SERVICE INSTRUCTIONS

FILMOSOUND PROJECTOR

(MANUAL THREADING)

MODELS

535	540	541	542
535T	540T	541T	542EX

PHOTO PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 70341 PRINTED IN U.S.A. OCTOBER 1969

SERVICE INSTRUCTIONS

FILMOSOUND PROJECTOR

(MANUAL THREADING)

MODELS

535 540 541 542

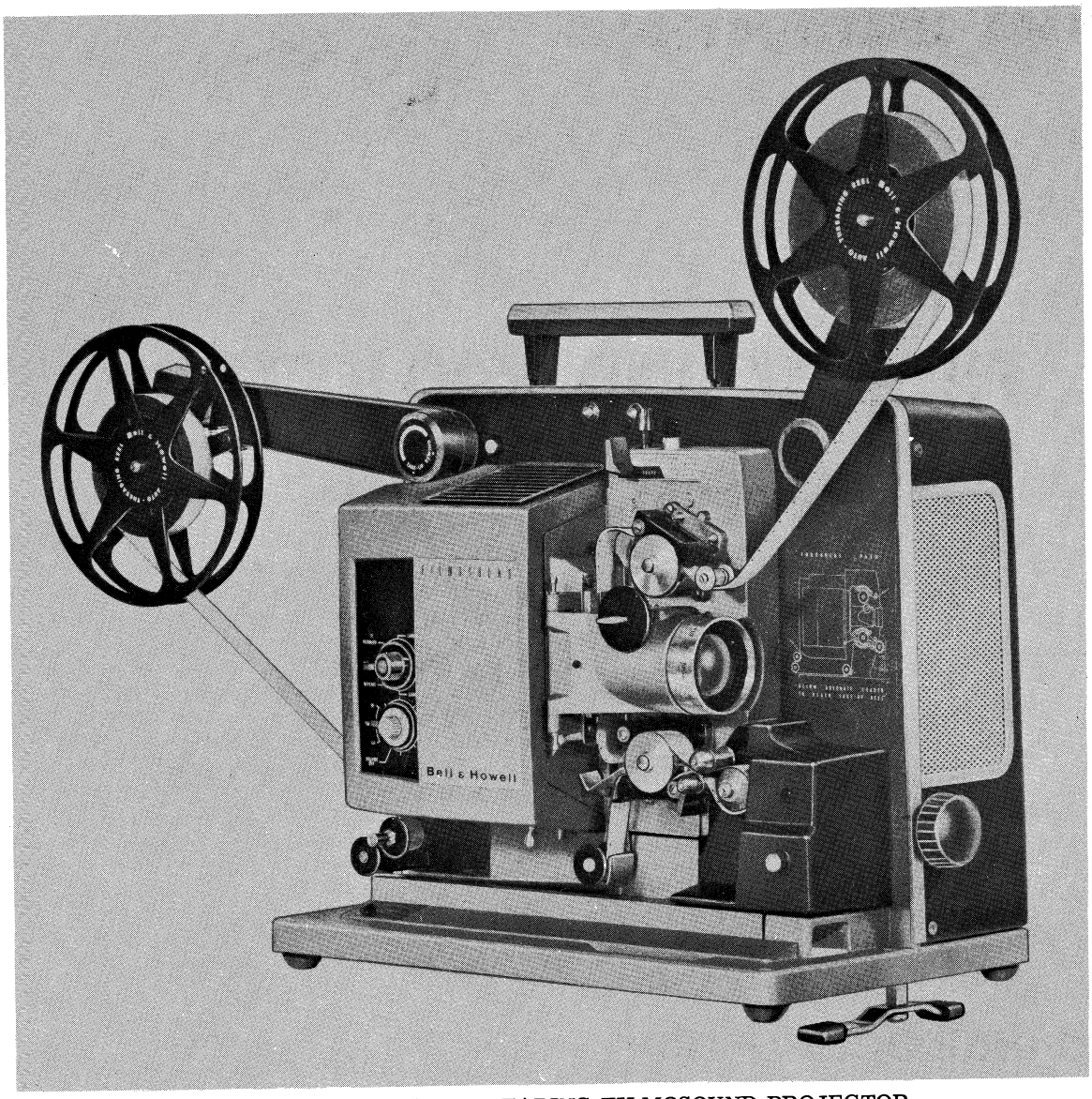
535T 540T 541T 542EX

PHOTO PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 70341 PRINTED IN U.S.A. REVISED OCTOBER 1969



500 SERIES MANUAL THREADING FILMOSOUND PROJECTOR

NOTE

The castings for these projectors are magnesium. Adhere to standard shop safety practices when machining or drilling castings.

FACTORY SERVICE ADDRESSES

PRODUCT ONLY

CHICAGO

Bell & Howell Photo Sales Co.
General Service Department
2409 West Howard Street
Evanston, Illinois 60202
Area Code: 312-673-3300

NEW YORK

Bell & Howell Photo Sales Co.
General Service Department
200 Smith Street
E. Farmingdale, L.I., New York 11735
Area Code: 516-293-8910

GLENDALE

Bell & Howell Photo Sales Co.
General Service Department
623 Rodier Drive
Glendale, California 91201
Area Code: 213-245-6631

PARTS ORDERS AND SERVICE INFORMATION

Bell & Howell Photo Sales Co.
General Service Department
7100 McCormick Road
Chicago, Illinois 60645
Area Code: 312-673-3300

TABLE OF CONTENTS

Introduction

GENERAL.

This Service Manual has been prepared to aid in the repair and adjustment of the Bell & Howell Filmosound Manual Threading 16-mm motion picture projectors listed in the following Feature Description List. An illustrated Parts Catalog is included at the rear of the manual to identify replacement parts and to aid the serviceman in the disassembly and reassembly of the projector.

All parts in the Parts Catalog illustrations are indexed in a suggested order of disassembly, with attaching parts immediately preceding those parts which they attach. Before proceeding with repairs, operate the projector to verify the customer complaint; then refer to the Troubleshooting Charts for possible causes and suggested remedies for the indicated trouble.

MAINTENANCE PRECAUTIONS.

In addition to the tools normally available in most repair shops, complete projector repair will require the use of the special tools illustrated in Figure A and the Bristol setscrew wrenches listed in the following chart.

Setscrew Size	No. of Flutes	B&H Part No.	
		Handle	Wrench
No. 4-40NC	6	G1271-F1	G1271-X2
No. 6-32	6	STK3852-B	STK3863-B
No. 8-32	6	G165-F1	G165-F1

NOTE: Wrench G165-F3 is required to tighten setscrew in tool handle.

CAUTION: In the current design of all projector models, castings are drilled (but not tapped) to accept swage screws (all with part numbers in the 30800 series). If the swage screw is the same size as the corresponding machine screw used in earlier model castings (with tapped screw holes), the swage screw only is listed in the parts lists and can be used in both early and current model projectors. However, machine screws cannot be used in current model (untapped) castings. Therefore, if any early model casting must be replaced with a current model casting, all machine screws used with that casting must be replaced with the new swage-type screws. Where the thread size of the swage screw differs from that of the corresponding machine screws used in earlier models, refer to the parts lists for the listing of both screws.

FEATURE DESCRIPTION LIST

FEATURE	535A	540A	542A	542EX
Color	Grey		Turquoise	
Projection Lens	2" f/1.6	2" f/1.6	2" f/1.4	2" f/1.4
Projection Lamp (120 Volt)				
Rating	1000W	750W	1000W	1000W
Lamp Designation	CTS	CWA	CTS	CTS
Exciter Lamp				
Rating	4V	4V	4V	4V
Lamp Designation	BAK	BAK	BAK	BAK
Projection Control				
Forward-Reverse	Yes	Yes	Yes	Yes
Still Projection	No	No	Yes	Yes
Still Projection Filter	No	No	Yes	Yes
Film Threading	← Manual →			
Number of Shutter Blades	3	3	3	2
Operating Voltage	117VAC	117VAC	117VAC	117VAC
Motor Frequency	60Hz	60Hz	60Hz	50/60Hz
Automatic Loop Restorer	No	Yes	Yes	Yes

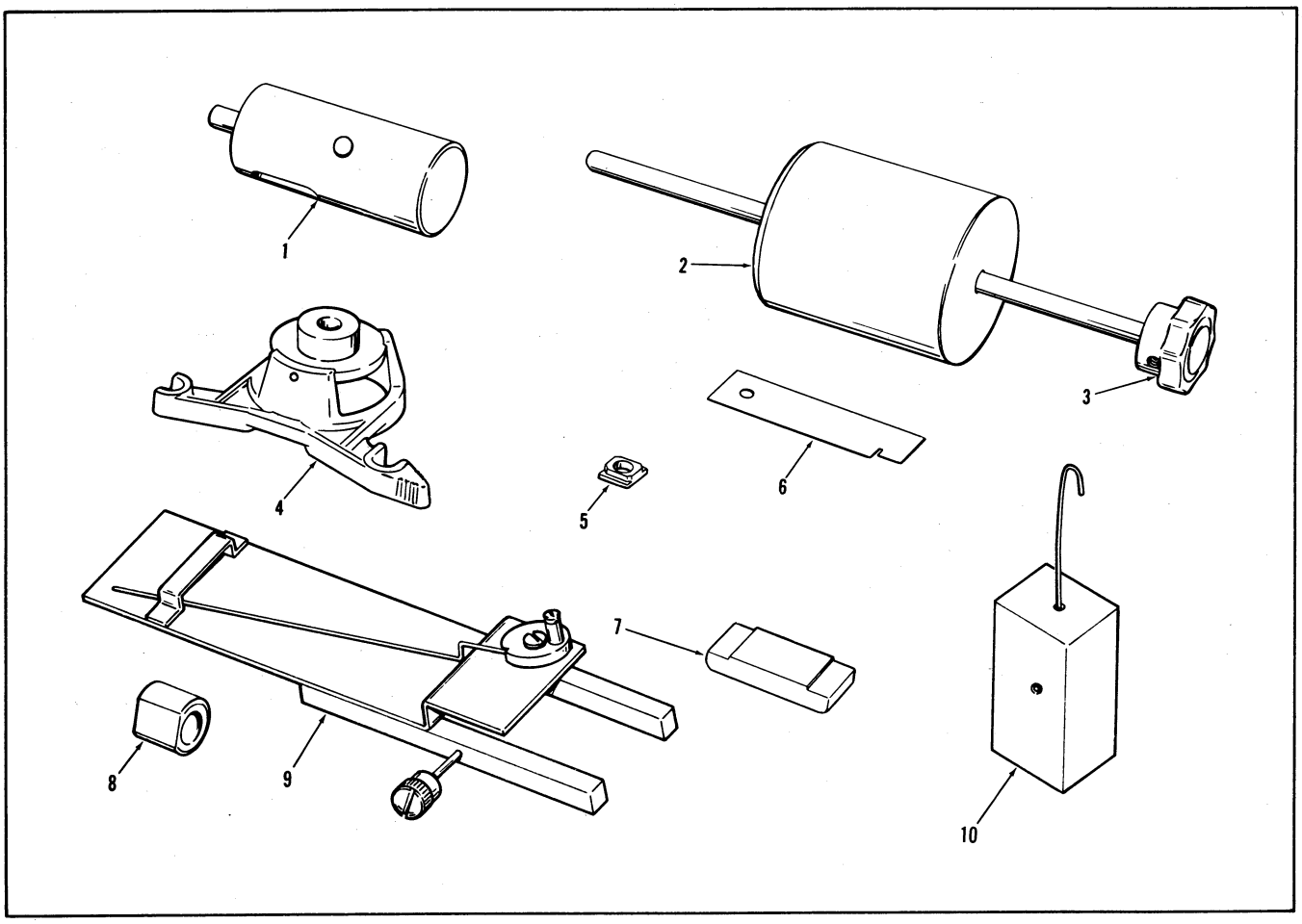


Figure A. Special Service Tools

INDEX NO.	TOOL NO.	TOOL NAME	USE
1	SER-550-2-N5	Lamp Plug	Alignment of optical system (see Figure J)
2	SER-550-2-N1	Lens Plug	
3	SER-550-2-N2	Alignment Rod	
4	SER-550-2-N4	Condenser Plug	
5	SER-550-2-N3	Aperture Plug	
6	SER-550-5-N2	Stroke Gage	Measure shuttle stroke (Figure N)
7	SER-550-6-N1	Shuttle Height Gage	Check shuttle protrusion (Figure L)
8	SER-552-2-N1	Restorer Positioning Tool	Adjusting the loop restorer (Figure S)
9	SER-552-4-N1	Shuttle Tension Gage	Adjusting shuttle tension (Figure M)
10	SER-552-4-N2	Weight for Shuttle Tension Gage	Adjusting shuttle tension (Figure M)
	SER-550-8-N1	Alignment Tool	Sound drum and photocell alignment (Figure Q)
	SER-550-5-N1	Shuttle Stroke Target	Measurement of shuttle stroke (Figure N)

Cleaning and Lubrication

1. CLEANING.

All sprockets and shoes must be kept free of emulsion build-up. Use Toluol, and/or an orange stick to remove emulsion, being careful not to scratch the surfaces. Pay particular attention to the sound head area.

Do not use Trichlorethylene solvents to clean plastic parts. Use a naphtha base cleaning fluid.

During periodic maintenance of the projector, the transport mechanism should be removed and thoroughly cleaned. Brush or blow out all large particles of dirt. Wash all moving parts except "Oilite" bearings with any good petroleum solvent. Wash "Oilite" bearings and the pull-down cams with naphtha. Wash the cam oilers in naphtha, and replace if not thoroughly cleaned by washing. Discard and replace the cam wiper and cam wiper wick. As soon as parts have been washed and dried, coat with a light film of the specified lubricant.

2. LUBRICATION.

The following Lubrication Chart lists those items which are to be lubricated during reassembly. Lubricants specified can be ordered from Bell & Howell by part number. Be careful not to over-lubricate. A drop or two of oil and a light film of grease (applied with a brush, if possible) will be adequate. Wipe away excess lubricant with a lint-free cloth.

Felt pads and wicks should be placed in a shallow pan of the specified grease or oil and allowed to stand until saturated. Permit the excess lubricant to drain away before installing these felt parts.

LUBRICATION CHART

PARTS TO BE LUBRICATED	LUBRICANT
Machined surfaces (non-bearing) of all castings	Oil (P/N 070003)
Reel arm clutch ball retainers and shafts (Figure 2) and sprocket shafts (37 and 38, Figure 14)	Oil (P/N 08963)
Framer shaft (27, Figure 16), bearing face of worm gear (24 or 24A, Figure 17), and pin of rewind sprocket (Figure 2)	Oil (P/N 04978)
Felt oil pads in cams and all shafts, sleeve bearings and sliding parts (friction surfaces) not otherwise specified	Oil (P/N 070032)
Slots in outboard bearing assembly (20, Figure 14)	Grease (P/N 070031)
The following items are to be greased sparingly: (1) Teeth of all nylon gears (2) Pin of take-up drive sprocket (Figure 2) (3) Friction surface of lamp release ring (15, Figure 13) (4) Reel arm lock plungers (20, Figure 7) (5) Tilt rack and pinions (Figure 8) (6) Meshing gears in reel arms (Figures 9 and 10) (7) Loop restorer shaft (31, Figure 15) (8) Self centering assembly (current models) (35, Figure 15) (9) Cam wiper and wick (current models) (14 and 15, Figure 16) (10) Shuttle arms and bearings (17, Figure 16) (11) Shuttle link bearings (17A, Figure 16) (12) In-out cam and cam follower (21, Figure 16) (13) Threads of framer shaft (27, Figure 16) (14) Sleeve of condenser holder (35, Figure 17) (15) Mechanism housing (38, Figure 17); film guide pivot posts, sprocket shaft bearings, camshaft bearings (16) Pinion teeth of focus knob (3, Figure 18)	Grease (P/N 070034)

Trouble Shooting

3. MISCELLANEOUS TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Nothing runs	1. Protective switch not operating.	1. Use correct screw in lower left rear corner of case or replace switch if defective.
	2. Damaged power cable.	2. Repair or replace cable.
	3. Loose connections.	3. Repair connections.
Motor hums but does not run	1. Starting circuit open or shorted.	1. Repair loose or transposed connections. Replace defective capacitor and/or relay.
Motor runs but mechanism does not run	1. Damaged switch.	1. Replace switch.
	2. Transposed leads on main switch.	2. Connect leads to proper terminals.
	3. Drive belt off of pulley.	3. Reinstall drive belt.
	4. Motor or driven pulley loose on shaft.	4. Position pulley and tighten setscrews.
	5. Damaged belt.	5. Replace belt.
	6. Animation clutch spring broken (Design 542 and 542EX Only).	6. Replace spring.
Rewind does not operate	1. Rewind clutch not engaging or clutch slipping.	1. Adjust (paragraph 72c).
Take-up does not operate	*1. Clutch balls or spring lost.	1. Replace.
	2. Take-up sprocket damaged.	2. Replace.
Feed spindle does not revolve in reverse	1. Dirt in feed spindle clutch.	1. Clean.
	2. Clutch spring lost.	2. Replace.
Gate will not lock	1. Latch spring set too close to lens mount stop.	1. Adjust latch spring.
	2. Pressure shoe out-of-line.	2. Realign pressure shoe.
Shuttle runs but sprockets do not revolve	1. Animation clutch spring broken or lost (Design 542 and 542EX).	1. Replace spring.

*Early Models Only.

3. MISCELLANEOUS TROUBLES AND REMEDIES (CONT).

TROUBLE	PROBABLE CAUSE	REMEDY
Short lamp life	1. Line voltage in excess of lamp voltage.	1. Use lamp of correct voltage rating.
	2. Blower belt off of pulley.	2. Replace belt.
	3. Dirt in blower.	3. Clean.
Speed changer does not work	1. Knob or shifter crank loose.	1. Tighten setscrew.
Speeds slow	1. Binding in the mechanism.	1. Free binding condition.
	2. Belt slipping.	2. Clean or replace belt.
Runs at speed between 18 and 24 FPS	1. Pulleys out-of-line.	1. Realign pulleys.
	2. Belt shifter out of adjustment.	2. Adjust belt shifter (par. 55c).
	3. Belt shifter toggle spring broken.	3. Replace spring.
	4. Power line frequency other than 60 cycles (except Design 542EX).	4. Use proper voltage and frequency.
*Solenoids buzz	1. Plungers not seating (Design 542 and 542EX).	1. Adjust (paragraphs 69c and 70b).

*Early Models Only.

4. PICTURE TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Film jump	1. Damaged film.	1. Repair or replace.
	2. Loose shuttle.	2. Adjust and tighten (paragraph 66c).
	3. Dirty gate.	3. Clean gate.
	4. Damaged or lost pressure shoe spring.	4. Replace spring.
	5. Pressure shoe misaligned.	5. Realign pressure shoe.
	6. Incorrect shuttle stroke.	6. Adjust (paragraph 66d).
Double image	1. Incorrect shuttle stroke.	1. Adjust (paragraph 66d).
	2. Excessive shuttle protrusion.	2. Adjust (paragraph 66b).
Weave	1. Sticking edge guide.	1. Clean guide.
	2. Replace tension spring lost.	2. Replace spring.
	3. Fixed edge guide out of position.	3. Reposition guide.
Poor illumination	1. Optics out-of-line.	1. Realign (paragraph 65).
	2. Fire shutter sticking (Design 542 and 542EX).	2. Free solenoid or linkage (paragraph 70). Check mechanical linkage for binding.
	3. Front condenser reversed.	3. Reassemble correctly.
Poor focus	1. Dirty lens and/or aperture.	1. Clean lens and/or aperture.
	2. Warped film.	2. Recondition or replace film.
	3. Projector lens mount out-of-line.	3. Realign (paragraph 68).
	4. Pressure shoe spring lost.	4. Replace spring.
	5. Bent pressure shoe.	5. Replace pressure shoe.
	6. Pressure shoe out-of-line.	6. Realign pressure shoe.
Frame line creeps	1. Framer eccentric loose.	1. Align and tighten (paragraph 66e).
Insufficient framing	1. Framer eccentric out of adjustment.	1. Adjust (paragraph 66e).
Trailer ghost	1. Shutter out-of-line.	1. Reassemble properly.

*Early Models Only.

5. FILM TRANSPORT TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Loss of loops	1. Damaged film.	1. Repair or replace film.
	2. Inadequate shuttle protrusion.	2. Adjust (paragraph 66b).
	3. Inadequate or excessive shuttle stroke.	3. Adjust (paragraph 66d).
	4. Pressure shoe spring lost.	4. Replace spring.
	5. Pressure mounting plate screws loose.	5. Tighten mounting screws.
	6. Sprocket shoe locks not closing.	6. Clean or adjust.
	7. Sprocket drive gear loose on shaft.	7. Retime and tighten.
	8. In-out bracket spring broken.	8. Replace spring.
Shuttle operates but sprockets do not revolve	1. Animation clutch spring broken or lost (Design 542 and 542EX).	1. Replace spring.
Lower loop not restored	1. Loop restorer stroke too short.	1. Adjust (paragraph 76 or 77).
	2. Loop restorer does not engage restorer cam.	2. Adjust (paragraph 76 or 77).
Film rubs on loop restorer roller	1. Restorer arm out of position.	1. Reposition (paragraph 76 or 77).
Excessive film slap	1. Damaged film.	1. Recondition or replace.
	2. Green film.	2. Age or buff film.
	3. Dirty gate.	3. Clean gate.
	4. Pressure shoe rubbing on edge guides.	4. Realign pressure shoe.
	5. Incorrect shuttle stroke.	5. Adjust (paragraph 66d).
Animation clutch does not operate (Design 542 and 542EX)	1. Open circuit.	1. Repair circuit.
	*2. Solenoid plunger set too high or too low.	2. Adjust solenoid plunger.
	3. Stop pawl clearance excessive.	3. Adjust (paragraph 69a).
Animation clutch stops sprocket but shuttle pulls film	1. Insufficient shuttle retraction (Design 542 and 542EX).	1. Adjust (paragraph 69b).
Splices jam in sprocket shoes	1. Bad splices.	1. Replace splices.
	2. Emulsion build-up.	2. Clean (see paragraph 1).

*Early Models Only.

6. SOUND SYSTEM TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Projector runs, tubes do not light	1. Loose connection.	1. Repair connection.
	2. Tube burned out.	2. Replace tube.
	3. Amplifier switch damaged.	3. Replace switch.
	4. Heater series resistor open.	4. Replace resistor.
Tubes light, exciter does not light	1. Exciter lamp cable disconnected.	1. Connect cable.
	2. Wrong exciter lamp used.	2. Replace with correct lamp.
	3. Damaged oscillator tube.	3. Replace tube.
	4. Projector switch open or leads disconnected.	4. Replace switch or connect leads.
Tubes and exciter light, but no sound	1. Speaker jack disconnected or speaker jack switch open.	1. Connect leads. Repair or replace jack.
	2. Photocell cable disconnected or leads reversed.	2. Connect cable. Connect leads to proper terminals.
	3. Damaged tubes.	3. Replace tubes.
	4. Photocell out-of-line.	4. Realign (paragraph 73b).
	5. Dirt on end of photocell.	5. Clean (paragraph 1).
	6. Wrong exciter lamp used.	6. Replace with correct lamp.
Low volume	1. Damaged tubes.	1. Replace tubes.
	2. Wrong exciter lamp used.	2. Replace with correct lamp.
	3. Photocell out-of-line.	3. Realign (paragraph 73b).
	4. Dirt on photocell or slit.	4. Clean (paragraph 1).
	5. Slit misaligned.	5. Realign (paragraph 73d).
	6. Buzz track misaligned.	6. Realign (paragraph 73e).
Distortion at all volume levels	1. Wrong exciter lamp used.	1. Replace with correct lamp.
	2. Inverter or output tubes damaged.	2. Replace tubes.
	3. Open element in one output tube.	3. Replace tube.

6. SOUND SYSTEM TROUBLES AND REMEDIES (CONT).

TROUBLE	PROBABLE CAUSE	REMEDY
Crackling noises	1. Damaged tubes.	1. Replace defective tubes.
	2. Broken ground lead to mechanism or blower housing.	2. Repair leads.
	3. Grounding springs loose, bent or lost.	3. Repair or replace springs.
	4. Buzz track out-of-line.	4. Realign (paragraph 73e).
	5. Broken cable shield.	5. Repair shield.
Wow or flutter	1. Stabilizer guide roller sticking.	1. Clean roller.
	2. Stabilizer guide roller spring broken, unhooked or lost.	2. Repair or replace spring.
	3. Film edge guide (soundhead) out-of-line.	3. Realign (paragraph 73e).
	4. Loose flywheel.	4. Tighten flywheel.
	5. Damaged sound drum bearing.	5. Replace bearing.
	6. Dirt causing guide roller arm pivot bearing to bind.	6. Clean and polish.
	7. Photocell or exciter cable rubbing against flywheel.	7. Reposition photocell.
	8. Chip or dirt in take-up sprocket gear teeth.	8. Remove and clean.
	9. Loop restorer stroke is too short or restorer set too low.	9. Adjust (paragraph 76 or 77).
Clicking noises	1. Dirt on sound drum.	1. Clean sound drum.
	2. Broken ground lead to mechanism or blower housing.	2. Repair leads.
	3. Sound drum grounding spring loose, bent or lost.	3. Repair or replace spring.
High frequencies fade (jumps focus)	1. Warped film.	1. Recondition or replace film.
	2. Film edge guide (soundhead) out-of-line.	2. Realign (paragraph 73e).
	3. Dirt on sound drum.	3. Clean sound drum.
Hum	1. Tube shield lost.	1. Replace shield.
	2. Screws holding amplifier base shield to PC board loose or lost.	2. Tighten or replace.
	3. Frame by-pass condenser open or disconnected.	3. Replace or repair condenser.
	4. Amplifier not at same potential as test equipment.	4. Operate amplifier from isolation transformer.
	5. Grounded wiring.	5. Correct grounded condition.

Disassembly Procedure

7. GENERAL INSTRUCTIONS.

a. Physical differences in models are clearly shown in parts catalog illustrations and clarified in parts list "Notes." Be sure to review these differences and determine which parts are applicable to your projector.

b. When removing riveted parts for replacement, the old rivet must be drilled out with a drill equal to, or slightly smaller than, the diameter of the rivet to be installed.

c. When unsoldering is required to replace electrical parts, care must be used to avoid the application of heat to adjacent parts. Use a heat sink, if necessary, or grip the lead with a pliers to provide additional heat dissipation.

CAUTION: In the current design of all projector models, castings are drilled (but not tapped) to accept swage screws (all with part numbers in the 30800 series). If the swage screw is the same size as the corresponding machine screw used in earlier model castings (with tapped screw holes), the swage screw only is listed in the parts lists and can be used in both early and current model projectors. However, machine screws cannot be used in current model (untapped) castings. Therefore, if any early model casting must be replaced with a current model casting, all machine screws used with that casting must be replaced with the new swage-type screws. Where the thread size of the swage screw differs from that of the corresponding machine screws used in earlier models, refer to the parts lists for the listing of both screws.

8. REMOVING FIGURE 1 PARTS. Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Most labels and nameplates are adhesive backed or cemented in place and should not be removed unless damaged, illegible or defaced.

b. If the rear cover (3) must be replaced on earlier projector models, refer to Note A following the Figure 1 parts list for special instructions.

9. REMOVING REEL ARMS AND CLUTCHES. (See Figure 2.) Various styles of reel arms and clutches, from early models to current styles, are illustrated in Figure 2. In all instances, reel arms can be removed by disassembling the clutch parts from the reel arm shafts; then withdrawing the reel arm and its bronze washer from the projector mechanism plate. If replacement of clutch parts is necessary, note the following special instructions.

a. When repairing clutch systems on rear reel arms, note that certain parts of the wobble plate clutch system (Figure 2A) and the ratchet and cushion clutch system (Figure 2B) will shortly be unavailable. If any of these indicated parts are in need of replacement, the clutch system must then be modified to the new Torrington system shown in Figure 2C. This is accomplished by discarding all of the indicated parts of the earlier system and installing the E-ring (P/N 21736) and the sprocket assembly (P/N 012654) in their place. In addition, the reel arm must be disassembled and the existing reel arm shaft replaced with the latest shaft (P/N 40295).

b. When replacing clutch systems on the front reel arms, note that certain parts of the wobble plate clutch system (Figure 2D) and the interim Torrington clutch system (Figure 2E) will shortly be unavailable. If any of these indicated parts are in need of replacement, the clutch system must then be modified to the new Torrington system shown in Figure 2F. This is accomplished by discarding all of the indicated parts of the earlier system and installing the latest rewind sprocket (P/N 012661) and take-up reverse sprocket (P/N 012662) in their place.

10. REMOVING FIGURE 3 PARTS. Remove Figure 3 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Early style condenser lens (P/N 200454) can be used in both the early and current condenser lens assemblies; however, the current lens (P/N 201611) can be used only in the current lens assembly together with the two retaining springs (P/N 37311 and 37312).

b. When removal of parts requires that leadwires be disconnected or unsoldered, tag the leadwires to facilitate rewiring during reassembly.

11. REMOVING FIGURE 4 PARTS. Remove Figure 4 parts, as necessary, in their indexed order of disassembly, noting the following special precautions. For earlier design snubber parts, refer to paragraph 13, following.

NOTE: Current idler rollers (item 4, P/N 41330) are not interchangeable with earlier rollers (P/N 39523) and can be used only with the current snubber roller shaft assembly (7, P/N 012330). If the snubber roller shaft assembly must be replaced, the current shaft assembly will be furnished, together with two of the current idler rollers.

a. Remove the snubber handle (3) and disassemble the idler roller (4) from the snubber shaft assembly (7). Remove the retaining ring (6) and disassemble

the snubber shaft assembly (7), snubber spring (8), spring retainer (9), and spring cover (10) from the snubber mounting post (11).

b. If the flywheel (17) must be removed, insert a 1/16-inch punch carefully through the hole in the sound drum shaft housing and into the hole in the sound drum shaft (rotate the shaft until the punch drops into hole). Hold the punch and shaft stationary while loosening the flywheel nut (16). When withdrawing the flywheel, note if there are spacing washers located on the shaft behind the drum. These washers are used on later model projectors where the inner hub of the flywheel was enlarged to eliminate binding against the sound drum. On earlier models, flywheels have a small shoulder on the inner hub which eliminates the need for spacing washers.

c. Support the soundhead assembly (21) while removing the mounting screws (19) and the washers (20), and withdraw the assembly carefully from the projector main plate.

d. The complete mechanism assembly (23) is secured to the main plate with four screws (22). Disengage the rewind timing belt and support the mechanism firmly while removing the mounting screws.

12. REMOVING EARLIER MODEL SNUBBER PARTS.

a. Early Base-Mounted Snubber (Figure 4A). Note the manner in which the springs (5) and (9) are engaged before disassembling parts. Remove the screw (2) and the hex nut (3). Remove the stud (1) and disassemble the snubber and roller assembly (4), spring (5), washer (6), detent (7) and its tubing (8) from the projector frame. Remove the screw (10) and slip the idler roller (11) from the roller shaft (12). In early frame mounted designs, the film exit below the sprockets consisted of an outer guide (13) and an inner guide (14) with a tension spring (9). In later models, a one piece film exit guide (15) was used.

b. Latest Base-Mounted Snubber (Figure 4B). Remove the screws (1), washers (2) and nut or nuts (3), and lift the snubber assembly (4) from the base. Remove the screw (6) and slip the idler roller (7) from the roller shaft (8). Remove the screw (9), washer (10) and shaft (8) to disassemble the film exit guide (11) from the projector frame.

NOTE: Film exit guide parts (6 through 11, Figure 4B), are also used in all projectors equipped with the snubber roller design shown in Figure 4. In some models, the exit guide was fastened to the projector frame exactly as shown in Figure 4B. In current projectors, the exit guide is attached to the mechanism casting as shown in Figure 14A.

13. REMOVING SOLENOID-OPERATED CLUTCH AND FIRE SHUTTER PARTS — 542 AND 542EX ONLY. The solenoid-operated clutch and fire shutter system (Figure 5) was used in earlier Model 542 and 542EX projectors. Note the following precautions when removing these parts.

a. Make a note of leadwire connections before removing the solenoids (6) or (15). To remove the clutch solenoid (6), first remove the mounting screws (4) and washers (5). Then loosen the setscrew (1) in the upper clutch rod collar (2) and withdraw the collar from the rod. Remove the solenoid, slipping the rod down until it disengages from the hole in the stop pawl (item 31, Figure 16).

b. Disengage the upper end of the fire shutter solenoid rod (11) from the fire shutter. Note the manner in which the ends of the fire shutter spring (12) are engaged, and disassemble the rod and spring from the fire shutter solenoid (15). Remove the screws (13) and washers (14) and disassemble the solenoid (15) from its bracket (17).

14. REMOVING THE MECHANICALLY-OPERATED CLUTCH AND FIRE SHUTTER PARTS — 542 AND 542EX ONLY. The mechanically-operated clutch and fire shutter system (Figure 6) is used in current Model 542 and 542EX projectors. Note the following precautions when removing these parts.

a. The projector drive motor must be removed (paragraph 15) to gain access to the clutch parts.

b. Loosen the setscrew (2) and remove the collar (3) from the lower end of the clutch rod (4). Disassemble the clutch rod from the clutch lever (15).

c. Disengage the short clutch rod (13) from the clutch lever (15) and the Still-Run bracket (18). Remove the retaining ring (14) and withdraw the clutch lever from the clutch lever shaft (6). Make certain that the Still-Run knob (8) has been removed from the camshaft (20).

d. Note the manner in which the springs (12) and (16) are engaged and the cams (21) and (23) are assembled. Remove three screws (17) and withdraw the Still-Run bracket (18) from the projector main plate. Removal of the retaining ring (19) will permit the camshaft assembly (20), cams (21) and (23) and pawl bushing (22) to be disassembled from the bracket (18).

15. REMOVING FIGURE 7 PARTS. Remove Figure 7 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Make a note of leadwire connections before disconnecting or unsoldering leads. Note also the manner in which the flat belt (28) threads around the motor pulley (35) and through the belt shifter (29).

b. Handle the speaker (4) carefully so as not to damage the cone. If damaged, place on a shelf for possible repair.

c. The starting capacitor (8) can be replaced by disconnecting the spade lugs from its terminals; then loosening the screw (5) and sliding the capacitor from its clamp (7).

d. If the motor relay (11) is to be replaced, check the inset in Figure 7 for the style of relay to be used

and the manner in which leadwires are connected to relay terminals. The relay is secured to the bracket (13) with two screws (9) and hex nuts (10).

e. The reel arm lock plungers (20) and their springs (19) are retained by the brackets (18). If the plungers are sticking or operating stiffly, remove them and check for burrs, caked lubricant or dirt, broken spring coils, etc. Remove burrs with crocus cloth, clean, re-lubricate and reinstall.

f. Disengage the blower belt (21) from the pulleys on the drive motor and blower motor. As noted in the Figure 7 parts list, projectors with Serial No. 76399 and lower use drive belt P/N 31687, while projectors with Serial No. 76400 and up use the V-type of belt, P/N 40283. Motor pulleys (35) are similarly affected and must be replaced with a pulley of the same identifying color and belt groove as that which was removed.

g. The drive motor (27) can be removed by loosening the screws in the bracket straps (25) and unhooking the straps from the motor mounting brackets (40). It should be noted that the motor discharge spring (26) is used only with earlier motors. Current motors are equipped with a grounding device which automatically grounds the motor to the main plate when the motor bracket strap (25) is tightened. Note also that motor (P/N 01189) (G.E. #5KCM49GG151) has been discontinued. If the projector being repaired is equipped with such a motor and the motor must be replaced, order motor (P/N 011893) plus one mounting bracket (P/N 31263). The mounting bracket (40) must be used in place of the bracket used at the closed end of the discontinued motor.

16. REMOVING FIGURE 8 PARTS. Remove Figure 8 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. If the rotary switch (4) is in need of replacement the current switch (P/N 41322) will be furnished. This latest switch is internally wired to provide sound cut-off during reverse operation.

b. In all current projector models, the amplifier assembly (12) is secured to the main plate (41) with No. 6-32 swage-type screws (10) in place of the No. 5-40 machine screws used in earlier models. If the main plate and bearing assembly is replaced, be sure to order the necessary swage screws (P/N 30881) and lock washers (P/N 17168) for remounting the amplifier.

c. The complete tilt mechanism assembly (20) can be removed by first disassembling the screw (15), lock washer (16) and tilt bar (17); then removing the two screws (18) that attach the tilt housing (20K) to the main frame. If the tilt housing has countersunk mounting holes, the attaching screws will either be slotted head Sems screws (P/N 36053) or swage-type screws (P/N 30857) used in the most current models. Early style tilt housings were attached with screws (P/N 31694) and lock washers (P/N 600797).

d. Be sure to check the style of interlock switch (27) used in the projector being repaired. As noted in the parts list, the part number of the terminal strip (25), the interlock switch bracket (30) and the projector base (42) will vary depending on the interlock switch being used. Refer to the inset in Figure 8 for the difference in appearance between early and current interlock switches.

e. When replacing the preamplifier (37), note that early projector models required the use of a spacer (37A) behind the lower right mounting hole of the amplifier board.

17. DISASSEMBLING THE FRONT REEL ARM. (See Figure 9.) Remove front reel arm parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. In earlier projector models, the reel arm cover (2) is secured with two machine screws and lock washers. In current projector models, the cover is secured with two swage-type screws (1). If the reel arm cover must be replaced, be sure to order two swage screws (P/N 30879) for cover installation. When the cover is removed, note the presence of any shim washers (3) between reel arm and cover.

b. To remove the spindle parts (5 through 1), drive out the spring pin (4). This pin must be replaced with a new one at reassembly. Withdraw the spindle (10) and its washer (11) from the reel arm, catching the collar (5), torsion spring (7), gear (8) and washers (9), (9A) and (9B) as they are freed.

c. Loosen the setscrews (12) and disassemble the upper gear assembly (13) and clutch spring (14) from the reel arm shaft (29). Remove the two retaining rings (15), the clutch disc assembly (16), the two brass washers (17) and the spring tension washer (17A). The reel arm shaft (29) is now free and can be pressed from the splined bearing (30).

d. Remove the retaining ring (18) and clips (19) and disassemble the nylon spur gears (20) and (20A), the washer (21) and the drive shaft (22) from the reel arm. Inspect the nylon bearings for damage and replace, if necessary.

e. Remove the two retaining rings (24) and disassemble the friction shoe (25), the friction shoe bracket (26), the disc assembly (27), bronze washer (28) and splined bearing (30) from the reel arm. Do not press out the needle bearings (30A, 34A and 34B) unless obviously in need of replacement.

f. Some early model projectors were equipped with an eccentric spacer, or stop, located beneath the brake spring (32). This eccentric serves no purpose and can be eliminated; however, a 5-40 by 3/16 inch fillister head screw (P/N 25837) must then be used to attach the brake spring. The eccentric is not used in current model projectors, and brake spring is attached with a swage-type screw (P/N 30804). If reel arm must be replaced, current (untapped) arm will be furnished and the swage screw (P/N 30804) also must be ordered.

18. DISASSEMBLING THE REAR REEL ARM. (See Figure 10.) Remove rear reel arm parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

NOTE: If the rear reel arm clutch system is being converted to the current Torrington style (paragraph 10), the rear reel arm shaft (P/N 31233) (27) must be replaced with shaft (P/N 40295). This can be accomplished by removing the reel arm cover (8) and disassembling only those parts outlined in step c, following.

a. Disconnect and remove the take-up belt (1) and swivel the take-up arm assembly (6), catching the spring (2) as it is released. Remove the screw (3) and disassemble the take-up spindle (4) from the arm. The take-up arm need not be removed from the rear reel arm (29) unless in need of replacement. Note that in some earlier models, a split roll pin (P/N 303188) was used to mount the take-up arm in place of the dowel pin (5) currently used. In such instances, the split roll pin must be used when replacement is necessary.

b. In earlier projector models, the reel arm cover (8) was secured with two machine screws and lock washers. In current projector models, the cover is secured with two swage-type screws (7). If the reel arm cover must be replaced, be sure to order two swage screws (P/N 30879) for cover installation. When the cover is removed, note the presence of any shim washers (P/N 34874) between the reel arm and cover.

c. Remove the retaining ring (9) and clips (10) and remove the nylon gears (11) and (12) and the washer (13) from the drive shaft (22). Loosen the setscrews (24) and disassemble the gear assembly (25), the washers (26) and the reel arm shaft (27) from the reel arm.

d. Remove the retaining ring (14) and withdraw the pulley and gear assembly (15) from the rewind drive shaft (21). Inspect the nylon bearings (16) and the rubber sleeve (30) for damage or wear. The shaft (21) can be removed by loosening the setscrew (20) in the reel arm boss.

e. Withdraw the drive shaft (22) from the cast ears of the reel arm and press out the splined bearing assembly (28). Inspect the nylon bearings (23) for damage or wear. Do not press out the needle bearings (6A) or (28A) unless obviously in need of replacement.

19. DISASSEMBLING THE LAMPHOLDER. (See Figure 11.) Remove the screws (1) and separate the lamp baffle (2) from the lamp socket bracket (8). Disassemble the release lever pin (3), release lever (4) and tension washer (5) from the bracket. Replace the vinyl sleeve (9) if torn or otherwise damaged. The lamp socket (7) is secured to the bracket with two rivets (6). If in need of replacement, the rivets must be drilled out.

20. DISASSEMBLING THE LAMPHOUSE. (See Figure 12.) Remove lamphouse parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. If the nameplate (1) must be replaced, note that the earlier styles (P/N 31971 and 31278) are cemented in place, while the current styles (P/N 41111 and 41112 are adhesive backed and can only be used on the current smooth-surfaced lamp housings (P/N 42207 or 42208).

b. Disassemble the screws (2), lamp shield (3), washers (4) spacer bushings (5) and heat reflector (6) from the lamphouse. Refer to Note B following the Figure 12 parts list for proper replacement of screws (2) and spacer bushings (5).

c. Unscrew and remove the lamphouse handle (7) and latch (8).

d. Early style lamphouse grilles (10) with two drilled holes for mounting are no longer available. Refer to the reassembly instructions for the procedure involved in installing single-hole grilles on early style lamp housings.

21. DISASSEMBLING THE SOUNDHEAD. (See Figure 13.) Remove soundhead parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

NOTE: Both photocell styles (germanium photodiode and silicon cell) are shown and listed in Figure 13 and its accompanying parts list. Germanium photodiodes are no longer available and, if in need of replacement, the projector must be converted to the silicon cell-preamplifier style currently in use. Refer to the Modifications section for pertinent instructions.

a. Make a careful note of leadwire connections before disconnecting or unsoldering leads during disassembly.

b. The optical slit assembly (4) can be removed by loosening the clamping screw (3) and withdrawing the assembly from the housing (38). Remove the retaining ring (5) and unscrew and remove the guide roller adjusting screw (6).

c. To remove the photodiode (8) on models so equipped, take out the two screws (7) that fasten the photodiode (8) to the photocell holder (19). Remove the hex nuts (9) and (9A) and disengage the leads of the cable (10) from the photocell terminal posts. The photocell holder (19) clamps around the sound drum shaft housing and can be removed by loosening the clamping screw (18).

d In earlier models projectors, the soundhead is tapped and two setscrews (21) were tightened against the sound drum housing to lock the assembly in place. In later models, the sound drum housing is drilled and tapped to receive two Sems screws (21A). In either case, remove these screws and loosen the locking setscrew (20). Withdraw the sound drum assembly carefully, noting the manner in which the light pipe (photodiode

models) or the silicon cell assembly (24) and its retainer (23) are assembled into the slot in the sound drum shaft. Wrap the sound drum assembly and light pipe or silicon cell assembly in tissue to protect them against damage.

e. Stabilizer arm assembly (34) (P/N 09833), has been discontinued and is superseded by stabilizer arm (34A) (P/N 31659). Torsion spring (P/N 31672) (36), is used only with the early arm assembly; therefore, if the early arm assembly is to be replaced with the current arm, spring (P/N 31672) also must be replaced with current spring (P/N 39789). The earlier style spring is still available for service.

f. The insets in Figure 13 illustrate the early and current style of exciter lamp retaining pins. Note that the springs are the same in both styles. However, the early style collar and pin are no longer available. If in need of replacement, order a set of current parts consisting of pin (P/N 41321) and bushing (P/N 41320). Refer to the Reassembly section for installation procedures.

g. Early style soundhead housings (with tapped screw holes) are no longer available. If the housing must be replaced, be sure to order the proper quantity of swage-type screws (items 3, 31 and 33) for reassembling parts to the new casting.

22. DISASSEMBLING THE MECHANISM. (See Figure 14.) Remove Figure 14 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Pry out the hinge pins (1) with a wire cutter or similar tool to free the lens carrier assembly (4). Note that the spring washer (2) is used with the upper pin and the flat washer (3) with the lower pin. Refer to paragraph 27 for lens carrier disassembly procedure.

b. When removing speed change knob parts (items 5 through 10), note the manner in which the spring (9) is installed.

c. Remove the screw (11) and washer (12) and disassemble the sprocket guard roller (13) from the roller post (15). Inspect the nylon bearings (14) and, if damaged, replace them. If the roller post must be replaced, be sure to check the thread size (8-32 or 10-32) and order replacement post accordingly.

d. Remove the two retaining rings (18) and withdraw the clutch lever shaft (19). Remove three screws (16) and disassemble the outboard bearing assembly (20) and the rewind clutch lever (21) from the upper sprocket shaft. Check the physical appearance of the clutch lever against the insets in Figure 14 to determine the proper part number for replacement. Withdraw the rewind button (22) and spring (23) from the opening in the mechanism casting.

e. Remove the rewind timing belt (24) and examine it for unusual wear or physical damage. Replace belt if necessary. Remove the retaining rings (25) and disassemble the rewind drive sprocket (26), flat washer (27), spring (28) and spline driver (29) from the upper sprocket shaft. Loosen the setscrews (30) and remove the take-up drive sprocket (31).

f. Early model projectors were equipped with the metal sprocket guards shown in Figure 15. Note that the early style upper sprocket (P/N 011196) (item 37, Figure 14) and lower sprocket (P/N 011198) (item 38) are used with the metal guards and that the lens carrier assembly (item 4) is similarly affected (Note A, Figure 14 parts list). All current model projectors are equipped with the molded sprocket guards and new sprocket assemblies shown in Figure 14A.

g. On projectors with metal sprocket guards, loosen the setscrews (34) and disassemble the gears (35), tension washers (36), sprocket assemblies (37) and (38), and the thrust washers (39) from the mechanism casting. Refer to paragraph 23 for removal of molded sprocket guards and new sprockets.

h. Only the current (drilled but untapped) mechanism housing will be available for replacement. If the housing must be replaced, be sure to order a sufficient quantity of the swage-type screws (16) for reinstalling the outboard bearing (20) to the new casting.

23. REMOVING CURRENT SPROCKET AND GUARDS. (See Figure 14A.) All current projectors are equipped with the molded sprocket guards and new sprocket assemblies illustrated in Figure 14A. These parts are not interchangeable with earlier style sprockets and metal sprocket guards.

a. Before removing the sprocket guards (5), make a note of the manner in which the torsion springs (6) are assembled. Then remove the screws (3) and washers (3A) and disassemble the sprocket guards (5), film rollers (4) and springs (6) from the mounting posts of the sprocket guard plates (18) and (19).

b. Disassemble the outboard bearing, sprockets and sprocket gears from the rear of the sprocket shafts as outlined in paragraph 22. Withdraw the sprockets (7) and (8), the lower sprocket flange (9) and the thrust washers (10) from the mechanism casting.

c. Remove the screws (17) and disassemble the sprocket guard plate assemblies (18) and (19) from the mechanism casting.

24. DISASSEMBLING THE MECHANISM. (See Figure 15.) The early style metal sprocket guard assemblies (5), (5A) and (5B) are shown in this illustration. Refer to Figure 14A for molded sprocket guards used in all current models.

a. On early models only, remove the screws (1) and disassemble the threading guide (3) and sprocket guards (5), (5A) and (5B) from the mechanism casting. Refer to paragraph 19 for sprocket guard disassembly instructions.

b. Remove two screws (6) and lift off the aperture plate assembly (7). Refer to paragraph 20 for aperture plate disassembly instructions.

c. Remove the screw (8), lens carrier catch (9) and spacer (10). Do not unscrew or remove the lens stop screw (11).

d. Early Loop Restorer Parts. Remove the screw (14), eccentric anchor (15) and overcenter springs (16). Loosen the hex head screw (17) and disassemble the cam follower support assembly (18) and loop restorer lever and shaft assembly (31A) from the mechanism casting. Remove two screws (18A) and disassemble the alinement bracket (18B) and cam follower (18C) from the follower support (18D).

e. Current Loop Restorer Parts. Remove the screw (19) and withdraw the roller (20) from the loop restorer shaft (31). Remove the screw (21) and washer (22) and disengage the free end of the spring (23) from the end of the loop restorer shaft. Remove the screw (24), lock washer (25) and flat washer (26) and lift off the cam follower support assembly (27). Do not disassemble cam follower parts unless in need of replacement. Loosen the hex head screw (28) and disassemble the loop restorer arm (29), washer (30) and loop restorer shaft assembly (31) from the mechanism casting. When removing the self centering assembly (35), check for the presence of washers (36) between the assembly and the casting. These washers are used only if the casting is machined at the mounting area.

25. DISASSEMBLING THE MECHANISM. (See Figure 16.) Remove Figure 16 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Loosen the two setscrews (1) and withdraw the mechanism pulley (2) from the end of the shuttle shaft. Remove screws (3) and (4) and lift off the fire shutter assembly (5) or the support bracket (5A). The fire shutter assembly is used only on Model 542 and 542EX projectors, and disassembly instructions will be found in paragraph 30. Remove two screws (3) and washers (3A) to free the heat baffle (6).

b. Remove the shutter nut (7), counterbalance weight (8), the shutter (9) or (9A) and the fiber washer (10). On current export models only, the two-bladed shutter (9A) is being used. When repairing export models equipped with the three-bladed shutter, the two-bladed shutter should be used for replacement when necessary. See following Note for replacement instructions.

NOTE: When stock of early style shutters (P/N 31004) is depleted, it will be necessary to furnish the current shutter (P/N 41308) (3-blade) or (P/N 41309) (2-blade) together with the current pull-down cam (18) (P/N 41307). The current cam and shutters are provided with identification markings (see inset, Figure 16).

c. Unless obviously in need of replacement, do not disassemble the ball and stud assemblies (12) or the shuttle link bearings (17A) from the shuttle arms (17). Inspect the pull-down cam followers (17B) for wear. These followers can be reversed or turned end-for-end if badly worn. In current model projectors, the followers are staked in place in the recess of the shuttle arm. Refer to the Reassembly section for replacement instructions. Unhook the extension spring (13) from the end of each arm (17) and remove the felt wiper (14) and shuttle arms from the assembly. The cam wiper wick (15) is inserted within the coils of the spring (13). If unusually dirty, the wiper and wick should be replaced. Lubricate new wicks as outlined in the Lubrication instructions, paragraph 2.

d. Remove the pull-down cam (18) from the camshaft. Refer to the note following paragraph 25, step b, for pull-down cam and shutter replacement. Remove screws (19) and withdraw the in-out cam (21) and the in-out bracket assembly (22). Note that the in-out follower (22A) and in-out spring (22B) are replaceable.

e. Unscrew the bearing support assembly (23) from the shuttle arm plate assembly (25). Remove two screws (24) and disassemble the shuttle arm plate from the mechanism housing, disengaging the upper forked arm of the plate from the framer shaft assembly (27). Pull out the stop pin (26) and unscrew the framer shaft assembly from the mechanism housing.

f. Models 542 and 542EX Only. Before disassembling the following parts, note the manner in which the legs of torsion spring (30) are engaged. This spring and the clutch stop (36) are used only on Model 542 and 542EX projectors equipped with the solenoid-operated clutch system (Figure 5). Remove the two retaining rings (28) and withdraw the stop pawl shaft (29), the torsion spring (30), and the stop pawl (31). Remove screws (32) and (35) to disassemble the shaft bracket (33) and bearing bracket (37) from the mechanism housing. Press the grommets (34) from the shaft bracket.

g. Only the current (drilled but untapped) mechanism housing will be available for replacement. If the housing must be replaced, be sure to order a sufficient quantity of swage-type screws (items 3, 24, 35 and 38) for reassembly of parts to the new casting.

26. DISASSEMBLING THE MECHANISM. (See Figure 17.) Remove Figure 17 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Models 535 and 540 Only. Remove the large retaining ring (8). Remove the two screws (9) and the bearing loading spring (10). Loosen the setscrew (11) in the loop restorer cam (27) and the two setscrews (24A) in the worm gear (24B). Shift the camshaft (30) to the left until the bearing (12) is forced from its seat. Remove the bearing and the shim washer (12A). Remove retaining ring (28) and slide the camshaft to the right, forcing out the large bearing (29). Remove the worm gear (24B) and loop restorer cam (27) as the shaft is withdrawn. Loosen the setscrew (32) and unscrew the rewind adjustment stud (33) from the top of the mechanism housing. Remove the screw (34), condenser holder (35), special washer (36) and tension spring

(37). Note that only the current (drilled but untapped) mechanism housing will be available for replacement. If the housing must be replaced, be sure to order new swage-type screws (9) and (34) and current bearing loading spring (P/N 42244) (item 10) as well. The No. 4-40 swage screw (P/N 30804) (item 9) cannot be used with earlier mechanism housings, since these screw holes were tapped with a No. 3-48 thread. Machine screws (P/N 31094) (item 9) must be used in earlier castings to secure the bearing loading spring (10).

NOTE: The following steps of disassembly are to be used only when repairing the Model 542 and 542EX projectors.

b. Unscrew and remove the round nut (4), washer (5) and shuttle adjustment bracket (6). Remove the two screws (1) and (2) and washers (3), and lift the animated clutch bracket assembly (7) from the mechanism housing. Remove the three retaining rings (7B) and slide the shaft (7C) from the clutch mounting bracket (7L), removing the slide bumper (7D), flat washer (7E), spring (7F) and clutch slide bar assembly (7G) as the shaft is withdrawn. Remove the screw (7H) and washer (7J) to free the strike (7K) from the clutch slide bar. Note that in current projector models a No. 4-40 hex washer head screw (P/N 41317) (item 7H) is used to hold the strike (7K) more firmly. This screw can only be used with the latest strike (P/N 41318). The earlier strike (P/N 31050) will be furnished until stock is depleted, after which the current strike and screw must be ordered. See Note A following Figure 17 parts list.

c. Remove the large retaining ring (8), the two screws (9) and the bearing loading spring (10). Loosen the setscrew (11) in the loop restorer cam (27) and shift the camshaft (30) to the left until the bearing (12) is forced from its seat. Remove the bearing and the shim washer (12A). Pry retaining rings (16) and (28) from the camshaft and slide the camshaft to the right, forcing out the large bearing (29). Remove the clutch parts (13 through 27) as the shaft is withdrawn, noting the manner in which torsion spring (14) is assembled. Refer to paragraph 31 for further disassembly of the worm gear (24).

d. Camshaft (P/N 31008) (item 30C) used in earlier model projectors will be made from camshaft (P/N 36039) and therefore will have two sets of slots and flats. The relative position of slots and flats of the modified camshaft is shown in the inset beneath the Figure 17 parts list.

e. Loosen the setscrew (32) and unscrew the rewind adjustment stud (33) from the top of the mechanism housing. Remove the screw (34), condenser holder (35), special washer (36) and tension spring (37).

f. Only the current (drilled but untapped) mechanism housing will be available for replacement. If the housing must be replaced, it also will be necessary to order two swage-type screws (P/N 30804) (item 9), current bearing loading spring (P/N 42244) (item 10) and the swage-type condenser holder screw (P/N 30884) (item 34).

27. DISASSEMBLING THE LENS CARRIER. (See Figure 18.) Remove Figure 18 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Remove the screws (1) and hold-down spring (2) and lift out the focus knob assembly (3).

b. Remove the two screws (4) and disassemble the pressure plate (6), spacer bushings (5), springs (7) and on early models only, the flat washer (8) from the lens carrier.

c. Remove screws (9) and adjustment plate (10). Note the difference in screws (1) and (9) used in earlier and current projector models. Machine screw can be used only with the early tapped lens carriers. The swage-type screws are required for current lens carriers (drilled but untapped). Only the current lens carrier will be available for replacement; therefore, if the lens carrier (11) must be replaced, be sure to order two each of the swage-type screws (1) and (9) for reassembly of the hold-down spring (2) and adjustment plate (10) to the new casting.

28. DISASSEMBLING SPROCKET GUARD (EARLY MODEL PROJECTORS ONLY). (See Figure 19.) The molded sprocket guards used in all current projectors are one-piece guards which do not require disassembly. To disassemble the metal sprocket guards, proceed as follows:

a. Remove the retaining ring (1) and disassemble the shoulder stud (2) and latch (3) from the sprocket guard plate (10).

b. Note the manner in which the bent ends of the torsion spring (9) are engaged. Remove the detent stud (4) and roller (7). Remove the screw (5) and shim washers (5A). Save these shim washers for later reassembly. Disassemble the sprocket guard (6), roller (7) and torsion spring (9) from the roller stud of the sprocket guard plate.

29. DISASSEMBLING THE APERTURE PLATE. (See Figure 20.) Remove Figure 20 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. As noted in the Figure 20 parts list, all projectors are now standardizing on chrome rails and spring retaining covers. Be sure to check these notes carefully before ordering replacement parts.

b. The insets in Figure 20 illustrate the early and current methods of mounting the spring retaining cover (4) and film tension rail (6).

c. Note that early model aperture plates were drilled only so that the film guide (11) is attached with a screw (8), hex nut (9) and lock washer (10). The current aperture plate is drilled and tapped, and the film guide is secured with screw (P/N 31978).

30. DISASSEMBLING THE FIRE SHUTTER — MODELS 542 AND 542EX ONLY. (See Figure 21.) Unhook and remove the extension spring (1). Note the

manner in which retainer spring (2) is assembled before removing the spring and the filter glass retainer (3). Carefully straighten the retaining ears on the filter arm and remove the fire shutter disc (4) and heat filter (5). Wrap the filter in tissue for protection.

31. DISASSEMBLING THE WORM GEAR — MODELS 542 AND 542EX ONLY. (See Figure 22.) Remove two screws (2), the setscrew (3), and Banc-lok (4) and separate the interlock retainer (1) from the worm gear (5).

32. REPAIRING THE PREAMPLIFIER. (See Figure 23.) Defective electrical parts can be removed by cutting the leads as close as possible to the body of the part or by unsoldering the leads from the terminal posts. When unsoldering, it is advisable to use a heat sink to avoid the direct application of heat to adjacent components. Refer to the NOTE in the schematic wiring diagram following Figure 23 for special instructions on replacing resistor R34 (item 2).

33. DISASSEMBLING THE EARLY STYLE BLOWER. (See Figure 24.) Early style blowers (used on projectors with Serial Number 76399 and lower) were equipped with removable bearings. Remove Figure 24 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Note that blower pulley (P/N 31586) (item 2) is used on early style blower assemblies. Current pulleys are designed to accept the V-type belt (see inset, Figure 24A).

b. To disassemble the blower, remove the screw (5) and hex nut (6); then drill out the eyelet-type rivets (3) and separate the housing halves (8). Note the location of nylon washers (10, 18 and 20) when disassembling blower parts.

34. DISASSEMBLING CURRENT STYLE BLOWER. (Figure 24A.) Current style blowers are equipped with pressed bearings which are not replaceable. Remove Figure 24A parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. If pulley replacement is necessary, be sure to order the proper pulley (2) for the projector being repaired. Current pulleys are designed to accept the V-belt (see inset, Figure 24A).

b. To disassemble the blower assembly, drill out the four eyelet-type rivets (3) and separate the front housing (5) from the rear housing (6). Remove the blower wheel and shaft assembly (9) and the nylon washers (8).

35. REPAIRING THE AMPLIFIER. (See Figures 25 and 26.) Using standard electronic shop techniques, check the amplifier for weak or faulty tubes, for continuity and for shorts and grounds. Refer to the proper schematic diagram (Figures 27 through 33) for voltages and ratings of components. Defective solder-secured parts can be removed by cutting the leads as close as possible to the body of the part or by unsoldering the leads from the terminals. When unsoldering it is advisable to use a heat sink to avoid the direct application of heat to adjacent components.

Reassembly Procedure

36. GENERAL INSTRUCTIONS.

a. When the reassembly procedure includes the staking of rivets or similar parts, all staking and riveting operations should be performed during the early stages of reassembly to avoid damage to other parts. Be sure to support the major part solidly during staking operations.

b. When installing electrical parts, refer to the appropriate wiring diagram (Figures 27 through 33) for proper leadwire connections. When soldering is required, use a heat sink to avoid the direct application of heat to adjacent parts.

c. Parts which require lubrication are listed in paragraph 2 of this Service Manual, together with the specified lubricant. Lubricate sparingly and wipe away excess lubricant with a clean, lint-free cloth. During reassembly, apply a drop of oil to screw holes to facilitate screw installation.

d. Reassembly instructions are not included for the amplifier (Figures 25 and 26) or the preamplifier (Figure 23). Refer to step b, above, for special precautions on parts replacement.

e. Many of the nameplates and instruction plates have a protected adhesive backing. Remove the protective paper and brush the adhesive with a mixture of three parts Toluol to one part trichlorethylene. When adhesive is tacky, press the nameplate carefully but firmly in place. Wipe away excess adhesive with a damp cloth.

f. In current projectors, several of the projector castings are drilled (but not tapped) to accommodate swage-type screws. Except where screw sizes were changed, these swage-type screws can be used in both early and current projectors. However, the machine screws used in earlier models cannot be used in current untapped castings. Only the current castings are available for replacement; therefore, should such a casting be replaced, certain of the machine screws used in earlier models also must be replaced. These instances are noted in the reassembly instructions.

37. REASSEMBLING CURRENT STYLE BLOWER. (See Figure 24A.) Current style blowers are equipped with pressed bearings which are not replaceable. Reassemble the blower as follows:

a. Assemble the retaining ring (7) into the groove of the blower wheel shaft. Install a nylon washer (8) on the long end of the blower wheel shaft and insert the short shaft end into the bearing in the rear blower housing (6).

b. Assemble the front housing (5) to the rear housing and secure the assembly with the four eyelet-type rivets (3). Note the location of the leadwire clamp (4) secured by one of these rivets.

c. Install the second nylon washer (8) down over the protruding end of the blower wheel shaft. If the blower pulley (2) was replaced, be sure that the proper pulley is used for the particular blower being repaired. Current pulleys are designed to accept the V-type belt (see inset, Figure 24A).

38. REASSEMBLING THE EARLY STYLE BLOWER. (See Figure 24.) The early style blower (used on projectors with Serial Number 76399 and lower) were equipped with removable bearings. Reassemble the blower as follows:

a. Insert a nylon washer (20) and bearing (19) into the bearing hole in each housing half (8). Install a large nylon washer (18) on each bearing shoulder, and assemble the retaining rings (17) into the housings to hold these parts in place.

b. Assemble the retaining ring (9) and the blower wheel (16) to the shaft (15) and tighten the setscrew (14). Assemble the collar (13) and nylon washer (10) to the shaft and tighten the setscrew enough to hold the collar in place. Assemble the blower wheel shaft into the rear housing bearing.

c. Install a second nylon washer (10) on the shaft and down against the retaining ring (9). Assemble the front housing half to the rear housing half and secure the assembly with three eyelet-type rivets (3) and the screw (5) and hex nut (6). Note the location of the leadwire clamp (4) and lug terminal (7).

d. Working through the large blower opening, loosen the two blower wheel setscrews (14) and shift the blower wheel until it is centered within the housing halves; then tighten the setscrews securely. Loosen the collar setscrew (12) and locate the collar (13) so that the blower shaft has a barely perceptible amount of end play (about 0.005 inch). Tighten the collar setscrew securely.

39. REASSEMBLING THE WORM GEAR — MODELS 542 AND 542EX ONLY. (See Figure 22.) Assemble the interlock retainer (1) to the worm gear (5) with two screws (2). Install Banc-lok (4) and setscrew (3).

40. REASSEMBLING THE FIRE SHUTTER — MODELS 542 AND 542EX ONLY. (See Figure 21.) Clean the heat filter (5) with lens cleaning fluid and/or lens tissue. Hold the filter by its edge while inserting it into the filter arm. Position the fire shutter disc (4) over

the filter and carefully bend the retaining ears on the filter arm to hold these parts in place. Assemble the retainer (3) and retainer spring (2) to the filter arm. Assemble the spring (1) between the ears of the fire shutter as shown in Figure 21.

41. REASSEMBLING THE APERTURE PLATE. (See Figure 20.) Reassemble the aperture plate as outlined in the following paragraphs.

a. As noted in the Figure 20 parts list, all projectors are now standardizing on chrome rails and spring retaining covers. Be sure to check parts list carefully before ordering replacement parts.

b. Early model aperture plates (12) are drilled so that the film guide (11) is attached with a screw (8), hex nut (9) and lock washer (10). Current aperture plates are drilled and tapped, and the film guide is secured with a single screw (8).

c. The insets in Figure 20 illustrate the early and current methods of mounting the film tension rail (6) and spring retaining cover (4). When assembling these parts to the aperture plate, the ends of the spring (7) should rest in the notched out portion of the film tension rail (6) and the center of the spring should bear against the aperture plate stud. Note that in earlier models, washers (5) are used in place of the spacer bushings (5A) used in current models. Tighten the retaining screws (3) securely. Install the film guide rail (2), tightening the two screws (1) securely.

42. REASSEMBLING SPROCKET GUARD (EARLY MODEL PROJECTORS ONLY). (See Figure 19.) The metal sprocket guards used on early model projectors are reassembled in the following manner.

a. Install the torsion spring (9) onto the roller stud of the sprocket guard plate (10). Hold the roller (7) between the ears of the sprocket guard (6) and install these parts on the roller stud. Engage the bent end of torsion spring (9) with the hole in the plate just behind the roller stud and hook the formed end of the spring behind the ear of the sprocket guard. Seat the guard down against the shoulder of the stud and install the screw (5), with the shims (5A) removed during disassembly.

b. Hold the second roller (7) between the ears of the sprocket guard while inserting the detent stud (4) through the guard and plate. Assemble the latch (3) to the plate, curved surface up and forked end engaging the slotted end of the detent stud. Install the shoulder stud (2) and retaining ring (1).

43. REASSEMBLING THE LENS CARRIER. (See Figure 18.) Reassemble the lens carrier parts as outlined in the following paragraphs.

a. Only the current lens carrier (11) with drilled but untapped screw holes is available for replacement. If the lens carrier casting is replaced, swage-type screws (P/N 30804) (items 1 and 9) also must be ordered for reassembling of parts.

b. Secure the adjustment plate (10) to the lens carrier with two screws (9). Assemble the pressure plate (6), springs (7), washers (8) used on earlier models only, and spacer bushings (5) to the adjustment plate and install and tighten the screws (4).

c. Assemble the focus knob assembly (3) to the lens carrier (11), and install the hold-down spring (2) and screws (1).

44. REASSEMBLING THE MECHANISM. (See Figure 17.) Reassemble Figure 17 parts as outlined in the following paragraphs. Note that steps a through d apply only to Model 535 and 540 projectors, with the remaining steps applying only to Model 542 and 542EX projectors.

NOTE: Only the current (drilled but untapped) mechanism housings will be available for replacement. The machine screws used to attach parts to earlier castings cannot be used with the current castings; therefore, if the mechanism housing was replaced, it will be necessary to order swage screws (P/N 30804) (item 9) and (P/N 30884) (item 34) for reassembly of parts to the new casting. Note also that the current bearing loading spring (P/N 42244) (item 10) also must be ordered because of the larger screw hole size.

Models 535 and 540 Only.

a. Install the condenser holder (35), special washer (36) and spring (37) on the screw (34) and assemble the screw to the mechanism housing (38). Screw the rewind adjustment stud (33) down into the mechanism housing and install the setscrew (32).

b. Lightly grease both bearing holes in the mechanism housing arms. Assemble the washer (12A) and ball bearing (12) into the bearing hole in the mechanism housing. Assemble bearing (29) to the camshaft (30) until the bearing is seated against the shoulder of the shaft. Install retaining ring (28) into the camshaft slot with the convex face of the ring away from the bearing.

c. Insert the end of the camshaft through the right-hand bearing hole in the casting arm and assemble the loop restorer cam (27) and worm gear (24B) to the shaft. Continue pressing the camshaft to the left, inserting the end of the shaft into the left-hand bearing (12) while seating the right-hand bearing (29) in the bearing hole of the cast arm. Install the bearing loading spring (10) with the two screws (9). (See Note preceding step a.) Assemble the large retaining ring (8) into the ring groove of the housing arm, with the convex face of the ring against the bearing (29).

d. Insert a 0.190-inch feeler gage between the loop restorer cam (27) and the cast arm of the housing. Press and hold the cam firmly against the feeler gage while tightening the setscrew (11). Temporarily tighten the worm gear setscrews (24A) until the worm gear can be adjusted at final assembly. Refer to paragraph 76 or 77 for loop restorer cam adjustment.

Models 542 and 542EX Only.

e. Assemble the condenser holder parts as outlined in step a and the camshaft bearings as outlined in step b, above.

f. Note that on current projectors the strike (7K) has a larger tapped hole to accept a No. 4-40 hex head screw (7H). See Note A below Figure 17 parts list for replacement. Assemble strike (7K) to the clutch slide bar assembly (7G) with screw (7H) and washer (7J). Hold the slide bar assembly in position between the ears of the mounting bracket assembly (7L) while inserting the shaft (7C). Slide bumper (7D) must be installed on the shaft between the right-hand ears of the slide bar and the bracket. Assemble the washer (7E) and spring (7F) on the shaft before it is inserted through the two left-hand ears. Install the three retaining rings (7B). The setscrew (7A) must be adjusted at final assembly. Secure the assembled clutch bracket (7) to the mechanism housing with the two screws (1) and (2) and lock washers (3). Assemble the adjustment bracket (6) to the long screw (2) with the washer (5) and round nut (4). Press down firmly on the clutch bracket while tightening the screws (1) and (2).

g. Assemble the three rubber bushings (25) into the holes in the worm gear (24). Assemble the bearing assembly (23) to the worm gear so that the ears of the bearing are aligned with corresponding notches in the worm gear. Insert the ears of the clutch yoke (21) through the slots in the bearing assembly (23) while assembling the spring (22) over the protrusion of the clutch yoke and into the hole in the bearing assembly. Assemble the two shoulder pins (20) to the bearing assembly, pressing them in until they engage the clutch yoke ears. Assemble the trigger (19) and sleeve bearing (18) to the assembled worm gear and bearing assembly.

h. Insert the camshaft, with ball bearing assembled, through the right-hand bearing hole in the casting arm and, to the shaft, assemble the loop restorer cam (27), washer (26) and assembled worm gear group (step g, preceding). Install the spring (14) over the hub of the driven clutch (15), spreading the spring legs so that they straddle the bent ear at the top of the driven clutch. Insert the hub of the driver clutch (13) through the hub of the driven clutch, spreading the legs of spring (14) still further until one of the lugs of the driver clutch is straddled. Install the washer (17) and assembled clutches on the camshaft. The driven clutch (15) must be installed on the camshaft flats so that the bent ear of the clutch is parallel with the flat for the loop restorer cam (27).

i. Continue pressing the camshaft to the left, inserting the end of the shaft into bearing (12) while seating bearing (29) in the bearing hole of the cast arm. Install the two retaining rings (16) in the camshaft grooves, one between washer (26) and cam (27) and the other between washer (17) and clutch (15). Check to make certain that the actuating ear extends beyond the inside edge of the strike (7K). Clutch and loop restorer adjustments will be made after final assembly is completed. Refer to paragraph 69 for clutch adjustments and to 76 or 77 for loop restorer cam adjustments.

j. Install the bearing loading spring (10) with the two screws (9). (See Note preceding step a.) Assemble the large retaining ring into the ring groove of the housing arm, with the convex face of the ring against the bearing (29).

k. Insert a 0.190-inch feeler gage between the loop restorer cam and the cast arm of the housing. Press and hold the cam firmly against the feeler gage while tightening the setscrew (11). The clutch adjustment views, Figure P, illustrate the assembly of clutch parts and can be referred to for assistance during reassembly.

45. REASSEMBLING THE MECHANISM. (See Figure 16.) Reassemble Figure 16 parts as outlined in the following paragraphs. Note that clutch parts (28 through 37) are used only in Model 542 and 542EX projectors. Therefore, disregard step g when repairing Models 535 and 540 projectors.

NOTE: Only the current (drilled but untapped), mechanism housings will be available for replacement. The machine screws used to attach parts to earlier castings cannot be used with the current castings; therefore, if the mechanism housing was replaced, it will be necessary to order the required quantity of swage-type screws (items 3, 19, 24, 35 and 38) for reassembly of parts to the new casting.

a. Screw the bearing support (23) up into the staked nut of the shuttle arm plate assembly (25) turning the support in all the way. Install the framer knob and shaft assembly (27) down into the mechanism housing and press the stop pin (26) into its opening so that the flat on the pin faces the shaft. Engage the fork-like end of the shuttle arm plate framing arm with the cut out of the framer shaft and secure the plate to the cast arm of the housing with screws (24).

b. Loosely assemble the in-out cam (21) to the in-out bracket assembly (22) so that the nylon face of the cam follower (22A) rides against the polished surface of the cam (indicated by arrow, Figure 16). Install this assembled group over the end of the camshaft and fasten the in-out bracket to the mechanism housing with two screws (19).

c. At this point, refer to Figure 15 and install the assembled aperture plate (7) with screws (6). Adjust the aperture plate as instructed in paragraph 65, step a; then return to Figure 16 and continue with reassembly as follows.

d. Make certain that the link bearings (17A) are firmly pressed into the notches at the front end of each shuttle arm (17) and that the cam followers (17B) are assembled into the center notched section of each shuttle arm. Shuttle arm parts (11 through 16) are shown assembled in Figure B. Insert the lubricated cam wiper wick (15) into the coils of the spring (13). Assemble the lubricated felt wiper (14) and the spring

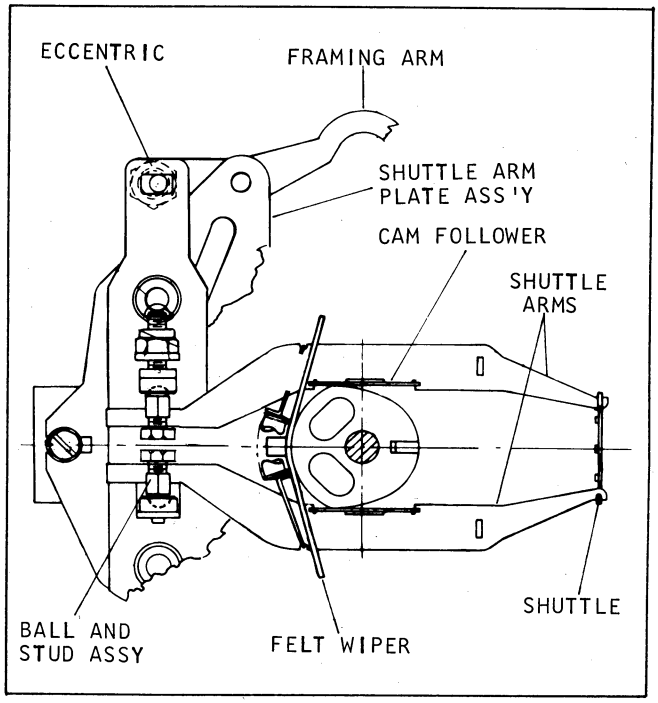


Figure B. Shuttle and Shuttle Arms Assembled

(13) to the rear ends of the shuttle arms. Then assemble the ball and stud assemblies (12) to the arms with the hex nuts (11). Carefully insert the front ends of the shuttle arms between the guides of the in-out bracket (22). Assemble the shuttle (16) to the front ends of the shuttle arms so that the shuttle teeth extend through the shuttle slot in the aperture plate and in toward the mechanism housing. Rotate the in-out cam (21), until the tongue on the unpolished face of cam rests down in the notch in the shoulder of the camshaft. Install the pull-down cam (18) on the camshaft spreading the two shuttle arms apart slightly until the cam is in place. The notch in the face of the pull-down cam must engage a mating protrusion on the face of the in-out cam (21). Back out the bearing support (23) until its socket-like nylon pad engages the ball of the ball and stud assembly (12) on the upper arm. The lower stud ball should rest in the socket of the nylon pad mounted on the shuttle arm plate (25). It may be necessary to loosen the hex nuts (11) and shift the ball and stud assemblies (12) until properly aligned. Temporarily install the shutter nut (7).

NOTE: As indicated in the Figure 16 parts list, a new pull-down cam (18) and shutters (9) are being used in current projectors. These new parts are provided with identification markings (see inset, Figure 16) and are interchangeable with the earlier cam and shutter only as a set. When the stock of early style shutters is depleted, it will be necessary to furnish the current shutter (P/N 41308) (3-blade) or (P/N 41309) (2-blade) together with the current pull-down cam (P/N 41307). The 2-blade shutter should be used on all export models (542EX) when replacement is necessary.

e. At this point, adjust the shuttle (all projectors) as instructed in paragraph 66, and the clutch mechanism (Models 542 and 542EX only) as instructed in paragraph 69, steps a and b. Then continue with the reassembly procedure as follows.

f. Remove the shutter nut (7) from the camshaft. Install the fiber washer (10) on the camshaft and up against the pull-down cam (18) so that the slot in the washer is aligned with the slot in the cam. Assemble the shutter (9) or (9A) to the camshaft (see Note preceding step e) and install the counterbalance weight (8) so that its pin enters the slots in the shutter and pull-down cam. Install the nut (7) with its shoulder in the center hole of the weight and tighten the nut securely while holding the end of the camshaft with an open-end wrench.

g. Models 542 and 542EX Only. Note that the torsion spring (30) and the clutch (36) are used only in projectors which are equipped with the solenoid-operated clutch and fire shutter system (Figure 5). Assemble the grommets (34) into the bracket (33). Install a retaining ring (28) into the groove nearest the end of the shaft (29) and insert the plain end of the shaft through the bearing bracket (37) and both ears of the stop pawl (31). Loosely attach the bearing bracket (37) to the cast arm of the housing with screws (35). (On projectors with the solenoid-operated clutch system, screws (35) also attach the clutch stop (36), and the torsion spring (30) must be installed on the shaft (29) and up against the left-hand ear of the stop pawl.) Assemble the mounting bracket (33) to the end of the shaft and secure the bracket with screws (32). Tighten screws (32) and (35) securely. Refer to paragraph 69, step a, for stop pawl to trigger clearance adjustment.

NOTE: On projectors with the solenoid-operated clutch system, hook one end of torsion spring (30) over the top edge of the bracket (33) and hook the other end up around the front edge of the stop pawl. When viewed from the spring end of the shaft, the spring must tend to rotate the stop pawl clockwise on the shaft.

h. Insert the rounded end of the heat baffle (6) under the shutter and secure the baffle to the mechanism housing with two screws (3) and flat washers (3A). Install the pulley (2) on the end of the camshaft and tighten the pulley setscrews (1) securely. Note the Model 542 and 542EX projectors are equipped with the fire shutter assembly (5) while the Model 535 and 540 projectors are equipped with a similarly shaped support bracket (5A). Attach the fire shutter assembly or the bracket to the mechanism housing with two screws (3). Assemble the lower condenser screw (4) into the tapped hole below the heat baffle screws (3).

46. REASSEMBLING THE MECHANISM. (See Figure 15.) Reassemble Figure 15 parts as outlined in the following paragraphs. The aperture plate assembly (7) was installed in paragraph 45. Note that early style metal sprocket guards (5), (5A) and (5B) are shown in this illustration. If the projector being repaired is equipped with molded sprocket guards, refer to paragraph 47 for sprocket guard reassembly instructions.

NOTE: Only the current (drilled but untapped) mechanism housings will be available for replacement. If the mechanism housing was replaced, swage-type

screws (items 8, 11 and 21) also must be ordered for reassembly to the new casting.

a. Installing Current Loop Restorer Parts. Attach the self centering assembly (35) to the mechanism casting with screws (32) and washers (33) and (34). If the casting is machined in the mounting area, washers (36) must be inserted between the assembly and the casting. Assemble the loop restorer shaft assembly (31) to the casting and install the washer (30) and restorer arm assembly (29) on the shaft. The forked fingers of the arm must be inserted between the two large centering washers of the self centering assembly. Insert a 0.0015 inch feeler gage between the washer (30) and the boss of the casting and hold all parts together firmly while tightening the hex head screw (28). Be sure that the shaft assembly (31) is positioned as shown in Figure 15, with the notched out area in its upper edge located beneath the lower sprocket shaft bearing in the mechanism casting. Assemble the cam follower (27E), damper (27D), springs (27C) and alinement bracket (27B) to the follower support (27F) with the two screws (27A). Secure this assembly to the restorer arm with the screw (24) and washers (25) and (26). Cam follower adjustment is made in final assembly (paragraph 77). Engage one end of the spring (23) around the end of the loop restorer shaft and secure the other end to the casting screw (21) and washer (22). Assemble the roller (20) to the loop restorer shaft and install screw (19).

b. Installing Early Loop Restorer Parts. Attach the eccentric anchor (15) to the mechanism casting with screw (14). Insert the shaft of the loop restorer arm assembly (31A) through the mechanism casting and install the cam follower assembly (18) on the shaft. Tighten the hex head screw (17) finger tight. One overcenter spring (16) must be inserted through the rectangular opening in the cam follower (18C), beneath the loop restorer shaft, and over the top of the eccentric anchor. The second spring must fit onto the notch at the lower end of the cam follower, over the top of the loop restorer shaft and beneath the eccentric anchor. Refer to paragraph 76 for early loop restorer adjustment.

c. On early models only, attach the metal sprocket guard parts in the following manner. Attach upper sprocket guard (5B) with screws (1). Attach the top lower sprocket guard (5A) and threading guide (3) with screws (1) and single washer (2). Attach bottom lower sprocket guard (5) and stop bracket (4) with screws (1). The stop bracket (4) was not used on the earliest metal sprocket guard designs.

d. Fasten the lens carrier catch (9) and its spacer washer (10) to the mechanism casting with the screw (8). It may be necessary to adjust the catch after the lens carrier is installed to insure proper latching of the lens carrier. Refer to paragraph 68 for adjustment of the lens stop screw (11).

47. INSTALLING CURRENT SPROCKETS AND GUARDS. (See Figure 14A.) All current projectors are equipped with the molded sprocket guards and new sprocket assemblies illustrated in Figure 14A. These parts are not interchangeable with earlier style sprockets and metal sprocket guards.

a. Fasten the sprocket guard plates (18) and (19) to the mechanism casting with the screws (17) and tighten the screws securely. Attach the film exit guide assembly (16) to the lower plate and casting with screw (15). Assemble the roller (14) to the exit guide roller post and install the screw (13).

NOTE: In earlier models equipped with the base-mounted snubber assembly (see Figure 4B), these same film exit guide parts are also used, but are fastened to the projector frame rather than to the mechanism casting.

b. Assemble the sprocket flange (9) and thrust washer (10) to the lower sprocket assembly (8) and insert the sprocket shaft through the lower bearings in the mechanism casting. Assemble the thrust washer (10) to the upper sprocket assembly and insert the sprocket shaft through the upper bearings in the mechanism casting. Refer to paragraph 48 and install the sprocket gears, sprockets and outboard bearing parts on the sprocket shafts.

c. Assemble the springs (6) and rollers (4) to the molded sprocket guards (5) and install these parts on the posts of the sprocket guard plates (18) and (19). The inner bent end of each spring must be inserted into small holes in the sprocket guard plates. The outer bent end must hook over the outer ledge of the sprocket guard. Spring action will bend to hold the guards around the sprockets. Install the screws (3) and washers (3A).

48. REASSEMBLING THE MECHANISM. (See Figure 14.) Reassemble Figure 14 parts as outlined in the following paragraphs.

NOTE: Only the current (drilled but untapped) mechanism housing is available for replacement. If the mechanism housing was replaced, swage-type screws (item 16) also must be ordered for reassembly of the outboard bearing assembly (20) to the new housing.

a. Assemble two retaining rings (8) to belt shift crank (10), and insert long end of crank into opening in housing. Install end of the spring (9) with the least amount of coils over end of crank and the opposite end over the spring anchor post (10A). The large center coil of the spring must project toward the rear edge of the housing. Secure the spring to the crank and anchor post with the two remaining retaining rings (8).

NOTE: The sprocket assemblies illustrated in Figure 14 (items 37 and 38) are those used with metal sprocket guards on earlier model projectors. Current sprocket assemblies, used with molded sprocket guards, are illustrated in Figure 14A. The procedure for installing sprocket assemblies and related parts (gears, drive sprockets, etc.) is the same for early and current models except that the current lower sprocket is equipped with a separate sprocket flange (item 9, Figure 14A).

b. Install a thrust washer (39) over shaft of upper sprocket assembly (37) and insert sprocket shaft through bearing hole in housing until shaft protrudes about 1/8-inch from rear of housing. Install tension washer (36) and sprocket gear (35), aligning either setscrew (34) with flat on sprocket shaft. Carefully mesh the sprocket gear with the worm gear (24, Figure 17), then slide the shaft through the sprocket gear until the sprocket rests against the bearing in the housing. Tighten both setscrews (34). Install the take-up drive sprocket (31) on the shaft, and tighten setscrews (30).

c. Install rewind button (22) and spring (23). Depress the button while assembling the rewind clutch lever (21) to the mechanism. The small forked end of the lever engages a groove in the button shaft; the large forked end encircles the upper sprocket shaft. Install the spline driver (29) on the sprocket shaft with the spline fitting through the forked end of the clutch lever and meshing with the drive sprocket (31). Install spring (28), washer (27), retaining rings (25) and rewind drive sprocket (26). Install the timing belt (24) over the rewind drive sprocket (26). Assemble the outboard bearing assembly (20) onto the sprocket shaft and install clutch lever shaft (19) and retaining rings (18). Secure the outboard bearing assembly to the mechanism housing with three screws (16).

d. Refer to Figure C. Loosen the locking setscrew and turn the rewind adjusting stud in or out to obtain 0.010-inch clearance between the rewind clutch lever and the spline driver. Then tighten the setscrew securely against the adjusting stud.

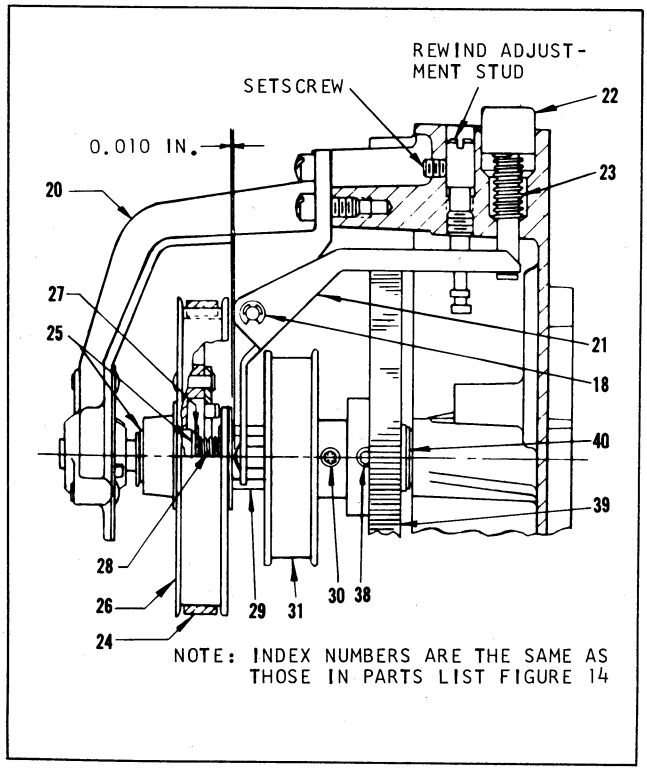


Figure C. Upper Sprocket Gear and Clutch Parts Assembled

e. Assemble the thrust washer (39) onto the lower sprocket assembly (38) and insert the sprocket shaft through bearings in mechanism housing. Install the tension washer (36) and sprocket gear (35) onto shaft, meshing teeth of sprocket gear with worm gear. Tighten setscrews (34) securely so that sprocket shaft turns freely but without noticeable end play.

f. The sprocket guard (33) is used only on earlier projectors equipped with the metal sprocket guard parts and is secured to the mechanism casting below the upper sprocket with two screws (32). Refer to paragraph 47 for installation of molded sprocket guards. Install the speed change knob (6) on the protruding end of the belt crank (10), and hold the knob in against the mechanism casting while tightening the setscrew (5). Hold the knob firmly and press the spring (9) in the direction of the sprocket gears; then hold the spring in this position and switch the knob to the SILENT setting.

g. Hold the lens carrier (4) between the hinge bosses of the mechanism housing. Insert washers (3) and (2) between the lens carrier hinge ears and mechanism housing hinge bosses and press the hinge pins (1) into place. The lens carrier catch (item 9, Figure 15) must be adjusted as necessary to permit the lens carrier to be opened freely, yet must hold carrier firmly against the stop screw (item 11, Figure 15) in the closed position.

h. All critical adjustments are to be made in final assembly of the projector and are covered in the Adjustments section of this manual.

49. REASSEMBLING THE SOUNDHEAD. (See Figure 13.) Reassemble Figure 13 parts as outlined in the following paragraphs.

NOTE: Only the current (drilled but untapped) soundhead housing (item 38) is available for replacement. If the housing was replaced, swage-type screws (items 3, 31 and 33) also must be ordered for reassembly of parts to the new housing.

a. As noted in the Figure 13 parts list and insets, exciter lamp mounting pins (38A) in current projectors differ from those used in earlier projector models. The early pin and keeper style has been discontinued; therefore, if pins must be replaced, the current pin (P/N 41321) and its bushing (P/N 41320) must be ordered as a set. Spring (P/N 602339) is used with both styles of pin. Assemble the spring and bushing into the hole in the casting. Insert the pin, forcing the pin into the bushing as shown in Figure 13.

b. Screw the adjusting (edge guide) screw (6) into the housing (38). Insert the shaft of the upper stabilizer arm (37) carefully through the soundhead housing and adjusting screw and install the retaining ring (5). Install the lower stabilizer arm (35) and spring (36) on the rear end of the upper arm shaft and secure these parts with the half-moon stabilizer arm (34) or (34A) and two screws (33). Attach spring terminal (32) with screw (31) and hook spring (30) between terminal and ear of lower arm (35).

NOTE: Stabilizer arm (P/N 09833) (item 34) has been discontinued and, if in need of replacement, current arm (P/N 31659) (item 34A) must be ordered together with the current torsion spring (P/N 39789) (item 36). The early torsion spring (P/N 31672) (item 36) will be available for service on earlier soundheads. Refer to Figure D for torsion spring and stabilizer arm installations.

c. Silicon Photocell Models Only. Assemble the silicon cell assembly (24) and its retainer (23) to the sound drum housing (22) and assemble the sound drum assembly carefully into the housing. Hold the sound drum while tightening the setscrew (20) against the retainer (23) just enough to hold all parts in place. In earlier models, two setscrews (21) were tightened down against the sound drum housing to hold it securely. In current models, the sound drum housing is drilled and tapped and two Sems screws are turned into these holes to secure the assembly.

d. Germanium Diode Photocell Models Only. Assemble the light pipe (24) and its retainer (23) to the sound drum housing (22) and insert the sound drum assembly carefully into the soundhead casting. Hold the sound drum while tightening the setscrew (20) against the retainer (23) just enough to hold all parts in place. If the sound drum housing had two drilled and tapped holes (current models), rotate the housing until those holes are aligned with corresponding holes in the soundhead casting and install two Sems screws (21). If undrilled (early models), secure the sound drum housing by installing and tightening two socket head setscrews (21). Assemble the photocell assembly (8) to the photocell holder (19) with the two screws (7). Install the holder over the protruding end of the sound drum housing and tighten the clamping screw (18) finger tight.

e. Assemble the contact assembly (13) and lamp release ring (15) to the soundhead housing with screws (12). Insert the optical slit assembly (4) into its opening in the housing and tighten the clamping screw (3) just enough to hold the slit assembly in place. Install the exciter lamp (2) on the lamp pins; press down and rotate clockwise to secure the lamp.

f. Lightly oil the roller shafts of both stabilizer arms (35) and (37) and assemble the rollers (28) and (29) to the shafts. In earlier model projectors, secure the rollers with the screws (26) and washers (27). In current models, assemble the upper bullet guide (27A) to roller (28) and install screw (26B) and washer (27); assemble the lower bullet guide (28A) to roller (29) and install screw (26A).

g. If the indicating ruby (1C) was replaced, cement the new ruby into the exciter lamp cover (1D). Assemble the retaining screw (1B) to the cover and install the retaining ring (1A). Temporarily install the cover to the soundhead housing to protect parts until installation.

h. The soundhead must be adjusted after final assembly. Refer to paragraph 73 for soundhead adjustment procedure.

50. REASSEMBLING THE LAMPHOUSE. (See Figure 12.) Reassemble Figure 12 parts as outlined in the following paragraphs.

a. In earlier model projectors, the lamphouse grille (10) was attached to the lamp housing (12) with two machine screws (9) at the rear corners. In current model projectors, the new grille (P/N 41338) and its corresponding housings are provided with a single mounting hole at the center of the rear edge. Two-hole grilles and housings no longer will be available

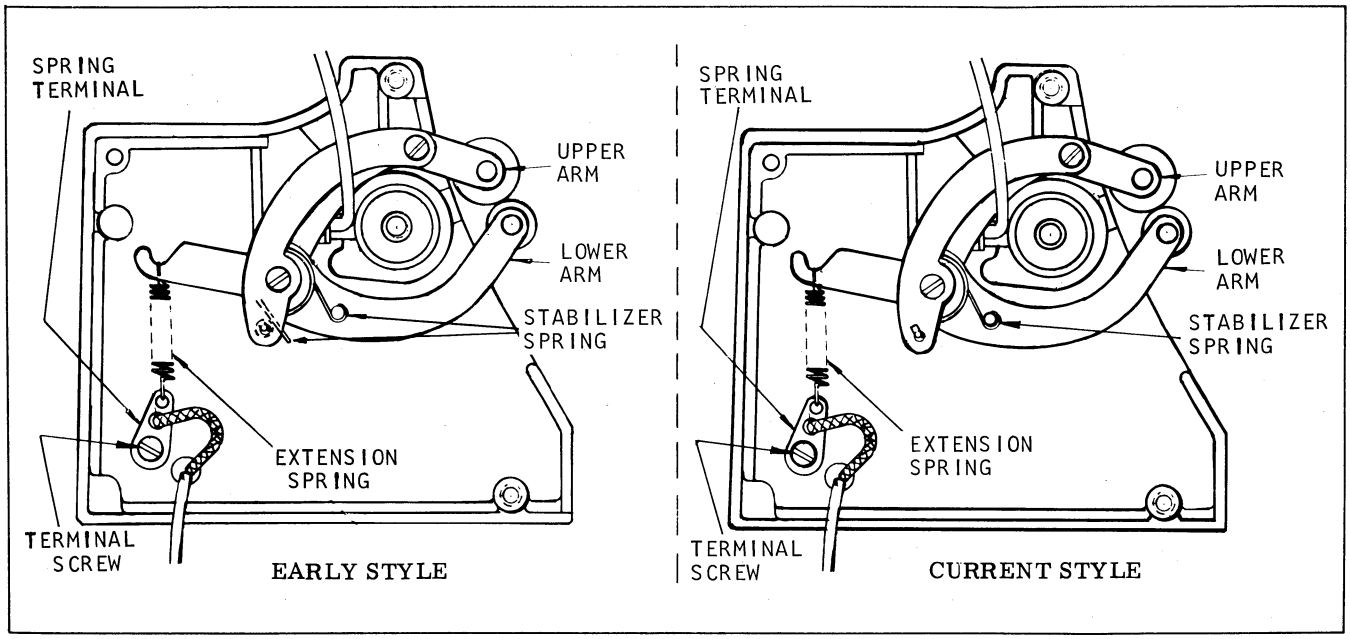


Figure D. Stabilizer Arms and Spring Assembled

for service. If the earlier two-hole housing is in good condition but the grille was replaced, clamp new grille in place and drill mounting hole with a 1.65 mm (0.066 ± 0.002-inch) drill. Use the mounting hole in the grille as a guide. Attach the grille with a single rivet (P/N 36100). If the housing was replaced, the old two-hole grille can be redrilled in the same manner, using the mounting hole in the housing as a guide. In addition, however, be sure to order two swage-type screws (P/N 30806) (item 2) for attaching the lamp shield (3) to the new housing.

b. Assemble the handle (7) and latch (8) to the lamphouse. As noted in the Figure 12 parts list, the thickness of the spacer bushing (5) will determine which screw (2) is used in reassembly.

51. REASSEMBLING THE LAMPHOLDER. (See Figure 11.) Reassemble Figure 11 parts in the following manner. Lightly grease both faces of the spring tension washer (5) and assemble the release lever (4) and washer (5) to pin screw (3). The convex (bowed) face of the washer must be against the lever. Assemble these parts to the lamp socket bracket (8) so that the releasing finger of the lever is inserted up through the slot in the bracket. Make certain that the lever is seated on the shoulder of the screw so that it can pivot smoothly; then tighten the screw. Fasten the lamp baffle (2) to the bracket with the three screws (1).

52. REASSEMBLING THE REAR REEL ARM. (See Figure 10.) Reassemble Figure 10 parts as outlined in the following paragraphs.

NOTE: If the rear reel arm was disassembled merely as part of the conversion to the current Torrington style clutch system (paragraph 62), only partial disassembly was required and certain of the following steps can be ignored. However, it would be advisable to inspect those parts which remain assembled and to clean and lubricate parts before reassembly.

a. Assemble the needle bearings (6A) and (28A) into the take-up arm assembly (6) and splined bearing assembly (28) respectively. Assemble nylon bearings (16) into the lower pulley and gear assembly (15) and nylon bearings (23) into the drive shaft support arms of the rear arm (29). Place one drop of oil in each nylon bearing and two drops of oil in each needle bearing. Assemble the splined bearing (28) into the reel arm.

b. Assemble the rubber sleeve (30) to the hub of the lower gear assembly (15). Assemble the retaining ring (19) and lower gear to the rewind drive shaft (21) and install the second retaining ring (14). Install the spring (18) and plunger (17) and hold in place while inserting the shaft (21) into the reel arm. Secure with the setscrew (20).

c. Assemble the lower spur gear (11) to the end of the drive shaft (22) which has one retaining ring slot, and install the retaining clip (10). Insert the opposite end of the drive shaft through both bearings (23) and install the washer (13), retaining clip (10), upper spur gear (12) and retaining ring (9). The lower nylon gear (11) must mesh with the crown gear teeth of the lower gear assembly (15) with a minimum of backlash. Loosen the setscrew (20) and shift the gear (15) and its shaft (21) in or out as necessary; then retighten the setscrew securely.

d. Hold the upper gear assembly (25) in place, its teeth engaging those of the upper nylon gear (12) while inserting the rear reel arm shaft (27). When converting to the current Torrington clutch system, be sure to use shaft (P/N 40295). (Shaft (P/N 31233) is used with the early wobble plate clutch system and the interim ratchet and cushion clutch system, both of which have been discontinued.) Note the use of brass shims (26) located beneath the gear assembly (25). Use shims, as necessary, to reduce gear backlash to a minimum. When proper shimming has been determined, secure the gear assembly (25) with two setscrews (24).

e. In most earlier model projectors, a straight pin (5) was used to secure the take-up arm (6) to the reel arm. Dowel pin (P/N 41331) is used in current models and will be furnished as a replacement. If you should find, however, that the take-up arm was mounted with a split roll pin (P/N 303188), a new split roll pin must be used in reassembly. Assemble the take-up spindle and pulley assembly (4) to the take-up arm with the socket head screw (3). Hold the take-up arm in place with the belt (1) looped around the pulley assembly and the hub of the lower gear (15). Spring (2) must be inserted into the drilled hole in the take-up arm and the free end of the spring will bear against the reel arm as shown in Figure E. Install the pin (5) to secure the take-up arm to the reel arm.

f. Refer to paragraph 72, step b, for final backlash adjustments and lightly lubricate all gear teeth. Check smoothness of gear train action by rotating the shaft (27). Assemble the reel arm cover (8) to the reel arm with the screws (7), using shims (P/N 34874) as necessary, between the reel arm bosses and cover bosses to eliminate dimpling of the cover as the screws are tightened. Note that only the current (drilled but

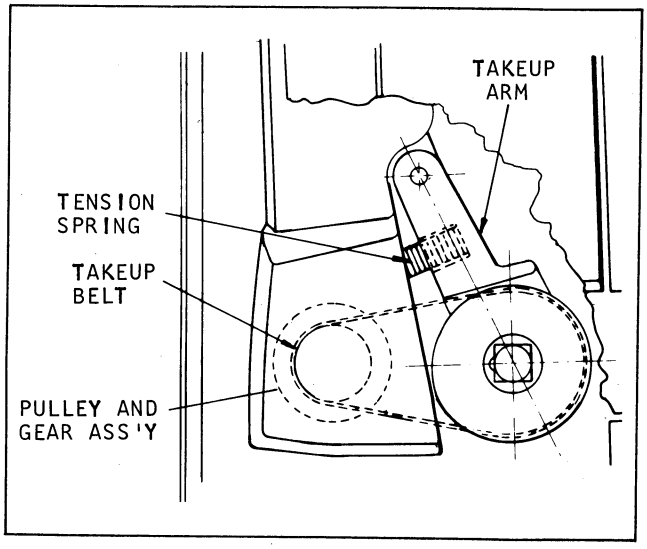


Figure E. Installing Take-Up Arm, Belt and Spring

untapped) cover (P/N 42218) is available for replacement. If the cover was replaced, be sure to order two swage-type screws (P/N 30879) for reassembling the new cover.

53. REASSEMBLING THE FRONT REEL ARM. (See Figure 9.) Reassemble Figure 9 parts as outlined in the following paragraphs.

a. Only the current (drilled but untapped) reel arm (34) and cover (2) are available for replacement. Therefore, if the reel arm was replaced, new swage-type screw (P/N 30804) (item 31A) will be required for attaching the brake spring (32) to the new arm. If the cover was replaced, two swage-type screws (P/N 30879) (item 1) will be required for installing the new cover. Machine screw (P/N 25837) (item 31) must be used to attach the brake spring to earlier (drilled and tapped) reel arms.

b. If, during disassembly, an eccentric washer was found beneath the brake spring (32), this washer can be discarded. The brake spring eliminates the need for this eccentric washer.

c. Assemble needle bearings (34A) and (34B) into the front reel arm (34), needle bearings (30A) into the splined bearing assembly (30) and nylon bearings (23) into the drive shaft support arms of the front reel arm. Place one drop of oil in each nylon bearing and two drops of oil in each needle bearing.

d. Assemble the brake spring (32) to the reel arm with the screw (31) or (31A). Assemble the friction shoe (25) to the pin of the bracket assembly (26) with the retaining ring (24). Assemble the splined bearing assembly (30) into the reel arm (34) and install the large bronze washer (28) and the disc assembly (27). Assemble the bracket assembly (26) to the disc assembly shaft and install the retaining ring (24).

e. Insert the reel arm shaft (29) through the splined bearing (30) and assemble the washers (17) and (17A) and one retaining ring (15) on the shaft. Assemble the clutch disc (16), pin facing out, and the second retaining ring (15) to the shaft.

f. Assemble the lower spur gear (20) to the end of the drive shaft (22) with the retaining clip (19). Insert the shaft through the two nylon bearings (23) and assemble the flat washer (21), retaining clip (19), upper spur gear (20A) and retaining ring (18) to the upper end of the shaft.

g. Loosely assemble the spring (7) lower gear (8) and feed spindle collar (5). One end of the spring is inserted into a hole in the inner face of the gear (8) and the other end hooked beneath the pin (6) in the collar. Add washers (9), (9A) and (9B) to this group and hold up in place while inserting the feed spindle assembly (10), with washer (11) installed, through the bearing (34A) and the loosely assembled group of parts. Turn the collar (5) until the pin hole in the collar and spindle shaft are aligned; then install spring pin (4) to secure all parts.

h. Assemble the upper gear assembly (13) to the end of the reel arm shaft (29) and install and tighten the setscrews (12). Refer to paragraph 72, step a, for reel arm end play and backlash adjustments. Assemble the reel arm cover (2) to the reel arm with screws (1). Use shims (3), as necessary, between the reel arm bosses and cover bosses to eliminate dimpling of the cover as the cover screws are tightened.

54. REASSEMBLY OF FIGURE 8 PARTS. Reassemble Figure 8 parts as outlined in the following paragraphs.

a. The inset in Figure 8 illustrates the difference in appearance between early and current interlock switches (item 27). Early style switch (P/N 31684) is used in early projector bases together with switch bracket (P/N 31695) (30) and terminal strip (P/N 09877) (25). The current switch (P/N 39504) is used in projector bases (P/N 42200 and P/N 42201) together with switch bracket (P/N 39517) (30) and terminal strip (P/N 012543) (25). Early and current style parts are not interchangeable individually but only as a set, base included. The early projector bases will be stocked for replacement on early model projectors. However, only current (drilled but untapped) bases are available for current projectors. When replacing the base on current model projectors, be sure to order swage-type screws (24) and (28) for reassembly of the terminal strip and switch bracket to the new base. Refer to the proper wiring diagram (Figures 28 through 34) when wiring the components in the base. Then install the insulator (23) over these components.

b. In early model projectors, the amplifier assembly (12) is attached with No. 5-40 machine screws (10) and No. 5 lock washers (11). In current model projectors, No. 6-32 swage-type screws and No. 6 lock washers are used.

c. In early model projectors, a spacer (37A) was used behind the lower right-hand mounting hole of the preamplifier assembly (37). In current model projectors, a machined boss is located at this point and the spacer is no longer required.

d. Assemble the washer (20J) to the tilt worm gear (20H). Lightly oil the gear shaft and insert it through the bearing holes in the tilt housing (20K). Install the spring washer (20G) on the shaft, bowed face toward the housing; then install flat washer (20F) and retaining ring (20E). Assemble the tilt pinion (20D) into the housing with the large spring pin (20C). Apply a light film of grease to the pinion, the worm gear, and the teeth of the tilt rack (20B). Insert the tilt rack down into the tilt housing and install the two small spring pins (20A).

e. Fasten the tilt mechanism assembly (20) to the projector main plate with screws (18) and the lock washers (19). Refer to Note B following Figure 8 parts list for proper screws to be used. Attach the tilt bar (17) to the lower end of the tilt rack (20B) with screw (15) and lock washer (16). Secure the tilt knob (14) to the end of the gear shaft (20H) with the setscrew (13). Rotate the knob to retract tilt bar up against the base.

f. Secure the blower assembly (8) and air deflector (9) to the main plate with the screws (5), lock washers (6) and brackets (7). Do not tighten the blower mounting screws until all rear mechanism parts are assembled and the blower pulley can be aligned with the drive motor pulley.

g. Be sure to install washer (P/N 28718) on the rotary switch shaft before assembling the rotary switch (4) to the main plate. Refer to the proper wiring diagram (Figures 28 through 34) when making wiring connections to electrical components.

55. REASSEMBLING FIGURE 7 PARTS. Reassemble Figure 7 parts as outlined in the following paragraphs.

a. If the projector being repaired (Models 542 and 542EX only) is equipped with the mechanically-operated clutch and fire shutter parts (Figure 6), those parts must be assembled to the main plate before the drive motor (27, Figure 7) is installed. Note, in the Figure 7 parts list, that the type of motor mounting brackets required is dependent on the type of motor assembly used. Motor (P/N 011189) (G.E. #5KCM49GG151) has been discontinued. When such motors are in need of replacement, order motor (P/N 011893) and an additional mounting bracket (P/N 31263) to replace the bracket originally used at the closed end of motor (P/N 011189). Early drive motors required a separate motor discharge spring (26). This spring is not required on current motors since a built-in grounding device automatically grounds the motor to the frame when the motor bracket strap (25) is locked in place. Proper brackets for use with each motor are listed in Figure 7 parts list Note F.

b. If the motor pulley (35) was replaced, be sure to check Figure 7 parts list notes for the proper pulley to be used in the projector being repaired. New type V-belts (21) (P/N 40283) are used in all projectors in the 76400 Serial Number group and up, and, as shown in the insets of Figures 7 and 24A, a new V-groove drive motor pulley and blower pulley are also used.

c. The relationship of belt shifter parts is shown in Figure F. Hold the belt shift stop (33) in place between the arms of bar stop bracket (31) so that the setscrew (32) is visible in the center hole of the bracket. Insert the leg of belt shifter (29) through the bracket and bar stop. Secure the bar bracket (31) to the end of the belt shifter leg with setscrew (30). Fasten the stop bracket (23) and belt shift spring (24) to the main plate with two screws (22). Move the belt shifter until the edge of stop bracket (23) is approximately 7/32 inch from the bar bracket (31) and tighten setscrew (32).

d. Temporarily insert the flat belt (28) up through the loop of the belt shifter (29) and engage it over the knurled diameter of the motor pulley (35). Let the belt hang free until the assembled projector mechanism is mounted on the main plate. Loop the blower belt around the blower pulley and the outer belt groove of the motor pulley. Shift the blower assembly until the belt is vertically aligned and tighten the blower mounting screws securely.

e. Reel arm locking parts (17 through 20) should not be installed until the reel arms and clutches are assembled to the main plate (paragraphs 61 and 62).

f. If rollers (15B) and (16B) were removed or replaced, place a drop of oil on each roller shaft before reassembly. Secure the idler assemblies (15) and (16) to the main plate with screws (14). Refer to paragraph 74 for method of adjusting the idler assemblies in final assembly to provide proper belt tension.

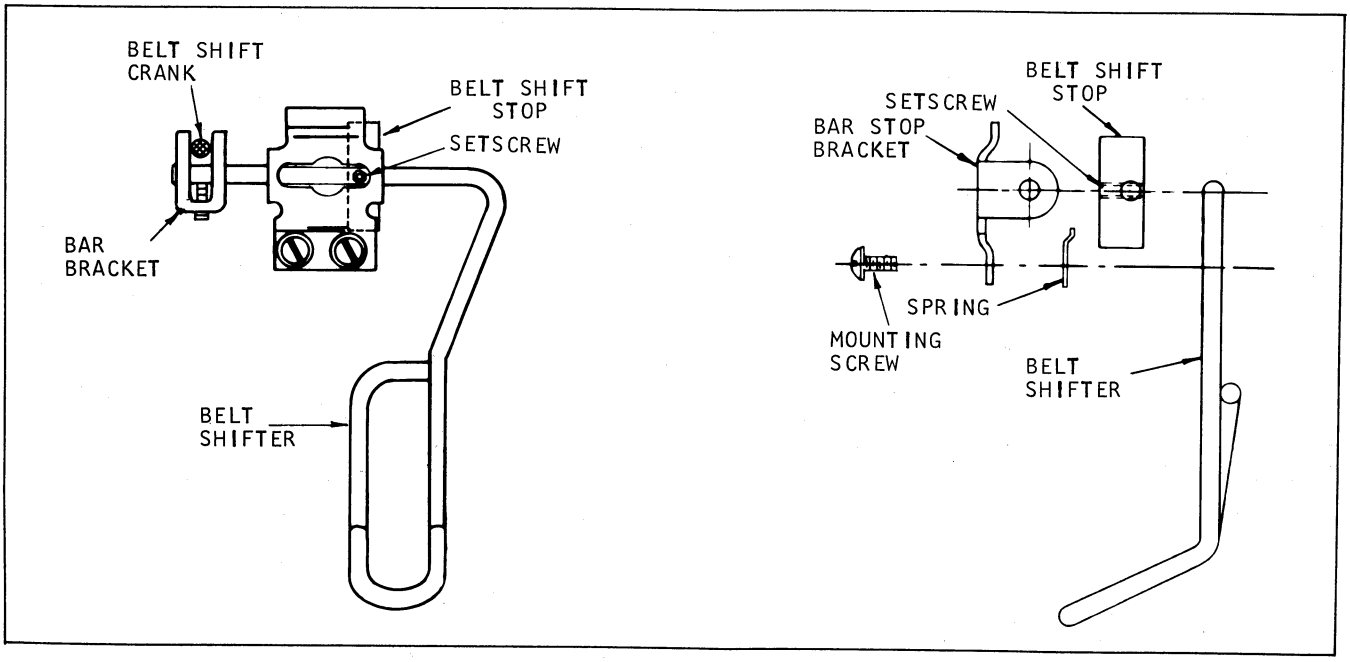


Figure F. Installing Belt Shifter Parts

g. Two styles of motor relay (11) are used in projectors (see inset, Figure 7). If in need of replacement, be sure to order the correct relay and make wiring connections to relay terminals as shown.

h. Refer to appropriate wiring diagram (Figures 28 through 34) for proper leadwire connections to the various electrical components.

56. REASSEMBLING MECHANICALLY-OPERATED CLUTCH AND FIRE SHUTTER COMPONENTS. (See Figure 6.) Parts shown in Figure 6 are used only in current Model 542 and 542EX projectors. Reassemble Figure 6 parts as outlined in the following paragraphs.

NOTE: If the projector being repaired is equipped with solenoid-operated clutch and fire shutter components, refer to paragraph 57 following for proper reassembly instructions.

a. Assemble the clutch cam and stud assembly (23) to the camshaft assembly (20), with the flanged side of the stud to be facing toward the washer and cam assembly. The stud of the camshaft assembly (20) must locate between the ears of the cam and stud assembly.

b. Assemble the pawl bushing (22) to the camshaft, with the large OD of the bushing toward the cam and stud assembly.

c. Assemble clutch cam (21) onto the large OD of the pawl bushing (22), with the stud of the camshaft assembly (20) located between the two ears of the cam.

d. Assemble the bracket and lever assembly (18) to the camshaft, with the stud of the clutch cam (21) located in the "banana" slot of the bracket. Install the large retaining ring (19) in the groove of the camshaft to hold all the bracket and cam parts (18 through 23) together.

e. Turn the projector belt shift knob to SILENT position. Insert the camshaft through the slot in the main plate casting and through the upper hole in the nameplate assembly (9). Locate the bracket and lever assembly between the motor mounting bosses and install the three screws (17).

f. Assemble the short clutch rod (13) through the hole in the long arm of the clutch lever (15), with the bent tip of the rod assembled from outside the bracket arm. Assemble the long clutch rod (4) through the hole in the formed ear on the opposite side of the clutch lever, with the bent end of the rod assembled from outside of the formed ear.

g. Assemble the free end of the short clutch rod (13) through the hole in the end of the clutch actuating lever of the bracket assembly (18). Turn the belt shift lever to the SOUND position. Carefully assemble the clutch lever (15) onto the protruding end of the clutch lever shaft (6) and onto the stud of the bracket and lever assembly (18), while inserting the free end of the long clutch rod (4) down through the hole in the stop pawl (item 31, Figure 16). Install the retaining ring (14) on the stud of the bracket and lever assembly. Install the collar (3), tapered end upward, on lower end of the long clutch rod and tighten setscrew (2).

h. Install the Still-Run knob (8) on the end of the camshaft (20), tightening the setscrew (7) against the flat on the shaft. Assemble the stop pawl spring (1) by hooking the right angle bent end of the spring around the clutch rod above the stop pawl. The lower bent end will be hooked beneath the terminal lug under the lower right-hand mounting screw of the complete mechanism assembly when that assembly is installed.

i. Rotate the Still-Run knob (8) and depress the clutch lever (15) until full travel of the long clutch rod (4) is attained. While maintaining this lever position, adjust collar (3) until there is a gap of 3/32-inch between top of collar and undersurface of stop pawl. (See Figure P.)

NOTE: When the clutch lever is depressed, make sure that the stop pawl is not riding on the trigger of the clutch assembly by rotating worm gear.

j. Install overcenter spring (16) by hooking the hook-like legs between the stud on the bracket and lever assembly (18) and the stud on the cam and stud assembly (23). Install fire shutter lever spring (12) with screw (10) and flat washer (11). The bent tip of the spring must rest on the top edge of the fire shutter support bracket. Refer to paragraph 71 for final adjustments.

57. REASSEMBLING SOLENOID-OPERATED CLUTCH AND FIRE SHUTTER COMPONENTS. (See Figure 5.) Parts shown in Figure 5 are used only in early Model 542 and 542EX projectors. Reassemble Figure 5 parts as outlined in the following paragraphs.

a. Secure the fire shutter solenoid bracket (17) to the projector base with the two screws (16). Assemble the spring (12) and fire shutter solenoid (15) to the bracket. The long leg of the spring must be inserted behind the pin in the solenoid plunger and the short bent end into the spring hole in the bracket (17). Install the washers (14) and screws (13), tightening the screws just enough to hold. Assemble the fire shutter rod (11) to the holes in the end of the fire shutter solenoid plunger. The upper end of the rod must be hooked to the fire shutter filter arm after the complete mechanism has been installed.

b. Assemble the rubber grommets (9) into the mounting holes in the clutch solenoid mounting bracket (10). Assemble the clutch solenoid assembly (6) to the bracket with two screws (4) and washers (5). Assemble one collar (2), tapered end up, on the clutch rod, leaving the setscrew loose. Insert the end of the rod up through the hole in the stop pawl (31, Figure 16) and position the solenoid on the mounting hole in the base. Insert metal bushings (8) into the rubber grommets (9) and secure the bracket to the base with screws (7). Install the spring (3) and remaining collar (2), tapered end down, on the upper end of the clutch rod and temporarily tighten the collar setscrew.

c. Raise the clutch solenoid rod until the solenoid plunger protrudes approximately 3/16 inch from the solenoid body. Slide the lower collar up until it makes contact with the underside of the stop pawl (31, Figure 16) and tighten the lower collar setscrew. Loosen the upper collar setscrew and position the upper collar on the rod until the distance between the top of the upper collar and bottom of lower collar is 7/8 inch. Tighten upper collar setscrew. Refer to paragraph 70 for final adjustments.

58. INSTALLING EARLIER MODEL SNUBBER PARTS.

a. Latest Base-Mounted Snubber (Figure 4B). Fasten the film exit guide (11) to the projector frame with roller shaft (8), screw (9) and washer (10). Wipe the roller shaft with an oil-damp cloth and install the roller (7) and the screw (6). Fasten the snubber assembly (4) to the projector base with the screws (1), washers (2) and hex nut or nuts (3). In some bases, one of the snubber mounting holes is tapped; therefore, only one hex nut will be required.

NOTE: Film exit guide parts (6 through 11), Figure 4B, are also used in all projectors equipped with the current snubber roller design shown in Figure 4. In some models, the exit guide was fastened to the projector frame exactly as shown in Figure 4B. In current projectors, the exit guide is attached to the mechanism casting as shown in Figure 14A.

b. Early Base-Mounted Snubber (Figure 4A). The early models were equipped with the two-piece film exit guide (items 13 and 14). These are assembled as shown and secured to the projector frame with the roller shaft (8). Spring (9) is hooked between the two exit guides. In later frame-mounted models, a one-piece film exit guide (15) was used and the spring (9) was eliminated. Wipe the roller shaft with an oil-damp cloth and install the roller (11) and screw (10). Assemble the snubber and roller assembly (4), spring (5), detent (7) and tubing (8) to the snubber roller stud (1). The straight leg of the spring (5) must lie flat against the snubber roller frame and point toward the snubber roller; the bent end of the spring hooks around the front end of the roller bracket. Install the washer (6) over the end of the stud (1) and screw the stud into the tapped hole in the projector frame. Secure the front end of the snubber assembly to the frame with the screw (2) and hex nut (3).

59. REASSEMBLY OF FIGURE 4 PARTS. Reassemble Figure 4 parts as outlined in the following paragraphs.

a. If repairs to the mechanism assembly (30) required that the mechanism housing be replaced with the current (drilled but untapped) style, new swage-type mounting screws (P/N 30824) (item 22) must be used to mount the mechanism to the main plate. Lift the assembled mechanism up into position against the main plate and install the mounting screws (22). When repairing current Model 542 and 542EX projectors equipped with the mechanically-operated clutch system, the free end of the long tension spring (item 1, Figure 6) must be hooked behind the head of the lower right-hand mounting screw before that screw is tightened. When repairing early Model 542 and 542EX projectors, the upper end of the fire shutter rod (item 11, Figure 5) must be engaged in the hole in the fire shutter filter arm.

b. Lift the soundhead assembly (21) up into position against the main plate. Make certain that all leadwires are behind the main plate and not caught between the plate and soundhead housing. Install and tighten the screws (19) with their washers (20). Refer to the appropriate wiring diagram (Figures 28 through 34) for proper wiring connections between the soundhead and other components.

c. Install the washer (18) on the sound drum shaft, plus any shim washers removed during disassembly. Carefully guide the flywheel (17) onto the sound drum shaft and install the flywheel nut (16), turning the nut on by hand as far as possible. Insert a 1/16-inch punch through the guide hole in the sound drum shaft housing and hold it lightly while rotating the sound drum shaft. When the punch drops into the hole in the shaft, hold it firmly and tighten flywheel nut with a wrench. Remove the punch. Fasten grounding spring (15) and cable clamp (14) to the base with screw (13). It may be necessary to bend the grounding spring until it applies tension against the end of the sound drum shaft.

d. Install the snubber mounting post (11) into the tapped hole in the main plate. Insert the snubber spring retainer (9) between the last two coils at the inner end of the snubber spring (8) and insert the spring and the retainer into the spring cover (10). Assemble these parts over the large diameter of the snubber mounting post (11). Assemble the hub of the snubber roller shaft assembly (7) over the snubber post and inside the spring (8). Before the shaft is fully in place, wind the spring one full turn counterclockwise and engage the bent end of the spring with the small hole in the crank arm of the shaft assembly. Press the shaft all the way in and install the retaining ring (6) to hold these parts in place.

e. Note in the inset of Figure 4 the appearance of the current idler rollers (P/N 41330) (item 4). These rollers are not interchangeable with the early style rollers (P/N 39523), which will continue to be available for service. However, when the early style snubber roller shaft assembly (P/N 011939) (item 7) is out-of-stock, the current shaft assembly (P/N 012330) will be supplied, together with two of the current rollers. Early style rollers must then be discarded or placed in stock as service spares. Assemble idler roller (4) to the shaft assembly (7) and install the snubber handle (3). Assemble washer (5) and idler roller (4) to the end of the snubber post (11) and install the screw (1) and washer (2).

60. REASSEMBLY OF FIGURE 3 PARTS. Reassemble Figure 3 parts as instructed in the following paragraphs.

a. Attach the pilot lamp bracket on nameplate bracket (22) to the main plate with screws (21). Assemble the lamphouse (19) to the bracket with three

screws (18) inserted through holes in the bracket hinge and turned into screw holes in the lamphouse. Close the lamphouse and check to make certain that the lamphouse contour matches with that of the mechanism housing. If necessary, loosen the bracket attaching screws (21) and shift the bracket. Check to make certain that the lamphouse opens and closes without binding. It may be necessary to adjust the lamphouse latch (item 8, Figure 12) to insure proper latching operation.

b. Models 542 and 542EX Only. Assemble the selector switch (16), with its switch guard and mounting plate, to the switch nameplate (13) and install switch nut and washers. Assemble the switch nameplate to the pilot lamp mounting bracket (22), threading the selector switch leadwires through the hole in the main plate and guiding the amplifier and relay switch control shafts through the lower two holes in the nameplate. Secure the nameplate to the pilot lamp bracket with three screws (12). Install the knobs (8), (9) and (11), with approximately 1/32-inch clearance between the knobs and the nameplate.

c. Model 535 and 540 Projectors Only. Assemble switch nameplate (13) to the bracket (22), guiding the amplifier and rotary switch control shafts through the holes in the nameplate. Secure the nameplate to the bracket with the three screws (12). Install the knobs (8), (9) and (11), with approximately 1/32-inch clearance between the knobs and the nameplate.

d. Early and current condenser assemblies (3) are shown in the inset in Figure 3. In early models, a coil spring (P/N 31584) separated the two lenses. In current models, two internal retaining springs (P/N 37311 and P/N 37312) are inserted into the housing (3E) to secure the first condenser (3D) and provide a spacing stop for the second condenser (3B). The second condenser is held in the housing with a third retaining spring (3A). Be sure to clean lenses thoroughly before reassembly and avoid leaving fingerprints on the lens surfaces. Engage the lower notched end of the condenser assembly with the lower mounting screw projecting from the mechanism below the aperture opening; then swing the upper end in toward the projector until the upper notch snaps over the spring-loaded condenser lens holder.

e. Perform optical alignment procedures outlined in paragraph 65 before continuing with reassembly.

NOTE: The Projection Lens Chart following the Figure 3 parts list indicates the projection lenses which are available, together with the appropriate field flattener and retaining ring for each. These field flatteners are available as service parts.

61. INSTALLING FRONT REEL ARM AND CLUTCH PARTS. Note, in the Figure 2 parts lists, that certain parts of the wobble plate clutch system (Figure 2D) and the interim Torrington clutch system (Figure 2E) will shortly be unavailable. If any one of the indicated parts is replaced, the clutch system must be modified to the new Torrington system (Figure 2F). This is accomplished by discarding all of the indicated parts of the old system and replacing those parts with the latest rewind sprocket (P/N 012661) and take-up reverse sprocket (P/N 012662). This installation of the reel arm with each clutch style is covered separately in the following paragraphs.

a. Front Arm and Current Torrington Clutch System. (See Figure 2F.)

(1) Assemble the washer (12) over the spline of the front reel arm and insert the reel arm shaft through the main plate. Assemble the black lock disc (10) over the spline of the reel arm so that the notch in the disc is approximately at the position shown in Figure G. Install the retaining collar (9) up against the lock disc and tighten its setscrews (8).

(2) Refer to Figure 7 and install lock plunger parts (items 17 through 20) as follows. Lightly oil the lock plunger (20) and assemble the spring (19) and lock plunger to the plunger bracket (18) so that the notch in the bracket straddles the narrow arm of the lock plunger bar. Secure this group of parts to the main plate with two screws (17) so that the narrow arm of the lock plunger bar is located in the notch of the reel arm lock disc (Figure G).

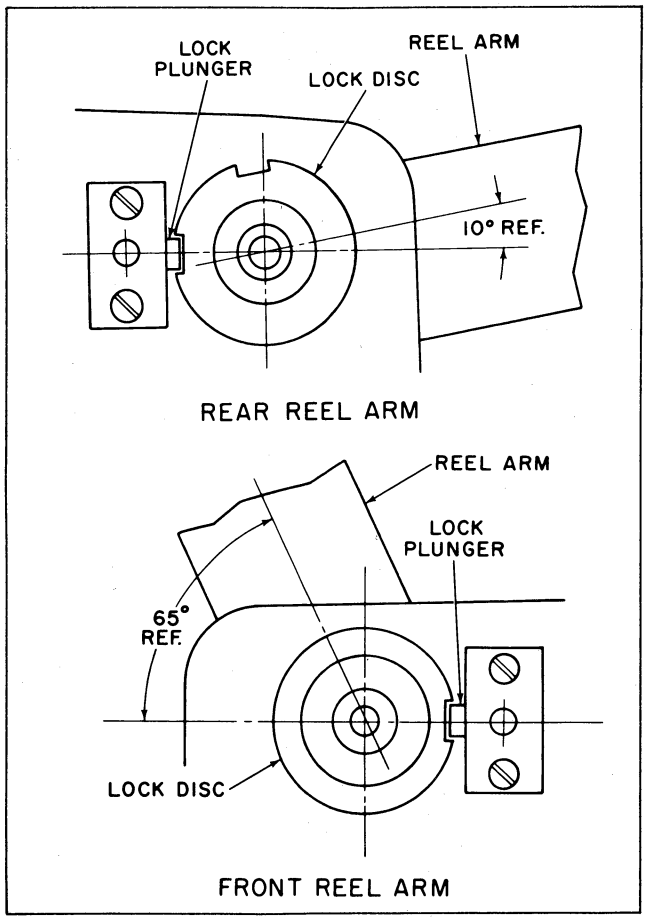


Figure G. Installing Reel Arm Lock Discs and Plungers

(3) Refer to Figure 2F and continue installation as follows: Apply a light film of oil to the reel arm shaft and install two brass washers (7), a nylon washer (6), reverse take-up sprocket (5), small diameter hub toward the main plate, and a second nylon washer (4) on the reel arm shaft. The rewind timing belt is hanging loose around the large rewind drive sprocket of the mechanism assembly. Loop this belt around the rewind sprocket (3) and slide the sprocket onto the reel arm shaft, slotted hub facing out. Install the locking collar (2) so that its tongue mates with the slot in the rewind sprocket hub. Insert a 0.003-inch feeler gage between nylon washer (6) and brass washer (7), press reel arm and clutch parts together and tighten setscrews (1). Remove feeler gage and refer to paragraph 74 for belt adjustment.

b. Front Arm and Intermediate Torrington Clutch System. (See Figure 2E.) The only difference between the current and intermediate Torrington clutch system is in the improved design of the reverse take-up sprocket (5) and rewind sprocket. The installation procedure is identical to that outlined in step a, above.

c. Front Arm and Wobble Plate Clutch System. (See Figure 2D.)

(1) Install the reel arm (15) and washer (16), the lock disc (14) and retaining collar (13) as outlined in step a (1), above.

(2) Install lock plunger parts as outlined in step a (2), above.

(3) Apply a light film of oil to the reel arm shaft and to the face of the clutch ball retainer (8). Install two brass washers (1), a nylon washer (10) and the reverse take-up sprocket (9), small diameter hub first, onto the reel arm shaft. Install the clutch ball retainer (8), formed ears facing away from sprocket (9), onto the reel arm shaft and into the counterbore of the sprocket.

(4) Install the clutch cam (7) so that the three notches in the cam OD straddle the three ears of the clutch ball retainer (8) and the shallowest end of each notch is at the left (counterclockwise) side. Rotate the cam counterclockwise against the ears of the retainer (8) and insert a steel ball (6) between each pair of retainer ears. Insert the spring (4) into the radial slot of the cam so that the spring tends to rotate the cam in a clockwise direction when released. Install nylon washer (5) on reel arm shaft.

(5) The rewind timing belt is hanging loose around the large rewind drive sprocket of the mechanism assembly. Loop this belt around the rewind sprocket (3) and slide the sprocket onto the reel arm shaft, slotted hub facing out. Install the locking collar (2) so that its tongue mates with the slot in the rewind sprocket hub. Insert a 0.003-inch feeler gage between nylon washer (10) and brass washer (11), and press and hold all parts together while tightening the setscrews (1). Remove the feeler gage and refer to paragraph 74 for belt adjustment.

62. INSTALLING REAR REEL ARM AND CLUTCH PARTS. Note, in the Figure 2 parts lists, that certain parts of the wobble plate clutch system (Figure 2A) and the ratchet and cushion clutch system (Figure 2B) will shortly be unavailable. If any one of the indicated parts is replaced, the clutch system must be modified to the new Torrington system (Figure 2C). This is accomplished by discarding all of the indicated parts of the old system, installing a new shaft (P/N 40295) in the rear reel arm (paragraphs 18 and 52), and installing current take-up sprocket assembly (P/N 012654) on the shaft with a retaining ring (P/N 21736). The installation of the reel arm with each clutch style is covered separately in the following paragraphs.

a. Rear Arm and Current Torrington Clutch System. (See Figure 2C.)

(1) Assemble the washer (11) over the spline of the rear reel arm (10) and insert the reel arm shaft through the main plate. Assemble the nickel-plated lock disc (9) over the spline of the reel arm so that the notch in the disc is approximately at the position shown in Figure G. Install retaining collar (8) up against the lock disc and tighten its setscrews (7).

(2) Install lock plunger parts as outlined in paragraph 61, step a (2). Then apply a light film of oil to the reel arm shaft and install two brass washers (6) and nylon washer (5).

(3) Install the take-up timing belt (item 18, Figure 1), looping it beneath the take-up drive sprocket on the mechanism assembly and around the reverse take-up sprocket of the front reel arm. This belt is shown installed in Figure R to aid in installation. Make certain that both idler roller brackets are loose to eliminate tension on the belt. Loop the free end of the timing belt around the rear take-up sprocket (item 4, Figure 2C) and slide the sprocket, the nylon washer (3) and brass washer (2) onto the reel arm shaft. Secure all parts with the retaining ring (1).

(4) Refer to paragraph 74 for belt tension adjustments.

b. Rear Arm and Ratchet-Cushion Clutch System. (See Figure 2B.)

(1) Install the reel arm (10), washer (11), lock disc (9) and retaining collar (8) as instructed in paragraph 62, step a (1), preceding.

(2) Install the lock plunger parts as outlined in paragraph 61, step a (2).

(3) Install the take-up timing belt (item 18, Figure 1), looping it beneath the take-up drive sprocket on the mechanism assembly and around the reverse take-up sprocket of the front reel arm. This belt is shown installed in Figure R to aid in installation. Make certain that both idler roller brackets are loose to eliminate tension on the belt. Loop the free end of the timing belt around the rear take-up sprocket (item 6, Figure 2B) before installing sprocket.

(4) Apply a light film of oil to reel arm shaft. Assemble the take-up sprocket assembly (6) to the shaft with the metal flange of the sprocket toward the main plate. Assemble the felt washer (5), ratchet (4) and cushion (3) to the reel arm shaft and slide the ratchet up against the face of the sprocket. Slide the locking collar (2) up until it just contacts the cushion and tighten the two setscrews (1) securely.

(5) Refer to paragraph 74 for belt tension adjustments.

c. Rear Arm and Wobble Plate Clutch System. (See Figure 2A.)

(1) Install the reel arm (14), washer (15), lock disc (13) and retaining collar (12) as outlined in paragraph 62, step a (1).

(2) Install the lock plunger parts as outlined in paragraph 61, step a (2).

(3) Install the take-up timing belt (item 18, Figure 1), looping it beneath the take-up drive sprocket on the mechanism assembly and around the reverse take-up sprocket of the front reel arm. This belt is shown installed in Figure R to aid in installation. Make certain that both idler roller brackets are loose to eliminate tension on the belt. Loop the free end of the timing belt around the rear take-up sprocket (item 8, Figure 2A) before installing sprocket.

(4) Apply a light film of oil to the reel arm shaft and to the face of the clutch ball retainer (7). Install two brass washers (10), a nylon washer (9) and the take-up sprocket (8), metal flange facing in, over the shaft and up against the collar (12). Install the clutch ball retainer (7), formed ears facing away from the sprocket (8), onto the reel arm shaft and into the counterbore of the sprocket. Install the nylon washer (6).

(5) Install the clutch cam (5) so that the three notches in the cam OD straddle the three ears of the clutch ball retainer (7) and the shallowest end of each notch is at the right (clockwise) side. Rotate the cam clockwise against the ears of the retainer (7) and insert a steel ball (4) between each pair of retainer ears. Insert the spring (3) into the radial slot of the cam so that the spring tends to rotate the cam counterclockwise when released. Install the rear reel arm bearing (2) up against the clutch cam (5) and tighten the setscrews (1) securely.

(6) Refer to paragraph 74 for belt tension adjustments.

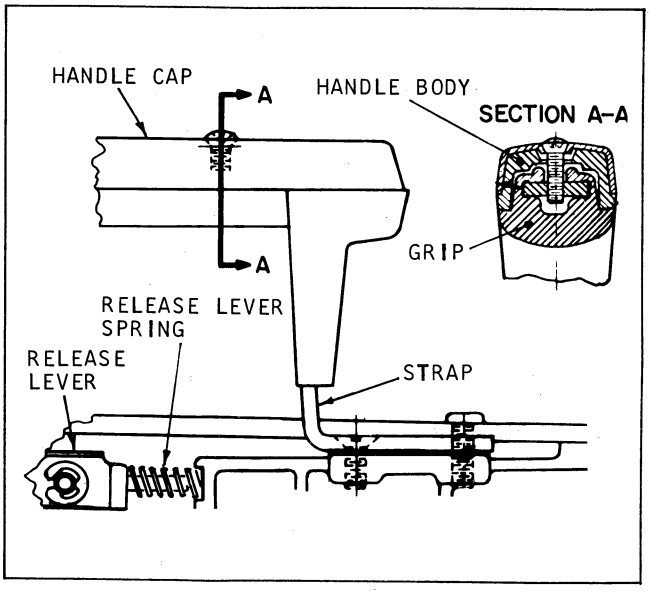


Figure H. Installing the Carrying Handle

63. REASSEMBLY OF FIGURE 1 PARTS. Reassemble Figure 1 parts as outlined in the following paragraphs.

a. Assemble the spring (17) to the spring pin at the right end of the cover release lever (16). Install the cover latch studs (15) and assemble the release lever to the studs. The free end of the spring (17) should be inserted in the recess of the main plate boss immediately to the right of the release lever (see Figure H).

b. When reassembling the carrying handle parts to the main plate, note that only early model projectors require the felt pads (12A). Current rear covers have eliminated the top center mounting hole located directly below the handle on earlier rear covers. Attach the carrying handle strap (12) to the main plate with two each of screws (11) and (11A) (Figure H), and note the spacers (13) must be used on the front two screws between the strap and the main plate mounting bosses. Assemble the rubber grip (10), handle body (9) and cap (8) to the handle strap as shown in Figure H and install the screws (7).

c. Refer to the Adjustments section and perform all adjustments and alignments before installing the projector covers.

Adjustments

64. GENERAL INSTRUCTIONS.

The alignment and adjustments covered in this section are necessary to the proper operation of the projector. Even though the projector may not have undergone complete overhaul and repair, it is recommended that all adjustments be checked as a routine measure. Routine adjustments such as those applicable to sliding fits, clearances and end play have been covered in the reassembly procedures and are not repeated here except where they directly affect other adjustments or alignments.

All special tools and fixtures required to perform the adjustment procedures are illustrated in Figure A. In addition, special test films and electronic test equipment (vacuum tube voltmeter, volt-ohmmeter, oscillator and tachometer or Strobotac) are needed to check and adjust the sound system.

WARNING

Many of the procedures listed in this section require operation with the rear cover removed and the protective interlock switch defeated. To avoid shock hazards, disconnect the power and discharge the motor starting capacitor, when not required. The use of an isolation transformer is recommended.

65. OPTICAL ALIGNMENT.

It is important that these alignments be performed in the following listed sequence (steps a through d). All special tools and fixtures required for optical alignment are shown in Figure A (items 1 through 5). Except for the aperture plug (item 5), these items are shown installed in the projector in Figure J. Be sure to turn the mechanism manually until the shutter blade is clear of the aperture opening.

a. Aligning the Aperture Plate.

(1) Remove the projection lens from the lens carrier. Open the lamphouse and remove the projection lamp and the condensing lens assembly.

(2) Swing the lens carrier fully open and disassemble the pressure plate from the lens carrier. (If necessary, refer to paragraph 27 for disassembly instructions.)

(3) Loosen the two aperture plate mounting screws just enough to permit movement of the aperture plate, and insert the aperture plug (item 5, Figure A) into the aperture opening. Close the lens carrier.

(4) Tip the projector carefully onto its back (lens opening facing up) and insert the lens plug (item 2, Figure J) down into the lens barrel. Insert the end of the alignment rod (item 3, Figure J) into the center hole of the lens plug and carefully lower the rod. It may be necessary to shift the aperture plate slightly so that the alignment rod enters the hole in the aperture plug. With the alignment rod in place, tighten the two aperture plate mounting screws.

b. Aligning the Condensing Lens.

(1) Withdraw the alignment rod (item 3, Figure J) enough so that the condenser plug (item 4, Figure J) can be installed on the condenser screw and holder protruding from the mechanism housing.

(2) Carefully lower the alignment rod through the aligning hole in the condenser plug. Due to the manner in which the plug is suspended it may shift slightly from side to side as the rod is inserted, but this will not affect alignment. However, if the tip of the rod should strike the top or bottom of the plug aligning hole, tighten or loosen the condenser holder screw (A, Figure J) until the plug is aligned with the rod and the rod slides freely in and out.

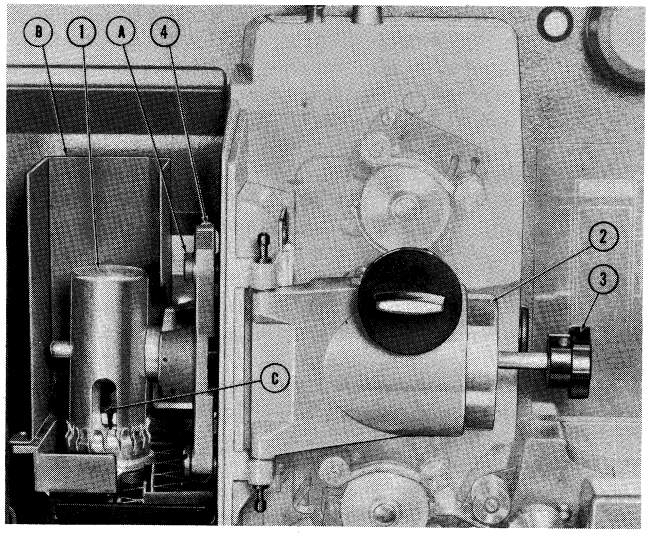


Figure J. Optical Alignment Tools Installed

c. Aligning the Lamp Socket.

(1) Tip the projector back into its normal, upright position. Loosen the two screws (behind the lamp socket) which secure the lamp holder assembly (B, Figure J) to the projector main plate.

(2) Withdraw the alignment rod enough so that the lamp plug (item 1, Figure J) can be inserted into the lamp socket. Rotate the lamp plug until its aligning hole is in line with the alignment rod.

(3) Slide the rod through the hole in the lamp plug. Grasp the lampholder and lamp plug, with thumb beneath the lamp socket bracket and fingers resting lightly on top of the lamp plug. Do not grip firmly. Press the lamp socket bracket upward until the socket bears lightly but evenly against the bottom of the plug. Do not force the bracket upward. The alignment rod must still move freely, without binding.

(4) While still holding the socket lightly against the bottom of the lamp plug, slide the lampholder and plug forward toward the lens until the lamp plug just touches the condenser plug. One of the lampholder mounting screws is accessible through the vertical slot (C, Figure J) in the lamp plug. Insert a screwdriver and tighten this screw securely without disturbing the position of the lampholder and lamp plug. Withdraw the alignment rod, remove the lamp plug, and tighten the remaining lampholder mounting screw.

d. Final Alignment Check.

(1) Reinstall the lamp plug in the lamp socket and rotate the plug until its aligning hole is in line with the alignment rod.

(2) Slide the alignment rod back and forth through all three plugs. Since the rod is a lapped fit in the aligning holes, a light resistance should be felt. However, if obvious binding is noted, determine the point at which the rod binds and realign accordingly.

(3) Make sure that the lamp plug does not rise, even slightly, from the lamp socket as the rod passes in and out. If it does, realign the lamp socket as outlined in step c, above.

(4) Tip the projector onto its back (lens opening facing up) and remove the alignment rod, lens plug, condenser plug and lamp plug. Swing open the lens carrier and remove the aperture plug from the aperture opening.

(5) Reassemble the pressure plate to the lens carrier as instructed in paragraph 43. Install the condenser lens assembly and projection lamp and close the lamp housing. Close the lens carrier and install the projection lens.

66. ADJUSTING THE INTERMITTENT MECHANISM.

a. Checking Shuttle Tooth Side Clearance. Advance the mechanism manually until the shuttle is at the center of its stroke as shown in Figure K. The clearance from the edge of the shuttle slot to the inner end of the shuttle tooth (nearest the aperture opening) should be 0.007-inch minimum. From the edge of the shuttle slot to the outer end of the shuttle tooth, the distance should be 0.050-inch maximum. Check these clearances at both the upper tooth and lower tooth. If the clearances vary at the upper and lower teeth and inner clearance is less than 0.007-inch at either end, the following possible causes should be checked and corrected.

(1) Aperture plate out of alignment. See paragraph 65, step a, Aligning the Aperture Plate.

(2) Shuttle stroke incorrect. See paragraph 66, step d, Shuttle Stroke Adjustment.

(3) Link bearing missing from end of shuttle arm. Partial disassembly required to remove shuttle arm and replace link bearing (refer to paragraph 25 and Figure B).

(4) Ball and stud assembly loose on shuttle arm. Reposition ball and stud assembly (Figure B) and tighten stud nut securely.

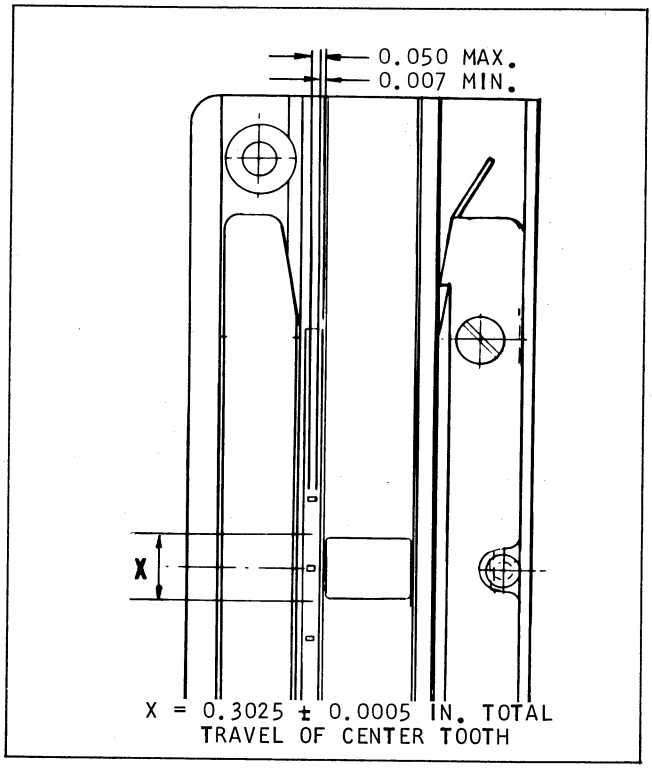


Figure K. Aperture Plate and Shuttle Tooth Clearances

b. Checking Shuttle Tooth Height. Swing open the lens carrier and advance the mechanism manually until the shuttle is at the center of its stroke as shown in Figure K. Hold the shuttle tooth height gage (item 7, Figure A) by its knurled handle and place it against the aperture plate between the rails. The center ears, on either side of the gage handle, are the height gages. Slowly slide the gage downward. The "Go" ear should pass over the shuttle tooth without catching. Rotate the gage so that the "No-Go" ear is over the shuttle slot and once more slide the gage downward. The "No-Go" ear must not pass over the shuttle teeth. If the shuttle teeth are too high or two low, adjust height as follows.

NOTE: If the mechanism assembly is installed on the main frame, it will be necessary to open the lamphouse and remove the projection lamp (2, Figure 3), the condenser assembly (3), the lampholder (5) and the pulley shield (7) before proceeding.

(1) Turn the mechanism drive pulley by hand until the access holes in the shutter and the fire shutter bracket are aligned as shown in Figure L.

(2) Insert a No. 4 Bristol Wrench into these access openings and engage it in the socket of the in-out cam follower screw.

(3) If the shuttle teeth were too low (No-Go ear passes over shuttle teeth), turn the cam follower screw counterclockwise to increase shuttle tooth height. If the shuttle teeth were too high (Go ear catches against shuttle teeth), turn the cam follower screw clockwise. It may be necessary to re-check shuttle tooth height with the gage several times before the proper height has been obtained.

(4) If one of the teeth cannot be brought into tolerance by the above method, it may be necessary to loosen the screws which attach the in-out bracket (Figure L) and shift the bracket slightly. Tighten the mounting screws securely and check and adjust shuttle tooth height as outlined above.

c. Checking Fit of Shuttle Arms to Pull-Down Cam. (See Figure M.) Remove rear cover, projection lamp and blower belt.

NOTE: If projector has just been lubricated, run for two or three minutes before proceeding with this adjustment.

(1) Open film gate and turn projector mechanism by hand until shuttle teeth are retracted and have moved downward to approximately the center of the stroke (center tooth approximately on horizontal center line of aperture). Slip guide bars of tool SER-552-4-N1 over casting to which shuttle mounting plate is attached (Figure M). When tool (A) is positioned so that stud (B) can bear on shuttle arm (C), tighten thumbscrew (D) just enough to hold tool in position. Engage hook of tool SER-552-4-N2 in slot of stud (B) as shown, and allow weight (E) to swing downward. Tilt projector, if required, so that the weight does not rub on any stationary parts.

(2) Loosen upper bearing support assembly (F) approximately one turn. Rotate projector framer knob so that pointer (G) moves above witness mark (H). Then turn framer knob in the opposite direction until pointer (G) moves back down in line with mark (H).

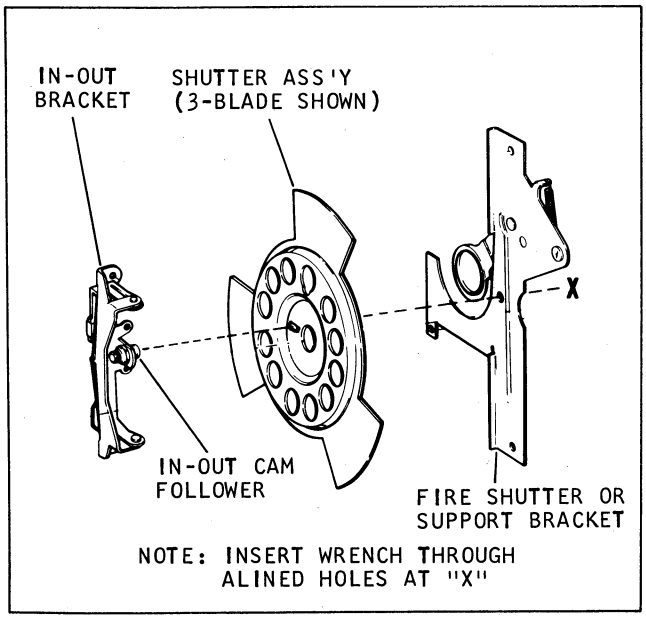


Figure L. Adjusting Shuttle Tooth Height

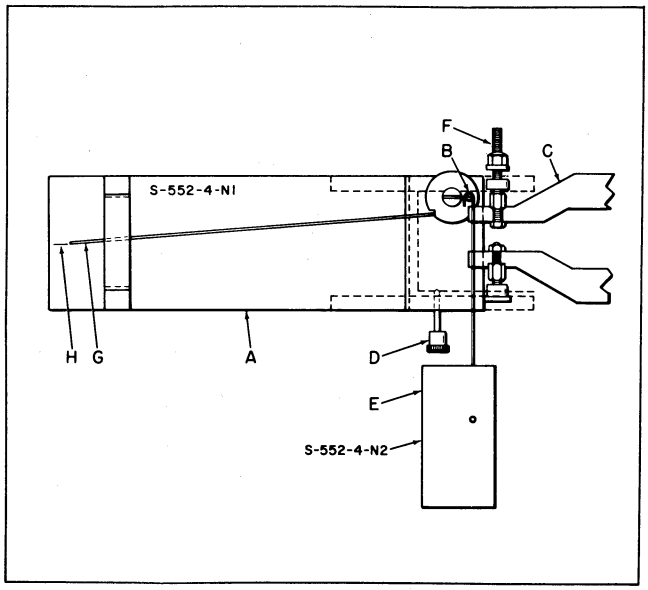


Figure M. Adjusting Fit of Shuttle Arms to Pull-Down Cam

NOTE: If adjustment of framer knob does not permit movement of pointer (G) as specified, it may be necessary to rotate the camshaft slightly to bring cam into proper position.

(3) Carefully tighten upper bearing support assembly (F) while observing alignment of pointer (G) with witness mark (H). The instant that pointer (G) starts to move upward stop turning support assembly (F). This is the proper adjustment.

CAUTION: Do not tighten shuttle arms more than is specified in an attempt to remove cam noise. Excessive tightening of shuttle arms for the purpose of reducing other noises will reduce life of cam and cam shoes.

d. Checking Shuttle Stroke. Normal shuttle stroke (vertical travel of shuttle teeth) is 0.3025 inches (Figure K). The most convenient means of measuring the stroke is to use the projector as an optical comparitor. The step on the stroke gage (item 6, Figure A) is the length of the nominal stroke. When it is inserted in the aperture and projected, it provides a reference dimension with which the actual stroke can be compared. Figure N is a sketch of a target. The A to B section is a 100 to 1 enlargement of the gage. The C and D lines represent 100 to 1 enlargements of the limits of tolerance.

(1) Procedure for Measuring Shuttle Stroke. (See Figure N.)

(a) Remove pressure plate assembly (paragraph 27), condensing lens assembly and the motor drive belt (item 28, Figure 7).

(b) Reinstall blower belt and set framer at the mid-point of its over-all travel.

(c) Suspend target approximately 18 feet from the projector with center of target on same horizontal line as optical axis of projector. If room arrangement necessitates tilting projector, target must also be tilted so that angle between target and optical axis is 90 degrees. If this is not done, "Keystone" error will be produced.

(d) Turn the projector mechanism by hand until shuttle is at bottom of stroke and shutter just clears aperture.

(e) Insert stroke gage (SER-550-5-N2) in the aperture plate and lightly press it down against the top tooth of the claw. Close the film gate.

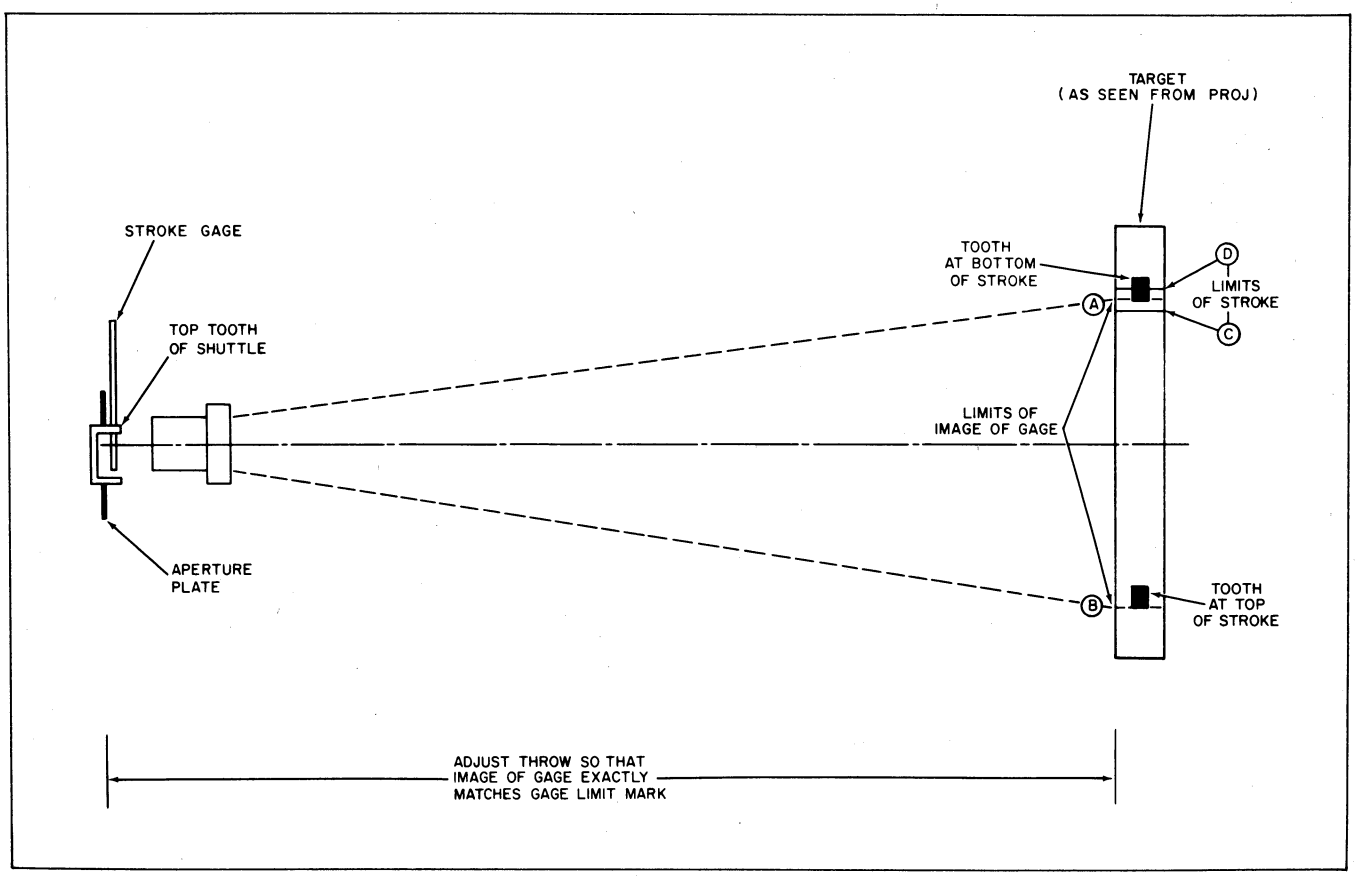


Figure N. Checking and Adjusting Shuttle Stroke with Target

(f) Turn on the projector lamp and focus shuttle slot on the target. Move projector toward or away from the target until a sharply focused image of the step at end of stroke gage just reaches from line A to line B (Figure N).

(g) Slide the stroke gage up out of field-of-view and turn mechanism pulley until center tooth of shuttle is at top of stroke indicated by image of tooth near line A. Adjust framer, if required, until projected image of edge of tooth just touches line A.

(h) Turn mechanism pulley until center tooth of shuttle reappears at top of target. Rock mechanism pulley to find top of shuttle stroke. Edge of tooth used as reference in step (g) must fall between lines (C) and (D) (Figure N). If image falls between (C) and (A), stroke is too short. If image falls beyond (D), stroke is too long.

(2) Procedure for Adjusting Shuttle Stroke. Loosen the two shuttle plate screws (Figure B) just enough to permit movement of the shuttle arm plate.

(a) To lengthen the stroke, shift the shuttle arm plate toward the pull-down cam.

(b) To shorten the stroke, shift the shuttle arm plate assembly away from the pull-down cam.

(c) After adjusting stroke, recheck shuttle tooth side clearance as instructed in paragraph 66, step a, and readjust if necessary.

CAUTION: Do not attempt to eliminate film slap by setting stroke outside established tolerance. This will produce double image and/or jump with films having different shrink or stretch.

e. Framing Adjustment. Thread the projector with film having proper frame line position. Project film and turn framing knob from one limit to the other. If at one limit a frame line is not visible, loosen nut on the framing eccentric located at top of shuttle arm plate assembly (Figure B) and turn eccentric until the frame line appears. Hold eccentric while tightening nut. Check adjustment by again turning framing knob from limit to limit while observing picture. When the eccentric is properly adjusted, either frame line can be projected and movement of film should be approximately equal at top and bottom of framer travel.

67. SPROCKET GUARD ADJUSTMENT (Early Models Only.) The sprocket guard (item 33, Figure 14 or item 2, Figure 14A) must be adjusted to hold the film in place around the sprocket and yet provide clearance for splices. Loosen the two screws which attach the sprocket guard to the mechanism casting. Place two thicknesses of film on the sprocket teeth and lightly press and hold the guard against the film. Shift the guard sidewise, if necessary, to insure full and even contact of the guard with the film strips; then tighten the retaining screws securely and remove the film strips.

68. LENS CARRIER ADJUSTMENT. Angular relationship between the lens carrier and the aperture plate is controlled by lens mount stop screw (item 11, Figure 15). Thread projector with roll title or target film having sharp images in corners and project a picture approximately 30 inches high onto a matte surface. Note: Projector must be square with the screen. Focus the picture and compare resolution of the two sides of the image when viewed from a distance of approximately twice the width of the picture. If one side appears to be soft, refocus to sharpen that edge of the picture and note whether the lens is moved toward or away from the aperture. For example, if image at right-hand edge of screen is soft until lens is moved toward aperture, then lens stop screw is set too far forward and should be turned clockwise.

CAUTION: This adjustment is critical. Lens stop screw should be turned only a few degrees between tests for sharpness.

69. ADJUSTING THE ANIMATION CLUTCH (MODELS 542 AND 542EX ONLY).

a. Checking Stop Pawl to Trigger Clearance. Rotate the mechanism by hand until the finger of the trigger is adjacent to the inner bent ear of the stop pawl as shown in View A, Figure P. If the trigger fails to clear the stop pawl ear, adjust as follows.

(1) On projectors equipped with the solenoid-operated clutch and fire shutter system, loosen the clutch stop screws (item 35, Figure 16) and shift the clutch stop (item 36, Figure 16) up or down, as necessary, to obtain approximately 0.010 to 0.015-inch clearance between the stop pawl ear and the end of the trigger; then tighten the two clutch stop screws securely.

(2) On projectors equipped with the mechanically-operated clutch and fire shutter system, loosen the setscrew in the clutch rod collar (Figure P, View A) and slide the collar upward, thus pivoting the stop pawl counterclockwise. When a clearance of 0.010 to 0.015-inch is obtained between the stop pawl ear and the end of the trigger, tighten the collar setscrew securely.

b. Checking Shuttle Retraction. Turn the mechanism pulley by hand while pressing down on the clutch pawl at a point where the clutch rod passes through it. The ear of the clutch pawl should latch behind the trigger as shown in View B, Figure P. Note also the clearance required between the finger on the clutch yoke and the curved arm of the strike. Adjust as follows:

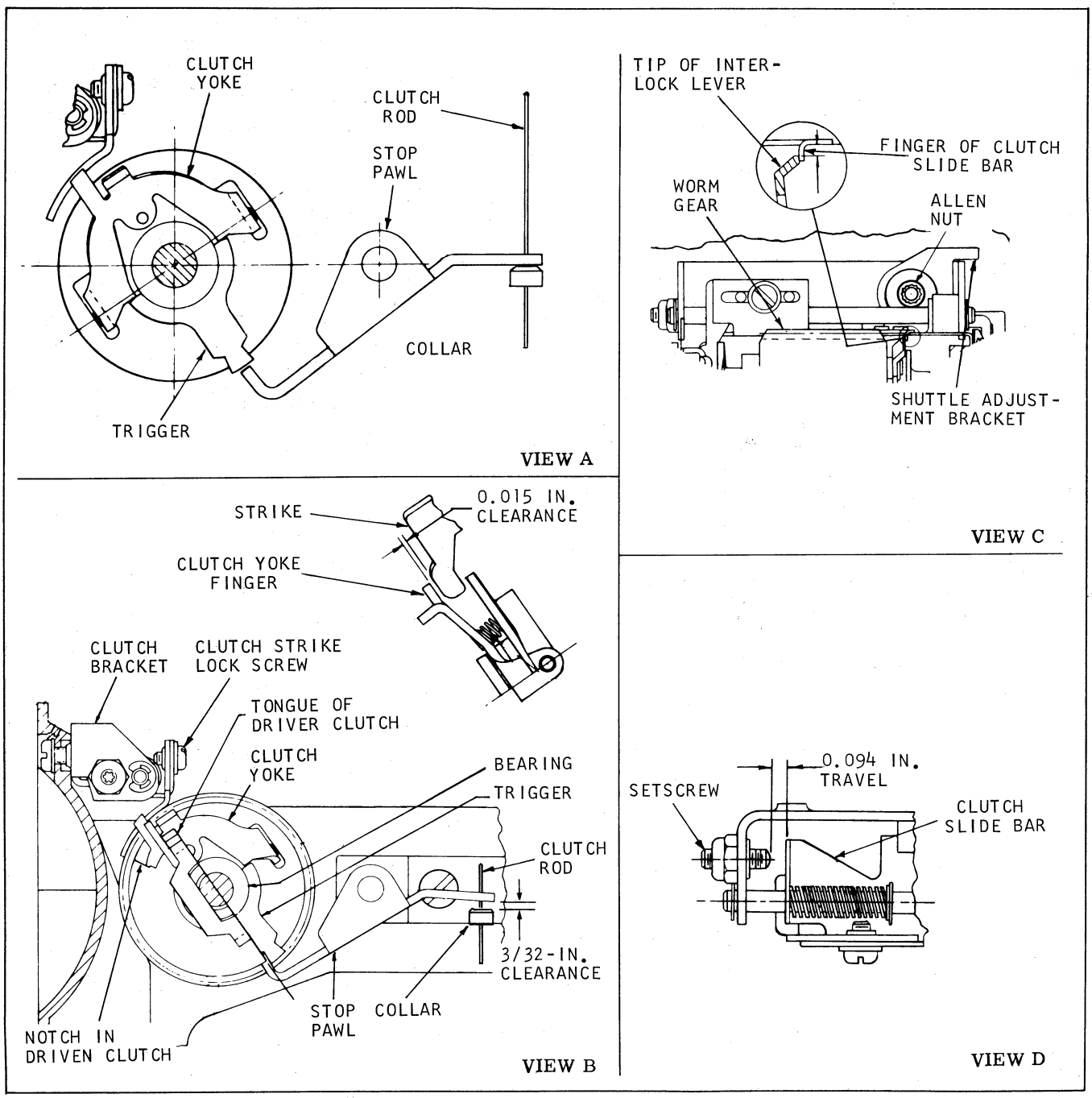


Figure P. Animation Clutch Adjustments

(1) Loosen the clutch strike screw (View B, Figure P) to permit the strike to be shifted. Insert a 0.015-inch feeler gage between the clutch yoke finger and the strike arm, and press and hold the strike against the feeler gage while retightening the strike screw. Remove the feeler gage.

(2) Refer to View C, Figure P. Loosen the round Allen nut slightly and shift the shuttle adjustment bracket slowly toward the shuttle (to the right) until the shuttle teeth are retracted below the level of the aperture plate rails. Retighten the Allen nut.

(3) Refer to View D, Figure P. Adjust the setscrew in or out to obtain a clearance of 0.094 inch between the left-hand ear of the clutch slide bar and the end of the setscrew.

(4) The shuttle interlock retainer is secured to the right end of the worm gear. Note, in View C, that the curved lip of this retainer must overlap the downward bent finger of

the clutch slide bar. If necessary, bend this finger to obtain positive overlap as shown.

c. Adjusting Clutch Solenoid Linkage (Early Models). Refer to Figure 5 in the parts list section for the following adjustment procedure. The clutch stop pawl must be disengaged as shown in Figure P, View A.

(1) Loosen the collar setscrews (1) so that both collars (2) are free on the clutch solenoid rod.

(2) Lift the clutch solenoid rod until the top of the solenoid plunger (6) is raised approximately 3/16 inch out of the solenoid frame. Hold in this position and slide the lower collar up against the stop pawl. Tighten the collar setscrew securely.

(3) Position upper collar so that distance from its top surface to bottom of the lower collar is approximately 7/8 inch. This should provide sufficient compression of the spring (3) to prevent rattling.

(4) Start the projector and check the operation of the clutch. If the solenoid pulls in sluggishly, the plunger is set too high. Hold the solenoid rod and lower collar while loosening the collar setscrew. Lower the collar a fraction of an inch on the rod and retighten the setscrew. Then recheck clutch operation. If the solenoid produces a buzzing noise it is set too high (lower the bottom collar) or the spring is compressed too much (loosen upper collar setscrew and raise collar slightly). If the plunger seats fully but the stop pawl ear does not engage behind the trigger, the plunger is either set too low or the spring is not sufficiently compressed. Reset the collars accordingly.

d. Checking Clutch Mechanical Linkage (Current Models). Refer to Figure 6 in the parts list section for the following adjustment procedure.

(1) Rotate the projector Still-Run knob to the Run position and press down fully on the forward edge of the clutch lever (15) so that the clutch lever rod (4) moves downward to the limit of its travel.

(2) While holding the clutch lever depressed, rotate the mechanism knob and check to make certain that the ear of the stop pawl clears the trigger as shown in View A, Figure P.

(3) Continue holding the clutch lever depressed and adjust the collar (3) beneath the stop pawl to obtain a clearance of 3/32-inch between the top of the collar and the underside of the stop pawl. Tighten the setscrew (2) securely.

(4) Rotate the Still-Run knob from Run to Still and back to Run, checking to see that the ear of the stop pawl engages behind the trigger in the Run position (View B, Figure P) and clears the trigger in the Still position (View A, Figure P).

70. ADJUSTING THE SOLENOID-OPERATED FIRE SHUTTER (EARLY MODEL 542 AND 542EX PROJECTORS). If the Model 542 or 542EX projector being repaired is equipped with the solenoid-operated fire shutter system, refer to parts list Figure 5 and adjust as follows.

a. Linkage Clearance. Turn mechanism pulley until one blade of interrupter shutter is adjacent to fire shutter rod (11). Check that rod clears interrupter shutter by at least 3/32 inch. If clearance is less than 3/32 inch, remove solenoid (15) and loosen two bracket retaining screws (16). Shift bracket to provide minimum link clearance of 3/32 inch, then tighten retaining screws securely and reinstall the solenoid.

b. Alignment. Open film gate and turn mechanism pulley until interrupter shutter clears aperture. Loosen two screws (13) which secure solenoid (15) to bracket (17). Place thumb of right-hand against outer end of solenoid frame and index finger on clevis at end of solenoid plunger. Note: Be sure to press on clevis, not on the linkage. Press solenoid against plunger. While looking straight into the aperture, position solenoid so that fire shutter covers aperture; then tighten screw (13) at outer end of solenoid bracket enough to hold solenoid in place. Release solenoid plunger and raise and lower the rod several times to make sure that the plunger slides freely in solenoid. Tip solenoid if necessary to free plunger, then tighten both retaining screws (13) securely.

71. ADJUSTING THE MECHANICALLY-OPERATED FIRE SHUTTER (CURRENT MODEL 542 AND 542EX PROJECTORS). When the projector has been completely assembled, install the projection lamp and lens and run the projector "forward" with the lamp on. Turn the Still-Run knob to the Still position and focus the image of the aperture on the screen. Check for full pattern of the fire shutter disc on the screen (image must show perforations of disc throughout). Note that a bent ear on the fire shutter bracket limits the travel of the fire shutter filter arm. If unfiltered light appears at the top or bottom of the aperture image, it will be necessary to bend this stop ear so that the amount of filter arm travel is increased or decreased accordingly.

72. ADJUSTING REEL ARMS AND REWIND CLUTCH.

a. Front Reel Arm Adjustment. (See Figure 9.) Adjust end play of drive shaft (22) to 0.008 inch ± 0.003 inch by positioning retaining ring (18) against an 0.008 inch shim. The backlash on the lower gear assembly (8) should be between 0.005 inch minimum and 0.018 inch maximum. Adjust by assembling, as required, a combination of 0.010 inch washers (9) and 0.005 inch washers (9B) on feed spindle assembly (10). Greater thickness in washer combinations reduces backlash.

b. Rear Reel Arm Adjustment. (See Figure 10.) Adjust end play of drive shaft (22) to 0.008 inch± 0.003 inch by positioning retaining ring (9) against an 0.008 inch shim. The backlash on the upper gear assembly (25) should be 0.015 inch ± 0.003 inch. Adjust by increasing or decreasing a build-up of 0.005 inch and 0.0025 inch washers (26), as required, beneath the upper gear assembly (25). Greater thickness in washer combinations reduces backlash.

c. Rewind Clutch Adjustment. The rewind clutch system must be adjusted to produce a supply spindle torque of 5-1/2 to 6 inch-ounces when the rewind button is pressed during operation. Install an empty reel on the supply spindle and wrap several turns of a ten-inch film strip around the reel hub. Hook a spring scale to the free end of the film strip. Turn on the projector and press the rewind button. The spring scale must measure between 5-1/2 and 6 inch-ounces of torque. All clutch systems (Figures 2D, 2E and 2F) are adjusted in the same manner, by tightening (to increase torque) or loosening (to decrease torque) the hex adjusting nut on the outer end of the rewind sprocket (item 3). Hold the sprocket firmly and adjust the nut with an open-end wrench.

73. ADJUSTING THE SOUNDHEAD.

a. Removal. Due to the ease with which the soundhead can be removed and the greater accessibility thereby obtained, time will be saved by removing the soundhead if major work is required. Remove the soundhead as follows.

(1) Remove the projection lens from the projector. Note that the rear lens element is held in place with a retaining ring and can be replaced if necessary. Wrap lens in tissue paper.

(2) Disconnect photocell and exciter lamp cable from amplifier and release cables from retaining clips.

(3) Remove grounding spring (19, Figure 4). Insert the end of an Allen wrench or short steel pin in hole in sound drum bearing housing directly behind the flywheel until wrench or pin drops through hole in sound drum shaft. Hold the pin firmly and remove flywheel retaining nut (20, Figure 4), flywheel (21) and washer (22).

(4) With a sharp pencil, draw a line on the main frame where the front edge of the soundhead meets the frame. This will provide a reference mark with reassembling.

(5) Remove the three screws (23 and 24, Figure 4) which tap into the soundhead from rear of main plate, and carefully withdraw the soundhead.

b. Photocell Alignment. Early projector models were equipped with the photodiode type of photocell which is no longer available. Current projectors use the silicon photocell. The adjustment procedure for each is essentially the same and requires that the setscrews (items 18 and 19, Figure 13) be loosened and exciter lamp (8) and optical slit assembly (11) be removed.

(1) Silicon Photocell. Insert the alignment tool (item 13, Figure A) into the optical slit mounting hole as shown in Figure Q, View A. Press the sound drum in until the inner face of the drum just contacts the first step of the alignment tool and tighten the sound drum screws (19, Figure 13) securely. Withdraw the alignment tool and, while looking into the optical slot mounting hole, shift the photocell assembly until its forward tip is flush with the inner face of the sound drum as shown in Figure Q, View B. Tighten the setscrew (18, Figure 13) securely. Reinstall the optical slit and exciter lamp.

(2) Photodiode Photocell. Insert the alignment tool (item 13, Figure A) into the optical slit mounting hole as shown in Figure Q, View A. Press the sound drum in until inner face of the drum just contacts the first step of the alignment tool and tighten the sound drum screws (19, Figure 13) securely. Shift light pipe until its inner edge makes contact with the second step of the alignment tool. Tighten the setscrew (18, Figure

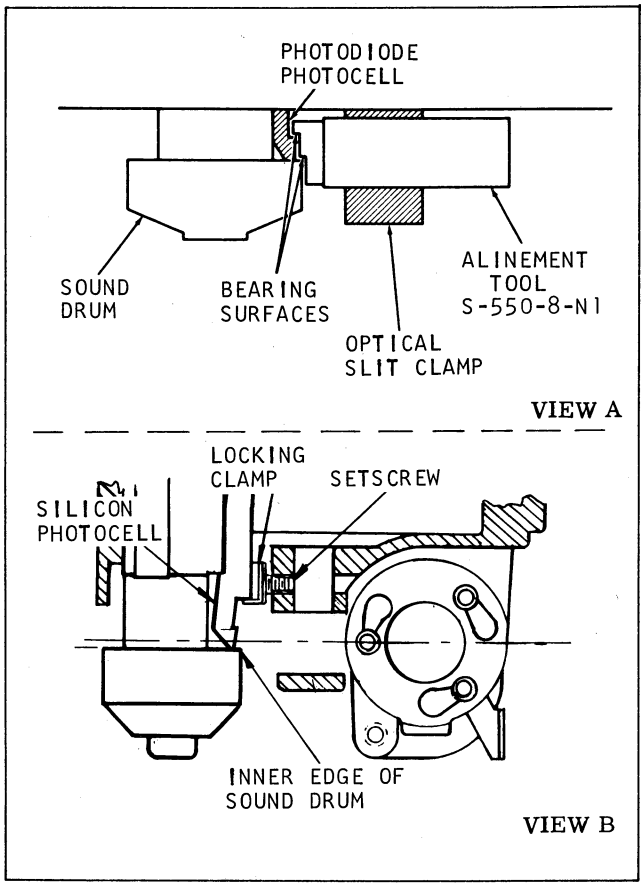


Figure Q. Positioning the Sound Drum and Photocell

13) securely and withdraw the alignment tool. Reinstall the optical slit and exciter lamp.

(3) The position of the germanium diode photocell in early models is critical with respect to the light pipe. The photocell can be exposed by removing the flywheel from the end of the sound drum shaft. Loosen the two screws (item 7, Figure 13) which attach the photocell (8) to the photocell holder (19). Also loosen clamping screw (18) so that the holder can be rotated if necessary.

(4) Connect a 16-ohm 10-watt resistor and an output meter to the speaker jack and thread the projector with 400 CPS constant frequency film. Start the projector and adjust the volume control to a convenient listening level. Position the photocell and holder for maximum output; then tighten all screws, disconnect test equipment and reinstall the flywheel.

c. Roller Arm Tension Adjustment. (See Figure 13). The arms upon which rollers (28 and 29) are mounted are linked by torsion spring (34); therefore the roller arms move as a pair. Counterbalance spring (30) offsets the weight of the rollers and arms. Place the soundhead on a level surface and move the roller arms (as a set) to various positions. If spring tension is incorrect, roller arms will not remain in the position in which placed. If the roller arms swing downward, loosen retaining screw (31) and move spring terminal (32) downward until the weight of the arms is counterbalanced. If roller arms move upward, move terminal upward to reduce counterbalancing force.

d. Optical Slit Adjustment. (See Figure 13.)

(1) Loosen the clamping screw (3). If the optical slit does not slide freely in its holder, insert a bit of a small screwdriver in the clamp slot and wedge clamp open to free optical slit assembly. Thread projector with 7000 CPS optical setting film and connect a 16-ohm, 10-watt load resistor and output meter to speaker jack.

NOTE: A pair of hairpin tongs approximately 6 inches long and formed with the ends turned inward and tapered to engage holes in end of slit barrel are very useful in adjusting the optical slit. They can be made from 20 to 26 gage music wire or 1/16 inch diameter drill rod.

(2) Set the volume control at approximately 12 o'clock position and start projector. Move slit toward or away from film, as required, to obtain an output reading. Rotate the slit to obtain peak reading and simultaneously move in or out until maximum output is obtained. If film was threaded with emulsion toward the optical slit, move slit toward film until output drops 1-1/2 to 2 DB. If emulsion is toward sound drum, move slit away from film to obtain 1-1/2 to 2 DB drop in output. Tighten slit clamping screw (3) securely to lock the adjustment.

e. Buzz Track Adjustment. The lateral position of the film in the soundhead is controlled by the flanged roller (28) and edge guide screw (25). Unless the adjustment has been disturbed, it is not probable that the edge guide screw (25) will require resetting. Thread the projector with buzz track film and adjust volume control to a suitable listening level. Turn adjusting screw (6) to move flanged roller laterally.

NOTE: There are two types of buzz track in use. On one, the track spacing exceeds the length of the scanning beam. This track can be positioned so that little or no signal is reproduced. On the other type of track, spacing is less than the length of the beam. This track should be positioned so that both tones are reproduced at approximately the same volume level. If, after adjustment of guide roller position, signal levels cannot be balanced (or eliminated on wide track), or level of tones fluctuates, adjust edge guide screw (25) to clear up the condition. If the edge guide screw is far out of adjustment, turn it clockwise until it clears the edge of film, adjust rollers and then set guide screw to stop weave of film.

f. Installing the Soundhead (Figure 4). Lift the soundhead assembly up into place against the main plate, making certain that the cables are threaded through the hole and behind the plate. Loosely install the soundhead screws (19) and washers (20). Align the front edge of the soundhead casting with the pencil mark drawn on the main plate prior to removal and tighten the mounting screws securely. Assemble the flat washer (18) and flywheel (17) on the sound drum shaft and install the flywheel nut (16) finger-tight. Insert a small diameter pin through the hole in the sound drum housing and rotate the drum until the pin drops into a similar hole in the shaft. Hold the pin securely and tighten the flywheel nut with an open-end wrench. Install the grounding spring (15).

74. ADJUSTING TIMING BELT TENSION. Both timing belts are adjusted by means of the idler assemblies shown in Figure R. Although belt tension is not critical, excessive tension will reduce belt life. Loosen the rewind idler bracket screws (Figure R) and position the rewind belt idler until the rewind timing belt can be depressed at mid-point approximately 1/8-inch with light thumb pressure. Tighten the idler bracket screws securely. Loosen the take-up idler bracket screws and position the take-up belt idler until the belt can just touch the motor relay mounting bracket when light thumb pressure is applied to the belt. Tighten idler bracket screws securely.

75. PROJECTOR SPEED CHECKS. Speed of the projector is not adjustable. Therefore, speed checks are primarily for the purpose of determining that the equipment is operating properly and as a means of detecting excessive mechanism loads, damaged drive belt or similar conditions.

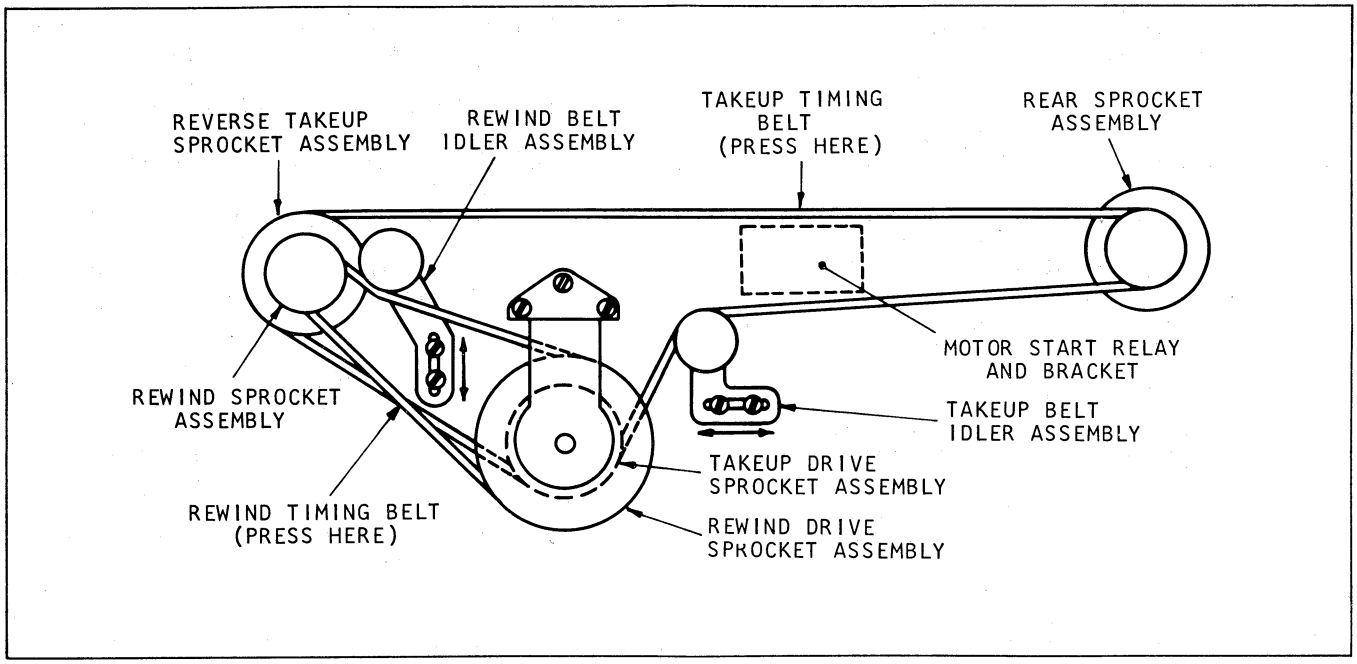


Figure R. Adjusting Timing Belt Tension

a. Methods of Measurement. Various devices and procedures can be used to check projector speed. The most common ones are as follows:

(1) Photocell and Frequency Meter. Used to measure the number of pulsations of the projection beam per second. Pulsations per second is then converted to projector speed. This method is quite practical in large volume shops.

(2) Strobatac or Similar Strobe Light. Usually synchronized with interrupter shutter of shuttle. Shutter makes one revolution per frame. Shuttle makes one stroke per frame.

(3) Tachometer (Preferably Having a Speed Range with a Maximum Speed of 150-200 RPM). Used to measure RPM of the sprocket.

(4) Strobe Disc. Attached to sprocket by means of suction cup or rubber foot. For viewing with light from 60 CPS source, disc should have 70 dots for sound speed, 93 dots for silent speed. Count number of apparent revolutions of pattern for one minute. If pattern drifts in direction of rotation, add to design speed to obtain true speed. If pattern drifts against rotation, subtract from design speed to obtain true speed.

(5) Timed Loop. Make loop of exactly 120 frames. At sound speed splice will pass aperture 12 times per minute plus or minus the permissible variation in speed and the timing error.

b. Speeds at 120 Volts, 60 CPS AC.

(1) Sound Speed (24 FPS ± 2%).
Shutter - 1440 RPM ± 2%
Sprocket - 102.86 RPM ± 2%

(2) Silent Speed (18 FPS ± 5%).
Shutter - 1080 RPM ± 5%
Sprocket - 77.1 RPM ± 5%

76. LOOP RESTORER ADJUSTMENTS (EARLY MODELS).

a. Test Film. Since film is transported by means of the sprocket holes and the shuttle and sprockets are synchronized by the gear train, there will always be the same number of frames in the lower loop, when the shuttle is at top of stroke position. The size of the loop, however, is dependent upon the actual length of the film in the loop. If the film is either stretched or shrunk, the size of the loop will change. This possible variation in the size of the loop, due to film condition, must be recognized and allowance made for it in adjusting the loop restorer. Therefore, it is necessary to measure the stretch or shrinkage of the piece of film which is to be used in adjusting the loop restorer in order that the adjustment can be made with the highest possible degree of accuracy. Proceed as follows:

(1) Count 40 frames of film and mark the first and last sprocket holes.

(2) Place the trailing edge of the first sprocket hole at one end of a 12 inch steel rule.

(3) Smooth the film along the rule. Do not apply more than 2 to 3 ounces of tension to the

film as this might produce an erroneous measurement.

(4) If there is zero shrinkage in the film, the trailing edge of the last sprocket hole will register exactly with the end of the rule.

(5) If the leading edge of the last sprocket hole registers with the end of the rule, the film has approximately 0.4 percent shrinkage. Since the variation is usually linear, a film which had shrunk 1/2 the height of a sprocket hole would have approximately 0.2 percent shrinkage.

(6) If the trailing edge of the last sprocket hole overshoots the end of the rule, the film is stretched. Generally you will find that the film will have some shrinkage. If the film is shrunk more than 0.5 percent (height of 1-1/4 sprocket holes), do not use for adjustments.

b. Adjustments (See Figure S, View A).

(1) Loosen retaining screw (14) and rotate eccentric anchor (15) so that end of cam follower (18C) clears end of restorer cam by approximately 0.015 inch. Note: If cam follower strikes casting before proper clearance is obtained, move cam away from casting.

(2) Thread projector with film of known shrinkage. Turn framer to maximum counterclockwise position. Turn mechanism by hand until shuttle has engaged perforations at top of stroke but stroke has not begun.

(3) Loosen screw (17) which holds cam follower support bracket (18D) to shaft.

(4) Position loop restorer (31A) as follows:

(a) Film shrinkage 0 to 0.2 percent: set restorer 0.015 to 0.020 inch above loop (use piece of #26 gage wire as a feeler gage).

(b) Film shrinkage 0.2 to 0.5 percent: set restorer 0.010 to 0.012 inch above loop (use piece of #30 gage wire as a feeler gage).

(5) After establishing correct clearance, tighten screw (17) securely.

(6) Turn mechanism by hand until lobe of restorer cam is on top dead center.

(7) Push cam follower (18C) forward until it passes under cam. If end of follower does not clear cam by 0.018 to 0.020 inch, loosen two screws (18A) and move follower downward to establish correct clearance.

(8) Turn the mechanism by hand until shuttle reaches end of stroke. Open gate and pull out the loop.

(9) Hold the film lightly against aperture and turn the mechanism to restore loop. Observe shuttle teeth as they re-enter perforations. Adjust as follows:

(a) If bottom edge of shuttle teeth does not clear bottom edge of sprocket holes, move cam follower upward.

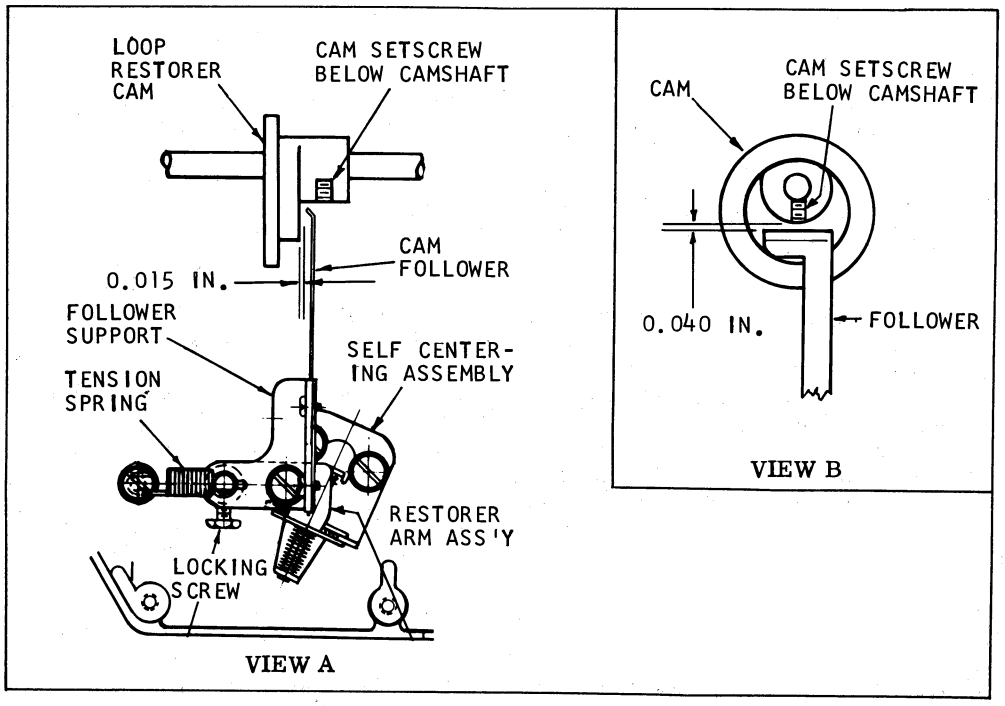


Figure S. Loop Restorer and Cam Adjustment

(b) If top edge of shuttle teeth does not clear top edge of sprocket holes, move cam follower downward.

(10) Run projector and check operation either by pulling out lower loop or opening and closing gate. After loop has been restored, place tip of finger on top of restorer and check for pulse at loop frequency. If pulse is detected, increase restorer clearance as instructed in step (4) (a), preceding.

77. LOOP RESTORER ADJUSTMENTS (CURRENT MODELS). Check operation of loop restorer by threading the projector with a loop of test film in which two or three successive perforations have been purposely enlarged at points approximately one foot apart. The first set of damaged holes should be located about two feet from the aperture. Run the projector in "forward" and observe the action of the loop restorer as the enlarged perforations run through the film gate. The lower loop should be automatically restored within five or six frames. To adjust the loop restorer, refer to Figure S, View B, and proceed as follows:

a. Slip the loop restorer position tool (item 8, Figure A) over the loop restorer roller with the flat on the tool facing the guide roller at the rear end of the upper sprocket guard. The flat of the tool should just touch the guide roller lightly. To adjust spacing between loop restorer roller and guide roller, loosen the mounting screws in the self-centering assembly (inset B, Figure S) and raise or lower that assembly until the proper spacing is obtained. Then tighten the mounting screws securely. Be sure that the ear of the loop restorer arm is postioned between the two spring-loaded keeper plates of the self-centering assembly.

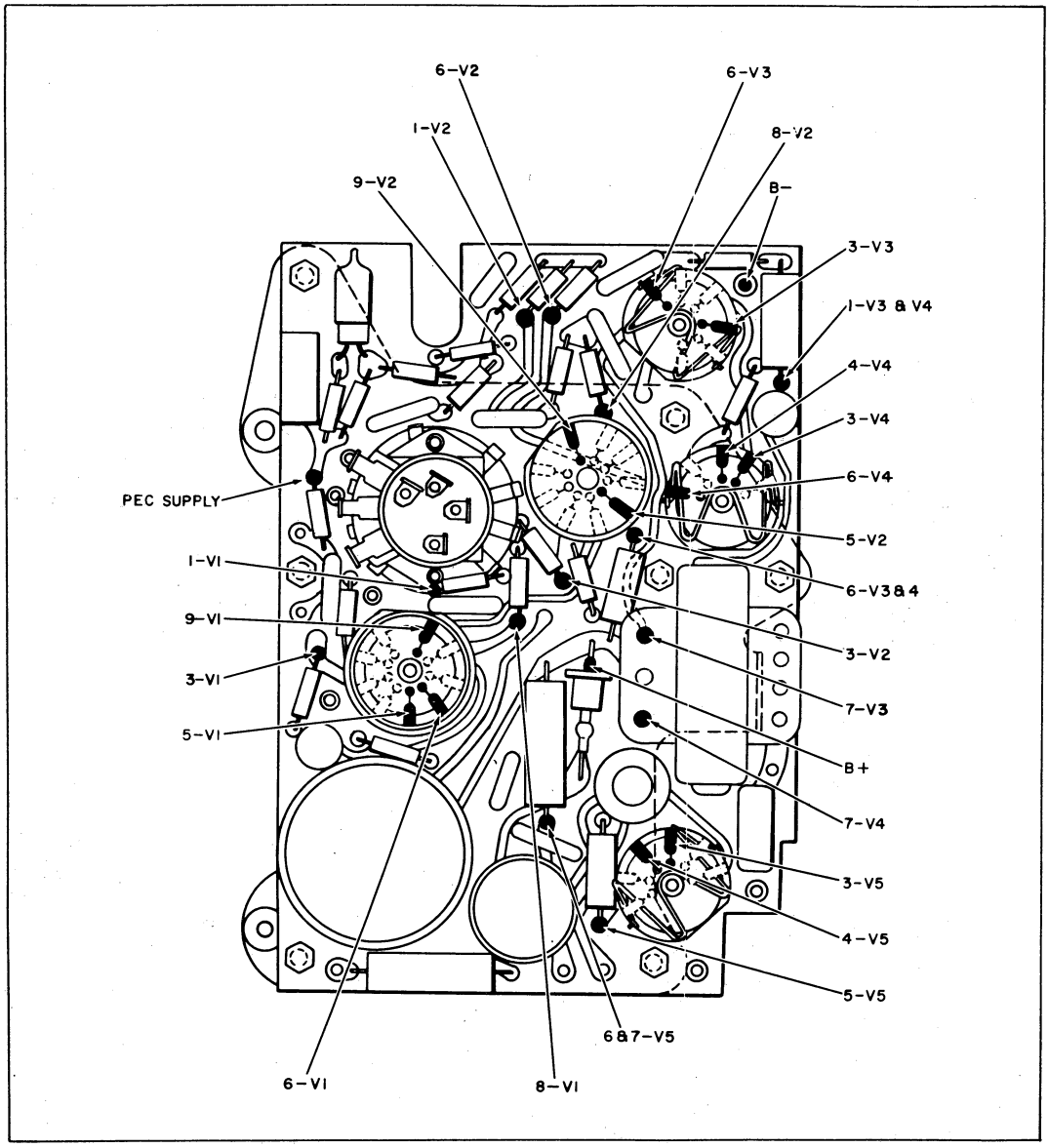


Figure T. Location of Amplifier Test Points

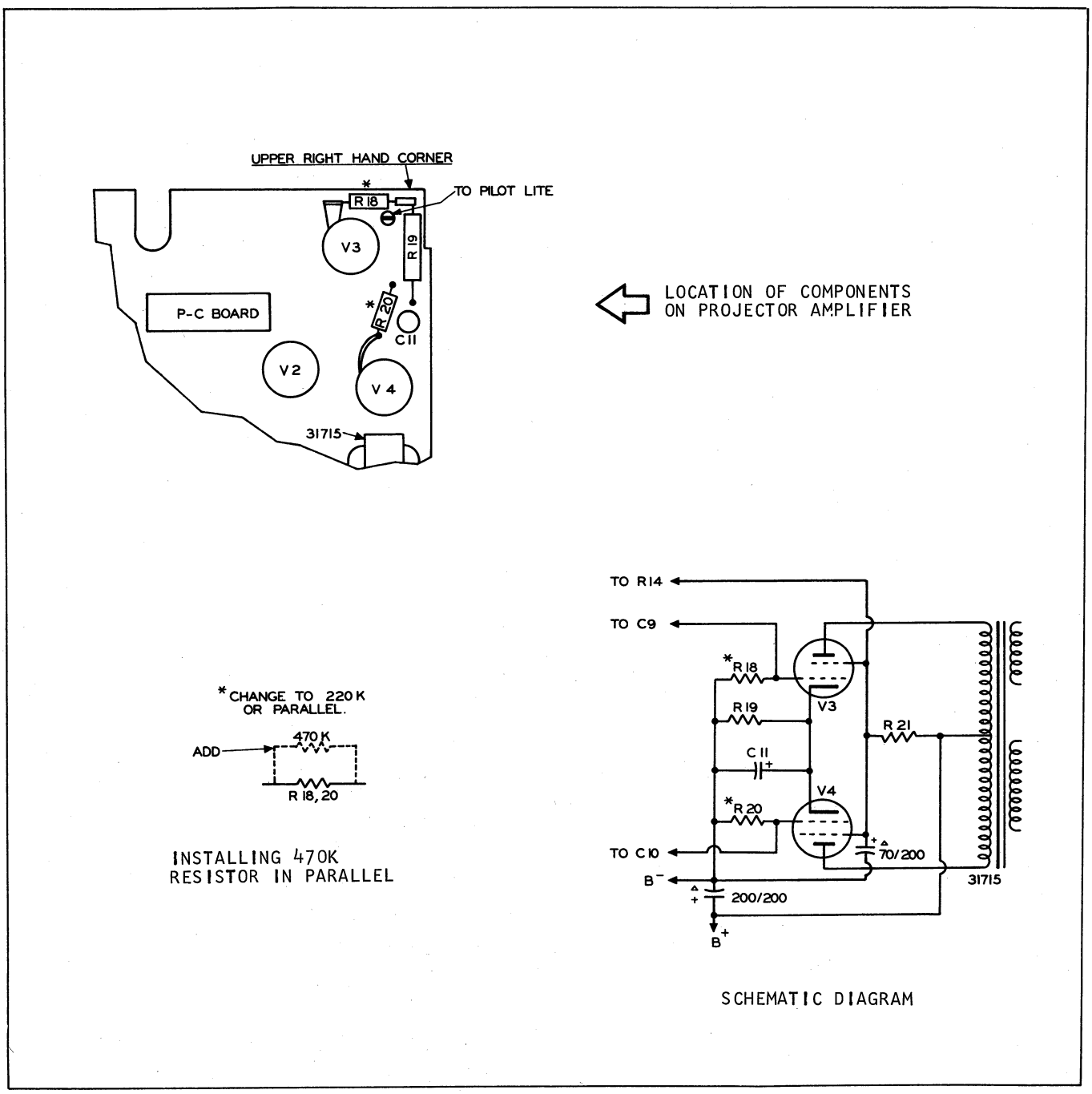


Figure U. Replacing Grid Resistors R18 and R20

b. Rotate the mechanism pulley until the setscrew in the loop restorer cam is at the bottom, diretly below the camshaft (see inset B, Figure S). The clearance between the upper tip of the cam follower blade and the face of the cam should be 0.015 inch. To adjust this clearance, loosen the cam follower support mounting screw (inset B) and rotate the support accordingly; then retighten the screw securely. Now check the clearance between the upper end of the cam follower and the small diameter of the loop restorer cam (inset B). This clearance should be 0.040-inch (± 0.005 inch). Be sure that the cam setscrew is still positioned at the bottom of the cam, below the camshaft. To adjust this clearance, loosen the two follower screws and raise or lower the cam follower blade as necessary; then retighten the two screws securely.

c. Recheck the clearance between the loop restorer roller and upper sprocket guard guide roller as outlined in step a, above. Remove the restorer positioning tool and once more check loop restorer operation with the loop of test film.

78. CHECKING THE EXCITER LAMP COVER CLEARANCE. Since the film must pass between the

sound drum and exciter lamp cover, the clearance between these two items should be checked. Insert a #77 drill or a straight piece of #25 wire into the channel between the drum and cover. Gage should enter channel with slight friction but without forcing. If clearance is inadequate, straighten the exciter cover locating pins to obtain proper clearance.

79. TESTING THE AMPLIFIER. Amplifier test points locations are indicated in Figure T. Observe the following test conditions during the tests.

TEST CONDITIONS:

Line voltage 120V 60 CPS

Oscillator generating 400 CPS. Properly loaded and coupled to photocell input through 0.5 mfd capacitor.

Input voltage at photocell terminals 0.1V R.M.S.

Volume control set to produce 7.5 volts (approximately mid-point) across 16 ohm load.

All signal voltages measured with high impedance VTVM.

All voltages measured to B - (Amplifier Ground).

Tone control in "Normal" position.

	Pin Number and Voltages							
Tube	1	2	3	4	5	6	7	8
V-1	0.12	0.09	0.09	-	-	4.85	*	0.02
V-2	7.65	0.12	0.97	-	-	7.35	*	7.9
V-3	0.12	-	-	-	7.2	-	61	-
V-4	0.12	-	-	-	7.3	-	61	-

*Essentially equal to voltage at preceding plate.

Voltage measured should be within approximately ± 20 percent of values shown on chart.

80. CORRECTING FOR REDUCED VOLUME FROM THE AMPLIFIER. When customer complaint indicates a gradual reduction of amplifier volume, it may be due to deterioration or weakness in the Type 25C5 tubes. On earlier projector models, this trouble usually can be corrected by replacing the 590 K-ohm grid resistors R18 and R20 with 220 K-ohm resistors P/N 34840, or by installing a 470 K-ohm resistor in parallel with each of the existing resistors. See Figure U for the location of these resistors on the amplifier.

Modifications

81. INSTALLING MIC-PHONO ADAPTER KIT.

The Mic-Phono Adapter Kit can be installed on Filmosound Projectors equipped either with the germanium photodiode or with the silicon photocell and its associated preamplifier. Preliminary installation procedures (paragraph 82) and final installation procedures (paragraph 85) are applicable to all Filmosound Projectors. Special wiring procedures for projectors equipped with the germanium photodiode are covered in paragraph 83, while those for silicon photocell projectors are covered in paragraph 84. Therefore, for projectors equipped with the germanium diode photocell, follow the procedures outlined in paragraphs 82, 83 and 85; for those equipped with the silicon photocell, follow paragraphs 82, 84 and 85.

To make the adaption, the following parts must be ordered from the Bell & Howell General Service Dept.

Part No.	Description	Qty
011931	Mic-Phono Adapter Assembly	1
011932	Cover and Mounting Plate Assembly	1
31928	Screw, Binding head	3
32099	Connector, Dual, spade type	1
36505	Screw, Hex head self-tapping	4
36519	Nameplate	1
31666	Soldering lug	2

82. PRELIMINARY INSTALLATION PROCEDURES.

a. Remove the projector rear cover and discharge the motor start capacitor. This must be done to avoid possible injury from electrical shock.

b. Refer to the proper projector wiring diagram (Figures 28 through 34) and make the following wiring changes to the switch (right center of diagram).

(1) Disconnect the red lead from terminal 2L1.

(2) Disconnect the black lead (coming from the 100-ohm heater dropping resistor) from terminal 2C.

(3) Install the push-on type dual connector from the adapter kit on terminal 2C so that the dual terminals point inward. It may be necessary to straighten the other connector on terminal 2C in order to obtain the necessary clearance for the dual connector.

(4) Reconnect the black lead to one of the dual connector terminals and the red lead to the other dual connector terminal. There now should be two black leads and one red lead connected to terminal 2C.

c. Remove the sound drum grounding spring and the flywheel from the projector. Note: If spacing washers have adhered to the hub of the flywheel, transfer them to the shaft and reinstall the flywheel retaining nut to prevent their loss.

d. Remove the cable retaining clip located on the projector base directly below the speaker, and save the clip for future use.

NOTE: If your projector is equipped with the germanium photodiode, complete the mic-phono adapter installation by following the instructions in paragraphs 83 and 85. If your projector is equipped with the silicon photocell, follow the instructions in paragraphs 84 and 85.

83. SPECIAL WIRING PROCEDURES FOR GERMANIUM PHOTODIODE PROJECTORS.

a. Note the terminal of the photodiode to which the pigtail from the photocell cable shield is attached and place a minus (-) mark adjacent to that terminal. Disconnect and remove the photocell cable.

b. Locate resistor R3 by referring to the proper amplifier schematic diagram. Remove this resistor by cutting its leads with a long-jaw, end-cutting pliers (Klein #204-6-C, Krauter #CG1650, or equal).

c. Note, in Figure V, that the adapter wiring consists of a yellow lead, a red lead, a long shielded lead and a short shielded lead. The short shielded lead is equipped with spade-type connectors which must be replaced by the lug type terminals (part no. 31666) supplied with the kit. Cut the pigtail of the shield (A) to a length of 3/4-inch and the core wire (B) to a length of 1/2 inch and install the lug type terminals. Connect this shielded lead to the photodiode terminals.

NOTE: The shield pigtail must be connected to the terminal marked minus (-) in step a, and the lead must be positioned so that the pigtail cannot touch other projector parts.

d. Temporarily disconnect the white lead from the top terminal of the volume control switch and push the lead back over the blower housing. Solder the red adapter lead to the amplifier terminal which serves as a junction for resistors R1 and R2 (this is the terminal from which the upper lead of R3 was detached in step b). Reconnect the white lead to the top terminal of the volume control switch and dress

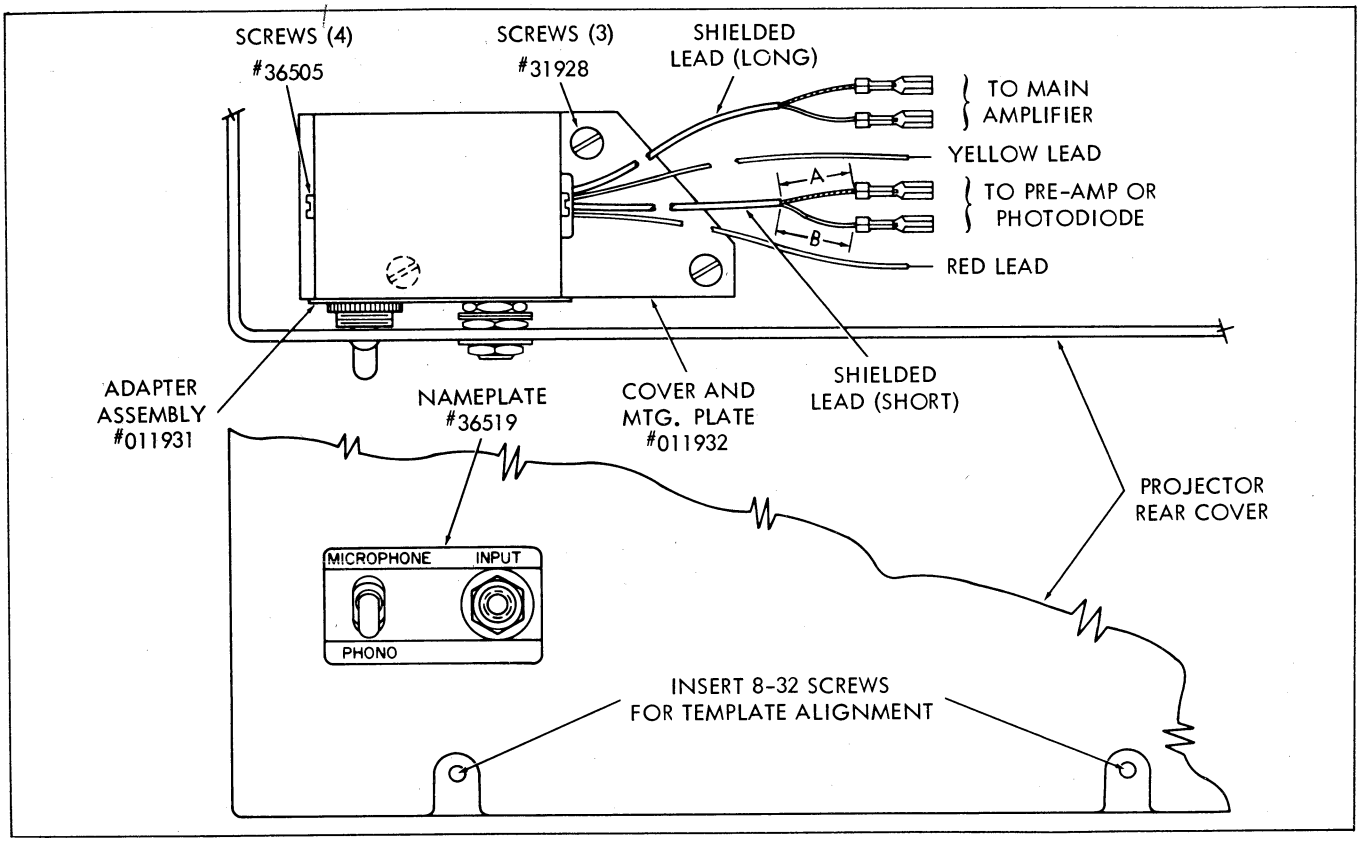


Figure V. Mic-Phon Modification, Parts Installed

the red lead down along the rear end of the blower housing.

e. Remove the 25C5 tube located directly above the output transformer and the 12AX7 tube which is adjacent to the 25C5. Dress the yellow lead to the adapter up along the rear end of the blower housing and pass it between the main projector switch and the tone control switch. Solder this lead to the tone control switch terminal to which another yellow lead already is attached. Reinstall the two tubes.

f. Connect the remaining (longer) shielded lead of the adapter to the amplifier photocell input. Be sure to observe proper polarity.

g. Secure long shielded lead and red and yellow leads to the projector base with the cable clamp located adjacent to the blower housing. Then complete the installation as instructed in paragraph 85.

84. SPECIAL WIRING PROCEDURES FOR SILICON PHOTOCELL PROJECTORS.

a. Disconnect and remove the shielded lead which connects the preamplifier to the input of the main amplifier.

NOTE: The pigtail from the shield of the photocell cable is soldered to the ground connector of this preamplifier-to-main amplifier lead. Carefully separate the ground connector from the preamplifier terminal. Hold pigtail with a long nose pliers while unsoldering pigtail of photocell lead from ground connector.

b. Note, in Figure V, that the adapter wiring consists of a yellow lead, a red lead, a long shielded lead and a short shielded lead. The red lead can be removed and discarded, since it is not required for installation in silicon photocell projectors.

c. The short shielded lead of the adapter must be connected to the output terminals of the preamplifier. Before making these connections, tin a spot on the shank of the ground connector referred to in the Note following step a, preceding. Press the lead connectors onto the output terminals of the preamplifier; then loop the pigtail of the photocell cable shield around the shank of the ground connector and spot solder the pigtail securely. Hold the ground connector with a long nose pliers to prevent over-heating.

d. Connect the spade type terminals of the longer shielded adapter lead to the input terminals of the main amplifier. Be sure to observe proper polarity.

e. Remove the 25C5 tube located directly above the output transformer and the 12AX7 tube which is adjacent to the 25C5. Dress the yellow lead of the adapter up along the rear end of the blower housing and pass it between the main projector switch and the tone control switch. Solder this lead to the tone control switch terminal to which another yellow lead already is attached. Reinstall the two amplifier tubes.

f. Secure the long shielded lead and yellow lead to the projector base with the cable clamp located adjacent to the blower housing. Then complete the installation as instructed in paragraph 85.

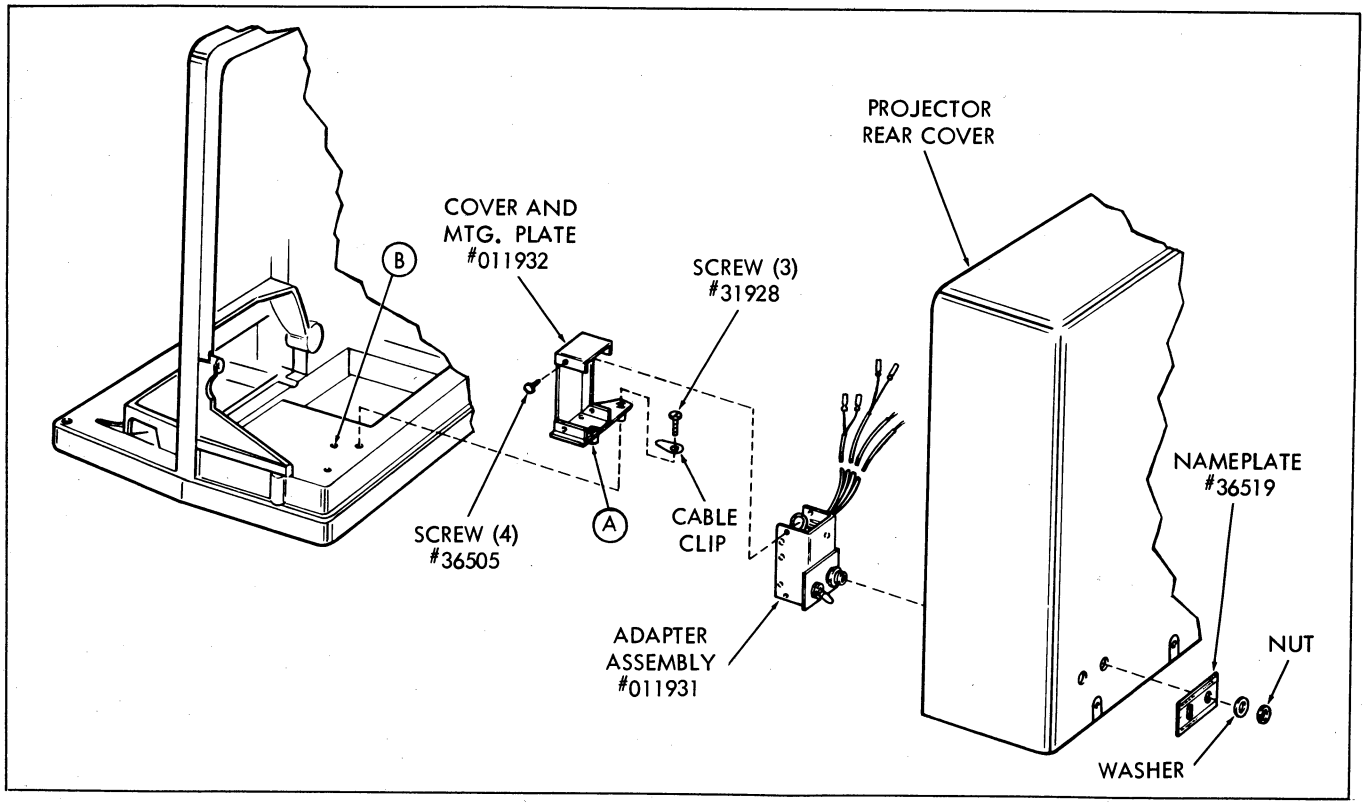


Figure W. Location of Adapter and Cover on Base

85. FINAL INSTALLATION PROCEDURES.

a. Reinstall the projector flywheel and flywheel nut.

b. Remove the cover and mounting plate assembly from the adapter kit and position it over the three holes in the projector base. Dress the leads to the soundhead and to the preamplifier (or to the germanium photodiode, as the case may be). The leads must lie flat on the projector base (no crossovers permitted) and must pass between the front and rear stand-off bushings of the adapter cover and mounting plate assembly.

NOTE: Carefully pull the speaker cable outward so that it will not be under the cover and mounting plate assembly.

c. Install one of the three kit screws (part no. 31928), through the stand-off bushing marked "A" in Figure W, and tighten screw finger-tight. Slip the mounting foot of the sound drum grounding spring between the rear stand-off bushing and the hole marked "B" and install the second screw. Install the cable clip (removed in paragraph 82, step d) on the last screw and install this screw in the remaining stand-off bushing. The clip should point toward the projector mechanism plate. Carefully align the adapter cover and mounting plate assembly with the rear edge of the projector base and tighten all three screws securely.

d. Insert the adapter assembly (part no. 011931) into the cover and mounting plate assembly and secure it in position with the four screws (part no. 36505). Dress all leads away from the flywheel, with the speaker cable running across the top of the cover and mounting plate assembly and down the side of the cover to join the adapter leads. Secure all leads against the projector base by bending over the cable clip installed in step c, preceding.

e. Before proceeding, check the installation at this stage to make certain that all wiring connections have been properly made. This can be done as follows:

(1) Temporarily install the long case cover screw to activate the projector safety switch. Then connect the projector to the power supply and turn on the projector volume control.

(2) Press the adapter toggle switch upward (to MICROPHONE position) and plug a high impedance microphone (such as the Bell & Howell part no. 29316) into the input jack. Hold or place the microphone at a spot five to six feet away from the projector speaker and gradually advance the projector volume control. Depending upon the sensitivity of the microphone and its relative position with respect to the speaker, acoustical feedback should occur when the volume control is somewhere between 9 and 2 o'clock.

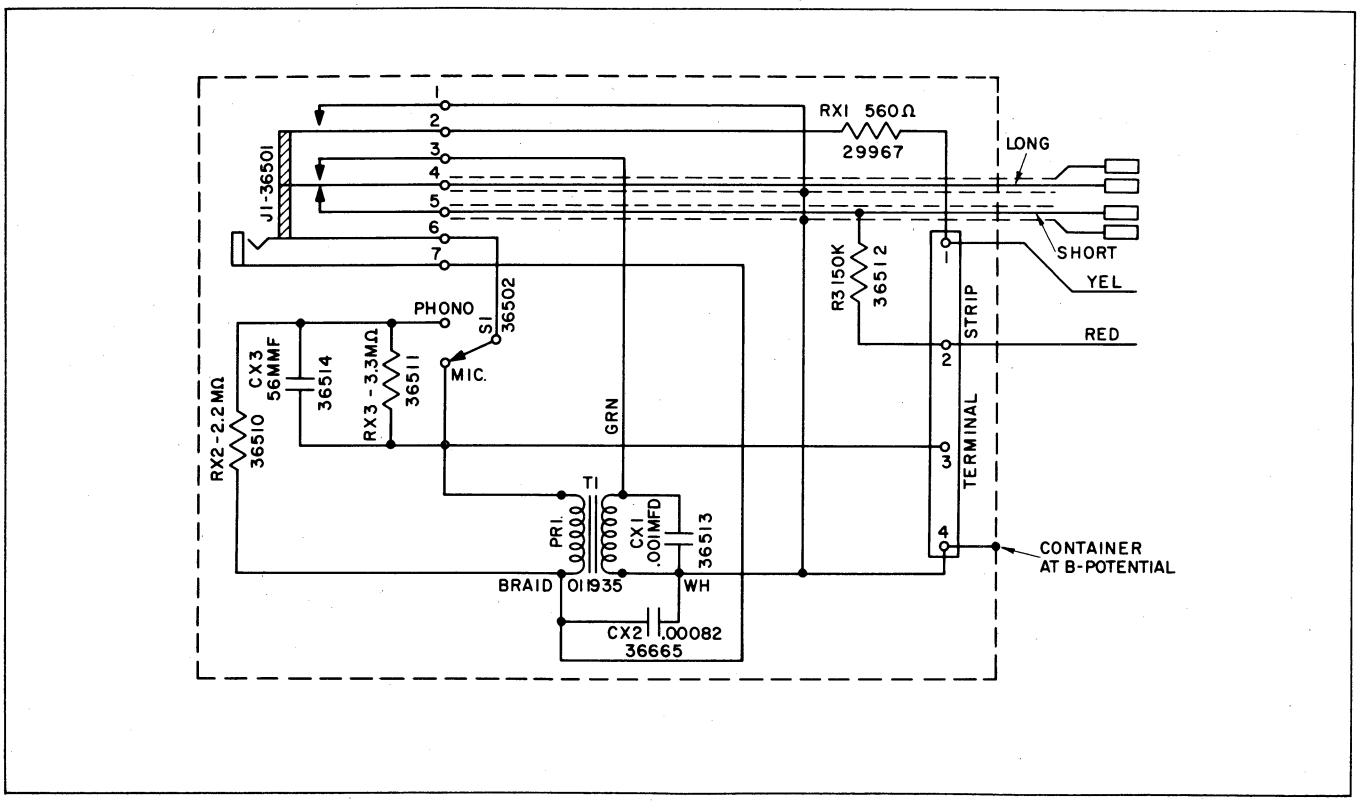


Figure X. Mic-Phono Modification Wiring Diagram

(3) Press the adapter toggle switch downward to PHONO position) and continue to advance the projector volume control. Acoustical feedback now should occur near the maximum volume position.

(4) If the system checks out as noted above, disconnect the microphone and projector power cord and remove the long case cover screw used to activate the safety switch. Then discharge the motor starting capacitor. If the system does not perform in the prescribed manner, recheck all connections (Figure X) for possible shorts and grounds.

f. Insert two 8-32 by 3/4-inch machine screws through the two mounting holes in the rear projector cover (see Figure V), with the screw heads on the inside of the cover. Install two 8-32 nuts finger-tight so that the screws do not wobble.

g. Trace the drilling template (Figure Y). Push the point of a pencil through the centers of the two small holes in the tracing, rotating the pencil carefully until the holes are enlarged to the size of the printed circles. Carefully install the tracing on the two 8-32 machine screws installed in step f, preceding. Smooth this template down against the surface of the rear cover and, with a center punch, mark the centers of the two larger holes in the template.

NOTE: If Service Stations anticipate several of these installations, it may be convenient to make a sheet metal template. Drill the two smaller holes with a #19 drill and install two 8-32 by 3/4-inch screws to serve as alignment pins. Use a #40 or #50 drill (depending on the thickness of the sheet metal) to drill the center-punch holes for the larger two holes in the template.

h. Remove the template and the 8-32 screws and nuts from the rear cover and drill the two 1/2-inch diameter holes in the rear cover. Remove the top nut and washer from the jack in the adapter assembly and install the rear projector cover. Check to make certain that the jack protrudes through its hole in the cover and that the adapter toggle switch does not strike the edge of its hole in either position. If interference is encountered, remove the projector rear cover and loosen the three screws that secure the adapter mounting plate to the projector base. Shift the mounting plate to eliminate the interference and retighten the screws.

i. Install the rear cover with its attaching screws. Activate the adhesive on the back of the adapter nameplate (part no. 36519) with toluol and install the nameplate so that its bottom edge is parallel with the bottom of the rear cover. Install the washer and hex nut on the adapter jack.

j. Connect projector to the power supply and check with microphone to make certain that the system operates properly. Also, check operation with film.

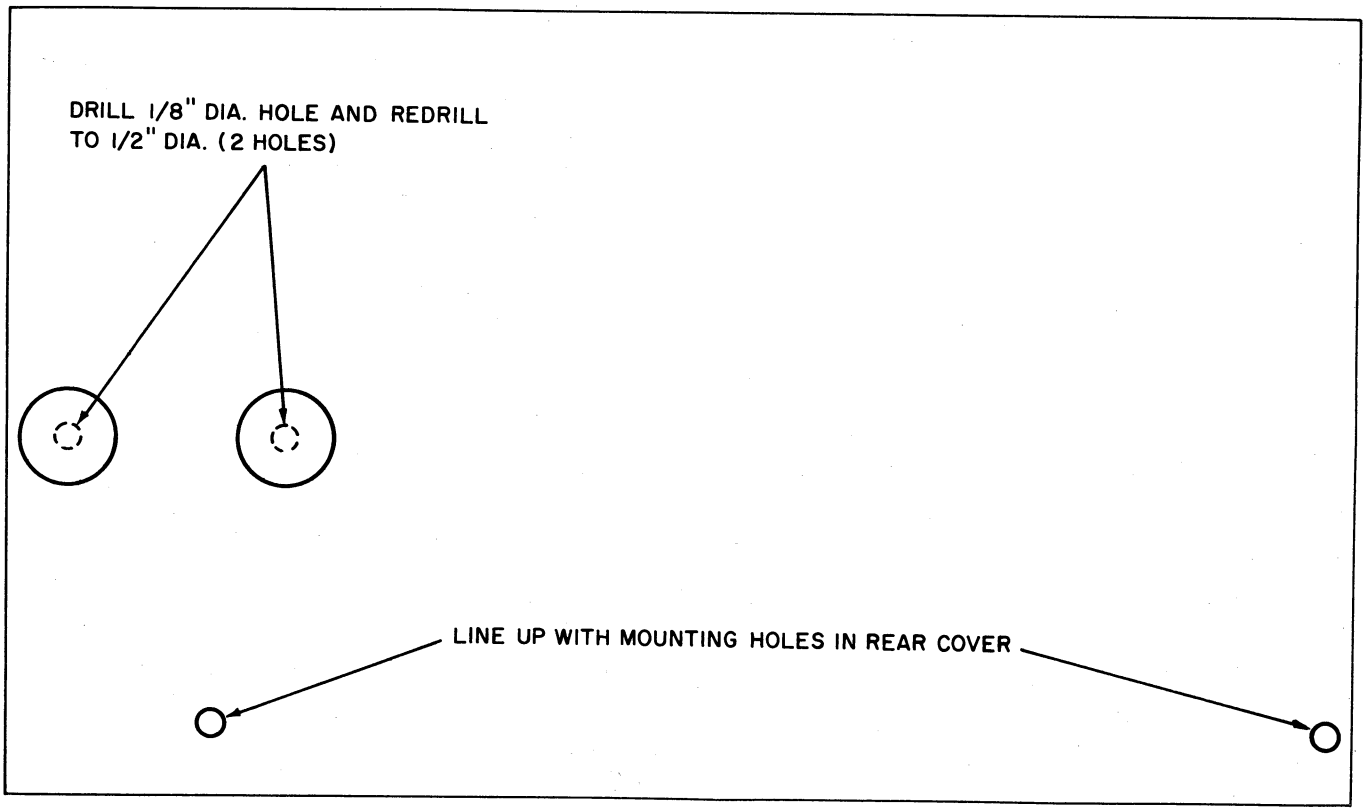


Figure Y. Template for Drilling Rear Cover Holes

86. CONVERTING TO SILICON PHOTOCELL OPERATION. The germanium diode photocell used in earlier model Filmosound Projectors has been discontinued and is no longer available for replacement. If a new photocell is required, the projector must be modified for silicon cell operation as outlined in the following paragraphs. The complete conversion kit, Part No. 012573, consists of the following parts.

Part No.	Description	Qty
011206	Preamplifier	1
011244	Silicon solar cell	1
31744	Resistor	2
31749	Resistor	1
35898	Capacitor	1
36011	Capacitor	1
36006	Leadwire, red	1
31491	Screw, machine	1

NOTE: These conversion instructions assume that the existing amplifier (part no. 011164) is in good operating condition and need only be modified as outlined in steps (10) through (15). If the amplifier is also in need of replacement, refer to paragraph 87 for special conversion instructions.

(1) Remove front and rear projector covers.

(2) Refer to the Disassembly section and disassemble the flywheel from the rear end of the soundhead stabilizer shaft. Remove the soundhead assembly from the projector.

(3) Remove the photocell holder, complete with germanium photocell, from the soundhead. The germanium photocell will be replaced by the silicon cell supplied with the kit; however, the photocell cable (part no. 09839, Figure Z) must be re-used. Disconnect the cable from the photocell by clipping the shield and leadwire as close as possible to the terminal lugs. Strip and tin the cut ends of the shield and leadwire approximately 1/4 inch.

(4) The sound drum and shaft assembly must be removed from the soundhead casting in order to install the silicon cell. To insure precise reinstallation of the drum and shaft assembly, pre-mark the casting and shaft as follows. First, using a razor blade or sharp knife, scribe a line on the barrel of the sound drum shaft flush with the face of the soundhead casting. Then, with a pencil, place aligning marks on the casting and the barrel so that the shaft assembly can be rotated to the identical position it maintained before removal.

(5) Refer to Figure AA. Loosen the clamp setscrew so that the retaining clamp can be lifted out. Also note that two screws are installed in the soundhead casting so that the

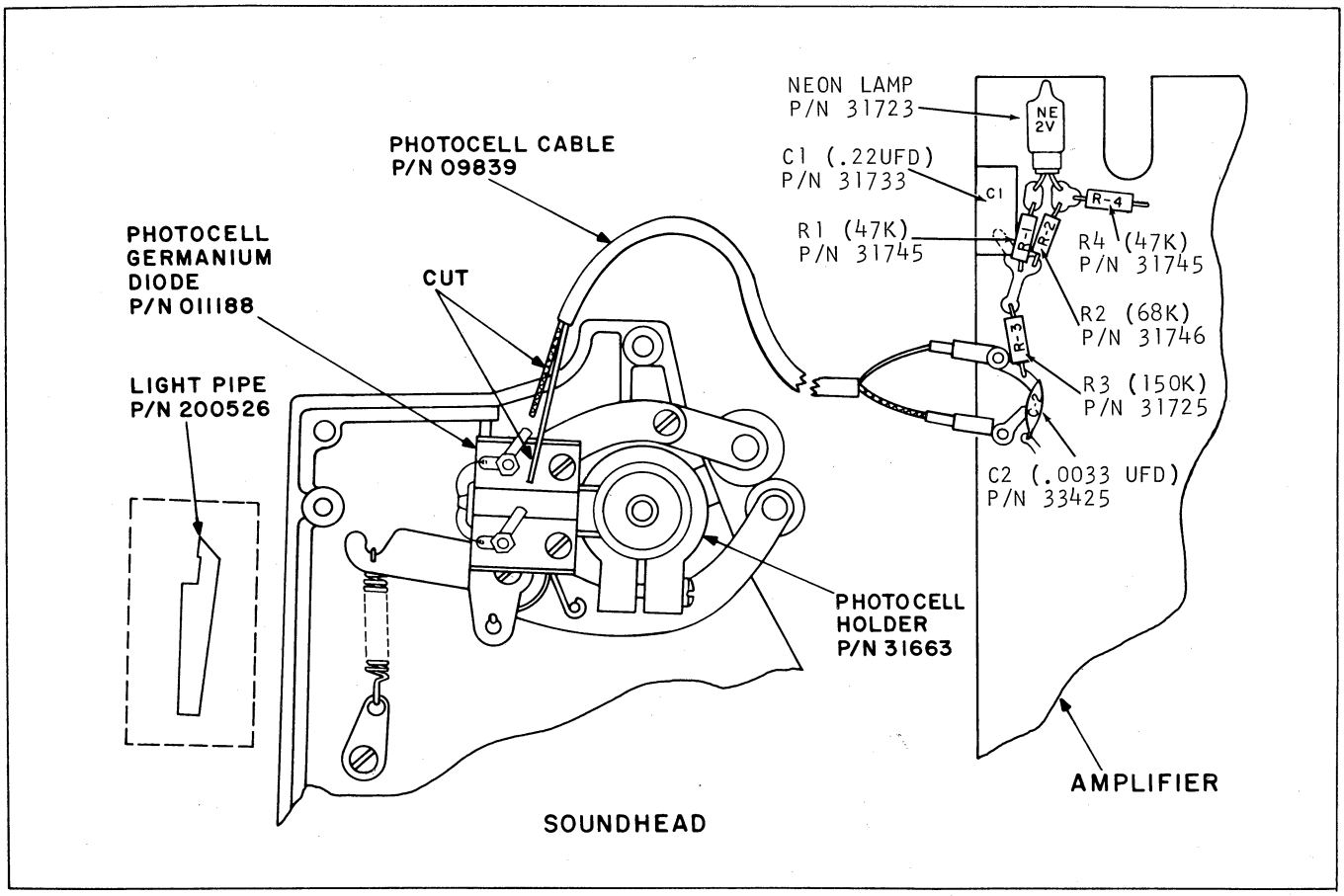


Figure Z. Amplifier and Soundhead Before Modification

ends of the screws bear against the barrel of the sound drum shaft. Loosen these two screws and withdraw the sound drum and shaft assembly from the soundhead casting.

(6) Remove the light pipe (Figure Z) from the slot in the barrel of the sound drum shaft. The light pipe is not used in this modification and can be discarded.

(7) Assemble the silicon cell (part no. 011244), into the slot from which the light pipe was removed (Figure AA). Position the silicon cell so that the extreme front end of the cell is aligned with the inner face of the sound drum. Hold these parts together and assemble them into the soundhead, threading the cell leadwires carefully through the mounting hole. Slip the retaining clamp down into place as shown in Figure AA, with the formed lips at the top and front engaging the silicon cell. Position the sound drum and shaft assembly in accordance with aligning marks placed on the shaft barrel and casting in step (4). Check once again to make certain that the front end of the silicon cell is in line with the inner face of the sound drum; then tighten the clamp setscrew (Figure AA) without disturbing any of the alignments.

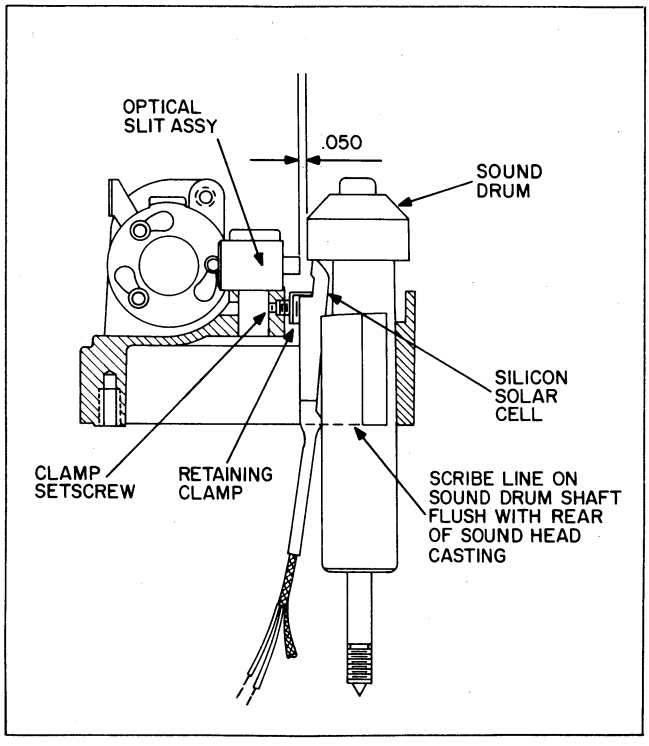


Figure AA. Aligning Silicon Cell and Sound Drum

(8) Solder the leads of the photocell cable (part no. 09839) and the silicon cell (part no. 011244) to the preamplifier (part no. 011206) as shown in Figure AB. Also, solder one end of the red leadwire (part no. 36006), supplied with the kit, to terminal 5 of the preamplifier.

(9) Install assembled soundhead to the projector main frame, using all but one of the original screws. A longer screw (part no. 31491), supplied with the kit, is used at the top of the soundhead and serves to attach the preamplifier as well as the soundhead.

(10) Disconnect all the wires and cables from the amplifier assembly and remove the amplifier from the projector. Refer to the Disassembly section for instructions on removal. Note that the switch (item 4, Figure 8) and blower assembly (item 8) must first be removed from the projector.

(11) With the amplifier components accessible, clip the leads of the neon lamp NE-2V and the 150K resistor R3 (Figure Z) and discard these items. The following amplifier components must be replaced with components from the conversion kit.

Remove (Figure Z)	Replace with (Figure AB)
Capacitor C1 (31733)	Capacitor C1 (35898)
Capacitor C2 (33425)	Capacitor C2 (36011)
Resistor R1 (31745)	Resistor R1 (31749)
Resistor R2 (31746)	Resistor R2 (31744)
Resistor R4 (31745)	Resistor R4 (31744)

(12) Solder free end of red leadwire from terminal 5 of the preamplifier to the amplifier at junction of C1 capacitor and R1 and R2 resistors (Figure AB).

(13) Solder the shield of photocell cable 09839 to terminal 2 of the amplifier and the cable lead to terminal 1 (Figure AB).

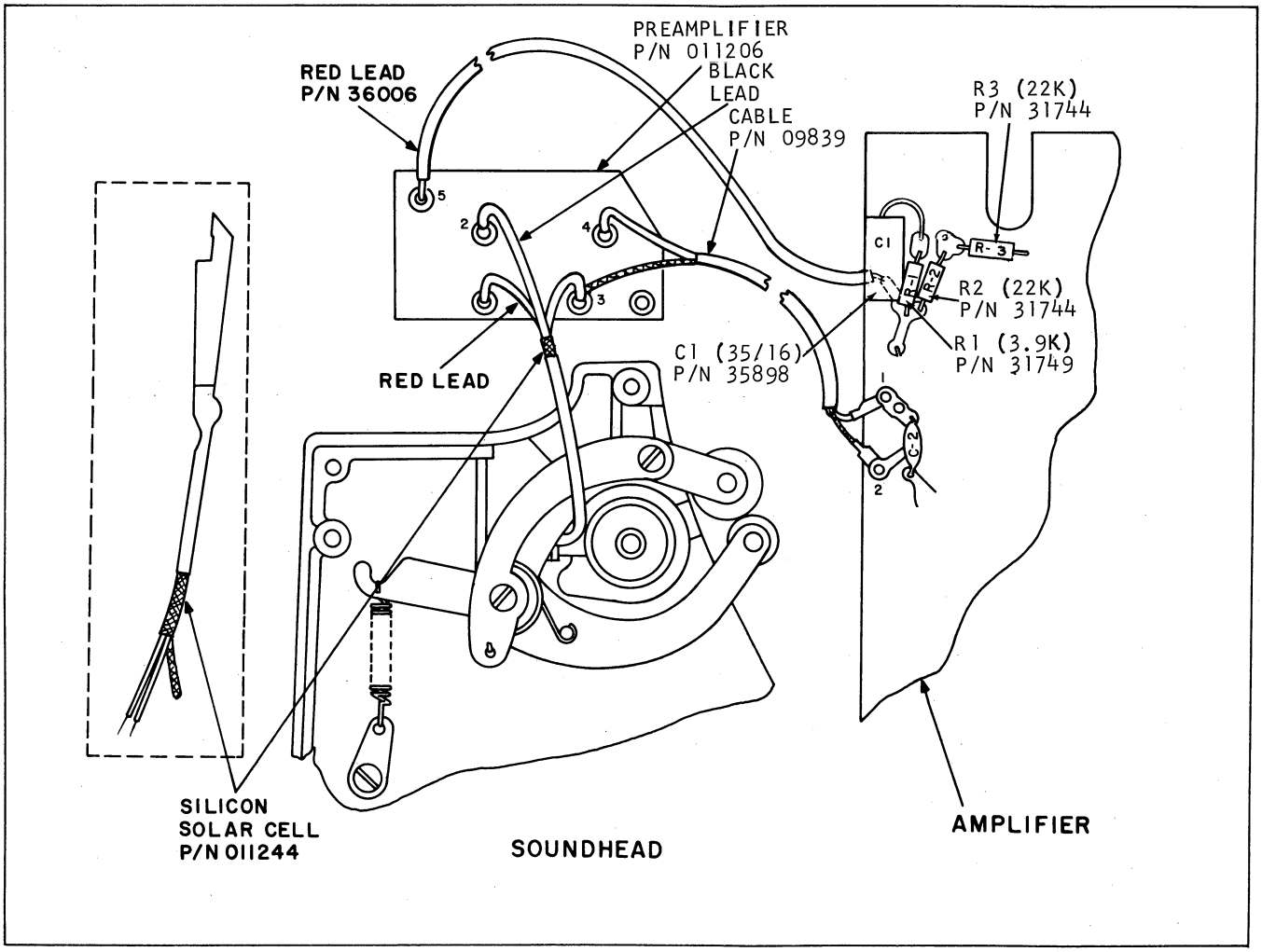


Figure AB. Amplifier and Soundhead After Modification

(14) Reconnect all cables and wires that were previously removed from the defective amplifier to the new amplifier. If necessary, refer to Figure 27 for proper wire and cable connections.

NOTE: In some earlier model projectors, the volume control switch has four terminal connections (see Figure AC). If the projector is so equipped, unsolder the white lead of the pilot lamp socket assembly from terminal 9 (B-) of the amplifier board and transfer that lead to the volume control switch terminal as shown in Figure AC.

(15) Refer to the Reassembly section and reinstall the amplifier, switch, blower assembly and flywheel to the projector. Check the soundhead per Adjustments section (paragraph 73) and check projector for proper operation before installing back cover on the projector.

87. REPLACING EARLY MODEL AMPLIFIER AND CONVERTING TO SILICON PHOTOCELL OPERATION. The amplifier (part no. 011164) used in early model Filmosound projectors has been discontinued and is no longer available for replacement. If this amplifier is defective, it and its companion germanium diode photocell must be replaced. A complete conversion kit (part no. 05940), is available for making the conversion, and consists of the following parts.

Part No.	Description	Qty
011208	Amplifier	1
011206	Preamplifier	1
011244	Silicon solar cell	1
36006	Leadwire, red	1
31491	Screw, machine	1

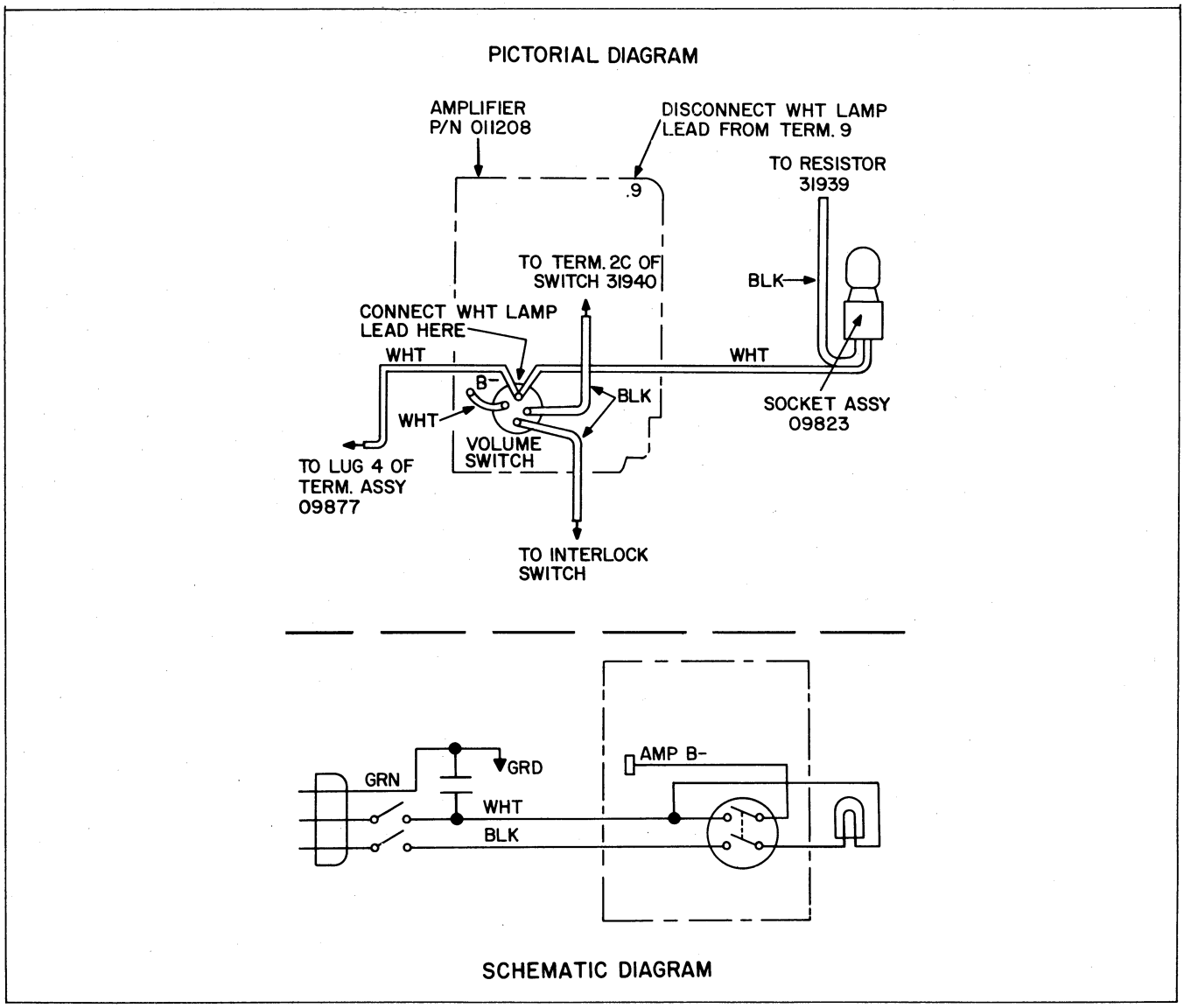


Figure AC. Pilot Lamp Re-Wiring Hook-Up

NOTE: The installation of the silicon solar cell and the preamplifier is covered in paragraph 86, steps (1) through (9). Install these items accordingly; then install the new amplifier as outlined below.

(1) Disconnect all wires and cables from the defective amplifier and remove the amplifier from the projector. Refer to the Disassembly section for instructions on removal. Note, in Figure 8, that the switch (item 4) and blower assembly (item 8) must first be removed from the projector.

(2) Disassemble the volume control switch from the defective amplifier and install it in the amplifier, (part no. 011208) furnished with the kit. All electron tubes also must be removed from the defective amplifier and installed in the kit amplifier. Make certain that all color-coded switch leads are correctly soldered in place as shown in Figure 27.

(3) Solder the free end of the red lead from terminal 5 of the preamplifier to the amplifier at the junction of the C1 capacitor and the R1 and R2 resistors (Figure AD).

(4) Solder the shield of photocell cable 09839 to terminal 2 of the amplifier and the cable lead to terminal 1 (Figure AD).

(5) Reconnect all cables and wires that were previously removed from the defective amplifier to the new amplifier. If necessary, refer to Figure 31 or 33 for proper wire and cable connections.

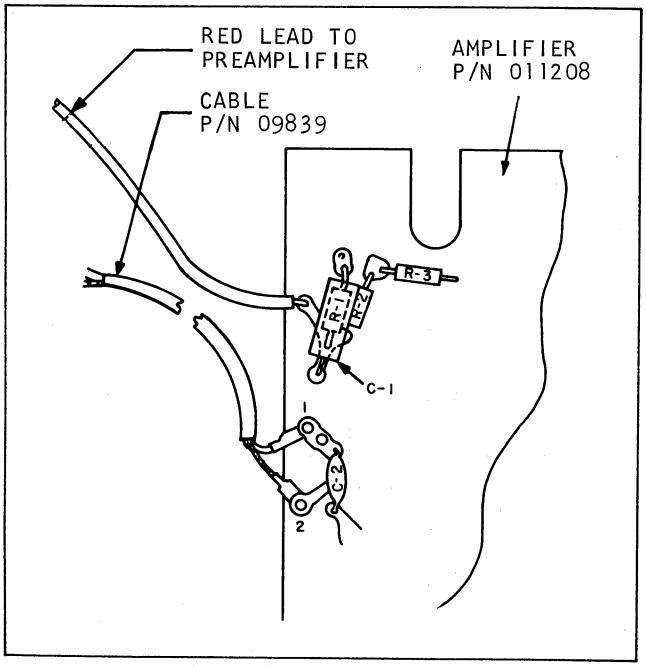


Figure AD. Wiring Connections to Amplifier (Part No. 011208)

NOTE: In some earlier model projectors, the volume control switch has four terminal connections (see Figure AC). If the projector is so equipped, unsolder the white lead of the pilot lamp socket assembly from terminal 9 (B-) of the amplifier board and transfer that lead to the volume control switch terminal as shown in Figure AC.

(6) Refer to the Reassembly section and reinstall the amplifier, switch, blower assembly and flywheel to the projector. Check the soundhead per Adjustments section (paragraph 73) and check projector for proper operation before installing the back cover on the projector.

88. MODIFYING THE FILM THREADING SYSTEM. Projectors manufactured before March 1962 can be modified to incorporate the latest threading guides for simplified film threading. Parts required to make this change are as follows.

Part No.	Description	Qty
35373	Bullet guide	1
35374	Bullet guide	1
35372	Stop bracket	1
35377	Film exit guide	1
35376	Screw	1
35393	Screw	1

(1) Refer to parts list Figure 4A and remove the screw (10), idler roller (11), roller shaft (12) and the film exit guide (15) or guides (13) and (14) with interconnecting spring (9). The screw, roller and roller shaft will be reused if in good condition; the remaining parts can be discarded.

(2) Refer to Figure 4B and assemble the new film exit guide (part no. 35377) (item 11) to the base, using the same mounting holes as were used for the obsolete guide. Roller shaft (8) is used at the lower mounting hole and screw (9) and washer (10) at the upper mounting hole. Leave the screw and shaft finger tight and adjust the exit guide vertically so that the formed upper leg just clears the roller in the closed lower sprocket guard (two thicknesses of film clearance). Make sure that the tip of the formed leg does not bind against the sprocket and that the guide does not conflict with loop restorer action. Hold the guide in adjusted position and tighten the screw (9) and shaft (8) securely.

(3) Refer to Figure 15 and remove the lower right-hand screw (1) from the lower sprocket guard (5). Hold the stop bracket (part no. 35372) (item 4) in place so that its largest hole (0.240 inch diameter) is positioned over the head of the screw that attaches the sprocket guard roller and the smallest hole (0.157 inch diameter) is aligned

with the sprocket guard mounting hole. Reinstall and tighten the sprocket guard screw (1). The two holes in the bracket should be visually vertical. Activate the lower stabilizer roller on the soundhead to make certain that there is adequate clearance between roller and stop bracket.

(4) Refer to Figure 13 and remove the two screws (26) and washers (27) that fasten the rollers (28) and (29) to the stabilizer arms. The screws (part no. 30163) can be discarded or placed in stock; the washers must be used in assembling the bullet guides. Fasten the larger diameter bullet guide (part no. 35374) to the upper stabilizer arm (item 37) with screw (part no. 35376) and one washer (item 27). Fasten the other bullet guide (part no. 35373) to the lower stabilizer arm (item 35) with screw (part no. 35393) and the remaining washer (item 27). Turn the rollers with the fingers to make certain that there is no binding.

89. CONVERTING TO NEW FILM SNUBBER ASSEMBLY. It is recommended that the early style film snubber parts shown in Figure 4A (items 1 through 7) be converted to the newer style snubber assembly shown in Figure 4B (items 1 through 4) in order to improve projector performance. The following parts are required to make this modification.

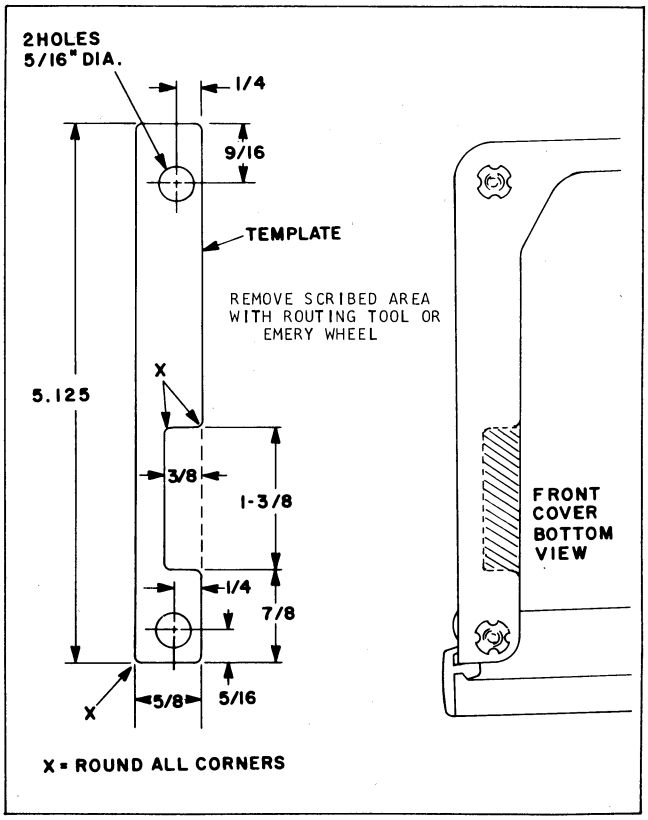


Figure AF. Template for Relieving Front Cover

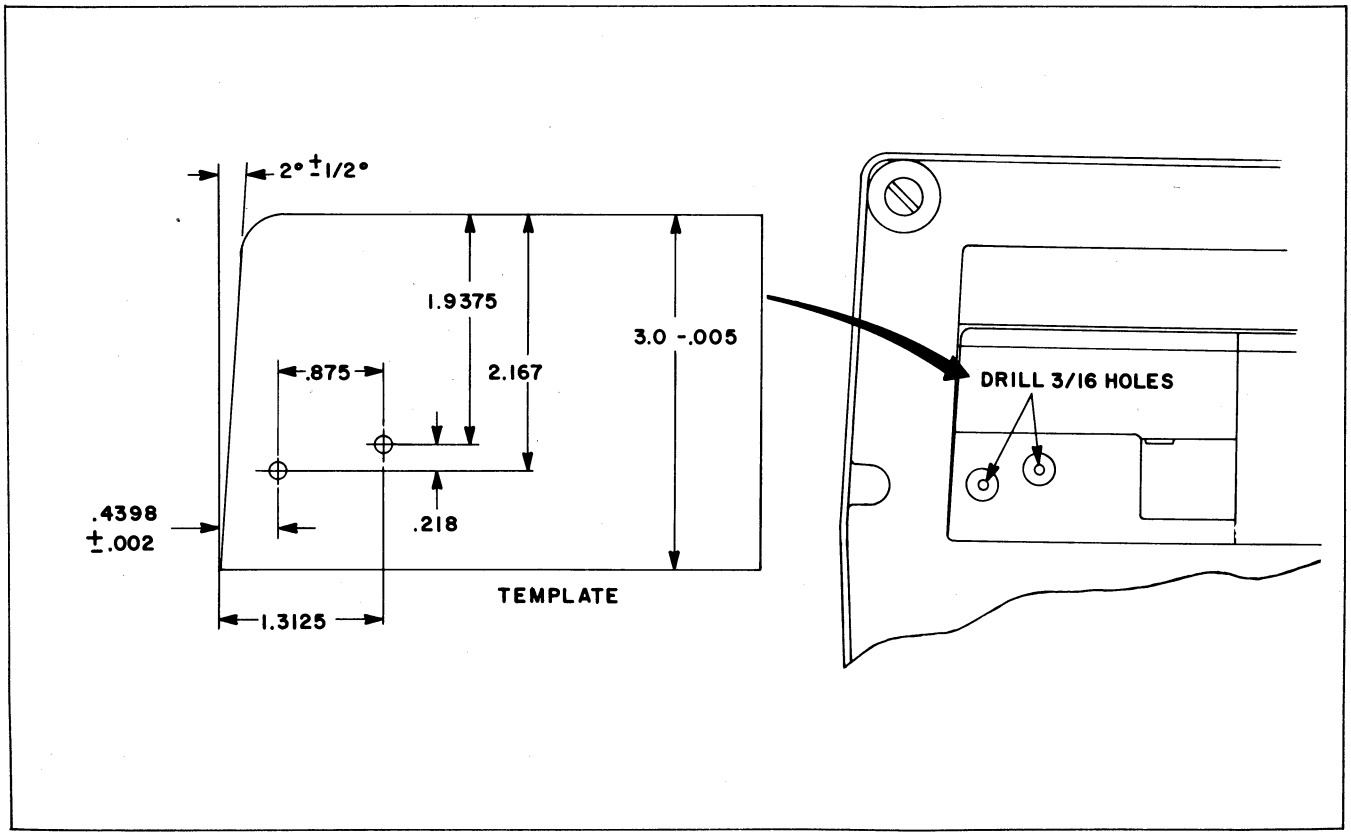


Figure AE. Template and Drilling Requirements for New Snubber Assembly

Part No.	Description	Qty
011223	Snubber assembly	1
700136	Screw	2
15563	Washer	2
19037	Hex nut	2
35886	Nameplate	1

(1) Refer to Figure 4A and remove the existing snubber assembly and related parts. These can be discarded or placed in stock for repair of other early model projectors.

(2) The mounting holes for the new snubber assembly must be drilled from the underside of the projector base. Make a drilling template to the exact dimensions shown in Figure AE. Place the projector on its back with the underside of the base facing forward. Locate the template as indicated in Figure AE and spot the two holes which must be drilled. Remove the template and drill two 3/16 inch diameter holes through the base. Touch up the drilled holes with primer (B&H Specification 988).

(3) Refer to Figure 4B and install the new snubber assembly (4) to the base with the screws (1), washers (2) and hex nuts (3).

(4) The nameplate (part no. 35886) is shown installed in Figure 4B (item 5). Clean the nameplate mounting area with carbontetrachloride. Remove the paper backing from the nameplate and activate the adhesive by brushing with acetone solution. Press the nameplate squarely and firmly in place and wipe with a clean cloth.

(5) It will be necessary to remove a small area at the mounting surface of the front cover to compensate for the new snubber assembly. The area to be removed is shown in Figure AF, together with the template to be made. Place the template over the feet of the cover as indicated and mark the area to be removed with a pencil or scribing tool. Remove the template and cut out the marked area with a routing tool on a drill press or an emery wheel on a tool grinder.

PARTS CATALOG

FILMOSOUND PROJECTOR

(MANUAL THREADING)

MODELS

535 540 541 542
535T 540T 541T 542EX

PHOTO PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 70341-1 PRINTED IN U.S.A. OCTOBER 1969

Replacement Parts

The following pages illustrate and list, by part number and description, all replacement parts for the Bell & Howell Design 500 Manual Threading Filmosound Projectors. Because of the number of models covered by this Parts Catalog, the application of parts to specific models is indicated by a coding system. Where the Usable on Code column is blank, the listed part is applicable to all projector models. Code letters used, and the specific model to which each applies, are listed in the Code Reference Table.

The basic projectors (code letters A through E) are equipped with the conventional amplifier/preamplifier circuitry (see Figures 25 through 34). All "T" series models (code letters F through H) are designated as "integrated circuit amplifier" models. Mechanically, all projector models are similar in design, and the basic service instructions contained in Service Manual 70341 will apply to all models. When servicing the electronics portion of "T" series models, refer to figures 35 through 38 for parts identification and electrical circuitry data.

NOTE: In all current projectors, most of the screw holes in the castings have been drilled but not tapped, and "swage type" self threading screws are used to attach parts at the non-tapped locations. When earlier (drilled and tapped) castings are replaced, be sure to check the related parts list and order the necessary swage screws for attaching those parts which are to be mounted to the casting. Figures A and B, following, will serve to locate all untapped holes in the main plate and projector base castings. Refer to the corresponding key for part numbers and descriptions of swage type screws required.

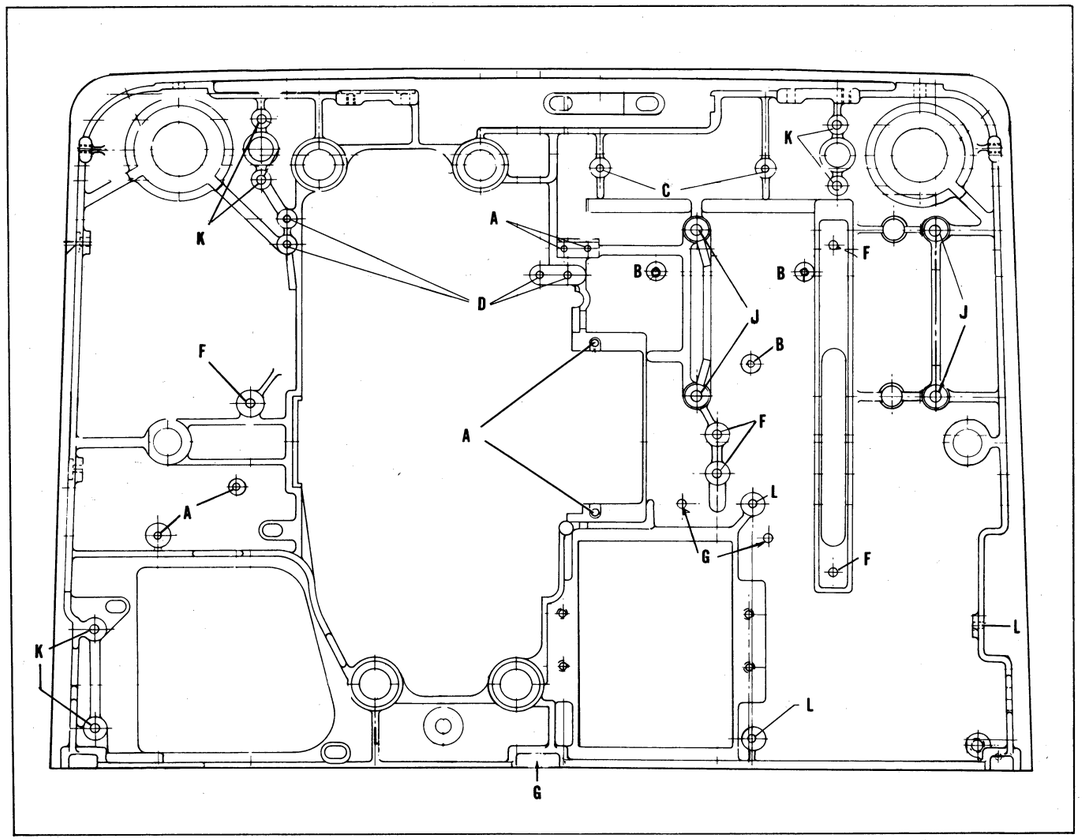
CODE REFERENCE TABLE

CODE A	DESIGN 535
CODE B	DESIGN 540
CODE C	DESIGN 542
CODE D	DESIGN 542EX
CODE E	DESIGN 541
CODE F	DESIGN 535T
CODE G	DESIGN 540T
CODE H	DESIGN 541T

SWAGE SCREW LISTING

REF.	PART NO.	DESCRIPTION	QTY USED	
			BASE	MECH. PLATE
A	30804	Hex washer head, 4-40 by 1/4 inch	2	6
B	30807	Hex washer head, 6-32 by 1/4 inch	-	2
C	30808	Hex washer head, 6-32 by 5/16 inch	2	2
D	30809	Hex washer head, 6-32 by 3/8 inch	-	4
E	30810	Hex washer head, 6-32 by 1/2 inch	2	-
F	30815	Hex washer head, 8-32 by 3/8 inch	1	5
G	30816	Hex washer head, 8-32 by 5/8 inch	1	5
H	30820	Hex head, 8-32 by 1-3/8 inch	-	2
J	30822	Flat head, 10-32 by 7/16 inch	-	4
K	30857	Flat head, 8-32 by 7/16 inch	-	6
L	30881	Phillips pan head, 6-32 by 9/16 inch	-	3

Figure A. Swage Screws Required for New Main Plate Castings



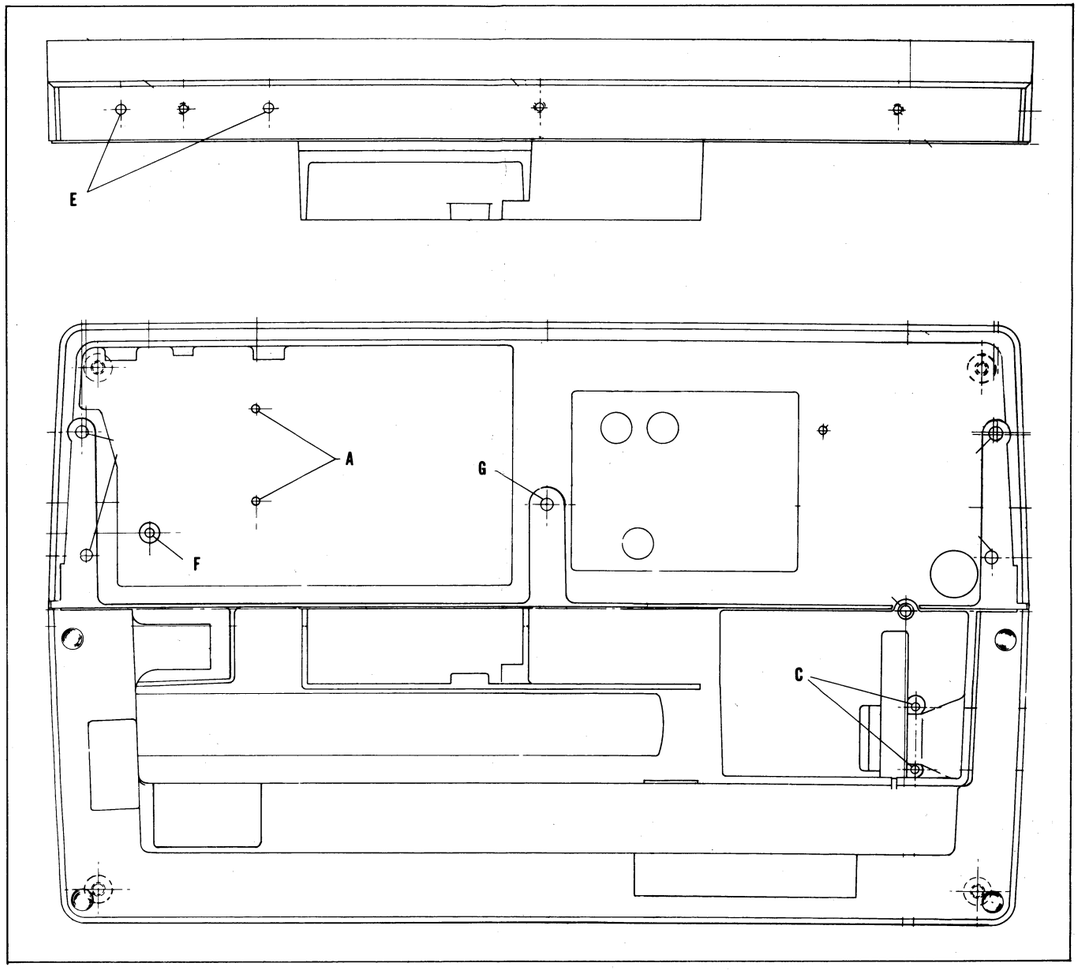


Figure B. Swage Screws Required for New Base Castings

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		COVERS, HANDLE AND RELEASE LEVER		
1-1	011184	COVER ASSEMBLY, Front	1	A
-1	011230	COVER ASSEMBLY, Front	1	BEG
-1	012893	COVER ASSEMBLY, Front	1	CD
-1	011898	COVER ASSEMBLY, Front	1	H
-1A	33388	. SCREW, Button head	2	A
-1A	36051	. SCREW, Truss head, recessed, 6-32 by 3/8 inch	2	BCDEG
-1B	33390	. SPEED NUT, Cover latch plate	2	
-1C	33383	. PLATE, Latch	1	
-1D	33373	. SCREW, Truss head tapping, recessed, 6-20 by 5/16 inch	4	
-1E	33372	. FOOT, Cover	4	
-1F	34865	. PLATE, Operating instructions	4	A
-1F	36992	. PLATE, Operating instructions	1	BCDE
-1F	36067	. PLATE, Operating instructions	1	GH
-1G	09909	. PANEL, Front cover (early models)	1	CD
-1G	41345	. PANEL, Front cover (current models)	1	CD
-1H	400422	. NAMEPLATE, Bell & Howell (early models)	1	B
-1H	43361	. NAMEPLATE, Bell & Howell (current models)	1	GH
-1J	400479	. NAMEPLATE, Specialist (early models)	1	CD
-1J	41344	. NAMEPLATE, Specialist (current models)	1	CD
-2	33388	SCREW, Button head (NOTE A)	7	
-2	36051	SCREW, Truss head, recessed, 6-32 by 3/8 inch (NOTE A)	6	
-3	09912	COVER ASSEMBLY, Rear (NOTE A)	1	A
-3	09914	COVER ASSEMBLY, Rear (NOTE A)	1	BCDE
-3	013381	COVER ASSEMBLY, Rear	1	F
-3	013372	COVER ASSEMBLY, Rear	1	GH
-3A	33494	. GUARD, Rubber (ventilation grille)	2	
-3B	011175	. GRILLE, Ventilation (front)	1	
-3C	09946	. GRILLE, Ventilation (rear)	1	
-4	33438	ADAPTER, Grounding, 3-wire	1	
-5	31576	CABLE ASSEMBLY, Power (NOTE C)	1	ABCD
-5	012536	CABLE ASSEMBLY, Power	1	E
-5	013937	CABLE ASSEMBLY, Power	1	FGH
-6	400476	MOLDING, Main plate	1	
-7	33391	SCREW, Oval head, recessed, 6-32 by 1/2 inch	2	
-8	33371	CAP, Carrying handle	1	ABCDE
-8	43360	CAP, Carrying handle	1	FGH
-9	33368	BODY, Carrying handle	1	
-10	33370	GRIP, Rubber	1	
-11	33392	SCREW, Flat head, 8-32 by 7/16 inch (early models)	4	
-11	36052	SCREW, Truss head, 6-32 by 5/8 inch (NOTE B)	2	
-11A	30859	SCREW, Swage type, 8-32 by 7/16 inch flat head	2	
-12	33369	STRAP, Carrying handle	1	
-12	36060	STRAP, Carrying handle (NOTE B)	1	
-12A	34845	PAD, Felt (early models) (NOTE B)	4	
-13	33300	SPACER, Handle strap (front end only)	2	
-14	33299	RING, Retaining, external, 0.156 inch ID (E)	2	
-15	33301	STUD, Cover latch	2	
-16	09910	LEVER ASSEMBLY, Cover release	1	
-17	33302	SPRING, Release lever	1	
-18	31342	BELT, Take-up timing	1	
-19	35865	NAMEPLATE, Model	1	ABCDE
-19	41167	NAMEPLATE, Model	1	FGH

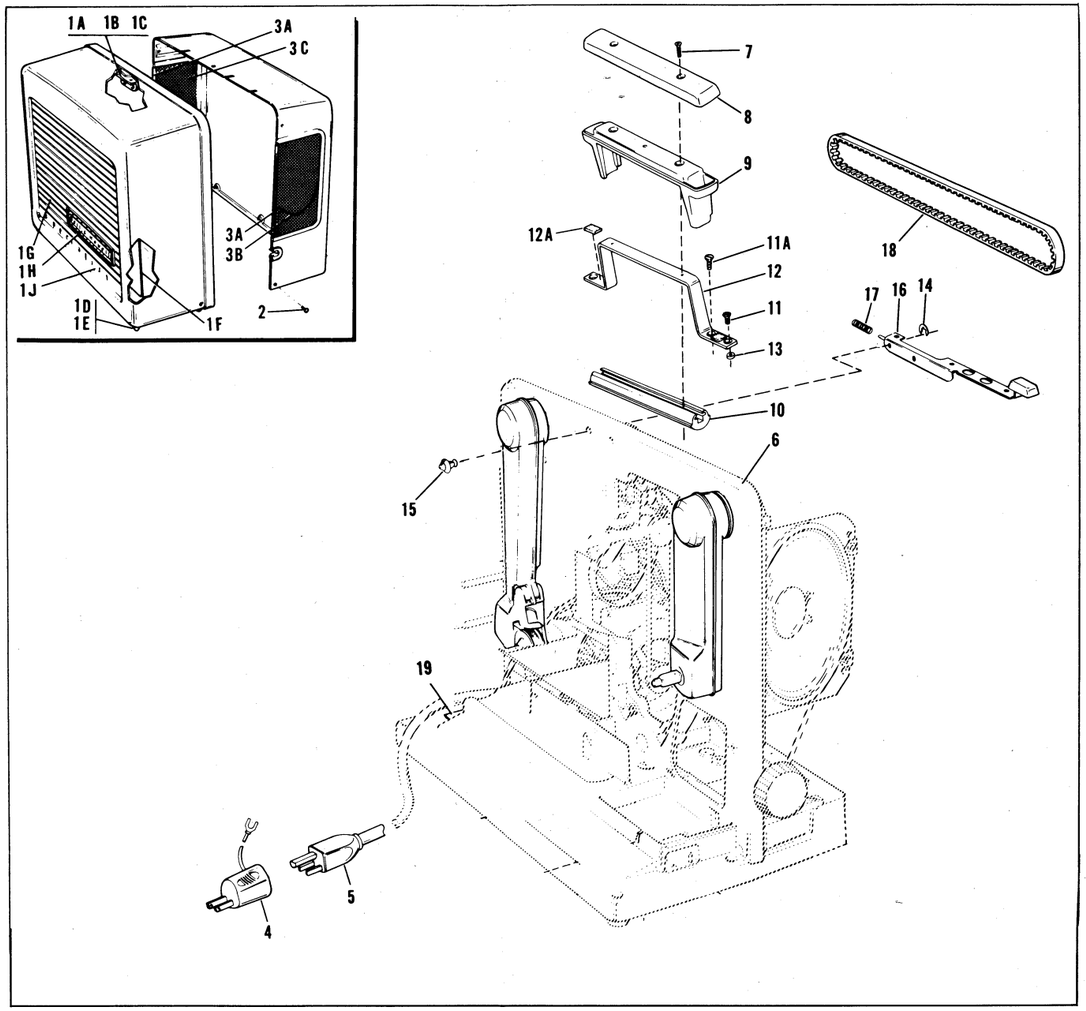


Figure 1. Projector Covers, Handle and Release Lever

NOTE A: Current rear covers have relocated top mounting holes eliminating the fastening screw under the handle. To mount these newer covers on earlier projectors it will be necessary to remove the two outside flat head screws (11) in the handle bracket (12) and the felt pads (12A). Slip the new cover on the projector and fasten with two truss head screws, 8-32 by 0.500 inch (P/N 304981). All other mounting screws remain the same.

NOTE B: Handle strap P/N 33369 is no longer available. Current strap P/N 36060 can be adapted by enlarging the outside handle strap holes to 0.1895 inch diameter and countersinking with an 82 degree countersink.

NOTE C: Power cables which connect to interlock switch P/N 31684 require two terminals #28820 and one terminal #34841; power cables which connect to interlock switch P/N 39504 require two terminals #31738 and one terminal #34841. (See Figure 8 for description of switches.)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		REAR REEL ARM AND CLUTCH PARTS		
2A-	No Number	REAR REEL ARM AND CLUTCH, Original (wobble plate) design	NP	
-1	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-2	*011945	. BEARING ASSEMBLY (See NOTE A following Figure 2B list)	1	
-3	10750	. SPRING, Clutch arm	1	
-4	5238	. BALL, Steel	3	
-5	*35876	. CAM, Clutch (see NOTE A following Figure 2B list)	1	
-6	31237	. WASHER, Nylon	1	
-7	*31351	. RETAINER, Clutch ball (see NOTE A following Figure 2B list)	1	
-8	*09771	. SPROCKET ASSEMBLY (See NOTE A following Figure 2B list)	1	
-9	31237	. WASHER, Nylon	1	
-10	31372	. WASHER, Brass	2	
-11	700420	. SETSCREW	2	
-12	35811	. COLLAR, Retaining	1	
-13	34765	. DISC, Locking, rear arm	1	
-14	09850	. ARM ASSEMBLY, Rear (see Figure 10 for breakdown)	1	
-15	31370	. WASHER, Bronze	1	
	34760	. DECAL, Take-up rewind	1	

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		REAR REEL ARM AND CLUTCH PARTS (CONT)		
2B-	No Number	REAR REEL ARM AND CLUTCH, Intermediate (ratchet) design	NP	
-1	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-2	*38434	. COLLAR, Locking (NOTE A)	1	
-3	*33698	. CUSHION, Ratchet (NOTE A)	1	
-4	*33699	. RATCHET (NOTE A)	1	
-5	*33955	. WASHER, Felt (NOTE A)	1	
-6	*012564	. SPROCKET ASSEMBLY, Original design (NOTE A)	1	
-7	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-8	35811	. COLLAR, Retaining	1	
-9	34765	. DISC, Locking, rear arm	1	
-10	09850	. ARM ASSEMBLY, Rear (see Figure 10 for breakdown)	1	
-11	31370	. WASHER, Bronze	1	
	34760	. DECAL, Take-up rewind	1	

NOTE A: The asterisked items in Figures 2A and 2B will be furnished until stock is depleted. Thereafter, if any of these items needs replacement, all asterisked items must be removed and discarded and must be replaced with the following set of parts: Sprocket assembly #012654 (item 4, Figure 2C), retaining ring #21736 (item 1, Figure 2C) and rear reel arm shaft #40295 (item 27, Figure 10).

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		REAR REEL ARM AND CLUTCH PARTS (CONT)		
2C	No Number	REAR REEL ARM AND CLUTCH, Current (Torrington) design	NP	
-1	21736	. RING, Retaining, 0.207 inch ID (IRRC 1000-25)	1	
-2	31372	. WASHER, Brass	1	
-3	31237	. WASHER, Nylon	1	
-4	012654	. SPROCKET ASSEMBLY, Current design	1	
-5	31237	. WASHER, Nylon	1	
-6	31372	. WASHER, Brass	2	
-7	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-8	35811	. COLLAR, Retaining	1	
-9	34765	. DISC, Locking, rear arm	1	
-10	03980	. ARM ASSEMBLY, Rear (see Figure 10 for breakdown)	1	
-11	31370	. WASHER, Bronze	1	
	34760	. DECAL, Take-up rewind	1	

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		FRONT REEL ARM AND CLUTCH PARTS		
2D-	No Number	FRONT REEL ARM AND CLUTCH, Original (wobble plate) design	NP	
-1	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-2	36532	. COLLAR, Locking	1	
-3	*09770	. SPROCKET ASSEMBLY, Rewind (see NOTE A following Figure 2E list)	1	
-4	*10750	. SPRING, Clutch cam (see NOTE A following Figure 2E list)	1	
-5	31237	. WASHER, Nylon	1	
-6	*5238	. BALL, Steel (see NOTE A following Figure 2E list)	3	
-7	*35876	. CAM, Clutch (see NOTE A following Figure 2E list)	1	
-8	*31346	. RETAINER, BALL (See NOTE A following Figure 2E list)	1	
-9	*012650	. SPROCKET ASSEMBLY, Take-up (see NOTE A following Figure 2E list)	1	
-10	31237	. WASHER, Nylon	1	
-11	31372	. WASHER, Brass	2	
-12	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-13	35811	. COLLAR, Retaining	1	
-14	31358	. DISC, Locking, front arm	1	
-15	09849	. ARM ASSEMBLY, Front (see Figure 9 for breakdown)	1	
-16	31370	. WASHER, Bronze	1	
2E-	No Number	FRONT REEL ARM AND CLUTCH, Interim (Torrington) design	NP	
-1	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-2	36532	. COLLAR, Locking	1	
-3	*012658	. SPROCKET ASSEMBLY, Rewind (NOTE A)	1	
-4	31237	. WASHER, Nylon	1	
-5	*012656	. SPROCKET ASSEMBLY, Take-up (NOTE A)	1	
-6	31237	. WASHER, Nylon	1	
-7	31372	. WASHER, Brass	2	
-8	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-9	35811	. COLLAR, Retaining	1	
-10	31358	. DISC, Locking, front arm	1	
-11	09849	. ARM ASSEMBLY, Front (see Figure 9 for breakdown)	1	
-12	31370	. WASHER, Bronze	1	

NOTE A: The asterisked items in Figures 2D and 2E will be furnished until stock is depleted. Thereafter, if any of these items need replacement, all asterisked items must be removed and discarded and must be replaced with the following set of parts: Rewind sprocket assembly (item 3, Figure 2F) and take-up sprocket assembly (item 5, Figure 2F).

2F-	No Number	FRONT REEL ARM AND CLUTCH, Current (Torrington) design	NP	
-1	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-2	36532	. COLLAR, Locking	1	
-3	012661	. SPROCKET ASSEMBLY, Rewind	1	
-4	31237	. WASHER, Nylon	1	
-5	012662	. SPROCKET ASSEMBLY, Take-up	1	
-6	31237	. WASHER, Nylon	1	
-7	31372	. WASHER, Brass	2	
-8	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-9	35811	. COLLAR, Retaining	1	
-10	31358	. DISC, Locking, front arm	1	
-11	09849	. ARM ASSEMBLY, Front (see Figure 9 for breakdown)	1	
-12	31370	. WASHER, Bronze	1	

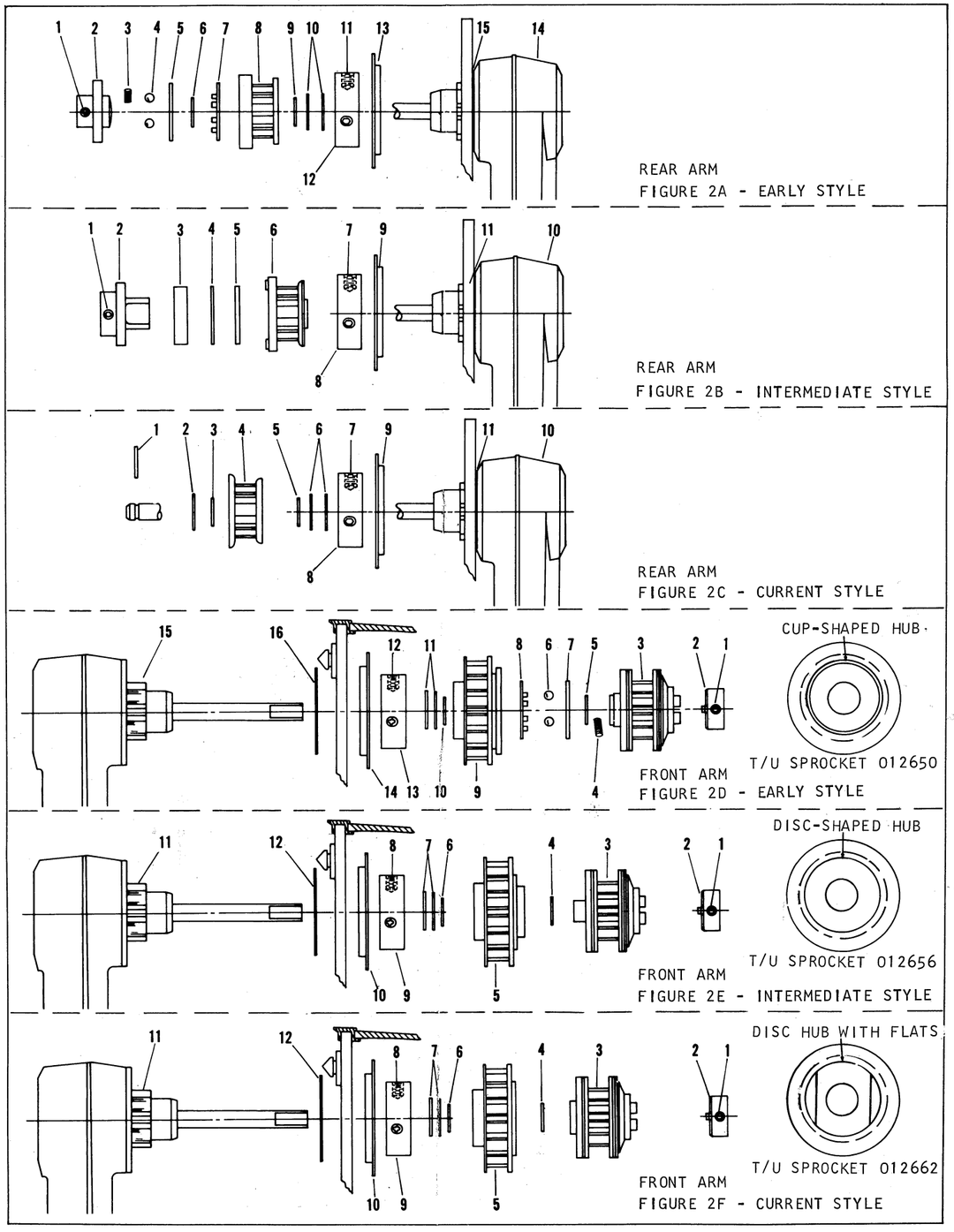


Figure 2. Reel Arms and Clutch Systems

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR MAIN PLATE COMPONENTS		
3-1	35909	NAMEPLATE, Threading guide	1	
-2	33459	LAMP, Projection, 1000 watt	1	ACDF
-2	33460	LAMP, Projection, 750 watt	1	BEGH
-3	09811	CONDENSER LENS ASSEMBLY	1	
-3A	31583	. SPRING, Condenser retaining	1	
-3B	200454	. LENS, 2nd condenser (early models) (NOTE A)	1	
-3B	201611	. LENS, 2nd condenser, blue-green (current models) (NOTE A)	1	
-3C	31584	. SPRING, Condenser (early models)	1	
-3C	37312	. SPRING, Retaining (current models) (NOTE A)	1	
-3C	37311	. SPRING, Retaining (current models) (NOTE A)	1	
-3D	200453	. LENS, 1st condenser	1	
-3E	37310	. HOUSING, Condenser lens	1	
-4	30815	SCREW, Swage type, 8-32 by 3/8 inch hex head	2	
-5	09759	LAMPHOLDER ASSEMBLY (See Figure 11 for breakdown)	1	
-6	30804	SCREW, Swage type, 4-40 by 1/4 inch hex head	2	
-7	31340	SHIELD, Pulley	1	
-8	09896	KNOB, Volume control	1	
-9	09887	KNOB, Tone control	1	
-10	36763	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch (one required for 535 and 540; two required for 542 and 542EX)	2	
-11	011946	KNOB, Projector control (one required for 535 and 540; two required for 542 and 542EX)	2	
-12	30807	SCREW, Swage type, 6-32 by 1/4 inch hex head	3	
-13	09821	NAMEPLATE, Switch	1	AB
-13	011179	NAMEPLATE, Switch	1	CD
-13	012534	NAMEPLATE, Switch	1	E
-13	013377	NAMEPLATE, Switch	1	FG
-13	013383	NAMEPLATE, Switch	1	H
-15	36095	NAMEPLATE, Lamp designation (part of item 3-20)	1	CD
-16	011180	SWITCH ASSEMBLY, Selector (includes the following three items)	1	CD
	34829	. SWITCH, Selector	1	CD
	33279	. GUARD, Switch	1	CD
	33280	. BRACKET, Switch mounting	1	CD
-17	430076	LAMP, Pilot	1	BCDE
-17	41142	LAMP, Pilot	1	FGH
-18	30804	SCREW, Swage type, 4-40 by 1/4 inch hex head	3	
-20	No Number	LAMPHOUSE ASSEMBLY (See Figure 12 for breakdown)	1	
-21	30816	SCREW, Swage type, 8-32 by 5/8 inch hex head	2	
-22	09822	BRACKET ASSEMBLY, Pilot lamp	1	ABCDE
-22A	19025	. RIVET, Pilot lamp socket	1	
-22B	012549	. SOCKET ASSEMBLY, Pilot lamp	1	ABCDE
-22B	41140	. SOCKET, Pilot lamp	1	

NOTE A: Condenser lens #200454 (item 3-3B) can be used in either the early model or the current condenser assembly; however, condenser lens #201611 can be used only in current model assemblies with current retaining springs (item 3-3C) P/N 37311 and 37312.

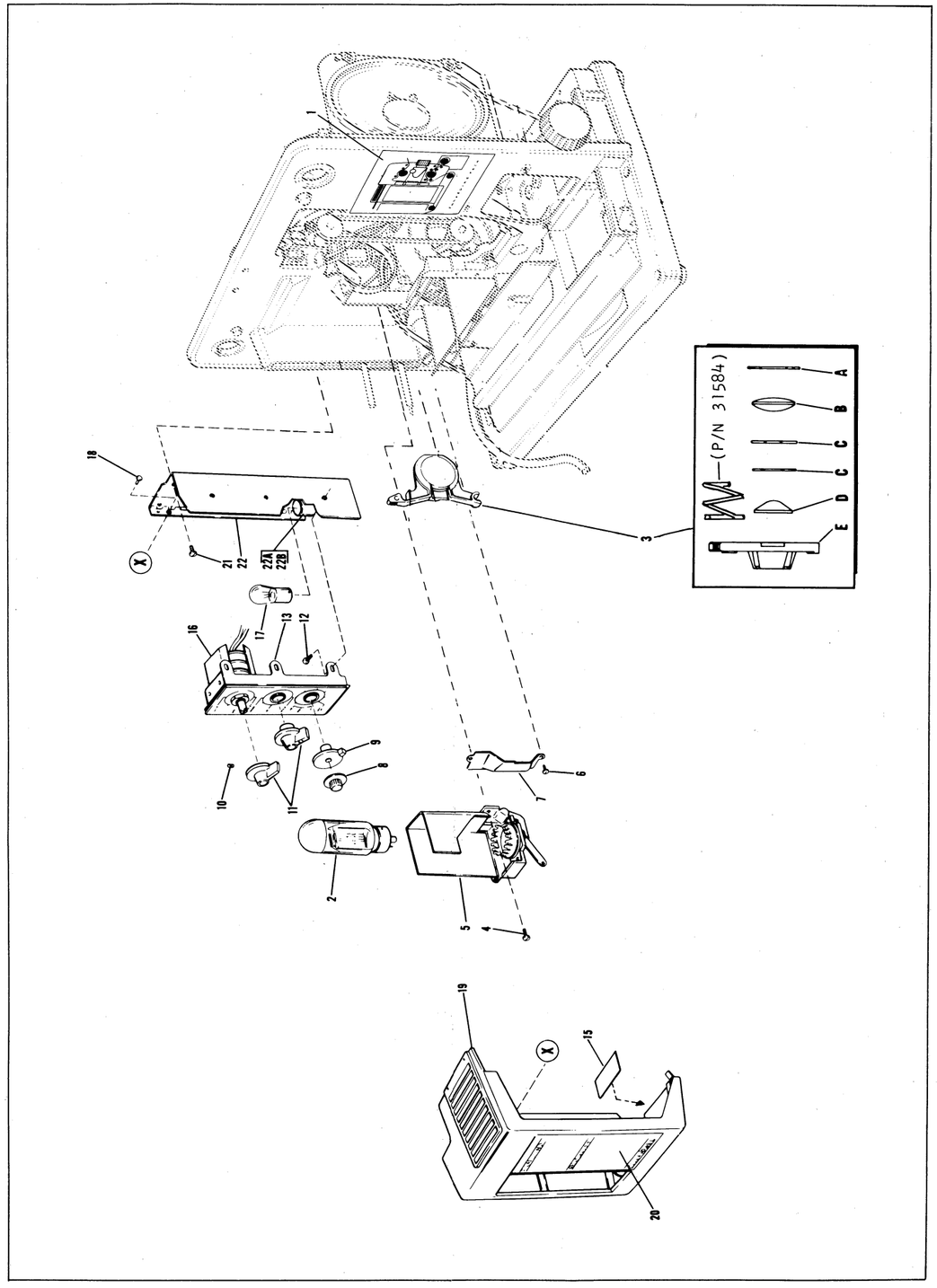


Figure 3. Projector Main Plate Components

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR MAIN PLATE COMPONENTS		
4-1	30164	SCREW, Binding head, 4-40 by 3/16 inch	1	
-2	34784	WASHER	1	
-3	36035	HANDLE, Snubber	1	
-4	39523	ROLLER, Idler (early models) (NOTE A)	2	
-4	41330	ROLLER, Idler (current models) (NOTE A)	2	
-5	31237	WASHER	1	
-6	97509	RING, Retaining, external, 0.250 inch ID (E)	1	
-7	011939	SHAFT ASSEMBLY, Roller (early models) (NOTE A)	1	ABCD
-7	012330	SHAFT ASSEMBLY, Roller (current models) (NOTE A)	1	
-8	35859	SPRING, Snubber	1	
-9	35858	RETAINER, Snubber spring	1	
-10	35856	COVER, Snubber spring	1	
-11	35860	POST, Snubber mounting	1	
-12	35886	NAMEPLATE, Snubber threading	1	
-13	30809	SCREW, Swage type, 6-32 by 3/8 inch hex head	1	
-14	31585	CLAMP, Cable	1	
-15	33418	SPRING, Grounding	1	
-16	31476	NUT, Flywheel	1	
-17	31592	FLYWHEEL	1	ABCDE
-17	40883	FLYWHEEL	1	FGH
-18	31017	WASHER, Flat	1	
-19	31491	SCREW, Binding head, soundhead attaching	3	
-20	31243	WASHER, Flat	3	
-21	011172	SOUNDHEAD ASSEMBLY (Photodiode) (See Figure 13 for breakdown)	1	ABCD
-21	013327	SOUNDHEAD ASSEMBLY (Silicon Cell) (See Figure 13 for breakdown)	1	ABCDE
-21	013483	SOUNDHEAD ASSEMBLY, Complete	1	FGH
-22	30824	SCREW, Swage type, 10-32 by 1 inch hex head	4	
-23	No Number	MECHANISM ASSEMBLY (See Figures 14 through 18 for breakdown)	1	

NOTE A: Idler rollers #39523 and #41330 (item 4) are not interchangeable. Note in the Figure 4 inset that the current roller (#41330) has a center seam while the early style (#39523) is seamless. Early style rollers are available for replacement on early model projectors. However, when the stock of roller shaft assembly (#011939) (item 7) is depleted, the current shaft assembly (#012330) will be furnished, together with two of the new style rollers (#41330).

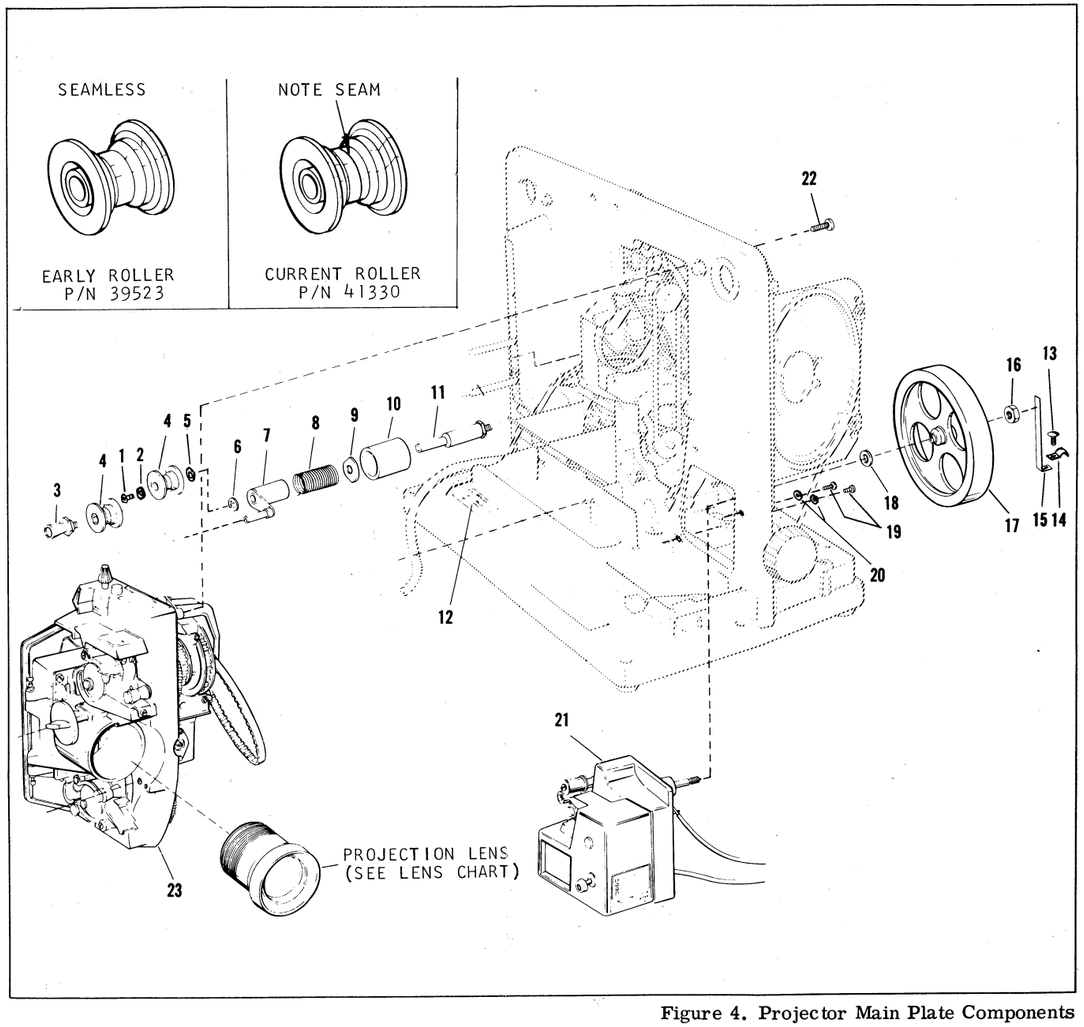


Figure 4. Projector Main Plate Components

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR MAIN PLATE (WITH FRAME MOUNTED SNUBBER)		
4A-1	31632	STUD, Snubber roller	1	
-2	34809	SCREW, Film guide	1	
-3	2843	NUT, Hex	1	
-4	09805	SNUBBER AND ROLLER ASSEMBLY.	1	
-5	31644	SPRING, Snubber roller.	1	
-6	31634	WASHER, Plain	1	
-7	31633	DETENT, Snubber, roller	1	
-8	33487	TUBING, Extruded	1	
-9	31918	SPRING, Film exit guide (early models)	1	
-10	36061	SCREW, Idler roller	1	
-11	09747	ROLLER, Idler	1	
-12	31915	SHAFT, Idler roller	1	
-13	31917	GUIDE, Film exit outer (early models)	1	
-14	31916	GUIDE, Film exit inner (early models)	1	
-15	34842	GUIDE, Film exit (intermediate models)	1	
-16	34853	NAMEPLATE, Threading guide	1	A
-16	34780	NAMEPLATE, Threading guide	1	BCD
		PROJECTOR MAIN PLATE (WITH BASE MOUNTED SNUBBER ASSY)		
4B-1	700136	SCREW	2	
-2	15563	WASHER	2	
-3	*19037	NUT (NOTE A)	2	
-4	011223	SNUBBER ASSY (Base Mounted)	1	
-5	35886	NAMEPLATE	1	
-6	36061	SCREW, Idler shaft	1	
-7	09747	ROLLER, Idler	1	
-8	31915	SHAFT, Idler roller	1	
-9	30029	SCREW	1	
-10	14175	WASHER	1	
-11	35377	GUIDE, Film exit	1	
-12	35909	NAMEPLATE, Threading guide	1	

NOTE A: With non-ribbed bases P/N 35893 and P/N 35896 two nuts are used. With ribbed bases P/N 35894 and P/N 35895 one nut is used, one of the snubber mounting holes in the base is threaded.

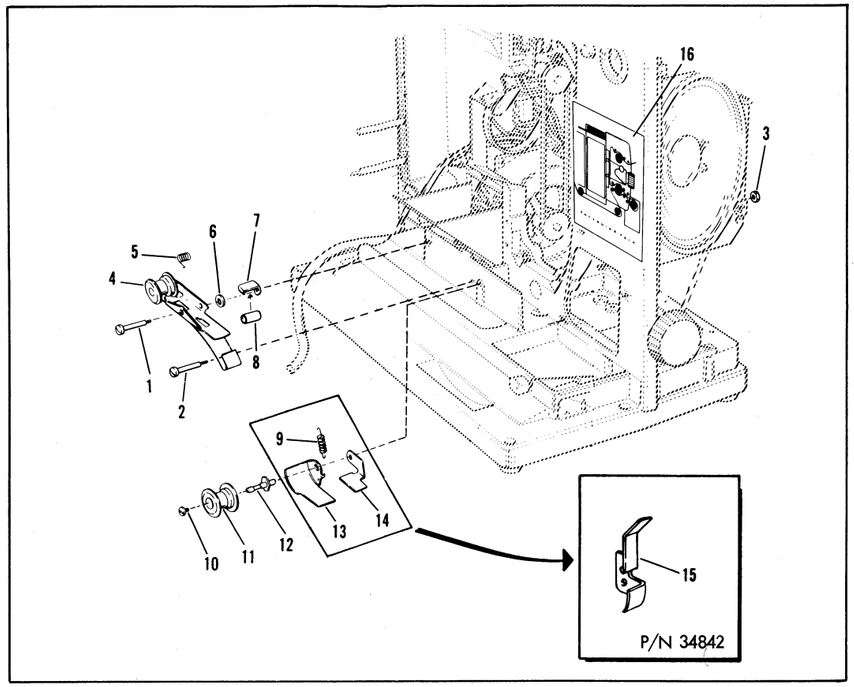


Figure 4A. Projector Snubber Parts (Early Models)

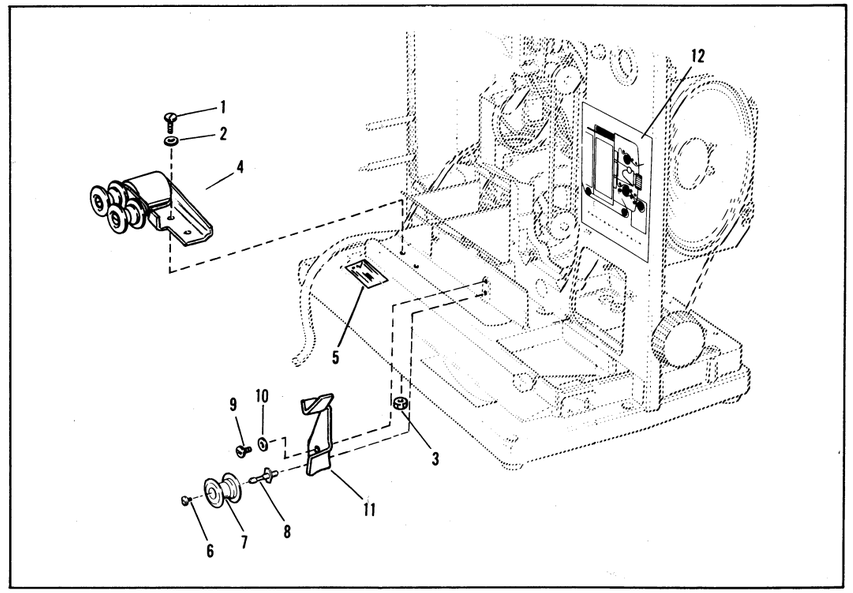


Figure 4B. Projector Snubber Parts (Interim Models)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		SOLENOID-OPERATED CLUTCH AND FIRE SHUTTER (MODELS 542 AND 542EX ONLY)		
5-1	36763	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	2	CD
-2	36533	COLLAR, Clutch rod	2	CD
-3	31482	SPRING, Clutch rod	1	CD
-4	399019	SCREW, Clutch solenoid	2	CD
-5	99301	WASHER, Flat	2	CD
-6	011162	SOLENOID AND ROD ASSEMBLY, Clutch	1	CD
-7	301366	SCREW, Solenoid bracket	3	CD
-8	33285	BUSHING, Shoulder	3	CD
-9	31489	GROMMET, Rubber	3	CD
-10	33281	BRACKET, Solenoid mounting	1	CD
-11	36526	ROD, Fire shutter solenoid	1	CD
-12	34843	SPRING, Fire shutter solenoid	1	CD
-13	34896	SCREW, Fire shutter solenoid	2	CD
-14	14175	WASHER, Flat	2	CD
-15	011163	SOLENOID ASSEMBLY, Fire shutter	1	CD
-16	31943	SCREW, Binding head, 6-32 by 0.187 inch	2	CD
-17	09879	BRACKET ASSEMBLY, Solenoid	1	CD

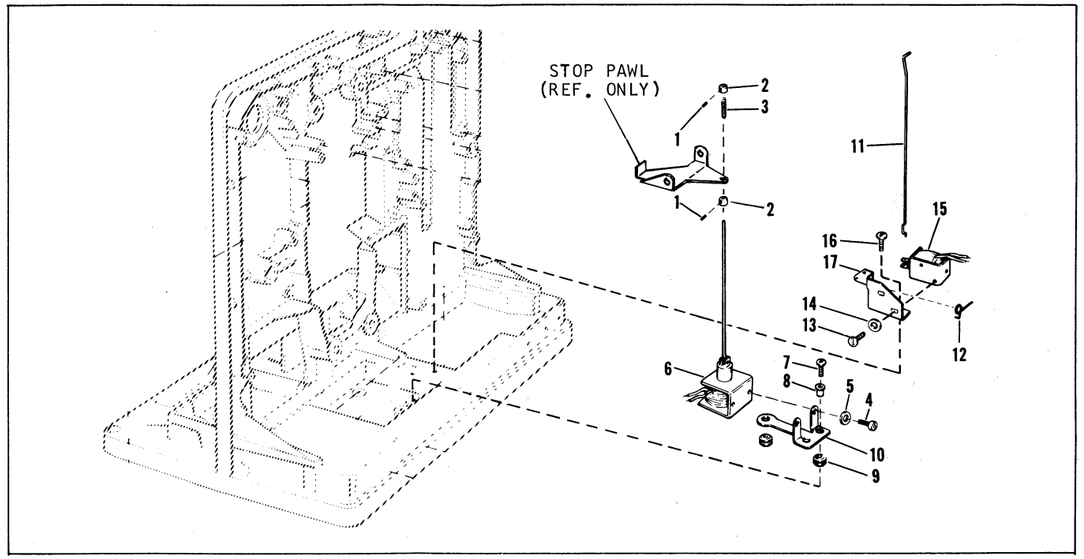


Figure 5. Solenoid Operated Clutch and Fire Shutter (542 and 542EX Only)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANICALLY-OPERATED CLUTCH AND FIRE SHUTTER (MODELS 541, 541T, 542 AND 542EX ONLY)		
6-1	40251	SPRING, Stop pawl	1	CDEH
-2	36763	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	1	CDEH
-3	36533	COLLAR, Clutch rod	1	CDEH
-4	3816	ROD, Clutch lever	1	CDEH
-5	17639	RING, Retaining, external, 0.125 ID (E) (early models only)	1	CDEH
-6	38167	SHAFT, Clutch lever (early models only)	1	CDEH
-7	36763	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	REF	CDEH
-8	011946	KNOB, Still-Run (see item 11, Figure 3)	REF	CDEH
-9	012535	NAMEPLATE ASSEMBLY (See item 3-13, Figure 3)	REF	CDEH
-10	36836	SCREW, Pan head, 4-40 by 3/16 inch	1	CDEH
-11	34784	WASHER, Flat	1	
-12	38162	SPRING, Fire shutter lever	1	CDEH
-13	38165	ROD, Clutch, short	1	CDEH
-14	17639	RING, Retaining, external, 0.125 inch ID (E)	1	CDEH
-15	38164	LEVER, Clutch	1	CDEH
-16	38160	SPRING, Overcenter	1	CDEH
-17	36842	SCREW, Pan head, 6-32 by 3/8 inch	1	CDEH
-17	30807	SCREW, Swage type, 6-32 by 1/4 inch hex head (NOTE A)	1	CDEH
-18	012428	BRACKET AND LEVER ASSEMBLY, Still-Run	1	CDEH
-19	97509	RING, Retaining, external, 0.250 inch ID (E)	1	CDEH
-20	012429	CAMSHAFT ASSEMBLY, Still-Run	1	CDEH
-21	38156	CAM, Clutch	1	CDEH
-22	38157	BUSHING, Pawl	1	CDEH
-23	012430	CAM AND STUD ASSEMBLY, Clutch	1	CDEH

NOTE A: Swage screws are used with all current castings.

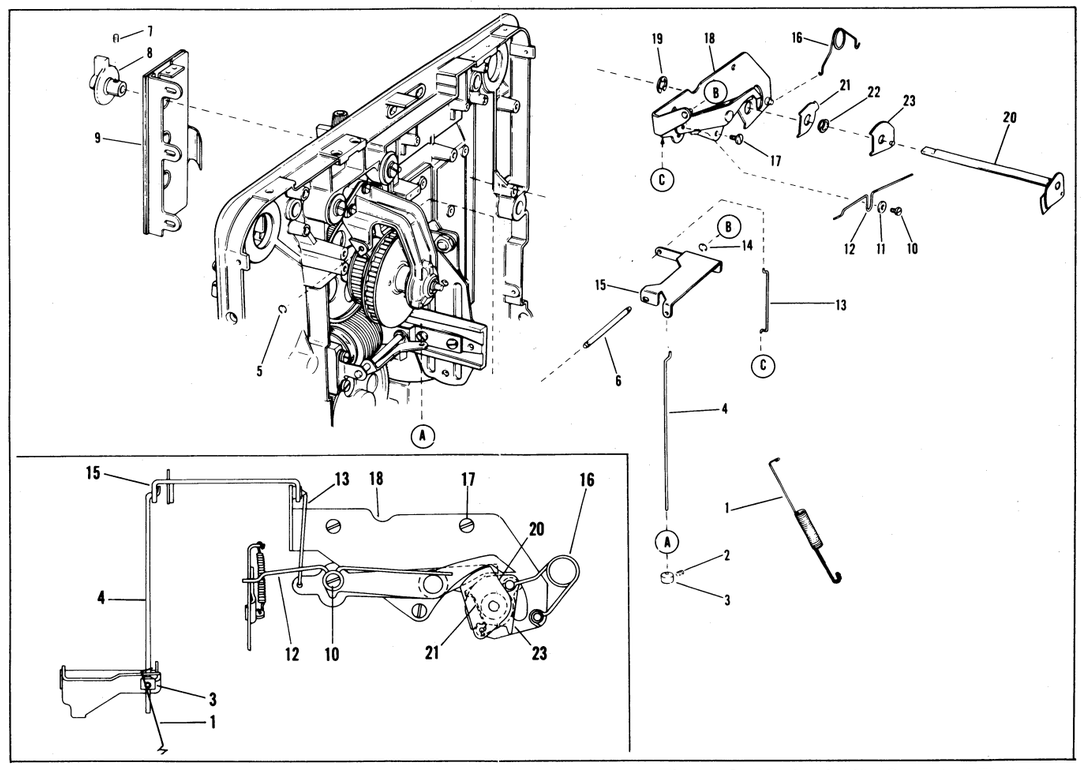


Figure 6. Mechanically Operated Clutch and Fire Shutter (542 and 542EX Only)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MOTOR AND ELECTRICAL PARTS		
7-1	30815	SCREW, Swage type, 8-32 by 3/8 inch hex head	1	
-2	43291	SCREW, Pan head, 6-32 by 3/8 inch	2	
-3	43290	NUT, Push-on	2	
-4	09810	SPEAKER ASSEMBLY	1	
-5	31928	SCREW, Binding head, 6-32 by 1/2 inch (NOTE A)	1	
-	30816	SCREW, Swage type, 8-32 by 5/16 inch hex head (NOTE A)	1	
-6	601190	NUT, Hex (use with 31928 screw)	1	
-7	31503	CLAMP, Starting capacitor	1	
-8	31266	CAPACITOR, Starting	1	
-9	34899	SCREW, Binding head, 6-32 by 5/16 inch (NOTE A)	2	
-9	30808	SCREW, Swage type, 6-32 by 5/16 inch hex head (NOTE A)	2	
-10	601190	NUT, Hex (use with 34899 screw)	2	
-11	NOTE B	RELAY, Motor (See insets, Figure 7, for motor relay styles)	1	
-12	30808	SCREW, Swage type, 6-32 by 5/16 inch hex head	2	
-13	31914	BRACKET, Relay (early style) (NOTE A)	1	
-13	41378	BRACKET, Relay (current style) (NOTE A)	1	
-14	30809	SCREW, Swage type, 6-32 by 3/8 inch hex head	4	
-15	09768	IDLER ASSEMBLY	1	
-15A	36083	. RING, Retaining, external, 0.250 inch ID	1	
-15B	611107	. ROLLER, Idler	1	
-16	09769	IDLER ASSEMBLY	1	
-16A	36083	. RING, Retaining, external, 0.250 inch ID	1	
-16B	611107	. ROLLER, Idler	1	
-17	30815	SCREW, Swage type, 8-32 by 3/8 inch hex head (NOTE C)	4	
-17	30857	SCREW, Swage type, 8-32 by 7/16 inch flat head (NOTE C)	4	
-18	31232	BRACKET, Reel arm lock (NOTE C)	2	
-18	38207	BRACKET, Reel arm lock (NOTE C)	2	
-19	31231	SPRING, Reel arm plunger	2	
-20	09888	PLUNGER ASSEMBLY, Reel arm lock	2	
-21	31687	BELT, Blower (Projectors with Serial No. 76399 and lower)	1	
-21	40283	BELT, Blower, V-type (Projectors with Serial No. 76400 and up)	1	
-22	30804	SCREW, Swage type, 4-40 by 1/4 inch hex head	2	
-23	31919	BRACKET, Bar stop	1	
-24	31921	SPRING, Belt shift	1	
-25	31265	STRAP, Motor bracket (includes screw and nut)	2	
-26	34900	SPRING, Motor discharge (not required with current motors).	1	
-27	09817	MOTOR ASSEMBLY, Drive (includes items 27A through 27D).	1	ABCE
-27	33428	. MOTOR, Drive (GE 5KCM49EG135)	1	ABCE
-27	011893	MOTOR ASSEMBLY, Drive (includes items 27A through 27D). (NOTE D)	1	
-27A	36068	. MOTOR, 50/60 cycle (Robbins-Meyer #FR-KL-E26AOTS)	1	
-27B	70345	. SUPPORT, Cushion (motor)	2	
-27C	28820	. TERMINAL, Tab snap-on	2	
-27D	32093	. TERMINAL, Flag snap-on	2	
-27E	39575	. TUBE, Insulating	1	
-28	[redacted] 43868	BELT, Flat	1	
-29	31339	SHIFTER, Belt	1	
-30	36765	SETSCREW, Fluted socket cup pt, 6-32 by 1/4 inch	1	
-31	36535	BRACKET, Bar	1	
-32	31909	SETSCREW, Fluted socket, flat pt, 5-40 by 3/16 inch	1	
-33	31920	STOP, Belt shift	1	
-34	36763	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	2	

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MOTOR AND ELECTRICAL PARTS (CONT)		
7-35	No Number	PULLEY, Motor (NOTE E)	1	
-36	31939	RESISTOR (With mounting parts)	1	ABCDE
-37	99301	WASHER, Shakeproof	1	ABCDE
-38	30822	SCREW, Swage type, 10-32 by 7/16 inch flat head	4	
-39	31698	PLATE, Resistor mounting	1	ABCE
-39	34872	PLATE, Resistor mounting	1	D
-40	No Number	BRACKET, Motor mounting (NOTE F)	2	

NOTE A: Current style relay bracket #41378 (item 7-13) requires that swage type screws (items 7-5 and 7-9) be used; when relay bracket #31914 is used, the motor relay and capacitor are attached with machine screws and hex nuts.

NOTE B: See relay insets, Figure 7, for identification and wiring of motor relays.

NOTE C: Reel arm lock brackets #31232 are no longer available. When replacement is necessary on earlier projectors, order bracket #38207 and countersink the mounting bosses 1/16 inch with a 90-degree countersink drill. Attach this bracket with screws #30857.

NOTE D: Motor #011189 (GE #5KCM49GG151) used on earlier projectors has been discontinued. If necessary to replace this motor, order motor #011893 and one mounting bracket #31263 to replace the bracket used at the "closed" end of motor #011189.

NOTE E: On projectors with serial number 76399 and lower, the motor pulley (item 35) must be replaced with a pulley of identical color, see list following.

Blue pulley	Part No. 35380	Green pulley	Part No. 35378
Black pulley	Part No. 35381	Brown pulley	Part No. 35387
Red pulley	Part No. 35379	Clear pulley	Part No. 40271
Gold pulley	Part No. 36071		

On projectors with serial number 76400 and up, pulleys are designed for V-belt drive (see inset, Figure 7), and must be replaced with a pulley of like color. See list following.

All Models Except 542EX		Model 542EX Only	
Red pulley	Part No. 40284	Green pulley	Part No. 40287
Gold pulley	Part No. 40285	Silver pulley	Part No. 40288
Blue pulley	Part No. 40298		

NOTE F: Motor P/N 09817 (GE #5KCM49EG135) uses two P/N 31263 brackets. Motor P/N 011893 (R-M #FR-KL-E26AOTS) uses one P/N 36076 bracket at shaft end of motor and one P/N 36527 bracket at closed end. For motors with die-cast end bells use two brackets P/N 37309.

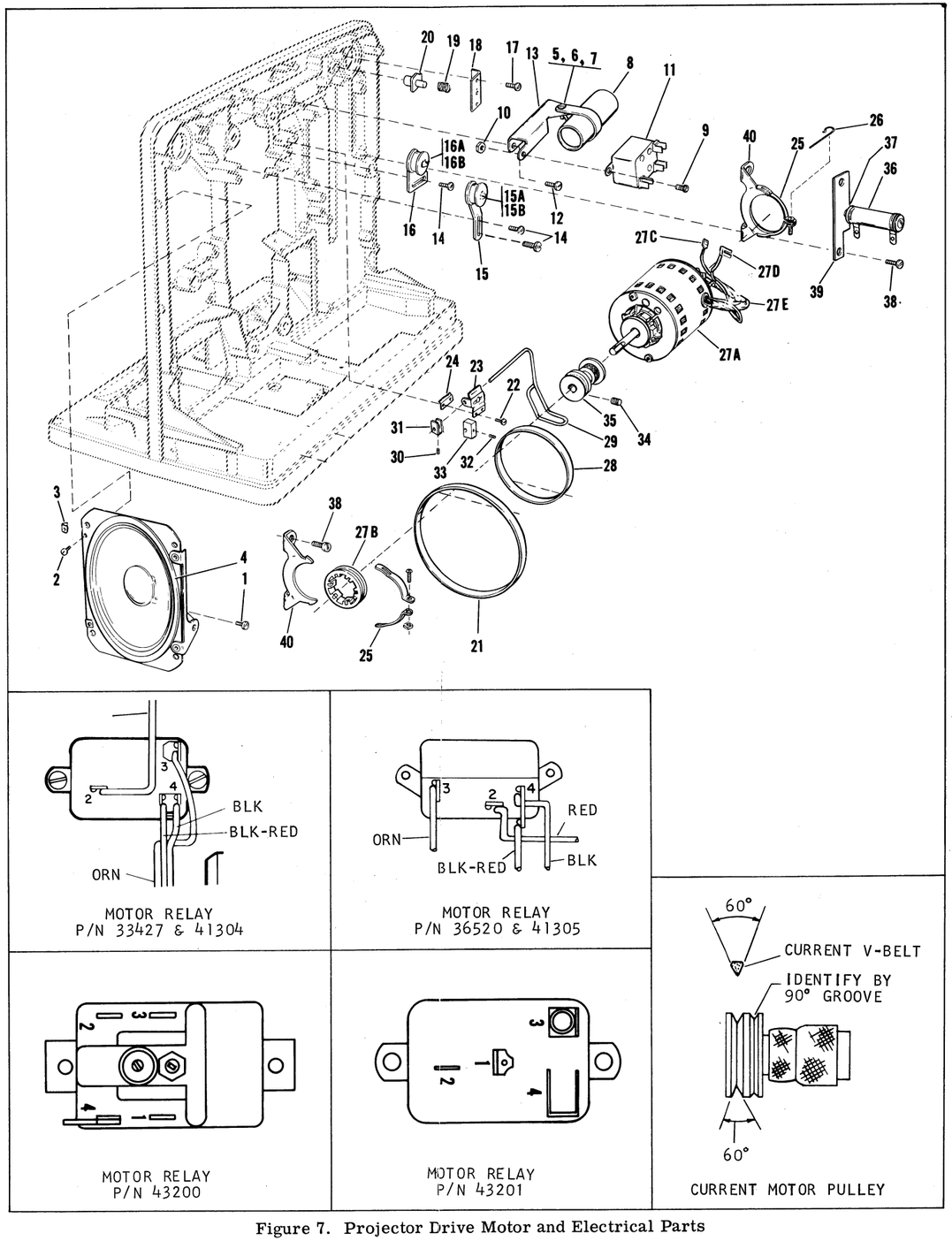


Figure 7. Projector Drive Motor and Electrical Parts

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		AMPLIFIERS, BLOWER AND TILT MECHANISM		
8-1	30815	SCREW, Swage type, 8-32 by 3/8 inch head head	2	
-3	31923	BRACKET, Rotary switch	1	ABCDE
-3	41129	BRACKET, Rotary switch	1	FGH
-4	41322	SWITCH, Rotary	1	ABCDE
-4	41195	SWITCH, Rotary	1	FGH
-4A	28718	WASHER, Switch insulating	1	
-5	31499	SCREW, Binding head, 6-32 by 0.375 inch	4	
-6	14175	WASHER, Lock	4	
-7	31692	BRACKET, Blower	2	
-8	No Number	BLOWER ASSEMBLY (See Figures 24 and 24A for breakdown)	1	
-9	011174	DEFLECTOR, Air	1	
-10	34833	SCREW, Binding head, 5-40 by 0.531 inch (early models) (NOTE A)	3	ABCDE
-10	30881	SCREW, Swage type, 6-32 by 9/16 inch pan head (current models) (NOTE A)	3	ABCDE
-11	34834	WASHER, Split lock (early models)	3	ABCDE
-11	17168	WASHER, Spring lock (current models)	3	ABCDE
-12	No Number	AMPLIFIER ASSEMBLY, Photodiode models (see Figure 25 for breakdown)	1	ABCDE
-12	No Number	AMPLIFIER ASSEMBLY, Silicon cell models (see Figure 26 for breakdown)	1	ABCDE
-13	36769	SETSCREW, Fluted socket, 8-32 by 1/4 inch	1	
-14	09902	KNOB, Tilt (part of tilt mechanism, item -20)	1	
-15	34889	SCREW, Binding head, 1/4-28 by 3/8 inch	1	
-16	8179	WASHER, Lock	1	
-17	34766	BAR, Tilt	1	
-17A	31561	FOOT, Rubber	2	
-18	30857	SCREW, Swage type, 8-32 by 7/16 inch flat head (NOTE A)	2	
-18	31694	SCREW, Tilt mechanism (NOTE B)	2	
-19	600797	WASHER, Lock (NOTE B)	2	
-20	09803	MECHANISM ASSEMBLY, Tilt	1	ABCD
-20	013915	MECHANISM ASSEMBLY, Tilt	1	EFGH
-20A	31567	. PIN, Spring	2	
-20B	31559	. RACK, Tilt	1	ABCD
-20B	41379	. RACK, Tilt	1	EFGH
-20C	31568	. PIN, Spring	1	
-20D	31565	. PINION, Tilt	1	
-20E	21736	. RING, Retaining, 0.207 inch ID (IRRC 1000-25)	1	
-20F	31039	. WASHER, Flat	1	
-20G	34822	. WASHER, Spring	1	
-20H	31564	. GEAR, Tilt worm	1	
-20J	31039	. WASHER, Flat	1	
-20K	31563	. HOUSING, Tilt (NOTE B)	1	
-21	012544	JACK ASSEMBLY, Speaker (includes mounting parts)	1	ABCDE
-22	34814	NAMEPLATE, Speaker jack	1	ABCDE
	25368	WASHER, Lock (between jack and casting)	1	ABCDE
-23	39506	INSULATOR, Upper (trim to fit early models)	1	ABCDE
-24	30804	SCREW, Swage type, 4-40 by 1/4 inch hex head	1	ABCDE
-25	09877	STRIP ASSEMBLY, Terminal (use with switch #31684, item 8-27)	1	ABCDE
-25	012543	STRIP ASSEMBLY, Terminal (use with switch #39504, item 8-27)	1	ABCDE
-25A	33268	LINE BY-PASS (Capacitor, ceramic, 0.0047 mfd min.)	1	ABCDE
-26	33421	INSULATOR, Terminal strip	1	ABCDE
-27	31684	SWITCH, Interlock (early models) (NOTE C)	1	ABCDE
-27	39504	SWITCH, Interlock (current models) (NOTE C)	1	ABCDE
	39507	. ADAPTER (On switch #39504)	1	ABCDE
-28	30810	SCREW, Swage type, 6-32 by 1/2 inch hex head	2	ABCDE
-29	601190	NUT, Hex	1	ABCDE
-30	31695	BRACKET, Interlock switch (use with switch #31684)	1	ABCDE

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		AMPLIFIERS, BLOWER AND TILT MECHANISM (CONT)		
8-30	39517	BRACKET, Interlock switch (use with switch #39504)	1	ABCDE
-31	31696	SPRING, Leaf (between bracket #31695 and casting)	1	ABCDE
-32	34788	SCREW, Button head (early models)	1	ABCDE
-32	43292	SCREW, Truss head, 6-32 by 5/8 inch (current models)	1	ABCDE
-33	33495	NAMEPLATE, Interlock	1	ABCDE
-34	39757	INSULATOR, Lower	1	ABCDE
	09815	RECEPTACLE, Room lamp (early models only)	1	ABCDE
-35	30804	SCREW, Swage type, 4-40 by 1/4 inch hex head (current models)	2	ABCDE
-36	31491	SCREW, Binding head, 8-32 by 1/2 inch (NOTE D)	1	ABCDE
-37	012367	PREAMPLIFIER (See Figure 23 for breakdown) (NOTE D)	1	ABCDE
-37A	36004	SPACER (NOTE D)	AR	ABCDE
-38	18086	FOOT, Rubber	4	
-39	30816	SCREW, Swage type, 8-32 by 5/8 inch hex head	3	
-40	30820	SCREW, Swage type, 8-32 by 1-3/8 inch hex head	2	
-41	No Number	PLATE AND BEARING ASSEMBLY	NP	
-42	No Number	BASE, Projector, gray (early models) (see GSB A-64-89) (NOTE E)	NP	A
-42	No Number	BASE, Projector, turquoise (early models) (see GSB A-64-89) (NOTE E)	NP	BCD
-42	33295	BASE, Projector, gray (with interlock switch #31684) (NOTE E)	1	A
-42	33360	BASE, Projector, turquoise (early models) (with interlock switch #31684) (NOTE E)	1	BCD
-42	42200	BASE, Projector, Charcoal (with interlock switch #35904) (NOTE E)	1	A
-42	42201	BASE, Projector, turquoise (with interlock switch #35904) (NOTE E)	1	BCDE
-42	41136	BASE, Projector	1	F
-42	41135	BASE, Projector	1	GH
-43	19037	NUT, Grounding screw	1	ABCDE
-44	31493	SCREW, Binding head, 8-32 by 0.310 inch	1	ABCDE
-45	41184	SWITCH, Volume control	1	FGH
-46	36808	SCREW	2	FGH
-47	700136	SCREW, Binding head, 8-32 by 3/8 inch	3	FGH
-48	013850	AMPLIFIER ASSEMBLY, Integrated circuit (NOTE F)	1	FGH

NOTE A: See CAUTION following paragraph 7 for special instructions on screw replacement.

NOTE B: In current models, tilt housing (item 8-20K) has countersunk mounting holes and attaches with screws #30857; early models attach with screws #31694 and washers #600797.

NOTE C: The interlock switch (item 8-27) used in the projector will determine the part number of several related parts. The switch used in early and current models can be identified by referring to the insets in Figure 8.

NOTE D: In early models, a spacer #36004 is required for mounting the preamplifier and mounting screw #31491 is used at this spot.

NOTE E: Early bases (No Number) were required with the base-mounted snubber assembly (see Figure 4B). Intermediate bases #33295 and #33360 and current bases #42200 and #42201 do not include the room lamp receptacle (item 8-34A) and the snubber assembly is mounted to the frame. Current bases have drilled but untapped screw holes, and swage type screws must be used to attach parts.

NOTE F: When repairing "T" series projectors with integrated circuit amplifier (Codes FGH), refer to Figures 35 through 38 for electronics data and parts identification.

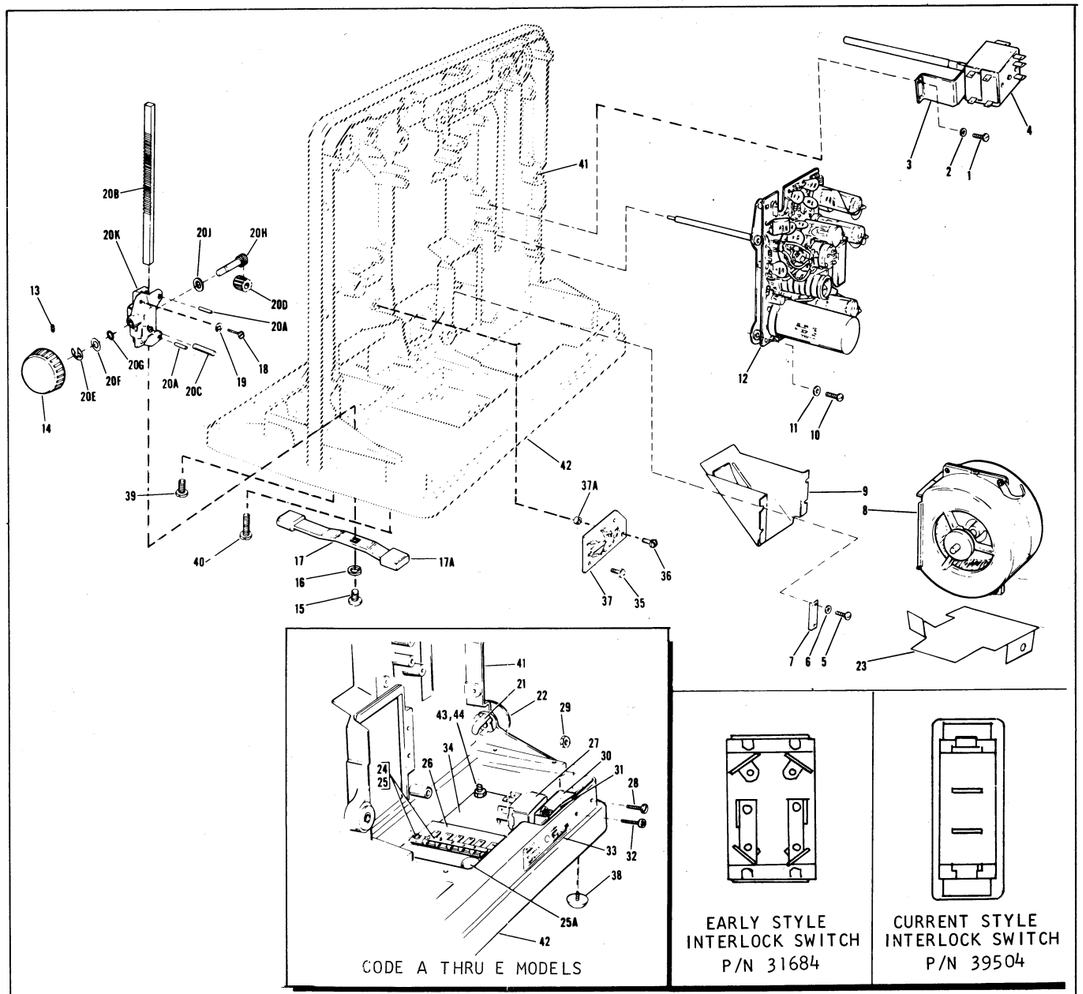


Figure 8. Projector Main Plate Components

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		FRONT REEL ARM ASSEMBLY		
9-	09849	REEL ARM ASSEMBLY, Front	REF	
-1	30879	. SCREW, Swage type, 6-32 by 3/8 inch pan head	2	
-2	42217	. COVER, Front reel arm	1	
-3	34874	. WASHER, Steel (shim)	AR	
-4	31366	. PIN, Spring	1	
-5	31363	. COLLAR, Feed spindle	1	
-6	31365	. PIN, Straight	1	
-7	31364	. SPRING, Torsion	1	
-8	09776	. GEAR ASSEMBLY, Lower	1	
-9	31371	. WASHER, Brass	1	
-9A	34860	. WASHER, Thrust	1	
-9B	36084	. WASHER (See service instructions)	AR	
-10	09774	. SPINDLE ASSEMBLY, Feed	1	
-11	31359	. WASHER, Steel	1	
-12	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-13	011948	. GEAR ASSEMBLY, Upper	1	
-14	31369	. SPRING, Clutch	1	
-15	24903	. RING, Retaining, external crescent, 0.250 inch ID	2	
-16	36080	. DISC ASSEMBLY, Clutch (acetal resin)	1	
-17	31372	. WASHER, Brass	2	
-17A	34861	. WASHER, Tension	1	
-18	31245	. RING, Retaining, external, 0.187 inch ID	1	
-19	31241	. CLIP, Gear retaining	2	
-20	31239	. GEAR, Spur (lower)	1	
-20A	33385	. GEAR, Spur (upper)	1	
-21	31243	. WASHER, Steel	1	
-22	31360	. SHAFT, Drive	1	
-23	31236	. BEARING, Nylon	2	
-24	17639	. RING, Retaining, external, 0.125 inch ID (E)	2	
-25	31367	. SHOE, Friction	1	
-26	09778	. BRACKET ASSEMBLY, Friction shoe	1	
-27	09777	. DISC ASSEMBLY, Spline bearing	1	
-28	31370	. WASHER, Bronze	1	
-29	31356	. SHAFT, Front reel arm	1	
-30	09752	. BEARING ASSEMBLY, Splined	1	
-30A	31911	. . BEARING, Needle	2	
-31	25837	. SCREW, Special, 5-40NC (NOTE A)	1	
-31	30813	. SCREW, Swage type, 4-40 by 3/8 inch hex head (NOTE B)	1	
-32	43282	. SPRING, Brake	1	
-33	31368	. STOP, Eccentric (NOTE B)	1	
-34	013337	. ARM AND BEARING ASSEMBLY, Front	1	
-34A	31911	. . BEARING, Needle	1	
-34B	31375	. . BEARING, needle (closed end)	1	

NOTE A: See CAUTION following paragraph 7 for special instructions on screw replacement.

NOTE B: With new brake spring #43282 (item 9-32), the eccentric stop is used only as a spacer and can be eliminated. Use swage screw #30813 when fastening brake spring to new arm assembly #013337.

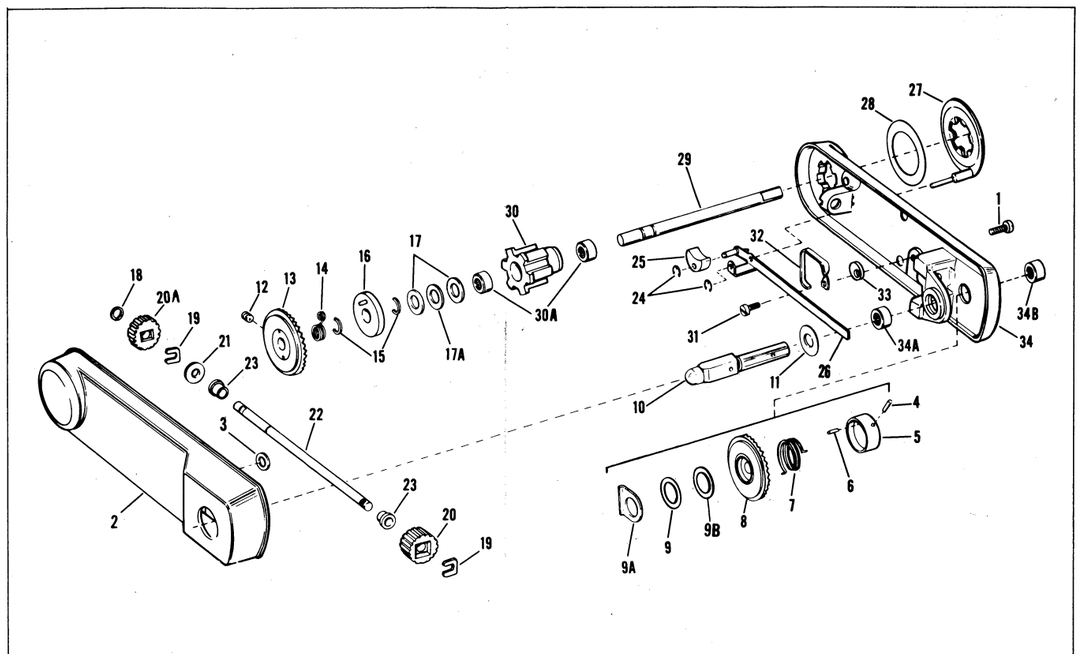


Figure 9. Front Reel Arm Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		REAR REEL ARM ASSEMBLY		
10-	09850	REEL ARM ASSEMBLY, Rear (early models)	REF	
10-	03980	REEL ARM ASSEMBLY, Rear (current models)	REF	
-1	24047	BELT, Take-Up	1	
-2	36038	. SPRING, Tension (take-up arm)	1	
-3	31247	. SCREW, Hex socket button cap, 10-32 by 1/4 inch	1	
-4	09753 01452	. SPINDLE AND PULLEY ASSEMBLY, Take-Up	1	
-5	41331	. PIN, Take-up arm (see NOTE A)	1	
-6	09755	. ARM ASSEMBLY, Take-Up	1	
-6A	43373	. . BEARING, Needle	2	
-7	30879	. SCREW, Swage type, 6-32 by 3/8 inch pan head	2	
-8	42218	. COVER, Rear reel arm	1	
-9	31245	. RING, Retaining, external, 0.187 inch ID	1	
-10	31241	. CLIP, Gear retaining	2	
-11	31239	. GEAR, Spur (lower)	1	
-12	31239	. GEAR, Spur (upper)	1	
-13	31243	. WASHER, Steel	1	
-14	36083	. RING, Retaining, external, 0.250 inch ID	1	
-15	011889	. PULLEY AND GEAR ASSEMBLY, Lower (with sleeve, item 10-30)	1	
-16	31235	. BEARING, Nylon	2	
-17	31242	. PLUNGER, Spring	1	
-18	31246	. SPRING, Compression	1	
-19	33966	. RING, Retaining, external, 0.219 inch ID (E)	1	
-20	36763	. SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	1	
-21	31234	. SHAFT, Rewind drive	1	
-22	31238	. SHAFT, Drive	1	
-23	31236	. BEARING, Nylon	2	
-24	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-25	011948	. GEAR ASSEMBLY, Upper	1	
-26	36085	. WASHER, Brass, 0.0025 inch thick (see service instructions)	AR	
-26	36086	. WASHER, Brass, 0.005 inch thick (see service instructions)	AR	
-27	31233	. SHAFT, Rear reel arm (used in 09850 Arm Assembly)	1	
-27	40295	. SHAFT, Rear reel arm (used in 03890 Arm Assembly)	1	
-28	09752	. BEARING ASSEMBLY, Splined	1	
-28A	24042	. . BEARING, Needle	2	
-29	31249	. ARM, Rear	1	
-30	~~36057~~ 45624	. SLEEVE, Rubber (see NOTE B)	1	

NOTE A: Dowel pin #41331 replaces straight pin #24043 used in early reel arms. In some units a split roll pin #303188 was used and, if in need of replacement, must be replaced with a new split roll pin.

NOTE B: Pulley #011889 supplied with rubber sleeve (item 10-30) cemented to pulley diameter.

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		LAMPHOLDER ASSEMBLY		
11-	09759	LAMPHOLDER ASSEMBLY	REF	
-1	31943	. SCREW, Binding head, 6-32 by 0.187 inch	3	
-2	31273	. BAFFLE, Lamp	1	
11-	011280	. SOCKET AND BRACKET ASSEMBLY	1	
-3	31604	. . PIN, Lamp release lever	1	
-4	31605	. . LEVER, Lamp release	1	
-5	31019	. . WASHER, Tension	1	
-6	700816	. . RIVET, Lamp socket	2	
-7	30707	. . SOCKET, Projection lamp	1	
-8	31602	. . BRACKET, Lamp socket	1	
-9	34835	. . SLEEVE, Vinyl	1	
		LAMPHOUSE ASSEMBLY		
12-	No Number	LAMPHOUSE ASSEMBLY, Complete	REF	
-1	31278	NAMEPLATE (Early models) (NOTE A)	1	A
-1	41111	NAMEPLATE (Current models) (NOTE A)	1	BCD
-1	31971	. NAMEPLATE, Specialist (early models) (NOTE A)	1	A
-1	41112	. NAMEPLATE, Specialist (current models) (NOTE A)	1	BCDEFGH
-2	30806	. SCREW, Swage, 4-40 by 1/2 inch (NOTE B)	2	
-2	34812	. SCREW, Binding head, 4-40 by 9/16 inch (NOTE B)	2	
-3	31933	. SHIELD, Lamp	1	
-4	34753	. WASHER	2	
-5	34751	. BUSHING, Spacer (0.281 inch thick) (early models) (NOTE B)	2	
-5	38461	. BUSHING, Spacer (0.187 inch thick) (current models) (NOTE B)	2	
-6	31937	. REFLECTOR, Heat	1	
12-	07999	. LAMPHOUSE SUBASSEMBLY	1	AFG
12-	011160	. LAMPHOUSE SUBASSEMBLY	1	BCDEH
-7	36026	. . HANDLE, Lamphouse	1	BCDEFGH
-8	09806	. . LATCH, Lamphouse	1	BCDEFGH
-9	83234	. . SCREW, Grille attaching (early models)	2	
-9	43378	. . RIVET, Grille attaching (current models)	2	
-10	33306	. . GRILLE, Lamphouse (two-hole mounting) (NOTE C)	1	
-10	41338	. . GRILLE, Lamphouse (one-hole mounting) (NOTE C)	1	
-11	33488	. . GUARD, Film	AR	
-12	42207	. . HOUSING, Lamp (NOTE C)	1	AFG
-12	42208	. . HOUSING, Lamp (NOTE C)	1	BCDEH
-13	36094	. . BAFFLE	1	
-14	36095	. NAMEPLATE, Lamp designation	1	

NOTE A: Nameplate #41111 and #41112 are adhesive backed and can be used only with current smooth-finish housings #42207 and #42208.

NOTE B: Screws #34812 (item 12-2) are used on early models with spacer #34751; screws #30806 are used on current models with spacers #38461.

NOTE C: Early (drilled and tapped) lamp housings and grilles with two mounting holes are no longer available. Refer to service instructions, paragraph 50, for grille replacement procedure.

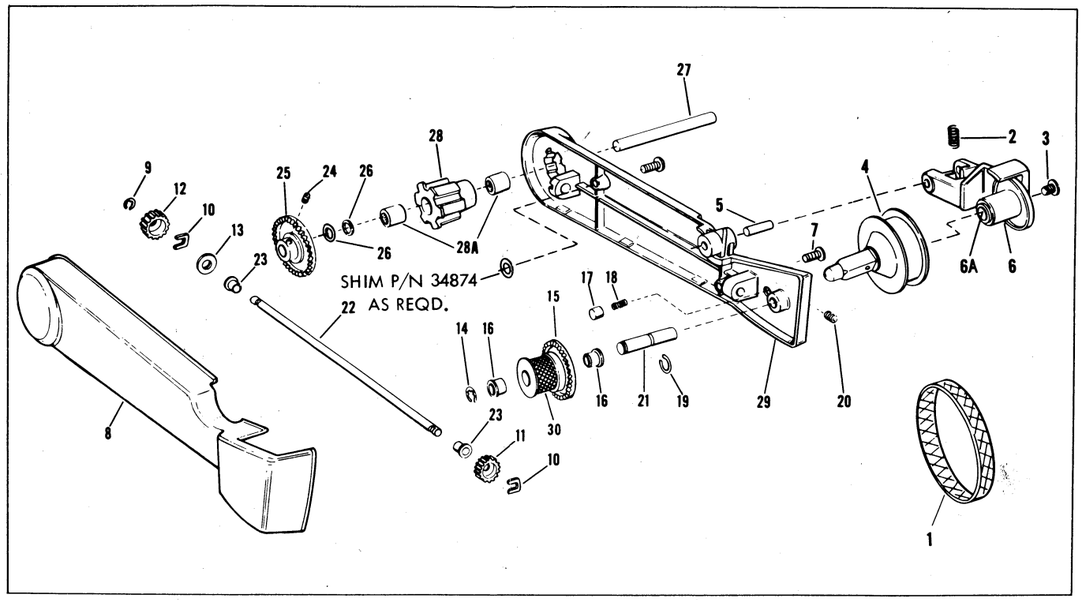


Figure 10. Rear Reel Arm Assembly

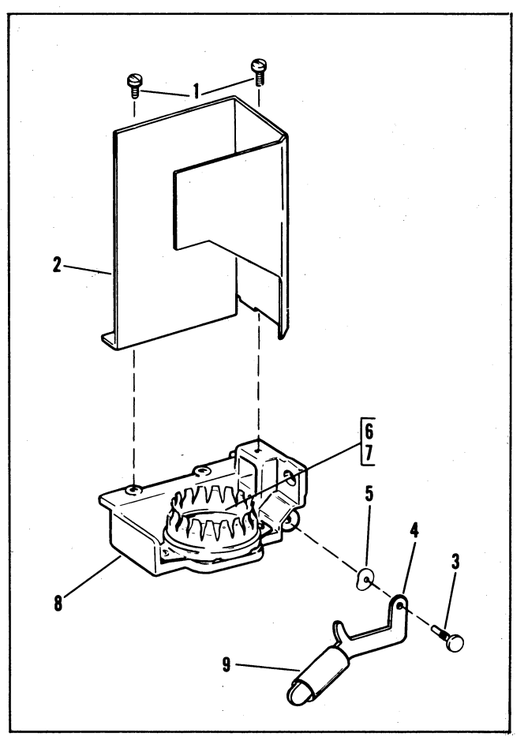


Figure 11. Projection Lampholder Assembly

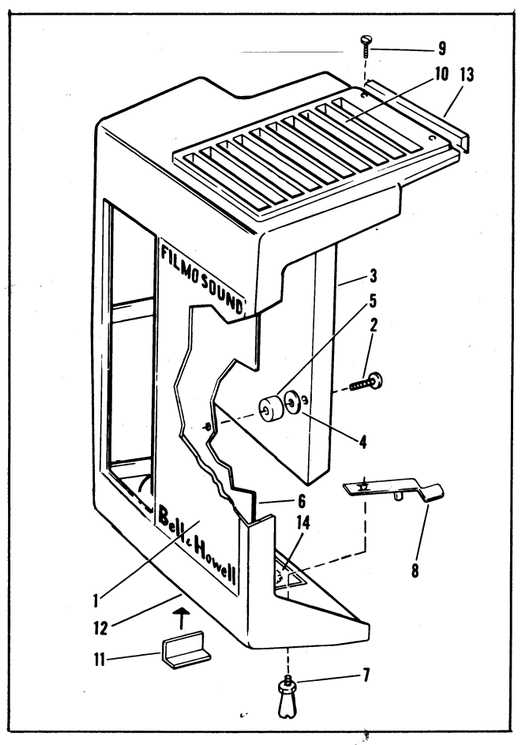


Figure 12. Lamphouse Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		SOUNDHEAD ASSEMBLY		
		USABLE ON CODE		
		X - Early models below Serial #AU99690 (with photodiode cell)		
		Y - Current models above Serial #AU99690 (with silicon cell)		
		Z - Current models equipped with integrated circuitry		
13-	No Number	SOUNDHEAD ASSEMBLY (Photodiode cell)	REF	X
13-	013327	SOUNDHEAD ASSEMBLY (Silicon cell)	REF	Y
13-	013483	SOUNDHEAD ASSEMBLY, Complete	REF	Z
-1	013332	. COVER ASSEMBLY, Exciter lamp	1	
-1A	20808	. . RING, Retaining, 0.145 inch ID (IRRC 1000-18)	1	
-1B	34837	. . SCREW, Cover retaining	1	
-1C	34787	. . RUBY, Indicating	2	
-1D	42214	. . COVER, Lamp	1	
-1E	31536	. . INSERT, Cover screw	1	
-2	34884	. LAMP, Exciter (4-Volt)	1	
-2A	34892	. NAMEPLATE, Exciter lamp	1	
-3	30810	. SCREW, Swage type, 6-32 by 1/2 inch hex head	1	
-4	020240	. SLIT ASSEMBLY, Optical (Bell & Howell) (NOTE A)	1	
-4	200828	. SLIT ASSEMBLY, Optical (Simpson) (NOTE A)	1	
-5	31671	. RING, Retaining, external, 0.250 inch ID	1	
-6	31630	. SCREW, Guide roller adjusting	1	
-7	29558	. SCREW, Photocell attaching (NOTE B)	2	X
-8	011188	. PHOTOCELL ASSEMBLY (NOTE B)	1	X
-9	33771	. NUT, Hex, photocell terminal post (NOTE B)	1	X
-9A	25042	. NUT (NOTE B)	1	X
-10	09839	. CABLE ASSEMBLY, Photocell (NOTE B)	1	X
-11	31638	. SCREW, Fillister head, 6-32 by 0.048 inch	4	
-12	11521	. SCREW, Gound lead locking (NOTE B)	1	X
-13	09828	. CONTACT ASSEMBLY, Exciter lamp	1	
-14	09840	. LEADWIRE ASSEMBLY, Lamp contact	1	
-14	013487	. LEADWIRE ASSEMBLY (to main switch 1L1)	1	Z
-15	31636	. RING, Lamp release	1	
-18	301435	. SCREW, Photocell holder clamping (NOTE B)	1	X
-19	31663	. HOLDER, Photocell (NOTE B)	1	X
-20	36765	. SETSCREW, Fluted socket cup pt, 6-32 by 1/4 inch	1	
-21	12636	. SETSCREW, Sound drum shaft locking (NOTE C)	2	
-21	36668	. SCREW, Pan head Sems, 6-32 by 5/16 inch (NOTE C)	2	
-22	011203	. SOUND DRUM AND SHAFT ASSEMBLY (NOTE C)	1	XY
-22	013398	. SOUND DRUM AND SHAFT ASSEMBLY	1	Z
-23	31669	. RETAINER, Light pipe	1	
-24	200526	. LIGHT PIPE (NOTE B)	1	X
-24	011244	. LIGHT PIPE AND SILICON CELL ASSEMBLY	1	Y
-24	013486	. LIGHT PIPE AND SILICON CELL ASSEMBLY	1	Z
-25	09826	. SCREW ASSEMBLY, Edge guide	1	
-26	30163	. SCREW, Binding head, 5-40 by 3/8 inch (early design)	2	XY
-26A	35393	. SCREW, Film guide roller (lower) (current design)	1	
-26B	35376	. SCREW, Film guide roller (upper) (current design)	1	
-27	31674	. WASHER, Steel	2	
-27A	35374	. GUIDE, Bullet (upper) (current design)	1	
-28	09834	. ROLLER, Flanged (early design)	1	XY
-28A	35373	. GUIDE, Bullet (lower) (current design)	1	
-29	09835	. ROLLER, Plain with shoulders (early design)	1	XY
-30	31673	. SPRING, Extension	1	
-31	30804	. SCREW, Swage type, 4-40 by 1/4 inch hex head	1	
-32	31675	. TERMINAL, Spring	1	
-33	30804	. SCREW, Swage type, 4-40 by 1/4 inch hex head	2	
-34	09833	. ARM ASSEMBLY, Stabilizer (early models) (NOTE D)	1	XY
-34	31659	. ARM ASSEMBLY, Stabilizer (current models) (NOTE D)	1	
-35	09832	. ARM ASSEMBLY, Stabilizer, lower	1	

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		SOUNDHEAD ASSEMBLY (CONT)		
13-36	31672	. SPRING, Stabilizer arm (early models (NOTE D)	1	XY
-36	39789	. SPRING, Stabilizer arm (current models) (NOTE D)	1	
-37	09838	. ARM ASSEMBLY, Stabilizer, upper	1	
-38	013330	. HOUSING ASSEMBLY, Soundhead	1	
-38A	41321	. . PIN (See inset, Figure 13) (NOTE E)	3	
-38B	41320	. . BUSHING (See inset, Figure 13) (NOTE E)	3	
-38C	602339	. . SPRING (See inset, Figure 13) (NOTE E)	3	

NOTE A: Optical slit assemblies #020240 and #200808 are interchangeable.

NOTE B: Germanium photodiodes #011188 (item 13-8) are no longer available. If in need of replacement, refer to the Modifications section (paragraph 84) for instructions on converting to the silicon cell preamplifier style currently in use.

NOTE C: If sound drum is drilled and tapped for mounting within the soundhead casting, use Sems screws #36668 (item 13-21), otherwise use setscrews #12636 (item 13-21).

NOTE D: Stabilizer arm #09833 is no longer available. If replacement is necessary, order arm #31659 and torsion spring #39789. Torsion spring #31672 will be available for replacement in earlier models.

NOTE E: Early style exciter lamp pins (see inset, Figure 13) are no longer available. If replacement is necessary, the new style pin (item 13-38A) and bushing (item 13-38B) must be ordered and installed as a set. Spring #602339 (item 13-38C) is used in early and current designs.

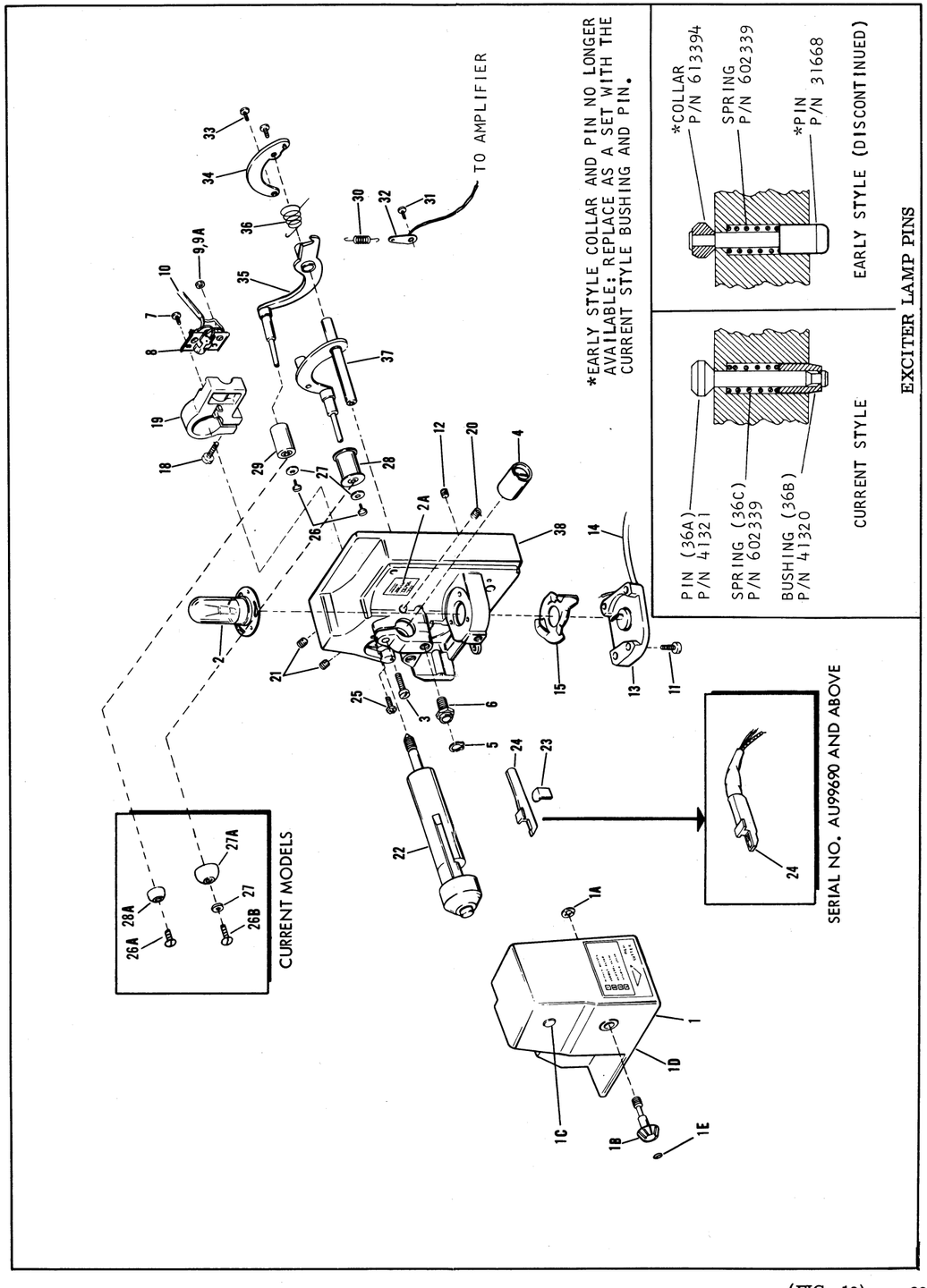


Figure 13. Sound Head Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY		
14-	No Number	MECHANISM ASSEMBLY, Complete	REF	
-1	31957	. PIN, Hinge	2	
-2	31019	. WASHER, Spring	1	
-3	31020	. WASHER, Flat	1	
-4	011200	. LENS CARRIER ASSEMBLY (See Figure 18 for breakdown) (NOTE A)	1	A
-4	013349	. LENS CARRIER ASSEMBLY (See Figure 18 for breakdown)	1	AF
-4	011199	. LENS CARRIER ASSEMBLY (See Figure 18 for breakdown) (NOTE A)	1	BCD
-4	013352	. LENS CARRIER ASSEMBLY (See Figure 18 for breakdown)	1	BCDEGH
-5	36764	. SETSCREW, Speed change knob	1	
-6	41425	. KNOB, Speed change	1	
-7	34894	. NAMEPLATE, Silent-Sound	1	ABCEFGH
-7	34895	. NAMEPLATE, 50/60 cycle	1	D
-8	31038	. RING, Retaining, external, 0.156 inch ID	4	
-9	31012	. SPRING, Belt shift lever	1	
-10	31014	. CRANK, Belt shift	1	
-10A	31013	. POST, Spring anchor	1	
-11	30164	. SCREW, Guard roller	1	
-12	34784	. WASHER	1	
-13	34825	. ROLLER, Sprocket guard	1	
-14	31164	. BEARING, Nylon	2	
-15	34824	. POST, Roller (thread size 8-32)	1	
-15	34824-S	. POST, Roller (thread size 10-32)	1	
-16	30879	. SCREW, Swage type, 6-32 by 3/8 inch pan head	3	
-18	17639	. RING, Retaining, external, 0.125 inch ID (E)	2	
-19	31045	. SHAFT, Clutch lever	1	ABFG
-19	38167	. SHAFT, Clutch lever	1	CDEH
-20	09721	. BEARING ASSEMBLY, Outboard (includes following parts)	1	
	31906	. . RIVET	3	
	31121	. . RETAINER, Bearing	1	
	7994	. . BEARING	1	
	31120	. . RING, Felt	1	
-21	31041	. LEVER, Rewind clutch (NOTE B)	1	
-22	31044	. BUTTON, Rewind	1	
-23	31042	. SPRING, Rewind button	1	
-24	31023	. BELT, Rewind timing	1	
-25	36083	. RING, Retaining, external, 0.250 inch ID	2	
-26	09724	. SPROCKET ASSEMBLY, Rewind drive	1	
-27	31039	. WASHER, Flat	1	
-28	31040	. SPRING, Compression	1	
-29	09730	. DRIVER ASSEMBLY, Spline	1	
-30	36769	. SETSCREW, Fluted socket, 8-32 by 1/4 inch	2	
-31	012121	. SPROCKET ASSEMBLY, Take-up drive (NOTE C)	1	
-31	013949	. SPROCKET ASSEMBLY, Take-up drive (NOTE C)	1	
-32	30171	. SCREW, Sprocket guard	2	
-33	34774	. GUARD, Sprocket	1	
-34	36771	. SETSCREW, Fluted socket cup pt, 8-32 by 3/8 inch (use with gear #012126)	4	
-35	012126	. GEAR ASSEMBLY, Sprocket (NOTE C)	2	
-35	013948	. GEAR ASSEMBLY, Sprocket (NOTE C)	1	
-36	31015	. WASHER, Sprocket tension	2	
-37	011196	. SPROCKET ASSEMBLY, Upper (early models) (NOTE D)	1	
-38	011198	. SPROCKET ASSEMBLY, Lower (early models) (NOTE D)	1	
-39	31017	. WASHER, Thrust	2	

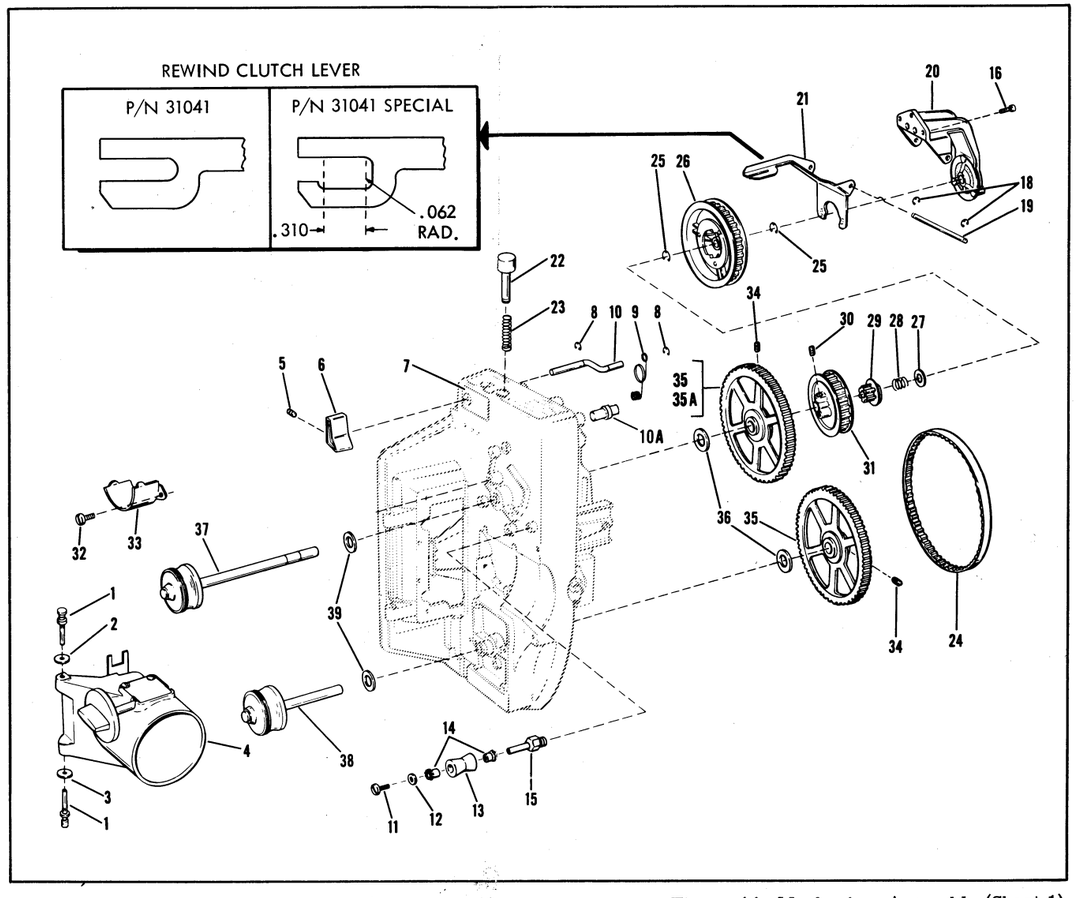


Figure 14. Mechanism Assembly (Sheet 1)

NOTE A: Early lens carrier assemblies #011199 and #011200 were used on projectors with metal sprocket guards. See Figure 14A for molded sprocket guards and associated parts. See Figure 15 for metal sprocket guards and associated parts.

NOTE B: A modified rewind clutch lever, #31041 special, was installed in some projectors. If clutch lever replacement is necessary compare the lever against the insets in Figure 14 before ordering the replacement lever.

NOTE C: Effective April 1969, all projector models have been equipped with the interlocking take-up drive sprocket P/N 013949 (item -31) and sprocket gear P/N 013948 (item -35A). Sprocket gear 013948 is used only on the upper sprocket shaft, but is interchangeable with earlier sprocket gear 012126. Take-up drive sprocket 013949 can be used only with the new sprocket gear 013948.

NOTE D: See Figure 14A for current (molded) sprocket guards and sprockets.

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MOLDED SPROCKET GUARDS (CURRENT DESIGN)		
14A-1	30171	SCREW, Sprocket guard	2	
-2	34774	GUARD, Sprocket	1	
-3	30164	SCREW, Binding head, 4-40 by 3/16 inch	3	
-3A	34878	WASHER, Shim	AR	
-3A	34879	WASHER, Shim	AR	
-3B	31551	SCREW, Pan head, 5-40 by 1/4 inch	1	
-3C	37315	BRACKET, Stop	1	
-4	36081	ROLLER, Film	3	
-5	35814	GUARD, Sprocket, molded	3	
-6	35830	SPRING, Sprocket guard tension	3	
-7	012138	SPROCKET ASSEMBLY, Upper	1	
-8	~~011226~~ 077456	SPROCKET ASSEMBLY, Lower	1	ABCD
-8	013946	SPROCKET ASSEMBLY, Lower	1	EFGH
-9	35910	FLANGE, Lower sprocket	1	
-10	31017	WASHER, Sprocket thrust	2	
-11	30164	SCREW, Binding head, 4-40 by 3/16 inch	3	
-12	36082	ROLLER, Film	3	
-13	36061	SCREW, Truss head, 5-40 by 0.123 inch	1	
-14	35885	ROLLER, Guide (early style) (NOTE A)	1	
-14	41330	ROLLER, Guide (current style) (NOTE A)	1	
-15	31943	SCREW, Binding head, 6-32 by 0.187 inch	1	
-16	012137	GUIDE ASSEMBLY, Film exit	1	
-17	31551	SCREW, Pan head, 5-40 by 1/4 inch	4	
-18	012140	PLATE ASSEMBLY, Sprocket guard, upper	1	
-19	012136	PLATE ASSEMBLY, Sprocket guard, lower	1	

NOTE A: Current guide rollers #41330 can be distinguished by the center seam, as shown in Figure 4. Early guide rollers #35885 are seamless.

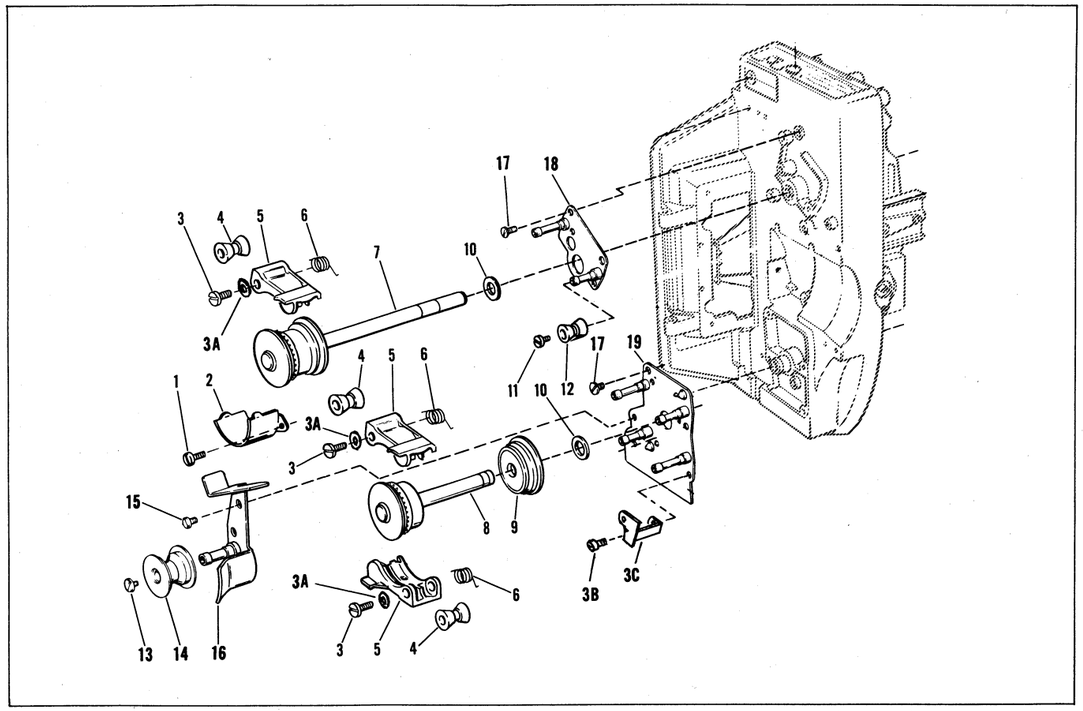


Figure 14A. Current (Molded) Sprocket Guards

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY (CONT)		
15-1	31551	. SCREW, Pan head, 5-40 by 1/4 inch	4	
-2	31977	. WASHER, Lock	1	
-3	34775	. GUIDE, Threading	1	
-4	DELETED			
-5	011195	. GUARD ASSEMBLY, Sprocket, upper (early models) (see Figure 19 for breakdown) (NOTE A)	1	
-5A	011178	. GUARD ASSEMBLY, Sprocket, upper (early models) (see Figure 19 for breakdown) (NOTE A)	1	
-5A	011182	. GUARD ASSEMBLY, Sprocket, upper (improved early models) (see Figure 19 for breakdown) (NOTE A)	1	
-6	31049	. SCREW, Binding head, 6-32 by 1/4 inch	2	
-7	No Number	. PLATE ASSEMBLY, Aperture (see Figure 20 for breakdown)	NP	
-8	30807	. SCREW, Swage type, 6-32 by 1/4 inch hex head	1	
-9	34885	. CATCH, Lens carrier	1	
-10	13918	. WASHER, Flat	1	
-11	41342	. SCREW, Swage type, 10-32 by 1/4 inch hex head	1	
-12	34851	. NAMEPLATE, Threading, upper	1	AE
-12	34778	. NAMEPLATE, Threading, upper	1	BCDFGH
-13	34852	. NAMEPLATE, Threading, lower (early models)	1	A
		EARLY LOOP RESTORER DESIGN (SEE INSETS)		
-14	31499	. SCREW, Binding head, 6-32 by 0.375 inch	1	BCD
-15	31470	. ANCHOR, Eccentric	1	BCD
-16	31469	. SPRING, Overcenter	2	BCD
-17	33347	. SETSCREW, Hex head cup pt, 6-32 by 1/4 inch	1	BCD
-18	09843	. CAM FOLLOWER AND SUPPORT ASSEMBLY	1	BCD
-18A	31555	. . SCREW, Pan head, 3-56 by 3/16 inch	2	BCD
-18B	31474	. . BRACKET, Follower alignment	1	BCD
-18C	36047	. . FOLLOWER, Cam	1	BCD
-18D	09786	. . SUPPORT, Cam follower	1	BCD
-18E	012527	. LEVER AND SHAFT ASSEMBLY, Loop restorer	1	BCD
		CURRENT LOOP RESTORER DESIGN		
-19	30164	. SCREW, Binding head, 4-40 by 3/16 inch	1	BCDEGH
-20	35840	. ROLLER, Plain	1	BCDEGH
-21	30808	. SCREW, Swage type, 6-32 by 5/16 inch hex head	1	BCDEGH
-22	21238	. WASHER, Flat	1	BCDEGH
-23	36044	. SPRING, Tension	1	BCDEGH
-24	36801	. SCREW, Sems, 6-32 by 1/4 inch	1	BCDEGH
-25	14175	. WASHER, Lock	1	BCDEGH
-26	21238	. WASHER, Flat	1	BCDEGH
-27	011249	. CAM FOLLOWER AND SUPPORT ASSEMBLY	1	BCDEGH
-27A	31555	. . SCREW, Pan head, 3-56 by 3/16 inch	2	BCDEGH
-27B	31474	. . BRACKET, Follower alignment	1	BCDEGH
-27C	36027	. . SPRING, Cam follower	2	BCDEGH
-27D	36099	. . DAMPER, Spring	1	BCDEGH
-27E	36047	. . FOLLOWER, Cam	1	BCDEGH
-27F	36028	. . SUPPORT, Cam follower	1	BCDEGH
-28	33347	. SCREW, Hex head cup pt, 6-32 by 1/4 inch	1	BCDEGH
-29	011250	. ARM ASSEMBLY, Loop restorer	1	BCDEGH

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		CURRENT LOOP RESTORER DESIGN (CONT)		
15-30	34878	. WASHER, Flat	1	BCDEGH
-31	011219	. LEVER AND SHAFT ASSEMBLY, Loop restorer	1	BCDEGH
-32	31551	. SCREW, Pan head, 5-40 by 1/4 inch (NOTE B)	2	BCDEGH
-32	31976	. SCREW, Pan head, 5-40 by 0.312 inch (NOTE B)	2	BCDEGH
-33	31977	. WASHER, Lock	2	BCDEGH
-34	31020	. WASHER, Flat	2	BCDEGH
-35	011248	. SELF CENTERING ASSEMBLY	1	BCDEGH
-36	25167	. WASHER, Flat (NOTE B)	2	BCDEGH

NOTE A: Sprocket guards (items 5 and 5A) shown in Figure 15 are early style metal guards. See Figure 14A for current molded sprocket guards.

NOTE B: Screws #31551 are used if casting has a boss at the point where self-centering assembly (item 35) attaches. If casting is machined, use screws #31976 and insert washers #25167 between the assembly and the casting.

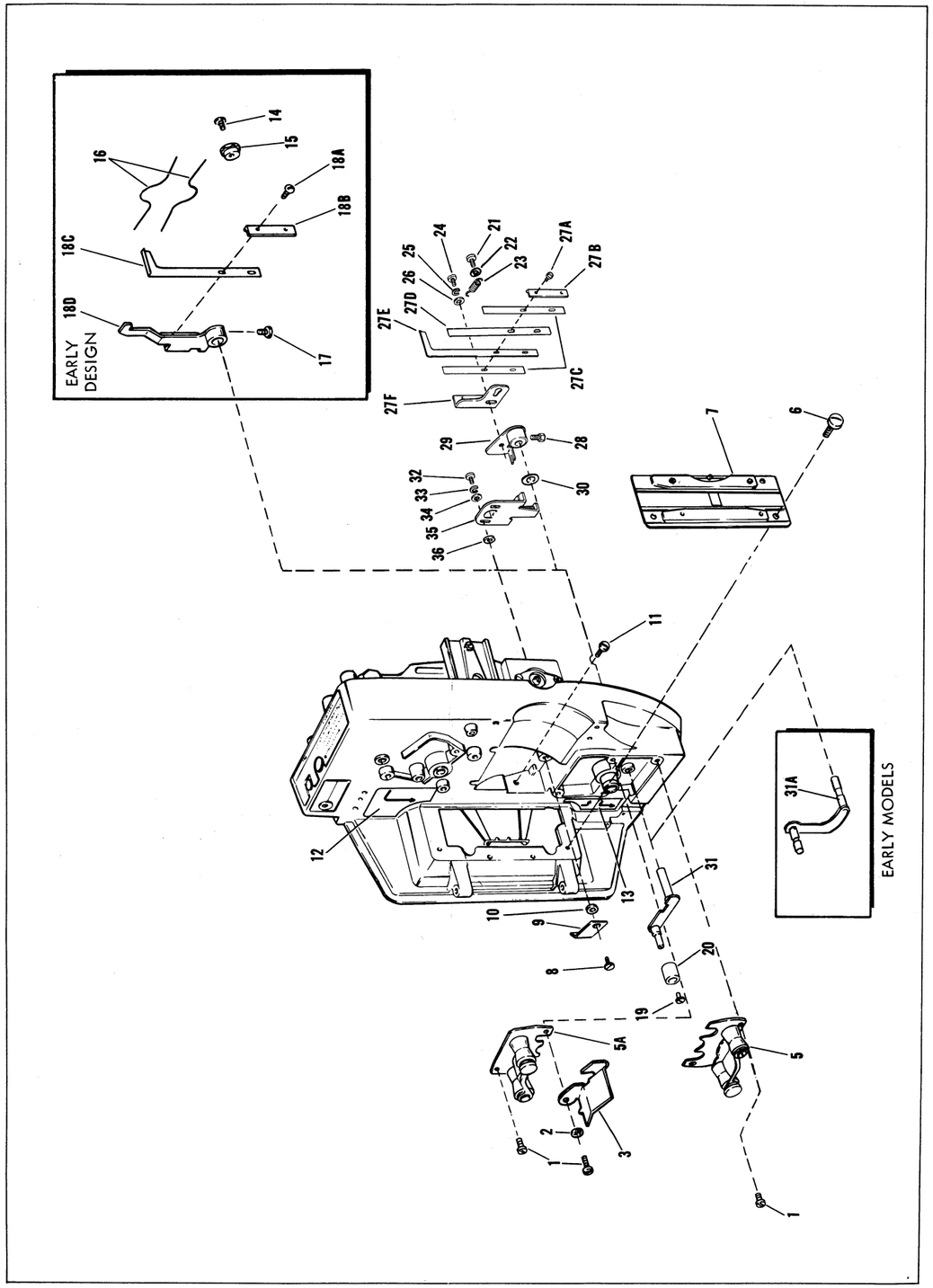


Figure 15. Mechanism Assembly (Sheet 2)

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY		
16-1	36770	. SETSCREW, Fluted socket cup pt, 8-32 by 1/4 inch	2	
-2	36525	. PULLEY, Mechanism	1	
-2	36669	. PULLEY, Mechanism (black) (optional on 542EX only)	1	D
-3	30808	. SCREW, Swage type, 6-32 by 5/16 inch hex head	4	
-3A	31943	. SCREW, Binding head, 6-32 by 0.187 inch	2	
-4	31960	. SCREW, Condenser	1	
-5	09729	. SHUTTER ASSEMBLY, Fire (see Figure 21 for breakdown)	1	CD
-5	012427	. SHUTTER ASSEMBLY, Fire (see Figure 21 for breakdown)	1	CDEH
-5A	38175	. BRACKET, Support	1	AB
-6	36662	. BAFFLE, Heat	1	ABCDEH
-6	43369	. BAFFLE, Heat	1	FG
-7	31005	. NUT, Shutter	1	
-8	31037	. WEIGHT, Counterbalance	1	
-9	31004	. SHUTTER, Three-bladed (early models) (NOTE A)	1	ABC
-9	41308	. SHUTTER, Three-bladed (current models) (NOTE A)	1	ABCEFGH
-9A	41309	. SHUTTER, Two-bladed (export models only)	1	D
-10	34797	. WASHER, Fiber	1	
-11	12087	. NUT, Stud assembly	2	
-12	011886	. BALL AND STUD ASSEMBLY	2	
-13	36015	. SPRING, Extension	1	
-14	36013	. WIPER, Felt	1	
-15	36014	. WICK, Cam wiper	1	
-16	31557	. SHUTTLE	1	
-17	011235	. ARM AND BEARING ASSEMBLY, Shuttle	2	
-17A	31011	. . BEARING, Shuttle link	1	
-17B	31003	. . FOLLOWER, Pull-down cam	1	
-18	33346	. CAM, Pull-down (early models) (NOTE A)	1	
-18A	41307	. CAM, Pull-down (current models) (NOTE A)	1	
-19	30830	. SCREW, Swage type, 6-32 by 3/8 inch pan head	2	
-21	31001	. CAM, In-out	1	
-22	011236	. BRACKET ASSEMBLY, In-out	1	
-22A	09702	. . FOLLOWER, In-out cam	1	
-22B	~~81160~~ 70711	. . SPRING, In-out	1	
-23	09712	. SUPPORT ASSEMBLY, Bearing	1	
-24	30817	. SCREW, Swage type, 8-32 by 7/16 inch hex head (NOTE B)	2	
-24A	24452	. SCREW, Shuttle arm plate (NOTE B)	2	
-24B	14175	. WASHER, Lock (NOTE B)	2	
-24C	31032	. NUT, Round (NOTE B)	2	
-25	013009	. PLATE ASSEMBLY, Shuttle arm	1	
-26	36048	. PIN, Framer stop	1	
-27	09732	. KNOB AND SHAFT ASSEMBLY, Framer	1	
-28	20808	. RING, Retaining, 0.145 inch ID (IRRC 1000-18)	2	CDEH
-29	31396	. SHAFT, Stop pawl	1	CDEH
-30	33258	. SPRING, Torsion (used only with solenoid clutch system)	1	CD
-31	31026	. PAWL, Stop	1	CDEH
-32	41377	. SCREW, Shoulder	2	CDEH
-33	31027	. BRACKET, Stop pawl shaft	1	CDEH
-34	24852	. GROMMET, Rubber	2	CDEH
-35	30807	. SCREW, Swage type, 6-32 by 1/4 inch hex head	2	CDEH
-36	33259	. STOP, Clutch (used only with solenoid clutch system)	1	CD
-37	31398	. BRACKET, Bearing	1	CDEH

NOTE A: If either the early model shutter or pull-down cam are in need of replacement, order current model shutter (41308) or (41309) and cam (41307) as a set. See inset, Figure 17, for cam and shutter identification marks.

NOTE B: In some earlier projectors, plate (item 25) was secured with screws (24A), washers (24B) and round nuts (24C).

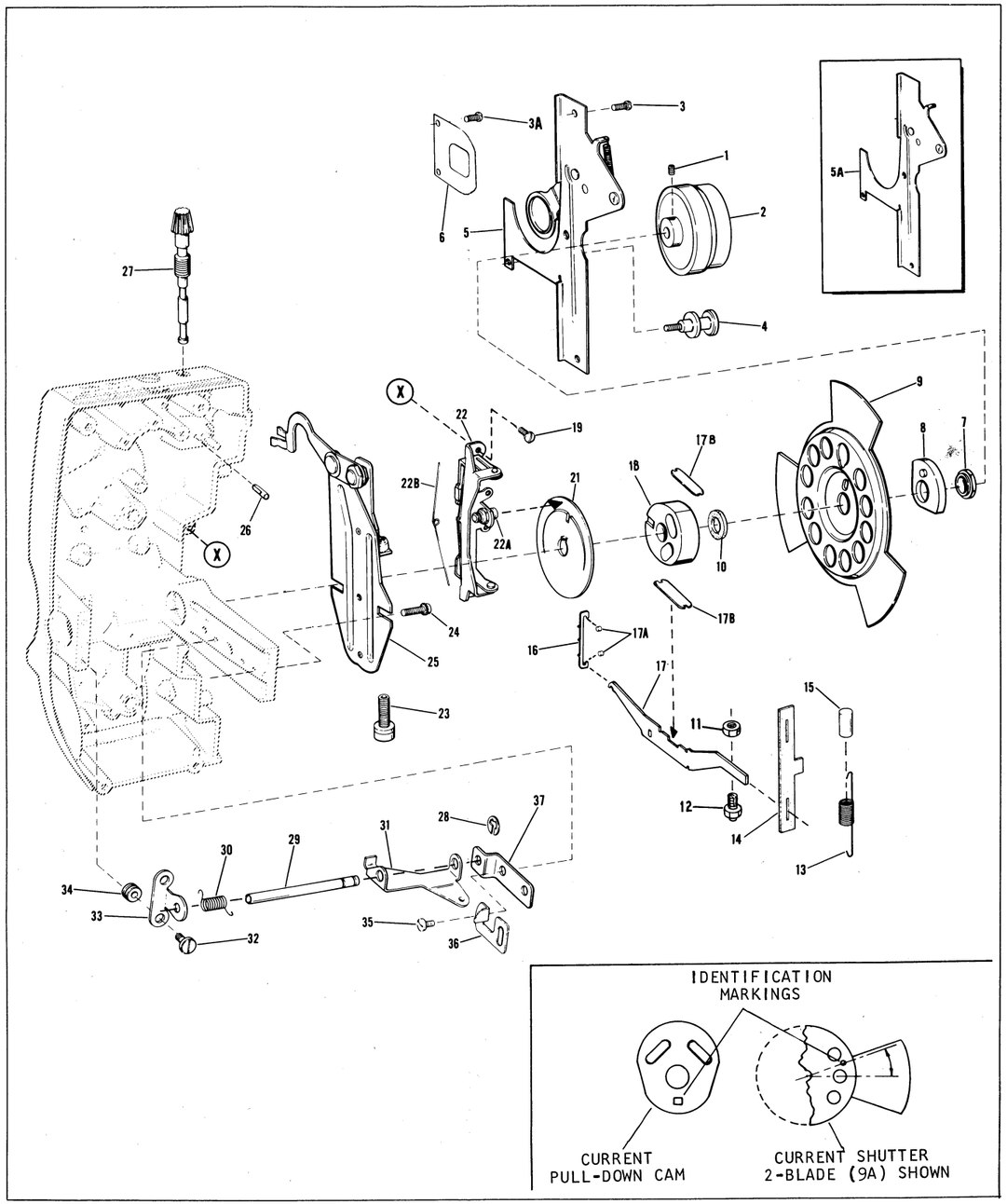


Figure 16. Mechanism Assembly (Sheet 3)

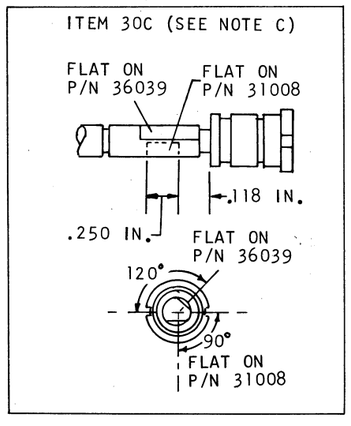
FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY		
17-1	31976	. SCREW, Pan head, 5-40 by 0.312 inch	1	CDEH
-2	30162	. SCREW, Binding head, 5-40 by 3/8 inch	1	CDEH
-3	31977	. WASHER, Lock	2	CDEH
-4	31397	. NUT, Round	1	CDEH
-5	31020	. WASHER, Flat	1	CDEH
-6	31048	. BRACKET, Shuttle adjustment	1	CDEH
-7	09870	. BRACKET ASSEMBLY, Animated clutch	1	CDEH
-7A	31405	. . SETSCREW, Fluted socket oval pt, 4-40 by 3/8 inch	1	CDEH
-7B	17639	. . RING, Retaining, external, 0.125 inch ID (E)	3	CDEH
-7C	31403	. . SHAFT, Clutch bracket	1	CDEH
-7D	31399	. . BUMPER, Slide	1	CDEH
-7E	31456	. . WASHER, Flat	1	CDEH
-7F	31036	. . SPRING, Compression	1	CDEH
-7G	09886	. . BAR ASSEMBLY, Clutch slide	1	CDEH
-7H	31555	. . SCREW, Pan head, 3-56 by 3/16 inch (NOTE A)	1	CDEH
-7H	41317	. . SCREW, Special, 4-40 hex washer head (NOTE A)	1	CDEH
-7J	31451	. . WASHER, Flat (NOTE A)	1	CDEH
-7K	31050	. . STRIKE (NOTE A)	1	CDEH
-7K	41318	. . STRIKE (NOTE A)	1	CDEH
-7L	09885	. . BRACKET ASSEMBLY, Clutch mounting	1	CDEH
-8	31009	. RING, Retaining, internal, bowed 0.866 inch ID	1	
-9	31094	. SCREW, Binding head, 3-48 by 0.197 inch (NOTE B)	2	
-9	30804	. SCREW, Swage type, 4-40 by 1/4 inch hex head (NOTE B)	2	
-10	31553	. SPRING, Bearing loading (NOTE B)	1	
-10	42244	. SPRING, Bearing loading (NOTE B)	1	
-11	31433	. SETSCREW, Loop restorer cam, 4-48 by 1/4 inch (use with #31424, item 17-27)	1	BCD
-11	36763	. SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch (use with #36042, item 17-27)	1	BCDEGH
-12	31007	. BEARING, Ball	1	
-12A	30667	. WASHER, Shim	AR	
-13	09710	. CLUTCH ASSEMBLY, Driver	1	CDEH
-14	31035	. SPRING, Clutch torsion	1	CDEH
-15	09711	. CLUTCH ASSEMBLY, Driven	1	CDEH
-16	21736	. RING, Retaining, 0.207 inch ID (IRRC 1000-25)	2	CDEH
-17	31029	. WASHER, Flat	1	CDEH
-18	31400	. BEARING, Sleeve	1	CDEH
-19	31145	. TRIGGER	1	CDEH
-20	31149	. PIN, Shoulder	2	CDEH
-21	31147	. YOKE, Clutch	1	CDEH
-22	31148	. SPRING, Compression	1	CDEH
-23	09728	. BEARING ASSEMBLY	1	CDEH
-24	09709	. GEAR ASSEMBLY, Worm (see Figure 22 for breakdown)	1	CDEH
-24A	36769	. SETSCREW, Worm gear, special	2	AB
-24B	09852	. GEAR, Worm	1	AB
-24B	012666	. GEAR, Worm	1	FG
-25	31031	. BUSHING, Rubber	3	CD
-26	31029	. WASHER, Flat	1	CD
-27	31424	. CAM, Loop restorer (early models)	1	BCD
-27	36042	. CAM, Loop restorer (current models)	1	BCDEGH
-28	31078	. RING, Retaining, external, bowed, 0.312 inch ID	1	
-29	31006	. BEARING, Ball	1	
-30	31967	. CAMSHAFT	1	AB
-30A	36065	. CAMSHAFT	1	ABFG
-30B	36039	. CAMSHAFT (Current models)	1	CDEH
-30C	31008	. CAMSHAFT (Early models) (NOTE C)	1	CD

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY (CONT)		
17-31	31954	. NAMEPLATE, Framer-Rewind	1	
-32	36763	. SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	1	
-33	35875	. STUD, Rewind adjustment	1	
-34	30884	. SCREW, Swage type, 6-32 by 1 inch pan head	1	
-35	33489	. HOLDER, Condenser	1	
-36	31962	. WASHER, Special	1	
-37	31959	. SPRING, Condenser holder	1	
-38	013342	. HOUSING ASSEMBLY, Mechanism	1	AF
-38	013344	. HOUSING ASSEMBLY, Mechanism	1	BG
-38	013345	. HOUSING ASSEMBLY, Mechanism	1	CDEH

NOTE A: Early style strike #31050 (item 17-7K) was attached with a 3-56 screw #31555 (item 17-7H). A 4-40 screw #41317) is currently being used to hold the new strike #41318 more securely. The early strike and its screw will be used until existing stock is depleted. In order to use the current strike on early models, the slot in bracket assembly (item 17-7L) must be enlarged slightly to provide clearance for the 4-40 screw.

NOTE B: Screw #31094 (item 17-9) is used to attach early spring #31553 (item 17-10). Swage type screw #30804 is used to attach spring #42244 used in current models. These parts are not interchangeable.

NOTE C: When required for replacement, camshaft 31008 must be made from camshaft 36039 and will have two sets of flats and slots. When installing this modified camshaft, see the inset below for the relative position of slots and flats.



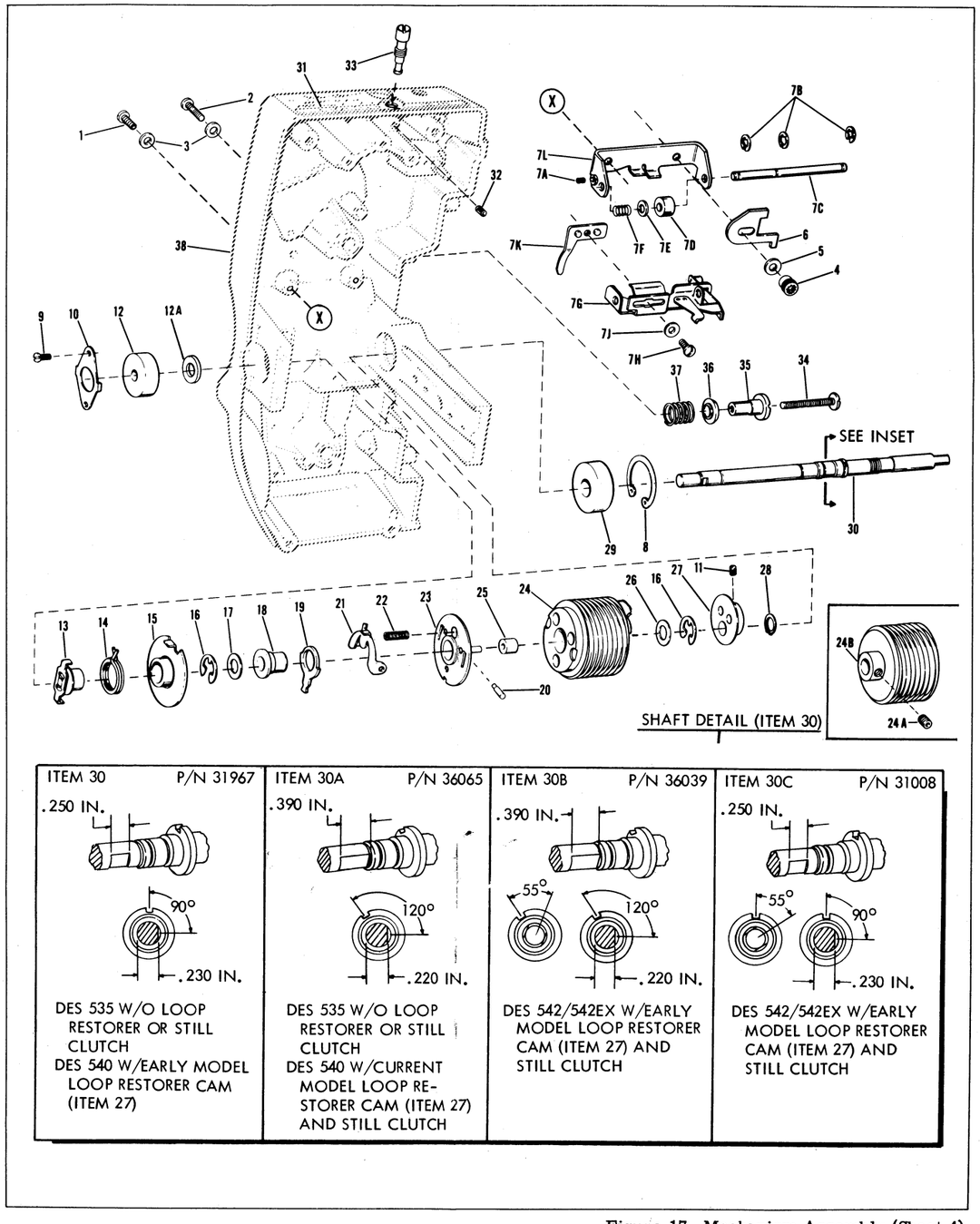


Figure 17. Mechanism Assembly (Sheet 4)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		LENS CARRIER ASSEMBLY		
18-	011200	LENS CARRIER ASSEMBLY (NOTE A)	REF	A
18-	013349	LENS CARRIER ASSEMBLY (Current style)	REF	AF
18-	011199	LENS CARRIER ASSEMBLY (NOTE A)	REF	BCD
18-	013352	LENS CARRIER ASSEMBLY (Current style)	REF	BCDEGH
-1	31094	. SCREW, Binding head, 3-48 by 0.197 inch (NOTE B)	2	
-1	30804	. SCREW, Swage type, 4-40 by 1/4 inch hex head (NOTE B)	2	
-2	31093	. SPRING, Hold-down	1	
-3	09847	. KNOB ASSEMBLY, Focus	1	
-4	35880	. SCREW, Truss head, 3-56 by 0.434 inch	2	
-5	31097	. BUSHING, Spacer	1	
-6	34888	. PLATE, Pressure	1	
-7	31096	. SPRING, Compression (early models)	2	
-7	34897	. SPRING, Compression (current models)	2	
-8	24366	. WASHER, Flat (early models)	2	
-9	31905	. SCREW, Binding head, 5-40 by 0.197 inch (NOTE B)	1	
-9	30804	. SCREW, Swage type, 4-40 by 1/4 inch hex head (NOTE B)	2	
-10	31095	. PLATE, Adjustment	1	
-10A	33309	. BUTTON, Stop	1	
-11	011941	. CARRIER, Lens (NOTE A)	1	A
-11	013351	. CARRIER, Lens (current style)	1	AF
-11	011940	. CARRIER, Lens (NOTE A)	1	BCD
-11	013355	. CARRIER, Lens (current style)	1	BCDEGH

NOTE A: Early style lens carriers #011199 and #011200 are used with projectors equipped with metal sprocket guards. Current lens carriers are used with projectors equipped with molded sprocket guards.

NOTE B: Because of the difference in thread size, these screws are not interchangeable. Swage type screws can be used only with the current (drilled but untapped) lens carrier castings.

		SPROCKET GUARD ASSEMBLY (SEE NOTE B)	
19-	011182	GUARD ASSEMBLY, Sprocket, upper (NOTE B)	REF
19-	011195	GUARD ASSEMBLY, Sprocket, lower top (NOTE B)	REF
19-	011178	GUARD ASSEMBLY, Sprocket, lower bottom (NOTE B)	REF
-1	17639	. RING, Retaining, external, 0.125 inch ID (E)	1
-2	31460	. STUD, Shoulder	1
-3	31124 or 38231	. LATCH	1
-4	011181	. STUD, Detent	1
-5	30164	. SCREW, Binding head, 4-40 by 3/16 inch	1
-5A	34878	. WASHER, Flat, 0.005 inch (NOTE A)	AR
-5A	34879	. WASHER, Flat, 0.010 inch (NOTE A)	AR
-6	34762	. GUARD, Sprocket	1
-7	34867	. ROLLER, Sprocket guard	2
-8	31435	. SPRING	1
-9	09722	. PLATE ASSEMBLY (For 011182 and 011195 guards only)	1
-9	011177	. PLATE ASSEMBLY (For 011178 guard only)	1

NOTE A: Replace with washer of identical thickness.

NOTE B: These sprocket guards are used on early model projectors only.

NOTE: IF THE LENS CARRIER (ITEM 11) IS TO BE REPLACED ON CURRENT PROJECTORS (WITH MOLDED SPROCKET GUARDS), THE LATEST (DRILLED BUT UNTAPPED) CASTING WILL BE SUPPLIED. THEREFORE, FOUR SWAGE SCREWS P/N 30804 ALSO MUST BE ORDERED FOR MOUNTING ITEMS (2) and (10).

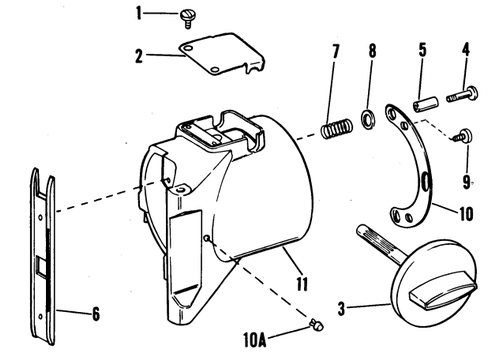


Figure 18. Lens Carrier

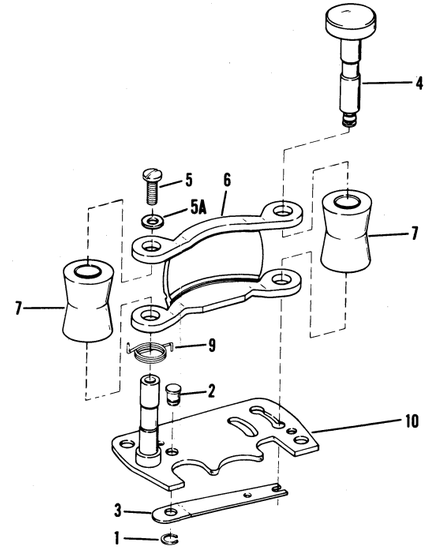


Figure 19. Sprocket Guard

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		APERTURE PLATE ASSEMBLY		
20-	No Number	APERTURE PLATE ASSEMBLY	REF	
-1	31978	. SCREW, Pan head, 3-56 by 1/8 inch	2	
-2	33252	. RAIL, Film guide, chrome (early models) (NOTE A)	1	A
-2	35883	. RAIL, Film guide, gold (early models) (NOTE A)	1	BCD
-2	36064	. RAIL, Film guide, chrome (current models) (NOTE A)	1	
-3	31555	. SCREW, Pan head, 3-56 by 3/16 inch (early models)	2	
-3	37296	. SCREW, Pan head, 3-56 by 1/4 inch (current models)	2	
-4	34819	. COVER, Spring retaining, chrome (early models) (NOTE B)	1	A
-4	34820	. COVER, Spring retaining, gold (early models) (NOTE B)	1	BCD
-4	34819	. COVER, Spring retaining, chrome (current models) (NOTE B)	1	
-5	10689	. WASHER, Flat (early models)	2	
-5A	37295	. BUSHING, Spacer (current models)	2	
-6	33251	. RAIL, Film tension, chrome (all pre-1964 models)	1	
-6	37294	. RAIL, Film tension, gold (early models) (NOTE C)	1	BCD
-6	37293	. RAIL, Film tension, chrome (all current models) (NOTE C)	1	
-7	31135	. SPRING, Side tension	1	
-8	30164	. SCREW, Binding head, 4-40 by 3/16 inch (use with drilled aperture plate #011243)	1	BCD
-8	31978	. SCREW, Pan head, 3-56 by 1/8 inch (use with tapped aperture plate #012132)	1	BCD
-9	25042	. NUT, Hex (use with drilled aperture plate #011243)	1	BCD
-10	19481	. WASHER, Lock (use with drilled aperture plate #011243)	1	BCD
-11	36075	. GUIDE, Film	1	BCD
-12	011243	. PLATE, Aperture (all early models)	1	
-13	012132	. PLATE, Aperture, tapped (all current models)	1	

NOTE A: All projector models will standardize on chrome guide rail #36064. When stock of rails #33252 (chrome) and #35883 (gold) is depleted, chrome rail #36064 will be furnished as a replacement.

NOTE B: Gold cover #34820 is being discontinued. When stock has been depleted, chrome cover #34819 will be used as a replacement on all models.

NOTE C: When stock of tension rails #33251 (chrome) and #37294 (gold) is depleted, chrome tension rail #37293 will be furnished as a replacement.

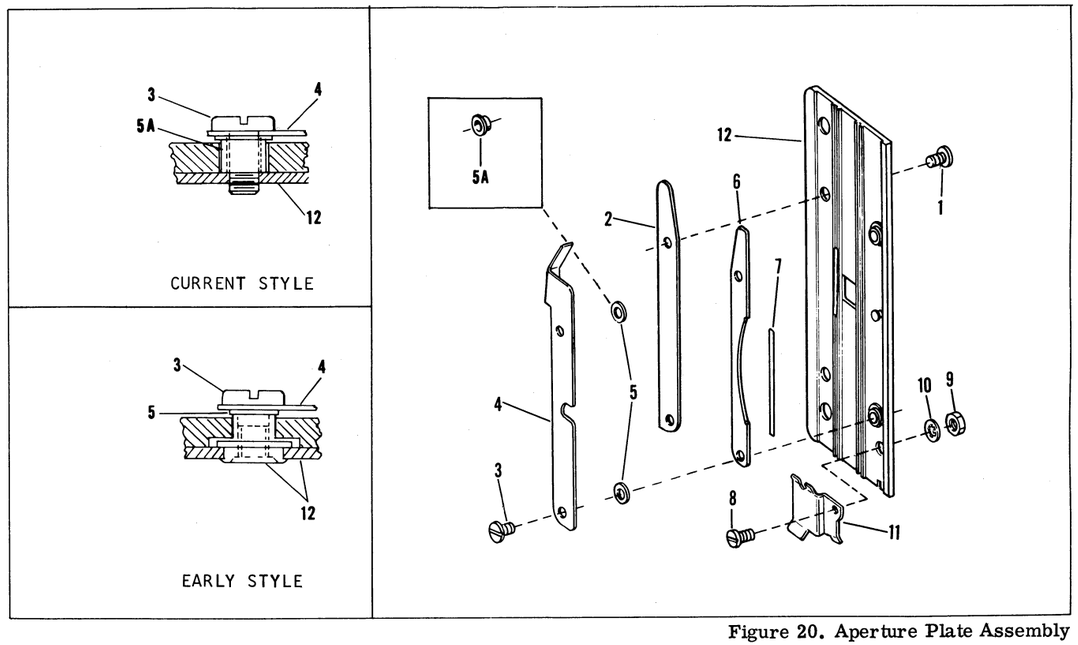


Figure 20. Aperture Plate Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		FIRE SHUTTER ASSEMBLY		
21-	09729	FIRE SHUTTER ASSEMBLY (Solenoid operated type)	REF	CD
21-	012427	FIRE SHUTTER ASSEMBLY (Mechanical linkage type)	REF	CDEH
-1	31143	. SPRING, Extension	1	CD
-2	34823	. SPRING, Filter retainer	1	CD
-3	31153	. RETAINER, Heat filter glass	1	CD
-4	31407	. DISC, Fire shutter	1	CD
-5	200508	. FILTER, HEAT	1	CD
-6	011282	. BRACKET ASSEMBLY, Fire shutter (for 09729 assembly only) .	1	CD
-6	012579	. BRACKET ASSEMBLY, Fire shutter (for 012427 assembly only)	1	CDEH
		WORM GEAR ASSEMBLY		
22-	09709	GEAR ASSEMBLY, Worm	REF	CD
-1	31081	. RETAINER, Shuttle interlock	1	CD
-2	31063	. SCREW, Interlock retainer	2	CD
-3	31083	. SETSCREW, Fluted socket oval pt, 4-48 by 1/4 inch	1	CD
-4	41319	. BANC-LOK	1	CD
-5	09784	. GEAR, Worm	1	CD
		PREAMPLIFIER ASSEMBLY (SILICON CELL MODELS ONLY)		
23-	012367	PREAMPLIFIER ASSEMBLY	REF	ABCDE
-1	36009	. RESISTOR, FIXED, Carbon, 1200 ohms 1/2 watt (R23) . . .	1	ABCDE
-2	36073	. RESISTOR, FIXED, Carbon, 150 ohms 1/2 watt (R34) . . . . (NOTE A)	1	ABCDE
-2	36007	. RESISTOR, FIXED, Carbon, 180 ohms 1/2 watt (R34) . . . . (NOTE A)	1	ABCDE
-2	36074	. RESISTOR, FIXED, Carbon, 220 ohms 1/2 watt (R34) . . . . (NOTE A)	1	ABCDE
-3	31737	. CAPACITOR, Ceramic, 0.0015 mfd ± 20% (C20)	1	ABCDE
-4	31742	. RESISTOR, FIXED, Carbon, 10,000 ohms 1/2 watt (R31) . .	1	ABCDE
-5	36008	. RESISTOR, FIXED, Carbon, 56,000 ohms 1/2 watt (R30) . .	1	ABCDE
-6	38336	. TRANSISTOR (Q1)	1	ABCDE
-7	35897	. CAPACITOR, Electrolytic, 50 mfd (C19)	1	ABCDE
-8	31749	. RESISTOR, FIXED, Carbon, 3900 ohms 1/2 watt (R32) . . .	1	ABCDE
-9	36004	. SPACER, Mounting (NOTE B)	1	ABCDE
-10	011229	. CIRCUIT BOARD ASSEMBLY	1	ABCDE

NOTE A: Refer to the Note on schematic diagrams, for method of determining proper replacement for resistor R34.

NOTE B: Spacer #36004 is required on models where mechanism plate does not have a cast mounting boss.

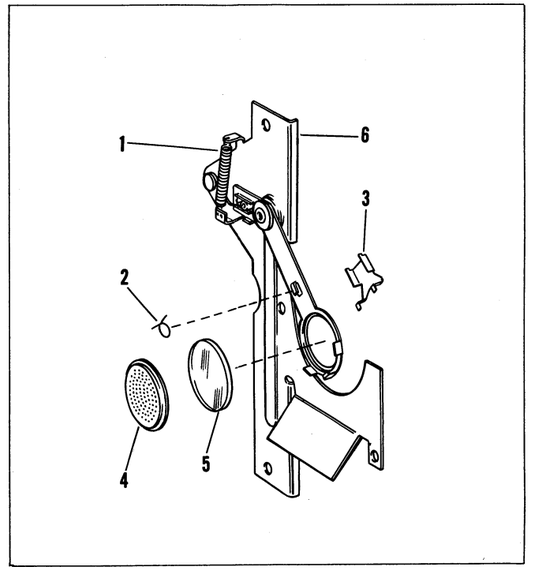


Figure 21. Fire Shutter Assembly

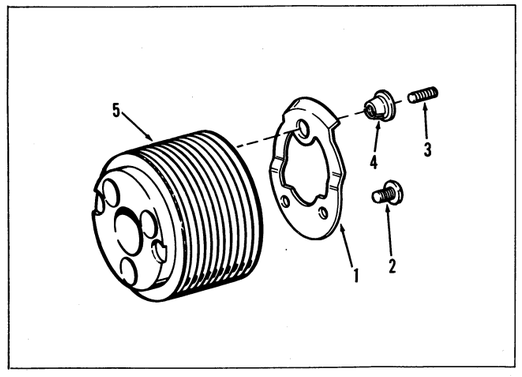


Figure 22. Worm Gear Assembly

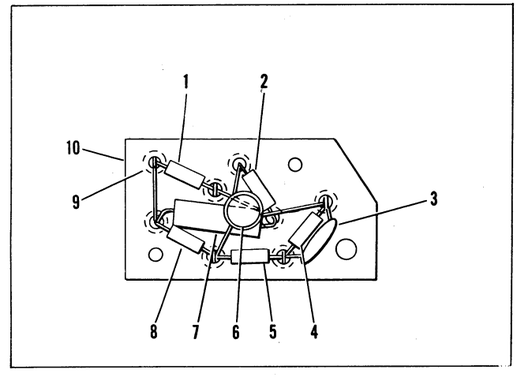


Figure 23. Pre-Amplifier Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		BLOWER ASSEMBLY (REMOVABLE BEARING TYPE)		
24-	09762	BLOWER ASSEMBLY (Removable bearing type) (Serial No. 76399 lower)	REF	
-1	12636	. SETSCREW, Pulley, 8-32 by 0.16 inch	2	
-2	31586	. PULLEY, Blower	1	
-3	26126	. EYELET	3	
-4	31585	. CLAMP, Leadwire	2	
-5	30029	. SCREW, Hex head tapping, 6-32 by 1/2 inch	1	
-6	601190	. NUT, Hex	1	
-7	17196	. TERMINAL, Lug	1	
-8	31948	. HOUSING, Blower	2	
-9	21736	. RING, Retaining, 0.207 inch ID (IRRC 1000-25)	1	
-10	31237	. WASHER, Nylon	2	
-12	21793	. SETSCREW, Collar	1	
-13	82655	. COLLAR	1	
-14	12636	. SETSCREW, Blower wheel	2	
-15	31590	. SHAFT, Blower wheel (early models)	1	
-16	09783	. BLOWER WHEEL ASSEMBLY (Early models)	1	
-16	011902	. BLOWER WHEEL AND SHAFT ASSEMBLY (Later models)	1	
-17	31589	. RING, Bearing retainer	2	
-18	33422	. WASHER, Nylon	2	
-19	31587	. BEARING, Bronze	2	
-20	34890	. WASHER, Nylon	2	
		BLOWER ASSEMBLY (PRESSED BEARING TYPE)		
24A-	012123	BLOWER ASSEMBLY, Pressed bearing type (Serial No. 76399 and lower)	REF	ABC
24A-	012652	BLOWER ASSEMBLY, Pressed bearing type (Serial No. 76400 and up)	REF	ABCEFGH
24A-	012653	BLOWER ASSEMBLY, Pressed bearing type (Export models. only)	REF	D
-1	36769	. SETSCREW, Fluted socket, 8-32 by 3/16 inch	2	
-2	31586	. PULLEY, Blower (Serial No. 76399 and lower)	1	ABC
-2	40286	. PULLEY, Blower, green (Serial No. 76400 and up)	1	ABCEFGH
-2	40289	. PULLEY, Blower, red (export models only)	1	D
-3	26126	. EYELET	4	
-4	31585	. CLAMP, Leadwire	2	
-5	012124	. HOUSING AND BEARING ASSEMBLY, Front	1	
-6	31301	. HOUSING, Rear	1	
-7	21736	. RING, Retaining, 0.207 inch ID (IRRC 1000-25)	1	
-8	36984	. WASHER, Nylon	2	
-9	012122	. WHEEL AND SHAFT ASSEMBLY, Blower	1	

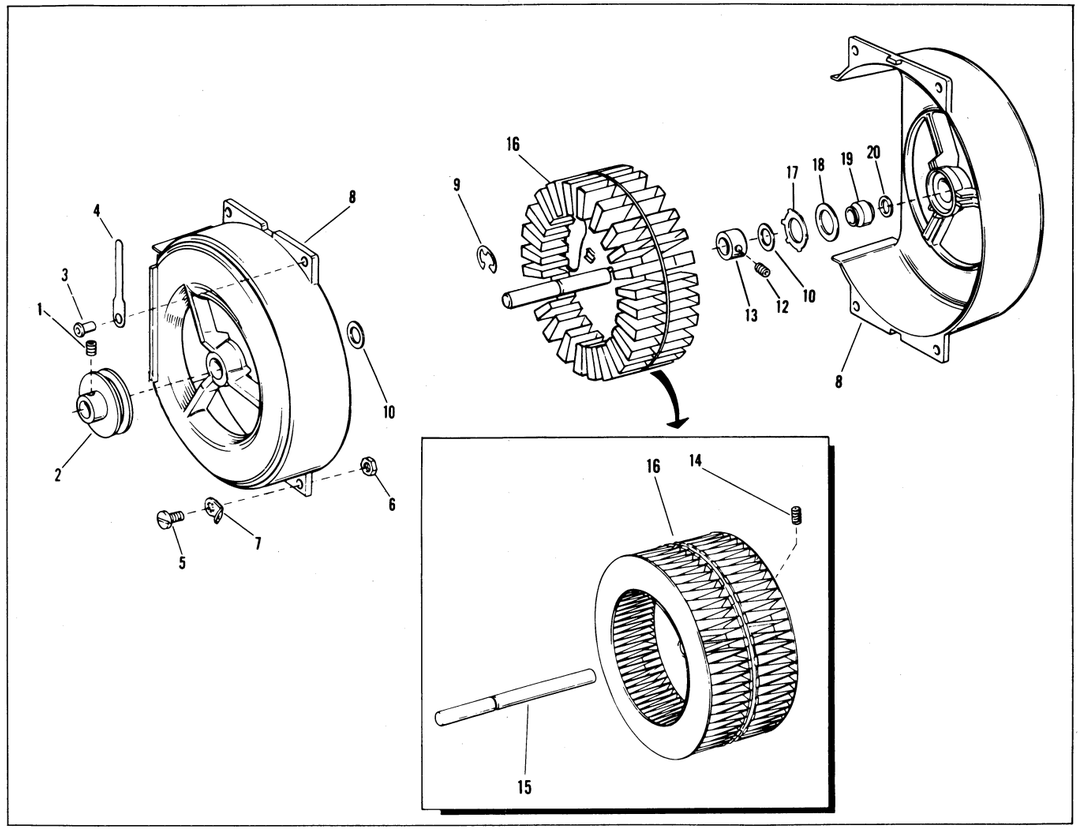


Figure 24. Blower Assembly (Removable Bearing Type)

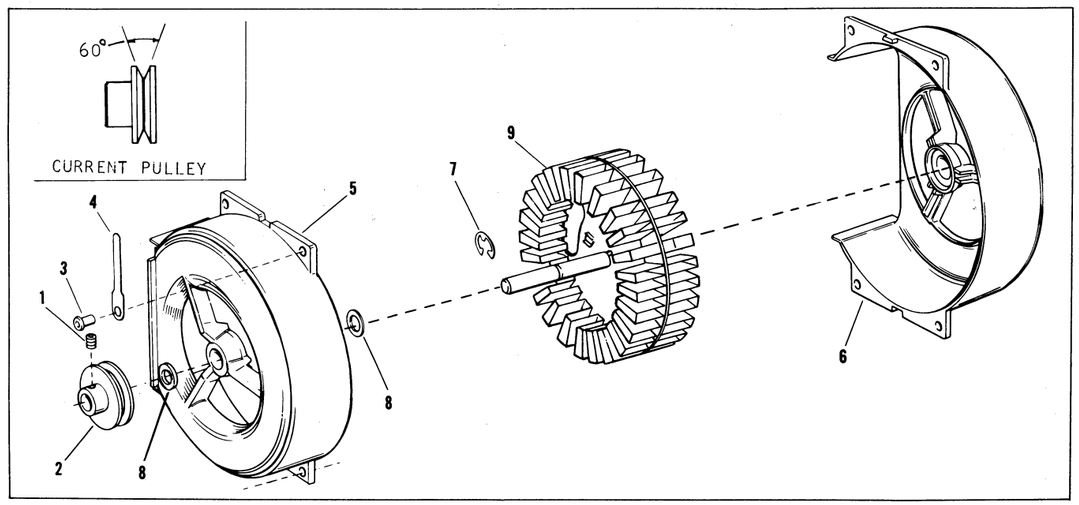


Figure 24A. Blower Assembly (Pressed Bearing Type)

REF. DESIGNATION	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7
		AMPLIFIER ASSY, PHOTO DIODE (09920 REF. ONLY) (SERIAL NO. AV-92158 TO AU-99689)
	NPN	AMPLIFIER ASSY, Projector (See Note *)
V1	22577	TUBE, 12AX7A or 7025
	31759	SOCKET, Tube V1
V2	22577	TUBE, 12AX7A or 7025
	31757	SOCKET, Tube V2
	31756	SHIELD, Tube V2
V3, V4, V5	31721	TUBE, 25C5
	31758	SOCKET, Tube w/clip, V3, V4, V5
	31715	TRANSFORMER, Output
	34810 or 34811	RECTIFIER, Silicon
	31719	COIL, Oscillator, (3.5V ±0.3V)
	09921	CONTROL ASSEMBLY, Volume and tone
	31722	. CONTROL (with DPST line switch P/N 70343)
	39515	. CONTROL (with SPST line switch P/N 70462)
	28019	TUBING (Lamp, Ne-2V)
NE-2V	31723	LAMP, Glow
R1, R4	31745	RESISTOR, Carbon, 47,000 ohm 1/2 W
R2	31746	RESISTOR, Carbon, 68,000 ohm 1/2 W
R3	31725	RESISTOR, Carbon, 150,000 ohm 1/2 W
R5, R10, R17 R18, R20	31740	RESISTOR, Carbon, 470,000 ohm 1/2 W
R6, R8, R12 R14, R16	31739	RESISTOR, Carbon, 100,000 ohm 1/2 W
R7, R11	31749	RESISTOR, Carbon, 3900 ohm, 1/2 W
R9, R13	31747	RESISTOR, Carbon, 1800 ohm, 1/2 W
R15	31741	RESISTOR, Carbon, 3300 ohm, 1/2 W
R19	31728	RESISTOR, Carbon, 100 ohm, 1/2 W
R21	31729	RESISTOR, Carbon, 820 ohm, 1 W
R22	31744	RESISTOR, Carbon, 22,000 ohm, 1/2 W
R23	31720	RESISTOR, Carbon, 1000 ohm, 1 W
R24	34891	RESISTOR, Wire wound, 700 ohm, 5 W
R25	31730	RESISTOR, Wire wound, 5 ohm, 5 W
R27, R28	17078	RESISTOR, Carbon, 220,000 ohm, 1/2 W
R29	31732	RESISTOR, Carbon, 1500 ohm, 1/2 W
C1, C12	31733	CAPACITOR, Mylar, 0.22 mfd
C2	33425	CAPACITOR, Ceramic disc, 0.0033 mfd
C3	31716	CAPACITOR, Electrolytic, 3 section 10/500, 80/200, 200/200
C4	31731	CAPACITOR, Electrolytic, 10 mfd
C5, C6, C8 C9, C10	31727	CAPACITOR, Ceramic disc, 0.01 mfd
C7	31735	CAPACITOR, Ceramic disc, 100 mmfd
C11	31718	CAPACITOR, Electrolytic, 35 mfd
C13	31734	CAPACITOR, Ceramic disc, 0.005 mfd
C14	33426	CAPACITOR, Ceramic disc, 220 mmfd
C15	31717	CAPACITOR, Electrolytic, 80 mfd
C16, C18	25824	CAPACITOR, Ceramic disc, 0.02 mfd
C17	27789	CAPACITOR, Ceramic disc, 0.002 mfd

NOTE Early model amplifiers less tubes and volume control (P/N 011164) are no longer available. If the amplifier requires replacement, the projector must be modified for silicon photocell operation and the current amplifier assembly installed (see Service Instructions, paragraph 87).

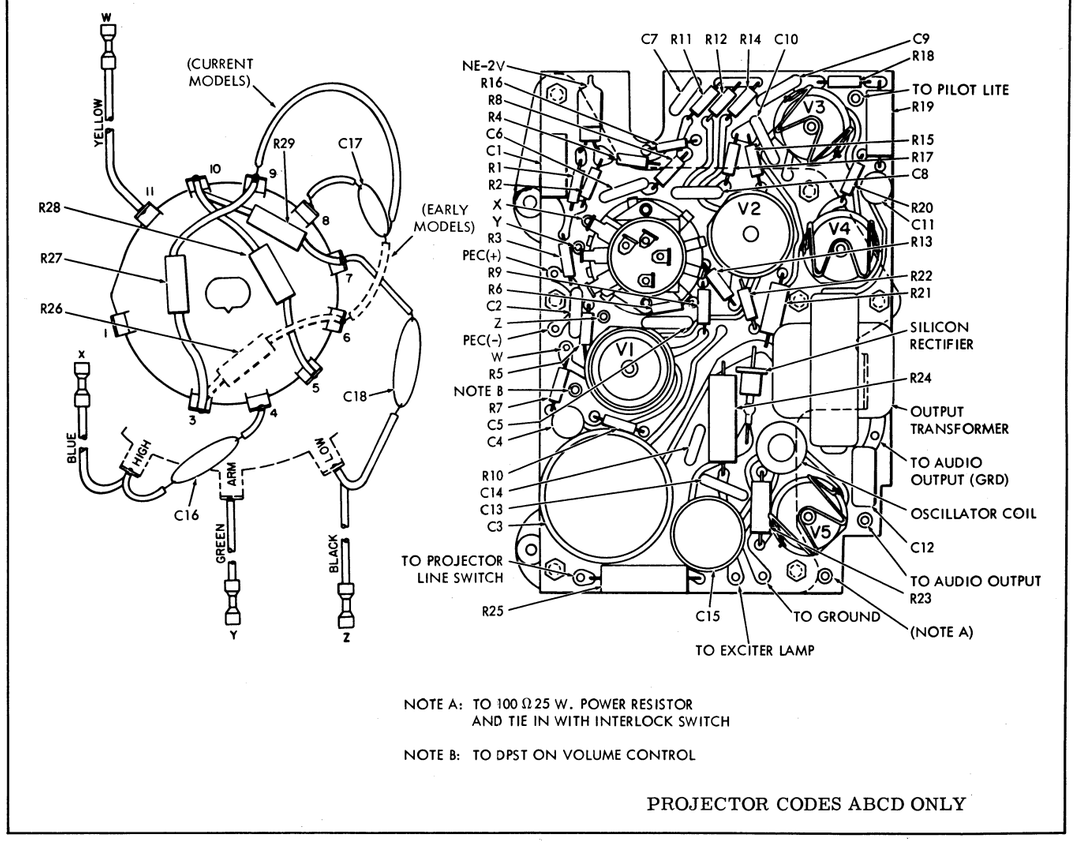
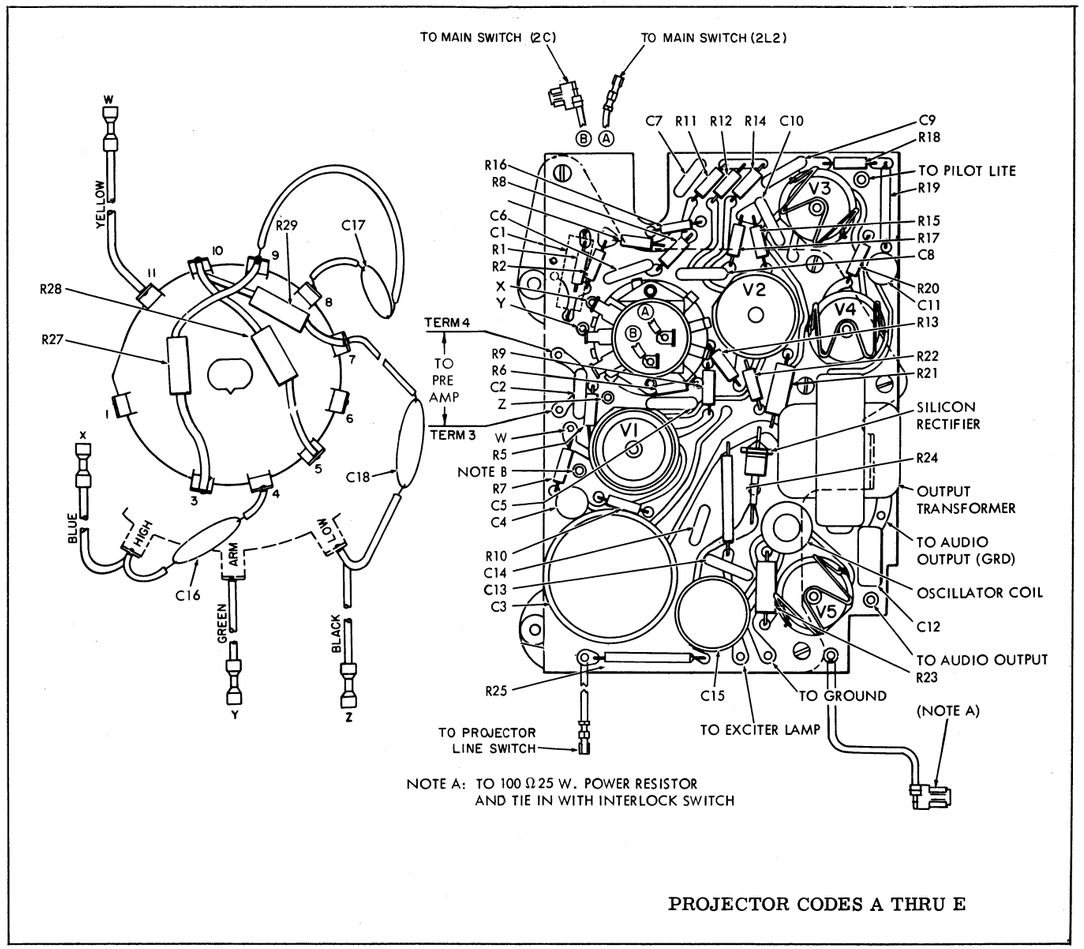


Figure 25. Amplifier Assembly, Photo Diode (Below Serial No. AU-99689)

REF. DESIGNATION	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7
		(SERIAL NO. AT-27350 TO AV-92157, CIRCUIT VALUE 40V ± 5V)
	33297	COIL, Oscillator (8V ± 0.75 V)
NE-2V	31723	LAMP, Glow (was NE-2E)
R1	31739	RESISTOR, Carbon, 100,000 ohm 1/2 W
R2	31745	RESISTOR, Carbon, 47,000 ohm 1/2 W
R3	34840	RESISTOR, Carbon, 220,000 ohm 1/2 W
R24	33335	RESISTOR, Wire wound, 350 ohm 5W
R26	Deleted	
C17	31737	(Current model wiring)
		(SERIAL NO. BELOW AT-27350)
R13	31743	RESISTOR, Carbon, 2200 ohm, 1/2 W
R26	31725	RESISTOR, Carbon, 150,000 ohm, 1/2 W
R27	31726	RESISTOR, Carbon, 180,000 ohm, 1/2 W
R28	31726	RESISTOR, Carbon, 180,000 ohm, 1/2 W
C17	31737	(Early model wiring)

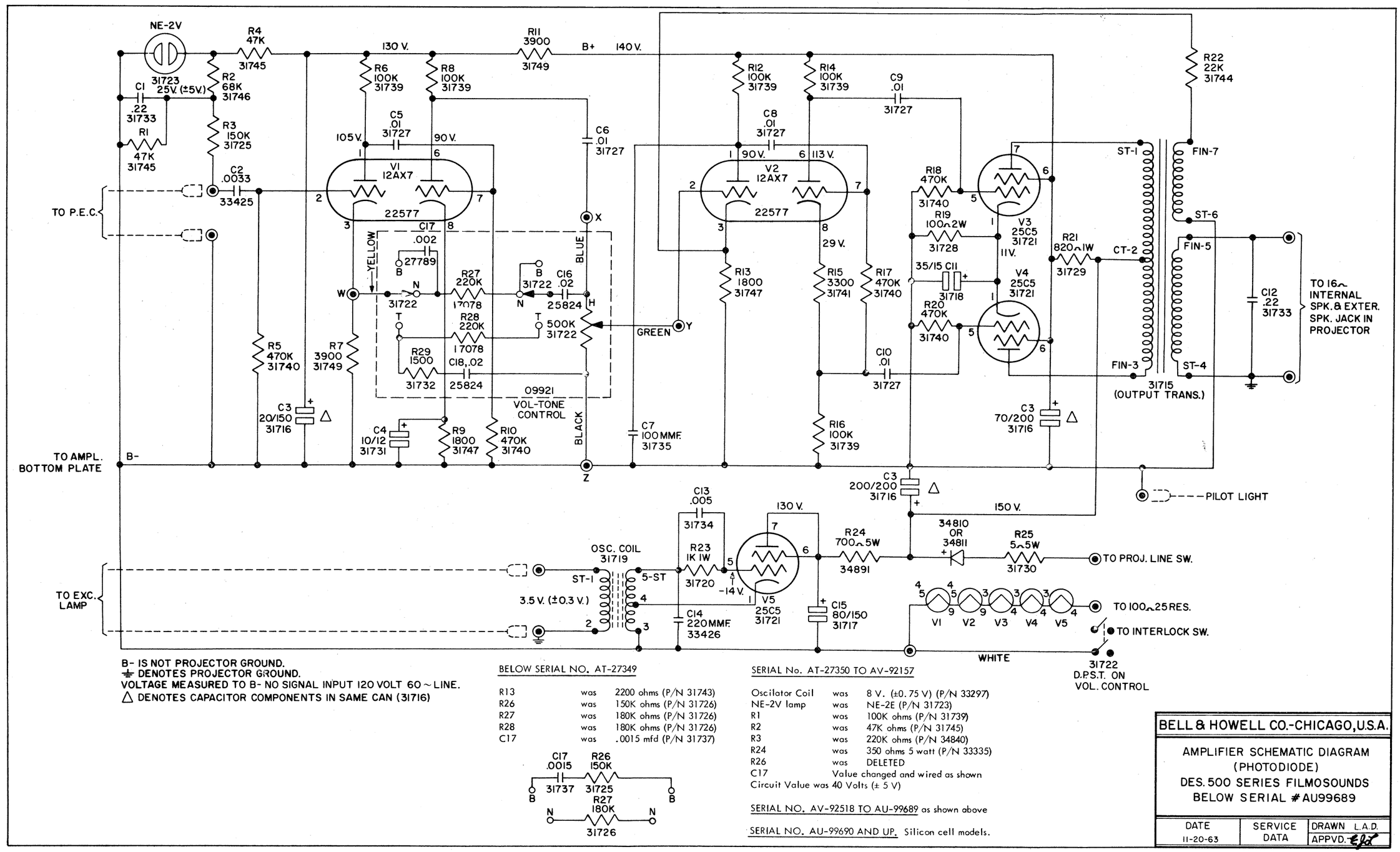
REFERENCE DESIGNATION	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7
		AMPLIFIER ASSEMBLY, SILICON CELL (012545 REFERENCE ONLY)
	No Number	AMPLIFIER ASSEMBLY, Projector (NOTE A)
V1, V2	22577	TUBE, 12AX7A or 7025
	39576	SOCKET, Tube V1
	39529	SOCKET, Tube V2
	37954	SHIELD, Tube V2
V3, V4, V5	31721	TUBE, 25C5
	31758	SOCKET, Tube, with clip, V3, V4, V5
	31715	TRANSFORMER, Output
	39508 or 34811	RECTIFIER, Silicon
	31719	COIL, Oscillator (3.5V ± 0.3V)
	09921	CONTROL ASSEMBLY, VOL-TONE (early models)
	31722	. CONTROL (With DPST line switch P/N 70343)
	39515	. CONTROL (With SPST line switch P/N 70462)
	012548	CONTROL ASSEMBLY, VOL-TONE (current models)
	41327	. CONTROL, Molded (with DPST line switch P/N 70512)
	41328	. CONTROL, Molded (with SPST line switch P/N 70513)
R1, R7, R11	31749	RESISTOR, Carbon, 3900 ohms, 1/2w
R2, R3 (early models)	31744	RESISTOR, Carbon, 22,000 ohms, 1/2w
R2, R3 (current models)	36315	RESISTOR, Carbon, 18,000 ohms, 1/2w
R5, R10, R17	31740	RESISTOR, Carbon, 470,000 ohms, 1/2w
R6, R8, R12, R14, R16	31739	RESISTOR, Carbon 100,000 ohms, 1/2w
R9, R13	31747	RESISTOR, Carbon, 1800 ohms, 1/2w
R15	31741	RESISTOR, Carbon, 3300 ohms, 1/2w
R18, R20 (early models)	31740	RESISTOR, Carbon, 470,000 ohms, 1/2w
R18, R20 (current models)	34840	RESISTOR, Carbon, 220,000 ohms, 1/2w
R19 (early models)	31728 or 36522	RESISTOR, Carbon, 100 ohms, 2w
R19 (current models)	37323	RESISTOR, Carbon, 150 ohms, 2w
R21	31729	RESISTOR, Carbon, 820 ohms, 1w
R22	31744	RESISTOR, Carbon, 22,000 ohms, 1/2w
R23	31720	RESISTOR, Carbon, 1000 ohms, 1w
R24 (early models)	34891	RESISTOR, Wirewound, 700 ohms, 5w
R24 (current models)	40273	RESISTOR, Wirewound, 700 ohms, 5w
R25 (early models)	31730	RESISTOR, Wirewound, 5 ohms, 5w
R25 (intermediate models)	37322	RESISTOR, Wirewound, 10 ohms, 5w
R25 (current models)	40274 or 40290	RESISTOR, Fuse type, 10 ohms, 5w
R27, R28	17078	RESISTOR, Carbon, 220,000 ohms, 1/2w
R29	31732	RESISTOR, Carbon, 1500 ohms, 1/2w
C1	35898	CAPACITOR, Electrolytic, 35 mfd, 16v
C2	36011	CAPACITOR, Ceramic disc, 0.0039 mfd
C3	31716	CAPACITOR, Electrolytic, 3 section 10.500, 80/200, 200/200
C4	31731	CAPACITOR, Electrolytic, 10 mfd
C5, C6, C8	31727	CAPACITOR, Ceramic disc, 0.01 mfd
C7	31735	CAPACITOR, Ceramic disc, 100 mfd
C9, C10 (early models)	31727	CAPACITOR, Ceramic disc, 0.01 mfd
C9, C10 (current models)	37325	CAPACITOR, Ceramic disc, 0.02 mfd
C11 (early models)	31718	CAPACITOR, Electrolytic, 35 mfd, 15v
C11 (current models)	37324	CAPACITOR, Electrolytic, 35 mfd, 25v
C12	31733	CAPACITOR, Mylar, 0.22 mfd
C13	31734	CAPACITOR, Ceramic disc, 0.005 mfd
C14	33426	CAPACITOR, Ceramic disc, 220 mfd
C15	31717	CAPACITOR, Electrolytic, 80 mfd
C16, C18	25824	CAPACITOR, Ceramic disc, 0.02 mfd
C17	27789	CAPACITOR, Ceramic disc, 0.002 mfd

NOTE A: For amplifier less tubes V1 through V5 and volume control P/N 012548, order P/N 011208. On amplifier assembly 011208 above serial number 25817, the leads to the volume and tone control connections are soldered directly to the amplifier (see appropriate schematic and wiring diagrams).



PROJECTOR CODES A THRU E

Figure 26. Amplifier Assembly (Silicon Cell)



B- IS NOT PROJECTOR GROUND.
⏚ DENOTES PROJECTOR GROUND.
VOLTAGE MEASURED TO B- NO SIGNAL INPUT 120 VOLT 60 ~ LINE.
△ DENOTES CAPACITOR COMPONENTS IN SAME CAN (31716)

BELOW SERIAL NO. AT-27349

R13	was	2200 ohms (P/N 31743)
R26	was	150K ohms (P/N 31726)
R27	was	180K ohms (P/N 31726)
R28	was	180K ohms (P/N 31726)
C17	was	.0015 mfd (P/N 31737)

SERIAL No. AT-27350 TO AV-92157

Oscilator Coil	was	8 V. (±0.75 V) (P/N 33297)
NE-2V lamp	was	NE-2E (P/N 31723)
R1	was	100K ohms (P/N 31739)
R2	was	47K ohms (P/N 31745)
R3	was	220K ohms (P/N 34840)
R24	was	350 ohms 5 watt (P/N 33335)
R26	was	DELETED
C17		Value changed and wired as shown

Circuit Value was 40 Volts (± 5 V)

SERIAL NO. AV-92518 TO AU-99689 as shown above

SERIAL NO. AU-99690 AND UP. Silicon cell models.

BELL & HOWELL CO.-CHICAGO, U.S.A.

AMPLIFIER SCHEMATIC DIAGRAM
(PHOTODIODE)
DES. 500 SERIES FILMOSOUNDS
BELOW SERIAL # AU99689

DATE	SERVICE DATA	DRAWN L.A.D.
11-20-63		APPVD.

Figure 27. Amplifier Schematic Wiring Diagram
(Photo Diode Cell, Serial No. AU-99689 and Below)

NOTES

1. EXCITER LAMP P/N 34884 CAN BE USED W/O WIRING CHANGES IN LIEU OF LAMP P/N 33307 (USED ON SERIAL NO. AV-91161 AND EARLIER).

2. DES. 542 AND 542EX (SOLID LEADS IN DIAGRAM) INCLUDE THE FOLLOWING:

   SELECTOR SWITCH P/N 011180
   FIRE SHUTTER SOLENOID P/N 011163
   CLUTCH SOLENOID P/N 011162
   ADAPTER P/N 32100
   INSULATOR P/N 34795

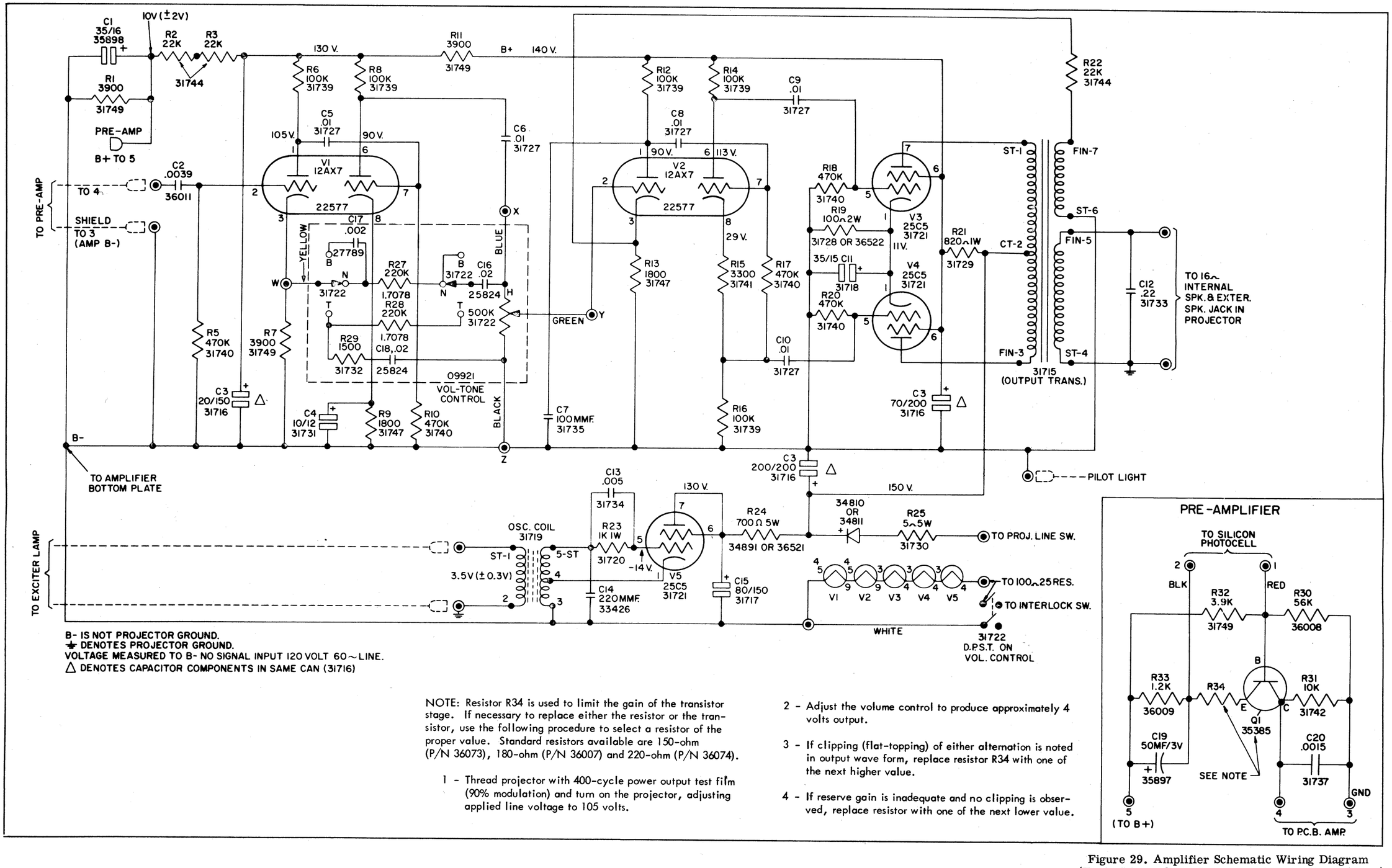
3. Mechanical Still Picture Control Starts with Serial No. 40526

BELL & HOWELL CO.-CHICAGO, U.S.A.

PROJECTOR WIRING DIAGRAM AND SCHEMATIC (PHOTODIODE) DES. 500 SERIES FILMOSOUNDS BELOW SERIAL # AU99689

DATE	SERVICE DATA	DRAWN L.A.D.
11-20-63		APPVD.

Figure 28. Projector Pictorial Wiring Diagram (Photo Diode Cell, Serial No. AU-99689 and Below)



NOTE: Resistor R34 is used to limit the gain of the transistor stage. If necessary to replace either the resistor or the transistor, use the following procedure to select a resistor of the proper value. Standard resistors available are 150-ohm (P/N 36073), 180-ohm (P/N 36007) and 220-ohm (P/N 36074).

1 - Thread projector with 400-cycle power output test film (90% modulation) and turn on the projector, adjusting applied line voltage to 105 volts.

2 - Adjust the volume control to produce approximately 4 volts output.

3 - If clipping (flat-topping) of either alternation is noted in output wave form, replace resistor R34 with one of the next higher value.

4 - If reserve gain is inadequate and no clipping is observed, replace resistor with one of the next lower value.

Figure 29. Amplifier Schematic Wiring Diagram
(Early Silicon Cell, Serial No. AU-99690 and Above)

*IN EARLY MODELS ONLY, ROOM LAMP RECEPTACLE (P/N 09815) WIRED AS SHOWN IN SCHEMATIC (NOT SHOWN IN PICTORIAL VIEW)

NOTE: FILMOSOUND WITH STILL PICTURE CONTROL

1. Solid Leads in Diagram

2. Addition of Following:

   Selector Switch 011180
   Fire Shutter Solenoid 011163
   Clutch Solenoid 011162
   Adaptor 32100
   Insulator 34795

3. Mechanical Still Picture Control Starts with Serial No. 40526

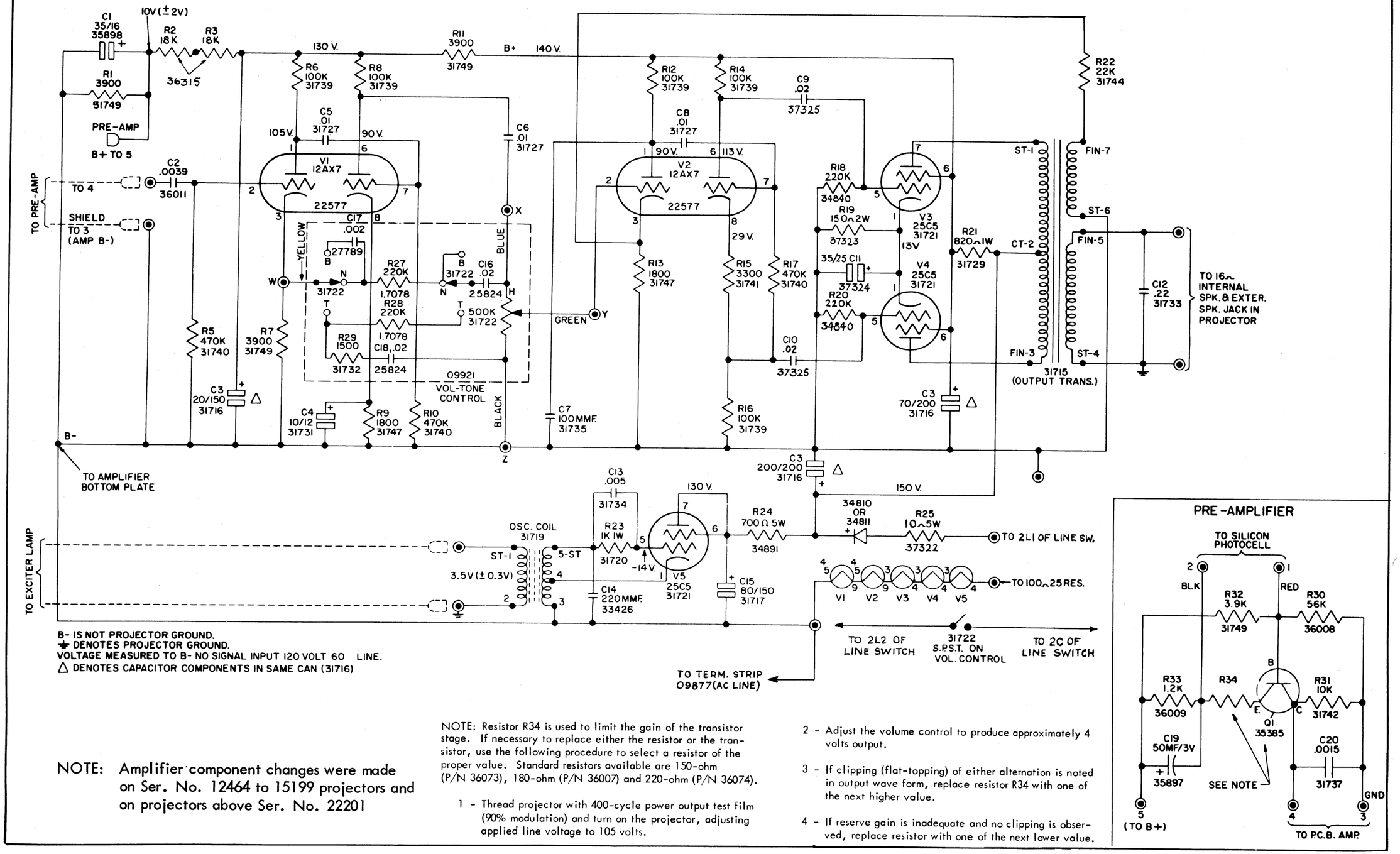
BELOW THIS LINE, DIAGRAM APPLIES TO PROJECTORS WITH STILL PICTURE CONTROL.

BELL & HOWELL CO.-CHICAGO, U.S.A.

PROJECTOR WIRING DIAGRAM AND SCHEMATIC (SILICON CELL) DES. 500 SERIES FILMOSOUNDS ABOVE SERIAL # AU99690

DATE	SERVICE DATA	DRAWN L.A.D.
1-15-63		APPVD.

Figure 30. Projector Pictorial Wiring Diagram (Early Silicon Cell, Serial No. AU-99690 and Above)



NOTE: Amplifier component changes were made on Ser. No. 12464 to 15199 projectors and on projectors above Ser. No. 22201

NOTE: Resistor R34 is used to limit the gain of the transistor stage. If necessary to replace either the resistor or the transistor, use the following procedure to select a resistor of the proper value. Standard resistors available are 150-ohm (P/N 36073), 180-ohm (P/N 36007) and 220-ohm (P/N 36074).

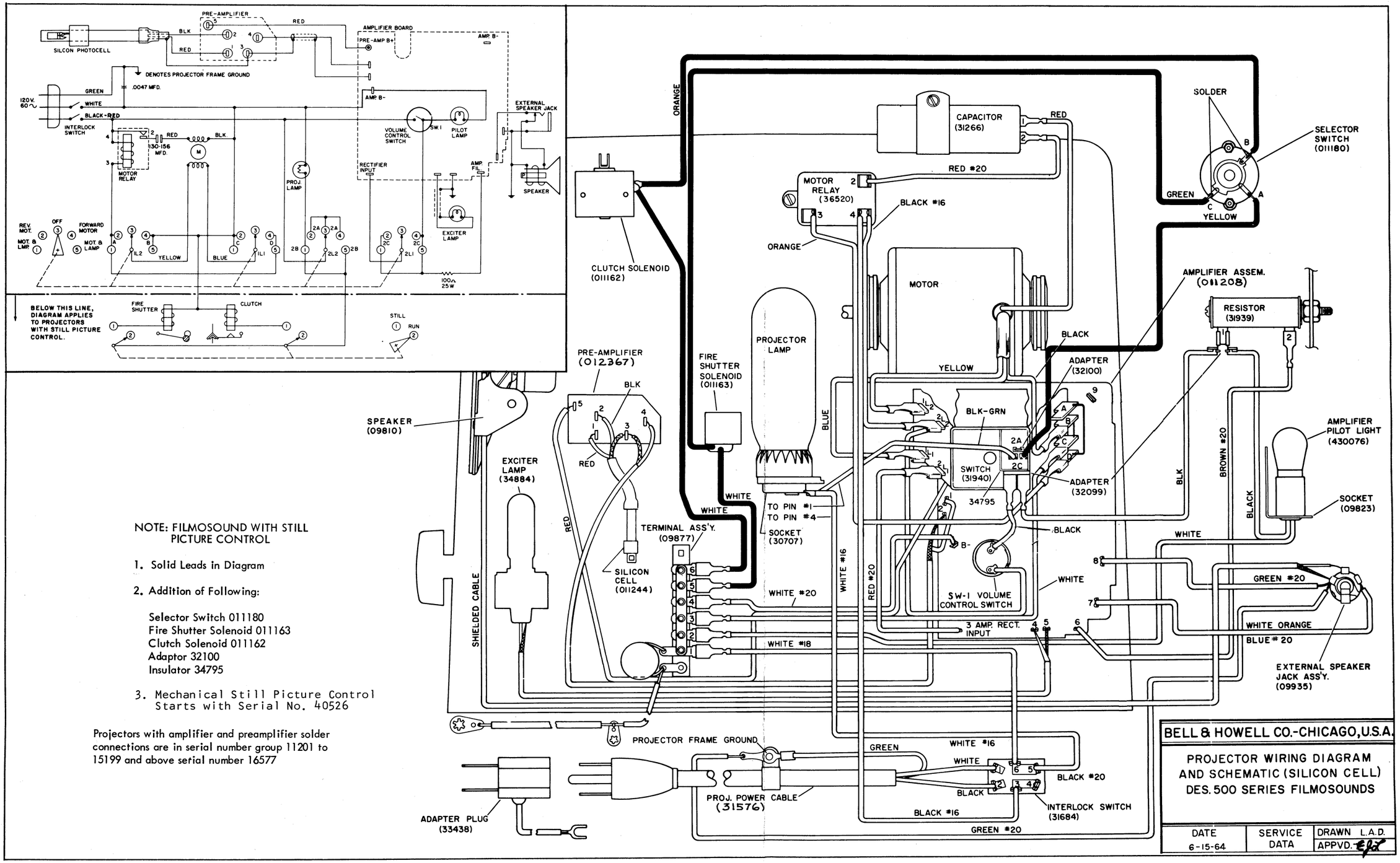
1 - Thread projector with 400-cycle power output test film (90% modulation) and turn on the projector, adjusting applied line voltage to 105 volts.

2 - Adjust the volume control to produce approximately 4 volts output.

3 - If clipping (flat-topping) of either alternation is noted in output wave form, replace resistor R34 with one of the next higher value.

4 - If reserve gain is inadequate and no clipping is observed, replace resistor with one of the next lower value.

Figure 31. Amplifier Schematic Wiring Diagram
(Interim Silicon Cell Models: See Note in Diagram)



NOTE: FILMOSOUND WITH STILL PICTURE CONTROL

1. Solid Leads in Diagram

2. Addition of Following:

   Selector Switch 011180
   Fire Shutter Solenoid 011163
   Clutch Solenoid 011162
   Adaptor 32100
   Insulator 34795

3. Mechanical Still Picture Control Starts with Serial No. 40526

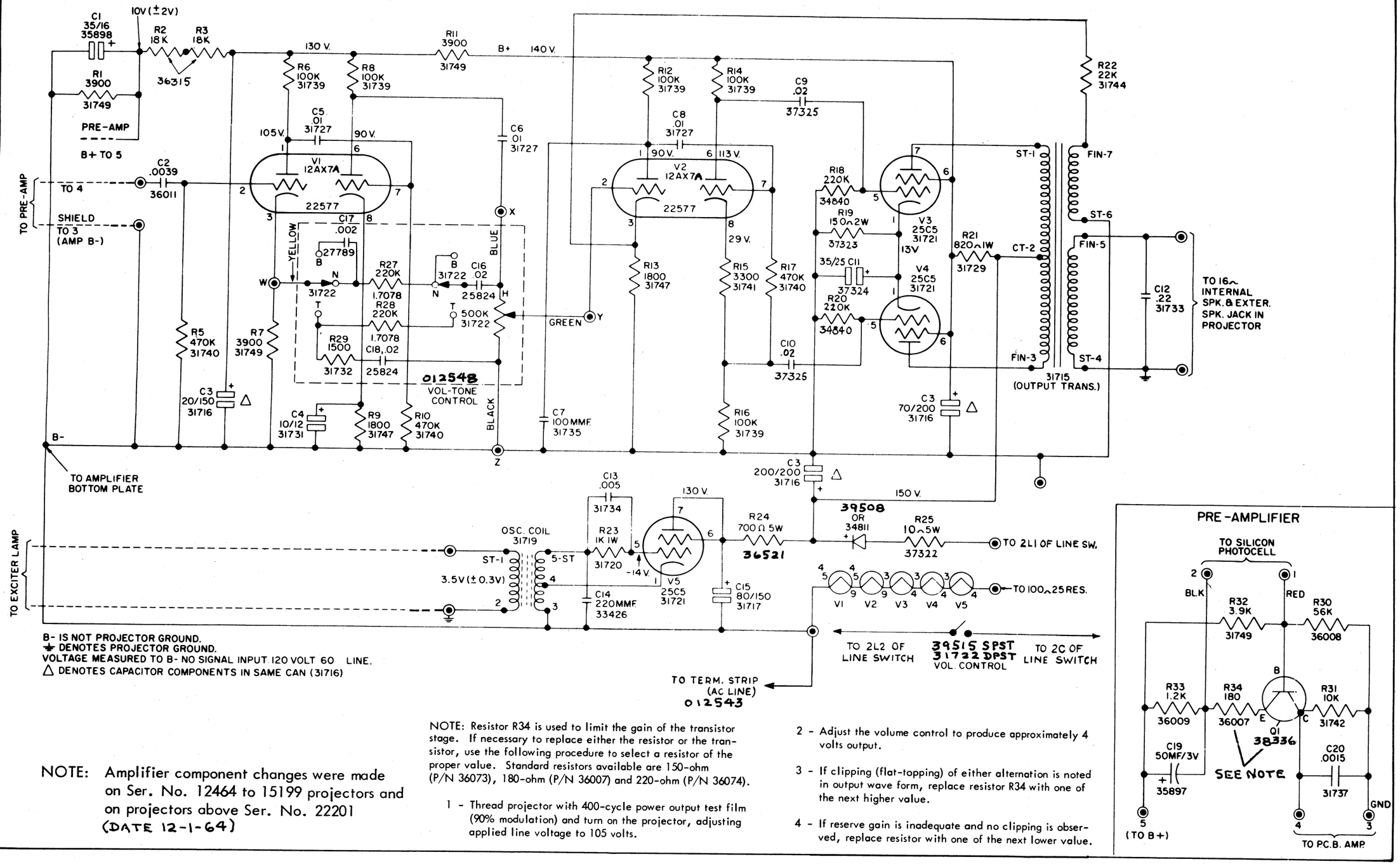
Projectors with amplifier and preamplifier solder connections are in serial number group 11201 to 15199 and above serial number 16577

BELL & HOWELL CO.-CHICAGO, U.S.A.

PROJECTOR WIRING DIAGRAM AND SCHEMATIC (SILICON CELL) DES. 500 SERIES FILMOSOUNDS

DATE	SERVICE DATA	DRAWN L.A.D.
6-15-64		APPVD.

Figure 32. Projector Pictorial Wiring Diagram (Interim Silicon Cell Models: See Note in Diagram)



NOTE: Amplifier component changes were made on Ser. No. 12464 to 15199 projectors and on projectors above Ser. No. 22201 (DATE 12-1-64)

NOTE: Resistor R34 is used to limit the gain of the transistor stage. If necessary to replace either the resistor or the transistor, use the following procedure to select a resistor of the proper value. Standard resistors available are 150-ohm (P/N 36073), 180-ohm (P/N 36007) and 220-ohm (P/N 36074).

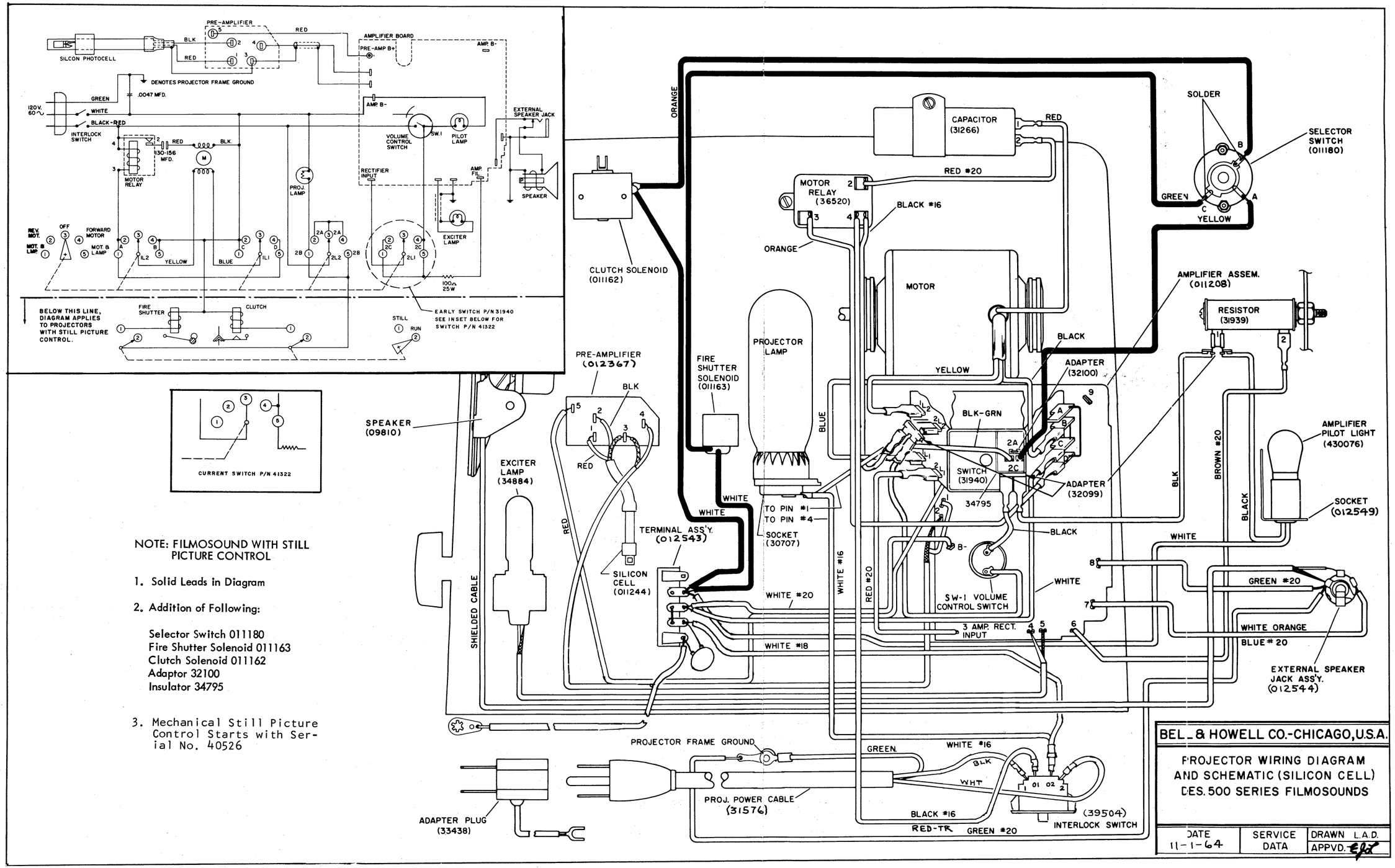
1 - Thread projector with 400-cycle power output test film (90% modulation) and turn on the projector, adjusting applied line voltage to 105 volts.

2 - Adjust the volume control to produce approximately 4 volts output.

3 - If clipping (flat-topping) of either alternation is noted in output wave form, replace resistor R34 with one of the next higher value.

4 - If reserve gain is inadequate and no clipping is observed, replace resistor with one of the next lower value.

Figure 33. Amplifier Schematic Wiring Diagram (Current Silicon Cell and Interlock Switch)



NOTE: FILMOSOUND WITH STILL PICTURE CONTROL

1. Solid Leads in Diagram
2. Addition of Following:

   Selector Switch 011180
   Fire Shutter Solenoid 011163
   Clutch Solenoid 011162
   Adaptor 32100
   Insulator 34795

3. Mechanical Still Picture Control Starts with Serial No. 40526

Figure 34. Projector Pictorial Wiring Diagram (Current Silicon Cell and Interlock Switch)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		INTEGRATED CIRCUIT AMPLIFIER (Projector Codes FGH only)		
35-	013850	AMPLIFIER ASSEMBLY, Integrated circuit	REF	FGH
-1	700008	. SCREW	1	FGH
-2	600735	. WASHER	1	FGH
-3	40814	. CLIP, Leadwire retaining	1	FGH
-4	36848	. SCREW	4	FGH
-5	35164	. NUT, Hex	4	FGH
-6	43204	. TRANSFORMER, Power	1	FGH
-7	36848	. SCREW	1	FGH
-8	014021	. BARRETTER AND BRACKET ASSEMBLY	1	FGH
-9	19233	. NUT, Hex	1	FGH
-10	19154	. WASHER, Lock	1	FGH
-11	43209	. CIRCUIT BREAKER	1	FGH
-12	621132	. SCREW	3	FGH
-13	34784	. WASHER	3	FGH
-14	36848	. SCREW	3	FGH
-15	014020	. CIRCUIT BOARD, Amplifier (see Figure 34 for parts)	1	FGH
-16	013853	. CIRCUIT BOARD, Power supply (see Figure 34 for parts)	1	FGH
-17	31685	. JACK, Auxiliary speaker	1	FGH
-18	41130	. PLATE, Amplifier mounting	1	FGH

FIGURE 36
AMPLIFIER CIRCUIT BOARD COMPONENTS

REFERENCE DESIGNATION	PART NO.	DESCRIPTION
C1	41398	CAPACITOR
C2, C3	88654	CAPACITOR
C5	41172	CAPACITOR
C6	41171	CAPACITOR
C7	41394	CAPACITOR
C8	29630	CAPACITOR
C9	41392	CAPACITOR
C10, C11	41393	CAPACITOR
C12	31733	CAPACITOR
D1, D2	43210	DIODE
D3 to D6	41173	DIODE
IC-1	41180	BARRETTER
Q1	41175	TRANSISTOR
Q2	41176	TRANSISTOR
Q3	41177	TRANSISTOR

REFERENCE DESIGNATION	PART NO.	DESCRIPTION
R1	41192	RESISTOR
R2	41191	RESISTOR
R3	41190	RESISTOR
R4	41189	RESISTOR
R5	31743	RESISTOR
R8	38187	RESISTOR
R9	41188	RESISTOR
R10	41186	RESISTOR
R11	31732	RESISTOR
R12	38182	RESISTOR
R13	41193	RESISTOR
R14, R15	36074	RESISTOR
R16, R17	765286	RESISTOR
R18, R19	36311	RESISTOR
R20, R21	43202	RESISTOR
R22	41194	RESISTOR
Q4	013950	TRANSISTOR ASSEMBLY
Q5, Q7	013955	TRANSISTOR ASSEMBLY

POWER SUPPLY CIRCUIT BOARD COMPONENTS

C13, C14	41396	CAPACITOR
C15	41397	CAPACITOR
C16	41395	CAPACITOR
C17	41393	CAPACITOR
D7 to D14	41174	DIODE
Q6	41177	TRANSISTOR
R23, R25	31743	RESISTOR
R24	41185	RESISTOR
	0131950	TRANSISTOR ASSEMBLY

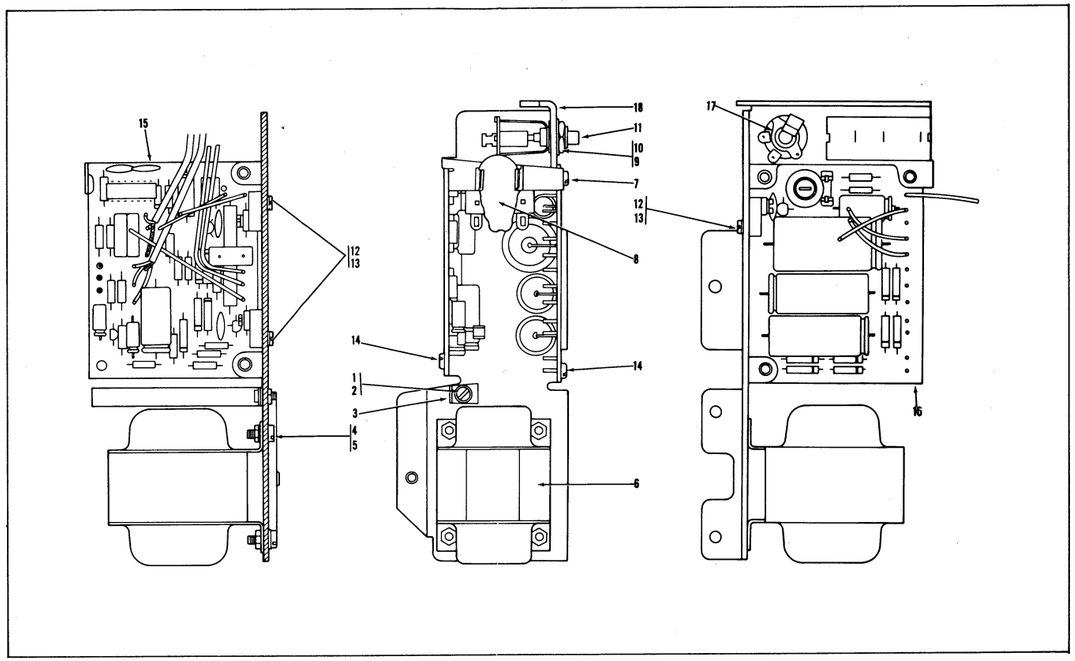


Figure 35. Integrated Circuit Amplifier Assembly, Complete

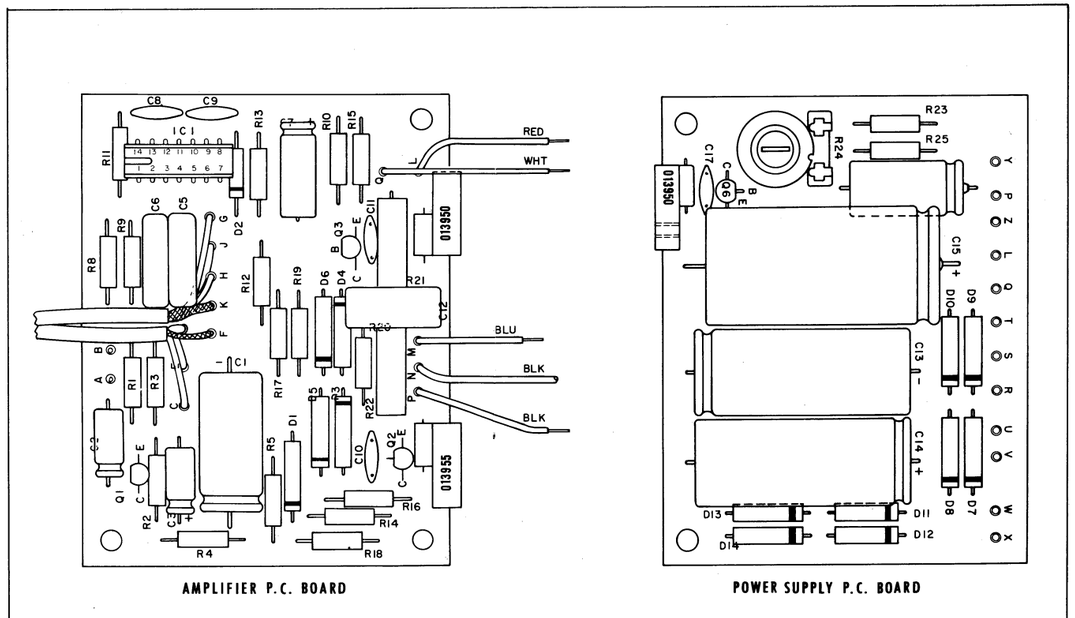
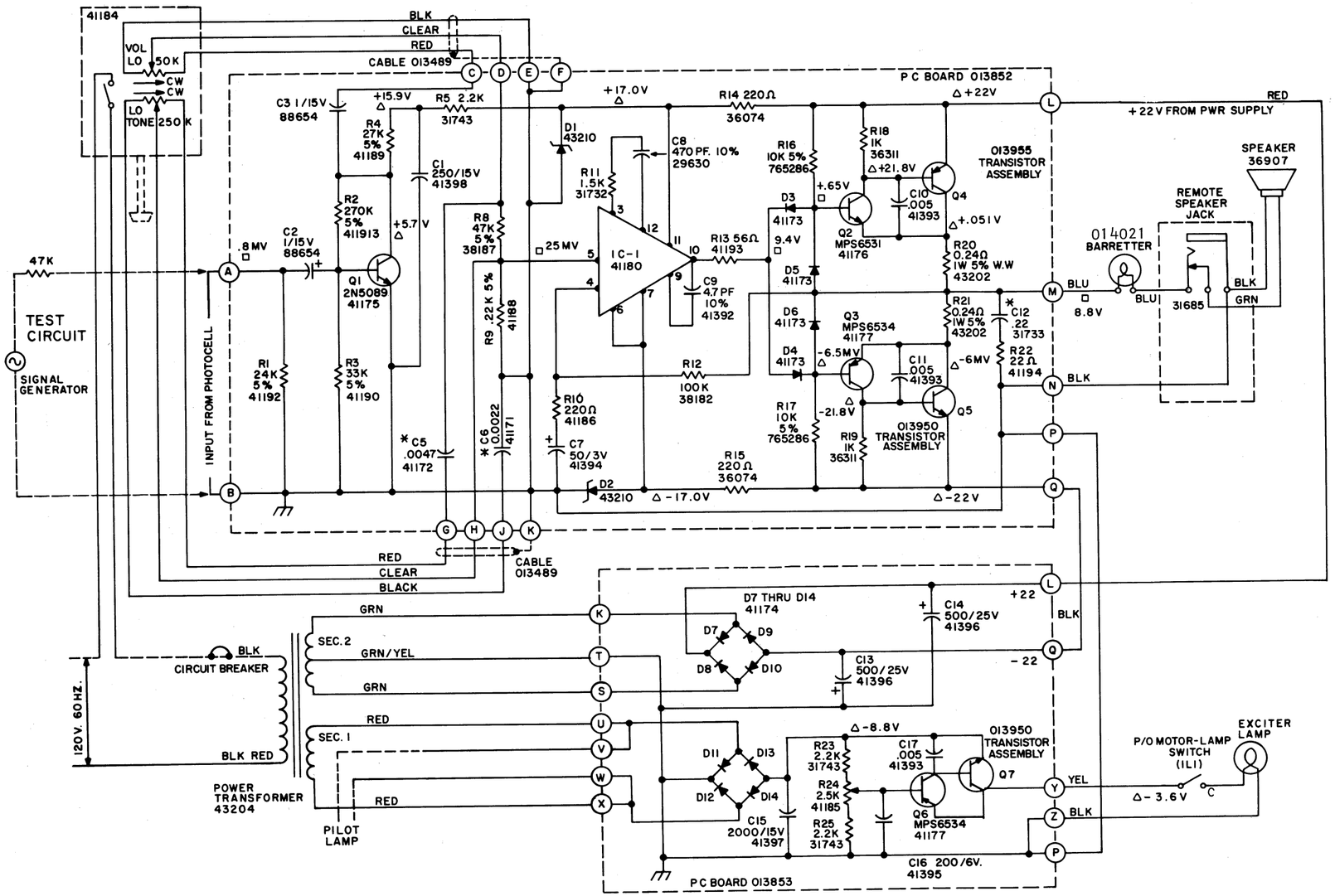
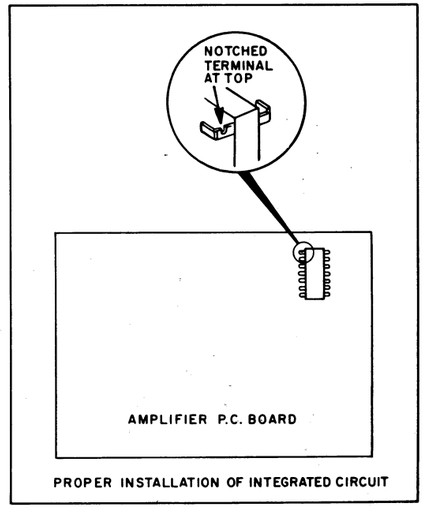


Figure 36. Printed Circuit Board Components (Integrated Circuit Style)





NOTES: ALL MEASUREMENTS MADE WITH 120V 60HZ LINE

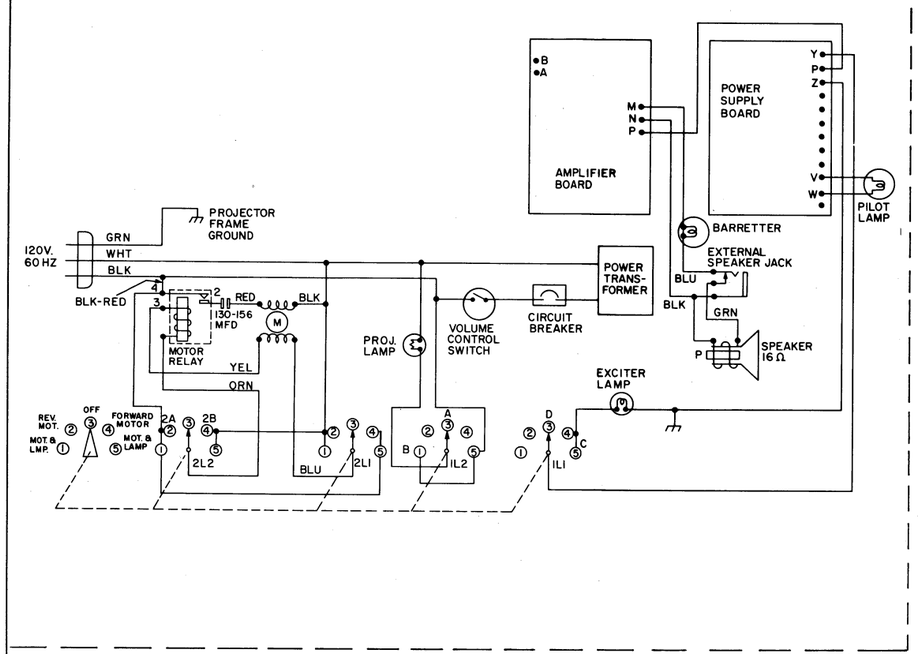
△ = DC VOLTAGES MEASURED TO GROUND USING ELECTRONIC VOLTMETER WITHOUT SIGNAL, ±10%.

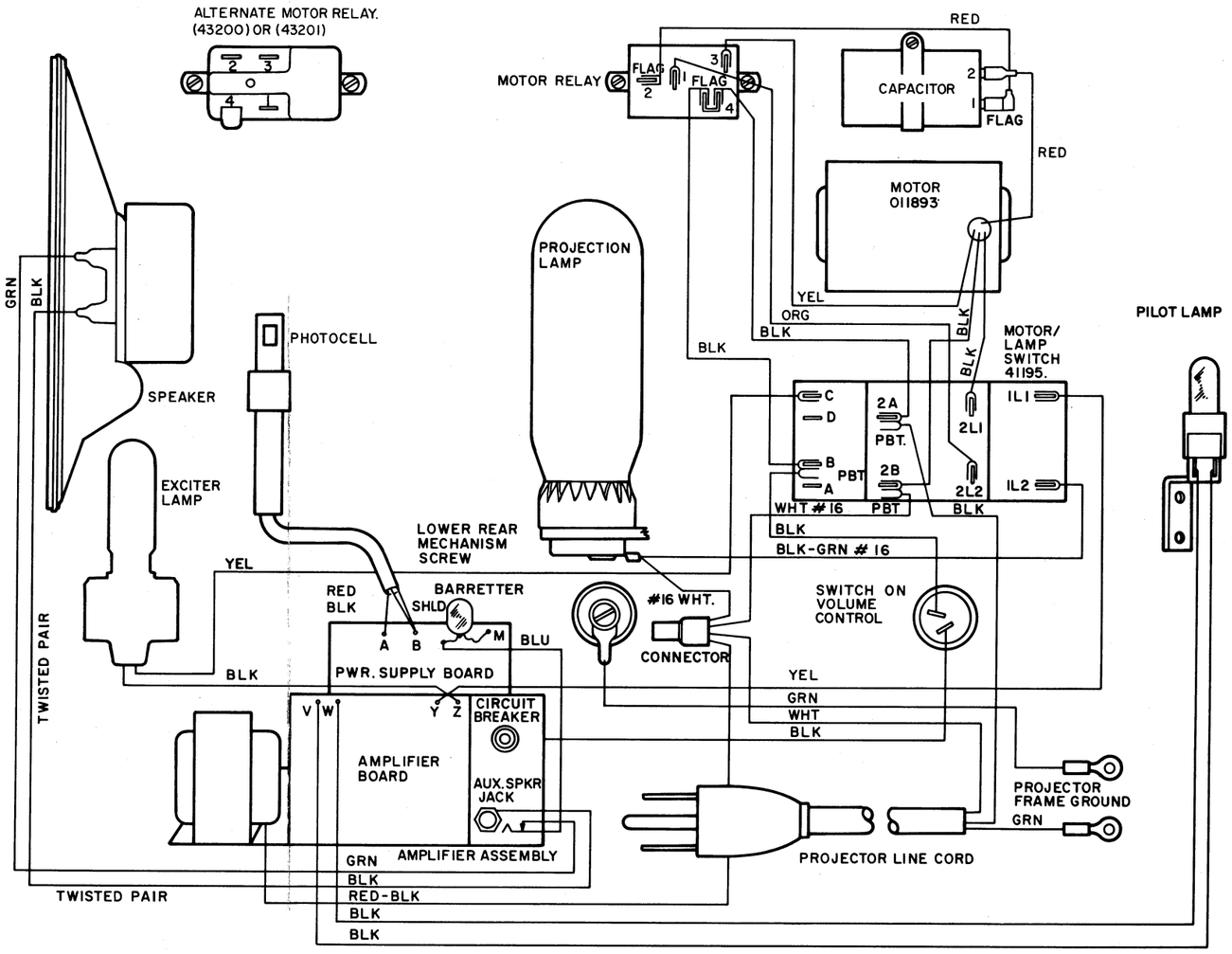
□ = SIGNAL VOLTAGES MEASURED TO GROUND, USING ELECTRONIC VOLTMETER; VOLUME CONTROL MAX. CW, 8 WATTS OUTPUT (8 VOLTS) INTO 8 OHM RESISTIVE LOAD AT 1000 HZ ± 10%.

EXCITER LAMP PART OF SOUNDHEAD ASSEMBLY.

PROJECTOR CODES FGH ONLY

Figure 37. Schematic Diagram - Integrated Circuit Amplifier and Power Supply





PROJECTOR CODES FGH ONLY

Figure 38. Projector Wiring Diagram and Schematic - Integrated Circuit Amplifier Models

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		DUAL AV SPEAKERS		
39-	011193	SPEAKER ASSY, Complete (black)	9	
39-	011194	SPEAKER ASSY, Complete (green)	2	
-1	33479	. SCREW, Front cover	2	
-2	33486	. SCREW, Front cover	1	
-3	33481	. NUT, Tinnerman, front cover	1	
-4	09939	. COVER ASSY, Front (black)	1	
39-	09942	. COVER ASSY, Front (green)	1	
39-	09940	. COVER ASSY, Rear, not shown (black)	4	
39-	09943	. COVER ASSY, Rear, not shown (green)	8	
-5	18086	. FOOT, Rubber	1	
-6	33482	. SCREW, Speaker attaching	1	
-7	34876	. SPEAKER, Woofer	4	
-8	33444	. SPEAKER, Tweeter	4	
-9	34485	. SCREW, Handle bracket	2	
-10	33483	. SPEEDNUT, Twin	4	
-11	33471	. BRACKET, Handle	1	
-12	33484	. SCREW, Handle attaching	1	
-13	33369	. STRAP, Handle	2	
-14	33368	. BODY, Handle	1	
-15	33391	. SCREW, Handle cap	1	
-16	33371	. CAP, Handle	1	
-17	33370	. GRIP, Handle	1	
-18	33470	. GROMMET, Rubber, speaker cable	1	
-19	34877	. CAPACITOR	1	
-20	19010	. NUT, Input jack	1	
-21	25368	. WASHER, Key	1	
-22	400449	. WASHER	1	
-23	28059	. INPUT JACK	1	
-24	28088	. PLUG, Phone-jack	1	

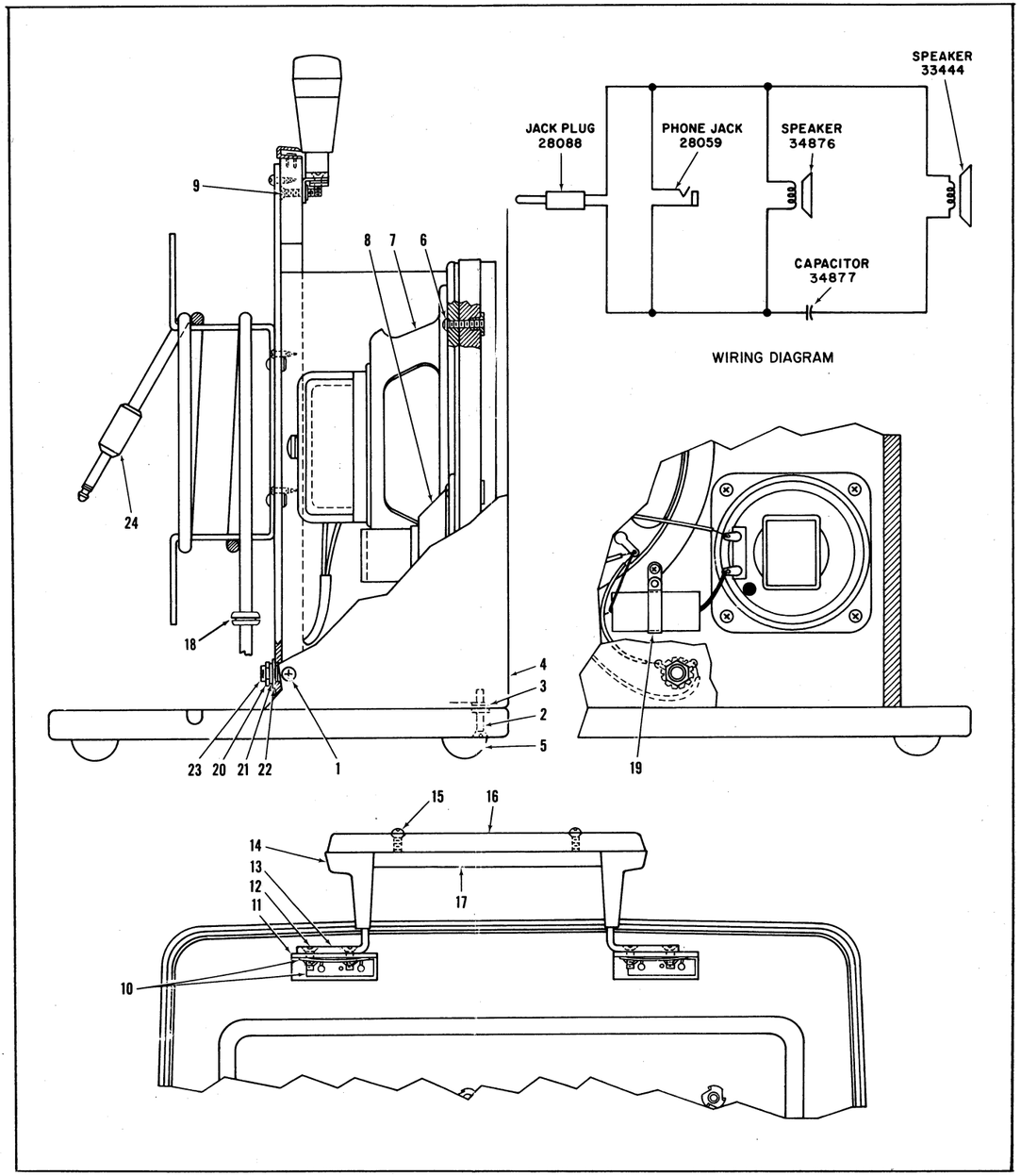


Figure 39. Dual AV Speaker Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		25-WATT POWER SPEAKER		
40-	040322	POWER SPEAKER, 25-watt	1	
40-	01873	. REEL, 1600 foot (not shown)	1	
40-	08985	. CABLE ASSY, 50-foot (not shown)	1	
-1	82034	. SCREW, Amplifier cover	4	
-2	620004	. WASHER	4	
-3	22045	. NUT, Speed	4	
-4	23736	. COVER, Amplifier	1	
-5	08995	. AMPLIFIER ASSY	1	
-6	23336	. . KNOB, Volume control	1	
40-	040323	. CASE ASSY, Speaker	1	
-7	28037	. . SCREW, Speaker attaching	4	
-8	28035	. . SPEAKER	1	
-9	1973	. . SCREW, Wood	1	
-10	17455	. . CLAMP, Cable	1	
-11	09050	. . CABLE ASSY, 12-inch	1	
-12	23414	. . SCREW, Reel clip attaching	4	
-13	23619	. . CLIP, Reel	1	
-14	28048	. . RIVET, Tubular	20	
-15	400304	. . HINGE	1	
-16	28042	. . DRAWBOLT	2	
-17	28043	. . CATCH, Drawbolt	2	
-18	18086	. . FOOT, Rubber	4	
-19	18087	. . NUT, Tee	1	
-20	23414	. . SCREW, Wood, guide bracket	2	
-21	28026	. . BRACKET, Guide	1	
-22	430145	. . SCREW, Machine, handle top	2	
-23	24736	. . NUT, Tinnerman	2	
-24	430062	. . HANDLE, Top	1	
-25	21736	. . RING, Retaining	2	
-26	430142	. . WASHER, Flat	2	
-27	430144	. . CUSHION	2	
-28	430193	. . SPRING	2	
-29	430192	. . SLEEVE, Stop	2	
-30	430097	. . PIN, Roll	2	
-31	430189	. . POST, Handle	2	
-32	430037	. . CHANNEL, Handle	1	

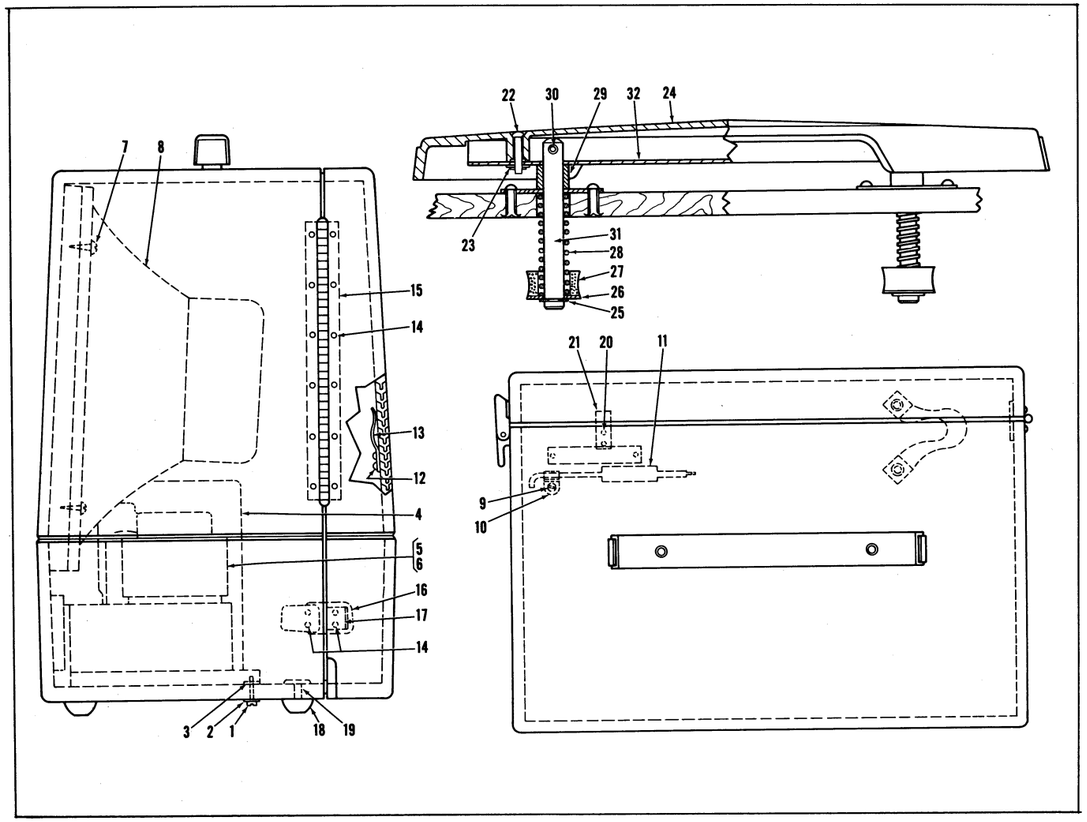


Figure 40. 25-Watt Power Speaker Assembly

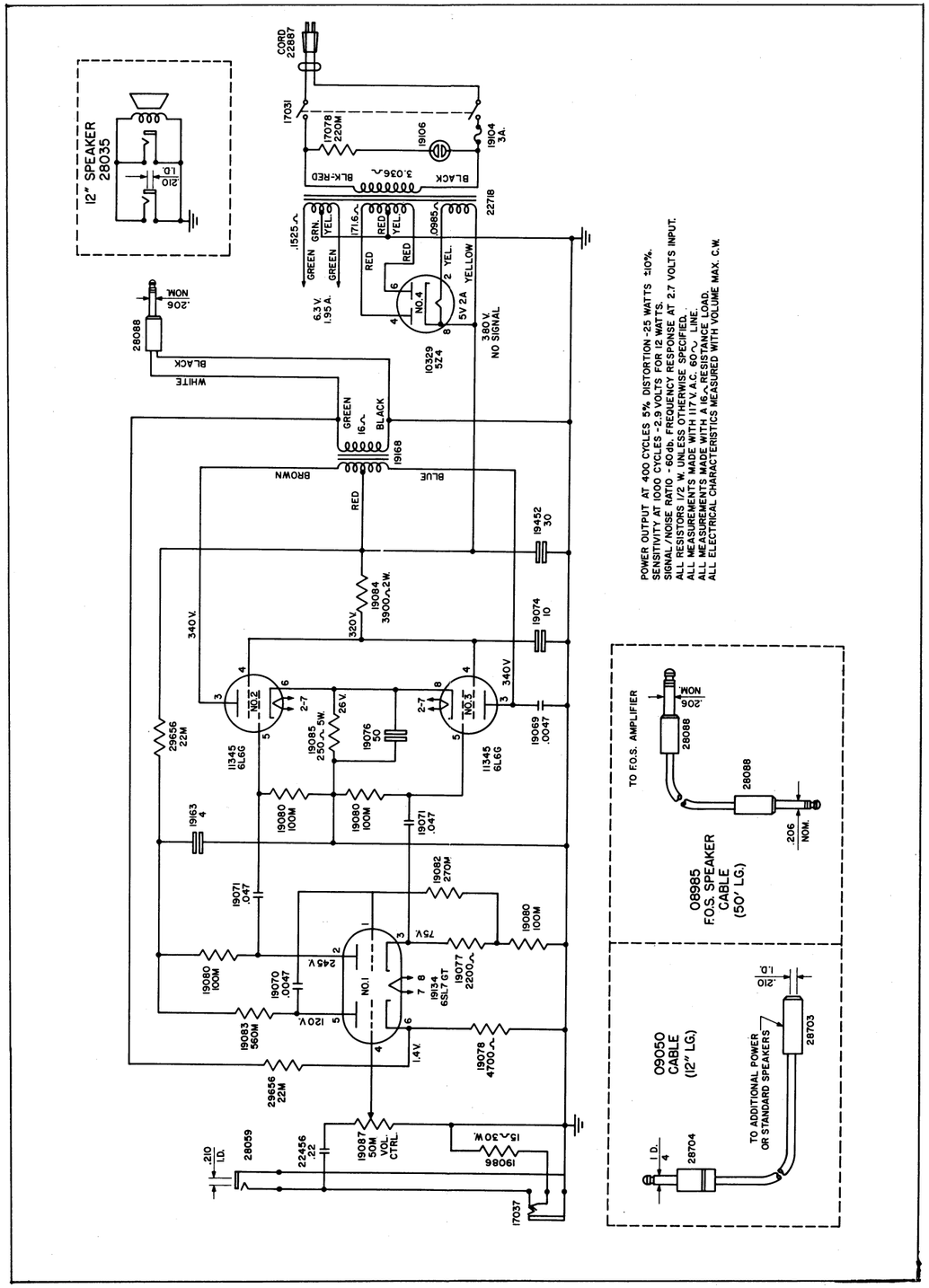
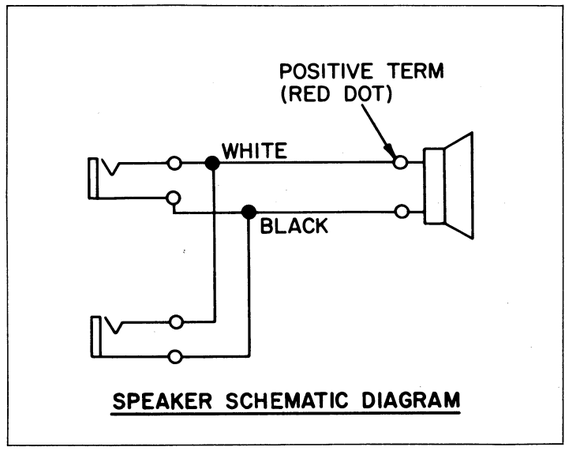


Figure 41. 25-Watt Power Speaker Schematic Diagram

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		ORCHESTRICON II SPEAKER ASSEMBLY		
42-	012568	SPEAKER ASSEMBLY, Orchestricon II	1	
-1	36293	. RIVET, Tubular	4	
-2	36291	. LATCH, Speaker Door	1	
-3	39190	. RIVET, Tubular	2	
-4	400541	. BUMPER, Recessed	2	
-5	700846	. RIVET, Tubular	10	
-6	39759	. HINGE, Speaker door	2	
-7	12087	. NUT, Hex	2	
-8	30404	. WASHER	2	
-9	39760	. HANDLE, Carrying, complete	1	
-10	012567	. CABLE AND CONNECTOR ASSEMBLY (NOTE A)	1	
-11	33464	. SCREW, Wood, flat head	9	
-12	012570	. REEL ASSEMBLY, Cable storage	1	
-13	012569	. STUD ASSEMBLY, Reel storage	1	
-14	37897	. WASHER	1	
-15	25617	. NUT, Special	1	
-16	38059	. RECEPTACLE, Jack plug	2	
-17	25368	. WASHER	2	
-18	012574	. BAFFLE ASSEMBLY, Speaker	1	
-19	39762	. GRILLE, Deflector (secure with staples 29062)	1	
-20	19037	. NUT, Hex	4	
-21	23382	. WASHER	4	
-22	40269	. SCREW, Special	4	
-23	39761	. SPEAKER	1	
-24	39765	. GRILLE, Speaker	1	
-25	40268	. TRIM, Decorative (cement in place)	1	
-26	18086	. FOOR, Rubber	4	
-27	25617	. WASHER, Flat	4	
-28	012571	. CASE AND DOOR ASSEMBLY, Speaker	1	
-29	40272	. PAD, (secured with grille p/n 39762)	1	
42-	39774	. NAMEPLATE, Bell & Howell	1	
42-	39775	. NAMEPLATE, Operating notice	1	

NOTE A: Molded cable and connector P/N 40291 may be furnished as an alternate for cable assembly P/N 012567.



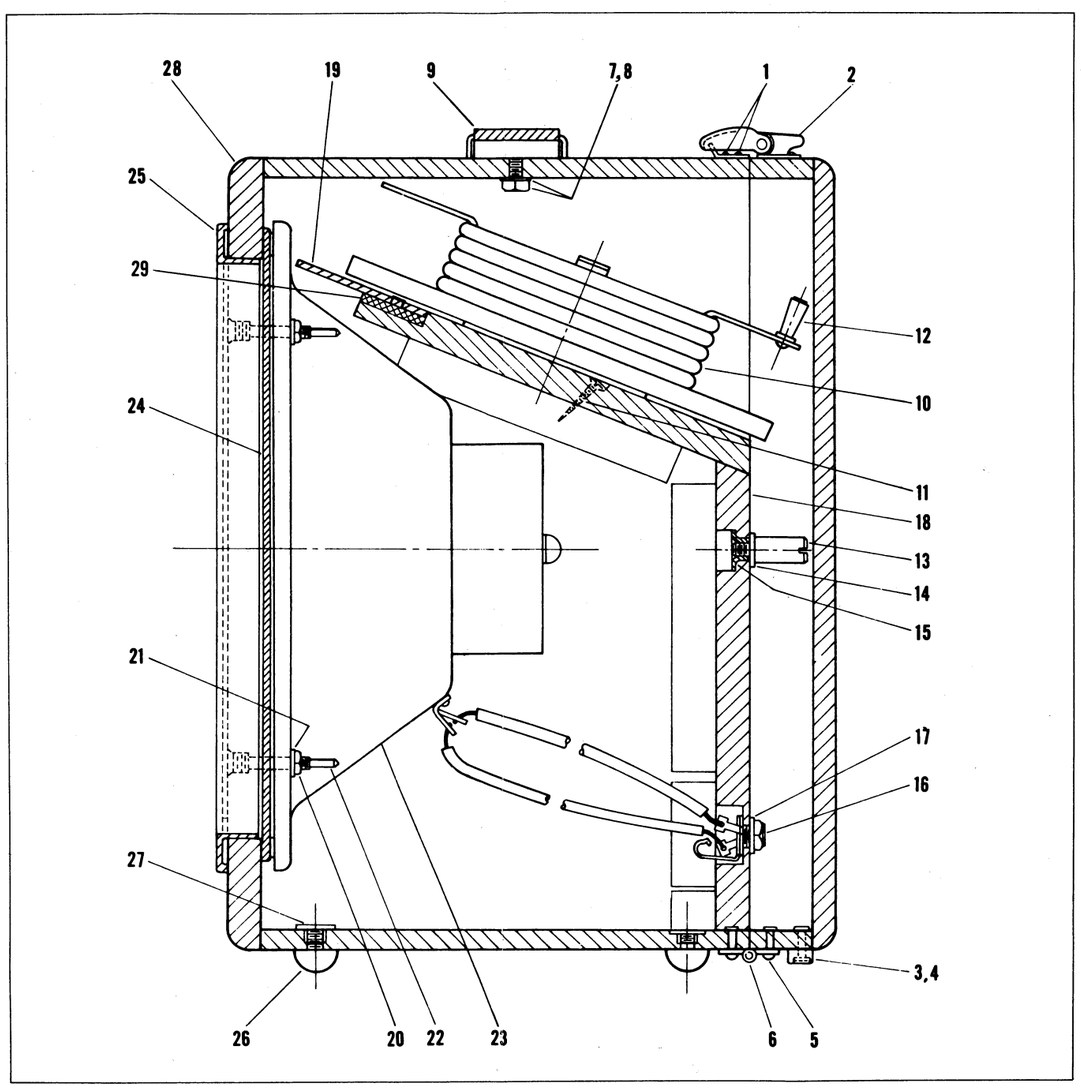


Figure 42. External (Orchestricon II) Speaker Assembly

NUMERICAL INDEX OF PARTS

PART NO.	FIG. & INDEX NO.
01873	40-
03980	2C-10, 10-
07999	12-
08985	40-
08995	40-5
09050	40-11
09702	16-22A
09709	17-24; 22-
09710	17-13
09711	17-15
09712	16-23
09721	14-20
09722	19-9
09724	14-26
09728	17-23
09729	16-5, 21-
09730	14-29
09732	16-27
09747	4A-11, 4B-7
09752	9-30, 10-28
09753	10-4
09755	10-6
09759	3-5, 11-
09762	24-
09768	7-15
09769	7-16
09770	2D-3
09771	2A-8
09774	9-10
09776	9-8
09777	9-27
09778	9-26
09783	24-16
09784	22-5
09786	15-18D
09803	8-20
09805	4A-4
09806	12-8
09810	7-4
09811	3-3
09815	8-
09817	7-27
09821	3-13
09822	3-22
09826	13-25
09828	13-13
09832	13-35
09833	13-34
09834	13-28
09835	13-29
09838	13-37
09839	13-10
09840	13-14
09843	15-18
09847	20-3
09849	2D-15, 2E-11, 2F-11, 9-
09850	2A-14, 2B-10, 10-
09852	17-24B
09870	17-7
09877	8-25
09879	5-17
09885	17-7L
09886	17-7G
09887	3-9
09888	7-20
09896	3-8
09902	8-14
09909	1-1G
09910	1-16
09912	1-3
09914	1-3
09939	39-4
09940	39-
09942	39-
09943	39-
09946	1-3C
011160	12-
011162	5-6
011163	5-15
011172	4-21
011174	8-9
011175	1-3B
011177	19-9
011178	15-5A, 19-
011179	3-13
011180	3-16
011181	19-4
011182	15-5A, 19-
011184	1-1
011188	13-8
011193	39-
011194	39-
011195	15-5, 19-
011196	14-37
011198	14-38
011199	14-4, 18-
011200	14-4, 18-
011203	13-22
011212	15-31
011219	16-19
011223	4B-4
011226	14A-8
011229	23-10
011230	1-1
011235	16-17
011236	16-22
011243	20-12
011244	13-24
011248	15-35
011249	15-27
011250	15-29
011280	11-
011282	21-6
011886	16-12
011889	10-15
011893	7-27
011898	1-1
011902	24-16
011939	4-7
011940	18-1
011941	18-11
011945	2A-2
011946	6-8
011948	9-13, 10-25
012121	14-31
012122	24A-9
012123	24A-
012124	24A-5
012126	14-35
012132	20-12
012330	4-7
012137	14A-16
012138	14A-7
012140	14A-18
012367	8-37, 23-
012427	16-5, 21-
012428	6-18
012429	6-20
012430	6-23
012527	15-18E
012534	3-13
012535	6-9
012536	1-5, 14A-19
012543	8-25
012544	8-21
012549	3-22B
012564	2B-6
012567	42-10
012568	42-
012569	42-13
012570	42-12
012571	42-28
012574	42-18
012579	21-6
012650	2D-9
012652	24A-
012653	24A-
012654	2C-4
012656	2E-5
012658	2E-3
012661	2F-3
012662	2F-5
012666	17-24B
012893	1-1
013009	16-25
013327	4-21, 13-
013330	13-38
013332	13-1
013337	9-34
013342	17-38
013344	17-38
013345	17-38
013349	14-4, 18-
013351	18-11
013352	14-4, 18-
013355	18-11
013372	1-3
013373	3-22
013377	3-13
013381	1-3
013383	3-13
013398	13-22
013483	4-21, 13-
013486	13-24
013487	13-14
013850	8-48
013853	35-16
013915	8-20
013937	1-5
013946	14A-8
013948	14-35
013949	14-31
013950	36-Q4
013955	36-Q5, 36-Q7
014020	35-15
014021	35-8
019946	3-11
020240	13-4
040322	40-
040323	40-
1973	40-9
2843	4A-3
3390	1-1B
5238	2A-4, 2D-6
7994	14-
8179	8-16
10689	20-5
10750	2A-3, 2D-4
11521	13-12
12087	16-11, 42-7
12636	13-21, 24-1, 24-14
13918	15-10
14175	4B-10, 5-14, 8-6, 15-25, 16-24B
15563	4B-2
17078	25-R27, 25-R28, 26-R27, 26-R28, 27-R27, 27-R28, 29-R27, 29-R28, 31-R27, 31-R28, 33-R27, 33-R28
17168	8-11
17196	24-7
17455	40-10
17639	6-5, 6-14, 9-24, 14-18, 17-7B, 19-1
18086	8-38, 39-5, 40-18, 42-26
18087	40-19
19010	39-20
19025	3-22A
19037	4B-3, 8-43, 42-20
19154	35-10
19233	35-9
19481	20-10
20808	13-1A, 16-28
21238	15-22, 15-26
21736	2C-1, 8-20E, 17-16, 24-9, 24A-7
21793	24-12, 40-25
22045	40-3
22577	25-V1, 25-V2, 26-V1, 26-V2, 27-V1, 27-V2, 29-V1, 29-V2, 31-V1, 31-V2, 33-V1, 33-V2
23336	40-6
23382	42-21
23414	40-12, 40-20
23619	40-13
23736	40-4
24042	10-28A
24047	10-1
24366	18-8
24452	16-24A
24736	40-23
24852	16-34
24903	9-15
25042	13-9A, 20-9
25167	15-36
25368	39-21, 42-17
25617	42-15, 42-27
25824	25-C16, 25-C18, 26-C16, 26-C18, 26-C16, 26-C18, 29-C16, 29-C18, 31-C16, 31-C18, 33-C16, 33-C18
25837	9-31
26126	24-3, 24A-3
27789	25-C17, 26-C17, 27-C17, 29-C17, 31-C17, 33-C17
28026	40-21
28035	40-8
28037	40-7
28042	40-16
28043	40-17
28048	40-14
28059	39-23, 42-16
28088	39-24
28718	8-4A
28820	7-27C
29558	13-7
29630	36-C8
30029	4B-9, 24-5
30162	17-2
30163	13-26
30164	4-1, 14-11, 14A-3, 14A-11, 15-19, 19-5, 20-8
30171	14-32, 14A-1
30404	42-8
30667	17-12A
30707	11-7
30804	3-6, 3-18, 7-22, 8-24, 8-35, 13-31, 13-33, 17-9, 18-1, 18-9
30806	12-2
30807	3-12, 6-17, 15-8, 16-35
30808	7-9, 7-12, 15-21, 16-3
30809	4-13, 7-14
30810	8-28, 13-3
30813	9-31
30815	3-4, 7-1, 7-17, 8-1
30816	3-21, 7-5, 8-39
30817	16-24
30820	8-40
30822	7-38
30824	4-22
30830	16-19
30857	7-17, 8-18
30859	1-11A
30879	9-1, 10-7, 14-16
30881	8-10
30884	17-34
31001	16-21
31003	16-17B
31004	16-9
31005	16-7
31006	17-29
31007	17-12
31008	17-30C
31009	17-8
31011	16-17A
31012	14-9
31013	14-10A
31014	14-10
31015	14-36
31017	3-18, 4-18, 14-39, 14A-10
31019	11-5, 14-2
31020	14-3, 15-34, 17-5
31023	14-24
31026	16-31
31027	16-33
31029	17-17, 17-26
31031	17-25
31032	16-24C
31035	17-14
31036	17-7F
31037	16-8
31038	14-8
31039	8-20F, 8-20J, 14-27
31040	14-28
31041	14-21
31042	14-23
31044	14-22
31045	14-19
31048	17-6
31049	15-6
31050	17-7K
31063	22-2
31078	17-28
31081	22-1
31083	22-3
31093	18-2
31097	18-5
31100	16-22B
31120	14-
31121	14-
31124	19-3
31135	20-7
31143	21-1
31145	17-19
31147	17-21
31148	17-22
31149	17-20
31153	21-3
31164	14-14
31223	10-27
31231	7-19
31232	7-18
31234	10-21
31235	10-16
31236	9-23, 10-23
31237	2A-6, 2A-9, 2C-3, 2C-5, 2D-5, 2D-10, 2E-6, 2F-4, 2F-6, 4-5, 24-10
31238	10-22
31239	9-20, 10-11, 10-12
31241	9-19, 10-10
31242	10-17
31243	4-20, 9-21, 10-13
31245	9-18, 10-9
31246	10-18
31247	10-3
31249	10-29
31265	7-25
31266	7-8
31273	11-2
31278	12-1
31301	24A-6
31339	7-29
31340	3-7
31341	7-28
31342	1-18
31346	2D-8
31351	2A-7
31356	9-29
31358	2D-14, 2E-10, 2F-10
31359	9-11
31360	9-22
31363	9-5
31364	9-7
31365	9-6
31366	9-4
31367	9-25
31368	9-33
31369	9-14
31370	2A-15, 2B-11, 2C-11, 2D-16, 2E-12, 2F-12, 9-28
31371	9-9
31372	2A-10, 2C-2, 2C-6, 2D-11, 2E-4, 2E-7, 2F-7, 9-17
31375	9-34B
31396	16-29
31397	17-4
31398	16-37
31399	17-7D
31400	17-18
31403	17-7C
31405	17-7A
31407	21-4
31424	17-27
31433	17-11
31435	19-8
31451	17-7J
31456	17-7E
31460	19-2
31469	15-16

PART NO.	FIG. & INDEX NO.
31470	15-15
31474	15-18B, 15-27B
31476	4-16
31482	5-3
31489	5-9
31491	4-19, 8-36
31493	8-44
31499	8-5, 15-14
31503	7-7
31536	13-1E
31551	14A-3B, 14A-17, 15-1, 15-32
31553	17-10
31555	15-18A, 15-27A, 17-7H
31557	16-16
31559	8-20B
31561	8-17A
31563	8-20K
31565	8-20H
31566	8-20D
31567	8-20A
31568	8-20C
31576	1-5
31583	3-3A
31584	3-3C
31585	4-14, 24-4, 24A-4
31586	24-2, 24A-2
31587	24-19
31589	24-17
31590	24-15
31592	4-17
31602	11-8
31604	11-3
31605	11-4
31630	13-6
31632	4A-1
31633	4A-7
31634	4A-6
31636	13-15
31638	13-11
31644	4A-5
31659	13-34
31663	13-19
31666	13-23
31671	13-5
31672	13-36
31673	13-30
31674	13-27
31675	13-32
31684	8-27
31685	35-17
31687	7-21
31692	8-7
31694	8-18
31695	8-30
31696	8-31
31698	7-39
31716	25-C3, 26-C3, 27-C3, 29-C3, 31-C3, 33-C3
31717	27-C15
31718	25-C11, 26-C11, 27-C11, 29-C11
31720	26-R23, 27-R23, 29-R23, 31-R23, 33-R23
31721	25-V3, 25-V4, 25-V5, 26-V3, 26-V4, 26-V5, 27-V3, 27-V4, 27-V5, 29-V3, 29-V4, 29-V5, 31-V3, 31-V4, 31-V5, 33-V3, 33-V4, 33-V5
31723	25-NE-2V, 27-NE-2V
31725	25-R3, 25-R26, 27-R3
31726	25-R27, 25-R28
31727	25-C5, 25-C6, 25-C8, 25-C9, 25-C10, 26-C5, 26-C6, 26-C8, 26-C9, 26-C10, 27-C5, 27-C6, 27-C8, 27-C9, 27-C10, 29-C5, 29-C6, 29-C8, 29-C9, 29-C10, 31-C5, 31-C6, 31-C8, 33-C5, 33-C6, 33-C8
31728	25-R19, 26-R19, 27-R19, 29-R19
31729	25-R21, 26-R21, 27-R21, 29-R21, 31-R21, 33-R21
31730	25-R25, 26-R25, 27-R25, 29-R25
31731	25-C4, 26-C4, 27-C4, 29-C4, 31-C4, 33-C4
31732	25-R29, 26-R29, 27-R29, 29-R29, 31-R29, 33-R29
31733	25-C1, 25-C12, 26-C12, 27-C1, 27-C12, 29-C12, 31-C12, 33-C12, 36-C12
31734	25-C13, 26-C13, 27-C13, 29-C13, 31-C13, 33-C13
31735	25-C7, 26-C7, 27-C7, 29-C7, 31-C7, 33-C7
31736	36-R11
31737	23-3, 25-C15, 25-C17, 26-C15, 27-C15, 29-C15, 29-C20, 31-C15, 31-C20, 33-C15, 33-C20
31739	25-R1, 25-R6, 25-R8, 25-R12, 25-R14, 25-R16, 26-R6, 26-R8, 26-R12, 26-R14, 26-R16, 27-R6, 27-R8, 27-R12, 27-R14, 27-R16, 29-R6, 29-R8, 29-R12, 29-R14, 31-R6, 21-R8, 31-R12, 31-R14, 33-R6, 33-R8, 33-R12, 33-R14
31740	25-R5, 25-R10, 25-R17, 25-R18, 25-R20, 25-R23, 26-R5, 26-R10, 26-R17, 26-R18, 26-R20, 27-R5, 27-R10, 27-R17, 27-R18, 27-R20, 29-R5, 29-R10, 29-R17, 29-R18, 29-R20, 31-R5, 31-R10, 31-R17, 33-R5, 33-R10, 33-R17
31741	25-R15, 26-R15, 27-R15, 29-R15, 31-R15, 33-R15
31742	23-4, 29-R31, 31-R31, 33-R31
31743	25-R13, 36-R5, 36-R23, 36-R25
31744	25-R22, 26-R2, 26-R3, 26-R22, 27-R22, 29-R2, 29-R3, 29-R22, 31-R2, 31-R3, 31-R22, 33-R22
31745	25-R1, 25-R2, 25-R4, 27-R1, 27-R4
31746	25-R2, 27-R2
31747	25-R9, 25-R13, 26-R9, 26-R13, 27-R9, 27-R13,
31747 (cont)	29-R9, 29-R13, 31-R9, 31-R13, 33-R9, 33-R13
31749	23-8, 25-R7, 25-R11, 26-R1, 26-R7, 26-R11, 27-R7, 27-R11, 27-R32, 29-R1, 29-R7, 29-R11, 29-R32, 31-R1, 31-R7, 31-R11, 31-R32, 33-R1, 33-R7, 33-R11, 33-R32
31905	18-9
31906	14-
31909	7-32
31911	9-30A, 9-34A
31914	7-13
31915	4A-12, 4B-8
31916	4A-14
31917	4A-13
31918	4A-9
31919	7-23
31920	7-33
31921	7-24
31923	8-3
31928	7-5
31933	12-3
31937	12-6
31939	7-36
31943	5-16, 11-1, 14A-15, 16-3A
31948	24-8
31954	17-31
31957	14-1
31959	17-37
31960	16-4
31962	17-36
31967	17-30
31971	12-1
31976	15-32, 17-1
31977	15-2, 15-33, 17-3
31978	20-1, 20-8
32093	7-27D
33251	20-6
33252	20-2
33258	16-30
33259	16-36
33268	8-25A
33281	5-10
33285	5-8
33295	8-42
33299	1-14
33300	1-13
33301	1-15
33302	1-17

PART NO.	FIG. & INDEX NO.
33306	12-10
33309	18-10A
33335	25-R24
33346	16-18
33347	15-17, 15-28
33360	1-12, 8-42
33368	1-9, 39-14
33369	1-12, 39-13
33370	1-10, 39-17
33371	1-8, 39-16
33372	1-1E
33373	1-1D
33383	1-1C
33385	9-20A
33388	1-1A, 1-2
33391	1-7, 39-15
33392	1-11
33418	4-15
33421	8-26
33422	24-18
33425	25-C2, 27-C2
33426	25-C14, 26-C14, 27-C14, 29-C14, 31-C14, 33-C14
33427	7-11
33438	1-4
33444	39-8
33459	3-2
33460	3-2
33464	42-11
33470	39-18
33471	39-11
33479	39-1
33481	39-3
33482	39-6
33483	39-10
33484	39-12
33486	39-2
33487	4A-8
33488	12-11
33489	17-35
33494	1-3A
33495	8-33
33698	2B-3
33699	2B-4
33771	13-9
33955	2B-5
33966	10-19
34485	39-9
34751	12-5
34753	12-4
34762	19-6
34765	2A-13, 2B-9, 2C-9
34766	8-17
34774	14-33, 14A-2
34778	15-12
34780	4A-16
34784	4-2, 6-11, 14-12, 35-13
34787	13-1C
34788	8-32
34797	16-10
34809	4A-2
34812	12-2
34814	8-22
34819	20-4
34820	20-4
34822	8-20G
34823	21-2
34824	14-15
34824-S	14-15
34825	14-13
34833	8-10
34834	8-1
34835	11-9
34837	13-1B
34840	25-R3, 26-R18, 26-R20, 31-R18, 31-R20, 33-R18, 33-R20
34842	4A-15
34843	5-12
34845	1-12A
34851	15-12
34852	15-13
34853	4A-16
34860	9-9A
34861	9-17A
34865	1-1F
34867	19-7
34872	7-39
34874	9-3
34876	39-7
34877	39-19
34878	14A-3A, 15-30, 19-5A
34879	14A-3A, 19-5A
34884	13-2
34885	15-9
34888	18-6
34889	8-15
34890	24-20
34891	25-R24, 27-R24, 29-R24, 31-R24
34892	13-2A
34894	14-7
34895	14-7
34896	5-13
34897	18-7
34899	7-9
34900	7-26
35164	35-5
35373	13-28A
35374	13-27A
35376	13-26B
35377	4B-11
35385	29-Q1, 31-Q1
35393	13-26A
35811	2A-12, 2B-8, 2C-8, 2D-13, 2E-9, 2F-9
35814	14A-5
35830	14A-6
35840	15-20
35856	4-10
35858	4-8
35859	4-9
35860	4-11
35865	1-19
35875	17-33
35876	2A-5, 2D-7
35880	20-4
35883	20-2
35885	14A-14
35886	4-12, 4B-5
35897	23-7, 29-C19, 31-C19, 33-C19
35898	26-C1, 29-C1, 31-C1, 33-C1
35909	3-1, 4B-12
35910	14A-9
36004	8-37A, 23-9
36007	23-2, 33-R34
36008	23-5, 29-R30, 31-R30, 33-R30
36009	23-1, 29-R33, 31-R33, 33-R33
36011	26-C2, 29-C2, 31-C2, 33-C2
36013	16-14
36014	16-15
36015	16-13
36026	12-7
36027	15-27C
36028	15-27F
36035	4-3
36038	10-2
36039	17-30B
36042	17-27
36044	15-23
36047	15-18C, 15-27E
36048	16-26
36051	1-1A, 1-2
36052	1-11
36057	10-30
36060	1-12
36061	4A-10, 4B-6, 14A-13
36064	20-2
36065	17-30A
36067	1-1F
36068	7-27A
36073	23-2
36074	23-2, 36-R14, 36-R15
36075	20-11
36080	9-16
36081	14A-4
36082	14A-12
36083	7-15A, 7-16A, 10-14, 14-25
36084	9-9B
36085	10-26
36086	10-26
36094	12-13
36095	3-15, 12-14
36099	15-27D
36291	42-2
36293	42-1
36311	36-R18, 36-R19
36315	26-R2, 26-R3
36520	7-11
36521	33-R24
36522	26-R19, 29-R19
36525	16-2
36526	5-11
36532	2D-2, 2E-2, 2F-2
36533	5-2, 6-3
36535	7-31
36662	16-6
36668	13-21A
36669	16-2
36763	3-10, 5-1, 6-2, 6-7, 7-34, 10-20, 17-11, 17-32
36764	14-5
36765	7-30, 13-20
36769	2A-1, 2B-1, 2B-7, 2C-7, 2D-1, 2D-12, 2E-1, 2E-8, 2F-1, 2F-8, 8-13, 9-12, 10-24, 14-30, 17-24A, 24A-1
36770	16-1
36771	14-34
36801	15-24
36808	8-46
36836	6-10
36842	5-17
36848	35-7, 35-14
36984	24A-8
36992	1-1F
37293	20-6
37294	20-6
37295	20-5A
37296	20-3
37310	3-3E

PART NO.	FIG. & INDEX NO.
37311	3-3C
37312	3-3C
37315	14A-3C
37322	26-R25, 31-R25, 33-R25
37323	31-R19, 33-R19
37324	26-C11, 31-C11, 33-C11
37325	26-C9, 26-C10, 31-C9, 31-C10, 33-C9, 33-C10
37897	42-14
38156	6-21
38157	6-22
38160	6-16
38162	6-12
38164	6-15
38165	6-13
38166	6-4
38167	6-6, 14-19
38175	16-5A
38182	36-R12
38187	36-R8
38207	7-18
38231	19-3
38336	23-6, 33-Q1
38434	2B-2
38456	3-22
38461	12-5
39190	42-3
39504	8-27
39508	8-23
39517	8-30
39523	4-4
39575	7-27E
39757	8-34
39759	42-6
39760	42-9
39761	42-23
39762	42-19
39765	42-24
39774	42-
39775	42-
39789	13-36
40251	6-1
40268	42-25
40269	42-22
40272	42-29
40273	26-R24
40274	26-R25
40283	7-21
40286	24A-2
40289	24A-2
40290	26-R25
40295	10-27
40814	35-3
40883	4-17
41111	12-1
41112	12-1
41129	8-3
41130	35-18
41135	8-42
41136	8-42
41140	3-22B
41142	3-17
41167	1-19
41171	36-C6
41172	36-C5
41173	36-D3 to D6
41174	36-D7, 36-D14
41175	36-Q1
41176	36-Q2
41177	36-Q3, 36-Q6
41180	36-IC-1
41184	8-45
41185	36-R24
41186	36-R10
41188	36-R9
41189	36-R4
41190	36-R3
41191	36-R2
41192	36-R1
41193	36-R13
41194	36-R22
41195	8-4
41304	7-11
41305	7-11
41307	16-18A
41308	16-9
41309	16-9A
41317	17-7H
41318	17-7K
41319	22-4
41320	13-38B
41321	13-38A
41322	8-4
41330	4-4, 4A-14
41331	10-5
41338	12-10
41342	15-11
41344	1-1J
41345	1-1G
41377	16-32
41378	7-13
41379	8-20B
41392	36-C9
41393	36-C10, 36-C11, 36-C17
41394	36-C7
41395	36-C16
41396	36-C13, 36-C14
41397	36-C15
41398	36-C1
41425	14-6
42200	8-42
42201	8-42
42207	12-12
42208	12-12
42212	13-1D
42217	9-2
42218	10-8
42244	17-10
43202	36-R20, 36-R21
43204	35-6
43209	35-11
43210	36-D1, 36-D2
43282	9-32
43290	7-3
43291	7-2
43292	8-32
43360	1-8
43361	1-H
43369	16-6
43373	10-6A
43378	12-9
70345	7-27B
82034	40-1
82655	24-13
83234	12-9
88654	36-C2, 36-C3
97509	4-6, 6-19, 15-3
99301	5-5, 7-37
200453	3-3D
200454	3-3B
200526	13-24
200828	13-4
201611	3-3B
300508	21-5
301366	5-7
301435	13-18
399019	5-4
400304	40-15
400422	1-1H
400499	39-22
400476	1-6
400479	1-1J
400541	42-4
430037	40-32
430062	40-24
430076	3-17
430097	40-30
430142	40-26
430144	40-27
430145	40-22
430189	40-31
430192	40-29
430193	40-28
600735	35-2
600797	8-19
601190	7-6, 7-10, 8-29, 24-6
602339	13-38C
611107	7-15B, 7-16B
620004	40-2
621132	35-12
700008	35-1
700136	4B-1, 8-47
700420	2A-11
700816	11-6
700846	42-5
765286	36-R16, 36-R17
0131950	36-