

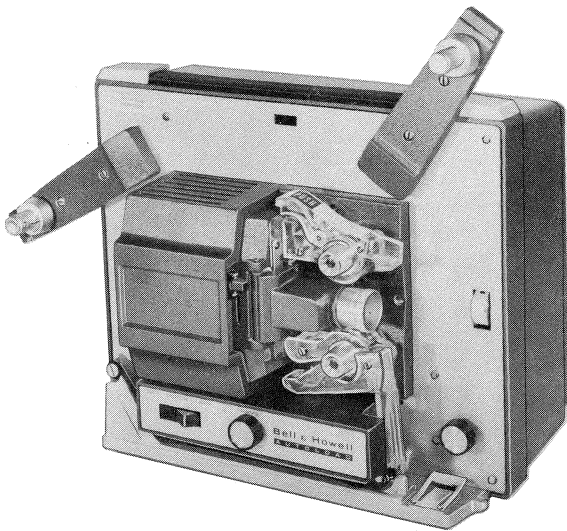
SERVICE INSTRUCTIONS

AUTOLOAD[®] **SUPER 8 PROJECTOR**

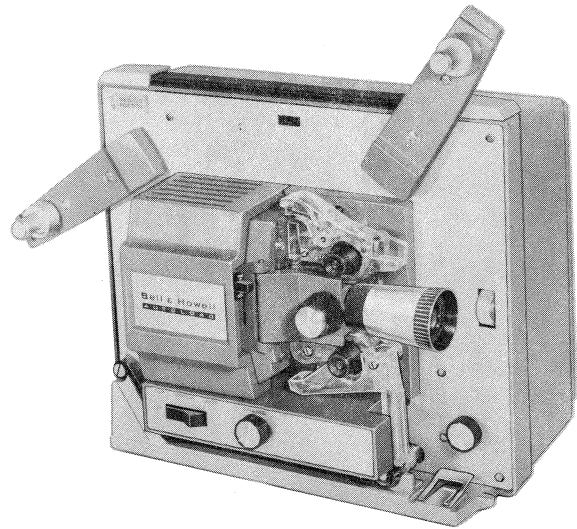
DESIGN 356 and 357

PHOTO PRODUCTS GROUP

 **BELL & HOWELL**



Design 356 Projector



Design 357 Projector

FEATURE DESCRIPTION LIST

	<u>Design 356</u>	<u>Design 357</u>
Color	Early Models brown and silver Current Models walnut and silver	blue and silver blue-gray and silver
Type of film	super 8-mm	super 8-mm
Projector operation	forward-still-reverse	forward-still-reverse
Still projection filter	glass and metal screen	glass and metal screen
Type of frame	screw knob	screw knob
*Projection lamp	type DJL, 120-volts, 155-watts with metal reflector	type DJL, 120-volts, 155-watts with metal reflector
Projection lens	f/1.6 (p/n 020460)	f/1.6 zoom (p/n 020557)
Loopformer system	hold-down	self-latching
*Operating voltage	120-volts, 60 cycles, a-c	120-volts, 60 cycles, a-c
Tilt device	gravity foot, knob lock	spring foot, knob lock
Special features	film trimmer mounted on base of projector	film trimmer mounted on base of projector

*NOTE: Design 356X and 356XP use the Type DEF 125-volt, 155-watt lamp with dichroic reflector. Operating voltage is adjustable from 115 to 240 volts.

FACTORY SERVICE ADDRESSES

PRODUCT ONLY

CHICAGO

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

NEW YORK

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

GLENDALE

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

PARTS ORDERS AND SERVICE INFORMATION

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

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Introduction

GENERAL.

This Instruction Book has been prepared to aid the serviceman in the overhaul and repair of the Bell & Howell Super 8-mm Autoload Projectors, Designs 356 and 357. Three versions of the Design 356 are covered: the Design 356A and two export versions, Designs 356X and 356XP. Export models will operate on 50 or 60 cycle current and from 115 to 240 volts.

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 judgement 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 projectors covered by this manual are very similar in design and construction. All four are designed for forward, still and reverse operation and use the Super 8-mm film. Note that the export models can be converted for either 50 or 60-cycle current and that the operating voltage is adjustable.

Major differences, as noted in the Feature Description List, are in the color, the type of lens and

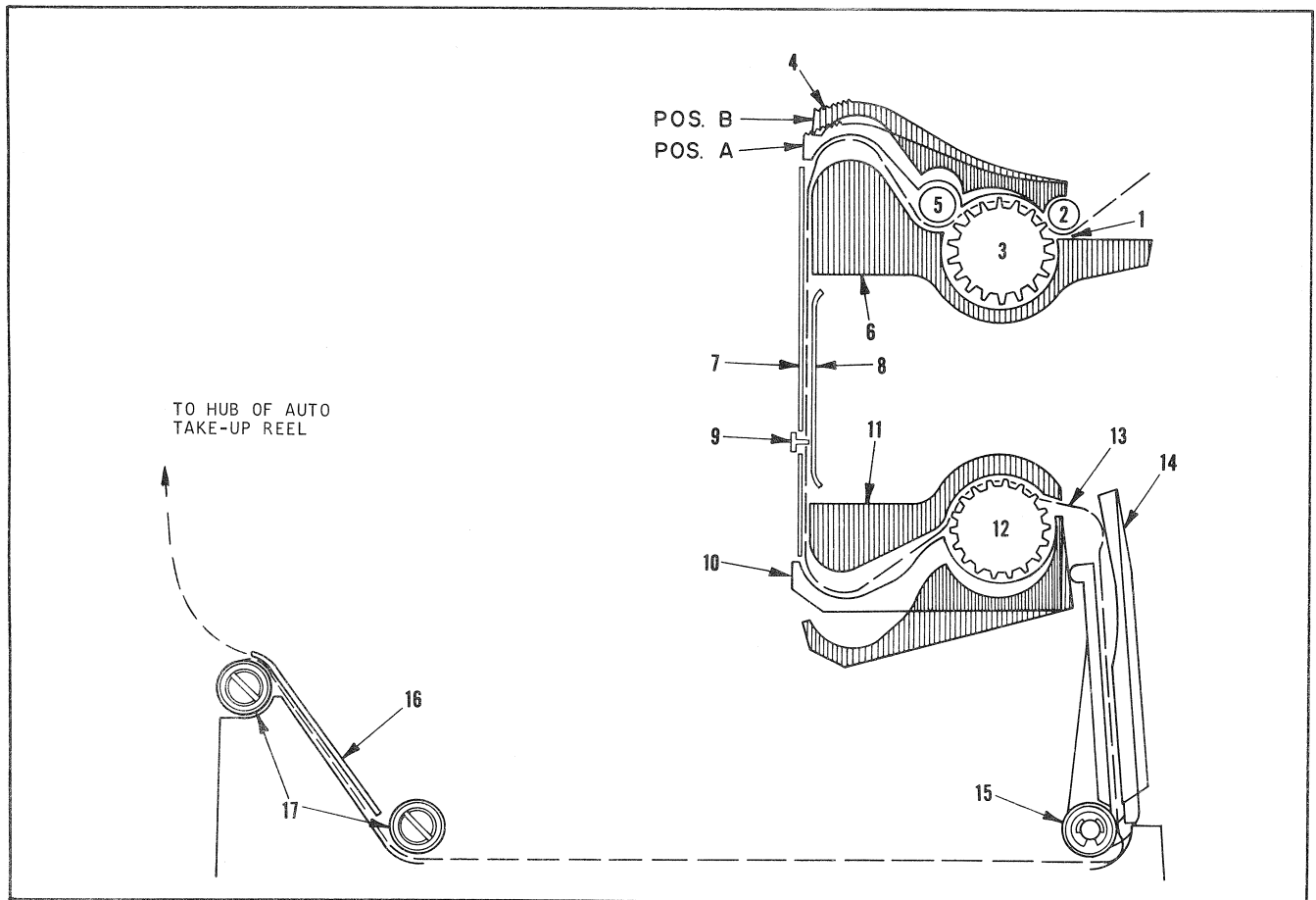


Figure A. Autoload Theory View

in the autoloading feature. All Design 356 projectors are equipped with the hold-down type loopformer, while the Design 357 projector has self-latching loopformers for fully automatic threading. In the parts lists Usable on Code column, all parts identified by letter "A" are used only on the 356A; those identified by "B" are used only on 357; "C" parts are used only on 356X; "D" parts are used only on 356XP. Where column is blank, parts are used on all models.

PRINCIPLES OF AUTOLOAD THREADING (Figure A).

a. The operator depresses the upper loopformer (4), which pivots to position A and, through a linkage system, simultaneously pivots the lower loopformer (10) to position A. For Design 356 projectors, the upper loopformer must be held down firmly during the entire threading process, Design 357 projectors are equipped with a latching device which latches the loopformers in position A.

b. The end of the film is trimmed with the film cutter mounted on the projector base. With projector control switch in "motor" position and direction lever at "forward," the cut end of the leader is inserted into opening (1) just forward of the feed sprocket (3) until a sprocket tooth engages a film perforation. This initiates the autoloading cycle.

c. The upper loopformer (4) serves to keep the film on the feed sprocket and to form the proper upper loop above the aperture plate. The feed sprocket advances the film past the idler roller (5) and through the passage between the upper loopformer and its bracket (6). The film is directed downward between the aperture plate (7) and pressure plate (8) where the shuttle (9) engages a perforation and assists in transporting the film.

d. When the film reaches the lower loopformer (10), it is directed upward through the passage between the loopformer and its bracket (11) to the take-up sprocket (12). The take-up sprocket teeth engage the film perforations and advance the film out through the opening (13) to the threading guide (14) which directs the film downward, around the guide roller (15) and toward the rear of the projector. There the film deflector (16) and two guide rollers (17) finally deflect the film upward toward the take-up reel arm where the toothed hub of the reel engages the film.

e. In order for the film to properly engage the hub of the take-up reel, it is important that the film have a natural inward curl toward the core of its film reel. This will insure that film threading will be completely automatic from feed reel to take-up reel. Once the leader begins to take up on the hub of the reel, release the upper loopformer (Design 356 only) and press the MOTOR-LAMP switch to the LAMP position to initiate film projection.

SPECIAL MAINTENANCE PRECAUTIONS.

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

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.

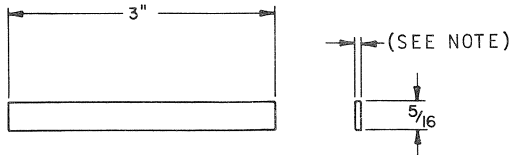
Grease (Bell & Howell Specs. 1516, 1956 and 1980).
Oil (Bell & Howell Spec. 1543).

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.

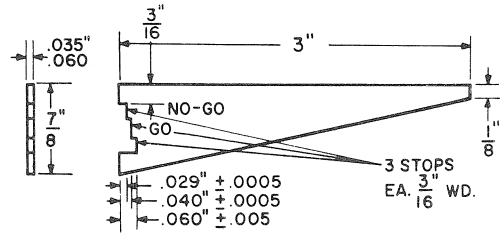
TOOLS WHICH CAN BE "SHOP-MADE"



MATERIAL: GA STK-(HON & GR)

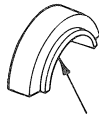
LENS CARRIER SETTING GAGE

NOTE: DES. 356 - $.0935 \pm .0005$ THK
 DES. 357 - $.072 \pm .001$ THK



SHUTTLE TOOTH PROTRUSION GAUGE

TOOLS WHICH CAN BE PURCHASED



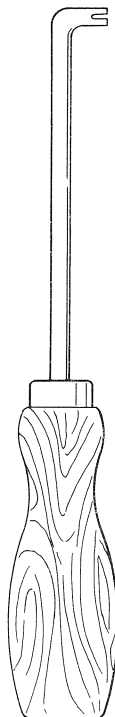
INSERT THIS LIP BETWEEN LOOP FORMER AND SPROCKET

SPROCKET CLEARANCE SETTING GAGE

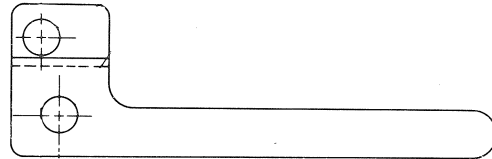
BELL & HOWELL NO. S-012600-34N4



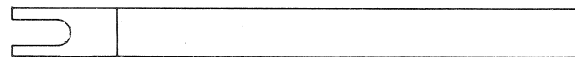
"POSTALETTE" 0 TO 8 OZ. SCALE
 (AVAILABLE FROM EXACTWEIGHT SCALE COMPANY, COLUMBUS, OHIO)



SHUTTLE BENDING TOOL
 BELL & HOWELL NO. SER356-1-FX1



SHUTTLE TOOTH CENTERING TOOL
 BELL & HOWELL NO. S-012600-15-F1



DRIVE PINION CLEARANCE GAGE
 BELL & HOWELL NO. SD-253-105-F1

Figure B. Special 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 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 (4) is secured by six screws. Four of these screws (2) are inserted through the mechanism plate and into tapped bosses in the cover; the remaining two screws (3) 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. The back cover of the Design 357 projector is equipped with a hinged door (4B) which can be replaced, complete with hinges, by drilling out the two rivets (4A) which secure the hinges (4D) to the back cover.

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 screw (3) while the remaining two screws (3) attach it to the lamp socket assembly (7). If the lamp socket is to be removed, take out the single screw (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 single screw (3) so that the deflector can be raised to expose the motor and blower fan for inspection.

b. Remove control housing (12) to replace framer control knob (19) and switch (23). The control housing attaching screws (11) are inserted through the mechanism plate into tapped holes in the housing. On early models the control knob is secured with a retaining ring (16), flat washer (17), and spring tension washer (18). Current models use a push nut (16) in place of retaining ring (16) and flat washer (17). Two screws (22) secure switch.

c. A retaining ring (24) retains the guide roller (25) on the roller shaft. Removal of a second retaining ring (24) will permit the withdrawal of the plastic threading guide (26), spacer (27) and torsion spring (28). Note the manner in which the bent ends of the spring (28) engage holes in the mechanism plate and spacer.

d. The tilt locking shaft (33) need not be loosened or removed unless tilt leg parts are to be replaced.

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 screws (1) and (2) will permit withdrawal of the feed arm and bearing assembly (3), the torque spring (4) and the assembled spindle parts (5 through 9). In like manner, the removal of screws (15) and (16) will permit withdrawal of the take-up arm and bearing assembly (17) and the assembled spindle parts (18 through 22). Do not disassemble the spindle parts unless in need of replacement.

b. Spur gears (10) and (11) can be lifted from the studs of the feed arm support assembly (34). To free gear and shaft assembly (14), loosen the setscrew (12) in the spur gear (13) and disassemble these parts from the support assembly.

c. In similar fashion, lift spur gears (23) and (24) from the gear studs of the take-up arm support assembly (35). Then loosen the setscrew (25) and disassemble the spur gear (26) and the gear and shaft assembly (27) from the support assembly.

d. Two small spur gears (29) and two large spur gears (30) are retained on the studs of the gear mounting plate by retaining rings (28). Note that spring tension washer (31) is located beneath the large gear which is closest to the take-up arm gear shaft.

e. The removal of a single screw (36) and two large retaining rings (32) will permit the gear mounting plate (37) and all remaining reel arm parts to be disassembled from the mechanism 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 sprocket and loopformer parts, note carefully the manner in which the sprocket gear retaining springs (1) and spring ratchets (3) are installed so that they can be reassembled in the same manner. Carefully remove the springs (1) and disassemble parts (2 through 9) from the rear of the two sprocket shafts.

b. Loosen screws (12) and (16) until they are free of their tapped holes in the mechanism casting. Grasp upper loopformer (13) and loopformer bracket assembly (17) between thumb and fingers and withdraw this group, the sprocket and shaft included, from the mechanism casting.

c. In similar fashion, loosen screws (19) and (21) until they are free of their tapped holes in the mechanism casting. Grasp lower loopformer bracket (20) and its loopformer assembly (22) between thumb and fingers and withdraw this group, sprocket and shaft included, from the mechanism casting.

d. The retaining spring (25), retainer plate (26) and pressure plate (27) can be removed from the lens carrier (29) without disassembling the carrier from the mechanism casting. Swing open the lens carrier and grasp the top and bottom ears of the pressure plate between thumb and forefinger of the right-hand. Press the upper end of the retainer plate away from the lens carrier casting, disengaging the plate and retaining spring from the pins in the casting. Remove the pressure plate parts.

e. To remove the lens carrier (29), the hinge pins (28) must be pried out. Note that the lens carrier for the Design 357 projector is equipped with a fine focus knob. To disassemble these parts from the lens carrier, the decorative cover (29A) must be pried free of focus knob (29D). Insert forefinger into lens carrier to hold eccentric shaft (29F) in place while removing screw (29B). Disassemble all focus knob parts from the lens carrier.

f. If aperture plate parts (30 through 35) are removed, note the manner in which side tension spring (32) and arm (33) are assembled.

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

a. Disengage the drive belt from the drive rollers (7). One of the rollers is readily accessible for replacement and can be disassembled from its mounting stud by removing the retaining ring (5). Note the washers (6) on either side of the drive roller. To gain access to the remaining drive roller, remove the screws (1) and the spring loading bracket (2); then remove the retaining ring (3) and withdraw the pulley mounting bracket assembly (4) from the projector. The inset in figure 5 illustrates the latest design of pulley mounting and spring-loading brackets. Note the new torsion spring (4A) and the manner in which its

legs engage to actuate the safety shutter (11).

b. Loosen screw (10) at the front end of the safety shutter (11). Remove the pivot screw (8) and, on early models, the pivot spring (9) and lift out the safety shutter assembly.

c. Remove two screws (12), the shutter washer (13), the shutter (14), and the in-out cam (15).

d. Rotate the main shaft knob (32) while inspecting the fit of the cam shoes (21) on the pull-down cam (27). The cam shoes should fit snugly, but without binding. If too loose, the cam shoes must be replaced. Remove the Sems nut (16) and disassemble the pivot screw (17), spring tension washer (18), shuttle and framing lever assembly (19) and sleeve spacer (20) from the shuttle pivot bracket (25), disengaging the shuttle from the pull-down cam (27) and the lower end of the shuttle from the framer shaft (37).

e. Loosen the setscrew (26) and disassemble the pull-down cam (27) and thrust washer (28) from the main shaft. Pry the retaining ring (30) from its groove in the main shaft (33). Loosen the setscrews (29) and (31) so that the drive pinion (34) and the manual knob (32) are loose on the main shaft. Press the shaft toward the rear of the projector until the knob can be slipped off and out of the cut-out in the mechanism plate; and then slide the shaft toward the front of the projector, removing the drive pinion (34) and friction washer (35) as the shaft comes free.

f. Unscrew the framer shaft (37) from the threaded bushing in the mechanism main plate. To separate the mechanism plate from the base, remove the hex head screws (42). If trigger lever parts (38 through 41) are removed for replacement, be sure to support the mechanism plate solidly when restaking the rivet (38).

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

a. Note that export models are equipped with a "T"-shaped tilt rather than the single rod type used on the 356A and 357 projectors. Only the 357 tilt shaft has a tension spring (3).

b. Loosen the pulley setscrew (5) to free the motor pulley (6). Note that the Design 356A and 357 projector motors are equipped with a two-blade, press-on fan (8) while the motors used in export models (356X and 356XP) have a multi-bladed fan (8A) secured to the motor shaft with setscrew (7).

c. Remove the motor bracket screws (9) and lift the motor assembly from the base. Disassemble the fan (13) and brackets (16) and (17) from the motor. On export models (356X and 356XP) remove transformer screws (23) and washers (24) and transformer (25).

d. The film cutter (22B) and rubber feet (22D) are secured to the base with rivets (22A) and (22C) respectively. If the base is damaged, replace the complete base assembly with film cutter and feet attached.

Reassembly and Adjustment

8. 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 noted in the chart at the end of this section. Lubricate sparingly and wipe away excess lubricant with a lint-free cloth.

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

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

a. When assembling rubber foot (22D) to base, note that counterbore of foot must be away from the base and that head of rivet (22C) is on upper surface of base. The film cutter (22B) is assembled to base with the formed-up end of the cutter away from the edge of the base.

b. The leadwire clamp (21) is used only on the 356A and 357 projectors and is secured with screw (19) and washer (20). After assembly, all leadwires will be retained by this clamp and one other.

c. Preassemble the motor and mounting brackets as follows: Assemble the grommets (18) into the motor mounting brackets (16) and (17). Assemble the washers (10A) to mounting inserts (10) and press the mounting inserts into the grommets. Insert the screws (15) through the short bracket (17) and the motor (11). Install the long mounting bracket (16) over the screws and secure all parts with the two nuts (14) and the washers (14A). Tighten the nuts securely. Assemble blower fan (13) to the long shaft of the motor, fan hub toward the motor. Leave the blower fan setscrew (12) loose until the motor is installed.

d. Position the motor on the base and line up the holes in the base with the holes in the mounting inserts (10). Install and tighten three motor bracket screws (9). Visually center the blower fan (13) in the cast well of the base and tighten its setscrew (12) securely. Install the motor fan. The Design 356A and 357 projectors use the two-bladed, press-on fan (8). Install flush

with the motor shaft. For export models, install the multi-bladed fan (8A), securing it to the shaft with the setscrew (7).

e. Dip setscrew (5) in shellac and assemble loosely to motor pulley (6). Assemble the motor pulley (6) onto the long end of the motor shaft with the pulley hub away from the motor. Center the pulley groove over the wall of the blower well and tighten the pulley setscrew (5) securely. The drive belt (4) need not be installed until the pulley mounting bracket is assembled (paragraph 10).

f. Assemble the tilt shaft assembly (2) to the projector by inserting the shaft through the hole in the base. When reassembling Design 357 projectors, a tension spring (3) is installed on the tilt shaft before it is assembled; then a washer (1A) is installed on protruding end of shaft. Press the retaining ring (1) into the groove at the upper end of the tilt shaft. Lock the tilt shaft in the "up" position by tightening the tilt lock knob (35, Figure 2) so that the locking shaft (33, Figure 2) bears against the tilt shaft. If the knob and locking shaft were removed, install these parts at this time.

10. REASSEMBLY OF PARTS IN FIGURE 5. Reassemble parts in reverse order of disassembly, noting the following special precautions.

NOTE

Trigger lever parts (38 through 41) are used only in Design 357 projectors. If these items were removed for replacement, be sure to support main frame while staking rivet (38).

a. Assemble the mechanism plate assembly (43) onto the base, against the mounting uprights and just behind the film guide groove. Install and tighten the three hex head screws (42). Assemble the retaining ring (36) into the groove near the flatted end of the framer shaft (37) and screw the shaft into threaded framer bushing (from front side of mechanism plate) until the retaining ring is approximately 1/16-inch from the face of the bushing.

b. Assemble the friction washer (35) to the main shaft (33) and lightly oil the rear end of the shaft. Insert end of shaft through the bearing in the short cast arm of the mechanism casting, assemble the drive pinion (34), hub to the right, to 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 at the front edge of the mechanism plate. Hold the

main shaft knob (32) in this cut-out and slide the main shaft forward until it engages the knob. Tighten the knob setscrew just enough to hold, and assemble the retaining ring (30) to the main shaft groove so that the friction washer (35) is captured against the bearing in the short cast arm. Temporarily tighten the drive pinion setscrew (29) just enough to hold.

c. Tap the knob end of the main shaft with a hard rubber mallet to seat the retaining ring (30) flush against the knob side of the recess wall. Assemble the thrust washer (28) onto the main shaft. Note that one face of the pull-down cam (27) has an identification dot. Install the cam on the main shaft with this dot facing the main shaft knob. Although the pull-down cam has two tapped holes for setscrews, only one setscrew (26) is used. Position the cam so that the identification mark (Figure C) is at the bottom, below the main shaft. Dip the setscrew (26) in shellac and insert it into the setscrew hole which now is facing you (the tapped hole furthest from the main plate). Tighten the setscrew securely, and wipe excess shellac from surface of cam.

d. Loosen the setscrew in the main shaft knob (32) and visually center the knob in the mechanism plate cut-out. There must be sufficient clearance on either side of the knob to eliminate any binding of the knob against the mechanism plate. Tighten the setscrew (31) securely and turn the main shaft. The shaft must turn freely with no binding or high spots. If binding does occur, tap the shaft lightly to free it up.

e. The shuttle pivot bracket (25) is triangular in shape and has one hole with a threaded protrusion which accepts the retaining screw (23). Hold the bracket with its smooth face against the long cast arm of the mechanism casting and insert the screw (23) through the hole closest to the mechanism plate, threading it finger tight into the threaded protrusion.

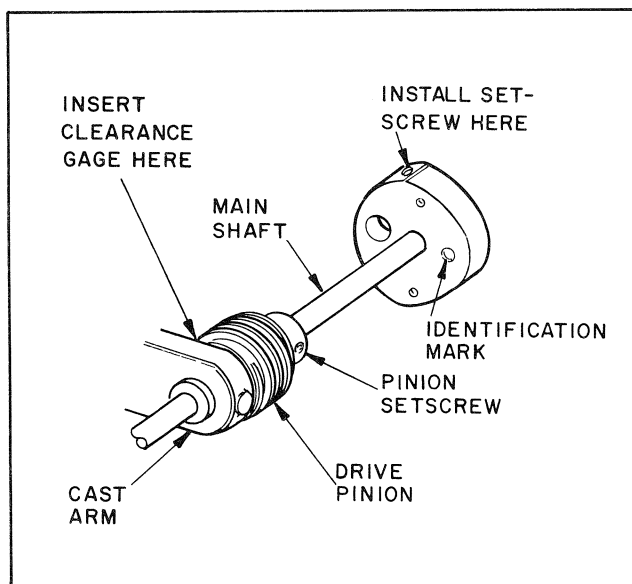


Figure C. Installing Pull-Down Cam and Drive Pinion

Insert the threaded end of the pivot stud (22) through the remaining hole in the bracket and in the cast arm and install a Sems nut (16) hand-tight.

f. When the supply of shuttle assembly 010363 is depleted, shuttle P/N 09168 will be furnished as a replacement together with spacer 39263 which must be used in place of spacer 39012. Grease the keyhole slot of the shuttle and both faces of spring washer (18). Assemble washer (18) to screw (17) with the bowed face against shoulder of screw. Then install the shuttle (19) and spacer (20) to the screw and assemble this group to the bracket (25). Engage the key slot of the shuttle with the framer shaft (27) and install the Sems nut (16). Tighten the pivot bracket screw (23) and the nut (16) securely.

g. Lightly grease the pull-down cam where the shoes will make contact. With the shuttle and pull-down cam in a horizontal position, insert the cam shoes (21) between the cam and the shuttle openings. Note that any combination of cam shoes (two white, two black, or one of each) may be used to obtain the proper fit. Turn the main shaft knob one full revolution in either direction; fit must be snug without binding. If too loose or too tight, correct the condition by selecting a suitable combination of cam shoes. Then finish securing the shuttle to the bracket (25) by tightening the Sems nut (16).

h. Install the in-out cam (15) so that its holes line up with those in the pull-down cam and the high section of its rim is toward the shuttle. Add the shutter (14) with the open side of the shutter away from the cams and the two screw holes lined up with those in the cams. Install the shutter washer (13), align all holes, and install the two screws (12). Before tightening the screws, hold the main shaft knob firmly and remove excess play in the in-out cam, shutter and washer by rotating these parts counterclockwise against the two screws; then tighten the screws securely. Turn the main shaft knob in both directions to make certain that all parts rotate freely and without binding. Now remove the drive pinion setscrew and insert the drive pinion clearance gage (Figure B) between the drive pinion and the face of the bearing in the short cast arm. Rotate the main shaft until the main shaft pull-down cam is at the position shown in Figure C; then rotate the drive pinion until its setscrew hole is aligned with the identification mark on the pull-down cam. Dip the setscrew in shellac and, while pressing the drive pinion and main shaft knob toward one another, install and tighten the setscrew securely. Remove the clearance gage.

i. Safety shutter (11) must locate on the shoulder of the pivot stud (22) with the front end of the shutter inserted through the mechanism plate. For early model projectors, install the torsion spring (9) around the shoulder of the pivot screw (8), and turn the screw tightly into the pivot stud (22). Cross the legs of the spring and engage them with the ears of the safety shutter bracket. Secure the front end of the safety shutter with the screw (10). Move the forward-reverse lever through all three positions to make sure the lever detents in each position. Place the lever in the

center (still) position and visually check the centering of the heat filter in the aperture opening. Adjust for proper centering and minimum end play by bending the legs of the spring (9) and shifting the front end of the safety shutter. Tighten screw (10) securely after adjusting. In later projector models, the torsion spring (4A), although installed and engaged in a different fashion, is adjusted in the same manner.

j. Lightly grease the ends of pulley bracket mounting studs (4) and install a washer (6) on each stud. Apply a light film of grease to each stud and install the drive rollers (7) and remaining washers (6) to the studs, securing these parts with the retaining rings (5). 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 insert the shaft through the bearing hole in the fire shutter assembly. One drive roller must be on each side of the shutter pulley. Install the retaining ring (3) to secure the pulley mounting bracket and engage the drive belt with the motor pulley and the two drive rollers.

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

a. If the lens carrier catch (37) was removed for replacement, tap the 0.095-inch diameter rivet holes in the mechanism casting with a No. 4-40NC thread. Fasten the new catch in place with two No. 4-40 by 1/4-inch binding head screws, part no. 30243.

b. Place the aperture plate (35) on the work bench with the stud up and away from you. Assemble the side tension arm (33) over the stud with the tension arm prongs down and into the aperture plate slots. Assemble the spring (32) with the center loop toward you and the ends of the springs 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. The side tension arm should exert a tension of 2-1/2 inch-ounces minimum to 3 inch-ounces maximum. Check by pressing the side tension arm to the limit of its travel and slowly releasing the arm against the stem of a fixed tension gage. It may be necessary to adjust the side tension spring (32) 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 (34). Line up the aperture opening and tighten the two screws securely. The aperture plate must be flush against the back edge of the casting. Assemble the guide rail (31) loosely to the aperture plate with two screws (30). Hold guide rail vertical with the fingers and push the rail forward so that both ears are against the sides of the slots in the aperture plate; then tighten the screws securely.

c. Note that the lens carrier for the Design 357 projector is equipped with a fine focus mechanism (items 29A through 29J). Assemble these parts as follows: Apply a light film of grease to the recess in the

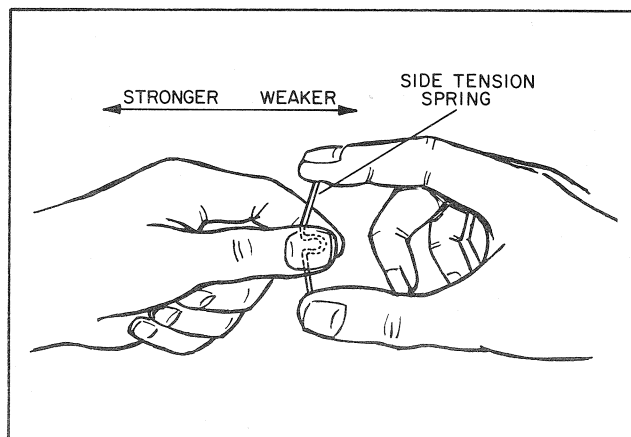


Figure D. Adjusting Tension of Aperture Plate Spring

eccentric focus shaft (29F) and install the O-ring (29H) over the shaft and into this recess. Install spring (29G) on the shaft and insert the shaft into the lens opening of the carrier and up into and through the shaft opening. Temporarily insert the projection lens into the lens carrier to hold the shaft up in place while installing the washer (29E), focus knob (29D) and a second washer (29C) over the end of eccentric shaft. Dip the threads of the screw (29B) in Loctite and turn the screw securely into the end of the shaft. Remove the lens from the lens carrier. Apply a thin coat of adhesive (3-M Company No. EC-847) to the inner lip of the decorative cover (29A) and assemble the cover over the raised rib of the focus knob. Press down firmly to assure proper adhesion and wipe away any excess adhesive.

d. Apply a light film of grease to the lens bore of the lens carrier (29) and across the steel locking ball (on the Design 356) or the eccentric shaft pin (on the Design 357). Hold the lens carrier in position between the ears of the mechanism casting and insert the hinge pins (28), pressing them firmly into place. Insert the lens carrier setting gage (Figure B) between the fingers of the lens carrier catch (37) and close the lens carrier so that it bears against the gage. Slip a thin strip of paper down behind the lens carrier at the point where the lip of the adjusting setscrew (38) protrudes through the main plate. Turn the setscrew in a bit at a time until it first grips the paper. Remove the setting gage and paint exposed threads of setscrew with shellac. Check to see that the carrier swings open easily and that it latches firmly in the closed position. If necessary, bend the ends of the lens carrier catch (37) to insure positive latching.

e. Hold the retainer plate (26) with the formed tabs facing up. Assemble the pressure plate spring (25) over the retainer plate with the elongated hole toward the narrow end of the plate, and engage the tabs of the spring with the slots at the ends of the plate. Assemble the pressure plate (27) to the spring and retainer plate, engaging the notched ear of the pressure plate with the notched end of the retainer plate. Compress this entire assembly and install it

to the lens carrier with the slotted end of the pressure plate at the top. Lock in place over the boss at the top and bottom of the carrier while locating the carrier dowel pins in the holes of the retainer plate and spring.

f. Preassemble the lower threading mechanism as follows. Insert the idler roller (23), small diameter end toward head of screw (21), between the ears of the loopformer and against the loopformer stop pin. Insert screw (21) through loopformer and roller and install the washer (24) over the end of the screw. Place the sprocket assembly (10) in the cavity of the loopformer and trap the sprocket by placing loopformer bracket (20) over the end of the screw (21). Install a friction washer (11) over the sprocket shaft and down against the rear flange of the sprocket and apply a drop or two of oil to the sprocket shaft. Lift this assembled group up into position, guiding the sprocket shaft through the bearing hole in the mechanism casting. Install and tighten the screws (19) and (21) just enough to hold all parts in place. Note that the pin of the lower loopformer assembly (22) must be inserted through a hole in the mechanism casting to engage a notch in the latch lever (5, Figure E) behind the mechanism casting.

g. Preassemble the upper threading mechanism as follows. Install the roller (18) on the pin of the upper loopformer bracket (17). Place the sprocket assembly (10) in the cavity of the loopformer bracket and assemble the upper loopformer (13) to the bracket, trapping the sprocket and the roller (18). Hold the flanged roller (14), flange toward head of screw (12), between the ears of the loopformer, and install the

screw (12). The screw must pass through the outer ear of the loopformer, the flanged roller, the inner ear of the loopformer, the washer (15) and the ear of the loopformer bracket, in that order. Insert screw (16) through its hole in the loopformer bracket. Install a friction washer (11) over the sprocket shaft and down against the rear flange of the sprocket and apply a drop or two of oil to the sprocket shaft. Lift this assembled group up into position, guiding sprocket shaft through the bearing hole in the mechanism casting. Note that the pin of the upper latch lever (Figure E) must enter a hole in the back of the upper loopformer. Secure the screws (12) and (16) just enough to hold all parts in place. Note that shaft, protruding from the top of the trip lever and through the mechanism plate, must engage a hole in the back of the upper loopformer.

h. Tighten the upper threading mechanism screws (12) and (16) securely. Insert the lip of the setting gage (S-012600-34N1, Figure B) over the teeth of the lower sprocket. Press the lower loopformer bracket down lightly against the setting spacer while tightening the lower threading mechanism screws (19) and (21).

i. Lightly grease the gear stud of the gear lever and stud assembly (6) and secure the gear (8) to the stud with the retaining ring (7). Assemble the sprocket gear (9) to the upper sprocket shaft with the three gear projections facing out. Install the assembled gear lever assembly (6) over the sprocket shaft and over the projections of the gear (9). Assemble the outer sprocket gear (5) to the upper sprocket shaft, engaging its three projections to those of the inner gear. Install the spacer washer (4), spring ratchet (3) and retaining spring (1), with the short end of the spring engaged in the slot of the sprocket shaft.

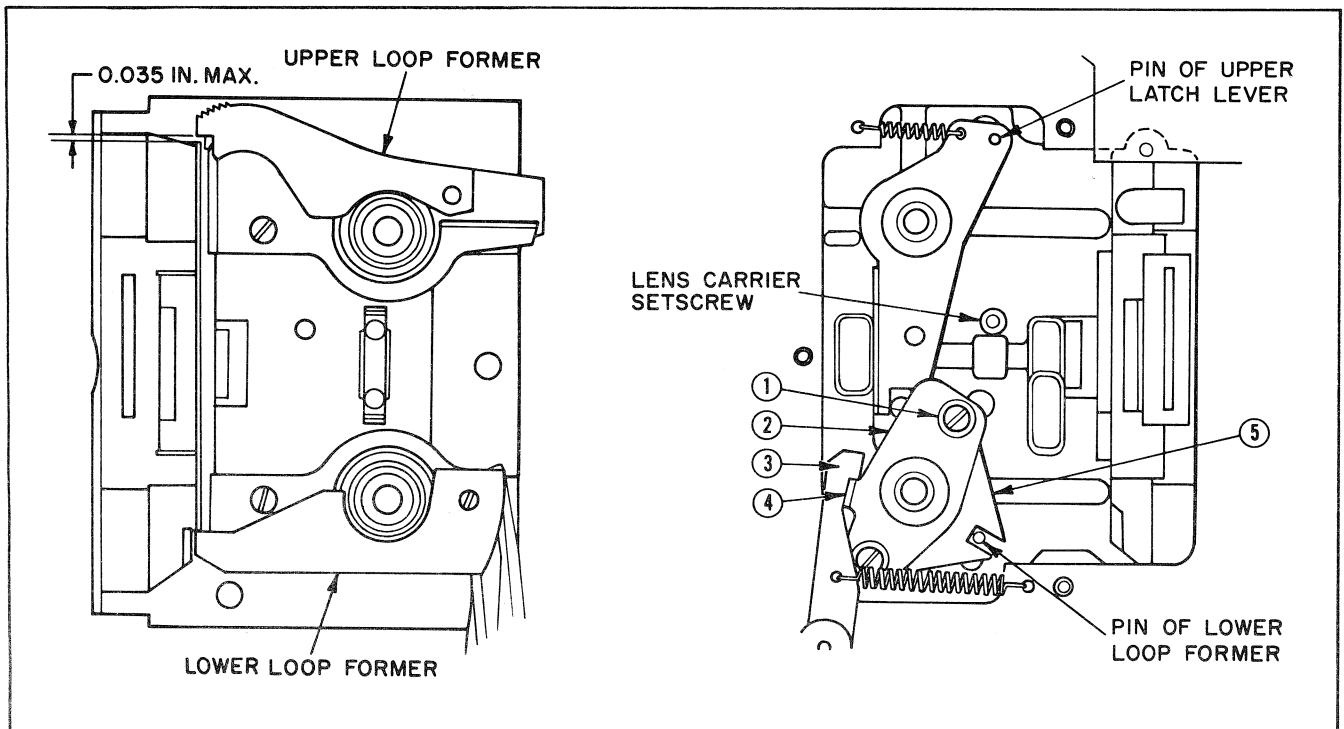


Figure E. Adjusting Trip Levers and Loopformers

j. Assemble the sprocket gear (9) to the lower sprocket shaft, with the three gear projections facing out. Install the outer sprocket gear to the shaft, engaging its three projections with those of the inner gear. Install spacer washer (4), spring ratchet (3), friction washer (2) and retaining spring (1), with the short end of the spring engaged in the slot of the sprocket shaft.

k. Design 357 Projectors Only. Hold loopformers in closed position. Loosen linkage lever adjusting screws (1, Figure E) and rotate lever (2) until its ear (4) is engaged and flush with the tip of the idler stud release lever (3). Tighten screws (1) securely and release the loopformers. The lip of the upper loopformer must not spring more than 0.035-inch away from the upper edge of the aperture plate when in the normal closed position. If the gap is greater than 0.035-inch, it may be necessary to loosen the screws holding the lower loopformer and bracket and shift these parts slightly to decrease the gap. If this is done, be sure to recheck the clearance between the lower sprocket and loopformer bracket as instructed in step h, preceding.

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

a. Insert bearing (33) through hole in feed arm support (34) from the unpainted side of the support and apply a film of grease to the arm around the protruding bearing sleeve. Repeat the process with the remaining bearing (33) and the take-up arm support (35) and assemble both support and bearing assemblies to the mechanism plate. Lay the mechanism plate on the work bench so that it is resting on the arm supports. Use a dab of grease to place a steel ball (41) on either side of each bearing as it protrudes through the mechanism plate. Add cam (40) over the bearing of take-up arm and cam (39) over the bearing of the feed arm, the prongs of the cam facing the middle of the mechanism plate. Install tension springs (38) over the bearings, small diameter down and end of small diameter toward top of mechanism plate. Assemble the gear mounting plate (37) and install the two large retaining rings (32) to secure all parts. Fasten the gear mounting plate to the mechanism plate with the single screw (36).

b. Lightly oil the end of the take-up arm gear shaft (27) and insert the shaft through the rear (take-up) bearing (33). Assemble spur gear (26), hub up, 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 setscrew (25) securely. Check to make certain that the assembled spur gear and gear and shaft assembly have 0.002 to 0.003-inch end play. Repeat the above procedure with the feed gear shaft assembly (14) and its spur gear (13).

c. Lightly grease each gear stud of gear mounting plate (37). Install one small spur gear (29), hub up, onto its gear stud so that it meshes with take-up spur gear (26). Install second small spur gear (29), hub down, onto its gear stud so that it meshes with feed

spur gear (13). Secure both gears with the retaining rings (28). Assemble the large spur gears (30) on their studs with a spring tension washer (31), bowed side down, beneath the gear closest to the take-up arm.

d. Apply a drop or two of oil to the shaft of one spindle assembly (22) and insert the shaft through the bearing in the take-up arm (17). Install spring tension washer (21), bowed face down, over the spindle shaft. Add one friction disc (19) and brush lightly with grease. Add spur gear (20) and brush lightly with grease. Assemble remaining friction disc (19) and the spacer (18). Repeat the above procedure with the feed arm assembly (3) and spindle parts (5 through 9). Spindles must turn freely and have a slight amount of end play. With a syringe, apply a light film of grease around the bottom of each spindle at the shaft hole. Assemble the torque spring (4), bulge up, into the lower end of the feed arm casting.

e. Lightly grease all gear studs of the reel arm supports (34) and (35). Assemble spur gears (23) and (24) to the studs of the take-up arm support and spur gears (10) and (11) to the studs of feed arm support. The hubs of all gears must face down. Lightly grease all gear teeth and carefully assemble the reel arms to the supports, installing and tightening the screws (1, 2, 15 and 16). Reel arm torque is checked and adjusted after projector is assembled (paragraph 16).

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

a. Assemble forward-reverse knob (37) to reversing lever with lettering positioned so as to be readable, and secure with the screw (36).

b. Assemble screws (29) to rollers (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 the hexnut (30).

c. Install the torsion spring (28), short tang first, over the idler stud protruding from the mechanism plate. In Design 356 projectors, this stud is staked to the mechanism plate. In Design 357 projector, the stud is staked to a movable lever on the back of the mechanism casting. Engage the short tang of the spring with the hole in the mechanism plate. Install spacer (27) and threading guide (26) 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 second retaining ring (24).

d. Install leadwires to switch (23) as illustrated in the wiring diagram, Figure 7 or Figure 8. Position rocker switch (23) within the control housing (12) so that the end of the switch with the two lugs is closest to the end wall of the housing. Install and tighten the two screws (22).

e. Remove backing from control housing name-plate (21) and activate the adhesive by brushing with

trichlorethylene. Allow adhesive to become tacky and assemble to housing, lining up all the openings properly. Press down at edges with clean, dry cloth. Place washer (20) on control knob (19) hub and insert hub through hole in control housing. On early models, assemble spring tension washer (18), bowed face in, and flat washer (17) over the hub. Secure all parts with retaining ring (16). Current models use a push nut (16) in place of flat washer (17) and retaining ring (16).

f. If the switch insulating shield (14) was replaced, attach new shield to hole in bottom of housing with rivet (13). Assemble the insulating tubing (15) over the switch leadwires. Assemble the control housing (12) to the mechanism plate, guiding the framer shaft into the control knob (19) and positioning the insulating tubing (15) so that it protects the switch leadwires as they pass through the mechanism plate. Install and tighten the two hex head screws (11), inserting screws from back of main plate.

g. Attach leadwires to lamp socket assembly (7) (See wiring diagram Figure 7 or Figure 8). Secure the air deflector (4) to the lamp socket bracket with two screws (3). Lift the lamp socket assembly up into position in the hole of the mechanism plate and secure it finger-tight with the two screws (5) and washers (6) inserted from front of mechanism plate. After the projector is assembled, the lamp socket must be aligned as instructed in paragraph 17.

h. Complete the wiring hook-up (see wiring diagram, Figure 7 or Figure 8. Bend the end of the air deflector (4) down around the blower fan and secure it to the blower well with the remaining screw (3). Assemble the switch leadwires into the clamp (10) and fasten the clamp to the tapped hole at the rear edge of the lamp socket bracket with the screw (8) and washer (9). Dress the leads and pull them up snugly so they do not touch the motor.

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

a. Assemble the lamphouse catch (14D), sleeve spacer (14C) and air baffle (14B) to the lamphouse with the rivet (14A). Do not install the assembled lamphouse (14) until the lamp socket is aligned (paragraph 17).

b. Assemble the handle insert (13) into the handle (12); then assemble handle and insert over the bosses of the end caps, so that ribbed side will be exposed when handle is installed. Secure the end caps to the back cover (4) with the screws (9) and washers (10).

c. Engage the locating bosses of the cord storage hooks (8) in the elongated slots of the back cover and install and tighten the two screws (7). Insert the stripped ends of the power cord (5) through the opening in the back cover from the painted side and pull the cord through until the stripped ends are even with the far inside corner of the cover (approximately 8 inches). Assemble the strain relief bushing (6) over the cord and into the cover opening from the painted side of the cover. Wrap power cord around cord hooks in a clockwise direction.

d. Design 357 projectors are equipped with a cord storage door and associated parts (4A through 4H). The inset in Figure 1 illustrates these parts which are applicable only to the export models (356X and 356XP). For the Design 357, dip the tip of the bumper (4G) in wax to facilitate its installation. Refer to the proper wiring diagram (Figure 7 or Figure 8) for wiring connections. Do not install the back cover until all adjustments have been made.

e. Insert cover release button (1C) down into the top hole in the front cover. Install cover catch (1B), bulge up, over the release button and secure these parts with the rivet (1A). Install the spring clip (1D) over the boss inside the front cover and press the clip firmly into place. Do not install the front cover until projector operation has been checked and all adjustments made.

15. FINAL INSPECTION.

a. Open the film gate and manually rotate the main shaft knob while watching the movement of the shuttle. The shuttle teeth should travel in the center of the shuttle slot. If necessary, bend the shuttle carefully to insure that the shuttle teeth do not touch either side of the slot. (Refer to paragraph 18.)

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 direction, move the forward-reverse lever to "still" (center) position. The safety shutter must drop in front of aperture opening at the very moment that the motor stops running. Repeat the same check by moving the forward-reverse lever to "reverse" position and then to "still" position. At the same time, check to make certain that the mechanism (drive rollers and sprockets) begin 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 20.

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 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 sure that all leadwire connections are secure by tugging gently on the leadwire near the terminal connection, and see that all leads are properly dressed out of the way of moving parts.

g. Make final projector adjustments as outlined in paragraphs 16 through 20. Then make a final test of projector operation as outlined in Final Test section.

16. SPINDLE TORQUE ADJUSTMENT. Spindle torque can be measured with a zero to eight-ounce Postalette scale and a modified 8-mm film reel as shown in Figure F. Note that the scale must be held vertically, directly above the screw in the reel, for a proper torque reading.

a. With the projector grounded and the line cord plugged into the 110 to 120 volts a-c outlet, swing both reel arms up to the operating position. Install the modified film reel on the take-up (rear) spindle and place the projector switch in the "motor" position. Engage Postalette scale with string loop and, holding the scale as shown in Figure F, press the forward-reverse lever up to the "forward" position. Proper torque (at the point where the spindle and film reel do not turn) should be 4.5 to 5-inch-ounces. Torque can be adjusted by tightening (to increase) or loosening (to decrease) the screw at the back of the reel arm support (Figure G).

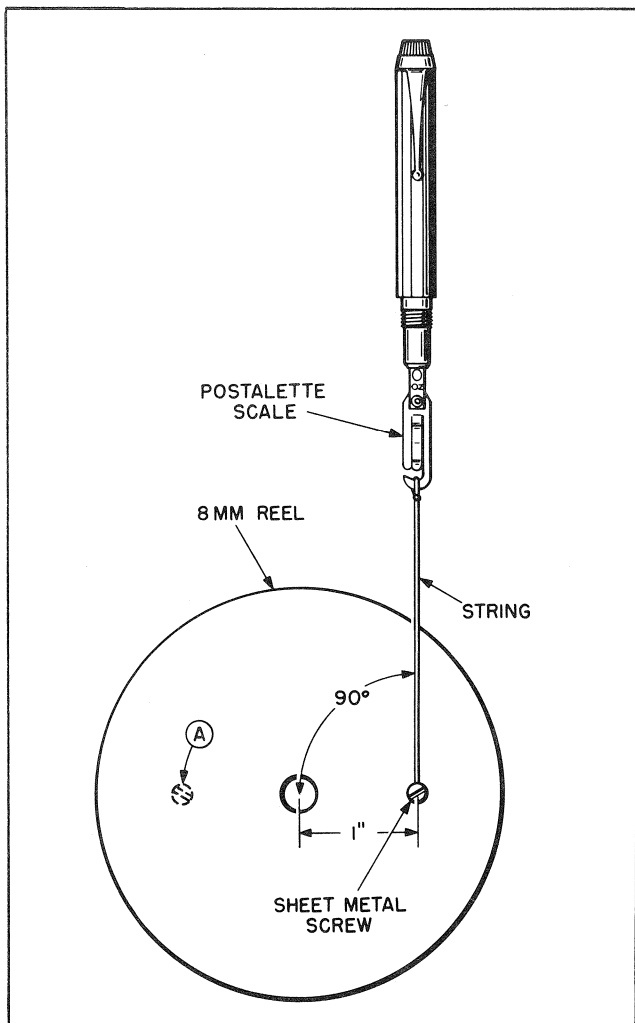


Figure F. Checking Reel Spindle Torque

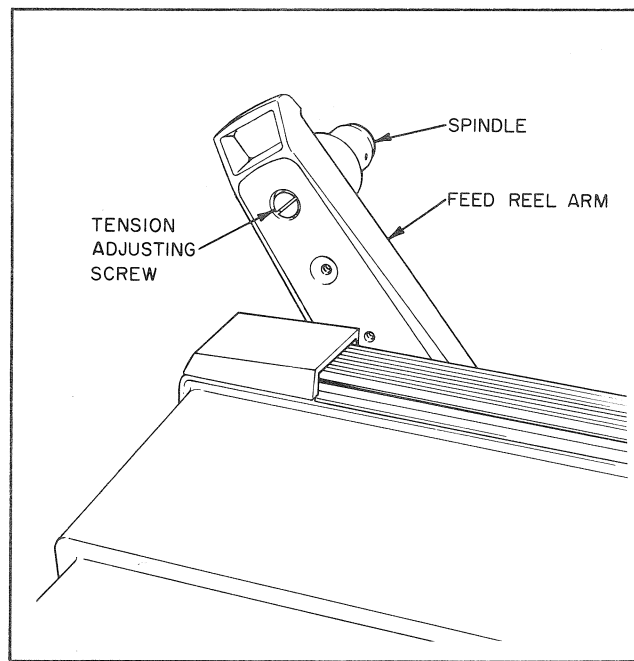


Figure G. Adjusting Reel Spindle Torque

b. Place forward-reverse lever in "still" (center) position and transfer the modified film reel to the feed (front) spindle. Note that the screw in the film reel must now be at position A. Engage Postalette scale with string loop and, holding the scale as shown in Figure F, press the forward-reverse lever down to the "reverse" position. Proper torque (at this point where the spindle and film reel do not turn) should be 5.5 to 6-inch-ounces. Torque can be adjusted by tightening (to increase) or loosening (to decrease) the screw at the back of the reel arm support (Figure G).

17. LAMP SOCKET ALIGNMENT. As illustrated in Figure H, the lamp socket is secured with two screws. The screw to the rear of the lamp socket is inserted through an over-sized 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,

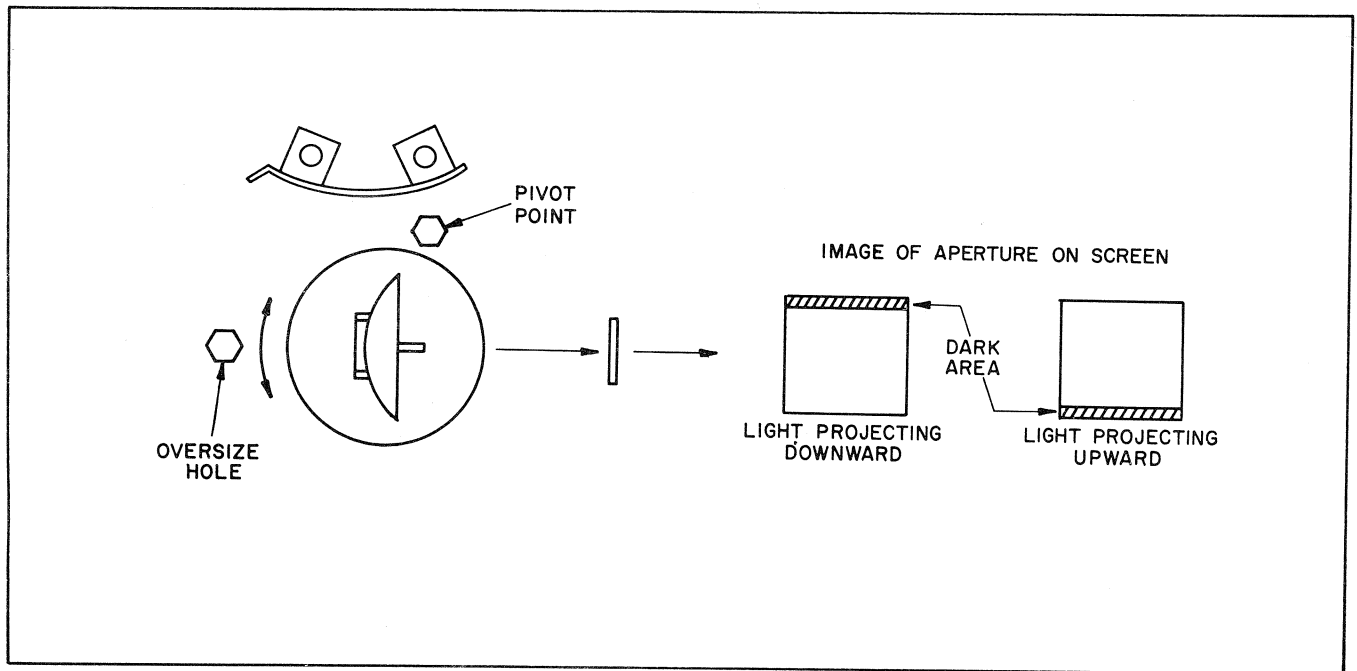


Figure H. Lamp Socket Alignment

thereby rotating the lamp socket slightly counter-clockwise.

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 lamp-house.

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

a. Set the framer knob at the approximate center of its travel range, and swing open the lens carrier.

b. Rotate the main shaft knob until the shuttle teeth reach the approximate center of the downstroke.

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, remove the lamphouse and lamp and rotate the manual knob until the shuttle teeth are at the center of the down stroke. Insert the shuttle bending tool through the opening in casting, just forward of the lamp socket, and engage the slot of the tool with the shuttle tooth arm. Note, in Figure J, that the bending tool should engage the arm in the annealed (shiny) area. To increase the height of shuttle teeth above the aperture plate surface, move the handle of the tool away from the projector main plate; to decrease height, move handle toward main plate. If shuttle teeth are protruding unevenly (one tooth protruding more than the other), 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 shuttle tooth height is properly established.

f. Carefully rest the projector on its back surface (lens pointing up) and open film gate. Set the framer knob in the extreme clockwise position and turn the manual knob until the shuttle teeth are at the extreme top and out position. With a magnifying glass, check to make certain that the teeth are centered in the slot. To adjust shuttle centering, refer to Figure J and loosen the screw (1) and hex nut (2), leaving hex nut (3) tight.

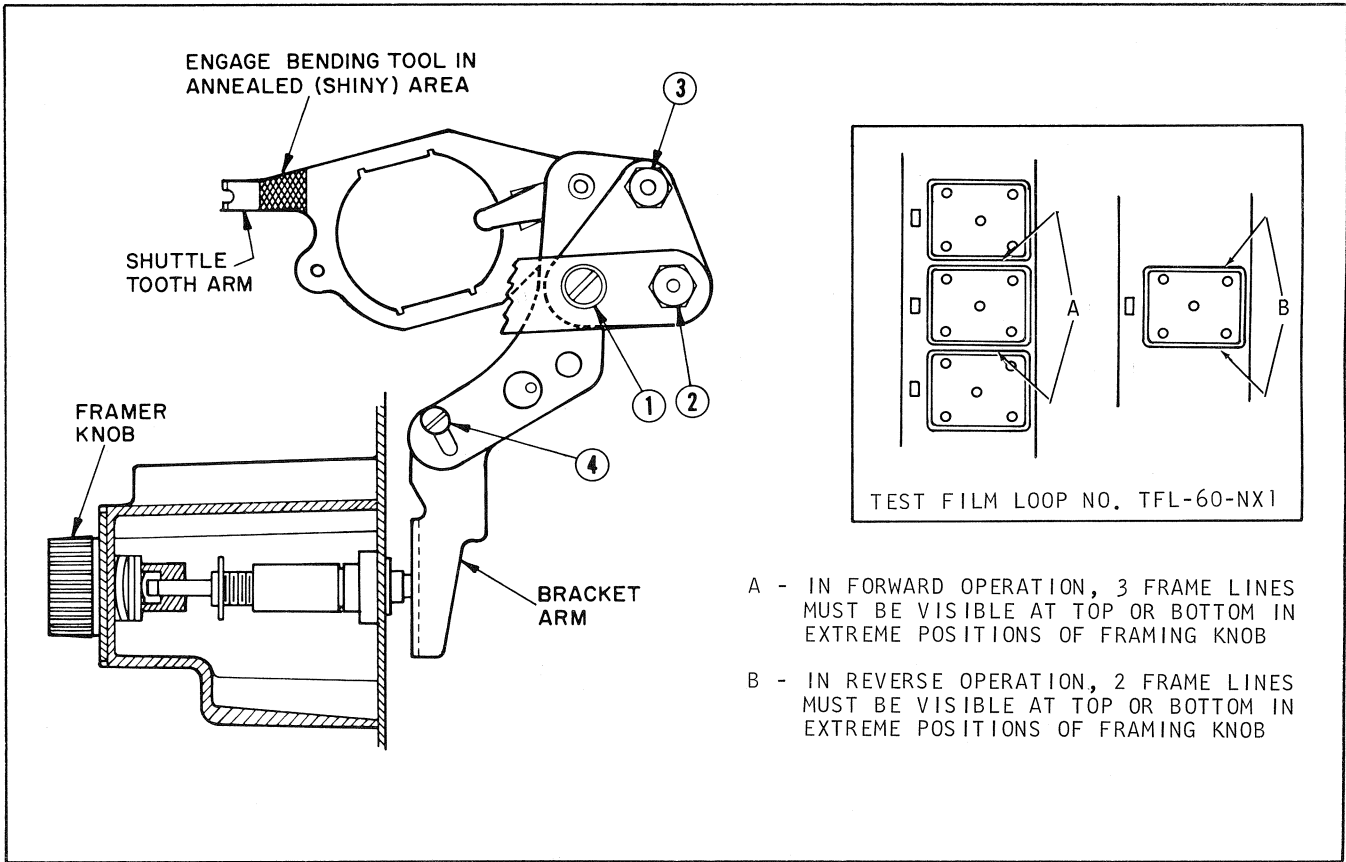


Figure J. Adjusting the Shuttle

Engage the 3/8-inch diameter holes of the shuttle tooth centering tool (Figure B) with the two hex nuts (2) and (3) and, while viewing the shuttle teeth through the magnifying glass, move the tool handle up or down until shuttle teeth are centered. Tighten the screw (1) and then the hex nut (2) to lock the adjustment.

19. PICTURE FRAMING ADJUSTMENT. The framing mechanism must be adjusted to permit maximum picture framing in either direction.

a. Thread the projector with a loop of test film and run the projector in the forward direction.

b. Rotate the framer knob to extreme clockwise position and then to extreme counterclockwise position. The camera frame line of adjacent frames must be visible as noted in Figure J when framing knob is at extreme positions.

c. To adjust picture framing, loosen screw (4) at the knee of the shuttle framing lever (Figure J) and shift the shuttle bracket arm up or down, as necessary, to center the frame in the aperture. Tighten the screw securely without disturbing the position of the bracket arm, and recheck picture framing.

20. SAFETY SHUTTER ADJUSTMENT. The rubber drive rollers which drive the shutter pulley must make contact and begin driving the mechanism (in forward

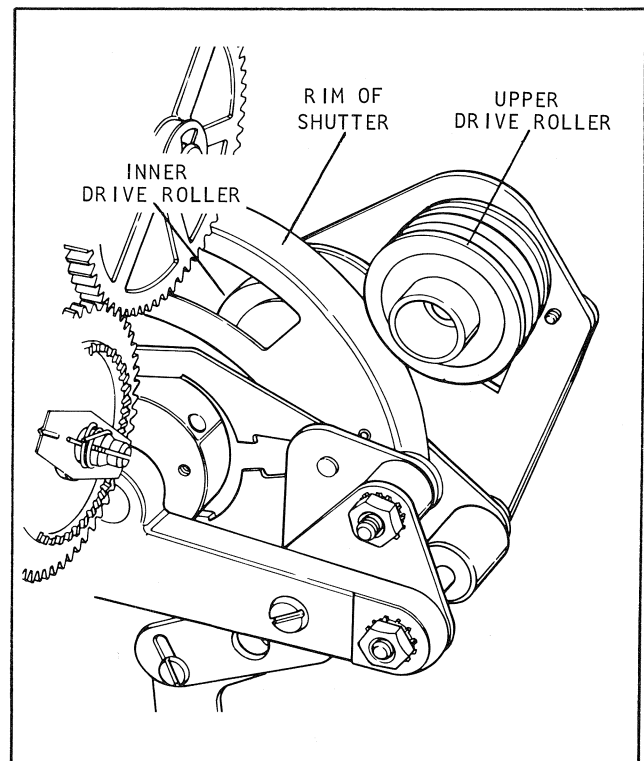


Figure K. Safety Shutter Adjustment

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 K). 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.

LUBRICATION CHART

NOTE: Where oil is specified, use Bell & Howell Spec. 1543 oil.

ITEM	LUBRICATION
Friction discs (3-6, 3-19)	Grease (Spec. 1980) both faces.
Spur gears (3-7, 3-20)	Grease (Spec. 1980) teeth and face.
Reel arm supports (3-34, 3-35)	Grease (Spec. 1956) all gear studs and around sleeve bearings (3-33).
Gear mounting plate (3-37)	Grease (Spec. 1956) all gear studs.
Lever and stud assembly (4-6)	Grease (Spec. 1956) gear stud.
Lens carrier (4-29)	Grease (Spec. 1956) lens bore.
Eccentric shaft (4-29F)	Grease (Spec. 1956) in O-ring groove.
Roller bracket (5-4)	Grease (Spec. 1516) drive roller studs.
Washer (5-18)	Grease (Spec. 1956) both faces.
Shuttle (5-19)	Grease (Spec. 1956) keyhole slot.
Pull-down cam (5-27)	Grease (Spec. 1956) shoe contact surface.
Framer shaft (5-37)	Grease (Spec. 1956) shaft threads.

Final Test

21. GENERAL INSTRUCTIONS.

This section contains specific inspections and tests to be performed to insure that the projector is in the 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-volts a-c, 60-cycles power source.

22. INSPECTION PROCEDURE.

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

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

c. Check all wires to make sure they are properly dressed out of the way and that all solderless connectors are securely pressed onto their lugs.

d. Press on ends of the sprocket shafts to check 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 the carrier latches securely in place. If necessary, bend the fingers of the lens carrier catch (37, Figure 4) to increase the tension.

f. Check the manual shaft to make certain that there is a slight amount of end play. Rotate the manual knob to check the fit of the cam shoes. Cam shoes should fit snugly but without binding, and proper fit is obtained by selecting the appropriate combination of shoes (two black, two white, or one of each).

23. 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 forward 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" to either of the operating positions. If necessary, adjust the drive rollers as instructed in paragraph 20.

24. 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, remove the back cover to gain access to the adjusting setscrew (Figure E). This setscrew bears against the machined surface of the lens carrier and determines the angular relationship between the optical axis and the aperture plate.

c. Turn adjusting setscrew in or out to obtain equal sharpness of the image along both sides of the picture. If the lens carrier is far out of alignment, it may be necessary to refocus the picture during the alignment procedure.

25. OPERATIONAL TEST. Thread projector with 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 may be necessary to tighten screw (2, Figure 3) slightly to apply additional tension.

c. If the film fails to maintain its loop above or below the aperture, check the shuttle tooth protrusion as described in paragraph 18, and readjust if necessary.

d. If the projected image appears soft at the edges, check the alignment of the optical axis as instructed in paragraph 24, and adjust if necessary.

Trouble Shooting

TROUBLE	PROBABLE CAUSE	REMEDY
Projector inoperative with switch in the MOTOR or LAMP position.	<ol style="list-style-type: none"> 1. No electrical power. 2. Loose motor pulley. 3. Broken drive belt. 4. Defective switch or wiring. 	<ol style="list-style-type: none"> 1. Check power source. 2. Tighten pulley setscrew. 3. Replace belt. 4. Check switch and circuitry.
Picture flicker.	<ol style="list-style-type: none"> 1. Drive roller assemblies not adjusted properly. 2. Defective drive belt pulley. 3. Dirt, wear or binding in gearing. 	<ol style="list-style-type: none"> 1. Readjust as instructed in paragraph 20. 2. Replace drive belt pulley. 3. Clean and repair or adjust gearing as instructed in reassembly instructions.
Film scratches.	<ol style="list-style-type: none"> 1. Excessively dirty film channel parts (sprockets, guides, etc.) 2. Worn pressure and aperture plates (27 and 35, Figure 4) 3. Worn or damaged film guide rail (31, Figure 4) 	<ol style="list-style-type: none"> 1. Clean projector thoroughly. 2. Replace if worn or marred. 3. Replace film guide rail.
Jumpy picture.	<ol style="list-style-type: none"> 1. Loss of film loop due to damaged film. 2. Green film. 3. Shuttle tooth worn. 4. Misaligned shuttle tooth. 5. Grooves worn in film guide rail (31, Figure 4). 	<ol style="list-style-type: none"> 1. Inspect and splice as required. 2. Run film through projector two or three times to age the film. 3. Replace shuttle assembly (19, Figure 5). 4. Adjust and align shuttle as instructed in paragraph 18. 5. Replace film guide rail.
Soft focus.	<ol style="list-style-type: none"> 1. Dirty projection lens. 2. Lens mount out of alignment. 3. Loose lens mount catch (37, Figure 4). 	<ol style="list-style-type: none"> 1. Clean projector lens. 2. Readjust as instructed in paragraph 11, step d. 3. Reset tension by bending catch carefully.
Autothreading not operating properly.	<ol style="list-style-type: none"> 1. Loopformer linkage improperly adjusted or binding. (Design 357 only.) 2. Loopformers not releasing. 	<ol style="list-style-type: none"> 1. Realign loopformers and reset linkage (paragraph 11, step k). 2. Linkage binding or springs stretched or broken on linkage.

SERVICE INSTRUCTIONS

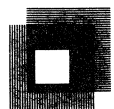
TROUBLE	PROBABLE CAUSE	REMEDY
Film spills.	1. Insufficient tension on feed spindle.	1. Adjust, paragraph 25, step b.
Fails to take up or rewind.	1. Defective drive belt. 2. Worn rim on drive roller. 3. Drive rollers not adjusted properly.	1. Replace belt. 2. Replace rim (7A, Figure 5). 3. Readjust as instructed in paragraph 20.
Noisy.	1. Loose attaching parts. 2. Gearing dry.	1. Tighten as necessary. 2. Lubricate as necessary.

PARTS CATALOG

AUTOLOAD[®] **SUPER 8 PROJECTOR**

DESIGN 356 and 357

PHOTO PRODUCTS GROUP



BELL & HOWELL

**GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645**

Replacement Parts

The following pages illustrate and list by part name and number all replacement parts of the Designs 356 and 357 Autoload Super 8 Projectors. Three versions of the Design 356 projector are covered: the Design 356A and two export versions, Designs 356X and 356XP. Since the illustrations are arranged in the suggested order of disassembly, they will serve as an aid to the repairman during disassembly and reassembly of the projector. Be sure to check footnotes for special instructions regarding replacement procedures.

in question applies to all projector models. The following list gives the applicable code letters and their corresponding projector model.

MODEL NO.	CODE LETTER
356A	A
357	B
356X	C
356XP	D

The Usable on Code column identifies, by code letter, those parts which are applicable to only one model projector. Where this column is blank, the part

NOTE: Refer to the Bristol Wrench Chart on page 2 for proper wrenches required for removal of the fluted socket setscrews illustrated in these parts lists.

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		1 2 3 4 5 6 7		
PROJECTOR COVERS AND LAMP				
1-1	010000	COVER ASSEMBLY, Front (Light Brown)	1	ACD
-1	07846	COVER ASSEMBLY, Front (Walnut)	1	ACD
-1	010018	COVER ASSEMBLY, Front (Blue)	1	B
-1	08764	COVER ASSEMBLY, Front (Blue-Gray)	1	B
-1A	30226	. RIVET, Tubular, 0.123 inch diameter	1	
-1B	39252	. CATCH, Cover	1	
-1C	32361	. BUTTON, Cover release	1	
-1D	39109	. CLIP, Film reel retaining	1	
-1E	39168	. COVER, Front (Light Brown) (order complete cover assembly)	NP	ACD
-1E	39279	. COVER, Front (Walnut) (order complete cover assembly) . .	1	ACD
-1E	39169	. COVER, Front (Blue) (order complete cover assembly) . . .	NP	B
-1E	39321	. COVER, Front (Blue-Gray) (order complete cover assembly)	1	B
-2	29065	SCREW, Hex head tapping, 4-40 by 1/2 inch (type 23)	4	AB
-2	36879	SCREW, Hex head tapping, 4-40 by 1/2 inch	4	CD
-3	37932	SCREW, Hex head, 6-32 by 5/8 inch	2	
-4	39165	COVER, Back (Light Brown) (Design 356 Only)	1	A
-4	40562	COVER, Back (Walnut) (Design 356 Only)	1	A
-4	010151	COVER ASSEMBLY, Back (Blue) (Design 357 Only)	1	B
-4	08969	COVER ASSEMBLY, Back (Blue-Gray) (Design 357 Only)	1	B
-4A	30226	. RIVET, Tubular, 0.123 inch diameter	2	B
-4B	010021	. DOOR AND HINGE ASSEMBLY, Storage (Blue)	1	B
-4B	08868	. DOOR AND HINGE ASSEMBLY, Storage (Blue-Gray)	1	B
-4C	26310	. RIVET, Tubular, 0.089 inch diameter	4	B
-4D	39207	. HINGE, Door	2	B
-4E	30226	. RIVET, Tubular, 0.123 inch diameter	1	B
-4F	39206	. LATCH, Storage door	1	B
-4G	39220	. BUMPER, Rubber	1	B
-4H	39166	. COVER, Back (Blue) (order complete cover assembly)	NP	B
-4H	39327	. COVER, Back (Blue-Gray) (order complete cover assembly)	NP	B

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
PROJECTOR COVERS AND LAMP (CONT)				
1-4	07922	COVER ASSEMBLY, Back (Design 356X Only) (Light Brown)	1	C
-4	07923	COVER ASSEMBLY, Back (Design 356XP Only) (Light Brown)	1	D
-4A	012806	NAMEPLATE AND PLUG ASSEMBLY	1	CD
-4B	25699	RIVET, Tubular	2	CD
-4C	39351	SOCKET, Noval tube	1	CD
-4D	39343	NAMEPLATE, Cover (Design 356X Only) (Light Brown)	1	C
-4D	39396	NAMEPLATE, Cover (Design 356XP Only) (Light Brown)	1	D
-4E	39346	COVER, Back (Design 356X Only) (Light Brown)	1	C
-4E	39285	COVER, Back (Design 356X Only) (Walnut)	1	C
-4E	39402	COVER, Back (Design 356XP Only) (Light Brown)	1	D
-4E	39286	COVER, Back (Design 356XP Only) (Walnut)	1	D
-4F	706679	SCREW, Hex head tapping, 6-32 by 3/8 inch	1	D
-4G	39401	CLIP, Plug retaining	1	D
-4H	36844	SCREW, Barrier strip	2	CD
-4J	26906	NUT AND WASHER, Hex	2	CD
-4K	39336	STRIP, Terminal barrier	1	CD
-4L	301391	SCREW, Cable clip	1	CD
-4M	39338	CLIP, Cable retaining	1	CD
-5	013641	CORD, Power	1	AB
-5	012803	CABLE ASSEMBLY (Design 356X Only)	1	C
-5	012810	CABLE ASSEMBLY (Design 356XP Only)	1	D
-5A	706695	TERMINAL, Lug	3	CD
-6	309761	BUSHING, Strain relief	1	AB
-6	39337	BUSHING, Strain relief	1	CD
-7	39200	SCREW, Hex head Sems tapping, 8-18 by 1/2 inch	2	
-8	39124	HOOK, Power cord storage	2	
-9	39204	SCREW, Hex head Sems tapping, 10-32 by 0.437 inch	2	
-10	35186	WASHER, Flat	2	
-11	39129	END CAP, Handle	2	
-12	39074	HANDLE, Carrying	1	
-13	39073	INSERT, Carrying handle	1	
-14	010153	LAMPHOUSE ASSEMBLY, Complete (Light Brown)	1	A
-14	09543	LAMPHOUSE ASSEMBLY, Complete (Walnut)	1	A
-14	010154	LAMPHOUSE ASSEMBLY, Complete (Blue)	1	B
-14	08763	LAMPHOUSE ASSEMBLY, Complete (Blue-Gray)	1	B
-14	07920	LAMPHOUSE ASSEMBLY, Complete (Light Brown)	1	CD
-14A	39190	RIVET, Tubular, 0.123 inch diameter	1	
-14B	39188	BAFFLE, Air	1	AB
-14B	39342	BAFFLE, Air	1	CD
-14C	39189	SPACER, Sleeve	1	
-14D	35360	CATCH, Lamphouse	1	
-14E	39160	LAMPHOUSE (Light Brown) (Order complete lamphouse assembly)	NP	ACD
-14E	40563	LAMPHOUSE (Walnut) (Order complete lamphouse assembly)	NP	ACD
-14E	39161	LAMPHOUSE (Blue) (Order complete lamphouse assembly)	NP	B
-14E	39316	LAMPHOUSE (Blue-Gray) (Order complete lamphouse assembly)	NP	B
-15	40591	LAMP, Projection, Type DJL	1	AB
-15	37407	LAMP, Projection, Type DEF	1	CD
-16	39100	NAMEPLATE, Lamphouse	1	B
-17	39102	NAMEPLATE, Front cover	1	ACD
-17	39105	NAMEPLATE, Front cover	1	B
-18	39178	NAMEPLATE, Back cover	1	A
-18	39179	NAMEPLATE, Back cover	1	B

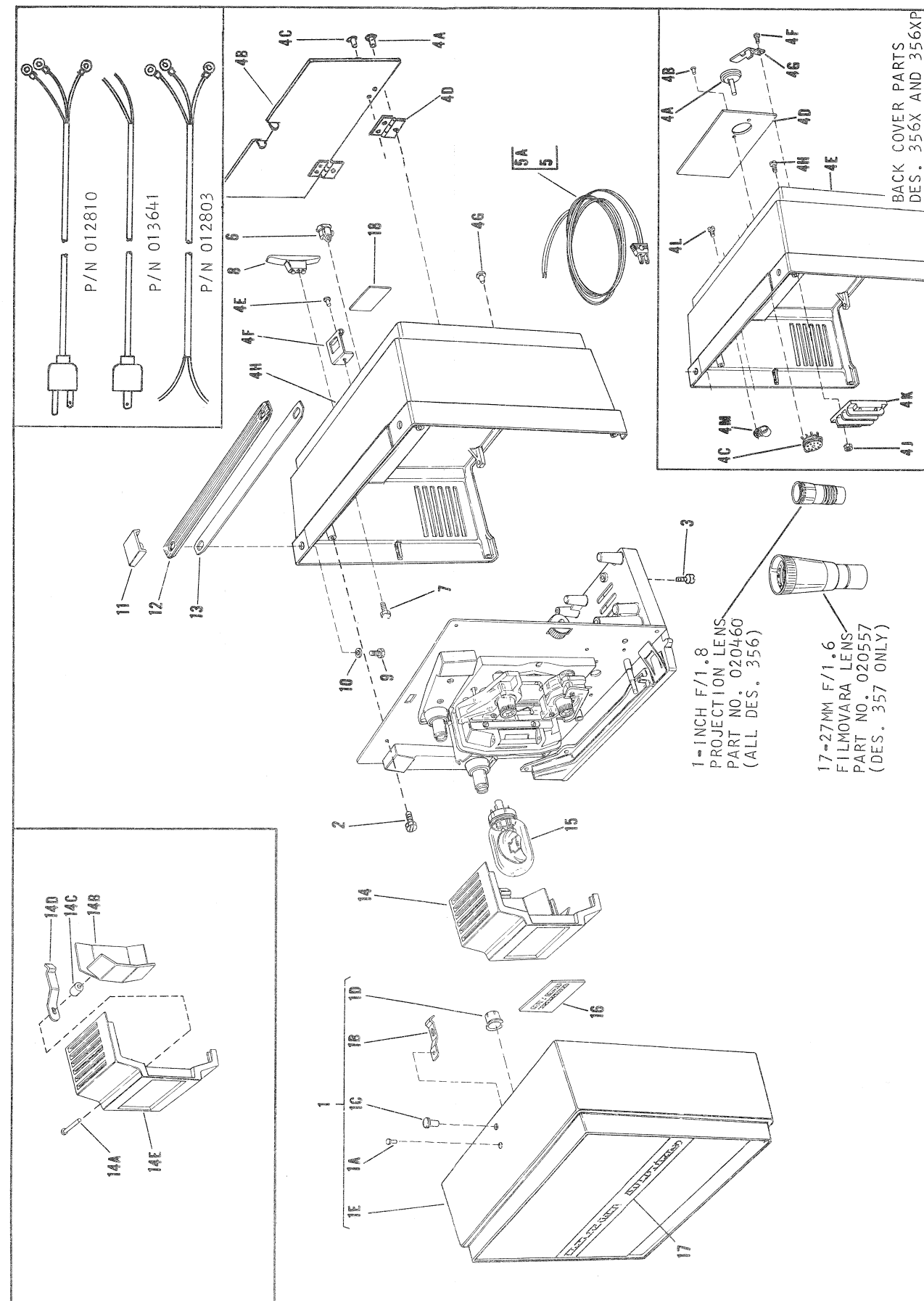


Figure 1. Projector Covers and Lamp

FIG. & INDEX NO.	PART NO.	DESCRIPTION							UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7		
CONTROL HOUSING AND ROLLERS										
2-1	19025	RIVET, Tubular, 0.123 inch diameter							2	
-2	32478	BAFFLE, Lamp							1	
-3	37947	SCREW, Hex head tapping, 4-40 by 1/4 inch							2	
-3A	30237	SCREW, Hex head, tapping, 4-40 by 1/4 inch							1	
-4	39235	DEFLECTOR, Air							1	
-5	706679	SCREW, Hex head tapping, 6-32 by 3/8 inch							2	
-6	17632	WASHER, Flat							2	
-7	010270	SOCKET AND BRACKET ASSEMBLY, Lamp							1	AB
-7	010271	SOCKET AND BRACKET ASSEMBLY, Lamp							1	CD
-8	36882	SCREW, Hex head tapping, 6-32 by 3/8 inch							1	
-9	17632	WASHER, Flat							1	
-10	83236	CLAMP, Leadwire							1	
-11	706679	SCREW, Hex head tapping, 6-32 by 1/8 inch							2	
-12	39157	HOUSING, Control (Light Brown)							1	ACD
-12	39284	HOUSING, Control (Walnut)							1	ACD
-12	39158	HOUSING, Control (Blue)							1	B
-12	39314	HOUSING, Control (Blue-Gray)							1	B
-13	706546	RIVET, Tubular, 0.123 inch diameter (early models)							1	AB
-14	39239	SHIELD, Insulating, paper (early models)							1	AB
-15	39182	TUBING, Insulating							1	AB
-15	39226	TUBING, Insulating							1	CD
-16	34539	RING, Retaining, external 0.375 inch ID (early models only)							1	
-16	43453	PUSH NUT (Current models)							1	
-17	33931	WASHER, Flat (early models only)							1	
-18	35349	WASHER, Spring tension							1	
-18A	43454	DECORATIVE DISC (Current models)							1	
-19	36740	KNOB, Control (early models)							1	
-19	43451	KNOB, Control (current models)							1	
-20	35348	WASHER, Flat (early models)							1	
-20	42967	WASHER, Flat (current models)							1	
-21	39104	NAMEPLATE, Control housing (early 356 models)							1	ACD
-21	43425	NAMEPLATE, Control housing (current models)							1	A
-21	39106	NAMEPLATE, Control housing							1	B
-22	34590	SCREW, Flat head, 6-32 by 3/8 inch							2	
-23	012588	SWITCH ASSEMBLY, OFF-MOTOR-LAMP (Early models)							1	AB
-23	013638	SWITCH ASSEMBLY, OFF-MOTOR-LAMP (Current models)							1	A
-23	013636	SWITCH ASSEMBLY, OFF-MOTOR-LAMP (Current models)							1	B
-23	012804	SWITCH ASSEMBLY, OFF-MOTOR-LAMP							1	CD
-24	20808	RING, Retaining, 0.145 ID (IRRC No. 1000-18)							2	
-25	39087	ROLLER, Guide							1	
-26	39052	GUIDE, Threading							1	
-27	39173	SPACER, Sleeve							1	
-28	39098	SPRING, Torsion							1	
-29	39089	SCREW, Guide roller, 4-40NC							2	
-30	39223	NUT, Plain hex, 4-40NC							1	
-31	39248	ROLLER, Guide							2	
-32	39143	DEFLECTOR, Film							1	
-33	39125	SHAFT, Tilt locking							1	
-34	36769	SETSCREW, Fluted socket cup pt, 8-32 by 1/4 inch							1	
-35	36714	KNOB, Tilt lock							1	
-35	013642	KNOB, Tilt lock (NOTE A)							1	
-36	32926	SCREW, Fillister head, 2-56 by 1/4 inch							1	
-37	39118	KNOB, Forward-Reverse							1	
-38	39225	NAMEPLATE, Lamp designation							1	AB
-38	39335	NAMEPLATE, Lamp designation							1	CD

NOTE A: Tilt lock knob 013642 replaces items 33, 34 and 35 on current models.

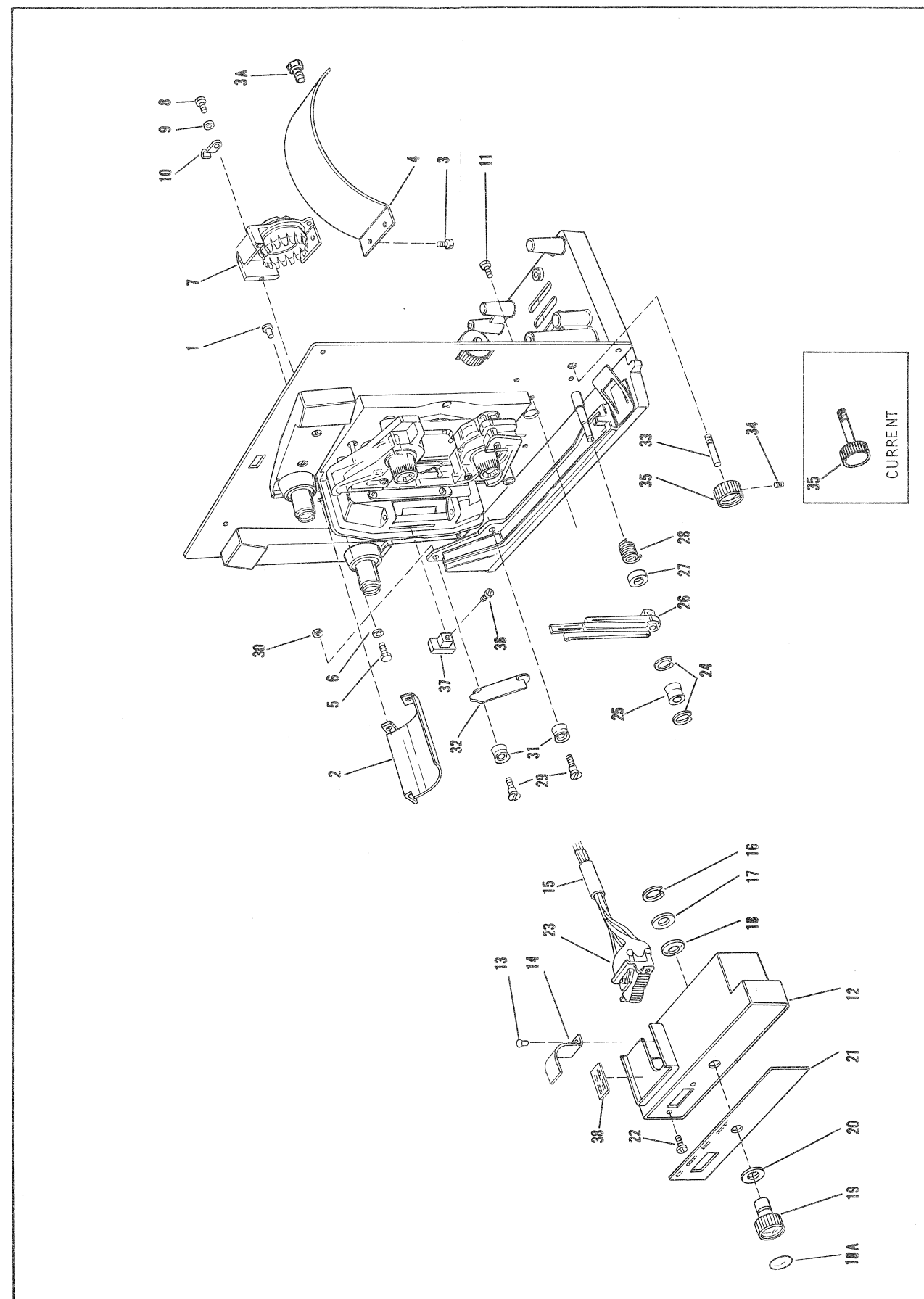


Figure 2. Control Housing and Rollers

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE		
					1	2
REEL ARMS AND GEARS						
3-1	23822	SCREW, Binding head, 5-40 by 0.203 inch	2			
-2	32861	SCREW, Truss head, 3-48 by 0.265 inch	1			
-3	012614	ARM AND BEARING ASSEMBLY, Feed (Light Brown)	1	ACD		
-3	012833	ARM AND BEARING ASSEMBLY, Feed (Walnut)	1	ACD		
-3	012616	ARM AND BEARING ASSEMBLY, Feed (Blue)	1	B		
-3	012883	ARM AND BEARING ASSEMBLY, Feed (Blue-Gray)	1	B		
-4	32979	SPRING, Torque	1			
-5	29726	SPACER, Sleeve	1			
-6	35580	DISC, Friction	2			
-7	35579	GEAR, Spur	1			
-8	29724	WASHER, Spring tension	1			
-9	010272	SPINDLE ASSEMBLY, Film reel	1			
-10	29707	GEAR, Spur	2			
-11	39049	GEAR, Spur	1			
-12	29192	SETSCREW, Fluted socket cup pt, 4-40 by 1/8 inch	1			
-13	35176	GEAR, Spur	1	AB		
-13	39060	GEAR, Spur	1	CD		
-14	010189	GEAR AND SHAFT ASSEMBLY, Feed arm	1			
-15	23822	SCREW, Binding head, 5-40 by 0.203 inch	2			
-16	32861	SCREW, Truss head, 3-48 by 0.265 inch	1			
-17	012615	ARM AND BEARING ASSEMBLY, Take-up (Light Brown)	1	ACD		
-17	012834	ARM AND BEARING ASSEMBLY, Take-up (Walnut)	1	ACD		
-17	012617	ARM AND BEARING ASSEMBLY, Take-up (Blue)	1	B		
-17	012884	ARM AND BEARING ASSEMBLY, Take-up (Blue-Gray)	1	B		
-18	29726	SPACER, Sleeve	1			
-19	35580	DISC, Friction	2			
-20	35579	GEAR, Spur	1			
-21	29724	WASHER, Spring tension	1			
-22	010272	SPINDLE ASSEMBLY, Film reel	1			
-23	29707	GEAR, Spur	2			
-24	29706	GEAR, Spur	1			
-25	29192	SETSCREW, Fluted socket cup pt, 4-40 by 1/8 inch	1			
-26	39056	GEAR, Spur	1			
-27	010190	GEAR AND SHAFT ASSEMBLY, Take-up arm	1			
-28	21736	RING, Retaining (IRRC No. 1000-25)	4			
-29	29706	GEAR, Spur, small	2			
-30	34718	GEAR, Spur, large	2			
-31	31015	WASHER, Spring tension	1			
-32	29744	RING, Retaining, external 0.562 inch ID	2			
-33	34705	BEARING, Reel arm	2			
-34	012605	SUPPORT ASSEMBLY, Feed arm	1			
-35	012402	SUPPORT ASSEMBLY, Take-up arm	1			
-36	80147	SCREW, Binding head, 5-40 by 3/16 inch	1			
-37	010273	PLATE ASSEMBLY, Gear mounting	1			
-38	39099	SPRING, Reel arm tension	2			
-39	29736	WASHER, Cam, feed arm	1			
-40	39228	WASHER, Cam, take-up arm	1			
-41	1261	BALL, Steel	4			

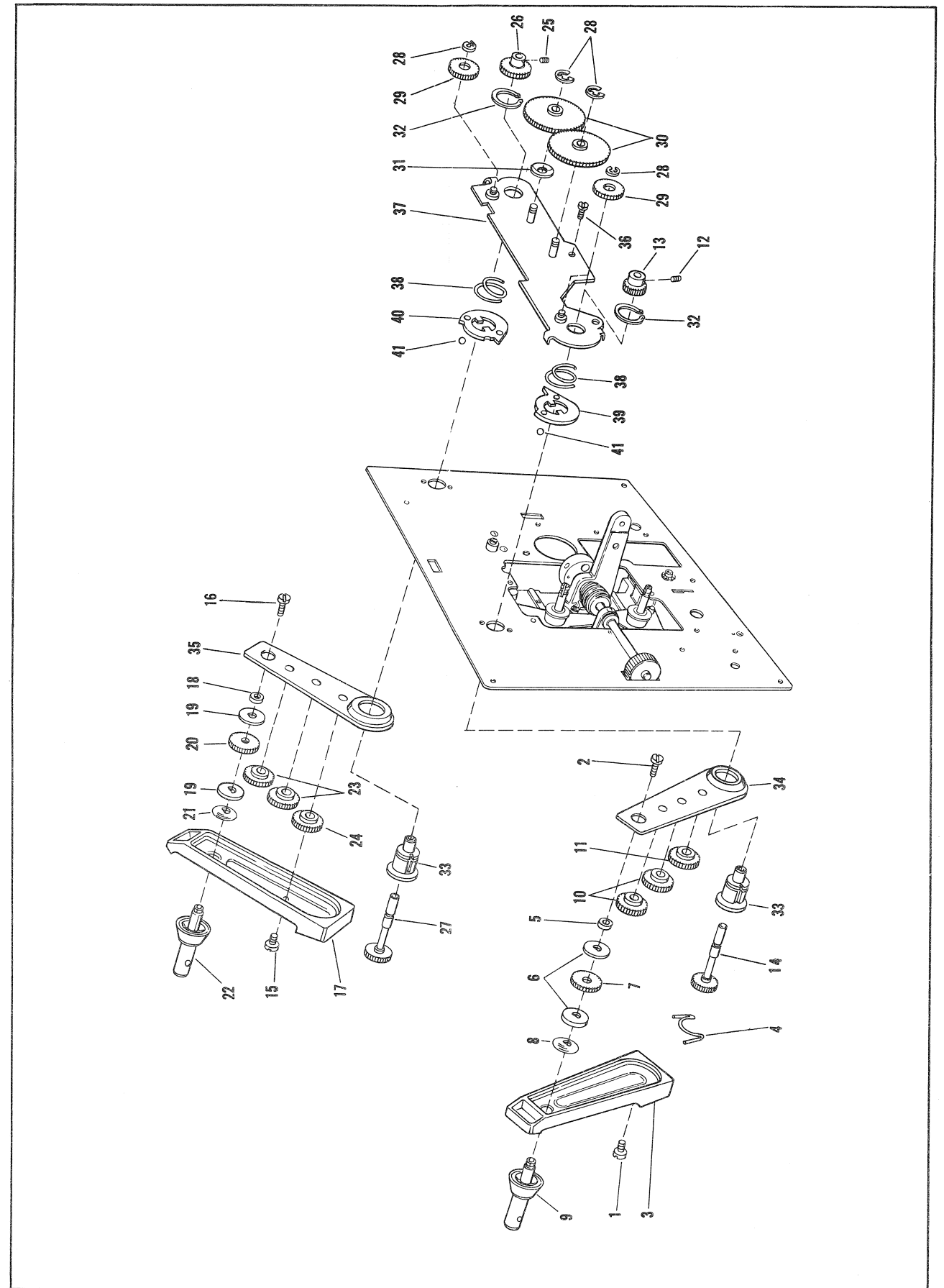


Figure 3. Reel Arms and Gears

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE		
					1	2
LOOPFORMERS, SPROCKETS AND GEARS						
4-1	35181	SPRING, Sprocket gear retaining	2			
-2	30667	WASHER, Friction (lower sprocket only)	1			
-3	35184	RATCHET, Spring	2			
-4	35186	WASHER, Spacer	2			
-5	35177	GEAR, Sprocket, outer	2			
-6	011459	LEVER AND STUD ASSEMBLY, Gear	1			
-7	21736	RING, Retaining (IRRC No. 1000-25)	1			
-8	34718	GEAR, Spur	1			
-9	39005	GEAR, Sprocket, inner	2			
-10	012583	SPROCKET AND SHAFT ASSEMBLY	2			
-11	26085	WASHER, Friction	2			
-12	30612	SCREW, Pin type, 3-48NC	1			
-13	39015	LOOPFORMER, Upper	1			
-13A	43432	NAMEPLATE, "Push"	1	ACD		
-14	39237	ROLLER, Flanged	1			
-15	30613	WASHER, Flat	1			
-16	39383	SCREW, Pan head, 5-40 by 1 inch	1			
-17	010274	BRACKET ASSEMBLY, Upper loopformer	1			
-18	30625	ROLLER, Guide	1			
-19	39383	SCREW, Pan head, 5-40 by 1 inch	1			
-20	39018	BRACKET, Lower loopformer	1			
-21	39028	SCREW, Pin type, 3-48NC	1			
-22	010275	LOOPFORMER ASSEMBLY, Lower	1			
-23	39249	ROLLER, TAPERED	1			
-24	30613	WASHER, Flat	1			
-25	39795	SPRING, Pressure plate retaining	1			
-26	39797	PLATE, Retainer	1			
-27	39798	PLATE, Pressure	1			
-28	26030	PIN, Hinge, lens carrier	2			
-29	010290	CARRIER ASSEMBLY, Lens (Light Brown)	1	ACD		
-29	07881	CARRIER ASSEMBLY, Lens (Walnut)	1	ACD		
-29	010330	CARRIER ASSEMBLY, Lens (Blue)	1	B		
-29	08765	CARRIER ASSEMBLY, Lens (Blue-Gray)	1	B		
-29A	39114	COVER, Focus knob decorative	1	B		
-29B	36947	SCREW, Pan head, 3-48 by 3/16 inch	1	B		
-29C	34784	WASHER, Flat	1	B		
-29D	39113	KNOB, Focus	1	B		
-29E	39121	WASHER, Special	1	B		
-29F	010288	SHAFT ASSEMBLY, Eccentric	1	B		
-29G	39097	SPRING, Tension	1	B		
-29H	39230	O-RING, Rubber	1	B		
-29J	No Number	CARRIER, Lens (order complete carrier assembly)	NP	B		
-30	30621	SCREW, Truss head, 3-48 by 3/16 inch	2			
-31	39796	RAIL, Film guide	1			
-32	28067	SPRING, Side tension	1			
-33	30639	ARM, Side tension	1			
-34	30620	SCREW, Truss head, 3-48 by 1/8 inch	2			
-35	010346	PLATE ASSEMBLY, Aperture	1			
-36	26642	RIVET, Tubular, 0.089 inch diameter	2			
-37	30615	CATCH, Lens carrier	1			
-38	39254	SETSCREW, Fluted socket oval pt, 6-32 by 1/4 inch (Nyloc)	1			
-39	37961	SPRING, Tension, upper	1			
-40	39229	SPRING, Tension, lower	1	B		
-41	39214	NAMEPLATE, Rewind position	1			

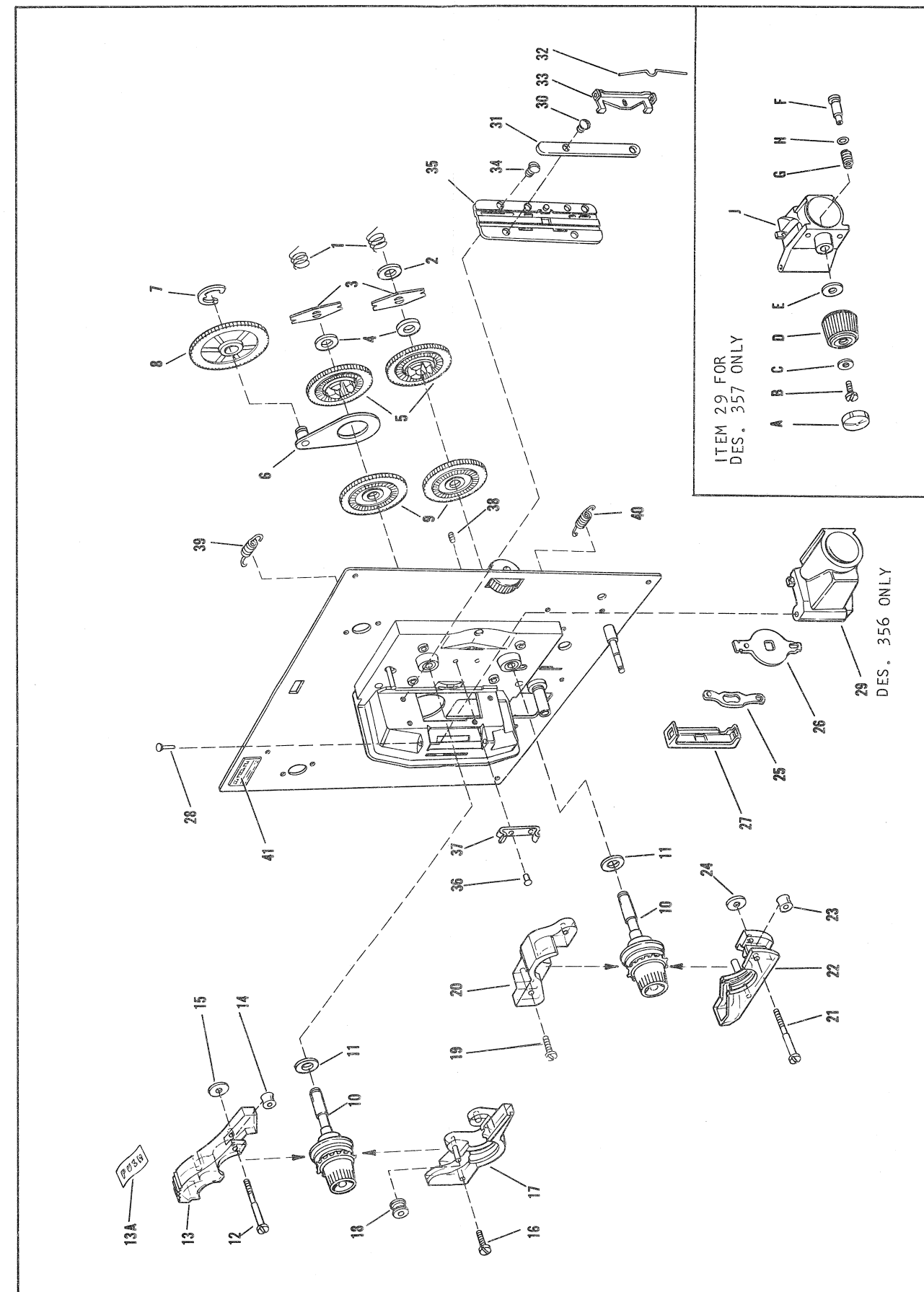


Figure 4. Loopformers, Sprockets and Gears

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
SHUTTER, SHUTTLE AND DRIVE MECHANISM				
5-1	35956	SCREW, Fillister head, 3-48 by 1/8 inch	2	
-2	010181	BRACKET ASSEMBLY, Spring loading (early models) . . .	1	
-2	09167	BRACKET ASSEMBLY, Spring loading (late models) . . .	1	
-3	25715	RING, Retaining, external bowed E, 0.145 inch ID	1	
-4	010278	BRACKET ASSEMBLY, Pulley mounting (early models) . .	1	
-4	012593	BRACKET ASSEMBLY, Pulley mounting (late models) . .	1	
-4A	39245	SPRING, Torsion (late models)	1	
-4B	34878	WASHER, Flat (late models)	1	
-5	27322	RING, Retaining, special	2	
-6	32172	WASHER, Flat	4	
-7	010667	ROLLER ASSEMBLY, Drive	2	
-8	29472	SCREW, Pivot (early models)	1	
-8	39264	SCREW, Pivot (late models)	1	
-9	32169	SPRING, Safety shutter pivot (early models)	1	
-10	34656	SCREW, Round head Sems, 6-32 by 1/4 inch	1	
-11	010348	SHUTTER ASSEMBLY, Safety	1	
-12	30551	SCREW, Fillister head, 3-48 by 1/4 inch	2	
-13	29175	WASHER, Shutter	1	
-14	39020	SHUTTER	1	
-15	39382	CAM, In-Out	1	
-16	26906	NUT AND WASHER, Sems	2	
-17	39011	SCREW, Pivot	1	
-18	39027	WASHER, Spring tension	1	
-19	010363	SHUTTLE AND FRAMING LEVER ASSEMBLY (NOTE A)	1	
-19	09168	SHUTTLE AND FRAMING LEVER ASSEMBLY (NOTE A)	1	
-20	39012	SPACER, Sleeve (NOTE A)	1	
-20	39263	SPACER, Sleeve (NOTE A)	1	
-21	32947	SHOE, Cam, white (NOTE B)	AR	
-21	33712	SHOE, Cam, black (NOTE B)	AR	
-22	39010	STUD, Pivot	1	
-23	36842	SCREW, Pan head, 6-32 by 3/8 inch	1	
-24	17632	WASHER, Flat	1	
-25	39013	BRACKET, Shuttle pivot	1	
-26	80591	SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	2	
-27	40580	CAM, Pull-down	1	
-28	26085	WASHER, Thrust	1	
-29	12498	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	1	
-30	26131	RING, Retaining, crescent external, 0.219 inch ID	1	
-31	80591	SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	
-32	39140	KNOB, Manual, main shaft	1	
-33	33039	SHAFT, Main	1	
-34	39004	PINION, Drive	1	
-35	30667	WASHER, Friction	1	
-36	21736	RING, Retaining, Type E (IRRC No. 1000-25)	1	
-37	39198	SHAFT, Framer	1	
-38	700816	RIVET, Tubular, 0.123 inch diameter	1	B
-39	39172	BUSHING, Flanged	1	B
-40	010366	LEVER ASSEMBLY, Trigger	1	B
-41	83088	WASHER, Flat	1	B
-42	29065	SCREW, Hex head tapping, 4-40 by 1/2 inch (Type 23)	3	
-43	012611	PLATE ASSEMBLY, Main and mechanism	1	ACD
-43	012612	PLATE ASSEMBLY, Main and mechanism	1	B

NOTE A: When the present supply of shuttle assemblies P/N 010363 is exhausted, Bell & Howell will supply shuttle assembly P/N 09168 and matching spacer P/N 39263 as replacements.
 NOTE B: Use any combination of black and/or white cam shoes to obtain proper fit on pull-down cam.

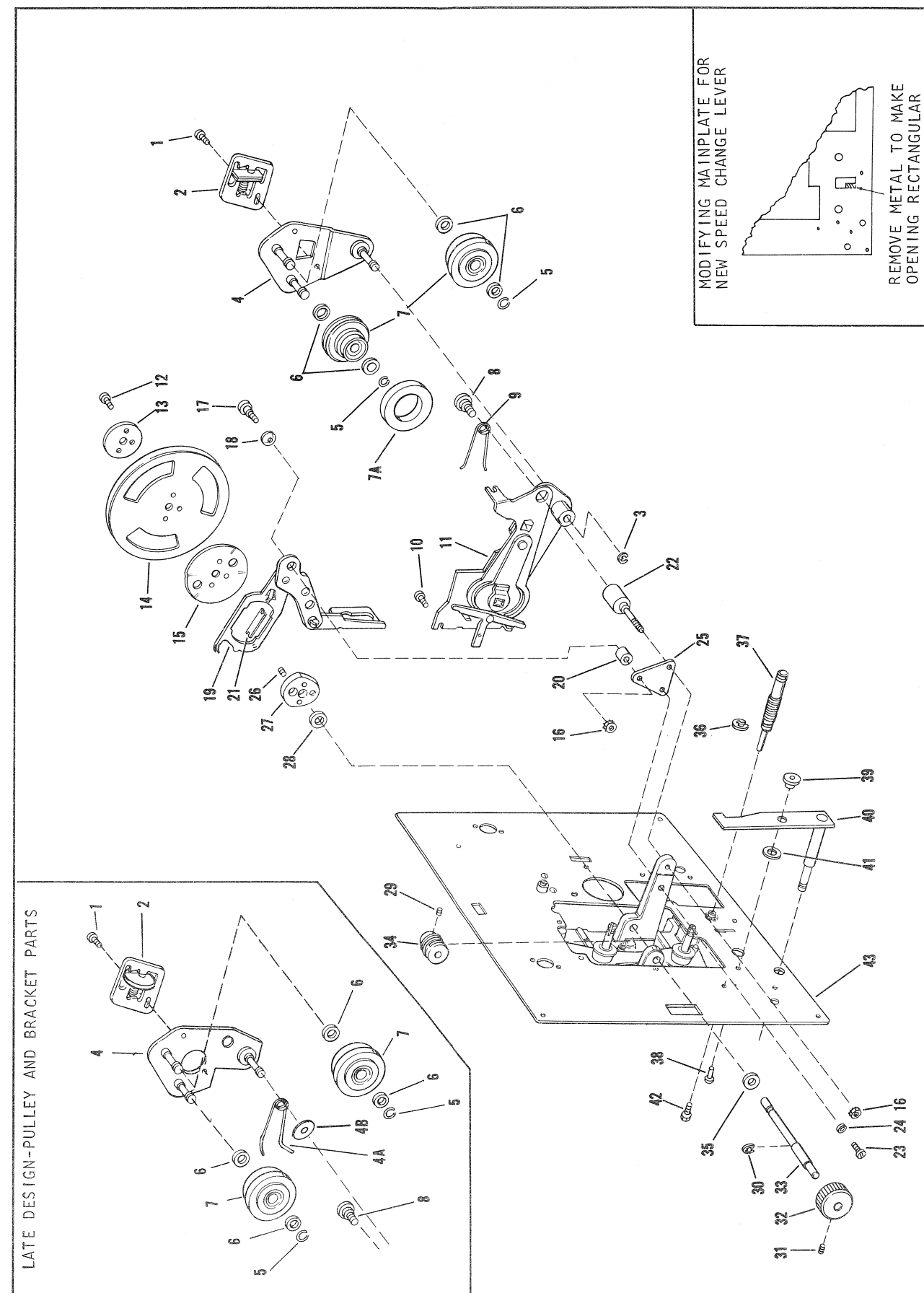


Figure 5. Shutter, Shuttle and Drive Mechanism

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
PROJECTOR BASE AND MOTOR				
6-1	21736	RING, Retaining, Type E (IRRC No. 1000-25)	1	AB
-1	22113	RING, Retaining, 0.219 inch ID (WKI No. 5133-21)	1	CD
-1A	30228	WASHER, Flat	1	B
-2	010187	SHAFT AND FOOT ASSEMBLY, Tilt	1	AB
-2	010367	TILT SHAFT ASSEMBLY	1	CD
-2A	31561	FOOT, Tilt bar	2	CD
-3	28145	SPRING, Tension, tilt shaft	1	B
-4	37885	BELT, Drive	1	AB
-4	32858	BELT, Drive	1	CD
-5	12498	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch (early models)	1	AB
-5	32136	SETSCREW, Round head, 6-32 by 1/4 inch	1	CD
-6	36564	PULLEY, Motor (early models)	1	ABCD
-6	37412	PULLEY, Motor (current models)	1	CD
-7	32974	SETSCREW, Fluted socket cup pt, 8-32 by 1/8 inch	1	CD
-8	32485	FAN, Press-on two blade	1	AB
-8A	39126	FAN, Multi-blade (secured with setscrew, item 7)	1	CD
-8B	43446	INSULATOR, Tubing (current models)	1	AB
-9	700454	SCREW, Pan head Sems, 6-32 by 3/8 inch	3	
-10	39065	INSERT, Mounting	3	
-10A	28718	WASHER, Flat	3	
-11	012607	MOTOR ASSEMBLY (Early models)	1	AB
-11	013635	MOTOR ASSEMBLY (Current models) (NOTE A)	1	AB
-11	39347	MOTOR ASSEMBLY	1	CD
-12	32974	SETSCREW, Fluted socket cup pt, 8-32 by 1/8 inch	1	
-13	013455	FAN AND PULLEY ASSEMBLY (Current models)	1	AB
-13	012873	FAN ASSEMBLY, Blower	1	CD
-14	26906	NUT AND WASHER, Sems 6-32 NC	2	
-14A	17632	WASHER, Flat	2	
-15	32774	SCREW, Round head, 6-32 by 5/8 inch	2	AB
-15	39350	SCREW, Hex head, 6-32 by 5/8 inch	2	CD
-16	39048	BRACKET, Motor mounting, long	1	
-17	39058	BRACKET, Motor mounting, short	1	
-18	39177	GROMMET, Rubber	3	
-19	36882	SCREW, Hex head tapping, 6-32 by 3/8 inch (early models)	1	AB
-19	43324	SCREW, Hex head tapping, 8-32 by 3/8 inch (current models)	1	AB
-20	17632	WASHER, Flat (early models)	1	AB
-20	22659	WASHER, Flat (current models)	1	AB
-21	39185	CLAMP, Leadwire (early models)	1	AB
-21	83286	CLAMP, Leadwire (current models)	1	AB
-22	010368	BASE ASSEMBLY, Projector	1	AB
-22	010369	BASE ASSEMBLY, Projector	1	CD
-22A	39202	RIVET, Tubular, 0.099 inch diameter	2	
-22B	39144	CUTTER, Film	1	
-22C	32652	RIVET, Tubular, 0.123 inch diameter	2	AB
-22C	39222	RIVET, Tubular, 0.123 inch diameter	2	CD
-22D	26135	FOOT, Rubber	2	AB
-22D	39221	FOOT, Rubber	2	CD
-23	39349	SCREW, Transformer mounting	3	CD
-24	700733	WASHER, Lock	3	CD
-25	012805	TRANSFORMER, 50-60 cycles	1	CD

NOTE A: Current model motors P/N 013635 are aluminum and are equipped with terminals for the connection of leadwires

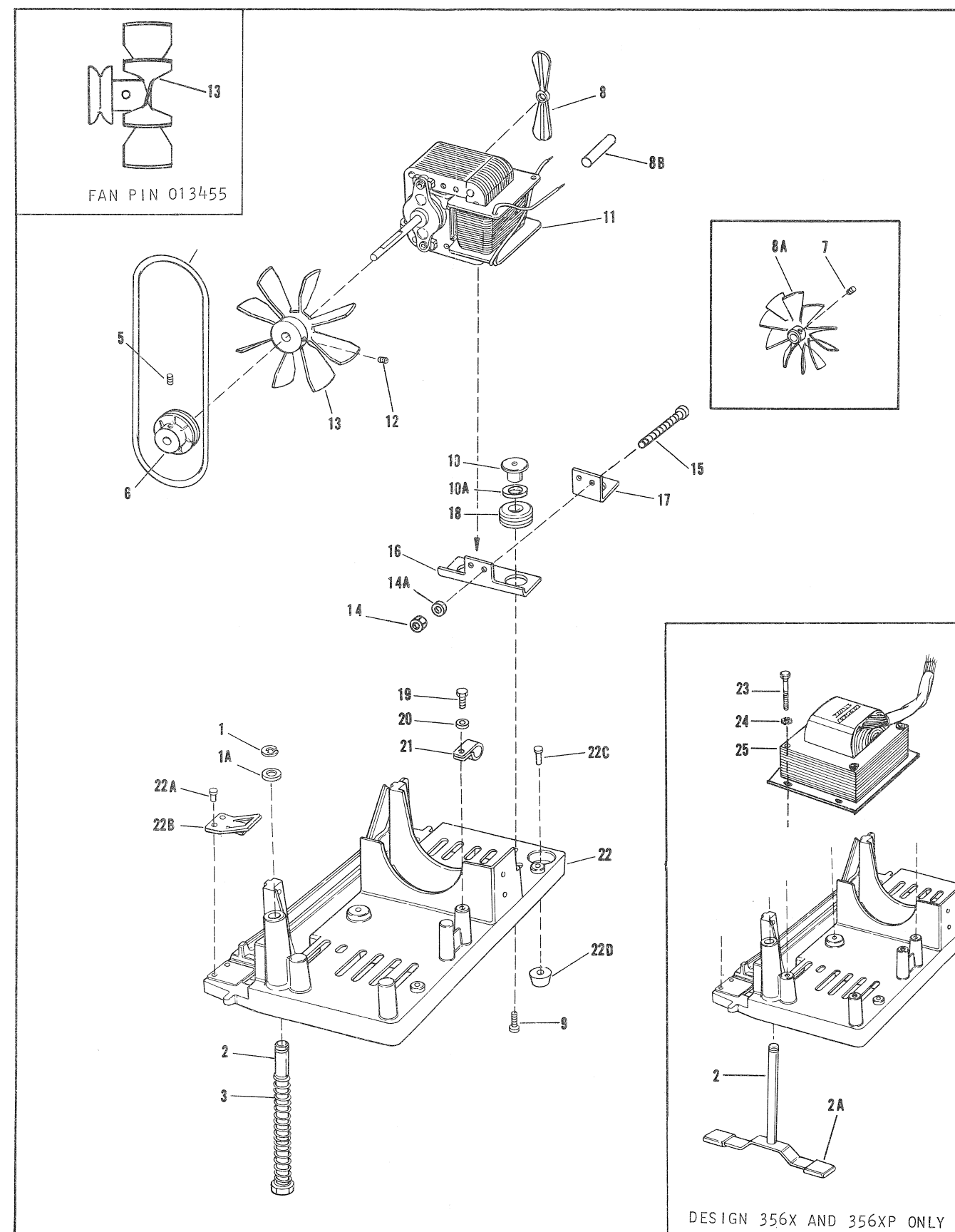
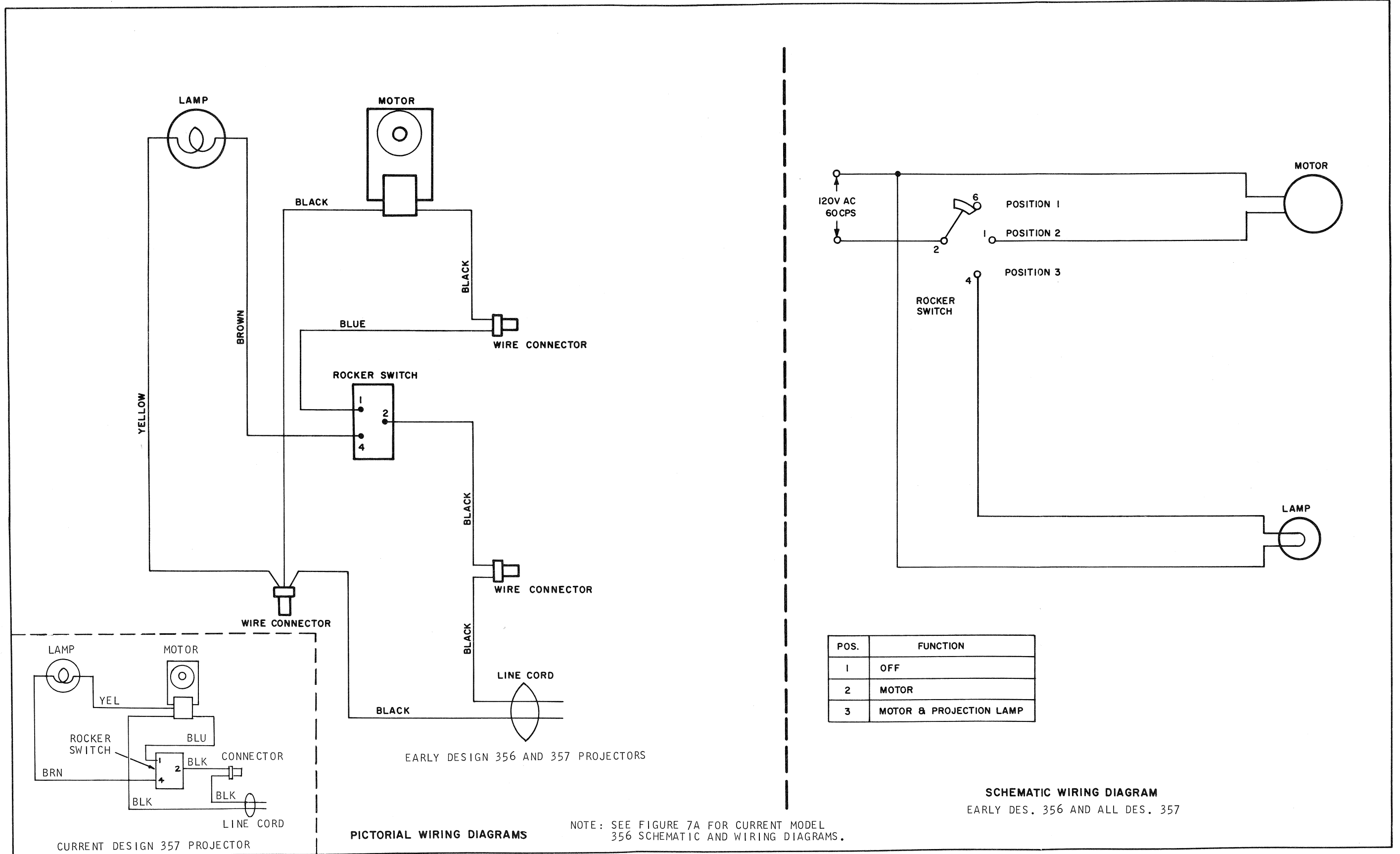


Figure 6. Projector Base and Motor



POS.	FUNCTION
1	OFF
2	MOTOR
3	MOTOR & PROJECTION LAMP

SCHEMATIC WIRING DIAGRAM
EARLY DES. 356 AND ALL DES. 357

NOTE: SEE FIGURE 7A FOR CURRENT MODEL 356 SCHEMATIC AND WIRING DIAGRAMS.

Figure 7. Projector Wiring Diagrams

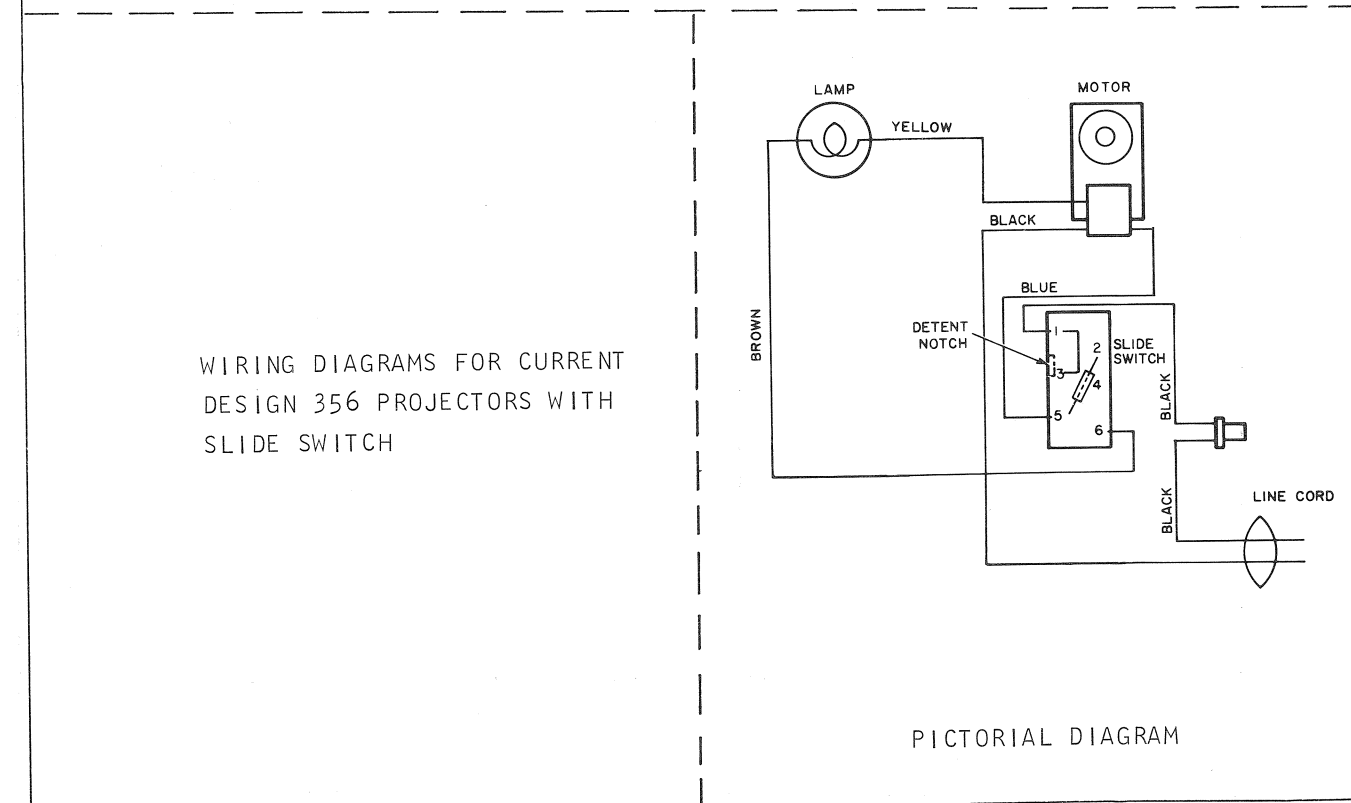
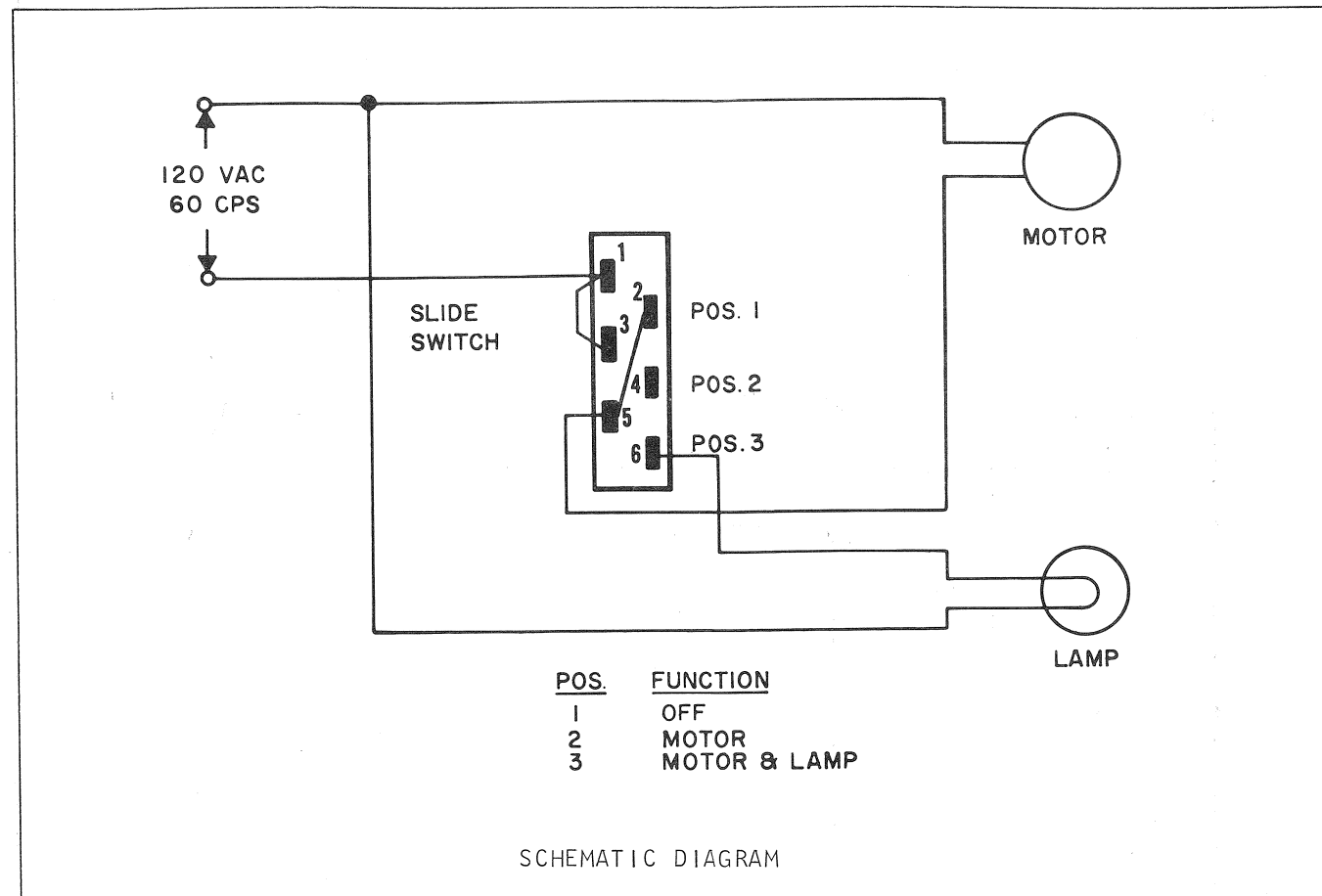


Figure 7A. Wiring Diagrams for Current Design 356 Projector

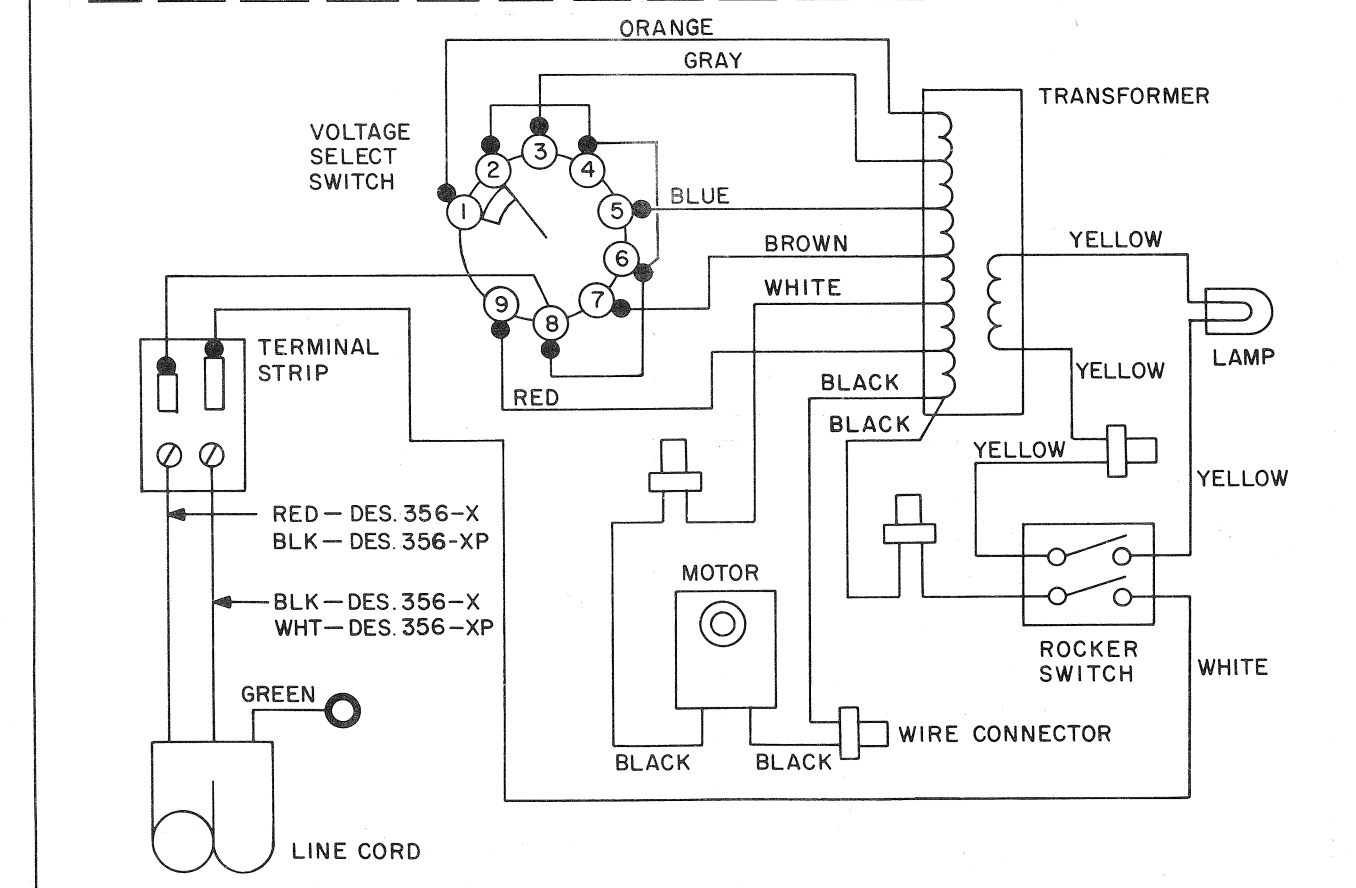
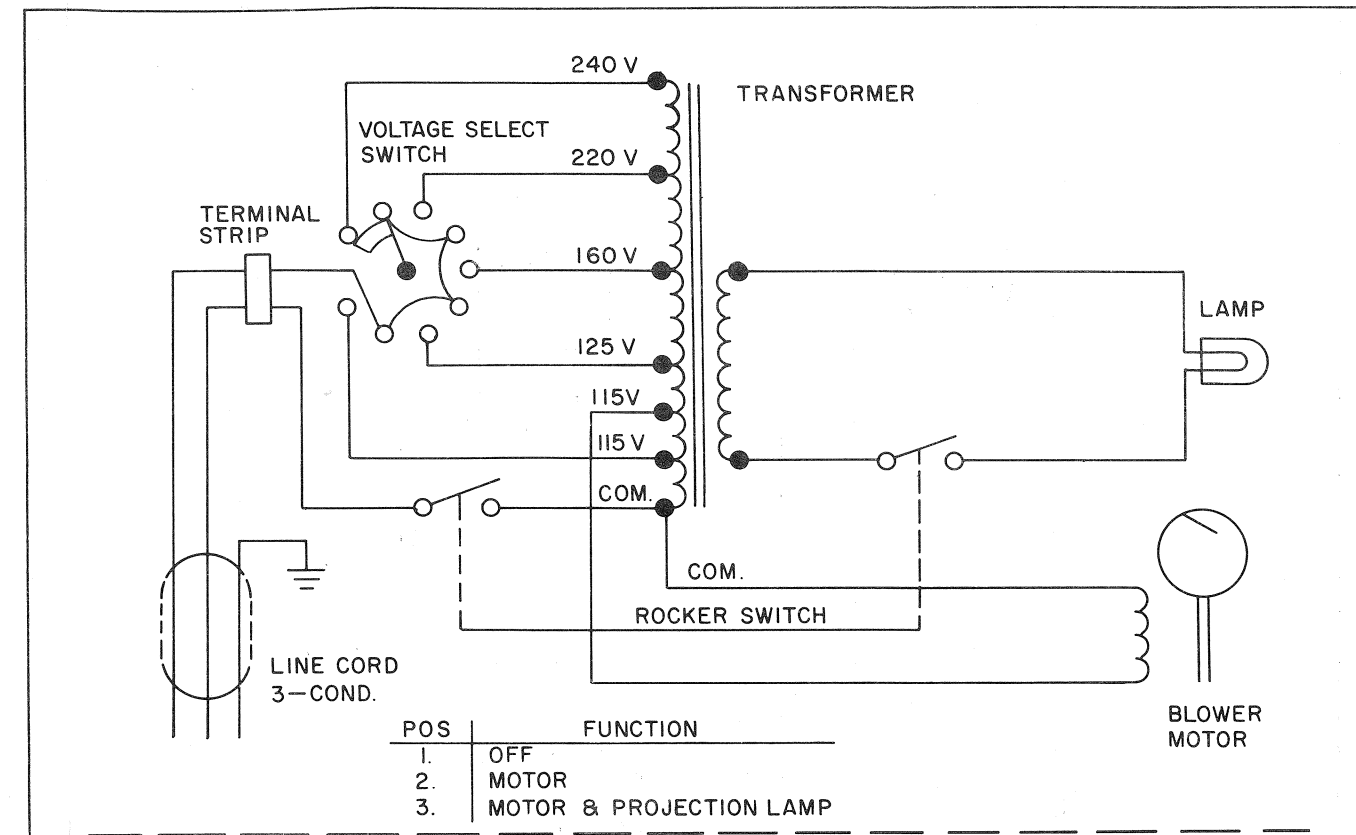


Figure 8. Schematic and Wiring Diagrams for 356X and 356XP.

NUMERICAL INDEX OF PARTS

PART NUMBER	FIG. & INDEX NO.	PART NUMBER	FIG. & INDEX NO.	PART NUMBER	FIG. & INDEX NO.	PART NUMBER	FIG. & INDEX NO.	PART NUMBER	FIG. & INDEX NO.	PART NUMBER	FIG. & INDEX NO.
07846	1-1	012804	2-23	30613	4-15, 4-24	37932	1-3	39178	1-18	39401	1-4G
07881	4-29	012806	1-4A	30615	4-37	37947	2-3	39179	1-18	39402	1-4E
07920	1-14	012810	1-5	30620	4-34	37961	4-39	39182	2-15	39795	4-25
07922	1-4	012833	3-3	30621	4-30	39004	5-34	39185	6-21	39796	4-31
07923	1-4	012834	3-17	30625	4-18	39005	4-9	39188	1-14B	39797	4-26
08763	1-14	012873	6-13	30639	4-33	39010	5-22	39189	1-14C	39798	4-27
08764	1-1	012883	3-3	30667	4-2, 5-35	39011	5-17	39190	1-14A	40562	1-4
08765	4-29	012884	3-17	31015	3-31	39012	5-20	39198	5-37	40563	1-14E
08868	1-4B	013455	6-13	31561	6-2A	39013	5-25	39200	1-7	40580	5-27
08969	1-4	013635	6-11	32136	6-5	39015	4-13	39202	6-22A	40591	1-15
09167	5-2	013636	2-23	32169	5-9	39018	4-20	39204	1-9	42967	2-20
09168	5-19	013638	2-23	32172	5-6	39020	5-14	39206	1-4F	43324	6-19
09543	1-14	013641	1-5	32361	1-1C	39027	5-18	39207	1-4D	43425	2-21
010000	1-1	013642	2-35	32478	2-2	39028	4-21	39214	4-41	43432	4-13A
010018	1-1	12498	5-29, 6-5	32485	6-8	39048	6-16	39220	1-4G	43446	6-8B
010021	1-4B	1261	3-41	32652	6-22C	39049	3-11	39221	6-22D	43451	2-19
010062	3-9, 3-22	17632	2-6, 2-9,	32774	6-15	39052	2-26	39222	6-22C	43453	2-16
010151	1-4		5-24, 6-14A,	32858	6-4	39056	3-26	39223	2-30	43454	2-18A
010153	1-14		6-20	32861	3-2, 3-16	39058	6-17	39225	2-38	80147	3-36
010154	1-14	19025	2-1	32926	2-36	39060	3-13	39226	2-15	80591	5-26, 5-31
010181	5-2	20808	2-24	32947	5-21	39065	6-10	39228	3-40	83088	5-41
010187	6-2	21736	3-28, 4-7,	32974	6-7, 6-12	39073	1-13	39229	4-40	83286	2-10, 6-21
010189	3-14		5-36, 6-1	32979	3-4	39074	1-12	39230	4-29H	301391	1-4L
010190	3-27	22113	6-1	33039	5-33	39087	2-25	39235	2-4	309761	1-6
010270	2-7	22659	6-20	33712	5-21	39089	2-29	39237	4-14	700454	6-9
010271	2-7	23822	3-1, 3-15	33931	2-17	39097	4-29G	39239	2-14	700733	6-24
010273	3-37	25699	1-4B	34539	2-16	39098	2-28	39245	5-4A, 5-8	700816	5-38
010274	4-17	25715	5-3	34590	2-22	39099	3-38	39248	2-31	706546	2-13
010275	4-22	26030	4-28	34656	5-10	39100	1-16	39249	4-23	706679	1-4F, 2-5,
010278	5-4	26085	4-11, 5-28	34705	3-33	39102	1-17	39252	1-1B		2-11
012805	6-25	26131	5-30	34718	3-30, 4-8	39104	2-21	39254	4-38	706695	1-5A
010288	4-29F	26135	6-22D	34784	4-29C	39105	1-17	39263	5-20		
010290	4-29	26310	1-4C	34878	5-4B	39106	2-21	39279	1-1E		
010330	4-29	26642	4-36	35176	3-13	39109	1-1D	39284	2-12		
010346	4-35	26906	1-4J, 5-16,	35177	4-5	39113	4-29D	39285	1-4E		
010348	5-11		6-14	35181	4-1	39114	4-29A	39286	1-4E		
010363	5-19	27322	5-5	35184	4-3	39118	2-37	39314	2-12		
010366	5-40	28067	4-32	35186	1-10, 4-4	39121	4-29E	39316	1-14E		
010367	6-2	28145	6-3	35348	2-20	39124	1-8	39321	1-1E		
010368	6-22	28718	6-10A	35349	2-18	39125	2-33				
010369	6-22	29065	1-2, 5-42	35360	1-14D	39126	6-8A				
010667	5-7	29175	5-13	35579	3-7, 3-20	39129	1-11	39327	1-4H		
011459	4-6	29192	3-12, 3-25	35580	3-6, 3-19	39140	5-32	39335	2-38		
012402	3-35	29472	5-8	35956	5-1	39143	2-32	39336	1-4K		
012583	4-10	29706	3-24, 3-29	36564	6-6	39144	6-22B	39337	1-6		
012588	2-23	29707	3-10, 3-23	36714	2-35	39157	2-12	39338	1-4M		
012593	5-4	29724	3-8, 3-21	36740	2-19	39158	2-12	39342	1-14B		
012605	3-34	29726	3-5, 3-18	36769	2-34	39160	1-14E	39343	1-4D		
012607	6-11	29736	3-39	36842	5-23	39161	1-14E	39346	1-4E		
012611	5-43	29744	3-32	36844	1-4H	39165	1-4	39347	6-11		
012612	5-43	30226	1-1A, 1-4A,	36879	1-2	39166	1-4H	39349	6-23		
012614	3-3		1-4E	36882	2-8, 6-19	39168	1-1E	39350	6-15		
012615	3-17	30228	6-1A	36947	4-29B	39169	1-1E	39351	1-4C		
012616	3-3	30237	2-3A	37407	1-15	39172	5-39	39382	5-15		
012617	3-17	30551	5-12	37412	6-6	39173	2-27	39383	4-16, 4-19		
012803	1-5	30612	4-12	37885	6-4	39177	6-18	39396	1-4D		