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SERVICE INSTRUCTIONS

AUTOLOAD®
FILMOSOUND® 16mm PROJECTOR
(AUTOMATIC THREADING)

MODELS

1585C/CH	1590C/CS
1585CH/CHS	1592C/CS
1585ML/MLS	1592CH/CHS

BELL & HOWELL

INTERNATIONAL SERVICE DEPT.

PART NO. 74404

MAY 1978

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RECOMMENDED SPARE PARTS LIST FOR

AUTOLOAD® FILMOSOUND® 16MM PROJECTOR MODEL 1592C

REFERENCE: SERVICE MANUAL NO. 74404 MAY 1978

THE FOLLOWING IS A RECOMMENDED SPARE PARTS LIST FOR REPAIR OF 50 PROJECTORS.

PART NO.	DESCRIPTION	QTY
17639	Ring, Retaining	12
21736	Ring, Retaining	12
24047	Belt, Take-up	12
30166	Screw, Binding head	24
30811	Screw, Hex washer head	12
31011	Bearing	6
31135	Spring	12
31237	Washer, Nylon	12
31239	Gear, Spur	12
31241	Clip, Retaining	12
31245	Ring, Retaining	12
31557	Shuttle	5
31561	Foot, Rubber	5
33385	Gear, Spur.	6
34766	Bar, Tilt	1
34878	Washer	12
34884	Lamp, Exciter	12
34889	Screw, Binding head	12
35814	Guard, Sprocket	5
35830	Spring	12
35846	Guide, Upper arm	3
35850	Guide, Lower arm	3
36013	Wiper, Felt	12
36014	Wick, Cam	12
36015	Spring	12
36018	Spring, Leaf	12
36038	Spring	12
36047	Follower, Cam	12
36064	Rail, Film guide	3
36065	Shaft, Cam	2
36083	Ring, Retaining	12
36769	Setscrew	24
36771	Setscrew	24
36999	Guard, Sprocket.	3
37293	Rail, Film tension	3
37302	Pawl, Locking	3
37302	Shaft, Locking pawl	2
41307	Cam, Pull down	3
44312	Key, Gear retaining	12
44370	Gear, Spur	3
44371	Gear, Spur	3

PART NO.	DESCRIPTION	QTY
44459	Belt, Drive	6
45682	Cover, Rear arm	2
45692	Capacitor, Start.	3
47431	Lamp, Projector (EKS-EMM).	12
49532	Shaft, Rear reel arm	3
49696	Cover, Front arm.	2
49945	Switch, Rotary	2
308638	Fuse	6
707073	Knob, Control	2
707110	Gear	3
707112	Gear, Clutch	3
707211	Spring, Tension	6
707281	Capacitor	2
707747	Speaker	2
708246	Screw, Hex washer head	12
765777	Ring, Retaining	12
99828	Ring, Retaining	12
09712	Bearing Assembly, Support.	2
09807	Knob, Tilt	2
09828	Contact Assembly, Exciter lamp	2
011214	Shaft and Link Assembly	2
011221	Lever and Pivot Assembly	2
011235	Bearing and Arm Assembly.	2
011236	In-Out Bracket Assembly	2
012132	Plate Assembly, Aperture	1
012133	Plate Assembly, Kick.	2
012134	Hub and Bracket Assembly	2
013946	Sprocket Assembly	2
014536	Sprocket Assembly, Upper	2
014558	Solenoid Assembly	1
014573	Switch Assembly, Animated	2
014575	Lampholder Assembly	2
014947	Gear and Bearing Assembly.	3
014949	Clutch Assembly, Take-up	3
015569	Photocell and Lite Pipe Assembly	1
015573	Motor Assembly.	1
015919	Clutch Assembly, Rewind.	3
016394	Clutch and Bearing Assembly.	3
016495	Motor	1
016530	P.C.B. Amplifier Assembly	2

Introduction

GENERAL.

This Service Manual has been prepared to assist in the repair and adjustment of Bell & Howell Company Automatic Threading 16mm Sound Projectors, Models 1585, 1590 and 1592. Design specifications are listed in the Feature Description List on the preceding page. An illustrated Parts Catalog is included at the rear of the manual to identify replacement parts and to aid the serviceman in the disassembly and reassembly of the projector.

DESCRIPTION.

With the exception of the 1585ML and MLS, all projectors covered in these instructions are "C" versions of the basic projector models (1585C, 1590C and 1592C). The additional suffix letters are used to identify variations of the basic models, as follows.

The suffix letter "S" signifies a basic "C" or ML model equipped with a front cover and speaker assembly (Parts Catalog Figure 15) rather than the standard front cover (Parts Catalog Figure 1, item 1).

The suffix letter H signifies a basic "C" model wired for 50/60Hz operation rather than 60Hz only.

The Models 1585ML and MLS are militarized versions of the 1585CH and CHS and also are designed for 50/60Hz operation.

Except for the above variations, the CS, CH, CHS, ML and MLS versions are identical with the basic "C" models and almost all components are interchangeable. The most notable physical difference in the 1585 models are the ML and MLS projectors, the top covers of which are provided with two five amp Slo-blo fuses. Part number differences between models are indicated by the use of code letters in the "Usable on Code" column of the parts lists. The coding system is explained on page 2 of the Parts Catalog. All models are equipped with a 15-watt amplifier.

Only the 1592 models are equipped with the "still" picture control and animation feature. The step-by-step motion is accomplished by placing the "Run-Still" control knob in the "Still" position and the "Motor-Lamp" switch in either the "Forward-Lamp" or "Reverse-Lamp" position; then depressing the animation lever at the top of the mechanism housing. The film will advance frame by frame each time the lever is depressed and released. If the lever is held down, the frames will continue to advance in sequence (for the animation effect) until the lever is released.

These 16mm sound projectors are completely gear driven, with shifting from forward to rewind accomplished by means of a rocker plate/idler gear arrangement. The autoload system consists of a series of guides, loopformers and rollers which, when the system is in the "load" position (closed), will guide the film through the threading path to the film take-up reel. When the system is in the "open" position, the guides and rollers clear the film path.

The upper and lower guides are connected by a mechanical linkage with a locking lever at the lower end to actuate (close) the system. A film escape mechanism is included at the upper end of the linkage to prevent damage to the film due to jamming. When a film jam occurs, the film will fold and flow out through the kickplate of the escape mechanism until the operator has had an opportunity to stop the projector.

SPECIAL MAINTENANCE PRECAUTIONS.

The removal and installation of most projector parts can be accomplished with tools normally available in photo equipment repair shops. A pencil-type soldering gun should be available for electrical repairs, and the Bristol wrenches listed in the following chart will also be required. Special tools and gages necessary for projector alignments and adjustments are illustrated and listed in Figure A and its accompanying chart.

BRISTOL SETSCREW WRENCHES REQUIRED FOR MAINTENANCE

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

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

CLEANING.

All film path areas must be kept free from emulsion build-up, or film jamming will take place during the automatic threading operation. Use Toluol, and/or an orange stick to remove emulsion from

the film path areas, being careful not to scratch the surfaces. Pay particular attention to the film path parts of the soundhead cover and soundhead.

Do not use trichloroethylene solvents to clean plastic parts. Use a naphtha base cleaning fluid and be sure that grease is NOT wiped off critical areas of lubrication. Do not use solvents on these critical areas, especially in the auto-threading linkage, since lubrication is applied during assembly and it would be difficult to replace without disassembling the linkage. Use a soft lint free cloth when necessary to remove any accumulation of dust or film chips.

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

LUBRICATION.

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

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

DRIVE BELT REPLACEMENT

Because of the compactness of design of these projectors, the drive belt is not easily accessible for replacement. To avoid extensive disassembly at the rear of the projector, the following procedure is recommended. Refer to Parts Catalog Figure 2.

a. Remove the rear cover (item 7, Figure 1) to expose the drive belt and associated components. Manually run the drive belt off of the large mechanism pulley and pull the free end of the belt from the belt shifter loop.

b. Remove the tie strips from around the wiring at both ends of the motor.

c. Loosen the screws in both motor bracket straps (28, Figure 3) and lift off the straps and stabilizer bracket (29) as a group.

d. Raise the motor just enough to permit the belt to be passed beneath the motor toward the transformer. Be very careful not to lift the motor so high as to damage the blower fan at the end of the motor shaft.

e. Disconnect the push-on connectors which connect the motor leads to the starting capacitor (item 7C, Figure 2) and remove the crimp-type solderless connector which joins the grey-yellow motor lead to the three white leads. The belt can now be removed from the projector.

f. Install the new belt by reversing the above order of removal. Replace the crimp-type solderless connector with a screw-on type connector and, when securing the motor with the motor bracket straps, make sure that the motor grounding strap (left end of motor) bears on the motor mounting bracket (28, Figure 3).

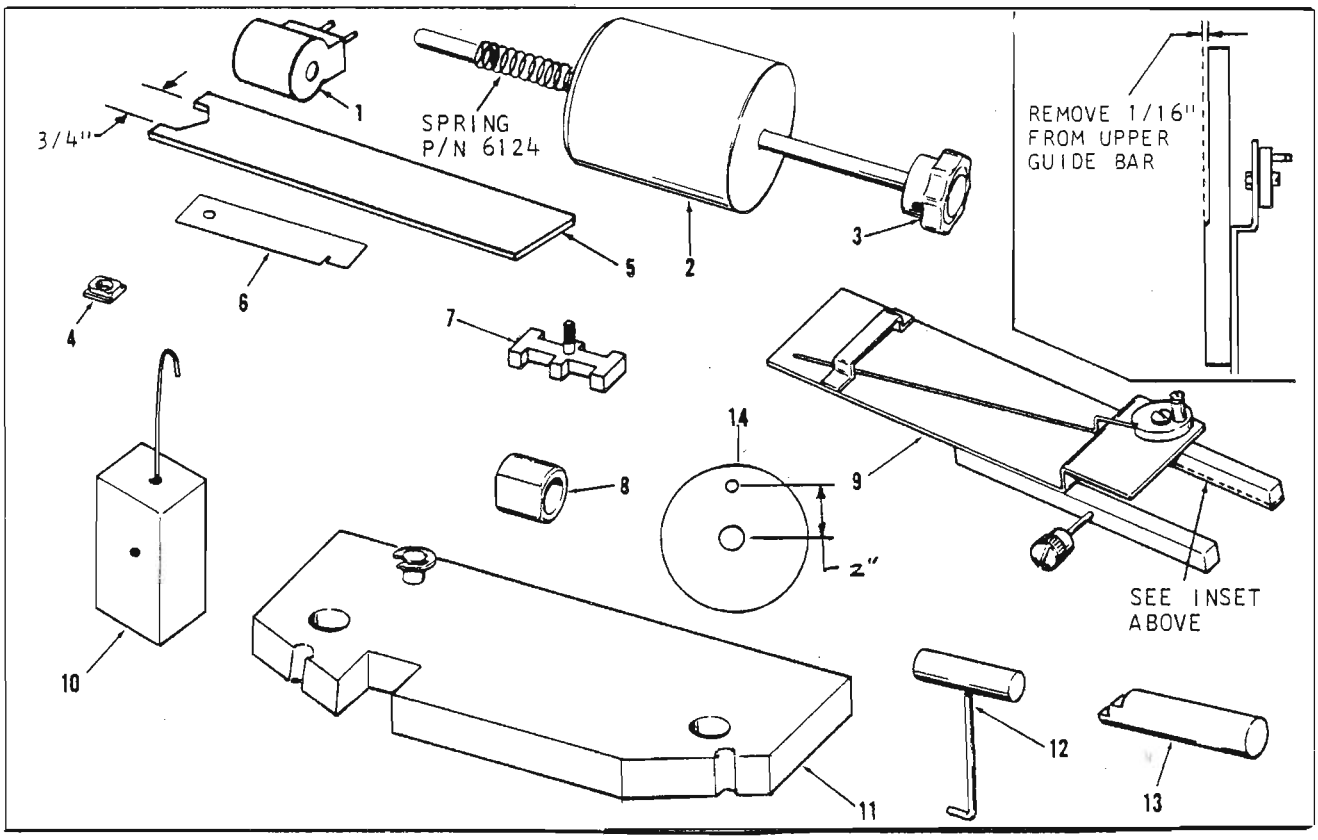
LUBRICATION CHART

Parts to be Lubricated	Lubricant
Machined surfaces (non-bearing) of all castings	Oil (P/N 070003)
Sprocket shafts (17 and 19, Figure 10)	Oil (P/N 08963)
Framer shaft (26, Figure 12) and bearing face of worm gear (24, Figure 13)	Oil (P/N 04978)
Felt oil pads in cams, and sliding parts (friction surfaces) not otherwise specified	Oil (P/N 070032)

The worm gear teeth and sprocket gear teeth are to be lubricated with special grease P/N The following items are to be lubricated with general purpose grease P/N 070034: All other gear and pinion teeth; all bearings and pivot posts; reel arm lock buttons; all shafts; cam wiper and wick. Specific instructions are noted in the reassembly section.

TEST FILM CHART

TFL-55-NX1	Centering and framing loop
TFL-37-NX1	Buzz track loop
TFL-26-NX3	7KHz azimuth loop
TFL-23-NX1	400Hz power output loop
TFR-D550-NX5	Audio-Center-Framing roll
TFS-D550-NX1	Loop restorer strip (bad holes)
TFS-D550-NX5	Loop restorer strip (elongated holes)



INDEX NO.	TOOL NO.	TOOL NAME	USE
1	S-1552-1-N1	Lamp Plug	
2	S-550-2-N1	Lens Plug	
3	S-550-2-N2	Alignment Rod	Alignment of optical system (Figure E).
4	S-550-2-N3	Aperture Plug	
5	Make in Shop	Torque Wrench	Adjust rewind torque (check torque with Chatillon #LP-72 (0 to 72 oz.) push-pull scale, Master Gauge Co., Chicago 60622)
6	S-550-5-N2	Sttoke Gage	Measure shuttle stroke (Figure F)
7	S-09701-35N2	Shuttle Height Gage	Check shuttle protrusion (Figure G)
8	S-552-2-N1	Restorer Positioning Tool	Adjusting the loop restorer (Figure R)
9	S-552-4-N1	Shuttle Tension Gage	Adjusting shuttle tension (Figure H)
10	S-552-4-N2	Weight for Shuttle Tension Gage	Adjusting shuttle tension (Figure H)
11	S-552-1-N1	Timing and Alignment Plate	Timing the sprockets (Figure R)
12	S-552-5-N1	Soundhead Locating Gage	Positioning the soundhead (Figure M)
13	S-550-8-N1	Alignment Tool	Aligning sound drum and photocell (Figure L)
	S-550-5-N1	Shuttle Stroke Target	Measuring shuttle stroke (Figure J)
14	Shop made	Rewind torque reel (use P/N 014570)	Torque adjustments
--	Purchase	Push-Pull Scale (chatillon #LP-72 (Master Gage C0, Chicago 60622	Torque adjustments

Figure A. Special Service Tools

Disassembly Procedure

1. GENERAL PRECAUTIONS.

a. Be sure to use the proper size tools for disassembly and reassembly procedures. After removing attaching parts (screws, nuts, etc.), loosely reinstall these parts to the removed part or tapped holes to prevent loss.

b. Cemented or adhesive backed parts are so noted in the parts lists and can be removed by prying up one edge with a knife blade. Be careful not to scratch surrounding areas, and remove traces of old adhesive with solvent.

c. When unsoldering is required to remove electrical parts, it is advisable to tag leadwires or make a rough sketch of leadwire connections to facilitate installation of the parts. Unsolder leads with a pencil type soldering gun, using a heat sink if available, or gripping the lead with a pliers to provide additional heat dissipation.

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

2. REMOVAL OF COVERS (Figure 1). Remove the parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

NOTE: The CS, CHS and MLS models are equipped with a front cover and speaker assembly (Parts Catalog Figure 15) rather than the standard front cover (item 1, Parts Catalog Figure 1).

a. Unlatch and remove the front cover assembly (1). If latches are to be replaced, the rivets (1B) must be carefully drilled out.

b. The rear cover (7) is secured by seven screws (6) and (6A), three along the bottom edge and two at each side. Use a thin-wall socket wrench to remove these screws, grinding it down if necessary, so that it can fully engage the screw heads.

c. Remove two screws (8) near the top of the mainplate to free top cover assembly (9). Remove the four screws (9A) and disassemble the carrying handle (9B) and brackets (9C) from the cover.

NOTE: The 1585ML and MLS are equipped with two additional fuses (9D) which are mounted in the top cover assembly.

d. Remove three screws (11) and (12) and disassemble the lamphouse assembly (13) from the mainplate. The lower screw also attaches the air deflector (14). The Still/Run knob (13F) is used only on the 1592 models. The lower end of the still-run lever engages the pin on the crank lever (item 11A, Figure 2).

3. REMOVAL OF END CAPS AND LAMP (Figure 2). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Loosen the setscrew (1) and disassemble the tilt knob assembly (2) from the tilt shaft.

b. Replacement of the speaker (6B), starting capacitor (7C) and receptacle (7F) can be accomplished without disassembling the end caps (6) and (7) from the projector. However, if the end caps are damaged and in need of replacement, proceed as follows: Tilt the projector so that the four screws (3) and one spacer (3A) which secure the end caps (6) and (7) to the base can be removed. Then set the projector upright and remove the remaining four screws (4) which are inserted through the front side of the mainplate. Be careful not to lose the speed nuts (5) assembled to the mounting bosses of the end caps.

c. The 1592 models use a single knob (11) for "Fwd-Rev-Lamp" control plus a crank lever (11A) to provide for the "Still/Run" control operation.

d. To remove the projection lamp (12), press down the lamp retaining spring and pull the lamp straight out from its socket. Do not rock or twist the lamp during removal, or the lamp pins may be damaged. The lamp shield (14) and lampholder (15) are secured to the mainplate with two screws (13).

4. REMOVAL OF ELECTRICAL PARTS (Figure 3). Before removing electrical components, note the manner in which the leadwires are routed and tied. The pictorial wiring diagrams at the rear of the Parts Catalog will assist in the proper reconnection of leadwires.

a. <u>1585 and 1592 Models Only.</u> If only the power transformer (4) is to be replaced, remove the two hex nuts (1), screws (2) and lockwashers (3) at the upper ends of the brackets (7) and (8). Export models also require spacers (3A) which are located between the bracket (8), brace (8A) and transformer. If the lamp transformer (10E) is to be replaced, the entire transformer group (items 1 through 10) must be removed from the base. In order to gain access to the two screws (9A), the amplifier cover (item 16, Figure 6) must also be removed.

b. 1590 Models Only. These projectors are equipped with only a power transformer (14) which is secured to the base with four screws (13). The mounting brackets (14C) and (14D) can be replaced by drilling out the rivets (14A). However, if the transformer itself is faulty, replace the complete transformer and bracket assembly (14).

c. The drive motor and blower components must be removed as a unit to permit belt replacement or motor and blower repairs. This is accomplished by removing the four motor mounting screws (15) and the four blower housing screws (16). If the drive belt (23) is in need of replacement, it can be cut with a sharp knife. If the belt is in good condition, slip it edgewise down between the mechanism pulley and the casting. Lift the assembled motor and blower from the base. Remove three screws (17) and disassemble the fan housing (19) from the housing cover (22). Loosen the setscrew (20) and disassemble the fan and hub assembly (21) and cover (22) from the motor shaft.

d. Loosen the screws in the top ears of the motor clamps (28) and disassemble the clamps and mounting brackets (30) from the motor end bells. Note the difference in motor clamp brackets (29) as used in earlier models and in the more current designs, as well as the addition of the coil-like thermal fuse (29A).

e. 1592 Models Only. Remove the two screws (33) and disassemble the animation switch and bracket assembly (34) and rotary switch and bracket assembly (35) from the projector mainplate. Disassemble as necessary, for repair or parts replacement.

f. 1585 and 1590 Models Only. Remove the nut (36), lockwasher (37) and rotary switch (38) from the mainplate. Remove the screw (40) and the fuseholder (41).

5. REMOVAL OF GEARS, REEL ARMS AND SOUNDHEAD (Figure 4). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. To remove the rear reel arm assembly (29) for repair or replacement, disassemble the retaining ring (1), washer (3), spur gear (4) and a second retaining ring (1) from the end of the reel arm shaft. Note the manner in which the reel arm disc (27) is positioned before disassembling the screws (26) and disc (27) from the mainplate; then carefully withdraw the reel arm assembly, catching the lock button (30) and spring (31) as they pop free.

b. To remove the front reel arm assembly (28) for repair or replacement, disassemble the gear and clutch parts (15) through (19) from the end of the reel arm shaft. Note the manner in which the reel arm disc (27) is positioned before disassembling the screws (26) and disc (27) from the mainplate. Carefully withdraw the reel arm assembly, catching the lock button (30) and spring (31) as they pop free.

c. To remove the soundhead assembly (40) for repair or replacement, it first is necessary to remove the amplifier cover (item 16, Figure 6) so that the soundhead leads can be unsoldered from the edge connector terminals (refer to appropriate wiring diagram). Assuming that the transformer assembly has already been removed (paragraph 4), refer to Figure 4 and disassemble the retaining ring (32), flywheel (35) and washers (33) and (34) from the end of the sound drum shaft. Then remove three screws (36) and washers (37) and carefully lift the soundhead assembly from the mainplate.

d. No special instructions are required for removal of the drive gearing in Figure 4 except to note in which direction the gear hubs are facing. Inspect all gears for chipped or broken teeth and replace if necessary. Clean and re-lubricate all reusable gears.

6. REMOVAL OF RUN-STILL LINKAGE AND MECHANISM ASSEMBLY (Figure 5). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

NOTE: The disassembly procedures in steps a through d, following apply only to the 1592 model projectors. Steps e and f apply to all models.

a. Loosen the setscrews (1) in the collars (2); then disengage the lower end of the still-run rod (4) from the pivoting link assembly (18) and disassemble the rod, collars and spring (3) from the stop pawl.

b. Loosen the setscrew (5) and remove the collar (6) and spring (7) from the lower end of the fire shutter rod. Disengage the upper end of the rod from the fire shutter and remove the rod (8).

c. Disassemble the still-run lever (9) from the mainplate.

d. Remove the two shoulder screws (12) and lift the sliding link assembly (13) and the two spacers (14) from the mainplate. Remove the pivot screw (15) and disassemble the pivoting link assembly (18), spacer (19), torsion spring (20) and flat washer (21) from the mainplate.

e. Remove two retaining rings (22) and lift out the torsion spring (23). Remove the shoulder studs (24), belt shifter bracket (25) and the spacers (26).

f. Hold the mechanism assembly (29) securely while removing the four screws (27) and the idler gear adjustment bracket (28). Carefully withdraw the mechanism assembly from the mainplate.

7. REMOVAL OF BASE COMPONENTS (Figure 6). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. The lever stop and pin (5) has been carefully adjusted to insure the proper advance of film and

then secured with screw (4). Do not disturb these items unless obvious damage indicates a need for replacement.

b. Remove the adapter shaft (7) and lift out the film guide roller (8). Remove the screw (9) and lift the sliding film guide assembly (10) from the flanges on the base. Disassemble, if necessary, for replacement of damaged parts.

c. To expose the amplifier assembly (20) and edge connector assembly (18), remove the five screws (15) and the cover (16). Remove the four screws (17) and (19) and lift out both assemblies. When separating the edge connector from the amplifier pull them straight apart without wriggling or twisting them and thus distorting the pins. Note the spacers (21) located beneath the amplifier.

d. Remove the four screws (22) and the cover (23) to expose the volume and tone control assembly (25). Four screws (24) secure the control assembly into the base.

e. Remove the screw (26) and lockwasher (27) and disassemble the tilt bar (28) from the lower end of the tilt gear rack (39). Remove two screws (37) and disassemble the adapter (38) and gear rack (39) from the base. Remove the retaining ring (40) and lift out the tilt gearshaft (41) and spring tension washer (42). Drive out the spring pin (43) and lift out the tilt worm gear (44).

8. DISASSEMBLING THE FRONT REEL ARM (Figure 7). Disassemble the front reel arm in the following manner, noting any special precautions.

a. Remove the two screws (1) and lift the reel arm cover (2) from the front arm (22). Note the shim washers (3) located between the cover and reel arm mounting bosses.

b. Remove the screw (4) and disassemble the feed spindle assembly (5) from the front reel arm. If spindle parts are damaged, loosen the setscrews (5A) and remove the gear (5B) and washer (5C) from the spindle (5D).

c. Remove the retaining ring (7) from the spring post in the reel arm to free the end of the torsion spring (10). Loosen the setscrews (8) and (8A) and lift the gear (9) and torsion spring (10) from the reel arm shaft (14). If damaged, disassemble the plastic sleeve (9A) from the gear hub.

d. Remove the two retaining rings (11) and disassemble the reel arm shaft (14) and washers (12) and (13) from the reel arm.

e. Remove the retaining ring (15) and withdraw the upper spur gear (16) from the gearshaft (20). Remove the two gear retaining clips (17), the washer (18) and the lower spur gear (19) and slide the gearshaft (20) from the bearing posts of the reel arm. Inspect the nylon bearings (21) and, if damaged, press them from the bearing posts.

9. DISASSEMBLING THE REAR REEL ARM (Figure 8). Disassemble the rear reel arm in the following manner, noting any special precautions.

a. Remove the two screws (1) and lift the reel arm cover (2) from the rear arm (32). Note the shim washers (3) located between the cover and the reel arm mounting bosses.

b. Press the take-up arm against the reel arm casting and slip the take-up belt (4) from the pulleys. Release the take-up arm slowly and catch the tension spring (5) as it drops free. Remove the screw (6) and disassemble the take-up spindle and pulley assembly (7) and shim washer (8) from the take-up arm. The take-up arm and rear reel arm are replaceable only as an assembly (32).

c. Remove the retaining ring (10) and large flat washer (11) from the end of the gearshaft (16). Remove the rubber sleeve (12) from the hub of the gear (14). Loosen the gear setscrew (13) and disassemble the gear (14), the shim washer (15) and the gearshaft (16) from the reel arm.

d. Remove the retaining ring (17) from the spring post in the reel arm to free the end of the torsion spring (18) and lift the torsion spring from the hub of the upper face gear (27).

e. Remove the retaining ring (19) and slide the upper spur gear (20) toward the upper face gear (27) until the upper gear retaining clip (21) can be removed. Move the gearshaft (24) down until the upper spur gear (20) and washer (23) can be removed. Remove the lower gear retaining clip (21) and lower spur gear (22), and slide the gearshaft (24) from the bearing posts of the reel arm. Inspect the nylon bearings (25) and, if damaged, press them from the bearing posts.

f. Loosen the setscrew (26) and lift the upper face gear (27) from the reel arm shaft (31). Remove the retaining ring (28) and disassemble the reel arm shaft (31) and washer (29) from the reel arm.

10. DISASSEMBLING THE EXCITER LAMP COVER AND SOUNDHEAD (Figure 9). Disassemble the exciter lamp cover and soundhead assembly in the following manner, noting any special precautions.

a. Inspect exciter lamp cover parts (1 through 7) and disassemble only as necessary for replacement.

b. Make a careful note of leadwire connections before disconnecting or unsoldering leads during disassembly of the soundhead. Remove the exciter lamp (8), wipe off fingerprints, and wrap the lamp in tissue paper.

c. Do not loosen the clamping screw (10) or disturb the lateral position of the optical slit assembly (11) unless it has been determined that the optical slit is in need of replacement or adjustment.

d. Unhook and remove the stabilizer arm spring (12). Remove the retaining ring (13) and disassemble the roller adjusting screw (14) and complete stabilizer arm assembly (15) from the soundhead casting. Remove the two screws (15A) and washers (15B) and disassemble the rollers (15C) and (15D) from the stabilizer arm roller shafts. The removal of screws (15E) will free the torsion spring (15G) and stabilizer arms (15F), (15H) and (15J).

e. Remove two screws (16) and disassemble the lamp contact assembly (17) and lamp release ring (18) from the soundhead casting.

f. Loosen the setscrew (19) which bears against the light pipe and photocell retainer (22). Then remove the two screws (20), and carefully withdraw the sound drum assembly (21), retainer (22) and photocell assembly (23) as a group from the soundhead casting. Wrap the sound drum and photocell in tissue paper to protect them from damage. Do not remove the edge guide screw (24).

g. To remove the stabilizer tension adjuster, remove the retaining ring (25) from the adjuster (27), and unscrew the adjuster from the tapped hole in the spring retainer (28). Be careful not to lose the friction washer (26) located at the lower end of the adjuster.

11. DISASSEMBLING THE MECHANISM (Figure 10). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. To remove the lens carrier assembly (5), pry out the hinge pins (1) and (2) with a wire cutter or similar tool and lift the lens carrier from the mechanism. Note that the spring washer (3) is used with the upper pin and the flat washer (4) with the lower pin. To disassemble the lens carrier, remove the two screws (5A) and remove the pressure plate (5B), flat washers (5D), springs (5E) and pressure plate lever (5F). The adjustment plate (5H) need not be removed. Pry up the nameplate (5J) with a knife blade. Remove two screws (5K) and disassemble the spring (5L) and the knob and pinion assembly (5M) from the lens carrier (5N).

b. Remove the retaining ring (6) and withdraw the actuating lever (7) from the animation switch actuating rod. Remove the two screws (9) and the hood (10).

c. Loosen two setscrews (11) in each sprocket gear (12) and (13) and remove the gears, tension washers (14) and flat washers (14A) from the sprocket shafts. Remove two screws (15) and the upper sprocket guard assembly (16), and withdraw the upper sprocket assembly (17) and its thrust washer (18) from the mechanism housing. Disassemble the lower sprocket assembly (19), flange (20) and thrust washer (21) from the mechanism housing.

d. Remove the retaining ring (22) from the lower end of the rewind button shaft, and lift the rewind button (23) and its spring (24) from the top of the mechanism housing.

e. When removing sprocket guards (27) and (28), note the manner in which the torsion springs (30) are assembled so that they may be properly reinstalled.

f. 1592 Models Only. Loosen the setscrew (34) and disassemble the animation switch lever assembly (35) and switch lever crank (37) from the mechanism housing. Note: in Models 1585 and 1590, the crank opening in the housing is sealed with a plug (38).

12. DISASSEMBLING THE MECHANISM (Figure 11). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Remove the three screws (1) and flanged rollers (2). Note the manner in which the torsion spring (5) is installed. Remove the retaining ring (3) and withdraw the threading arm (4) and torsion spring (5) from the mounting posts of the guard mounting plates.

b. Note the manner in which the legs of the torsion spring (14) are engaged. Remove the screw (6), idler roller (7), roller stud (8), locking lever eccentric (9), torsion spring (10) and autothread lever assembly (11).

c. Note the manner in which the legs of the torsion spring (14) are engaged. Remove the retaining ring (12) and lift off the lower loopformer (13) and torsion spring (14).

d. Remove the screw (15) and back-up bracket (16). Remove the large retaining ring (17) and lift off the lower film guide (19) and two washers (18). Remove two screws (20) and the lower guard mounting plate (21). Remove the retaining ring (22) and disassemble the toggle lever and pivot assembly (23) and lower film guide (24) from the mounting plate.

e. Loosen the locking screw (27) and disassemble the threading lever assembly (28) from the rear shaft end of the loopformer (31). Remove the retaining ring (30) and withdraw the upper loopformer assembly (31). Remove the connecting link and stud assembly (35).

f. The hex head screw (36) is used to adjust the lens carrier and should not be disturbed. Do not remove the lens carrier catch (38) unless damaged and in need of replacement.

g. Remove two screws (40) and the upper guard mounting plate assembly (41). Note the manner in which the legs of the torsion spring (44) are engaged. Loosen two setscrews (42) and disassemble the shaft and link assembly (43), torsion spring (44), flat washer (45) and the loopformer and lock pawl assembly (46) from the mechanism housing. Do not disassemble the loopformer and lock pawl assembly unless parts are damaged and obviously in need of replacement.

h. Remove the screw (49) and flat washer (50) and disengage and remove the tension spring (51). Remove the screw (52) and flat washer (53) and lift out the cam follower and support assembly (54). Do not disassemble unless parts are damaged and in need of replacement. Loosen the hex head locking screw (55) and disassemble the arm assembly (56), flat washer (57) and the lever and shaft assembly (58) from the mechanism housing.

i. Remove the two screws (60), lock washers (61) and flat washers (62) which secure the self-centering assembly (63) to the mechanism housing. The self-centering device is furnished only as an assembly.

j. Remove screws (64) and the aperture plate assembly (65). Refer to paragraph 15 for aperture plate disassembly instructions.

13. DISASSEMBLING THE MECHANISM (Figure 12). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Loosen the two setscrews (1) and withdraw the mechanism pulley (2) from the end of the camshaft. Remove four screws (3) and lift off the support bracket (4), used on 1585 and 1590 models, or the fire shutter assembly (4), used on 1592 model projectors. Disassemble the fire shutter only if parts are damaged and need of replacement.

b. Remove two screws (5) and the heat baffle (6). Remove the shutter nut (7), counterbalance weight (8), shutter (9) and fiber washer (10).

c. Unless obviously in need of replacement, do not disassemble the ball and stud assemblies (12) or the shuttle link bearing (17A) from the shuttle arms (17). Inspect the pull-down cam follower (17B) for wear. The cam follower is staked in place in the recess of the shuttle arm and can be reversed or turned end-for-end if badly worn. Unhook the extension spring (13) from the end of each shuttle arm and remove the felt wiper (14) and shuttle arms. The cam wiper wick (15) is inserted within the coils of the spring (13). If the wiper and wick appear especially dirty, discard them.

d. Withdraw the pull-down cam (18) from the camshaft. Remove the two screws (19) and disassemble the in-out cam (20) and cam bracket assembly (21) together from the mechanism housing. Inspect the cam follower (21A) and spring (21B) and replace if damaged. Remove two screws (22) and the shuttle arm plate assembly (23). Inspect the bearing support (24) and replace if damaged.

e. Pull out the stop pin (25) and unscrew the framer knob and shaft (26) from the mechanism housing. Remove the screw (27), the in-out spring (28) and the shuttle retractor pin (29).

f. 1592 Models Only. Remove the two retaining rings (30) and disassemble the stop pawl shaft (31) and stop pawl (32). Remove the screws (33) and (35) and disassemble the bearing bracket (34) and stop pawl shaft bracket (36) from the mechanism housing. Inspect the grommets (37) and, if damaged, press them from the bracket (36).

14. DISASSEMBLING THE MECHANISM (Figure 13). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. 1592 Models Only. Remove the round nut (1) and washer (2) and disassemble the shuttle adjustment bracket (3) from the animated clutch bracket assembly. Remove the screws (4) and (5) and lock washers (6) and lift the animated clutch bracket assembly (7) from the mechanism housing. If the bracket assembly parts are in need of replacement, proceed as follows. Remove the three retaining rings (7B) and slide the shaft (7C) from the clutch mounting bracket (7L), removing the slide bumper (7D), washer (7E), spring (7F) and clutch slide bar assembly (7G) from the shaft as it is withdrawn. Remove the screw (7H) and washer (7J) to free the strike (7K) from the clutch slide bar.

b. 1585 and 1590 Models Only. Remove the two retaining rings (8) and (28), the two screws (9) and the bearing loading spring (10). Loosen the setscrews (11) and (24A) in the loop restorer cam (27) and worm gear (24) and press the camshaft (30) to the left until the bearing (12) is forced from its seat in the housing. Then press the camshaft to the right to force the large bearing (29) from its seat. Remove the worm gear and loop restorer cam as the camshaft is withdrawn from the housing.

c. 1592 Models Only. Remove the large retaining ring (8), the two screws (9) and the bearing loading spring (10). Loosen the setscrew (11) in the loop restorer cam (27) and press the camshaft (30) to the left until the bearing (12) is forced from the mechanism housing. Pull the bearing from the camshaft. Remove retaining rings (16) and (28) from the camshaft and press the camshaft to the right to force the large bearing (29) from its seat. Remove the clutch, gear and cam parts (13) through (27) as the camshaft is withdrawn. Make a note of the manner in which the torsion spring (14) is assembled. Inspect worm gear parts (24A through 24D) and, if damaged, disassemble for replacement.

15. DISASSEMBLING THE APERTURE PLATE (Figure 14). Disassemble the aperture plate by removing parts, as necessary, in their indexed order of disassembly. Be very careful not to scratch or nick the rails or aperture plate with the screwdriver when removing screws.

16. COVER AND SPEAKER ASSEMBLY (Figure 15). No special instructions are necessary for repairing the cover and speaker assembly. Refer to the accompanying schematic (Figure 16) for proper lead-wire connections.

17. TESTING AND REPAIRING THE AMPLIFIER ASSEMBLY (Figure 19). Amplifier circuit board repairs are not recommended except as an emergency measure and then only if qualified electronics personnel and test equipment are available. If a faulty condition is traced to the amplifier, replace the complete assembly. Using standard electronic shop test equipment and techniques, check the amplifier assembly and its components for continuity and for shorts and open circuits. Refer to the appropriate wiring diagram for voltages and ratings of components and for test points. Defective solder-secured parts can be replaced by cutting the leads as close as possible to the body of the part or by unsoldering the leads from their terminal points. When unsoldering, it is advisable to use a heat sink to avoid the direct application of heat to adjacent components. When replacing parts, note the following special precautions.

a. Each of the three transistors are furnished with a special lock washer and a mica washer. The lock washer is to be installed beneath the head of the screw with its teeth against the flat washer. Apply thermal compound (Bell & Howell Spec. 28-7-001) to both sides of the mica washer and install this washer between the transistor and the metal heat sink bracket. The metal collector plate of the transistor must be toward the heat sink.

b. The integrated circuit must be installed with its polarity mark or notch toward the edge of the board indicated by the dashed arrow drawn on the top of the circuit in Figure 19. This arrow is not imprinted on the integrated circuit.

Reassembly Procedure

18. GENERAL REASSEMBLY INSTRUCTIONS.

a. Before reassembling parts, be sure to clean them thoroughly. Metal parts can be immersed in a pan of non-flammable solvent or wiped with a cloth dampened with solvent; then blown dry with a low pressure jet of compressed air or dried with a lint-free cloth. Do not clean plastic or electrical components with solvent. Simply wipe plastic and electrical components with a clean, dry cloth. Clean optical parts with a good quality lens cleaner and lens tissue or a lint-free cloth.

b. When reassembly procedures include staking or riveting operations, it is wise to perform these operations before assembling other parts. Be sure to support the major casting or plate solidly during staking operations to avoid distorting the casting or plate.

c. When installing electrical components, refer to the appropriate wiring diagram at the rear of the Parts Catalog for the proper connection of leadwires. When resoldering components to the amplifier assembly (Figure 19), use a heat sink to avoid the direct application of heat to adjacent components on the board. Refer to paragraph 17 for special instructions regarding circuit board component replacement.

d. Most of the nameplates and the instruction plates are provided with an adhesive backing. Make certain that the area to which such parts are to be secured is thoroughly clean by wiping with a cloth dampened with solvent. Remove the protective paper backing and brush the adhesive with a mixture of three parts Tulouol to one part of trichloroethylene. When the adhesive is tacky, press the nameplate carefully but firmly in place. Wipe away any excess adhesive with a cloth dampened with solvent.

e. Lubrication instructions are provided in the Introduction section of this service manual. Do not over-lubricate. Apply grease and oil sparingly as indicated, and wipe away any excess lubricant with a lint-free cloth. Gears should be lubricated by specking the gear teeth and then running the projector for a few moments to distribute the grease. Where oil is indicated, a drop or two will usually suffice.

19. REASSEMBLING THE APERTURE PLATE (Figure 14).

a. Assemble the film guide (9) to the aperture plate (10) with the screw (8). The right end of the film guide should be square with the edge of the aperture plate.

b. Assemble the side tension spring (7) and the film tension rail (6) to the aperture plate. The ends of the spring should engage the notches in the film tension rail and the center of the spring should bear against the staked pin in the aperture plate. Assemble the spacer bushings (5) and spring retaining cover (4) to the aperture plate and install the two screws (3).

c. Attach the film guide rail (2) to the aperture plate with the two screws (1), tightening the screws securely. Refer to paragraph 20, step d, for installation instructions.

20. REASSEMBLING THE MECHANISM (Figure 13). Reassemble Figure 13 parts as outlined in the following paragraphs.

NOTE: When reassembling 1592 model projectors use only steps a through g following. When reassembling 1585 and 1590 model projectors, refer to steps h and j only.

a. Assemble the strike (7K) to the clutch slide bar assembly (7G) with the screw (7H) and washer (7J). Insert the shaft (7C) part way through the right-hand arm of the mounting bracket assembly (7L) and install the bumper (7D) on the end of the shaft. Hold the slide bar assembly (7G) in position between the arms of the bracket assembly and continue to insert the shaft, assembling the flat washer (7E) and the spring (7F) on the shaft before it is inserted through the left-hand arms. Install the three retaining rings (7B), with the center ring to the right of the spring and washer. The setscrew (7A) must be adjusted at final assembly to limit slide bar travel. Assemble the complete clutch bracket assembly (7) to the mechanism housing with the two screws (4) and (5) and lock washers (6), and press down firmly on the bracket while tightening the screws. Assemble the adjustment bracket (3) to the end of

the longer screw (5) and install the washer (2) and the round nut (1), tightening the nut finger tight.

b. Lightly grease both bearing openings in the cast arms of the mechanism housing. Press the ball bearing (12) into its bearing opening until fully seated. Assemble the large bearing (29) to the camshaft (30) until the bearing is seated against the shoulder of the shaft. Install the retaining ring (28) to the camshaft with the bowed surface of the ring facing away from the ball bearing.

c. Assemble the three rubber bushings (25) into the corresponding openings in the face of the worm gear assembly (24). Assemble the bearing assembly (23) to the worm gear so that the formed ears of the bearing are aligned with corresponding notches in the worm gear. Insert the bent ears of the clutch yoke (21) through the slots in the bearing assembly, while assembling the spring (22) over the protruding finger of the clutch yoke and into the hole in the bearing assembly. Hold these parts together while assembling the two shoulder pins (20) to the bearing assembly, pressing them in until they engage the bent ears of the clutch yoke. Assemble the trigger (19) to the sleeve bearing (18) and press the bearing through the bearing assembly (23) and into the worm gear.

d. Insert the end of the camshaft (30), with ball bearing (29) assembled, through the bearing hole in the right-hand cast arm of the mechanism housing. To the shaft, assemble the loop restorer cam (27), shim washer (26) and the assembled worm gear group. Assemble the torsion spring (14) over the hub of the driven clutch (15), spreading the legs of the spring so that they straddle the bent ear at the top of the clutch. Insert the hub of the driver clutch (13) through the hub of the driven clutch, spreading the legs of the torsion spring still further until one of the lugs of the driver clutch is also straddled by the spring legs. Install the washer (17) and the assembled clutches on the camshaft. When installed, the bent ear of the driven clutch (15) must be parallel with the camshaft flat for the loop restorer cam (27).

e. Slide the camshaft all the way in place, inserting the end of the camshaft into bearing (12) while seating the large bearing (29) in the bearing hole of the cast arm. Assemble the two retaining rings (16) to the camshaft, one between washer (26) and loop restorer cam (27); the other between washer (17) and clutch (15). Clutch and loop restorer adjustments will be made after reassembly has been completed.

f. Fasten the bearing loading spring (10) to the cast arm of the mechanism housing with two screws (9). Assemble the large retaining ring (8) into the ring groove of the housing arm, with the bowed face of the ring against the bearing (29).

g. Insert a 0.190-inch feeler gage between the loop restorer cam and the cast arm of the mechanism housing. Hold the cam firmly against the feeler gage while tightening the setscrew (11) against the flat of the camshaft. Remove the feeler gage.

NOTE: Steps h through j, following apply only to the 1585 and 1590 model projectors.

h. Lightly grease both bearing openings in the cast arms of the mechanism housing. Press the ball bearing (12) into its bearing opening until fully seated. Assemble the large bearing (29) to the camshaft (30) until the bearing is seated against the shoulder of the shaft. Install the retaining ring (28) to the camshaft with the bowed surface of the ring facing away from the ball bearing.

i. Insert the long end of the camshaft through the bearing hole in the long cast arm of the mechanism housing. As the shaft end protrudes through the cast arm, assemble the loop restorer cam (27), shim washer (26) and worm gear (24) to the shaft. Continue sliding the shaft to the left, inserting the end of the shaft into the left-hand bearing (12) while seating the large bearing (29) in the bearing opening of the right-hand cast arm. Make certain that both bearings are fully seated; then install the bearing loading spring (10) to the left-hand cast arm with the two screws (9). Assemble the large retaining ring (8) into the inner ring groove in the right-hand bearing opening. The bowed surface of the ring must face the large bearing (29).

j. Insert a 0.190 inch feeler gage between the loop restorer cam and the cast arm of the mechanism housing. Hold the cam firmly against the feeler gage while tightening its setscrew (11) against the flat of the camshaft. Remove the feeler gage. Tighten the worm gear setscrew (24A) enough to hold until final adjustment can be made.

21. REASSEMBLING THE MECHANISM (Figure 12). Reassemble Figure 12 parts as outlined in the following paragraphs.

a. Assemble the shuttle retractor pin (29) and in-out spring (28) and insert the rounded end of the pin into the hole in the long cast arm, just to the right of the camshaft. Secure the loop end of the spring to the casting with the screw (27).

b. Screw the framer knob and shaft (26) down into the mechanism housing. Orient the stop pin (25) so that the flat side of the pin is parallel with and facing the framer shaft, and press the pin in place. Screw the bearing support (24) all the way up into the staked nut of the shuttle arm plate assembly (23). Engage the fork-like end of the shuttle arm plate framing arm with the cut-out at the lower end of the framer shaft, and fasten the plate to the cast arm of the mechanism housing with the two screws (22).

c. Loosely assemble the in-out cam (20) to the cam bracket assembly (21) so that the nylon face of the cam follower (21A) rides against the polished surface of the cam (indicated by the dash arrow in

Figure 12). Install this assembled group over the end of the camshaft and secure the cam bracket assembly to the cast arm of the mechanism housing with the two screws (19).

d. At this point, refer to Figure 11 and install the assembled aperture plate (65) with screws (64). Then return to Figure 12 and continue with reassembly as follows.

e. Make certain that the shuttle link bearings (17A) are firmly pressed into the notches at the front end of each shuttle arm (17) and that the cam followers (17B) are assembled into the center notched section of each arm (see Figure B). Insert the lubricated cam wiper wick (15) into the coils of the extension spring (13). Assemble the lubricated felt wiper (14) and the extension spring (13) to the shuttle arms as shown in Figure B. Assemble the ball and stud assemblies (12) to the ends of the arms with the hex nuts (11), tightening the nuts only fingertight. Carefully insert the front ends of the shuttle arms between the guides of the in-out bracket assembly (21). Assemble the shuttle (16) to the front ends of the shuttle arm so that the shuttle teeth extend through the shuttle slot in the aperture plate and face in toward the mechanism housing. Rotate the in-out cam (20) until the tongue protruding from the unpolished face of the cam rests down in the notch in the shoulder of the camshaft. Assemble the pull-down cam (18) to the camshaft, spreading the shuttle arms lightly until the cam is fully in place. The notch in the inner face of the pull-down cam must engage a mating protrusion on the face of the in-out cam. Back out the bearing support (24) until its socket-like nylon pad engages the ball of the upper stud assembly (12). The ball of the lower stud assembly should rest in the socket of the nylon pad mounted on the shuttle arm plate assembly (23). It may be necessary to loosen the hex nuts (11) and shift the ball and stud assemblies (12) until proper alignment is obtained.

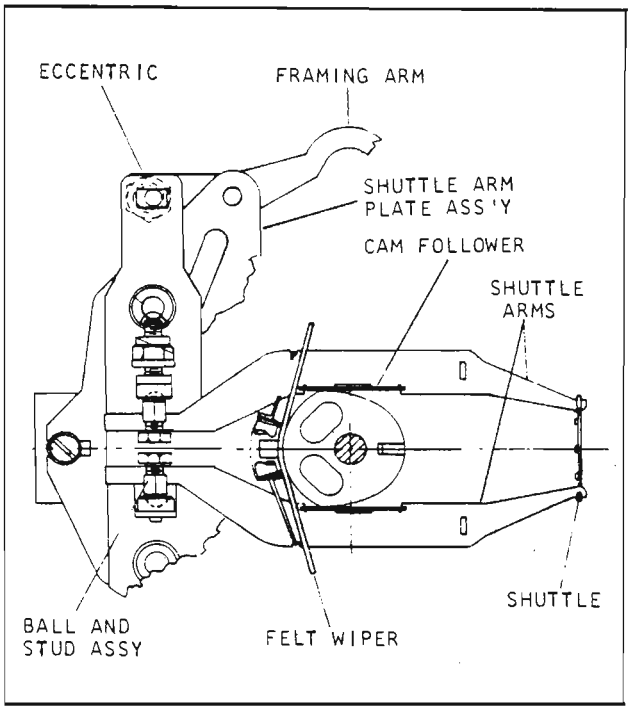


Figure B. Shuttle and Shuttle Arms Assembled

f. Install the fiber washer (10) on the camshaft and up against the pull-down cam (18) so that the slot in the washer is aligned with the slot in the cam. Assemble the shutter (9) to the camshaft and install the counterbalance weight (8) so that its pin engages the slots in the shutter and the pull-down cam. Install the shutter nut (7) with its shoulder in the center hole of the counterweight. Grip the flats at the end of the camshaft with an open-end wrench and tighten the nut (7) securely.

g. 1592 Models Only. Assemble the grommets (37) into the bracket (36). Assemble a retaining ring (30) into the groove nearest the end of the stop pawl shaft (31) and insert the opposite end of the shaft through the shaft hole in the bearing bracket (34) and both ears of the stop pawl (32). Loosely attach the bearing bracket to the cast arm of the mechanism housing with two screws (33). Assemble bracket (36) to the opposite end of the shaft and fasten the bracket to the mechanism housing with screws (35). Tighten screws (33) and (35) securely. Assemble the second retaining ring (30) into the groove of the shaft so that the right-hand ear of the stop pawl is held against the bearing bracket (34).

NOTE: Only the 1592 model projectors are equipped with the fire shutter assembly (4). On 1585 and 1590 model projectors, a support bracket is installed in place of the fire shutter.

h. Insert the rounded end of the heat baffle (6) up under the shutter and secure the baffle with the two screws (5). Fasten the bracket or fire shutter assembly (4) to the mechanism housing with four screws (3) and washers (3A). Install the pulley (2) on the end of the camshaft, and tighten the pulley setscrews (1) down on the flats of the shaft.

22. REASSEMBLING THE MECHANISM (Figure 11). Reassemble Figure 11 parts as outlined in the following paragraphs.

a. Attach the self centering assembly (63) to the mechanism housing with the two screws (60), lock washers (61) and flat washers (62). Assemble the lever and shaft assembly (58) to the mechanism housing and install the washer (57) and arm assembly (56) on the end of the shaft. The fork-like finger of the arm assembly must engage the pin of the self centering assembly between the two large washers. Insert a 0.0015-inch feeler gage between the washer (57) and the machined boss of the housing. Grip the shaft (58) and arm (56) to hold the feeler gage while

tightening the hex head screw (55); then remove the feeler gage. Assemble the retaining ring (59) to the shaft assembly (58).

NOTE: The shaft assembly (58), when installed, must be positioned approximately as shown in Figure 11, with the notched area in its upper edge positioned beneath the lower sprocket shaft bearing of the mechanism housing.

b. Assemble the cam follower parts (54A) through (54F) as shown in Figure 11. Attach this assembled group to the arm assembly (56) with the screw (52) and washer (53). Tighten the screw just enough to hold the follower group. Hook one end of the spring (51) around the end of the lever shaft (58) and secure the other end to the mechanism housing with the screw (49) and washer (50).

c. Assemble the film escape mechanism components (46A) through (46G) in the following manner. Assemble the hub assembly (46F) to the locking pawl (46E) with the screw (46D). Insert the shaft (46B) through one ear of the upper loopformer assembly (46G) and install the spring (46C) and the assembled hub and pawl on the shaft. Then engage the end of the shaft with the second ear of the loopformer. Assemble the retaining rings (46A) to the shaft, with the center ring between the spring (46C) and hub assembly (46F). Hook one end of the spring over the outer ear of the loopformer and hook the other end behind the upper finger of the hub assembly (46F). The spring should tend to rotate the hub and locking pawl in a clockwise direction.

d. Install the torsion spring (44), short leg first, on the shaft of the shaft and link assembly (43) and insert the shaft through the bearing in the mechanism housing. Hook the long leg of the spring beneath the tapped mounting boss in the upper left-hand corner of the mechanism housing. Hook the short, bent end of the spring behind the left edge of the link. Assemble the washer (45) and the film escape mechanism parts (step c, above) to the protruding end of the shaft (43) and temporarily tighten the setscrews (42).

e. Attach the upper sprocket guard mounting plate (41) to the mechanism housing with two screws (40), the upper screw being inserted through the half-moon slot in the upper loopformer (46G).

f. Attach the lens carrier catch (38) to the mechanism housing with the screw (37). Turn the hex head lens stop screw (36) into the tapped hole in the housing until only one thread is visible. It may be necessary to adjust the catch and stop screw at final assembly to insure proper operation of the lens carrier.

g. Assemble the shuttle retractor (34) to the link and stud assembly (35) with the screw (32), lock washer (33) and flat washer (33A). Assemble the upper loopformer assembly (31) to the upper end of the connecting link (35) and install the retaining ring (30). Slip the pin end of the threading lever (28) up behind the link (43), engaging the pin with the rectangular slot in the link. Insert the shaft of the loopformer assembly through the mounting plate (41) and mechanism housing, and into the hub of the threading lever (28). Tighten the hex head locking screw (27) securely. Attach the leaf spring (26) to the upper loopform with two screws (25).

h. Assemble the small hole in the film guide (24) over the pin in the lower sprocket guard mounting plate (21) and hold the film guide in place while inserting the shaft of the toggle lever assembly (23) through the guard plate. The forked end of the toggle lever must straddle the film guide mounting pin. Secure the toggle lever to the mounting plate with the retaining ring (22). Engage the remaining forked end of the toggle lever with the pin at the lower end of the connecting link (35) and secure the lower mounting plate (21) to the mechanism housing with the two screws (20). The film guide (24) must be lifted slightly during this operation so that its large pivot hole slides over the sprocket shaft bearing in the housing.

i. Assemble one large washer (18) and the lower film guide (19) over the lower sprocket bearing, at the same time inserting the pin at the lower end of the connecting link (35) through the hole in the arm of the film guide (19). Install the second large washer (18) and secure these parts with the retaining ring (17).

j. Fasten the back-up bracket (16) to the mounting plate (21) with the screw (15). Assemble the loopform (13) and the torsion spring (14) onto the lower pin of the connecting link (35) and install the retaining ring (12). The legs of the spring must bear against the underside of the loopform in such a manner that they will force the loopform to pivot clockwise around the connecting link pin.

k. Assemble the film guide (11E) to the autothread lever (11F) with the screw (11D), tightening the screw finger-tight. Assemble the roller (11C) and film guide (11B) to the shaft of the autothread lever and secure with the screw (11A).

l. Assemble the autothread lever (11) and eccentric (9) to the mounting plate (21) with the threaded stud (8). The loopform (13) must be pivoted counterclockwise and held in that position while installing these parts. Again hold the loopform (13) in the counterclockwise rotation while securing the idler roller (7) to the stud (8) with the screw (6). Release the loopform (13). Assemble the torsion spring (10), short leg first, to the eccentric (9). Hook the short leg of the spring into the hole in the mechanism housing above and to the left of the eccentric (9). Hook the long leg of the spring in the V-like notch along the left edge of the lever (11).

m. Assemble the torsion spring (5) and threading arm (4) to the stud in the lower right-hand corner of the mounting plate (21). Engage the legs of the spring

so that they tend to pivot the threading arm clockwise. Install the retaining ring (3) to secure the arm to the stud.

n. Install the rollers (2) on their respective studs and secure them with the screws (1).

23. REASSEMBLING THE LENS CARRIER (Figure 10). Reassemble the lens carrier assembly as outlined in the following paragraphs.

a. Lightly grease the gear teeth of the pinion assembly (5M), the pinion slots of the carrier (5N) and the notches of the pinion spring (5L).

b. Assemble the spring (5L) into the two grooves of the pinion assembly (5M) and assemble the pinion into the grooves of the carrier (5N). Fasten the spring securely with the two screws (5K). Check to make certain that the knob rotates smoothly.

c. Place the pressure plate (5B) on the work surface, polished surface down and the forked end of the plate to the left. Assemble the pressure plate lever (5F) to the pressure plate with the small extrusion of the lever fitted into the corresponding hole in the pressure plate. Assemble the flat washers (5D) into the springs (5E) and assemble these parts and the adjustment plate (5H) to the pressure plate, with the shorter bushing located at the lever (5F). Install and tighten the two screws (5A).

d. Slip the adjustment plate, with pressure plate assembled, into place within the lens carrier and loosely install the two screws (5G). Insert the lens plug (Figure A) into the lens bore of the carrier with the rectangular boss of the plug fitted into the opening in the pressure plate. Tighten screws (5G) securely and withdraw the lens plug.

e. Clean the nameplate area of the lens carrier with a cloth dampened with solvent. Remove the backing from the nameplate (5J) and activate the adhesive as instructed in paragraph 18, step c. Assemble the nameplate to the lens carrier and wipe away excess adhesive with a soft cloth dampened with solvent.

24. REASSEMBLING THE MECHANISM (Figure 10). Reassemble Figure 10 parts as outlined in the following paragraphs.

a. Rotate and hold the lower loopform (13, Figure 11) fully counterclockwise and assemble the filter exit guide (32, Figure 10) to the mechanism housing with the screw (31).

b. Assemble the sprocket guards (27) and (28), rollers (29) and torsion springs (30) to the tapped mounting posts of the guard mounting plates. The rollers must be assembled as shown in the inset of Figure 10. The inner bent end of each spring is inserted into small spring holes in the mounting plates adjacent to the tapped posts. The outer bent end of each spring hooks over the outer edge of each sprocket guard (27) and (28). The springs should tend to rotate the free (unmounted) end of the sprocket guard toward the sprocket bearings in the mechanism housing. Secure the sprocket guards to their mounting post with the screws (25) and the shim washers (26).

c. Assemble the spring (24) to the shaft of the rewind button (23) and insert the shaft down into the opening in the top of the mechanism housing. Depress the button and assemble the retaining ring (22) into the groove at the lower end of the shaft.

d. Assemble the sprocket flange (20) and thrust washer (21) onto the shaft of the lower sprocket assembly (19). Spread the two lower sprocket guards and insert the sprocket shaft through the lower bearings in the mechanism housing until the sprocket is fully seated. Release the sprocket guards. Assemble a flat washer (14A), a spring tension washer (14) and the lower sprocket gear (13) to the sprocket shaft, meshing the sprocket gear teeth with the worm gear. Align either setscrew (11) with the flat on the sprocket shaft and tighten both setscrews securely. The sprocket and gear must turn freely but with only a minimum of end play.

e. Assemble the thrust washer (18) to the shaft of the upper sprocket assembly (17). Lift the free end of the upper sprocket guard (27) and insert the sprocket shaft through the upper bearings in the mechanism housing until the sprocket is fully seated. Release the sprocket guard.

f. Assemble the sprocket guard parts (16A) through (16D). Slip the assembled sprocket guard (16) up into position beneath the upper sprocket and secure the guard with two screws inserted from the rear of the mechanism housing. Assemble a flat washer (14A), tension washer (14) and the upper sprocket gear (12) to the sprocket shaft. Align either setscrew (11) with the flat on the sprocket shaft and carefully mesh the sprocket gear with the worm gear. Tighten both setscrews (11) securely. The sprocket and gear must turn freely, but with a minimum of end play.

g. Fasten the hood (10) to the mechanism housing with the two screws (9). Press down and hold the upper loopformer (31, Figure 11) while assembling the actuating lever (7, Figure 10) to the lever shaft. Install the retaining ring (6).

h. Hold the assembled lens carrier (5) between the hinge bosses of the mechanism housing. Insert the flat washer (4) on top of the lower hinge boss and the spring tension washer (3) beneath the upper hinge boss. Press the hinge pins (1) and (2) into place to hold the lens carrier. Adjust the lens carrier catch (38, Figure 11) so that it holds the lens carrier firmly against the stop screw (36, Figure 11) in the closed position; yet permits the carrier to be opened easily.

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

25. REASSEMBLING THE SOUNDHEAD AND EXCITER LAMP COVER (Figure 9). Reassemble the soundhead and lamp cover parts as outlined in the following paragraphs.

a. If exciter lamp mounting pin parts (31) through (31C) were replaced, assemble the spring (31C) and bushing (31B) into the opening in the casting and insert the mounting pin (31A), forcing the end of the pin carefully through the bushing.

b. Fasten the terminal (30) to the soundhead casting with the screw (29). The free end of the terminal should be approximately at the 5 o'clock position. Loosely assemble the optical slit locking screw (10), the setscrew (19) and the edge guide screw (24) to the soundhead casting. Leave approximately three threads of the guide screw exposed.

c. Apply ahesive (B&H Spec. 1761-34) to the end four threads of the roller adjusting screw (14) and assemble the screw to the soundhead, leaving approximately two threads exposed.

d. Assemble the light pipe and photocell assembly (23) and light pipe retainer (22) to the sound drum and shaft assembly (21) and insert the sound drum shaft carefully through the opening in the soundhead casting. Hold the sound drum while tightening the setscrew (19) against the retainer (22) just enough to hold all parts in place. Install the two screws (20), turning them down in the tapped holes in the sound drum housing.

e. Lightly oil the roller shafts of stabilizer arms (15H) and (15J). Assemble the lower stabilizer arm (15H) over the short shaft end of the upper stabilizer arm (15J). Assemble the torsion spring (15G), straight leg first, over the tapped hub of the lower stabilizer arm (15H). Assemble the stabilizer arm (15F) to the tapped hubs of the upper and lower arms and install the two screws (15E). Hook the bent end of the spring (15G) through the small hole near the end of stabilizer arm (15F). Wind the straight leg of the spring one full turn clockwise and hook it behind the small post in the lower arm (15H). Assemble the rollers (15C) and (15D) to their respective roller studs. Roller (15D) must be installed with its narrow flange nearest the shoulder of the stud. Secure both rollers with the screws (15A) and washers (15B). Insert the shaft of the upper stabilizer arm carefully through the soundhead casting and the adjusting screw (14) and install the retaining ring (13). Position the retaining ring for 0.0005 to 0.005 inch end play of the stabilizer arm shaft. See Figure C for stabilizer and installation.

f. Lightly grease both surfaces of the lamp release ring (18) and assemble the release ring and the lamp contact assembly (17) to the soundhead casting with the two screws (16).

g. Insert the optical slit assembly (11) into its opening in the soundhead casting and tighten screw (10) just enough to hold the slit in place.

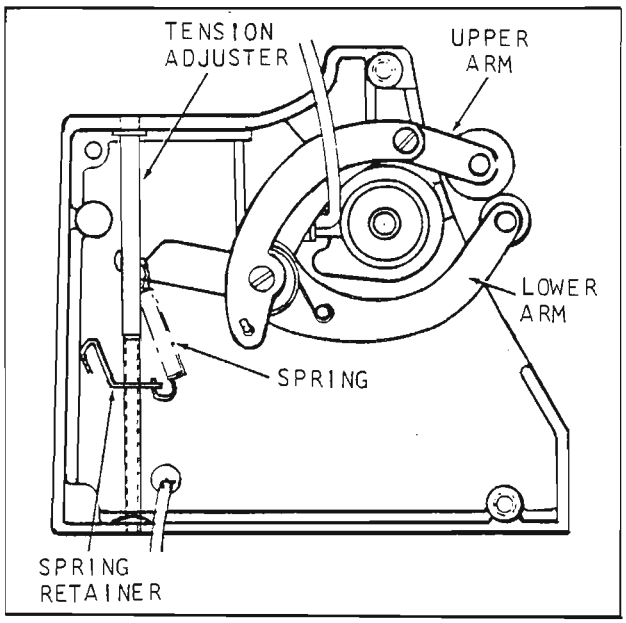


Figure C. Stabilizer Arms Installed on Suundhead

h. Insert the small end of the stabilizer tension adjuster (27) through the hole in the top of the soundhead casting. Assemble the spring retainer (28) to the adjuster, threading it approximately midway in the threaded area. Before inserting pin end of adjuster into the small hole at the bottom of the casting, assemble the friction washer (26), bowed face up, to the end of the adjuster. Assemble the retaining ring (25) into the groove at the upper end of the adjuster. Hook the tension spring (12) between the end of the lower stabilizer arm (15H) and the hole in the spring retainer (28). Install the exciter lamp (8). Refer to paragraph 40 for soundhead adjustments.

i. Reassemble the exciter lamp cover as follows. Remove the cloth backing from the light shield (6) and assemble the light shield to the left-hand inside upper wall of the lamp cover (7) so that it is flush with the outer edge of the cover. Remove any excess or overlap with a sharp knife or razor blade. Assemble the cover screw (2) to the cover and install the retaining ring (1). Press the hole plug (5) into the hole in the cover. Position the film guide (4) over the tapped holes in the cover with the flange of the guide wrapped around the front of the cover, and loosely install the screws (3). Insert a 0.020-inch spacer between the guide flange and the cover, press the flange against the spacer, and tighten the screws (3) securely. Remove the spacer.

26. REASSEMBLING THE REAR REEL ARM ASSEMBLY (Figure 8). Reassemble the rear reel arm as outlined in the following paragraphs.

a. Apply one drop of oil to the unflanged end of the bearing in the rear reel arm (32). Assemble one retaining ring (28) to the rear reel arm shaft (31) in the groove nearest the two narrow flats on the shaft. Assemble the thrust washer (29) over the long end of the

shaft and down against the retaining ring. Insert the shaft through the reel arm bearing. Assemble the face gear (27) to the reel arm shaft (31), gear teeth facing up, and tighten setscrew (26) against flat of shaft.

b. Assemble the nylon bearings (25) into the cast bearing arms of the rear reel arm, engaging the key tabs of the bearings with the cross-slots of the bearing holes. Assemble the lower gear (22) to that end of the gear shaft (24) where the flats are nearest the end. The gear face with the square recess must face away from the cast bearing boss. Install the gear retaining clip (21). Insert the gear shaft through both nylon bearings (25). Assemble the washer (23) and gear retaining clip (21) to the end of the gear shaft. Install the upper gear (20), square recess facing inward to engage clip (21), and assemble the grip ring (19) to the end of the shaft. Insert a 0.010 inch feeler gage between the upper gear (20) and washer (23) and press the grip ring (19) in against the gear. Remove feeler gage.

c. Assemble the rubber sleeve (12) to the hub of the face gear (14). The sleeve must rest down against the shoulder of the gear. Insert the small diameter end of gear shaft (16) up through the hole in the lower end of the reel arm. Hold the shaft in place and assemble the washer (15), the face gear (14) and the large washer (11) to the gear shaft. Secure these parts with the retaining ring (10).

d. Install the setscrew (13) into the tapped hole in the reel arm casting near the lower end of gear shaft (16). Do not tighten the setscrew. Move the gear shaft (16) to engage the teeth of the face gear (14) with the lower spur gear (22) and tighten the setscrew (13). Rotate the face gear in both directions to check backlash. There should be approximately 0.005 to 0.018 inch backlash around the total gear circumference. If necessary, loosen the setscrew (13) and remesh gear teeth until proper backlash is obtained; then tighten setscrew securely.

e. Apply a light film of grease to all gear teeth and to the hub of the upper face gear (27). Assemble the torsion spring (18) to the hub of face gear (27) with the loop of the spring over the casting boss near upper spur gear (20). Secure the spring loop to the boss with the retaining ring (17). Rotate the upper face gear in both directions to make certain that the retaining ring does not restrict movement of the spring loop on the boss. Reposition retaining ring if necessary.

f. Apply one drop of oil to the mouth of the bearing in the take-up arm assembly. Assemble the washer (8) to the shaft of the take-up spindle (7) and insert the shaft through the take-up arm bearing. Install and tighten the screw (6). Assemble the take-up arm to the mounting pin in the reel arm. Assemble the take-up belt (4) around the spindle pulley and the rubber sleeve of the lower face gear. See Figure D. Insert the tension spring (5) into the recess in the take-up arm and compress the spring

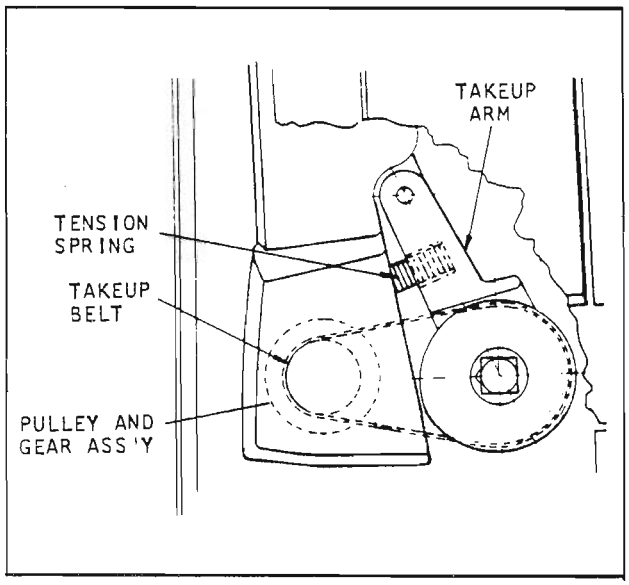


Figure D. Take-Up Arm Assembled

with a piece of shim stock while assembling the reel arm cover (2) to the reel arm. Be sure to place a shim washer (3) on each of the reel arm mounting bosses before lowering the cover in place. Install and tighten the two screws (1).

27. REASSEMBLING THE FRONT REEL ARM ASSEMBLY (Figure 7). Reassemble the front reel arm as outlined in the following paragraphs.

a. Assemble the washer (5C) and then the face gear (5B) down against the shoulder of the feed spindle (5D). Install but do not tighten the two setscrews (5A).

b. Place the reel arm (22) on the bench with the lower (spindle) end of the arm at your left. Assemble the nylon bearings (21) into the cast bearing bosses of the reel arm, engaging the key tabs of the bearings with the cross slots in the bearing bosses. Insert the gear shaft (20) through the nylon bearings from right to left, make sure that the end with the flats furthest from the tip of the shaft is at the right (upper end of the reel arm). Assemble the lower spur gear (19) to the left end of the shaft. The gear face with the square recess must face away from the cast bearing boss. Install the gear retaining clip (17) to the flats of the gear shaft. Assemble the washer (18) and the second gear retaining clip to upper end of the gear shaft (20). Assemble the upper spur gear (16) to the shaft, with the square recess of the gear engaging the retaining clip. Install the grip ring (15) on the end of the shaft. Insert a 0.010-inch feeler gage between the upper spur gear (16) and washer (18), and press the grip ring in against the gear. Remove the feeler gage.

c. Assemble the retaining ring (11) into the ring groove nearest the two flats of reel arm shaft (14). Assemble the washer (12) onto the shaft and down

against the retaining ring. Place a drop of oil at the unflanged end of the reel arm upper bearing. Insert the long end of the shaft (14) through the upper bearing and install the spacer washer (13) and the second retaining ring (11). Make certain that the setscrews (8) and (8A) are not protruding into the shaft hole of the face gear (9) and that the sleeve (9A) is in place on the hub of the gear. Apply a light coat of grease to the gear teeth. Assemble the torsion spring (10) to the hub of the gear with the loop end of the spring furthest from the gear teeth. Assemble the face gear to the reel arm shaft while engaging the loop end of the spring over the spring boss of the reel arm. Secure the loop with the retaining ring (7) and tighten the gear setscrew (8) securely. The retaining ring (7) must not be so tight as to restrict movement of the spring loop when the face gear is rotated.

d. Apply one drop of oil at the flanged end of the reel arm lower bearing. Assemble the feed spindle assembly (5) down through the reel arm bearing. Install and tighten the screw (4) securely.

e. Rotate face gears (5B) and (9) in both directions to check backlash. There should be approximately 0.005-0.018 inch backlash around the total circumference of each gear. By the trial and error method, loosen the gear setscrews (5A) or (8) and reposition the engagement of face gears with spur gears until proper backlash is obtained. Then tighten setscrews securely.

f. Place a shim washer (3) on each of the reel arm mounting bosses and carefully assemble the cover (2) to the reel arm. Install and tighten the two screws (1).

28. REASSEMBLING THE BASE COMPONENTS (Figure 6). Reassemble Figure 6 parts as outlined in the following paragraphs.

a. Lightly grease the teeth of the worm gear (44), tilt gearshaft (41) and gear rack (39). Assemble spring washer (42) to the tilt gearshaft (41), bowed surface toward the worm gear. Insert the shaft through the hole in the base and secure it with the retaining ring (40). Fasten the tilt adapter (38) loosely to the base with the screw (37). Assemble the gear rack (39) and worm gear (44) into the base, holding the worm gear between the two formed ears of the base with all gear teeth (worm gear, gearshaft and tilt rack) engaged. Secure the worm gear with a new spring pin (43). Position the tilt adapter (38) so that the gear rack does not bind in the rectangular cut-out and tighten the screw (37) securely.

b. Assemble the rubber feet (31) and flat washer (32) to the base with the four screws (30). Assemble the tilt bar (28) to the lower end of the gear rack (39) with the screw (26) and lock washer (27). The short leg of the tilt bar must be toward the front (operating side) of the base. New rubber feet (29) are cemented to the tilt bar.

c. Assemble the volume and tone control assembly (25) into the base and secure with the four screws (24). Check to make certain that the control knobs are not binding in the cut-outs of the base before tightening the four screws. Do not install the cover (23) until all wiring connections and adjustments have been made.

d. Assemble the edge connector (18) to the amplifier (20) and position these components within the base. The two spacers (21) are positioned between the amplifier and base at the end furthest from the tilt bar. Loosely assemble the two amplifier screws (19); then install the two edge connector screws (17) and tighten all screws securely. Do not install the cover (16) until all wiring connections and adjustments have been made.

e. Turn the base right side up and, if the mainplate (35) had been removed for any reason, assemble the mainplate to the uprights of the base with the four screws (34).

NOTE: At this point, refer to Figure 5 and carefully assemble the complete mechanism assembly (29) to the mainplate with the four screws (27), the upper two screws also serving to attach the idler gear adjustment bracket (28). Then refer to Figure 6 for balance of reassembly as follows.

f. Assemble a roller (10C) and the adapter (10B) to the shaft at the squared end of the film guide bracket (10D). Assemble the second roller (10C) to the shaft at the rounded end of the film guide bracket and install both retaining rings (10A). Engage the free end of the adapter (10B) with the guide rails of the film guide which is assembled to the lower rear corner of the mechanism assembly (see Figure 11, item 11B). Lower the rear end of the film guide assembly (10) so that the ears of the adapter (10B) are between the cast ears of the base. Hold the guide roller (8), large diameter facing out, between the ears while installing the adapter shaft (7) through the cast ears and roller. Install the screw (9) to secure the assembly.

g. Assemble the lever stop and pin (5) loosely to the base with the screw (4). The lever stop must be adjusted after the mechanism assembly has been installed. Refer to step a, paragraph 29 following.

29. INSTALLING THE RUN-STILL LINKAGE (Figure 5). Reassemble Figure 5 parts as outlined in the following paragraphs.

a. All Models. Lightly grease the elongated slot and sliding contact surface of the belt shifter bracket assembly (25) and assemble the spacers (26) and bracket assembly (25) to the tapped bosses of the projector main plate with the two shoulder studs (24). Assemble one loop end of the torsion spring (23) to the right-hand shoulder stud (24) and the other loop end to the bent ear of the bracket assembly just above the shoulder stud. Install the retaining rings (22) to retain the spring loops.

b. All Models. Assemble the lever stop and pin assembly (5) to the base with the screw (4). Before tightening the screw, insert a 0.060 inch (1.52mm) shim between the stop pin and snubber lever of the mechanism assembly. Rotate the stop until the stop pin just touches the shim and hold the stop securely while tightening the screw (4) securely. Remove the shim.

NOTE: Steps c through g, following, apply only to 1592 model projectors.

c. Assemble one loop of the torsion spring (20) over the shoulder stud of the pivoting link assembly (18). Assemble the large washer (21) down against the shoulder. Position the link assembly against the projector mainplate, with the end of the stud engaged in the rectangular opening just below the projection lamp socket area, add the other end on the tapped boss of the mainplate. Insert the spacer (19) between the link assembly and the tapped boss and install the pivot screw (15). Secure the shaft of the link (18) with the washer (17) and retaining ring (16).

d. Engage the remaining loop of the torsion spring (20) with the pin at the lower end of the sliding link assembly (13) while assembling the spacers (14) and sliding link to the projector mainplate. Install and tighten the two shoulder screws (12).

e. Assemble a retaining ring (9) into the ring groove closest to the slotted end of the switch shaft tube (11) and insert the short end of the tube through the mainplate from the front. Assemble the run-still arm assembly (10) over the protruding end of the tube (11), engaging the key lugs of the arm in the slot of the tube and the slot in the end of the arm with the staked pin at the upper end of the sliding link assembly (13). Install the second retaining ring (9) into the ring groove at the end of the tube (11).

f. Insert the long straight end of the fire shutter rod (8) down behind the pivoting link assembly (18) and through the hole in the bent ear of the link. Engage the upper end of the rod with the hole in the fire shutter filter arm. Assemble the spring (7) and collar (6), small diameter up to the lower end of the rod, and tighten the collar setscrew (5).

g. Assemble a collar (2), small diameter up, to the still-run rod (4). Insert the straight end of the still-run rod up through the hole in the tip of the stop pawl of the mechanism assembly. Hook the bent end of the rod through the hole in the long arm of the pivoting link assembly (18). Assemble the spring (3) and the second collar (2), small diameter down, to the upper end of the rod. Slide the lower collar up against the underside of the stop pawl and compress the spring slightly with the upper collar. Tighten both collar setscrews (1) securely.

30. INSTALLING THE SOUNDHEAD, REEL ARMS AND GEARS (Figure 4). Install Figure 4 parts as outlined in the following paragraphs.

a. Carefully assemble the soundhead assembly (40) to the projector mainplate. Be sure that all leadwires are pulled through behind the mainplate so as not to be pinched between the mainplate and the soundhead. Hold the soundhead while installing and tightening the three screws (36) and their washers (37). Refer to the appropriate wiring diagram at the rear of the Parts Catalog for proper wiring connections between soundhead and other projector parts.

b. Assemble the bowed washer (34) and the flywheel (35) to the sound drum shaft, with the bowed face of the washer against the flywheel. Install the flat washer (33) and retaining ring (32) on the end of the sound drum shaft. Spin the flywheel to make certain that the shaft rotates smoothly.

c. Insert a spring (31) and a reel arm lock button (30) into the opening to the right of the rear reel arm mounting hole in mainplate. Hold the button in with a piece of shim stock while assembling the rear reel arm (29) to the mainplate. Assemble the reel arm disc (27) over the shoulder of the reel arm, with the bent fingers of the disc pointing away from the mainplate. Align the screw holes in the disc with those in the reel arm and install and tighten the screws (26). Install the front reel arm assembly (28) in the same manner.

d. Assemble the spur gears (25C), hubs inward, to the gear studs of the rewind lever assembly (25D). Place a washer (25B) on the gear stud nearest the end of the lever, and secure the gears with the retaining rings (25A). Hook the bent end of the long leg of the spring (24) through the hole in the upper lip of the rewind lever (25D) and assemble the spring loop and the rewind lever to the gear stud of the mainplate (located near the upper left-hand corner of the cut-out for the mechanism assembly). Wind the short leg of the spring one full turn counterclockwise and hook the bent end behind the edge of the cut-out. Assemble the idler gear (23), hub inward, and the washer (22) to the protruding gear stud, meshing gear (23) with gears (25C). Install the retaining ring (21).

e. Assemble the gear retaining key (19) to the slot of the front reel arm shaft. Assemble the rewind gear (18) to the shaft so that the square recess in the inner face of the gear engages the retaining key. Lightly grease the outer hub of the rewind gear. Assemble the clutch gear (17) to the shaft with the longer end of the clutch gear mating up with the formed outline of the rewind gear. Assemble the gear and bearing assembly (16) to the shaft and up against the clutch gear so that the bearing spring is positioned between the two bosses on the face of the clutch gear. Install the retaining ring (15) into the groove of the shaft to lock the entire clutch assembly in place.

f. Assemble the gear (11B), long hub out, to the gear stud of the arm assembly (11C) and install the retaining ring (11A). Assemble the rewind clutch assembly (14) and flat washer (13) to the upper sprocket shaft and assemble the gear retaining key (12) to

the flats of the shaft. Assemble the large hole in the idler arm over the inner shoulder of the spur gear (9) and install these parts and washer (10) on the upper sprocket shaft. Slide the gear (9) inward until the square recess in its face engages the key (12). The staked pin of the idler arm must be inserted into the triangular cut-out in the rewind lever (25D). Install the spring tension washer (7) bowed face out, and the grip ring (6).

g. Install the washers (5) and spur gears (4), hubs in, on their respective gear studs, and secure them with the retaining rings (1). Assemble the washer (3) and the spur gear (2) to the shaft and install the retaining ring (1).

h. Speck all gear teeth sparingly with grease. After the projector is completely assembled, grease can be distributed by running the projector briefly.

31. INSTALLING ELECTRICAL COMPONENTS (Figure 3). Install Figure 3 parts as outlined in the following paragraphs. Refer to the appropriate wiring diagram at the rear of the Parts Catalog for proper connection of leadwires between components.

a. 1592 Models Only. Place the solenoid assembly (47) on the work surface with the rod pointing toward you and the tapped holes in the solenoid bracket facing up (leadwires at the right). Place the mounting plate (47B) over the tapped holes, with the leg containing the single mounting hole toward you and at the left. Install and tighten the two screws (47A). Assemble the three rubber bushings (46), small diameter first, into the mounting holes of the mounting plate (47B). Install a collar (43), large diameter first, on the solenoid rod, pressing it up against the yoke while tightening its setscrew (42). Assemble this solenoid group to the support plate mounted on the long cast arm of the mechanism assembly, while guiding the solenoid rod down through the hole in the tongue of the stop pawl. Fasten the mounting plate (47B) to the mechanism support plate with the three screws (44), inserting the spacer washers (45) between the rubber bushings (46) and the mechanism support plate. Temporarily assemble the reamining collar (43) on the lower end of the solenoid rod (beneath the stop pawl) and tighten its setscrew.

b. 1585 and 1590 Models Only. Attach the fuseholder (41) with the screw (40). Assemble the switch (38) to the projector mainplate with the locking nut (36) and lockwasher (37).

c. 1592 Models Only. Assemble the rotary switch (35C) to the bracket assembly (35D) with the locking nut (35A) and lockwasher (35B). Lift the assembled switch and bracket (35) up into position against the mainplate while guiding the switch shaft through the tube (item 11, Figure 5) already assembled to the mainplate. Engage the free end of the animation switch lever crank (item 37, Figure 10) into the hole at the top of the animation switch bracket (item 34, Figure 3) and secure both switch brackets (34) and (35) to the mainplate with two screws (33). Insert a 0.010 inch feeler gage between the animation switch lever (item 35, Figure 10) and the mechanism housing and hold the lever against the shim while pressing the crank grip ring (item 36, Figure 10) in against the mechanism housing. Remove the shim.

d. All Models. Assemble the motor mounting brackets (30) and motor bracket straps (28) with stabilizer bracket (29) to the motor end caps. When mounted to the projector base, the motor should be positioned so that the nameplate can be easily read. Install the motor pulley (27) on the motor shaft, small pulley diameter toward the motor. If the pulley was replaced, be sure to use the same color of pulley as the one which was removed. Position the pulley so that its inner face is approximately 1/4-inch from the rubber mounting ring of the motor and temporarily tighten the setscrews (26). Assemble the strain relief (24) to the jacket of the line cord (25) and assemble the strain relief into the center hole in the stabilizer bracket (29). Loop the drive belt (23) around the motor pulley and insert the end of the motor shaft through the blower fan housing cover (22). Assemble the blower fan (21) to the end of the motor shaft, with the fan hub containing the setscrews facing toward the motor. Position the fan on the shaft so that the end of the shaft is approximately 1/16-inch below the face of the outer fan hub and tighten the two setscrews (20). Assemble the fan housing (19) to the cover with the three screws (17). Manually rotate the motor pulley to make certain that the fan is not striking the cover or housing.

e. All Models. Lift the assembled motor and blower group into position on the projector base, threading the drive belt through the loop of the belt shifter bracket assembly (item 25, Figure 5). Guide the belt edgewise upward and around the large mechanism pulley. Align the motor and blower mounting holes with those in the base, and install and tighten the eight mounting screws (15) and (16). Refer to the appropriate wiring diagram at the end of the Parts Catalog section and make the necessary wiring connections.

f. 1590 Models Only. Assemble the power transformer assembly (14) to the projector base with the four screws (13). Refer to the appropriate wiring diagram at the end of the Parts Catalog section for proper wiring connections.

g. 1585 and 1592 Models Only. Assemble the brackets (10C) and (10D), mounting flanges facing inward, to the lamp transformer (10E) with the screws (10B) and hex nuts (10A). Make wiring connections to the transformer according to the appropriate wiring diagram. Position the transformer so that the mounting holes in the bracket are aligned with those in the base. Install the two front screws (9); then tip the projector so that the two rear screws (9A) can be inserted up through the base. Tighten all screws. Assemble the brackets (7) and (8) to the top of the lamp transformer with the screws (6) and hex nuts (5). Make wiring connections to

the power transformer (4) according to the appropriate wiring diagram. Secure the power transformer to the upper fingers of the brackets (7) and (8) with two screws (2) with lockwashers (3) and hex nuts (1). Note that two sleeve spacers (3A) are inserted between the bracket (8) and transformer on 1592H and 1592BH model projectors.

32. REASSEMBLING END CAPS AND LAMP COMPONENTS (Figure 2). Reassemble Figure 2 parts as outlined in the following paragraphs.

a. Pull the lamp leads through the access hole in the mainplate and connect them to the terminals of the lampholder (15). Secure the lampholder and the lamp shield (14) to the mainplate with the two screws (13), and pull excess lamp leads back behind the mainplate. Assemble the projection lamp (12) into the lamp socket and swing the lamp retaining spring up into place.

b. Loosely assemble the still-run lever (11A) to the switch shaft with its setscrew. Assemble the control knob (11) to the shaft, pressing in until fully seated.

c. Assemble the axuiliary speaker jack (9) and its insulating washer (10) to the rear end cap (7) with the hex locking nut (8). Reassemble the rear end cap components (7A) through (7H), noting that only the 1592 model projectors are equipped with the Directamotion remote control receptacle (7F). An adhesive-backed cover (7G) is installed over the receptacle opening in 1585 and 1590 model projectors. The starting capacitor (7C) is mounted with its terminals up and the top end of the capacitor approximately 1/8-inch above the top edge of the capacitor clamp (7B). Secure the clamp to the rear end cap with two screws (7A).

d. Assemble the speaker (6B) over the four molded pins of the front end cap (6C) and install the four grip-type retaining rings (6A). Speaker should be installed with the terminals at the top.

e. Make certain that all twelve speed nuts (5) are in place on the formed mounting ears of the two end caps. Position the front end cap assembly (6) on the base with mounting holes aligned and, from beneath the base, install the two base-to-end cap mounting screws (3) finger tight; then install two screws (4) through the mainplate and into the speed nuts on the front mounting ears of the end cap. Tighten all four screws securely. Install the rear end cap assembly (7) in the same manner.

f. Assemble the tilt knob (2) to the protruding end of the tilt shaft and tighten the setscrew (1) securely. Rotate the tilt knob to check the tilting mechanism.

g. Refer to the appropriate wiring diagram at the end of the Parts Catalog section for proper wiring connections.

33. REASSEMBLING LAMPHOUSE AND COVERS (Figure 1). No special instructions are necessary for the reassembly of the lamphouse or cover components. These items need not be installed until after all adjustments have been made (see the following section).

Adjustments

34. GENERAL INSTRUCTIONS.

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

All special tools and fixtures required to perform the adjustment procedures are listed and illustrated in Figure A. In addition, special test films and electronic test equipment (vacuum tube voltmeter, voltohmmeter, oscillator and tachometer or Strobotac) are needed to check and adjust the sound system of the projector. The test films are listed in the Introduction section.

WARNING

Many of the procedures listed in this section require operation with the rear projector cover removed. To avoid shock hazards, disconnect the power and discharge the motor starting capacitor, when not required.

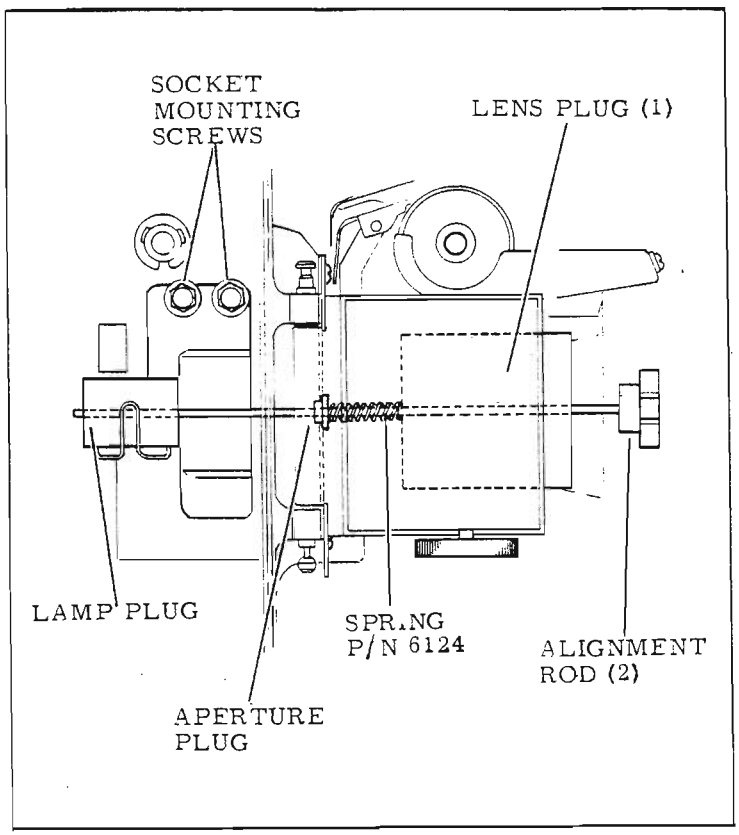


Figure E. Aligning the Optical System

35. OPTICAL ALIGNMENT.

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

a. Aligning the Aperture Plate.

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

(2) Swing the lens carrier fully open and disassemble the pressure plate from the lens carrier.

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

(4) Insert the alignment rod (Figure E) through the lens plug until the rod end protrudes enough to install the spring (P/N 6124). Insert the lens plug into the lens barrel until the tip of the alignment rod engages the aperture plug previously installed. Tip the projector carefully onto its back (lens opening facing up). The alignment rod must slide freely through the aperture plug without binding. If necessary, shift the aperture plate slightly until free rod movement is obtained; then tighten aperture plate screws.

b. Aligning the Lamp Socket.

(1) Tip the projector back into its normal, upright position and reassemble the pressure plate to the lens carrier. Close the lens carrier.

(2) Loosen the two lampholder mounting screws just enough to permit movement of the lampholder. Insert lamp plug (1, Figure A) into lamp socket and secure the lamp spring. Slide alignment rod completely into place until tip of rod engages the hole in lamp plug. Shift socket as necessary until rod slides freely in the lamp plug hole. Then tighten the screws securely and remove all tools.

36. ADJUSTING THE INTERMITTENT MECHANISM.

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

(1) Aperture plate out of alignment. See paragraph 35, step a, Aligning the Aperture Plate.

(2) Shuttle stroke incorrect. See paragraph 36, step d, Shuttle Stroke Adjustment.

(3) Link bearing missing from end of shuttle arm. Partial disassembly required to remove shuttle arm and replace link bearing (refer to Disassembly section).

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

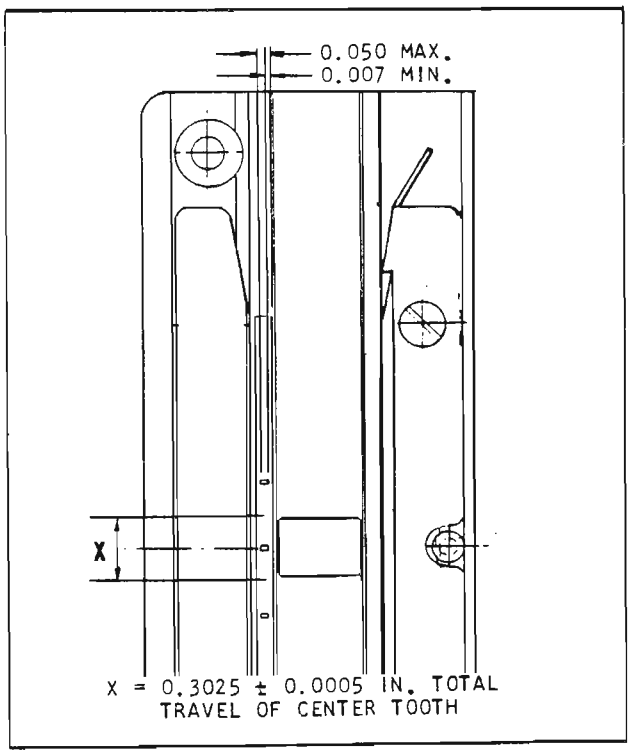


Figure F. Aperture Plate and Shuttle Tooth Clearance

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

NOTE: If the mechanism assembly is installed on the mainframe, it will be necessary to remove the lamphouse, the projection lamp and the lampholder before proceeding.

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

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

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

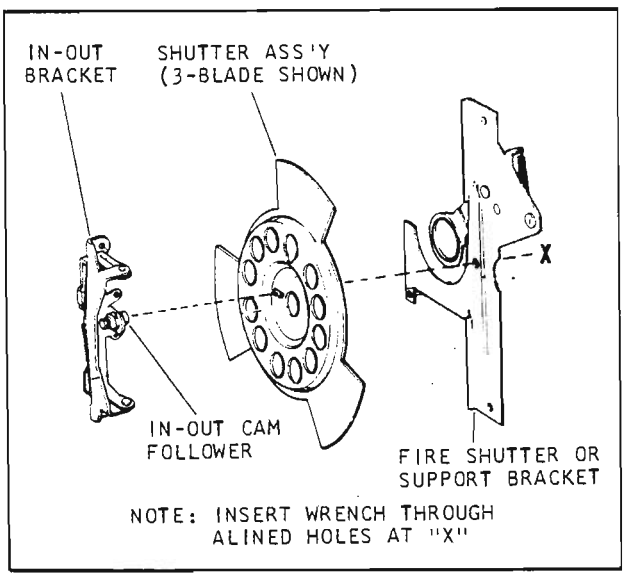


Figure G. Adjusting Shuttle Tooth Height

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

c. Checking Fit of Shuttle Arms to Pull-Down Cam (See Figure H). Remove rear cover and the projection lamp.

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

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

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

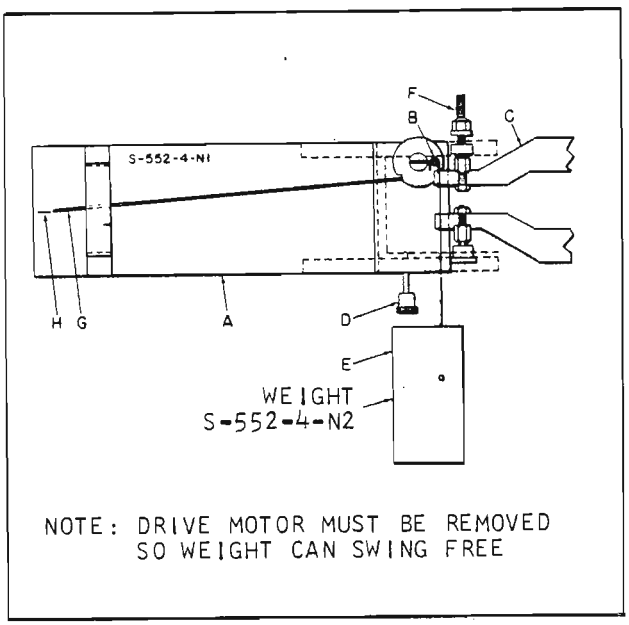


Figure H. Adjusting Fit of Shuttle Arms to Pull-Down Cam

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

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

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

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

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

(a) Remove pressure plate assembly from the lens carrier.

(b) Set the framer knob at the mid-point of its over-all travel.

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

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

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

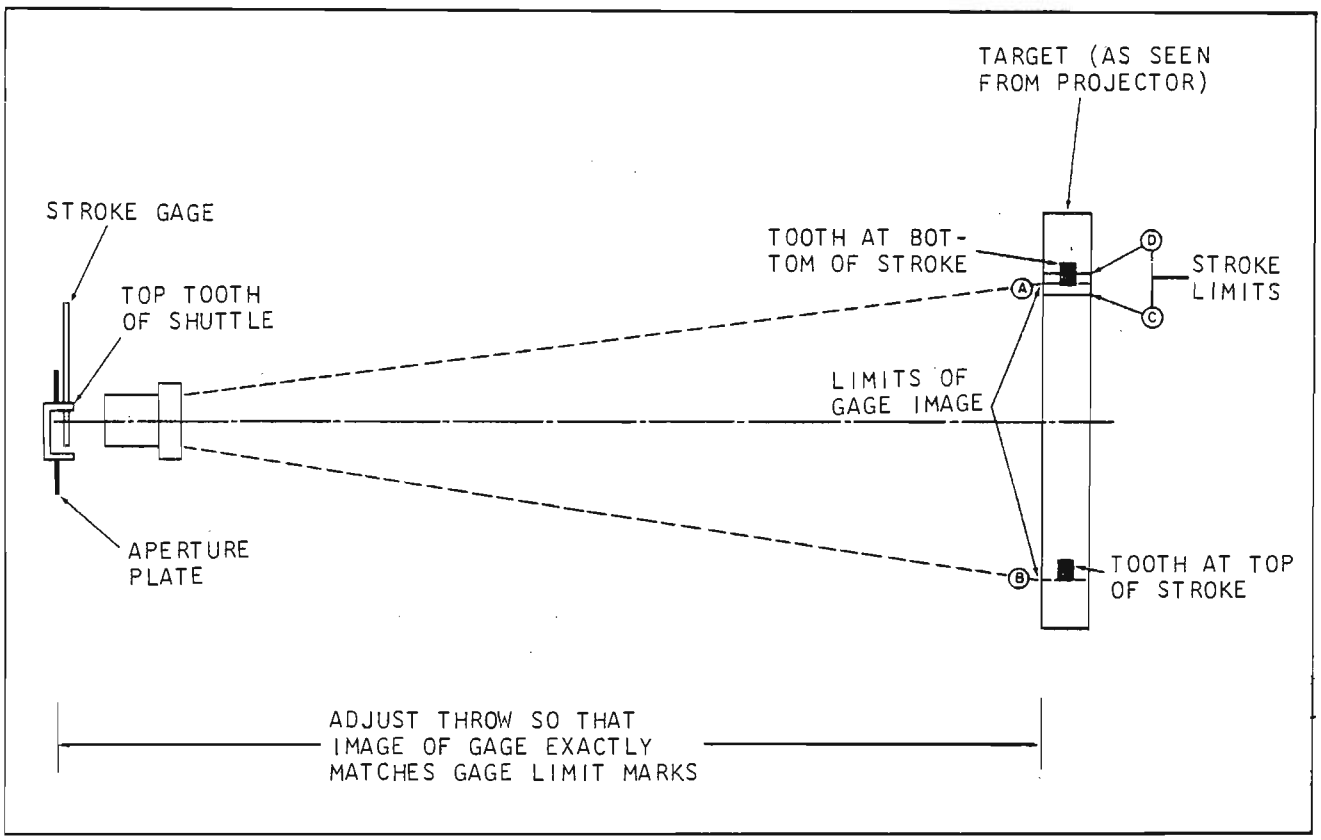


Figure J. Checking and Adjusting Shuttle Stroke with Target

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

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

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

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

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

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

(c) After adjusting stroke, recheck shuttle tooth side clearance as instructed in paragraph 36, step a, and readjust if necessary.

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

e. Framing Adjustment. Thread projector with framing test film loop TFL-55-NX1. Project film and turn framing knob from one limit to the other. If at one limit a frame line is not visible, loosen nut on the framing eccentric located at top of shuttle arm plate assembly (Figure B) and turn eccentric until the frame line appears. Hold eccentric while tightening nut. Check adjustment by again turning framing knob from limit to limit while observing picture. When the eccentric is properly adjusted, either frame line can be projected and movement of film should be approximately equal at top and bottom of framer travel.

37. LENS CARRIER ADJUSTMENT. Angular relationship between the lens carrier and the aperture plate is controlled by lens mount stop screw (item 36, Figure 11). Thread projector with roll title or target film having sharp images in corners and project a picture approximately 30 inches high onto a matte surface. The projector must be square with the screen. Focus the picture and compare resolution of the two sides of the image when viewed from a distance of approximately twice the width of the picture. If one side appears to be soft, refocus to sharpen that edge of the picture and note whether the lens is moved toward or away from the aperture. For example, if image at right-hand edge of screen is soft until lens is moved toward aperture, then lens stop screw is set too far forward and should be turned clockwise.

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

38. ADJUSTING THE ANIMATION CLUTCH (1592 Models Only).

a. Checking Stop Pawl to Trigger Clearance. Rotate the mechanism by hand until the finger of the trigger is adjacent to the inner bent ear of the stop pawl as shown in View A, Figure K. If the trigger fails to clear the stop pawl ear, adjust as follows. Loosen the bearing bracket screws (item 33, Figure 12) and shift the bearing bracket (item 34, Figure 12) up or down, as necessary, to obtain approximately 0.010 to 0.015-inch clearance between the stop pawl ear and the end of the trigger; then tighten the two screws securely.

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

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

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

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

(4) The shuttle interlock retainer is secured to the right end of the worm gear. Note, in View C, that the curved lip of this retainer must overlap the downward bent finger of the clutch slide bar. If necessary, bend this finger to obtain positive overlap as shown.

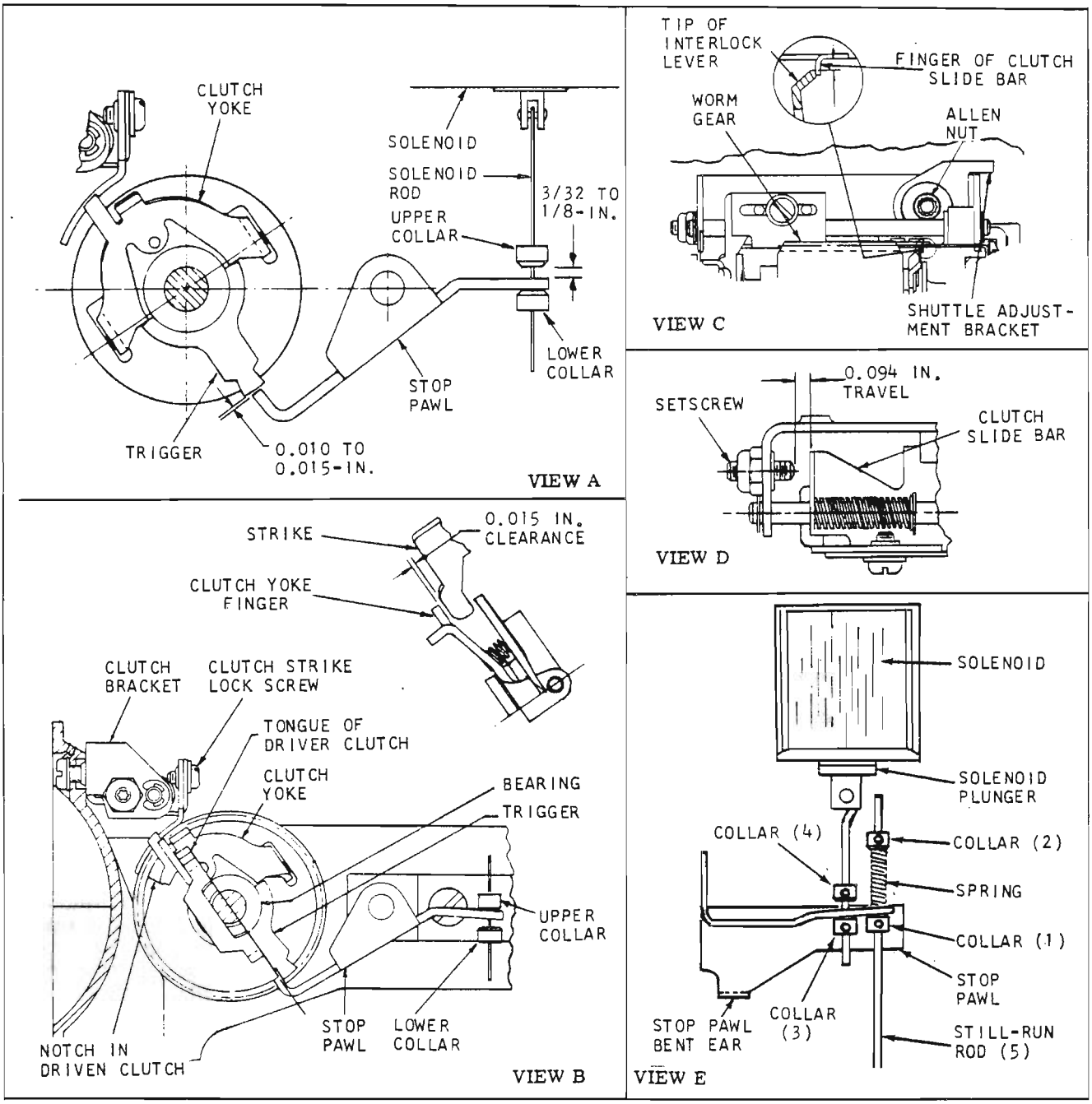


Figure K. Animation Clutch Adjustments

c. Adjusting Clutch Solenoid Linkage. Refer to Figure K for the following adjustment procedure. Rotate the mechanism by hand until the finger of the stop pawl is centered at the tip of the trigger as shown in Figure K, View A, and place Still-Run knob in "Run."

(1) Refer to Figure K, View E. Loosen setscrews in collars (1) and (2) and press lower collar (1) up against the underside of the stop pawl until a clearance of 0.010 to 0.015-inch is obtained between stop pawl finger and tip of trigger. Tighten collar (1) setscrew.

(2) With the tip of an appropriate spring gage, press down on upper collar (2) until gage indicates a spring pre-load of 5 ounces; then tighten upper collar setscrew.

(3) Loosen setscrews in collars (3) and (4). Use a suitable clamp to hold the solenoid plunger

up to its seat; then raise lower collar (3) until it just touches the stop pawl and tighten the collar setscrew. Position the upper collar (4) so that there is 1/16 to 1/8 inch clearance between collar and stop pawl and tighten upper collar setscrew.

d. Checking Still-Run Linkage. Refer to Figure K, View E in this section for the following adjustment procedure.

(1) Rotate the projector Still-Run knob to the Run position so that the still-run rod (5) moves downward in the limit of its travel.

(2) Rotate the mechanism knob and check to make certain that the ear of the stop pawl clears the trigger as shown in View A, Figure K.

(3) Operate the projector and switch from "Run" to "Still" position. The stop pawl is engaged with the trigger mechanically and is disengaged electrically (by the solenoid). If the preload tension of the spring (paragraph c, step 2, preceding) is set too low, the stop pawl may not engage the trigger properly and a chattering will result. If set too high, the solenoid may not be able to overcome spring tension to disengage the stop pawl from the trigger. Readjust spring tension until proper operation is obtained.

39. ADJUSTING THE FIRE SHUTTER (1592 Models Only). When the projector has been completely assembled, install the projection lamp and lens and run the projector "forward" with the lamp on. Turn the Still-Run knob to the Still position and focus the image of the aperture on the screen. Check for full pattern of the fire shutter disc on the screen (image must show perforations of disc throughout). Note that a bent ear on the fire shutter bracket limits the travel of the fire shutter filter arm. If unfiltered light appears at the top or bottom of the aperture image, it will be necessary to bend this stop ear so that the amount of filter arm travel is increased or decreased accordingly.

40. ADJUSTING THE REEL ARMS AND REWIND CLUTCH.

a. Front Reel Arm Adjustment (See Figure 7). Adjust end play of the shaft (14) to 0.008 inch ± 0.003 inch by positioning retaining ring (11) against an 0.008 inch shim. The backlash for both face gears should be between 0.005-inch (minimum) and 0.016-inch (maximum). Adjustment is made by loosening the face gear setscrews (5A), (8) and (8A) and repositioning the face gears (5B) and (9) as necessary.

b. Rear Reel Arm Adjustment (See Figure 8). Adjust end play of the shaft (31) to 0.008 inch ± 0.003 inch by positioning retaining ring (28) against an 0.008 inch shim. The backlash for both face gears should be between 0.005-inch (minimum) and 0.018-inch (maximum). The upper gear (27) is adjusted by loosening its setscrew (26) and repositioning the gear as necessary. The lower gear (14) is adjusted by loosening the setscrew (13) in the tapped hole of the arm and shifting the shaft (16) in and out as necessary.

c. Rewind Clutch Adjustment. The rewind clutch system must be adjusted to produce a supply spindle torque of 5-1/2 to 6 inch-ounces when the rewind button is pressed during operation. Install an empty reel on the supply spindle and wrap several turns of a ten-inch film strip around the reel hub. Hook a spring scale to the free end of the film strip. Turn on the projector, rotate the "Motor-Lamp" switch to "Reverse" and press and release the rewind button at the top of the mechanism housing. The spring scale must register between 2.5 and 4.5 in.-lbs. When the rewind clutch system begins to slip. Take-up torque is adjusted by means of the take-up clutch assembly (item 18, Figure 4). Grip the flats on the inner face of the clutch with a wrench while loosening or tightening the nut on the clutch hub. Rewind torque (also 2.5 to 4.5 in.-lbs.) is adjusted by means of the rewind clutch assembly (item 14, Figure 4). This clutch is installed with the adjusting nut facing inward toward the mainplate, and a special wrench (item 5, Figure A) must be used for the adjustment.

41. ADJUSTING THE SOUNDHEAD.

a. Soundhead Removal.

(1) Remove the projection lens from the lens carrier and wrap it in tissue or a soft cloth.

(2) Loosen the cover thumbscrew and remove the exciter lamp cover from the soundhead.

(3) Remove the rear cover (Figure 1) from the projector. Remove the assembled power transformer and lamp transformer (Figure 3) from the projector base, being careful not to place undue strain on the transformer leads. Remove the flywheel (35, Figure 4) from the sound drum shaft.

(4) Refer to the wiring diagram at the rear of the Parts Catalog section and disconnect or unsolder soundhead leadwires as necessary.

(5) With a sharp pencil or scribing tool, scribe a line on the projector main plate along the front edge of the soundhead casting. This will provide a reference mark for locating the soundhead during installation.

(6) Remove the three screws (36, Figure 4) and flat washers (37) and carefully withdraw the soundhead assemby from the projector main plate, disengaging the Volume control shaft from its opening in the soundhead housing.

b. Photocell Alignment (Figure 9).

(1) Loosen the setscrew (19) and the two housing screws (20). Remove the exciter lamp (8) and the optical slit (11).

(2) Insert the sound drum alignment tool into the optical slit opening as shown in Figure L.

(3) Press the sound drum in until its inner face just makes contact with the first step, or bearing surface, of the alignment tool, and maintain this contact while tightening the two screws (20) securely.

(4) Withdraw the alignment tool and, while looking into the optical slit mounting hole, shift the photocell until its forward tip is flush with the inner face of the sound drum. Maintain this position while tightening the setscrew (19).

c. Roller Tension Adjustment (Figure C). The roller arms are linked by a torsion spring and, therefore, will move as a pair. The counterbalance spring must be adjusted to offset the weight of the rollers and roller arms. Place the soundhead on a level surface and move the roller arms (as a set) to various positions. If the roller arms fail to remain in the set positions, engage the slotted head of the tension adjuster with a screwdriver and turn the adjuster clockwise or counterclockwise until proper counterbalance is obtained.

NOTE: The following adjustments must be made with the soundhead installed and the projector threaded with special test film.

d. Soundhead Installation.

(1) Carefully assemble the soundhead assembly to the projector mainplate, while inserting the Volume control shaft through the soundhead casting. Install and tighten the Volume control mounting nut.

(2) Install the three screws (36, Figure 4) with their washers (37) from the rear of the mainplate and tighten the screws finger tight. Shift the soundhead until the forward edge of the soundhead housing is aligned with the scribe or pencil mark on the mainplate and maintain this position while tightening the three screws securely.

(3) Refer to the appropriate wiring diagram at the rear of the Parts Catalog section and reconnect or resolder all soundhead leadwires.

(4) Assemble the bowed washer (34, Figure 4), flywheel (35) and flat washer (33) to the sound drum shaft and secure these parts with the retaining ring (32).

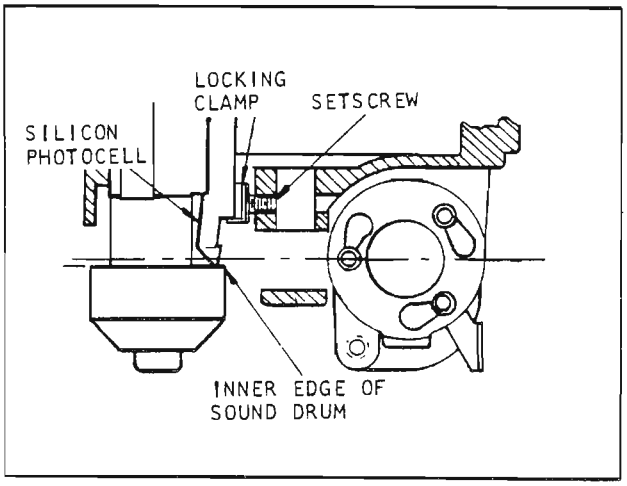


Figure L. Positioning the Sound Drum and Silicon Cell

(5) Reinstall the assembled power transformer and lamp transformer (Figure 3) to the projector base.

e. Optical Slit Adjustment (Figure 9).

(1) Insert the optical slit (11) into its opening in the soundhead. The adjusting hole in the barrel of the slit must be at top center.

(2) Insert a 0.050-inch feeler gage between the tip of the optical slit and the sound drum and press the optical slit in against the feeler gage. Hold in this position while tightening the locking screw (10) just enough to hold the slit in place.

(3) Thread the projector with audio framing test film TFR-D550-NX5 and connect a 16-ohm, 15-watt load resistor and output meter to the speaker jack.

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

(4) Set the volume control at approximately 12 o'clock position and start projector. Move slit toward or away from film, as required, to obtain an output reading. Rotate the slit to obtain peak reading and simultaneously move in or out until maximum output is obtained. If film was threaded with emulsion toward the optical slit, move slit toward film until output drops 1-1/2 to 2 DB. If emulsion is toward sound drum, move slit away from film to obtain 1-1/2 to 2 DB drop in output. Tighten slit clamping screw (10) securely to lock the adjustment.

f. Buzz Track Adjustment (Figure 9). The lateral position of the film in the soundhead is controlled by the flanged roller (15C) and edge guide screw (24). Unless the adjustment has been disturbed, it is not probable that the edge guide screw (24) will require resetting. Thread the projector with buzz track test loop TFL-37-NX1 and adjust volume control to a suitable listening level. Turn adjusting screw (14) to move flanged roller laterally.

NOTE: Originally two types of buzz track were in use. On one, the track spacing exceeds the length of the scanning beam. This track can be positioned so that little or no signal is reproduced. On the other type of track, spacing is less than the length of the beam. This track should be positioned so that both tones are reproduced at approximately the same volume level. If, after adjustment of guide roller position, signal levels cannot be balanced (or eliminated on wide track), or level of tones fluctuates, adjust edge guide screw (24) to clear up the condition. If the edge guide screw is far out of adjustment, turn it clockwise until it clears the edge of film, adjust rollers and then set guide screw to stop weave of film.

g. Positioning the Soundhead.

(1) Lock the autoload system in the load position and loosen the three soundhead mounting screws (36, Figure 4) just enough to permit the soundhead to be shifted.

(2) Hold the soundhead locating gage (Figure A) by its handle and insert the gage carefully between the sound drum and take-up sprocket as shown in Figure M. The gage must be between the sound drum threading guides. Position the gage so that one end bears against the supporting ribs for the sound track edge of the film and with the round body of the gage in contact with the rear sprocket flange, as shown.

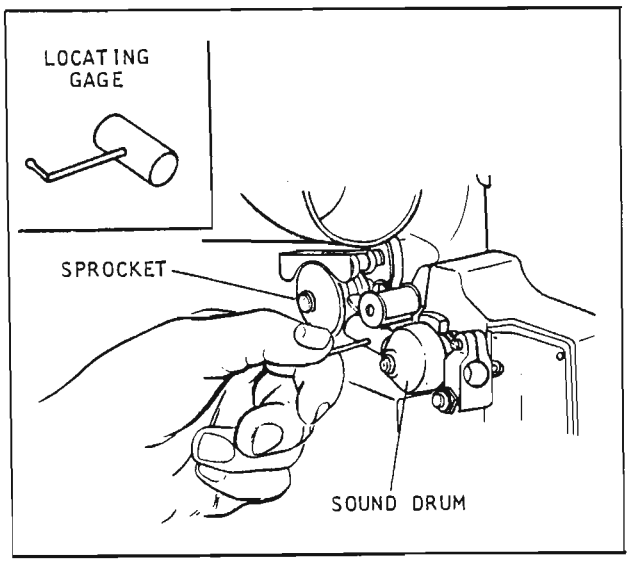


Figure M. Positioning the Soundhead

(3) Tilt the gage so that it lies on a centerline between the take-up sprocket and sound drum. Shift the soundhead toward the take-up sprocket until the sound drum bears lightly against the end of the gage, and tighten the soundhead attaching screws securely.

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

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

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

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

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

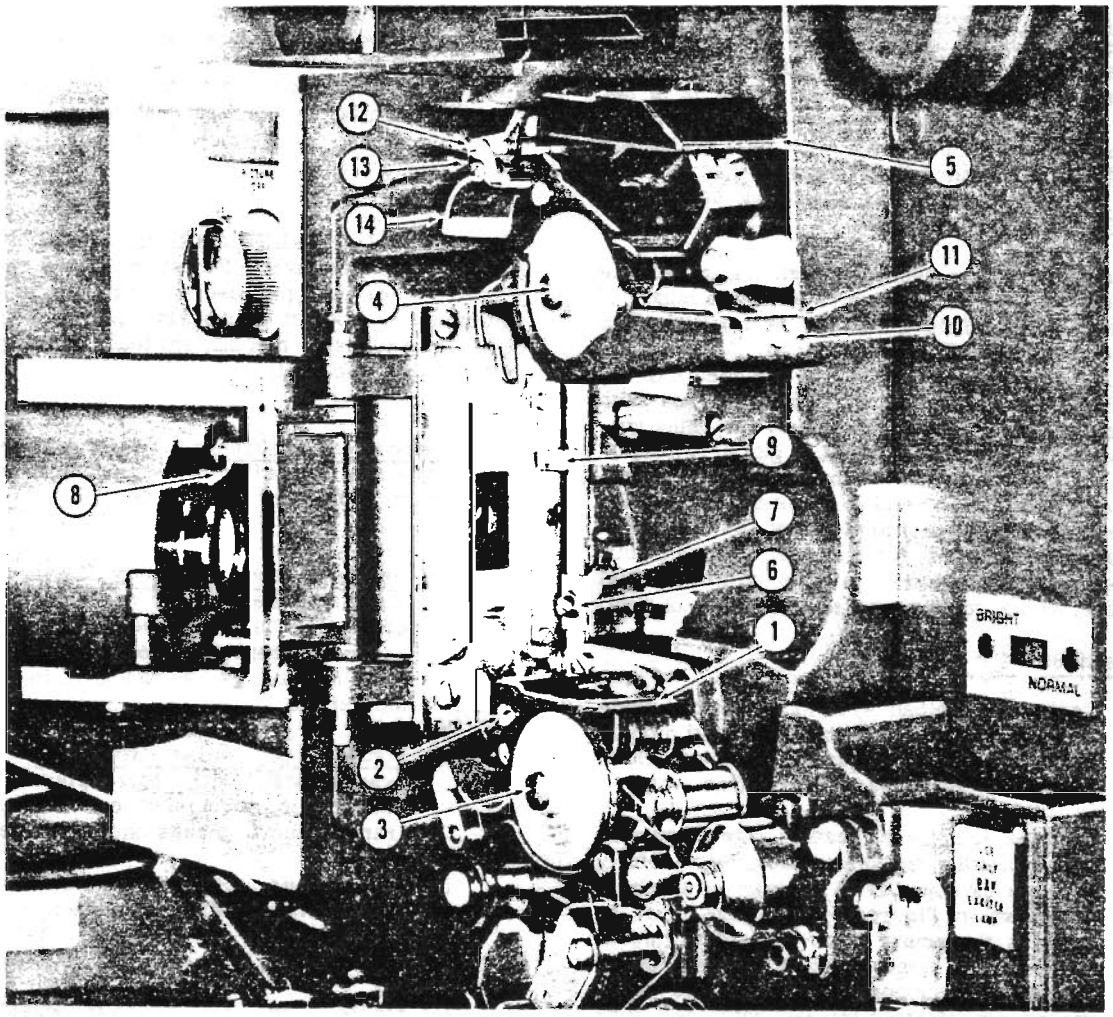
(4) Strobe Disc. Attached to sprocket by means of suction cup or rubber foot. For viewing with light from 60 Hz source, disc should have 70 dots for sound speed, 93 dots for silent speed. Count number of apparent revolutions of pattern for one minute. If pattern drifts in direction of rotation, add to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

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

b. Speeds at 120 Volts AC, 60 Hz.

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

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



1. Sprocket guard
2. Guard retaining screw
3. Lower sprocket hub
4. Upper sprocket hub
5. Actuating assembly
6. Shuttle retractor screw
7. Shuttle retractor
8. Pressure plate lift-off ear
9. Connecting link ear
10. Film guide screw
11. Film guide
12. Escape hub screw
13. Film escape hub
14. Loopformer

Figure N. Autoload System Adjustments — View I

43. AUTO-LOAD SYSTEM ADJUSTMENTS — GENERAL.

a. The auto-load system consists of a series of guides and rollers which, when the system is in the load position, are so located as to guide the film through the threading path. When the system is in the open position, the guides and rollers clear the film path.

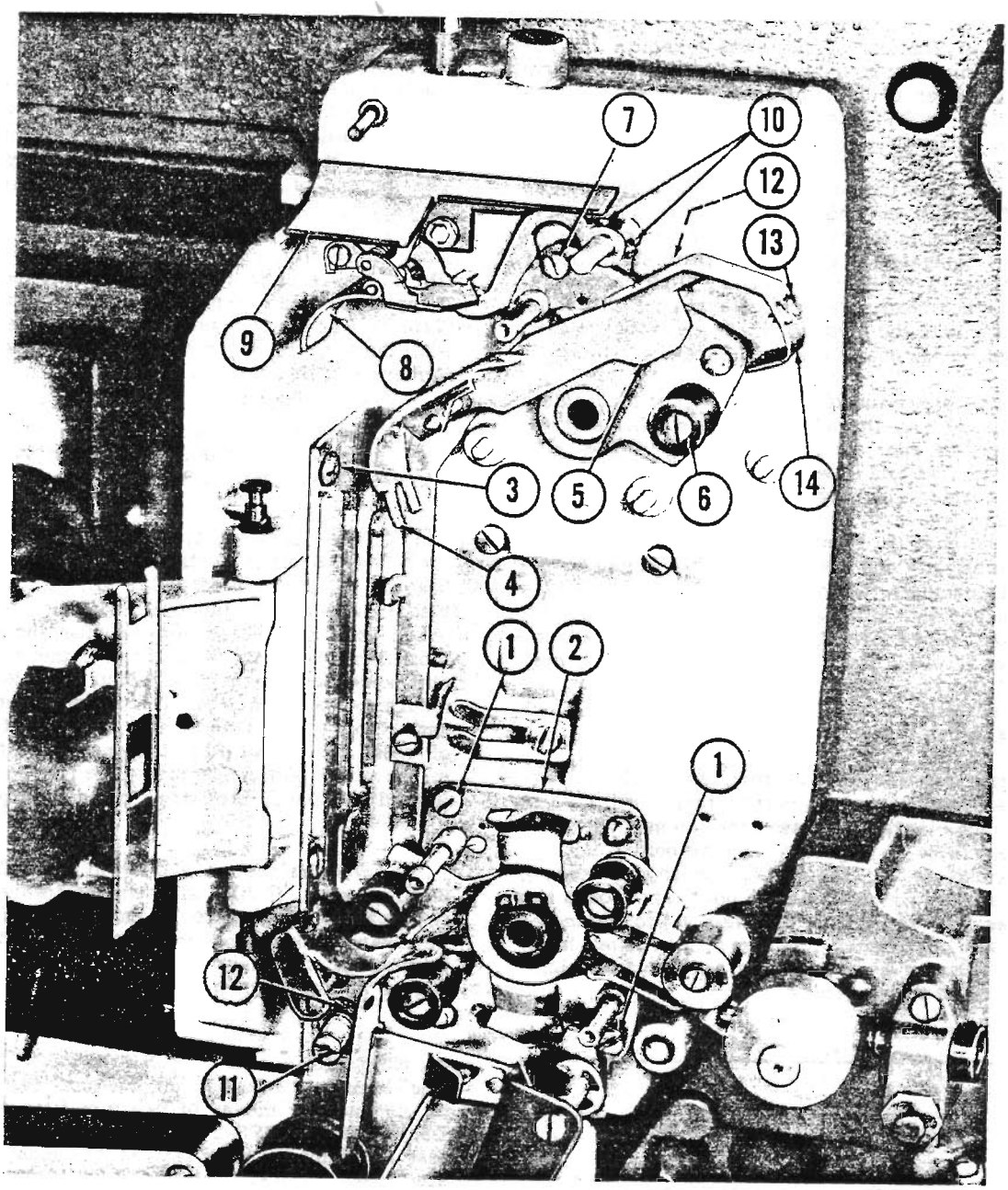
b. When the system is in the open position, the location of the guiding parts is not critical. Therefore, adjustments to assure proper location of the guiding parts are made with the system in the load position.

c. The guides are connected by mechanical linkage. The system is actuated by a cocking lever at the lower end of the linkage and the movement is stopped at the top end of the linkage. The specified clearances must be checked with the system in the load position. If the need for adjustments is detected, it is important that the repairman proceed in the sequence listed in this section. The sprocket timing and the locating of the soundhead may be done without disturbing the film guide adjustments.

44. ADJUSTING THE LOADING GUIDES.

a. Swing open the lens carrier upper take-up sprocket guard (1, Figure N) and remove the retaining screw (2).

b. Place the timing plate (S-552-1-N1) over the sprocket hubs (3 and 4, Figure N). The timing plate locating pin should enter the counterbore from which screw (2) was removed. If the locating pin does not enter counterbore, loosen three sprocket guard plate



1. Guard plate attaching screw
2. Sprocket guard plate
3. Aperture plate screw
4. Lower loopform assembly
5. Heel of lower loopform
6. Entrance guide roller
7. Upper guard plate screws
8. Film escape kickplate
9. Hood
10. Kickplate setscrews
11. Eccentric pivot screw
12. Eccentric pivot
13. Leaf spring screw
14. Leaf spring

Figure P. Autoload System Adjustments — View II

attaching screws (1, Figure P) and rotate the lower guard plate (2) until pin enters hole. Then tighten the three screws securely.

c. Remove retaining ring that secures the actuating assembly (5, Figure N) and lock the auto-load system. Place a 0.015 inch feeler gage between the film support rails of the aperture plate and the rear surface of the lower loop form assembly (4, Figure P). This surface should touch the feeler gage just as the heel of the loop form (5, Figure P) strikes the shoulder on the mounting stud for the entrance guide roller (6, Figure P). To adjust, loosen two screws (7, Figure P) which attach the upper sprocket guard plate. Press

downward on front end of loop form assembly and rotate upper sprocket guard plate until heel of loop form strikes shoulder of stud and rear surface clears aperture rails by 0.015 inch. Then tighten screws (7, Figure P) securely.

NOTE: Depress and hold the lower loop form assembly (4, Figure P) and check, at rear of mechanism, to see that the pin in the threading lever clears the bottom of the elongated slot in the loop form shaft link by approximately 1/64 inch. (See Figure Q.) If necessary, loosen the hex head screw that secures the threading lever and rotate the lever to obtain the proper clearance; then retighten the hex head screw.

d. Check operation of the film escape mechanism by leaving the auto-thread system open. Manually advance the film and jam it in the upper channel. The film should fold and flow out through the kickplate in the loop former (14, Figure N). If the kickplate does not release, the arm of the hub assembly (13) is not striking the hood (9, Figure P) properly. The hood can be moved slightly and the hub assembly should be adjusted accordingly. When the auto-thread system is activated and the kickplate does not lock in position, loosen the screw (12, Figure N) holding the hub assembly to locking pawl and adjust the hub assembly until the tip of the bracket touches the upper curved surface of the loop former. This will lock kickplate in position.

e. Again depress the loop form assembly (4, Figure N) and check to make certain that there is 0.012 to 0.015 inch clearance between the top surface of the lower loop form (4, Figure N) and the bottom surface of the kickplate (8, Figure P). To adjust, remove the two screws which attach the hood (9). Loosen two setscrews (10) and rotate kickplate (8) to obtain desired clearance. Tighten setscrews and reinstall hood. Before tightening hood retaining screws, press hood toward rear of the projector.

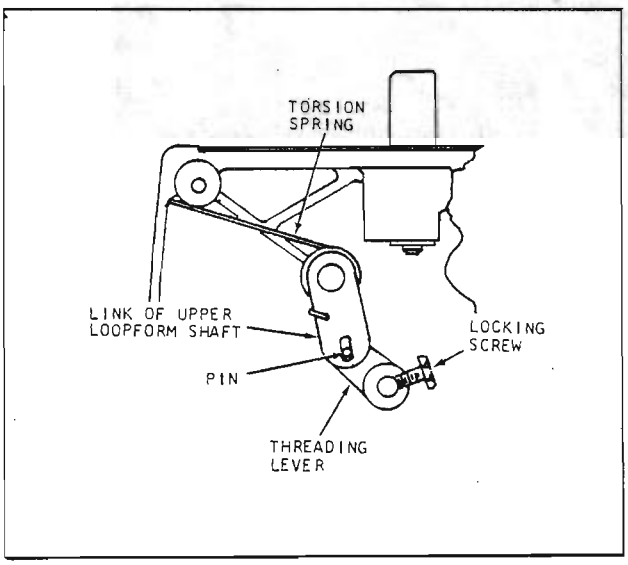


Figure Q. Threading Lever Clearance Adjustment

f. With the auto-load system locked and film gate open, check to make certain that the shuttle teeth do not protrude through the slot in the aperture plate. If shuttle teeth protrude, loosen screw (6, Figure N) and carefully raise the shuttle retractor (7) until teeth are retracted; then tighten screw (6) securely. CAUTION: The top end of the shuttle retractor must not strike the casting.

g. Close film gate while observing to see that the film pressure plate does not contact the aperture plate. If pressure plate remains in contact with aperture plate, either the pressure plate lift-off ear (8, Figure N) or the ear (9) on the threading guide linkage is bent. Reform ear, or ears, as necessary.

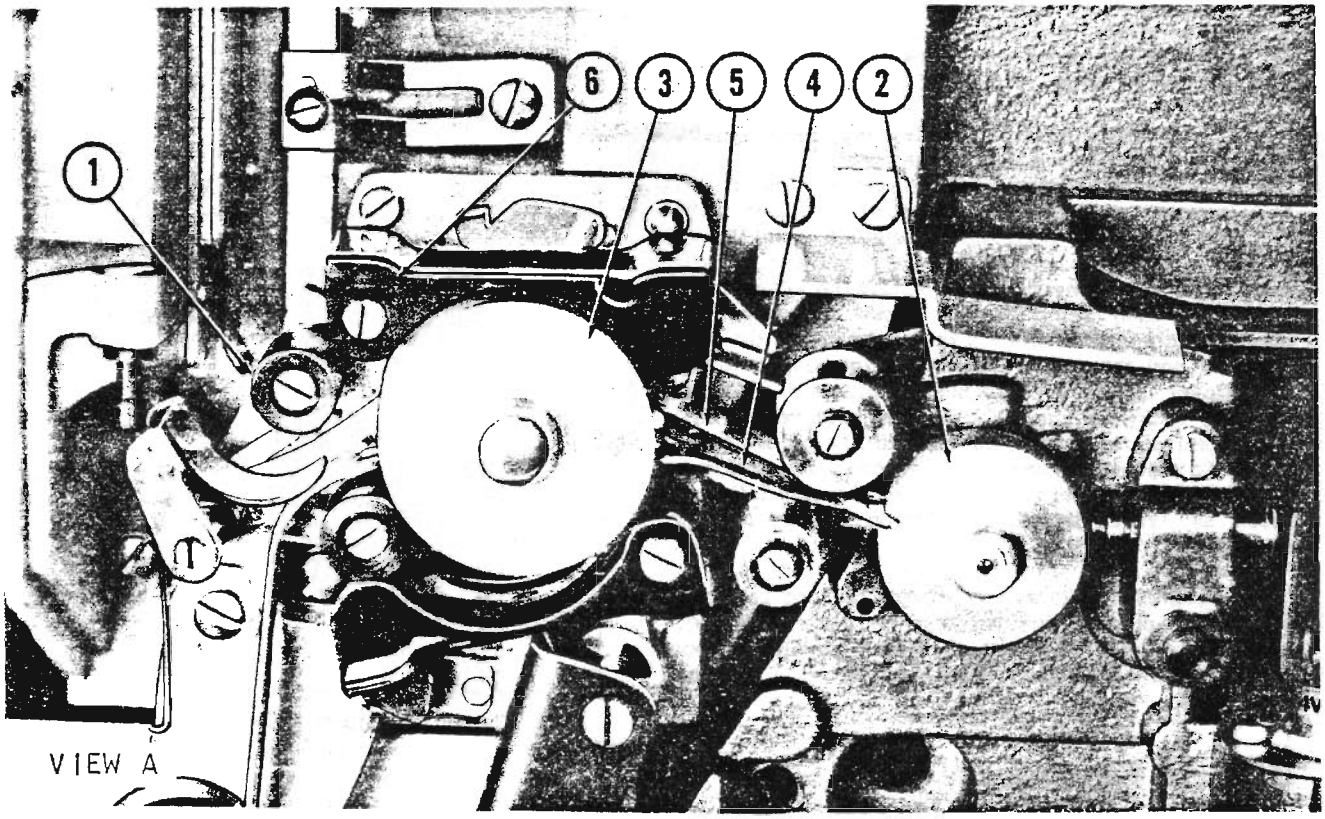
h. Loosen the screw (10, Figure N) and align the film guide (11) so that film will feed squarely to the sprocket; then retighten screw (10).

i. Loosen screw (11, Figure P), lock the system, and check to make certain that loop form heel (5) is bearing on shoulder of roller stud (6). If necessary, rotate the eccentric pivot (12) with a wire pick or pin punch until heel bears against stud shoulder. When loop form is pressed downward, there must be no clearance between heel and stud shoulder. Recheck clearance between rear of loop form and aperture rails (step c, preceding). Also, make certain that end of upper loop form (8) is tangent to or slightly ahead of the plane of the aperture plate film support rails. If readjustment is necessary, refer to steps c through e, preceding.

j. Lock the system and try to insert film into the feed sprocket. If film slips in too freely, loosen the two screws (13, Figure P) and move leaf spring (14) downward to increase pressure on the film. If film buckles as it is inserted, move leaf spring upward to reduce pressure; then tighten screws (13).

45. CHECKING AND ADJUSTING LOOP RESTORER. The automatic response of the loop restorer should be checked by means of two test film strips, TFS-D550-NX1 and TFS-D550-NX5. The first provides a test for damaged perforations; the second for elongated perforations. Run each test strip through the projector in "forward" and observe the reaction of the loop restorer as the damaged and elongated perforations pass through the film gate. The lower loop should be automatically restored within five or six frames. To adjust the loop restorer, refer to Figure R (View B) and proceed as follows.

a. Slip the loop restorer position tool (Figure A) over the loop restorer roller (1, Figure R) with the flat on the tool facing the guide roller at the rear end of the upper sprocket shoe (6, Figure R). The flat of the tool should just touch the guide roller lightly. To adjust spacing between loop restorer roller and guide roller, loosen the mounting screws in the self-centering assembly (inset B, Figure R) and raise or lower that assembly until the proper spacing is obtained. Then tighten the mounting



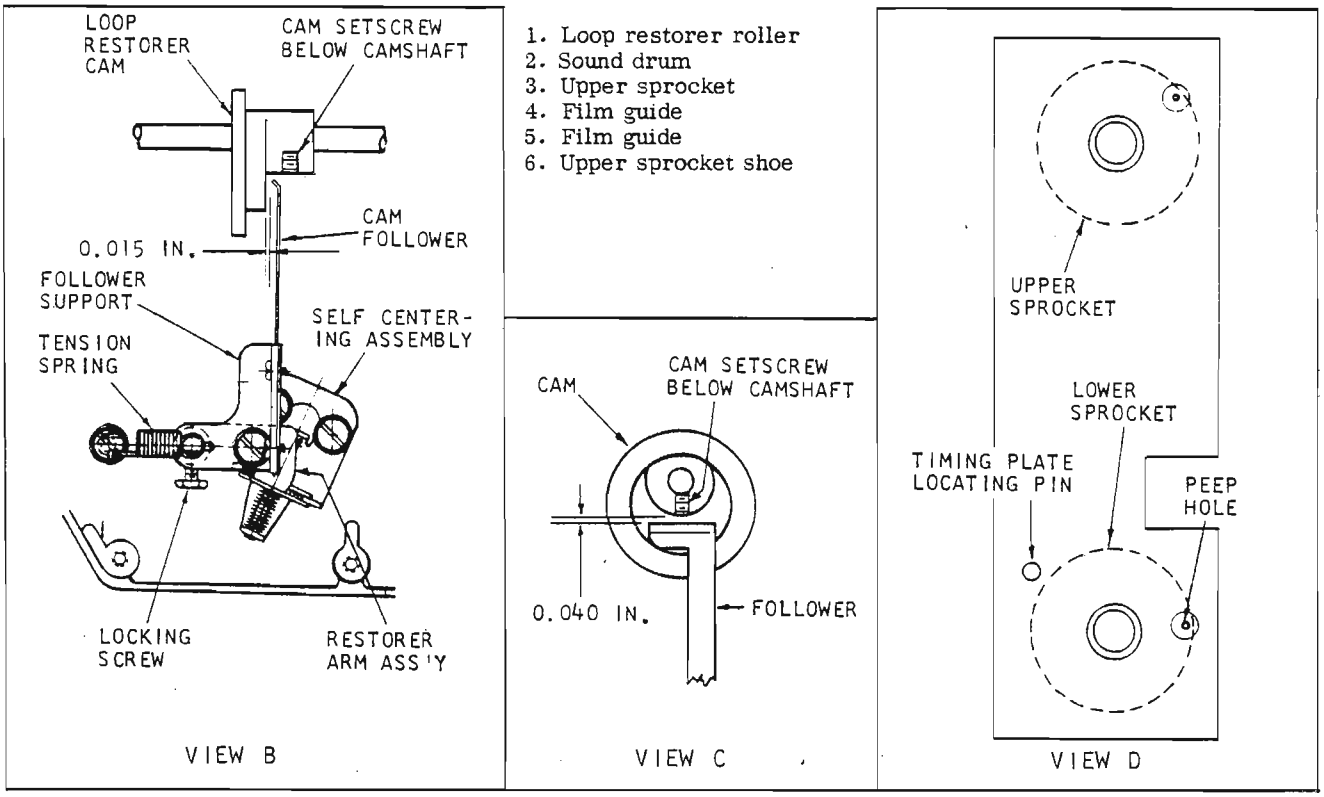


Figure R. Autoload System Adjustments — View III

screws securely. Be sure that the ear of the loop restorer arm is positioned between the two spring-loaded keeper plates of the self-centering assembly.

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

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

46. TIMING THE SPROCKETS.

a. Open the film gate and turn down the framer shaft as far as it will go. Then turn the mechanism manually until the shuttle is at the bottom of the stroke (teeth protruding) and the edge of the shutter blade bisects the aperture opening.

b. Push upward on the underside of the worm gear and check to make certain that the tongue on the driver clutch bears against edge of notch in driven clutch (see Figure K, View B).

c. Open the film shoes and place the timing plate (item 11, Figure A) over the sprocket hubs (View D, Figure K). Dip the end of a straightened paper clip in red lacquer and insert it down through the peep holes to mark the face of each sprocket. Remove timing plate and place a light pencil mark on the face of each sprocket in line with the teeth nearest the red dot. If this pencil mark does not align with the red dot, the sprockets are out-of-time. Note the direction in which each sprocket must be rotated to bring the teeth back in line with the peep holes; then proceed as follows:

d. To retime the sprockets, the rear cover of the projector must be removed to expose the large sprocket gears at the rear of the mechanism assembly. Hold the sprocket gear stationary while loosening its setscrews; then, still holding the gear stationary, carefully rotate the sprocket and shaft assembly in the proper direction until the pencil alignment mark appears in the center of the timing plate peep hole. Tighten the gear setscrews securely without retaining the gear or the sprocket.

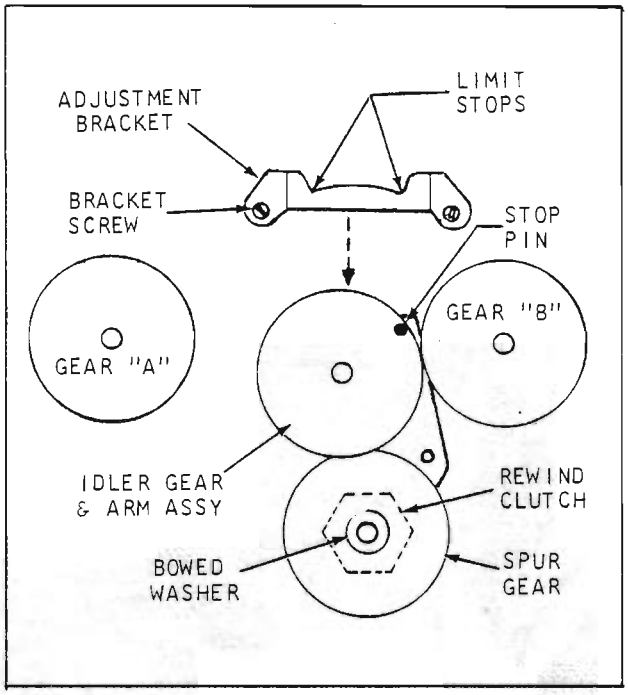


Figure S. Adjusting Gear Shift Tension and Backlash

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

48. GEAR SHIFT TENSION ADJUSTMENT. When shifting from forward to rewind, or vice versa, the idler gear arm (Figure S) should pivot smoothly to effect the engagement of the idler gear with gear "A" or gear "B." This can be checked by rotating the drive belt pulley manually, first in one direction and then the other. If the pivoting action seems hesitant, increase the tension on the arm assembly by pressing the retaining ring more firmly on the spur gear shaft until the bowed washer (Figure S) is flattened against the face of the gear.

49. IDLER GEAR BACKLASH ADJUSTMENT. In both the forward and rewind positions, there must be a perceptible amount of backlash between the idler gear and gears "A" and "B," Figure S. As the idler arm pivots, a stop pin protruding at the upper end of the arm rides the slightly curved rim of the adjustment bracket from one limit stop to the other. Check gear backlash at both limit stops. If there is no backlash at one stop and too much at the other, loosen the adjustment bracket screws and shift the bracket slightly to balance the backlash in both positions.

Trouble Shooting

50. MISCELLANEOUS TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Nothing runs	1. Defective On-Off switch.	1. Replace switch.
	2. Damaged power cable.	2. Repair or replace cable.
	3. Loose connections.	3. Repair connections.
Motor hums but does not run	1. Starting circuit open or shorted.	1. Repair loose or transposed connections; replace defective capacitor and/or relay.
Motor runs but mechanism does not run	1. Damaged switch.	1. Replace switch.
	2. Transposed leads on main switch.	2. Connect leads to proper terminals.
	3. Drive belt broken or unhooked from pulley.	3. Replace or reinstall drive belt.
	4. Motor pulley loose on shaft.	4. Position pulley and tighten setscrews.
	5. Animation clutch spring broken (1592 Models Only).	5. Replace spring.
Rewind does not operate	1. Rewind clutch not engaging or clutch slipping.	1. Adjust (paragraph 40, step c).
Take-up does not operate	1. Take-up sprocket damaged.	1. Replace sprocket.
Feed spindle does not rotate	1. Dirt in reverse take-up clutch.	1. Clean clutch.
Gate will not lock	1. Latch spring set too close to lens mount stop.	1. Adjust latch spring.
	2. Pressure plate out-of-line.	2. Realign pressure plate.
Shuttle runs but sprockets do not revolve	1. Animation clutch spring broken or lost (1592 Models Only).	1. Replace spring.
Short lamp life	1. Line voltage in excess of lamp voltage.	1. Use lamp of correct voltage rating.
	2. Drive belt broken or disengaged.	2. Replace or re-engage belt.
	3. Dirt and lint clogging blower housing.	3. Clean.
Projector speed slow	1. Binding in the mechanism.	1. Free binding condition.
	2. Belt slipping.	2. Clean or replace belt.
Runs at speed between 18 and 24 FPS	1. Pulleys out-of-line.	1. Realign pulleys.
	2. Belt shifter bent.	2. Straighten belt shifter.
	3. Improper power line frequency.	3. Use proper voltage and frequency.

51. PICTURE TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Film jump	1. Damaged film.	1. Repair or replace.
	2. Loose shuttle.	2. Adjust and tighten (paragraph 36, step c).
	3. Dirty film aperture.	3. Clean film aperture.
	4. Damaged or lost pressure plate spring.	4. Replace spring.
	5. Pressure plate misaligned.	5. Realign pressure plate.
	6. Incorrect shuttle stroke.	6. Adjust (paragraph 36, step d).
Double image	1. Incorrect shuttle stroke.	1. Adjust (paragraph 36, step d).
	2. Excessive shuttle protrusion.	2. Adjust (paragraph 36, step b).
Weave (due to faulty aperture plate)	1. Sticking edge guide.	1. Clean guide.
	2. Replace tension spring lost.	2. Replace spring.
	3. Fixed edge guide out of position.	3. Reposition guide.
Poor illumination	1. Optics out-of-line.	1. Realign (paragraph 35).
	2. Fire shutter sticking.	2. Check mechanical linkage ffor binding.
Poor focus	1. Dirty lens and/or aperture.	1. Clean lens and/or aperture.
	2. Warped film.	2. Recondition or replace film.
	3. Projector lens mount out-of-line.	3. Realign (paragraph 37).
	4. Pressure plate spring lost.	4. Replace spring.
	5. Bent pressure plate.	5. Replace pressure plate.
	6. Pressure plate out-of-line.	6. Realign pressure plate.
Frame line creeps	1. Framer eccentric loose.	1. Align and tighten (paragraph 36, step e).
Insufficient framing	1. Framer eccentric out of adjustment.	1. Adjust (paragraph 36, step e).
Trailer ghost	1. Shutter out-of-line.	1. Reassemble properly.

52. FILM TRANSPORT TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Loss of loops	1. Damaged film.	1. Repair or replace film.
	2. Inadequate shuttle protrusion.	2. Adjust (paragraph 36, step b).
	3. Inadequate or excessive shuttle stroke.	3. Adjust (paragraph 36, step d).
	4. Pressure plate spring lost.	4. Replace spring.
	5. Pressure mounting plate screws loose.	5. Tighten mounting screws.
	6. Sprocket guards not closing.	6. Clean or adjust.
	7. Sprocket drive gear loose on shaft.	7. Retime (paragraph 46) and tighten setscrews.
	8. In-out bracket spring broken.	8. Replace spring.
Lower loop not restored	1. Loop restorer stroke too short.	1. Adjust (paragraph 45).
	2. Loop restorer does not engage restorer cam.	2. Adjust (paragraph 45).
Film rubs on loop restorer roller	1. Restorer arm out of position.	1. Reposition (paragraph 45).
	2. Loop restorer does not engage restorer cam.	2. Adjust (paragraph 45).
Excessive film slap	1. Damaged film.	1. Recondition or replace.
	2. Green film.	2. Age or buff film.
	3. Dirty pressure plate.	3. Clean pressure plate.
	4. Pressure plate rubbing on aperture plate guide rails.	4. Realign pressure plate.
	5. Incorrect shuttle stroke.	5. Adjust (paragraph 36, step d).
Animation clutch does not operate (1592 Models Only)	1. Open in animation clutch circuit.	1. Repair circuit.
	2. Solenoid plunger set too high or too low.	2. Adjust solenoid plunger (paragraph 38, step c).
	3. Stop pawl clearance excessive.	3. Adjust (paragraph 38, step a).
Animation clutch stops sprocket but shuttle pulls film (1592 Models Only)	1. Insufficient shuttle retraction.	1. Adjust (paragraph 38, step b).
Splices jam in sprocket shoes	1. Bad splices.	1. Replace splices.
	2. Emulsion build-up.	2. Clean film path components.

53. SOUND SYSTEM TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Projector runs, no voltage at P.C. board	1. Loose connection.	1. Repair connection.
	2. Amplifier switch damaged.	2. Replace switch.
Projector runs, voltage at P.C. board, but exciter lamp does not light	1. Exciter lamp cable disconnected.	1. Connect cable.
	2. Wrong exciter lamp used.	2. Replace with correct lamp.
	3. Projector main switch open or leads disconnected.	3. Replace main switch or connect leads.
Voltage at P.C. board, exciter lamp lights, but no sound	1. Speaker jack disconnected or speaker jack switch open.	1. Connect leads. Repair or replace jack.
	2. Photocell cable disconnected or leads reversed.	2. Connect cable. Connect leads to proper terminals.
	3. Photocell out-of-line.	3. Realign (paragraph 41, step b).
	4. Dirt on end of photocell.	4. Clean photocell.
	5. Wrong exciter lamp used.	5. Replace with correct lamp.
Low volume	1. Trouble in printed circuit board.	1. Check out the circuit board.
	2. Wrong exciter lamp used.	2. Replace with correct lamp.
	3. Photocell out-of-line.	3. Realign (paragraph 41, step b).
	4. Dirt on photocell or slit.	4. Clean photocell and slit.
	5. Slit misaligned.	5. Realign (paragraph 41, step e).
	6. Buzz track misaligned.	6. Realign (paragraph 41, step f).
Distortion at all volume levels	1. Wrong exciter lamp used.	1. Replace with correct lamp.
	2. Trouble in printed circuit board.	2. Check out the circuit board.
Crackling noises	1. Broken ground lead to main frame.	1. Replace defective lead.
	2. Buzz track out-of-line.	2. Realign (paragraph 41, step f).
	3. Broken cable shield.	3. Repair shield or replace cable.
Wow or flutter	1. Soundhead stabilizer guide roller sticking.	1. Clean roller and roller shaft.
	2. Stabilizer guide roller spring broken, unhooked or lost.	2. Repair or replace spring.
	3. Film edge guide (soundhead) out-of-line.	3. Realign (paragraph 41, step f).
	4. Loose flywheel.	4. Tighten flywheel.
	5. Damaged sound drum bearing.	5. Replace sound drum.

53. SOUND SYSTEM TROUBLES AND REMEDIES (CONT'D).

TROUBLE	PROBABLE CAUSE	REMEDY
Wow or flutter (Cont'd)	6. Dirt causing guide roller arm pivot bearing to bind.	6. Clean and polish.
	7. Photocell or exciter cable rubbing against flywheel.	7. Reposition cables.
	8. Chips or dirt in take-up sprocket gear teeth.	8. Remove and clean sprocket gear.
	9. Loop restorer stroke is too short or restorer set too low.	9. Adjust (paragraph 45).
Clicking noises	1. Dirt on sound drum.	1. Clean sound drum.
	2. Broken ground lead to main frame.	2. Replace lead.
High frequencies fade (jumps focus)	1. Warped film.	1. Recondition or replace film.
	2. Film edge guide (soundhead) out-of-line.	2. Realign (paragraph 41, step f).
	3. Dirt on sound drum.	3. Clean sound drum.
Hum	1. Ground wiring.	1. Correct grounded condition.
	2. Trouble in printed circuit board.	2. Check out the circuit board.

54. TROUBLE SHOOTING AUTOLOAD SYSTEM.

a. General. Any obstruction in the film path, such as caked emulsion, film chips or splicing tape can be expected to interfere with proper threading. Time will be saved by cleaning the threading path and, at the same time, making a visual inspection of all shoes and guides before attempting to localize the trouble. Do not use metal tools to remove material adhering to guides or rollers. Use an orange stick, plastic rod or toothpick whenever scraping is necessary. Pipe cleaners dampened with toluol, naptha or isopropyl-alcohol are very convenient for cleaning in restricted areas. Do not use trichloroethylene or carbon tetrachloride as cleaning solvents as they might damage or stain plastic parts. Do not use excessive amounts of solvents, or lubricants will be removed from linkage pivots, slides, etc., and will have to be replenished.

b. Test Film. The autoload system has been designed to function properly with all films which can be described as being in projectable condition (see Operators Instructions for limits of shrinkage, curl, etc.). Generally, any film which functions properly in other Bell & Howell projectors (such as Designs 399, 542 and 552) can be used for testing the autoload system. Any film which does not thread properly should be inspected. The end of the leader must be properly trimmed and free from sharp bends. All sprocket holes in the first 18-inches of leader must be in good condition. Splices must be properly registered and in good condition. Sprocket holes restricted by cement or splicing tape must be cleared or the splice remade. The repairman is cautioned that it would be a waste of time to adjust or attempt to adjust the autoload system to autothread a film which is in such poor condition as to be incapable of being the source of an uninterrupted film presentation of acceptable quality.

c. Autoload Trouble Shooting Chart.

TROUBLE	PROBABLE CAUSE	REMEDY
Film cannot be inserted into feed sprocket	1. Obstruction below roller of channel (16C, Figure 10).	1. Remove obstruction.
	2. Roller channel (16C, Figure 10) bent or binding.	2. Straighten or replace assembly.
	3. Excessive pressure on leaf spring (26, Figure 11).	3. Adjust leaf spring (paragraph 44, step j).
Film will not pull between feed sprocket and sprocket shoe	1. Entrance guide (11, Figure N) misaligned.	1. Realign per paragraph 44, step h).
	2. Feed sprocket guard sticking.	2. Clean sprocket shoe pivot.
	3. Feed sprocket guard spring (30, Figure 10) broken.	3. Replace spring.
	4. Caked emulsion or burr on sprocket shoe film rails.	4. Clean; remove burr with crocus cloth.
Film comes out the side of top sprocket	1. Obstruction in sprocket guard.	1. Remove obstruction.
	2. Damaged sprocket guard.	2. Replace sprocket shoe.
	3. Sprocket guard and sprocket misaligned laterally.	3. Realign.
Film strikes top of aperture plate and begins to pile up	1. Upper loop former (8, Figure P) bent or out of adjustment.	1. Straighten or replace if bent; readjust per paragraph 44, step e.
	2. Lower loop former (4, Figure P) set too close to aperture plate.	2. Readjust per paragraph 44, step e.
Film butts into or goes under top end of aperture plate side tension rail or strikes fixed rail	1. Upper loop former (8, Figure P) bent causing sidewise deflection of film.	1. Straighten or replace if bent; readjust per paragraph 44, step e.
	2. Lower loopformer (4, Figure P) bent or out of adjustment.	2. Straighten or replace if bent; readjust per paragraph 44, step c.
Film butts against top of film pressure plate or passes over outside of pressure plate	1. Lower loop former (4, Figure P) out of adjustment.	1. Readjust per paragraph 44, step c.
	2. Pressure plate not lifting off of aperture plate when film gate is closed.	2. Bent parts need straightening (paragraph 44, step g) or replacing.
Film ejects between bottom of gate and top of take-up sprocket, or piles up in this area	1. Lower loopformer (13, Figure 11) bent or sticking.	1. Straighten, remove bind, or replace as necessary.
	2. Lower loop former spring (14, Figure 11) broken.	2. Replace spring.
	3. Loop restorer out of adjustment or restorer roller stud bent.	3. Readjust loop restorer (paragraph 45); replace damaged parts.
	4. Obstruction or burr in take-up sprocket upper guard.	4. Clean; remove burr with crocus cloth.
	5. Sprockets out of time.	5. Time sprockets per paragraph 46.

TROUBLE	PROBABLE CAUSE	REMEDY
Film not threading over take-up sprocket	1. Sprocket guard mounting plate (21, Figure 11) out of position.	1. Reposition per paragraph 44, step b).
	2. Obstruction in upper sprocket guard.	2. Remove obstruction.
	3. Sprocket guard spring (30, Figure 10) broken.	3. Replace spring.
	4. Take-up sprocket shaft loose in gear (13, Figure 10).	4. Retime sprockets (paragraph 46) and tighten setscrews (11, Figure 10).
Film piles up ahead of sound drum	1. Insufficient clearance between soundhead threading guides (4 and 5, Figure R).	1. Readjust all guides per paragraph 44.
	2. Back-up bracket (16, Figure 11) bent downward.	2. Straighten bracket.
	3. Exciter lamp cover loose.	3. Tighten cover retaining screw.
	4. Obstruction in gap between sound drum and exciter lamp cover.	4. Remove obstruction.
	5. Not enough clearance between sound drum and cover.	5. Check clearance per paragraph 47.
	6. Edge guide adjusting screw (24, Figure 9) out too far.	6. Adjust per paragraph 41, step f.
Film ejects ahead of lower take-up sprocket shoe or piles up in this area	1. Insufficient clearance between soundhead threading guides (4 and 5, Figure R).	1. Readjust all guides per paragraph 44.
	2. Soundhead loose or improperly positioned.	2. Reposition per paragraph 41, step g.
	3. Obstruction or burr in lower take-up sprocket guard.	3. Remove obstruction; remove burr with crocus cloth.
	4. Film guide (4, Figure 9) improperly positioned.	4. Reposition guide.
Film sticks in or is ejected from lower take-up sprocket guard	1. Obstruction or burr in lower take-up sprocket guard.	1. Remove obstruction; remove burr with crocus cloth.
	2. Sprocket guard sticking.	2. Clean sprocket guard pivot.
	3. Broken sprocket guard spring (30, Figure 10).	3. Replace spring.
	4. Sprocket guard and sprocket misaligned laterally.	4. Realign.
	5. Autothread lever (11, Figure 11) bent or improperly positioned.	5. Reposition or straighten lever.
Film piles up ahead of idler roller (11C, Figure 11) or is ejected from this area	1. Autothread lever (11F, Figure 11) bent or improperly positioned.	1. Reposition or straighten lever.
	2. Idler roller sticking or roller stud loose or bent.	2. Remedy sticking condition; replace autothread lever (11F, Figure 11).

TROUBLE	PROBABLE CAUSE	REMEDY
System will not lock	1. Autothread lever (11F, Figure 11) binding.	1. Repair or replace lever.
	2. Release spring (10, Figure 11) disengaged or broken.	2. Engage spring with locking lever, or replace spring.
	3. Eccentric bushing (12, Figure P) improperly adjusted.	3. Readjust bushing per paragraph 44, step i.
Loop restorer cycles continuously	1. Restorer out of adjustment.	1. Adjust per paragraph 45.
	2. Shuttle retractor pin (29, Figure 12) sticking.	2. Clean and lubricate pin.
	3. Pressure plate (5B, Figure 10) binding on aperture plate edge guide.	3. Realign pressure plate.
Slack film in soundhead area	1. Sprocket guards sticking.	1. Clean sprocket shoe pivots.
	2. Take-up jerking.	2. Check take-up torque and check for binding in take-up reel arm.
	3. Jockey rollers (soundhead) sticking.	3. Clean and lubricate.
	4. Soundhead improperly positioned.	4. Reposition per paragraph 41, step g.
	5. Dirt or obstruction between sound drum and exciter lamp cover.	5. Remove obstruction.
Film scratches	1. Caked emulsion on film path parts.	1. Clean film path.
	2. Film chips in sprocket guards.	2. Remove film chips.
	3. Scratches or burrs on film guides, guards, aperture or pressure plate.	3. Polish with crocus cloth or replace.
	4. Jockey rollers (soundhead) sticking.	4. Clean and lubricate.
Perforations checked	1. Shuttle not retracting.	1. Adjust per paragraph 44, step f.
	2. Pressure plate not lifting from aperture plate.	2. Adjust per paragraph 44, step g.
	3. Excessive feed or take-up tension.	3. Adjust tension.
Film dimpled between perforations	1. Sprocket shoes sticking.	1. Clean sprocket shoe pivots.
	2. Shuttle not retracting.	2. Adjust per paragraph 44, step f.
	3. Sprockets out of time.	3. Retime per paragraph 46.
	4. Inadequate pressure on leaf spring (26, Figure 11).	4. Adjust per paragraph 44, step j.
	5. End of film leader not cut clean and square.	5. Check your film cutter; replace if dull or broken.

TROUBLE	PROBABLE CAUSE	REMEDY
Film escape mechanism does not open to permit exit of film	1. Film exit latching is out of adjustment.	1. Readjust per paragraph 44, step d.
Film escape locking pawl does not seat properly; film exits constantly	1. Torsion spring (46C, Figure 11) is disconnected.	1. Connect torsion spring.
	2. Locking pawl (46E, Figure 11) out of adjustment.	2. Readjust locking pawl per paragraph 44, step d.

SUPPLEMENT NO. 1

AUTOLOAD® FILMOSOUND® 16mm PROJECTOR

MODELS

1585CX	1592CX
1585CXU	1592CSX

NOTE: THIS SUPPLEMENT CONTAINS THE SERVICE AND PARTS REPLACEMENT DATA PECULIAR TO 16MM SOUND MOTION PICTURE PROJECTORS, EXPORT MODELS 1585CX, 1592CX, 1592CSX AND 1585CXU AND IS TO BE USED WITH BASIC SERVICE MANUAL NO. 74404.

BELL & HOWELL

INTERNATIONAL SERVICE DEPT.

SUPPLEMENT TO
PART NO. 74404

MARCH 1979

SUPPLEMENTAL DATA FOR

SERVICE MANUAL NO. 74404

(MODEL 1585CX, 1585CXU, 1592CX AND 1592CSX PROJECTORS)

1. GENERAL INFORMATION

This Supplement has been prepared to provide the necessary information for the maintenance, repair and adjustment of the Models 1585CX, 1592CX and 1592CSX Automatic Threading 16mm Sound Projectors. These three projectors are modified versions of related models already covered in the basic service manual (Part No. 74404, dated May 1978). Modifications consist primarily of manufacturing changes necessary to adapt these units to meet foreign electrical requirements, as noted by the wiring diagrams included with this Supplement.

Most of the physical differences consist in changes of part numbers (see paragraph 3). Basically, the Model 1585CX is the modified version of the Model 1585C, whose replacement parts are coded "A" in the parts catalog of manual No. 74404. In like manner, the Models 1592CX and 1592CSX are the modified versions of Models 1592C and 1592CS respectively, which are coded "E" in the basic parts catalog. The most obvious physical differences are as follows.

All models covered in the basic service manual are provided with an integrated line cord which plugs into any convenient 120 volt outlet. The Models 1585CX, 1592CX and 1592CSX are provided with a separate line cord which must be connected between a socket located at the rear of the projector (see Figure A, this Supplement) and the outlet. A voltage selector switch is included so that incoming voltage can be set at 120, 220 or 240 volts. A separate lamp transformer is not included.

Unlike the 1592 models covered in the basic service manual, the 1592CX and 1592CSX are not provided with the "animation" feature. The Model 1585CX is not provided with the "still" feature.

2. REPAIR AND ADJUSTMENT PROCEDURES

NOTE: Except as noted in the following paragraphs, all repair and adjustment information contained in Service Manual No. 74404 will apply to Models 1585CX, 1592CX and 1592CSX projectors. If electrical repairs are necessary, refer to the pictorial and schematic diagrams included with this Supplement. The most prominent physical differences are referenced to parts catalog illustrations in the basic manual and, for the most part, require no detailed repair instructions.

REPAIR OF FIGURE 1 ITEMS

The disassembly/reassembly procedures for Models 1585CX, 1592CX and 1592CSX are the same except for the cord wrap and socket assembly (Figure A). This assembly is removed in the same manner as the line cord retainer bracket (item 1-4), but is withdrawn only as far as necessary to expose the leadwire connections to the input connector and voltage selector switch.

REPAIR OF FIGURE 2 ITEMS

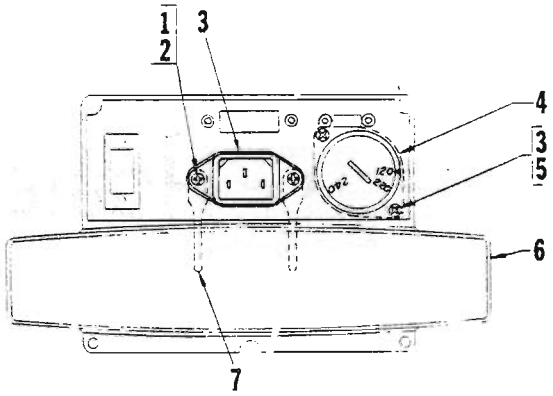
The disassembly/reassembly procedures for Models 1585CX, 1592CX and 1592CSX are the same as those in the basic service manual.

REPAIR OF FIGURE 3 ITEMS

Except as follows, the disassembly/reassembly procedures for Models 1585CX, 1592CX and 1592CSX are the same as those in the basic service manual.

In place of the "stacked" transformer arrangement (items 3-1 through 3-10), the "X" models are equipped with the power transformer (item 3-14) similar to the Model 1590.

Since the "X" models are provided with a separate line cord and plug-in socket (Figure A), any reference to the strain relief (items 3-24) and line cord wiring connections are to be disregarded.



1. SCREW P/N 434198
2. NUT P/N 436950
3. LINE CORD RECEPTACLE P/N 709737
4. VOLTAGE SELECTOR P/N 077606
5. SCREW P/N 436949
6. BRACKET P/N 710252
7. WIRE TIES P/N 072348

Figure A. Cord Wrap and Socket Assembly

Since the "X" models are not provided with the "animation" feature, the animation switch (item 3-34) is not included.

All "X" models use rotary switch assembly item 3-39; therefore, references to other rotary switch designs (items 3-34 and 3-35) can be disregarded.

The solenoid and its related components (items 3-44 through 3-47) are not used on "X" models.

Parts which are peculiar only to the Models 1585CX, 1592CX and 1592CSX are the amplifier fuses and fuse board mounted near the drive motor. These parts are shown in Figure B of this Supplement.

REPAIR OF FIGURE 4 ITEMS

The disassembly/reassembly procedures for Models 1585CX, 1592CX and 1592CSX are the same as those in the basic service manual.

REPAIR OF FIGURE 5 ITEMS

The disassembly/reassembly procedures for Models 1585CX, 1592CX and 1592CSX are the same as those in the basic service manual.

REPAIR OF FIGURE 6 ITEMS

The disassembly/reassembly procedures for Models 1585CX, 1592CX and 1592CSX are the same as those in the basic service manual.

REPAIR OF FIGURE 7 ITEMS

The disassembly/reassembly procedures for Models 1585CX, 1592CX and 1592CSX are the same as those in the basic service manual with one exception. The face gear (item 7-5B) has been altered (new part number 709806) and is now being used in current production models of all projectors covered by this Supplement and the basic service manual. The newly designed face gear eliminates the need for the flat washer (item 7-5B). If it should be necessary to replace the face gear in earlier model projectors, the new gear should be installed and the washer (item 7-5B) discarded.

REPAIR OF PARTS IN FIGURES 8 THROUGH 14

The disassembly/reassembly procedures for Models 1585CX, 1592CX and 1592CSX are the same as those in the basic service manual. Be sure to remember that all uncoded and code "A" parts apply to Model 1585CX and that all uncoded and code "E" parts apply to Models 1592CX and 1592CSX.

REPAIR OF FIGURE 15 PARTS

The disassembly/reassembly procedures for Model 1592CSX are the same as those in the basic service manual.

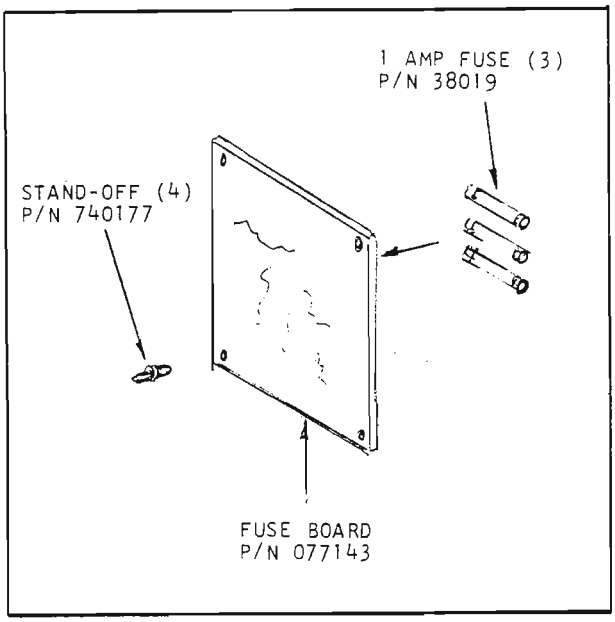


Figure B. Amplifier Fuse Board and Fuses

NOTE: Pictorial and schematic diagrams for Models 1585CX, 1592CX and 1592CSX are included at the end of this Supplement.

3. PARTS CATALOG DIFFERENCES

Since the Models 1585CX, 1592CX and 1592CSX are simply modified versions of the Models 1585C, 1592C and 1592CS respectively, all replacement parts listed for the basic models (suffix C and CS) will apply to the CX and CSX models except as noted herein. In other words, parts listed for the Model 1585C (coded "A" in the Usable on Code column) will apply to the Model 1585CX; parts listed for the Models 1592C and 1592CS (coded "E") will apply to the Models 1592CX and 1592CSX. Differences are as follows:

PARTS CATALOG FIGURE 1

Item 1-1, Front Cover and Speakers Assembly P/N 016507. Applicable to Model 1592CSX.

Item 1-1, Front Cover Assembly P/N 016527. Applicable to Models 1585CX and 1592CX.

Item 1-1A, Instruction Plate. For 1585CX, 1592CX and 1592CSX, use P/N 708200.

Item 1-2, Front Cover Nameplate P/N 48058. Used on all models except those with Front Cover and Speakers Assembly (see Parts Catalog Figure 15).

Item 1-4, Line Cord Retainer Bracket. Models 1585CX, 1592CX and 1592CSX use Cord Wrap and

Socket Assembly P/N 077607 in place of this bracket. Replacement parts for the Cord Wrap and Socket Assembly are shown in Figure A of this Supplement.

Item 1-5, Control Panel Cover Plate. This plate is not used on Models 1585CX, 1592CX and 1592CSX projectors.

Item 1-7, Rear Cover. Models 1585CX, 1592CX and 1592CSX use Rear Cover P/N 710065.

Item 1-9, Top Cover Assembly. Models 1585CX, 1592CX and 1592CSX use Top Cover Assembly P/N 077472. This assembly includes items 1-9A, 1-9B, 1-9C, 1-9H, 1-9J and 1-9K as listed in the basic Parts Catalog. The top cover less preceding parts can be ordered under part number 016534.

Item 1-14, Air Deflector. Models 1585CX, 1592CX and 1592CSX use Air Deflector P/N 707447.

Item 1-16, Lamp Type Label. Models 1585CX, 1592CX and 1592CSX use Lamp Type Label P/N 49112.

Item 1-18, 50/60 Hz Label. Models 1585CX, 1592CX and 1592CSX use 50/60 Hz Label P/N 44490.

PARTS CATALOG FIGURE 2

Item 2-6, Front End Cap Assembly. Models 1585CX, 1592CX and 1592CSX use Front End Cap Assembly P/N 077461. Components of this assembly are Tinnerman nuts P/N 45102 (item 2-6A), 8 ohm speaker P/N 708994 (item 2-6B) and front end cap P/N 710063 (item 2-6C), plus six speed nuts P/N 709218 (item 2-5).

Item 2-7, Rear End Cap Assembly. Models 1585CX, 1592CX and 1592CSX use Rear End Cap Assembly P/N 077473. Components of this assembly include only the following items: the receptacle opening cover P/N 48066 (item 2-7G), the rear end cap P/N 710064 (item 2-7H), the hex locking nut P/N 19010 (item 2-8), the auxiliary speaker jack P/N 43878 (item 2-9) and the insulating washer P/N 25368, plus six speed nuts P/N 709218 (item 2-5).

Item 2-11A, Still/Run Lever P/N 709040. This lever is not used on Model 1585CX projectors.

PARTS CATALOG FIGURE 3

NOTE: Items 3-1 through 3-11 are not applicable to Model 1585CX, 1592CX and 1592CSX projectors. Transformer Assembly P/N 077631 (item 3-14) is used and is secured to the projector base with four hex head screws P/N 30815 (item 1-13). Replacement transformers are pre-wired and ready for installation.

Items 3-24 (Strain Relief) and 3-25 (Line Cord Assembly). The Models 1585CX, 1592CX and 1592CSX do not require the strain relief (item 3-24) since they are provided with a separate line cord (P/N 710318) which plugs into a receptacle that is mounted to the cord wrap and socket assembly (see Figure A of this Supplement).

Item 3-27, Motor Pulley. All motor pulleys are color coded and, if badly worn or damaged, must be replaced with a pulley of the same color as that on the projector being repaired. Pulleys used on Models 1585CX, 1592CX and 1592CSX can be ordered under P/N 709524, 709549 or 709550.

Item 3-29, Motor Clamp Bracket Assembly. For Models 1585CX, 1592CX and 1592CSX, use Bracket Assembly P/N 016947.

Item 3-29A, Fuse and Sleeve Assembly. For Models 1585CX, 1592CX and 1592CSX, use Fuse and Sleeve Assembly, P/N 077632.

Item 3-31, Motor Assembly, 50/60 Hz. For Models 1585CX, 1592CX and 1592CSX, use Motor Assembly P/N 016495 (preferred) or 709107. Replacement motors are pre-wired and ready for installation.

Item 3-32, Main Fuse. For Models 1585CX, 1592CX and 1592CSX, use 4 amp 250 volt Slo-Blo fuse P/N 117172.

Item 3-34, Animation Switch. Not used on Models 1585CX, 1592CX and 1592CSX.

Item 3-35, Rotary Switch and Bracket Assembly. Not used on Models 1585CX, 1592CX and 1592CSX. See item 3-39.

Item 3-39, Rotary Switch Assembly. For Models 1585CX, 1592CX and 1592CSX, use Rotary Switch Assembly P/N 077655. This switch is pre-wired and ready for installation.

Items 3-40 through 3-47. These items are not used on Model 1585CX, 1592CX and 1592CSX projectors.

NOTE: Parts which are peculiar only to the Models 1585CX, 1592CX and 1592CSX are the amplifier fuses and fuse board mounted near the drive motor. These parts are shown in Figure B of this Supplement.

PARTS CATALOG FIGURE 4

All uncoded and code "A" parts apply to Model 1585CX; all uncoded and code "E" parts apply to Models 1592CX and 1592CSX.

PARTS CATALOG FIGURE 5

Only items 5-22 through 5-29 apply to Model 1585CX; all listed items apply to Models 1592CX and 1592CSX.

b. 1590 Models Only. These projectors are equipped with only a power transformer (14) which is secured to the base with four screws (13). The mounting brackets (14C) and (14D) can be replaced by drilling out the rivets (14A). However, if the transformer itself is faulty, replace the complete transformer and bracket assembly (14).

c. The drive motor and blower components must be removed as a unit to permit belt replacement or motor and blower repairs. This is accomplished by removing the four motor mounting screws (15) and the four blower housing screws (16). If the drive belt (23) is in need of replacement, it can be cut with a sharp knife. If the belt is in good condition, slip it edgewise down between the mechanism pulley and the casting. Lift the assembled motor and blower from the base. Remove three screws (17) and disassemble the fan housing (19) from the housing cover (22). Loosen the setscrew (20) and disassemble the fan and hub assembly (21) and cover (22) from the motor shaft.

d. Loosen the screws in the top ears of the motor clamps (28) and disassemble the clamps and mounting brackets (30) from the motor end bells. Note the difference in motor clamp brackets (29) as used in earlier models and in the more current designs, as well as the addition of the coil-like thermal fuse (29A).

e. 1592 Models Only. Remove the two screws (33) and disassemble the animation switch and bracket assembly (34) and rotary switch and bracket assembly (35) from the projector mainplate. Disassemble as necessary, for repair or parts replacement.

f. 1585 and 1590 Models Only. Remove the nut (36), lockwasher (37) and rotary switch (38) from the mainplate. Remove the screw (40) and the fuseholder (41).

5. REMOVAL OF GEARS, REEL ARMS AND SOUNDHEAD (Figure 4). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. To remove the rear reel arm assembly (29) for repair or replacement, disassemble the retaining ring (1), washer (3), spur gear (4) and a second retaining ring (1) from the end of the reel arm shaft. Note the manner in which the reel arm disc (27) is positioned before disassembling the screws (26) and disc (27) from the mainplate: then carefully withdraw the reel arm assembly, catching the lock button (30) and spring (31) as they pop free.

b. To remove the front reel arm assembly (28) for repair or replacement, disassemble the gear and clutch parts (15) through (19) from the end of the reel arm shaft. Note the manner in which the reel arm disc (27) is positioned before disassembling the screws (26) and disc (27) from the mainplate. Carefully withdraw the reel arm assembly, catching the lock button (30) and spring (31) as they pop free.

c. To remove the soundhead assembly (40) for repair or replacement, it first is necessary to remove the amplifier cover (item 16, Figure 6) so that the soundhead leads can be unsoldered from the edge connector terminals (refer to appropriate wiring diagram). Assuming that the transformer assembly has already been removed (paragraph 4), refer to Figure 4 and disassemble the retaining ring (32), flywheel (35) and washers (33) and (34) from the end of the sound drum shaft. Then remove three screws (36) and washers (37) and carefully lift the soundhead assembly from the mainplate.

d. No special instructions are required for removal of the drive gearing in Figure 4 except to note in which direction the gear hubs are facing. Inspect all gears for chipped or broken teeth and replace if necessary. Clean and re-lubricate all reusable gears.

6. REMOVAL OF RUN-STILL LINKAGE AND MECHANISM ASSEMBLY (Figure 5). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

NOTE: The disassembly procedures in steps a through d, following apply only to the 1592 model projectors. Steps e and f apply to all models.

a. Loosen the setscrews (1) in the collars (2); then disengage the lower end of the still-run rod (4) from the pivoting link assembly (18) and disassemble the rod, collars and spring (3) from the stop pawl.

b. Loosen the setscrew (5) and remove the collar (6) and spring (7) from the lower end of the fire shutter rod. Disengage the upper end of the rod from the fire shutter and remove the rod (8).

c. Disassemble the still-run lever (9) from the mainplate.

d. Remove the two shoulder screws (12) and lift the sliding link assembly (13) and the two spacers (14) from the mainplate. Remove the pivot screw (15) and disassemble the pivoting link assembly (18), spacer (19), torsion spring (20) and flat washer (21) from the mainplate.

e. Remove two retaining rings (22) and lift out the torsion spring (23). Remove the shoulder studs (24), belt shifter bracket (25) and the spacers (26).

f. Hold the mechanism assembly (29) securely while removing the four screws (27) and the idler gear adjustment bracket (28). Carefully withdraw the mechanism assembly from the mainplate.

7. REMOVAL OF BASE COMPONENTS (Figure 6). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. The lever stop and pin (5) has been carefully adjusted to insure the proper advance of film and

then secured with screw (4). Do not disturb these items unless obvious damage indicates a need for replacement.

b. Remove the adapter shaft (7) and lift out the film guide roller (8). Remove the screw (9) and lift the sliding film guide assembly (10) from the flanges on the base. Disassemble, if necessary, for replacement of damaged parts.

c. To expose the amplifier assembly (20) and edge connector assembly (18), remove the five screws (15) and the cover (16). Remove the four screws (17) and (19) and lift out both assemblies. When separating the edge connector from the amplifier pull them straight apart without wriggling or twisting them and thus distorting the pins. Note the spacers (21) located beneath the amplifier.

d. Remove the four screws (22) and the cover (23) to expose the volume and tone control assembly (25). Four screws (24) secure the control assembly into the base.

e. Remove the screw (26) and lockwasher (27) and disassemble the tilt bar (28) from the lower end of the tilt gear rack (39). Remove two screws (37) and disassemble the adapter (38) and gear rack (39) from the base. Remove the retaining ring (40) and lift out the tilt gearshaft (41) and spring tension washer (42). Drive out the spring pin (43) and lift out the tilt worm gear (44).

8. DISASSEMBLING THE FRONT REEL ARM (Figure 7). Disassemble the front reel arm in the following manner, noting any special precautions.

a. Remove the two screws (1) and lift the reel arm cover (2) from the front arm (22). Note the shim washers (3) located between the cover and reel arm mounting bosses.

b. Remove the screw (4) and disassemble the feed spindle assembly (5) from the front reel arm. If spindle parts are damaged, loosen the setscrews (5A) and remove the gear (5B) and washer (5C) from the spindle (5D).

c. Remove the retaining ring (7) from the spring post in the reel arm to free the end of the torsion spring (10). Loosen the setscrews (8) and (8A) and lift the gear (9) and torsion spring (10) from the reel arm shaft (14). If damaged, disassemble the plastic sleeve (9A) from the gear hub.

d. Remove the two retaining rings (11) and disassemble the reel arm shaft (14) and washers (12) and (13) from the reel arm.

e. Remove the retaining ring (15) and withdraw the upper spur gear (16) from the gearshaft (20). Remove the two gear retaining clips (17), the washer (18) and the lower spur gear (19) and slide the gearshaft (20) from the bearing posts of the reel arm. Inspect the nylon bearings (21) and, if damaged, press them from the bearing posts.

9. DISASSEMBLING THE REAR REEL ARM (Figure 8). Disassemble the rear reel arm in the following manner, noting any special precautions.

a. Remove the two screws (1) and lift the reel arm cover (2) from the rear arm (32). Note the shim washers (3) located between the cover and the reel arm mounting bosses.

b. Press the take-up arm against the reel arm casting and slip the take-up belt (4) from the pulleys. Release the take-up arm slowly and catch the tension spring (5) as it drops free. Remove the screw (6) and disassemble the take-up spindle and pulley assembly (7) and shim washer (8) from the take-up arm. The take-up arm and rear reel arm are replaceable only as an assembly (32).

c. Remove the retaining ring (10) and large flat washer (11) from the end of the gearshaft (16). Remove the rubber sleeve (12) from the hub of the gear (14). Loosen the gear setscrew (13) and disassemble the gear (14), the shim washer (15) and the gearshaft (16) from the reel arm.

d. Remove the retaining ring (17) from the spring post in the reel arm to free the end of the torsion spring (18) and lift the torsion spring from the hub of the upper face gear (27).

e. Remove the retaining ring (19) and slide the upper spur gear (20) toward the upper face gear (27) until the upper gear retaining clip (21) can be removed. Move the gearshaft (24) down until the upper spur gear (20) and washer (23) can be removed. Remove the lower gear retaining clip (21) and lower spur gear (22), and slide the gearshaft (24) from the bearing posts of the reel arm. Inspect the nylon bearings (25) and, if damaged, press them from the bearing posts.

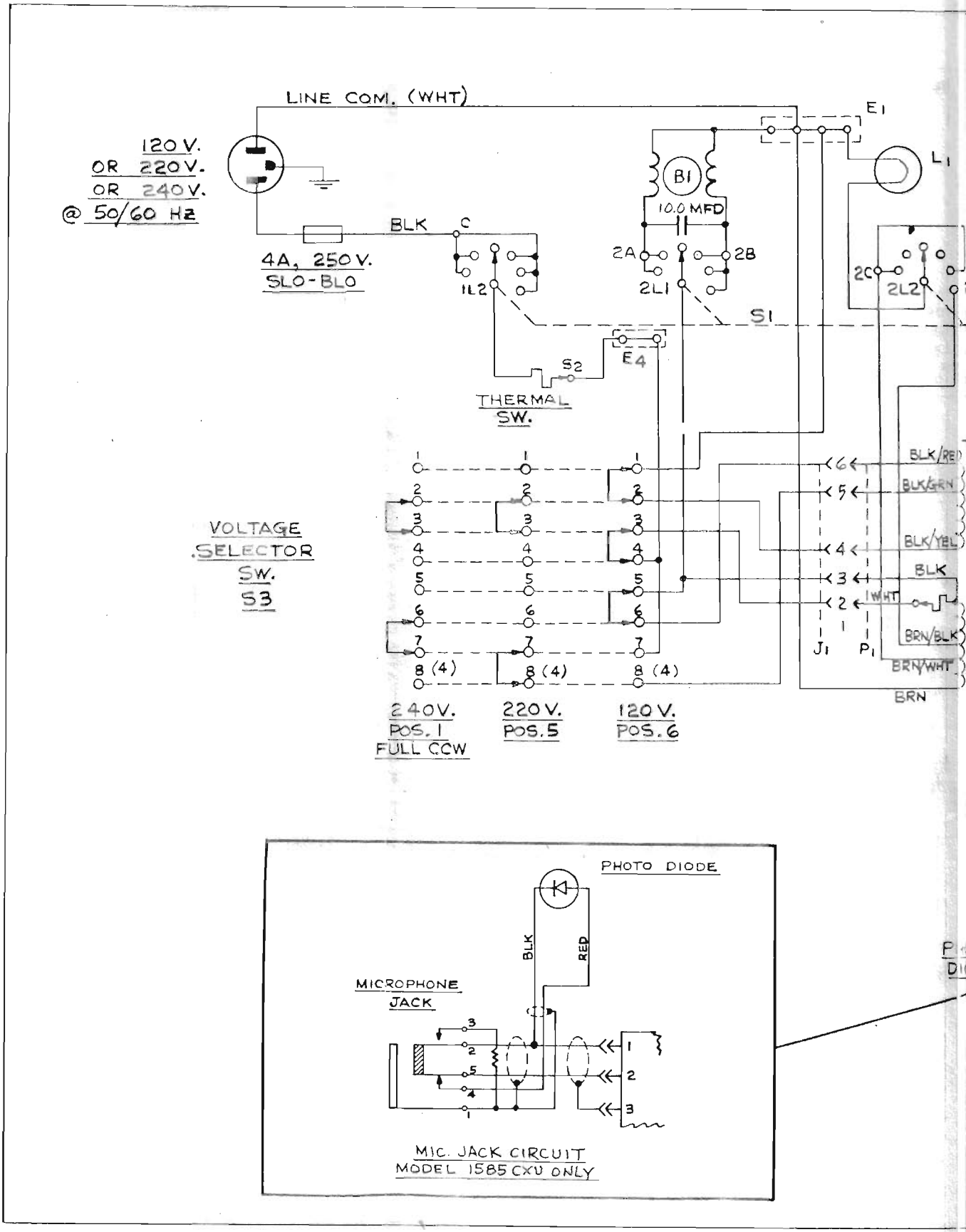
f. Loosen the setscrew (26) and lift the upper face gear (27) from the reel arm shaft (31). Remove the retaining ring (28) and disassemble the reel arm shaft (31) and washer (29) from the reel arm.

10. DISASSEMBLING THE EXCITER LAMP COVER AND SOUNDHEAD (Figure 9). Disassemble the exciter lamp cover and soundhead assembly in the following manner, noting any special precautions.

a. Inspect exciter lamp cover parts (1 through 7) and disassemble only as necessary for replacement.

b. Make a careful note of leadwire connections before disconnecting or unsoldering leads during disassembly of the soundhead. Remove the exciter lamp (8), wipe off fingerprints, and wrap the lamp in tissue paper.

c. Do not loosen the clamping screw (10) or disturb the lateral position of the optical slit assembly (11) unless it has been determined that the optical slit is in need of replacement or adjustment.


LINE COM. (WHT)
120 V.
OR 220 V.
OR 240 V.
@ 50/60 HZ
4A, 250 V.
SLO-BLO
BLK
C
1L2
B1
10.0 MFD
2A
2B
2L1
E1
L1
2C
2L2
S1
E4
S2
THERMAL
SW.
VOLTAGE
SELECTOR
SW.
S3
BLK/RED
BLK/GRN
BLK/YEL
BLK
WHT
BRN/BLK
BRN/WHT
BRN
J1
P1
240V.
POS. 1
FULL CCW
220V.
POS. 5
120V.
POS. 6
PHOTO DIODE
BLK
RED
MICROPHONE
JACK
MIC. JACK CIRCUIT
MODEL 1585 CXU ONLY

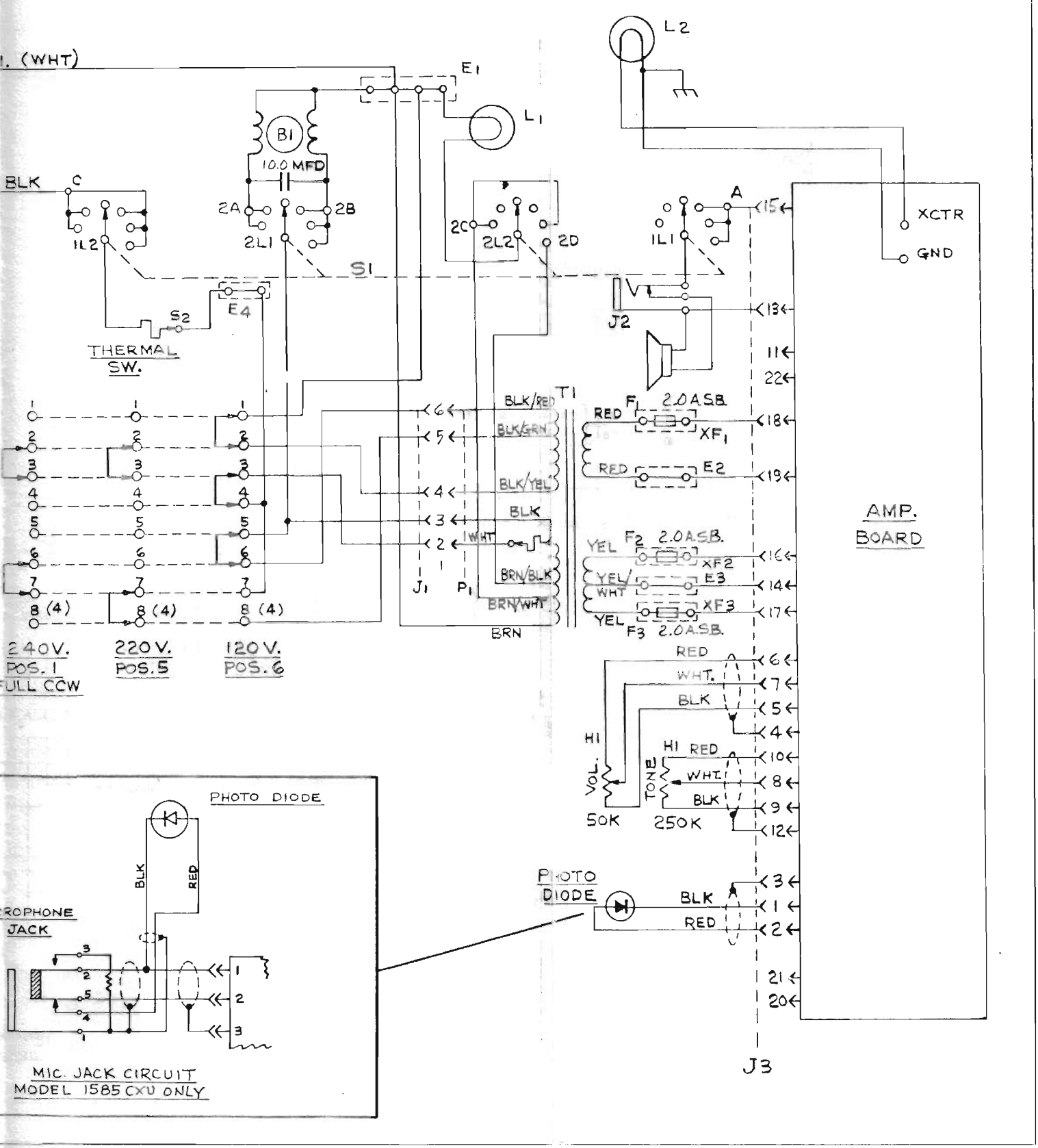
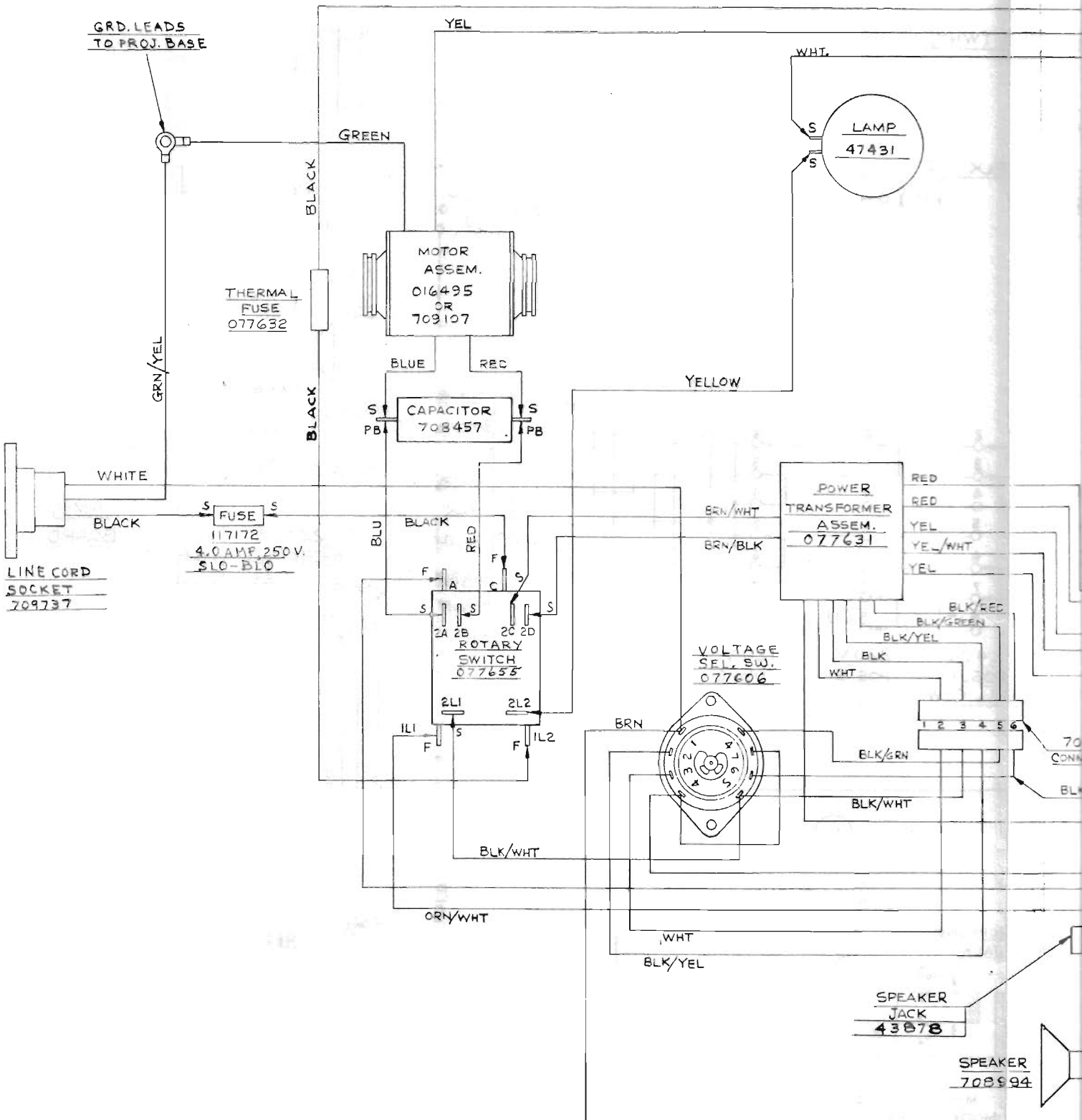


Figure C. Schematic Diagram
Models 1585CX, 1592CX, 1592CSX, 1585CXU


GRD. LEADS TO PROJ. BASE
YEL
WHT.
GREEN
BLACK
LAMP 47431
MOTOR ASSEM. 016495 OR 709107
THERMAL FUSE 077632
GRN/YEL
BLUE
RED
YELLOW
CAPACITOR 708457
PB
WHITE
BLACK
FUSE 117172 4.0 AMP, 250 V. SLO-BLO
LINE CORD SOCKET 709737
BLU
BLACK
RED
POWER TRANSFORMER ASSEM. 077631
BRN/WHT
BRN/BLK
RED
RED
YEL
YEL/WHT
YEL
BLK/RED
BLK/GREEN
BLK/YEL
BLK
WHT
ROTARY SWITCH 077655
2A 2B 2C 2D
2L1 2L2
1L1 1L2
VOLTAGE SEL. SW. 077606
BRN
BLK/GRN
BLK/WHT
BLK/WHT
ORN/WHT
WHT
BLK/YEL
SPEAKER JACK 43878
SPEAKER 708994

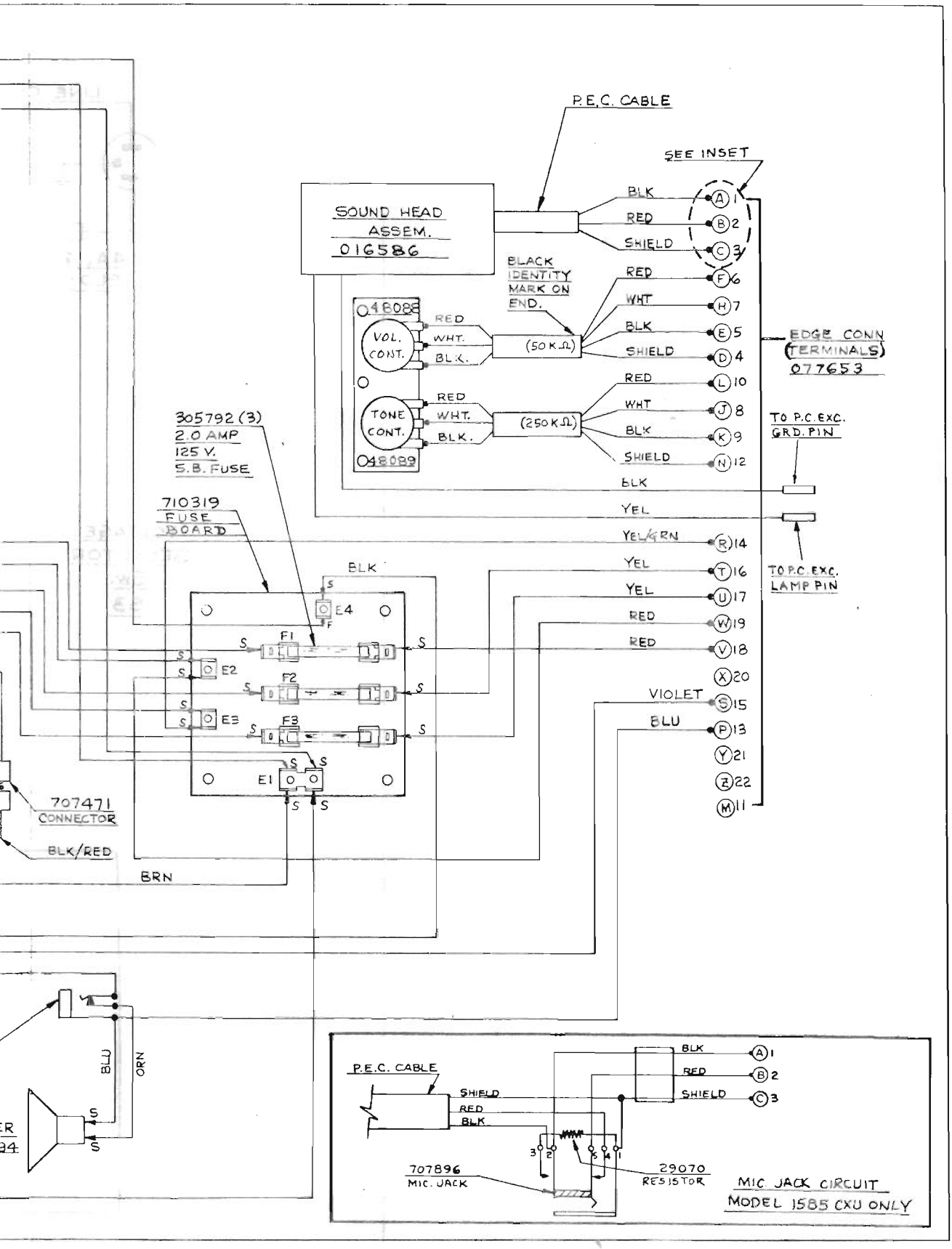


Figure D. Pictorial Diagram
Models 1585CX, 1592CX, 1592CSX, 1585CXU