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SERVICE INSTRUCTIONS

AUTOLOAD 8
CASSETTE PROJECTOR

DESIGN 459

CONSUMER PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 72726 PRINTED IN U.S.A. FEBRUARY 1971

FACTORY SERVICE ADDRESSES

PRODUCT ONLY

CHICAGO

General Service Department
2200 Brummel Place
Evanston, Illinois 60202
Area Code: 312-673-3300

NEW YORK

General Service Department
200 Smith Street
E. Farmingdale, L.I., New York 11735
Area Code: 516-293-8910

GLENDALE

General Service Department
623 Rodier Drive
Glendale, California 91201
Area Code: 213-245-6631

PARTS ORDERS AND SERVICE INFORMATION

General Service Department
7100 McCormick Road
Chicago, Illinois 60645
Area Code: 312-673-3300

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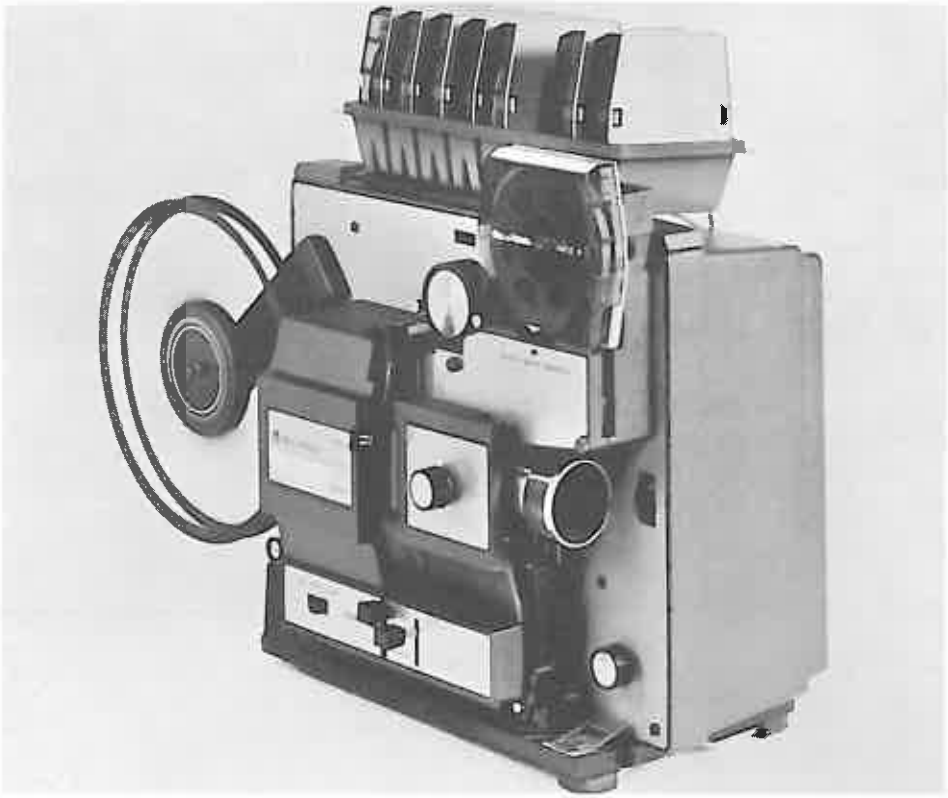


Design 459 Compatible Autoload Cassette Projector

FEATURE DESCRIPTION LIST

Color	Pewter and black
Type of Film	Standard 8-mm and Super 8-mm
Projector Operating Modes	Forward, still and reverse
Film Speed	18 frames per second
Still Projection Filter	Perforated metal screen
Type of Framer	Screw knob
Projection Lamp:	
Model 459A	120v, 155w, Type DJL
Model 459X	21.5v, 150w, Type DNF
Film Loading	Autoload, cassette or open reel
Operating Voltage:	
Model 459A	120 volts, 60 cycles
Model 459X	115 to 240 volts, 50 cycles
Tilt Device	Gravity lowered tilt bar, knob locked
Rewind Operating	High speed, through the mechanism; Automatic rewind triggered by clip near end of film.
Weight	16 pounds

Introduction

GENERAL.

This manual has been prepared to aid in the servicing and repair of the Bell & Howell Design 459 Compatible 8-mm and Super 8-mm Autoload Cassette Projector with automatic rewind. Two projector models are covered in these instructions; the Design 459A, which operates on 120 volt 60 cycle current, and the Design 459X, which operates on 50 cycle current within a range of 115 to 240 volts. 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 exploded view illustrations are indexed in a suggested order of disassembly, with attaching parts immediately preceding those parts which they attach. Where disassembly and reassembly of parts is purely mechanical and no critical adjustments are involved, no attempt has been made to elaborate on the removal or installation of such items. When making specific projector repairs, the serviceman must use his own judgment in eliminating unnecessary steps of procedure. Illustrations referred to by letter (Figure A, Figure B) will be found in the Service Instructions portion of this manual, while those identified by number will be found in the Parts Catalog section.

DESCRIPTION.

The Design 459 Projector uses either standard or super 8-mm film and is equipped with self-latching loopformers for fully automatic film threading, a fully automatic through-the-system rewind capability, and operation in forward and reverse. Special design features are listed in the Feature Description List.

FEED-OUT OPERATION (Figure A).

When the feed-out lever is pressed downward (View A), the fork lever is rotated to pivot the gear engagement lever assembly in a counterclockwise direction around the input gear. This brings engagement lever gears "A" and "B" into mesh with module gears "X" and "Y," respectively (View B). Gear "Y" begins to drive the feed-out belt through the module gear train. Gear "X" is the driven gear of the module clutch assembly and, as this gear begins to rotate, the hobbed black gear beneath it drives the pulley plate gear rack. This causes the complete pulley plate assembly to move upward into the film cassette (View C) until the feed-out belt makes contact with the film and begins to pull the film from the cassette.

The film is guided down into the slot between the stripper and the pulley plate; then upward around the module snubber and down to the aperture where

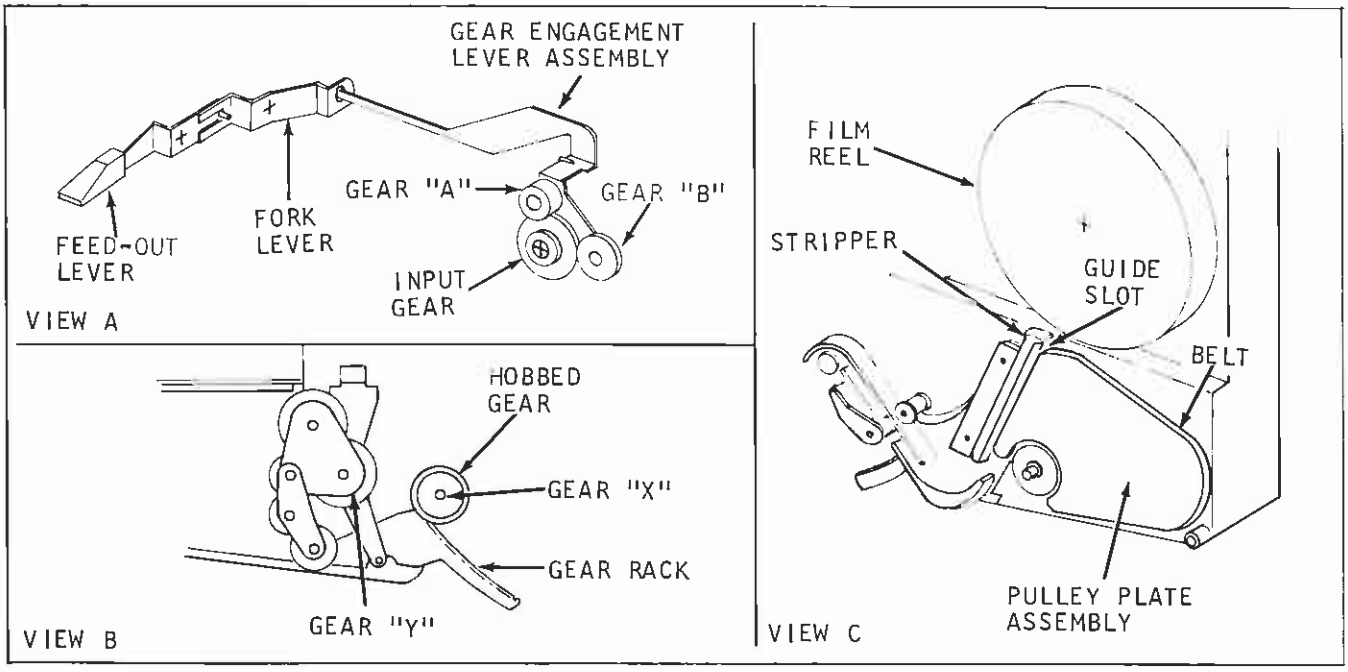


Figure A. Feed-Out Operation

the shuttle teeth engage the film perforations and take over the film advance operation. As soon as this occurs, the threading lever must be released, and the gears and pulley plate will revert to their normal positions. It should be noted that the stripper is spring-loaded in order to provide the proper deflection angle of the film into the guide slot no matter what size of reel is used (fully extended with 50-foot reels and increasingly retracted as reel size increases).

PROJECTOR GEAR TRAIN OPERATION. The power flow of the gear train in the various modes of operation is shown in Figure A-1. Each is discussed separately in the following paragraphs.

a. Forward-Project Mode. In the Forward-Project mode of operation, the worm gear drives the gear train through gear "X" to the take-up gear at the rear of the take-up arm. The gear train within the arm itself rotates the take-up spindle. Although rewind gears "A" and "B" are being rotated by the helical gear, these gears are not connected into the gear train and therefore are simply idling.

b. Reverse-Project Mode. When the Forward-Reverse lever is placed in Reverse, the lever arm to which gear "G" is mounted is pvioted counterclockwise as the gears begin to drive. This disengages gear "G" from gear "H" so that the gear train to the take-up gear is inactive and engages gear "G" with outer slip clutch gear "D1." The slip clutch tension between gears "D1" and "D2" is such that gear "D2" will not rotate. As a result, the complete puck arm assembly is forced to pivot counterclockwise until the puck makes contact with the film. Now slip clutch tension is overcome and the puck is driven through gears "D2," "E" and "F" to rewind the film onto the cassette reel. Note that gears "A" and "B" still are not connected into the gear train.

c. Rewind Mode. When the projector is placed in the Rewind mode, the rewind linkage is actuated to bring gear "B" into mesh with gear "C." Although the worm gear is still driving gear "X," gear "B" is totally disengaged and thus gears "X" and "G" are idling. The power to the puck gear is now transmitted by the helical gear through gears "A" and "B" and the puck rewinds the film back onto the cassette reel at high speed.

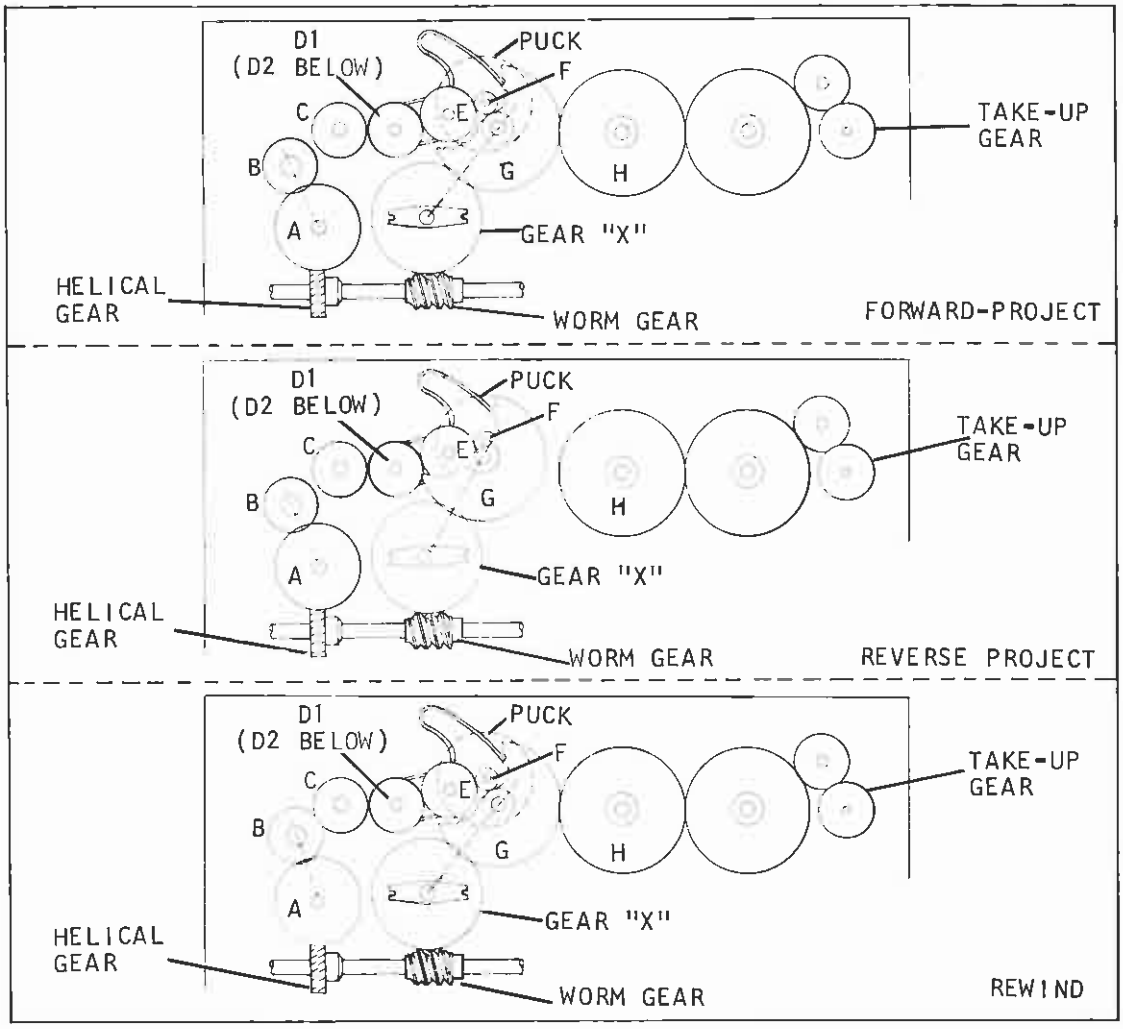


Figure A-1. Gear Train Operation

AUTOMATIC REWIND.

Automatic rewind through the system is triggered by a clip that attaches to the film at the reel hub. The clip taughtens the film which exerts pressure on the upper loopformer assembly, displacing it momentarily. This displacement triggers the reversing gear mechanism. The film pressure plate is raised, the forward-reverse lever is unlatched from the forward position and moves to the center or still position, and the film side tension arm is retracted so that the film will have a smooth, clear path during the automatic rewinding. The automatic rewind can also be triggered at any point in the film by pressing down on the run-rewind lever.

SPECIAL MAINTENANCE PRECAUTIONS.

The removal and installation of projector parts is comparatively simple and, for the most part, requires tools normally available in most repair shops (retaining ring pliers, Bristol setscrew wrenches, assorted screwdrivers and socket hex wrenches, etc.). Where required, special tools and gages are clearly noted in the instructions and illustrated in Figure B.

When repairing equipment, be sure that the work table surface is clean. As parts are removed, group them in an orderly fashion to avoid confusion during reassembly. Clean dirt and old lubricant from parts (except electrical components) by washing them in a pan of solvent. Hardened film emulsion can be removed from film path parts by using alcohol and a wooden implement (tooth pick or orange stick). Do not use a knife or other metal tool to scrape film emulsion from film path components.

After the projector has been repaired, reassembled and adjusted, perform the inspections and test procedures outlined in the Final Test section to insure satisfactory projector operation.

During reassembly, be sure to lubricate parts as noted in the service instructions. If possible, use only recommended Bell & Howell lubricants as listed in the lubrication chart at the end of the Reassembly and Adjustment section. If Bell & Howell lubricants are not immediately available, use only the best grades of ball bearing grease and projector oil obtainable from local commercial outlets.

Grease (Bell & Howell Specs. 1516, 1956 and 1980)
Oil (Bell & Howell Spec. 1543 and 1987)

BRISTOL SETSCREW WRENCHES REQUIRED FOR MAINTENANCE

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

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

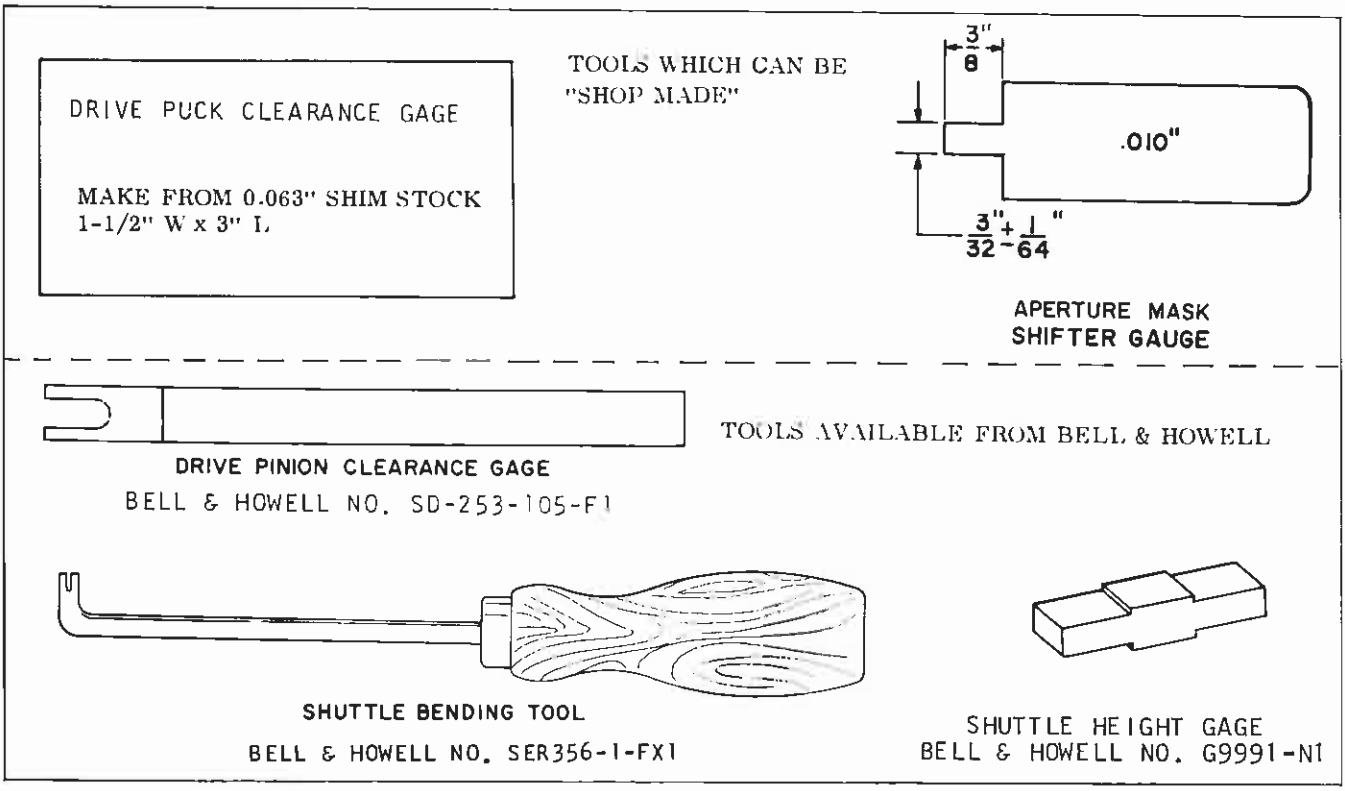


Figure B. Special Service Tools

Disassembly Procedure

1. GENERAL DISASSEMBLY INSTRUCTIONS.

a. Before beginning the disassembly procedure, be sure to disconnect the projector from the power source and remove the projection lamp and lens. Wrap the lamp and lens in tissue paper and place them on a shelf to protect them from possible damage.

b. If repairs require the replacement of electrical items (lamp socket, motor, or switch), refer to the wiring diagram, Figure 9, at the end of the Parts Catalog as an aid to wire identification and unsolder or disconnect wires as necessary.

c. When removing riveted parts for replacement, the old rivet must be drilled out of the casting. Use a drill equal to, or slightly smaller than, the diameter of the rivet to be removed.

d. When attaching parts (screws, nuts, etc.) are removed, reassemble them loosely to the removed part or to the tapped casting to prevent loss.

2. REMOVAL OF PARTS IN FIGURE 1. Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. The back cover (12) is secured by six screws. Four of these screws (10) are inserted through the mechanism plate and into tapped bosses in the cover; the remaining two screws (11) are inserted up through the base and into tapped bosses in the cover.

b. The end of the plug (15) has been heat-sealed to secure it in the tube socket (14) and these parts should not be disassembled from the back cover of Design 459X projectors unless replacement is necessary.

c. The feed-out module assembly (49) is secured to the projector main plate with four screws. All screws are inserted through the main plate from the rear and threaded into tapped holes in the module housing. Screw (48) is located just to the right of the flip-flop gear lever (item 7, Figure 4).

3. REMOVAL OF PARTS IN FIGURE 2. Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. The lower end of the air deflector (5) is secured to the base casting with a press-in type retaining clip (4). The motor and blower fan can be exposed for inspection by prying out this clip and raising the deflector. The upper end of the deflector is secured to the lamp socket bracket with two similar clips (459A models) or two machine screws (459X models), item -3.

b. To replace the Off-Motor-Lamp switch (23), the control housing (18) must be removed. Remove the crimp connectors from the leadwires which pass through the projector main plate into the control housing. Remove the two control knobs (14) from their levers and remove two screws (17) at the rear of the main plate which thread into tapped holes in the control housing. Separate the housing from the main plate, and remove the tubing (19) from the leadwires. Carefully pry off the Off-Motor-Lamp nameplate (16) to expose the switch screws (20). Remove these screws and disassemble the switch (23), interlock lever (22) and spacer bushings (21) from the housing.

c. If the film guide (27) and roller (25) are to be removed, note the manner in which the ends of the torsion spring (26) engage the film guide and main plate.

4. REMOVAL OF PARTS IN FIGURE 3. Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Removal of two screws (1) and screw (2) will permit withdrawal of both the reel arm (3) and the assembled spindle (5). Do not disassemble the reel spindle assembly.

b. Spur gears (6) and (7) can be lifted from the studs of the stud and support assembly (17). To free spur gear and shaft assembly (10) loosen setscrew (8) in spur gear (9) and disassemble these parts from the support assembly (17).

c. A small spur gear (12) and two large spur gears (13) are retained on the studs of gear mounting plate by retaining rings (11).

d. The removal of screw (14) and retaining ring (15) will permit the gear mounting plate assembly (18) and all remaining reel arm parts (19 through 21) to be disassembled from the mechanism plate.

e. Unhook and remove the tension spring (22) from between the retractor lever (24) and gear mounting plate (18). Unhook the fire shutter rod (23) from the retractor lever. Disassemble the retractor lever (24), screws (25) and (26) and slotted lever guides (27) from the gear mounting plate.

f. Remove the retaining ring (28) and shim washer (29) and disassemble the spur gear (30), wave-type tension washer (31) and rewind arm assembly (32)

from the main plate gear stud. Remove retaining ring (33) and spur gear (34) from main plate gear stud.

g. Remove retaining ring (35) and lift the assembled clutch and gear group (35 through 44) from the main plate gear stud. To disassemble this group of parts, simply remove the retaining ring (36) from the end of the long hub of gear (42).

h. Remove screw (43) and washer (43A) and disassemble the spur gear (44) and wave-type tension washer (45) from the gear stud of the drive puck gear plate (53). Loosen setscrew (46) and withdraw the drive puck assembly (47) from the drive puck gear shaft (50). Remove the retaining ring (48) and spacing washer (49) and withdraw the drive puck shaft assembly (50) and its spacing washer (51). Remove the retaining ring (52) and lift the gear plate (53) from the main plate gear stud. Remove two screws (54) to disassemble the guide bar (55) from the main plate.

5. REMOVAL OF PARTS IN FIGURE 4. Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Before disassembling the film drive roller and shaft assembly and loopformer parts, note carefully the manner in which the spring ratchet (5) is installed so that it can be reassembled in the same manner. Carefully remove the retaining ring (3) and disassemble parts (4 through 9) from the rear of the film drive gear and shaft assembly.

b. Disengage the ends of the torsion spring (12). Remove the retaining ring (10) and disassemble the gear and shaft assembly (11), torsion spring (12), retractor lever (13) and engagement lever assembly (14) from the main plate. Pry the knob (15) from the end of the feed-out lever assembly (17). Remove the screw (16) and lift the lever assembly (17) and torsion spring (18) from the tapped stud inside the aperture housing. Remove the round nut (19) and actuating arm (20).

c. To remove lens carrier assembly (26), swing open lens carrier assembly, loosen three setscrews (21) in collars (24) and (25) and unscrew framer knob assembly (22) from mechanism casting.

d. When removing lower loopformer (30) from mechanism casting, note the manner in which the parts were disassembled to insure proper reassembly. The lower loopformer parts (29 through 44) can be removed as an assembled group by taking out three screws (27).

e. The lens mount catch assembly (47) is secured to the main plate with two rivets (45). Remove the catch assembly only if in need of replacement.

f. To remove the aperture plate assembly (53), take out the two screws (52) at the bottom corners of the plate and the screws (49) and (50) and standoff stud (51) at the upper corners of the plate.

6. DISASSEMBLING THE FEED-OUT MODULE (Figure 5). Remove Figure 5 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. The dampening arm (1) is loose and can be lifted from the module housing. Remove the retaining ring (2) and lift the complete clutch and gear group (3 through 8) from the housing gear stud. These parts can be disassembled by removing the large retaining ring (3) from the hub of the spur gear (8).

b. To remove the gear train assembly (11), loosen the setscrew (9) in the hub of the lowermost (black) gear and remove the retaining ring (10) from the stud of the support plate assembly (13). Lift the gear train from the housing.

c. Remove the push-on retaining washer (12). Lift the lower end of the support plate (13) to clear the stud and pull the plate downward to disengage the upper end from the slots in the housing.

d. With a tweezers, disengage the snubber springs (14) and (15) and dampening pad (16) from the slotted post and remove these parts from the housing. Disassemble the rear trigger (17), spacer (19), front trigger assembly (20) and snubber (21) from the housing. Remove the guide roller (22) from the snubber. Remove screw (23) and roller and bracket assembly (24).

e. If the reel adapter assembly (28) is to be replaced, it will be necessary to pry off the cover plate (item 51, Figure 1) from the rear of the module housing to expose the adapter retaining parts (25), (26) and (27).

f. Carefully unhook the end of the spring (32) from the stripper base (34) and lift the drum and spring assembly (32) from the housing stud.

g. Remove two screws (33) and disassemble the stripper base (34), stripper (35), spring (36) and pulley and plate assembly (37) from the housing. Remove the belt (38) from around the pulleys. Remove retaining rings (39) and disassemble the drive pulley (40) and pulley shaft (41) from the plate assembly (37).

h. If roller (42) is in need of replacement, carefully pry it from the module housing (46).

7. REMOVAL OF PARTS IN FIGURE 6. Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. The lens carrier assembly need not be removed to replace the pressure plate (17). Swing open the lens carrier and remove the two retaining rings (15). Disassemble the compression springs (16), pressure plate assembly (17) and lifter (18) from the lens carrier.

b. For lens carrier assembly removal, see paragraph 5, step c.

c. Remove the setscrew (1) and withdraw the focus knob (3) from its shaft. Remove the retaining ring (7) from the end of the focus shaft (10), and remove the shaft, the spring (8) and the washer (9) from inside the lens barrel opening of the lens mount assembly (12).

8. REMOVAL OF PARTS IN FIGURE 7. Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Unhook the drive belt from around the two drive pulleys. Remove the retaining ring (1) and disassemble the complete pulley mounting bracket assembly (2) from the projector, disengaging the legs of the torsion spring (3) from the ears on the safety shutter as the assembly is removed. To replace the drive rollers (6), remove the retaining rings (4) and washers (5) from the pulley mounting studs. The spring loading bracket assembly (8) can be disassembled from the pulley mounting bracket by removing two screws (7).

b. The front end of the safety shutter mounting plate is secured by a single screw (9) just above the projection lamp. Remove this screw and pivot screw (10) and carefully lift the safety shutter assembly (11) from the projector main plate.

c. Remove two screws (12) and disassemble the shutter washer (13) and shutter (14) from the end of the main shaft. Remove the pivot screw (15), flat washer (16) and tension washer (17) and lift out the shuttle and bracket assembly (18). Inspect the cam shoes (19) and (20) for excessive wear and replace if necessary. Remove the pull-down cam (21) from the main shaft. The nut (22) and spacer (23) need not be removed. Loosen the two setscrews (24) and remove the in-out cam (25) and thrust washer (26) from the main shaft.

d. Pry the retaining ring (27) from the groove in the main shaft and loosen the setscrews (28) and (29) in the manual knob (31), helical gear (32) and drive pinion (34). Withdraw the main shaft (30) toward the rear of the projector, removing the manual knob, helical gear and drive pinion as they are freed.

e. Remove two retaining rings (35) and disengage the looped ends of the spring assembly (36) from the studs in the rewind actuating lever assembly (40) and the support bracket and stud assembly (58). Remove the Sems nut (37), washer (38) and pivot stud (39) and lift out the complete rewind actuating lever assembly (40) and the spacer (41). Unhook and remove the extension spring (42). Remove the screw (43) and separate the arm and lever assembly (44) from the actuating lever assembly. The two adjusting screws (45) and (46) need not be removed from the adjusting plates of the actuating lever assembly.

f. Unhook the upper end of the actuating rod assembly (47) from the lock assembly (51). Withdraw the actuating rod with its spring (48) and bushing (49), down through the mechanism. Remove the retaining ring (50) and the lock assembly (51). Remove the shuttle retractor pin (52) with its retaining ring (53). Pry the spring clip (54) from the end of the retractor plate stud (55) and disassemble the stud and retractor plate (56) from the projector main plate.

g. Remove two screws (57) and lift the assembled support bracket (58) and shifting lever (60) from the main plate. Remove the retaining ring (59) and disassemble the shifting lever (60) from the bracket (58).

9. REMOVAL OF PARTS IN FIGURE 8. Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. The motor assembly (3) can be removed by taking out the three screws (2) inserted from beneath the base and up into the mounting inserts (12). Loosen the setscrews (4) and pull the fan (5) and the fan and pulley assembly (6) from the motor shaft.

b. Note that the Design 459X projector is equipped with a transformer (22) mounted on three tapped bosses of the base assembly (25) with screws (20) and lock washers (21).

Reassembly and Adjustment

10. GENERAL.

a. When the reassembly procedure includes the staking of rivets or other parts, all such riveting and staking should be accomplished before any other reassembly procedures are attempted. Be sure to support the casting or plate solidly while performing the riveting or staking operation.

b. Be sure to follow the lubrication procedures indicated in the reassembly instructions, using the Bell & Howell lubricants. Lubricate sparingly and wipe away excess lubricant with a lint-free cloth.

c. When installing adhesive-backed nameplates, clean the contact surface of the projector. Remove paper backing from nameplate and moisten adhesive with trichloroethylene. When tacky, install nameplate and smooth down with a clean cloth.

d. When installing electrical parts (motor, switch or lamp socket), refer to the wiring diagram, Figure 9, at the end of the Parts Catalog for proper wiring connections.

11. REASSEMBLY OF PARTS IN FIGURE 8. Reassemble parts in reverse order of disassembly, noting the following special precautions.

a. Reassemble the film cutter (29) on the base with the formed-up end of the cutter toward the projector main plate and secure it with the two rivets (28). When assembling rubber feet (27) to base, note that the counterbore of the foot must be away from the base and the rivets (26) installed down through the base and foot.

b. The transformer assembly (22) is used only on the Design 459X projector. Position the transformer on the three tapped bosses of the base and secure it with three screws (20) and lock washers (21).

c. Motor parts should be preassembled as follows: Assemble the grommets (14) into the motor mounting brackets (10) and (11) and the inserts (12) into the grommets. Note that washer (13) is used between the insert and grommet of the short mounting bracket (11). Assemble the two brackets to the motor with screws (7), washers (9) and Sems nuts (8), tightening the nuts securely. Assemble the pulley and fan assembly (6) onto the long end of the motor shaft with pulley away from the motor and tighten the setscrew (4) just enough to hold.

d. Position the motor on the base, taking care not to damage the fan blades against the cast walls of the blower housing. Install the three screws (2) up through the base and into the inserts (12) and tighten them securely. Assemble the fan (5), hub inward, to the short motor shaft and tighten its setscrew (4) securely.

12. REASSEMBLY OF PARTS IN FIGURE 7. Reassemble parts in reverse order of disassembly, noting the following precautions.

a. Assemble the format shifting lever (60) to the support bracket assembly (58) and secure these two assemblies with the retaining ring (59). Position the support bracket against the projector main plate with the shift lever inserted through the slot in the main plate, and install and tighten the two screws (57).

NOTE: The retractor plate (56), stud (55) and spring clip (54) are to be installed after the aperture plate is assembled to the projector (refer to paragraph 15).

b. Assemble the retaining ring (53) to the shuttle retractor pin (52). Lightly grease the pin and insert it into the hole in the long cast arm of the mechanism plate. Press pin all the way in place.

c. Assemble the spring (48) and guide bushing (49) to the actuating rod assembly (47). Insert the formed end of the rod up through the hole at the edge of the mechanism plate and up into place, with the guide bushing pressed into the hole. Engage the upper (formed) end of the rod into the hole in the lock and bushing assembly (51). Lightly grease the mounting stud for the lock and bushing assembly and secure the assembly to the stud with retaining ring (50).

d. Assemble the arm and lever assembly (44) to the rewind actuating lever assembly (40) with the screw (43). Hook the tension spring (42) between the arm and lever of lever assembly (44). Assemble the actuating lever assembly to the mechanism plate, guiding the shifting lever through the slot in the main plate and aligning the lever pivot hole with the hole in the long cast arm. The foot of the actuating rod assembly (47) must rest on top of the shifting lever protruding through the main plate. Slip the spacer (41) up into place between the lever and the cast arm and insert the threaded end of the pivot stud through the cast arm, the spacer, and the lever assembly. Install the flat washer (38) and Sems nut (37) and tighten the nut securely. Slip the loop ends of the spring assembly (36) over the studs at the lower end of lever assembly (40) and support bracket (58) and install the retaining rings (35).

e. Lightly oil the end ot the main shaft (30) and insert it through the bearing in the long cast arm. Hold the drive pinion (34) in position between the

two cast arms, hub facing toward rear of projector, and press the main shaft through the pinion and the bearing in the short cast arm. Assemble the thrust washer (33) over the end of the main shaft. Hold the helical gear (32), hub facing toward rear of projector, in the cut-out in the main plate while pressing the main shaft through the gear. Hold the manual knob in its cut-out in the main plate while pressing the main shaft through the knob. Tighten the knob setscrew (28) just enough to hold. Install the retaining ring (27) so that the thrust washer (33) is held captive against the bearing in the short cast arm. Lightly tap the knob end of the main shaft to seat the retaining ring and thrust washer; then loosen the knob setscrew (28) and center the manual knob in its cut-out opening in the main plate.

f. Assemble the thrust washer (26) over the rear end of the main shaft. Lightly grease the cam surface of the in-out cam (25) and assemble the cam to the main shaft with the cam gear toward the drive pinion (34). Dip setscrew (24) in shellac and, while holding the cam against the thrust washer to remove all end play in the main shaft, install and tighten the setscrew securely. Wipe excess shellac from cam surface with a clean cloth and turn the shaft manually with the knob. The shaft must turn freely with no binding high spots. If binding occurs, tap the knob end of the shaft lightly to free up the binding condition.

g. Assemble the tapped spacer (23) to the long cast arm and install the Sems nut (22). Assemble the flat washer (16) and bowed tension washer (17) to the screw (15) with the bowed face of the tension washer away from the head of the screw. Lightly grease the tension washer. Assemble the shuttle and bracket assembly (18) to the projector mechanism, aligning the pivot hole of the shuttle bracket with the tapped hole in the spacer (23) and engaging the pin at the lower end of the bracket with the forked slot in the format shifting lever assembly (60). Install the pivot screw and washers to secure the shuttle to the tapped spacer.

h. Assemble cam shoe (20) to the shuttle with the stepped follower surface of the shoe against the in-out cam. Assemble cam shoe (19) to the remaining cam ledge of the shuttle. Lightly grease the cam surfaces of the pull-down cam (21) and assemble the cam to the main shaft between the cam shoes with the cam identification mark down and the through holes aligned with those in the in-out cam. Install the shutter (14), open side away from the pull-down cam, and the washer (13). Align the holes in the shutter washer, shutter and cams, and install and tighten the two screws (12). Turn the manual knob to check the fit of the cam shoes on the pull-down cam. The fit must be snug without binding and can be adjusted by means of the long screw at upper end of shuttle.

i. Insert the drive pinion clearance gage (Figure B) between the drive pinion (34) and the bearing in the short cast arm. Dip the setscrew (29) in shellac and, while holding the pinion and clearance gage against the cast arm, install and tighten the setscrew. Remove the gage and wipe away excess shellac.

j. Lightly oil the roller studs of the pulley mounting bracket assembly (2) and assemble a washer (5), a drive roller (6), a second washer (5) and a pivot screw (10) on each stud. Check to make certain that the rollers spin freely and smoothly. Assemble the spring loading bracket assembly (8) to the pulley mounting bracket with two screws (7). Align the lower edge of bracket (8) with the step in mounting bracket (2) and tighen the screws enough to hold. Lightly oil the pivot shaft of the pulley mounting bracket and assemble the torsion spring (3) over the shoulder of the shaft. Insert the shaft through the pivot bushing of the safety shutter assembly (11) and install the retaining ring (1). Cross the legs of the torsion spring and engage them above and below the slotted ears of the safety shutter bracket.

k. Hook the drive belt (1, Figure 8) around the pulley and rollers while assembling the complete safety shutter and pulley bracket group to the projector. The pivot hole in the safety shutter must locate on the shoulder of the pivot stud (39) with the shutter mounting plate protruding through the main plate just forward of the projection lamp socket. The rim of the shutter must be captured between the two drive rollers. Install the screw (10) through the pivot hole and into the pivot stud. Install the screw (9) in the front upper corner of the safety shutter mounting plate. Move the forward-reverse lever through the three positions to make certain that the lever moves freely and locks at each position. Place the lever in the center (still) position and visually check the centering of the perforated heat filter with the aperture opening. Adjust for centering by loosening screw (9) and shifting the shutter mounting plate as necessary. Remove excessive play in lever by bending the legs of the torsion spring (3).

l. Loosen the setscrew in the pulley and fan assembly (item 6, Figure 8) and shift the pulley until the drive belt is in vertical alignment with the drive rollers; then tighten setscrew securely.

13. REASSEMBLY OF PARTS IN FIGURE 6. Reassemble parts in reverse order of disassembly, noting the following special precautions.

a. Assemble lens carrier parts as follows. Grease recess of shaft (10) and assemble washer (9) and spring (8) over end of shaft. Assemble focus shaft and pin assembly (10) through hole of lens mount (12), and secure focus shaft with retaining ring (7).

b. Lightly grease both studs and assemble springs (16) over studs on pressure plate and stud assembly (17). Assemble pressure plate and springs to lens carrier with longest rail toward mounting ears of lens carrier. Place pressure plate lifter (18) over ends of studs protruding through lens mount with tab of lifter towards pressure plate. Secure pressure plate and lifter to lens mount with retaining rings (15). Retaining rings must be assembled straight in from end of casting to avoid interference.

CAUTION: Do not distort pressure plate when assembling. When holding in, press only in the area at the staked ends of the studs.

c. Assemble cover plate (14) to lens carrier and loosely secure with two screws (13). Assemble lens carrier cover (6) to lens mount using shim washers (11) between cover and lens mount. Shims are to be used in pairs, as required, to maintain a minimum clearance of 0.005 between lens carrier cover and loopformers, without binding. Tighten previously assembled screws (13).

14. REASSEMBLY OF FEED-OUT MODULE (Figure 5). Reassemble parts in reverse order of disassembly, noting the following special precautions.

a. Assemble a retaining ring (39) to the end of the pulley shaft (41). Hold the drive pulley (40) in place on the pulley and plate assembly (37) and insert the free end of the shaft through the pulley and pulley plate and install the second retaining ring (39). Loop the belt (38) around the three rollers of the pulley plate assembly.

b. Lightly brush both surfaces of the housing guide rails with grease and assemble the pulley and plate assembly to the housing, tilting the assembly to guide the ratchet arm through the opening in the housing. Assemble the stripper base (34), spring (36) and stripper (35) to the housing and pulley plate and secure with two screws (33). Assemble the drum and spring assembly (32) to the post on the module housing and, with a tweezers, engage the free end of the spring to the stripper.

c. Assemble the adapter springs (30) to the bosses within the spindle adapter (31). Apply adhesive (Bell & Howell Spec. 327) to the top of the two adapter bosses and around the step just below the outside edge of the adapter. Be careful not to get adhesive in the spindle holes of the adapter bosses. Press the cover plate (29) into place on the adapter and wipe away excess adhesive with a cloth dampened in naphtha. Assemble the adapter assembly (28) into the housing and install the flat washer (27), wave washer (26) and push-on retaining washer (25) to secure the adapter. Open and close the adapter to make certain that it does not bind. Activate the adhesive backing of a new cover plate (item 51, Figure 1) with trichloroethylene and press in place at the top rear of the housing.

d. Fasten the roller and bracket assembly (24) to the housing with the screw (23). Hold the bracket up against the split post of the housing while tightening the screw.

e. Assemble the setscrew (18) into the "angled" side of the rear trigger (17), screwing it in until the point of the screw just protrudes on the opposite side. Assemble the guide roller (22) to the snubber (21). Insert the shaft of the front trigger assembly through the snubber and assemble these parts to the housing. Install the spacer (19) and rear trigger (17) on the front trigger shaft.

f. Hold the long spring (15) with the bent end to the left and pointing down. Place dampening pad (16) on top of spring and flush with bent end of spring. Place short spring (14) on top of dampening pad with bent end to the left and pointing up. Assemble these parts into the slot of the split post with the free end of the short spring curved counterclockwise to bear against the underside of the front trigger and the free end of the long spring curved counterclockwise to engage the slot in the snubber (See Figure C). With a tweezers, push the "T" end of the springs against the split post.

g. Assemble the support plate assembly (13) into the housing, engaging the upper end of the plate with the slots in the housing and lowering the other end down over the mounting stud. Secure the lower end with the push-on retaining washer (12). Lightly grease the support plate stud. Install the gear train assembly (11), with the small black gear located on the pulley shaft (41) and the large white gear located on the support plate stud. Install retaining ring (10) on support plate stud and tighten the setscrew (9) in the hub of the small black gear.

h. Over the hub of the spur gear (8), assemble the clutch disc (7), clutch gear (6) and with hub facing up, washer (4), spring (5) and a second washer (4). Compress the spring until the retaining ring (3) can be installed to secure the assembly. Lightly grease the housing stud just above the rear trigger and install the assembled clutch group to the stud, with the teeth of the spur gear meshing with the pulley plate gear rack. Install the retaining ring (2) into the groove of the stud.

i. Apply a drop of silicone oil to the housing boss to which the dampening arm (1) will be installed. Assemble the dampening arm to the boss, engaging the slot at the upper end of the arm with the pin of the snubber (21). Set the module assembly aside until ready for installation (paragraph 18).

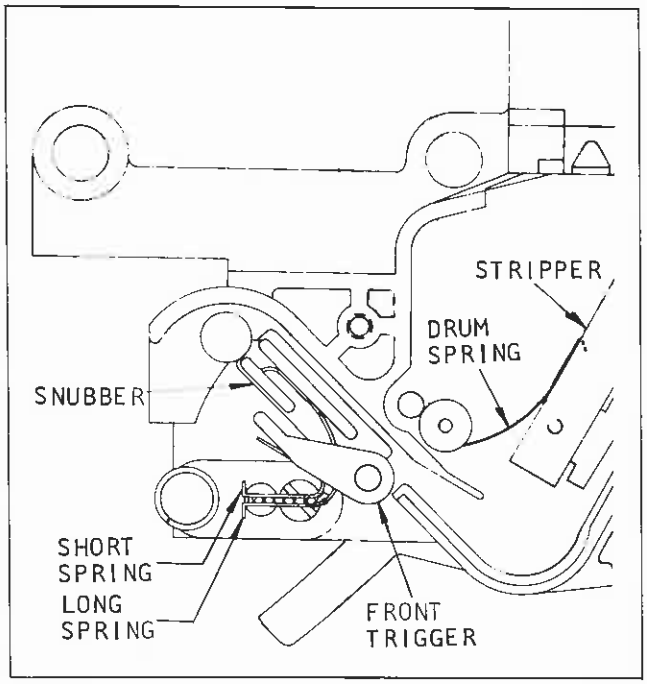


Figure C. Installing Module Snubber Springs

15. REASSEMBLY OF PARTS IN FIGURE 4. Reassemble parts in reverse order of disassembly, noting the following special precautions.

a. Place aperture plate (53) on the work bench with the stud up and away from you. Assemble the side tension arm (56) over the stud with the tension arm prongs down and into the aperture plate slots. Assemble the spring (55) with the center loop toward you and the ends of the spring entering the holes in the side tension arm. Place the loop opening of the spring into the stud groove and press the spring in until it seats. Side tension arm should exert a tension of 160 grams minimum to 180 grams maximum. It may be necessary to adjust the side tension spring (55) as shown in Figure D until the proper tension is obtained. Then assemble the aperture plate loosely to the mechanism plate with the two screws (52). Line up the aperture opening and tighten the two screws. Assemble the film guide (57) to the aperture plate. Position the film guide over the threaded studs, and while holding the film guide in, with tangs against the inside edge of the slots in the aperture rail and aperture plate, secure the film guide with two screws (54). Secure upper right-hand corner of aperture plate with screw (49) and upper left-hand corner with screw (50) and stand-off stud (51).

NOTE: Before proceeding, install the retractor plate (item 56, Figure 7) as follows. Grease the retractor plate stud (55, Figure 7) lightly and hold the retractor plate in position against the projector mechanism plate with the bent finger pressing lightly against the aperture plate side tension arm. Install the stud and secure the end of the stud with the spring clip (54, Figure 7).

b. Assemble one retaining ring (39) to the groove at one end of shaft (41); then from other end of shaft assemble spring washer (40) with bow up. Assemble spring (42) and plate (43) over the shaft. Assemble remaining retaining ring (39) to other end of shaft to complete the assembly.

c. Apply a light coat of grease to the roller shafts of the lower loopformer (34). Assemble two rollers (33) to the lower loopformer with recess up and add two washers (32), one over each shaft, into the roller recess. Secure rollers to shafts with two retaining rings (31). Secure lower film guide (29) to edge of mounting plate with one screw (27). Oil the shaft of the loopformer and roller assembly and add one washer (37) to the shaft. Insert the lower loopformer shaft into the bushing of mounting plate (44), engaging the tabs of loopformer between lower stop plate and bumper. Place a 0.002-inch shim between loopformer and bearing washer. Assemble bushing (36) to the shaft and secure with two setscrews (35). Secure lower loopformer assembly to the mechanism plate with two screws (27) while holding the loopformer assembly against aperture plate. Actuate loopformer to assure free operation. Assembly must be free from any binding.

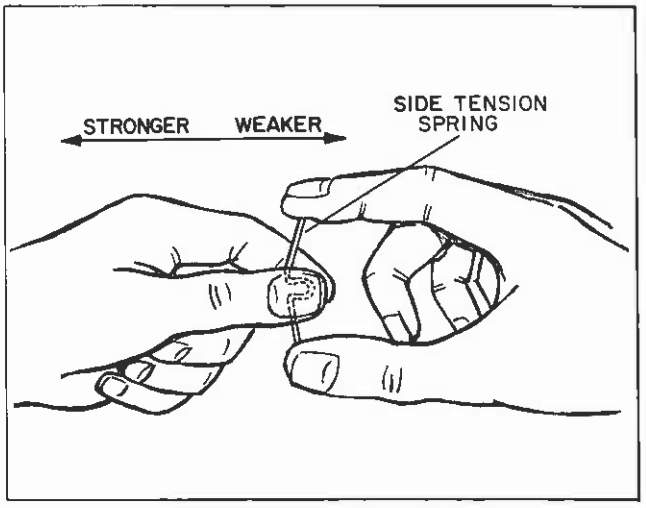


Figure D. Adjusting Aperture Plate Side Tension

d. Assemble framer shaft (22) through collars (24 and 25) into lens carrier (26). Adjust collars (24 and 25) on shaft as instructed in paragraph 23; then secure collars with three setscrews (21).

e. Assemble the torsion spring (18) over the stand-off stud (51), with the long leg of the spring parallel to the side of the casting. Assemble the feed-out lever assembly (17), stud down, to the stand-off stud and locate the formed end of the spring (18) on top of the lever stud. Secure the feed-out lever with screw (16). Assemble the actuating arm (20) over the protruding end of the aperture plate screw (49), and engaging the forked end of the actuating lever with the stud of the feed-out lever (17). The forked end of the actuating lever should be positioned between the leg of the spring (18) and the feed-out lever. Assemble the nut (19) to the aperture plate screw (49) to secure the actuating lever. Assemble the knob (15) to the end of the feed-out lever and actuate the lever several times to check freedom of movement.

f. Assemble engagement lever assembly (14) over the protruding end of the mechanism assembly bearing, while engaging the left-hand finger of the lever with the hole in the end of the actuating arm (20) previously installed. Assemble the retractor lever (13) to the shaft of the drive gear and shaft assembly (11). Lightly grease the shaft and insert it through the mechanism bearing. The tangs of the retractor lever must seat down over the end of the bearing. Install the retaining ring (10) into the groove in the gear shaft. Assemble the torsion spring (12) over the rear end of the mechanism bearing and hook the left end over the engagement lever and the right end over the ledge of the mechanism casting as shown in the inset of Figure 4.

g. Assemble washer (9) over the end of drive gear and shaft assembly (11) and oil the end of the shaft. Lightly oil gears (8) and (6) on side with projections. Assemble gear (8) to the drive gear shaft with the projections facing out. Lightly grease both sides of the gear lever (7) around the large diameter

hole. Install the lever assembly with the large diameter hole over the projections of gear (8). Install gear (6), engaging its projections with those of gear (8). Assemble ratchet spring (5) to gear shaft with the dimples at either end engaged in teeth of gear (6). Install washer (4) and depress washer while securing parts with the retaining ring (3). Do not install large spur gear (2) until gear train and reel arm components have been assembled (paragraph 16).

16. REASSEMBLY OF PARTS IN FIGURE 3. Reassemble parts in reverse order of disassembly, noting the following special precautions.

a. Secure the guide bar (55) to the main plate with the two screws (54). Install the gear plate (53) over the main plate stud and secure it with the retaining ring (52). Pull outward on the retaining ring to seat it against the outside of the groove, thereby providing the plate with some play. Apply a light coat of grease to the washer (51) and the gear shaft (50) and assemble the washer to the shaft. Insert the shaft through the gear plate (53) and the main plate, install the washer (49) on the shaft, and secure the washer with retaining ring (48). Assemble the wave-type tension washer (45) over the gear plate boss to which spur gear (44) is to be installed. Lightly grease the smooth face of gear (44) and assemble the gear to the boss, greased side down, meshing its teeth with those of the drive puck gear shaft (50). Install the washer (43A) and screw (43) and tighten the screw until the tension washer (45) flattens slightly. Do not install the drive puck assembly (47) until the feed-out module has been installed (paragraph 18).

b. Over the long hub of the large spur gear (42), assemble the clutch disc (41), rewind spur gear (40), washer (39), spring (38) and washer (37). Compress the spring and install the retaining ring (35) to secure these parts. Lightly grease the take-up clutch stud of the gear plate and the main plate stud to the left of the gear plate. Install the assembled take-up clutch onto the clutch stud, engaging the large gear (42) with spur gear (44) previously installed. Secure the clutch assembly with retaining ring (35). Assemble the rewind idler gear (34) to the main plate stud, meshing it with gear (42), and install retaining ring (33).

c. Assemble the rewind arm and gear assembly (32) onto the main plate stud (grease stud lightly), engaging its gear with rewind idler gear (34) and engaging the long tab of the lever into the jaw-like rewind actuator of the shift bracket assembly. Assemble the tension washer (31), large spur gear (30) and flat washer (29) to the main plate stud and secure these parts with retaining ring (28).

d. Assemble the retractor lever guides (27) to the gear mounting plate (18) with the hex head shoulder screw (26) and pan head screw (25). The flats on the inner ends of the guides should be horizontal. Hook one end of the fire shutter rod (23) into the small hole in the retractor lever (24). Assemble retractor lever (24) to the guides and turn the guides until the flats are vertical; then tighten screws (25) and (26) securely. Hook the spring (22) between the right end of the retractor lever and the notch at the upper edge of the gear mounting plate. Set this assembly aside.

e. Insert the reel arm bearing (16) through the hole in the take-up arm support assembly (17) and lightly grease the support around the protruding bearing. Assemble support and bearing to the main plate. Use a speck of grease to hold the steel balls (21) in the detents on either side of the bearing. Assemble the cam (20) over the bearing, with the prongs toward the top of the main plate. Assemble spring (19) over the bearing, with the small diameter down and the small diameter end of spring toward top of main plate. Carefully position the gear mounting plate (18) onto the main plate, engaging the notch at the upper end of the drive gear lever (item 7, Figure 4) beneath the head of the hex head shoulder screw (item 26, Figure 3). When the gear mounting plate is fully seated on the reel arm bearing, press down to compress the spring (19) and install the retaining ring (15). Secure the gear mounting plate to the main plate with screw (14). With a tweezers, hook the lower end of the fire shutter rod (23) into the elongated slot in the fire shutter arm.

f. Lightly oil the end of the spur gear and shaft assembly (10) and assemble the shaft into the take-up arm bearing from the arm side. Assemble spur gear (9) over end of gear shaft. Insert a 0.003-inch shim between gear face and bearing face, press down lightly on the spur gear, and tighten its setscrew (8) securely. Check to make certain that the assembled spur gear and gear and shaft assembly have 0.002 to 0.003 inch end play.

g. Lightly grease each gear stud of the gear mounting plate (18). Install spur gear (12) onto its gear stud so that it meshes with the take-up spur gear (9). Secure the gear with the retaining ring (11). Assemble the large spur gears (13) on their studs and secure them with retaining rings (11).

h. Lightly grease all gear studs of the reel arm support (17). Assemble gear (7), hub down, onto its stud on the take-up support. Add gears (6), with hubs down, on the two remaining studs. Lightly grease all gear teeth and carefully assemble the reel arm (3) to the support, installing and tightening the screws (1). Assemble reel spindle assembly (5), with gear (4) in place on spindle shaft, to feed reel arm with flat of shaft engaged with flat of reel arm support. Secure with screw (2).

NOTE: At this point, the large gear (item 2, Figure 4) can be secured to the gear stud on the drive gear lever (item 7, Figure 4) with the retaining ring (item 1). Then center the helical gear (item 32, Figure 7) in its cut-out in the main plate and tighten its setscrew securely.

17. REASSEMBLY OF PARTS IN FIGURE 2. Reassemble parts in reverse order of disassembly, noting the following special precautions.

a. Assemble forward-reverse knob (36) to reversing lever with lettering positioned so as to be readable, and secure with screw (35).

b. Assemble screws (28) to rollers (30) and (31), with head of screw in recess of roller, and install to the upright of the base. Assemble the film deflector (32) over the threaded end of the upper screw so that it fits into the formed recess and secure in place with hex nut (29).

c. Install the torsion spring (26), short tang first, over the idler stud protruding from the mechanism plate. Engage the short tang of the spring with the hole in the mechanism plate. Install film guide (27) over the stud and the long tang of the spring and secure these parts with retaining ring (24). Assemble roller (25) to stud and secure with the second retaining ring (24).

d. Apply grease to all surfaces of the interlock lever (22) which will contact the control housing (18). Assemble end of lever with elongated slot through notch in center wall, with angled edge toward top of control housing. Place two bushings (21) on the assembly. Assemble switch (23) into the control housing with notch side of switch toward top of control housing. Secure switch to housing with two screws (20). Actuate the switch to assure switch and interlock lever are working properly. Assemble tubing (19) over the three switch leads and slide down as close as possible to rear of switch assembly. Apply nameplate (37) to shelf of control housing approximately 1/8-inch in from the front edge and centered. Smooth down to assure good adhesion using clean dry rag.

e. Assemble the control housing to the main plate while guiding the leadwires and tubing through the opening in the main plate and guiding the operating levers through the slots in the control housing. Install and tighten the two control housing mounting screws (17). Install the nameplates (15) and (16) and the control lever knobs (14).

f. Design 459X Only. Fasten the support plate (13) to the projector main plate with two screws (12). Mount the lamp socket (11A) to the main plate with two screws (9A). Secure the leadwire clamp (8) to the main plate with the screw (6A) and Sems nut (7A). Secure the upper end of the air deflector (5) to the support plate (13) with two screws (3) and the lower end to the blower housing casting with the press-in clip (4).

g. Design 459A Only. Mount the lamp socket assembly (11) to the projector main plate with two screws (9) and washers (10). Secure the leadwire clamp (8) to the lamp socket bracket with screw (6) and washer (7). Secure the upper end of the air deflector (5) to the lamp socket bracket with two press-in clips (3) and the lower end of the blower housing casting with press-in clip (4).

h. Refer to the wiring diagrams, Figure 9, for proper leadwire connections. Dress all wires so that they do not interfere with moving projector parts.

18. REASSEMBLY OF PARTS IN FIGURE 1. Reassemble parts in reverse order of disassembly, noting the following special precautions.

a. Position the feed-out module assembly (49) against the main plate, engaging its gears carefully with the disengagement lever gears, and install the four screws (46), (47) and (48). Screw (48) is inserted through a hole in the main plate just above the upper end of the actuating rod assembly.

b. Assemble the drive puck assembly (item 47, Figure 3) to the end of the drive puck shaft. Place the spacing gage (Figure B) against the four locating pads of the module housing. Lift the drive puck and arm to the fully raised position and press and hold the puck lightly against the spacing gage while tightening the setscrews alternately, a bit at a time. Do not install the module cover until all module adjustments have been made.

c. Design 459X Only. If the plug and nameplate assembly (15) or socket (14) was replaced, the end of the plug must be heat-sealed after these parts are reassembled to the back cover.

d. Assemble the cover release button (4) to the front cover and install the cover catch (3) to the button with the bulge facing up. Secure these parts with the rivet (2).

19. FINAL INSPECTIONS.

a. Open the film gate and rotate, the manual knob while watching the movement of the shuttle. The shuttle tooth should travel in the center of the shuttle slot. Refer to paragraph 22 for shuttle tooth adjustments.

b. With the projector grounded, plug the line cord into the proper voltage outlet. With the Off-Run Lamp switch in the RUN position, run the projector in "Forward" while applying grease to the gear train with a brush. Be very careful not to get grease on the drive belt or the motor pulley. After greasing and with the projector still running, apply naphtha to the drive belt and pulley with a brush to remove any grease or oil from these parts; then blow dry with a low pressure jet of compressed air.

c. With the lens removed, film gate open and projector running in "Forward," move the forward-reverse lever to "still" (center) position. The safety shutter must drop in front of the aperture opening at the very moment that the motor stops running. Repeat this procedure by moving the forward-reverse lever to "Reverse" position and then to the "Still" position. At the same time, check to make certain that the mechanism (drive rollers and sprockets) begins to drive just before the safety shutter clears the aperture opening. Turn off projector and, if necessary, adjust safety shutter operation as instructed in paragraph 25.

d. With the film gate closed, check to make certain that there is no play in the lens carrier. If necessary, bend the lens carrier spring catch with a pliers to eliminate play.

e. Check all attaching screws and nuts to make certain that they are tightened securely and visually check the projector for missing parts. Pick up the unit, turn it over and shake it to make sure no loose parts are lying in the mechanism.

f. Check to make certain that all leadwire connections are secure by tugging gently on the leadwire near the terminal connection, and see that all leadwires are properly dressed out of the way of moving parts.

g. Make final projector adjustments as outlined in paragraphs 20 through 27. Then make a final test of projector operation as outlined in the Final Test section.

20. CHECKING TAKE-UP SPINDLE TORQUE. The spindle assembly on the rear (take-up) arm must be replaced if (1) the reel will not take up film which is an indication that spindle is too loose, or (2) it pulls bottom loop out or damages film perforations or causes picture unsteadiness.

21. LAMP SOCKET ALIGNMENT. As illustrated in Figure E, the lamp socket is secured with two screws. The screw to the rear of the lamp socket is inserted through an oversized hole in the main plate; thus when both screws are loosened slightly, the socket can be rotated to obtain full and even light through the aperture opening.

a. Rotate the manual knob until the shutter clears the aperture opening. Install the projection lamp, aligning the key on the lamp base with the key slot in the socket and pressing down firmly on top of lamp until it is seated.

b. Install the projection lens and switch on the projector. Focus the lens until the image of the aperture is sharp on the screen and note whether a dark area is evident at the top or bottom of the image.

c. If dark area was noted, switch off the projector and loosen the lamp socket screws just enough to permit the lamp socket to be rotated. A dark area at the top of the aperture image indicates that light is projecting at a slightly downward angle. With the blade end of a screwdriver, apply a slight amount of pressure against the top edge of the rear socket screw, thereby rotating the lamp socket slightly counterclockwise.

d. If the dark area appeared at the bottom of the aperture image, it indicates that the light is projecting at a slightly upward angle. In that case, apply pressure to the bottom edge of the rear socket screw, rotating the lamp socket clockwise.

e. It may be necessary to repeat the adjustment several times, switching on the lamp between adjustments to check the image. When the aperture image appears fully and evenly lighted, tighten both lamp socket screws securely, watching the image to make certain that the socket does not move out of alignment. Then switch off the projector and install the lamphouse.

22. SHUTTLE TOOTH ADJUSTMENT. Excessive or inadequate protrusion of the shuttle teeth will result in improper film transport during operation. Proper shuttle tooth protrusion is checked with shuttle tooth Go-No-Go gage shown in Figure B. Proceed as follows.

a. Make the following adjustments to the projector controls.

(1) Set the framer knob at the approximate center of its travel range.
(2) Set the format lever at 8-MM.
(3) Set the RUN-REWIND lever at RUN.
(4) Set forward and reverse lever to either forward or reverse.
(5) Swing open the lens carrier.

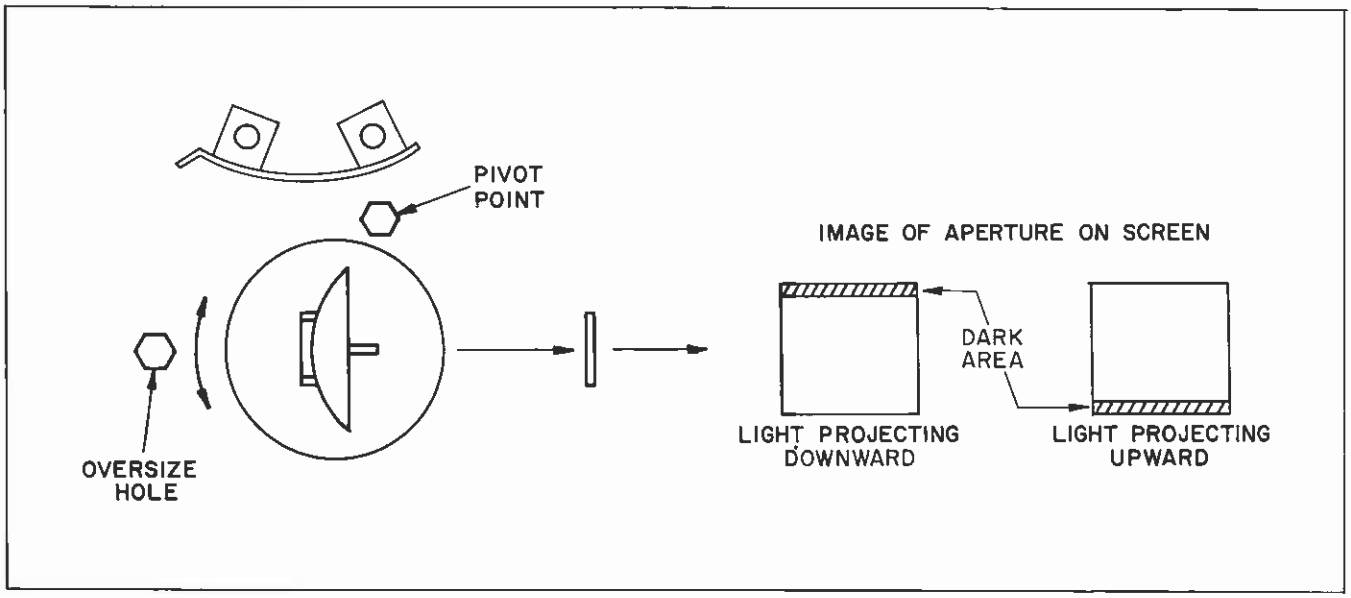


Figure E. Aligning the Lamp Socket

b. Rotate the manual knob until the shuttle teeth reach approximate mid-stroke.

c. Place the notched edge of the shuttle protrusion gage against the aperture plate with the deepest notch positioned directly over the shuttle teeth.

d. While holding the gage lightly but firmly against the aperture plate, slide the gage slowly downward. If the shuttle teeth catch against the "go" step of the gage, the teeth are protruding too far beyond the surface of the aperture plate. If the teeth pass the "go" step of the gage but fail to catch against the "no-go" step, the teeth are not protruding far enough. Also, note if shuttle teeth are protruding an equal amount.

e. Adjustment of shuttle tooth height is made by means of the tapped spacer (item 23, Figure 7) to which the pivot point of the shuttle assembly is attached. To adjust shuttle tooth protrusion loosen the spacer locking nut with a socket wrench. Insert a screwdriver in slotted end of pivot spacer. To increase the height of the shuttle teeth, turn the spacer clockwise. To decrease the height of the teeth, turn the spacer counterclockwise.

f. When teeth are within the minimum and maximum setting, carefully tighten the locking nut with a socket wrench. Recheck teeth for proper height after securing locking nut. If teeth have gone out of adjustment, repeat above adjusting sequence.

g. To adjust shuttle teeth for uneven protrusion (one tooth protruding more than the other), remove lamphouse assembly and lamp. Rotate the manual knob until the shuttle is visible through the casting just forward of the lamp socket and the shutter opening. Insert the shuttle bending tool and engage the slot of the tool with the shuttle tooth arm. The bending tool can be raised or lowered, thereby twisting the shuttle tooth arm slightly.

CAUTION: The shuttle tooth arm must be bent carefully, and in small amounts, checking between each bending operation until evenness of shuttle teeth is properly established. Use extreme care when bending so as not to distort aperture plate components or damage the shuttle teeth.

h. Carefully rest the projector on its back surface (lens pointing up) with the format shifter locked in Super 8-mm position. Open the lens carrier and set the framer knob at the approximate center of its travel range. Place a strip of film onto the aperture plate and turn the manual knob until the shuttle teeth are at the extreme top and extending through the film. With a magnifying glass, check to make certain that the teeth are approximately in the center of the perforations. Adjust centering as necessary by loosening screw (item 7, Figure H) in adjusting slot at the knee of the shuttle bracket and moving bracket in either direction. Tighten the screw securely after adjustment has been made.

i. If pivot spring tension is insufficient to maintain shuttle pressure of upper cam shoe against inout cam, adjust shuttle leaf spring adjusting screw clockwise. Reseal screw threads with shellac and center leaf spring over end of adjusting screw.

23. FRAMER ADJUSTMENT. The framing mechanism must be adjusted to permit maximum picture framing in either direction. Proceed in the following manner. Refer to Figure F.

a. If not previously installed, install the lens carrier as follows. Apply a light brushing of grease to the threads of framer shaft assembly. Assemble threaded end of framer knob and shaft assembly through the upper ear of mechanism plate. Position lens carrier assembly between the ears of the mechanism plate while pushing framer shaft through upper ear of carrier. Assemble the upper and lower collars with threaded hole toward upper ear, and framer collar onto framer shaft. Then push framer shaft through lower ear of lens carrier and thread into lower ear of mechanism plate. Thread shaft until end is just coming through the ear, and flat side is facing you.

b. Place a 0.027-inch shim between the lower ear of the mechanism casting and the lens mount.

c. Press the lens mount down against the shim. Hold the upper and lower collars against both the lens mount ears and tighten the collar setscrews securely against the flat of the framer shaft.

d. Place 0.10-inch shim between the lower collar and the framer collar and tighten the framer collar setscrew securely against the flat of the framer shaft.

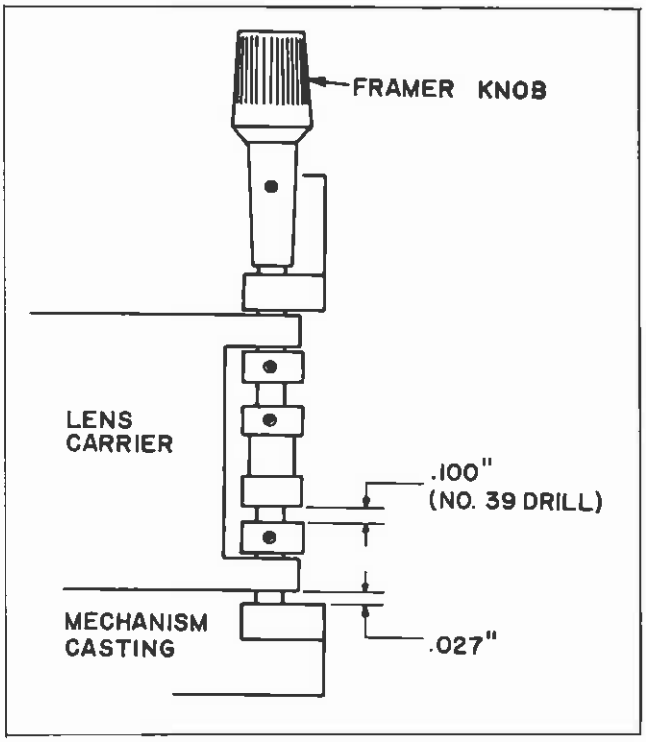


Figure F. Adjusting Projector Framing

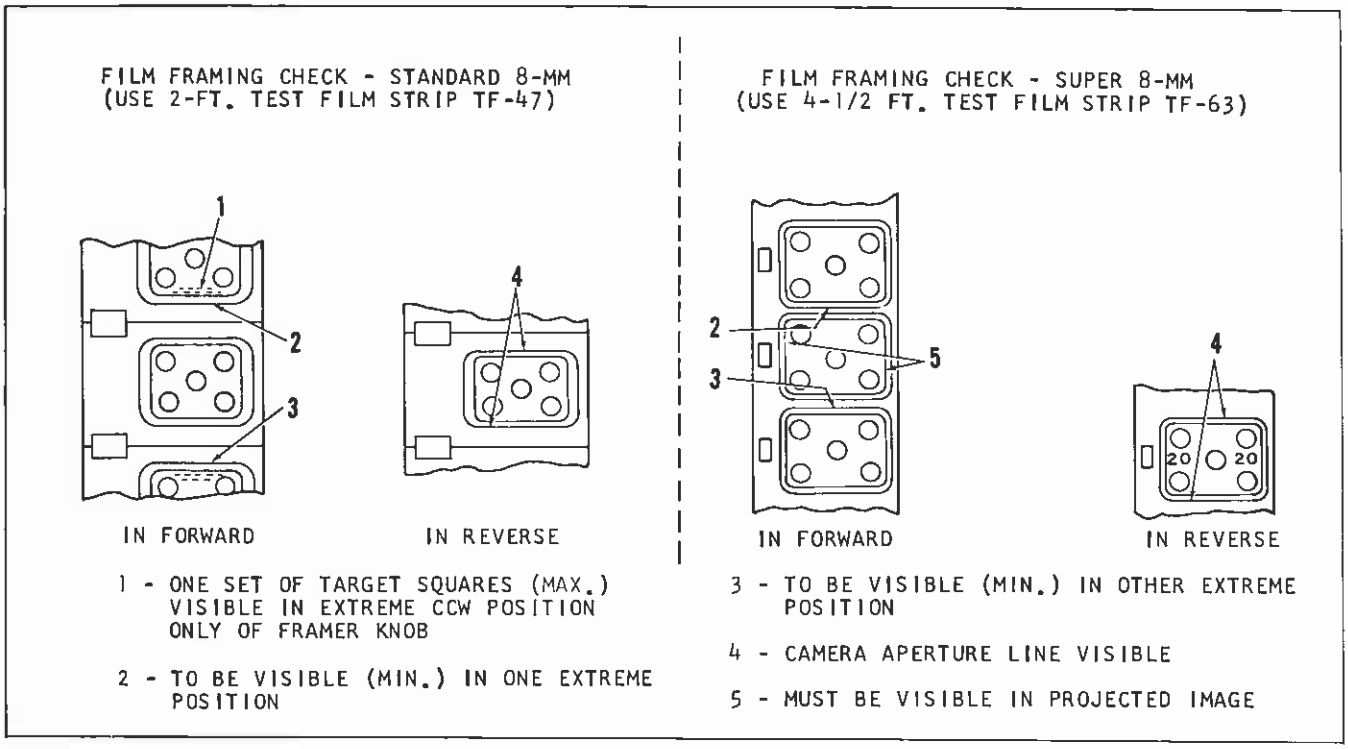


Figure G. Checking Film Framing Adjustment

e. Framer knob must turn freely, without binding. If it does not, adjust the upper collar to free it.

f. Using the test film strips indicated in Figure G, check the framing both in Standard and Super 8-mm modes of operation. Framing results should be as noted in Figure G.

24. APERTURE MASK ADJUSTMENT (Figure H).

a. Remove the knob from the end of the format shifting lever. Place the projector slide switch in the OFF position and the format shifting lever in Super 8 position; then move the slide switch to the LAMP position so that the format shifting lever is locked in Super 8.

b. Insert the narrow tip of the shifter gage (Figure B) through the shifting lever slot in front of the control housing so that it is located between the shifting lever and the top edge of the switch interlock lever. Note that the threaded ends of the eccentrics are slotted. Loosen the lock nut (2, Figure H) on eccentric (1) and rotate the eccentric until it just makes contact with the rear edge of the shifting lever arm; then tighten the lock nut securely.

c. Return the slide switch to the OFF position and place the shifting lever in the Standard-8 position; then move the slide switch back to the LAMP position. Again insert the shifter gage, this time between the shifter lever and the bottom edge of the switch interlock lever. Loosen the lock nut (4) on eccentric (3) and rotate the eccentric until it just makes contact with the forward edge of the shifting lever arm; then tighten the lock nut securely.

d. Swing open the lens carrier and visually check the centering of the aperture mask both in Standard-8 and Super 8. The mask must shift completely from one format to the other in either extreme of the framing knob. Also, the mask actuating lever (5) must not touch the actuating ears of the mask after shifting to either format and in the extremes of framing range. If the mask does not shift completely, or if actuating lever touches the ears of the mask, adjust by loosening the screw (6) and moving the lever in the proper direction.

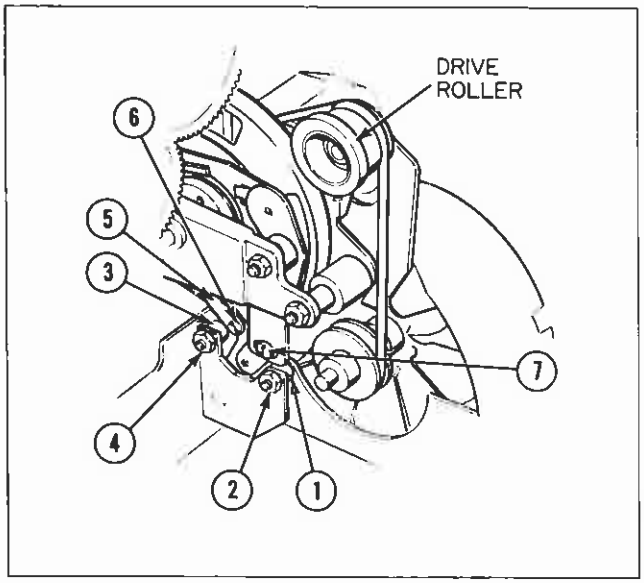


Figure H. Adjusting the Aperture Mask

25. SAFETY SHUTTER ADJUSTMENT. The rubber drive rollers which drive the shutter pulley must make contact and begin driving the mechanism (in forward and in reverse) before the safety shutter clears the aperture opening. With the back cover removed and the projector line cord connected to the power source, switch on the projector. This test is to be made without film.

a. Operate the projector, first in the forward direction and then in the reverse direction. Watch the safety shutter carefully as the lever is moved from the "still" position to either of the operating positions.

b. Proper operation of the safety shutter is controlled by the clearance between the outer drive roller and the rim of the shutter (Figure H). The nominal clearance is 0.062 ± 0.015 inch. If, when operating in reverse, the safety shutter tends to clear the aperture opening before the shutter begins to revolve, this clearance should be increased toward the high (0.077 inch) tolerance limit. If, when operating in forward, the safety shutter clears the aperture opening too soon, the clearance should be reduced toward the lower (0.047 inch) tolerance limit.

c. To adjust, place the lever in the "still" (center) position and loosen the two screws which attach the spring loading bracket to the pulley mounting bracket. Insert shim stock of the desired thickness (to increase or decrease nominal clearance of 0.062 inch) between upper drive roller and rim of shutter. While maintaining a light pressure on the roller, tighten the two loading bracket screws securely.

d. Retest safety shutter operation and readjust, if necessary, by changing the thickness of the shim stock inserted between roller and shutter rim.

e. To adjust the rewind actuating lever assembly (44, Figure 7) loosen screw (43) and move the lever assembly until it is approximately 3/16-inch from the outer drive roller shaft. Tighten screw (2). Operate the projector in the forward direction. When the rewind lever is pressed down to rewind position the pressure of the lever on the outer drive roller shaft should be sufficient to reverse the film drive gears. Reset the projector to run. The gears must start to drive in forward immediately. Vary the distance between lever and shaft until a positive reverse and forward shift is effected.

26. ADJUSTING REWIND ENGAGEMENT LEVER (Figure J).

a. Remove the retaining ring (33, Figure 3) and spur gear (34, Figure 3) from the stud of the gear and mounting plate assembly.

b. Swing open the lens carrier and rotate the manual knob until the shuttle is at mid-stroke with the shuttle teeth retracted below the aperture plate. Place the Run-Rewind lever in the full-up (Run) position.

c. Assemble the small adjusting spacer over the tab at the upper end of the rewind engagement lever as shown in Figure J, View A. Loosen locking screw (A) and adjust the lower arm of the rewind trip lever until the spacer on the engagement lever is just touching the lower edge of the puck arm. Tighten locking screw (A) securely, and remove the small adjusting spacer.

d. Assemble the large adjusting spacer onto the mounting plate gear stud (Figure J, View B), and place the Run-Rewind lever in the full-down (Rewind) position. Make sure that the lever is bottomed in the

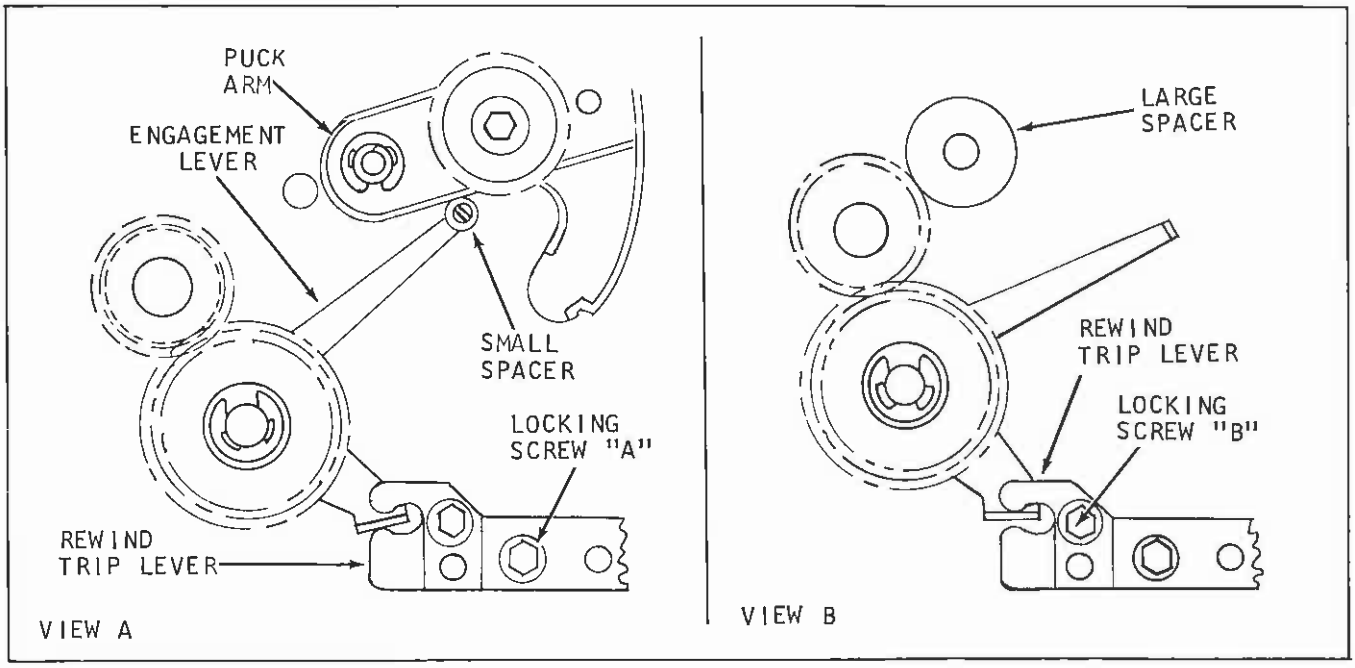


Figure J. Adjusting the Rewind Engagement Lever

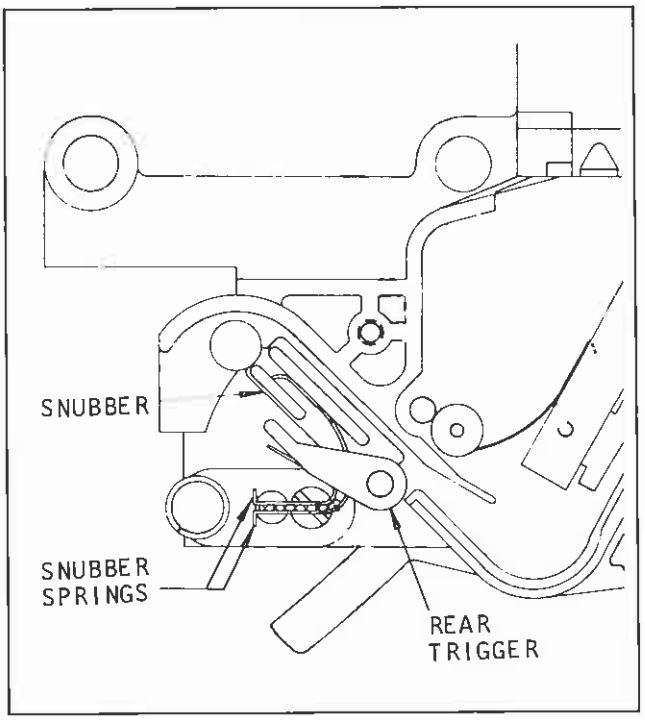


Figure K. Adjusting Auto-Rewind Trigger Mechanism

slot of the main plate. Loosen locking screw (B) and adjust the upper arm of the rewind trip lever until the rewind gear on the engagement lever is just touching the large adjusting spacer. Tighten locking screw (B) securely and remove the large adjusting spacer.

e. Reassemble the spur gear (34, Figure 3) to its mounting stud and install the retaining ring (33, Figure 3).

27. AUTO-REWIND TRIGGER MECHANISM ADJUSTMENT (Figure K).

a. Using a suitable gram tension gage, press down on the snubber until it moves downward just prior to touching the top edge of the trigger. At that point, the reading on the gage must be between 160 and 230 grams. If tension does not fall within the specified limits, replace the long snubber spring (item 15, Figure 5).

b. Place the Run-Rewind lever in the up and locked position. Press the snubber counterclockwise until the snubber spring just touches the "T" of the springs. Hold snubber in this position and adjust the rear trigger adjusting screw until the projector trips into rewind. Move the Run-Rewind lever up. The lever must not lock in the Run position until the snubber is released.

c. Place the Run-Rewind lever in the up and locked position. Using a suitable gram tension gage, press the snubber counterclockwise until the projector trips into rewind. At that point, the reading on the gage must be between 165 and 235 grams.

Final Test

28. GENERAL INSTRUCTIONS.

This section contains specific tests to be performed to insure that the projector is in proper working order. Tests will also serve to indicate the possible trouble or malfunction in the projector so that time can be saved in trouble shooting and servicing. Note that the projector is to be operated only from a 115 to 120 volts a-c, 60-cycle power source.

29. INSPECTION PROCEDURE.

a. Visually inspect the projector for missing parts. Pick up the projector, turn it over, and shake it to make sure that no loose parts are inside.

b. Check attaching screws and nuts for tightness, and tighten if necessary.

c. Check to see that all leadwires are properly dressed out of the way and that all solderless connectors are securely pressed onto their lugs.

d. Press on the ends of the sprocket shafts to check for end play. Sprockets must be under spring tension and springs must not be loose.

e. Open and close the lens carrier to make certain that it latches securely in place. If necessary, bend the fingers of lens mount catch (47, Figure 4) to increase the tension.

f. Check the manual knob shaft for a slight amount of end play. Rotate manual knob to check the fit of the cam shoes. Cam shoes should fit snugly but without binding, and proper fit is obtained by adjusting the long screw on the shuttle.

g. With MOTOR-LAMP switch in MOTOR position, and RUN-REWIND lever in RUN position, move direction lever back and forth several times between "still" and "reverse." Shutter must not rotate when lever is in "still" position. Switch lever to "forward" operation. Shutter now must rotate. Refer to paragraph 25 for adjustment.

30. SAFETY SHUTTER OPERATION TEST. It is important that the drive rollers, which drive the shutter pulley, make contact and begin driving the mechanism (either in forward or reverse) before the fire shutter clears the aperture opening. With the back cover removed and the projector connected to the power source, switch on the projector. This test is to be made without film. Operate the projector, first in the foward direction and then in reverse. Watch the action of the safety shutter and the drive rollers against the shutter rim as the lever is moved from the "still" position to either of the operating positions. If necessary, adjust drive rollers as instructed in paragraph 25.

31. REWIND OPERATION TEST. With the projector operating in forward direction, shift the RUN-REWIND lever to REWIND. The projector must reverse at once. Reset RUN-REWIND lever to RUN and REWIND alternately several times. Refer to paragraph 27 for adjustment.

32. OPTICAL ALIGNMENT TEST. The alignment of the optical axis of the projection lens in the vertical plane is held to very close tolerance in the machining of the lens mount pivot. However, alignment in a horizontal plane is subject to possible variation, and provision has been made for adjusting the lens carrier accordingly. Check alignment as follows:

a. Thread the projector with resolution test film, roll title film, or other film known to have good resolution at the edges of the frame.

b. Project and focus the picture on a matte-surface screen. If the picture is "soft" along either edge, swing open the lens carrier and turn the adjusting screw (46, Figure 4) in or out, as necessary to obtain equal sharpness of the image along both sides of the projected picture. The head of this screw bears against the machined surface of the lens carrier and determines the angular relationship between the optical axis and the aperture plate.

c. The adjustment should be made a bit at a time, and it may be necessary to refocus the lens during the alignment procedure.

33. TESTING OPERATION WITH THE AUTOLOAD CASSETTE.

a. Insert the cassette with automatic rewind clip attached with the arrow on the cassette matching the arrow on the module cover. Press against the cassette until it snaps in place.

b. Set the film format selector lever for the film being used (8mm or Super 8mm) and place the Multi-Motion lever in the "Normal " position.

c. Press the Off-Motor-Lamp switch to the "Motor" position and place the Forward-Reverse lever in "Forward." Press and hold the film threading lever down until the shuttle makes a clicking sound; then release the threading lever immediately. The film should advance through the projector and onto the take-up reel automatically. If the film does not advance properly, refer to the Troubleshooting section for probable causes and suggested remedies.

d. Press the Off-Motor-Lamp switch to the "Lamp" position and focus the projected image as sharply as possible on the screen. If the image appears soft at the edges, check the alignment of the optical axis and adjust as outlined in paragraph 32.

e. If the picture is out-of-frame and cannot be properly framed with the framing knob, check and readjust the framer (paragraph 23) and/or the aperture mask and format shifting lever (paragraph 24).

f. Remove the lens and swing open the lens carrier. Place the Forward-Reverse lever in the "Still" (center) position. The safety shutter must drop in front of the aperture opening at the very moment that the motor stops running. Move the lever to "Reverse" and then back to "Still," again checking safety shutter operation. Move the lever back to "Forward" and check to make certain that the projector mechanism (rollers, gears) begin to drive just before the safety shutter clears the aperture opening. If the safety shutter does not function as noted above, it must be readjusted as instructed in paragraph 25.

g. Run the projector until the end of the film is reached. The rewind clip near the end of the film should trigger the rewind mechanism and the film should immediately begin to rewind. If there should be any failure in the automatic rewind system, refer to "Rewind Failure" in the Troubleshooting section for probable causes and suggested remedies.

34. TESTING OPERATION WITH OPEN REEL. For open reel projection, install the proper spindle adapter (regular 8mm or super 8mm) into the appropriate socket of the reel adapter at the top of the feed-in module. For 50-foot and 100-foot reels, leave the reel adapter in its down position and insert the adapter into the socket marked "50-100." For 200-foot and 400-foot reels, swing the reel adapter clockwise to its vertical position and insert the adapter into the socket marked "200" (for 200-foot reels) or "400" (for 400-foot reels).

a. Install the film reel on the spindle adapter with the leader coming off the top in a clockwise direction and press it firmly in place.

b. Set the film format selector lever for the film being used (8mm or Super 8mm) and place the Multi-Motion switch lever in the "Normal" position. Press the film guide plate of the module down into the notched-out position of the module cover.

c. Press the Off-Motor-Lamp switch to the "Motor" position and place the Forward-Reverse levers in "Forward." Insert the trimmed end of the leader into the film channel of the guide plate and down into the threading slot while holding down the film threading lever. As soon as the shuttle begins to make a clicking sound, release the threading lever. The film should advance through the projector and onto the take-up reel automatically. If the film does not advance properly, refer to the Troubleshooting section for probable causes and suggested remedies.

NOTE: Tests to be performed with an open reel are identical to those performed with the cassette (paragraph 33, steps d through g).

Trouble Shooting

TROUBLE	PROBABLE CAUSE	REMEDY
Projector inoperative with switch in the MOTOR or LAMP position	1. No electrical power.	1. Check power source.
	2. Loose blower fan.	2. Tighten fan setscrew (9-4).
	3. Broken drive belt.	3. Replace belt.
	4. Defective switch or wiring.	4. Check switch and circuitry.
Picture flicker	1. Drive roller assemblies not adjusted properly.	1. Readjust as instructed in paragraph 25.
	2. Defective drive belt pulley.	2. Replace drive belt pulley.
	3. Dirt, wear or binding in gearing.	3. Clean and repair or adjust gearing as instructed in reassembly instructions.
Film scratches	1. Excessively dirty film channel parts (rollers, guides, etc.).	1. Clean projector thoroughly.
	2. Worn aperture plate (4-53) or pressure plate (6-17).	2. Replace worn or marred parts.
	3. Worn or damaged aperture plate film guide rail.	3. Replace aperture plate (4-53).
Jumpy picture	1. Loss of film loop due to damaged film.	1. Inspect and splice as required.
	2. Green film.	2. Run film through projector two or three times to age the film.
	3. Shuttle tooth worn.	3. Replace shuttle assembly (7-18).
	4. Misaligned shuttle tooth.	4. Adjust and align shuttle as instructed in paragraph 22.
	5. Grooves worn in aperture plate film guide rail.	5. Replace aperture plate (4-53).
	6. Lower loopformer binding.	6. Free up binding loop-former.
Soft focus	1. Dirty projection lens.	1. Clean projection lens.
	2. Lens mount out of alignment.	2. Readjust focus screw as necessary (paragraph 32).
	3. Loose lens mount catch (4-47).	3. Reset tension by bending catch carefully.

TROUBLE	PROBABLE CAUSE	REMEDY
Autothreading not operating properly	1. Loopformer binding.	1. Free-up loopformer.
	2. Safety shutter binding.	2. Free-up safety shutter.
Film spills	1. Insufficient tension on take-up spindle.	1. Replace spindle.
Fails to take-up or rewind	1. Defective drive belt.	1. Replace belt.
	2. Worn rim on drive roller.	2. Replace worn roller (7-6).
	3. Drive rollers not adjusted properly.	3. Readjust as instructed in paragraph 25.
	4. Defective reel spindle.	4. Replace spindle.
Noisy	1. Loose attaching parts.	1. Tighten as necessary.
	2. Gearing dry.	2. Lubricate as necessary.
Dim projected pictures	1. Projector lamp dirty.	1. Clean projector lamp.
	2. Wrong lamp used.	2. Use proper lamp (Type DJL for 459A; Type DNF for 459X).
	3. Lamp socket out of alignment.	3. Align lamp socket as instructed in paragraph 21.
Pictures not framing properly	1. Framing spacers out-of-adjustment.	1. Adjust framing (paragraph 23).
	2. Format shifting lever out-of-adjustment.	2. Adjust aperture mask and shifting lever (paragraph 24).
Film transport problems	1. Incorrect shuttle tooth penetration or centering.	1. Adjust as instructed in paragraph 22.
	2. Cam shoes too tight or too loose.	2. Correct shoe fit by adjusting long screw on shuttle.
	3. Cam holes not lined up.	3. Align holes as directed in reassembly.
	4. Shuttle pivot leaf spring too loose.	4. Adjust leaf spring adjusting screw clockwise. Recenter spring over end of screw.
	5. Bent shuttle (7-18).	5. Straighten or replace bent shuttle.
	6. Defective or wrong upper cam shoe (7-20).	6. Replace cam shoe.
	7. Upper cam shoe (7-20) assembled backwards.	7. Assemble cam shoes as instructed in reassembly.

TROUBLE	PROBABLE CAUSE	REMEDY
Rewind failure	1. Spring (7-36) disconnected from studs.	1. Secure spring with retaining rings (7-35).
	2. Rewind arm (7-44) twisted or out of adjustment.	2. Straighten or replace arm and adjust (paragraph 25, step e).
	3. Defective spindle (3-5).	3. Replace spindle.
	4. Dry pull-down cam.	4. Lightly grease cam (7-21).
	5. Tight cam shoes (7-19) and (7-20).	5. Correct fit by turning long adjusting screw on shuttle counterclockwise.
	6. Pressure plate does not retract.	6. Replace defective pressure plate (6-17), retractor plate (7-56), or lifter (6-18).
	7. Excessive shuttle tooth penetration.	7. Adjust shuttle tooth protrusion (paragraph 22).
	8. Rewind engagement lever out-of-adjustment.	8. Adjust engagement lever (paragraph 26).
Rewind Failure (Auto-Rewind only)	1. Loose or missing rewind clip.	1. Replace rewind clip.
	2. Auto-rewind trigger out-of-adjustment.	2. Adjust snubber and trigger (paragraph 27).
Improper film feed-out	1. Oil on module pulley belt (5-38) causing slippage.	1. Clean belt with detergent and water.
	2. Insufficient tension on clutch disc (5-7) prevents belt from bearing on film.	2. Increase clutch tension by stretching or replacing spring (5-5).
	3. Film stripper not adjusting for size of film reel.	3. Missing or broken stripper spring (5-36). Replace.
	4. Gears not engaging when threading lever is pressed down.	4. Linkage to gear engagement lever disconnected.

PARTS CATALOG

AUTOLOAD 8
CASSETTE PROJECTOR

DESIGN 459

CONSUMER PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 72726-1 PRINTED IN U.S.A. FEBRUARY 1971

Replacement Parts

The following pages illustrate and list, by part number and description, all replacement parts for the Design 459 Automatic Rewind Standard and Super 8-mm Projector. The Design 459A projector operates at 120 volts, 60 cycles, while the Design 459X projector operates at 50 cycles with a voltage range of 115 to 240. Parts which are peculiar only to the 459A are coded "A" in the parts list; those peculiar only to the 459X projector are coded "B." The illustrations are arranged and indexed in a suggested order of disassembly to serve as an aid to the repairman during projector repairs.

ACCESSORIES

Take-Up Reel . . . . . P/N 014118
Spindle Adapter, Regular 8-mm . . P/N 014088
Spindle Adapter, Super 8-mm . . . . P/N 014089

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR COVERS AND LAMP		
1-1	014398	COVER ASSEMBLY, Front	1	A
1-1	014399	COVER ASSEMBLY, Front	1	B
-2	44835	. RIVET, Tubular, 0.123 inch diameter	1	A
-2	30226	. RIVET, Tubular, 0.123 inch diameter	1	B
-3	39252	. CATCH, Cover	1	
-4	44717	. BUTTON, Cover release	1	A
-4	32361	. BUTTON, Cover release	1	B
-5	40553	. CLIP, Film reel retaining	1	
-6	44705	. NAMEPLATE, Front cover (adhesive backed)	1	A
-6	43573	. NAMEPLATE, Front cover (adhesive backed)	1	B
-7	44849	. TRIMPLATE, Front cover (adhesive backed)	1	B
-8	44860	. NAMEPLATE, Movie cassette (adhesive backed)	1	A
-8	44885	. NAMEPLATE, Movie cassette (adhesive backed)	1	B
-9	No Number	. COVER, Front (order complete cover assembly)	NP	
-10	43199	SCREW, Hex head tapping, 4-40 by 1/2 inch	4	A
-10	44884	SCREW, Hex head tapping, 4-40 by 1/2 inch	4	B
-11	37932	SCREW, Hex head, 6-32 by 5/8 inch	2	A
-11	39340	SCREW, Hex head, 6-32 by 5/8 inch	2	B
-12	44723	COVER, Back	1	A
-12	014400	COVER ASSEMBLY, Back	1	B
-13	25699	. RIVET, Tubular	2	B
-14	39351	. SOCKET, Tube	1	B
-15	012086	. PLUG AND NAMEPLATE ASSEMBLY	1	B
-16	44887	. NAMEPLATE, Data (adhesive backed)	1	B
-17	26906	. NUT AND WASHER, Sems	2	B
-18	36844	. SCREW, Pan head, 6-32 by 5/8 inch	2	B
-19	39336	. TERMINAL STRIP	1	B
-20	700097	. SCREW, Terminal	1	B
-21	No Number	. COVER, Back (order complete cover assembly)	NP	B

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR COVERS AND LAMP (CONT)		
1-22	44095	NAMEPLATE, Data (adhesive backed)	1	A
-23	301391	SCREW, Cable clip	1	B
-24	39338	CLIP, Cable retaining	1	B
-25	39181	CORD, Power	1	A
-25	014064	CORD, Power	1	B
-26	22464	BUSHING, Strain relief	1	A
-26	39337	BUSHING, Strain relief	1	B
-27	39200	SCREW, Hex head Sems tapping, 8-18 by 1/2 inch	2	
-28	39124	HOOK, Power cord storage	2	
-29	39204	SCREW, Hex head Sems tapping, 10-32 by 0.437 inch	2	
-30	35186	WASHER, Flat	2	
-31	44724	END CAP, Handle	2	A
-31	39129	END CAP, Handle	2	B
-32	39074	HANDLE, Carrying	1	
-33	39073	INSERT, Carrying handle	1	
-34	014404	LAMPHOUSE ASSEMBLY, Complete	1	A
-34	014405	LAMPHOUSE ASSEMBLY, Complete	1	B
-35	44731	. RIVET, Tubular, 0.123 inch diameter	1	A
-35	39190	. RIVET, Tubular, 0.123 inch diameter	1	B
-36	39188	. BAFFLE, Heat	1	A
-36	39231	. BAFFLE, Heat	1	B
-37	39189	. SPACER, Sleeve	1	
-38	35360	. CATCH, Lamphouse	1	
-39	44707	. NAMEPLATE, Lamphouse (adhesive backed)	1	A
-39	44072	. NAMEPLATE, Lamphouse (adhesive backed)	1	B
-40	44714	. LABEL, Film feed (adhesive backed)	1	A
-40	44091	. LABEL, Film feed (adhesive backed)	1	B
-41	No Number	. LAMPHOUSE (Order complete lamphouse assembly)	NP	
-42	40591	LAMP, Projection, Type DJL	1	A
-42	39297	LAMP, Projection, Type DNF	1	B
-43	43651	THUMBSCREW, Module cover	2	
-44	014379	COVER ASSEMBLY, Feed-out module	1	A
-44	014406	COVER ASSEMBLY, Feed-out module	1	B
-45	44859	. NAMEPLATE, Module cover (adhesive backed)	1	A
-46	44857	. NAMEPLATE, Module cover (adhesive backed)	1	B
-47	30809	SCREW, Swage type, 6-32 by 3/8 inch hex head	2	
-48	30237	SCREW, Hex head tapping, 4-40 by 1/4 inch	1	
-48	36725	SCREW, Pan head tapping, 6-20 by 7/16 inch	1	
-49	014396	MODULE ASSEMBLY, Feed-out (see Figure 5 for detail parts)	1	A
-49	014396	MODULE ASSEMBLY, Feed-out (see Figure 5 for detail parts)	1	B
-50	44029	COVER, Drive gear	1	
-51	44709	COVER PLATE, Reel adapter (adhesive backed)	1	A
-51	44074	COVER PLATE, Reel adapter (adhesive backed)	1	B

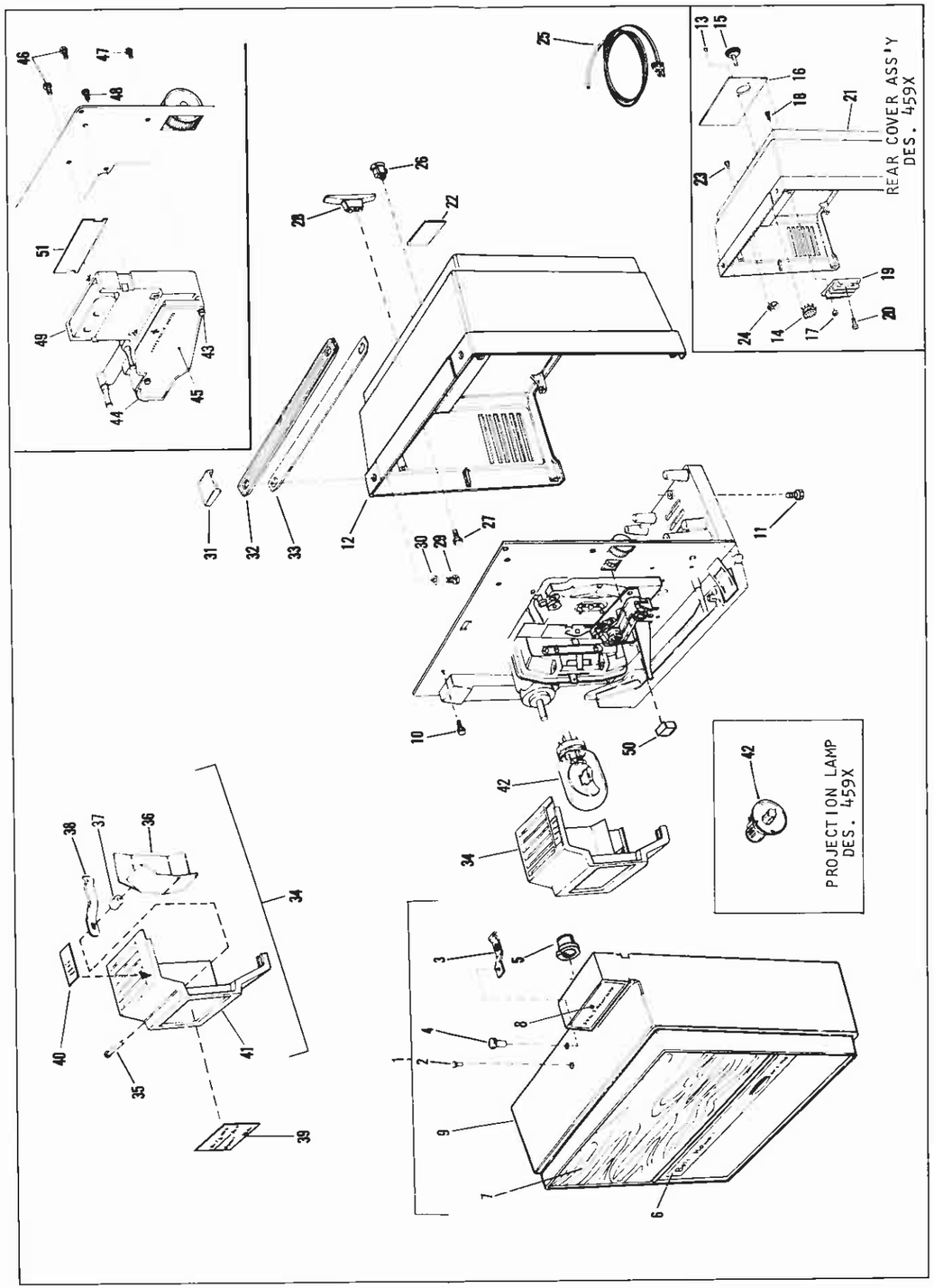


Figure 1. Projector Covers and Lamp

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		CONTROL HOUSING AND ROLLERS		
2-1	19025	RIVET, Tubular, 0.123 inch diameter	2	
-2	32478	BAFFLE, Lamp	1	
-3	44608	CLIP, Deflector retaining	2	A
-3	37947	SCREW, Hex head tapping, 4-40 by 1/4 inch	2	B
-4	44608	CLIP, Deflector retaining	1	
-5	42905	DEFLECTOR, Air	1	A
-5	39301	DEFLECTOR, Air	1	B
-6	36882	SCREW, Hex head tapping, 6-32 by 3/8 inch	1	A
-6	36843	SCREW, Pan head, 6-32 by 1/2 inch	1	B
-7	17632	WASHER, Flat	1	A
-7A	26906	NUT AND WASHER, Sems, 6-32	1	B
-8	83286	CLAMP, Leadwire	1	
-9	706679	SCREW, Hex head tapping, 6-32 by 3/8 inch	2	A
-9A	36841	SCREW, Pan head, 2-56 by 1/4 inch	2	B
-10	17632	WASHER, Flat	2	A
-11	010270	SOCKET ASSEMBLY, Lamp	1	A
-11A	40578	SOCKET, Lamp	1	B
-12	36841	SCREW, Pan head, 2-56 by 1/4 inch	2	B
-13	39296	SUPPORT PLATE, Lamp socket	1	B
-14	44173	KNOB, Control lever	2	
-15	44702	NAMEPLATE, Run-Rewind (adhesive backed)	1	A
-15	43572	NAMEPLATE, Run-Rewind (adhesive backed)	1	B
-16	44700	NAMEPLATE, Off-Motor-Lamp (adhesive backed)	1	A
-16	43071	NAMEPLATE, Off-Motor-Lamp (adhesive backed)	1	B
-17	706679	SCREW, Hex head tapping, 6-32 by 3/8 inch	2	
-18	44728	HOUSING, Control	1	A
-18	43127	HOUSING, Control	1	B
-19	39182	TUBING, Insulating	1	
-20	34590	SCREW, Flat head, 6-32 by 3/8 inch	2	
-21	40495	BUSHING, Interlock lever	2	
-22	40454	LEVER, Interlock	1	
-23	012860	SWITCH, Slide	1	
-24	20808	RING, Retaining, 0.145 inch ID	2	
-25	39087	ROLLER, Guide	1	
-26	39098	SPRING, Torsion	1	
-27	40419	GUIDE, Film	1	
-28	39089	SCREW, Guide roller, 4-40NC	2	
-29	39223	NUT, Plain hex, 4-40NC	1	
-30	39248	ROLLER, Guide	1	
-31	40518	ROLLER, Guide	1	
-32	39143	DEFLECTOR, Film	1	
-33	44713	DISC, Decorative, tilt knob	1	A
-33	43454	DISC, Decorative, tilt knob	1	B
-34	013642	KNOB, Tilt	1	
-35	32926	SCREW, Fillister head, 2-56 by 1/4 inch	1	
-36	40420	KNOB, Forward-Reverse	1	
-37	39225	NAMEPLATE, Lamp designation (adhesive backed)	1	A
-37	39293	NAMEPLATE, Lamp designation (adhesive backed)	1	B
-38	39298	STRIP, Felt, control housing (cement in place)	1	B

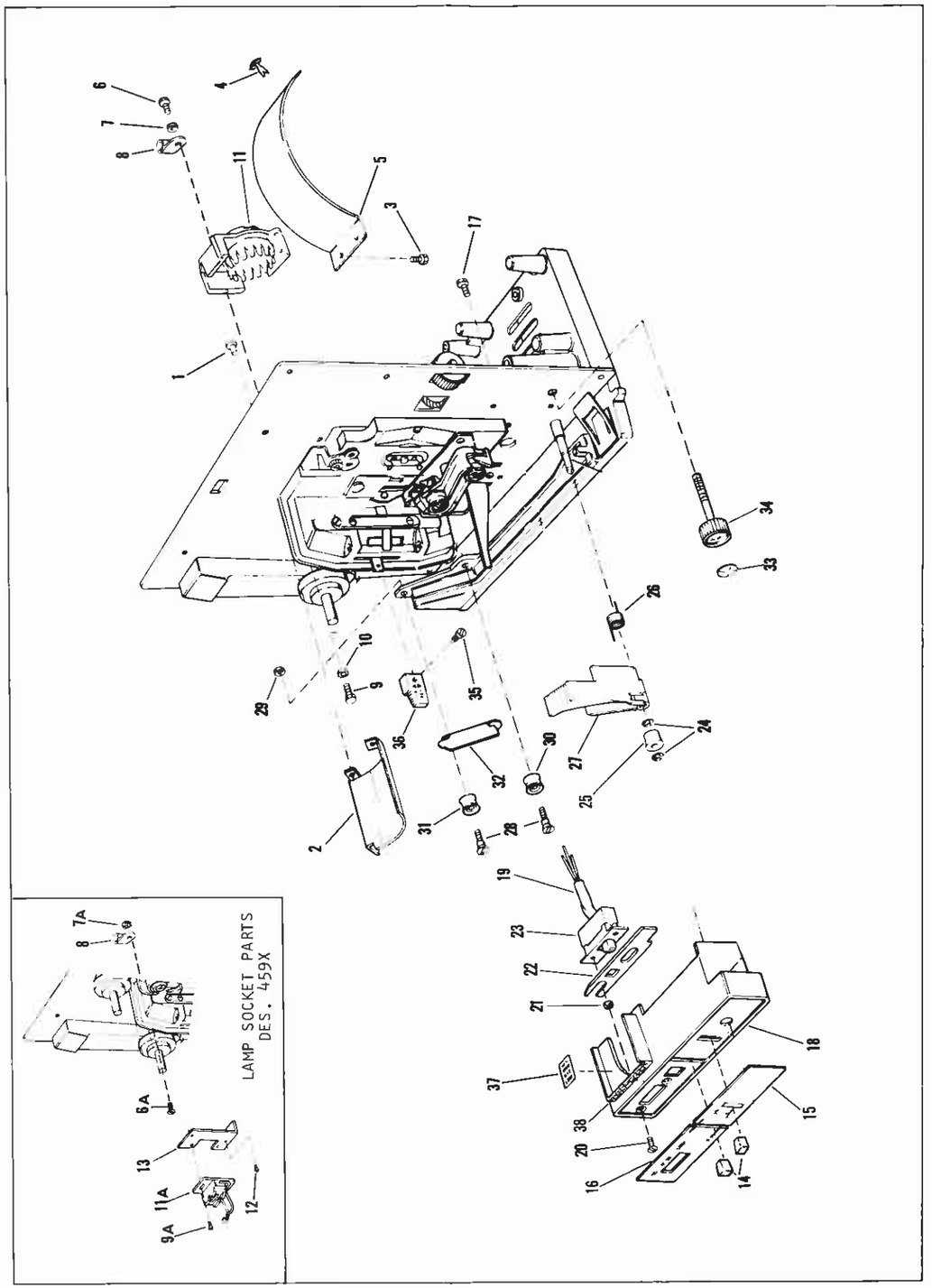


Figure 2. Control Housing and Rollers

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		REEL ARMS AND GEARS		
3-1	44732	SCREW, Binding head, 5-40 by 3/16 inch	2	A
-1	23822	SCREW, Binding head, 5-40 by 0.203 inch	2	B
-2	36836	SCREW, Pan head, 4-40 by 3/16-inch	1	
-3	44727	ARM, Reel	1	A
-3	43194	ARM, Reel	1	B
-4	43189	GEAR, Spur	1	
-5	014376	SPINDLE ASSEMBLY, Film reel	1	A
-5	09578	SPINDLE ASSEMBLY, Film reel	1	B
-6	29707	GEAR, Spur	2	
-7	39049	GEAR, Spur	1	
-8	29192	SETSCREW, Fluted socket cup pt, 4-40 by 1/8 inch	1	
-9	39056	GEAR, Spur	1	
-10	010189	SPUR GEAR AND SHAFT ASSEMBLY	1	
-11	21736	RING, Retaining, 0.207 inch ID	3	
-12	29706	GEAR, Spur, small	1	
-13	34718	GEAR, Spur, large	2	
-14	80147	SCREW, Binding head, 5-40 by 3/16 inch	1	
-15	29744	RING, Retaining, external 0.562 inch ID	1	
-16	34705	BEARING, Reel arm	1	
-17	012863	STUD AND SUPPORT ASSEMBLY	1	
-18	014383	PLATE ASSEMBLY, Gear mounting	1	
-19	39099	SPRING, Reel arm tension	1	
-20	39228	WASHER, Cam, take-up arm	1	
-21	1261	BALL, Steel	2	
-22	44038	SPRING, Tension	1	
-23	44869	ROD, Fire shutter	1	
-24	44039	LEVER, Retractor	1	
-25	36837	SCREW, Pan head, 4-40 by 1/4 inch	1	
-26	44040	SCREW, Special hex head	1	
-27	44036	GUIDE, Retractor lever	2	
-28	33966	RING, Retaining, external, 0.219 inch ID (E)	1	
-29	34861	WASHER, Shim	1	
-30	43621	GEAR, Spur	1	
-31	31649	WASHER, Tension, wave-type	1	
-32	014384	ARM AND GEAR ASSEMBLY, Rewind	1	
-33	33966	RING, Retaining, external, 0.219 inch ID (E)	1	
-34	43690	GEAR, Spur	1	
-35	17639	RING, Retaining, 0.125 inch ID (E)	1	
-36	21736	RING, Retaining, 0.207 inch ID	1	
-37	34861	WASHER, Flat	1	
-38	44862	SPRING, Compression	1	
-39	34861	WASHER, Flat	1	
-40	43691	GEAR, Spur	1	
-41	43686	DISC, Clutch	1	
-42	43689	GEAR, Pinion	1	
-43	40532	SCREW, Tension adjusting	1	
-43A	30613	WASHER, Tension, wave-type	1	
-44	43691	GEAR, Spur	1	
-45	44861	WASHER, Tension, wave-type	1	
-46	29192	SETSCREW, Fluted socket cup pt, 4-40 by 1/8 inch	1	
-47	014378	DRIVE PUCK ASSEMBLY	1	A
-47	014401	DRIVE PUCK ASSEMBLY	1	B
-48	17676	RING, Retaining, external, 0.156 inch ID (E)	1	
-49	36279	WASHER, Spacing	1	
-50	014386	GEAR AND SHAFT ASSEMBLY, Drive puck	1	
-51	36279	WASHER, Spacing	1	
-52	33966	RING, Retaining, external, 0.219 inch ID (E)	1	
-53	43619	PLATE, Gear, drive puck	1	
-54	42392	SCREW, Pan head, 6-32 by 1/4 inch	2	
-55	43694	GUIDE BAR, Puck gear plate	1	

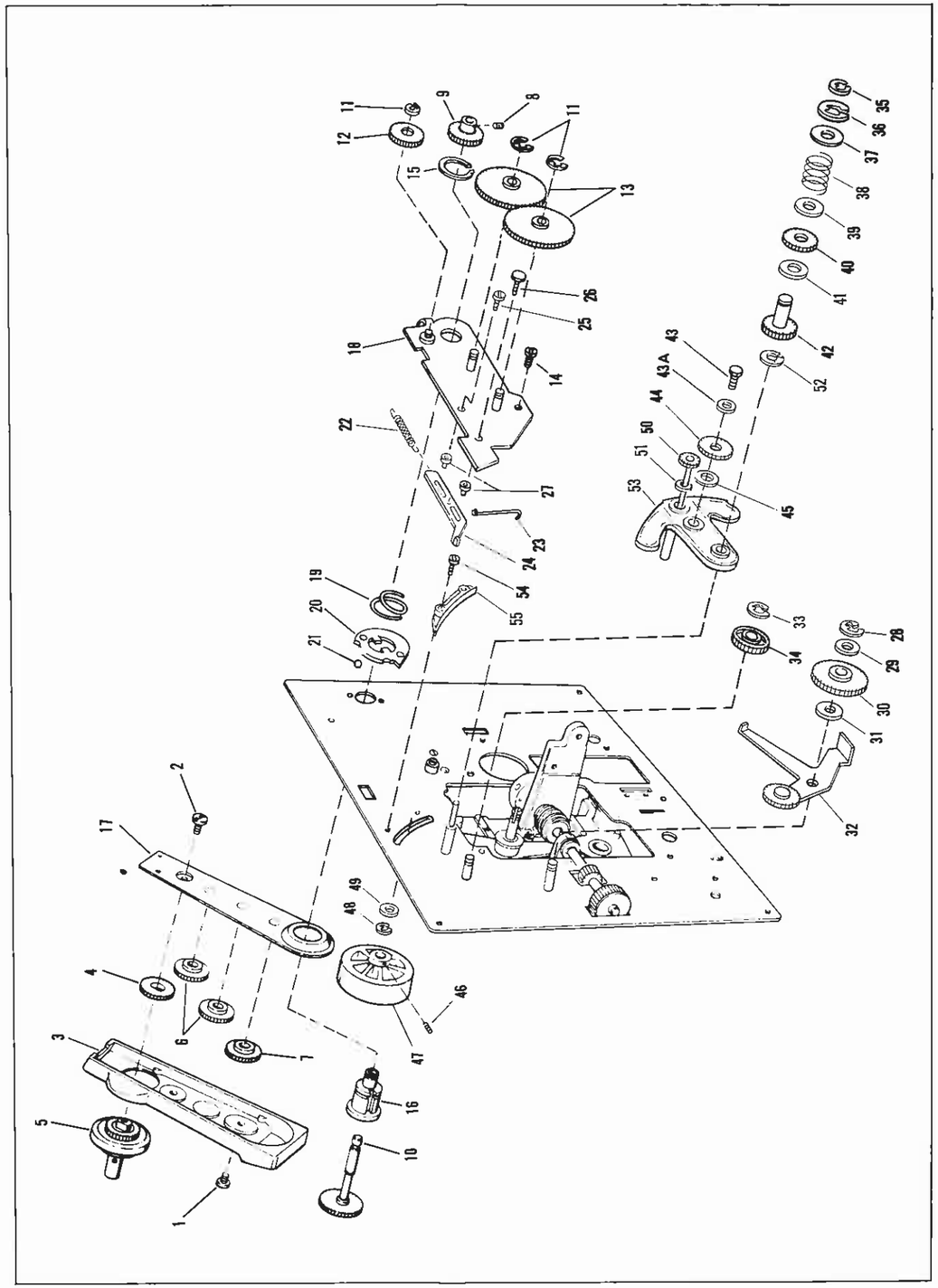


Figure 3. Reel Arms and Gears

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		LOOPFORMERS, SPROCKETS AND GEARS		
4-1	21736	RING, Retaining, 0.207 inch ID	1	
-2	34718	GEAR, Spur	1	
-3	33966	RING, Retaining, external, 0.219 inch ID (E)	1	
-4	35186	WASHER, Spacer	1	
-5	44873	RATCHET, Spring	1	
-6	35177	GEAR, Outer	1	
-7	014385	DRIVE GEAR LEVER AND STUD ASSEMBLY	1	
-8	43868	GEAR, Inner	1	
-9	30667	WASHER, Friction	1	
-10	33966	RING, Retaining, external, 0.219 inch ID (E)	1	
-11	014061	GEAR AND SHAFT ASSEMBLY, Drive	1	
-12	44857	SPRING, Torsion	1	
-13	44870	LEVER, Retractor	1	
-14	014389	GEAR AND LEVER ASSEMBLY, Engagement	1	
-15	87073	KNOB, Feed-out lever	1	
-16	30620	SCREW, Washer head, 3-48 by 1/8 inch	1	
-17	014381	LEVER ASSEMBLY, Feed-out	1	
-18	43681	SPRING, Torsion	1	
-19	44090	NUT, Round	1	
-20	43666	ARM, Engagement lever actuating	1	
-21	41973	SETSCREW, Fluted socket cup pt, 4-40 by 0.093 inch	3	
-22	014033	FRAMER KNOB AND SHAFT ASSEMBLY	1	
-23	40491	. DISC, Decorative	1	
-24	40479	COLLAR	2	
-25	40462	COLLAR, Framer	1	
-26	014395	LENS CARRIER ASSEMBLY (See Figure 6 for detail parts)	1	A
-26	014407	LENS CARRIER ASSEMBLY (See Figure 6 for detail parts)	1	B
-27	36836	SCREW, Pan head, 4-40 by 3/16 inch	3	
-28	43856	BAR, Film guide	1	
-29	40412	GUIDE, Film, lower	1	
-30	09627	LOWER LOOPFORMER ASSEMBLY	1	
-31	40567	. RING, Self-locking, retaining external	2	
-32	40492	. WASHER	2	
-33	40536	. ROLLER	2	
-34	014397	. LOOPFORMER AND SLEEVE ASSEMBLY, Lower	1	
-35	29192	SETSCREW, Fluted socket cup pt, 4-40 by 1/8 inch	2	
-36	40468	BUSHING	1	
-37	705972	WASHER, Thrust	1	
-38	09629	LOWER LOOPFORMER MOUNTING PLATE ASSEMBLY	1	
-39	17639	. RING, Retaining, external, 0.125 inch ID (Type E)	2	
-40	17188	. WASHER, Spring	1	
-41	40473	. SHAFT, Spring, lower	1	
-42	40541	. SPRING, Snubber	1	
-43	40446	. PLATE, Spring stop, lower	1	
-44	No Number	. PLATE, Lower (order complete lower loopformer mounting plate assembly)	NP	
-45	40467	RIVET, Lens mount catch	2	
-46	40533	SCREW, Hex head, 4-40 by 1/4 inch	1	
-47	09630	LENS MOUNT CATCH ASSEMBLY	1	
-48	40621	SHIM	2	
-49	36838	SCREW, Pan head, 4-40 by 3/8 inch	1	
-50	28308	SCREW, Binding head, 3-48 by 7/16 inch	1	
-51	44089	STUD, Stand-off	1	
-52	30621	SCREW, Truss head, 3-48 by 3/16 inch	2	
-53	014411	APERTURE PLATE ASSEMBLY	1	
-54	30620	. SCREW, Truss head, 3-48 by 1/8 inch	2	
-55	40531	. SPRING, Side tension	1	
-56	30639	. ARM, Side tension	1	
-57	40440	. GUIDE, Film	1	
-58	No Number	. APERTURE PLATE (Order complete aperture plate assembly)	NP	

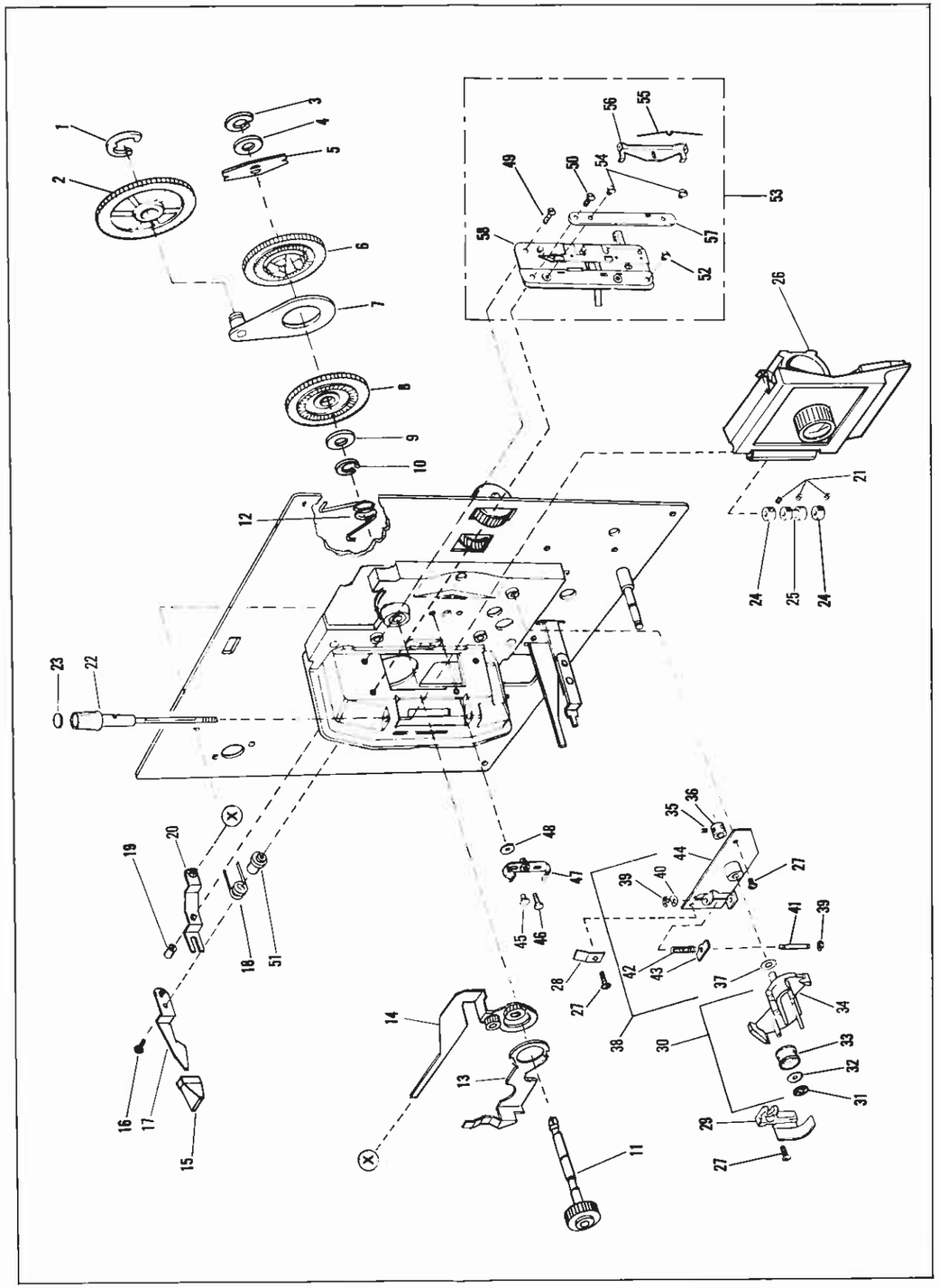


Figure 4. Loopformers, Sprockets and Gears

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		FEED-OUT MODULE ASSEMBLY		
5-	014396	FEED-OUT MODULE ASSEMBLY	REF	A
5-	014396	FEED-OUT MODULE ASSEMBLY	REF	B
-1	44066	. ARM, Dampening	1	
-2	17639	. RING, Retaining, external, 0.125 inch ID	1	
-3	26131	. RING, Retaining, external, 0.219 inch ID	1	
-4	26085	. WASHER, Flat	2	
-5	44863	. SPRING, Compression	1	
-6	43682	. GEAR, Clutch	1	
-7	44769	. DISC, Clutch	1	
-8	43696	. GEAR, Spur	1	
-9	29192	. SETSCREW, Fluted socket cup pt, 4-40 by 1/8 inch	1	
-10	17639	. RING, Retaining, external, 0.125 inch ID	1	
-11	014171	. GEAR TRAIN ASSEMBLY	1	
-12	44096	. WASHER, Retaining, push-on	1	
-13	No Number	. PLATE ASSEMBLY, Support	NP	A
-13	No Number	. PLATE ASSEMBLY, Support	NP	B
-14	44059	. SPRING, Snubber, short	1	
-15	43699	. SPRING, Snubber, long	1	
-16	44061	. PAD, Dampening	1	
-17	44856	. TRIGGER, Rear	1	
-18	31405	. SETSCREW, Fluted socket oval pt, 4-40 by 3/8 inch	1	
-19	44099	. SPACER, Trigger	1	
-20	014409	. TRIGGER ASSEMBLY, Front	1	
-21	43648	. SNUBBER	1	
-22	43633	. ROLLER, Guide	1	
-23	44837	. SCREW, Pan head Type F, 4-40 by 3/16 inch	1	
-24	No Number	. ROLLER AND BRACKET ASSEMBLY	NP	
-25	44025	. WASHER, Retaining, push-on	1	
-26	44024	. WASHER, Wave-type	1	
-27	307574	. WASHER, Flat	1	
-28	No Number	. REEL ADAPTER ASSEMBLY	NP	A
-28	No Number	. REEL ADAPTER ASSEMBLY	NP	B
-29	44710	. . PLATE, Cover (cement in place)	1	A
-29	44075	. . PLATE, Cover (cement in place)	1	B
-30	44015	. . SPRING, Adapter	2	
-31	No Number	. . ADAPTER, Reel (order adapter assembly complete).	NP	
-32	014388	. DRUM AND SPRING ASSEMBLY	1	
-33	43640	. SCREW, Special	2	
-34	44079	. BASE, Stripper	1	
-35	43662	. STRIPPER	1	
-36	43669	. SPRING, Stripper	1	
-37	014091	. PULLEY AND PLATE ASSEMBLY	1	
-38	44058	. BELT, Pulley	1	
-39	613428	. RING, Retaining, external, 0.125 basic	2	
-40	43647	. PULLEY, Drive	1	
-41	44004	. SHAFT, Drive pulley	1	
-42	43639	. ROLLER	1	
-43	No Number	. HOUSING ASSEMBLY, Feed-out module.	NP	A
-43	No Number	. HOUSING ASSEMBLY, Feed-out module.	NP	B

NOTE: IF THE ORIGINAL CASSETTE LOCKING TABS SHOULD BREAK, BOTH SHOULD BE REPLACED WITH THE SPECIAL FINGER TABS SHOWN IN THE INSET. IF ONLY ONE TAB HAS BEEN DAMAGED, BREAK OFF THE REMAINING TAB. POSITION THE FINGER TABS IN THE MODULE HOUSING SLOTS WITH THE REAR EDGE OF TABS FLUSH WITH MOUNTING SURFACE OF MODULE, AND LIGHTLY CENTER PUNCH THROUGH THE TAB MOUNTING HOLE. USING A 45 (0.082) DRILL, DRILL STRAIGHT-THROUGH HOLES FOR ATTACHING THE FINGER TABS. BE SURE HOLES ARE DRILLED STRAIGHT AND BE CAREFUL NOT TO DAMAGE THE MODULE HOUSING. ATTACH THE FINGER TABS WITH THE TWO SCREWS.

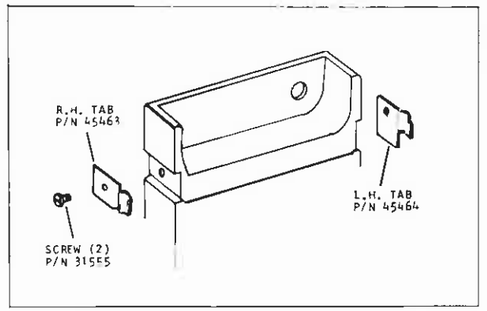


Figure 5. Feed-Out Module Assembly

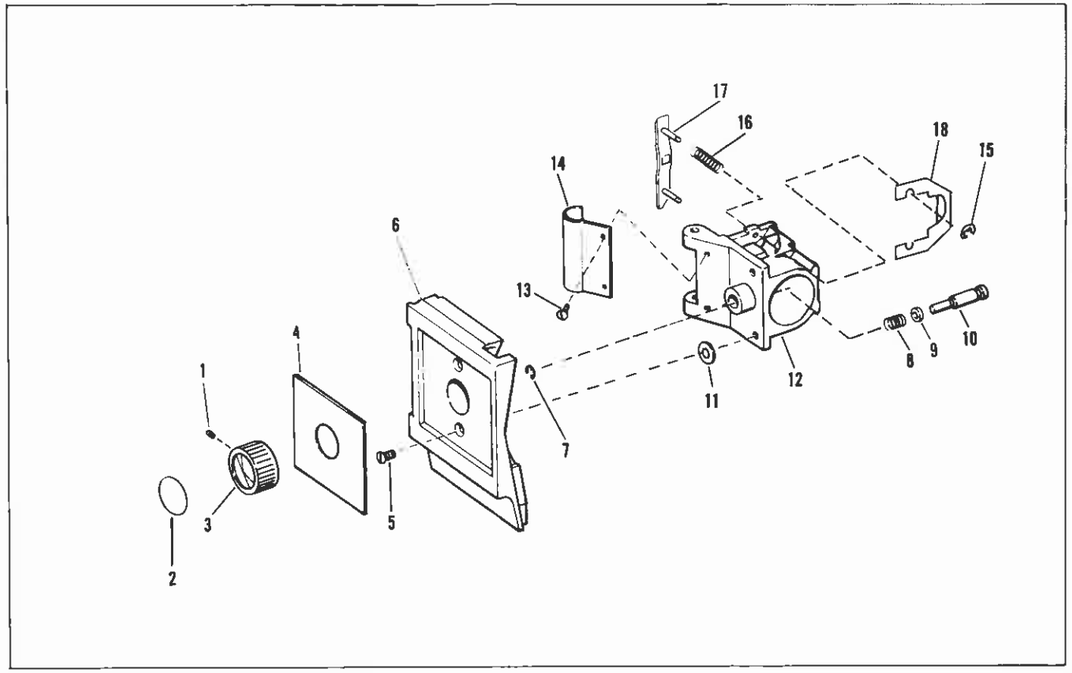


Figure 6. Lens Carrier Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		LENS CARRIER ASSEMBLY		
6-	014395	LENS CARRIER ASSEMBLY	REF	A
6-	014407	LENS CARRIER ASSEMBLY	REF	B
-1	36770	. SETSCREW, Fluted socket, cup pt, 8-32 by 1/4 inch	1	
-2	44713	. CAP, Decorative	1	A
-2	43454	. CAP, Decorative	1	B
-3	013643	. KNOB, Focus	1	
-4	44704	. PLATE, Trim	1	A
-4	44071	. PLATE, Trim	1	B
-5	25618	. SCREW, Pan head, 6-32 by 9/16 inch	2	
-6	44730	. COVER, Lens carrier	1	A
-6	43698	. COVER, Lens carrier	1	B
-7	20808	. RING, Retaining, 0.145 inch ID	1	
-8	39097	. SPRING, Focus	1	
-9	39230	. WASHER	1	
-10	09621	. FOCUS SHAFT AND PIN ASSEMBLY	1	
-11	705972	. WASHER, Shim	2	
-12	014380	. LENS MOUNT AND BUSHING ASSEMBLY	1	A
-12	014402	. LENS MOUNT AND BUSHING ASSEMBLY	1	B
-13	36836	. SCREW, Pan head, 4-40 by 3/16 inch	2	
-14	44729	. PLATE, Cover	1	A
-14	43196	. PLATE, Cover	1	B
-15	40564	. RING, Retaining, external, Type E	2	
-16	44890	SPRING, Pressure plate	2	
-17	014129	PRESSURE PLATE AND STUD ASSEMBLY	1	
-18	44738	LIFTER, Pressure plate	1	

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		SHUTTER. SHUTTLE AND DRIVE MECHANISM		
7-1	25715	RING, Retaining, external bowed E, 0.145 inch ID	1	
-2	013458	BRACKET ASSEMBLY, Pulley mounting	1	
-3	39245	SPRING, Torsion	1	
-4	27322	RING, Retaining, special	2	
-5	32172	WASHER, Flat	4	
-6	010667	DRIVER ROLLER ASSEMBLY	2	
-7	35956	SCREW, Pan head, Sems, 3-48 by 3/16 inch	2	
-8	09167	BRACKET ASSEMBLY, Spring loading	1	
-9	34656	SCREW, Round head Sems, 6-32 by 1/4 inch	1	
-10	39264	SCREW, Pivot	1	
-11	014403	SHUTTER AND BRACKET ASSEMBLY, Safety	1	
-12	44172	SCREW, Slotted binding head, 3-48 by 7/16 inch	2	
-13	29175	WASHER, Shutter	1	
-14	40431	SHUTTER ASSEMBLY	1	
-15	706964	SCREW, Pivot	1	
-16	43857	WASHER, Flat	1	
-17	39027	WASHER, Spring tension	1	
-18	014034	SHUTTLE AND BRACKET ASSEMBLY	1	
-19	32947	SHOE, Cam, lower	1	
-20	44137	SHOE, Cam, upper	1	
-21	43166	CAM, Pull-down	1	
-22	35164	NUT AND WASHER, Sems, 8-32NC	1	
-23	43862	SPACER, Shuttle	1	
-24	12498	SETSCREW, Fluted socket cup pt, 6-32 by 1/8-inch	2	
-25	43167	CAM, In-out	1	
-26	26085	WASHER, Thrust	1	
-27	26131	RING, Retaining, crescent external, 0.219 inch ID	1	
-28	80591	SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	
-29	12498	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	2	
-30	44874	SHAFT, Main	1	
-31	44718	KNOB, Manual, main shaft	1	A
-31	39140	KNOB, Manual, main shaft	1	B
-32	44871	GEAR, Drive	1	
-33	30667	WASHER, Friction	1	
-34	39004	PINION, Drive	1	
-35	27067	RING, Retaining, external, 0.094 inch ID	2	
-36	014057	SPRING AND SLEEVE ASSEMBLY	1	
-37	26906	NUT AND WASHER, Sems, 6-32NC	1	
-38	41733	WASHER, Flat	1	
-39	43119	STUD, Pivot	1	
-40	014391	REWIND ACTUATING LEVER ASSEMBLY	1	
-41	44875	SPACER	1	
-42	43819	SPRING, Extension	1	
-43	706679	SCREW, Hex head tapping, 6-32 by 3/8 inch	1	
-44	014053	REWIND ARM AND ACTUATING LEVER ASSEMBLY	1	
-45	30807	SCREW, Swage type, 6-32 by 1/4 inch hex head	1	
-46	30813	SCREW, Swage type, 4-40 by 3/16 inch hex head	1	
-47	014387	ACTUATING ROD ASSEMBLY	1	

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		SHUTTER, SHUTTLE AND DRIVE MECHANISM (CONT)		
7-48	43162	SPRING, Compression	1	
-49	43161	BUSHING, Guide, actuating rod	1	
-50	20808	RING, Retaining, 0.145 inch ID	1	
-51	014039	LOCK AND BUSHING ASSEMBLY	1	
-52	44140	RETRACTOR, Shuttle	1	
-53	17639	RING, Retaining, external, 0.125 inch ID (E)	1	
-54	43184	SPRING, Film guard	1	
-55	43143	STUD, Retractor plate	1	
-56	44131	PLATE, Retractor	1	
-57	32350	SCREW, Round head, 8-32 by 5/16 inch	2	
-58	014382	SUPPORT BRACKET AND STUD ASSEMBLY	1	
-59	33968	RING, Retaining, special	1	
-60	09623	FORMAT SHIFTING LEVER ASSEMBLY	1	
-61	26906	NUT AND WASHER, Sems, 6-32NC	2	
-62	40474	STUD, Eccentric	2	

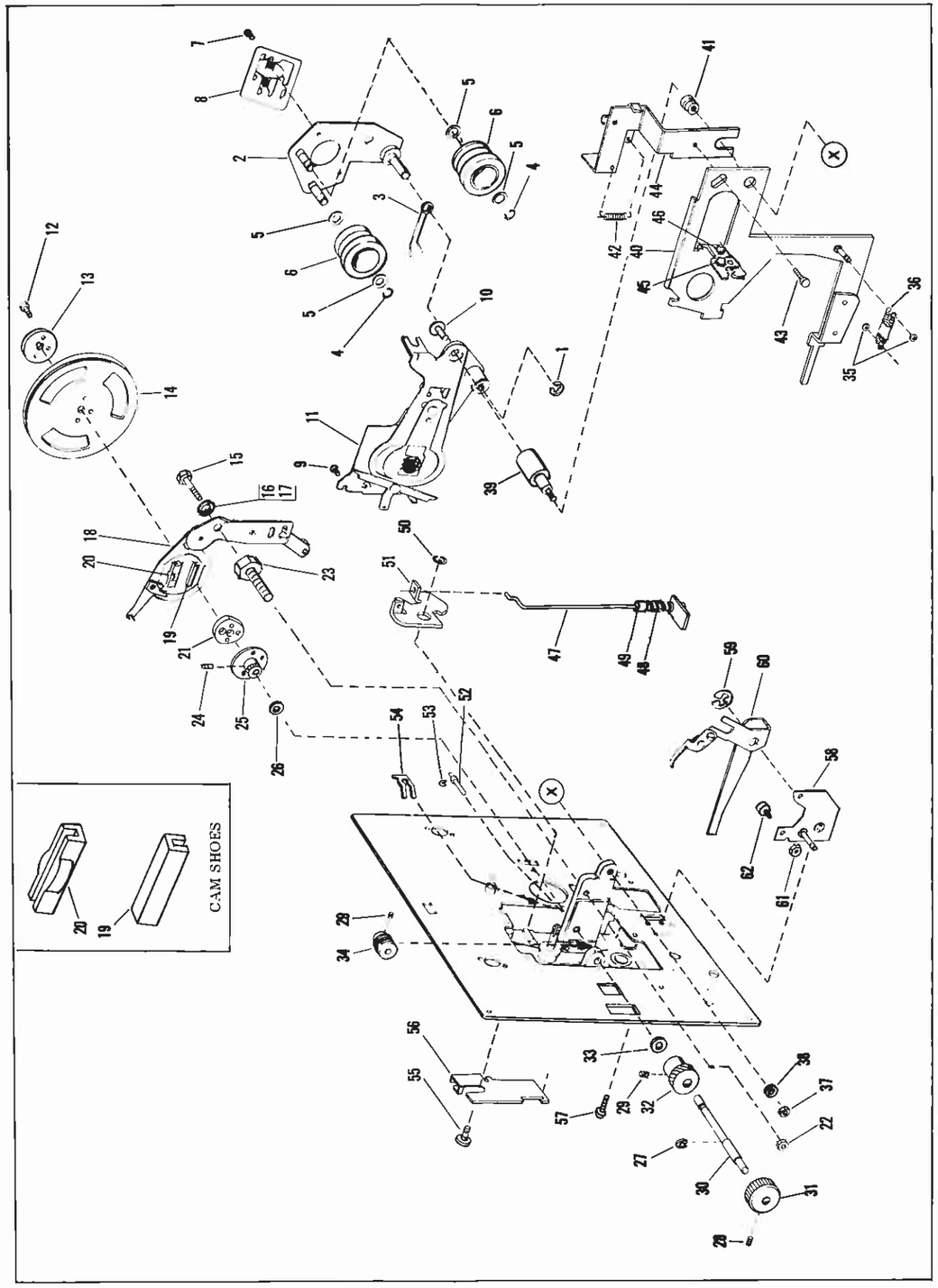


Figure 7. Shutter, Shuttle and Drive Mechanism

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR BASE AND MOTOR		
8-1	37885	BELT, Drive	1	
-2	700454	SCREW, Pan head Sems, 6-32 by 3/8 inch	3	
-3	012606	MOTOR ASSEMBLY	1	A
-3	44848	MOTOR ASSEMBLY	1	B
-4	32974	SETSCREW, Fluted socket cup pt, 8-32 by 1/8 inch	2	
-5	39126	FAN, Multi-bladed	1	
-6	013455	PULLEY AND FAN ASSEMBLY	1	A
-6	012873	PULLEY AND FAN ASSEMBLY	1	B
-7	39256	SCREW, Round head, 6-32 by 1-7/8 inch	2	
-8	26906	NUT AND WASHER, Sems 6-32 NC	2	
-9	17632	WASHER, Flat	2	
-10	40612	BRACKET, Motor mounting, long	1	
-11	39058	BRACKET, Motor mounting, short	1	
-12	39065	INSERT, Mounting	3	
-13	28718	WASHER, Flat (used on short bracket only)	1	
-14	39177	GROMMET, Motor mounting	3	
-15	22113	RING, Retaining, 0.129 inch ID	1	
-16	010367	SHAFT AND BAR ASSEMBLY, Tilt	1	
-16A	31561	FOOT, Rubber, tilt bar	2	
-17	43324	SCREW, Hex head tapping, 8-32 by 3/8 inch	1	A
-18	22659	WASHER, Flat	1	A
-19	39185	CLAMP, Leadwire	1	A
-20	39349	SCREW, Hex head tapping, 8-32 by 1/2 inch	3	B
-21	700733	WASHER, Lock	3	B
-22	012871	TRANSFORMER ASSEMBLY, 50-60 cycles	1	B
-23	43199	SCREW, Hex head tapping, 4-40 by 1/2 inch	3	
-24	No Number	MECHANISM PLATE AND MAIN PLATE ASSEMBLY	NP	
-25	014377	BASE ASSEMBLY, Projector	1	
-26	39222	. RIVET, Tubular, 0.123 inch diameter	2	
-27	39221	. FOOT, Rubber	2	
-28	39202	. RIVET	2	
-29	39144	. CUTTER, Film	1	
-30	No Number	. BASE (Order complete base assembly)	NP	

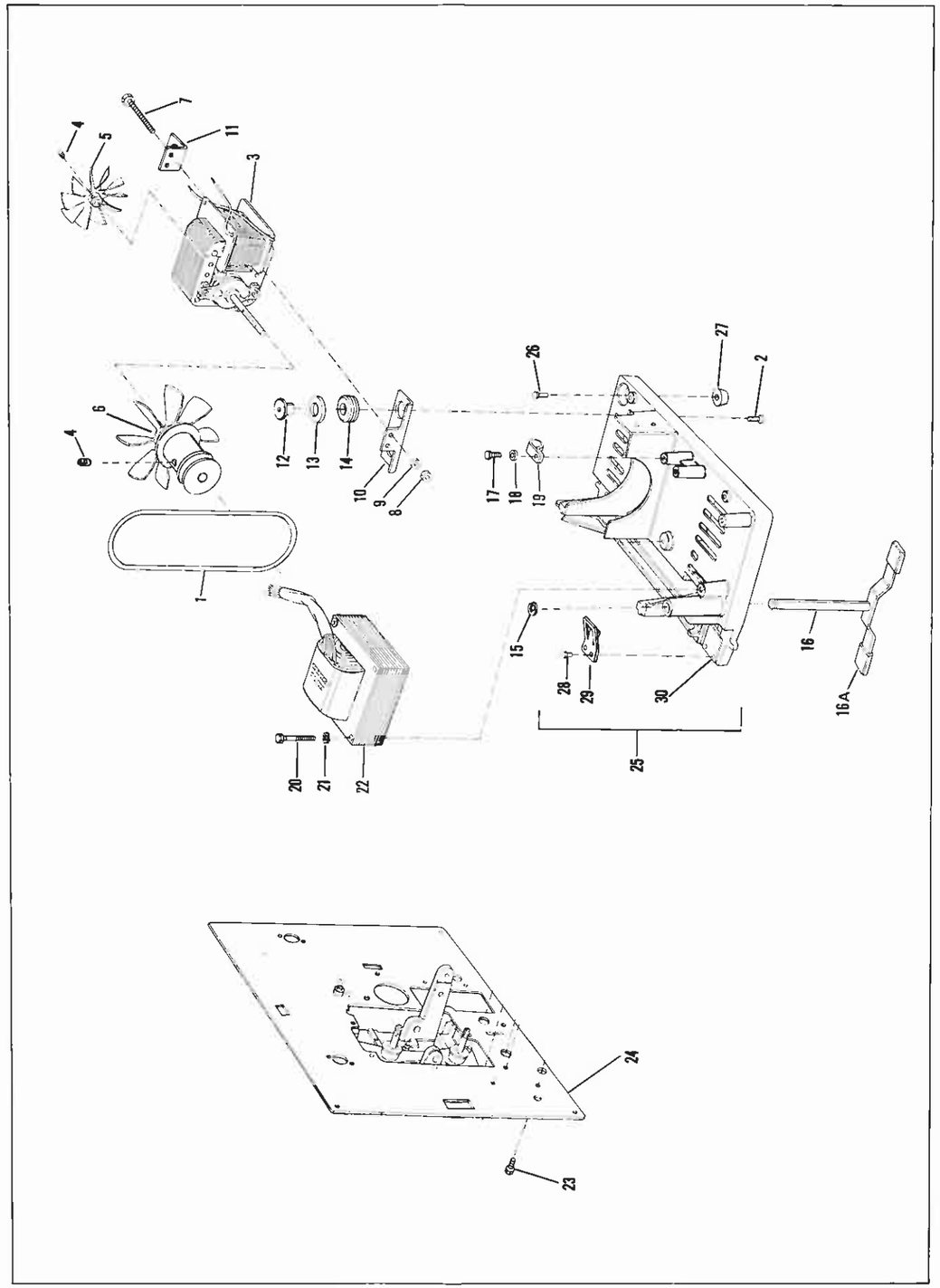
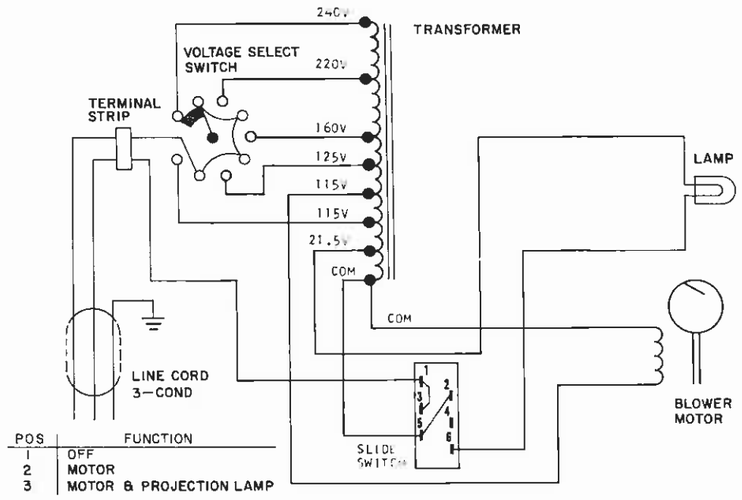
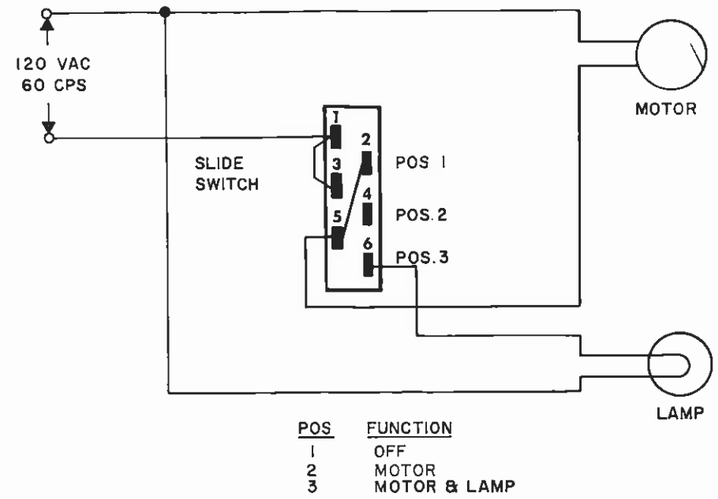


Figure 8. Projector Base and Motor



SCHEMATIC



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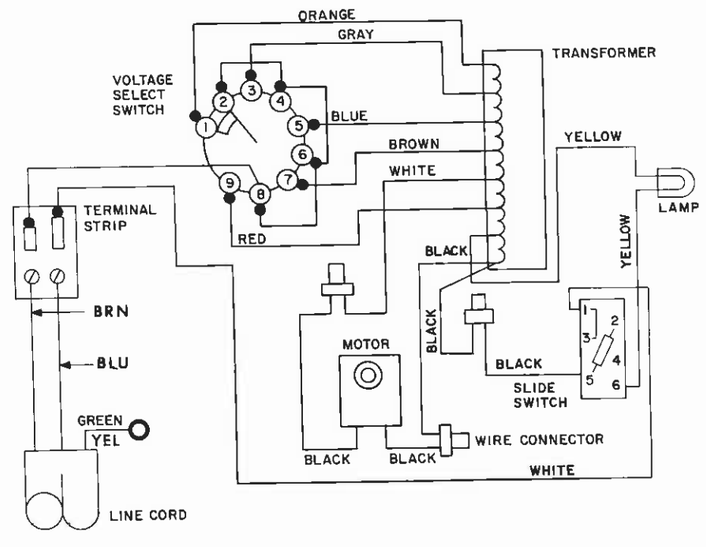

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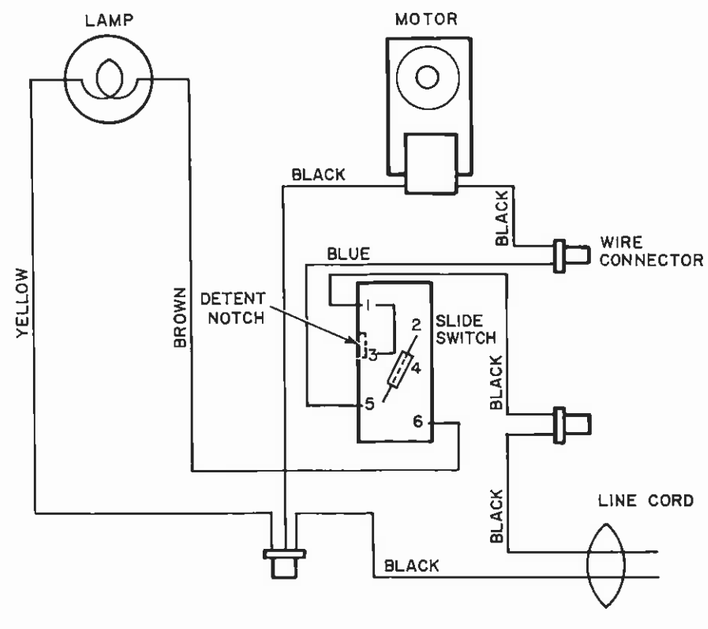
PICTORIAL



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PICTORIAL

Figure 9. Projector Wiring Diagram

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