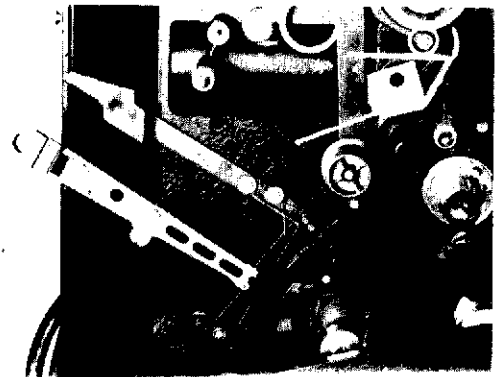


Figure 3-28. LOOP SETTING

Move control lever up and down. Note position of bottom tooth at right side of bearing slot. It must be approximately equal. This clearance will allow control lever to move about 1/4" before sprocket starts to rotate and sprocket will stop rotation when control lever is about 1/4" from top of run position. This gear clearance at each end of control lever travel disengages the loop set gear during Run and Rewind.

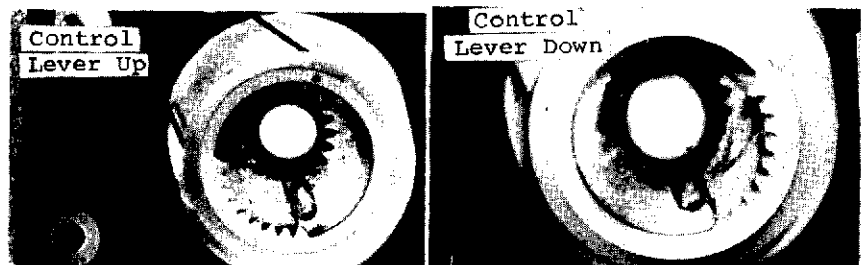


Figure 3-29. GEAR CLEARANCE.

## 22. LOOP SETTING GEAR AND ARBOR INSTALLATION

Lubricate the loop setting gear with a film of DC 44 grease (39470-P9).

Lubricate the clutch spring arbor with a drop of Teresso Instrument oil (39479-P8) and assemble as shown.

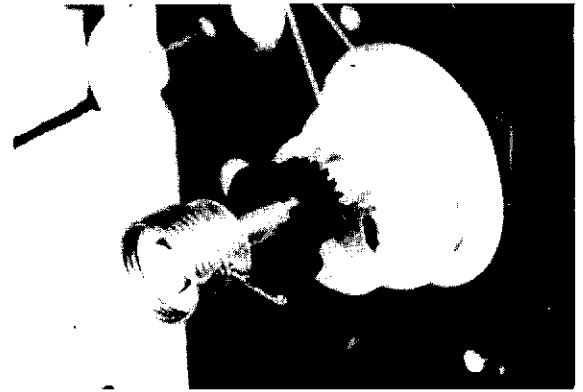


Figure 3-30. LOOP SETTING GEAR AND ARBOR INSTALLATION

The loop setting gear should turn smoothly in both directions.

Move the master control lever up and down several times after assembling each part. If binding occurs, the last part assembled is probably the cause.

Continue assembling the sprocket and film stripper and check for smooth operation of the Master Control Lever.

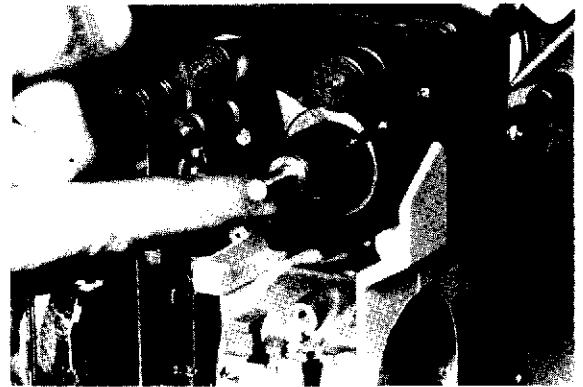


Figure 3-31. LOOP SETTING GEAR AND ARBOR OPERATION

## 23. REMOVAL OF TAKE-UP CLUTCH

Note; Liner 42952-P1 (DC 44 Impregnated ) may be used as replacement in the original gear; however, the kit (44335-G1) is preferred service replacement.

- a. Remove the motor and motor mounting plate to expose the take-up clutch for servicing.
- b. In its normal position, the roll pin which holds the upper end of the clutch arm to the reel arm shaft is difficult to remove.
- c. Remove the reel arm belt and place a block of wood under the arm as shown to hold it in a vertical position.

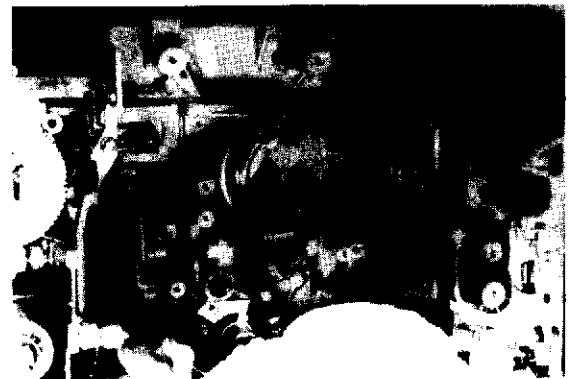


Figure 3-32. TAKE-UP CLUTCH

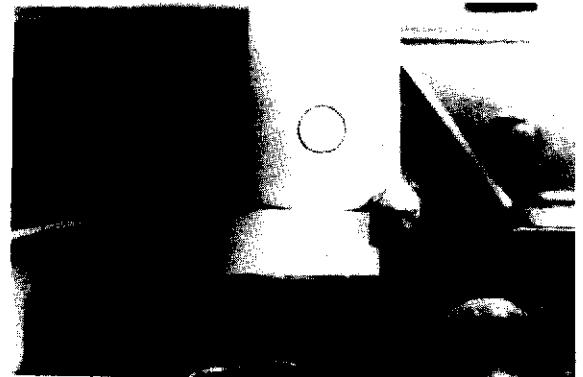


Figure 3-33. REEL ARM BLOCKED

d. Drive the roll pin out with a  $3/32$ " (2.5mm) pin punch.

e. Remove the upper end of the clutch arm from the reel shaft. Remove the reel arm. Clean the shaft and casting hole and relubricate with G. E. Versilube G-322L. (39479-P14)

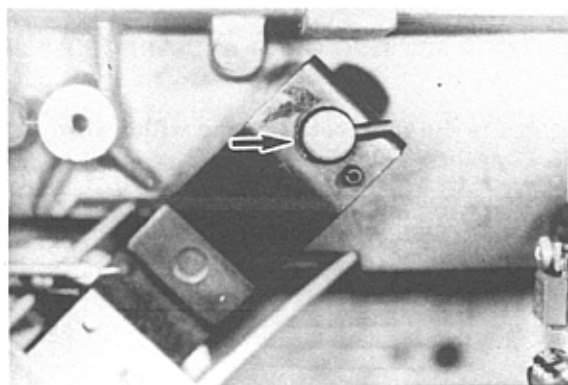


Figure 3-34. ROLL PIN IN POSITION

f. Pull the clutch hub (pulley) out of the take-up gear and push down on it to compress the bias spring and allow the hook of the rod to rise up in the slot.

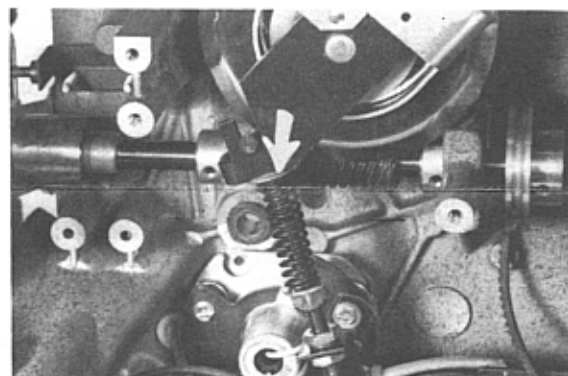


Figure 3-35. PUSH DOWN ON BIAS SPRING

g. As soon as the hook clears the slot, the clutch arm can be swung out and lifted up off the rod.

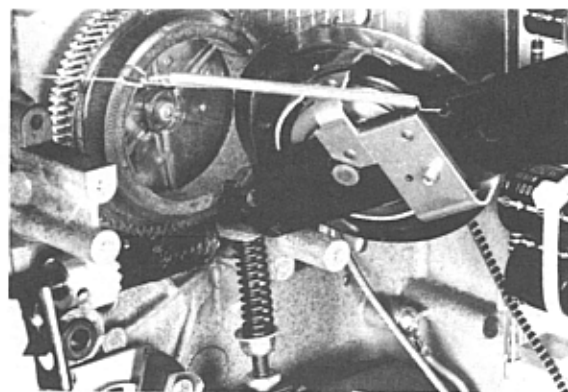


Figure 3-36. SWING CLUTCH ARM OUT

h. Clean the main shaft worm gear and the take-up gear with a clean, dry cloth or toothbrush. (DO NOT USE SOLVENTS ON THESE GEARS AS THEY WILL CRAZE OR CRACK).

j. Grasp the take-up gear and attempt to move it up and down. If noticeable movement is detected, the rear main casting bearing is worn and must be replaced. Remove the rear sprocket and take-up gear, press the old bearing out and a new bearing in and reassemble the sprocket and take-up gear.

k. Lubricate the worm gear and take-up gear with DC 44 grease (39479-P9) applied with a brush onto the teeth.

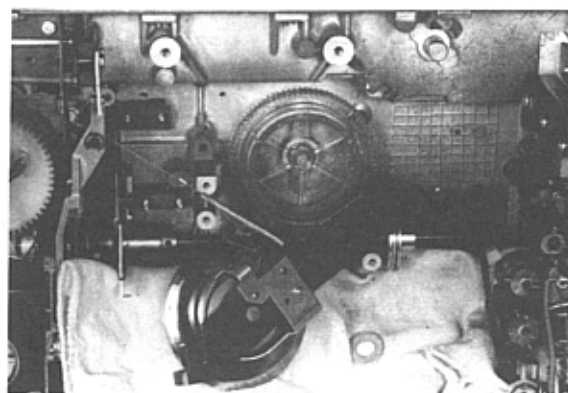


Figure 3-37. CHECK and CLEAN GEARS and BEARING

#### 24. TAKE - UP CLUTCH ARM SERVICING

- a. On projectors without the FAST FORWARD option, it is necessary to disassemble and thoroughly clean the take-up pulley and brake spring.
- b. Use a cotton swab saturated with Teresso Instrument Oil (39479-P8) to clean the pulley oilite bearing. **DO NOT IMMERSE THE BEARING IN SOLVENT.**
- c. Replace the brake spring and brake spring hub if deformed or scored.
- d. Lubricate the brake spring hub with four small drops of Teresso Instrument Oil.

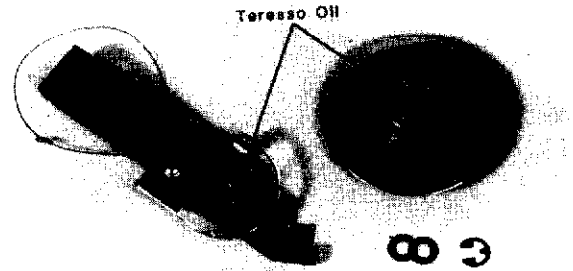


Figure 3-38. CLEAN and SERVICE CLUTCH ARM

#### 25. INSTALLATION OF CLUTCH LINER

- a. Grease impregnated felt liner (42952-P1)
  - (1) Replace grease impregnated felt liner. DO NOT try to reuse or relubricate
  - (1) Replace grease impregnated felt liner. DO NOT try to relubricate or reuse or substitute. Use only new factory supplied liner.
  - (2) Be sure ends butt and do not overlap.
- b. Green clutch liner
  - (1) Butt the two ends of the liner against the key inside the take-up gear.
  - (2) Form a slight belly in the liner opposite the key and push the liner into the take-up gear.
  - (3) Push out on the belly formed in step 2 and the liner will snap into correct position inside the gear.

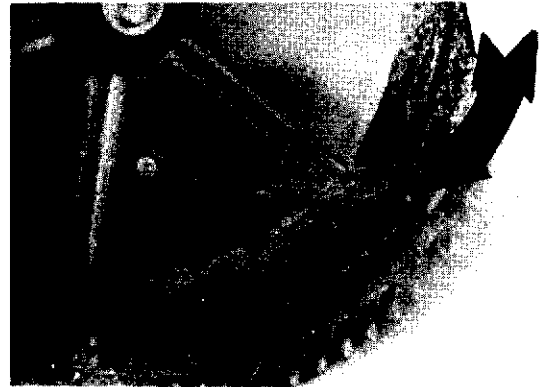


Figure 3-39. INSTALLATION OF CLUTCH LINER

NOTE: The liner may appear to be too long. However, it is not. **DO NOT CUT THE LINER TO MAKE IT SHORTER.**

#### 26. TAKE - UP CLUTCH REASSEMBLY

- a. Reassemble the take-up clutch and assemble it to the projector.
- b. Press a new roll pin in place making sure that it extends far enough to contact the roll pin on the take-up arm.

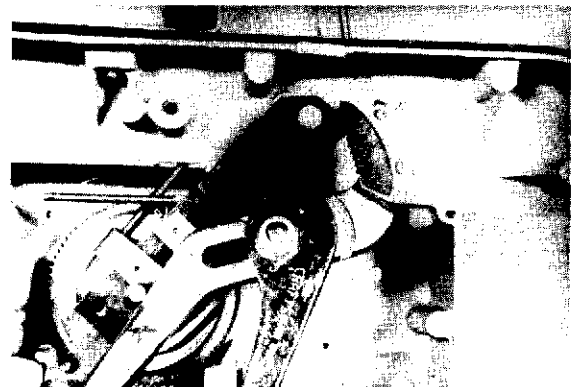


Figure 3-40. INSTALL ROLL PIN

## G. ADJUSTMENTS

### 1. Lens Holder Adjustment (See Figure 5-7)

a. Turn eccentric pins (29 and 33) outward to locate just below center. Loosen both toggle link nuts (28).

b. Set control lever at "load"; hold lens mount open and slide thread control link back. Tighten the rear toggle nut. Set control lever at "forward" and tighten front toggle nut.

c. Move control lever to "forward", adjust eccentric pin (33) upward only enough to kick off at end of the forward travel of the control pawl (20).

d. Move control lever to "load", adjust eccentric pin (29) only enough to kick off at end of the backward travel of control pawl.

### 3. DRIVE MOTOR BELT REQUIREMENT.

Reinstall the motor to the projector.

Hook the take-up tension gage to the motor drive belt as shown in the illustration and pull down on the gage.

Sight along an imaginary line which touches the bottom of the motor pulley and main shaft pulley while pulling down on the tension gage.

When the top of the gage wire touches this line, the gage should read 7 to 10 ounces.

### 4. DRIVE MOTOR BELT ADJUSTMENT

Back the lock nut away from the motor plate and adjust the belt tension nut for correct tension. Turn it counterclockwise to increase belt tension and clockwise to decrease tension.

Tighten the lock nut securely against the motor plate when adjustment is completed.

e. If eccentric pin (29) is set to high, pawl travel is restricted and the lens mount cannot be closed positively. If eccentric pin (33) is set too high, maximum opening of the lens mount cannot be obtained. Setting either pin too low will cause the control lever to catch on movement between "forward" and "load".

### 2. Pressure Plate Adjustment (See Figure 5-3)

a. Loosen two screws visible through the front of lens mount (25).

b. Close lens mount slowly, noting contact between pressure shoe and left edge (viewed from front) of the aperture plate (41).

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

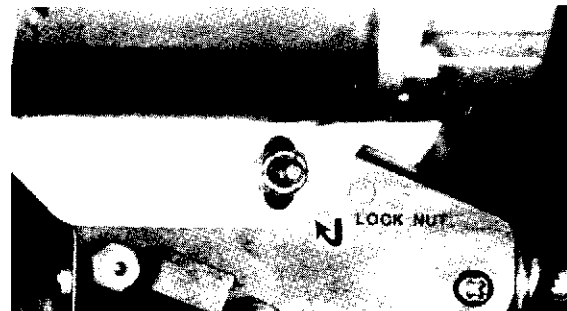
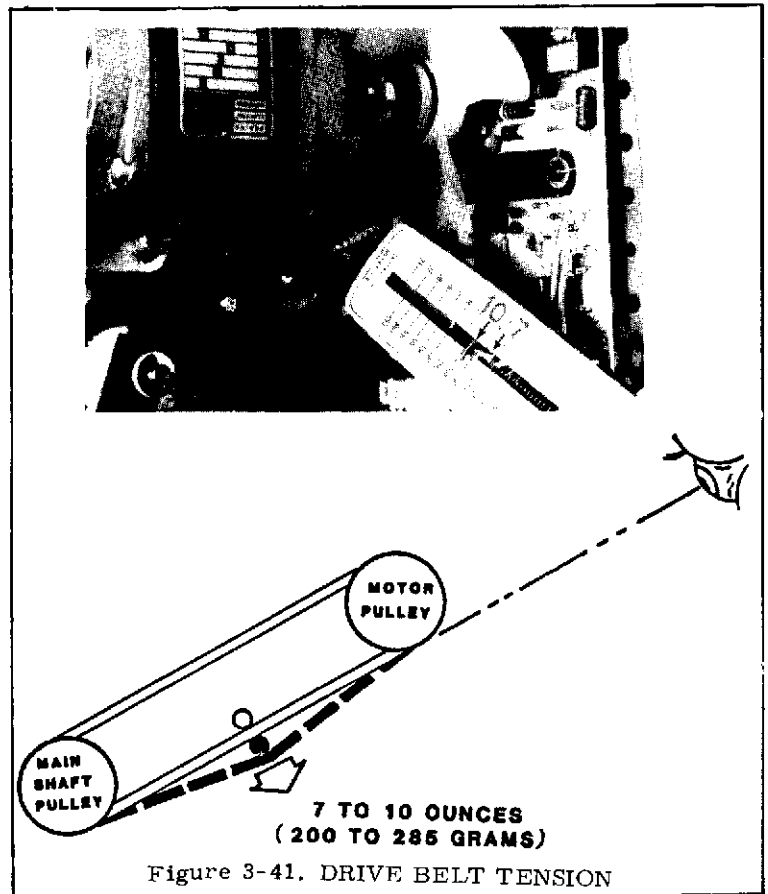


Figure 3-42. DRIVE BELT TENSION ADJUSTMENT

## 5. REWIND BRAKE REQUIREMENT

Before attempting any take-up or lift-off adjustments, check the operation of the rewind brake (on models without Fast Forward).

Move the Master Control Lever to LOAD.

Viewed from the motor side of the projector, the take-up reel arm belt should move freely in a counterclockwise direction but bind or grip in a clockwise direction. The feed and rewind arm belt should move freely in both directions.

Manually operate the rewind solenoid.

The take-up reel arm belt should move freely in both directions and the feed and rewind arm belt should bind in the counterclockwise direction but move freely in the clockwise direction.

If the above requirements are not met, make sure the brake cable is on the pulleys. If so, adjust the brake cable by loosening the clamp screw on the solenoid paddle and lengthen or shorten the cable as required.

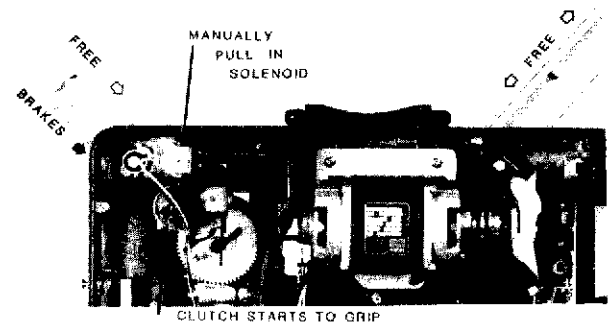


Figure 3-43. BRAKE REQUIREMENTS

## 6. TAKE-UP ADJUSTMENT

Take-up tension is adjusted with the nut directly under the bias spring.

Place an empty 400-foot reel on the take-up arm.

Thread the projector. (Film may be pulled from the front reel directly to the rear sprocket, bypassing the normal film path if desired.)

Insert the film tension gage (T-38000-S) as illustrated with the idler directly above the last roller of the film path. Hold the gage at about a 30° angle, operate the projector in FORWARD PROJECT. The gage should read 4 to 6 ounces with 25 to 40 feet of film on the take-up reel. Favor the low side of this requirement with the blue or green clutch liner.

Adjust the take-up tension adjusting nut up to increase tension and down to decrease it.

If difficulty is experienced meeting the take-up adjustment requirement, perform the lift-off adjustment and try the take-up adjustment again. If the take-up requirement is met, it is not necessary to do the lift-off adjustment.

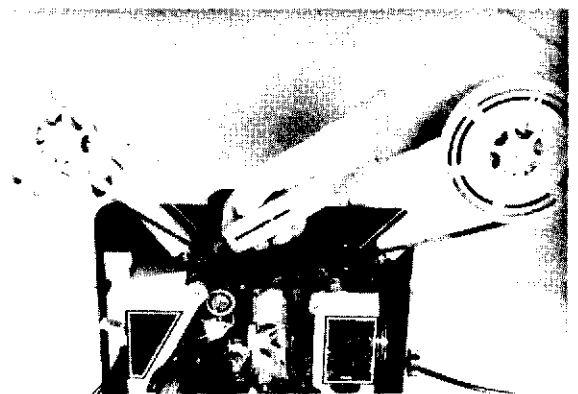


Figure 3-44. TAKE-UP TENSION MEASUREMENT

## 7. LIFT-OFF THEORY AND ADJUSTMENT

The lift-off adjustment establishes the proper point of contact of the take-up clutch pulley with the take-up clutch liner. It is accomplished by adjusting the bottom two nuts on the threaded rod so the pulley exerts just the right amount of pressure on the liner. Too little pressure will result in erratic take-up, and too much pressure may break the take-up gear.

Mount an empty 400-foot reel on the take-up arm, move the master control lever to PROJECT and run the projector in FORWARD.

Turn both bottom nuts up until the 400-foot reel just stops turning. Make sure the flat plate always remains firmly trapped between these two nuts.

Mark one face of the bottom nut for reference and turn the bottom nut down three turns. Turn the top nut down until it snugs tightly against the flat plate. This establishes correct lift-off.

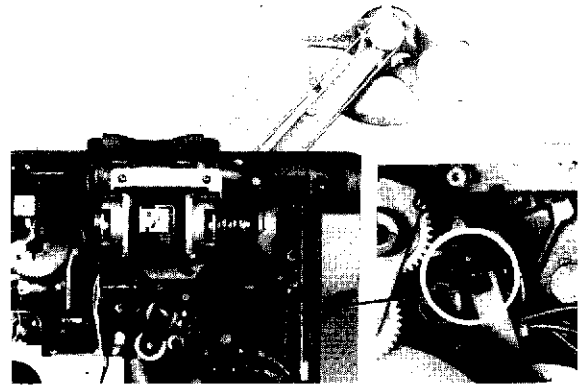


Figure 3-45. LIFT-OFF ADJUSTING NUTS

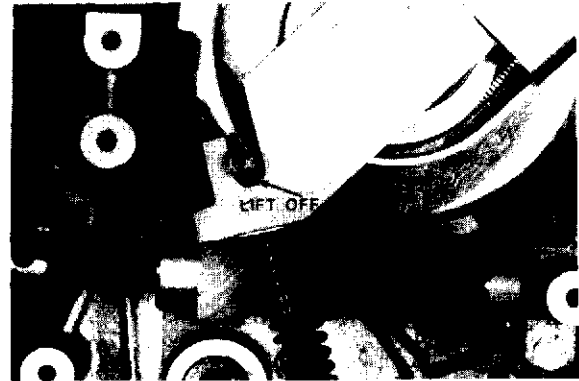


Figure 3-46. LIFT-OFF

## 8. FAST FORWARD DRIVE REQUIREMENT

Place an empty 400-foot reel on the take-up arm. Connect the Take-up Film Tension Gage (T-38000-S) to this reel about 3" out from the center by means of a paper clip or other wire suitable for this purpose.

Run projector in "FAST FORWARD" mode. The gage should read 13 to 18 ounces.

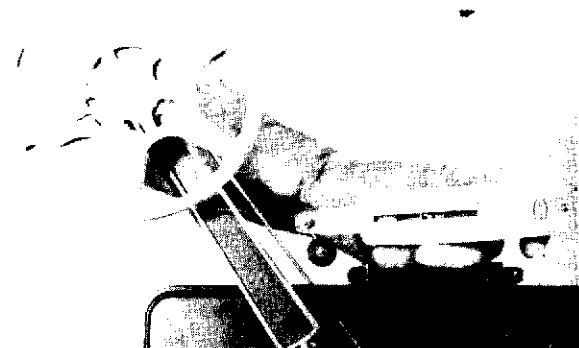


Figure 3-47. FAST FORWARD DRIVE MEASUREMENT

## 9. FAST FORWARD DRIVE BELT ADJUSTMENT

Loosen the screw holding the Adjusting Plate and move the plate either up to decrease torque or down to increase torque. Tighten the screw.

Note: If this fails to change the torque, make sure the FAST FORWARD Solenoid is causing the FAST FORWARD clutch to engage. As a last resort, it is permissible to adjust the lift-off setting (the double nuts on the bottom of the take-up clutch threaded rod). Turn these nuts up 1/2 turn.

NOTE: On projectors prior to code B3S, torque should provide 12 to 16 ounces scale reading. If too high, turn double nuts down 1/4 to 3/4 turn to obtain a Fast Forward torque within specified limits.

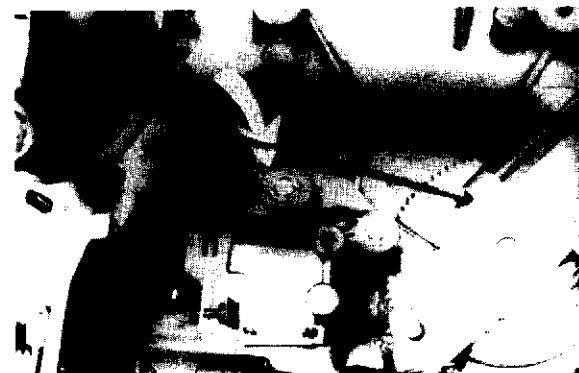


Figure 3-48 FAST FORWARD DRIVE ADJUSTMENT



## 10. SHUTTER AND CAM OPERATION

The shutter and cam are locked together and require no timing.

The cam moves the claw arm up and down (stroke) and in and out of the film sprocket holes (protrusion).

Up-and-down movement occurs as the cam follower on the front of the claw arm follows the radial (round) surface of the cam.

In-and-out movement occurs as the cam follower Button (see arrow) on the back of the claw arm follows the axial surface (wobble plate) of the cam.

The pivot (lower right) is used to adjust stroke, and repositioning of the shutter and cam assembly on the main shaft is what determines protrusion.

Tools required for adjusting stroke and protrusion are:

- a. Protrusion Gage G10-38000 (Left)
- b. Pivot Adjusting Tool ST-5884 (Upper Left)
- c. Stroke Gage ST-5880 (second from left)
- d. .050" Allen wrench
- e. 1/16" Allen wrench
- f. 1/4" - 3/16" open-end wrench
- g. Continuity Tester

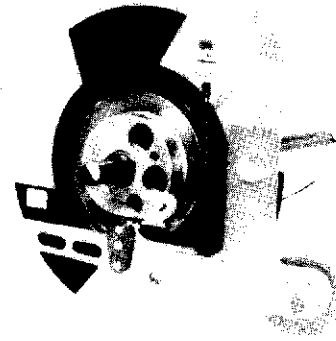


Figure 3-49. SHUTTER AND CAM

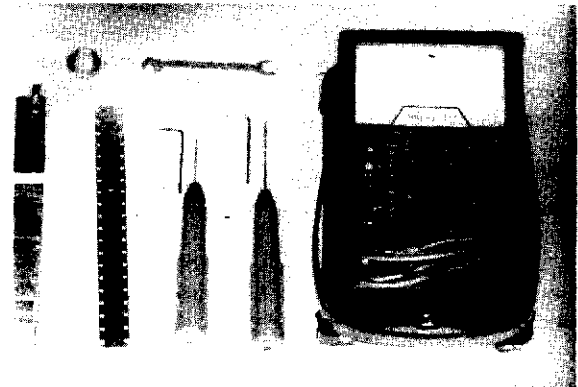


Figure 3-50. STROKE AND PROTRUSION TOOLS

## 11. SIDE CLEARANCE ADJUSTMENT

Before attempting any adjustments, manually rotate the inching knob to make sure the Claw Arm Pins do not strike the sides of the Aperture Plate Claw Slot.

At the bottom of its travel, this Pin will be nearer to the outside edge of the Aperture Plate Slot.

To observe this condition, watch the back of the aperture plate as the Claw Arm is cycled slowly through its stroke by turning the main shaft.

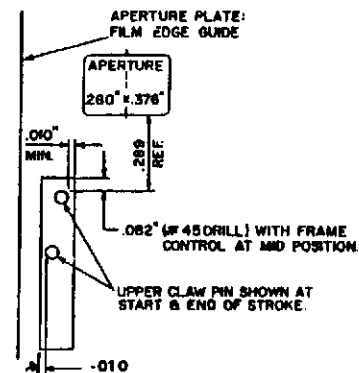


Figure 3-51. SIDE CLEARANCE

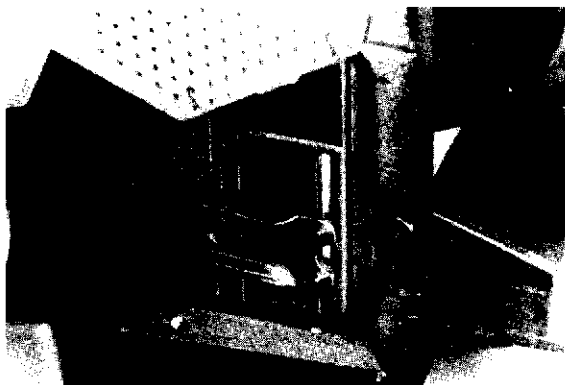


Figure 3-52. CLAW ARM PINS

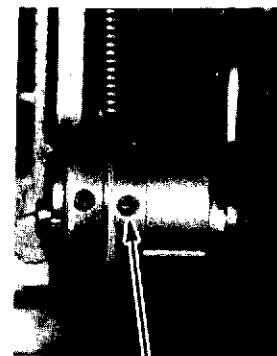


Figure 3-53. CLAW ARM ADJUSTING SCREWS

To adjust, loosen the setscrew in the Claw Arm with the .050" Allen wrench and move the oilite bushing so the two distances are equal.

## 12. CLAW PIN PROTRUSION REQUIREMENT.

a. Pin Protrusion is the distance which the Claw Pins extend through the aperture plate, and is one of the most critical adjustments on all Telex 16-mm Projectors. If protrusion is not correct, the operation of the machine may be erratic even though all other adjustments are correct.

b. The end of the Claw Pin must extend .035" to .040" beyond the film rail of the aperture plate.

## 13. CLAW PIN PROTRUSION MEASUREMENT

a. Raise the Master Control Lever to PROJECT position.

b. Move the Master Control Lever down and open the lensmount just enough to insert the gage. Then raise the control lever just enough to hold the gage snugly in place.

NOTE: Do not insert the gage and then close the lensmount. The lensmount may pop open and not hold the gage properly.

c. Connect the screw on the Protrusion Gage to one side of the continuity meter. Connect the other side of the continuity meter to the chassis of the projector (connecting point must be free from paint, dirt or grease).

d. Rotate the Inching Knob clockwise and observe the Claw Arm. Stop rotating the Inching Knob when the Claw Arm Pins enter the slot in the Aperture Plate and start down. (The edge of the Shutter blade will be just below the Aperture).

e. Push the Claw Arm toward the Aperture Plate and gently push the Gage down until the bottom of the gage touches the top pin of the Claw Arm. (The ohm meter or continuity tester will show continuity).

f. Release the Claw Arm and reference the position of the red and yellow reference tapes to a point on the projector. Slide Gage down 1/2 width (1/4 width with new style gage) of either tape. The bottom step of the gage should be opposite the top pin of the Claw Arm. (Figure A)

g. If the meter or tester shows continuity, protrusion is more than .040" and should be adjusted. If no continuity is shown, gently push gage down one width of tape. The top step of the gage should be opposite the top pin of the Claw Arm. Continuity indicates correct protrusion between .035" and .040". No continuity indicates protrusion is less than .035" and should be adjusted. (Figure B)

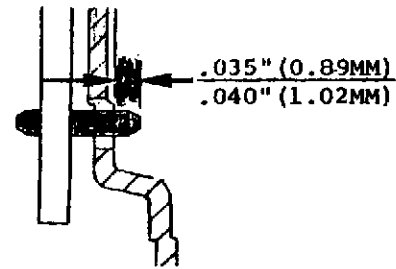


Figure 3-54. CLAW PIN PROTRUSION



Figure 3-55. CLAW PIN PROTRUSION MEASURING

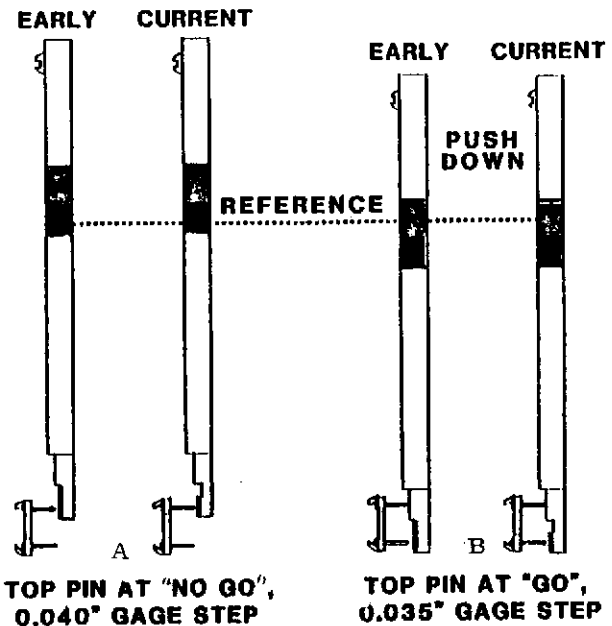


Figure 3-56. CLAW PIN STEP GAUGE READING

#### 14. CLAW PIN PROTRUSION ADJUSTMENT.

- a To adjust, loosen the "W" point screw and remove the outer oval point screw.
- b Position the gage with the bottom step aligned with the top pin of the Claw (Claw must be positioned as in step (d) above). Grasp the Shutter and loosen the inner oval point screw.
- c Move the shutter on the Main Drive Shaft while observing the meter or tester. When continuity is established, allow the shutter to move back to the point of just breaking continuity and tighten the inner oval point screw on the flat of the shaft. Rocking the shutter slightly while tightening this screw will insure proper alignment on the flat of the shaft.
- d Push the gage down as in step (g) above and check for continuity. If no continuity exists, repeat this entire process until no continuity exists on the lower step of the gage but continuity does exist on the upper step.
- e Tighten the "W" point screw and recheck the requirements of step (d) above. If tightening the "W" point screw results in failure to meet these requirements, repeat steps (c) and (d) until tightening of the "W" point screw no longer causes failure.
- f Tighten the "W" point screw and the inner oval point screw to 140 inch ounces of torque. Replace the outer oval point screw to 140 inch/ounces of torque. (If a torque wrench is not available, tighten the screws until the allen wrench shaft starts to twist.

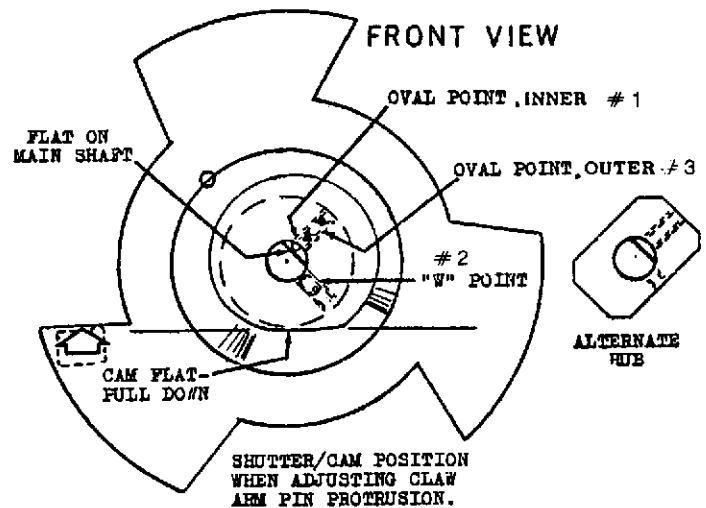


Figure 3-57. SHUTTER AND CAM POSITION



3-58. ADJUSTING SHUTTER AND CAM

#### 15. LENSHOLDER STOP PIN THEORY

The Lensholder Stop Pin limits the distance that the bottom of the pressure shoe moves away from the Aperture Plate when the Loop Restorer resets the lower loop. This should be checked and reset if necessary each time preventive maintenance or overhaul is performed on the projector.

#### 16. LENSHOLDER STOP PIN GAGE

Lay the Protrusion Gage (G10-38000) on a flat surface with the protrusion measuring steps facing up.

With a set of callipers or a depth gage, measure from both steps to the flat surface. Select the step which measures  $.138 \pm .003$ " for the lensholder stop pin adjustment.

If neither step measures  $.138 \pm .003$ ", build up the back side of the gage with tape until the correct thickness is obtained.

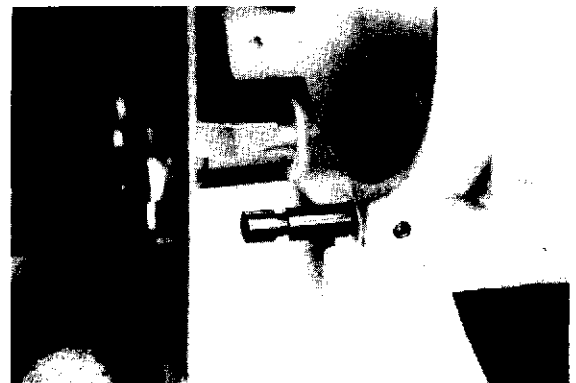


Figure 3-59. LENSHOLDER STOP PIN

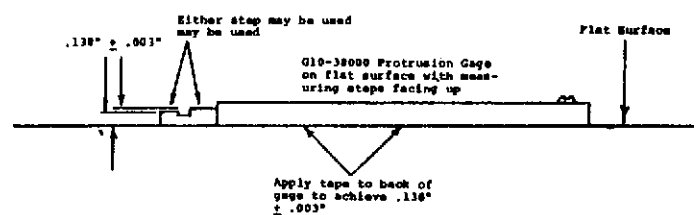


Figure 3-60. LENSHOLDER STOP PIN GAGE.

## 17. LENSHOLDER STOP PIN ADJUSTMENT

Move the Master Control Lever to LOAD and remove the lensholder cover.

Rotate the inching knob until the Claw Arm pins have been completely retracted from the Aperture Plate.

Insert the Protrusion Gage in the Aperture Plate with the measuring steps facing the lensholder stop pin and the  $.138'' \pm .003''$  step directly in line with the pin.

Move the master control lever to PROJECT.

Loosen the Stop Pin Setscrew and adjust the Pin until it just touches the  $.138'' \pm .003''$  step. Tighten the screw.

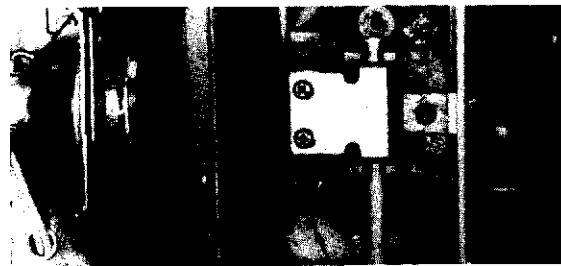


Figure 3-61 LENSHOLDER STOP PIN ADJUSTMENT.

## 18. PRESSURE SHOE REQUIREMENT

Move the Master Control Lever to LOAD AND assemble the Lensholder Cover with the Pressure Shoe.

Place an Index Card below the Pressure Shoe and sight down the edge of the Pressure Shoe as the Master Control Lever is moved toward PROJECT.

The Pressure Shoe should enter the aperture plate channel without striking either side. The outside edge clearance should be  $.005''$  to  $.010''$ .

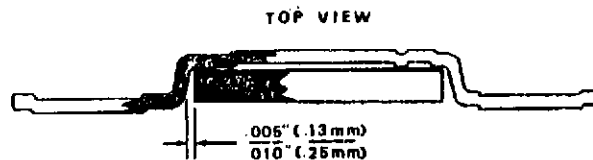


Figure 3-62 PRESSURE SHOE

## 19. PRESSURE SHOE ADJUSTMENT.

Adjust by loosening the two socket head screws which hold the "C" carrier to the lensholder and moving the carrier to obtain the  $.005''$  to  $.010''$  dimension. (Loosen the screws just enough to permit carrier movement with considerable resistance. The carrier should not be too loose.)

Run the projector forward with film. Move the carrier to obtain quietest operation and steadiest picture. These two requirements will generally occur simultaneously.

Reverse project. Readjust, if necessary, for quiet, steady operation. Recheck (b) above.

Tighten the carrier.

Move the control lever up and down several times to be sure that the pressure shoe seats properly and recheck with film.

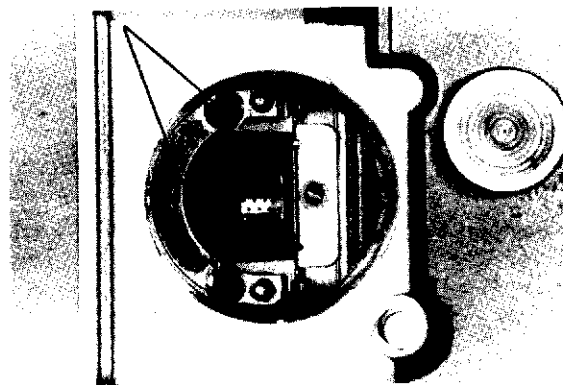


Figure 3-63. ADJUSTING PRESSURE SHOE.

## 20. INTERLOCK ADJUSTMENT

- a. Adjust solenoid (SO-2) by moving solenoid in or out until outer pin on clutch assembly (40, fig 5-2) hits bottom. After adjustment, solenoid must not buzz or hum.
- b. Bend interlock wire (p/o 7, fig. 5-2) to achieve mechanical main lever interlock. If solenoid (SO-2) begins to hum or buzz, readjust solenoid (SO-2).
- c. Adjust solenoid (SO-1) so that supply belt ( 13, fig 5-2) begins to slip on pulley. Move solenoid approximately  $1/16''$  . After adjustment, solenoid must buzz or hum.

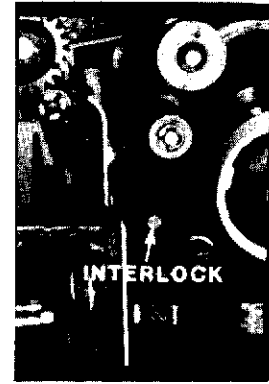


Figure 3-64. INTERLOCK PIN

## 21. PRESSURE ROLLER ARM ADJUSTMENT

Adjust the pressure roller to lie flat and parallel against the sound drum when the threading control lever is in FORWARD position.

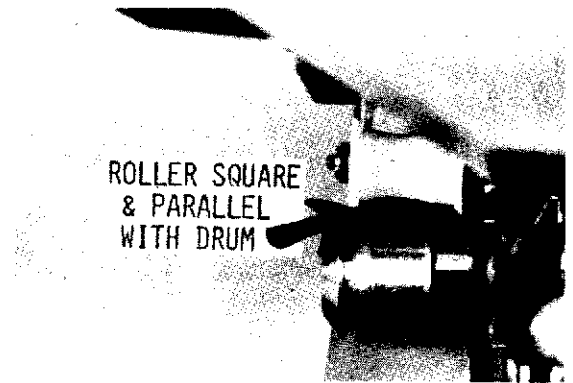


Figure 3-65. PRESSURE ROLLER ALIGNMENT

## 22. REWIND ADJUSTMENT

- a. Move solenoid forward ( in ) and apply solenoid holding clamp ( T-43411-G1A ).
- b. Loosen two screws and rotate actuator within actuator assembly ( 9, fig. 5-2 ) until clutch actuator paddle is visually vertical; retighten actuator screws.
- c. Turn projector on and apply thumb pressure at feed arm pulley. Turn adjusting screw of holding clamp counterclockwise until feed belt slips on pulley of feed arm.
- d. Insert solenoid stroke gage ( SS-327 ) between solenoid armature and solenoid wall to limit armature travel. Clutch should just start to grab.
- e. Remove gage, if solenoid buzz is heard, turn holding clamp adjusting screw clockwise until buzz stops. Recheck with solenoid stroke gage.

### NOTE

If actuator assembly is disassembled the actuator must be reassembled to permit clutch spring to ride against sloped surface of actuator lug. The clutch will not operate if the actuator is incorrectly oriented.

- f. Adjust solenoid cable ( 6, fig. 5-8) only when solenoid is energized in rewind mode. Cable should be sufficiently taut to disengage take-up spindle and permit it to rotate in either direction. When de-energized, solenoid should slacken cable sufficiently to

lock take-up clutch and permit the take-up spindle to rotate in one direction only.

## 23. PRESSURE ROLLER AND SPROCKET CLEARANCE

- a. Adjust eccentric ( 7, fig. 5-3 ) so that inside roller, with light finger pressure applied, will just touch sprocket but firm pressure will cause slight rotation of sprocket.
- b. Adjust eccentric ( 17, fig. 5-8) so that bottom roller touches sprocket, but gap in link lever does not close.

## 24. SWITCH ADJUSTMENTS

- a. Switches S-3 and S-7 should be adjusted to close in LOAD position and open in PROJECT positions.
- b. Switch S-4 should be adjusted to close in LOAD and PROJECT positions and open between positions.

## 25. PROJECTION LAMP ADJUSTMENT (Figure 5-5)

Bend Z bracket ( part of 15 ) to center lamp image when projected approximately 3 inches in front of lens aperture.

## 26. PROJECTION LENS

Clean and replace the projection lens.

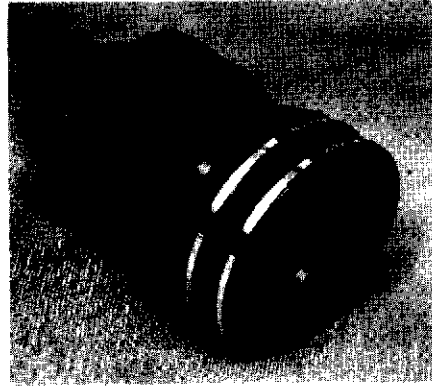


Figure 3-67. PROJECTION LENS

## 27. BUZZ AND SOUND OPTIC FOCUSING

- a SMPTE P16-BT Buzz Track film (45191-G3) is used to adjust the lateral position of the front pressure roller with respect to the sound drum.
- b SMPTE P16-SF-A 7000 Hz sound focusing film (Singer 45191-G2) or SMPTE P16-SF-B 5000 Hz sound focusing film Telcx 45191-G1) is used to adjust the focusing of the sound optic and the azimuth of the sound optic.
- c These two adjustments are interdependent. If difficulty is experienced in making either of these adjustments, check the other one and adjust it as necessary.

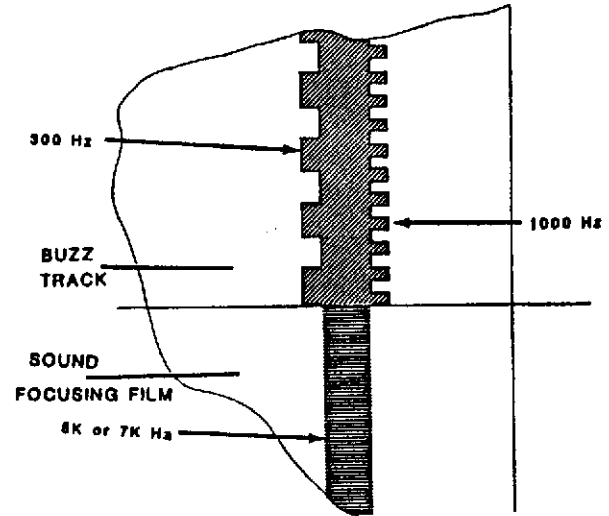


Figure 3-68. BUZZ TRACK FILM

## 28. SOUND OPTIC FOCUSING ADJUSTING

- a Cut two strips of 7000 Hz sound focusing film about 40" long. SMPTE P16-SF-A, Telcx P/N 45191-G2).
- b Splice them together to form a closed loop with the emulsion side of one strip on the outside circumference of the loop and the emulsion side of the other strip on the inside circumference of the closed loop.
- c Thread this loop in the projector and adjust the Tone Control to its maximum right-hand position.
- d Connect an AC Voltmeter across the speaker terminals and set the meter range switch to read 50 volts full scale minimum.
- e Run the projector Forward and adjust the Volume Control for comfortable listening level. Adjust the voltmeter range scale for a reading between 1/2 scale and full scale.

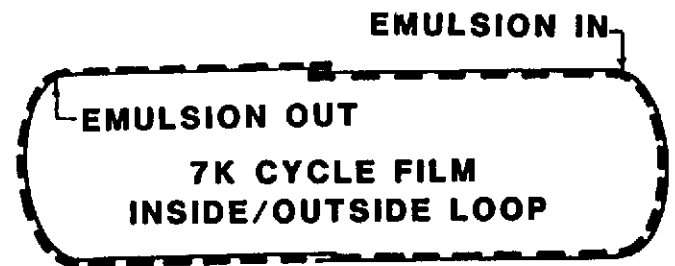


Figure 3-69. 7000 Hz. SOUND FOCUSING FILM

**Requirement 1:** Meter readings from both sections of the loop must be within 3 db of each other.

If the meter used does not have db scales, set the Volume Control so one section of the loop produces one of the Set Value voltage readings shown in the Chart and check that the other section of the loop meets the Allowable Deviation Requirements.



Figure 3-70. CHECKING SOUND FOCUSING FILMS

If this requirement cannot be met, proceed to Step f. Otherwise, disconnect the meter and proceed with the "Buzz" adjustment.

Loop Section I Set Value	Loop Section II Allowable Deviation	
	Maximum Reading	Minimum Reading
.775 VAC	1.10 VAC	.54 VAC
2.450 VAC	3.45 VAC	1.73 VAC
7.750 VAC	10.95 VAC	5.40 VAC

f. Loosen the Sound Optics Setscrew and remove the Sound Optics. It may be difficult to remove due to the wedging action of the nylon plug used to lock it in place. Rotating it back and forth while pushing up on it will aid in its removal. DO NOT pry up on the bottom of the cartridge as this may damage the bottom lens. Inspect bottom element for damage.

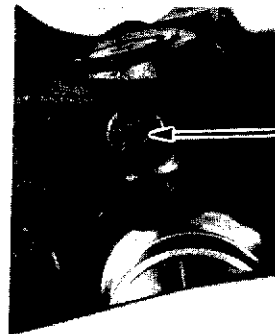


Figure 3-71. SOUND OPTICS ADJUSTING SCREW

g. Turn the setscrew as though tightening. This will force the nylon plug out of the hole. Be careful to prevent the plug from falling into the projector.

h. Remove the setscrew. Insert a NEW NYLON PLUG (38162-P1) and start the setscrew into the threads. After cleaning the top and bottom lenses of the optic, insert it in the projector and tighten the setscrew until it is held in place but can be turned and moved up and down easily. Be careful to prevent the optic from dropping onto the sound drum as this may damage the bottom lens.

Note: You may find it more convenient to replace the nylon plug and setscrew with a new NYLON Tip Setscrew (45209-P1).

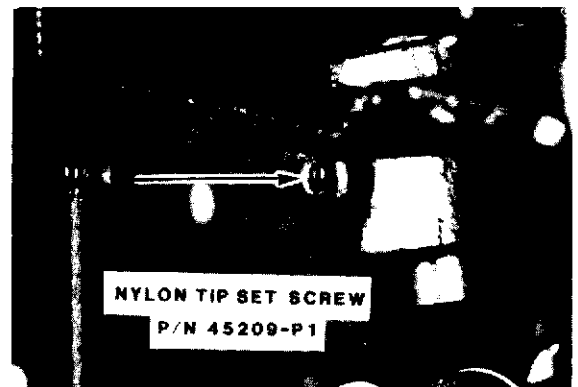


Figure 3-72. REMOVING SOUND OPTICS SETSCREW

j. Run the projector in FORWARD and focus the Sound Optics Cartridge by moving it up or down while rotating it back and forth until both requirements of Step (e) above are met. Tighten setscrew VERY tight when adjustments are complete.

Note 1: Use of Tool T-43680-G1 might make focusing of the Sound Optic more convenient. To use the tool, attach the ring portion to the optic and clamp the adjusting rod portion to the lamp-house platform of the main casting.

Note 2: No attempt should be made to remove the lens elements. If difficulty is encountered meeting the above requirements and the Sound Optic is suspected, replace the entire cartridge.



Figure 3-73. ADJUSTING SOUND OPTICS

## 29. BUZZ ADJUSTMENT

Thread a continuous loop of "BUZZ" track film (SMPTE-P16-BT) (45191-G3) in projector and set the Tone Control to its maximum right-hand position. Set the Volume Control for comfortable listening.

Run the projector Forward and adjust the BUZZ adjusting nut until no sound is heard or until the high and low frequencies are heard with equal volume. (There is a Buzz Track included as part of the Jiffy Test Film SMPTE-P16-PP).

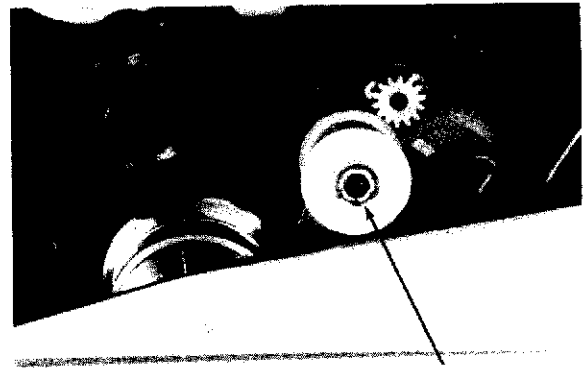


Figure 3-68. ADJUSTING BUZZ

## 30. FLYWHEEL DRIVE ADJUSTMENT

To make the flywheel drive adjustment more positive, the following improvements have been made, Starting with Date Code E4AL.

- Replace washer 43620-P9 with friction washer 43260-P11, assembled with shiny side out.
- Replace washer 40627-P21 with washer 38500-P12A 38500-P12A
- Replace the retaining ring 251-11-1 or 250-9-1 with ring 251-19-1.

\* After assembling steel washer, pull pulley outwards to flatten and press cork washer against steel washer.

c Note: This assembly with nylon washers should be updated by using cork and steel washers as above.

\*\* Note: Early Models, (Prior to Date Code F3W) have oilite bearings, use 44335-G1 consisting of these five parts.

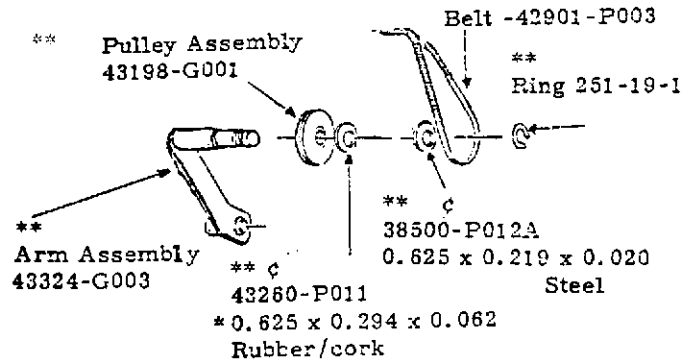


Figure 3-69. REPLACING FLYWHEEL DRIVE PARTS

### CHECK OPERATION AS FOLLOWS

- No film threaded, projector level and control lever up.
- Switch between forward and reverse operation.
- Observe flywheel - it must drive in reverse only.
- Elevate front of projector full lift of elevation control, plus 2 inches (total of 5 inches).
- Switch between forward and reverse.
- Observe flywheel - it must function same as when level (Step 3 above).

## 31. FLYWHEEL BELT POP-OFF

If you experience flywheel belt pop-off, check small pulley on main shaft and move forward or backward to position so that belt runs perpendicular to main shaft. Then add stop plate sketched below, this plate will limit swing of flywheel drive pulley so that the initial start will not cause a bounce to the rear and throw the belt off pulleys.

NOTE: Dress exciter lamp wires away from moving parts when operating controls from forward to reverse.

NOTE: Take-Up Clutch adjustments must be made prior to the following.

- Loosen bottom nut (1/4 turn) on take-up arm.
- Using long nose pliers in notch of stop, you can slide stop back or pliers at back end of stop will slide it forward.
- Observe 1/8 to 1/16 inch (1.6 to 3.2mm) clearance with projector operating in reverse project mode.

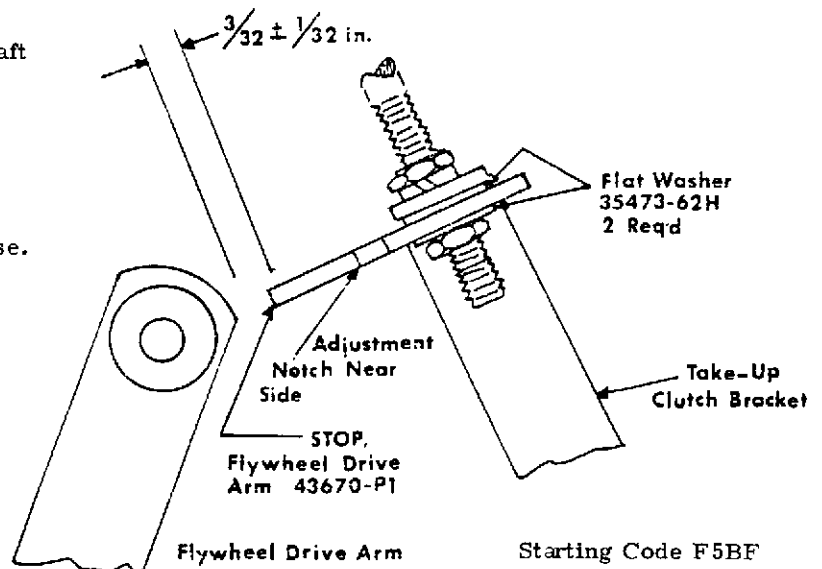


Figure 3-70. Adjustment of ARM STOP 43670-P1



### 32. REASSEMBLY OF CLAW ARM TO PROJECTOR

**Note:** Extreme care should be exercised during this procedure to insure that the pins on the Claw Arm are not allowed to hit the aperture plate or any other part of the projector, causing damage to them.

- a. Apply DC 44 grease (39479-P9) to the Pin (12) and stick the Pin in place on the Claw Arm (13) making sure the notch lines up with the hole in the Claw Arm (13).
- b. Apply DC 44 grease to Rod (1) threads.
- c. Hook Spring (15) onto the Claw Arm (13) and insert the Claw Arm (13) into the projector between the Framing Arm (20) and the Shutter and Cam Assembly .
- d. Lubricate both sides of Washer (17) with FS-1290 lubricant (39479-P4).
- e. Assemble Pivot (18), Washer (17), Claw Arm (13), Bushing (8), Washers (11) and (10) and Nuts (9).
- f. Tighten Nuts (9) for .001" end play and coat Nuts with Blue Glyptal (39490-P1). The outside Nut is a jam nut to prevent the inside nut from turning off the Pivot shaft.
- g. Rotate the Pivot (18) so the Eccentric Pin is between 6 and 7 o'clock when viewed from the front of the projector. Tighten the Pivot Setscrew (19).
- h. Rotate the Bushing (8) so its circumference lines up with the circumference of the Pivot (18) and the groove in its side is slightly below the groove in the side of the Pivot (18). Tighten the Claw Arm Setscrew (14).
- j. Gently push the Shutter and Cam Assembly forward while pushing down on the Claw Arm (13) making sure the cam follower on the Claw Arm slides under the Cam. Tighten the Setscrew (#1 in the Shutter and Shaft Alignment insert of Figure 3-57) on the flat of the main drive shaft. (See Step 9 under Reassembly of Main Shaft.) Make sure the Claw Arm (13) is not hitting the aperture plate.
- k. Hook the top of the Claw Arm Spring (15) on the Framing Arm (20) being very careful that the cam follower on the Claw Arm contacts the radial surface of the Cam.

**Note:** Be very careful not to damage the Claw Arm pins.

- l. Make sure Pin (12) is trapped in place by Spring (15).
- m. Perform all Claw Arm Adjustments - Side Clearance, Pull-down Stroke, Framing and Pin Protrusion.

### 33. CLAW ARM ADJUSTMENTS

#### SIDE CLEARANCE PULL-DOWN STROKE.

**Note:** These two adjustments are interdependent and must be adjusted at the same time. If either one is adjusted, the other must be checked and adjusted as necessary until requirements for both can be met.

A good starting position for the Pivot (18) (Figure 3-71) places its eccentric pin at about 7 o'clock when viewed from the front of the projector. (See Figure 3-75) The notch in Bushing (8) should be slightly below the notch in Pivot (18) so an imaginary line drawn across the top of the Bushing notch aligns with the bottom of the Pivot notch.

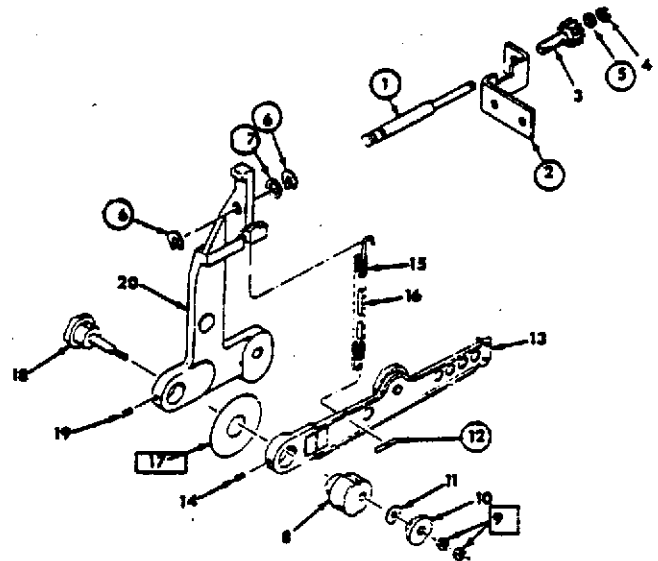


Figure 3-71. CLAW ARM ADJUSTMENTS

Before attempting any adjustments, manually rotate the inching knob to make sure the Claw Arm pins do not strike the sides 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 (Figure 3-72). At the bottom of its travel, this Pin will be nearer the outside edge of the Aperture Plate Slot. Loosen Screw (14) and adjust Bushing (8) (Figure 3-71) so these two distances are equal. (Removing the Lamphouse Cover and viewing the Pins from behind the Aperture Plate aids in this adjustment.)

- a. Thread an old film in the projector (do not use a good film for this adjustment) and adjust the Framing Knob to eliminate any frame lines at the top or bottom of the projected image with the projector running in FORWARD. If excessive noise results when the Framing Knob is moved, stop the projector and check the location of the Claw Arm Pins in the sprocket holes of the film. When Framing is correct, the Top Claw Arm Pin should be the same distance from the inside edge of the sprocket hole at the top of its stroke as it is from the outside edge of the sprocket hole at the bottom of its stroke. (Figure 3-72). Loosen Screw (14) and adjust the Bushing (8) (Figure 3-71) so these two distances are equal. Remove the film from the projector after proper Framing and Side Clearance are established.

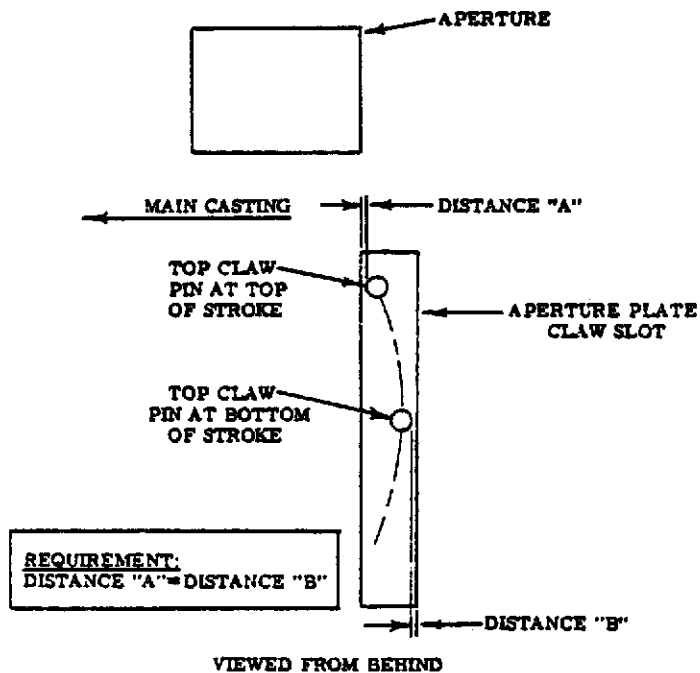


Figure 3-72. SIDE CLEARANCE

- b. Remove the Motor Drive Belt or disconnect the Motor wires so the Main Drive Shaft will not turn during the next adjustments. Be careful not to disconnect the Blower wires.

(As an alternative, the STILL button may be depressed on models having that feature.)

- c. Rotate the Inching Knob clockwise until the Claw Arm Pins are in the Aperture Plate Slot at the bottom of their travel. Insert the Stroke Setting Gauge (ST-5880) into the Aperture Plate Film Channel. Close the Film Gate. Make sure the Pressure Shoe seats properly. Push the Gauge down until it hits the Claw Arm Pins.
- d. Rotate the Inching Knob clockwise through enough cycles of the Claw Arm to draw the target in the Gauge into the Aperture. Be careful not to allow the Claw Arm to move up at any time when the Pins are engaged in the sprocket holes. The Pins must pull the Gauge down smoothly for the measurement to be valid.

- e. After the Gauge Target has been moved into the Aperture, continue turning the Inching Knob clockwise so the Claw Arm Pins withdraw at the bottom of the stroke and raise to the top of the stroke. STOP turning the Inching Knob when the Pins reenter the sprocket holes BEFORE they start moving down. (The Shutter Blade will be even with the bottom edge of the Aperture.)

Note: If you go too far, go back to Step (3) and repeat.

- f. Turn the Lamp on and project an image at least 8" wide (a wide angle lens will help achieve this width at a shorter projection distance), raise the elevation approximately 1" (this will get you set up in case the Stroke is in need of adjustment), and draw a reference line the full width of the Target on the bottom step (Figure 3-73).

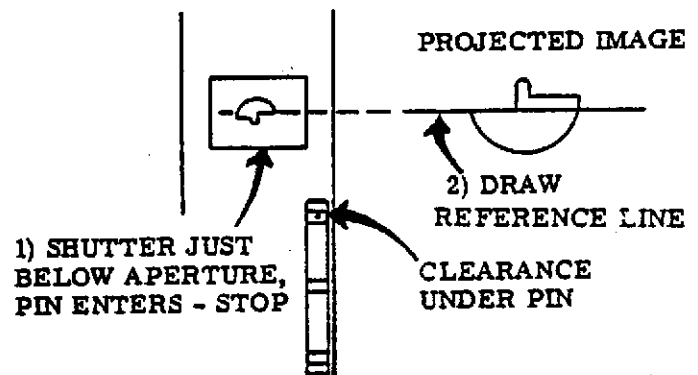


Figure 3-73. CLAW PULL DOWN STROKE SET UP

- g. Pull up on the Gauge. The projected Target will move down. The upper Target step must touch the reference line drawn in Step 6 for correct stroke (Figure 3-74).

- 3) PULL GAUGE UP

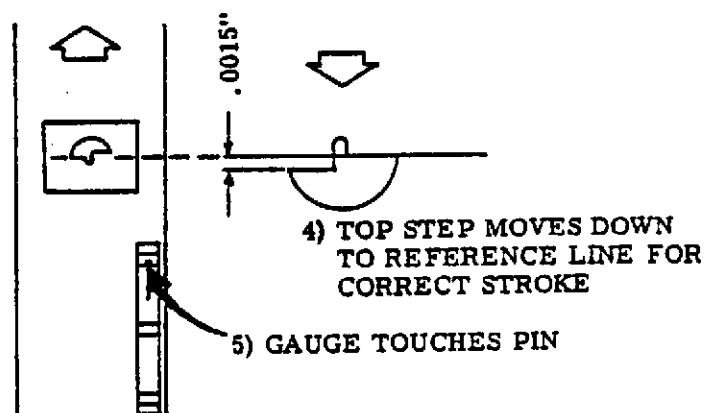


Figure 3-74. CLAW PULL DOWN STROKE

- h. Adjust stroke by placing the Shuttle Cam Adjusting Tool (ST- 5884) on the Claw Arm Pivot (18) (Figure 3-71), loosening Screws (14) and (19) and rotating the Pivot (18) and Bushing (8) the same amount in the same direction simultaneously. Turn counterclockwise (as viewed from the front of the projector) to shorten the stroke, and clockwise to lengthen the stroke (Figure 3-75).

Note: Theoretically, turning the Pivot (18) and the Bushing (8) equally will change Pull-Down Stroke but not Side Clearance. However, Side Clearance should be checked.

**REQUIREMENT:**

The Top Claw Arm Pin should be the same distance from the inside edge of the Gauge

sprocket hole at the top of its stroke as it is from the outside edge of the gauge sprocket hole at the bottom of its stroke. (Figure 3-72)

Loosen Screw (14) and adjust the Bushing (8) (Figure 3-71) so these two distances are equal.

WHEN ADJUSTMENTS ARE COMPLETE, THE ECCENTRIC PIN IN THE FRONT PIVOT (18) MUST ALWAYS BE BETWEEN 6 AND 9 O'CLOCK AS VIEWED FROM THE FRONT OF THE PROJECTOR. IF NOT, the cam follower on the Claw Arm may be severely worn requiring replacement of the Claw Arm.

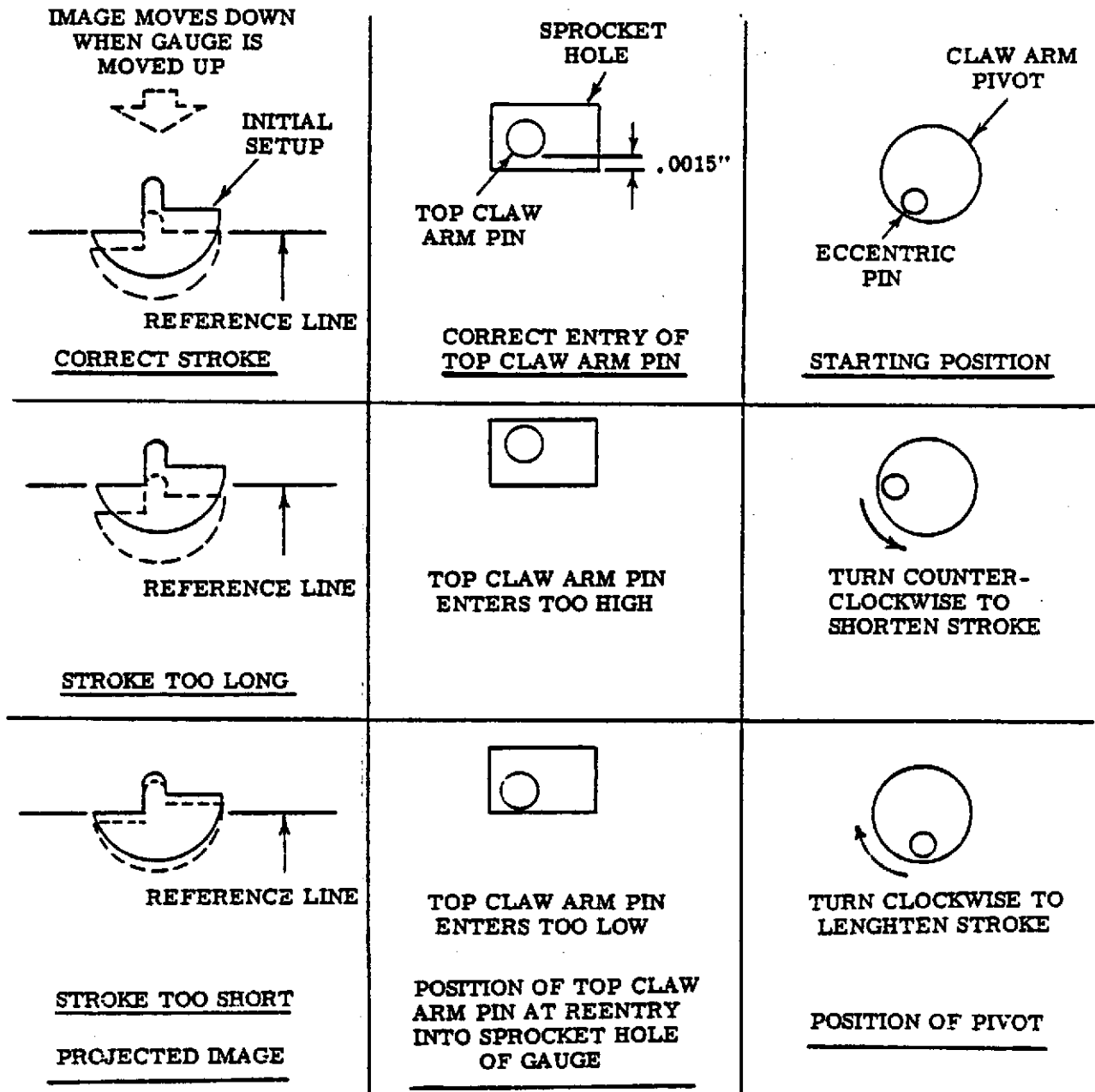


Figure 3-75. CLAW PULL DOWN STROKE ADJUSTMENTS

- j. If the stroke was adjusted, repeat Steps c through 8. When performing Step f, it is quite probable that the bottom step of the projected Target no longer rests on the reference line. ADJUST THE ELEVATION to line up the bottom step of the projected Target with the reference line and then proceed with Steps g and h. It may be necessary to repeat this sequence of steps several times until correct stroke and side clearance are obtained.
- k. A final, dynamic check for proper Side Clearance is made during the Framing Adjustment which follows.

34. CLAW ARM ADJUSTMENTS ( Model 1180A )  
SIDE CLEARANCE  
PULL-DOWN STROKE

**CAUTION:** When working on Model 1180 Projectors, NEVER LOOK AT THE LAMP! It is advisable to wear dark or tinted glasses (preferably safety glasses) when working on these projectors.

**Note:** These two adjustments are interdependent and must be adjusted at the same time. If either one is adjusted, the other must be checked and adjusted as necessary until requirements for both can be met.

A good starting position for the Pivot (18) (Figure 3-76) places its eccentric pin at about 7 o'clock when viewed from the front of the projector. (See Figure 3-75) The notch in Bushing (8) should be slightly below the notch in Pivot (18) so an imaginary line drawn across the top of the Bushing notch aligns with the bottom of the Pivot notch.

Before attempting any adjustments, manually rotate the Inching Knob to make sure the Claw Arm pins do not strike the sides 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 (Figure 3-77). At the bottom of its travel, this Pin will be nearer the outside edge of the Aperture Plate Slot. Loosen Screw (14) and adjust Bushing (8) (Figure 3-76) so these two distances are equal. (Removing the Lamphouse Cover and viewing the Pins from behind the Aperture Plate aids in this adjustment.)

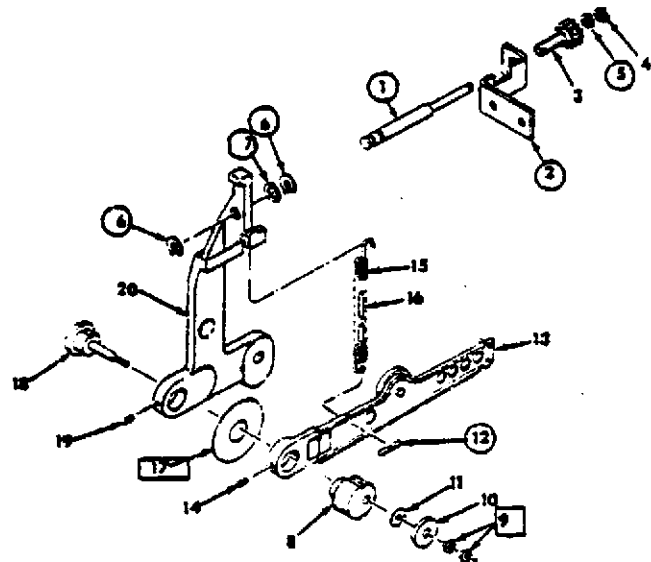
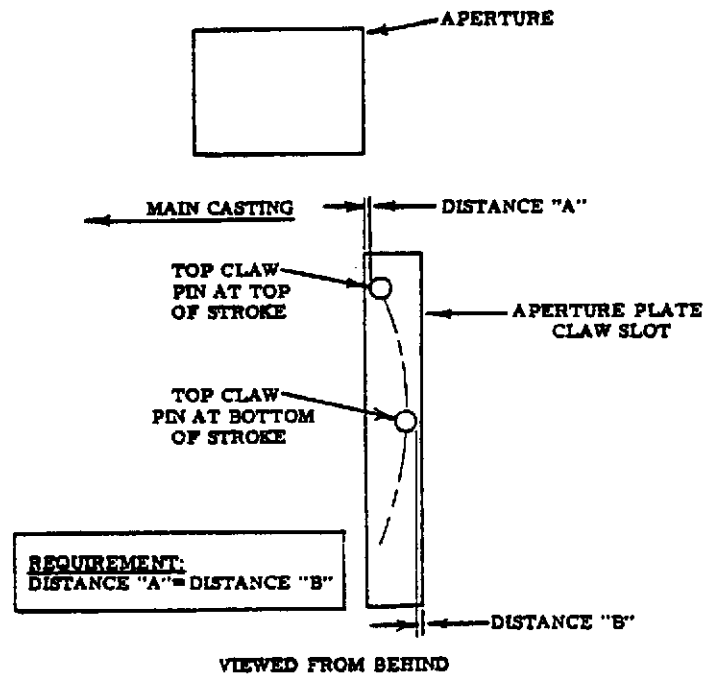


Figure 3-26. CLAW ARM ADJUSTMENTS

Arm Pins in the sprocket holes of the film. When Framing is correct, the Top Claw Arm Pin should be the same distance from the inside edge of the sprocket hole at the top of its stroke as it is from the outside edge of the sprocket hole at the bottom of its stroke. (Figure 3-77) Loosen Screw (14) and adjust the Bushing (8) (Figure 3-76) so these two distances are equal. Remove the film from the projector after proper Framing and Side Clearance are established.



VIEWED FROM BEHIND  
Figure 3-77. SIDE CLEARANCE

- a. Thread an old film in the projector (do not use a good film for this adjustment) and adjust the Framing Knob to eliminate any frame lines at the top or bottom of the projected image with the projector running in FORWARD. If excessive noise results when the Framing Knob is moved, stop the projector and check the location of the Claw

- b. Rotate the Inching Knob clockwise until the Claw Arm Pins are in the Aperture Plate Slot at the bottom of their travel. Insert the Stroke Setting Gauge (ST-5880) into the Aperture Plate Film Channel. Close the Film Gate. Make sure the Pressure Shoe seats properly. Push the Gauge down until it hits the Claw Arm Pins.

c. Rotate the Inching Knob clockwise through enough cycles of the Claw Arm to draw the Target in the Gauge into the Aperture. Be careful not to allow the Claw Arm to move up at any time when the Pins are engaged in the sprocket holes. The Pins must pull the Gauge down smoothly for the measurement to be valid.

d. After the Gauge Target has been moved into the Aperture, continue turning the Inching Knob clockwise so the Claw Arm Pins withdraw at the bottom of the stroke and raise to the top of the stroke. STOP turning the Inching Knob when the Pins re-enter the sprocket holes BEFORE they start moving down. (The Shutter Blade will be even with the bottom edge of the Aperture.)

Note: If you go too far, go back to Step (b) and repeat.

e. Modify a discarded 42994-G1 Safety Shutter as shown in (Figure 3-78). (A similar heat filter may be used)

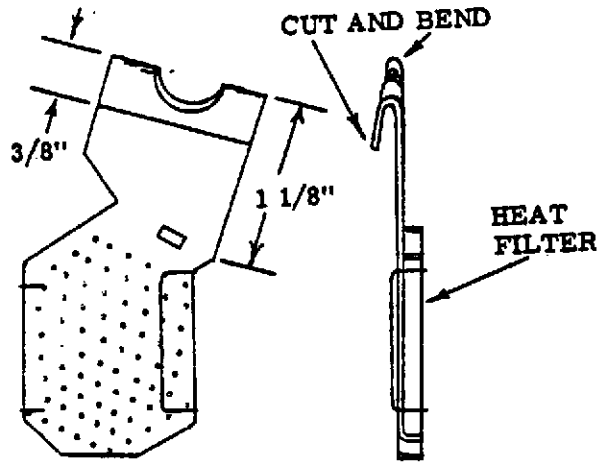


Figure 3-78. MODIFIED SAFETY SHUTTER (42994-G1)

f. Hang this Heat Filter on the front of the Arc Lamp Mounting Bracket so it is between the Lamp and the Aperture. Make sure there is enough clearance so the Douser does not hit the Filter when the Douser is raised.

g. Operate the LAMP switch to "ON". Leave the main pushbutton switch on "STOP". It is suggested that the Lamp be left "ON" during the remaining tests. If the Lamp is turned "OFF", it must be allowed to cool before it will strike again.

h. Manually raise the Douser and project an image at least 8" wide (a wide angle lens will help achieve this width at a shorter projection distance), raise the elevation approximately 1" (this will get you set up in case stroke is in need of adjustment), and draw a reference line the full width of the Target on the bottom step. (Figure 3-79)

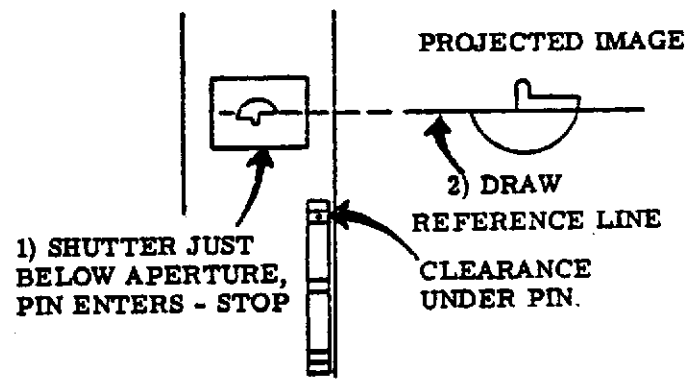


Figure 3-79. CLAW PULL DOWN STROKE SET-UP

j. Pull up on the Gauge. The projected Target will move down. The upper Target step must touch the reference line drawn in Step 8 for correct stroke (Figure 3-80).

3) PULL GAUGE UP

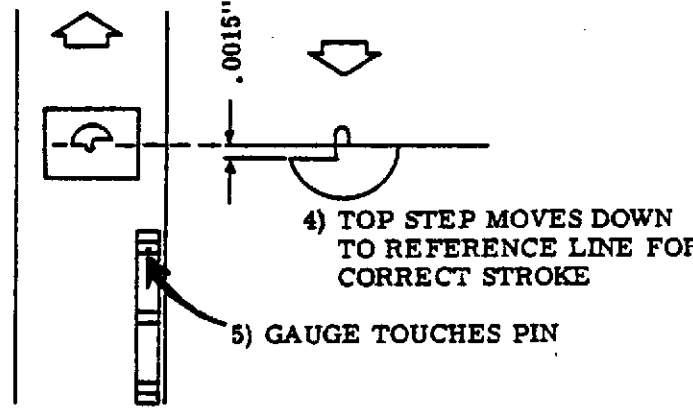


Figure 3-80. CLAW PULL DOWN STROKE

k. Adjust stroke by placing the Shuttle Cam Adjusting Tool (ST-5884) on the Claw Arm Pivot (18) (Figure 3-76), loosening Screws (14) and (19) and rotating the Pivot (18) and the Bushing (8) the same amount in the same direction simultaneously. Turn counterclockwise (as viewed from the front of the projector) to shorten the stroke, and clockwise to lengthen the stroke. (Figure 3-81)

Note: Theoretically, turning the Pivot (18) and the Bushing (8) equally will change Pull-Down Stroke but not Side Clearance. However, Side Clearance should be checked.

**REQUIREMENT:**  
The Top Claw Arm Pin should be the same distance from the inside edge of the Gauge sprocket hole at the top of its stroke as it is from the outside edge of the Gauge sprocket hole at the bottom of its stroke. (Figure 3-77)

Loosen Screw (14) and adjust the Bushing (8) (Figure 3-76) so these two distances are equal.

WHEN ADJUSTMENTS ARE COMPLETE, THE ECCENTRIC PIN IN THE FRONT

PIVOT (18) MUST ALWAYS BE BETWEEN 6 AND 9 O'CLOCK AS VIEWED FROM THE FRONT OF THE PROJECTOR. IF NOT, the cam follower on the Claw Arm may be severely worn requiring replacement of the Claw Arm.

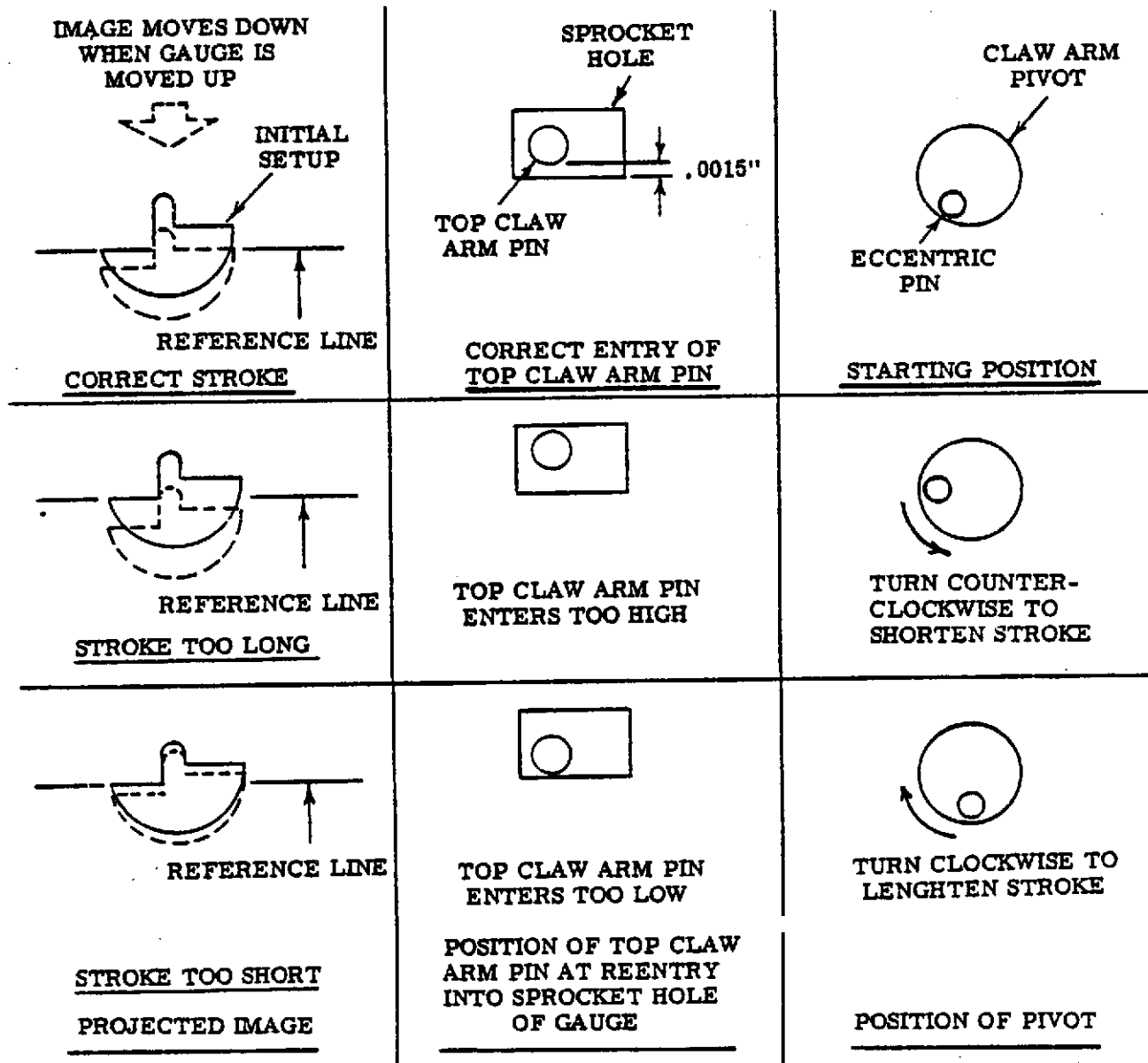


Figure 3-81. CLAW PULL DOWN STROKE ADJUSTMENTS

1. If the stroke was adjusted, repeat Steps b through k. When performing Step h. it is quite probable that the bottom step of the projected Target no longer rests on the reference line. ADJUST THE ELEVATION to line up the bottom step of the

projected Target with the reference line and then proceed with Steps j and k. It may be necessary to repeat this sequence of steps several times until correct stroke and side clearance are obtained.

### 35. FRAMING ADJUSTMENT

- a. After the Claw Arm Adjustments have been checked and/or made, the Framing Limit Plate can be adjusted. (Figure 3-82)
- b. Thread film in the Projector and run it in FORWARD. Adjust the Framing Knob to eliminate any frame lines at the top or bottom of the projected image.
- c. Loosen two Screws (41) and slide the Framing Limit Plate (40) so the top of the Framing Arm (43) is centered in the notch of the Framing Limit Plate (40). Tighten the two Screws (41).

- d. Run the projector in FORWARD and adjust the Framing Knob maximum in both directions. A frame line should move into the projected picture an equal amount on both top and bottom. Readjust the Framing Limit Plate (40) until this requirement is met.

Note: If the projector becomes noisy when the Framing Knob is rotated maximum in either direction, the Side Clearance is not correct and must be adjusted. (See Claw Arm Adjustments.)

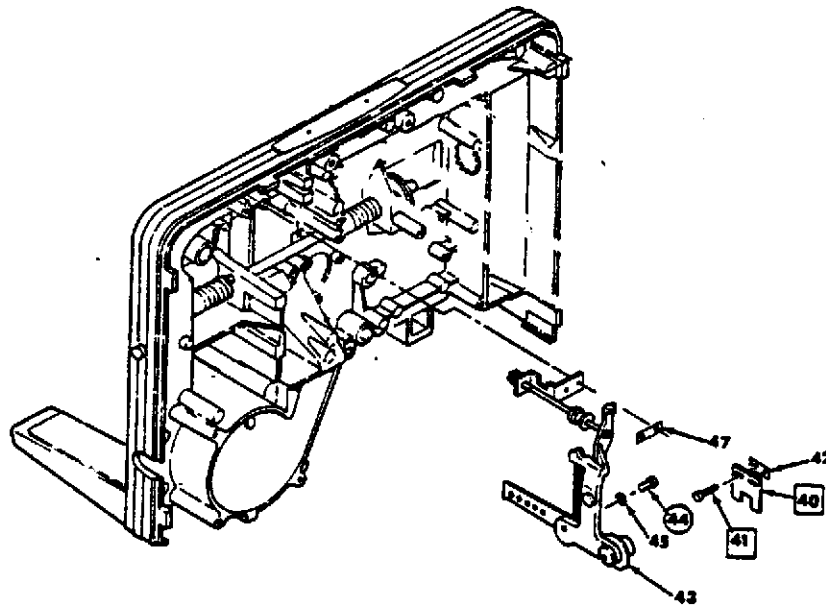


Figure 3-82. FRAMING ADJUSTMENT

### 36. REPLACING PHOTODIODE CHIP IN SOUND DRUM

- a. Mark the body of the Sound Drum Support at the outer end of the Photo Diode (this establishes proper orientation for installation of a new Diode).
- b. Remove the Retainer (1) and the Photo Diode (2) out of the slot. Clip the leads and discard the Diode. (Figure 3-83)
- c. Remove the Insulating Tubing (3) and unsolder the remaining portion of the Diode leads.
- d. Clean the residual epoxy cement from the Photo Diode Slot.
- e. Position a new Photo Diode into the slot with the shiny, black surface up (red wire) and the end aligned with the mark made in Step 1. Assemble the Retainer (1) to hold the Photo Diode in place, orienting the Retainer as shown in Figure 3-83. Make sure the Photo Diode is perfectly flat in the slot. (The end of the Photo Diode should be .293" --about 9/32"-- from the end of the Sound Drum Support.) **THE PHOTO DIODE IS VERY FRAGILE. BE VERY CAREFUL NOT TO BREAK IT!**

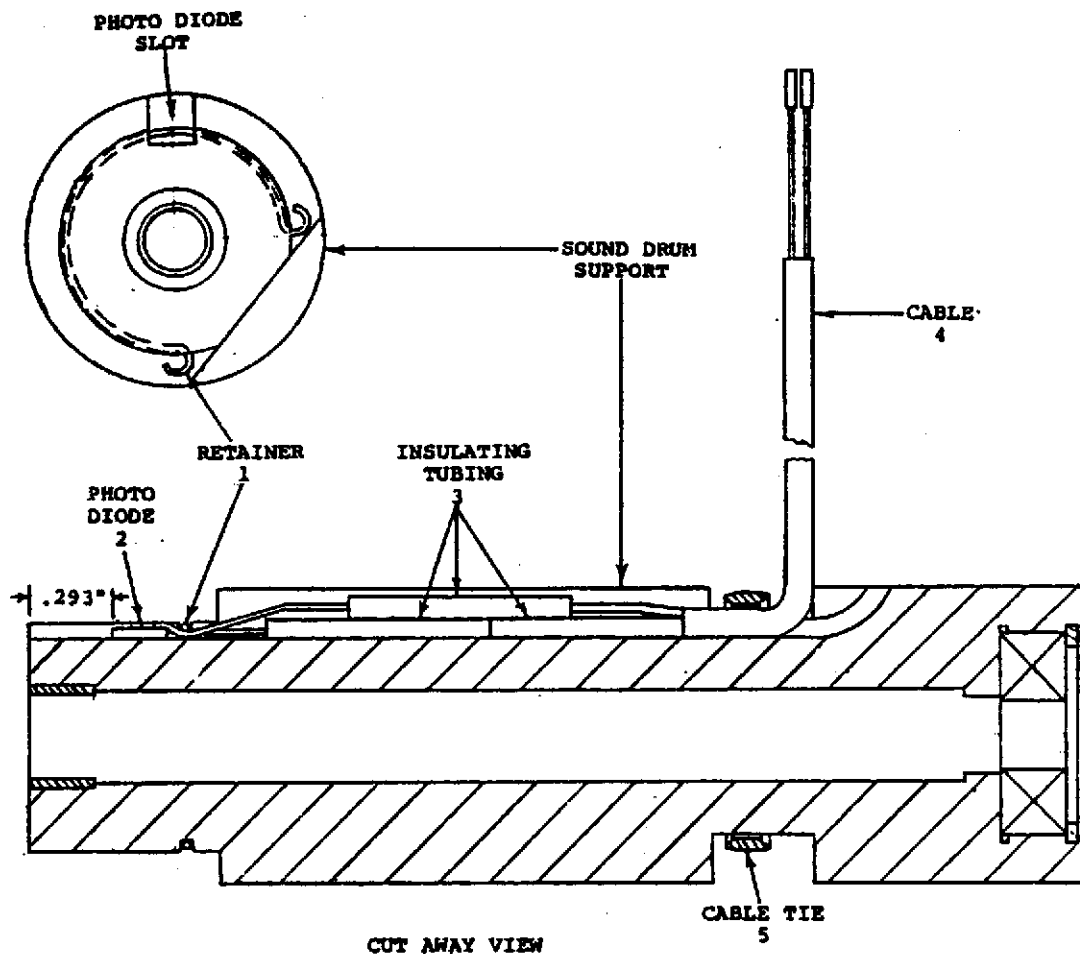


Figure 3-83. REPLACING PHOTO DIODE CHIP IN SOUND DRUM SUPPORT

- f. Mix 100 parts of Hysol R9-2039 Resin to 11 parts of Hysol H2-3404 Hardener (by weight). Dip a toothpick or paperclip in the cement mixture and apply cement to the slot, contacting the front edge of the Photo Diode so the cement will run under the Diode. DO NOT allow the cement to get on the top surface of the Diode. Allow the cement to dry thoroughly (overnight) before proceeding.
- g. Slide the insulating tubing on the leads of the Photo Diode and make sure that the third piece of tubing is on the shield of the Cable (4). Solder the Black lead of the Photo Diode to the Shield of the Cable and the Red lead to the Center Conductor. Slide the tubing over the solder connections (It may be helpful to cut the Cable Tie (5) so the Cable can be lifted out of the slot for soldering). Dress the wires into the slot and replace the Cable Tie, if cut.
- h. Measure the resistance between the Shield of the Cable and the Sound Drum Support with an Ohmmeter. The resistance must be 5 Megohms MINIMUM.

### 37. SOUND DRUM ADJUSTMENTS

- a. Loosen the Sound Optic Setscrew and remove the Sound Optic Cartridge. (This Cartridge may be very difficult to remove due to the wedging action of the nylon plug used to lock it in place. Rotating it back and forth while pushing up on it will aid in its removal. DO NOT pry up on the bottom of the Cartridge as this will damage the bottom lens.) Inspect the bottom lens element for damage.
- b. Insert the Sound Drum Locating Plug (T-38001-G) in place of the Sound Optic Cartridge. Push the Plug down until the small pin in its end is just above the Photo Diode in the Sound Drum Support (the pin should not touch the Diode).
- c. Loosen the Sound Drum Support Retaining Screw and rotate the Support until the Photo Diode notch of the Support is centered on the pin in the end of the locating Plug. (The sound drum support Setscrew is accessible through a small hole in the bottom of the projector base. Use a long-bladed 1/16" Allen Wrench.)



- d. Insert the Sound Drum in the Sound Drum Support and push this entire assembly toward the main casting until the back edge of the Sound Drum just touches the Pin on the Locating Plug. (Figure 3-84) Be sure to maintain the centering accomplished in Step c while making this adjustment.

Note: Be sure the Sound Drum is butted against the end of the Sound Drum Support during this adjustment. Having the Flywheel attached during this adjustment will help in holding these parts together in proper orientation.

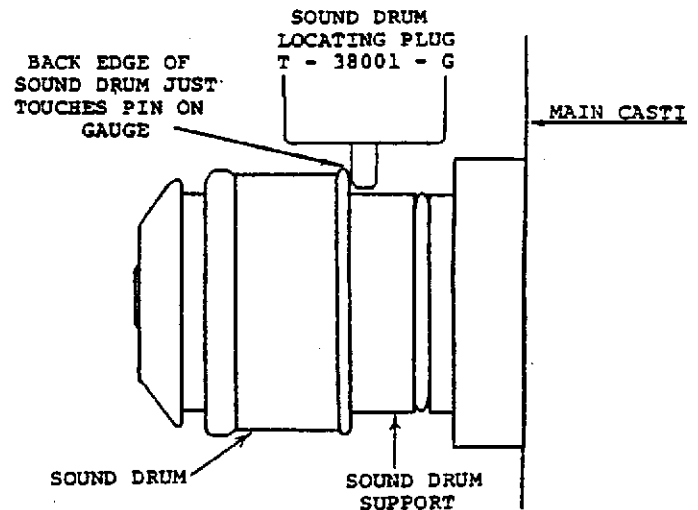


Figure 3-84. SOUND DRUM ALIGNMENT

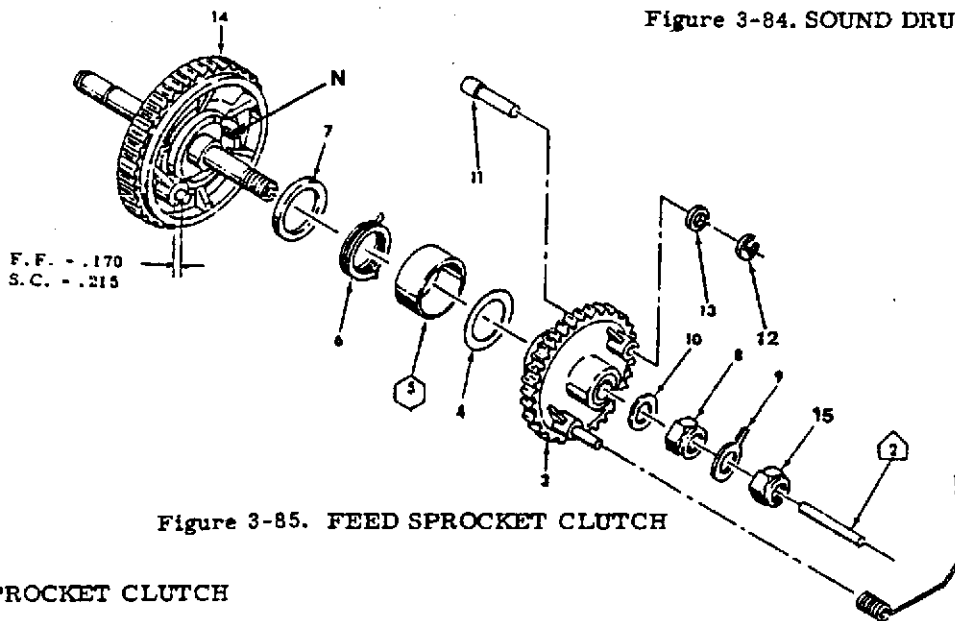


Figure 3-85. FEED SPROCKET CLUTCH

### 38. FEED SPROCKET CLUTCH

- a. Lubricate the Spring (6) with 009 Lubricant (39479-P7) (Figure 3-85).
- b. Assemble the Lubricating Pad (7) and the Clutch Spring (6) making sure the tail of the Spring (6) is trapped in the Notch (N) of Gear (14).
- c. Assemble Pin (11) to the Gear and Hub Assembly (3) and assemble the remaining parts on the shaft of Gear (14) in the order shown.
- d. Adjust the Nut (8) to obtain .002" to .010" end play on the Gear and Hub Assembly (3).
- e. Assemble the clutch to the projector (see Reassembly of Front Clutches to Projector).
- f. Assemble Stop (9) and Nut (15) and tighten the Nut (15) just enough to hold the Stop in place.
- g. Depress Pin (A) and turn Clutch Gear (B) clockwise until Pin (A) touches Pin (C). HOLD GEAR (B) — DO NOT ALLOW IT TO SPRING BACK. (Figure 3-86)
- h. Position the Stop (D) so that the corner or edge is just over the small cross pin of Pin (A) as shown.
- j. Hold Nut (F) to prevent it from turning and tighten Nut (E) being careful not to allow Stop (D) to turn during this tightening process.
- k. Recheck the end play of the Gear and Hub Assembly (B) for .002" to .010". Repeat Steps 6 through 9 until the Stop (D) is positioned properly and the end play is correct.

STEPS f. THROUGH k. PERTAIN TO FAST FORWARD PROJECTORS ONLY. PROCEED TO STEP m. IF YOUR PROJECTOR IS NOT A FAST FORWARD MODEL.

- m. Lubricate the outside diameter of Pin (2) with Teresso Instrument Oil (39479-P8) and insert the pin in the hole in the end of the shaft of Gear (14). (Figure 3-85)
- n. Insert the Spring (1) through the hole in the end of Pin (2) and then into the hole in the end of Pin (11).
- o. Push the Spring (1) onto the Roll Pin protruding from the Gear and Hub Assembly (3). (On Fast Forward models, be sure the cross pin in Pin (11) is pointing toward the shaft of Gear (14).

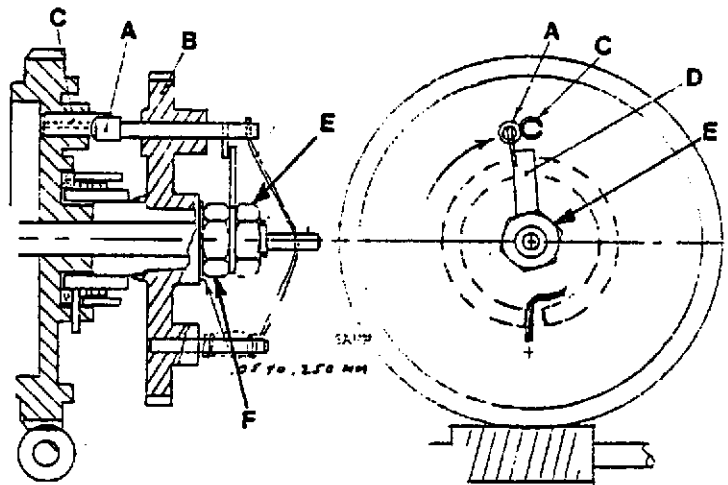


Figure 3-86. FEED SPROCKET CLUTCH ADJUSTMENT

### 39 FAST FORWARD AND REWIND CLUTCHES

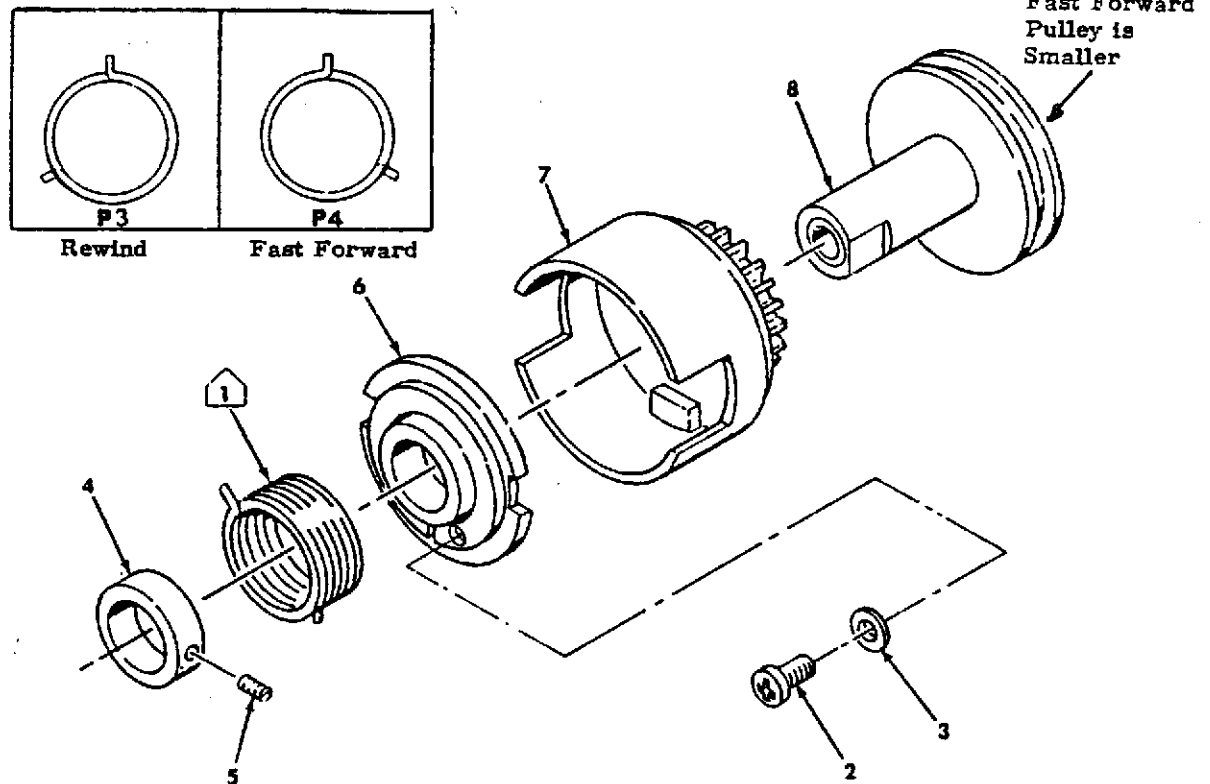


Figure 3-87. REWIND and FAST FORWARD CLUTCH REASSEMBLY

- a. Lubricate the outside diameter of the shaft of the Pulley Assembly (8) and assemble the Gear (7) and the Drum (6) to the shaft as shown (Figure 3-87)
- b. Seat the notches of the Drum (6) over the raised lugs inside the Cup Gear (7).
- c. Assemble the Arbor (4) on the shaft of the Pulley (8) and tighten the Setscrew (5) in the notch in the end of the shaft allowing for end play of .005" to .010".
- d. Apply three or four small drops of Teresso Instrument Oil (39479-P8) on the Arbor (4) and push the Spring (1) over the Arbor until it is seated on the Drum (6) with its tail trapped in the slot in the Drum.
- e. Assemble Screw (2) and Washer (3) to the Drum (6) trapping the tail of the Spring (1) permanently in the slot of the Drum (6).
- f. Assemble the Clutch to the projector (see Reassembly of Front Clutches to Projector).

#### 40. SWITCH ADJUSTMENTS

- a. Switches (S-3), (S-5), (S-6), and (S-7) should be adjusted to actuate in the LOAD position and relax in the PROJECT position. (Figure 3-88)
- b. Switch (S-4) should be adjusted to relax in the LOAD and PROJECT positions and actuate between these two positions.

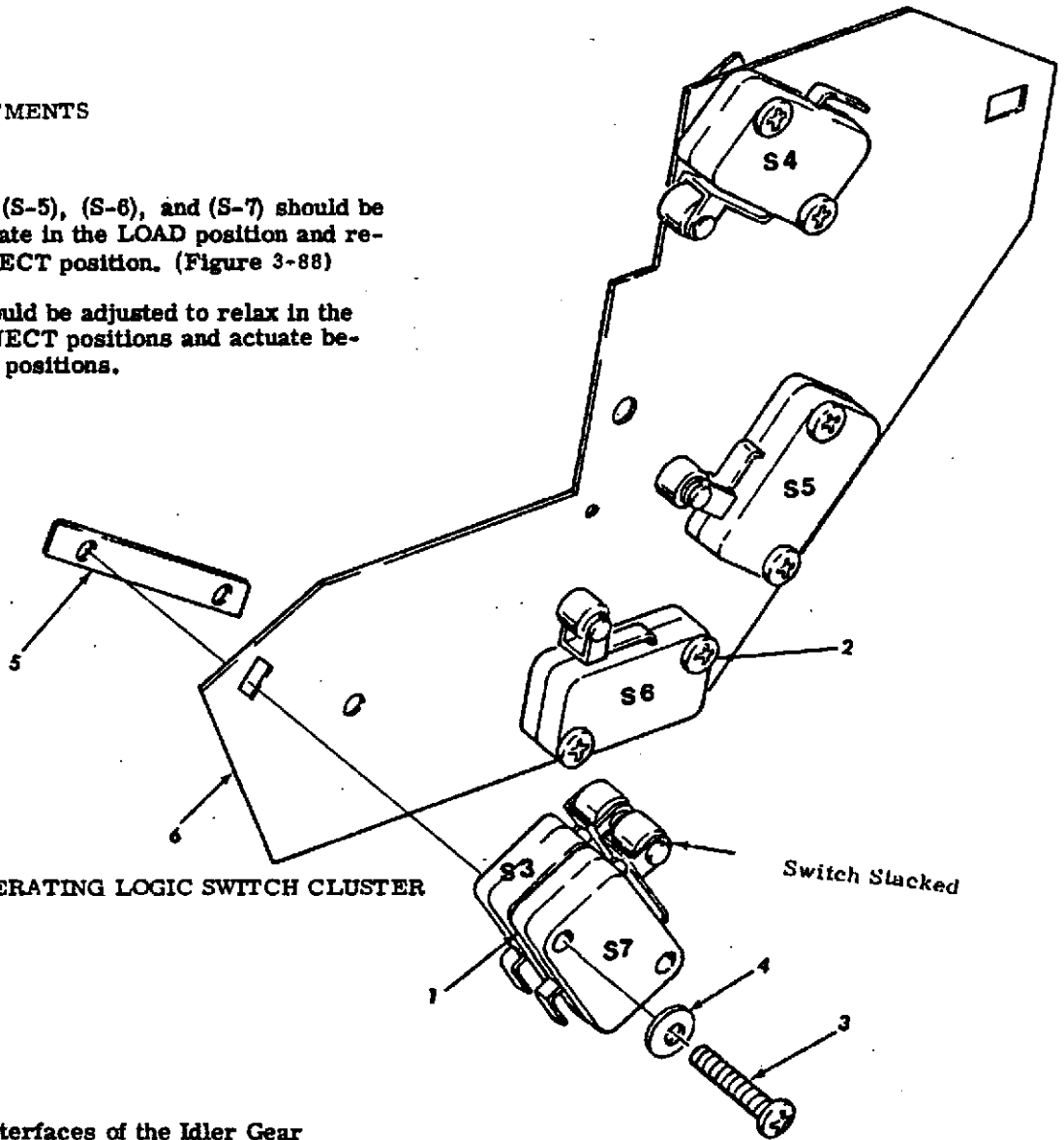


Figure 3-88. OPERATING LOGIC SWITCH CLUSTER

#### 41. FILM COUNTER

- a. Lubricate the interfaces of the Idler Gear Assembly Shaft (8) and the Bearing (10) with Teresso Instrument Oil (39479-P8). (Figure 3-89)
- b. When the Gear (6) is rotated, the entire gear train and counter must operate freely and smoothly.

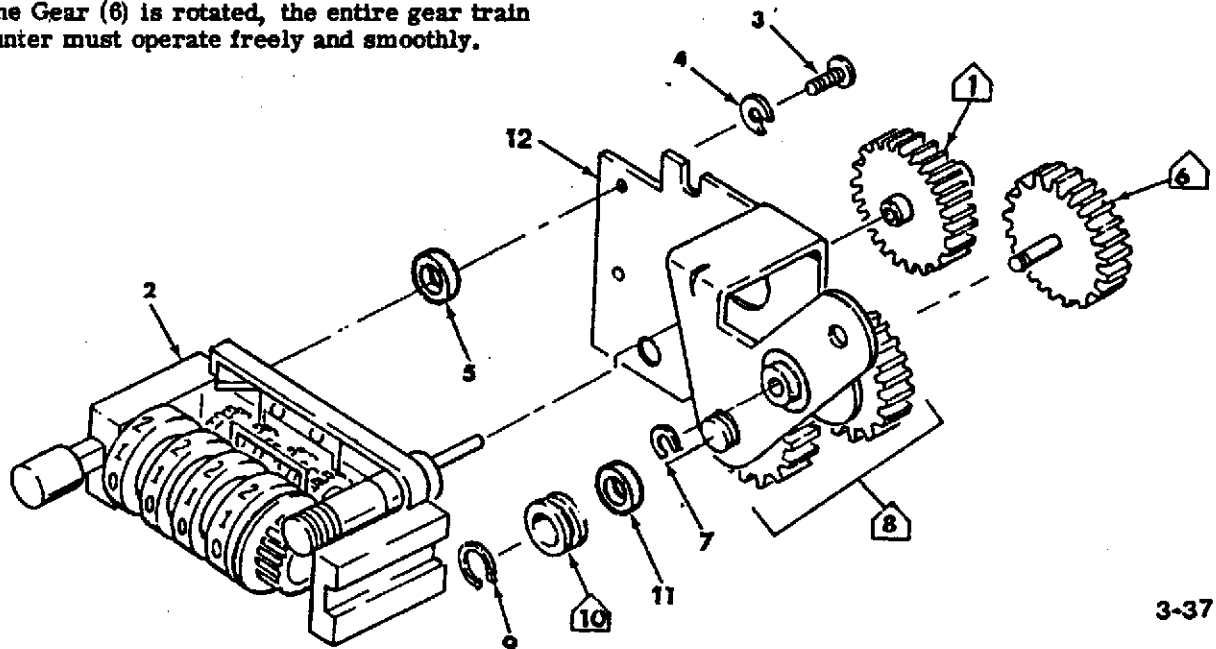
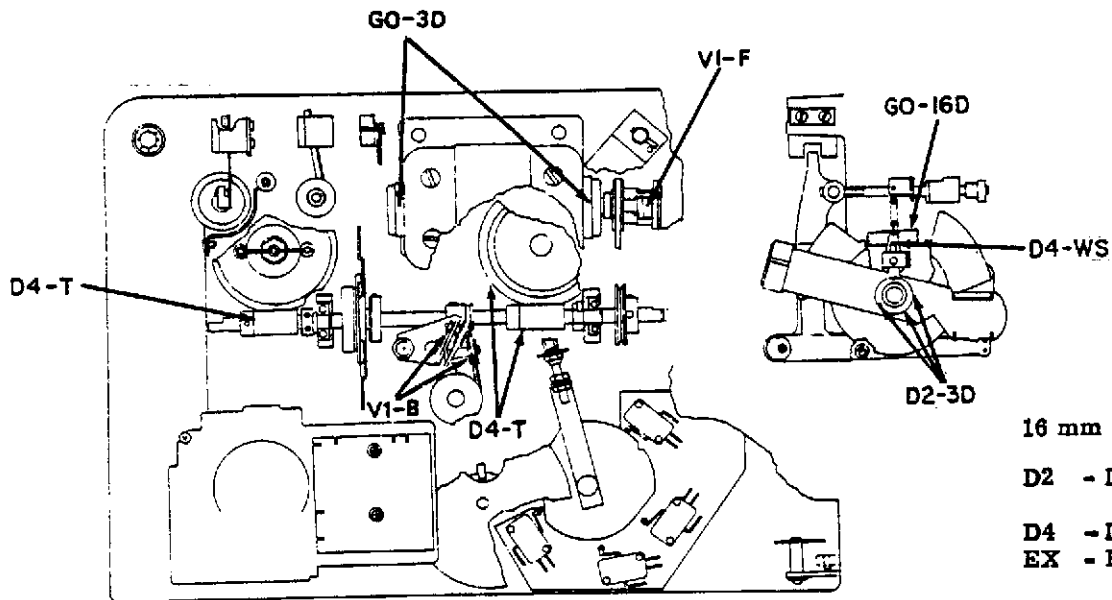
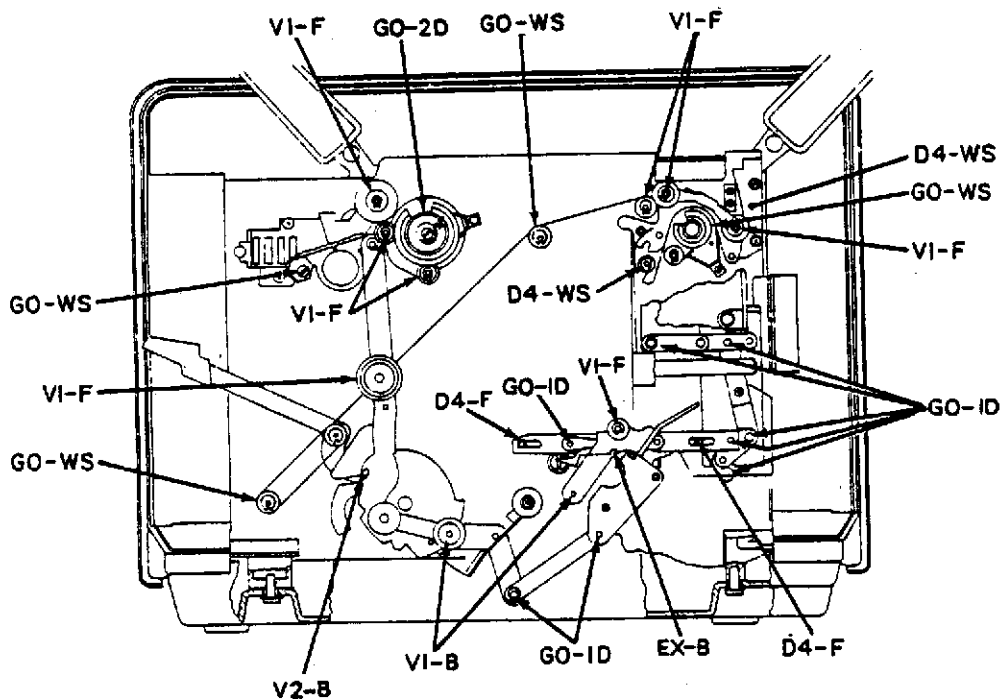


Figure 3-89. FILM COUNTER

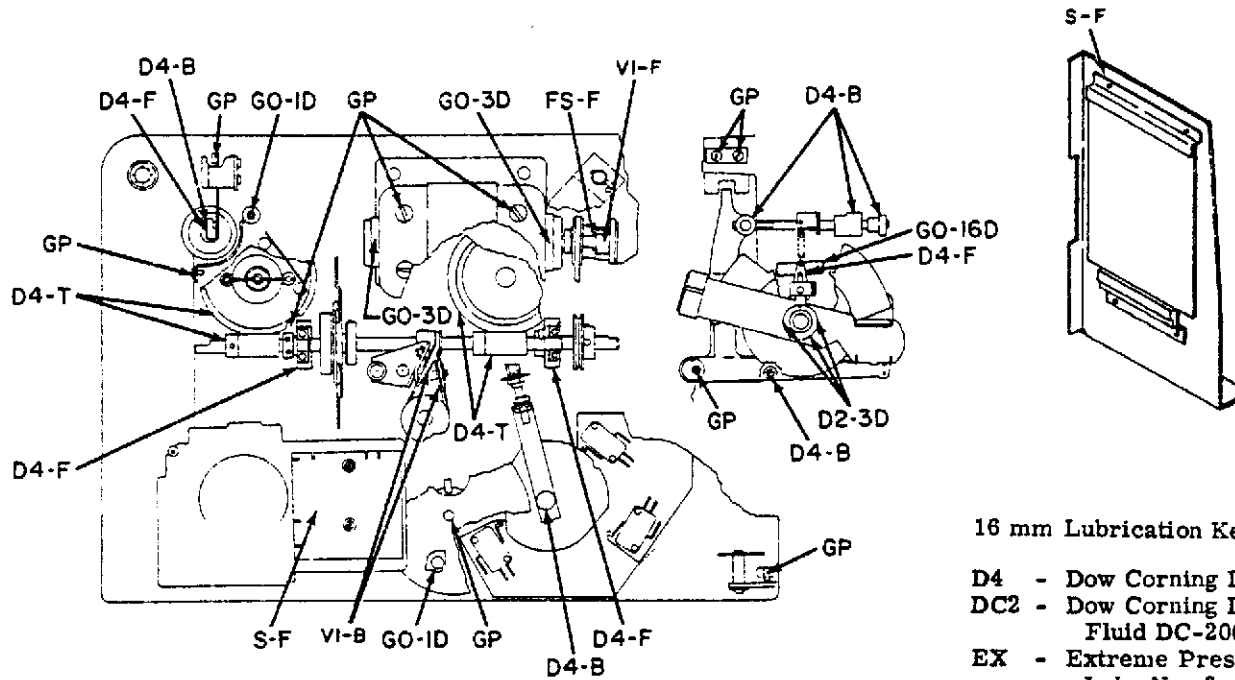


**16 mm Lubrication Key**

- D2 - Dow Corning Damp Fluid D-200
- D4 - Dow Corning DC-44
- EX - Extreme Pressure Lube No. 3
- GO - Instrument Oil N-75
- V1 - Viscem No. 352 Grease
- V2 - Versalube G-322 Grease
- WS - Working Surface
- B - Bearing Surface or Pivot
- F - Interface
- T - Teeth
- XD - X Drops



**Figure 3-90. PREVENTIVE MAINTENANCE LUBRICATION POINT DIAGRAM**



- 16 mm Lubrication Key**
- D4 - Dow Corning DC-44
  - DC2 - Dow Corning Damp. Fluid DC-200
  - EX - Extreme Pressure Lube No. 3
  - FS - Fluorosilicone FS-1290
  - GO - Instrument Oil V-79
  - GP - Glyptal 7526 Blue
  - S - 8101-S Silicone Heat Zink Jell
  - V1 - Vischem No. 352 Grease
  - V2 - Versaluba G-332 Grease
  - B - Bearing Surface or Pivot
  - F - Interface
  - T - Teeth
  - XD - X Drops

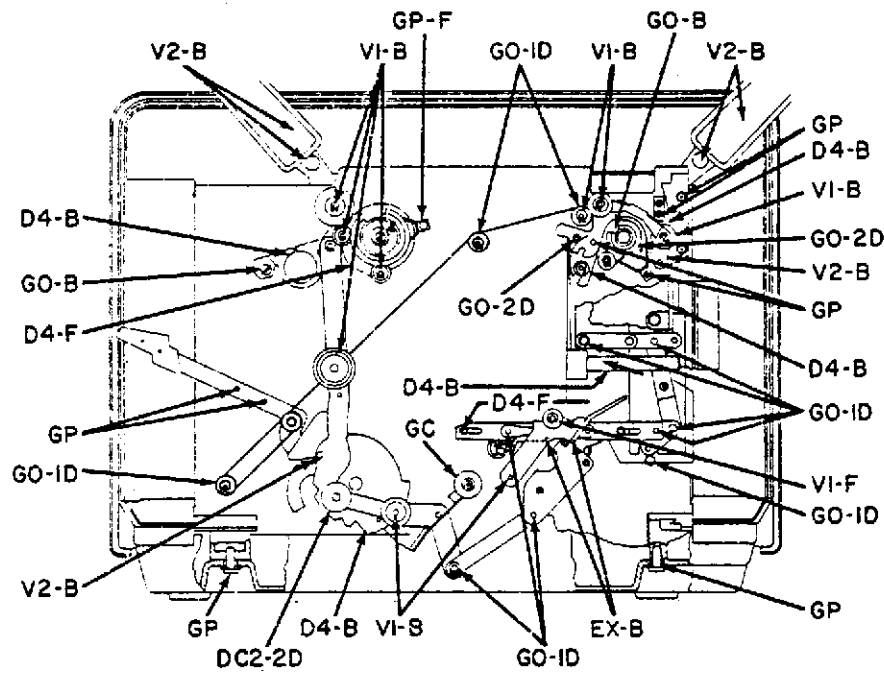


Figure 3-91. Overhaul Maintenance Lubrication Point Diagram