**SERVICE INSTRUCTIONS**

# COMPATIBLE 8MM-SUPER 8MM MULTI-MOTION® PROJECTOR

## DESIGN 471

CONSUMER PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 72765● PRINTED IN U.S.A. AUGUST 1971

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### PRODUCT ONLY

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Evanston, Illinois 60202
Area Code: 312-673-3300

**NEW YORK**

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200 Smith Street
E. Farmingdale, L.I., New York 11735
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**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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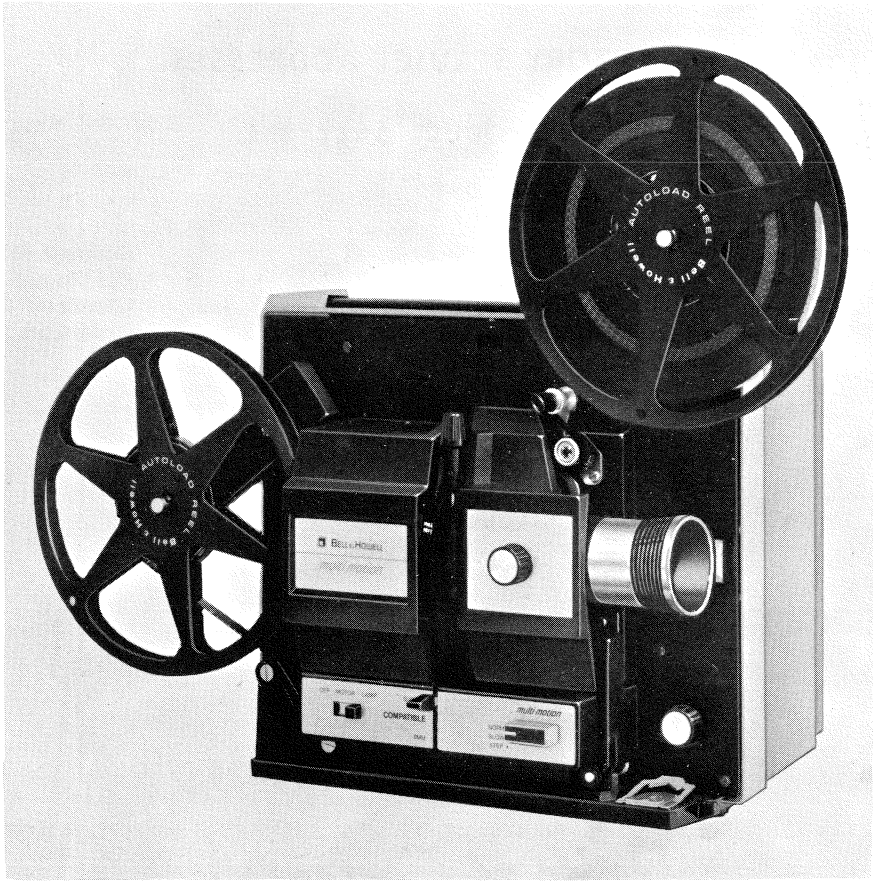


Design 471 Compatible 8-mm Multi-Motion Projector

## FEATURE DESCRIPTION LIST

| | |
|---|---|
| Color | Black and pewter |
| Type of Film | Standard and super 8-mm |
| Film Format Selection | Selector lever |
| Projector Operation | Forward, still and reverse |
| Film Speeds | Normal (18 fps), slow motion (6 fps) and stop (2 fps) |
| Heat Filter (For Still Projection) | Perforated metal screen |
| Framing Device | Screw knob |
| Film Threading | Automatic, reel-to-reel |
| Tilt Device | Gravity shaft, knob-locked |
| Projection Lamp | Type DFZ, 30 volts, 80 watts (part no. 43057) |
| Operating Voltage | 120 volts, 60Hz |

# Introduction

GENERAL.

This manual has been prepared to aid in the servicing and repair of the Bell & Howell Compatible 8-mm and Super 8-mm Multi-Motion Projector Design 471. 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 the manual, while those identified by number will be found in the Parts Catalog section.

DESCRIPTION.

The Design 471 Projector uses either Standard 8-mm or Super 8-mm film and is equipped with self-latching loopformers for fully automatic film threading. Design specifications are listed in the Feature Description List preceding this section.

AUTOLOAD THREADING (Figure A).

a. Before attempting to thread the film, place the Format Selector Lever into either the Super 8 or Regular 8 position, depending on the film which is to be shown. The Format Selector Lever can only be operated when the control switch is "OFF."

b. To thread the film, first trim the end with the film cutter mounted on the projector base. Place the control switch in the "MOTOR" position and the direction lever in the "FORWARD" position. Depress the threading knob (1) down and feed the cut end of the film leader between the two metal guide rollers (2), until the clicking of the shuttle can be heard. Immediately release the film threading lever gently to its original position.

NOTE: Failure to release the film threading lever as soon as the clicking is heard may cause a threading malfunction.

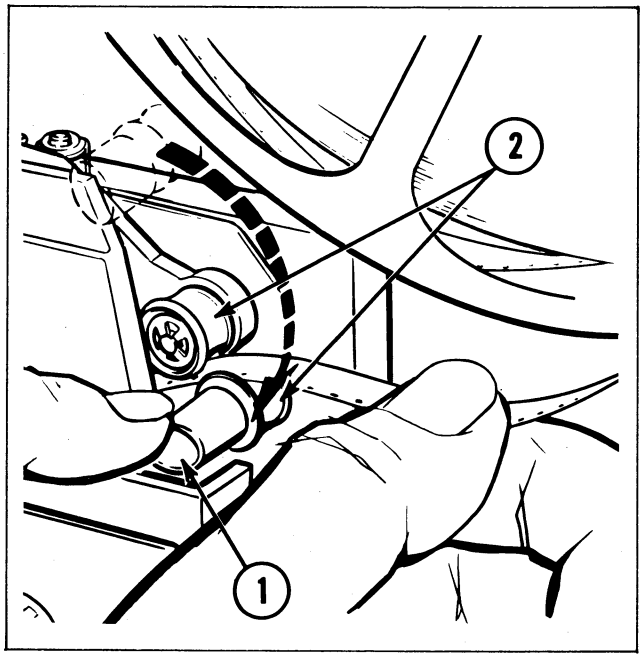


Figure A. Autoload Threading

c. The film will now thread itself through the projector automatically, and attach itself to the take-up reel. Once the leader begins to take up on the hub of the reel, press the "MOTOR-LAMP" switch to the "LAMP" position to begin film projection.

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 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 below. 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. 1956 and 1980)
Oil (Bell & Howell Specs. 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 handle.

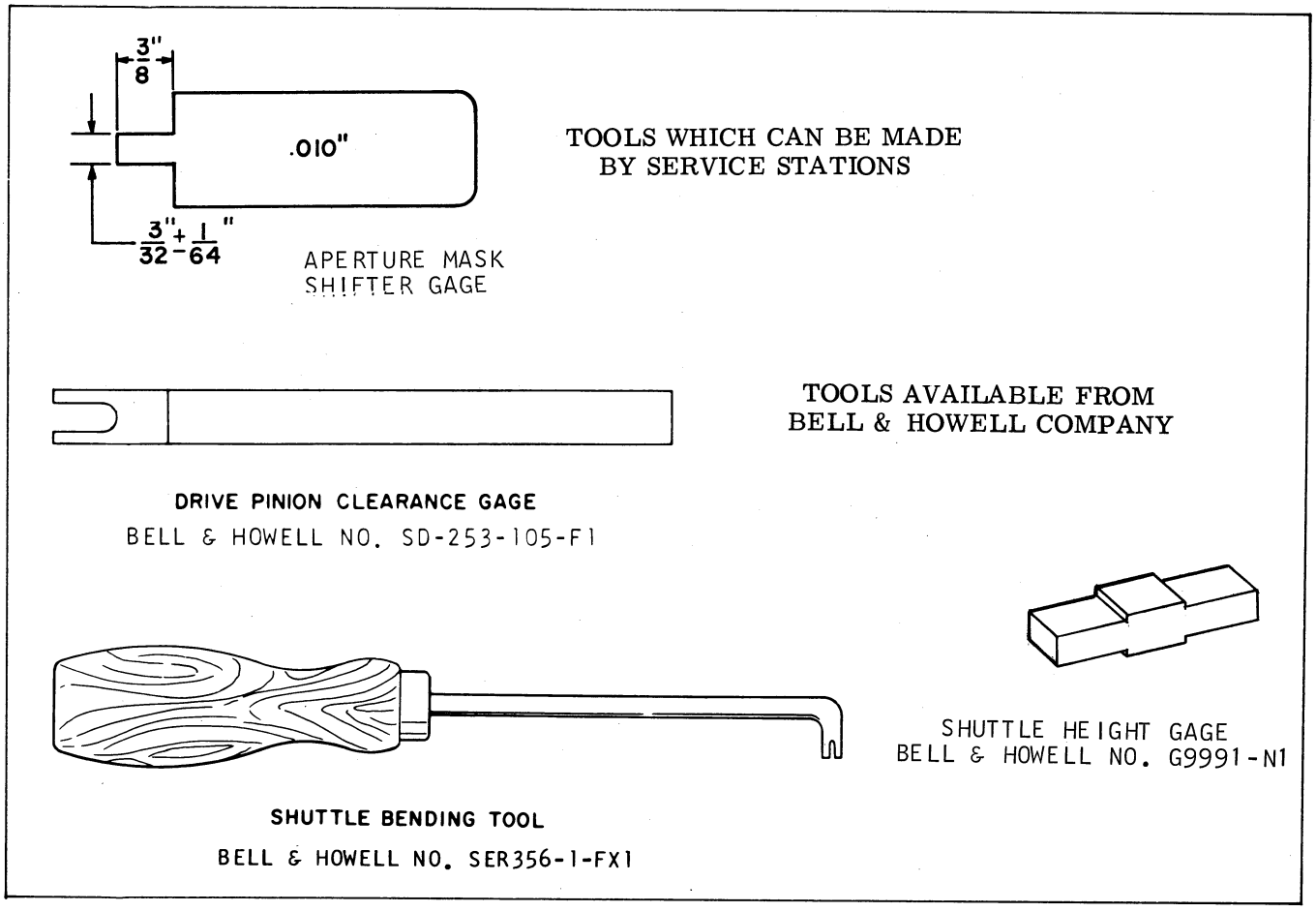


Figure B. Special Service Tools

# 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 set them aside 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, 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 with 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.

e. The basic components for the multi-motion function are grouped in Parts List Figure 5.

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 (10) is secured by six screws. Four of these screws (8) are inserted through the mechanism plate and into tapped bosses in the cover; the remaining two screws (9) are inserted up through the base and into tapped bosses in the cover. To remove the back cover completely, disconnect the power cord leads from the crimp connectors.

b. If the lamphouse catch (26) is damaged or broken, be very careful not to damage the lamphouse when disassembling parts.

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

a. Note that the air deflector (4) is secured to the base casting with one clip (3) while the remaining two clips (3) attach it to the lamp socket assembly (10). If the lamp socket is to be removed, pry out the lower clip (3) and the two lamp socket screws (5) and washers (6) and remove the socket with deflector attached. If the lamp socket need not be removed, remove only the lower clip (3) so that the deflector can be raised to expose the motor and blower fan for inspection.

b. The control housing (15) must be removed in order to replace the switch assembly (22). Remove the two control lever knobs (11) and loosen setscrew (12) so that the multi-motion knob (13) can be removed. Disconnect the switch leads at the lamp socket and the blower motor. From the rear of the main plate, remove two screws (14) which are threaded into tapped bosses of the control housing and withdraw the control housing from the main plate. During removal, be careful not to bend the control levers, and thread the tubing (16) and leadwires carefully through the access hole in the main plate. With a knife blade pry off the Off-Motor-Lamp nameplate (17) to expose the two switch mounting screws (19). Remove the two screws and disassemble the switch (22), interlock lever (21) and two sleeve bushings (20) from the control housing.

c. A retaining ring (23) retains the guide roller (24) on the roller shaft. Removal of a second retaining ring (23) will permit the withdrawal of the film guide (25) and torsion spring (26). Note the manner in which the bent ends of the spring (26) engage holes in the mechanism plate and film guide (25).

d. The lower guide roller (29) is secured to the main plate with a single shoulder screw (27). A second shoulder screw (27) and hex nut (28) secure the upper roller (30) and the film deflector (31) to the projecting ear of the base.

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

a. Remove the canoe clip (1) and the single screw (2) and lift off the lower multi-motion link (3). Loosen the setscrew (4) and lift the multi-motion lever (5) from the shaft (7). Loosen the Sems nut (8) and washer (9) and support the multi-motion gear and cam assembly (11) while removing the screw (10) which secures the assembly to the tapped hole in the gear stud. Lift off the assembly and refer to paragraph 6 for disassembly instructions.

b. Removal of four screws (12) and two screws (13) will permit withdrawal of both the reel arm covers (14), the assembled reel spindles (16) and gears (15). Do not disassemble the reel spindle assemblies.

c. Lift the spur gears (17) and (18) from the gear studs of the support assemblies (31) and (32). Loosen setscrew (19) and disassemble the spur gear (20) and the gear and shaft assembly (21) from the projector. Loosen setscrew (22) and remove spur gear (23) from the end of the gear and shaft assembly (24).

d. Two small spur gears (26) and two large spur gears (27) are retained on the studs of gear mounting plate with retaining rings (25).

e. The removal of a single screw (28) and two retaining rings (29) will permit the gear mounting plate assembly (33) and all remaining reel arm parts to be disassembled from the main plate. Be careful not to mix the front and rear cam washers (35) and (36).

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 gear retaining spring (3) and spring ratchet (4) are installed so that they can be reassembled in the same manner. Carefully remove the spring (3) and disassemble drive parts (4 through 7) from the rear of the film drive roller and shaft assembly (8). Remove the roller and shaft assembly and the washer (9).

b. To remove lens carrier assembly (66), swing open lens carrier. Loosen three setscrews (10) in collars (12) and (13) and unscrew the framer knob and shaft (11) from mechanism plate. Refer to paragraph 7 for lens carrier disassembly.

NOTE: Pressure plate parts (items 15 through 17, Figure 6) can be removed from the lens mount without disassembling the lens carrier assembly from the mechanism casting. Swing open the lens carrier and remove the retaining rings from the pressure plate studs.

c. When removing the lower loopformer assembly (16) and upper loopformer assembly (33) from mechanism casting, note the manner in which the parts were disassembled to insure proper reassembly.

d. If the aperture plate assembly (58) is removed, note carefully the manner in which side tension spring (61) and arm (62) are assembled to insure proper reassembly.

6. DISASSEMBLING THE MULTI-MOTION GEAR AND CAM ASSEMBLY (Figure 5). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Disassemble the upper link (2) from the lever (4) by prying out the canoe clip (1). Loosen the setscrew (3) and withdraw the lever (4) from the shaft of the detent cam (5). As the detent cam is disassembled from the ears of the bracket assembly (15), the steel ball (6) and spring (7) will be released. Be careful not to lose these parts.

b. Remove the retaining ring (8) and disassemble the spring (9) and the actuator and shaft assembly (10) from the mounting ears of the bracket assembly (15). The cam follower (11) need not be removed unless the rounded tip is badly worn or is nicked or burred.

c. Remove the retaining ring (12) and lift the washer (13) and timing gear (14) from the post of the bracket assembly (15).

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

a. The pressure plate assembly (17) can be removed from the lens mount (12) without disassembling the mount from the mechanism casting. Swing open the lens carrier and remove the retaining rings (15) and springs (16). Remove the pressure plate parts (17) and (18).

b. Remove the setscrew (1) from the focus knob (2) and pry the knob from its shaft. Pry off the trim plate (4) and remove two screws (5) and the lens carrier cover (6). If shim washers (11) were used between the cover and the lens mount (12), save these washers for reassembly. Remove the retaining ring (7) from the focus shaft (10) and remove the shaft, the washer (9) and the spring (8) from inside the lens barrel. Remove the two screws (13) that secure the cover plate (14) to the lens mount.

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

a. Disengage the drive belt from the drive rollers (8). Outer drive roller (8) is accessible for replacement and can be disassembled from its mounting stud by removing the retaining ring (6). Note the flat washers (7) on either side of the roller. To replace inner drive roller (8), it will be necessary to remove retaining ring (3) and withdraw pulley mounting bracket assembly (4) and torsion spring (5) from the projector. Remove screws (1) and spring loading bracket (2).

b. Make certain that the forward-still-reverse knob has been removed from the safety shutter on the operating side of the projector main plate. Remove the pivot screw (9); then loosen the screw (10) which retains the front end of the safety shutter (11) to the mechanism casting just behind the aperture opening and lift out the safety shutter.

c. Remove two screws (12), the shutter washer (13), the shutter (14), spacing washer (14A) and the pull-down cam (15).

d. Remove the Sems nut (17) and washer (18) and disassemble the pivot screw (19), washer (20), spring tension washer (21), shuttle and bracket assembly (22) and spacer (23) from the cast arm of the mechanism. Loosen the setscrews (33) and withdraw the in-out cam from the main shaft. Check the felt wiper on the shuttle for looseness or damage.

e. Remove the Sems nut (16) from the pivot stud (26), and disassemble the pivot stud (26) from the cast arm of the mechanism.

f. Remove the two screws (27) and withdraw the assembled format shifter parts (28 through 31) from the main plate. Remove retaining ring (30) and disassemble the format shifting lever assembly (32) from the support bracket and stud assembly (31). The eccentric studs (29) and nuts (28) need not be removed unless the support bracket and stud assembly is in need of replacement.

g. Loosen setscrews (36) and (38) so that the drive pinion (41) and manual knob (39) are loose on the main shaft. Pry retaining ring (37) from its groove in the main shaft and press the shaft toward the rear of the projector until the manual knob can be slipped from the shaft; then withdraw the shaft toward the front of the projector, removing the drive pinion (41) and friction washer (43) in the process.

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

a. The small fan (3) can be removed by loosening its setscrew (2) and pulling the fan from the motor shaft. To remove the fan and pulley assembly (4), the motor and bracket assembly (7) must first be dismounted from the projector base. This is accomplished by removing the three screws (5) and (6) which are inserted from the underside of the base. If the motor (11) is to be replaced, remove the two screws (10), washers (9), and Sems nuts (8) which secure the motor to the brackets (12) and (13). Disassemble the inserts (14) and grommets (15) from the long bracket (12) and the single insert (16) and grommet (18) from the short bracket (13).

b. The support feet (28) and film cutter (30) are riveted to the base and can be replaced. However, please note that the base is replaceable only as a complete assembly (26) with riveted items installed.

# *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. Position the film cutter (30) on the base with the formed-up end of the cutter toward the projector main plate and secure it with the two rivets (29). When assembling rubber feet (28) to base, note that counterbore of foot must be away from the base. Insert the rivets (27) down through the base and foot.

b. Assemble the grommet (18) into the short motor mounting brackets (13) and press the insert (16) into the grommet. Assemble two grommets (15) into the long mounting bracket (12) and press the flat headed mounting inserts (14) into the grommets. Assemble the washers (9) to the screws (10) and insert the screws through the holes in the short bracket (13) and the motor assembly (11). Assemble the long motor bracket (12) to the ends of the screws and install and tighten the two Sems nuts (8) securely. Assemble the small blower fan (4), hub facing inward, on the short motor shaft. Position the fan so that the beveled end of the motor shaft protrudes beyond the face of the fan and tighten the setscrew (2) securely.

c. Assemble the fan and pulley assembly (4) to the long motor shaft and carefully position the assembled motor and bracket group on the base, shifting the fan assembly (4) as necessary so that the fan blades do not strike the walls of the blower housing. Align the motor mounting bracket holes with those in the base and install the three screws (5) and (6). The two short screws (5) are threaded up into the front mounting inserts (14); the longer screw (6) is threaded up into the mounting bracket stop (17). Tighten all three screws securely; then visually center the fan assembly (4) between the walls of the blower housing and tighten the setscrew (2) securely. Temporarily loop the drive belt (1) around the pulley.

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

a. Hold the main shaft (40) so that the end with the twin setscrew grooves is to the right. When installed, the right end of the shaft will be toward the rear of the projector and should be lightly oiled. Slide the friction washer (42) onto the left end of the shaft and insert the right end of the shaft into the bearing in the short cast arm, or tang, of the mechanism plate. Continue inserting the shaft while assembling the drive pinion (41), hub to the right, onto the shaft, and insert the shaft through the bearing in the long cast arm. Press the shaft toward the rear of the mechanism plate until the front end of the shaft clears the cut-out of the front edge on the mechanism plate. Hold the manual knob (39) in this cut-out and slide the main shaft forward until it engages the knob. Tighten the knob setscrew (38) just enough to hold, and assemble the retaining ring (37) to main shaft groove so that the friction washer (42) is captured against the bearing in the short cast arm. Temporarily tighten the drive pinion setscrew (36) just enough to hold.

b. Tap the knob end of the main shaft with a mallet to seat the retaining ring (37) flush against the knob side of the recess wall. Assemble the thrust washer (35) onto the main shaft. Lightly grease cam surface and assemble in-out cam (34) over washer (35) on shaft with gear portion of cam toward knob end of shaft. With no end play in main shaft, dip setscrew (33) in shellac and secure cam. Wipe excess shellac from cam surface.

c. Loosen setscrew (38) in the manual knob (39) and visually center the knob in the main plate cut-out. There must be sufficient clearance on either side of the knob to eliminate any binding of the knob against the main plate. Tighten the setscrew (38) securely and turn the main shaft. The shaft must turn freely with no binding or high spots. If binding does occur, tap the knob end of the shaft lightly to free it.

d. Assemble the eccentric studs (29) to the support bracket and stud assembly (31) and tighten the Sems nuts (28) finger-tight. Install the format shifting lever assembly (32) on the support bracket stud and secure in place with the retaining ring (30). Guide the format shifting lever through its slot in the main plate and fasten bracket securely to the main plate with two screws (27).

e. Screw the shuttle spacer (23) into the threaded hole in the long cast arm of the mechanism plate. Hold a 0.035-inch shim between the cast arm and the head of the shuttle spacer and screw the spacer in until the head bottoms against the shim. Install the washer (18) and Sems nut (17) on the threaded end of the shuttle spacer. Assemble flat washer (20) to pivot screw (19). Grease both sides of washer (21) and assemble to pivot screw with bowed face against the flat washer. Assemble the shuttle and bracket assembly to the spacer (23) with pivot screw and washers, engaging the stud at lower end of bracket (22) with the fork of format shifting bracket. Hold the hex shank of the shuttle spacer with a wrench while tightening the Sems nut (17) securely; then loosen the spacer just enough to permit the shim to be withdrawn.

f. Assemble cam shoe (25) to left side of shuttle cam opening with stepped follower surface against in-out cam. Assemble cam shoe (24) to right side of shuttle cam opening. Assemble pull-down cam (15) into shuttle opening between shoes with identification mark down and holes lined up with holes in the in-out cam. Lightly grease cam surfaces and add the spacing washer (14A) and then the shutter (14) with open side away from cams. Place washer (13) on main shaft. Align all holes and secure shutter and cam with screws (12). Turn hand knob to check fit of shoes on cam. Adjust long screw near top of shuttle to obtain slightly snug fit. Insert drive pinion clearance gage (Figure B) between drive pinion and bearing in short cast arm. Hold drive pinion against gage, dip end of setscrew in shellac and secure pinion to shaft. Remove clearance gage.

g. Assemble the shoulder stud (26) through the hole in the long cast arm of the mechanism and secure the stud with the Sems nut (16). Assemble the safety shutter assembly (11) to the projector, guiding the shifting lever through the slot in the mechanism plate and locating the pivot hole of the assembly over the shoulder of the pivot stud (26). Secure the front end of the fire shutter assembly to the tapped boss of the mechanism plate casting (behind the aperture plate) with screw (10). Insert screw (9) through the pivot hole of the fire shutter assembly and tighten it securely into the pivot stud (26).

h. Oil the studs of the pulley mounting bracket (4) and install a washer (7) on each stud. Install the driver rollers (8) and remaining washers (7) to the studs, securing these parts with the retaining rings (6). Check to make sure that the rollers spin freely and smoothly. Assemble the spring loading bracket assembly (2) to the pulley mounting bracket assembly with the two screws (1). Line up the edges of both brackets and tighten the screws enough to hold. Lightly oil the end of the pulley mounting bracket shaft and assemble spring (5) over shoulder of shaft. Insert the shaft through the bearing hole in the safety shutter assembly, with the ear of the actuating plate between shoes of the drive pulley assembly. One drive roller must be on each side of the shutter rim. Install a retaining ring (3) to secure pulley mounting bracket and engage the drive belt with the motor pulley and the two drive rollers.

i. Cross the legs of the torsion spring (5) and engage them in the slotted ears of the safety shutter bracket. Move the safety shutter shifting lever (Forward-Still-Reverse) through all three positions to make certain that the lever moves smoothly and detents in 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 centering of heat filter by loosening the front mounting screw (10) and shifting the safety shutter

mounting plate up or down as necessary; then retighten the screw. Remove unnecessary play in shifting lever by bending the legs of torsion spring (5) to increase the tension.

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

a. Lightly grease the lens barrel bore and focus shaft bore of the lens mount assembly (12). Assemble the lens carrier parts as follows. Grease pin of shaft (10) and assemble washer (9) and spring (8) over end of shaft. Assemble focus shaft and pin assembly (10) into hole of lens mount (12). Secure focus shaft to lens mount with retaining ring (7).

b. Lightly grease both pressure plate studs and assemble springs (16) to studs of pressure plate assembly (17). Assemble pressure plate and springs to lens carrier with longest rail toward mounting ears of lens carrier and secure pressure plate 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 carrier with screws (5), using shim washers (11) between cover and lens carrier. Shims are to be used in pairs, as required, to maintain a minimum clearance of 0.005 inch between lens carrier cover and loopformers, without binding. Tighten previously assembled screws (13).

14. REASSEMBLING THE MULTI-MOTION GEAR AND CAM ASSEMBLY (Figure 5). Reassemble parts as instructed in the following paragraphs, noting any special precautions.

a. Assemble the timing gear (14), long hub down, over the post of the multi-motion bracket assembly (15), aligning the timing hole in the gear with the notch in the bracket plate as shown in Figure C. Install the washer (13) on the post and secure the gear and washer with the push-on retaining ring (12).

b. Screw the cam follower (11) into the nut of the actuator bracket and shaft assembly (10), and insert the shaft of the assembly through the mounting holes in the bracket assembly (15). Assemble the spring (9) over the protruding end of the shaft and install the retaining ring (8).

c. Assemble the spring (7) and steel ball (6) into the detent hole in the bracket assembly plate and hold in place with shim stock while inserting the shaft of the detent cam (5) through the mounting holes in the bracket assembly. Orient the detent cam so that the canal in the cam hub captures the steel ball to retain it in the detent hole and withdraw the shim stock. Assemble the lever (4), hub portion out, to the shaft of the detent cam and secure the lever with the setscrew (3). Assemble the upper link (2) to the lever (4) with the canoe clip (1).

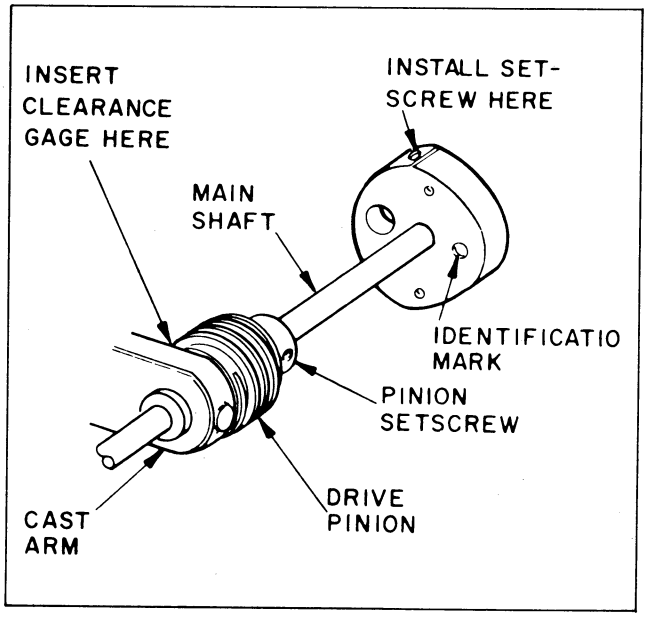


Figure C. Installing Pull-Down Cam and Drive Pinion

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

a. Assemble the fire shutter tension spring (64) to recess of fire shutter pivot stud. Short end of the spring is to be engaged with fire shutter actuating ear and long end is to be hooked over side tension arm (62). Actuate ear of the fire shutter and release slowly several times to check proper operation of shutter. Shutter must return to stop on framing bracket without binding.

b. Place aperture plate (58) on the work bench with the stud up and away from you. Assemble the side tension arm (62) over the stud with the tension arm prongs down and into the aperture plate slots. Assemble the spring (61) 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 (61) 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 (57) and (59). Assemble the guide rail (63) to the aperture plate. Position the guide rail over the threaded studs, and while holding the guide rail in, with tangs against the inside edge of the slots in the aperture rail and aperture plate, secure the guide rail with two screws (60). After all aperture plate screws are tightened, unhook fire shutter tension

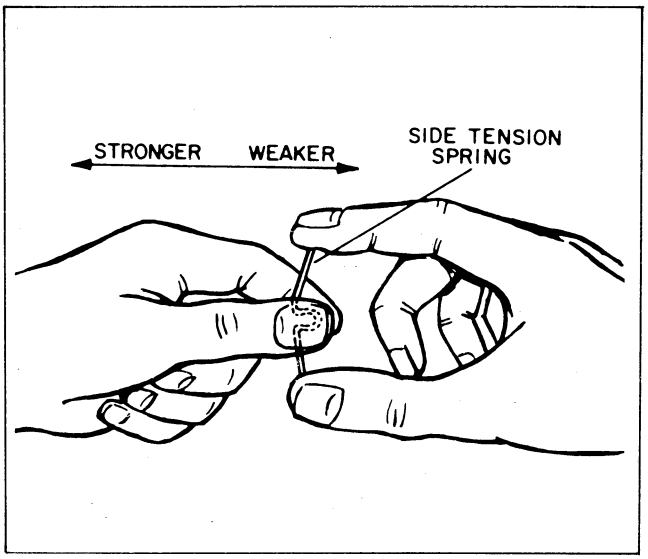


Figure D. Adjusting Tension of Aperture Plate Spring

spring (64) from ear of the side tension arm (62). Engage free end of spring (64) between rear of side tension arm and mechanism plate.

c. Assemble a retaining ring (46) to the ring groove at one end of the shaft (48). Lightly grease the shaft and insert it up through the lower ear of the mounting plate (52), the spring (51), the two stop plates (50), the upper spring (49) and the upper ear of the mounting plate. Assemble spring tension washer (49), bowed face against upper ear, and secure all parts with the second retaining ring (46).

d. Assemble spring (44) over snubber pivot bushing with straight end of spring engaged in the shear formed notch of upper loopformer mounting plate. Liberally apply oil to the snubber shaft (43), assemble into bushing of mounting plate and secure at rear side with retaining ring (42). Snubber must pivot freely without binding and the spring must return snubber arm to the running position. Apply light coating of grease to the roller shaft of snubber arm. Assemble roller (44) over the shaft and secure to the shaft with one retaining ring (40). Assemble the threading knob assembly (39) to the snubber arm shaft with the flat of the knob over the flat of the shaft. Press knob firmly onto the shaft to seat.

e. Apply a light coating of grease to two roller shafts of upper loopformer (38). Place guide roller (37) over the right shaft of the loopformer and roller (36) over the left shaft of the loopformer, both with recess up. Assemble two washers (35), one over each shaft, to the loopformer. Secure rollers with two retaining rings (34). Rollers must not have excessive end play and must be free of binding. Position upper film guide (32) against the mounting plate and loosely secure with one screw (31). Film guide will be final tightened after assembly to the mechanism plate. Assemble one washer (23) to shaft of upper loopformer assembly, and liberally apply oil to the shaft. Insert the loopformer shaft into the bushing of the mounting plate, engaging tabs of loopformer between the spring loaded shoes of the mounting plate. Place a 0.002 inch shim between loopformer and bearing washer. Place locking bushing (22) on the rear of the shaft and secure it with two setscrews (21). Secure the upper loopformer assembly (33) to the mechanism plate with two screws (14). Do not fully tighten these screws. Tighten the screw (14) from inside of mechanism plate in to tapped hole in film guide (32). Tighten two previously assembled screws (14) to complete assembly of upper loopformer assembly. Actuate loopformer up and down to assure free operation. Assembly must be free from binding in either direction.

f. Assemble one retaining ring (25) to the ring groove at the lower end of the shaft (27). Lightly grease the shaft and insert it up through the lower ear of the mounting plate (30), the stop plate (29), the spring (28) and the upper ear of the mounting plate. Assemble spring tension washer (26), bowed face against upper ear, and secure all parts with the second retaining ring (25).

g. Apply a light coat of grease to the roller shafts of the lower loopformer (20). Assemble two rollers (19) to the lower loopformer with recess up and add two washers (18), one over each shaft, into the roller recess. Secure rollers to shafts with two retaining rings (17). Secure lower film guide (15) to edge of mounting plate with one screw (14). Oil the shaft of the loopformer and roller assembly (16) and add one washer (23) to the shaft. Insert the lower loopformer shaft into the bushing of mounting plate (30), engaging the tabs of loopformer between lower mounting plate ear and stop plate (29). Place a 0.002-inch shim between loopformer and thrust washer. Assemble bushing (22) to the shaft, hold all parts together, and secure with two setscrews (21). Secure lower loopformer assembly to the mechanism plate with two screws (14) while holding the loopformer assembly against aperture plate. Actuate loopformer to assure free operation. Assembly must be free from any binding.

h. Lightly grease the threaded end of the framer shaft (11). Hold the assembled lens carrier (66) in position between the two mounting ears of the mechanism plate and insert the threaded end of the framer shaft (11) down through the upper mounting ears of the mechanism plate and lens carrier. While pressing the framer shaft down into place, install a collar (12), spool collar (13) and second collar (12) to the shaft between the two lens carrier ears. Engage the threaded end of the framer shaft with the tapped hole in the lower mechanism plate ear and screw the shaft down until the threaded end just begins to come through below the mounting ear and the flat on the shaft is facing the front of the projector. Before tightening the collar setscrews (10), adjust collar spacing as instructed in paragraph 23.

i. Assemble washer (9) over the end of drive roller and shaft assembly (8), oil the end of the shaft and insert shaft through mechanism plate bearing. Lightly oil gears (7) and (5) on side with projections.

Assemble gear (7) to the drive roller shaft and install drive gear lever assembly (6) over this gear. Assemble gear (5) and add ratchet spring (4) to the shaft with depressions engaged with gear teeth. Assemble spring (3) to shaft with the short end of the spring engaged in the slot on the shaft. Apply light film of grease to the remaining stud on the gear plate and assemble gear (2) securing it with retaining ring (1).

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

a. Lightly grease both support assemblies (31) and (33) around the bearing hole bosses. Assemble the reel arm bearings (30) to the two reel arm support assemblies (31) and (32) and then through the bearing holes in the projector main plate. Place a speck of grease into the two small through-holes on either side of the protruding bearings (30) and place a steel ball (37) in each of these holes. Carefully assemble the cam washers (35) and (36) over the bearings with the prongs of the washer toward the top edge of the main frame and the detent holes locating over the steel balls (37). Assemble the tension spring (34) over the bearing, small diameter toward main plate and end of small diameter pointing toward top edge of main plate. Assemble the gear mounting plate assembly (33) over the protruding bearing ends and press the mounting plate down to compress the spring until the retaining rings (29) can be installed in the ring grooves of the bearings. Secure the gear mounting plate to the main plate with the single screw (28).

b. Lightly oil the end of the spur gear and shaft assemblies (21) and (24) and assemble one shaft into the supply arm support bearing and one shaft into the take-up arm support bearing. Assemble spur gear (23) over end of the gear shaft. Insert a 0.003-inch shim between inner gear face and bearing (30), press all parts lightly together, and tighten gear setscrew (22) securely. Check to make certain that the assembled spur gear and gear and shaft assembly have 0.002 to 0.003 inch end play. Assemble spur gear (20) to the spur gear shaft (21). Insert a 0.003 inch shim between inner gear face and bearing face, press all parts lightly together, then tighten gear setscrew (19) securely.

c. Lightly grease each gear stud of the gear mounting plate (33). Install spur gear (26) onto its gear stud so that it meshes with spur gear (20). Install second spur gear (26) onto its gear stud so that it meshes with the spur gear (23). Secure both gears with the retaining rings (25). Assemble the large spur gears (27) on their studs and secure with retaining rings (25). Lightly grease all gear teeth.

d. Lightly grease all gear studs of the reel arm supports (31) and (32). Assemble one gear (18), hub down, onto its stud on the rear support and the other gear (18) onto its stud on the front support, also with hub down. Add four gears (17), with hubs down, on the remaining studs of both supports. Assemble a reel spindle assembly (16) and spur gear (15) to each reel arm cover (14). Lightly grease all gear teeth and assemble the covers to the supports, carefully meshing gear teeth. Install and tighten the screws (12) and (13) after turning the spindles manually to check that all gear teeth are properly meshed and not binding.

e. Rotate the manual knob of the projector until the shuttle teeth are in the mid-position of the downward stroke. Check to make certain that the in-out cam is positioned as shown in Figure E. Place the multi-motion gear and cam assembly (11) in the 6 fps position by manually rotating the multi-motion detent cam until the activator shaft is engaging the second highest step of the cam. Rotate the actuator bracket downward so that the tip of the multi-motion cam follower is contacting the surface of the multi-track cam. Make certain that the aligning hole in the multi-motion gear is in line with the notch in the cam plate as shown in Figure E. Insert a small pin or rivet through the aligning hole to insure that the gear stays in alignment during installation. Temporarily remove the Sems nut (8) and washer (9) from the end of the shuttle spacer (23), Figure 7. Carefully assemble the multi-motion mechanism to the projector, engaging the open slot at the lower end of the multi-motion bracket with the shuttle spacer and meshing the multi-motion gear with the gear portion of the in-out cam. Secure the multi-motion bracket to the tapped gear stud of the gear mounting plate (33) with the screw (10). Check to make certain that gears and cams are properly meshed (minimum backlash) and timed as shown in Figure E; then reinstall the Sems nut (8) and washer (9) and tighten the nut securely.

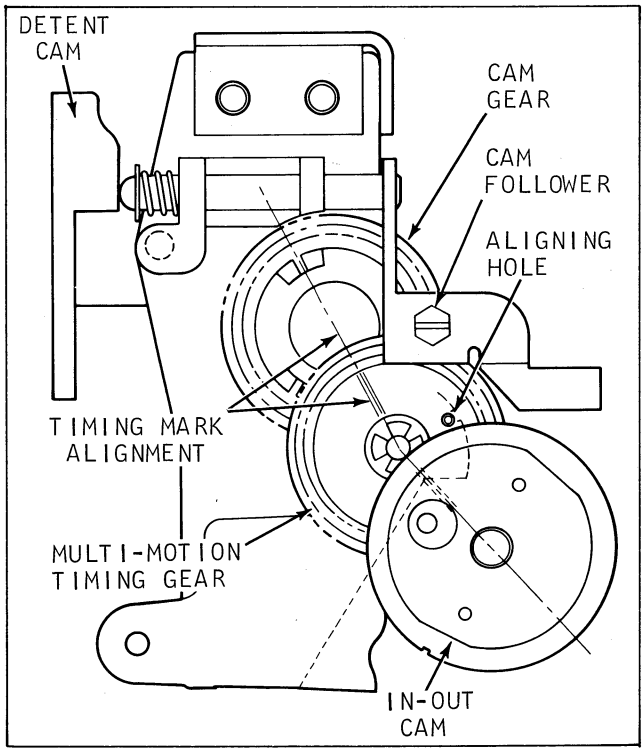


Figure E. Timing and Installing the Multi-Motion Gear and Cam Assembly

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

a. Assemble forward-reverse knob (35) to reversing lever with lettering positioned so as to be normally readable, and secure with screw (34).

b. Assemble screws (27) to rollers (29) and (30), with head of screw in recess of roller, and install to the upright of the base. Assemble the film deflector (31) over the threaded end of the upper screw so that it fits into the formed recess and secure in place with hex nut (28).

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 (25) over the stud and the long tang of the spring and secure these parts with retaining ring (23). Assemble roller (24) to stud and secure with the second retaining ring (23).

d. Apply grease to all surfaces of the interlock lever (21) which will contact the control housing (15). Assemble end of lever with elongated slot through notch in center wall, with angled edge toward top of control housing. Place two bushings (20) in the elongated holes of the lever. Assemble switch (22) into the control housing with notch side of switch toward top of control housing. Secure switch to housing with two screws (19). Actuate the switch to assure switch and interlock lever are working properly. Assemble tubing (16) over the three switch leads and slide down as close as possible to rear of switch assembly.

e. Carefully lift the control housing up into position against the main plate, guiding the shift levers and speed control shaft through their respective openings at the front of the housing and pulling the switch leads and tubing through the hole in the main plate. Secure the housing (15) to the main plate with the two screws (14). Assemble the multi-motion knob (13) to the protruding speed control shaft and tighten its setscrew (12) securely. Press the two knobs (11) firmly onto the ends of the shifting levers.

f. Pull the leadwires of lamp socket and bracket assembly through clamp (9), and assemble clamp to socket with screw (7) and washer (8). Secure lamp socket assembly (10) to main plate with two screws (5) and washers (6). Attach leadwires to lamp socket assembly as shown in the wiring diagram, Figure 9. After the projector is assembled, the lamp socket must be aligned as instructed in paragraph 21. Secure the air deflector (4) to the lamp socket bracket with two clips (3). Bend the end of the air deflector down around the fan and secure it to the blower well with the remaining clip (3). Dress the leads and pull them up snugly so they do not touch the motor.

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

a. Assemble the lamphouse baffle (24), spacer (25) and catch (26) to the lamphouse (27) with one rivet (23). Do not install the assembled lamphouse assembly (22) until the lamp socket is aligned.

b. Insert cover release button (4) into top hole of front cover (7). Add catch (3) onto button with bulge up and rivet together with 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 24 for shuttle tooth adjustments.

b. With the projector grounded, plug the line cord into the 110 to 120 volts outlet. With the Off-Motor Lamp switch in the Motor 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 26.

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 19 through 26. Then make a final test of projector operation as outlined in the Final Test section.

20. CHECKING SPINDLE TORQUE.

a. The spindle assembly on the upper (supply) arm must be replaced if (1) film spills from the reel

which indicates that the spindle is too loose, or (2) projector pulls film from the reel or perforations on the film are damaged which indicates that the spindle is too tight.

b. The spindle assembly on the lower (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. ADJUSTING MULTI-MOTION LINKAGE.

a. Check to make certain that the multi-motion mechanism is still set in the 6 fps position (tip of actuator shaft, Figure E, engaging second highest step of multi-motion detent cam). If necessary, loosen the screw which joins the upper and lower multi-motion links and manually rotate the detent cam to the proper position.

b. With the multi-motion mechanism set as instructed in step a, the multi-motion knob at the front of the control housing should be aligned with the SLOW setting on the nameplate. Reposition the knob if necessary and tighten the knob setscrew securely.

c. Take up all play between the upper and lower multi-motion links and tighten the locking screw securely. Operate the knob through all three positions several times to make certain that the cam detents positively at each position.

22. LAMP SOCKET ALIGNMENT. As illustrated in Figure F, 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, unplug the projector cord 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.

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 G.

a. Install the lens carrier assembly as outlined in paragraph 15, step h. Leave the collar setscrews loose,

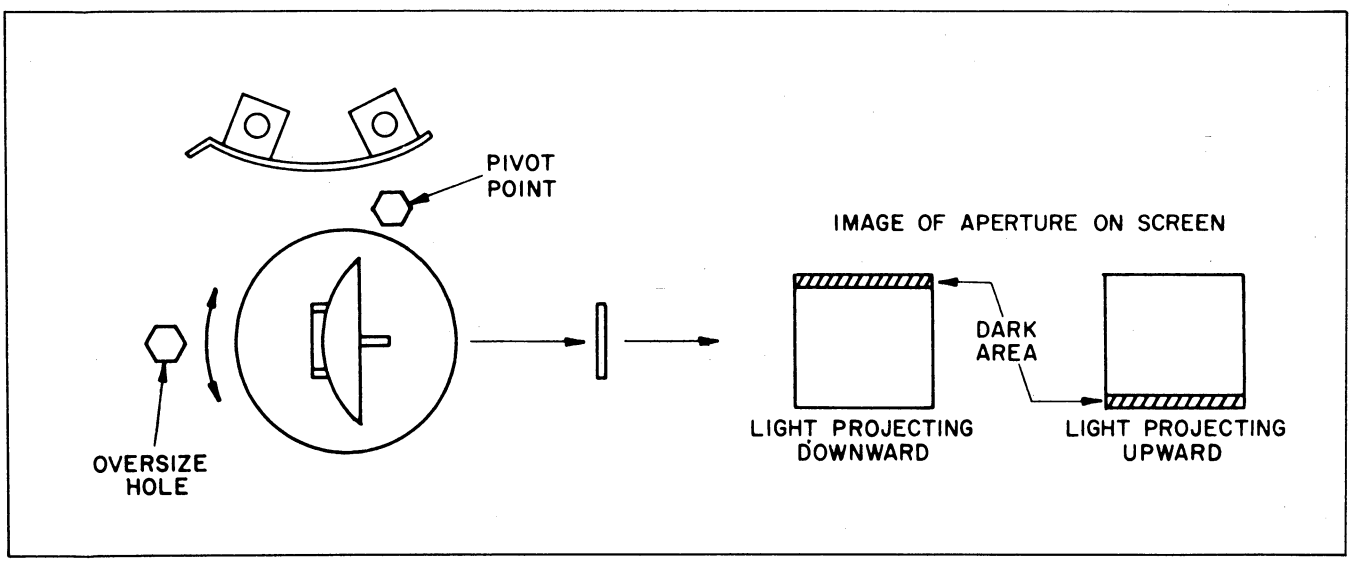


Figure F. Lamp Socket Alignment

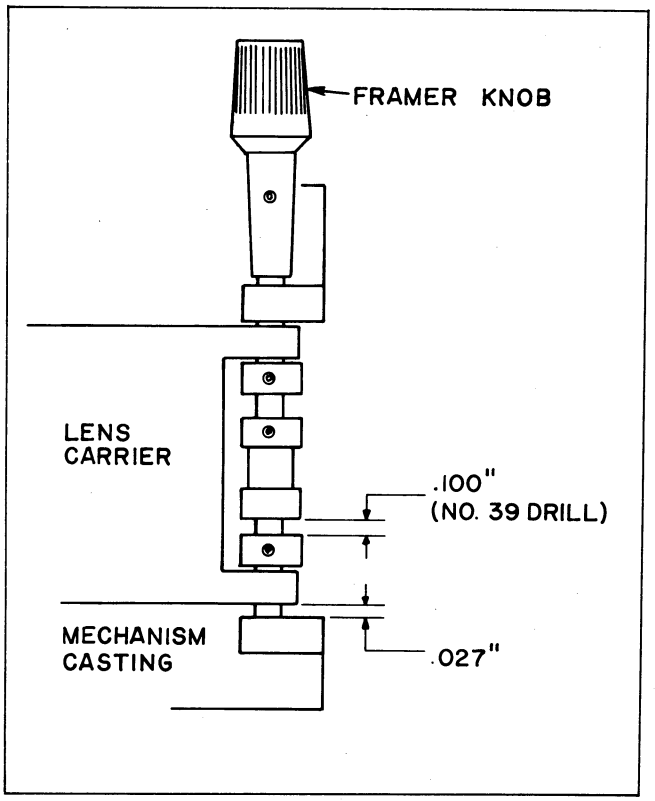


Figure G. Framer Adjustments

and make sure that the flat on the framer shaft is facing you as you look straight at the aperture plate.

b. Place a 0.027 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 the lens mount ears and tighten the collar setscrews against the flat of the framer shaft.

d. Place a 0.10 spacer between the lower collar and the spool-type collar. Press spool-type collar down against shim and tighten the framer collar setscrew securely against the flat of the framer shaft.

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 H, check the framing both in Standard and Super 8-mm modes of operation. Framing results should be as noted in Figure H.

24. 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 the MULTI-MOTION lever to NORM.

(5) Set forward and reverse lever to forward.

(6) Swing open the lens carrier.

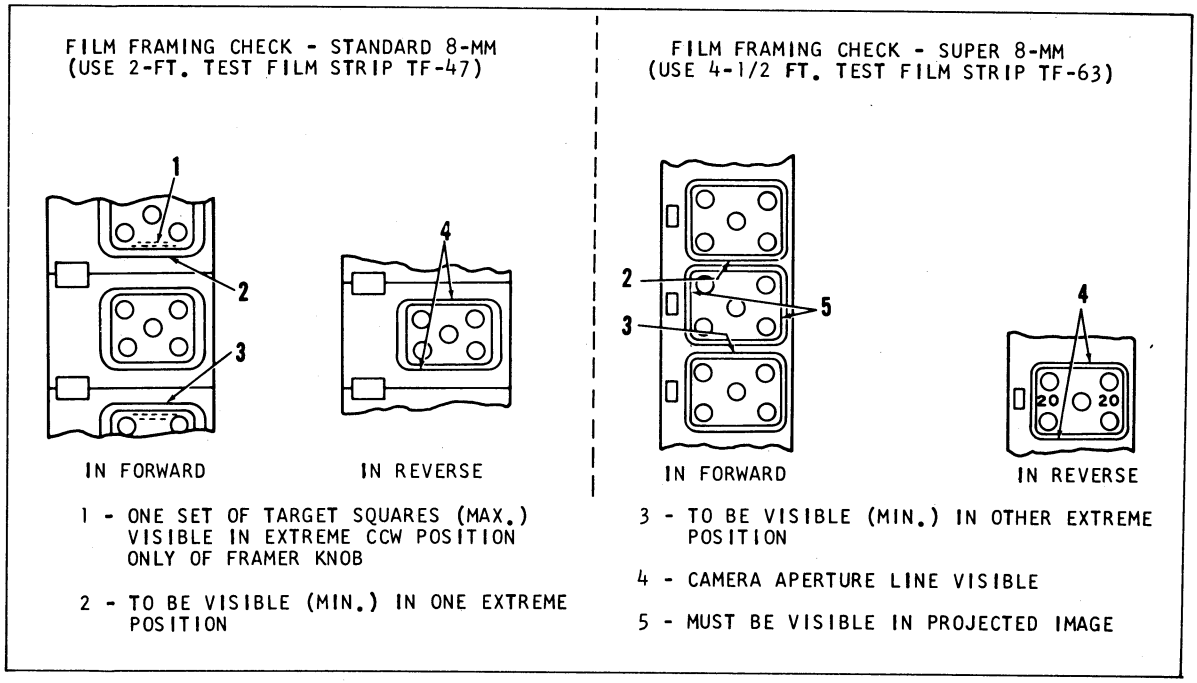


Figure H. Film Framing Check

b. Rotate the manual knob until the shuttle teeth reach approximate mid-position on the downward 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. To adjust shuttle tooth protrusion loosen locking nut (8, Figure J) with a socket wrench. Insert a screwdriver in slotted end of pivot spacer (9). To increase the height of the shuttle teeth, turn the spacer clockwise. To decrease the height of the teeth, turn the spacer counterclockwise. First check protrusion of shuttle teeth at NORM speed setting. Then, when shifting to SLOW and STEP, teeth must not move. If teeth moved when shifted to STEP setting, adjust cam follower on speed shift bracket assembly (Figure E) to get more play between follower and cam. Readjust tooth protrusion at NORM setting if needed.

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 sequences. If it is necessary to reset cam timing, refer to Figure E and paragraph 16, step f.

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 (7, Figure J) in adjusting slot and moving

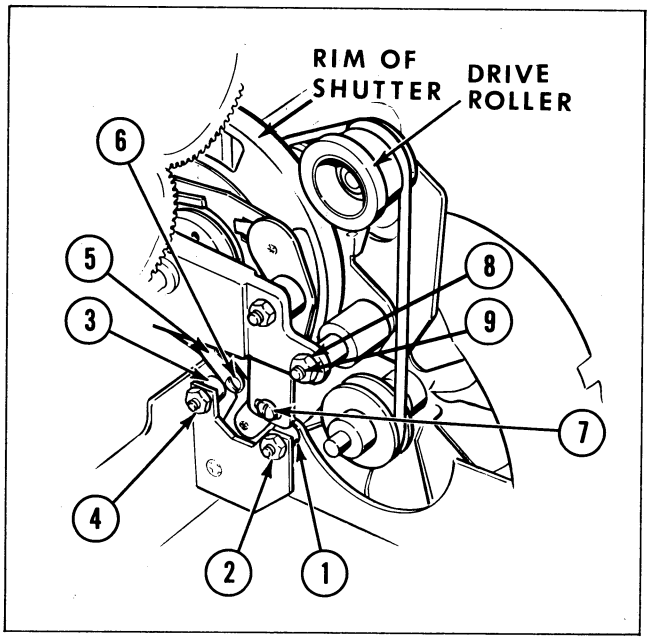


Figure J. Adjusting Shuttle, Aperture Mask and Format Shifting Lever

bracket in either direction. Tighten the screw securely after adjustment has been made.

25. APERTURE MASK ADJUSTMENT (Figure J).

a. Remove the knob from the end of the format shifting lever. Place the projector OFF-MOTOR-LAMP switch in the OFF position and the format shifting lever in Super 8 position; then move the OFF-MOTOR-LAMP 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 at the front of the control housing so that the gage 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) on eccentric (1), Figure J, 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, Figure J) 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.

26. 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 upper drive roller and the rim of the shutter (Figure J). 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.

# Final Test

27. 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 ac 60-cycle power source.

28. GENERAL 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 carrier catch (55, 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. Proper fit is obtained by adjusting the screw on the shutter and bracket assembly.

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 26 for adjustment.

29. SAFETY SHUTTER OPERATION TEST. It is important that the mechanism begins to drive (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 as the lever is moved from the "still" position to either of the operating positions. If necessary, adjust safety shutter as instructed in paragraph 26.

30. 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 (54, 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.

31. OPERATIONAL TEST. Thread the projector with silent film, using a full reel, and run the projector to check for proper operation. Check the following items during the test.

a. Listen for unusual noises that may indicate insufficient lubrication.

b. If film should spill from the feed reel during operation, it is necessary to replace the reel spindle.

c. If the film fails to maintain its loop above or below the aperture, check shuttle tooth height as described in paragraph 23 and readjust if necessary.

# 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 (8-2). |
| | 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 26. |
| | 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 (4-58) or pressure plate (6-17). | 2. Replace worn or marred parts. |
| | 3. Worn or damaged aperture plate film guide rail. | 3. Replace aperture plate (4-58). |
| 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 (7-22). |
| | 4. Misaligned shuttle tooth. | 4. Adjust and align shuttle as instructed in paragraph 24. |
| | 5. Grooves worn in aperture plate film guide rail. | 5. Replace aperture plate (4-58). |
| | 6. Lower loopformer binding. | 6. Free up binding loopformer. |
| Soft focus | 1. Dirty projection lens. | 1. Clean projection lens. |
| | 2. Lens mount out of alignment. | 2. Readjust focus screw as necessary (paragraph 30). |
| | 3. Loose lens mount catch (4-35). | 3. Reset tension by bending catch carefully. |
| Autothreading not operating properly | 1. Loopformer binding. | 1. Free-up loopformer. |
| | 2. Safety shutter binding. | 2. Free-up safety shutter. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| 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 (7-8). |
| | 3. Drive rollers not adjusted properly. | 3. Readjust as instructed in paragraph 26. |
| | 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 Type DFZ 30V, 80W lamp only. |
| | 3. Lamp socket out of alignment. | 3. Align lamp socket as instructed in paragraph 22. |
| 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 25). |
| Film transport problems | 1. Incorrect shuttle tooth penetration or centering. | 1. Adjust as instructed in paragraph 24. |
| | 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. Bent shuttle (7-22) or shuttle not parallel to tang. | 4. Tighten mounting screw (7-9). Straighten or replace bent shuttle. |
| | 5. Defective or wrong upper cam shoe (7-25). | 5. Replace cam shoe. |
| | 6. Upper cam shoe (7-25) assembled backwards. | 6. Assemble can shoes as instructed in reassembly. |
| Speed change failure | 1. Cam follower out of adjustment. | 1. Adjust follower (paragraph 16, step e). |
| | 2. Multi-motion gearing out-of-time, or linkage loose. | 2. Time multi-motion mechanism (paragraph 16, step e); readjust linkage (paragraph 22). |
| Rewind failure | 1. Defective spindle (3-16). | 1. Replace spindle. |
| | 2. Dry pull-down cam. | 2. Lightly grease cam (7-15). |
| | 3. Tight cam shoes (7-24) and (7-25). | 3. Correct fit by turning long adjusting screw on shuttle counterclockwise. |
| | 4. Excessive shuttle tooth penetration. | 4. Adjust shuttle tooth protrusion (paragraph 24). |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| 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 (7-8). |
| | 3. Drive rollers not adjusted properly. | 3. Readjust as instructed in paragraph 26. |
| | 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 Type DFZ 30V, 80W lamp only. |
| | 3. Lamp socket out of alignment. | 3. Align lamp socket as instructed in paragraph 22. |
| 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 25). |
| Film transport problems | 1. Incorrect shuttle tooth penetration or centering. | 1. Adjust as instructed in paragraph 24. |
| | 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. Bent shuttle (7-22) or shuttle not parallel to tang. | 4. Tighten mounting screw (7-9). Straighten or replace bent shuttle. |
| | 5. Defective or wrong upper cam shoe (7-25). | 5. Replace cam shoe. |
| | 6. Upper cam shoe (7-25) assembled backwards. | 6. Assemble can shoes as instructed in reassembly. |
| Speed change failure | 1. Cam follower out of adjustment. | 1. Adjust follower (paragraph 16, step e). |
| | 2. Multi-motion gearing out-of-time, or linkage loose. | 2. Time multi-motion mechanism (paragraph 16, step e); readjust linkage (paragraph 22). |
| Rewind failure | 1. Defective spindle (3-16). | 1. Replace spindle. |
| | 2. Dry pull-down cam. | 2. Lightly grease cam (7-15). |
| | 3. Tight cam shoes (7-24) and (7-25). | 3. Correct fit by turning long adjusting screw on shuttle counterclockwise. |
| | 4. Excessive shuttle tooth penetration. | 4. Adjust shuttle tooth protrusion (paragraph 24). |

**PARTS CATALOG**

# COMPATIBLE 8MM-SUPER 8MM MULTI-MOTION® PROJECTOR

## DESIGN 471

CONSUMER PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 72765-1 PRINTED IN U.S.A. AUGUST 1971

# Replacement Parts

The following pages illustrate and list, by part number and description, all replacement parts for the Bell & Howell Design 471 Multi-Motion 8mm/Super 8mm Projector. Parts are listed in a suggested order of disassembly to serve as an aid to the repairman during projector repair. Following is a list of accessories available for this projector.

Adapter, Spindle . . . . . part no. 013098
Lens, 1-inch f/1.6 . . . . . part no. 022660
Reel, Take-Up . . . . . part no. 014118

| 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 | 014465 | COVER ASSEMBLY, Front | 1 | |
| -2 | 30226 | . RIVET, Tubular, 0.123 inch diameter | 1 | |
| -3 | 39252 | . CATCH, Cover | 1 | |
| -4 | 32361 | . BUTTON, Cover release | 1 | |
| -5 | 40553 | . CLIP, Film reel retaining | 1 | |
| -6 | 39105 | . NAMEPLATE, Front cover (adhesive backed) | 1 | |
| -7 | 43567 | . COVER, Front (order complete cover assembly) | 1 | |
| -8 | 29065 | SCREW, Hex head tapping, 4-40 by 1/2 inch | 4 | |
| -9 | 37932 | SCREW, Hex head, 6-32 by 5/8 inch | 2 | |
| -10 | 43555 | COVER, Back | 1 | |
| -11 | 45461 | PLATE, Data | 1 | |
| -12 | 39181 | CORD, Power | 1 | |
| -13 | 22464 | BUSHING, Strain relief | 1 | |
| -14 | 39200 | SCREW, Hex head Sems tapping, 8-18 by 1/2 inch | 2 | |
| -15 | 39124 | HOOK, Power cord storage | 2 | |
| -16 | 39204 | SCREW, Hex head Sems tapping, 10-32 by 0.437 inch | 2 | |
| -17 | 35186 | WASHER, Flat | 2 | |
| -18 | 43197 | END CAP, Handle | 2 | |
| -19 | 39074 | HANDLE, Carrying | 1 | |
| -20 | 39073 | INSERT, Carrying handle | 1 | |
| -21 | 44072 | NAMEPLATE, Lamphouse | 1 | |
| -22 | 014461 | LAMPHOUSE ASSEMBLY, Complete | 1 | |
| -23 | 39190 | . RIVET, Tubular, 0.123 inch diameter | 1 | |
| -24 | 39231 | . BAFFLE, Heat | 1 | |
| -25 | 39189 | . SPACER, Sleeve | 1 | |
| -26 | 35360 | . CATCH, Lamphouse | 1 | |
| -27 | No Number | . LAMPHOUSE (Order complete lamphouse assembly) | NP | |
| -28 | 43057 | LAMP, Projection, Type DFZ | 1 | |

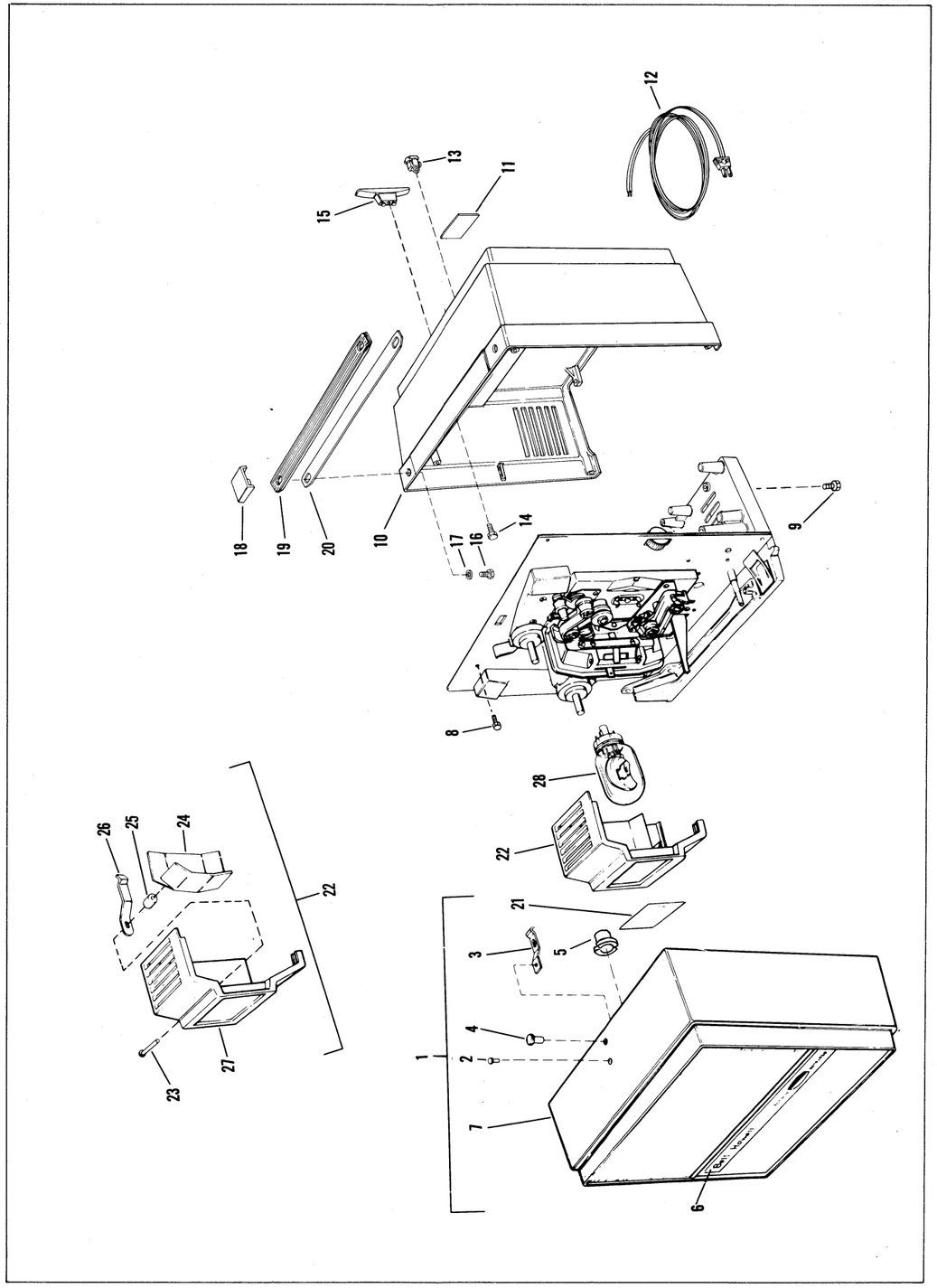


Figure 1. Projector Covers and Lamp

| 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 | 3 | |
| -4 | 39301 | DEFLECTOR, Air | 1 | |
| -5 | 706679 | SCREW, Hex head tapping, 6-32 by 3/8 inch | 2 | |
| -6 | 17632 | WASHER, Flat | 2 | |
| -7 | 36882 | SCREW, Hex head tapping, 6-32 by 3/8 inch | 1 | |
| -8 | 17632 | WASHER, Flat | 1 | |
| -9 | 83286 | CLAMP, Leadwire | 1 | |
| -10 | 010270 | SOCKET AND BRACKET ASSEMBLY, Lamp | 1 | |
| -11 | 44173 | KNOB, Control lever | 1 | |
| -12 | 36769 | SETSCREW, Fluted socket, cup pt, 8-32 by 1/4 inch | 1 | |
| -13 | 43059 | KNOB, Multimotion | 1 | |
| -14 | 706679 | SCREW, Hex head tapping, 6-32 by 3/8 inch | 2 | |
| -15 | 43127 | HOUSING, Control | 1 | |
| -16 | 39182 | TUBING, Insulating | 1 | |
| -17 | 43071 | NAMEPLATE, Control box, "Compatible" | 1 | |
| -18 | 45458 | NAMEPLATE, Control box, "MultiMotion" | 1 | |
| -19 | 34590 | SCREW, Flat head, 6-32 by 3/8 inch | 2 | |
| -20 | 40495 | BUSHING, Interlock lever | 2 | |
| -21 | 40454 | LEVER, Interlock | 1 | |
| -22 | 013638 | SWITCH, Slide | 1 | |
| -23 | 20808 | RING, Retaining, 0.145 inch ID | 2 | |
| -24 | 39087 | ROLLER, Guide | 1 | |
| -25 | 40419 | GUIDE, Film | 1 | |
| -26 | 39098 | SPRING, Torsion | 1 | |
| -27 | 39089 | SCREW, Guide roller, 4-40NC | 2 | |
| -28 | 39223 | NUT, Plain hex, 4-40NC | 1 | |
| -29 | 39248 | ROLLER, Guide | 1 | |
| -30 | 40518 | ROLLER, Guide | 1 | |
| -31 | 39143 | DEFLECTOR, Film | 1 | |
| -32 | 43454 | DISC, Decorative, tilt knob (adhesive backed) | 1 | |
| -33 | 013642 | KNOB AND SHAFT ASSEMBLY, Tilt | 1 | |
| -34 | 32926 | SCREW, Fillister head, 2-56 by 1/4 inch | 1 | |
| -35 | 44994 | KNOB, Forward-Reverse | 1 | |
| -36 | 43065 | NAMEPLATE, Lamp designation (adhesive backed) | 1 | |

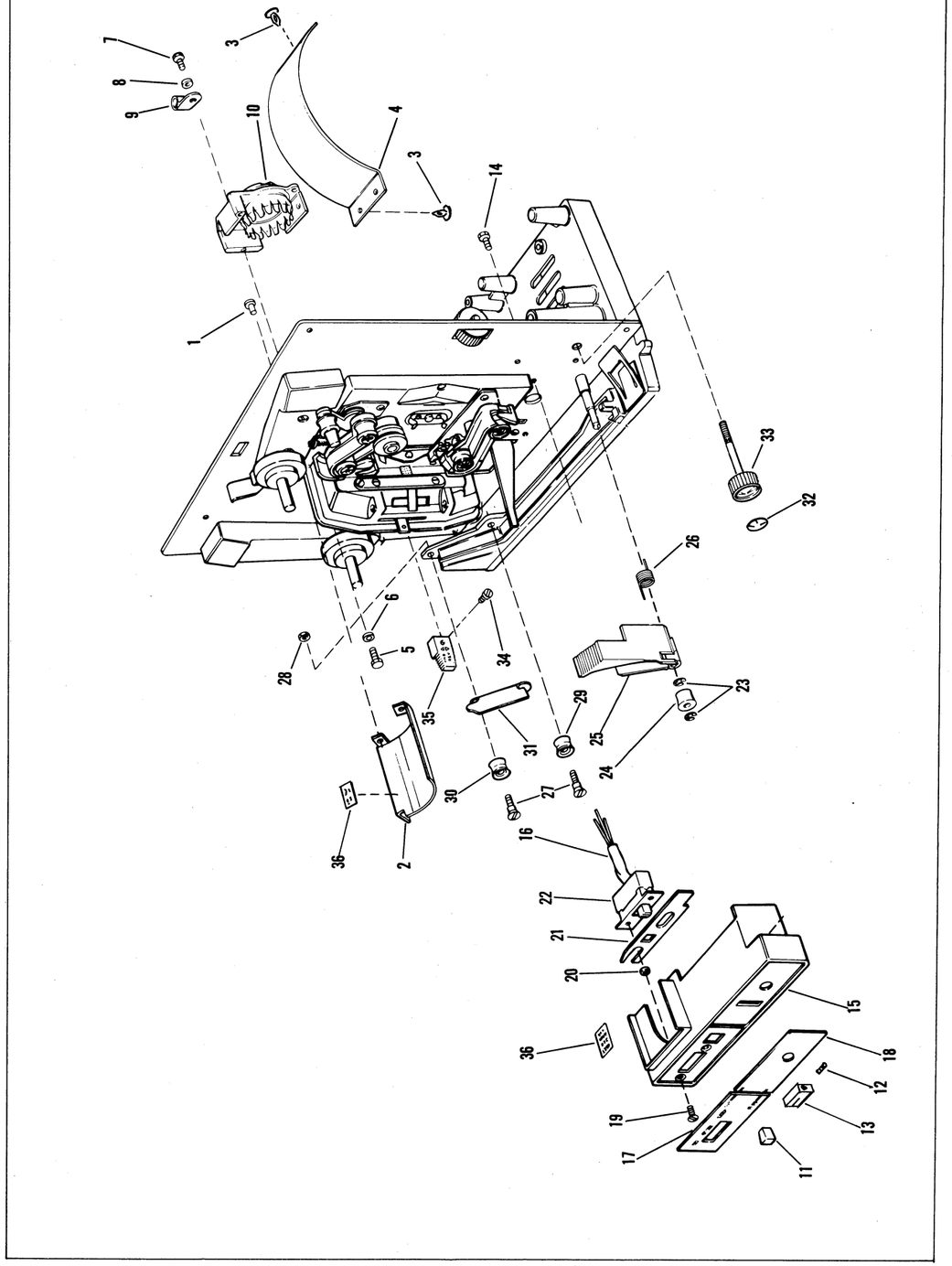


Figure 2. Control Housing and Rollers

| FIG. & INDEX NO. | PART NO. | 1 2 3 4 5 6 7 DESCRIPTION | UNITS PER ASSY | USABLE ON CODE |
|---|---|---|---|---|
| | | MULTIMOTION LEVERS AND REEL ARMS | | |
| 3-1 | 44608 | CLIP, Canoe | 1 | |
| -2 | 705235 | SCREW, Pan head, 6-32 by 1/4 inch | 1 | |
| -3 | 44979 | LINK, Multi-motion, lower | 1 | |
| -4 | 80591 | SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch | 1 | |
| -5 | 44993 | LEVER, Multi-motion | 1 | |
| -6 | 765449 | RING, Retaining | 1 | |
| -7 | 44151 | SHAFT, Multi-motion | 1 | |
| -8 | 35164 | NUT, Sems, 8-32NC (see item 7-17) | REF | |
| -9 | 22659 | WASHER, Flat (see item 7-18) | REF | |
| -10 | 705235 | SCREW, Pan head, 6-32 by 1/4 inch | 1 | |
| -11 | No Number | GEAR AND CAM ASSEMBLY, Multi-motion (see Figure 5 for detail parts) | NP | |
| -12 | 23822 | SCREW, Binding head, 5-40 by 0.203 inch | 4 | |
| -13 | 36836 | SCREW, Pan head, 4-40 by 3/16-inch | 2 | |
| -14 | 43194 | COVER, Reel arm | 2 | |
| -15 | 43189 | GEAR, Spur | 2 | |
| -16 | 014376 | SPINDLE ASSEMBLY, Film reel | 2 | |
| -17 | 29707 | GEAR, Spur | 4 | |
| -18 | 39049 | GEAR, Spur | 2 | |
| -19 | 29192 | SETSCREW, Fluted socket cup pt, 4-40 by 1/8 inch | 1 | |
| -20 | 39056 | GEAR, Spur | 1 | |
| -21 | 010189 | SPUR GEAR AND SHAFT ASSEMBLY | 1 | |
| -22 | 29192 | SETSCREW, Fluted socket cup pt, 4-40 by 1/8 inch | 2 | |
| -23 | 40587 | GEAR, Spur | 1 | |
| -24 | 010189 | SPUR GEAR AND SHAFT ASSEMBLY | 1 | |
| -25 | 21736 | RING, Retaining, 0.207 inch ID | 4 | |
| -26 | 29706 | GEAR, Spur, small | 2 | |
| -27 | 34718 | GEAR, Spur, large | 2 | |
| -28 | 80147 | SCREW, Binding head, 5-40 by 3/16 inch | 1 | |
| -29 | 29744 | RING, Retaining, external 0.562 inch ID | 2 | |
| -30 | 34705 | BEARING, Reel arm | 2 | |
| -31 | 09559 | SUPPORT AND REWIND ASSEMBLY | 1 | |
| -32 | 012863 | STUD AND SUPPORT ASSEMBLY | 1 | |
| -33 | 014459 | PLATE ASSEMBLY, Gear mounting | 1 | |
| -34 | 39099 | SPRING, Reel arm tension | 2 | |
| -35 | 29736 | WASHER, Cam, feed arm | 1 | |
| -36 | 39228 | WASHER, Cam, take-up arm | 1 | |
| -37 | 1261 | BALL, Steel | 2 | |

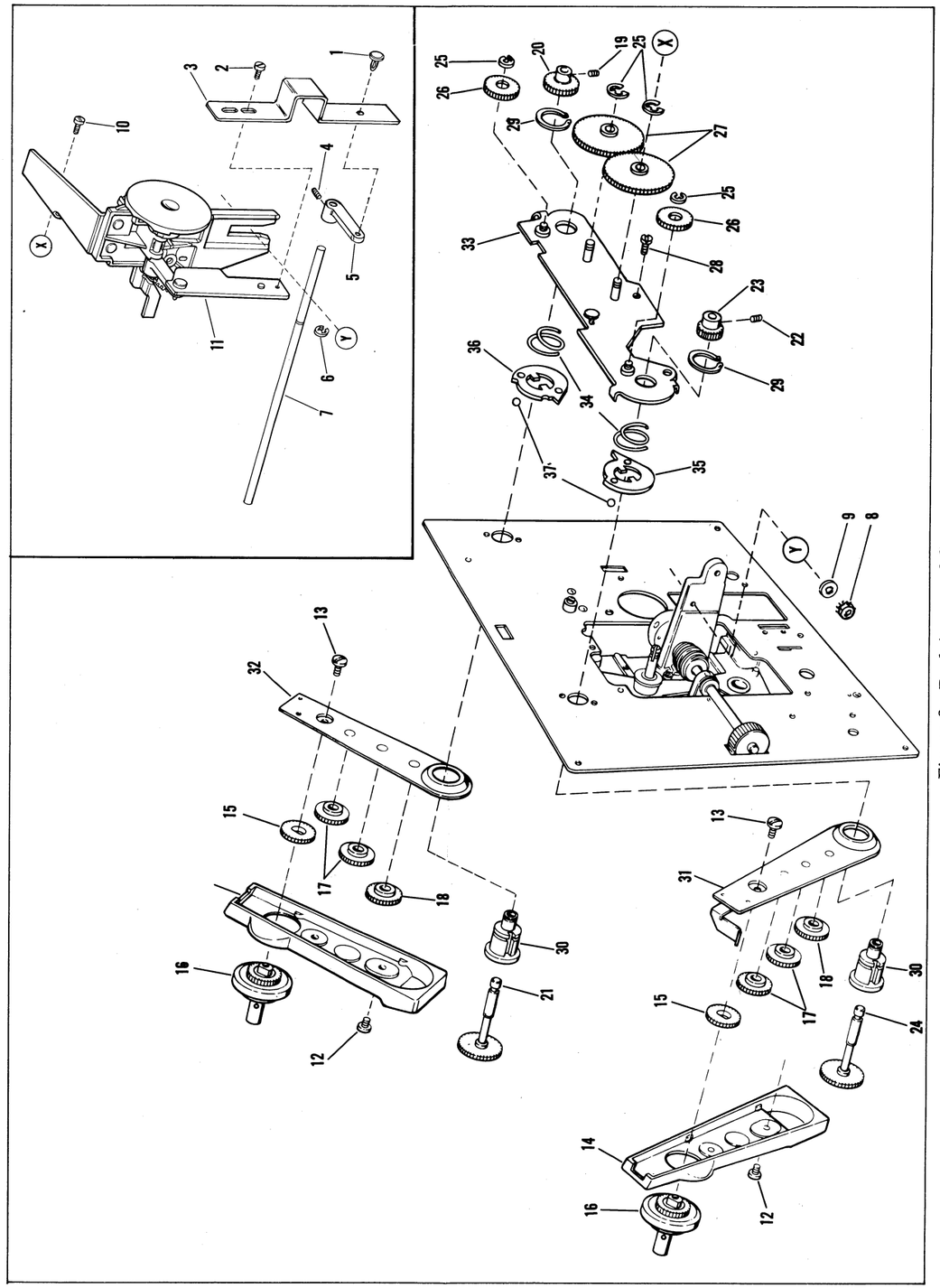

Figure 3. Reel Arms and Gears

| 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 | 45462 | GEAR, Spur | 1 | |
| -3 | 35181 | SPRING, Gear retaining | 1 | |
| -4 | 35184 | RATCHET, Spring | 1 | |
| -5 | 35177 | GEAR, Outer | 1 | |
| -6 | 011459 | DRIVE GEAR LEVER AND STUD ASSEMBLY | 1 | |
| -7 | 43868 | GEAR, Inner | 1 | |
| -8 | 09624 | FILM DRIVE ROLLER AND SHAFT ASSEMBLY | 1 | |
| -9 | 26085 | WASHER, Friction | 2 | |
| -10 | 41973 | SETSCREW, Fluted socket cup pt, 4-40 by 0.093 inch | 4 | |
| -11 | 014033 | FRAMER KNOB AND SHAFT ASSEMBLY | 1 | |
| -11A | 40491 | . DISC, Decorative, focusing knob | 1 | |
| -12 | 40479 | COLLAR | 2 | |
| -13 | 40462 | COLLAR, Framer | 1 | |
| -14 | 36836 | SCREW, Pan head, 4-40 by 3/16 inch | 6 | |
| -15 | 40412 | GUIDE, Film, lower | 1 | |
| -16 | 09627 | LOWER LOOPFORMER ASSEMBLY | 1 | |
| -17 | 40567 | . RING, Self-locking, retaining external | 2 | |
| -18 | 40492 | . WASHER | 2 | |
| -19 | 40536 | . ROLLER | 2 | |
| -20 | 014397 | . LOOPFORMER AND SLEEVE ASSEMBLY, Lower | 1 | |
| -21 | 29192 | SETSCREW, Fluted socket cup pt, 4-40 by 1/8 inch | 4 | |
| -22 | 40468 | BUSHING | 2 | |
| -23 | 705972 | WASHER, Thrust | 2 | |
| -24 | 09629 | LOWER LOOPFORMER MOUNTING PLATE ASSEMBLY | 1 | |
| -25 | 17639 | . RING, Retaining, external, 0.125 inch ID (Type E) | 2 | |
| -26 | 17188 | . WASHER, Spring | 1 | |
| -27 | 40473 | . SHAFT, Spring, lower | 1 | |
| -28 | 40541 | . SPRING, Snubber | 1 | |
| -29 | 40446 | . PLATE, Spring stop, lower | 1 | |
| -30 | No Number | . PLATE, Lower (order complete lower loopformer mounting plate assembly) | NP | |
| -31 | 36838 | SCREW, Pan head, 4-40 by 3/8 inch | 1 | |
| -32 | 40410 | GUIDE, Film, lower | 1 | |
| -33 | 09626 | UPPER LOOPFORMER ASSEMBLY | 1 | |
| -34 | 40567 | . RING, Self-locking, retaining external | 2 | |
| -35 | 40492 | . WASHER | 2 | |
| -36 | 40536 | . ROLLER | 1 | |
| -37 | 40535 | . ROLLER, Guide | 1 | |
| -38 | 09164 | . LOOPFORMER AND SLEEVE ASSEMBLY, Upper | 1 | |
| -39 | 09622 | THREADING KNOB ASSEMBLY | 1 | |
| -40 | 20808 | RING, Retaining, 0.145 inch ID (IRRC 1000-18) | 1 | |
| -41 | 40585 | ROLLER | 1 | |
| -42 | 86799 | RING, Retaining, crescent, 0.156 inch ID | 1 | |
| -43 | 09619 | SNUBBING ARM AND PIVOT SHAFT ASSEMBLY | 1 | |
| -44 | 40530 | SPRING, Upper snubber | 1 | |
| -45 | 09628 | UPPER LOOPFORMER MOUNTING PLATE ASSEMBLY | 1 | |
| -46 | 17639 | . RING, Retaining, external, 0.125 inch ID (Type E) | 2 | |
| -47 | 17188 | . WASHER, Spring | 1 | |
| -48 | 40577 | . SHAFT, Spring, upper | 1 | |
| -49 | 40543 | . SPRING, Snubber | 2 | |
| -50 | 40447 | . PLATE, Spring stop, upper | 2 | |
| -51 | 40541 | . SPRING, Snubber | 1 | |
| -52 | No Number | . PLATE, Upper (order complete upper loopformer mounting plate assembly) | NP | |

| FIG. & INDEX NO. | PART NO. | DESCRIPTION 1 2 3 4 5 6 7 | UNITS PER ASSY | USABLE ON CODE |
|---|---|---|---|---|
| | | LOOPFORMERS, SPROCKETS AND GEARS (CONT) | | |
| 4-53 | 40467 | RIVET, Lens mount catch | 2 | |
| -54 | 40533 | SCREW, Hex head, 4-40 by 1/4 inch | 1 | |
| -55 | 09630 | LENS MOUNT CATCH ASSEMBLY | 1 | |
| -56 | 40621 | SHIM | 2 | |
| -57 | 30621 | SCREW, Truss head, 3-48 by 3/16 inch | 1 | |
| -58 | 014219 | APERTURE PLATE ASSEMBLY | 1 | |
| -59 | 40551 | . SCREW, Truss head, 3-48 by 1/4 inch | 1 | |
| -60 | 30620 | . SCREW, Truss head, 3-48 by 1/8 inch | 2 | |
| -61 | 40531 | . SPRING, Side tension | 1 | |
| -62 | 30639 | . ARM, Side tension | 1 | |
| -63 | 40440 | . GUIDE, Film | 1 | |
| -64 | 40494 | . SPRING, Fire shutter | 1 | |
| -65 | 39214 | NAMEPLATE, Rewind position | 1 | |
| -66 | No Number | LENS CARRIER ASSEMBLY (See Figure 6 for detail parts) | NP | |

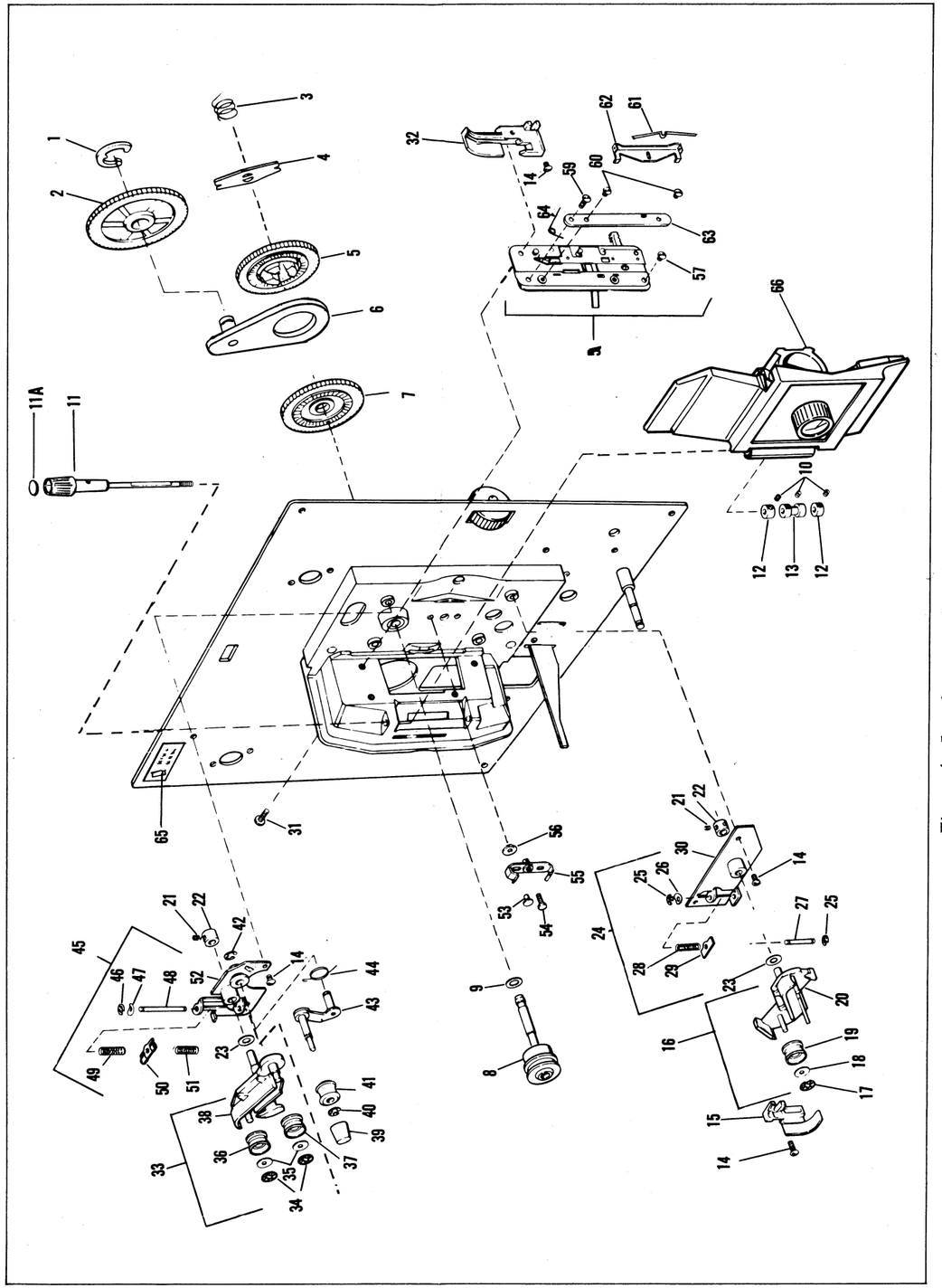


Figure 4. Loopformers, Sprockets and Gears

| FIG. & INDEX NO. | PART NO. | DESCRIPTION 1 2 3 4 5 6 7 | UNITS PER ASSY | USABLE ON CODE |
|---|---|---|---|---|
| | | MULTIMOTION GEAR AND CAM ASSEMBLY | | |
| 5- | No Number | GEAR AND CAM ASSEMBLY, Multi-motion | REF | |
| -1 | 44608 | . CLIP, Canoe | 1 | |
| -2 | 44978 | . LINK, Multi-motion, upper | 1 | |
| -3 | 80591 | . SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch | 1 | |
| -4 | 44993 | . LEVER, Multi-motion | 1 | |
| -5 | 44987 | . CAM, Speed control | 1 | |
| -6 | 145 | . BALL, Steel | 1 | |
| -7 | 45460 | . SPRING, Compression | 1 | |
| -8 | 765449 | . RING, Retaining | 1 | |
| -9 | 43162 | . SPRING, Compression | 1 | |
| -10 | 014466 | . BRACKET AND SHAFT ASSEMBLY, Actuator | 1 | |
| -11 | 44985 | . FOLLOWER, Cam | 1 | |
| -12 | 40567 | . RING, Retaining, self-locking | 1 | |
| -13 | 40492 | . WASHER, Flat | 1 | |
| -14 | 44989 | . GEAR, Timing | 1 | |
| -15 | 014462 | . CAM AND BRACKET ASSEMBLY, Multi-motion | 1 | |

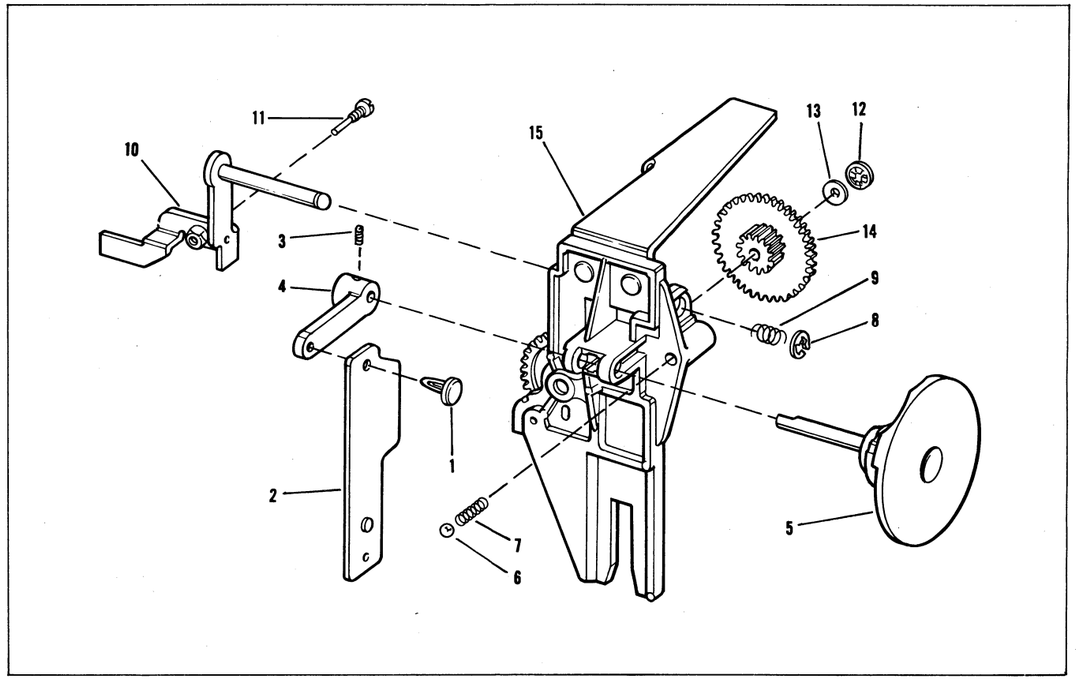


Figure 5. Multi-Motion Gear and Cam Assembly

| FIG. & INDEX NO. | PART NO. | DESCRIPTION 1 2 3 4 5 6 7 | UNITS PER ASSY | USABLE ON CODE |
|---|---|---|---|---|
| | | LENS CARRIER ASSEMBLY | | |
| 6- | No Number | LENS CARRIER ASSEMBLY | REF | |
| -1 | 36770 | . SETSCREW, Fluted socket, cup pt, 8-32 by 1/4 inch | 1 | |
| -2 | 013643 | . KNOB ASSEMBLY, Focus | 1 | |
| -3 | 43454 | . DISC, Decorative, focus knob | 1 | |
| -4 | 43502 | . PLATE, Trim | 1 | |
| -5 | 25618 | . SCREW, Pan head, 6-32 by 9/16 inch | 2 | |
| -6 | 43195 | . COVER, Lens carrier | 1 | |
| -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 | 014463 | . LENS MOUNT AND BUSHING ASSEMBLY | 1 | |
| -13 | 36836 | SCREW, Pan head, 4-40 by 3/16 inch | 2 | |
| -14 | 43196 | PLATE, Cover | 1 | |
| -15 | 40564 | RING, Retaining, external, Type E | 2 | |
| -16 | 40542 | SPRING, Pressure plate | 2 | |
| -17 | 012867 | PRESSURE PLATE AND STUD ASSEMBLY | 1 | |

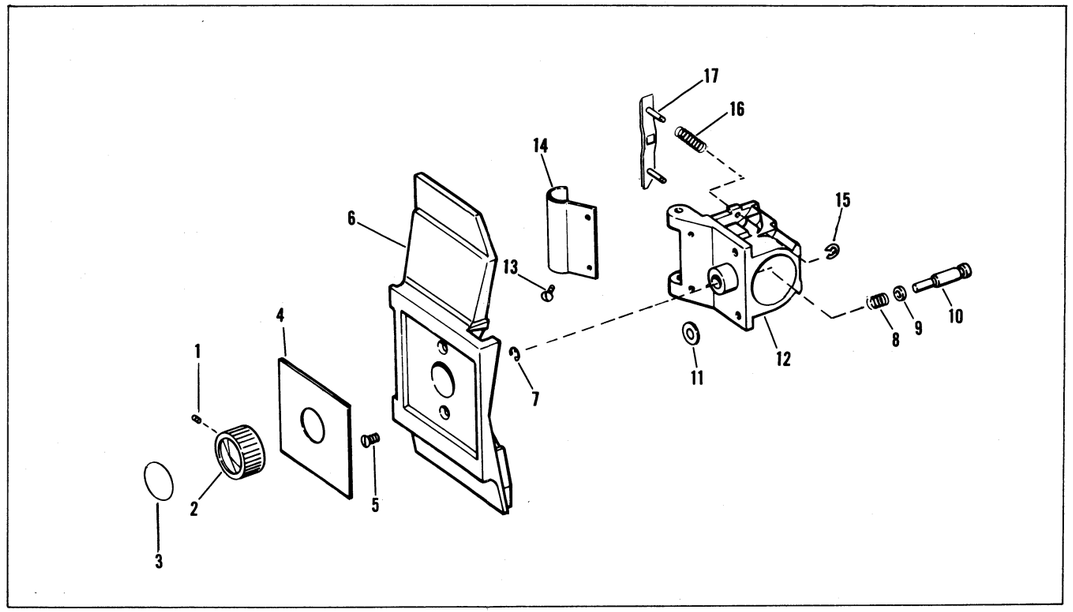


Figure 6. Lens Carrier Assembly

| FIG. & INDEX NO. | PART NO. | DESCRIPTION 1 2 3 4 5 6 7 | UNITS PER ASSY | USABLE ON CODE |
|---|---|---|---|---|
| | | SHUTTER, SHUTTLE AND DRIVE MECHANISM | | |
| 7-1 | 35956 | SCREW, Pan head, Sems, 3-48 by 3/16 inch | 2 | |
| -2 | 09167 | BRACKET ASSEMBLY, Spring loading | 1 | |
| -3 | 25715 | RING, Retaining, external bowed E, 0.145 inch ID | 1 | |
| -4 | 012593 | BRACKET ASSEMBLY, Pulley mounting | 1 | |
| -5 | 39245 | SPRING, Torsion | 1 | |
| -6 | 27322 | RING, Retaining, special | 2 | |
| -7 | 32172 | WASHER, Flat | 4 | |
| -8 | 010667 | DRIVER ROLLER ASSEMBLY | 2 | |
| -9 | 39264 | SCREW, Pivot | 1 | |
| -10 | 34656 | SCREW, Round head Sems, 6-32 by 1/4 inch | 1 | |
| -11 | 010348 | 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 | |
| -14A | 43826 | WASHER, Spacing | 1 | |
| -15 | 43166 | CAM, Pull-down | 1 | |
| -16 | 26906 | NUT AND WASHER, Sems, 6-32NC | 1 | |
| -17 | 35164 | NUT AND WASHER, Sems, 8-32NC | 1 | |
| -18 | 22659 | WASHER, Flat | 1 | |
| -19 | 706964 | SCREW, Pivot | 1 | |
| -20 | 43857 | WASHER, Flat | 1 | |
| -21 | 39027 | WASHER, Spring tension | 1 | |
| -22 | 014464 | SHUTTLE AND BRACKET ASSEMBLY | 1 | |
| -23 | 43862 | SPACER, Shuttle | 1 | |
| -24 | 32947 | SHOE, Cam, lower | 1 | |
| -25 | 44137 | SHOE, Cam, upper | 1 | |
| -26 | 40581 | STUD, Pivot, tapped | 1 | |
| -27 | 32350 | SCREW, Round head, 8-32 by 5/16 inch | 2 | |
| -28 | 26906 | NUT AND WASHER, Sems, 6-32NC | 2 | |
| -29 | 40474 | STUD, Eccentric | 2 | |
| -30 | 33968 | RING, Retaining, special | 1 | |
| -31 | 09620 | SUPPORT BRACKET AND STUD ASSEMBLY | 1 | |
| -32 | 09623 | FORMAT SHIFTING LEVER ASSEMBLY | 1 | |
| -33 | 12498 | SETSCREW, Fluted socket cup pt, 6-32 by 1/8-inch | 2 | |
| -34 | 43167 | CAM, In-out | 1 | |
| -35 | 26085 | WASHER, Thrust | 1 | |
| -36 | 12498 | SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch | 1 | |
| -37 | 26131 | RING, Retaining, crescent external, 0.219 inch ID | 1 | |
| -38 | 80591 | SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch | 1 | |
| -39 | 39140 | KNOB, Manual, main shaft | 1 | |
| -40 | 43183 | SHAFT, Main | 1 | |
| -41 | 39004 | PINION, Drive | 1 | |
| -42 | 30667 | WASHER, Friction | 1 | |

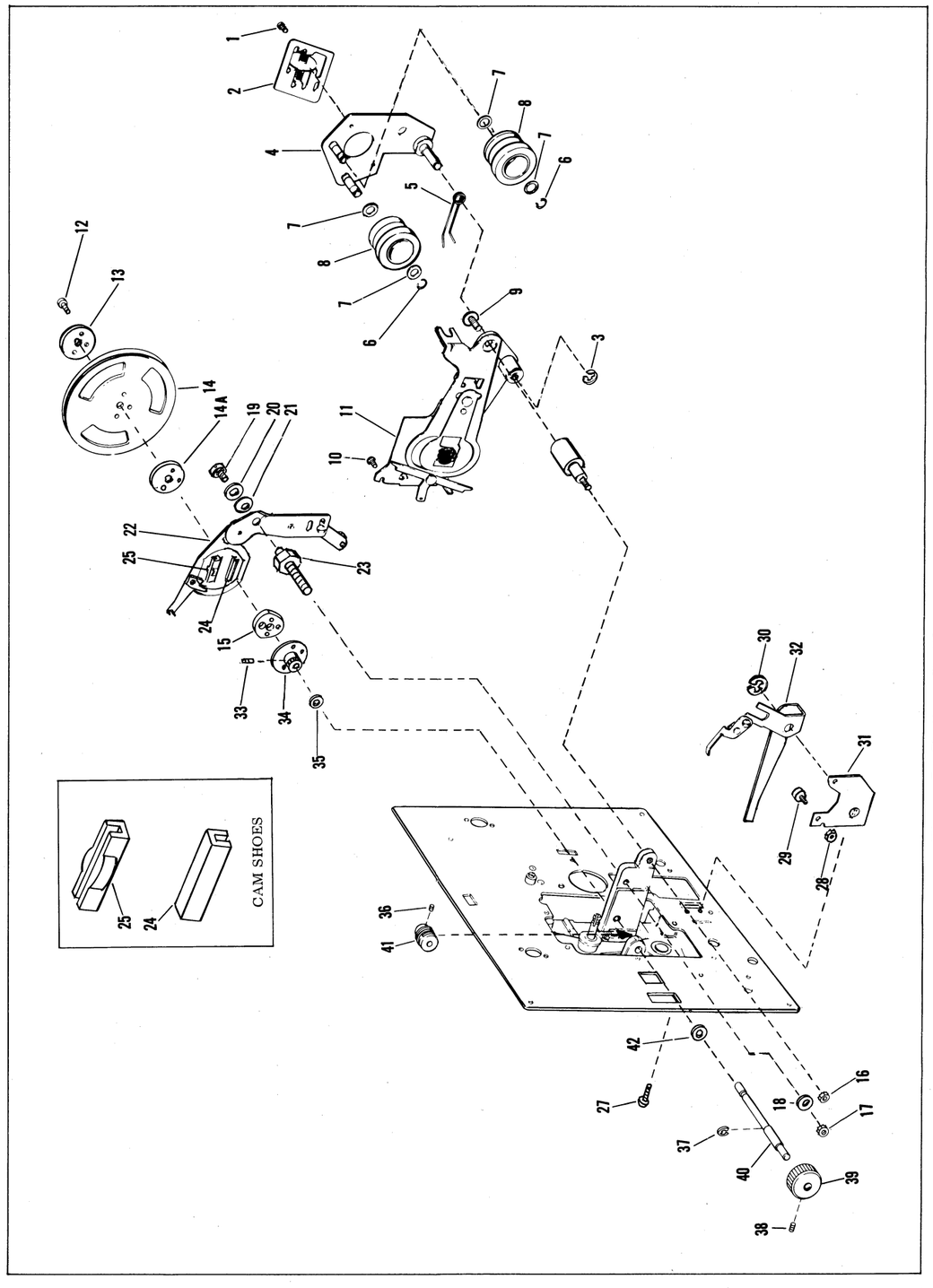


Figure 7. Shutter, Shuttle and Drive Mechanism

| 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 | 32974 | SETSCREW, Fluted socket cup pt, 8-32 by 1/8 inch | 2 | |
| -3 | 39126 | FAN, Multi-bladed | 1 | |
| -4 | 013455 | PULLEY AND FAN ASSEMBLY | 1 | |
| -5 | 700454 | SCREW, Pan head Sems, 6-32 by 3/8 inch | 2 | |
| -6 | 36246 | SCREW, Pan head Sems, 6-32 by 5/8 inch | 1 | |
| -7 | No Number | MOTOR AND BRACKET ASSEMBLY | NP | |
| -8 | 26906 | . NUT AND WASHER, Sems 6-32NC | 2 | |
| -9 | 17632 | . WASHER, Flat | 2 | |
| -10 | 39256 | . SCREW, Round head, 6-32 by 1-7/8 inch | 2 | |
| -11 | 013462 | . MOTOR ASSEMBLY | 1 | |
| -12 | 45434 | . BRACKET, Motor mounting, long | 1 | |
| -13 | 45430 | . BRACKET, Motor mounting, short | 1 | |
| -14 | 39065 | . INSERT, Mounting | 2 | |
| -15 | 45433 | . GROMMET, Motor mounting | 2 | |
| -16 | 45432 | . INSERT, Mounting | 1 | |
| -17 | 45431 | . SPACER | 1 | |
| -18 | 45429 | . GROMMET, Motor mounting | 1 | |
| -19 | 21736 | RING, Retaining, 0.207 inch ID | 1 | |
| -20 | 010373 | SHAFT AND BAR ASSEMBLY, Tilt | 1 | |
| -21 | 43324 | SCREW, Hex head tapping, 8-32 by 3/8 inch | 1 | |
| -22 | 22659 | WASHER, Flat | 1 | |
| -23 | 83286 | CLAMP, Leadwire | 1 | |
| -24 | 29065 | SCREW, Hex head tapping, 4-40 by 1/2 inch | 3 | |
| -25 | No Number | MECHANISM PLATE AND MAIN PLATE ASSEMBLY | NP | |
| -26 | 014460 | BASE ASSEMBLY, Projector | 1 | |
| -27 | 32652 | . RIVET, Tubular, 0.123 inch diameter | 2 | |
| -28 | 45561 | . FOOT, Rubber | 2 | |
| -29 | 39202 | . RIVET, Tubular | 2 | |
| -30 | 39144 | . CUTTER, Film | 1 | |
| -31 | No Number | . BASE, Projector (order complete assembly, item -26) | NP | |

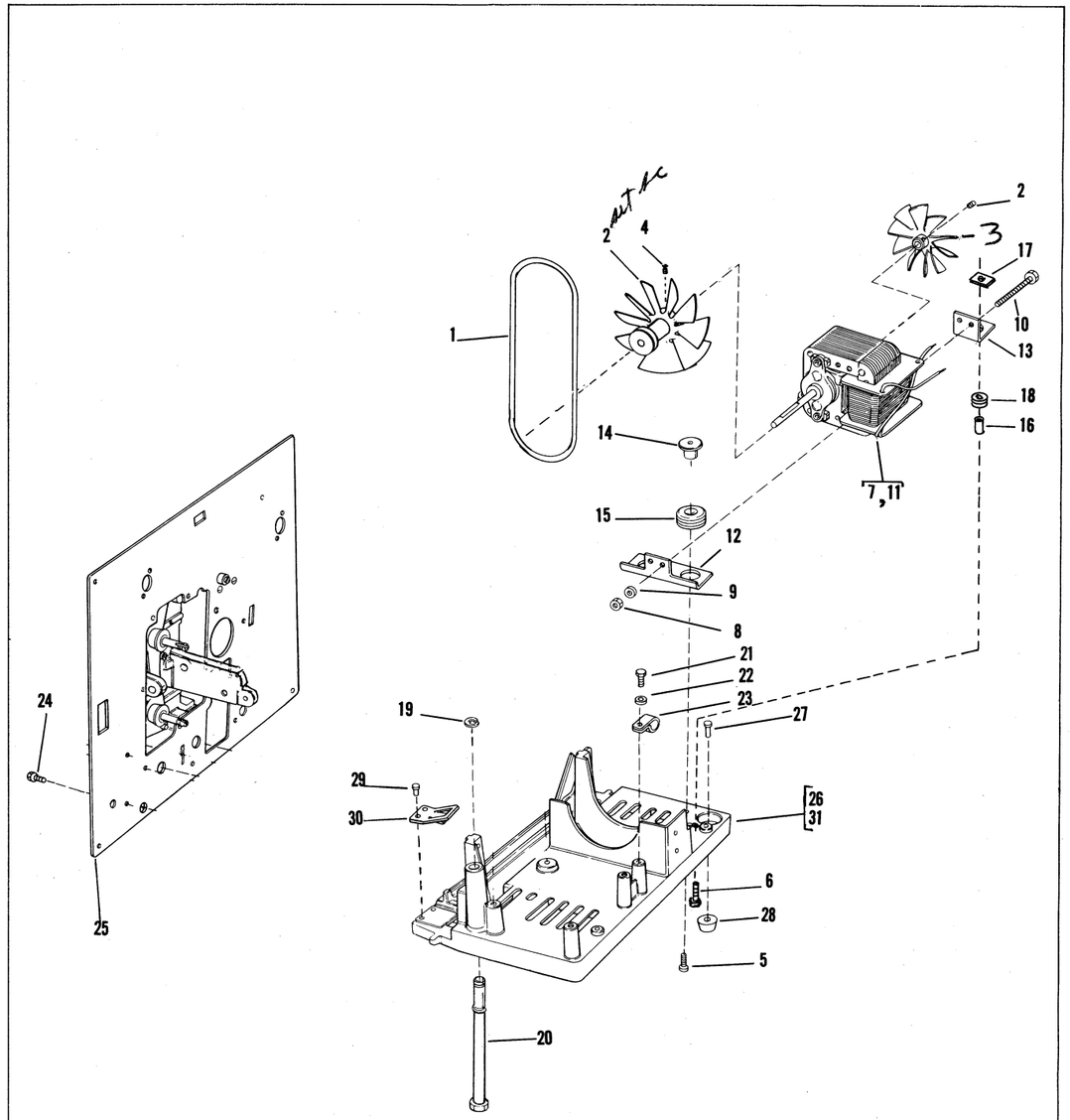


Figure 8. Projector Base and Motor

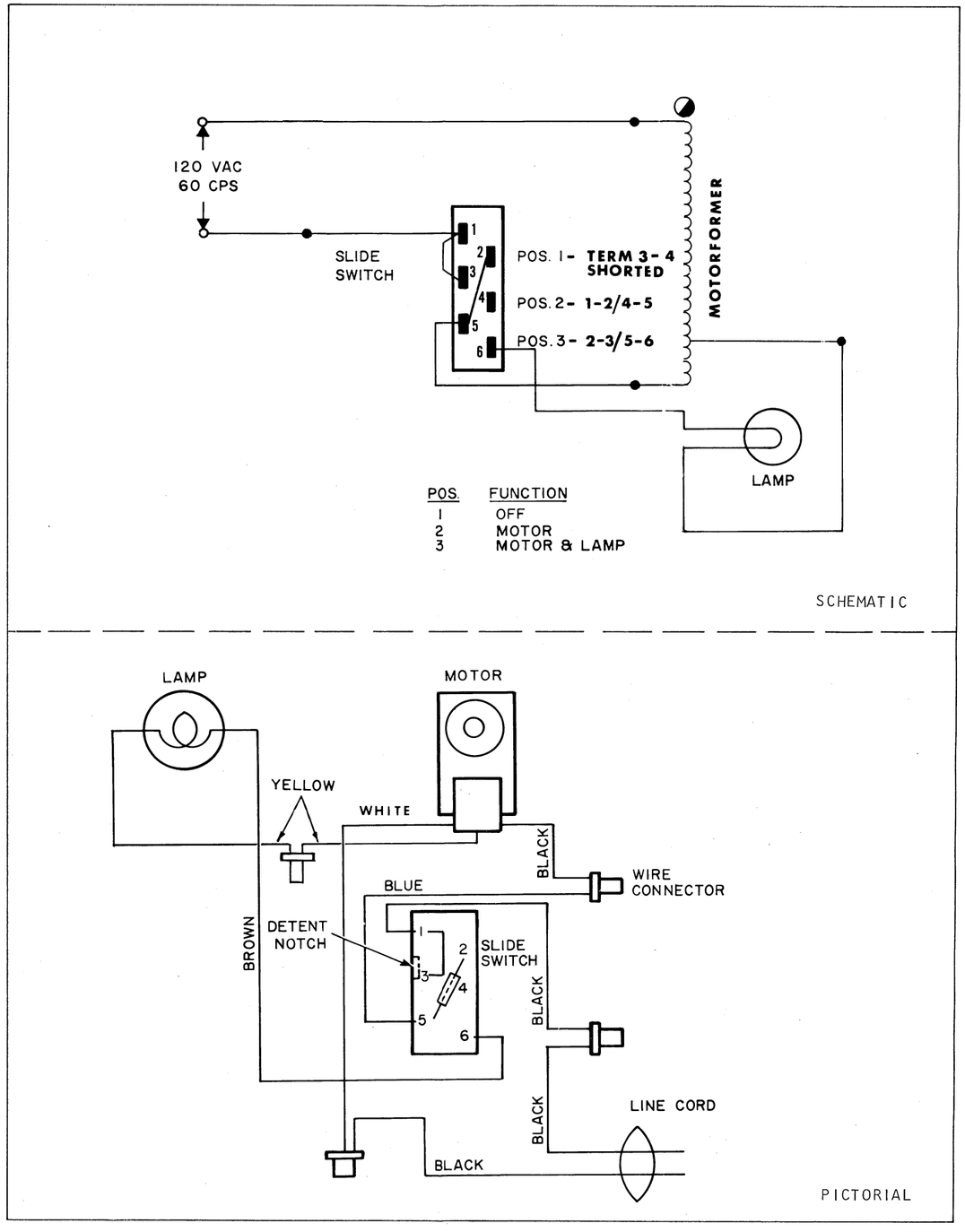


Figure 9. Projector Wiring Diagrams

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