SERVICE INSTRUCTIONS

SLOT-THREADING FILMOSOUND® PROJECTOR

MODELS 1575, 1580, 1680

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

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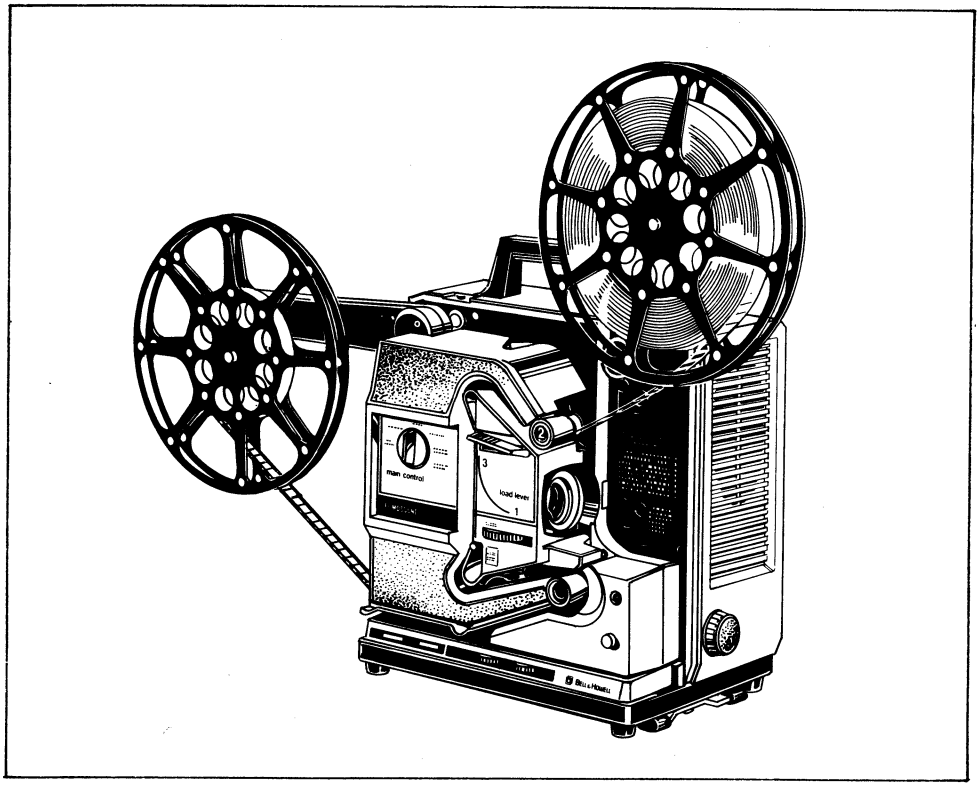


Slot-Threading Filmosound Projectors

FEATURE DESCRIPTION LIST

COLOR:	Model 1575	Black
	Model 1580 and 1680	Charcoal gray and torquoise
INPUT VOLTAGE:	Model 1575 and 1580	120VAC, 60Hz
	Model 1680	100/110/130/200/220/240/250VAC, 50/60Hz
FILM TRANSPORT:		Automatic slot-threading system
FILM SPEEDS:	Model 1575 and 1580	24fps only in forward and reverse
	Model 1680	18 and 24fps in forward and reverse; hi-speed reel-to reel rewind
ILLUMINATION:	Model 1575	120VAC, 350W, 25 hour lamp, Type BHB
	Model 1580 and 1680	24V, 250W, 50 hour lamp, Type EKS or Type EMM; normal/bright control
AUDIO SYSTEM:		Optical type with 4VDC exciter lamp (Type BAK) and silicon cell pick-up
AMPLIFIER:		Plug-in P.C. board; 15WRMS output
SPEAKER:		Built-in 16 ohm permanent magnet
WEIGHT:	Model 1575	30 pounds (13.6Kg)
	Model 1580	32 pounds (14.5Kg)
	Model 1680	34 pounds (15.4Kg)
AVAILABLE ACCESSORIES:		(See Parts Catalog Introduction)

INTRODUCTION

1. GENERAL.

This Service Manual has been prepared to provide necessary information for the repair and adjustment of the 16mm Slot-Threading Sound Motion Picture Projectors listed in the chart below. Design features and operating characteristics are listed in the Feature Description List on the preceding page.

An illustrated Parts Catalog is included at the rear of the service instructions to identify replacement parts and to assist in the disassembly and reassembly of these projectors. As noted in the following chart, this manual covers several variations of the Model 1575A, 1580 and 1680 projectors. For that reason, each model has been assigned a "letter" code in the parts listings so that replacement parts which are not common to all projectors can be readily identified. In the case of common parts (those used on all projectors, the "Usable on Code" column is blank.

MODEL/LETTER-CODE CHART

MODEL	CODE
1580A	A
1580AG	B
1580C	C
1580CS	D
1580CG	E
1680A	F1
1680AC	F2
1680C	F3
1680CC	F4
1680B	G
1680BC	H
1680E	J
1680EC	K
1680US	L
1680UC	M
1575A	N

The disassembly and repair procedures covered in this manual are limited to those areas and components which experience has shown to be the most likely cause of projector troubles. If more extensive repairs are required, see the exploded view illustrations in the Parts Catalog for further disassembly and parts replacement. Parts are listed in a suggested sequence of disassembly with attaching parts preceding the parts they attach.

2. GENERAL DESCRIPTION.

All projectors covered in this Service Manual are equipped with the slot-threading system designed by the Bell & Howell Company. A brief description of slot-threading operation is provided in paragraph 3 and illustrated in Figure A.

Single-Line Voltage Models. The Model 1575 projector is a color-change version of the 1580 series projectors and includes most of the features and product improvements provided in the 1580 units, with the following exceptions: the 1575 projector has a fixed, 120 line voltage lamp and utilizes a two blade shutter. The projectors are designed for 120VAC, 60Hz operation and normally are equipped with a 2-inch f/1.6 lens. The most noticeable variation in the 1580 series is the Model 1580CS, which is equipped with the front cover and speakers assembly illustrated in Parts Catalog Figure 18. Because of color variations, the part numbers of such items as covers, castings and trim plates will differ between models.

Multi-Line Voltage Models. With only slight variations, all models in the 1680 series are basically identical both mechanically and electrically. These models can be easily distinguished from the 1575/1580 series by the presence of the controls panel located above the cord wrap on the rear cover (see Figure B). On this panel are mounted the power input fuse, the voltage selector and speed selector switches (features which are not provided in the 1575/1580 series) and the input receptacle

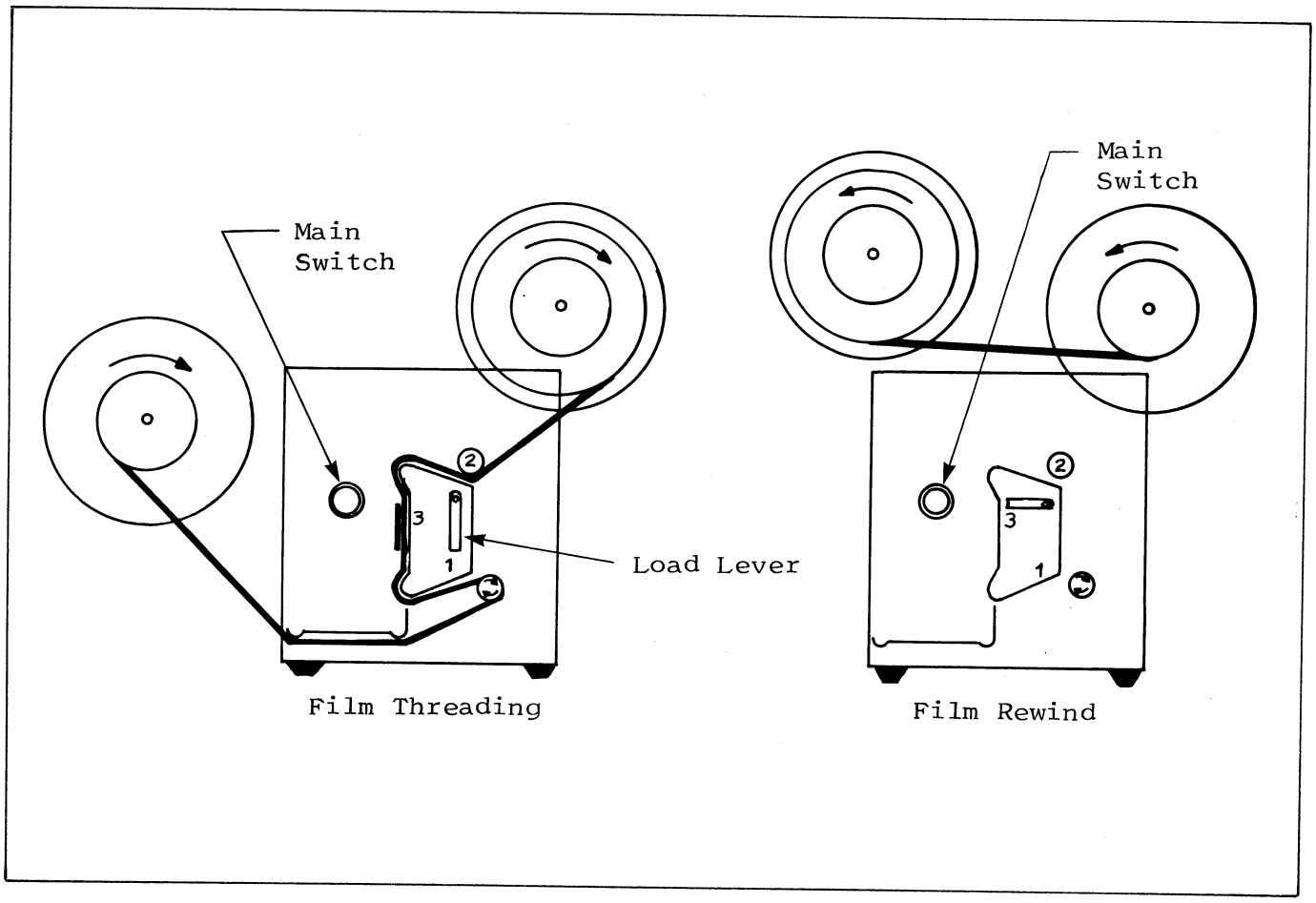


Figure A. Slot-Load Threading System

for the separate line cord. The Models 1680US and 1680UC are equipped with the front cover and speakers assembly illustrated in Parts Catalog Figure 18; the Models 1680BC and 1680EC with the front cover and speakers assembly illustrated in Figure 19.

3. SLOT-THREADING OPERATION.

With the load lever in position "1" (Figure A), the film transport system is open for threading and all projector electrical systems except the projection lamp are connected to the power input. This precaution is necessary to prevent heat damage to the film while the film is not being transported. As shown in Figure A, the film is slipped beneath the large entrance roller (numbered "2"); then around the roller located behind the upper left-hand corner of the lens cover, down through the film channel and around the roller at the lower left-hand corner of the lens cover. From this point, the film is threaded around the lower front guide roller (with the two clockwise arrows) and back along the film guide path beneath the lamphouse cover; then up around the rear guide roller to the take-up reel. Note that the take-up reel rotates clockwise during projection.

After the film has been threaded and attached to the take-up reel, move the load lever to the "3" position. This closes the film transport system and connects input power to all electrical systems including the projection lamp. The projector is designed to self-seat the film if threaded correctly. However, if the film is too far out-of-line, movement of the load lever to position "3" will cause the film to be automatically ejected from the lower portion of the film path. If this should occur,

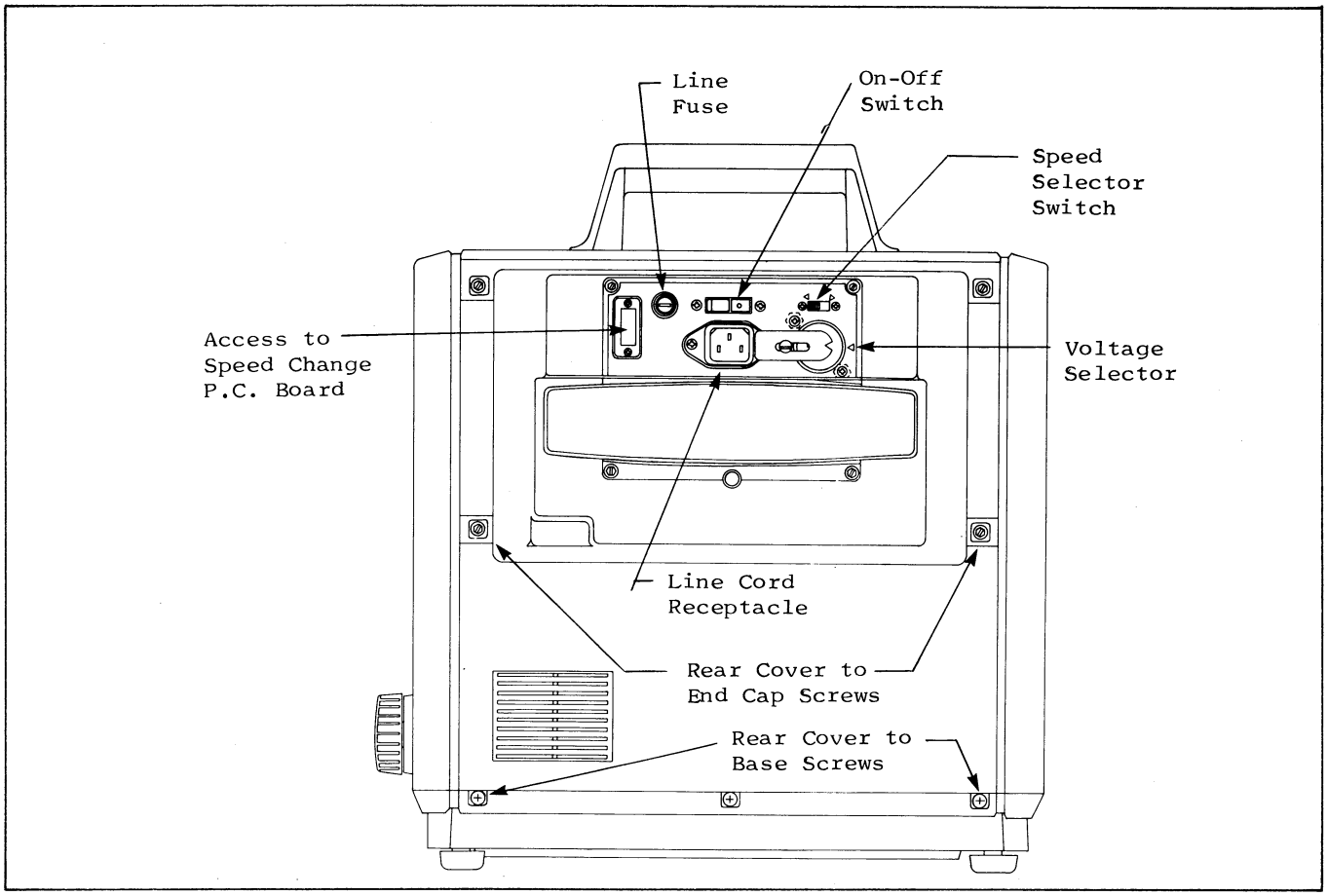


Figure B. Control Panel for 1680 Models

return the load lever to position "1" and manually rotate the take-up reel in a clockwise direction until the film is taut and properly aligned. When proper film threading has been established, movement of the main switch to the "forward project" position will initiate projection of the film.

NOTE: An interlock switch has been provided to shut off all electrical power while the load lever is in an intermediate position between positions "1" and "3."

To rewind the film, the rear reel arm must be raised to the full-up rewind position and the film brought directly to the front reel as shown in Figure A. Note that the front reel will rotate in a counter-clockwise direction during rewinding and that the load lever is in the "3" position. Turning the main switch to the rewind position will initiate the rewinding operation.

4. SPECIAL MAINTENANCE PRECAUTIONS.

Before beginning repairs, check specific customer complaints against the trouble shooting charts in this service manual for the most probable causes and suggested remedies. When repairs have been made, be sure to clean and lubricate the projector before it is returned to the customer.

The removal and installation of most projector components can be accomplished with tools normally available in photo equipment repair shops. Although most wiring connections are made by quick disconnects, a soldering gun should be available for repairs. Special tools and gages necessary for projector alignments and adjustments are illustrated and listed in Figure C and its accompanying chart. The setscrew wrenches listed in the chart are not shown in Figure C.

It should be noted that the Model 1575 Projector incorporates all of the latest improvements included in the current 1580 and 1680 models. When repairing earlier 1580 and 1680 models, it is advisable to check the Product Improvements section at the rear of these instructions to see if the projector has been brought up to date. This section contains all of the up-dates, retrofits, improvements and trouble shooting procedures for earlier model 1580 and 1680 projectors.

Keep your work bench clean and uncluttered. As parts are removed, group them together in an orderly fashion and reassemble attaching parts loosely to the parts they attach. Note or tag electrical wires or connectors so that they can be properly reconnected. If there is any doubt as to the connection of leadwires, refer to the proper wiring diagram at the rear of the Parts Catalog.

5. CLEANING INSTRUCTIONS.

Keep film path areas free of dirt and emulsion build-up; otherwise film jamming may occur during loading operations and projection. Use isopropyl alcohol and the special cleaning pad (P/N 48478) to remove hardened emulsion, and be careful not to scratch the surfaces that contact the film. Pay particular attention to the sound drum and the soundhead rollers.

Use isopropyl alcohol to clean plastic parts and be careful not to remove lubricants from critical areas, especially in the film threading linkage. These lubricants are applied during the assembly of the projector and, in many cases, it would be necessary to partially disassemble the projector to relubricate these parts. Blow away dust and film chips with a low-pressure jet of compressed air and wipe with a soft, lint-free cloth.

If the projector is especially dirty, the transport mechanism should be removed from the mainplate and thoroughly cleaned. Brush or blow out all accumulations of dirt and film chips. Wash "Oilite" bearings and cams with naphtha. If cleaning does not remove old lubricant from the felt cam oilers, the oilers should be replaced. Clean all other moving parts with isopropyl alcohol and dry all parts with a low-pressure jet of compressed air. As soon as all parts have been cleaned and dried, apply a light film of the specified lubricants and reinstall the transport mechanism.

6. LUBRICATION INSTRUCTIONS.

The Lubrication Chart in this section indicates those parts and areas requiring lubrication. These are also pointed out in the Parts Catalog illustrations by means of ballooned letters "L" (for oil) and "G" (for grease). Specified lubricants are available from the Bell & Howell Company. Be sure that the part or area to be lubricated is clean before lubricant is applied, and be careful not to over-lubricate. A drop or two of oil or a very light film of grease will be adequate. Apply grease with a camel's hair brush and wipe away excess lubricant with a lint-free cloth.

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

7. GENERAL REPLACEMENT DATA.

These projectors are designed for easy accessibility to and replacement of most major components. Routine inspection, trouble shooting and lubrication generally can be accomplished by the removal of the front cover, the rear cover and the two covers located on the underside of the base. Most of the wiring connections for the major electrical components are made by means of molded nylon connectors or screw-on wire nuts, thus minimizing unsoldering operations. Wiring connections and leadwire colors are indicated in the wiring diagrams at the rear of the Parts Catalog.

The front cover is easily removed by unlatching the two top cover latches and lifting the cover from the projector. The rear cover is secured to the projector base with three screws and to the end caps with two screws each (see Figure B). When these seven screws have been removed, carefully work the cover free from the projector to the limit of the interconnecting leadwires. The covers on the underside of the base are secured by screws and can be removed to expose the amplifier and its controls.

8. FUSE REPLACEMENT.

For all multi-line voltage models, the power input fuse is located on the rear cover control panel (Figure B) and can be replaced by unscrewing the fuse cap. The power input fuse of the single-line voltage models is located on a fuseboard mounted directly above the drive motor. To gain access to this fuse, as well as to the four audio system fuses for all projector models, the rear cover must be removed as instructed in paragraph 11.

9. LAMP REPLACEMENT.

a. Projection Lamp — All Models. With the line cord disconnected and the front cover removed, swing open the lamphouse and snap down the wire clamp that holds the projection lamp in place. Pull the lamp straight out from its socket (do not twist or wiggle the lamp during removal). Check the leadwires to the lampholder for condition and secure connection. Assemble the new lamp into the socket and swing the wire clamp up into place. Remove fingerprints from the lamp with lens tissue or a lint-free cloth and close the lamphouse.

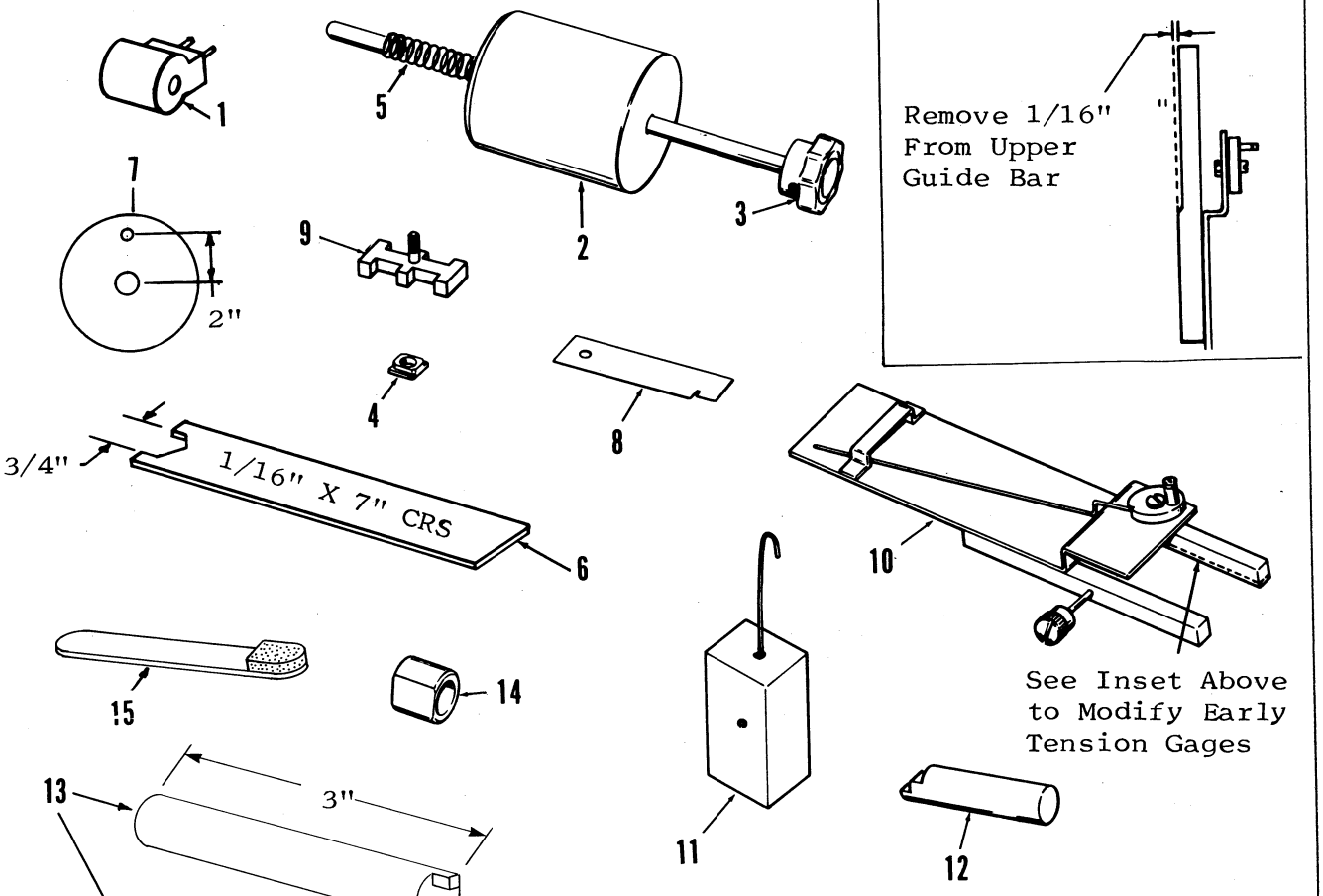
b. Exciter Lamp — All Models. Disconnect the line cord. Loosen the knurled screw on the exciter lamp cover and remove the cover. Rotate the lamp release ring until the exciter lamp can be lifted from the lamp socket pins. Install the new lamp, pressing down while rotating the release ring. Remove fingerprints from the lamp with lens tissue or a lint-free cloth and reinstall the covers.

LUBRICATION CHART

Parts To Be Lubricated	Lubricant
Non-bearing machined surfaces of castings	Oil P/N 07003 (L1)
Upper sprocket shaft	Oil P/N 08963 (L2)
Framer shaft	Oil P/N 04978 (L3)
Bearing face of worm gear	Oil P/N 04978 (L3)
Lower sprocket shaft	Oil P/N 078215 (L4)
Felt pads	Oil P/N 070032 (L5)
Friction surfaces of all sliding parts (not otherwise specified)	Oil P/N 070032 (L5)
Worm gear and sprocket gear teeth	Grease P/N 070043 (G1)
All other gear and pinion teeth	Grease P/N 070034 (G2)
Reel arm lock buttons	Grease P/N 070034 (G2)
Shuttle link bearings	Grease P/N 070034 (G2)
In-out cam, cam follower and cam wicks	Grease P/N 070034 (G2)
All pivot posts and bearings (in the mechanism housing)	Grease P/N 070034 (G2)

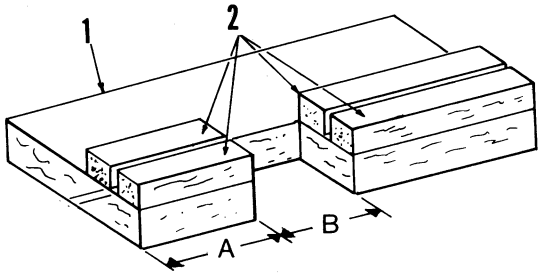
SERVICE TOOLS AND SUPPLIES CHART

Figure C Index No.	Tool No.	Tool Description	Tool Usage
1	S-1552-1-N1	Lamp Plug	Optical system alignment (Fig. S).
2	S-550-2-N1	Lens Plug	Optical system alignment (Fig. S).
3	S-550-2-N2	Alignment Rod	Optical system alignment (Fig. S).
4	S-550-2-N3	Aperture Plug	Optical system alignment (Fig. S).
5	P/N 6124	Tension Spring	Optcial system alignment (Fig. S).
6	Make in Shop	Torque Wrench	Adjust rewind torque (para. 31).
7	Make in Shop from P/N 014570	Rewind Torque Reel	Adjust rewind torque (para. 31).
	Purchase	Push-Pull Torque Scale (Chatillon #LP-72, Master Gage Co., Chicago, IL 60622)	Adjust rewind torque (para. 31).
	S-550-5-N1	Shuttle Stroke Target	Measure shuttle stroke (Fig. W).
8	S-550-5-N2	Shuttle Stroke Gage	Measure shuttle stroke (Fig. W).
9	S-09701-35-N2	Shuttle Height Gage	Check shuttle protrusion (Fig. U).
10	S-552-4-N1	Shuttle Tension Gage	Adjust shuttle tension (Fig. V).
11	S-552-4-N2	Shuttle Gage Weight	Adjust shuttle tension (Fig. V).
12	S-550-8-N1	Alignment Tool	Align sound drum (Fig. R).
13	Make in Shop	Sprocket Plate Adjust Tool	Remove play from sprocket plate.
14	S-552-2-N1	Loop Restorer Tool	Preset loop restorer position.
15	P/N 48478	Cleaning Tool	Clean film path area.
	G1271-F1	Setscrew Wrench and Handle	For 4-40 Bristol-type setscrews.
	G1271-X2	Setscrew Wrench and Handle	For 4-40 Bristol-type setscrews.
	STK3852-B	Setscrew Wrench and Handle	For 6-32 Bristol-type setscrews.
	STK3863-B	Setscrew Wrench and Handle	For 6-32 Bristol-type setscrews.
	G165-F1	Setscrew Wrench and Handle	For 8-32 Bristol-type setscrews.
	G165-X2	Setscrew Wrench and Handle	For 8-32 Bristol-type setscrews.
	G165-F3	Special Setscrew Wrench	For setscrews in wrench handles.
	P/N 04978	Lubricating Oil	See Lubrication Chart
	P/N 07003	Lubricating Oil	See Lubrication Chart
	P/N 08963	Lubricating Oil	See Lubrication Chart
	P/N 070032	Lubricating Oil	See Lubrication Chart
	P/N 078215	Lubricating Oil	See Lubrication Chart
	P/N 070034	General Purpose Grease	See Lubrication Chart
	P/N 070043	Special Grease	See Lubrication Chart
	P/N 704	Heat Sync Compound	See paragraph 27.
	TFL-D1580-NX2	Test Film Loop	Adjust centering and framing.
	TFL-D1580-NX3	Test Film Loop	Check buzz track.
	TFL-D1580-NX4	Test Film Loop	Check 7KHz azimuth.
	TFL-D1580-NX5	Test Film Loop	Check 400Hz power output.
	TFR-D550-NX5	Test Film Roll	Final audio/centering/framing test.
	TFS-D550-NX1	Test Film Strip (bad holes)	Check loop restorer function.
	TFS-D550-NX5	Test Film Strip (elongated holes)	Check loop restorer function.



Sprocket Plate
Adjusting Tool

Make From Aluminum Rod
5/16" O.D. By 3" Long



1-Plywood Base 1-1/2 THK By 9" By 14-1/2"
2-1" By 2" Wood Strips, Cut to Fit
A-Distance From Edge of Mainplate to P.C.B.
B-Base Cut-Out to Provide Clearance For P.C.B.

Mainframe Holding Fixture

Figure C. Service Tools

DISASSEMBLY/REASSEMBLY PROCEDURES

10. GENERAL PRECAUTIONS.

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

b. Cemented or adhesive-backed parts are so noted in the parts lists and can be removed by carefully prying up one edge with a decal removal tool. Be careful not to scratch surrounding areas and remove traces of old adhesive with solvent before installing new labels or nameplates. If the new item is to be cemented in place, use (Bell & Howell Company P/N 70507 cement). If the new item is adhesive-backed, peel off the protective tissue and smooth the item in place.

c. When disconnecting leadwires prior to the removal of electrical components, tag the leads or make a rough sketch of more complicated connections to assist in reinstallation. Where unsoldering is necessary, use a soldering gun and a heat sink to avoid the transfer of heat to adjacent parts. Leadwire colors and connections are shown in the wiring diagrams at the rear of the Parts Catalog section.

d. When removing riveted parts for replacement, drill out the old rivets with a drill equal in size or slightly smaller than the diameter of the rivets. Use screws and nuts of corresponding size to attach the replacement part, making sure that these parts do not interfere with the proper operation of the equipment.

e. The instructions contained in this section are limited to the replacement and/or repair and adjustment of major projector components. If further disassembly is required, refer to the Parts Catalog section for a more complete breakdown. All parts listings are arranged in a suggested order of disassembly to assist service personnel in the removal and replacement of worn or damaged parts.

11. PROJECTOR REAR COVER REMOVAL (Figure B).

The lower end of the rear cover is secured to the base of the projector with three screws and to each end cap with two screws. When these seven screws have been removed, the rear cover can be carefully pulled away from the projector base and end caps to the limit of the interconnecting leadwires. Normally, this will be enough to expose all projector mainplate and base-mounted components for inspection, cleaning, lubrication and parts replacement. If it is necessary for the rear cover to be completely removed, all leadwires to the rear cover components must be disconnected. When reinstalling the rear cover, be sure that no leadwires have become caught and that the cover is fully seated before installing the mounting screws.

12. DRIVE BELT REPLACEMENT. Disconnect the line cord and remove the rear cover (paragraph 11). Then proceed as follows:

a. Single-Line Voltage Models. If the drive belt is badly worn and in need of replacement, cut the old belt and remove it from the projector. Unplug the motor lead connector. Loosen the screw at the upper end of each motor bracket strap and disengage the straps from the motor end bells. Remove the four screws that secure the motor support brackets to the projector base and raise the motor just enough to permit the new belt to be passed around the motor toward the blower. Be careful not to lift the motor so high as to damage the blower fan. Clean both belt pulleys with isopropyl alcohol and loop the belt around the pulleys with as little stretching as possible. Reassemble the bracket straps to the motor end

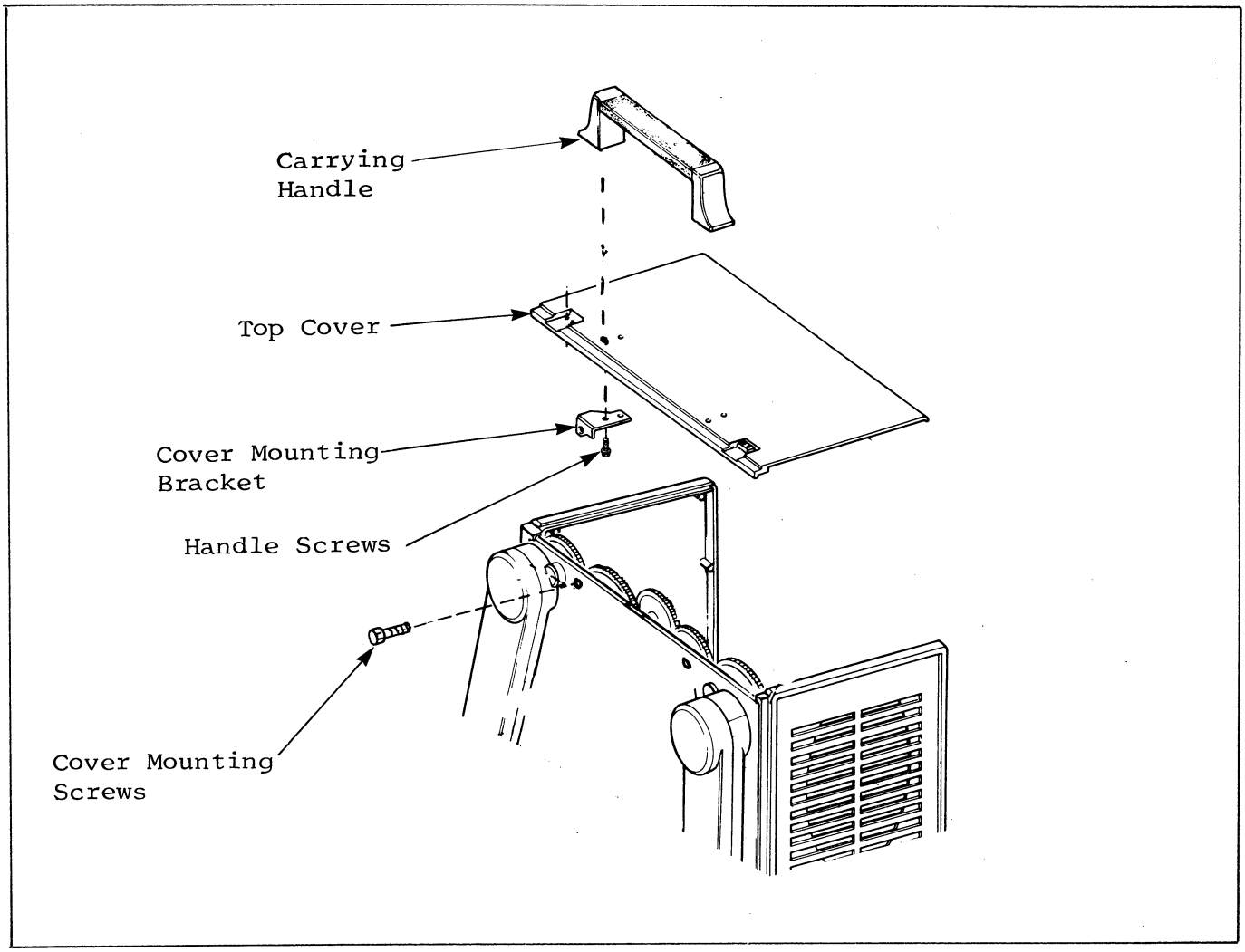


Figure D. Removing the Top Cover and Handle

bells and tighten the screws securely. Secure the motor mounting brackets to the projector base with the four screws and reconnect the motor lead connector. Reinstall the rear cover.

b. Multi-Line Voltage Models. Remove the old drive belt from the pulleys and clean both pulleys with isopropyl alcohol. Loop the new belt around the pulleys with as little stretching as possible and reinstall the rear cover.

13. PROJECTOR TOP COVER AND HANDLE REMOVAL (Figure D).

Remove the rear cover (paragraph 11). The top cover is secured by two screws which are inserted through the upper sides of the mainplate and threaded into tapped mounting brackets on the underside of the top cover (see Figure D). Remove these two screws and lift the top cover from the projector. To replace the carrying handle, the two handle screws and cover mounting brackets must be disassembled from the top cover.

14. INTERNAL SPEAKER REPLACEMENT (Figure E).

The internal speaker is mounted to the front end cap and can be removed without disassembling the front end cap from the projector. Remove the rear cover (paragraph 11) to expose the speaker, and disconnect

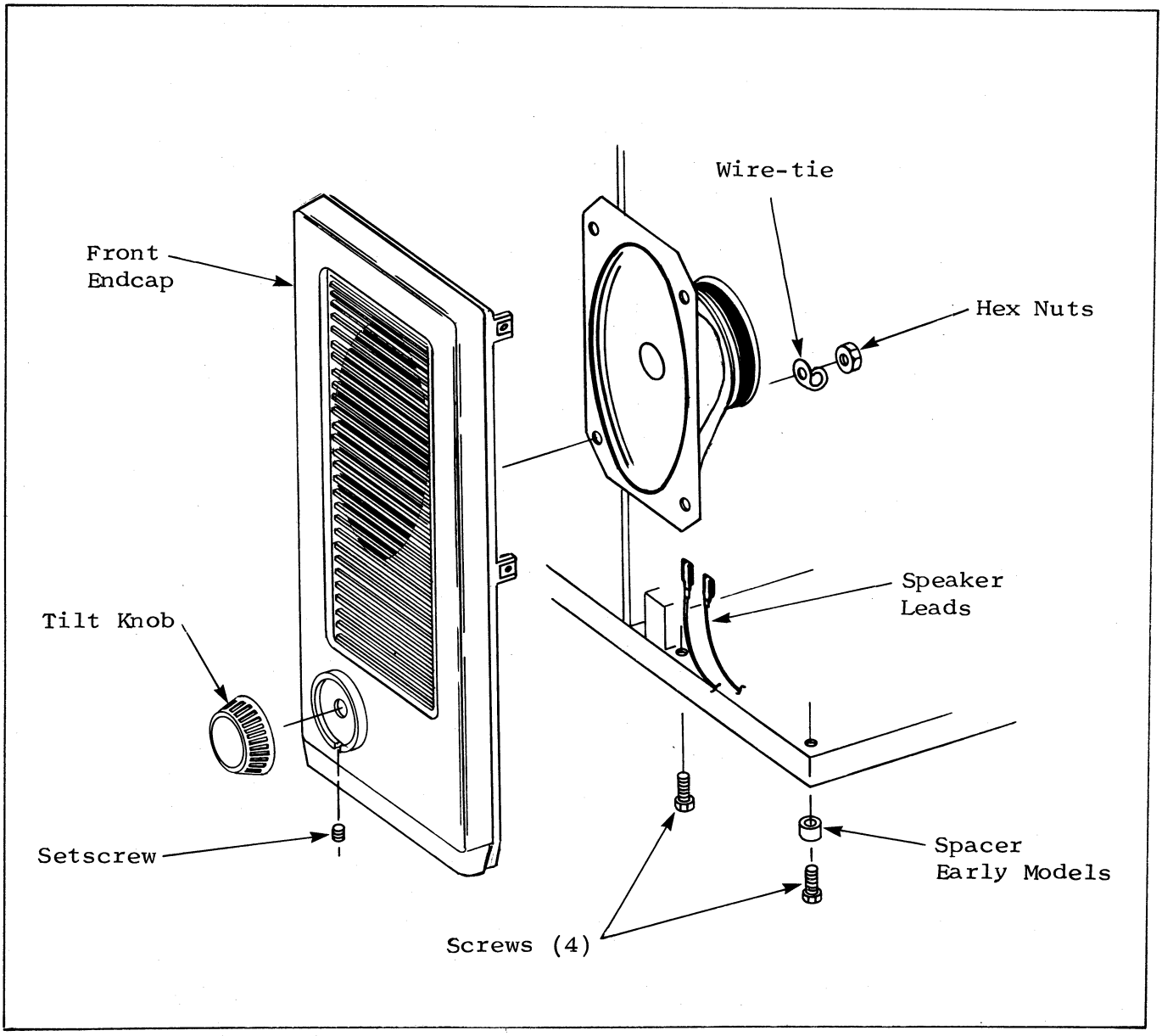


Figure E. Front End Cap and Speaker Removal

the two leads from the speaker terminals. Remove the four speed nuts from the mounting studs in the end cap and lift the speaker out from the projector. Reinstall the speaker in reverse fashion, pressing the leadwire lug connectors firmly in place on the speaker terminals. Redress any leadwires which may have been disturbed during speaker removal.

15. END CAP REMOVAL (Figure E).

If it should become necessary to remove either end cap from the projector, either for replacement or to gain access to other components, proceed in the following manner.

a. Front End Cap. Remove the rear cover (paragraph 11) and top cover (paragraph 13) from the projector. Disconnect the leadwires from the internal speaker terminals and tip the projector so that the underside of the base is exposed. Rotate the tilt knob unit its setscrew is visible through the cutout in the collar surrounding the tilt knob. Loosen this setscrew and withdraw the tilt knob. Remove the two screws that are inserted through the base and threaded into

the lower Tinnerman nuts assembled to the underside of the end cap. Note that a spacer bushing is located on the rear screw. Reinstall the end cap in reverse fashion and reconnect the speaker leads to the speaker terminals. Reassemble the top cover and rear cover to the projector.

b. Rear End Cap. Remove the rear cover (paragraph 11) and top cover (paragraph 13) from the projector. Tip the projector so that the underside of the base is exposed and remove the two screws that are inserted through the base and threaded into the lower Tinnerman nuts assembled to the underside of the end cap. If the rear end cap is to be replaced, move the end cap far enough away from the projector so that the leadwires to the end cap receptacles can be disconnected. Reinstall the end cap in reverse fashion, making certain that all leadwires are properly connected.

16. BLOWER REPAIRS (Figure F).

a. Single-Line Voltage Models. Remove the rear cover (paragraph 11) and the rear end cap (paragraph 15) from the projector, moving the end cap far enough away to clear the blower housing without placing too much strain on interconnecting leadwires. The right-hand blower housing is attached to the left-hand housing with three screws and to the projector base with two screws. Remove these five screws and lift out the right-hand housing. Rotate the blower fan until the two setscrews in the fan hub can be loosened, and withdraw the fan from the motor shaft. Assemble the new fan to the motor shaft and tighten the setscrews just enough to hold. Assemble the right-hand housing and hold in mounted position (screw holes aligned) while spinning the fan. Reposition the fan as necessary until there is clearance between the fan and both housings; then tighten both setscrews securely. Install the five housing mounting screws and check to make certain that all leadwires are properly dressed. Reassemble the rear end cap and rear cover to the projector.

b. Multi-Line Voltage Models. Remove the rear cover (paragraph 11) and the rear end cap (paragraph 15) from the projector, moving the end cap far enough away to expose the blower housing without placing too much strain on interconnecting leadwires. The right-hand blower housing is attached to the left-hand housing with three screws and to the projector base with two screws. Remove these five screws and lift out the right-hand housing with blower motor and fan assembled. Loosen the two setscrews in the blower fan hub and withdraw the fan from the blower motor shaft. Remove the three screws and disassemble the blower motor from the right-hand housing. If the motor is to be replaced, disconnect the leadwires from the motor terminals. Reassemble and install blower parts in reverse fashion, tightening the fan setscrews just enough to hold. Hold the housing in mounted position (screw holes aligned) while spinning the fan. Reposition the fan as necessary until there is sufficient clearance between the fan and both housings; then tighten both setscrews securely. Install the five housing mounting screws and check to make certain that all leadwires are properly connected and dressed. Reassemble the rear end cap and rear cover to the projector.

17. MAIN SWITCH REPLACEMENT (Figure G).

Remove the rear cover (paragraph 11) from the projector to expose the switch. Swing open the lamphouse and remove the switch knob and grip ring from the front end of the switch shaft. Loosen the setscrew in the flywheel brake cam and unscrew the lock nut that secures the switch to the mounting bracket. Withdraw the switch from the bracket, catching the brake cam, lock nut and lockwasher as they become free.

NOTE: Single-Line Voltage Models Only. The capacitors wired across the switch terminals (see inset, Figure G) must be disconnected from the old switch and reconnected to the replacement switch. Be sure to include the insulating sleeving on the capacitor lead to the fuseholder above the switch.

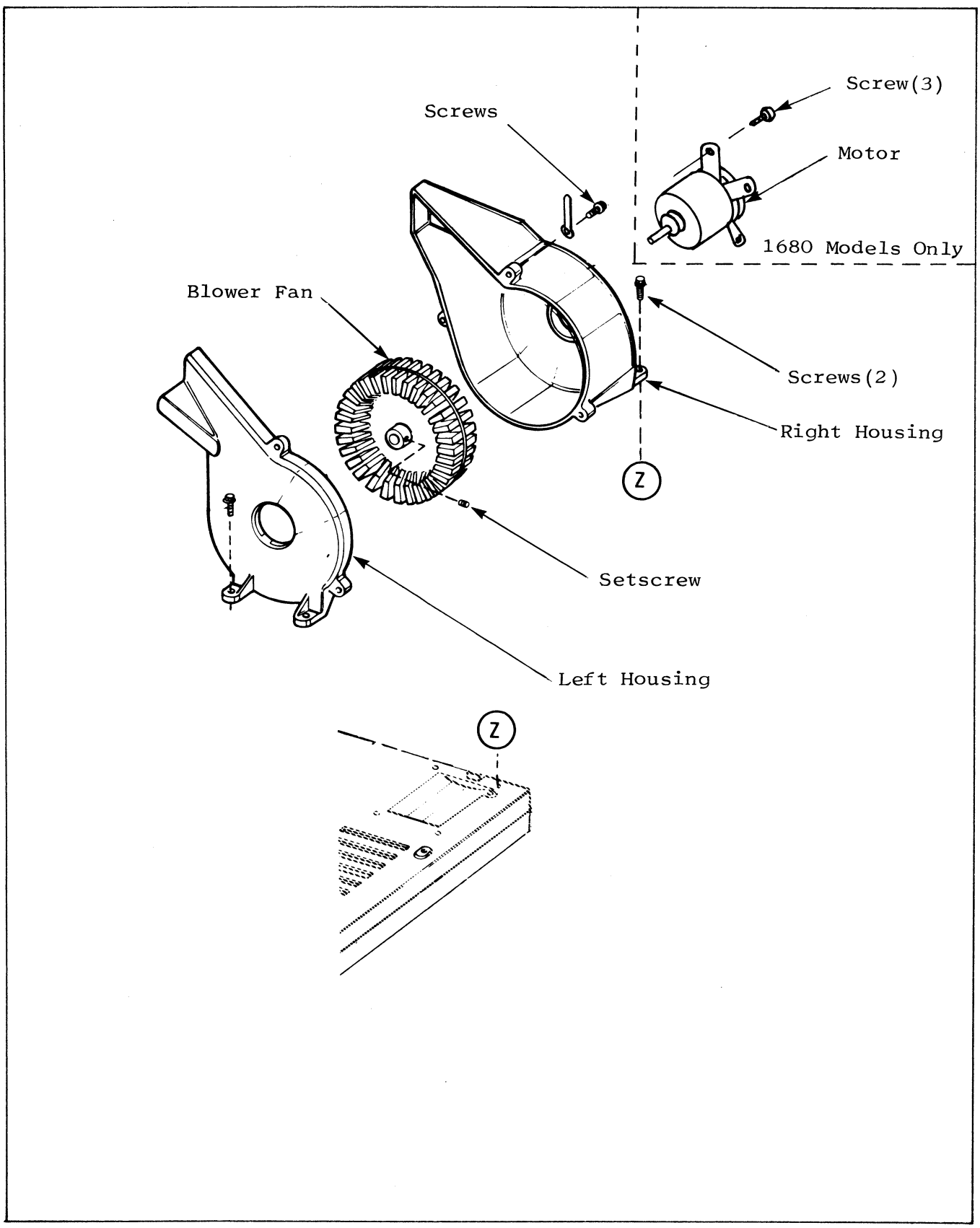


Figure F. Blower Repairs

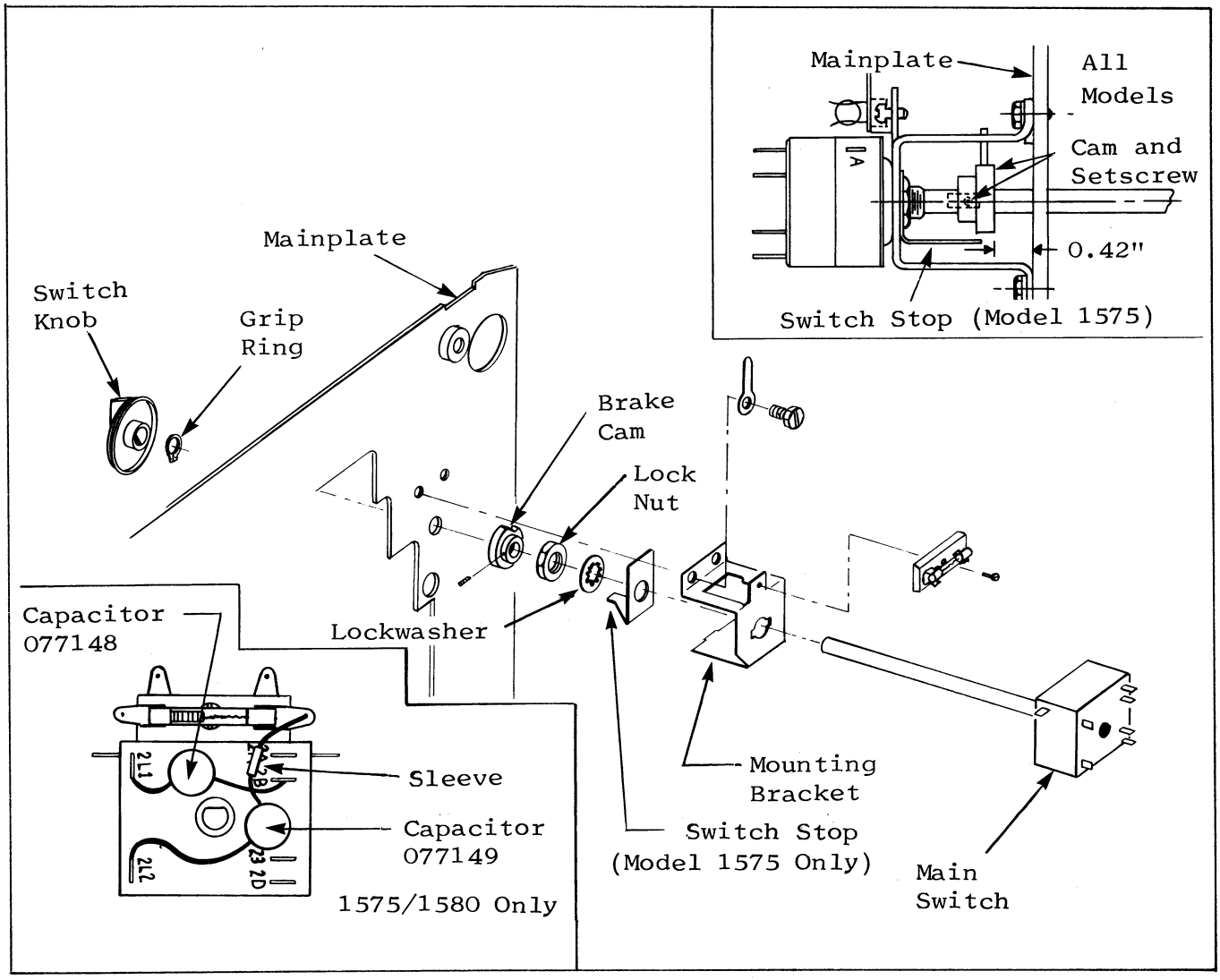


Figure G. Replacing the Main Switch

Insert the shaft of the new switch through the hole in the bracket and assemble the lockwasher, lock nut and brake cam to the shaft before inserting it through the mainplate. Slide the lockwasher up against the switch boss and tighten the lock nut securely. Raise the cam follower (see Figure L) and shift the brake cam until the follower rests on the outer surface of the cam. Using appropriate feeler gages, position the cam so that its inner surface is 0.42 inch (10.7mm) from the mainplate and hold securely while tightening the setscrew in the cam. Assemble the grip ring and switch knob to the end of the switch shaft and close the lamphouse. Reinstall the projector rear cover.

18. DRIVE MOTOR REPLACEMENT (Figure H).

a. Single-Line Voltage Models. Remove the projector rear cover and disconnect the motor leads. Remove the blower right-hand housing and blower fan (paragraph 16). Loosen the screw in the upper ears of each end bell clamp and disengage the clamps from the tongues of the mounting brackets. Remove the two screws from the left-hand mounting bracket only and slide the motor and bracket forward and out of the projector, while disengaging the drive belt from the motor pulley. If the motor is to be replaced, remove the pulley from the motor shaft. Assemble the new motor and left-hand bracket to the

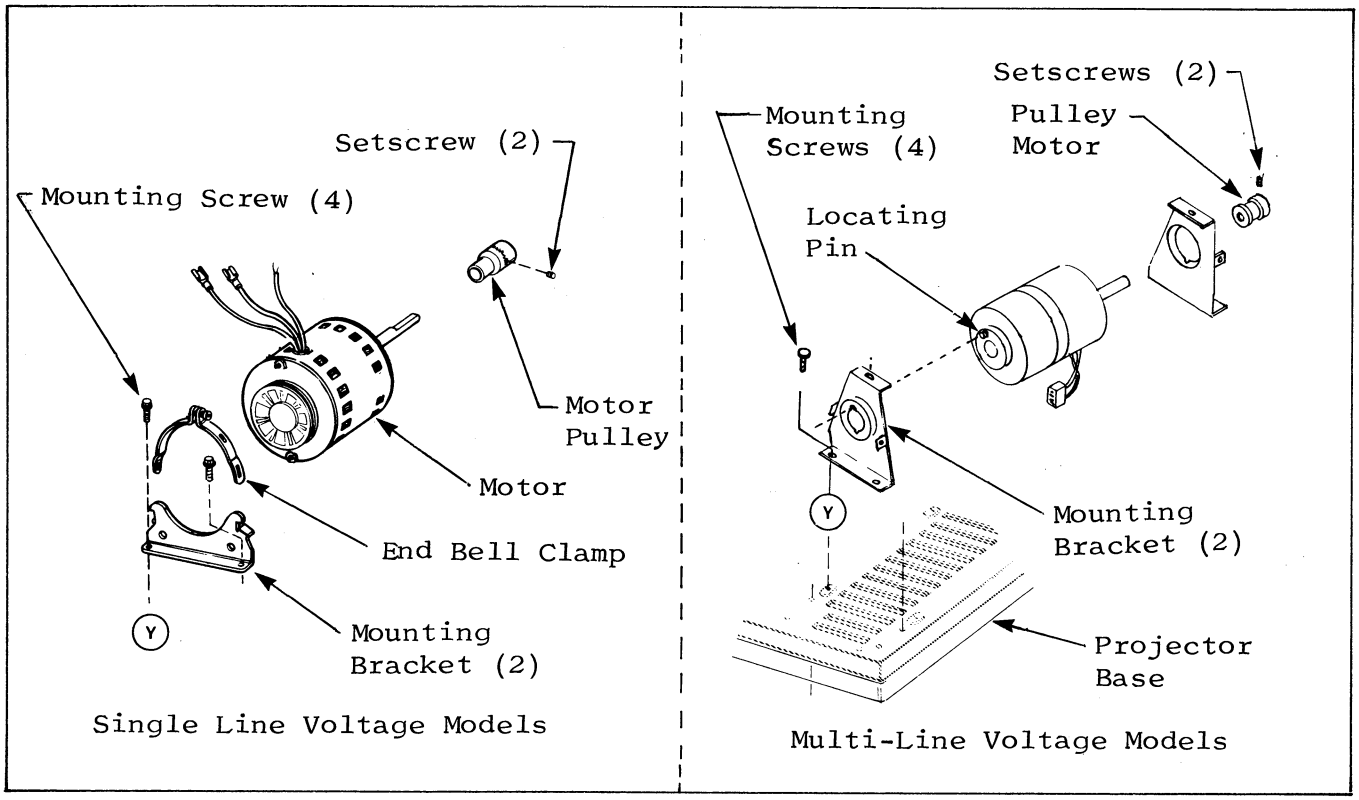


Figure H. Replacing the Drive Motor

projector base, with the pulley loosely installed on the motor shaft, and the drive belt looped around the pulley. Rest the motor end bell in the cradle of the right-hand mounting bracket and position the left-hand bracket so that the mounting screws can be installed. Assemble the end bell clamps to the end bells and mounting bracket ears and tighten the clamp screws. Reassemble the right-hand blower housing and blower fan to the motor shaft (paragraph 16). Position the drive pulley so that the drive belt is perpendicular between drive pulley and mechanism pulley. Then tighten the two pulley setscrews securely.

b. Multi-Line Voltage Models. Remove the projector rear cover (paragraph 11) and disconnect the motor leads. Remove the screw that secures the fuseboard (directly above the motor) to the left-hand mounting bracket. Remove the two screws that attach the left-hand mounting bracket to the projector base. Disengage the drive belt from the motor drive pulley and support the motor while shifting the motor and bracket to the left and away from the projector. Clean the drive pulley and assemble it loosely to the new motor shaft. Assemble the new motor to the left-hand bracket, engaging the locating pin with the hole in the bracket. Assemble the motor and bracket to the base and right-hand mounting bracket, again engaging the opposite locating pin into the hole in the right-hand bracket. Align the left-hand bracket with the mounting holes in the base and install and tighten the two screws. Secure the fuseboard to the top of the left-hand bracket with the single screw. Loop the drive belt around the drive pulley and shift the pulley until the belt is perpendicular to the base. Then tighten the two pulley setscrews securely and reinstall the rear cover (paragraph 11).

19. TRANSFORMER REPLACEMENT (Figure J).

The transformer set-up for the single line voltage models is shown in Figure J.

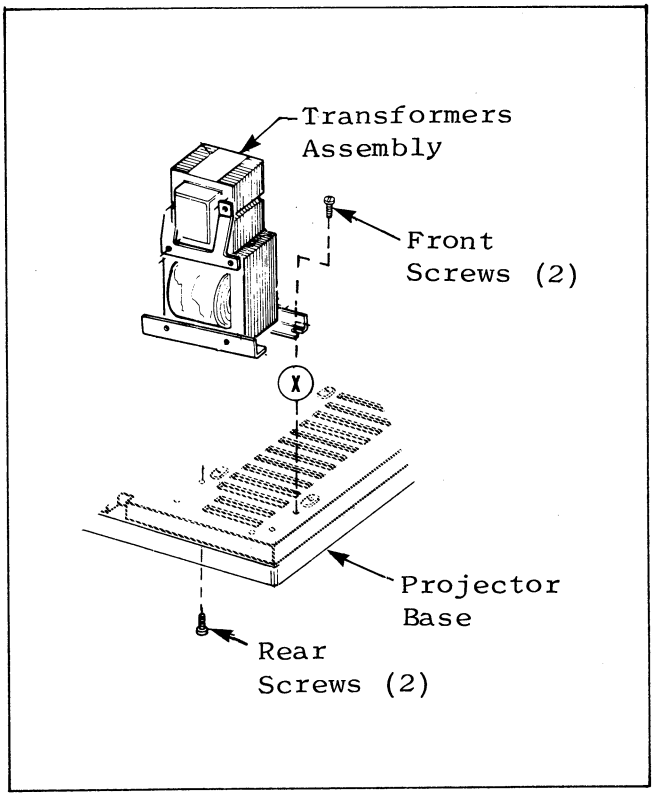


Figure J. Replacing the Transformers (Single-Line Voltage 1580 Models Shown)

Although the transformers for the single line voltage models projectors differ in appearance and are wired differently, they are mounted to the base in the same manner. Disconnect leads as necessary and remove the amplifier cover from the underside of the base to expose the two rear mounting screws. (See Figure P for amplifier cover removal.) After the rear screws have been removed, tip the projector upright and remove the two front screws. Lift the transformer assembly from the projector base. A complete breakdown of the single line voltage transformers group is shown in Parts Catalog Figure 11A. Reinstall the transformer in reverse fashion, referring to the appropriate wiring diagram at the rear of the Parts Catalog for leadwire connections. Reinstall the amplifier cover and projector rear cover.

20. REWIND CORD REPLACEMENT (Figure K).

If the rewind cord should break, remove the projector rear cover (paragraph 11) and proceed in the following manner. Remove

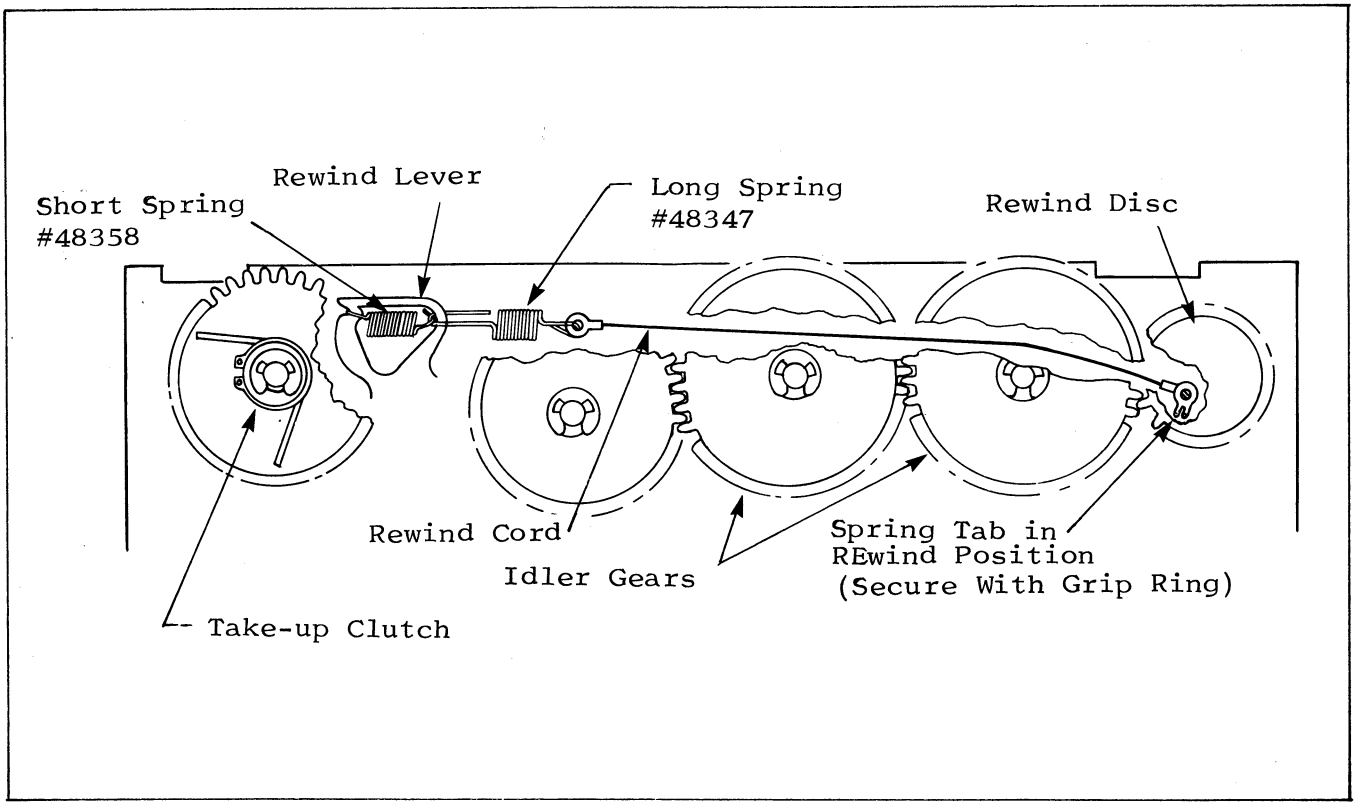


Figure K. Replacing the Rewind Cord

the grip ring from the formed tab of the rewind disc and slide the metal loop of the rewind cord from the tab. Unhook the short spring from the notch at the upper end of the rewind lever and disassemble both springs from the broken cord. Assemble the short end of the long spring through one end loop of the new rewind cord and the other end of this spring through the end loop of the short spring. Hook the free end of the short spring around the notch in the upper corner of the rewind lever. Stretch the rewind cord to the right, behind the two large idler gears and above the gear studs. Pull the cord with a long-nose pliers until the end loop of the cord can be placed over the formed tab of the rewind disc. Secure the end loop in place with the grip ring previously removed. Check to make certain that there are no obstructions to proper rewind cord operation.

21. BRAKE RELEASE CABLE REPLACEMENT (Figure L).

If the brake cable should break or become disengaged, remove the projector rear cover and proceed in the following manner. Remove and discard the broken cable, retaining the tension spring. Assemble the "V" end of the tension spring to one end of the new cable. Loop the other end of the cable over the notch at the rear end of the cam follower. Dress the cable down around the center groove of the cable sheave; then to the left, stretching the tension spring just

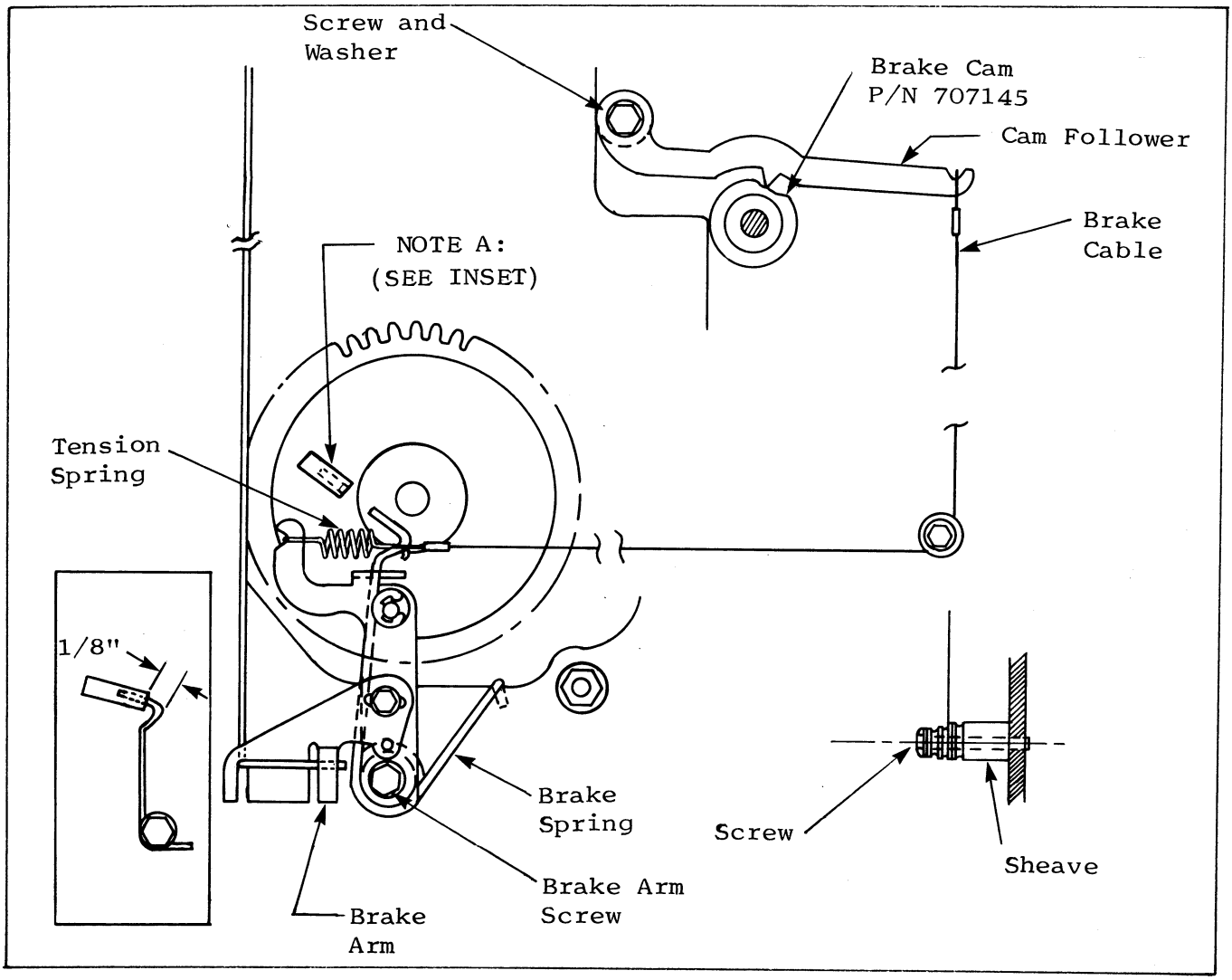


Figure L. Brake Release System

enough to engage the upper notch in the brake arm. Proper brake release tension can be adjusted by engaging the cable in the outer or inner grooves of the sheave as necessary.

NOTE: On all projectors with serial numbers above 7112001, the upper finger of the brake spring has been fitted with a 1/2-inch length of 1/32" I.D., 5/32" O.D. tubing to prevent the brake cable from becoming disengaged. To install this sleeve, enlarge one end opening with a center punch and press the sleeve over the end of the finger as shown in the inset of Figure L. Place a drop of cement (B&H P/N 70507) on the enlarged hole end of the sleeve.

22. REAR REEL ARM REPLACEMENT (Figure M).

a. Remove the projector rear cover (paragraph 11). Disassemble the retaining ring, spur gear, large flat washer and second retaining ring from the end of the reel arm shaft. Remove the grip ring that secures the rewind cord to the formed tab of the rewind disc. Note the manner in which the rewind disc and reel arm disc are oriented in regard to the mainplate. If necessary, scribe these discs and the mainplate to assure proper reassembly. Remove the three screws that attach the two discs. When the discs and reel arm are disassembled from the mainplate, the lock button and its spring will "pop" from position. Do not lose these parts.

NOTE: If further reel arm repair is required, refer to Parts Catalog Figure 12 for a complete breakdown of reel arm parts. Parts are listed in their order of disassembly to assist in making repairs. When reassembling the reel arm, be sure to maintain the proper backlash (0.005" minimum to 0.018" maximum, 0.127mm to 0.460mm) between the upper face gear and its mating spur gear. No other adjustments are necessary.

b. Reel arm installation is essentially the reverse of disassembly. Apply a light film of grease (B&H P/N 070034) to the mounting flange of the reel arm and around the reel arm hole in the mainplate. Assemble the tension spring to the shaft of the lock button and insert the button shaft into the small hole adjacent to the reel arm hole.

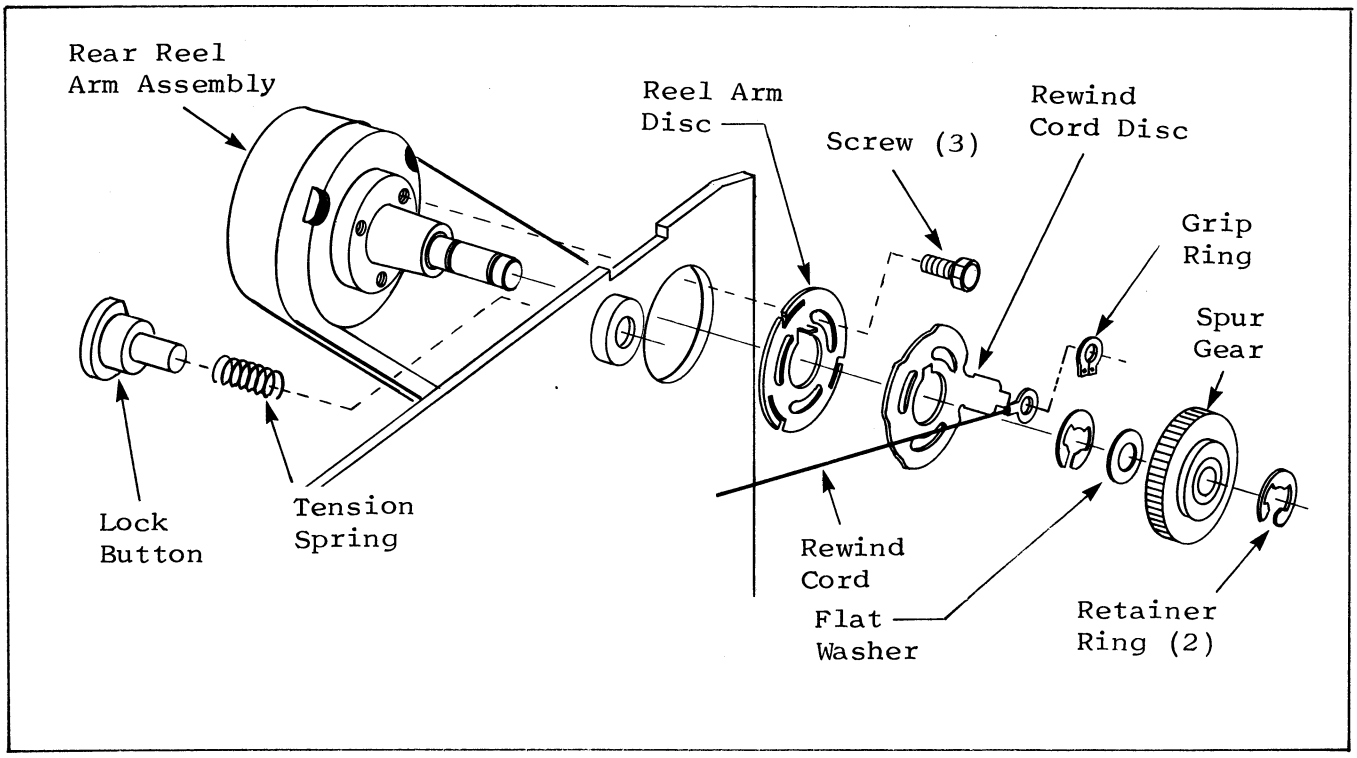


Figure M. Replacing the Rear Reel Arm

Hold the button depressed while installing the reel arm to the mainplate. With the reel arm in the "down" position, release the button so that it is held in place by the mounting flange of the arm. Assemble the reel arm disc and rewind disc to the reel arm shaft, aligning the scribe marks with those on the mainplate. The shear form in the center hole of the reel arm disc should face toward you and down. The shear form of the rewind disc should be up and the center hole notch engaged over the shear form of the reel arm disc. Install the three mounting screws and tighten to 14 inch-pounds minimum. Manually depress and hold the lock button while moving the reel arm up and down to check for freedom of movement. Secure the free end of the rewind cord to the formed ear of the rewind disc with the grip ring. Assemble a retaining ring, flat washer and the spur gear to the reel arm shaft and secure parts with the second retaining ring. Manually rotate the spur gear to check gear tooth engagement with the adjacent large idler gear. Lightly brush gear teeth with grease and install the rear projector cover (paragraph 11).

23. FRONT REEL ARM REPLACEMENT (Figure N).

a. Remove the projector rear cover (paragraph 11). Note the manner in which the clutch gearing is assembled to the reel arm shaft. The early style clutch gearing (see inset, Figure N) is no longer available and, if replacements are necessary, the new style gearing must be installed. This will also necessitate the disassembly of the front reel arm (see Figure 13 in Parts

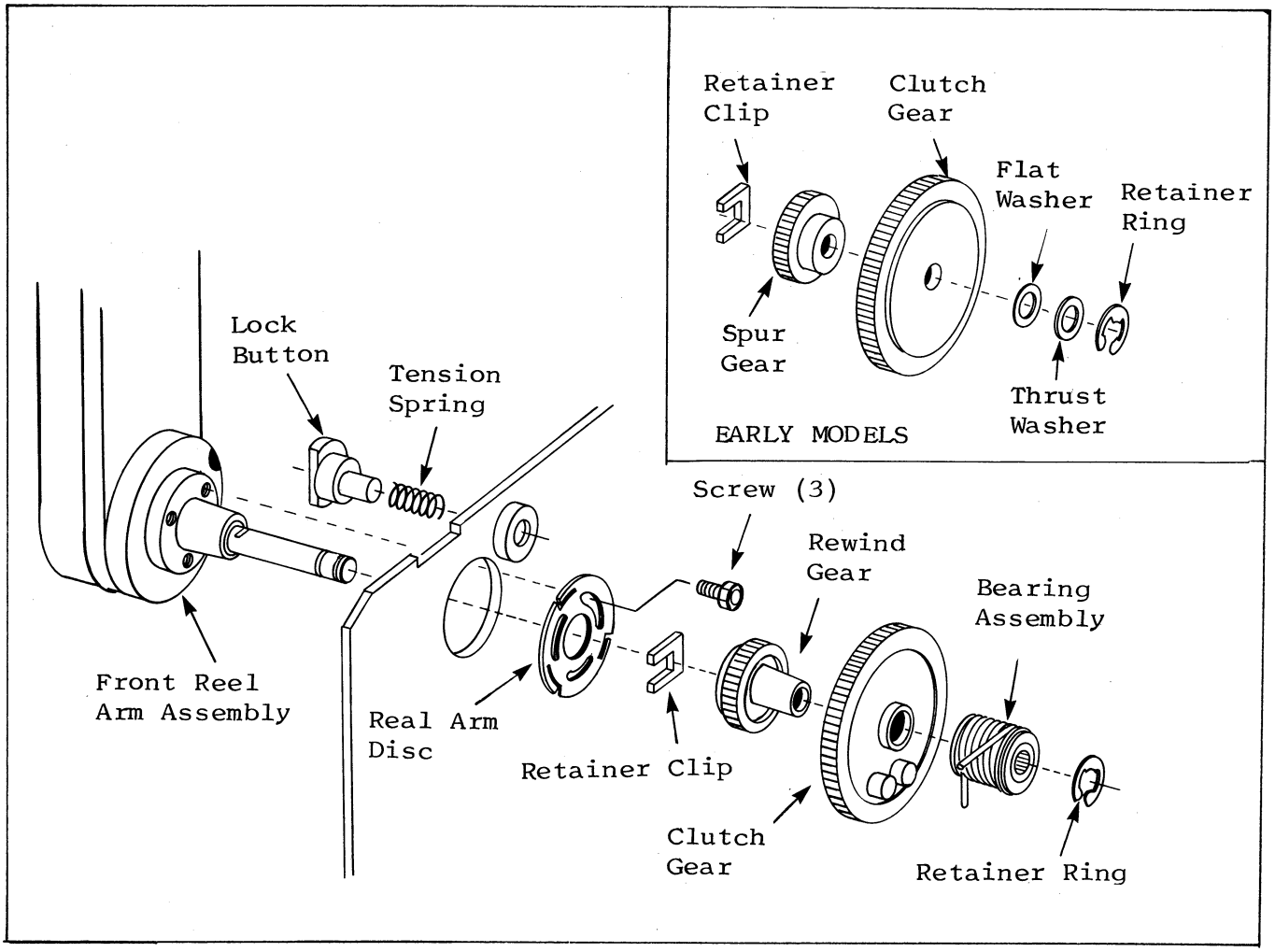


Figure N. Replacing the Front Reel Arm

Catalog) for the replacement of the reel arm shaft. A new shaft (P/N 707111) is required with the new clutch gearing set-up. Remove the front reel arm in the following manner.

b. Remove the retaining ring and disassemble the bearing assembly, clutch gear, rewind gear and retaining clip from the reel arm shaft. Note the manner in which the reel arm disc is oriented in regard to the mainplate. If necessary, scribe the disc and mainplate to assure proper reassembly. Remove the three screws and disassemble the disc from reel arm shaft. When withdrawing the front reel arm from the mainplate, be careful not to lose the lock button and spring which are held in place by the reel arm flange.

NOTE: If further disassembly of the reel arm is required, refer to Parts Catalog Figure 13 for a complete breakdown of reel arm parts. Parts are listed in their order of disassembly to assist in making repairs. When reassembling the reel arm, be sure to maintain the proper backlash (0.005" minimum to 0.018" maximum, 0.127mm to 0.460mm) between the upper face gear and its mating spur gear. No other adjustments are necessary.

c. Reel arm installation is essentially the reverse of removal. Apply a light film of grease (B&H P/N 070034) to the mounting flange of the reel arm and around the reel arm hole in the mainplate. Assemble the tension spring to the shaft of the lock button and insert the button shaft into the small hole adjacent to the reel arm hole. Hold the button depressed while assembling the reel arm to the mainplate. With the reel arm in the "down" position, release the button so that it is held in place by the mounting flange of the arm. Assemble the reel arm disc to the reel arm shaft, aligning the scribe marks with those on the mainplate. The shear form in the center hole of the disc should face toward you and up. Install the three mounting screws and tighten to 14 inch-pounds minimum. Assemble the retaining clip into the second groove from the end of the reel shaft. Assemble the rewind gear to the shaft with the square hole in the gear hub engaging the retaining clip. Assemble the clutch gear and bearing assembly to the reel arm shaft, winding the spring leg of the bearing assembly and engaging it behind the protruding pin of the clutch gear. Install the retaining ring to secure all parts. Depress and hold the lock button while swinging the reel arm up and down to check freedom of operation. Manually rotate the clutch gear to check for freedom of movement. Apply a light film of grease to all gear teeth with a brush, and reinstall the rear cover (paragraph 11).

24. AMPLIFIER AND CONTROLS REPAIR (Figure P).

NOTE: Amplifier circuit board repairs are not recommended except as an emergency measure and then only if qualified electronics personnel and test equipment are available. 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. If a faulty condition is traced to the amplifier, replace the complete assembly.

a. Tip the projector to expose the underside of the base. The amplifier cover and volume/tone controls cover are each secured to the base with hex washer head screws. Remove both covers to expose the amplifier and controls for inspection and repairs.

b. If the amplifier must be replaced, remove the two screws which attach the amplifier edge connector to the base and the two screws and spacers which attach the amplifier assembly to the base. Lift out the amplifier and disconnect the amplifier board from the edge connector. Reassemble the new amplifier to the edge connector and assemble these items back into the base with the screws and spacers. Be sure to redress all leadwires.

c. To replace the volume and/or tone control, remove the two screws that attach the controls bracket to the base. Pull the knobs from the control shafts. Remove the hex nut from the faulty control and disconnect the leadwires. Install the new control, reassemble leads and reinstall the controls assembly.

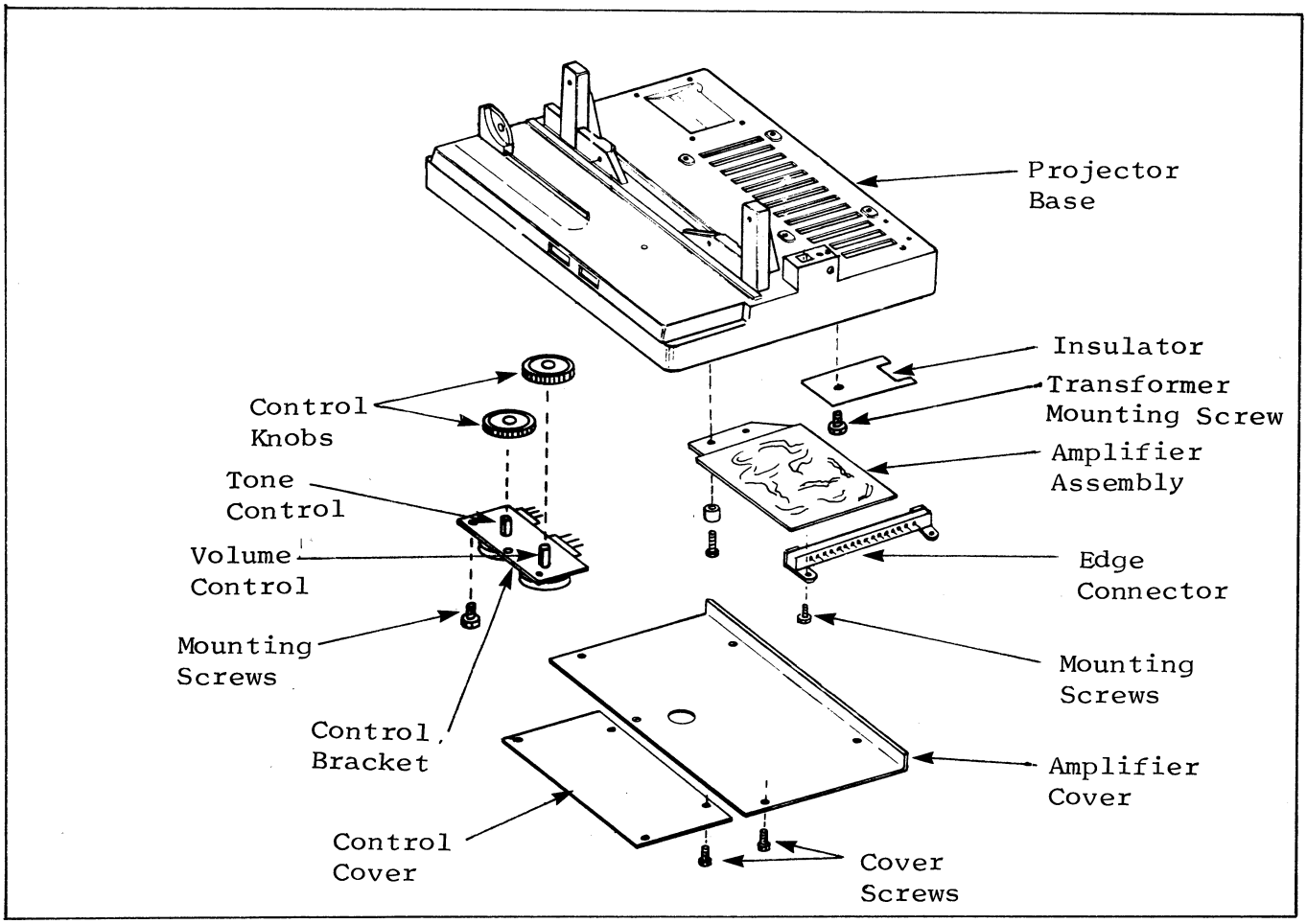


Figure P. Amplifier and Controls Repair

25. COMPLETE MECHANISM REPLACEMENT (Figure Q).

a. Removal. Remove the projector rear cover (paragraph 11) and remove the transformer (paragraph 19) to expose the flywheel. Remove the retaining ring from the rear end of the sound drum shaft. In some earlier models, you will find four flat washers located between the retaining ring and the flywheel. In current models, the ring groove is closer to the flywheel and these flat washers are not required. Carefully remove the flywheel from the sound drum shaft, guiding it out from behind the drive motor. Remove the flat washer and bowed washer from the shaft. Unplug the small edge connector from the printed circuit board mounted at the bottom of the mechanism casting.

For Earlier Models Only. Remove the screw and washer from the banana slotted adjustment plate just visible above the sound drum area of the mechanism casting. This plate is under spring tension and will rotate in a clockwise direction when the screw is removed. At the top rear of the mainplate, remove the gear adjustment bracket by disassembling the screw and washer from the left-hand hole and the screw only from the right-hand hole. Reassemble these screws loosely to the mainplate so that their positions are not reversed. Support the mechanism with one hand while removing the remaining two screws at the gear side of the mainplate. One screw is located near the bottom center of the mainplate below the mechanism cut-out; the other is located just to the left of the sound drum shaft. When withdrawing the mechanism from the mainplate, be very careful not to hit the sound drum shaft. Also do not lose the tension spring assembled to the post adjacent to the lower left-hand roller of the mechanism assembly.

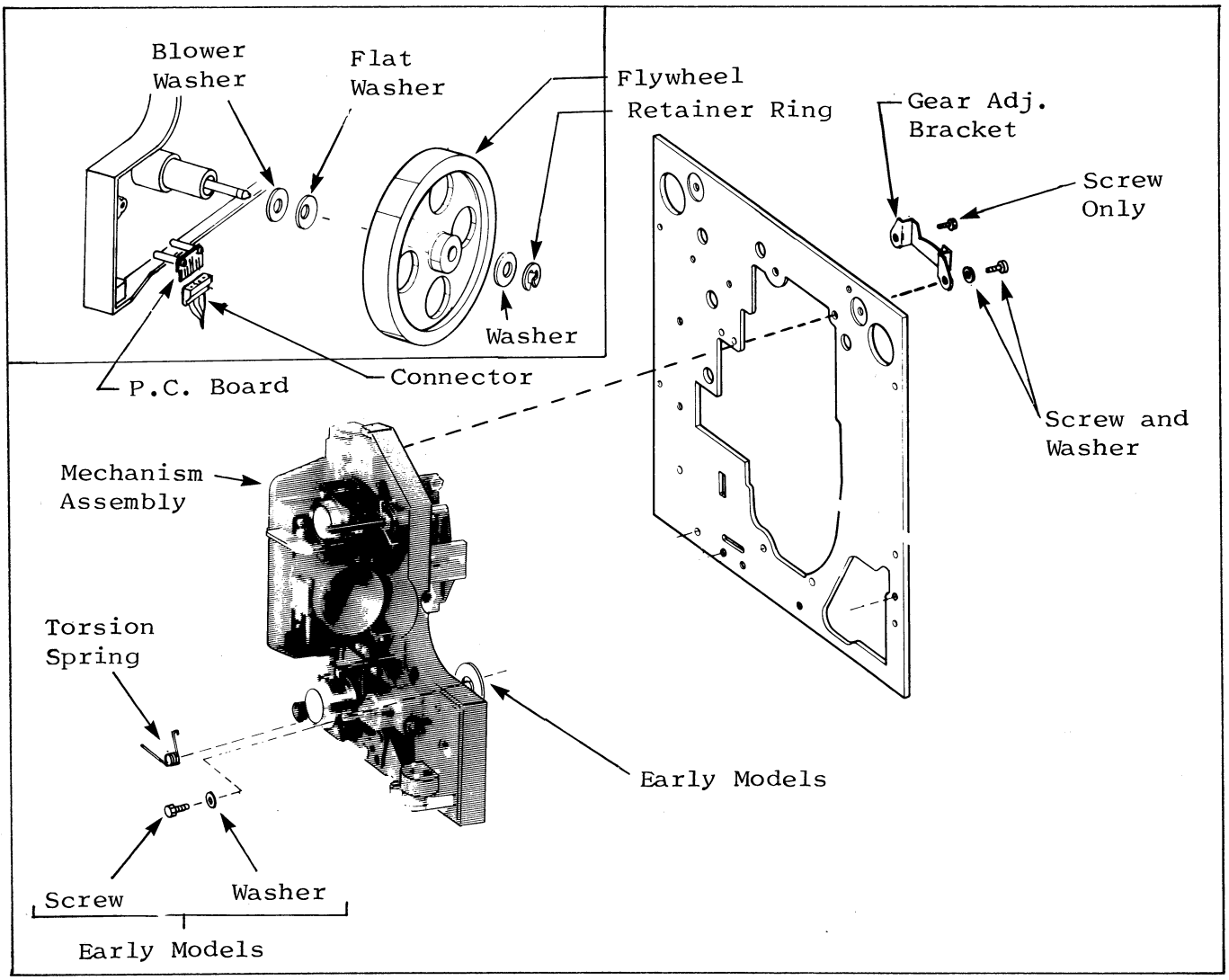


Figure Q. Replacing Complete Mechanism Assembly

b. Installation. Carefully lift the complete mechanism assembly up into position against the mainplate, guiding the assembly into the contoured cut-out. Do not strike the sound drum against the cut-out during installation. From the back (gear) side of the mainplate, align the mounting holes and install the two lower mounting screws. One screw hole is located below the right lower corner of the cut-out; the other is located just to the left of the sound drum shaft. Tighten both screws securely (20 inch-pounds minimum). Assemble the gear adjustment bracket to the top of the mainplate, aligning the screw holes in the bracket with those in the mainplate and mechanism casting. Install the hex washer head screw in the right-hand screw hole and the slotted pan head screw with washer in the left-hand hole. Tighten both screws securely. Turn the mainplate so that the front or sprocket side of the mechanism is facing you. Assemble the torsion spring, hooked leg first, over the pivot stud of the retention pawl (lower left-hand corner of the mechanism assembly) with the straight leg extending to the left and resting on the base.

For Earlier Models Only. In the area just above the exciter lamp location, rotate the fan-like adjustment plate clockwise until the banana slot is at the 12 o'clock position and centered over the tapped hole in the mainplate. Install the screw with washer and tighten the screw securely. Plug the small edge connector to the mini-circuit board mounted at the bottom of the mechanism

assembly. Assemble a bowed washer to the sound drum shaft with the convex face toward the mainplate. Assemble the flat washer and flywheel to the shaft with the knurl on the outer diameter of the flywheel facing toward the mainplate. Press the flywheel inward to compress the bowed washer and install the retaining ring. (In some earlier models, the retaining ring groove is closer to the end of the shaft and four washers are installed between the flywheel and retaining ring.) Spin the flywheel to make certain that it rotates freely. Install the transformer assembly (paragraph 19) and install the projector rear cover (paragraph 11).

26. SOUND SYSTEM REPAIRS (Figure R).

Sound system components are located behind the exciter lamp cover and are easily exposed for inspection and replacement or adjustment. Remove the cover and exciter lamp.

a. If the optical slit is in need of replacement, remove the clamping screw above the slit and withdraw the slit from its opening in the casting. After installing the new optical slit, the sound system must be adjusted (paragraph 32).

b. If the photocell or the sound drum assembly must be replaced, the complete

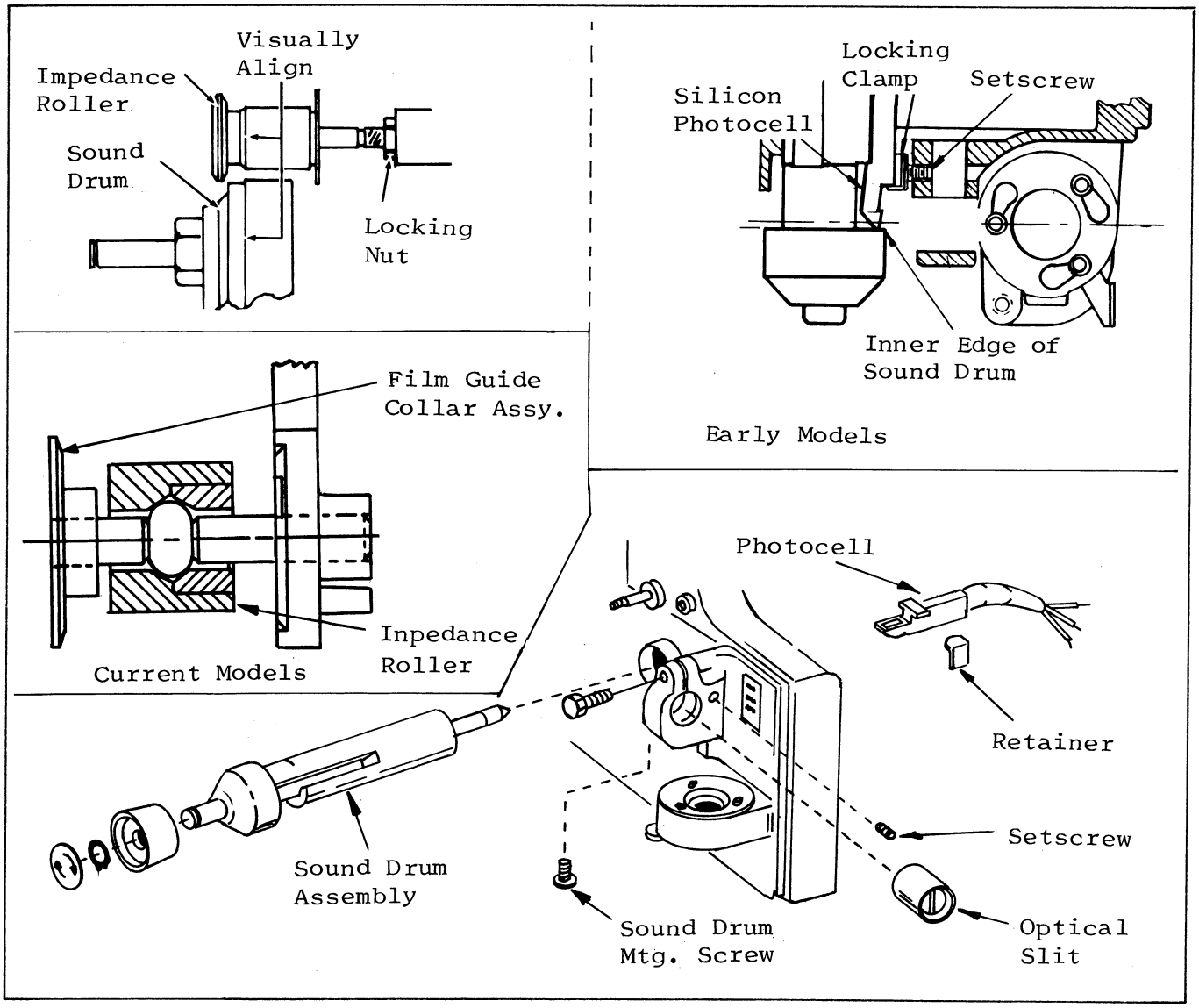


Figure R. Sound System Repairs

mechanism must be removed from the mainplate (paragraph 25) to expose the attaching parts. Then the two sound drum mounting screws and photocell retaining screw must be loosened enough to permit the withdrawal of the sound drum, photocell, and photocell retainer. To reassemble the new components, proceed as follows:

Hold the sound drum and shaft assembly so that the tapped holes in the sound drum housing are aligned with the holes in the mechanism casting. Carefully insert the shaft through the bore hole in the mechanism casting until the two screws can be inserted up through the holes in the casting boss (front and back sides of the housing) and threaded into the sound drum housing. Tighten both screws securely. From the back side of the casting, assemble the photocell and its holder into the slot in the sound drum housing and slide these parts forward until the step of the photocell holder is flush with the front side of the mechanism casting. Assemble the photocell retainer into the slot in the mechanism casting until it is seated against the photocell holder. Hold the photocell and retainer in position while tightening the setscrew up against the retainer. Rotate the sound drum to make certain that there is no binding condition. Check the condition and security of the photocell leads to the small circuit board mounted at the lower edge of the mechanism casting. Refer to paragraph 32 for sound system adjustments.

27. MAINFRAME REMOVAL AND INSTALLATION.

The following instructions provide the method whereby the complete mainframe can be removed from the projector base for ease of repair and/or preventive maintenance. All figure references are to illustrations located in the Parts Catalog section and are usually followed by the index number of the referenced part. For example, "(Fig. 5-1)" refers to indexed item 1 in Parts Catalog Figure 5. A Mainframe Holding Fixture, illustrated in Figure C, should be made so that the mainframe can be set in an upright position while performing inspection and maintenance procedures.

MAINFRAME REMOVAL.

a. Remove the projector front cover, the rear cover (paragraph 11), the drive belt (paragraph 12), and the top cover (paragraph 13). The front and rear end caps need not be removed from the projector base; however, each end cap is additionally secured by two screws inserted through the upper front and rear edges of the mainframe. These screws (Fig. 2-15 and 2-18) must be removed. To expose the rear end cap screws, raise the rewind arm fully up to the rewind position.

b. Carefully tilt the projector so that it is resting on the rear cover side. Remove four screws (Fig. 6-1) and the volume/tone control cover (Fig. 6-2). Remove five screws (Fig. 6-4) and the amplifier cover (Fig. 6-5). Disconnect the large edge connector (Fig. 6-9) from the amplifier assembly. At the bottom edge of the mainframe (behind the flywheel), disconnect the small edge connector (Fig. 6-15) from the soundhead printed circuit board. On multi-line voltage models only, disconnect the connector from the servo amplifier (Fig. 6-19). Return the projector to the upright position.

c. Swing open the lamphouse door and pull the main switch control knob (Fig. 2-3) and its grip ring (Fig. 2-3A) from the switch shaft. At the rear of the mainframe, remove the three screws (Fig. 3A-4) that attach the switch and bracket assembly (Fig. 3A-5) to the mainframe. For multi-line voltage models, these items are (Fig. 3B-6) and (Fig. 3B-8) respectively. Carefully disassemble the switch and bracket assembly from the mainframe.

d. With the lamphouse door open, remove the two hex head screws (Fig. 7-23) that secure the mainframe to the rear support posts of the base. Remove the exciter lamp cover and the exciter lamp and place the load lever in the No. 1 position. Remove the two screws (Fig. 7-22 and Fig. 7-23) that secure the mainframe to the front support post of the base.

e. Disconnect the leads from the terminals of all electrical components mounted to the mainframe (projection lamp socket, line

interlock switch, lamp interlock switch, thermal fuse). Make certain that the wire straps used to dress leadwires to the mainframe are opened to free the wires. Grasp the mainframe and lift it straight up from the base, spreading the end caps if necessary. Place the mainframe in the holding fixture (see Figure C) with the soundhead printed circuit board positioned in the notched-out area of the fixture.

MAINFRAME INSTALLATION.

a. Push the front and rear end caps outward slightly to facilitate the installation of the mainframe. Lift the mainframe from the holding fixture and carefully lower it down into the slot in the projector base while guiding the small printed circuit board into its hole in the base. Shift the mainframe in its receiving slot until the holes in the mainframe are aligned with the tapped holes in the front and rear support posts of the base. Press the end caps back into position.

b. Check to see that no leadwires are being pinched and that the brake release cable is not being interfered with. It may be helpful to guide the brake release cable (Fig. 4-18) over or through the leadwires of the external speaker jack.

c. Carefully place the projector on its rear cover side and put the load lever in the No. 1 position. At the front support post, hold the spring behind the exciter lamp location to the left and install one screw (Fig. 7-22) through the exposed opening. Install the second screw (Fig. 7-23) in the opening just below the lower sprocket plate (Fig. 15-29). Open the lamphouse door and install the remaining two screws (Fig. 7-23) through the mainframe and into the rear support post.

d. Reinstall the exciter lamp and exciter lamp cover. With the rewind arm in the fully-up (rewind) position, install the two screws (Fig. 2-18) through the rear edge of the mainframe and into the nuts of the rear end cap. Install the remaining two screws (Fig. 2-15) through the front edge of the mainframe and into the nuts of the front end cap. Return the projector to the upright position and turn it so that the rear cover side is facing you.

e. Reconnect the lamp socket leads, interlock switch leads, thermal fuse leads and speaker leads and dress all leadwires in the same manner as they were before the mainframe was removed. Reassemble the drive belt to the pulleys (paragraph 12).

f. Reinstall the assembled switch and bracket assembly (Fig. 3A-5) as follows: Lift up on the free end of the brake release cam follower (Fig. 4-21) while guiding the switch shaft through its opening in the mainframe. Lower the V-shaped ear of the cam follower into the notch of the brake cam mounted on the switch shaft while seating the mounting flange of the switch bracket against the mainframe. Secure the switch bracket to the mainframe with the three screws (Fig. 3A-4) and tighten all screws securely.

NOTE: For the multi-line voltage models, the upper left-hand screw (Fig. 3B-6) is inserted through a wire wrap (Fig. 3B-7) when assembling the switch and bracket assembly (Fig. 3B-8) to the mainframe.

Assemble the grip ring (Fig. 2-3A) and the switch control knob (Fig. 2-3) to the switch shaft. Place the knob in the "OFF" position so that the lamphouse door can open and close properly.

g. Reassemble the top cover to the projector (paragraph 13). Reassemble the rear cover to the projector (paragraph 11). Place the projector carefully on its rear cover side, and check the condition of the heat sink compound on the output transistors of the amplifier printed circuit board. If necessary, replenish the heat sink compound (Bell & Howell Company P/N 70910). Reassemble the edge connector (Fig. 6-9) to the amplifier board and reinstall the

amplifier cover (Fig. 6-5) to the base with the five screws (Fig. 6-4). At the rear bottom edge of the mainframe, reconnect the small edge connector to the soundhead printed circuit board and reinstall the volume/tone controls cover (Fig. 6-2) to the base with the four screws (Fig. 6-1).

h. Check to make certain that the torsion spring (Fig. 7-15) is still assembled to the projector mechanism assembly. This spring is installed on the shaft which protrudes through the retention pawl) (Fig. 15-38). The straight end rests on the projector base while the hooked end is engaged behind the left edge of the retention pawl.

NOTE: This completes the installation of the mainframe and, if all preceding instructions have been followed, the projector should be ready for operation.

ADJUSTMENTS

28. 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 overhaul and repair, it is recommended that all adjustments be checked as a routine measure. Routine adjustments such as those applicable to sliding fits, clearances and end play have been covered in the reassembly procedures and are not repeated here except where they directly affect other adjustments or alignments.

All special tools and fixtures required to perform the adjustment procedures are illustrated in Figure C. 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. For accurate results, connect the projector to a variable transformer set at 120 volts, 60Hz.

WARNING

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

29. OPTICAL ALIGNMENT.

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

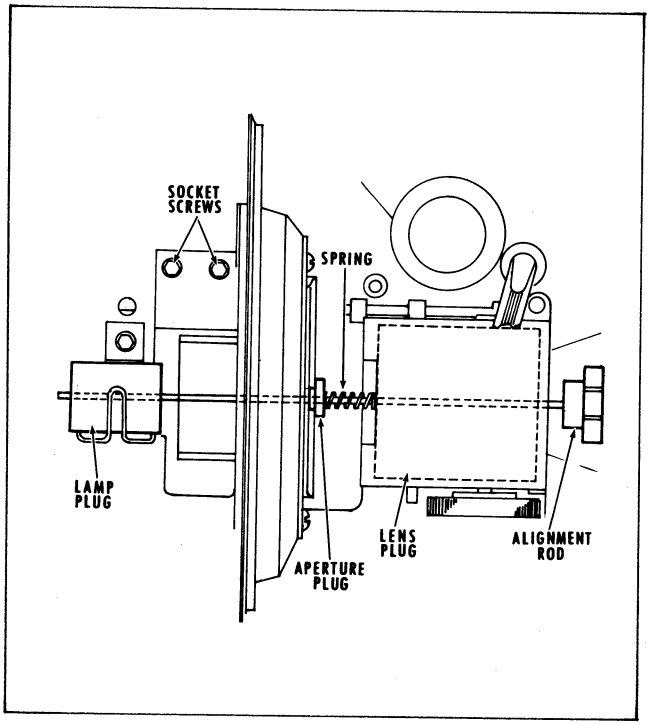


Figure S. Aligning the Optical System

a. Aligning the Aperture Plate.

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

(2) With the load lever in the "UP" position, pull off the lens carrier cover. Then move the load lever down to the "LOAD" position 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 (Figure C) into the aperture opening.

(4) Insert the alignment rod (Figure S) 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 by moving the load lever up to horizontal.

(2) Loosen the lampholder mounting screws just enough to permit movement of the lampholder. Insert lamp plug (Figure C) 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.

30. 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 T. 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 (0.178mm) minimum. From the edge of the shuttle slot to the outer end of the shuttle tooth, the distance should be 0.050-inch (1.27mm) 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 (0.178mm) at either end, the following possible causes should be checked and corrected.

(1) Aperture plate out-of-alignment. See paragraph 29, step a, for aperture plate alignment.

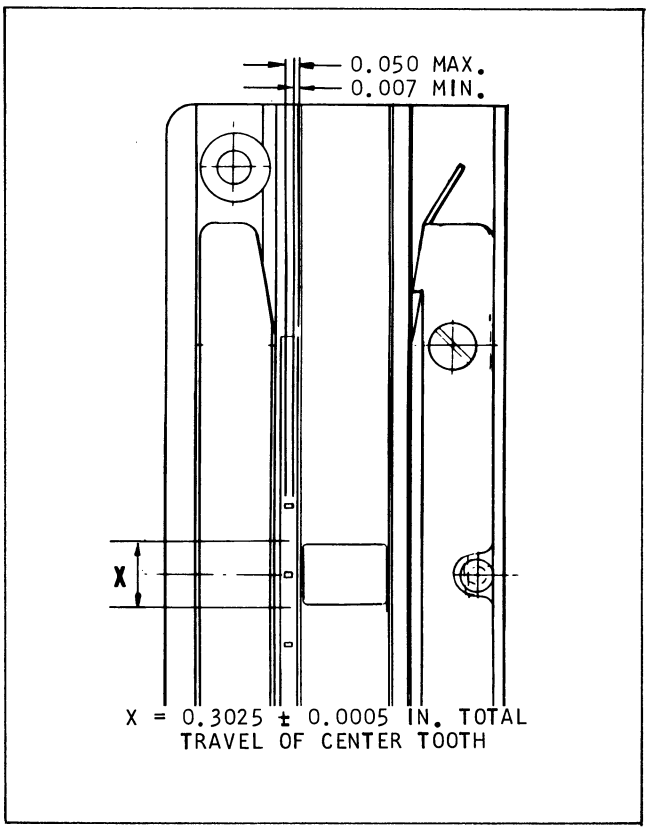


Figure T. Aperture Plate and Shuttle Tooth Clearances

(2) Shuttle stroke incorrect. See paragraph 30, step d, for shuttle stroke adjustment.

(3) Link bearing missing from end of shuttle arm. Partial disassembly is required to remove the shuttle arm and replace the link bearing. Refer to Parts Catalog Figure 17.

NOTE: The assembled intermittent mechanism is shown in Figure U.

(4) Ball and stud assembly loose on shuttle arm. With rear cover removed, reposition ball and stud assembly (Figure U) and tighten stud nut securely.

b. Checking Shuttle Tooth Height. Unscrew the handle from the shuttle tooth height gage (item 8, Figure C). Carefully place the projector on its rear end cap with the front of the projector facing you, and disengage and

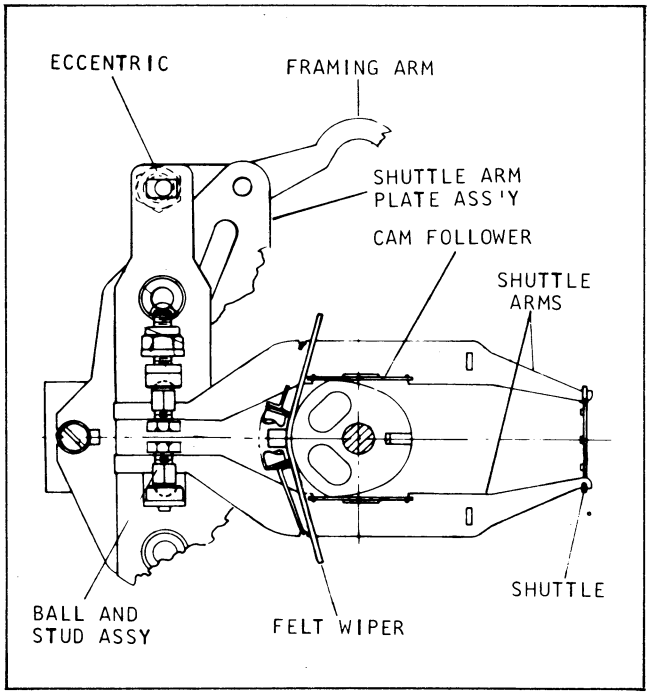


Figure U. Shuttle Arms and Cams Assembled

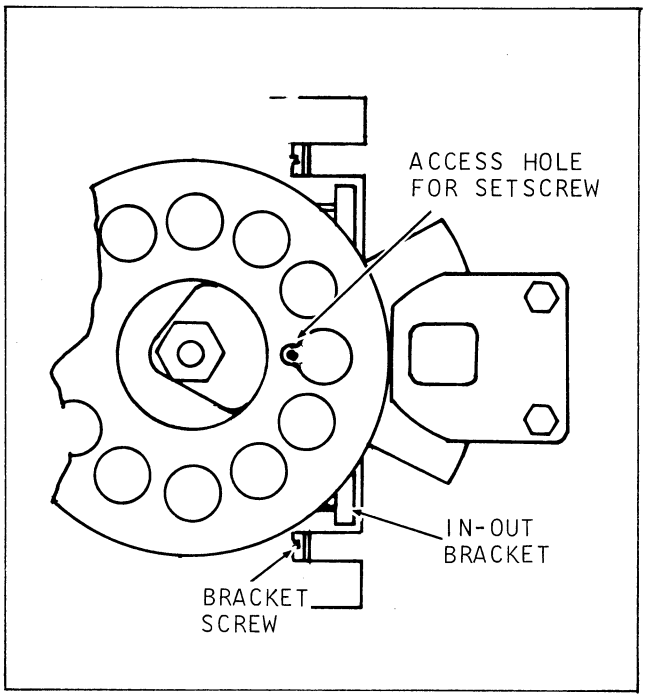


Figure V. Adjusting Shuttle Tooth Height

remove the pressure plate. The steps at either end of the gage are the height gages and are marked "GO" and "NO GO." Insert the gage, "GO" end first, into the film channel between the rails of the aperture plate and slide it to the right. The "GO" step should pass over the shuttle teeth without catching. Repeat this inspection with the "NO GO" end of the gage. The "NO GO" step must not pass over the shuttle teeth. If the shuttle teeth are too high or too low, adjust height as follows:

NOTE: To perform the adjustments with the mechanism assembly installed on the mainframe, the lamphouse, projection lamp and lampholder must first be removed.

(1) Turn the mechanism drive pulley manually until the access holes in the shutter and fire shutter support bracket are aligned (Figure V).

(2) Insert a No. 4 Bristol-type wrench through the 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" step passes over the shuttle teeth), turn the cam follower screw counterclockwise to increase tooth height. If the shuttle teeth were too high ("GO" step catches against shuttle teeth), turn the adjusting screw clockwise. Recheck shuttle tooth height and continue to adjust the follower screw until the proper height is obtained.

(4) If only one tooth cannot be brought into tolerance, it may be necessary to loosen the screws which secure the in-out bracket (Figure V) and twist the bracket slightly. Then retighten the mounting screws and adjust shuttle tooth height as outlined above.

NOTE: Upon completion of shuttle tooth height adjustment, reassemble the lampholder and lamphouse and, if necessary, realign the lamp socket as outlined in paragraph 29, step b.

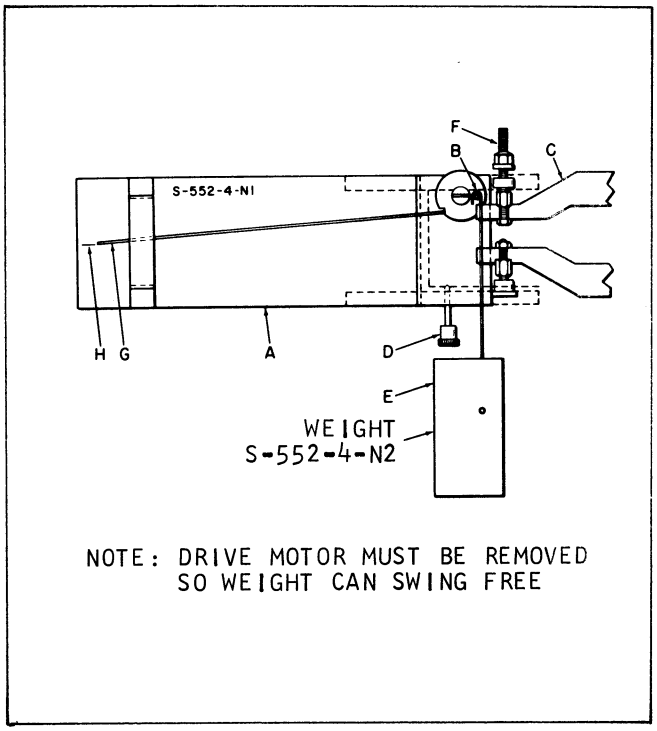


Figure W. Adjusting Fit of Shuttle Arms to Pull-Down Cam

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

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

(1) Open film gate and turn projector mechanism by hand until shuttle teeth are retracted and have moved downward to approximately the center of the stroke (center tooth approximately on horizontal center line of aperture). Slip guide bars of tool S-552-4-N1 over casting to which shuttle mounting plate is attached (Figure W). 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 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).

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 (77mm) (Figure T). The most convenient means of measuring the stroke is to use the projector as an optical comparitor. The step on the stroke gage (S-550-5-N2) 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 X. 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 X.)

(a) Move the load lever down to the load position. Remove pressure plate assembly from the lens carrier.

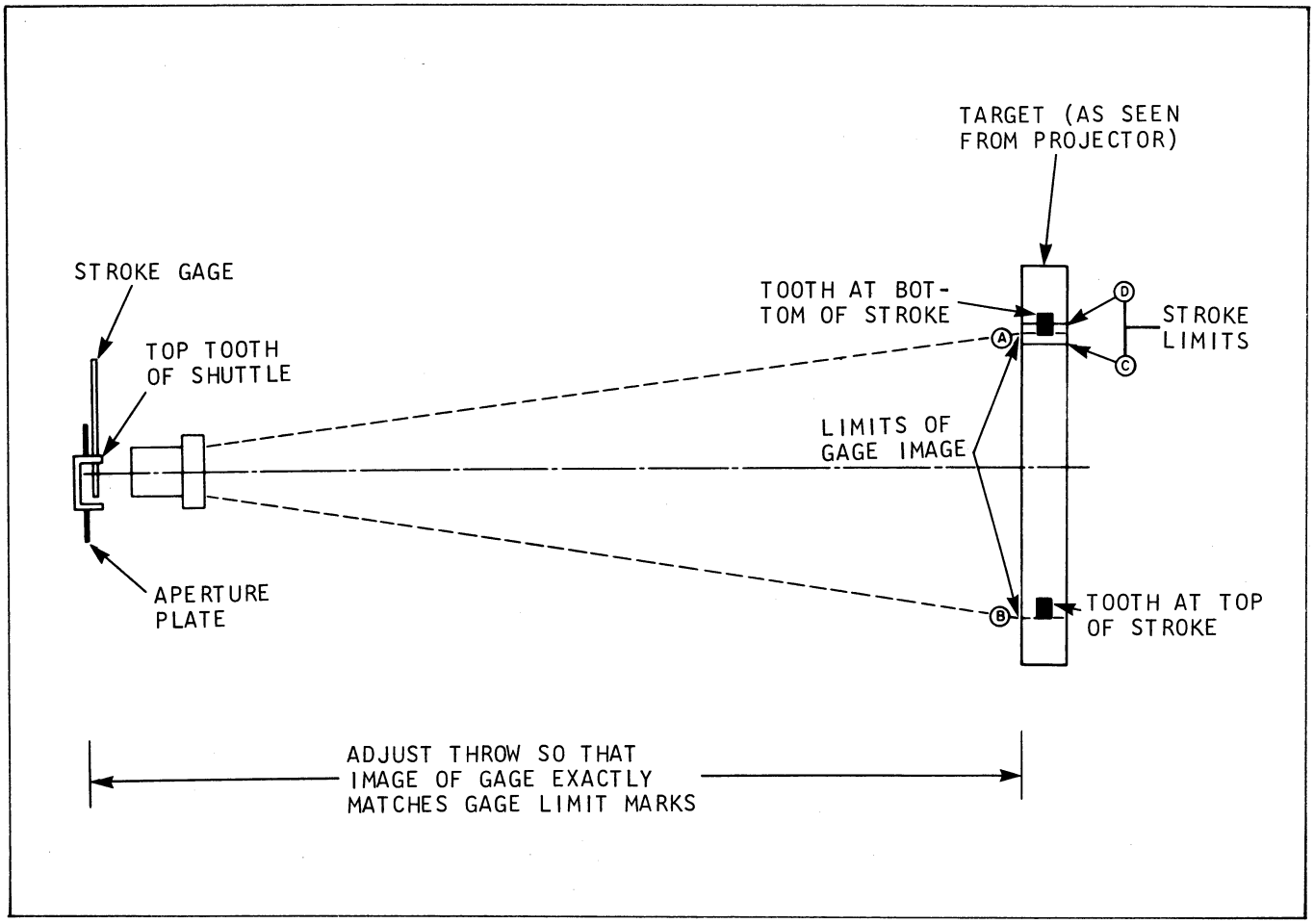


Figure X. Checking and Adjusting Shuttle Stroke with Target

(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 the projector, target must also be tilted so that angle between target and optical axis is 90 degrees. If this is not done, "Keystone" error will be produced.

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

(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 the end of the stroke gage just reaches from line A to line B (Figure X).

(g) Slide the stroke gage up out of field-of-view and turn mechanism pulley until center tooth of shuttle is at the top of the 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 X). 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 30, 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 film having proper frame line position. Project film and turn framing knob from one limit to the other. If at one limit a frame line is not visible, loosen nut on the framing eccentric located at top of shuttle arm plate assembly (Figure U) 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.

31. ADJUSTING REEL ARMS AND REWIND CLUTCH (Figure Y).

a. Reel Arm Face Gear Adjustment. Only the upper face gears of the reel arms are shown in Figure Y; however, the lower face gears are adjusted in a similar manner. With the reel arm cover removed, check the backlash between the face gear and its mating spur gear through a full 360-degree rotation of the gears. Gear backlash should be a minimum of 0.005-inch (0.127mm) and a maximum of 0.018-inch (0.460mm). To adjust the backlash of either face gear in the front reel arm and the upper face gear only in the rear reel arm, loosen the setscrews in the face gear hubs and shift the gears as necessary. To adjust the lower face gear in the rear reel arm, loosen the setscrew in the tapped hole in the reel arm casting and move the lower gear shaft back and forth.

b. Rewind Clutch Adjustment. The rewind clutch system must be adjusted to produce a supply spindle torque when the rewind button is pressed during operation. Install an empty reel on the supply spindle and wrap several turns of a short film strip around the reel hub. Hook a spring scale to the free end of the film strip and turn on the projector. Rotate the "Master" switch to the "Reverse" position 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 inch-pounds at the point when the rewind clutch system begins to slip. Grip the flats on the inner face of the take-up clutch (see Figure 4, items 7 or 7A) with a wrench while loosening or tightening the nut on the clutch hub. Rewind torque (also 2.5 to 4.5 inch-pounds) is adjusted by means of the rewind clutch assembly (item 19, Figure 5). The rewind clutch adjusting nut faces inward toward the mainplate and a special wrench (item 6, Figure C) must be used for the adjustment.

32. ADJUSTING THE SOUND SYSTEM.

a. Photocell Alignment (Figure R).

(1) Loosen the setscrew, clamping screw and the two sound drum mounting

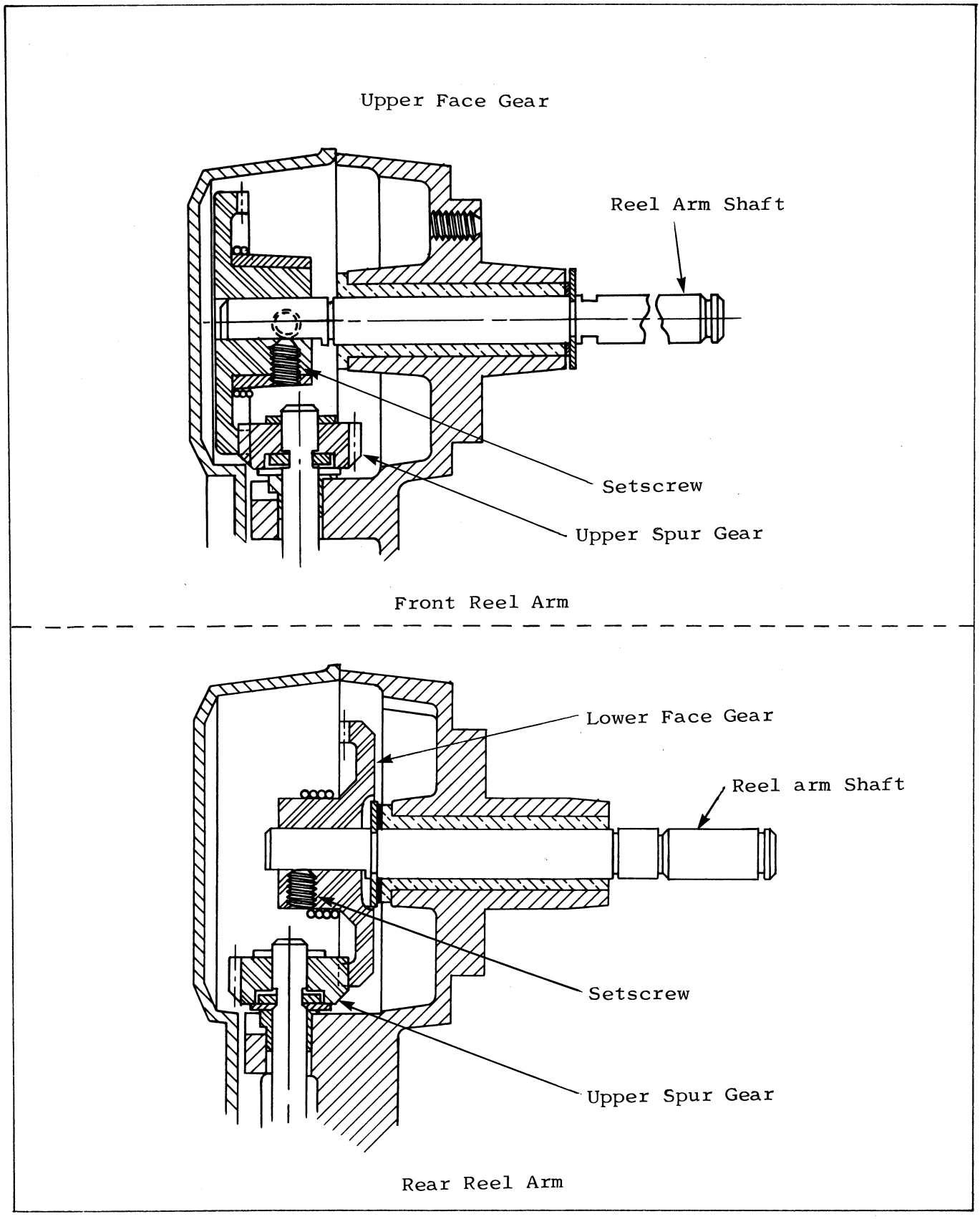


Figure Y. Adjusting Reel Arms

screws. Remove the exciter lamp and the optical slit.

(2) Insert the sound drum alignment tool S-550-8-N1 into the optical slit opening.

(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 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.

b. Stabilizer Roller Tension Adjustment (Figure Z). The stabilizer roller at the end of the stabilizer arm protrudes through the vertical slot in the mechanism housing. Adjust the long adjusting screw (18) until the counter-balance spring (7) applies enough tension to lift the roller slightly from the bottom of the slot.

c. Optical Slit Adjustment (Figure R).

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

(2) Insert a 0.050-inch (1.27mm) 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 clamping screw just enough to hold the slit in place.

(3) Thread the projector with 7000 CPS optical setting film TFL-D1580-NX4 and connect a 16-ohm, 10-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

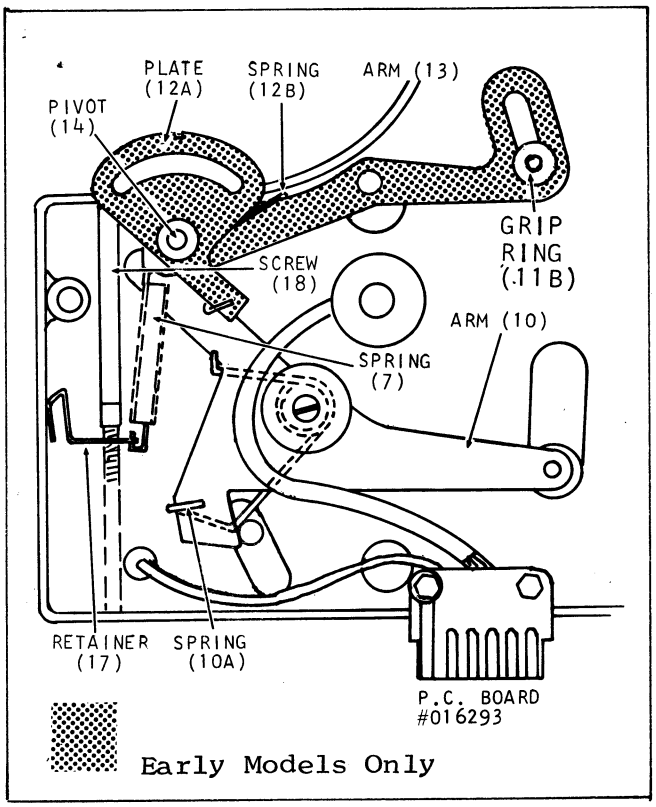


Figure Z. Arms and Counterbalance Spring Installed

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 securely to lock the adjustment.

d. Buzz Track Adjustment. The lateral position of the film at the "soundhead" location is controlled by the impedance roller. The precise distance of this roller to the

surface of the mechanism housing is adjusted by turning the roller shaft in or out of the tapped hole in the housing.

(1) Loosen the hex locking nut to permit roller shaft adjustment.

(2) Connect a vacuum tube voltmeter with 8-ohm load to the speaker jack output, and thread the projector with buzz track test film TFL-D1580-NX3.

(3) Turn the rotary switch to "Forward-Run" position and adjust the volume control to a suitable listening level.

(4) Adjust the lateral position of the impedance roller by screwing the shaft in or out until a minimum voltage output reading is obtained. Hold the shaft steady at this point and tighten the locking nut down against the roller arm stud. Remove the buzz track film and voltmeter.

NOTE: There are two types of buzz track film in common use. On one, the track spacing exceeds the length of the scanning beam, and the track can be positioned so that little or no signal is reproduced. On the other type, track spacing is less than the length of the scanning beam. This track should be positioned so that both tones are reproduced at approximately the same volume level.

33. 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 the sprocket by means of suction cup or rubber foot. For viewing with light from 60Hz 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, 60Hz.

(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%

34. GEAR SHIFT TENSION ADJUSTMENT. When shifting from forward to rewind, or vice versa, the idler gear arm (Figure AA) 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 AA) is flattened against the face of the gear.

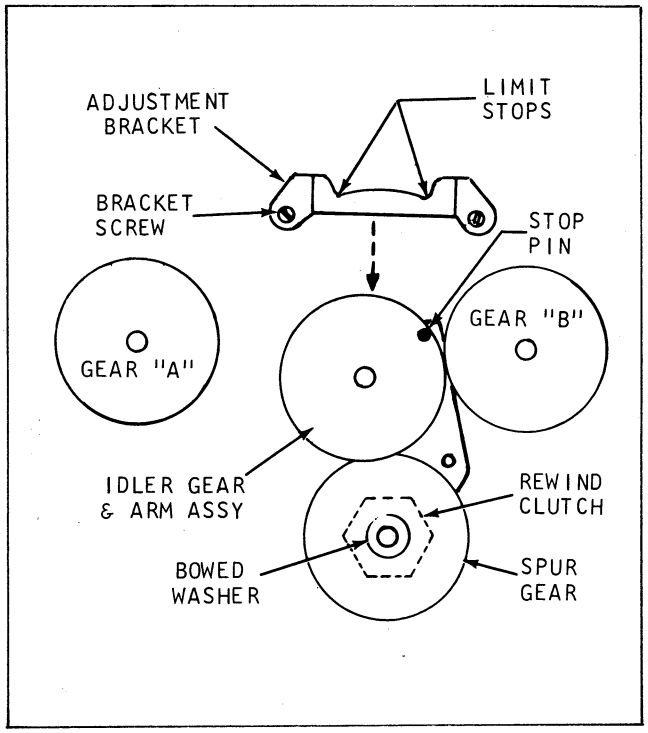


Figure AA. Adjusting Gear Shift Tension and Backlash

35. 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 AA. 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 limits 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.

36. SETTING LOAD LEVER (Figure AB). Place the load lever in the open (down position) and loosen the setscrews that secure the lever into the mode selector bushing. Withdraw the lever from the bushing enough to expose the flat on the large diameter of the lever shaft. Hold the flat end of a No. 43 drill perpendicular to the ground flat of the lever and push the lever in until the shoulder of the flat is against the drill. Hold in this position while tightening the outer setscrew securely. Apply Loctite to

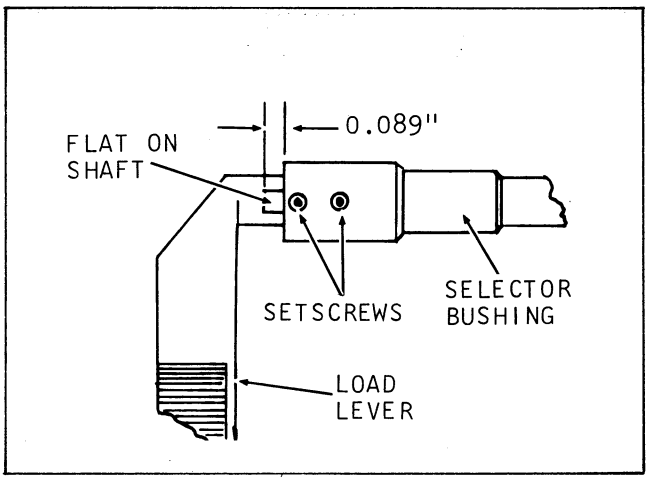


Figure AB. Setting the Load Lever

the threads of the inner setscrew and tighten securely. Shift the lever to the closed (up) position and install the lens carrier cover. The load lever must be as close as possible to the cover but must be free to move without interference.

37. ADJUSTING BRAKE ARM RELEASE.

a. Place the load lever in the down (gate open) position and control switch at OFF and loosen the brake arm screw (Figure L slightly.

b. Hold a 0.047 inch (1.20mm) shim against the knurl of the flywheel and manually press and hold the neoprene brake roller against the shim while retightening the screw. Remove the shim and flex the cable release system by lifting the cable end of the cam follower (Figure L) and then releasing it.

c. Operate the projector and check flywheel rotation. If neoprene roller slows or stops the flywheel, readjust clearance as above or adjust cable tension by engaging cable in a different groove of the sheave (Figure L).

38. MOTOR INTERLOCK SWITCH ADJUSTMENT (Figure AC). The motor interlock switch is assembled to the gear side of the mechanism assembly casting with the switch button facing up and to the left. Loosen the switch mounting screws just enough to permit the switch to be shifted.

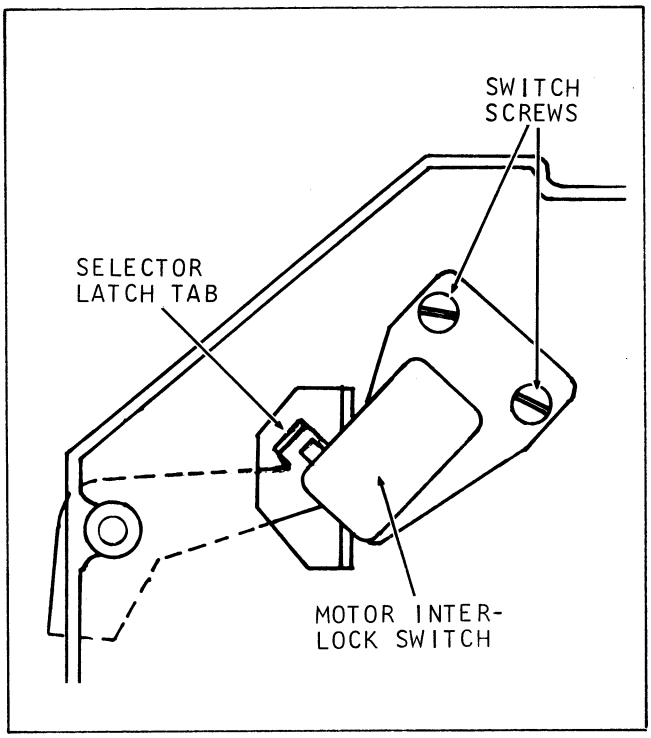


Figure AC. Adjusting Motor Interlock Switch

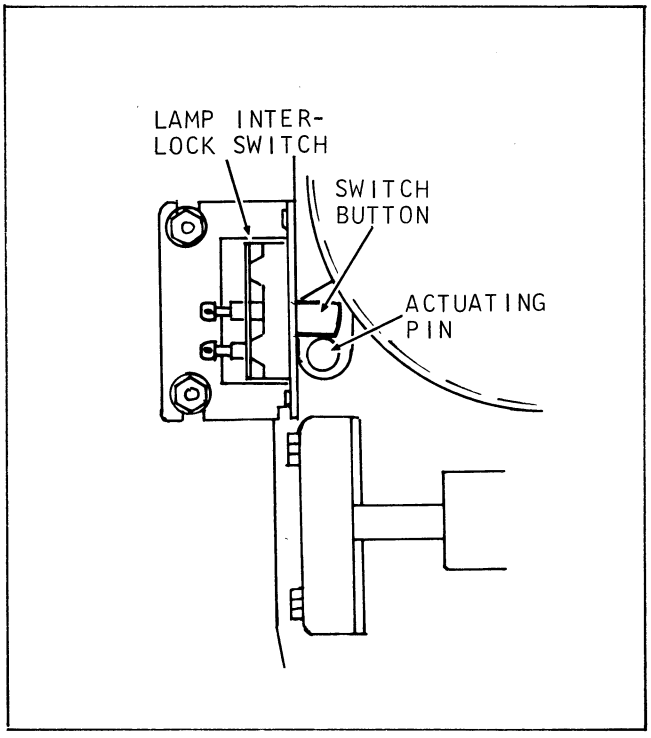


Figure AD. Adjusting Lamp Interlock Switch

Move the load lever counterclockwise so that the selector latch tab is positioned at the halfway point on the radius of the mode selector arm and the switch button is positioned beneath the tab. While holding a 0.020-inch (0.50mm) feeler gage between the switch button and the tab, adjust the switch until the switch button is just making contact with the feeler gage. Hold the switch securely to maintain this clearance while tightening the switch screws.

39. LAMP INTERLOCK SWITCH ADJUSTMENT (Figure AD). The lamp interlock switch is fastened to the gear side of the mainframe just to the left and slightly above the left end of the shutter shaft. Make certain that the switch button is positioned above the activating pin protruding through the slot in the mainframe. With the switch screws slightly loosened, place a 0.010-inch (0.25mm) feeler gage on top of the protruding pin. Adjust the position of the switch until the switch button is resting on the feeler gage. Hold the switch to maintain this clearance while tightening the two switch mounting screws securely.

NOTE: The following are loopformer adjustments which can be made with the projector mechanism assembled to the mainframe. Parenthetical references are to illustrations and indexed parts in the Parts Catalog. For example, "Fig. 14-8" refers to indexed item 8 in Parts Catalog Figure 14.

40. CHECKING THE LOADING SYSTEM.

a. Remove the lens carrier cover and the exciter lamp cover and open the lamphouse door. While watching and feeling the response of the loading system, open and close the system several times by means of the load lever. In this manner you will be able to determine the kind of problem that exists and in what threading area the trouble is located.

b. The movement of the load lever must be smooth, and there must be no evidence of binding or jamming. When pressed and released, the load lever should return smoothly to its original position. While depressing the load lever, a definite spring tension should be felt before any parts begin to move to open the system for threading.

c. As the load lever is moved to the "Open" position, a click should be heard from the motor interlock switch (Fig. 15-4). Instructions for adjusting this switch will be found in paragraph 38. This microswitch stops the projector to prevent tearing of the film when the load lever is in the "Open" position.

41. UPPER SPROCKET AREA ADJUSTMENTS. The upper sprocket guard is located just above the upper sprocket (Fig. 14-46). This sprocket guard should be adjusted so that it cannot be lifted enough to allow the film to be removed or to permit the film to escape from the sprocket. Adjustment is as follows:

a. Loosen the screw (Fig. 16-22) enough so that the mode selector latch (Fig. 16-24) can be moved up and down. Move the mode selector switch down toward the mode selector bushing (Fig. 16-28), until the load lever is tight and there is no movement in the loopformer. However, this should not be so tight as to cause the load lever to bind. The load lever must move smoothly. While holding all parts securely, retighten screw (Fig. 16-22).

b. Check the motor interlock microswitch to make certain that it clicks when the load lever is pressed down 1/2-inch. In this 1/2-inch travel, movement of the load lever should be free and smooth except for return spring tension and the system should not begin to open.

c. If the microswitch does not click as specified in step b, even after switch adjustment (paragraph 38), use a needle-nose pliers to CAREFULLY bend the microswitch actuator down to meet those specifications. Bend the actuator a little at a time until the adjustment has been properly made.

42. LOWER SPROCKET AREA ADJUSTMENTS. The lower sprocket guard (Fig. 15A-10) is located just below the lower sprocket and is adjusted in the following manner:

a. Loosen the screw (Fig. 15-25). Hold the lower sprocket guard down and open and close the system several times with the load lever.

b. With the system closed (loaded or run position), snap the sprocket guard up against the lower sprocket and retighten the screw (Fig. 15-25). This will balance the system so that the upper and lower sprocket guards will apply equal pressure on the sprockets.

43. IMPEDANCE ROLLER ADJUSTMENTS. The projector being repaired may be equipped with the early style impedance roller set-up (Fig. 14-16 through 14-20) or the current style set-up (Fig. 14-21 through 14-26). In either case, impedance roller performance and adjustment is similar. When the system is "open," the roller should be retracted to its full upper position. Adjustment is as follows:

a. Loosen the two screws (Fig. 14-15) located below the lens carrier and behind the focus knob.

b. Open the system by pressing the load lever down to position "1" and push the impedance roller forward and up toward the exciter lamp.

c. While holding the impedance roller in this full upward position, retighten the screws (Fig. 14-15). Caution: Be careful not to overtighten these screws as this may strip the threads.

NOTE: The following instructions apply only to projectors equipped with the early style impedance roller set-up.

d. The spring (Fig. 14-19) beneath the impedance roller should be adjusted to the middle and against the bottom of the roller. With the load lever down (system "open") loosen the screw (Fig. 14-17) and position the spring as specified. Hold the spring in position while retightening the screw (Fig. 14-17). Close the system and lift up and down on the impedance roller. The roller should move freely with no binding or hanging. If the roller does bind or hang-up, proceed with step e, following.

e. Loosen the screw (Fig. 7-10) located just above the exciter lamp until the impedance roller arm (Fig. 15-13) can be moved freely. Move the impedance roller arm to the left or right until the arm is positioned at the point which provides maximum free movement of travel for the impedance roller. The notch on the arm should be approximately at the 12 o'clock position. Hold the arm securely while retightening the screw (Fig. 7-10).

44. FINAL THREADING SYSTEM CHECKS.

a. After system adjustments have been made (paragraphs 40 through 43) close the lamphouse door and reinstall the exciter lamp cover and the lens carrier cover.

b. Open the threading system (load lever at position "1") and place a reel of film on front reel arm.

c. Thread the film into the projector in the normal manner. If all the adjustments have been properly made, the film should thread through the system smoothly.

45. CORRECTING FILM SKEW. If there is a loss of sound or if the film does not enter the film slot easily during loading, it is possible that the film is tracking off the sound drum. If this should happen, proceed as follows:

a. Clean the sound drum and impedance roller as instructed in paragraph 5.

b. Close the system with the load lever. Grasp the adjusting plate (Fig. 15A-16) with the thumb and forefinger and attempt to move the bracket up and down. If the bracket does not move, proceed to step c. If the bracket does move, loosen screw (Fig. 15-25), and insert the pin-end of the sprocket plate adjusting screw (Figure C, item 13) down into the slot of the sprocket plate. With the large diameter of the tool inserted into the adjustment plate hole above the slot, slowly rotate the tool clockwise to the point where resistance is felt. Do not use force to rotate the tool beyond this point of initial resistance. Hold the tool steady while tightening the screw (Fig. 15-25) securely. Switch the projector to "Forward" and the motor should run. If the motor does not run, readjust the mode selector latch per paragraph 38.

c. Open the film track with the load lever. Thread film through the system to the take-up reel. Check that the film lines up with the film track and tuck the film in where necessary. Close the system and turn the main switch knob to forward only. Open the lamphouse and check the position of the stabilizer roller (Fig. 14-13). The roller must run centered in its slot. If necessary, adjust the roller by means of the adjusting screw (Fig. 15-18). The head of this screw is located above the exciter lamp position. Turn the screw clockwise to lower the roller or counterclockwise to raise the roller.

d. In early model projectors, the impedance roller adjustment bracket (Fig. 15-12A) should be positioned with its notch at approximately "12 o'clock." This adjustment is outlined in paragraph 43, step e.

TROUBLE SHOOTING

46. MISCELLANEOUS TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Nothing runs	1. Defective rotary switch.	1. Replace switch (para. 17).
	2. Damaged power cable.	2. Repair or replace cable.
	3. Loose connections.	3. Repair connections.
	4. Mode selector latch not activating motor interlock switch.	4. Adjust switch (para. 38) and/or reposition mode selector latch.
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 (para. 17).
	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 (para. 12).
	4. Motor pulley loose on shaft.	4. Position pulley and tighten setscrews.
Rewind does not operate	1. Rewind clutch not engaging or clutch slipping.	1. Adjust (para. 31, step b).
Take-up does not not rotate	1. Take-up sprocket damaged.	1. Replace sprocket.
Feed spindle does 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.
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 (para. 12).
	3. Dirt and lint clogging blower housing.	1. Clean.

46. MISCELLANEOUS TROUBLES AND REMEDIES (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Projector speed slow	1. Binding in the mechanism.	1. Free binding condition.
	2. Belt slipping.	2. Clean or replace belt (para. 12).
Projector noisy in reverse mode (below Serial No. 6247001)	1. Projector not equipped with stabilizer retractor lever (Fig. 15-6B and spring (6A).	1. Install new idler gear and retractor parts (Fig. 15, items 5 through 6C).
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. Power line frequency other than 60 cycles.	3. Use proper voltage and frequency.

47. PICTURE TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Film jump	1. Damaged film.	1. Repair or replace.
	2. Loose shuttle arms.	2. Adjust and tighten (para. 30, 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 (para. 30, step d).
Double image	1. Incorrect shuttle stroke.	1. Adjust (para. 30, step d).
	2. Excessive shuttle protrusion.	1. Adjust (para. 30, step b).
Weave (due to faulty aperture plate)	1. Side tension spring missing.	1. Replace spring.
	2. Sticking edge guide.	2. Clean guide.
	3. Fixed edge guide out of position.	3. Reposition guide.

47. PICTURE TROUBLES AND REMEDIES (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Poor illumination	1. Optics out-of-line.	1. Realign (para. 29).
	2. Projection lamp wearing out.	2. Replace projection lamp.
Poor focus	1. Dirty lens and/or aperture.	1. Clean lens and/or aperture.
	2. Warped film.	2. Recondition or replace film.
	3. Pressure plate spring lost.	3. Replace spring.
	4. Bent pressure plate.	4. Replace pressure plate.
	5. Pressure plate out-of-line.	5. Realign pressure plate.
Frame line creeps	1. Framer eccentric loose.	1. Align and tighten (para. 30, step e).
Insufficient framing	1. Framer eccentric out-of-adjustment.	1. Adjust (para. 30, step e).
Trailer ghost	1. Shutter out-of-alignment.	1. Reassemble properly.
Film does not easily enter film slot when loading	1. Film catching on lower sprocket guard.	1. Replace early style exciter lamp cover (P/N 016557) with new style cover.
	2. Film catching on lower film stripper.	2. Loosen stop post (Fig. 15-36), push down stripper and tighten post.
	3. Film catching on spring (Fig. 14-19).	3. Adjust impedance roller and spring (para. 43, steps d and e).
	4. Film tracking off sound drum.	4. See "Correcting Film Skew" (para. 45).

48. 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 (para. 30, step b).
	3. Inadequate or excessive shuttle stroke.	3. Adjust (para. 30, 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. In-out bracket spring broken.	7. Replace spring.
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 (para. 30, step d).
Splices jam in sprocket shoes	1. Bad splices.	1. Replace splices.
	2. Emulsion build-up.	2. Clean film path components.

49. 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 P.C. board (para. 24).
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 rotary switch open or leads disconnected.	3. Replace rotary switch or connect leads (para. 17).
Voltage at P.C. board, exciter lamp lights, but 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 (para. 32, step a).
	4. Dirt on end of photocell.	4. Clean photocell.
	5. Wrong exciter lamp used.	5. Replace with correct lamp.
Low volume	1. Trouble in amplifier circuit board.	1. Check out the circuit board; replace if faulty.
	2. Wrong exciter lamp used.	2. Replace with correct lamp.
	3. Photocell out-of-line.	3. Realign (para. 32, step a).
	4. Dirt on photocell or slit.	4. Clean photocell and slit.
	5. Slit misaligned.	5. Realign (para. 32, step c).
	6. Buzz track misaligned.	6. Realign (para. 32, step d).
Distortion at all volume levels	1. Wrong exciter lamp used.	1. Replace with correct lamp.
	2. Trouble in amplifier circuit board.	2. Check out the circuit board; replace if faulty (para. 24).

49. SOUND SYSTEM TROUBLES AND REMEDIES (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Crackling noises	1. Broken ground lead to mainframe.	1. Replace defective lead.
	2. Buzz track out-of-line.	2. Realign (para. 32, step d).
	3. Broken cable shield.	3. Repair shield or replace cable.
Wow or flutter	1. 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. Loose flywheel.	3. Tighten flywheel.
	4. Damaged sound drum bearing.	4. Replace sound drum.
	5. Dirt causing guide roller arm pivot bearing to bind.	5. Clean and polish.
	6. Photocell or exciter cable rubbing against flywheel.	6. Reposition cables.
	7. Chips or dirt in take-up sprocket gear teeth.	7. Remove and clean sprocket gear.
Clicking noises	1. Dirt on sound drum.	1. Clean sound drum.
	2. Broken ground lead to mainframe.	2. Replace lead.
High frequencies fade (jumps focus)	1. Warped film.	1. Recondition or replace film.
	2. Dirt on sound drum.	2. Clean sound drum.
Hum	1. Ground wiring.	1. Correct grounded condition.
	2. Trouble in amplifier circuit board.	2. Check out the circuit board; replace if faulty (para. 24).

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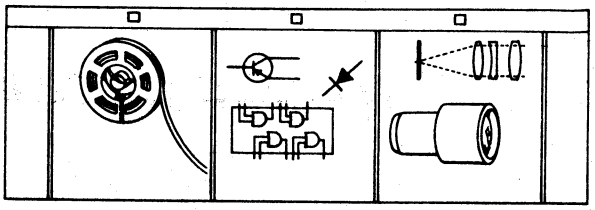
7100 N. McCormick Road Chicago, Illinois 60645

GENERAL SERVICE BULLETIN

A-80-281



SUBJECT

REWIND CLUTCH (P/N 016083 MODIFICATION FOR 16MM PROJECTOR MODELS 1575-1580-1680

DATE 5-27-80

Reference: Bell & Howell Company Service Manual P/N 74403 (Revised Feb. 1980)

CONDITION:

Field reports have indicated that some of the models 1575, 1580 and 1680 (16mm slot-threading) projectors are experiencing rewind failure which routine service procedures have not been able to resolve.

CAUSE:

This can be attributed to the bearing slipping in the clutch assembly P/N 016083 (Fig. 5-19) in the Service Manual P/N 74403.

REMEDY:

To help prevent bearing slippage, reseat the bearing on all inventory of 016083 to the opposite end of the clutch assembly using the shop made tool as shown on the drawing on the reverse side. The bearing can be reseated without clutch disassembly, using the tool as illustrated. After reseating the bearing, recheck the torque and set if required.

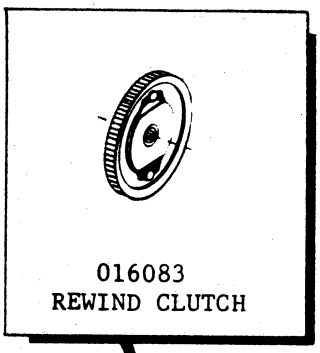
POLICY:

This improvement should be done on all new clutch assemblies in inventory and verified prior to installing the assembly in the projector. All production models starting with serial number 0063001 will have the modified clutch assembly. The use of this remedy is not recommended on used clutch assemblies which have exhibited rewind reliability problems. When in doubt, replace with new clutch assembly.

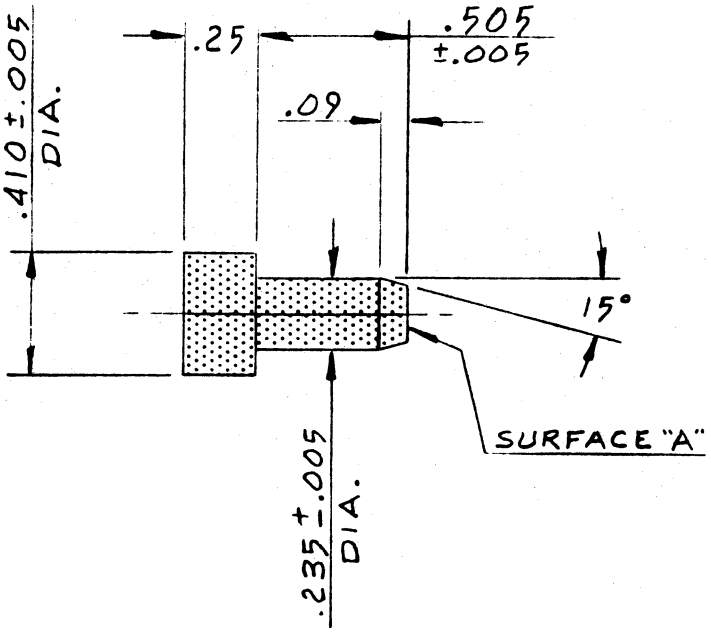
GENERAL SERVICE DEPARTMENT/AUDIO-VISUAL DIVISION

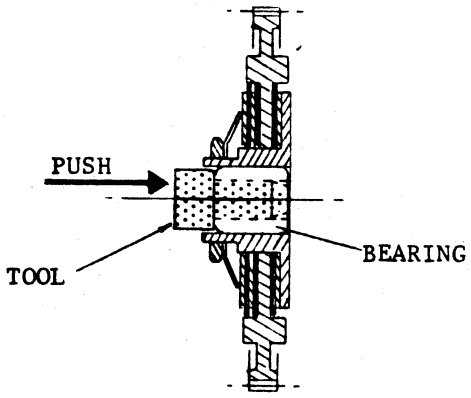
OVER.....

REWIND CLUTCH MODIFICATION



016083
REWIND CLUTCH





PUSH BEARING UNTIL SURFACE "A" OF TOOL IS STOPPED AGAINST REST SURFACE OF VISE

MATERIAL: STEEL BAR

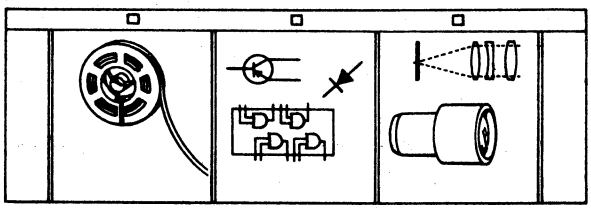
TOOL FOR RESEATING BEARING IN REWIND CLUTCH #016083 USED IN SLOT-THREADING MODELS

BELL & HOWELL

100 N. McCormick Road Chicago, Illinois 60645

GENERAL SERVICE BULLETIN

A-80-282



SUBJECT GARBLED SOUND ON MODELS 1575, 1580 & 1680 DATE 5-27-80

Reference: Bell & Howell Company Service Manual P/N 74403
Figure 4-40, p. 13-14

CONDITION:

Field reports have indicated that some Model 1575, 1580 and 1680 16mm slot threading projectors intermittently produce garbled sound.

CAUSE:

This can be attributed to the flywheel drive gear assembly contacting and slowing the speed of the flywheel during the run-mode. The present grease (P/N 070034) being used dries out and dissipates, causing the plastic gears to wear from contact with the washer and each other.

REMEDY:

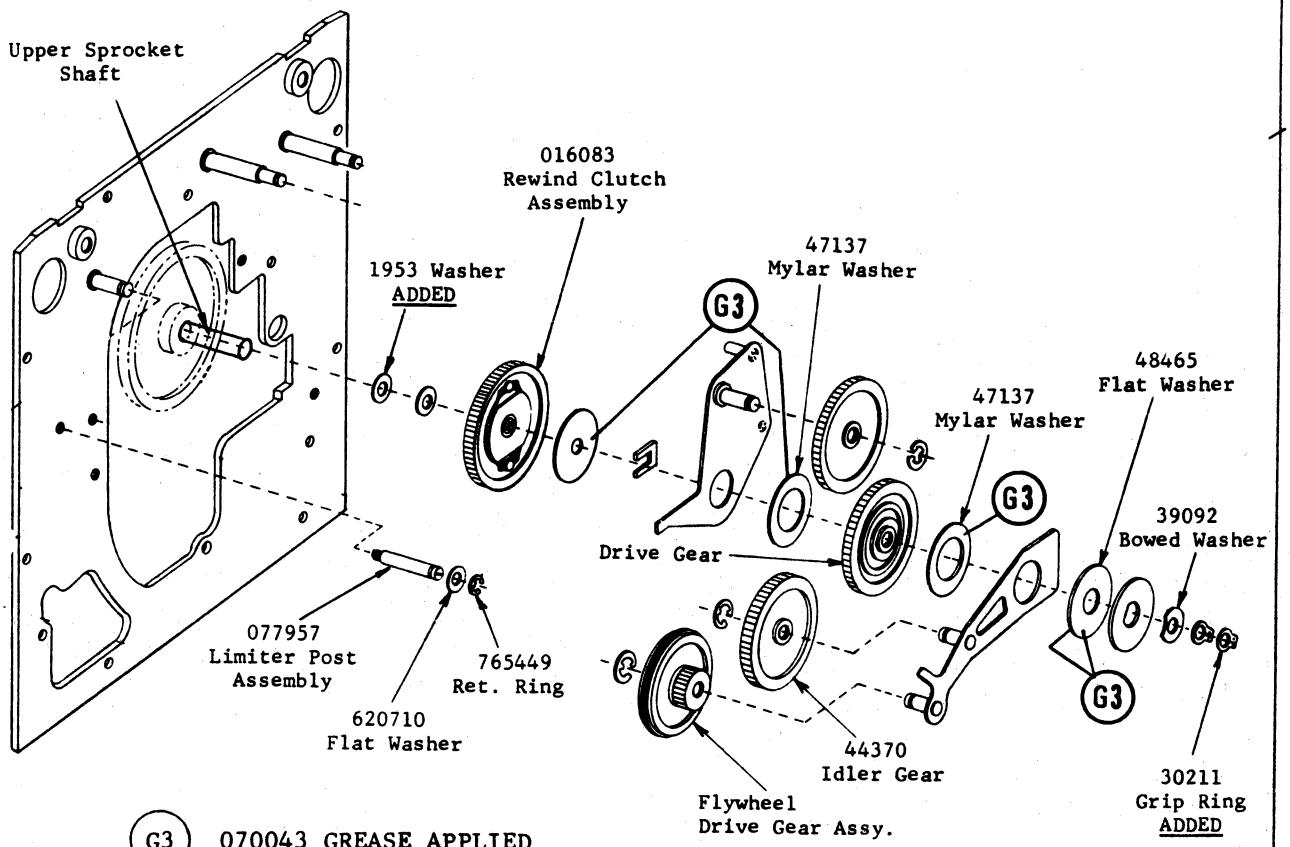
It is intended that the torque generated by the items (see attached figure) between the rewind clutch assembly and the grip rings will hold the drive wheel away from the flywheel during the forward run mode.

1 - To correct the situation, a washer (P/N 1953) can be added in the position shown on the illustration on the reverse side.
2 - Add the lubricant P/N 070043 to all plastic gears, gear shaft and nylon washers to help eliminate the problem.
3 - Add an extra grip ring (P/N 30211) to the shaft as shown. This should compress the bowed washer to its maximum and eliminate any play between the items. Run the projector and observe that the drive wheel does not contact the flywheel during the run mode in the forward direction.

POLICY:

All Models 1575, 1580 and 1680 16mm projectors having the above problems will be repaired under warranty. Please note these changes in your manual. Revised pages will be released in the near future.

GENERAL SERVICE DEPARTMENT/AUDIO-VISUAL DIVISION OVER.....



(G3) 070043 GREASE APPLIED IN PLACE OF 070034

SUPPLEMENT NO. 1

SERVICE INSTRUCTIONS

SLOT-THREADING FILMOSOUND® PROJECTOR

MODELS 1680G, 1680GS, 1680GSA

NOTE: THIS SUPPLEMENT IS TO BE USED TOGETHER WITH BASIC SERVICE MANUAL NO. 74403 (REV. FEB. 1980) FOR REPAIR AND ADJUSTING MODELS 1680G, 1680GS AND 1680GSA SLOT-THREADING, 16MM SOUND PROJECTORS.

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

SUPPLEMENT TO
PART NO. 74403

PRINTED IN U.S.A.

JUNE 1981

LIST OF ILLUSTRATIONS

Basic Service Manual No. 74403 Illustrations

1680 G-Series Service Manual Supplement Illustrations

FACTORY SERVICE RECEIVING ADDRESS

Bell & Howell Company
General Service Department
Audio-Visual Division
7100 No. Central Park, Dock 1
Chicago, IL 60645

FOR PARTS, ORDERS AND SERVICE INFORMATION

Bell & Howell Company
General Service Department
Audio-Visual Division
7100 No. McCormick Road
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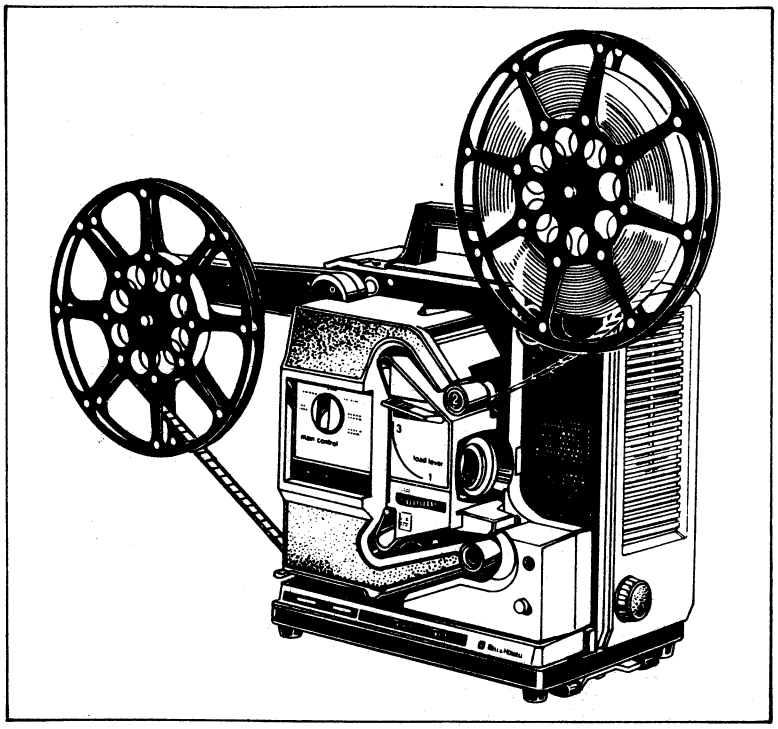


16mm Slot-Threading Projectors

1680 G-SERIES FEATURE DESCRIPTION LIST

COLOR	Charcoal grey
INPUT VOLTAGE	100/110/130/200/220/240/250VAC, 50/60Hz
FILM TRANSPORT	Automatic slot-threading system; inching capability
FILM SPEED	18 and 24 fps in forward and reverse; hi-speed reel-to-reel rewind
ILLUMINATION	24V, 250W, 50 hour lamp, type ELC; economy/bright control
AUDIO SYSTEM	Optical type with 4VDC exciter lamp (type BAK) and silicon cell pick-up
AMPLIFIER	Plug-in P.C. board; 20W RMS at less than 5% distortion
AMPLIFIER CONTROLS	Volume/Bass/Treble controls
PROJECTOR CONTROLS	Forward/Reverse and Run/Still
SPEAKER	Built-in 16 ohm permanent magnet
WEIGHT Model 1680G	34 pounds (15.4Kg)
Model 1680GS, 1680GSA	37 pounds (16.8Kg)

INTRODUCTION

DESCRIPTION.

The 1680 G-series projectors are modified versions of the 1680 global models covered in basic service manual 74403. In addition to the design features and operating characteristics listed on the preceding page, the 1680GS and 1680GSA units have front cover and speaker assemblies; and all the 1680GSA units are wired to meet Australian requirements.

Mechanically, the principal difference between the 1680 global models and the 1680 G-series units is the addition of the run/still and animated clutch bracket assemblies. Other noticeable differences occur in the volume and control assembly, front and rear end cap assemblies, lamphouse cover assembly and the projection lamp and holder.

GENERAL INFORMATION.

This supplement contains repair and replacement instructions for the above mentioned G-series differences and, refined and expanded adjustment and test procedures. These refined procedures are covered in the supplemental Adjustments section and are to be used in place of the instructions found in basic service manual paragraphs 28 through 44.

Service parts and schematic wiring diagrams necessary to repair and service the 1680 G-series units are listed and illustrated in the parts catalog supplement. When applicable, these parts are "letter" coded as follows:

1680G	P
1680GS	Q
1680GSA	R

REPAIR AND REPLACEMENT INSTRUCTIONS

Basically, the service instructions for the 1680 global models provided in service manual 74403 will apply to the 1680G-series units except for the following differences.

A. SLOT-THREADING OPERATION DIFFERENCE.

As noted earlier, the 1680 G-series projectors are equipped with the run/still feature. These units cannot be threaded when the run/still lever is in the "still" position because the flywheel is locked. Place the run/still lever in the "run" position, then proceed with the slot-threading operation.

B. SPECIAL SERVICE TOOLS DIFFERENCE.

Some of the service tools illustrated in Figure C of the basic manual are no longer needed for the refined adjustments and tests described in this supplement. One part number change should be noted however, the tension spring (item 5) currently used to align the aperture plate is P/N 44507.

C. LAMP REPLACEMENT DIFFERENCE.

a. Projection Lamp. Disconnect the line cord and remove the front cover. Open the lamphouse and press in on the top of the lamp retainer spring to unlock the spring, then swing the spring down to release the tension on the projection lamp. Pull the lamp straight out from its socket (do not twist or wiggle the lamp during removal). Check the lamp socket leadwires for fraying or poor connections. Assemble the new

lamp into the socket and swing the lamp retainer spring up into place. Remove fingerprints from the lamp with lens tissue or a lint-free cloth. Close the lamphouse and replace the front cover.

b. Exciter Lamp. With the line cord disconnected and the front cover removed, loosen the thumbscrew on the exciter lamp cover and remove the cover. Rotate the lamp release ring until the lamp can be turned and lifted from the lamp socket pins. Install the new lamp in the socket; then press down on the lamp release ring and rotate to close the ring. Remove fingerprints from the lamp with lens tissue or a lint-free cloth and reinstall the covers.

D. END CAP REMOVAL DIFFERENCE.

In order to disassemble the front end cap from the base, first remove the screws and washers holding the tilt bar assembly and rubber foot to the base and remove these parts. Then remove the two end cap base screws.

NOTE: Both the front and rear end cap assemblies are attached to the mainplate. After removing the base screws, remove the screws that are inserted through the mainplate and threaded into the Tinnerman nuts assembled to the front edge of the end cap.

E. REWIND CORD REPLACEMENT DIFFERENCE.

After the rewind cord has been replaced, adjust the cord as follows.

To make certain that there are no obstructions to proper rewind cord operation, check that the rewind cord disc is adjusted to the mid-slot position on the take-up arm. To adjust for rewind cord tension, the formed tab on the rewind disc is turned clockwise when the take-up arm is in the take-up (horizontal) position. Lift the take-up arm to the rewind position. In the rewind position the two rewind springs attached to the rewind lever must pull the rewind cord taut, as shown in Figure K. This stretched taut rewind cord moves the rewind lever gears against the supply arm (for rewind) and the upper sprocket gear. This action causes the film to rewind back onto the supply reel. After adjusting the rewind cord replace the projector covers.

NOTE: Do not lift the projector arm to the rewind position when film is threaded in the system.

F. REEL ARM REPLACEMENT DIFFERENCE.

The reel arm lock button assemblies for the 1680 G-series units are held in position with retainers (P/N 44408).

NOTE: Make certain replaced reel arm assemblies are charcoal grey in color. Order front reel arm assembly P/N 078166 and/or rear reel arm assembly P/N 078167.

G. RUN/STILL AND HEAT SHUTTER LINKAGE REPAIR.

The run/still and heat shutter linkages are shown assembled at the gear side (rear) of the mainplate in Figure AF of this supplement. Except for compression spring replacement, it is doubtful any other parts replacement will be necessary. If compression spring(s) must be replaced, make sure that the beveled face of the collar is toward the spring when replacing the spring and collar on the lower end of the rod. If noise is heard during operation after spring replacement, the collar has been set too loose. Reset the collar, as necessary, to eliminate noise. For linkage adjustment procedures, refer to paragraph 44 in the Adjustment section of this supplement.

H. INCHING KNOB REPLACEMENT.

If the inching knob has been removed or requires replacement, refer to supplement parts catalog Figure S8 and reassemble as follows.

Assemble the inching knob (7) to the camshaft (29) aligning the knob setscrews (8) over the groove on the end of the camshaft. Then space the knob 0.250 inch (0.635mm) from the mechanism housing (30) to align

with the slot in the mainframe using a set gage between the mechanism housing and inching knob for positioning. After the knob has been properly spaced, tighten the knob setscrews.

I. AMPLIFIER AND CONTROLS REPAIR DIFFERENCE.

The 1680 G-series units are equipped with three amplifier controls (treble, bass and volume). Service parts for the volume and tone control assembly and the amplifier assembly are listed and illustrated in supplent parts catalog Figure S3.

A circuit explanation for the amplifier assembly is provided in the Adjustments section of this supplement. If a faulty condition is traced to the amplifier, replace the complete amplifier assembly noting the NEW and rebuilt amplifier policy given in Figure S3.

J. MAINFRAME REMOVAL AND INSTALLATION DIFFERENCE.

When applying basic service manual paragraph 27 instructions to the 1680 G-series, it should be noted that references to Fig. 2- and Fig. 6- will change to supplement parts manual Fig. S2- and Fig. S3- respectively. These changes do not effect the index numbers of the referenced parts except for the front and rear end cap screws assembled to the mainframe. These screws are index number (S2-12). All other referenced figure and index numbers will apply to the 1680 G-series units.

NOTE: After removing the main switch control knob parts (Fig. S2) from the switch shaft, secure the cam follower (Fig. 4-21) in its upright position with a rubber band. This will enable the switch shaft to be reinstalled through the mainframe opening without interference. Do not forget to remove the rubber band after reinstalling these parts.

K. TROUBLE SHOOTING FOR THE 1680 G-SERIES UNITS.

The basic service manual trouble shooting charts are applicable to the 1680 G-series units. Additional trouble shooting instructions covering the run/still and animated clutch bracket assemblies are as follows.

(1) When film cannot be threaded into the system or the projector will not operate in the rewind mode, check the position of the run/still lever. If the run/still lever is in the "still" position (causing the flywheel to be locked), reset the lever to the "run" position.

(2) If the motor runs but the mechanism will not run, the animated clutch spring may be lost or broken. Refer to supplement parts catalog Figure S8 and replace the animated clutch spring.

(3) If the animated clutch will not operate, stop pawl clearance may be excessive. To readjust stop pawl clearance, see supplement paragraph 45, step a.

(4) If the animated clutch stops the sprocket but the shuttle continues to pull film, the shuttle is not retracing properly. To adjust the shuttle for proper retraction, see supplement paragraph 45, step b.

(5) If the shuttle runs but the sprockets do not revolve, the animated clutch spring may be weak or broken. Refer to supplement parts catalog Figure S8 and replace the animated clutch spring.

ADJUSTMENTS

28. 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 a complete overhaul and repair, it is recommended that all adjustments be checked as a routine measure. Routine adjustments such as those applicable to sliding fits, clearances and end play have been covered in the reassembly procedures and are not repeated here except where they directly affect other adjustments or alignments.

All special tools, test films and fixtures required to perform the adjustment procedures are illustrated and listed in Figure B. In addition, special electronic test equipment (voltohmmeter, oscillator and tachometer or Strobotac) are needed to check and adjust the sound system of the projector. For accurate results, connect the projector to a line variable transformer set at 120 volts, 60Hz, or rated nominal voltage.

WARNING

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

29. OPTICAL ALIGNMENT.

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

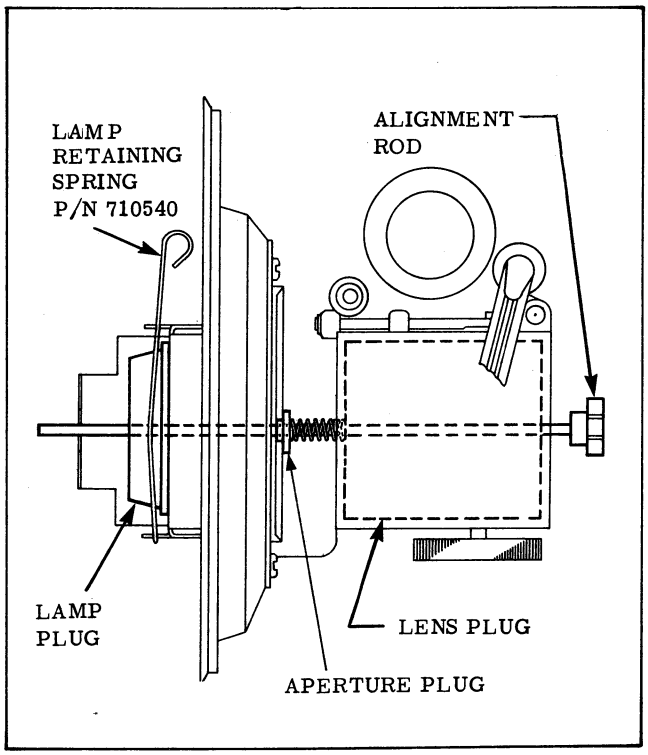


Figure S. Aligning the Optical System

a. Aligning the Aperture Plate.

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

(2) With the load lever in the horizontal position, disassemble the lens carrier cover. Then move the load lever down to the vertical position 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 4, Figure B) into the aperture opening.

(4) Insert the alignment rod (Figure S) through the lens plug until the rod end protrudes enough to install the spring (P/N 44507). 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 keeping it horizontal (shuttle tooth travel is even from top to bottom) until free rod movement is obtained; then tighten aperture plate screws.

b. Aligning the Lamp.

(1) Tip the projector back into its normal, upright position and reassemble the pressure plate to the lens carrier. Close the theading system by moving the load lever up to horizontal.

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

NOTE: After alignment has been completed, touch up the aperture area with a flat black paint as required. This will prevent any reflections which may occur from the aperture.

30. ADJUSTING THE INTERMITTENT MECHANISM.

NOTE: All of the following mechanism adjustments must be made with the framer knob in the "center" position.

a. Checking Shuttle Tooth Side Clearance. Advance the mechanism manually until the shuttle is at the center of its stroke as shown in Figure T. 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 (0.178mm) minimum. From the edge of the shuttle slot to the outer end of the shuttle tooth, the distance should be 0.050-inch (1.27mm) 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 (0.178mm) at either end, the following possible causes should be checked and corrected.

(1) Aperture plate out-of-alignment. See paragraph 29, step a, for aperture plate alignment.

(2) Shuttle stroke incorrect. See paragraph 30, step d, for shuttle stroke adjustment.

(3) Link bearing missing from end of shuttle arm. Partial disassembly is required to remove the shuttle arm and replace the link bearing. Refer to Parts Catalog Figure 18.

(4) The shuttle tooth side clearances can be adjusted by loosening the shuttle plate support nut. Slide the shuttle arm as required to obtain the clearances as specified in Figure T.

NOTE: The assembled intermittent mechanism is shown in Figure U.

(5) Ball and stud assembly loose on shuttle arm. With rear cover removed, reposition ball and stud assembly (Figure U) and tighten stud nut securely.

b. Checking Shuttle Tooth Height. Unscrew the handle from the shuttle tooth height gage (item 8, Figure B). Carefully place the projector on its rear end cap with the front of the projector facing you, and disengage and remove the pressure plate. The steps at either end of the gage are the height gages and are marked "GO" and "NO GO." Insert

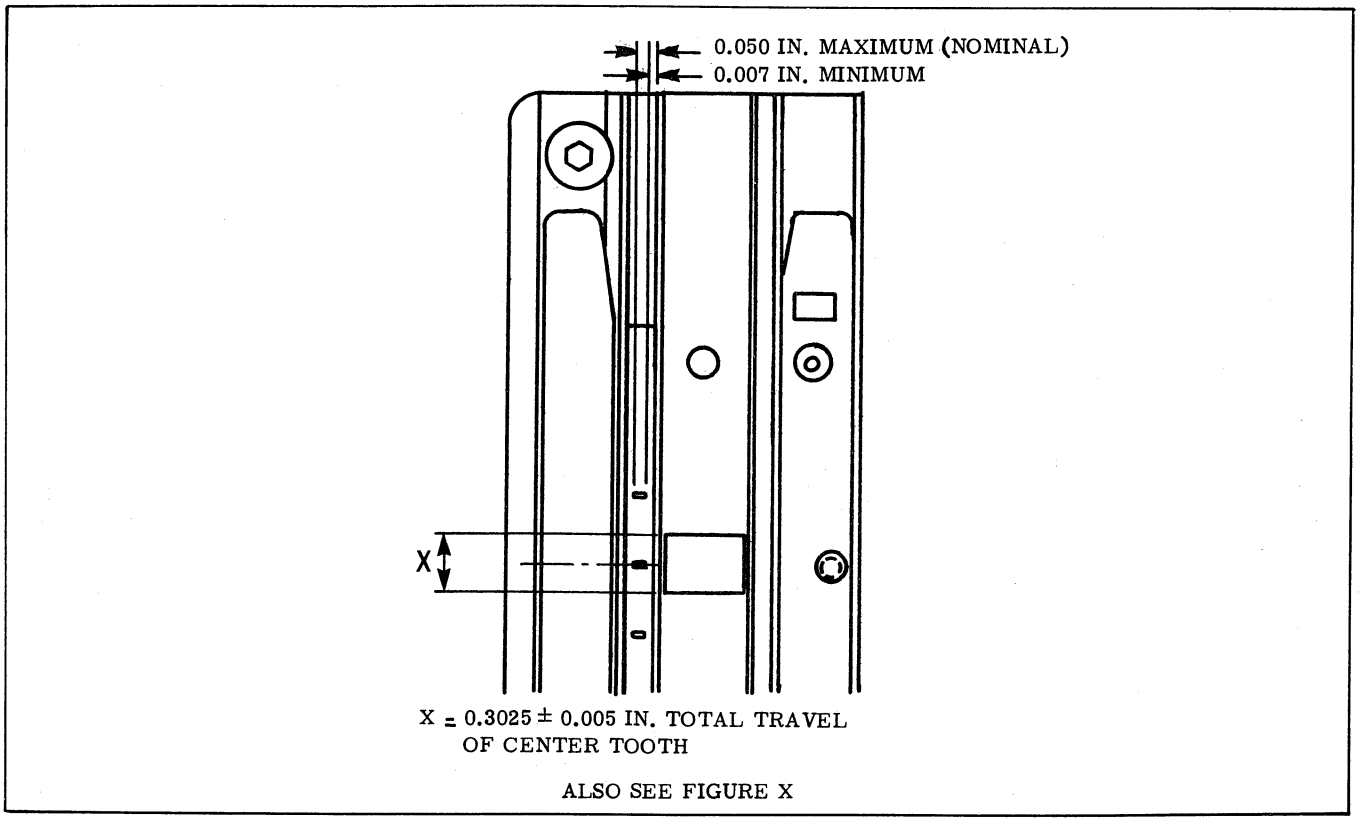


Figure T. Aperture Plate and Shuttle Tooth Clearance

the gage, "GO" end first, into the film channel between the rails of the aperture plate and slide it to the right. The "GO" step should pass over the shuttle teeth without catching. Repeat this inspection with the "NO GO" end of the gage. The "NO GO" step must not pass over the shuttle teeth. If the shuttle teeth are too high or too low, adjust height as follows:

NOTE: To perform the adjustments with the mechanism assembly installed on the main-plate, the lamphouse, projection lamp and heat shutter assembly must be removed.

(1) Remove the belt from the mechanism pulley. Turn the mechanism drive pulley manually until the access hole in the shutter and setscrew on the in-out bracket are aligned (Figure V).

(2) Move the run-still lever to the "still" position. Insert a No. 4 spline wrench through the access opening and engage it in the socket of the in-out cam follower screw.

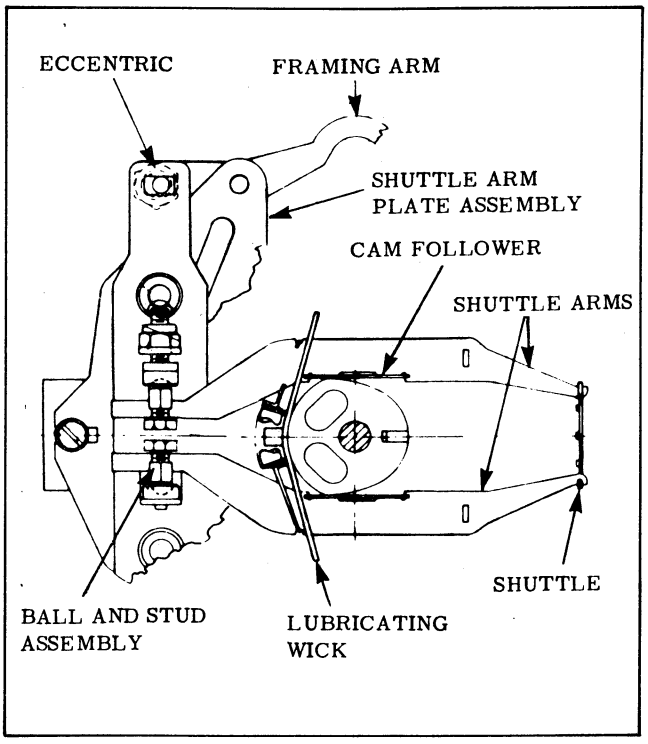


Figure U. Shuttle Arms and Cam Assembly

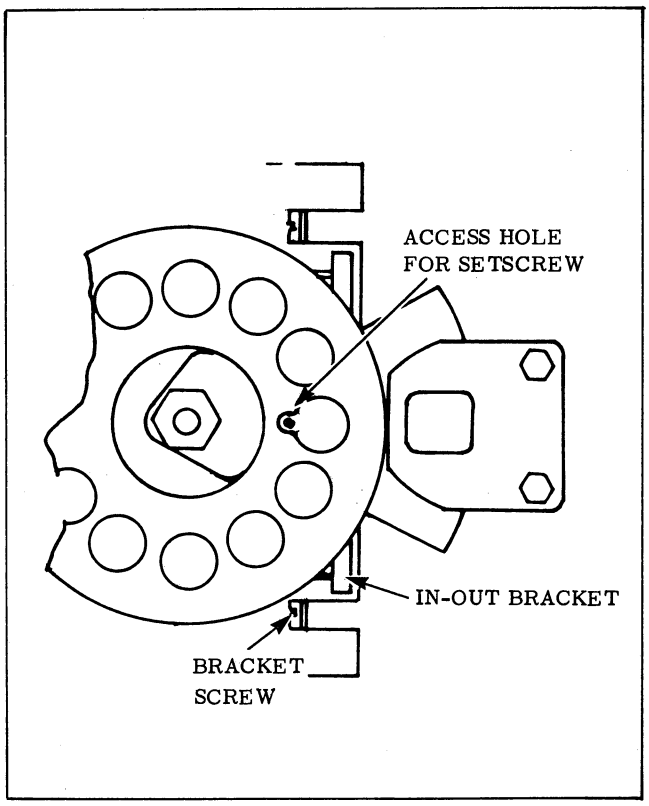


Figure V. Adjusting Shuttle Tooth Height

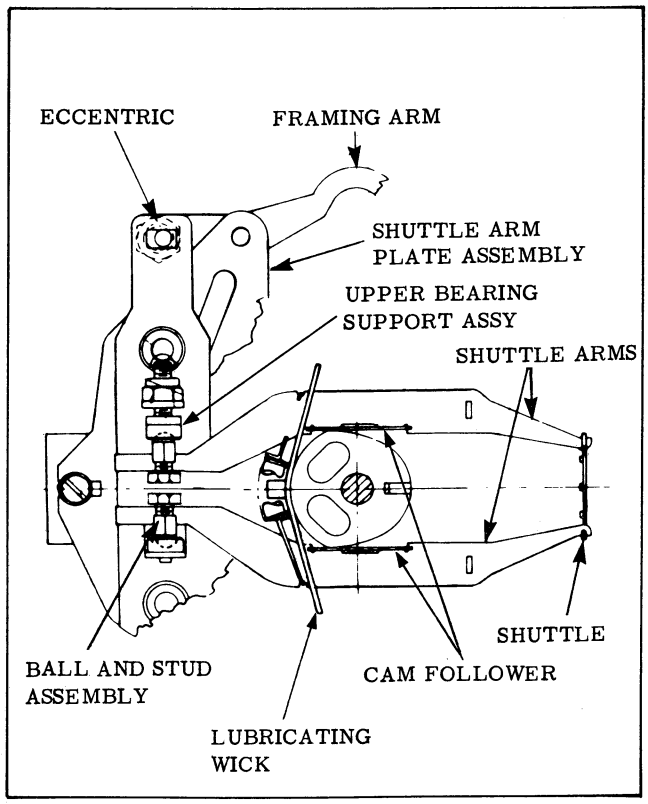


Figure W. Adjusting Fit of Shuttle Arms to Pull Down Cam

(3) If the shuttle teeth were too low ("NO-GO" step passes over the shuttle teeth), turn the cam follower screw counterclockwise to increase tooth height. If the shuttle teeth were too high ("GO" step catches against shuttle teeth), turn the adjusting screw clockwise. Recheck shuttle tooth height and continue to adjust the follower screw until the proper height is obtained.

(4) If only one tooth cannot be brought into tolerance, it may be necessary to loosen the screws which secure the in-out bracket (Figure V) and adjust the bracket slightly. Then retighten the mounting screws and adjust shuttle tooth height as outlined above.

NOTE: Upon completion of shuttle tooth height adjustment, reassemble the heat shutter assembly and lamphouse. Realign the lamp as outlined in paragraph 29, step b.

c. Checking Fit of Shuttle Arms to Pull-Down Cam (See Figure W). Disconnect the projector line cord and remove the rear cover (paragraph 11) and the drive motor (paragraph 18).

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

(1) Open the lens carrier and turn the projector mechanism by hand until the shuttle teeth are retracted and have moved downward to approximately the center of the stroke (center tooth approximately on horizontal center line of aperture). Tighten the upper bearing support assembly to the point of having a slight binding or ratcheting while turning the camshaft. Turn the upper bearing support assembly counterclockwise approximately 1/16 turn, allowing the cam to turn freely without binding.

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, cam shoes and possible use of excess current by loading the motor or affecting the speed.

d. Checking and Adjusting Shuttle Stroke (Figures T and X). Shuttle stroke (vertical travel on down stroke) is set at the factory at 0.3025 ± 0.005 inch. Therefore, the procedures for checking and adjusting shuttle stroke are required only when the shuttle arm plate assembly or arms have been moved. Before starting these procedures, make sure the mechanism is assembled correctly.

(1) Procedure for Checking Shuttle Tooth Stroke. If the shuttle arm plate assembly or arms have been disturbed, the pivot point must be checked for proper alignment. Turn the framer knob until the bottom edge of the center tooth is aligned with the top edge of the aperture opening as shown in Figure X. Check proper setting of the shuttle stroke, side-to-side shuttle tooth clearance and protrusion as shown in Figure T.

NOTE: Before proceeding to step (2) following, return the framer knob to the center position and verify the results of the aperture plate and aperture alignment (paragraph 29), shuttle tooth side clearance and shuttle tooth height (paragraph 30, steps a and b).

(2) Turn the framer knob until the teeth move to the upper position (down stroke). Remove the drive belt from the mechanism pulley. Turn the pulley until the center tooth is at the extreme top of the pull down stroke. The bottom edge of the center tooth is now in line with the top edge of the aperture opening. Rotate the camshaft until the center tooth is at the bottom of the pull down stroke. In this position the top edge of the center tooth should be in line with the bottom of the aperture opening as shown in Figure X. Shuttle stroke (vertical travel) is now placed in a close proximity of the factory setting at 0.3025 ±0.005 inch without tooling. Replace the drive belt on the mechanism pulley and return the framer knob to the center position.

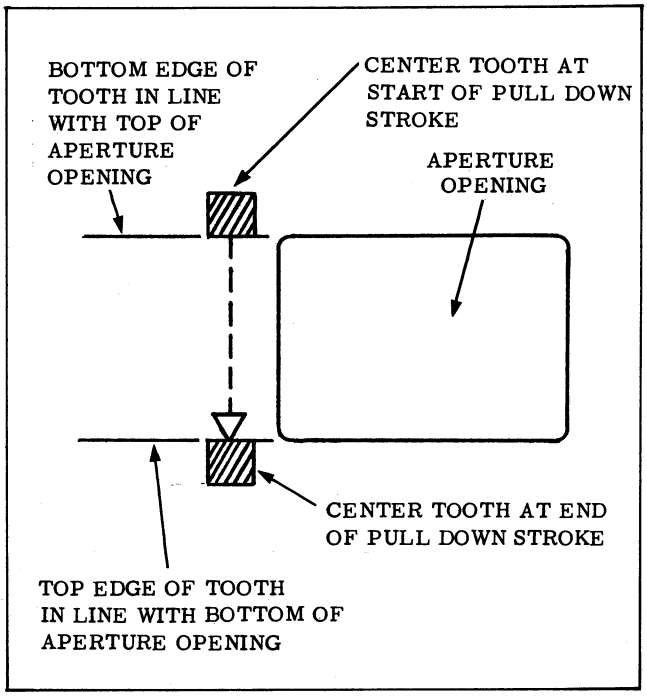


Figure X. Center Shuttle Tooth Travel Adjustment

(3) 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 30, step a, and readjust the shuttle arms for proper tooth side clearance.

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 and a clicking noise from the shuttle teeth hitting the pressure plate.

e. Framing Adjustment. Thread the projector with test film TFL-1580-NX2. Project the film and turn framing knob from one limit to the other. If at one limit a frame line is not visible, loosen the nut on the framing eccentric located at the top of the shuttle arm plate assembly (Figure U) and turn the eccentric until the frame line appears. Hold the eccentric while tightening the nut.

f. Check the adjustment by again turning the framing knob from limit to limit while observing the 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.

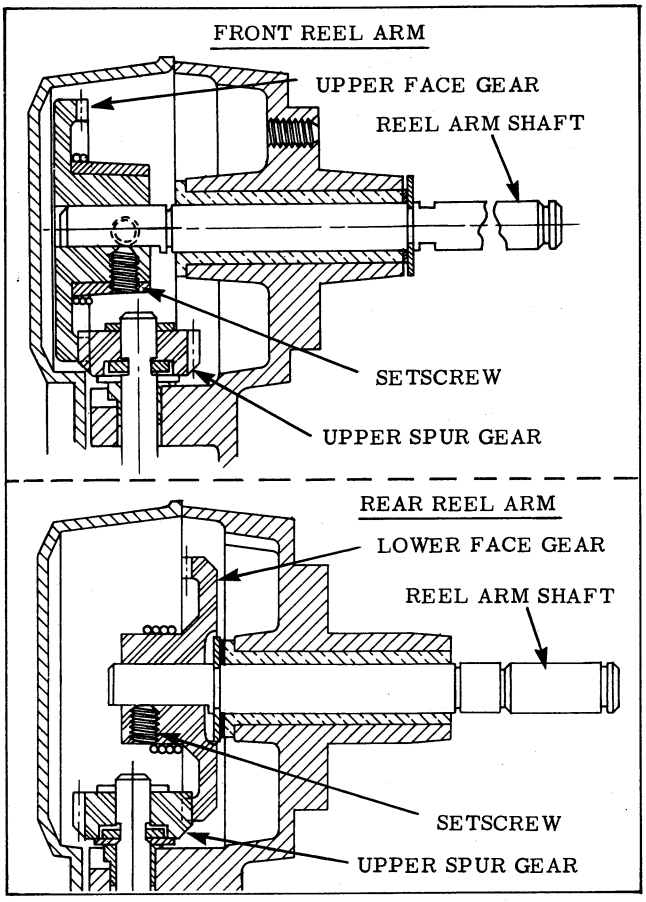


Figure Y. Adjusting Reel Arms

31. ADJUSTING REEL ARMS AND REWIND CLUTCH (Figure Y).

a. Reel Arm Face Gear Adjustment. Only the upper face gears of the reel arms are shown in Figure Y; however, the lower face gears are adjusted in a similar manner. With the reel arm cover removed, check the backlash between the face gear and its mating spur gear through a full 360-degrees rotation of the gears. Gear backlash should be a minimum of 0.005-inch (0.127mm) and a maximum of 0.018-inch (0.460mm). To adjust the backlash of either face gear in the front reel arm and the upper face gear only in the rear reel arm, loosen the setscrews in the face gear hubs and shift the gears as necessary. To adjust the lower face gear in the rear reel arm, loosen the setscrew in the tapped hole in the reel arm casting and move the lower gear shaft back and forth.

b. Rewind Clutch Adjustment. The rewind clutch system must be adjusted to produce a supply spindle torque when the take-up arm is raised to the rewind position during operation. Install an empty reel on the supply spindle and wrap several turns of a short film strip around the reel hub. Hook a spring scale to the free end of the film strip and turn on the projector. Rotate the main switch to the "reverse" position. The spring scale must register between 2.5 and 4.5 inch-pounds at the point when the rewind clutch system begins to slip. With a wrench grip the flats on the inner face of the take-up clutch (Fig. 4-5) while loosening or tightening the grip ring on the clutch hub. Rewind torque (14 to 22 ounces) is adjusted by means of the rewind clutch assembly (Fig. 5-19). The rewind clutch adjusting grip ring faces inward toward the mainplate and a special wrench (item 6, Figure B) must be used for the adjustment.

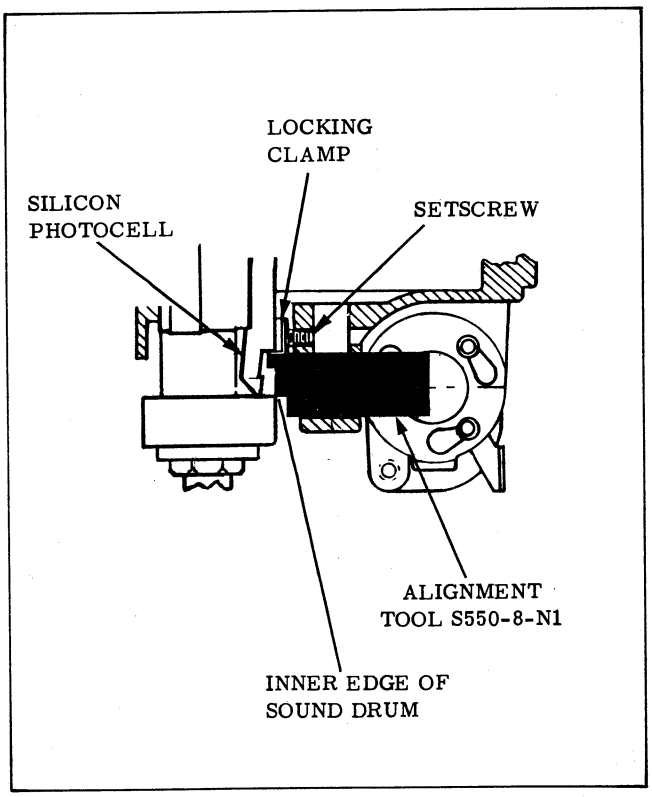


Figure Z. Positioning the Sound Drum and Silicon Photocell

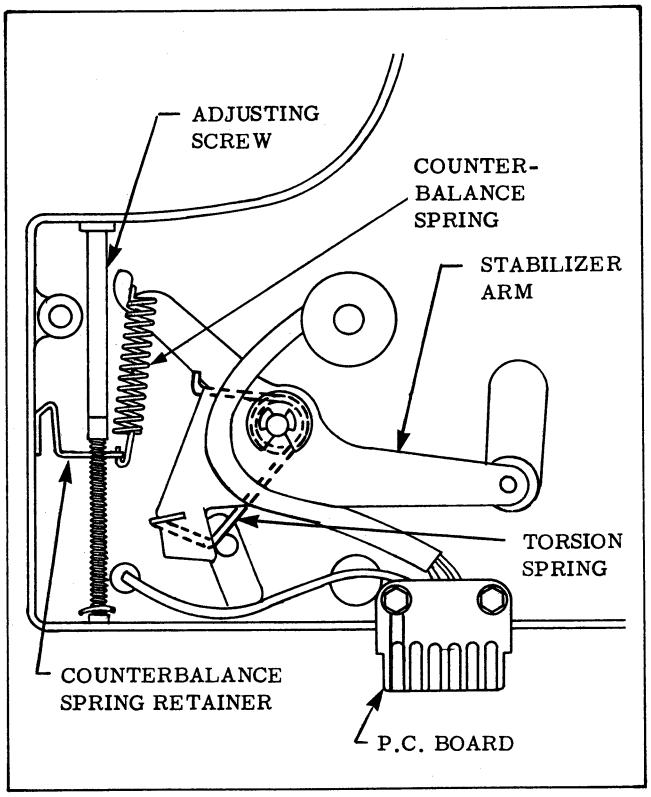


Figure AA. Arms and Counterbalance Spring Installed (Rear View)

32. ADJUSTING THE SOUND SYSTEM.

a. Photocell Alignment (Figure R).

(1) Loosen the photocell setscrew, clamping screw and the two sound drum mounting screws. Remove the exciter lamp and the optical slit.

(2) Insert the sound drum alignment tool (item 9, Figure B) into the optical slit opening as shown in Figure Z.

(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 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.

b. Stabilizer Roller Tension Adjustment (Figure AA). The stabilizer roller at the end of the stabilizer arm protrudes through the vertical slot in the mechanism housing. Thread the projector with film and turn the adjusting screw until the tension on the counter-balance spring is equalized and lifts the roller at approximately mid-stroke.

c. Optical Slit Adjustment (Figure R).

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

(2) Insert a 0.050-inch (1.27mm) 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 clamping screw just enough to hold the slit in place. Replace the exciter lamp.

(3) Thread the projector with 7000Hz optical setting film TFL-D1580-NX4 and connect a 16-ohm, 10-watt load resistor and voltmeter 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 mid-position and start the 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 from both sides of the film loop. Move the slit toward film until output is within 1 to 2 DB. Tighten slit clamping screw securely to lock the adjustment.

d. Buzz Track Adjustment. The lateral position of the film at the "soundhead" location is controlled by the impedance roller and adjusted by an adjustment nut located on the impedance roller pivot stud. Turn the adjustment nut in or out for precise lateral distance of the impedance roller to the surface of the mechanism.

(1) Connect a voltmeter with 8-ohm load to the speaker jack output, and thread the projector with buzz track test film TFL-D1580-NX3.

(2) Turn the main switch to the "Forward-Run" position and adjust for minimum output on the voltmeter. Disconnect the voltmeter and adjust the volume control to a suitable listening level. Then check centering by listening to audio.

(3) Reconnect the voltmeter and adjust the lateral position of impedance roller by turning the adjustment nut on roller pivot stud in or out until the minimum voltage output reading is obtained. Remove buzz track film and voltmeter.

33. 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 the sprocket by means of suction cup or rubber foot. For viewing with light from 60Hz 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. 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, 60Hz. Sound speed — 24FPS ±2%, shutter - 1440RPM ±2%, sprocket - 102.86RPM ±2%. Silent speed — 18FPS ±5%, shutter - 1080RPM ±5%, sprocket - 77.1RPM ±5%.

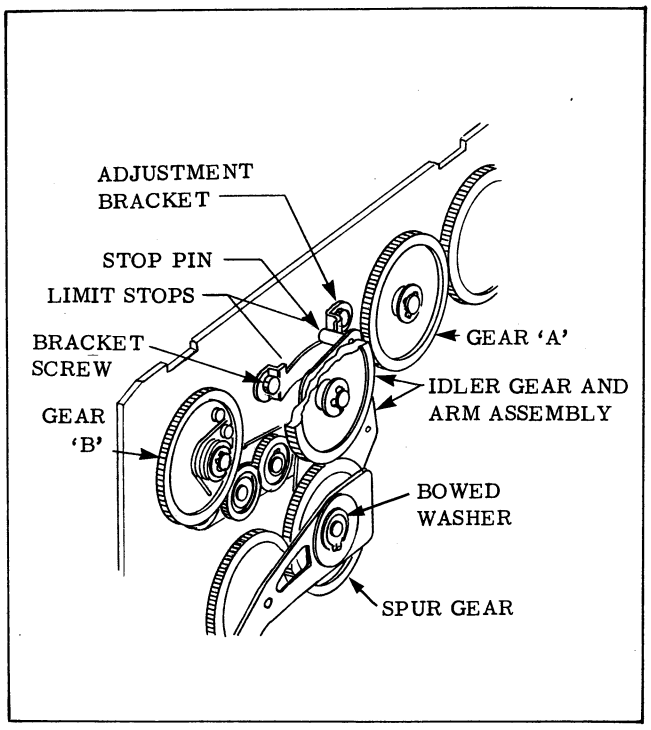


Figure AB. Adjusting Gear Shift Tension and Backlash

34. GEAR SHIFT TENSION ADJUSTMENT. When shifting from forward to reverse, or vice versa, the idler gear arm (Figure AB) 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 AB) is flattened against the face of the gear.

35. IDLER GEAR BACKLASH ADJUSTMENT. In both the forward and reverse positions, there must be a perceptible amount of backlash between the idler gear and gears "A" and "B," Figure AB. 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 limits 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.

36. ADJUSTING BRAKE ARM RELEASE.

a. Place the load lever in the load (vertical) position and the main switch at "off" and loosen the brake arm screw (Figure L) slightly.

b. Hold a 0.020 inch (0.50mm) shim against the knurl of the flywheel and manually press and hold the neoprene brake roller against the shim while retightening the screw. Remove the shim and flex the cable release system by lifting the cable end of the cam follower (Figure L) and then releasing it.

c. Operate the projector and check flywheel rotation. If neoprene roller slows or stops the flywheel in the "forward" position, readjust clearance as above or adjust cable tension by engaging cable in a different groove of the sheave (Figure L).

37. MOTOR INTERLOCK SWITCH ADJUSTMENT (Figure AC). The motor interlock switch is assembled to the gear side of the mechanism assembly casting with the switch button facing up and to the left. Loosen the switch mounting screws just enough to permit the switch to be shifted. Move the load lever counterclockwise so that the selector latch tab is positioned at the halfway point on the radius of the mode selector arm and the switch button is positioned beneath the tab. While holding a 0.020-inch (0.50mm) feeler gage between the switch button and the tab, adjust the switch until the switch button is just making contact with the feeler gage. Hold the switch securely to maintain this clearance while tightening the switch screws.

38. LAMP INTERLOCK SWITCH ADJUSTMENT (Figure AD). The lamp interlock switch is fastened to the gear side of the mainplate just to the left and slightly above the left end of the shutter shaft. Make certain that the switch button is positioned above the activating finger protruding through the slot in the mainplate. With the two switch screws slightly loosened, place a 0.010-inch (0.25mm) feeler gage on top of the protruding finger. Adjust the position of the switch until the switch button is resting on the feeler gage. Hold the switch to maintain this clearance and tighten the switch screws securely.

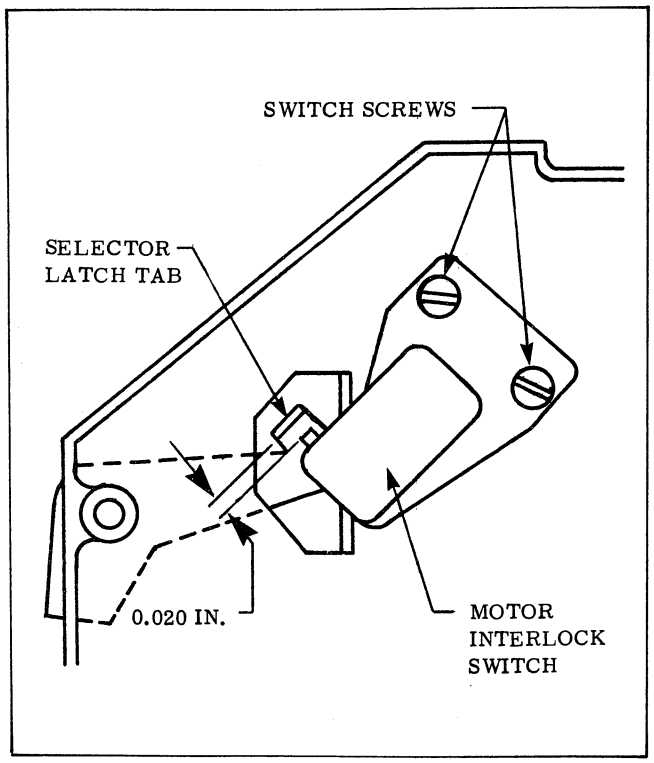


Figure AC. Adjusting Motor Interlock Switch

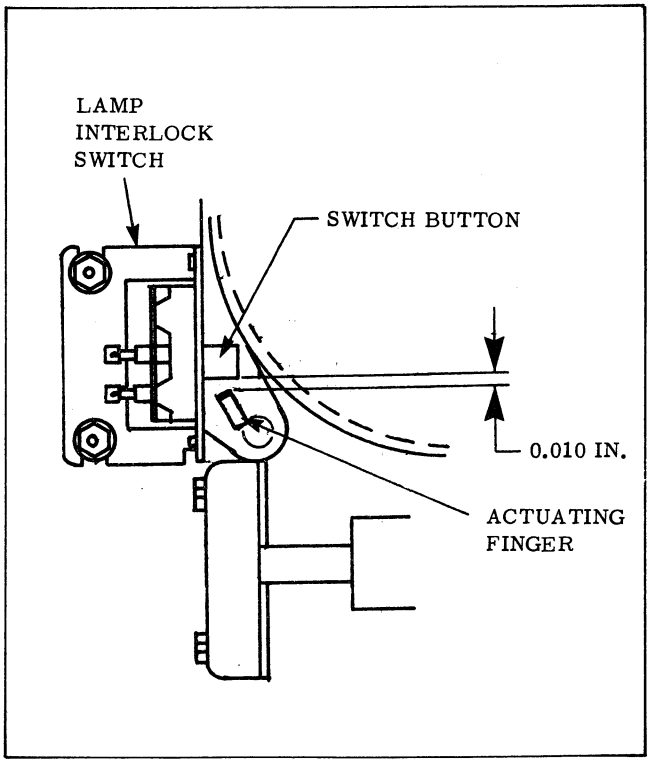


Figure AD. Adjusting Lamp Interlock Switch

NOTE: The following are loopformer adjustments which can be made with the projector mechanism assembled to the mainplate.

39. CHECKING THE THREADING SYSTEM.

a. Remove the lens carrier cover and the exciter lamp cover and open the lamphouse door. Open and close the threading system several times and note the response of the load lever. The movement of the load lever must be smooth, and there must be no evidence of binding or jamming. When pressed and released, the load lever should return smoothly to its original position. While depressing the load lever, a definite spring tension should be felt before any parts begin to move to open the system for threading. Observe the film threading operation to determine the kind of problem that exists and in what threading area the trouble is located.

b. As the load lever is moved toward the "load" position, a click should be heard from the motor interlock switch. Instructions for adjusting this switch will be found in paragraph 37. This microswitch stops the projector to prevent tearing of the film when the load lever is in transition to the "load" position. Once in the "load" position, the motor interlock switch recloses to allow the motor to run.

40. UPPER SPROCKET AREA ADJUSTMENTS. The upper sprocket guard is located just above the upper sprocket. This sprocket guard should be adjusted so that it cannot be lifted enough to allow the film to be removed or to permit the film to escape from the sprocket. Adjustment is as follows:

a. Loosen the screw enough so shuttle mode slector latch can be moved up and down. Move the mode selector latch down toward the mode selector bushing until the load lever is tight and there is no movement in the loopformer. However, this should not be so tight as to cause the load lever to bind. The load lever must move smoothly. While holding all parts securely, retighten screw.

b. Check the motor interlock microswitch to make certain that it clicks when the load lever is pressed down 1/2 inch. In this 1/2-inch travel, movement of the load lever should be free and smooth except for return spring tension and the system should not begin to open.

c. If the microswitch does not click as specified in step b, even after switch adjustment (paragraph 37), use a needle-nose pliers to CAREFULLY reform the microswitch actuator down to meet those specifications. Bend actuator a little at a time until the adjustment has been properly made.

41. LOWER SPROCKET AREA ADJUSTMENT. The lower sprocket guard is located just below the lower sprocket and is adjusted in the following manner:

a. Loosen the screw and open and close the system with the load lever.

b. With the system closed (loaded or run position), move the sprocket guard up against the lower sprocket and retighten the screw. This will balance the system so that the upper and lower sprocket guards will apply equal pressure on the sprockets.

42. IMPEDANCE ROLLER ADJUSTMENTS.

a. Loosen the two screws located below the lens carrier and behind the focus knob.

b. Open the system by pressing the load lever down to position "1" and push the impedance roller forward and up toward the exciter lamp.

c. While holding impedance roller in this full upward position, retighten the screws. Caution: Be careful not to over torque these screws as this may strip the threads.

d. The torsion spring is used to guide the film past the flange of the impedance roller when threading or unthreading the projector. This torsion spring should be adjusted to the approximate center of the impedance roller in the load (open) position. Loosen the two screws retaining the impedance adjusting plate attached to the lens carrier. Move the plate to correctly position the

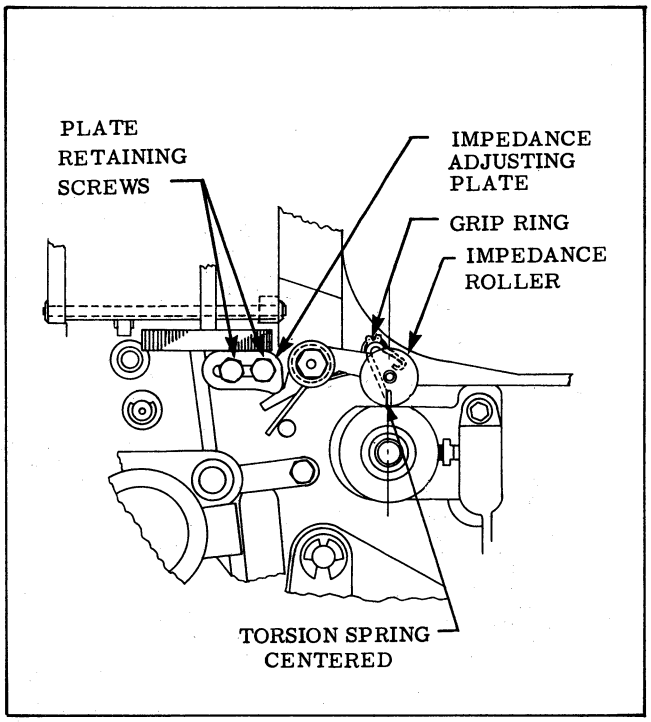


Figure AE. Adjusting the Torsion Spring

torsion spring to the center of the impedance roller and tighten the screws. The grip ring should be tightened against the torsion spring with a slight movement of the spring allowed (use a 0.005-inch shim) between the grip ring and torsion spring. The torsion spring must not be bent or twisted. Adjust as outlined above. The grip ring should be assembled with the opening at the 12:00 o'clock position. Wow and flutter may result if the grip ring is overtightened or turned past the 12 o'clock position allowing the spring to hang on the grip ring.

43. FINAL THREADING SYSTEM CHECKS.

a. After systems adjustments have been made (paragraphs 39 through 42) close the lamphouse door and reinstall the exciter lamp cover and the lens carrier cover.

b. Open the threading system (load lever at position "1") and place a reel of film on the front reel arm.

c. Thread the film into the projector in the normal manner. If all adjustments have been properly made, the film should thread through the system smoothly.

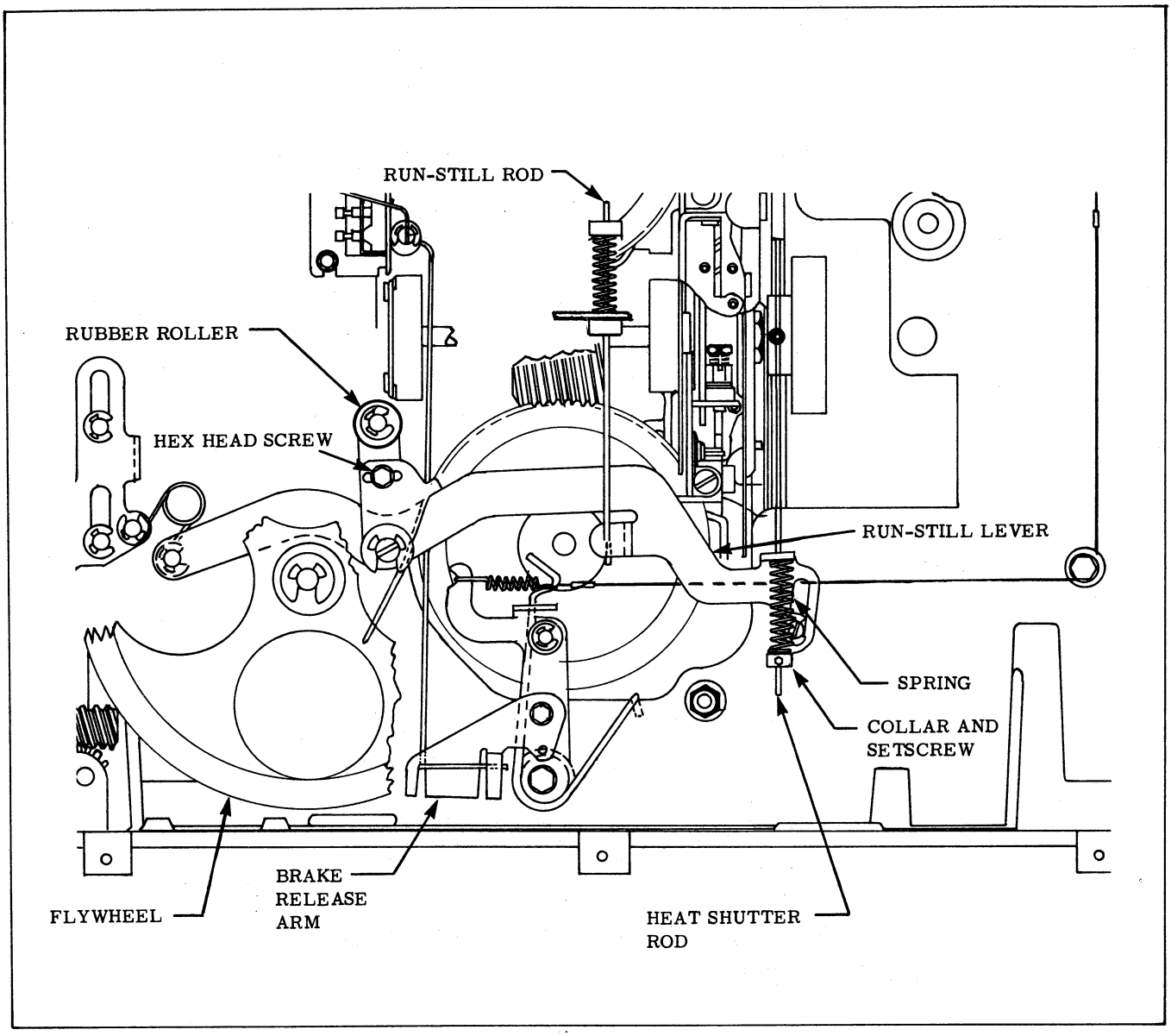


Figure AF. Adjusting Run-Still Brake and Heat Shutter

44. RUN-STILL AND HEAT SHUTTER ADJUSTMENTS (Figure AF).

The run-still and heat shutter operations are controlled by the mechanical linkages shown in Figure AF. If either of these operations is functioning improperly, adjustment can be made as follows:

a. Run-Still Brake Adjustment.

(1) With the unit in the "run" position, check to make certain that the brake release arm is functioning properly (refer to paragraph 36).

(2) Move the load lever to the load position and check that the rubber roller on the run-still lever (Figure AF) is not rubbing against the flywheel.

(3) Loosen the hex head screw in the brake arm and center the screw head in the elongated slot. Use a 0.020 inch (0.50mm) shim to set the clearance between the rubber roller and the inside rim of the flywheel while tightening the screw. Then move the run-still lever down to the "still" position and check to make sure that the roller is pressing firmly against the flywheel.

(4) Move the run-still lever up to the "run" position and the flywheel should spin freely. Move the run-still lever to the "still" position; the roller should stop the flywheel. If the roller does not stop the flywheel, readjust for a closer setting between the roller and the flywheel.

b. Heat Shutter Adjustment.

(1) Be sure that the collar and compression spring are assembled to the lower end of the heat shutter rod as shown in Figure AF (beveled face of collar toward spring).

(2) Place the projector in the "run" position; the collar should slightly compress the spring.

(3) With the projector lamp "on," move the run-still lever down to the "still" position. The heat shutter should be centered over the aperture opening and no light leaks should be visible when looking into the lens barrel.

(4) Move the run-still lever up to the "run" position. The heat shutter should swing completely away from the aperture opening.

(5) To adjust the heat shutter, loosen the collar setscrew and lower the collar as necessary.

NOTE: If noise is heard during operation after adjustment, the collar is set too loose.

45. ADJUSTING THE RUN-STILL CLUTCH (Figure AG).

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 AG. If the trigger fails to clear the stop pawl ear, adjust as follows. Loosen the bearing bracket screws (View B, Figure AG) and shift the bearing bracket 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 AG. 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 AG) 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

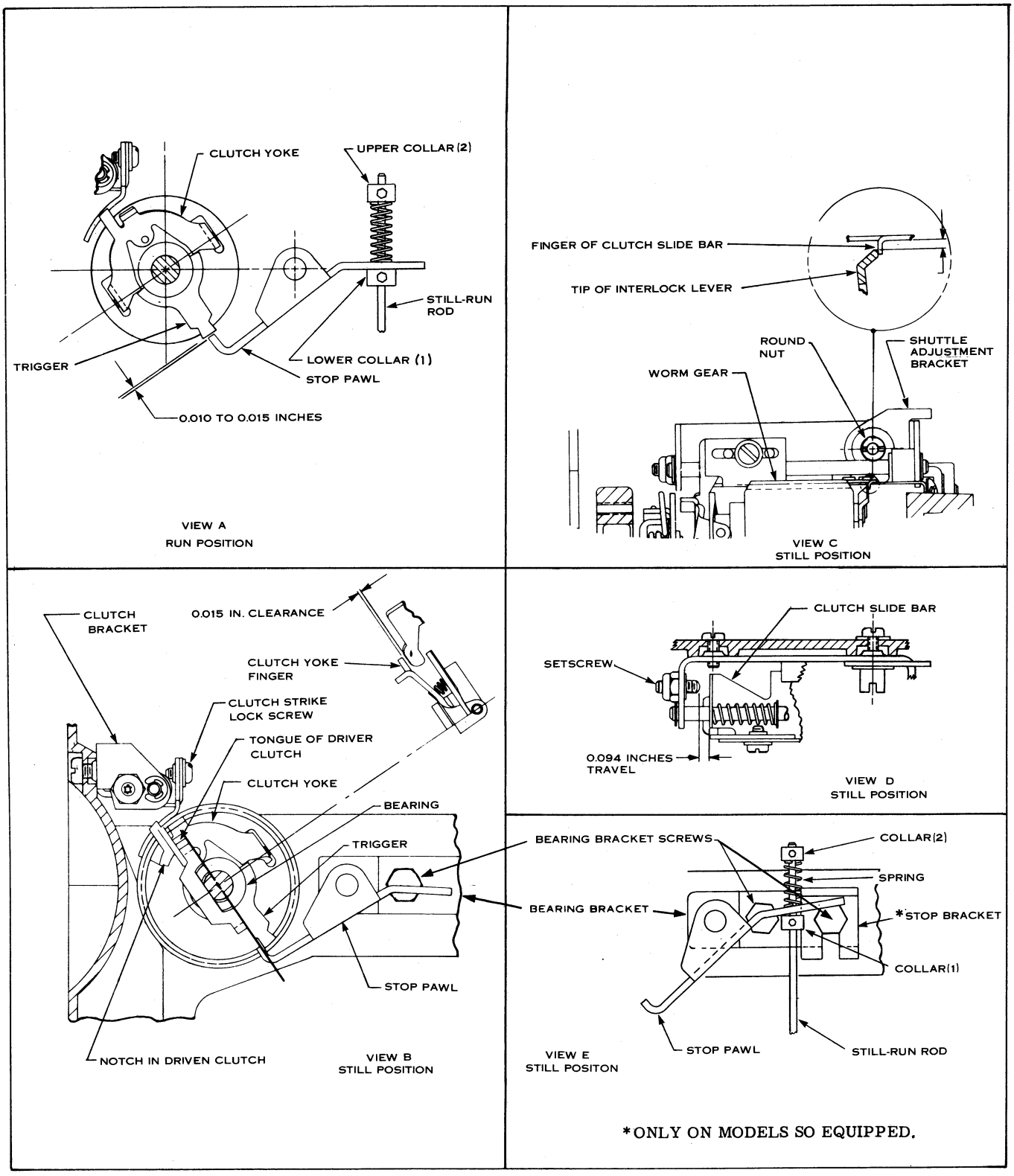


Figure AG. Run-Still Clutch Adjustments

gage while retightening the strike screw. Remove the feeler gage.

(2) Refer to View C, Figure AG. 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 AG. 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, adjust this finger to obtain positive overlap as shown.

c. Adjusting Run-Still Clutch Linkage. Refer to Figure AG 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 View A, Figure AG, and place the run-still lever in the "run" position.

(1) Refer to View E, Figure AG. Loosen the 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 the upper collar (2) until the gage indicates a spring pre-load of 5 ounces; then tighten the upper collar setscrew.

d. Checking Run-Still Linkage. Refer to View E, Figure AG for the following adjustment procedures.

NOTE: Disconnect the line cord and discharge the motor capacitor before attempting the following adjustments.

(1) Move the projector run-still lever to the "run" position so that the run-still rod moves up to the limit of its travel.

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

(3) Operate the projector and switch from "run" to "still" position. The stop pawl is engaged with the trigger mechanically. 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 spring tension may not be able to disengage the stop pawl from the trigger. Readjust spring tension until proper operation is obtained.

46. CIRCUIT EXPLANATION FOR THE 20 WATT AMPLIFIER (WITH OR WITHOUT DUAL TONE CONTROL).

To adequately discuss the 20 watt amplifier, the unit has been divided into seven basic stages. Each stage will be discussed in the following order:

(1) Optical Pre-Amplifier Stage

(2) Tone Control Network Stage

(3) Pre-Driver IC Stage

(4) Driver Transistor Stage

(5) Power Output Transistor Stage

(6) Overload Protection Stage

(7) Exciter Lamp Power Supply Stage

(1) Optical Pre-Amplifier Stage.

The optical pre-amplifier stage converts optical signal inputs to electrical outputs. The operational amplifier (half of IC1) gets its signal from the modulated output of the photo diode (optical pick-up). This output signal has an order of magnitude in the 1mV range. R18 acting as a DC load on the photo diode, stabilizes the photo diode so that it works into a relatively small DC load and also stabilizes the gain of IC1 in the event that the photo diode becomes completely cut-off from light (such as when the exciter lamp is extinguished). C1 and C14 block DC current from upsetting the bias on IC1 inputs. R26 returns the non-inverting (+) input of IC1 to ground to set the output of IC1 at 0 volt DC with respect to ground. Dual purpose resistor R1 returns the inverting input (-) of IC1 to a DC voltage which looks like ground (that is the output of IC1) and provides stabilizing feedback to the inverting input. As signal appears on the photo diode its impedance changes proportionally to the signal generated. This means that for higher signal output levels more feedback is applied to the IC1 optical pre-amplifier stage. The constantly changing feedback produces a linearizing effect on the output of the photo diode to reduce the system distortion. Since the photo diode is connected between the inverting and non-inverting inputs, any noise generated on the wires of the photo diode will be in phase at these inputs and cancelled by the common mode rejection ratio of IC1. Completing this stage is capacitor C2 which is non-polar due to the fact that the output pin of IC1 is at 0 volt DC level and goes plus and minus about 1 volt around this level (ground).

(2) Tone Control Network Stage.

Two types of tone controls are used with the 20 watt amplifier; a single tone control and a dual tone control. The dual tone control is located on a separate PC board that is connected to the 20 watt amplifier.

a. Single Tone Control. The single high frequency boost/cut control forms a high pass filter to the tone control arm or a high pass filter to ground. When the tone control arm is advanced toward the high end of the control, higher frequency signal components are routed through C15 and fed forward into the next stage. As the arm of the tone control is advanced toward the low side of the control, a high pass network is formed between the signal source and ground, thus shunting the higher freqeuncy components of the signal to ground and away from the next stage. This results in a simple treble boost and cut control with the center position being considered the flat position.

b. Dual Tone Control. The dual tone control is a dual and treble control assembly using both IC1A and IC1B. Pin 1 of IC1A is connected to pin 2 thus making IC1A a voltage follower. Pin 3 (the non-inverting input) of this IC is tied to ground to efficiently disable this unused op-amp stage. The other half of IC1 (IC1B) is used as the amplifier stage for the dual tone control.

There is less than 1dB of loss in this active feedback, dual tone control network, due to the amplification of IC1B (shown in assembly 078561). The signal from the photocell is amplified by the optical sound pre-amplifier and outputted from the main amplifier board through terminal 6. A shielded cable brings this signal to pin 3 on connector J2 of the dual tone control PC board. Pin 3 is connected to the top of the volume control (R22). The attenuated signal at the arm of the volume control follows two paths to the inverting input (pin 6) of IC1B: First through R17 and the parallel combination of the plus side of the bass control and C12, then through R18; the other path is through R19 in series with the plus side of the treble control and through C14. Opposing the input signal is a signal from the output of IC1B which is out of phase (180°) with the input signals. This allows the user to select more feedback in the frequency range desired by moving the treble or bass controls to the minus side (producing bass and treble cut conditions) or, to select more

signal by moving the treble and bass controls toward the plus side (producing bass or treble boost conditions). The bass and treble tone circuits have a design center frequency of 700Hz. Maximum bass boost or cut effect is at 70Hz, while the maximum treble boost or cut effect is at 7000Hz. In other words, two selective filter networks have been incorporated in the feedback path of IC1B. By advancing either the treble or bass control to the positive side more signal is introduced to the inverting input of IC1B to obtain the boost characteristic. By moving the bass or treble control toward the minus side, more negative feedback is introduced to attenuate certain frequencies and produce the cut conditions. The output of IC1B is fed to the pre-driver op-amp stage on the main amplifier board through pin 4 of J2.

Both IC1A and IC1B are fed voltages from the ±14 volts supply on the main amplifier. Except for the ±14 volts supplies on the dual tone control assembly all other DC voltages on this board are 0 volt ±50 millivolts.

c. Trouble Shooting the Dual Tone Control PC Board Assembly.

(a) If the dual tone control board assembly has attenuation, the fault is probably in the IC1B. Any excessive DC offsets at pin 7 of IC1B can be traced either to a defective IC or the lack of balanced ±14 volts DC supplies to this board.

(b) Defective AC signal paths on this board can be found by noting the frequency at which the board deviates from specification. If there is deviation in the low frequency (lower than 350Hz range) the problem is most likely due to a defect in R20, C13, C12, R17 or the bass control itself. A defect in higher frequencies (3500Hz and up) will be found in the treble side of the system. Look for defects in R19, R21, C14 or the treble control itself.

(c) In some instances a crackling sound may be heard in the audio output as the bass control is rotated; this indicates a defective wiper in the bass control. The bass control has a DC current path from the output of IC1B back to the inverting input (the treble control will not produce the same kind of scratchy effect if defective).

(3) Pre-Driver IC Stage.

Utilizing the second half of IC1, this stage provides amplification and control of the audio signal for presentation to the driver and power output stages of the amplifier. The large open loop gain of IC1 allows it to clean-up the signals presented to the driver and output stages. This stage also compares the output signal applied to the speaker with the input signal coming from the tone control stage. The pre-driver corrects any non-linearity in the output waveform so that it resembles, as close as possible, the input waveform from the tone control stage. Thus, any non-linearities in the driver transistors or power output transistors are removed from the system.

Main parts comprising the pre-driver IC stage are: second half of IC1, C3, C11, C5, R4, R5 and R23. C3 couples the signal from the tone control stage to the non-inverting input of the pre-driver IC and also provides DC isolation of the non-inverting input. R5 references the non-inverting input to the DC ground potential (0 volt). The resistance of R5 is equal to the resistance of R23 to insure that the DC offset voltage appearing at the IC output pin (pin 7) is held as nearly as possible to 0 volt DC. The power amplifier circuit is designed to be used without capacitor coupling between the output of the power amplifier and speaker; so the DC output voltage must be kept as close as possible to ground. R23 provides a direct connection from the output of the power amplifier to the inverting input of the pre-driver stage. C11 DC isolates the inverting input pin from ground.

Therefore, the DC voltage appearing at the inverting input (pin 6) is exactly equal to the power amplifier output offset voltage. Since the lower end of resistor R5 is tied to ground, the DC output voltage for the entire power amplifier is 0 volt with respect to ground. Resistor R23 forms a divider with R4 for AC signals. The ratio of R23 to R4 sets the AC (signal) gain of the power amplifier stage. That is, if R23 is 330K ohms and R4 is 3.3K ohms the power amplifier voltage gain is 330 divided by 3.3; this equates to a voltage gain of 100.

The pre-driver output feeds the driver transistor stage.

(4) Driver Transistor Stage.

The driver transistor stage has two functions; (1) to boost the output current of the pre-driver sufficiently to drive the output transistor, and (2) to set the quiescent operating current of the output transistors. Q2 and Q3, the driver transistors, are maintained in a slightly conductive (on-state) condition when no signal is being applied to the amplifier. R9 and R10 source a small amount of current through D13 and D14. The D13 and D14 diode drops maintain Q2 and Q3 in the slightly "on" condition. Trimmer pot P2 adjusts the amount of voltage available to the bases of Q2 and Q3 to limit their base currents. The emitter-collector conduction of Q2 and Q3 is limited, thus limiting the base currents of Q4 and Q5. One of the small heat sinks on Q2 and Q3 is a formed aluminum part which cradles D13 and D14. This part transmits the heat developed in the driver transistor to the two diodes. As the temperatures of the driver transistors rise, these transistors tend to be "turned on" more fully. The thermal feedback to the diodes allows the diode junction to track the driver transistor junction so that a stable quiescent base current is maintained throughout the projector's operating temperature range. By controlling the collector-emitter resistance of the driver transistors, the on-state of Q4 and Q5 is also controlled.

(5) Power Output Transistor Stage.

The power output transistors Q4 and Q5 share a common heat sink with the exciter lamp series regulator Q7. These two transistors directly drive the load (speaker) while being controlled and fed signal from the driver transistors Q2 and Q3. Two pairs of resistors (R16, R12 and R17, R13) form local DC feedback networks from the power output transistor to the driver transistor. The driver transistor/power output transistor pair has a gain set by the associated feedback resistors. If R16 is 240 ohms and R12 is 15 ohms the stage gain is 240 divided by 15 which is approximately 16. That means the output of the power amplifier to the speaker should be approximately 16 times greater than the output of the pre-driver IC. This voltage gain is based on the output voltage swing of the pre-driver IC. Because the pre-driver IC is driven from a ±14VDC source, the maximum output voltage swing at pin 7 is approximately 22 volts peak-to-peak. If the output waveform is a sine wave, 22 volts peak-to-peak equals approximately 7.75 volts RMS. To obtain 15 watts output into an 8 ohm load, approximately 11 volts RMS must be produced across the load. This means some voltage gain is needed in the driver and power output stages; and the voltage gain of approximately 16 does not require an excessive amount of drive from the pre-driver IC. The overall gain of the pre-driver, driver, and power output stages is set by the ratio of R23 to R4, but the local voltage gain of 16 is not additive to the gain of the entire amplifier because the pre-driver IC gets its control feedback directly from the output of the power amplifier stage. R22 and C4 form a cell to allow the amplifier to work into a relatively low impedance load at high frequencies (above 30KHz). R20 and R21 act as local feedback sources to linearize the outputs of Q4 and Q5.

(6) Overload Protection Stage.

Transistor Q1 senses the emitter current of Q5. Q1 is driven from a half-wave rectifier stage comprised of D9, R6 and C10. As the power amplifier sources current to the speaker, the voltage drop across R20 (also functional above) increases.

NOTE: Because Q5 conducts only on the positive half of the output sine wave, the voltage wave form across R20 will look like the positive half of the output sine wave. As the voltage drop across R20 increases past 0.6 volt, D9 begins to conduct on the peaks. If the peak voltage across R20 increases above 1.0 volt, there will be sufficient voltage developed on C10 to turn on the base emitter junction of Q1. This voltage must remain present on repetitive peaks or R11 will discharge C10 and no action at the base emitter junction of Q1 will take place.

Since R20 is 0.33 ohms, 1.2 volts is developed with 3.64 amps peak emitter current flowing through Q5. This amount of current will flow from the amplifier only when a load of less than 3 ohms (a fault condition or short circuit) is connected to the output of the amplifier. As this or a greater amount of current flows, the voltage on C10 will build-up in a short period of time. When the voltage on capacitor C10 rises above 0.6 volt DC, Q1 turns on and directs current to flow from the positive terminal of the power supply into the gate of SCR Q8. Anytime more than 200 microamps of current flows into the gate of SCR Q8, the SCR will be turned on (go into its low impedance conduction state from anode to cathode) and when Q8 turns on, the ±14VDC sources are removed from the pre-driver IC (and the optical pre-amp IC as well). The SCR latches in the "on" state until the current flowing through it is reduced to near 0. Its operation sequence is as follows:

1: Amplifier senses extremely low impedance at its output.
2: Voltage drop on R20 exceeds 1.2 volts.
3: Q1 turns on.
4: SCR turns on and latches.
5: No sound is output from the system.
6: User notices sound is off, shuts down the projector.
7: User locates source of problem and corrects.
8: User turns projector back on again.

When the projector is off for more than 10 seconds, the current through the SCR decays to the point where the SCR is brought out of its latched condition. If the projector is turned back on at this time, it will not operate normally unless the cause of the problem has been cleared.

(7) Exciter Lamp Power Supply Stage.

The Type BAK exciter lamp has a normal rating of 4.0 volts at approximately 700 milliamperes current. Actually, the exciter lamp source is a negative DC (-3.9 volts DC set at the factory) with respect to the projector chassis frame ground. The exciter lamp voltage must be well regulated and virtually free of any noise which could degrade both the signal-to-noise ratio and dynamic range of the projector amplifier system. This dual function is handled by a voltage regulator/filter comprised of transistors Q6 and Q7, incorporated on the projector amplifier PC board.

D1 through D4 are connected in a conventional bridge system with capacitive input filter (C9). Q6 is connected as an emitter follower stage to control the base current of Q7. Q7 is located on the amplifier heat sink assembly so it can dissipate approximately 3.9 watts under normal operating conditions. The base of Q6 is connected to a variable voltage source which is divided down from the regulated -14 volts supply of the projector amplifier. The voltage at the arm of P1 should be approximately -4.6VDC with respect to projector frame ground. C12 filters any audio voltage components which would appear at the base of Q6. R41 and C6 prevent Q6 from becoming a common base oscillator. With the proper setting of pot P1, Q6 conducts just enough to maintain a constant voltage on the exciter lamp by controlling the base current to Q7. Q7 conducts only enough to maintain the exciter lamp at the proper -3.9 volts with less than 10 millivolts peak-to-peak noise.

SUPPLEMENT NO. 1

PARTS CATALOG

SLOT-THREADING FILMOSOUND® PROJECTOR

MODELS 1680G, 1680GS, 1680GSA

NOTE: THIS SUPPLEMENT IS TO BE USED TOGETHER WITH BASIC SERVICE MANUAL NO. 74403 (REV. FEB. 1980) FOR REPAIR AND ADJUSTING MODELS 1680G, 1680GS AND 1680GSA SLOT-THREADING, 16MM SOUND PROJECTORS.

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

SUPPLEMENT TO
PART NO. 74403

PRINTED IN U.S.A.

MARCH 1981

LIST OF ILLUSTRATIONS

RECOMMENDED SPARE PARTS LIST

FOR REPAIR OF 25

MODEL 1680G/1680GS/1680GSA

SLOT-THREADING 16MM SOUND PROJECTORS

REFERENCE: SUPPLEMENT NO. 1 TO SERVICE MANUAL NO. 74403

PART NO.	DESCRIPTION	QTY
48176	SPRING, Compression	2
432672	FUSE, Type 4AT	2
432673	FUSE, Type 2AT	3
707823	SWITCH, Rotary	1
709147	SPRING, Torsion	4
709771	FUSE, Slo-Blo, 2.5 amp	4
710399	LAMP, Projection, Type ELC	3
710519	SPRING, Torsion	2
710520	SPRING, Run/Still Lever	2
710622	CONTROL, Volume, 5K	1
710623	CONTROL, Bass, 100K	1
710624	CONTROL, Treble, 500K	1
711601	SPRING, Condenser retainer	2
711604	SPRING, Lamp retainer	2
043385	MOTOR ASSEMBLY, Drive	1
044231	MOTOR ASSEMBLY, Blower	1
078578	AMPLIFIER ASSEMBLY	2

INTRODUCTION

BASIC DIFFERENCES BETWEEN 1680 G SERIES GLOBAL MODELS

The 1680 G series are modified versions of the 1680 global models covered in parts manual 74403. The 1680 G series projectors are charcoal grey in color and are equipped with a volume control and two tone controls; one for treble and one for bass. The 1680 G series are also equipped with a run-still feature.

In addition, Models 1680GS and 1680GSA have Front Cover and Speaker Assemblies. Model 1680GSA is wired to meet Australian requirements.

All of the parts listings and exploded view illustrations for Model 1680 (covered in basic parts manual 74403) apply to Models 1680G, 1680GS and 1680GSA except as noted in this supplement. Additional parts listings, exploded view illustrations and schematic wiring diagrams are provided for the information necessary to service and repair the 1680G, 1680GS and 1680GSA slot-threading 16mm projectors.

Where applicable the 1680 G series is "letter" coded as follows:

1680G	P
1680GS	Q
1680GSA	R

FIGURE 1B PARTS DIFFERENCES

The 1680 G series projectors are charcoal grey in color. See figure S1 in this supplement for a complete parts breakdown of projector covers.

FIGURE 2 PARTS DIFFERENCES

The 1680G series projectors use a different lamphouse cover assembly, projection lamp and holder, nameplates and front and rear end cap assemblies. See figure S2 of this supplement for a complete parts breakdown and exploded view illustration of these parts.

FIGURE 3B PARTS DIFFERENCES (for the 1680 G series)

Item 3B-2A, Fuse - use part number 709771.

Item 3B-4, Fuseboard assembly - use part number 078666.

Item 3B-8, Rotary switch and bracket assembly - use part number 077966.

All other parts coded "F thru M" apply to the 1680 G series.

FIGURE 4 PARTS DIFFERENCES (for the 1680 G series)

Item 4-16, Brake release rod - use part number 710669.

Item 4-30, Rear reel arm assembly (charcoal color) - use part number 078167.

Item 4-33, Front reel arm assembly (charcoal color) - use part number 078166.

Item 4-34, Reel arm position decal - not used on 1680 G series projectors.

Item 4-35, Reel arm lock button assembly - use part number 078108 which is held in position with a 44408 retainer.

See figure S6 of this supplement for the parts listing and exploded view illustration of the added run/still service parts.

FIGURE 5 PARTS DIFFERENCES (for the 1680G series)

Item 5-, Lamp interlock switch assembly - use part number 016284.

FIGURE 6 PARTS DIFFERENCES

See figure S3 of this supplement for projector base electrical parts applicable to the 1680 G series.

FIGURE 7 PARTS DIFFERENCES (for the 1680 G series)

Item 7-15, Torsion spring - use part number 710610.

Item 7-24, Projector mainplate assembly - use part number 078155.

Item 7-25, Base assembly - use part number 078145.

Item 7-25K, Projector base (charcoal color) - use part number 710488.

The serial number identification is now stamped on the plate shown on figure S2, this supplement.

NOTE: The replacement threading label for the 1680 G series is part number 707131.

FIGURE 8 PARTS DIFFERENCES

See figure S4 of this supplement for the control plate assembly service replacement parts applicable to the 1680 G series.

FIGURE 9 PARTS DIFFERENCES (for the 1680 G series)

Item 9-, Front end cap assembly - use part number 078141.

Item 9-3, Speaker - use part number 708994.

Item 9-5, Front end cap - use part number 710482.

Items 9-1, 9-2 and 9-4 from basic parts manual 74403 apply to the 1680G series.

FIGURE 10 PARTS DIFFERENCES

See figure S5 of this supplement for rear end cap assembly parts applicable to the 1680 G series.

FIGURE 12 PARTS DIFFERENCES (for the 1680 G series)

Item 12-, Rear reel arm assembly (charcoal color) - use part number 078167.

Item 12-3, Shim washers are not used on 1680 G series projectors.

Item 12-7, Take-up spindle and pulley assembly - use part no. 044178.

Item 12-16, Lower face gear shaft - use part number 711622.

FIGURE 13 PARTS DIFFERENCES (for the 1680 G series)

Item 13-, Front reel arm assembly (charcoal color) - use part number 078166.

Item 13-2, Front reel arm cover - use part number 710405.

Item 13-3 (shim washer) and 5C (flat washers) are not used.

Item 13-5D, Feed spindle assembly - use part number 043390.

Item 13-14, Front reel arm shaft - use part number 707111.

Item 13-22, Front reel arm and bearing assembly - use part number 078119.

FIGURE 14 PARTS DIFFERENCES

The 1680G series projectors use a mechanism assembly that features run/still parts and animation clutch parts. The mechanism is not available as a complete assembly. See figures S6, S7 and S8 in this supplement for service parts breakdown.

FIGURE 15 PARTS DIFFERENCES (for the 1680 G series)

Item 15-4, Motor interlock switch assembly - use part number 016285.

Item 15-10, Lower stabilizer arm assembly - use part number 016976.

Item 15-38, Retention pawl assembly - use part number 078552.

FIGURE 16 PARTS DIFFERENCES (for the 1680 G series)

Item 16-28, Mode selector bushing assembly - use part number 077452.

FIGURE 17 PARTS DIFFERENCES (for the 1680 G series)

Item 17-5, Two-blade shutter - use part number 41309.

Item 17-24, Worm gear assembly - use part number 09709.

Item 17-25A, Camshaft - use part number 710766.

Item 17-33, Mechanism housing assembly - use part number 078143.

Also see figure S8 in this supplement for animation clutch and related parts breakdown.

See figure S6 in this supplement for run/still and brake assembly parts.

FIGURE 19 PARTS DIFFERENCES

The 1680GS and GSA projectors use a different front cover and speaker assembly and are not available as a complete assembly. See figure S9 in this supplement for a complete piece parts breakdown.

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR COVERS		
		(See Figure S9 for Front Cover and Speaker Assembly Detail Parts - 1680GS/1680GSA)		
S1-1	016684	COVER ASSEMBLY, Front	1	P
-1A	700816	. RIVET, Semi-tubular	4	P
-1B	45083	. LATCH, Cover release	2	P
-1C	49283	. SPRING, Cover latch, front	1	P
-1D	707751	. SPRING, Cover latch, rear	1	P
-1E	NPN	. COVER, Front (replace complete cover assy)	NP	P
-1F	710456	. NAMEPLATE, Front cover (adhesive backed)	1	P
-2	077178	KNOB ASSEMBLY, Loop restorer	1	
-3	078126	COVER ASSEMBLY, Exciter lamp	1	
-3A	20808	. RING, Retaining, 0.145 inch ID	1	
-3B	710421	. THUMBSCREW, Cover retaining	1	
-3C	34787	. PLUG, Hole	1	
-3D	NPN	. COVER, Exciter lamp (replace complete cover assy)	NP	
-4	078694	COVER ASSEMBLY, Lens	1	
-4A	48375	. RING, Compression	1	
-4B	710451	. NAMEPLATE, Lens cover (adhesive backed)	1	
-4C	NPN	. COVER, Lens (replace complete cover assy)	NP	
-4D	710437	SCREW, Slotted pan head, 4-40 by 5/8 inch	1	
-4E	710438	SCREW, Slotted pan head, 4-40 by 7/8 inch	1	
-5	46367	SCREW, Lock plate, No. 7 by 5/16 inch	1	
-6	437731	LOCK PLATE, Voltage selector	1	
-7	49275	SCREW, Rear cover, lower	3	
-8	49637	SCREW, Rear cover, upper	4	
-9	078172	COVER AND CONTROLS ASSEMBLY, Rear	1	PQ
-9	078173	COVER AND CONTROLS ASSEMBLY, Rear	1	R
-9A	49638	. SCREW, Control plate, 6-32 by 1/2 inch	4	
-9B	078192	. CONTROL PLATE ASSEMBLY (See Figure S4 for detail parts)	1	PQ
-9B	078193	. CONTROL PLATE ASSEMBLY (See Figure S4 for detail parts)	1	R
-9C	48190	. COVER, Rear	1	
-10	436947	. SCREW, Phillips oval head, M2.6 by 0.5	2	
-10	437609	. SCREW, Speed selector switch	2	
-11	436845	. SWITCH, Speed selector	1	
-12	436952	. SCREW, Phillips binding head, M2 by 6.0	2	PQ
-12	437611	. SCREW, Speed change bracket	2	R
-13	707125	. BRACKET, Speed change printed circuit board	1	
-14	436951	. SCREW, Phillips binding head, M2.6 by 4.0	2	
-15	043465	. P.C. BOARD ASSEMBLY, Speed change	1	
-16	49638	SCREW, Hex washer head, 6-32 by 1/2 inch	2	
-17	NPN	COVER AND HANDLE ASSEMBLY, Top	NP	
-17A	707449	. SCREW, Hex washer head, 8-18	4	
-17B	48063	. BRACKET, Cover mounting	2	
-17C	48052	. HANDLE, Carrying	1	
-17D	078586	. COVER AND STRIKERS ASSEMBLY, Top	1	
-18	707447	TRIMPLATE, Carrying handle (adhesive backed)	1	
-19	30822	SCREW, Hex washer head, 10-32 by 7/16 inch	1	
-20	016522	WIRE TIE	1	

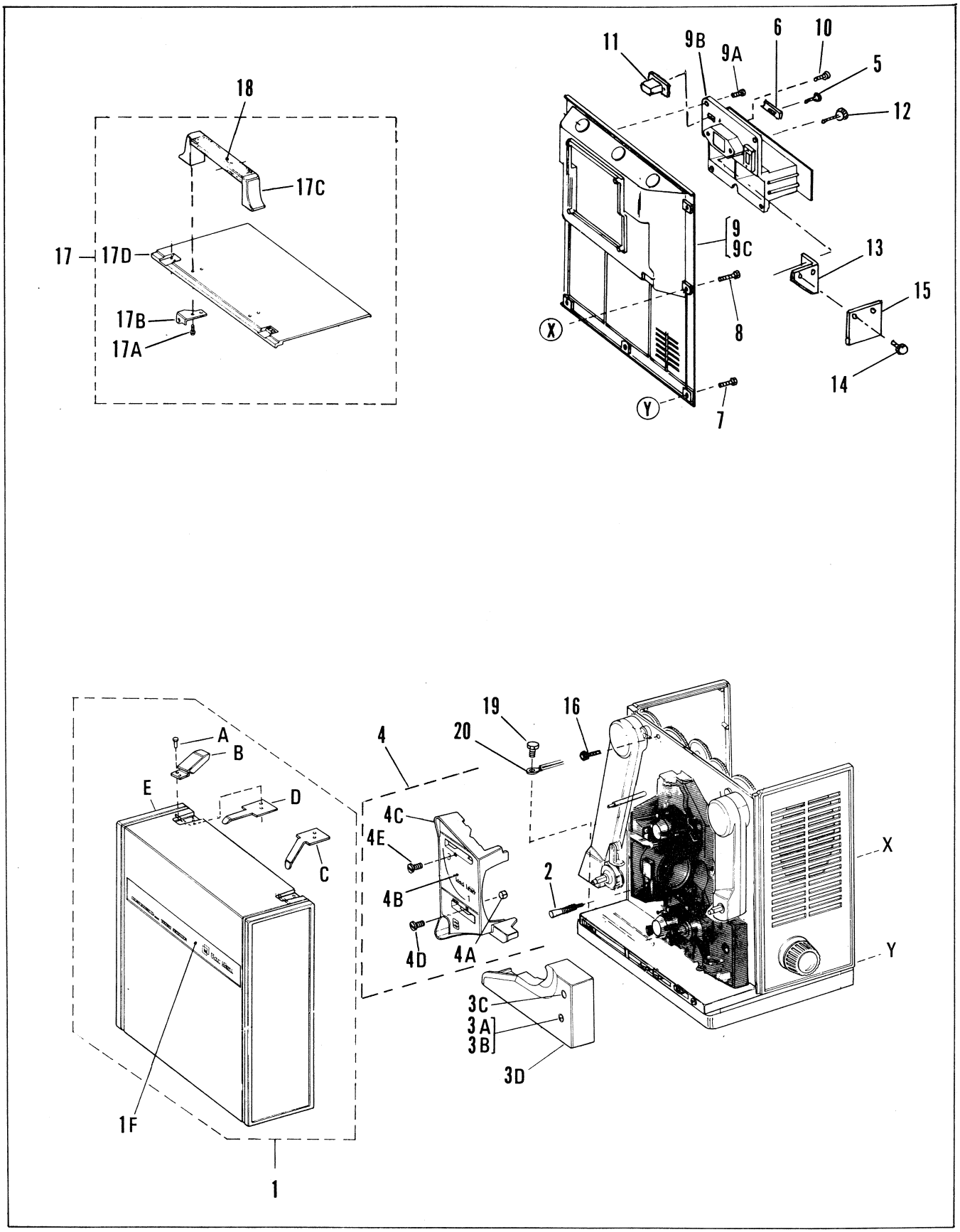


Figure S1. Projector Covers

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		LAMPHOUSE AND END CAPS		
S2-1	36769	SETSCREW, Fluted socket cup pt, 8-32 by 1/4 inch	1	
-2	09807	KNOB ASSEMBLY, Tilt	1	
-3	710459	KNOB, Main switch	1	
-3A	30211	RING, Grip	1	
-3B	710768	SHIELD, Heat	1	
-4	766395	SCREW, Hex washer head, 6-32 by 5/16 inch	3	
-5	078685	LAMPHOUSE ASSEMBLY	1	
-5A	48493	. SCREW, Pan head tapping, 4-24 by 3/16 inch	6	
-5B	48466	. LOCKWASHER	3	
-5C	48385	. LATCH, Lamphouse	2	
-5D	710715	. SHIELD, Heat	1	
-5E	078678	. BRACKET AND HINGE ASSEMBLY	1	
-5F	NPN	. LAMPHOUSE (replace complete assy)	NP	
-5G	710718	. SHIELD, Heat	2	
-5H	13918	. WASHER, Flat	2	
-5J	17676	. RING, Retaining, external, 0.156 inch ID	2	
-5K	710996	. SHAFT, Exit roller	1	
-5L	710995	. ROLLER, Exit	1	
-6	710546	. LABEL, Lamp designation (adhesive backed)	1	
-7	710396	LAMP, Projection (Type ELC)	1	
-8	078530	SOCKET, Projection lamp	1	
-9	710845	STRAIN RELIEF, Lamp socket	1	
-10	710604	NAMEPLATE, Volume/Tone (adhesive backed)	1	
-11	078141	END CAP ASSEMBLY, Front (see Figure 9 in basic parts manual no. 74403 for replacement parts)	1	
-12	49637	SCREW, Hex washer head, 6-32 by 3/4 inch	4	
-13	078169	END CAP ASSEMBLY, Rear (see Figure S5 for replacement parts)	1	
-14	710603	NAMEPLATE, Model and serial no. (see NOTE)	1	
-15	710602	NAMEPLATE, Lamphouse (adhesive backed)	1	

NOTE: This part is stamped with unit model and serial number. When ordering a replacement part, return the nameplate from the customer's unit, so that the replacement part can be stamped accordingly.

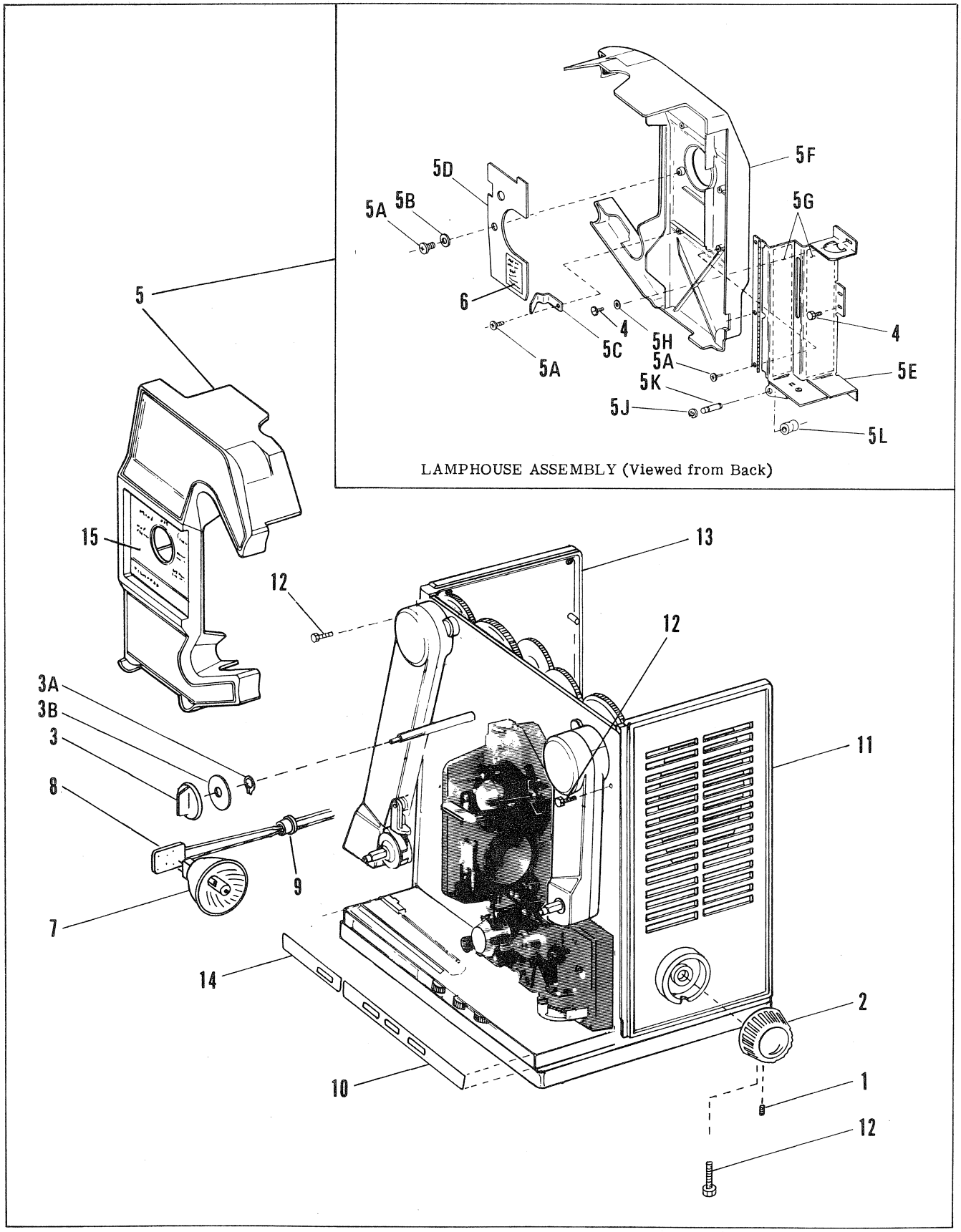


Figure S2. Lamphouse and End Caps

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR BASE ELECTRICAL COMPONENTS		
S3-1	766395	SCREW, Hex washer head, 6-32 by 5/16 inch	4	
-2	48078	COVER, Volume/Tone control	1	
-3	708237	PLUG, Hole	1	
-4	766395	SCREW, Hex washer head, 6-32 by 5/16 inch	5	
-5	48069	COVER, Amplifier assembly	1	
-6	30808	SCREW, Hex washer head, 6-32 by 5/16 inch	2	
-7	30811	SCREW, Hex washer head, 6-32 by 5/8 inch	3	
-8	47974	SPACER, Sleeve	3	
-9	016839	EDGE CONNECTOR ASSEMBLY	1	
-10	078578	AMPLIFIER ASSEMBLY (See NOTE)	1	
-11	766395	SCREW, Hex washer head, 6-32 by 5/16 inch	4	
-12	078561	VOLUME AND TONE CONTROL ASSEMBLY	1	
-12A	48074	. KNOB, Control	3	
-12B	48075	. TRIMPLATE, Volume knob (adhesive backed)	1	
-12C	48076	. TRIMPLATE, Tone knob (adhesive backed)	2	
-12D	710622	. CONTROL, Volume, 5K	1	
-12E	710623	. CONTROL, Tone, bass, 100K	1	
-12F	710624	. CONTROL, Tone, treble, 500K	1	
-12G	NPN	. BOARD ASSEMBLY, Controls (replace complete assy)	NP	
-13	34884	LAMP, Exciter (BAK)	1	
-14	34892	LABEL, Exciter lamp type (adhesive backed)	1	
-15	45057	EDGE CONNECTOR, Soundhead PCB	1	
-16	016679	JACK ASSEMBLY, Microphone (with mounting parts)	1	
-17	30802	SCREW, Hex washer head, 4-40 by 1/8 inch	2	
-18	044685	SERVO AMPLIFIER	1	
-19	436977	CONNECTOR, Servo amplifier	1	
-20	078579	EDGE CONNECTOR, P.C. Board (on component side)	1	

NOTE: Part number listed is for a NEW amplifier assembly. For a REBUILT amplifier assembly add (-001) to the appropriate part number.

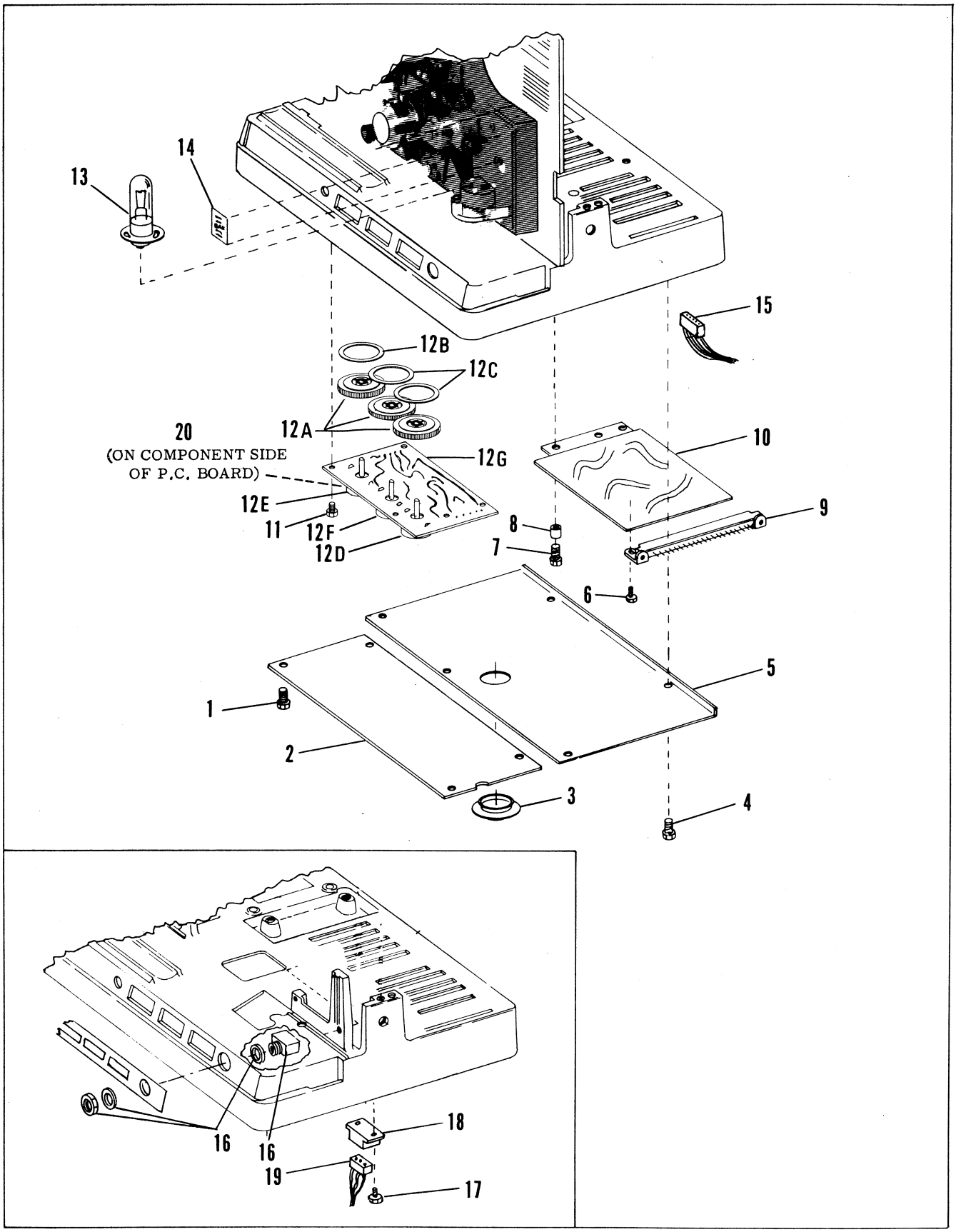


Figure S3. Projector Base Electrical Components

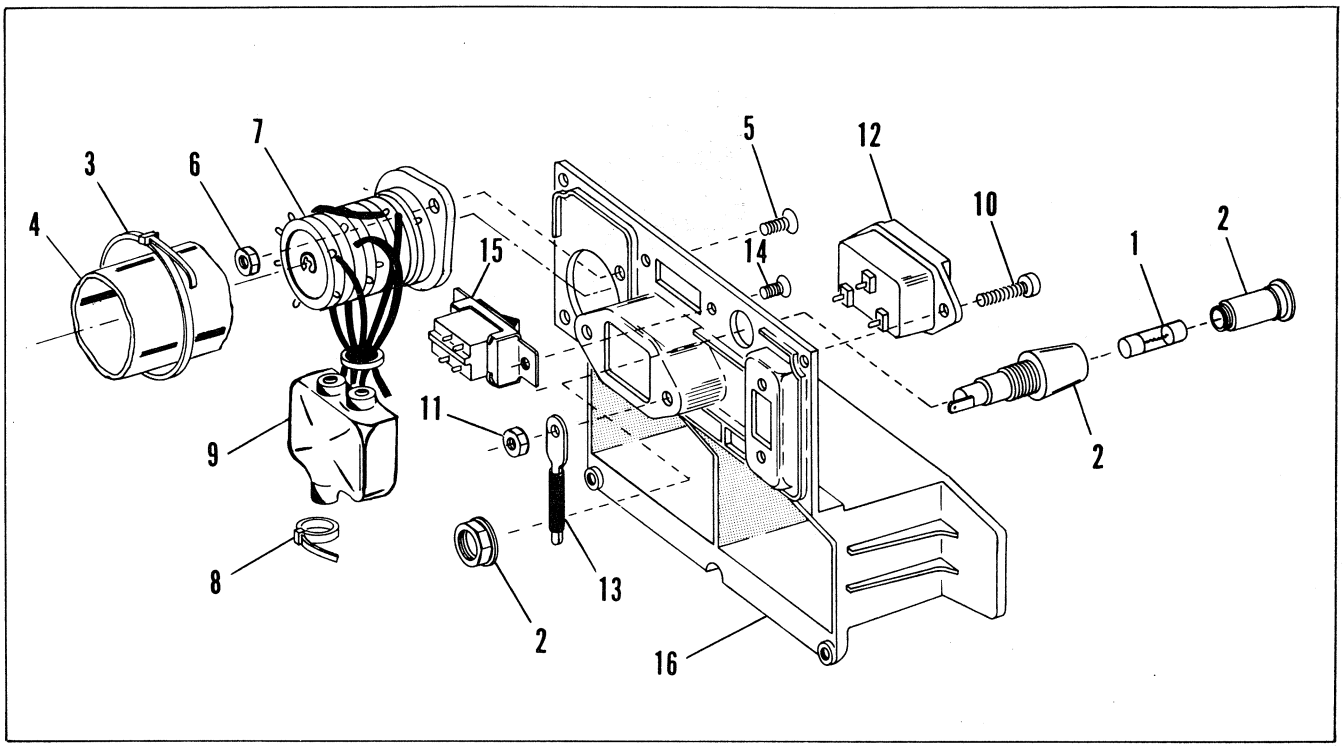


Figure S4. Control Plate Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		CONTROL PLATE ASSEMBLY		
S4-	078192	CONTROL PLATE ASSEMBLY	REF	PQ
S4-	078193	CONTROL PLATE ASSEMBLY	REF	R
-1	432672	. FUSE, 4AT	1	
-2	435177	. FUSEHOLDER (with mounting parts)	1	
-3	707140	. TIE WRAP	1	
-4	711621	. INSULATOR, Voltage selector	1	
-5	436949	. SCREW, Phillips oval head, M3 by 10.0	2	PQ
-5	437756	. SCREW, Voltage selector	2	R
-6	436950	. NUT, Hex	2	
-7	043966	. SWITCH ASSEMBLY, Voltage selector	1	
-8	45767	. TIE WRAP	1	
-9	437417	. INSULATOR, Input socket	1	
-10	434198	. SCREW, Phillips binding head, M3 by 16.0	2	
-11	436950	. NUT, Hex	2	
-12	437559	. SOCKET, Line input	1	
-13	072848	. CLAMP AND SLEEVE ASSEMBLY, Leadwire	2	
-14	436948	. SCREW, Phillips oval head, M3 by 0.5	2	PQ
-14	437610	. SCREW, Main switch	2	R
-15	015865	. SWITCH ASSEMBLY, Main	1	
-16	48186	. PLATE, Switch and socket	1	

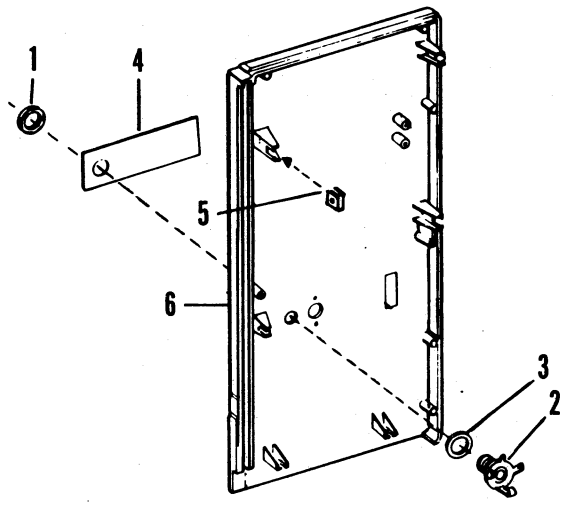


Figure S5. Rear End Cap Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		REAR END CAP ASSEMBLY		
S5-	078169	END CAP ASSEMBLY, Rear	REF	
-1	19010	. NUT, Lock	1	
-2	43878	. JACK, Speaker (includes items -1 and -3)	1	
-3	25368	. WASHER, Lock	1	
-4	710600	. TRIMPLATE, Speaker jack (adhesive backed) . . .	1	
-5	709218	. NUT, Speed	6	
-6	710481	. END CAP, Rear	1	

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		RUN/STILL AND BRAKE ASSEMBLIES		
S6-1	711623	PROTECTOR, Edge	1	
-2	710644	DECAL, Run/Still	1	
-3	36763	SETSCREW, Fluted socket cup pt, 6-32 by 1/2 inch	3	
-4	36533	COLLAR	3	
-5	48176	SPRING, Compression	2	
-6	44516	ROD, Run/Still	1	
-7	710508	ROD, Heat shutter	1	
-8	765777	RING, Retaining, external, 0.250 inch ID	1	
-9	078218	BRAKE ARM ASSEMBLY	1	
-9A	710522	. ROLLER, Brake	1	
-9B	765449	. RING, Retaining, external, 0.188 inch ID	1	
-9C	078217	. ARM AND POST ASSEMBLY, Brake	2	
-9D	30803	. SCREW, Hex washer head, 4-40 by 3/16 inch	1	
-9E	710516	. PLATE, Brake adjustment	1	
-10	765449	RING, Retaining, external, 0.188 inch ID	6	
-11	078216	LINK ASSEMBLY, Run/Still	1	
-12	710520	SPRING, Run/Still lever	1	
-13	078219	LEVER ASSEMBLY, Run/Still	1	
-13A	710524	. LEVER, Run/Still	1	
-13B	710526	. KNOB, Run/Still	1	
-13C	710525	. POST, Run/Still	2	
-13D	765449	. RING, Retaining, external, 0.188 inch ID	2	
-14	710517	PIVOT, Run/Still link	1	
-15	710518	STOP, Run/Still link	1	
-16	710519	SPRING, Torsion	1	
-17	765449	RING, Retaining, external, 0.188 inch ID	1	

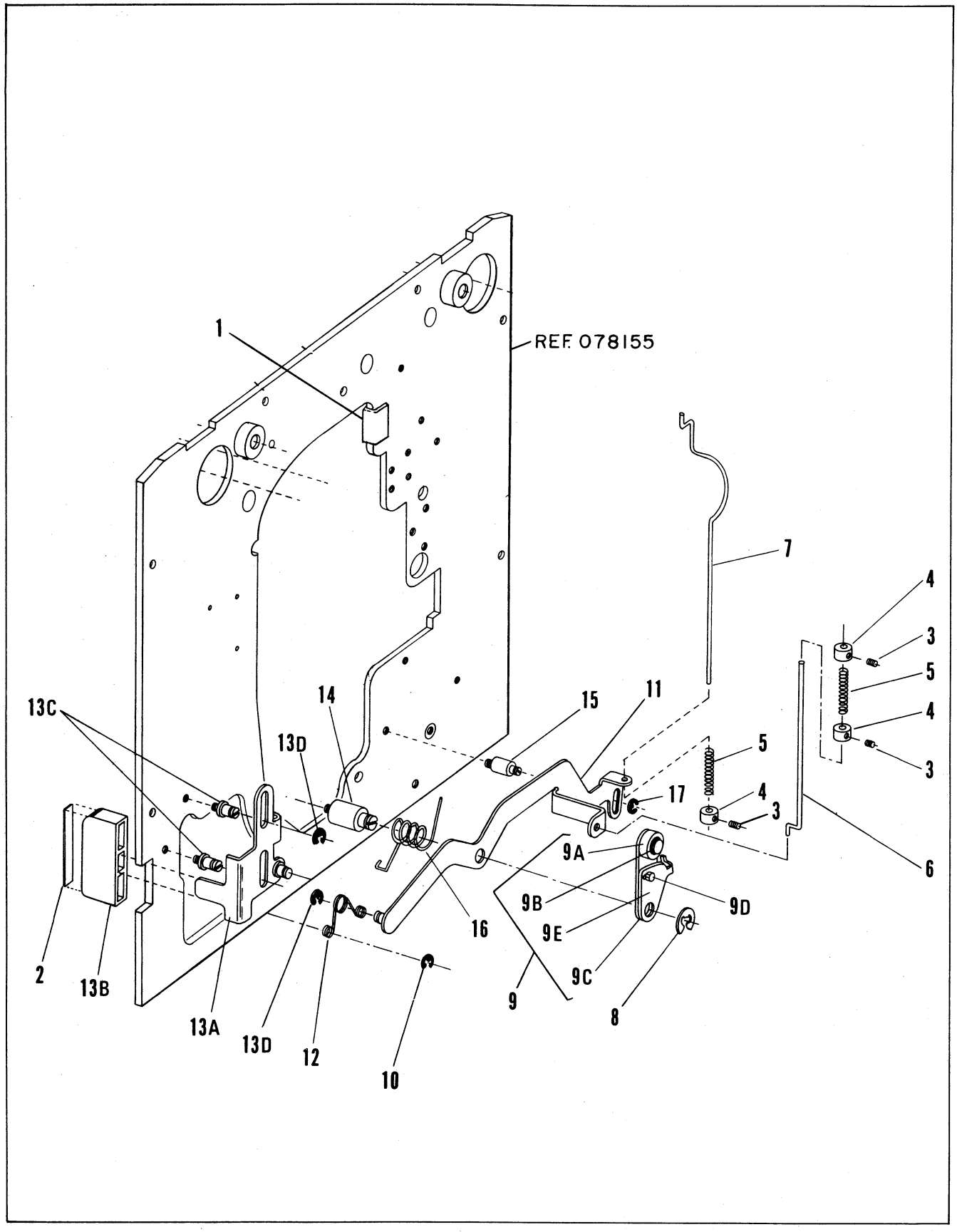


Figure S6. Run/Still and Brake Assemblies

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY — VIEW I		
S7-	NPN	MECHANISM ASSEMBLY, Complete	NP	
-1	30809	. SCREW, Hex washer head, 6-32 by 3/8 inch	4	
-2	711604	. SPRING, Lamp retainer	1	
-3	078688	HEAT SHUTTER ASSEMBLY	1	
-3A	31143	. . SPRING, Tension	1	
-3B	711601	. . SPRING, Filter retainer	1	
-3C	31407	. . DISC, Heat filter	1	
-3D	204129	. . FILTER, Heat	1	
-4	36770	. SETSCREW, Fluted socket cup pt, 8-32 by 1/4 inch	2	
-5	709593	. PULLEY, Mechanism	1	
-6	30809	. SCREW, Hex washer head, 6-32 by 3/8 inch	2	
-7	36662	. BAFFLE, Heat	1	
-8	700424	. SETSCREW, Load lever	2	
-9	710426	. LEVER, Load	1	
-10	710452	. TRIMPLATE, Entrance roller (adhesive backed)	1	
-11	710420	. RETAINER, Entrance roller	1	
-12	710457	. ROLLER, Entrance	1	
-13	30163	. SCREW, Slotted binding head, 5-40 by 3/8 inch	1	
-14	31674	. WASHER, Flat	1	
-15	016086	. ROLLER ASSEMBLY, Stabilizer	1	
-16	48367	. STOP, Lamphouse, lower	1	
-17	30804	. SCREW, Hex washer head, 4-40 by 1/4 inch	2	
-18	709148	. PLATE, Impedance roller adjusting	1	
-19	707048	. NUT, Roller assembly	1	
-20	077181	. ROLLER AND PLATE ASSEMBLY, Impedance	1	
-21	709149	. SPRING, Torsion	1	
-22	31245	. RING, Grip	1	
-23	709147	. SPRING, Torsion	1	
-24	30805	. SCREW, Hex washer head, 4-40 by 3/8 inch	2	
-25	611734	. LOCKWASHER, Internal tooth	2	
-26	48485	. BOARD, Printed circuit	1	
-27	30812	. SCREW, Hex washer head, 6-32 by 3/4 inch	1	
-28	36765	. SETSCREW, Fluted socket cup pt, 6-32 by 1/4 inch	1	
-29	020240	. OPTICAL SLIT ASSEMBLY	1	
-30	31669	. RETAINER, Photocell	1	
-31	016293	. PHOTOCELL AND HOLDER ASSEMBLY	1	
-32	36668	. SCREW, Pan head Sems, 6-32 by 5/16 inch	2	
-33	710453	. INSERT, Decorative (adhesive backed)	1	
-33A	611767	. RING, Retaining	1	
-33B	710458	. ROLLER, Threading	1	
-34	015537	. SOUND DRUM AND SHAFT ASSEMBLY	1	
-35	09828	. CONTACT ASSEMBLY, Exciter lamp	1	
-35A	31638	. SCREW, Fillister head, 6-32 by 7/16 inch	2	
-36	31636	. RING, Lamp release (B&H grease #070034)	1	
-37	36771	. SETSCREW, Fluted socket cup pt, 8-32 by 3/8 inch	4	
-38	016808	. GEAR ASSEMBLY, Helical, upper	1	
-39	31015	. WASHER, Spring tension	2	
-39A	708640	. WASHER, Flat	2	
-40	015538	. GEAR ASSEMBLY, Helical, lower	1	
-41	48335	. SHAFT, Helical gear, lower	1	
-42	24903	. RING, Retaining, crescent	1	
-43	015535	. SPROCKET ASSEMBLY, Upper	1	
-44	87030	. RING, Grip	1	
-45	31017	. WASHER, Thrust	3	
-46	36764	. SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	2	
-47	015533	. GEAR ASSEMBLY, Lower sprocket	1	
-48	31015	. WASHER, Spring tension	1	
-49	078551	. SPROCKET ASSEMBLY, Lower	1	
-50	35910	. FLANGE, Lower sprocket	1	
G	070034	GREASE		
L	08963	OIL		
L1	07215	OIL		

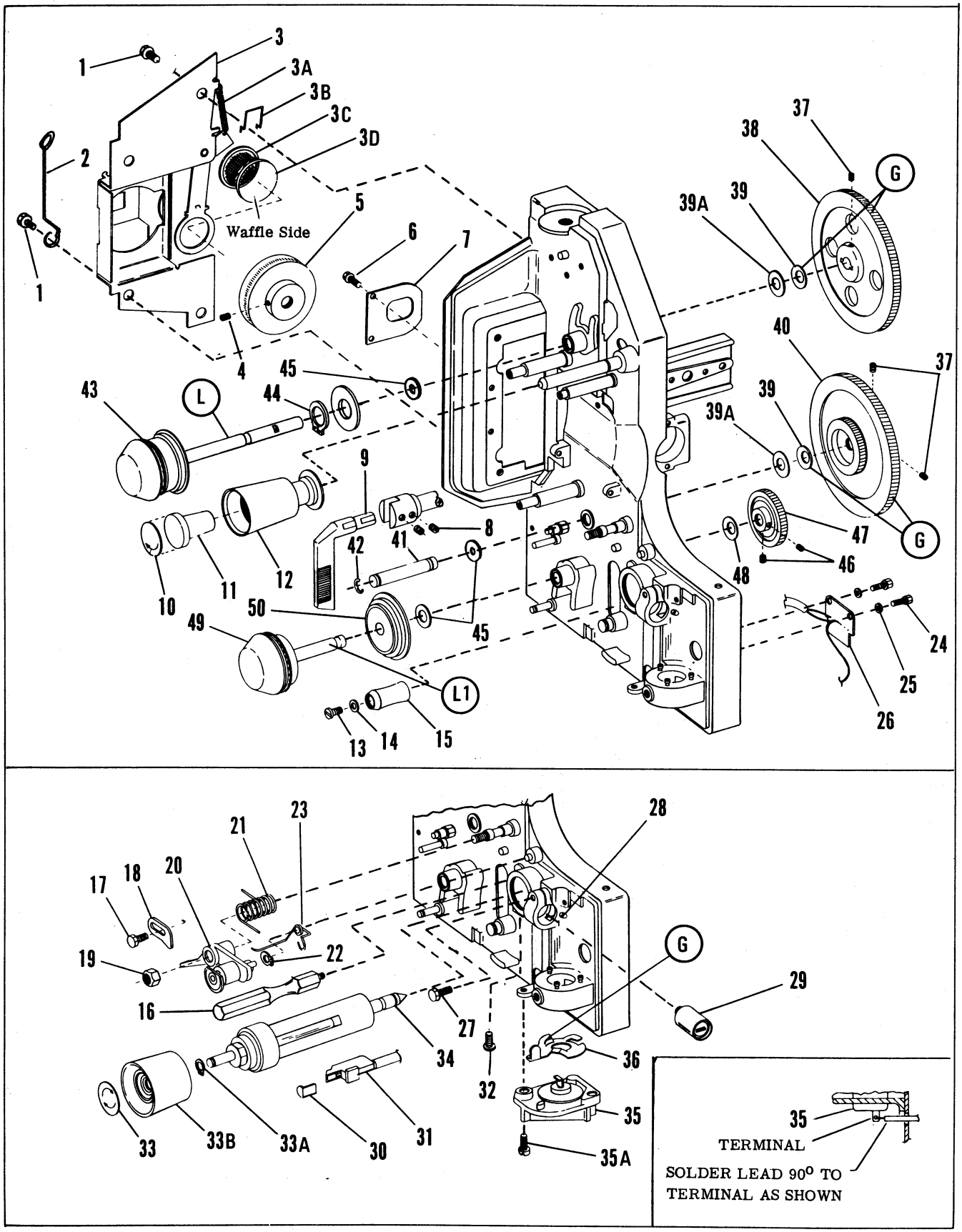


Figure S7. Mechanism Assembly — View I (Heat Shutter, Impedance Roller Lower Sprocket, Photocell and Sound Drum Parts)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY — ANIMATED CLUTCH PARTS		
S8-1	30808	. SCREW, Hex washer head, 6-32 by 5/16 inch	2	
-2	41377	. SCREW, Shoulder	2	
-3	44325	. . BRACKET, Stop pawl shaft	1	
-4	24852	. . GROMMET, Rubber	2	
-5	078154	. BEARING BRACKET ASSEMBLY	1	
-5A	20808	. . RING, Retaining, external, 0.145 inch ID	2	
-5B	31396	. . SHAFT, Stop pawl	1	
-5C	48177	. . PAWL, Stop	1	
-5D	31398	. . BRACKET, Bearing	1	
-6	31009	. RING, Retaining, internal, bowed, 0.866 inch ID	1	
-7	436897	. KNOB, Inching	1	
-8	31909	. SETSCREW, Flat pt, 5-40 by 3/16 inch	2	
-9	30804	. SCREW, Hex washer head, 4-40 by 1/4 inch	2	
-10	710436	. SPRING, Bearing loading	1	
-11	31007	. BEARING, Ball	1	
-12	09710	. CLUTCH ASSEMBLY, Driver	1	
-13	31035	. SPRING, Torsion, clutch	1	
-14	09711	. CLUTCH ASSEMBLY, Driven	1	
-15	21736	. RING, Retaining, external, 0.207 inch ID	2	
-16	31029.	. WASHER, Shim (use 31029 and/or 44205)	AR	
-17	31400	. BEARING, Sleeve	1	
-18	31145	. TRIGGER	1	
-19	31149	. PIN, Shoulder	2	
-20	31147	. YOKE, Clutch	1	
-21	31148	. SPRING, Compression	1	
-22	09728	. BEARING ASSEMBLY	1	
-23	31031	. BUSHING, Rubber	3	
-24	09709	. WORM GEAR ASSEMBLY	1	
-25	31029	. WASHER, Shim (use item -25 and/or item -26)	AR	
-26	44205	. WASHER, Shim	AR	
-27	31078	. RING, Retaining, external, bowed, 0.312 inch ID	1	
-28	31006	. BEARING, Ball	1	
-29	710766	. CAMSHAFT	1	
-30	078143	. HOUSING ASSEMBLY, Mechanism	1	
-31	709756	. NUT, Round	1	
-32	31020	. WASHER, Flat	1	
-33	31048	. BRACKET, Shuttle adjustment	1	
-34	31551	. SCREW, Pan head, 5-40 by 1/4 inch	1	
-35	30162	. SCREW, Binding head, 5-40 by 3/8 inch	1	
-36	31977	. WASHER, Lock	2	
-37	09870	. BRACKET ASSEMBLY, Animated clutch	1	
-37A	31405	. . SETSCREW, Fluted socket oval pt, 4-40 by 3/8 inch	1	
-37B	17639	. . RING, Retaining, external, 0.125 inch ID	3	
-37C	31403	. . SHAFT, Clutch bracket	1	
-37D	31399	. . BUMPER, Slide	1	
-37E	31456	. . WASHER, Flat	1	
-37F	31036	. . SPRING, Compression	1	
-37G	09886	. . BAR ASSEMBLY, Clutch slide	1	
-37H	30803	. . SCREW, Hex washer head, 4-40 by 3/16 inch	1	
-37J	34784	. . WASHER, Flat	1	
-37K	41318	. . STRIKE	1	
-37L	09885	. . BRACKET ASSEMBLY, Clutch	1	
G	070034	GREASE		

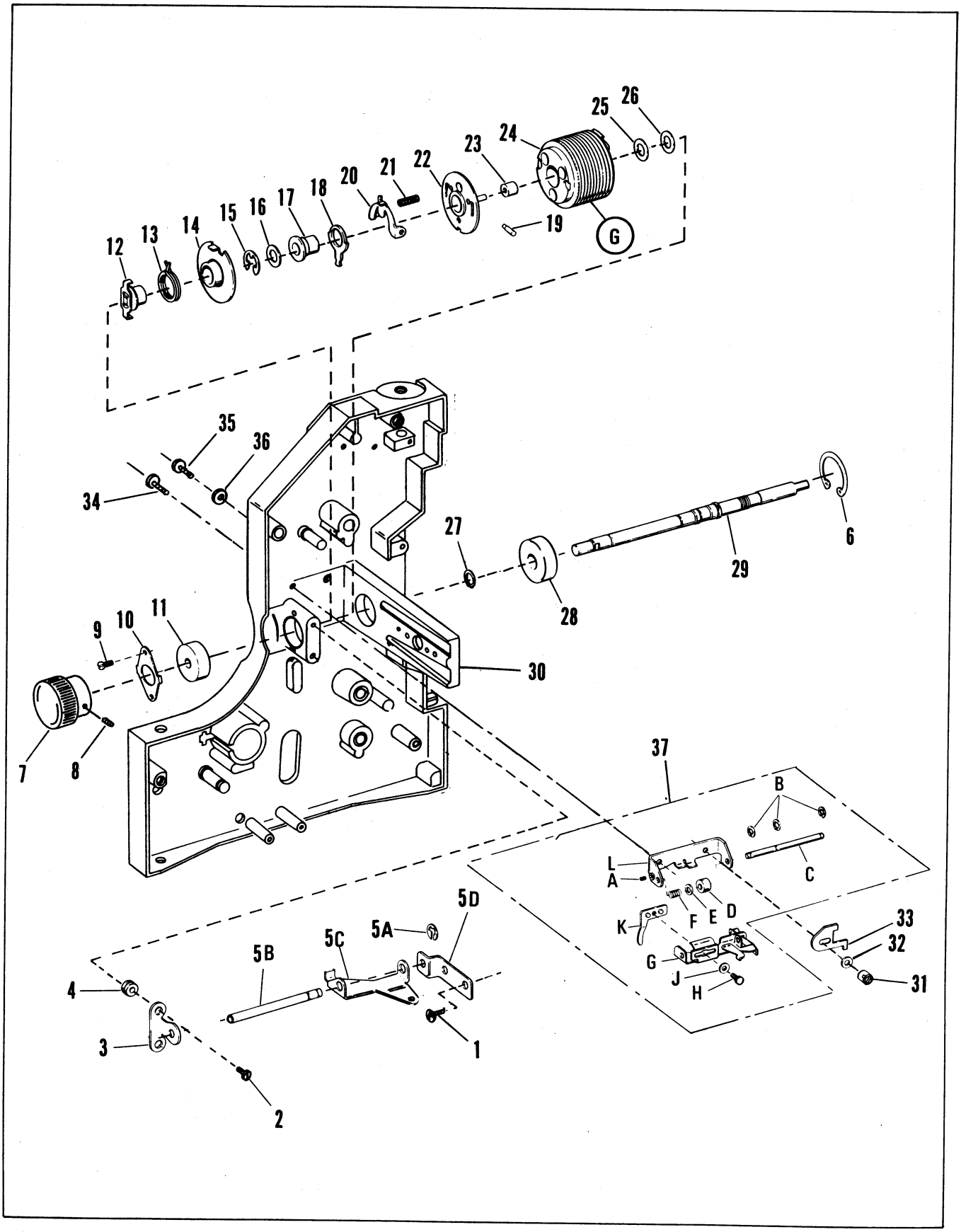


Figure S8. Mechanism Assembly — View II (Animated Clutch Parts)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		FRONT COVER AND SPEAKER ASSEMBLY (MODELS 1680GS AND 1680GSA)		
S9-	No Number	COVER AND SPEAKER ASSEMBLY, Front	NP	
-1A	078271	. COVER ASSEMBLY, Front (includes items 1 through 7)	1	
-1	765460	. . RIVET, Semi-tubular	4	
-2	45083	. . LATCH, Cover release	2	
-3	707751	. . SPRING, Latch	2	
-4	49284	. . PLATE, Stiffener	1	
-5	710448	. . NAMEPLATE, Front cover (adhesive backed)	1	
-6	31561	. . FOOT, Rubber (secure with adhesive)	2	
-7	710682	. . DAMPER, Vibration (adhesive backed)	1	
-8	710774	. SCREW, Slotted flat head	1	
-9	309923	. NUT, Hex Sems	1	
-10	707414	. CLAMP, Leadwire	1	
-11	45102	. NUT, Tinnermann	7	
-12	No Number	. BAFFLE BOARD ASSEMBLY	NP	
-13	710810	. . SCREW, Slotted flat head	8	
-14	35164	. . NUT, Plain hex	8	
-15	440662	. . SPEAKER	2	
-16	440664	. . NAMEPLATE, Speaker	1	
-17	710650	. . CUSHION	1	
-18	707770	. . CUSHION	1	
-19	710651	. . GRILLE CLOTH (cement in place)	1	
-20	707416	. . SCREW, Slotted flat head	4	
-21	436895	. . CORD WRAP	1	
-22	48493	. . SCREW, Phillips head tapping	2	
-23	434684	. . JACK, Auxiliary speaker	1	
-24	043384	. . LINE CORD ASSEMBLY (see wiring diagram)	1	
-25	710005	. LABEL, Threading (adhesive backed)	1	
A	70509	ADHESIVE		

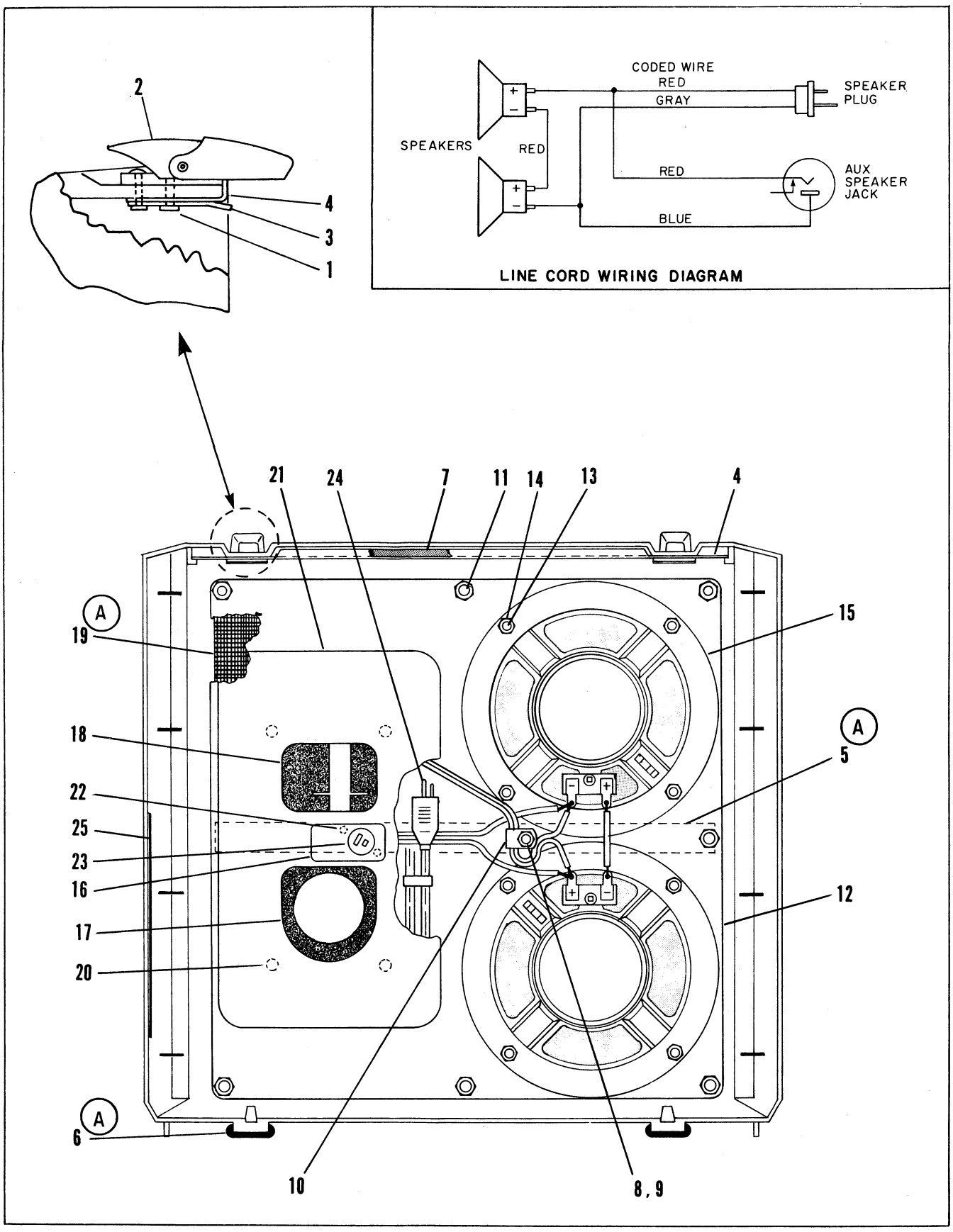


Figure S9. Front Cover and Speaker Assembly

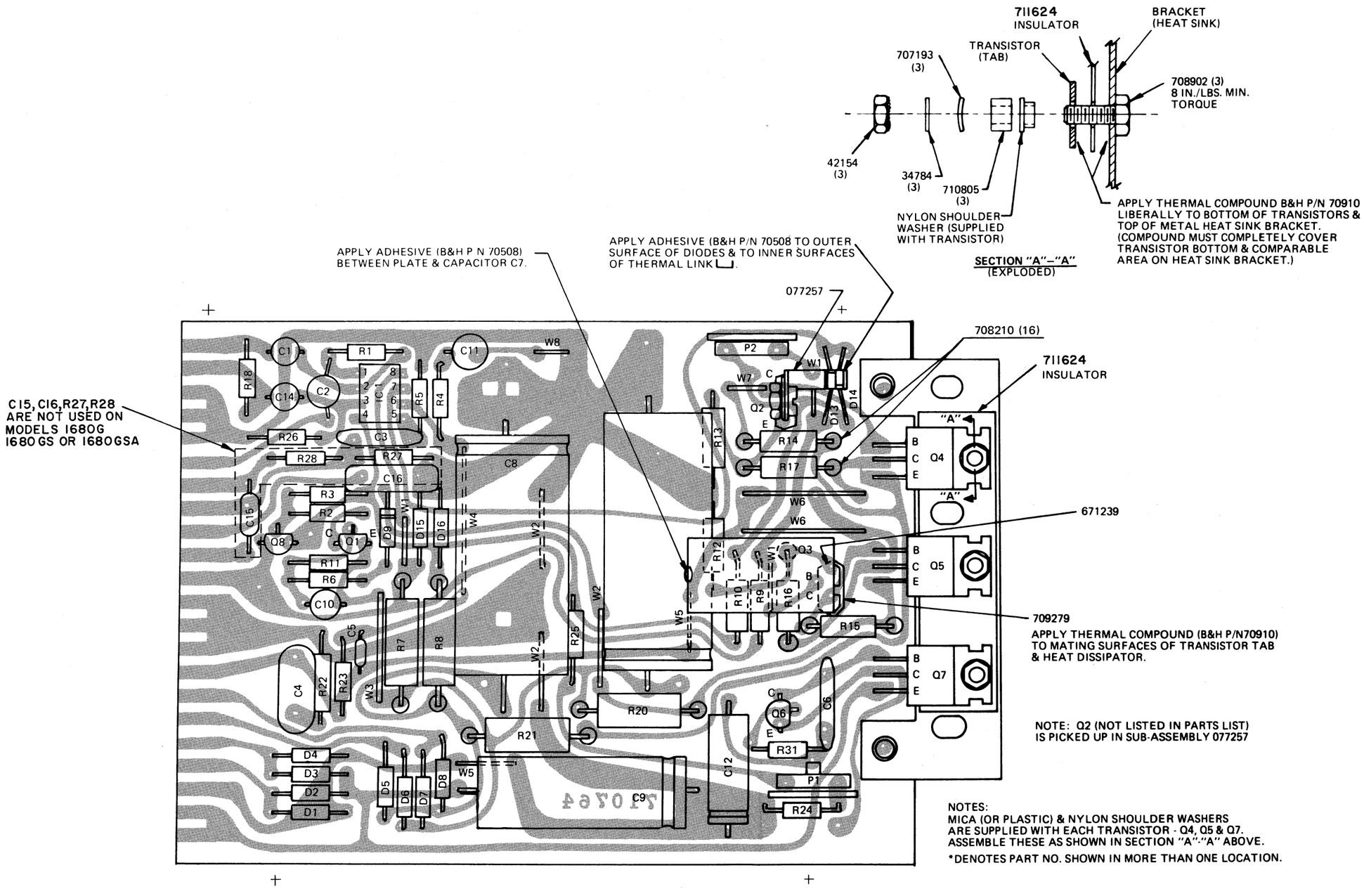
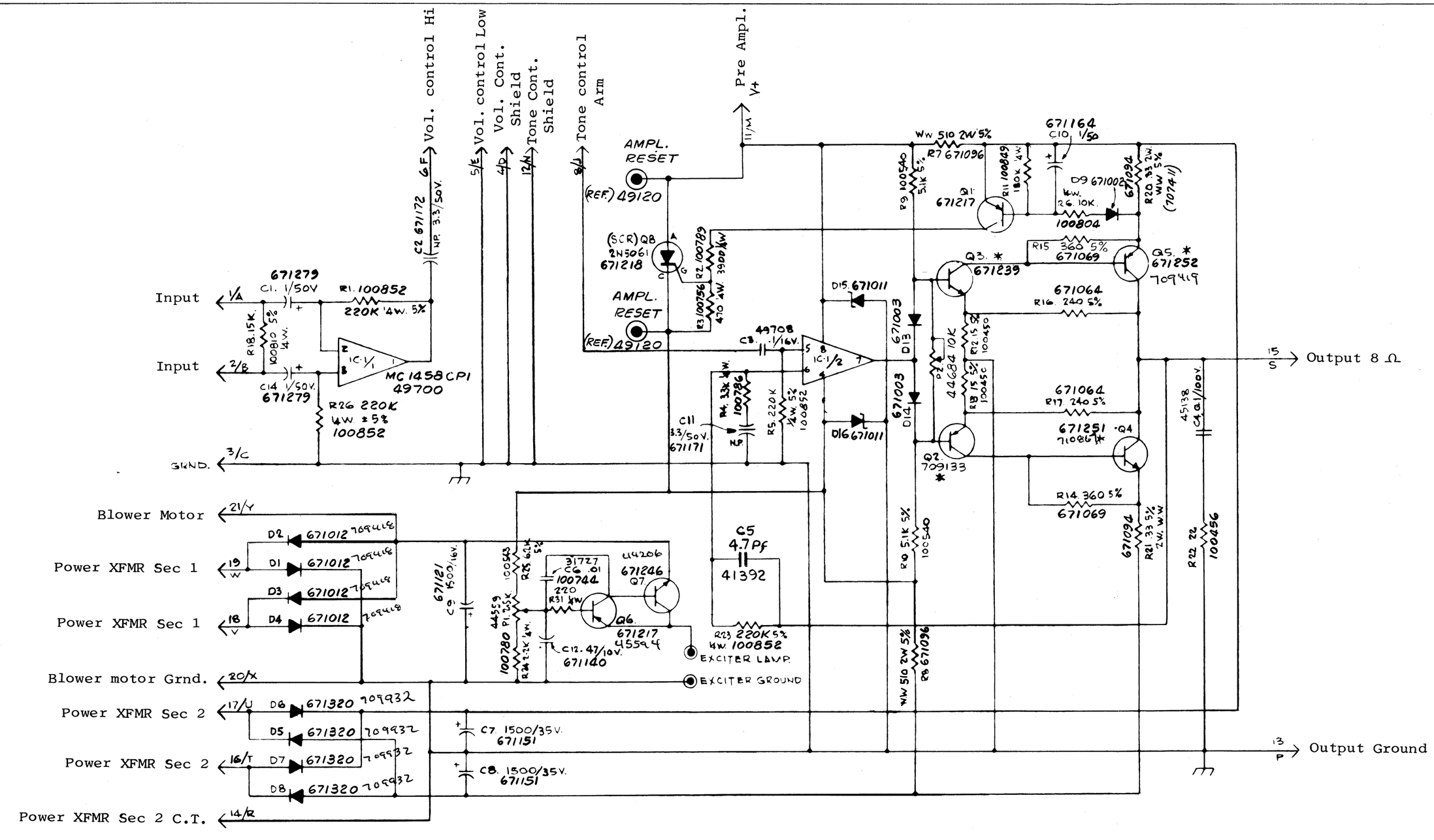


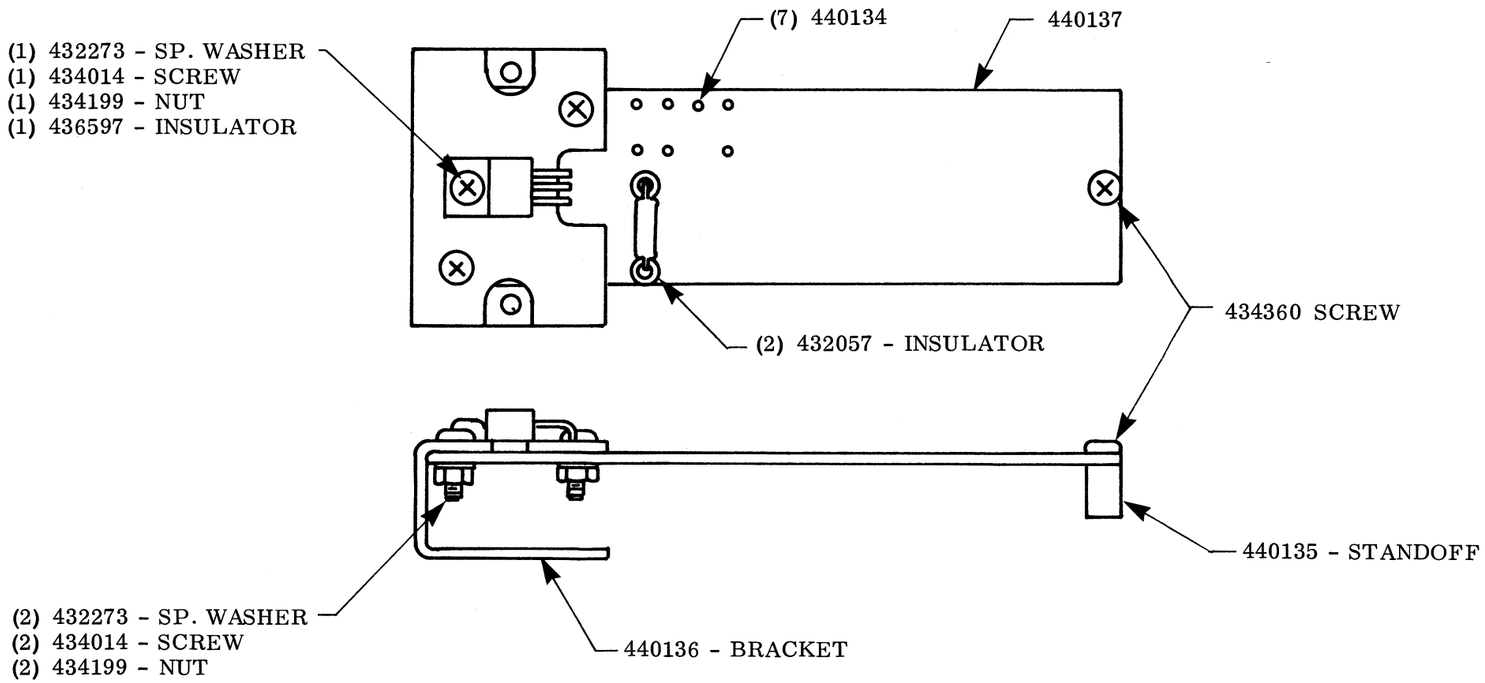
Figure S10. Audio Amplifier Pictorial Diagram

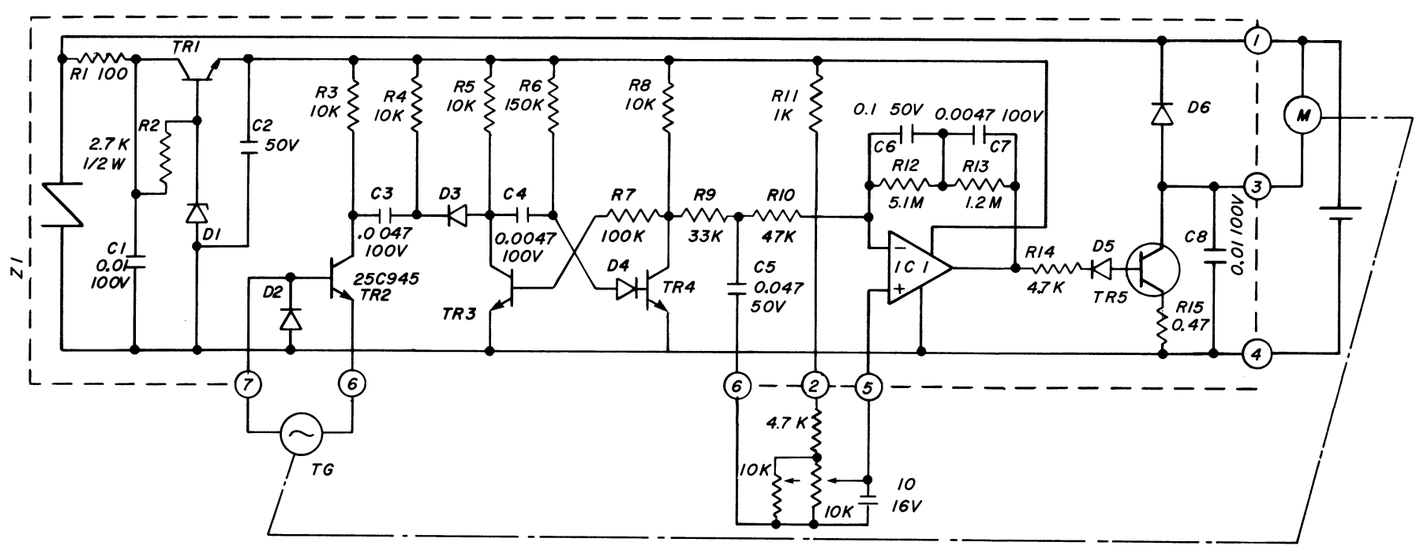


*- Transistor Note
Q2 & Q3 are complimentary paired As are Q4 & Q5.

Notes
All resistors ½ Watt carbon film 10% unless otherwise indicated
All capacitances in microfarads unless otherwise indicated
Numbers at connector ends correspond to terminal numbers
on connector to be used, letters ditto.

Figure S11. Audio Amplifier Schematic Diagram





Sym.	Part #
C1	440124
C2	437653
C3, C4	440125
C5	431269
C6	436018
C7	440125
D1	440126
D2, D4	440127
D3	440128
D5	440129
D6	436522
IC1	440132
R1	432064
R2	437806
R3, R4	432073
R5	432073
R6	440122
R7	431295
R8	432073
R9	431292
R10	432074
R11	431533
R12	437805
R13	437992
R14	431288
R15	440123
TR1	440130
TR2	436836
TR3	436836
TR4	436836
TR5	440131
Z1	440133

Figure S12. Speed Control Printed Circuit Board

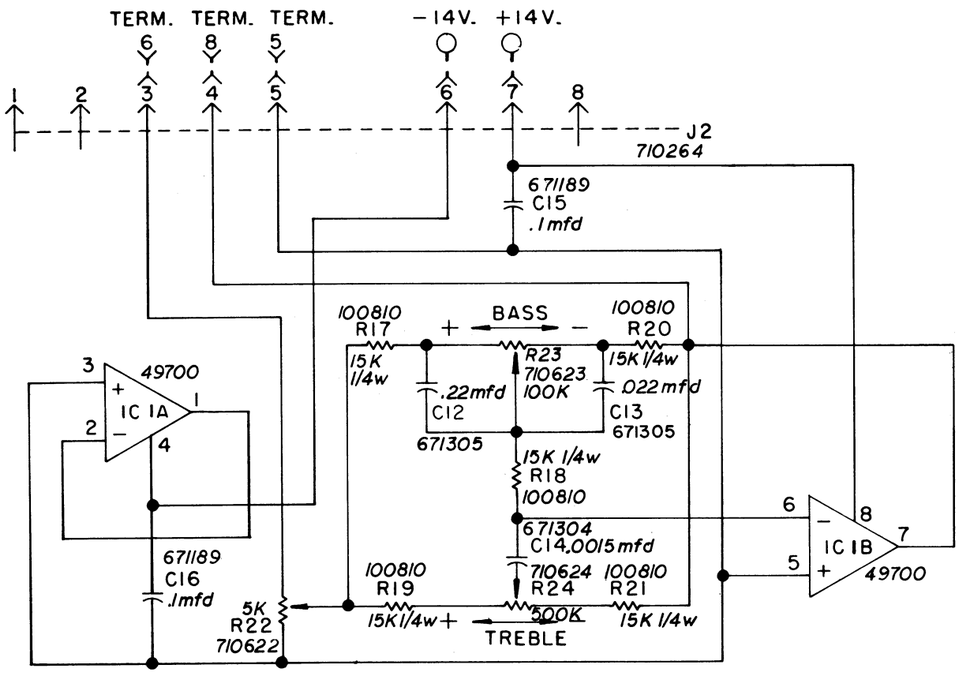


Figure S13B. Dual Tone Control Schematic Diagram

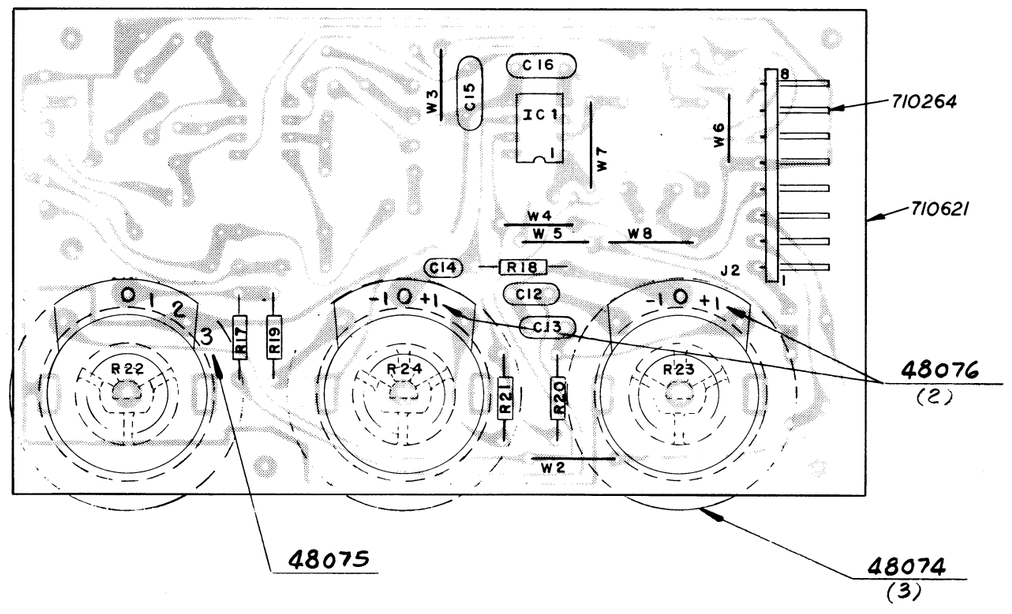


Figure S13A. Dual Tone Control Pictorial Diagram

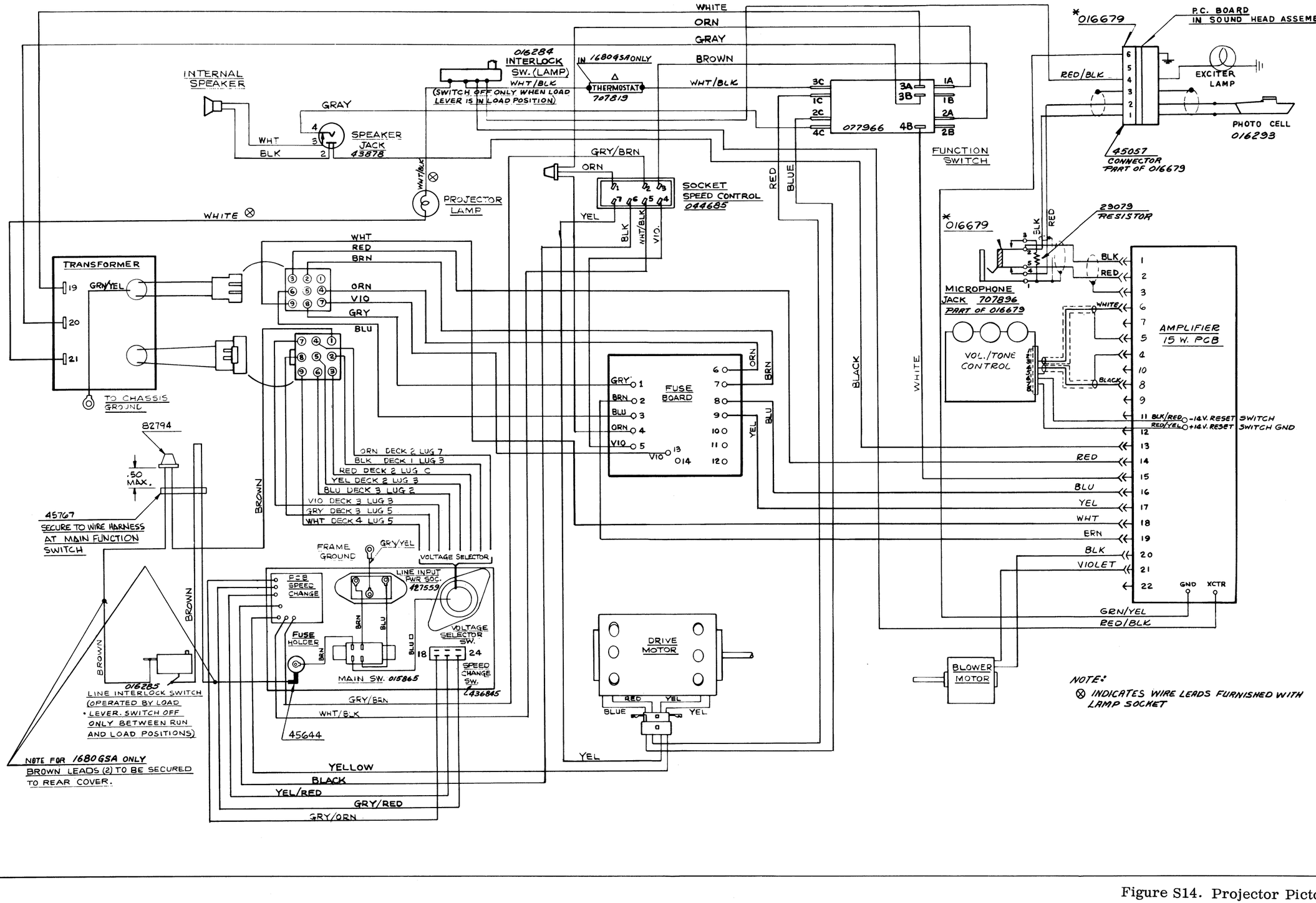


Figure S14. Projector Pictorial Diagram

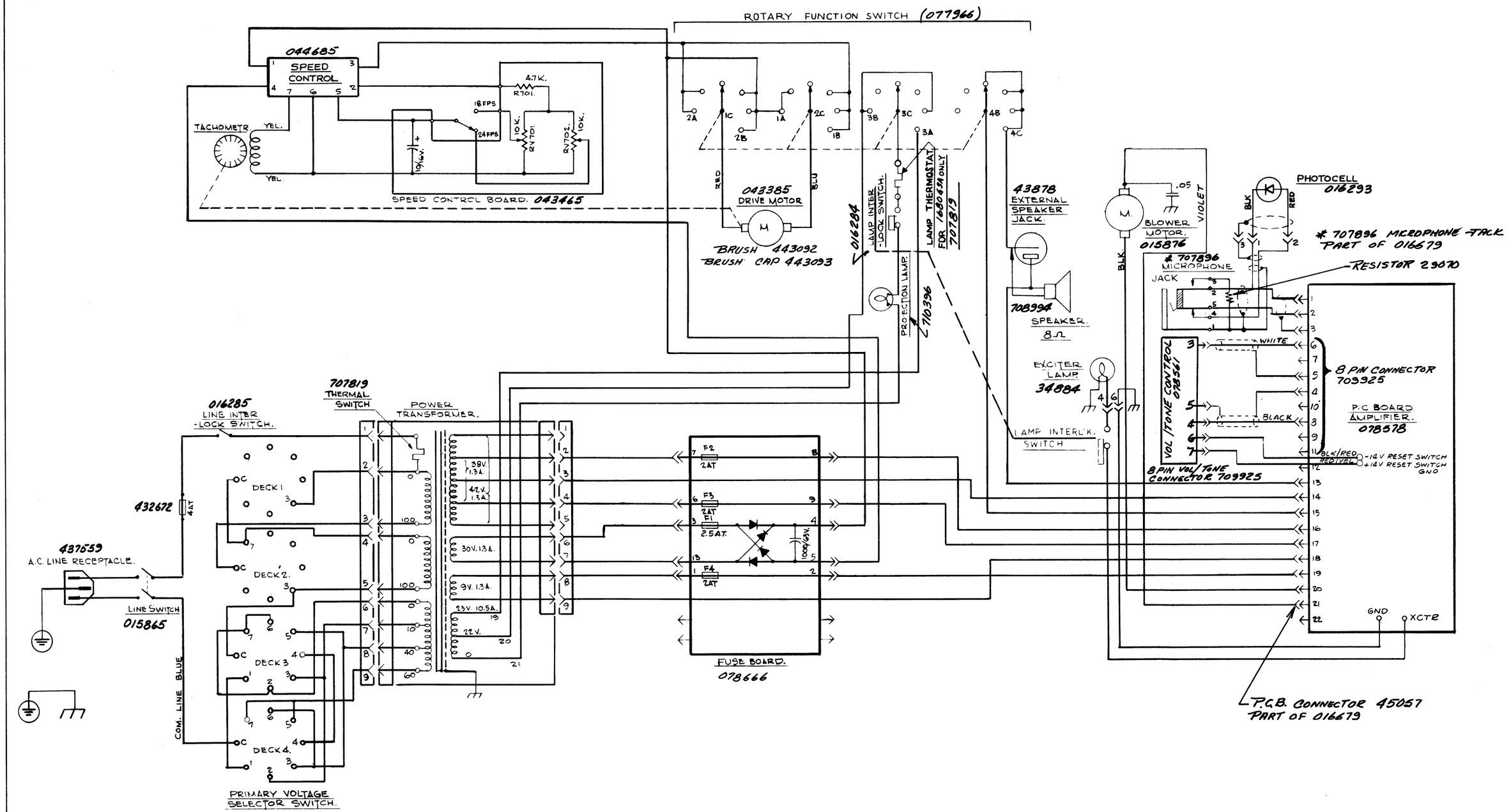


Figure S15. Projector Schematic Diagram

NUMERICAL INDEX OF PARTS FOR MODEL 1680G/1680GS/1680GSA SUPPLEMENT

PART NO.	FIG. & INDEX NO.
09709	S8-24
09710	S8-12
09711	S8-14
09728	S8-22
09807	S2-2
09828	S7-35
09870	S8-37
09885	S8-37L
09886	S8-37G
015533	S7-47
015535	S7-43
015537	S7-34
015538	S7-40
015865	S4-15
016086	S7-15
016284	5-
016285	15-4
016293	S7-31
016522	S1-20, 9-2
016679	S3-16
016684	S1-1
016808	S7-38
016839	S3-9
016976	15-10
020240	S7-29
044178	12-7
043384	S9-24
043390	13-5D
043465	S1-15
043966	S4-7
044685	S3-18
072848	S4-13
077178	S1-2
077181	S7-20
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710525	S6-13C
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710546	S2-6
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710603	S2-14
710604	S2-10
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710624	S3-12F
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PARTS CATALOG

SLOT-THREADING FILMOSOUND® PROJECTOR

MODELS 1575, 1580, 1680

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 74403 PRINTED IN U.S.A. REVISED FEBURARY 1980

RECOMMENDED SPARE PARTS LIST

FOR REPAIR OF 25
MODEL 1575, 1580 AND 1680 SLOT-THREADING
16MM FILMOSOUND® PROJECTORS

PART	DESCRIPTION	QTY
17639	Ring, Retaining	12
21736	Ring, Retaining	12
24047	Belt, Take-Up	6
30811	Screw, Hex washer head	6
31011	Bearing	3
31135	Spring	12
31239	Gear, Spur	6
31241	Clip, Retaining	12
31245	Ring, Retaining	12
31557	Shuttle	2
31561	Foot, Rubber	4
33385	Gear, Spur	3
34884	Lamp, Exciter (BAK)	6
36013	Wiper, Felt	12
36014	Wick, Cam	12
36015	Spring	12
36038	Spring	12
36047	Follower, Cam	12
36764	Setscrew	6
36765	Setscrew	6
36769	Setscrew	12
41307	Cam, Pull down	2
44223	Lamp, Projection (BHB)	6
44312	Key, Gear retaining	6
44367	Face Gear, Lower	2
43370	Gear, Spur	2
44521	Lamp, Projector (EKS)	6
45577	Face Gear, Upper	2
45578	Sleeve, Face gear	2
45579	Spring, Tension	2
45682	Cover, Rear arm	2
45685	Face Gear, Lower	2
47431	Lamp, Projector (EMM)	6

PART	DESCRIPTION	QTY
48088	Control, Volume	1
48089	Control, Tone	1
48907	Speaker	1
49532	Shaft, Rear reel arm	3
49696	Cover, Front arm	2
308638	Fuse, Slo-Blo, 0.75 amp	6
707112	Gear, Clutch	3
707211	Spring, Tension	6
707749	Switch, Rotary	2
708994	Speaker	1
709679	Belt, Drive	6
710151	Gear, Rewind	3
765777	Ring, Retaining	12
09712	Bearing Assembly, Support	2
09807	Tilt Knob Assembly	1
09828	Contact Assembly, Exciter lamp	2
011235	Bearing and Arm Assembly	1
012132	Aperture Plate Assembly	1
014947	Gear and Bearing Assembly	3
015532	Rail Assembly, Film tension	2
015535	Sprocket Assembly, Upper	2
015540	Sprocket Assembly, Lower	2
016083	Clutch Assembly, Rewind	3
016099	Cord Assembly, Rewind	2
016293	Photocell and Holder Assembly	1
016607	Motor Assembly	1
016660	Cable Assembly, Brake release	2
016693	In-Out Bracket Assembly	1
077195	PCB Amplifier Assembly	2
077920	Tilt Bar Assembly	1
077957	Post Assembly, Limiter	2

INTRODUCTION

The following pages illustrate and list, by part number and description, all replacement parts for the Bell & Howell Company Slot-Threading Projectors listed below. Parts are indexed and listed in a recommended sequence of disassembly to serve as an aid during repair procedures. The letters "NP" in the "Units Per Assembly" column indicate that the listed item is "not procurable." In such instances it will be necessary either to order the main assembly of which it is a part or, in the case of non-procurable assemblies, to order the indented parts separately.

The projector models covered in this Parts Catalog are very similar in design and construction. However, where piece parts and component assemblies differ between models, those differences are so indicated by means of code letters in the "Usable on Code" column (see list below). When this column is blank, the listed replacement part is usable on all projector models.

MODEL	CODE
1580A	A
1580AG	B
1580C	C
1580CS	D
1580CG	E
1680A	F1
1680AC	F2
1680C	F3
1680CC	F4
1680B	G
1680BC	H
1680E	J
1680EC	K
1680US	L
1680UC	M
1575A	N

ACCESSORIES FOR 1575A/1580 MODELS

Lens (Standard), 2 inch f/1.6 . . P/N 021257

Lens Anti-Theft Kit . . . . . P/N 021255

Cleaning Pad . . . . . P/N 48478

Reel Assembly, 400 foot (122m) . . . . P/N 710365

Reel Assembly, 400 foot (122m) . . . . P/N 710138

ACCESSORIES FOR 1680 MODELS

Dust Cover (For Speaker-Cover) . . . . . P/N 707768

Fuse, 4AT (Spare) . . . . . P/N 432672

Lens (Standard), 2 inch f/1.2 . . P/N 021247

Lens Anti-Theft Kit . . . . . P/N 021255

Line Cord . . . . . P/N 49060

Cleaning Pad . . . . . P/N 48478

Reel Assembly, 1500 foot (457m) . . . . P/N 016520

Speaker Cover Assembly (See Figure 18 for parts) . . . . P/N 016507

Speaker Cover Assembly (See Figure 19 for parts) . . . . P/N 016698

NOTE: Additional accessory lenses, film reels and speakers are also available for use with these projectors.

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR COVERS (1575 AND 1580 MODELS ONLY)		
1A-1	No Number	COVER AND SPEAKER ASSEMBLY, Front (see Figure 18 for detail parts)	NP	D
-1	016527	COVER ASSEMBLY, Front	1	AC
-1	016684	COVER ASSEMBLY, Front	1	BE
-1	078114	COVER ASSEMBLY, Front	1	N
-1A	707118	. PAD, Cushion (adhesive backed)	1	ABCDE
-1A	709196	. PAD, Cushion (adhesive backed)	1	N
-1B	765460	. RIVET, Semi-tubular	4	ABCDE
-1B	700816	. RIVET, Semi-tubular	4	N
-1C	45083	. LATCH, Cover release	2	ABCDEN
-1D	49283	. SPRING, Cover latch, front	1	ABCDEN
-1E	49282	. SPRING, Cover latch, rear	1	ABCDEN
-1F	49284	. PLATE, Stiffener	1	ABCDEN
-1G	No Number	. COVER, Front (replace complete cover assembly)	NP	ABCDEN
-2	48058	NAMEPLATE, Front cover (adhesive backed)	1	ABCE
-2	707412	NAMEPLATE, Front cover (adhesive backed)	1	D
-2	710435	NAMEPLATE, Front cover (adhesive backed)	1	N
-3	016557	COVER ASSEMBLY, Exciter lamp (early style)	1	AB
-3	077327	COVER ASSEMBLY, Exciter lamp (current style)	1	CDE
-3	078116	COVER ASSEMBLY, Exciter lamp (current style)	1	N
-3A	20808	. RING, Retaining, 0.145 inch ID	1	ABCDEN
-3B	709773	. THUMBSCREW, Cover retaining	1	ABCDE
-3B	710424	. THUMBSCREW, Cover retaining	1	N
-3C	34787	. PLUG, Hole	1	ABCDEN
-3D	No Number	. COVER, Exciter lamp (replace complete cover assembly)	NP	ABCDEN
-4	016556	COVER ASSEMBLY, Lens carrier (early style)	1	AB
-4	077691	COVER ASSEMBLY, Lens carrier (current style)	1	CDE
-4	078115	COVER ASSEMBLY, Lens carrier (current style)	1	N
-4A	48375	. RING, Compression	1	AB
-4B	707871	. NAMEPLATE, Lens carrier cover (adhesive backed)	1	ABCDE
-4B	710429	. NAMEPLATE, Lens carrier cover (adhesive backed)	1	N
-4C	No Number	. COVER, Lens carrier (order complete cover assembly)	NP	ABCDEN
-4D	709562	SCREW, Slotted pan head, 4-40 by 7/8 inch (nickel)	1	ABCDE
-4D	710437	SCREW, Slotted pan head, 4-40 by 5/8 inch (black)	1	N
-4E	36840	SCREW, Slotted pan head, 4-40 by 5/8 inch (nickel)	1	ABCDE
-4E	710438	SCREW, Slotted pan head, 4-40 by 7/8 inch (black)	1	N
-5	49638	SCREW, Hex washer head, 6-32 by 1/2 inch	4	ABCDEN
-6	707195	CORD WRAP	1	A
-6	48186	CORD WRAP	1	BE
-6	710066	CORD WRAP	1	CD
-6	710415	CORD WRAP	1	N
-7	49275	SCREW, Special	3	ABCDEN
-8	49637	SCREW, Hex washer head, 6-32 by 3/4 inch	4	ABCDEN
-9	48055	COVER, Rear	1	A
-9	48190	COVER, Rear	1	BE
-9	710065	COVER, Rear	1	CD
-9	710414	COVER, Rear	1	N
-10	48062	NAMEPLATE, Cord wrap (adhesive backed)	1	AB
-10	708629	NAMEPLATE, Cord wrap (adhesive backed)	1	CDEN
-11	87129	LABEL, Caution (adhesive backed)	1	ABCDEN
-12	766109	PAD, Damper (adhesive backed)	3	ABCDEN
-13	49638	SCREW, Hex washer head, 6-32 by 1/2 inch	2	ABCDEN
-14	No Number	COVER AND HANDLE ASSEMBLY, Top (order parts)	NP	ABCDEN
-14A	707449	. SCREW, Hex washer head, 8-18	4	ABCDEN
-14B	48063	. BRACKET, Cover mounting	2	ABCDEN
-14C	48052	. HANDLE, Carrying	1	ABCDE
-14C	710410	. HANDLE, Carrying	1	N
-14D	016534	. COVER AND STRIKERS ASSEMBLY, Top	1	ACD
-14D	016535	. COVER AND STRIKERS ASSEMBLY, Top	1	BE
-14D	078274	. COVER AND STRIKERS ASSEMBLY, Top	1	N
-15	48377	TRIMPLATE, Carrying handle (adhesive backed)	1	ABCDE
-15	710432	TRIMPLATE, Carrying handle (adhesive backed)	1	N
-16	077178	KNOB ASSEMBLY, Loop restorer	1	ABCDEN

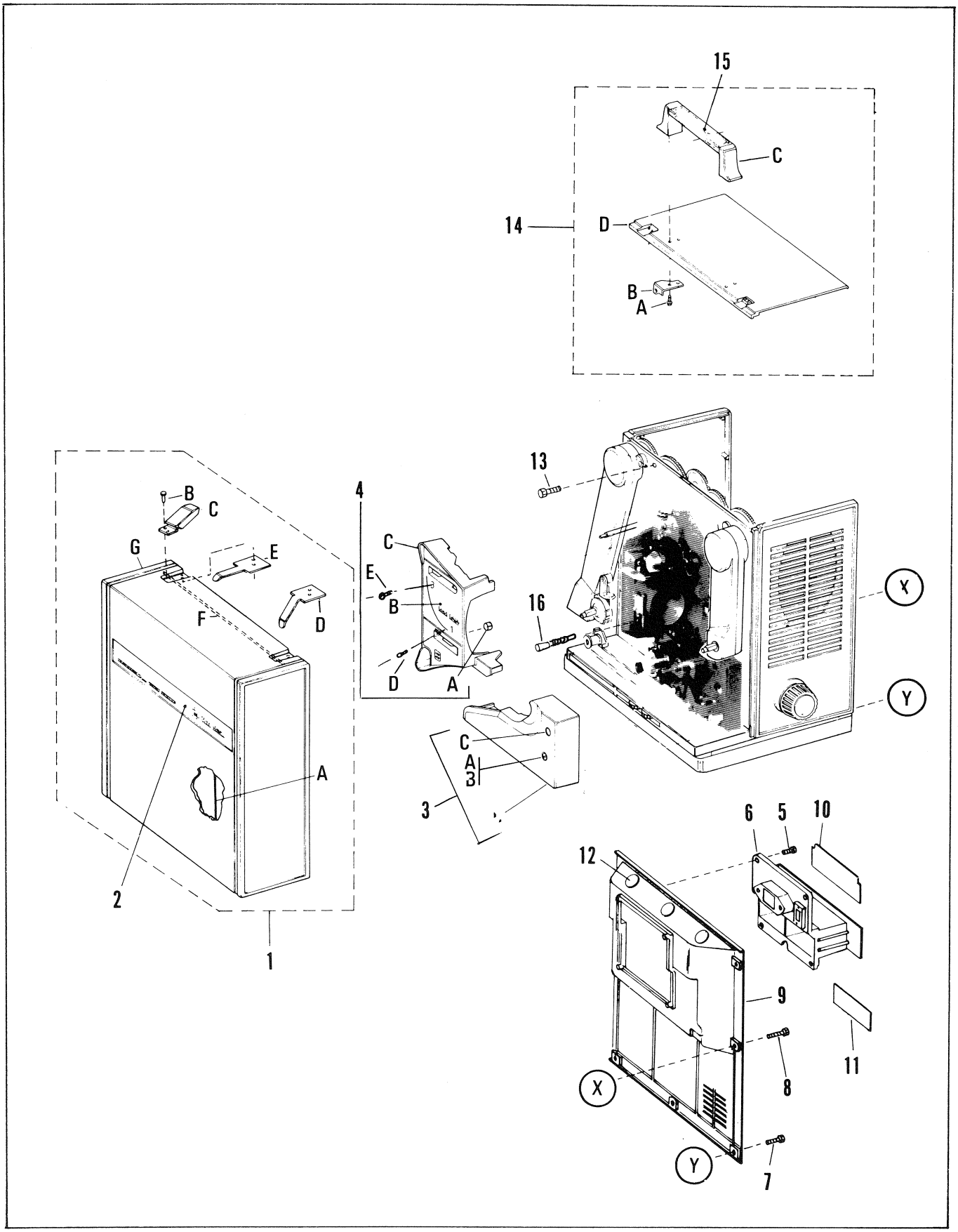


Figure 1A. Projector Covers
(1575 and 1580 Models Only)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR COVERS (1680 MODELS ONLY)		
1B-1	No Number	COVER AND SPEAKER ASSEMBLY, Front (see Figure 19 for detail parts)	NP	F2,F4,HK
-1	No Number	COVER AND SPEAKER ASSEMBLY, Front (see Figure 18 for detail parts)	NP	LM
-1	016527	COVER ASSEMBLY, Front	1	F1,F3,GJ
-1A	707118	. PAD, Cushion (adhesive backed)	1	F1,F3,GJ
-1B	765460	. RIVET, Semi-tubular	4	F1,F3,GJ
-1C	45083	. LATCH, Cover release	2	F1,F3,GJ
-1D	49283	. SPRING, Cover latch, front	1	F1,F3,GJ
-1E	49282	. SPRING, Cover latch, rear	1	F1,F3,GJ
-1F	49284	. PLATE, Stiffener	1	F1,F3,GJ
-1G	No Number	. COVER, Front (replace complete cover assembly)	NP	F1,F3,GJ
-2	48058	NAMEPLATE, Front cover (adhesive backed)	1	FGJ
-2	707412	NAMEPLATE, Front cover (adhesive backed)	1	HKLM
-3	016557	COVER ASSEMBLY, Exciter lamp (early style)	1	FM
-3	077327	COVER ASSEMBLY, Exciter lamp (current style)	1	GHJKL
-3A	20808	. RING, Retaining, 0.145 inch ID	1	F thru M
-3B	709973	. THUMBSCREW, Cover retaining	1	F thru M
-3C	34787	. PLUG, Hole	1	F thru M
-3D	No Number	. COVER, Exciter lamp (replace complete cover assembly)	NP	F thru M
-4	016583	COVER ASSEMBLY, Lens (early style)	1	FM
-4	077692	COVER ASSEMBLY, Lens (current style)	1	GHJKL
-4A	48375	. RING, Compression	1	FM
-4B	707070	. NAMEPLATE, Lens cover (adhesive backed)	1	FM
-4B	708429	. NAMEPLATE, Lens cover (adhesive backed)	1	GHJKL
-4C	No Number	. COVER, Lens (replace complete cover assembly)	NP	F thru M
-4D	709562	SCREW, Slotted pan head, 4-40 by 7/8 inch (nickel)	1	F thru M
-4E	36840	SCREW, Slotted pan head, 4-40 by 5/8 inch (nickel)	1	F thru M
-5	46367	SCREW, Pan head tapping, No. 7 by 5/6 inch (lock plate)	1	F1,F2,GHLM
-5	437607	SCREW, M4.7 by 6.0	1	F3,F4,JK
-6	437731	LOCK PLATE, Voltage selector	1	F thru M
-7	49275	SCREW, Rear cover, lower	3	F thru M
-8	49637	SCREW, Rear cover, upper	4	F thru M
-9	077969	COVER AND CONTROLS ASSEMBLY, Rear	1	F1,F2,M
-9	077967	COVER AND CONTROLS ASSEMBLY, Rear	1	GHL
-9	077968	COVER AND CONTROLS ASSEMBLY, Rear	1	F3,F4,JK
-9A	*49638	SCREW, Hex washer head, 6-32 by 1/2 inch (control plate)	4	F thru M
-9B	016283	CONTROL PLATE ASSEMBLY (See Figure 8 for detail parts)	1	F1,F2,GHLM
-9B	016523	CONTROL PLATE ASSEMBLY (See Figure 8 for detail parts)	1	F3,F4,JK
-9C	48055	COVER, Rear	1	FM
-9C	710065	COVER, Rear	1	G thru L
-10	436947	SCREW, Phillips oval head, M2.6 by 0.5	2	FGHLM
-10	437609	SCREW, Speed selector switch	2	JK
-11	436845	SWITCH, Speed selector	1	F thru M
-12	436952	SCREW, Phillips binding head, M2 by 6.0	2	F1,F2,GHLM
-12	437611	SCREW, Speed change bracket	2	F3,F4,JK
-13	707125	BRACKET, Speed change P.C. board	1	F thru M
-14	436951	SCREW, Phillips binding head, M2.6 by 4.0	2	F thru M
-15	043465	P.C. BOARD ASSEMBLY, Speed change	1	F thru M
-16	49638	SCREW, Hex washer head, 6-32 by 1/2 inch	2	F thru M
-17	No Number	COVER AND HANDLE ASSEMBLY, Top	NP	F thru M
-17A	707449	. SCREW, Hex washer head, 8-18	4	F thru M
-17B	48063	. BRACKET, Cover mounting	2	F thru M
-17C	48052	. HANDLE, Carrying	1	F thru M
-17D	016534	. COVER AND STRIKERS ASSEMBLY, Top	1	F thru M
-18	707068	TRIMPLATE, Carrying handle (adhesive backed)	1	F thru M
-19	077178	KNOB ASSEMBLY, Loop restorer	1	F thru M
-20	30822	SCREW, Hex washer head, 10-32 by 7/16 inch	1	GHJKL
-21	016522	WIRE TIE	1	GHJKL

*Apply adhesive to screw before securing (codes F3, F4, J, K).

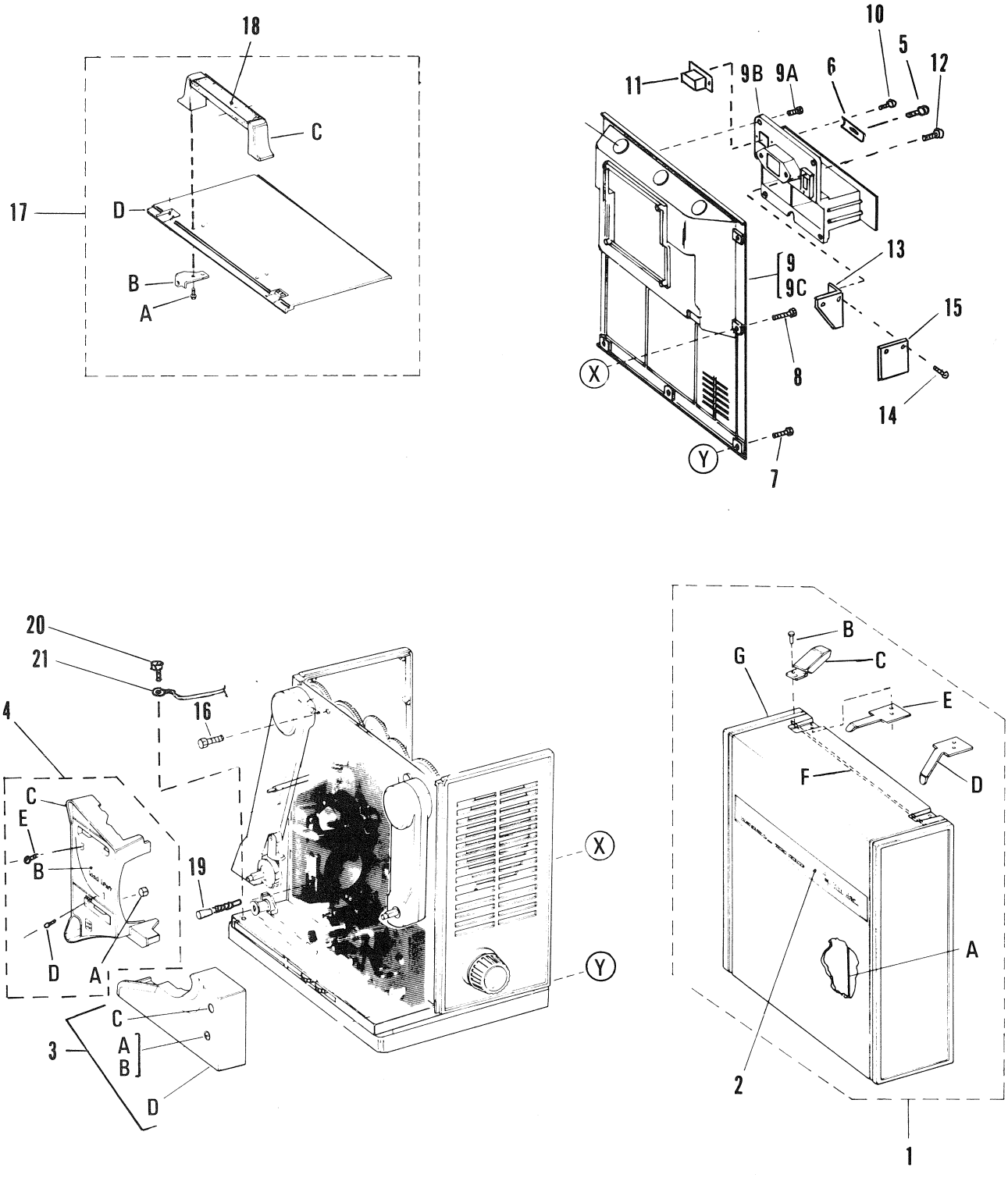


Figure 1B. Projector Covers
(1680 Models Only)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		LAMPHOUSE AND END CAPS (ALL MODELS)		
2-1	36769	SETSCREW, Fluted socket cup pt, 8-32 by 1/4 inch	1	
-2	09807	KNOB ASSEMBLY, Tilt	1	A thru M
-2	078113	KNOB ASSEMBLY, Tilt	1	N
-3	707721	KNOB, Main switch	1	A thru M
-3	710425	KNOB, Main switch	1	N
-3A	30211	RING, Grip	1	
-4	766395	SCREW, Hex washer head, 6-32 by 5/16 inch	3	
-4A	13918	WASHER, Flat	2	
-5	48351	DEFLECTOR, Air	1	
-6	077142	LAMPHOUSE ASSEMBLY	1	A thru M
-6	078109	LAMPHOUSE ASSEMBLY	1	N
-6A	48493	. SCREW, Pan head tapping, 4-24 by 3/16 inch	6	
-6B	48466	. LOCKWASHER	1	
-6C	48385	. LATCH, Lamphouse	2	
-6D	48352	. HEAT SHIELD	1	
-6E	016815	. BRACKET AND HINGE ASSEMBLY	1	
-6F	No Number	. LAMPHOUSE	NP	
-7	48378	NAMEPLATE, Lamphouse (adhesive backed)	1	A thru E
-7	707069	NAMEPLATE, Lamphouse (adhesive backed)	1	F thru M
-7	710428	NAMEPLATE, Lamphouse (adhesive backed)	1	N
-8	32232	RING, Retaining, 1/4 inch	1	
-9	48380	ROLLER, Exit	1	
-10	48441	STUD, Exit roller	1	A thru M
-11	47431	LAMP, Projection (Type EMM) or 44521 (Type EKS)	1	A thru M
-11	44223	LAMP, Projection (Type BHB)	1	N
-12	30808	SCREW, Hex washer head, 6-32 by 5/16 inch	3	
-12A	600792	WASHER, Flat	2	F3,F4,JK
-13	015827	LAMPHOLDER ASSEMBLY	1	A-E, F1, F2,GHLM
-13	016526	LAMPHOLDER ASSEMBLY	1	F3,F4,JK
-13	078102	LAMPHOLDER ASSEMBLY (See Fig. 20A for insulating parts)	1	N
-14	707229	LABEL, Lamp designation (adhesive backed)	1	A thru E
-14	49112	LABEL, Lamp designation (adhesive backed)	1	F thru M
-14	707231	LABEL, Lamp designation (adhesive backed)	1	N
-15	49637	SCREW, Hex washer head, 6-32 by 3/4 inch	4	
-16	47974	SPACER, Sleeve (early models only)	1	
-17	016521	END CAP ASSEMBLY, Front (see Fig. 9 for parts)	1	AFM
-17	016685	END CAP ASSEMBLY, Front (see Fig. 9 for parts)	1	B
-17	077474	END CAP ASSEMBLY, Front (see Fig. 9 for parts)	1	CD,G-L
-17	016920	END CAP ASSEMBLY, Front (see Fig. 9 for parts)	1	E
-17	078111	END CAP ASSEMBLY, Front (see Fig. 9 for parts)	1	N
-18	49637	SCREW, Hex washer head, 6-32 by 3/4 inch	4	
-19	015559	END CAP ASSEMBLY, Rear (see Fig. 10 for parts)	1	A
-19	015552	END CAP ASSEMBLY, Rear (see Fig. 10 for parts)	1	BE
-19	077473	END CAP ASSEMBLY, Rear (see Fig. 10 for parts)	1	CDL
-19	015867	END CAP ASSEMBLY, Rear (see Fig. 10 for parts)	1	F thru K
-19	016619	END CAP ASSEMBLY, Rear (see Fig. 10 for parts)	1	M
-19	078112	END CAP ASSEMBLY, Rear (see Fig. 10 for parts)	1	N
-20	26474	SCREW, Special, 6-20 (Type AB)	1	F3,F4,JK
-21	710670	CLAMP	1	F3,F4,JK
-22	709218	NUT, Speed	1	F3,F4,JK
-23	707819	THERMOSTAT (Furnished with mylar sleeve)	1	F3,F4,JK
-24	710654	BRACKET, Thermostat	1	F3,F4,JK

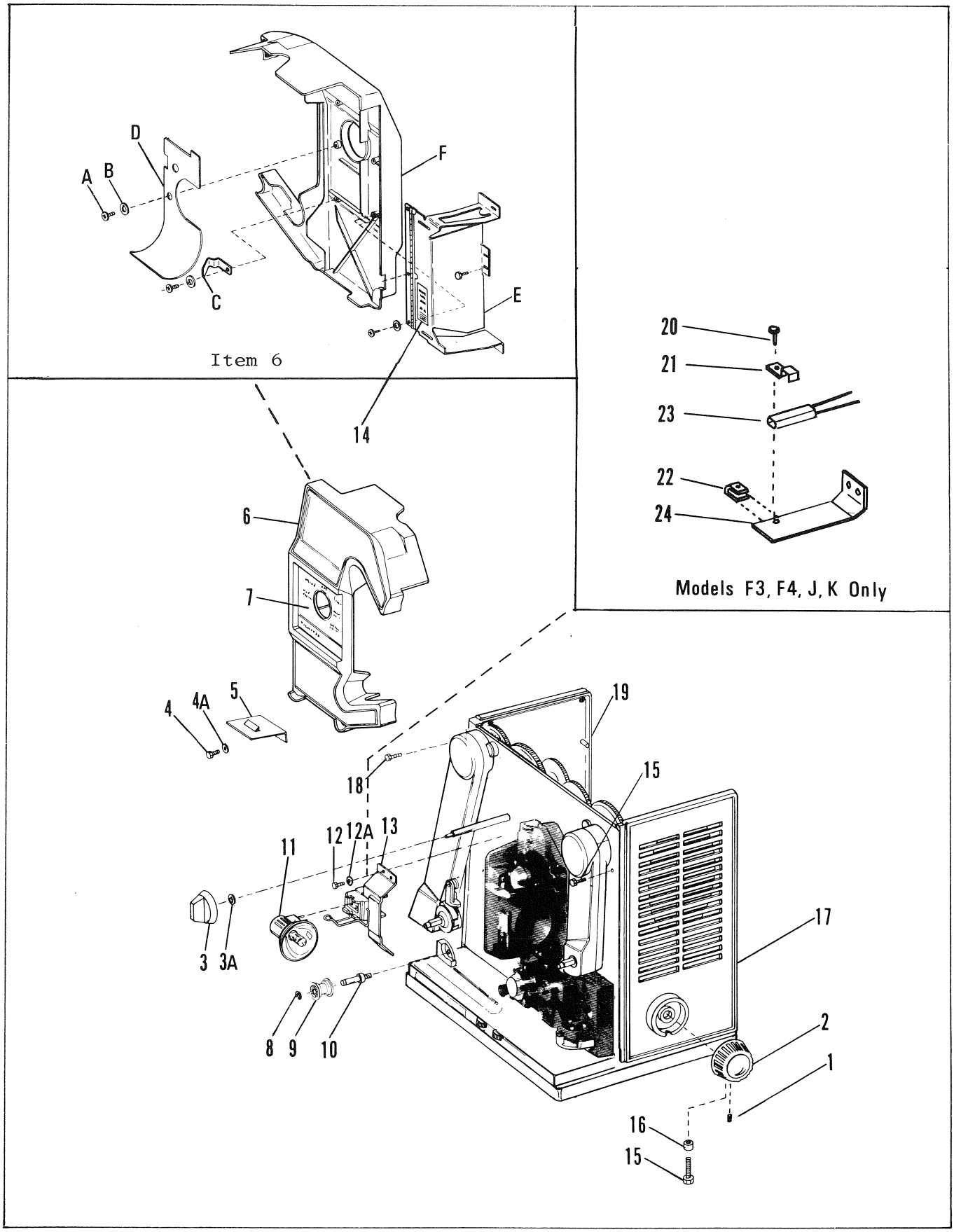


Figure 2. Lamphouse and End Caps
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		ELECTRICAL COMPONENTS (1575 AND 1580 MODELS ONLY)		
3A-1	308638	FUSE, Slo-Blo, 0.75 amp	1	ABCDEN
-2	30875	SCREW, Slotted pan head, 4-40 by 1/4 inch	1	ABCDEN
-3	44586	FUSEHOLDER	1	ABCDEN
-4	30809	SCREW, Hex washer head, 6-32 by 3/8 inch	3	ABCDEN
-5	077971	SWITCH AND BRACKET ASSEMBLY, Rotary	1	A thru E
-5	No Number	SWITCH AND BRACKET ASSEMBLY, Rotary	NP	N
-5A	36764	. SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	A thru E
-5A	36767	. SETSCREW, Fluted socket cup pt, 6-32 by 1/2 inch	1	N
-5B	707145	. CAM, Flywheel brake	1	ABCDEN
-5C	44467	. NUT, Hex locking	1	ABCDEN
-5D	600736	. LOCKWASHER, Internal tooth	1	ABCDEN
-5E	707144	. BRACKET, Rotary switch	1	ABCDEN
-5F	707749	. SWITCH, Rotary	1	ABCDEN
-5G	077148	CAPACITOR ASSEMBLY	1	ABCDEN
-5H	077149	CAPACITOR ASSEMBLY	1	ABCDEN
-5J	708900	. SLEEVE, Insulating	1	ABCDEN
-5K	710402	. STOP, Switch (1575 Models Only)	1	N
-6	30817	SCREW, Hex washer head, 8-32 by 1/2 inch	2	ABCDEN
-7	30815	SCREW, Pan washer head, 8-32 by 3/8 inch	2	ABCDEN
-8	No Number	TRANSFORMER ASSEMBLY, Power/Lamp (see Figure 11A for detail parts)	NP	A thru E
-8	No Number	TRANSFORMER ASSEMBLY, Power (see Figure 11B for detail parts)	NP	N
-9	30810	SCREW, Hex washer head, 6-32 by 1/2 inch	3	ABCDEN
-10	072848	WIRE CLAMP	1	ABCDEN
-11	30809	SCREW, Hex washer head, 6-32 by 3/8 inch	2	ABCDEN
-12	44377	HOUSING, Blower R.H.	1	ABCDEN
-13	80408	SETSCREW, Fluted socket flat pt, 6-32 by 3/16 inch	2	ABCDEN
-14	014538	FAN ASSEMBLY, Blower	1	ABCDEN
-15	709679	BELT, Drive	1	ABCDEN
-16	30809	SCREW, Hex washer head, 6-32 by 3/8 inch	2	ABCDEN
-17	44376	HOUSING, Blower, L.H.	1	ABCDEN
-18	30822	SCREW, Hex washer head, 10-32 by 7/16 (ground)	1	ABCDEN
-19	709659	LOCKWASHER, Internal tooth (ground)	1	ABCDEN
-20	48610	BUSHING, Strain relief (Heyco)	1	ABCDEN
-21	015650	POWER CORD ASSEMBLY	1	AB
-21	016608	POWER CORD ASSEMBLY	1	CDEN
-22	707281	CAPACITOR, Starting	1	ABCDEN
-23	016091	FUSE AND SLEEVE ASSEMBLY	1	ABCDEN
-24	80408	SETSCREW, Fluted socket flat pt, 6-32 by 3/16 inch	2	ABCDEN
-25	48320	PULLEY, Motor	1	ABCDEN
-26	30822	SCREW, Hex washer head, 10-32 by 7/16 inch	4	ABCDEN
-27	44356	BRACKET, Motor mounting	2	ABCDEN
-27A	41323	STRAP, Motor bracket (includes screw and nut)	2	ABCDEN
-28	016607	MOTOR, Drive (alternate P/N 016495 or 709107).	1	ABCDEN
-29	077959	BRACKET, Capacitor	1	ABCDEN

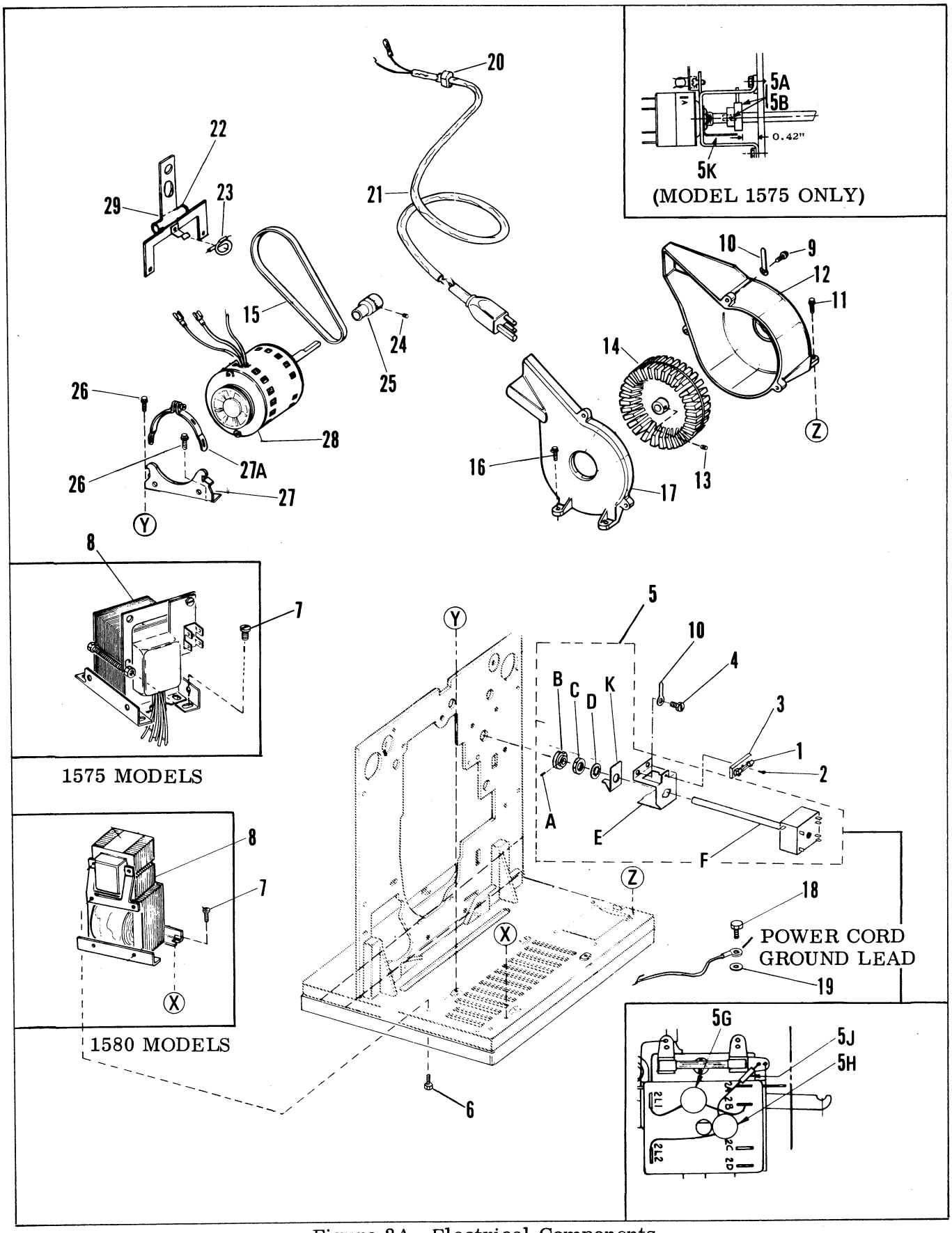


Figure 3A. Electrical Components
(1575 and 1580 Models Only)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		ELECTRICAL COMPONENTS (1680 MODELS ONLY)		
3B-1	709679	BELT, Drive	1	F thru M
-2	432673	FUSE, Type 2AT	4	FM
-2	432673	FUSE, Type 2AT	3	G thru L
-2A	709930	FUSE, Slo-Blo, 2.5 amp	1	G thru L
-3	44483	SCREW, Hex washer head, 4-40 by 7/16 inch	2	F thru M
-4	015872	FUSE BOARD ASSEMBLY	1	F thru M
-5	49121	SPACER, Fuse board, molded	1	F thru M
-6	30809	SCREW, Hex washer head, 6-32 by 3/8 inch	3	F thru M
-7	072848	CLAMP, Leadwire	1	F thru M
-8	No Number	SWITCH AND BRACKET ASSEMBLY, Rotary	NP	FM
-8	077966	SWITCH AND BRACKET ASSEMBLY, Rotary	1	G thru L
-8A	36764	SETSCREW, Fluted socket cup pt, 6-32 by 1/16 inch	1	F thru M
-8B	707145	CAM, Flywheel brake	1	F thru M
-8C	44467	NUT, Hex locking	1	F thru M
-8D	600736	LOCKWASHER, Internal tooth	1	F thru M
-8E	707144	BRACKET, Rotary switch	1	F thru M
-8F	707823	SWITCH, Rotary	1	F thru M
-9	30809	SCREW, Hex washer head, 6-32 by 3/8 inch	2	F thru M
-10	434028	SCREW, Phillips binding head, M2.6 by 12.0	4	F thru M
-11	30822	SCREW, Hex washer head, 10-32 by 7/16 (ground)	1	F thru M
-12	709659	LOCKWASHER, Internal tooth (ground)	1	F thru M
-13	437628	TRANSFORMER, Power	1	F thru M
-14	30822	SCREW, Hex washer head, 10-32 by 7/16 inch	4	F thru M
-15	437247	BRACKET, Drive motor mounting	2	F thru M
-16	077965	MOTOR ASSEMBLY, Drive	1	F thru M
-16A	36763	. SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	2	F thru M
-16B	436954	. PULLEY, Motor	1	F thru M
-16C	043385	. MOTOR, Drive	1	F thru M
-17	30809	SCREW, Hex washer head, 6-32 by 3/8 inch	4	F thru M
-18	044230	BLOWER ASSEMBLY, Complete	1	F thru M
-18A	30810	. SCREW, Hex washer head, 6-32 by 1/2 inch	3	F thru M
-18B	072848	. CLAMP, Leadwire	1	F thru M
-18C	44376	. HOUSING, Blower, L.H.	1	F thru M
-18D	437430	. SETSCREW, Blower fan	1	F thru M
-18E	043341	. FAN ASSEMBLY, Blower	1	F thru M
-18F	436903	. SCREW, Phillips binding head, M3 by 0.45	3	F thru M
-18G	~~015876~~ 044231	MOTOR ASSEMBLY, Blower	1	F thru M
-18H	436872	. HOUSING, Blower, R.H.	1	F thru M

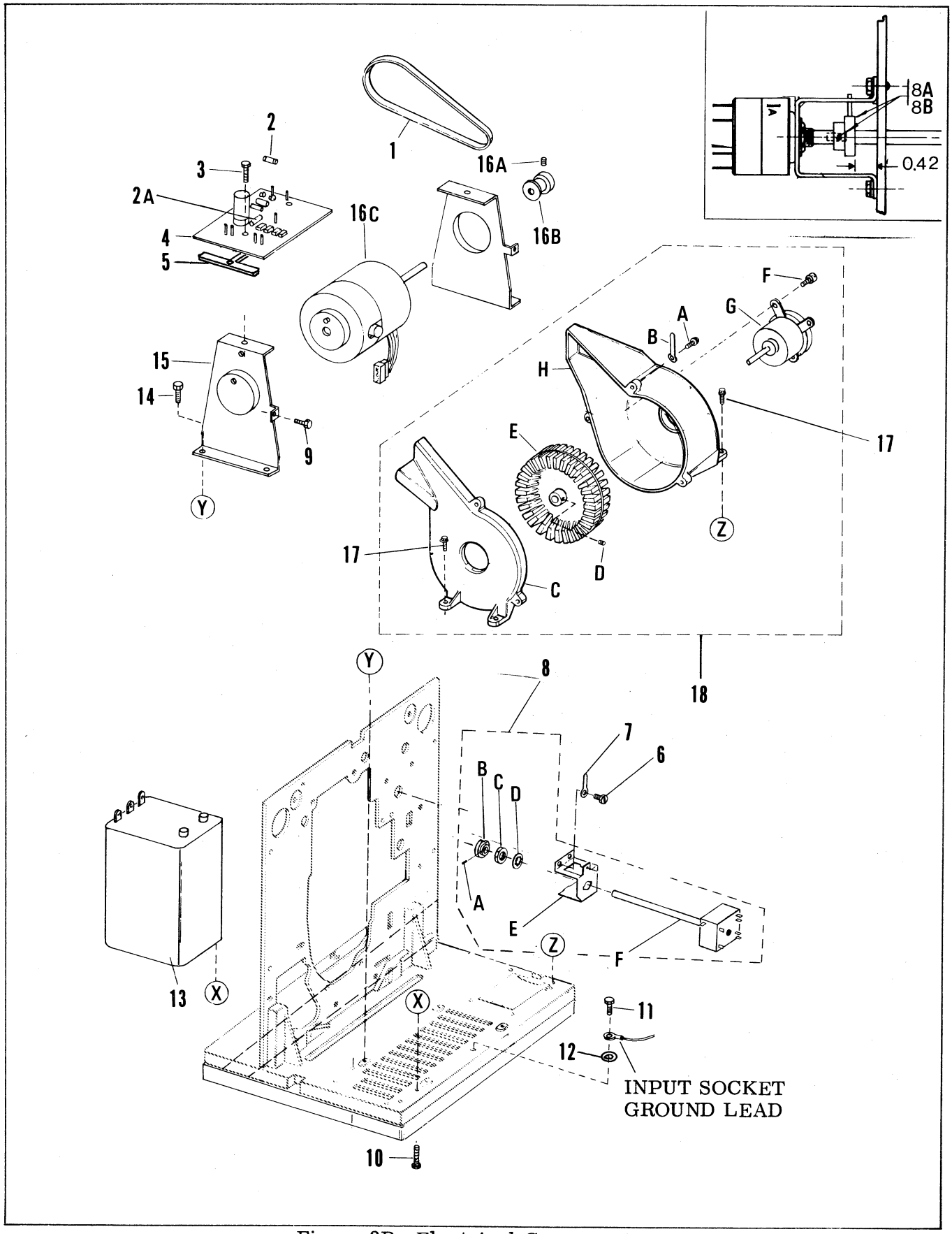


Figure 3B. Electrical Components
(1680 Models Only)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		REEL ARMS AND BRAKE SYSTEM (ALL MODELS)		
4-1	765777	RING, Retaining, external, 0.250 inch ID	2	
-2	014947	GEAR ASSEMBLY	1	
-3	34861	WASHER, Flat	AR	
-4	765777	RING, Retaining, external, 0.250 inch ID	1	
-5	31015	WASHER, Thrust (below Serial No. 6352004)	1	
-6	31237	WASHER, Flat (below Serial No. 6352004)	1	
-7	014949	CLUTCH ASSEMBLY, Reverse take-up (below Serial No. 6352004)	1	
-7A	016394	BEARING ASSEMBLY (Serial No. 6352004 and up)	1	
-8	46534	GEAR, Spur (below Serial No. 6352004)	1	
-8A	707112	GEAR, Clutch (Serial No. 6352004 and up)	1	
-8B	710151	GEAR, Rewind (Serial No. 6352004 and up)	1	
-9	44312	CLIP, retaining	1	
-10	31038	RING, Retaining, grip-type	1	
-11	016099	CORD ASSEMBLY, Rewind	1	
-12	48358	SPRING, Rewind extension	1	
-13	48347	SPRING, Rewind extension	1	
-14	765449	RING, Retaining, 0.188 inch ID	2	
-15	709682	SPRING, Torsion	1	
-16	708655	ROD, Brake release	1	
-17	48358	SPRING, Extension	1	
-18	016660	CABLE ASSEMBLY, Brake release	1	
-19	45718	SCREW, Hex washer head, 4-40 by 3/4 inch	2	
-20	34784	WASHER, Flat	2	
-21	707146	FOLLOWER, Brake release cam	1	
-22	016716	BRAKE ARM ASSEMBLY	1	
-23	707719	SPRING, Brake arm	1	
-24	707718	SPACER, Tapped	2	
-25	707720	SHEAVE, Brake release cable	1	
-26	47698	SCREW, Hex washer head, 6-32 by 7/8 inch	1	
-27	30809	SCREW, Hex washer head, 6-32 by 3/8 inch	3	
-28	48346	DISC, Rewind cord	1	
-29	48348	DISC, Rear reel arm	1	
-30	016263	REEL ARM ASSY, Rear (see Figure 12 for parts).	1	A thru E
-30	015819	REEL ARM ASSY, Rear (see Figure 12 for parts).	1	F thru M
-30	078107	REEL ARM ASSY, Rear (see Figure 12 for parts).	1	N
-31	30809	SCREW, Hex washer head, 6-32 by 3/8 inch	3	
-32	44313	DISC, Front reel arm	1	
-33	014948	REEL ARM ASSY, Front (see Figure 13 for parts)	1	A thru E
-33	015816	REEL ARM ASSY, Front (see Figure 13 for parts)	1	F thru M
-33	078106	REEL ARM ASSY, Front (see Figure 13 for parts)	1	N
-34	707818	DECAL, Reel arm position (adhesive backed)	1	F thru M
-35	016585	BUTTON ASSEMBLY, Reel arm lock	2	A thru M
-35	078108	BUTTON ASSEMBLY, Reel arm lock	2	N
-36	44507	SPRING, Lock button	2	

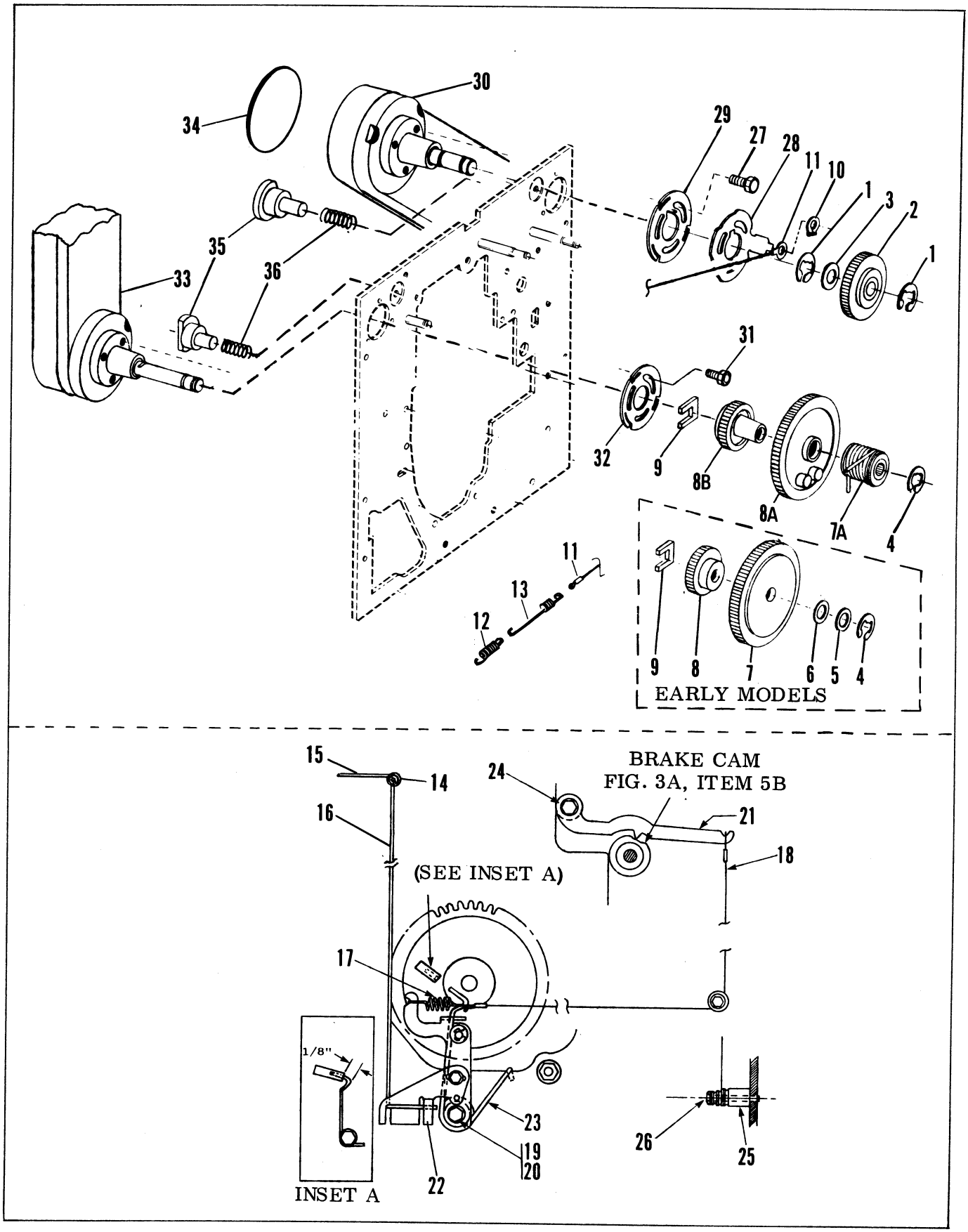


Figure 4. Reel Arms and Brake System
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		DRIVE AND REWIND GEARING (ALL MODELS)		
5-1	765777	RING, Retaining, external, 0.250 inch ID	2	
-2	44370	GEAR, Idler	2	
-3	31029	WASHER, Flat	2	
-4	36083	RING, Retaining, external, 0.250 inch ID	1	
-5	1953	WASHER, Flat	1	
-6	44372	GEAR, Idler	1	
-7	016558	LEVER ASSEMBLY, Rewind	1	
-7A	36083	. RING, Retaining external, 0.250 inch ID	2	
-7B	1953	. WASHER, Flat	2	
-7C	44373	. GEAR, Idler	2	
-7D	016081	. LEVER, Rewind	1	
-8	48357	SPRING, Torsion	1	
-9	30211	RING, Retaining, grip-type	1	
-10	39092	WASHER, Spring tension, bowed	1	
-11	48316	WASHER, D-hole	1	
-12	48465	WASHER, Flat	1	
-13	016559	DRIVER ARM ASSEMBLY, Flywheel	1	
-13A	765777	. RING, Retaining, 0.250 inch ID	2	
-13B	016075	. GEAR ASSEMBLY, Flywheel drive	1	
-13C	44370	. GEAR, Idler	1	
-13D	016074	. ARM, Flywheel drive	1	
-14	48315	GEAR, Drive	1	
-15	47137	WASHER, Mylar	2	
-16	015545	GEAR AND IDLER ARM ASSEMBLY	1	
-16A	765777	. RING, Retaining, external, 0.250 inch ID	1	
-16B	44370	. GEAR, Idler	1	
-16C	015544	. ARM ASSEMBLY, Idler	1	
-17	44312	CLIP, Retaining	1	
-18	44317	WASHER, Flat	1	
-19	016083	CLUTCH ASSEMBLY, Rewind	1	
-20	48360	WASHER, Thrust	1	
-21	30803	SCREW, Hex washer head, 4-40 by 3/16 inch	2	
-22	016084	SWITCH ASSEMBLY, Lamp interlock	1	ABCDEN
-22	016284	SWITCH ASSEMBLY, Lamp interlock	1	F thru M
-23	765449	RING, Retaining, 0.188 inch ID	1	
-24	620710	WASHER, Flat	1	
-25	077957	POST ASSEMBLY, Limiter	1	

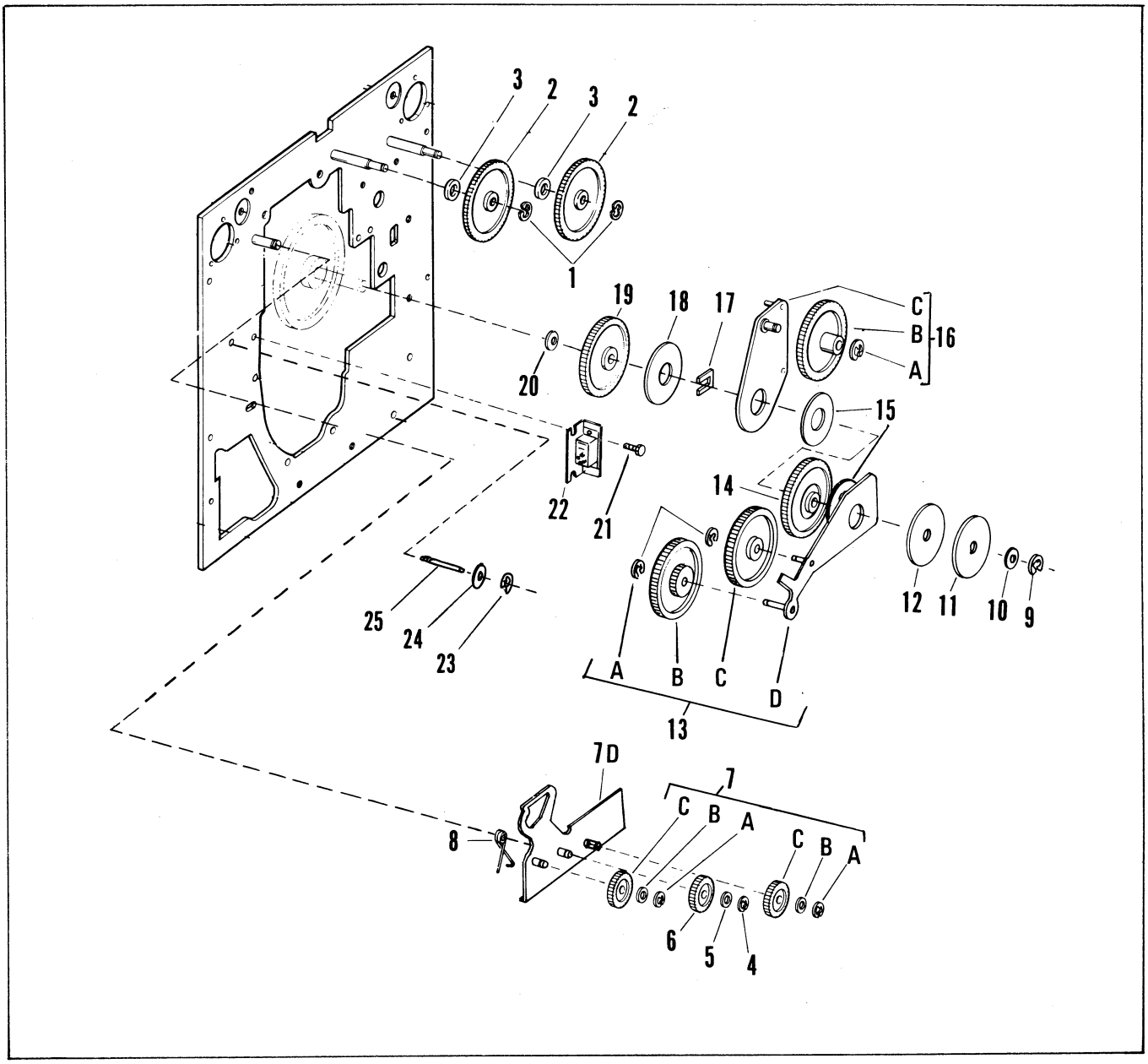


Figure 5. Drive and Rewind Gearing
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR BASE ELECTRICAL COMPONENTS (ALL MODELS)		
6-1	766395	SCREW, Hex washer head, 6-32 by 5/16 inch . . .	4	
-2	48078	COVER, Volume/Tone control	1	
-3	708237	PLUG, Hole	1	
-4	766395	SCREW, Hex washer head, 6-32 by 5/16 inch . . .	5	
-5	48069	COVER, Amplifier assembly	1	
-5A	87129	LABEL, Caution (adhesive backed)	1	CDEN
-5B	708647	INSULATOR (Attach with item 6, Figure 3A) . . .	1	CDEN
-6	30808	SCREW, Hex washer head, 6-32 by 5/16 inch . . .	2	
-7	30811	SCREW, Hex washer head, 6-32 by 5/8 inch	2	
-8	47974	SPACER, Sleeve	2	
-9	014603	EDGE CONNECTOR ASSEMBLY	1	AB
-9	016645	EDGE CONNECTOR ASSEMBLY	1	CDEN
-9	014603	EDGE CONNECTOR ASSEMBLY	1	F thru M
-10	077195	AMPLIFIER ASSEMBLY (NOTE A)	1	ABCDEN
-10	015868	AMPLIFIER ASSEMBLY (NOTE A)	1	FM
-10	077196	AMPLIFIER ASSEMBLY (NOTE A)	1	G thru L
-11	766395	SCREW, Hex washer head, 6-32 by 5/16 inch . . .	2	
-12	015502	VOLUME AND TONE CONTROL ASSEMBLY . . .	1	AB
-12	016613	VOLUME AND TONE CONTROL ASSEMBLY . . .	1	CDEN
-12	015502	VOLUME AND TONE CONTROL ASSEMBLY . . .	1	F thru M
-12A	48074	. KNOB, Control	2	
-12B	48075	. TRIMPLATE, Volume knob (adhesive backed) .	1	
-12C	48076	. TRIMPLATE, Tone knob (adhesive backed) . . .	1	
-12D	48088	. CONTROL, Volume, 50K (with mounting parts).	1	
-12E	48089	. CONTROL, Tone, 250K (with mounting parts) .	1	
-13	34884	LAMP, Exciter (BAK)	1	
-14	34892	LABEL, Exciter lamp type (adhesive backed) . . .	1	
-15	016296	EDGE CONNECTOR, Soundhead P.C. board	1	
-16	016518	JACK ASSEMBLY, Microphone (with mounting parts)	1	FM
-16	016679	JACK ASSEMBLY, Microphone (with mounting parts)	1	G thru L
-17	437495	WASHER, Insulating	1	F thru M
-18	30802	SCREW, Hex washer head, 4-40 by 1/8 inch	2	F thru M
-19	437765	SERVO AMPLIFIER	1	FM
-19	044685	SERVO AMPLIFIER	1	G thru L
-20	436977	CONNECTOR, Servo amplifier	1	F thru L
-21	48067	NAMEPLATE, Volume/Tone (adhesive backed) . .	1	ABCDE
-21	49118	NAMEPLATE, Volume/Tone (adhesive backed) . .	1	F thru M
-21	710434	NAMEPLATE, Volume/Tone (adhesive backed) . .	1	N

NOTE A: Part number listed is a NEW Amplifier Assembly. For a REBUILT Amplifier Assembly add a (-001) to the appropriate part number.

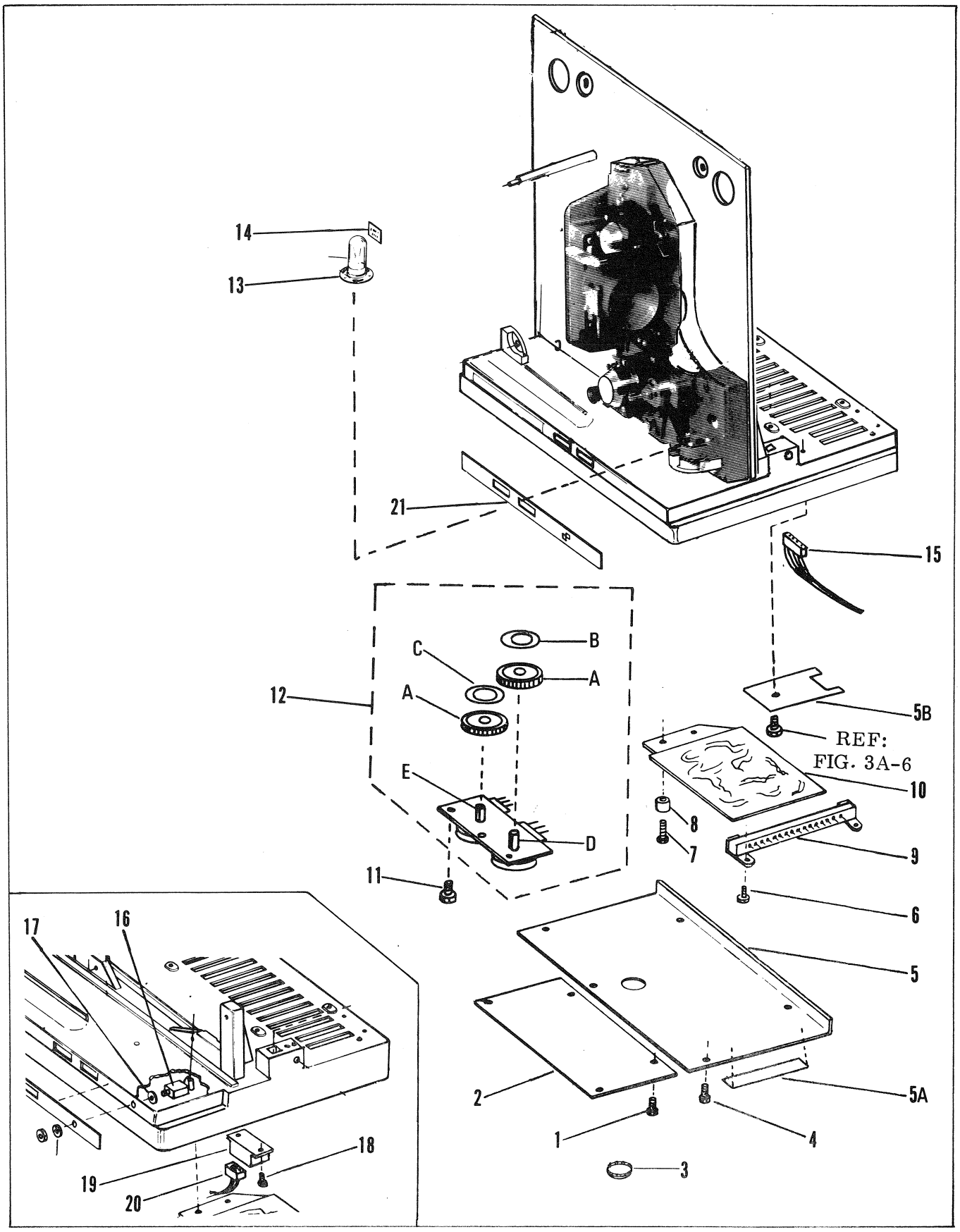
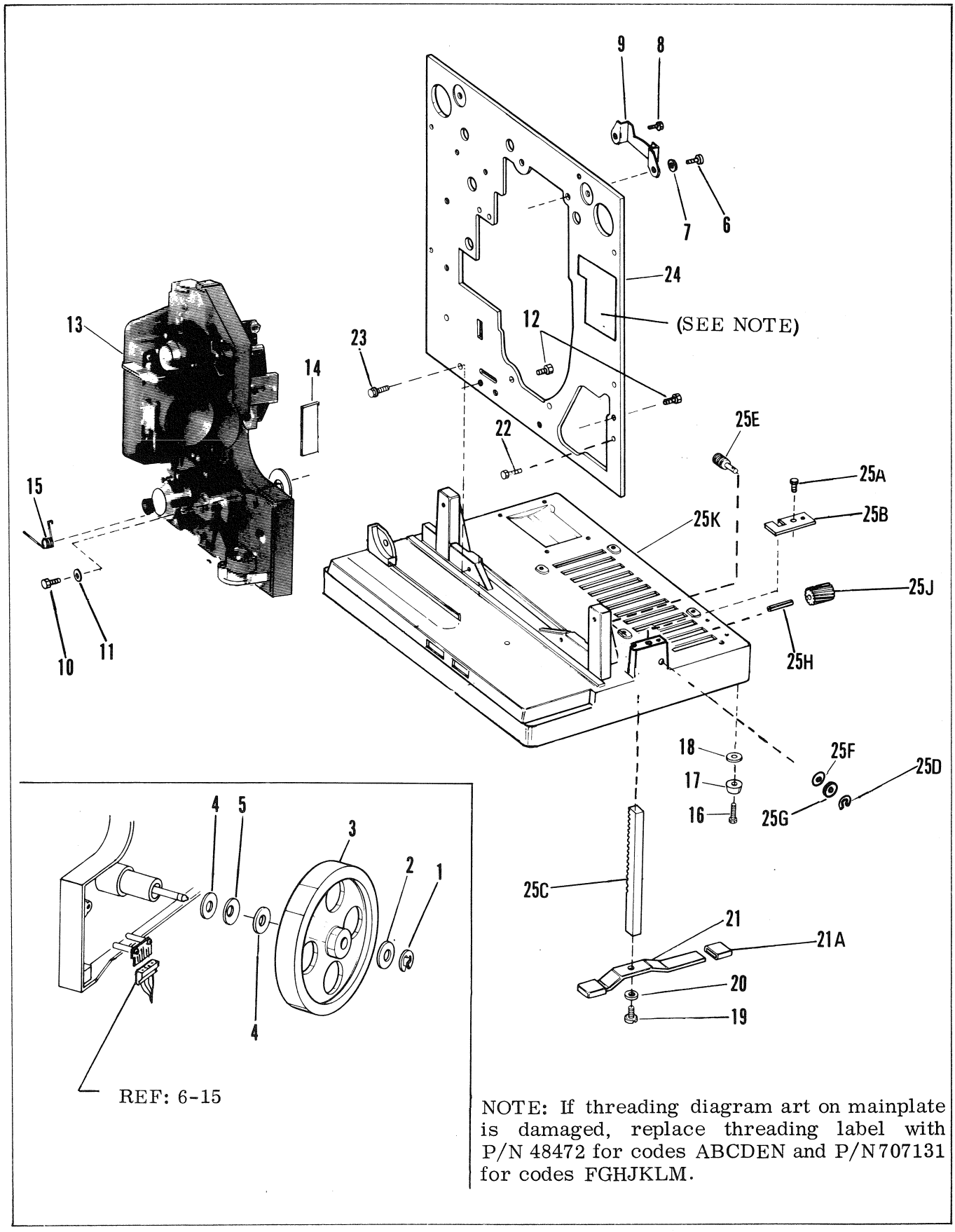


Figure 6. Projector Base Electrical Components
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR BASE MECHANICAL COMPONENTS (ALL MODELS)		
7-1	765777	RING, Retaining, 0.250 inch ID	1	
-2	45581	WASHER, Flat (early models)	4	
-3	48327	FLYWHEEL	1	
-4	700672	WASHER, Flat	2	
-5	44512	WASHER, Spring tension (bow toward main plate)	1	
-6	117031	SCREW, Slotted pan head, 10-32 by 1/4 inch	1	
-7	30667	WASHER, Flat	1	
-8	48381	SCREW, Hex washer head, 10-32 by 1/2 inch	1	
-9	44348	BRACKET, Idler gear adjustment	1	
-10	766181	SCREW, Hex washer head, 4-40 by 5/16 inch (adjusting plate)	1	FM
-11	48466	WASHER, Flat (adjusting plate)	1	FM
-12	44297	SCREW, Special	2	
-13	No Number	MECHANISM AND SOUNDHEAD ASSEMBLY (See Figures 14 thru 17 for detail parts)	NP	
-14	44546	SEAL, Light (adhesive backed)	1	A thru E
-15	48426	SPRING, Torsion (loop retention pawl)	1	
-16	30816	SCREW, Hex washer head, 8-32 by 5/8 inch	4	
-17	44532	FOOT, Rubber	4	
-18	44462	WASHER, Flat	4	
-19	34889	SCREW, Slotted binding head, 1/4-28 by 3/8 inch	1	
-20	8179	LOCKWASHER, Internal tooth	1	
-21	077920	TILT BAR ASSEMBLY	1	
-21A	31561	. FOOT, Tilt bar (secure with adhesive)	2	
-22	30835	SCREW, Phillips pan head, 6-32 by 1/2 inch	1	
-23	30810	SCREW, Hex washer head, 6-32 by 1/2 inch	3	
-24	016711	MAINPLATE ASSEMBLY, Projector	1	A thru E
-24	016712	MAINPLATE ASSEMBLY, Projector	1	F thru M
-24	078105	MAINPLATE ASSEMBLY, Projector	1	N
-25	016096	BASE ASSEMBLY, Complete	1	
-25A	30809	. SCREW, Hex washer head, 6-32 by 3/8 inch	1	
-25B	48070	. ADAPTER, Tilt gear rack	1	
-25C	48071	. GEAR RACK	1	
-25D	21736	. RING, Retaining, 0.207 inch ID	1	
-25E	48073	. GEARSHAFT, Tilt	1	
-25F	34822	. WASHER, Spring tension	1	
-25G	31039	. WASHER, Flat	1	
-25H	44533	. PIN, Spring	1	
-25J	48072	. WORM GEAR, Tilt	1	
-25K	708217	. BASE, Projector (See NOTE)	1	

NOTE: For Models A, B, C, D, E, N — Return old base for transfer of Serial No. to new base.



NOTE: If threading diagram art on mainplate is damaged, replace threading label with P/N 48472 for codes ABCDEN and P/N707131 for codes FGHJKLM.

Figure 7. Projector Base Mechanical Components
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		CONTROL PLATE ASSEMBLY (1680 MODELS ONLY)		
8-	016283	CONTROL PLATE ASSEMBLY	REF	F1,F2,GHLM
8-	016523	CONTROL PLATE ASSEMBLY	REF	F3,F4,JK
-1	432672	. FUSE, 4AT	1	F thru M
-2	435177	. FUSEHOLDER (With mounting parts)	1	F thru M
-3	707140	. TIE WRAP	1	F thru M
-4	437646	. INSULATOR, Voltage selector	1	F thru M
-5	436949	. SCREW, Phillips oval head, M3 by 10.0	2	F1,F2,GHLM
-5	437756	. SCREW, Voltage selector	2	F3,F4,JK
-6	436950	. NUT, Hex	2	F thru M
-7	043966	. SWITCH ASSEMBLY, Voltage selector	1	F thru M
-8	45767	. TIE WRAP	1	F thru M
-9	437417	. INSULATOR, Input socket	1	F thru M
-10	434198	. SCREW, Phillips binding head, M3 by 16.0	2	F1,F2,GHLM
-10	437608	. SCREW, Input socket	2	F3,F4,JK
-11	436950	. NUT, Hex	2	F thru M
-12	437559	. SOCKET, Line input	1	F thru M
-13	072848	. CLAMP AND SLEEVE ASSEMBLY, Leadwire	2	F thru M
-14	436948	. SCREW, Phillips oval head, M3 by 0.5	2	F1,F2,GHLM
-14	437610	. SCREW, Main switch	2	F3,F4,JK
-15	015865	. SWITCH ASSEMBLY, Main	1	F thru M
-16	707195	. PLATE, Switch and socket	1	F thru M

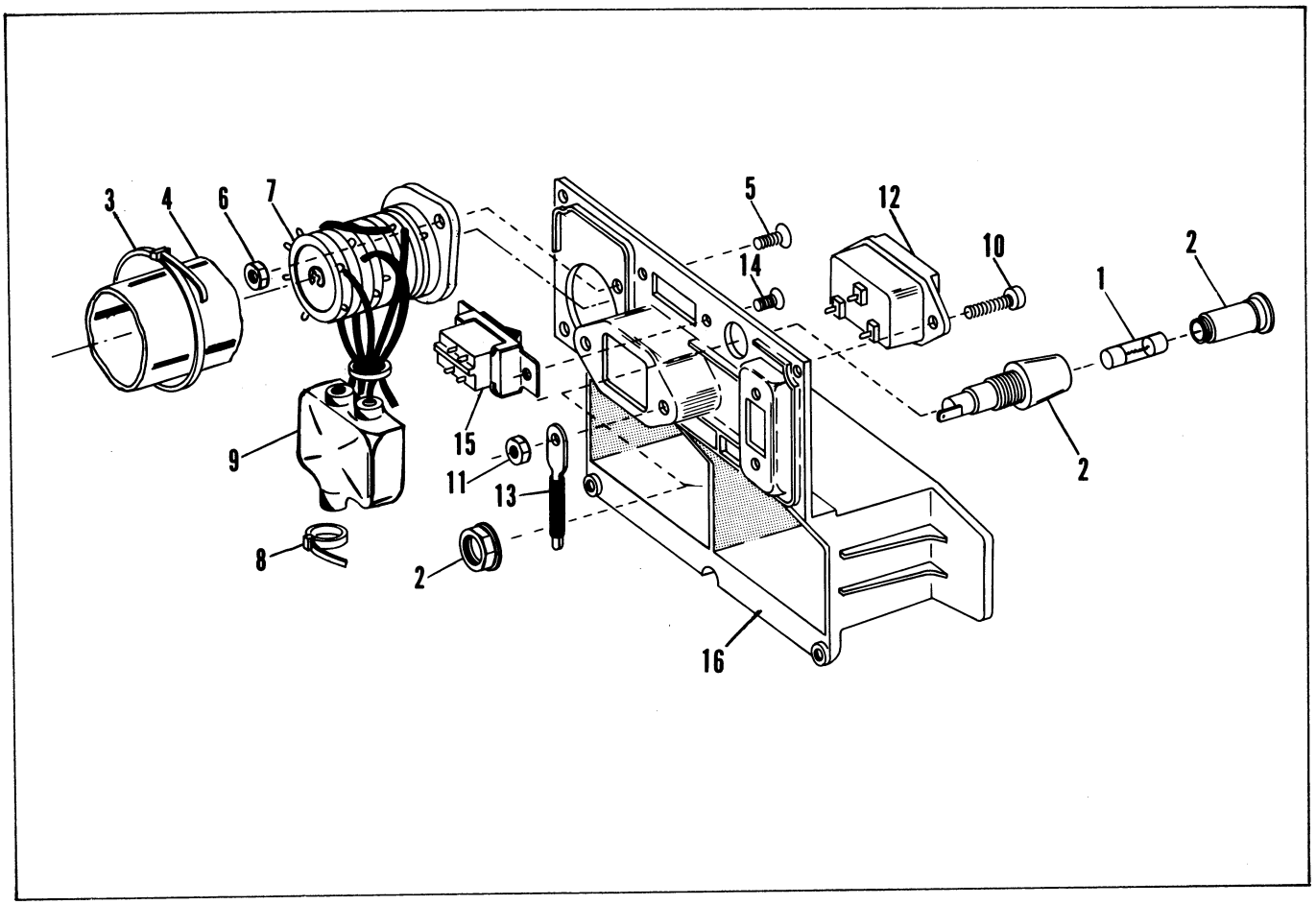


Figure 8. Control Plate Assembly
(1680 Models Only)

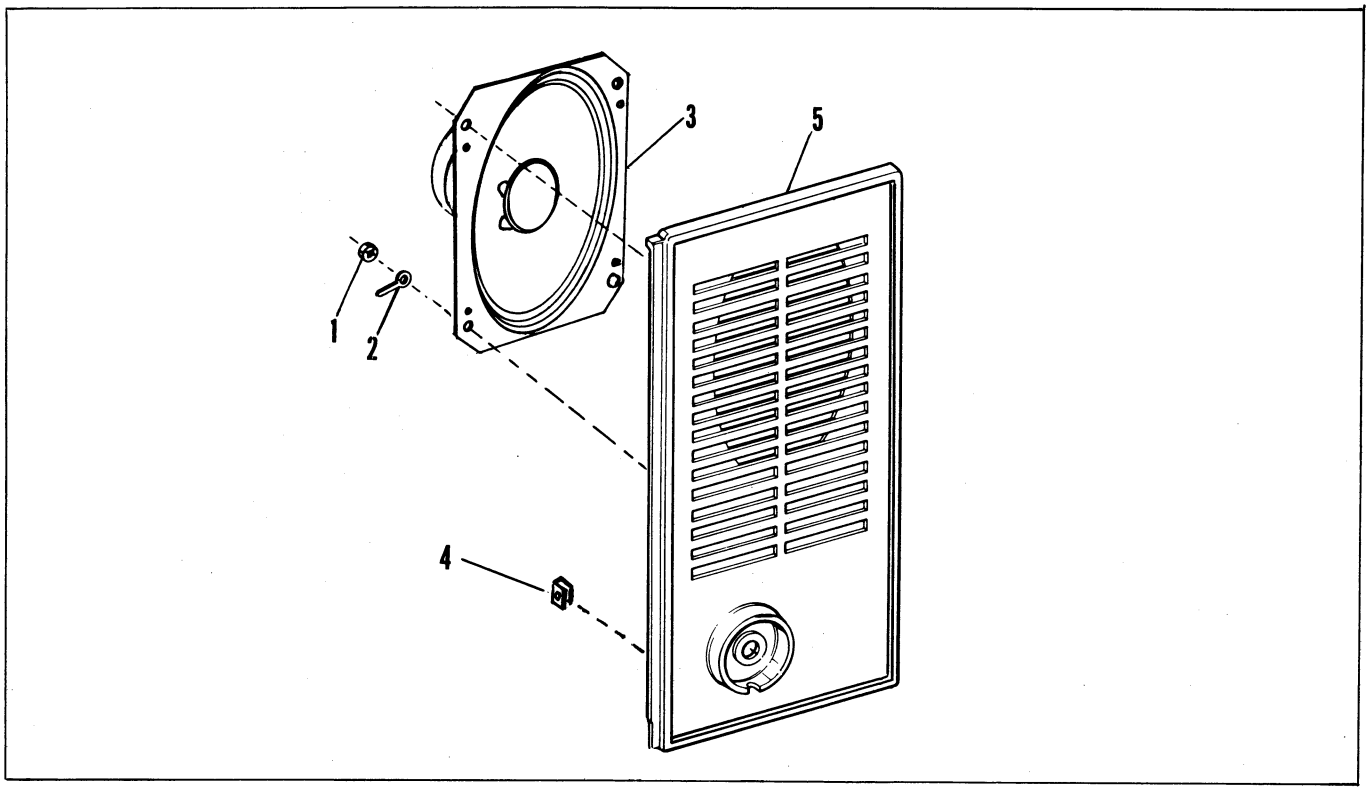


Figure 9. Front End Cap Assembly
(All Models)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		FRONT END CAP ASSEMBLY (ALL MODELS)		
9-	016521	END CAP ASSEMBLY, Front	REF	AFM
9-	016685	END CAP ASSEMBLY, Front	REF	B
9-	077474	END CAP ASSEMBLY, Front	REF	CDGH JKL
9-	016920	END CAP ASSEMBLY, Front	REF	E
9-	078111	END CAP ASSEMBLY, Front	REF	N
-1	45102	. NUT, Tinnerman	4	
-2	016522	. WIRE-TIE ASSEMBLY	1	
-3	48907	. SPEAKER	1	ABFM
-3	708994	. SPEAKER	1	CDEGH JKLN
-4	709218	. NUT, Speed	6	
-5	48053	. END CAP, Front	1	AFM
-5	48187	. END CAP, Front	1	BE
-5	710063	. END CAP, Front	1	CDGH JKL
-5	710411	. END CAP, Front	1	N

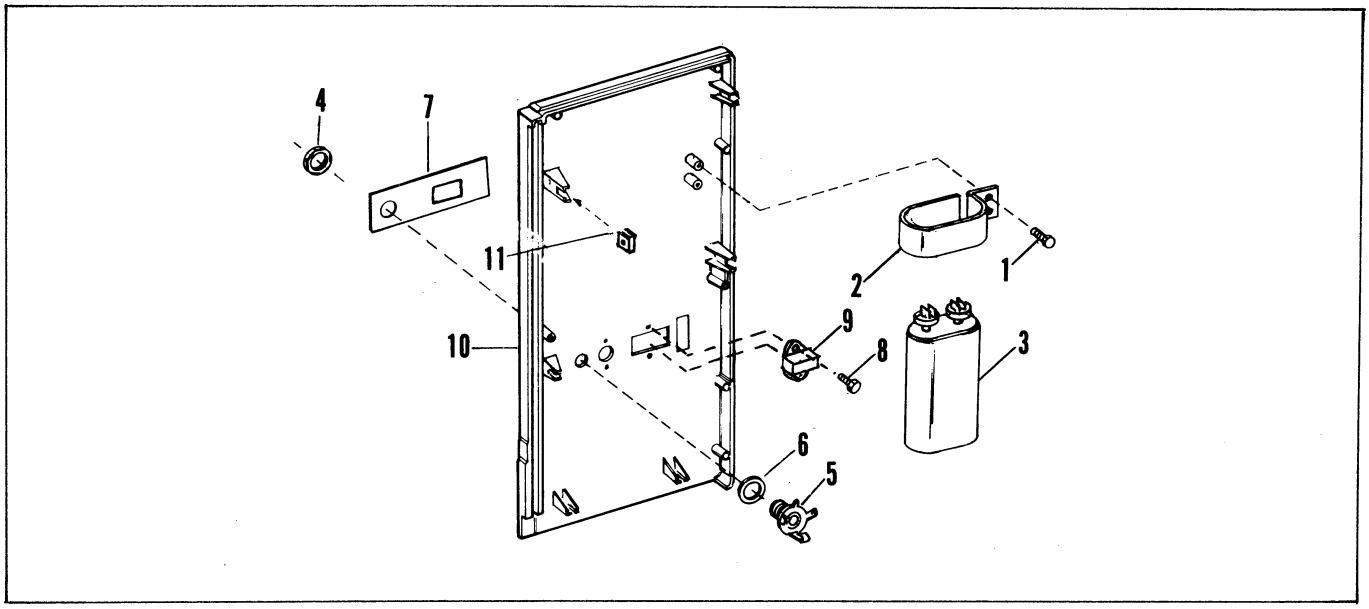


Figure 10. Rear End Cap Assembly
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		REAR END CAP ASSEMBLY (ALL MODELS)		
10-	015559	END CAP ASSEMBLY, Rear	REF	A
10-	015552	END CAP ASSEMBLY, Rear	REF	BE
10-	077473	END CAP ASSEMBLY, Rear	REF	CDL
10-	015867	END CAP ASSEMBLY, Rear	REF	FGHJK
10-	016619	END CAP ASSEMBLY, Rear	REF	M
10-	078112	END CAP ASSEMBLY, Rear	REF	N
-1	30809	. SCREW, Hex head, 6-32 by 3/8 inch (early models)	2	ABEMN
-2	44226	. CLAMP, Capacitor (early models)	1	ABEMN
-3	45692	. CAPACITOR, Starting (early models)	1	ABEMN
-4	19010	. NUT, Lock	1	CDLMN
-5	43878	. JACK, Speaker (includes items 4 and 6)	1	CDLMN
-6	25368	. WASHER, Lock	1	CDLMN
-7	48066	. TRIMPLATE, Speaker jack (adhesive backed)	1	A-E, LM
-7	49108	. TRIMPLATE, Mic jack (adhesive backed)	1	FGHJK
-7	710427	. TRIMPLATE, Speaker jack (adhesive backed)	1	N
-8	31976	. SCREW, Mic jack	2	FGHJK
-9	47350	. JACK, Mic	1	FGHJK
-10	49992	. END CAP, Rear	1	AM
-10	48188	. END CAP, Rear	1	BE
-10	710064	. END CAP, Rear	1	CD, F-L
-10	710412	. END CAP, Rear	1	N
-11	709218	. NUT, Speed	6	A thru N

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

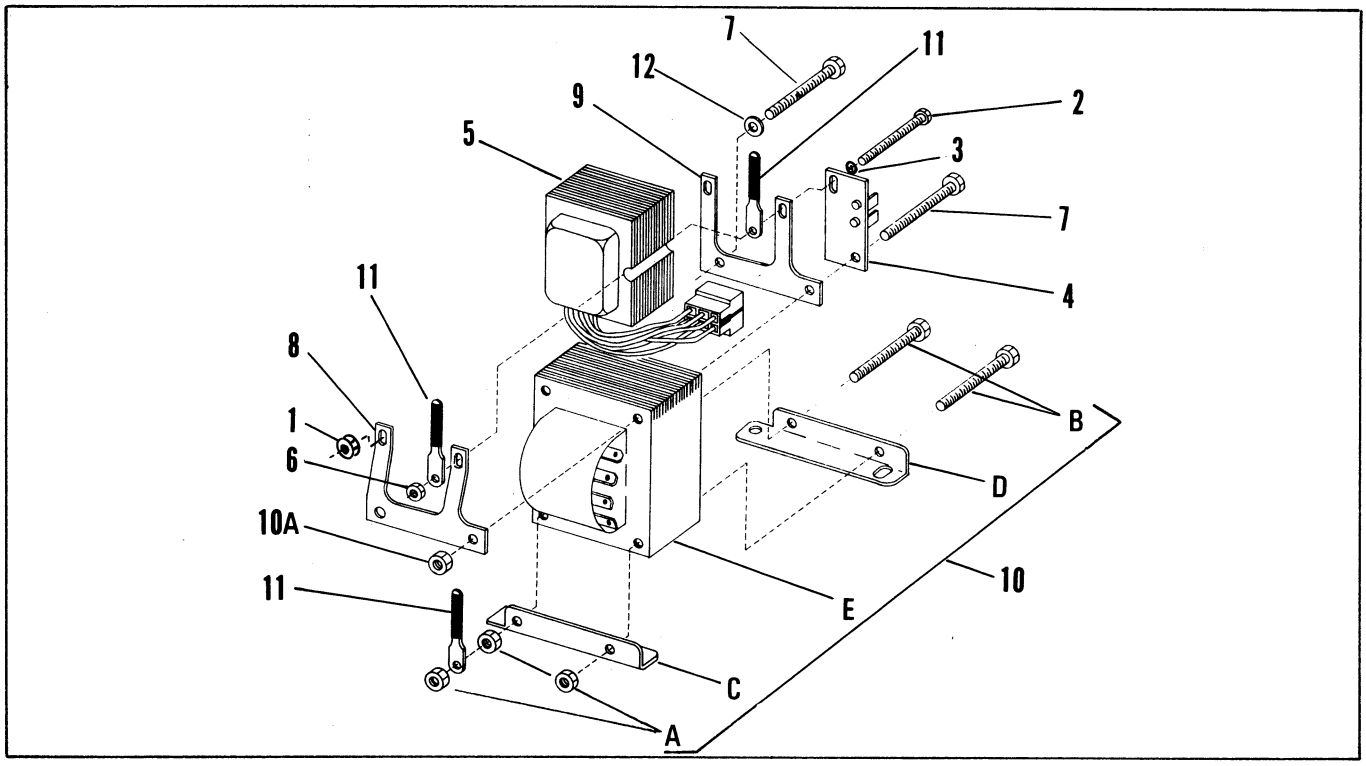


Figure 11A. Power and Lamp Transformers
(1580 Models Only)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		POWER AND LAMP TRANSFORMERS (1580 MODELS ONLY)		
11A-	No Number	POWER/LAMP TRANSFORMERS ASSEMBLY. . .	REF	A thru E
-1	19327	. NUT, Plain hex, 6-32	2	A thru E
-2	45598	. SCREW, Slotted round head, 6-32 by 1-7/8 inch	2	A thru E
-3	700735	. LOCKWASHER, External tooth, No. 6	2	A thru E
-4	707470	. TERMINAL BOARD	1	CDE
-5	48608	. TRANSFORMER, Power	1	AB
-5	016580	. TRANSFORMER ASSEMBLY, Power	1	CDE
-6	19037	. NUT, Hex Sems, 8-32	2	A thru E
-7	46484	. SCREW, Slotted round head, 8-32 by 2-1/4 inch .	2	A thru E
-8	44345	. BRACKET, Power transformer, L.H.	1	AB
-8	707746	. BRACKET, Power transformer, L.H.	1	CDE
-9	44346	. BRACKET, Power transformer, R.H.	1	AB
-9	707745	. BRACKET, Power transformer, R.H.	1	CDE
-10	015663	. TRANSFORMER ASSEMBLY, Lamp	1	AB
-10	016579	. TRANSFORMER ASSEMBLY, Lamp	1	CDE
-10A	19037	. . NUT, Hex Sems, 8-32	2	A thru E
-10B	46484	. . SCREW, Slotted round head, 8-32 by 2-1/4 inch	2	A thru E
-10C	44332	. . BRACKET, Lamp transformer, L.H.	1	A thru E
-10D	44333	. . BRACKET, Lamp transformer, R.H.	1	A thru E
-10E	No Number	. . TRANSFORMER, Lamp (order complete assy)	NP	AB
-10E	No Number	. . TRANSFORMER, Lamp (order complete assy)	NP	CDE
-11	016522	. . TIE, Wire	3	CDE
-12	709417	. . WASHER, Fiber	1	CDE

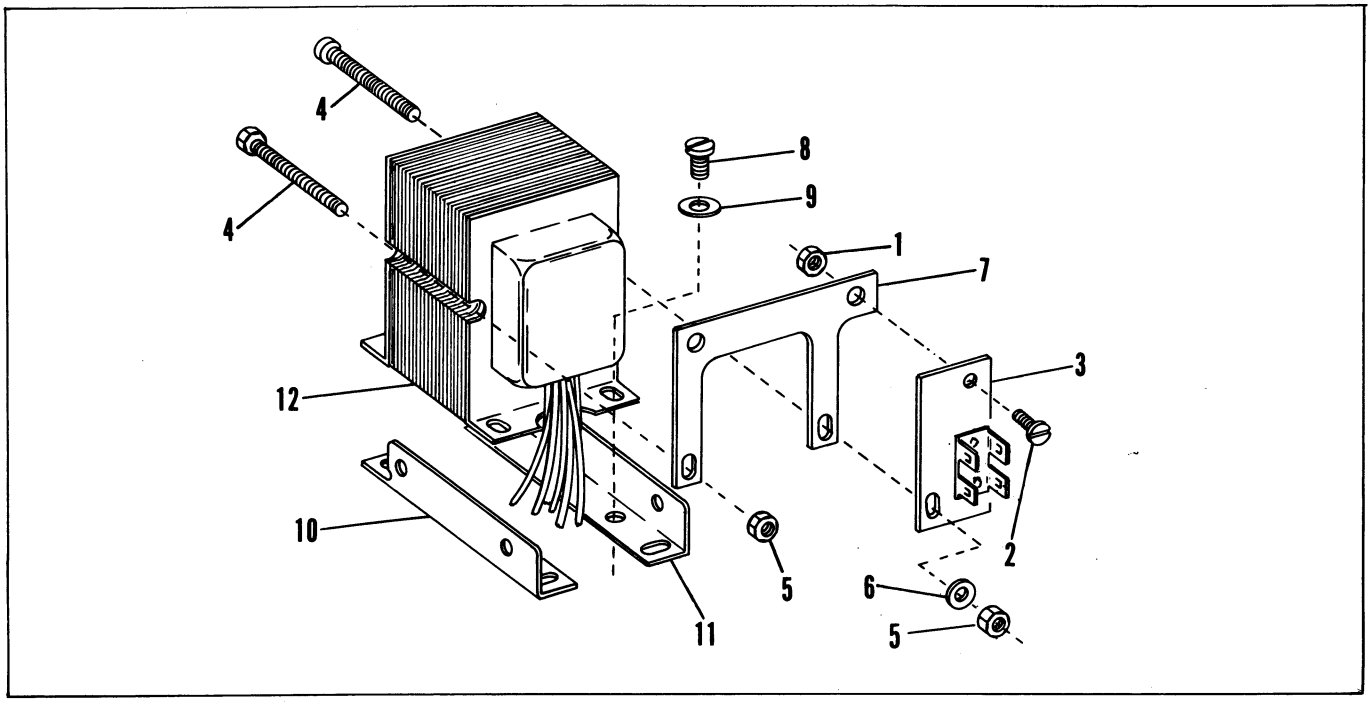


Figure 11B. Power Transformer
(1575 Models Only)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		POWER TRANSFORMER ASSEMBLY (1575 MODELS ONLY)		
11B-	No Number	POWER TRANSFORMER ASSEMBLY	REF	N
-1	601190	. NUT, Plain hex	1	N
-2	765340	. SCREW, Slotted pan head	1	N
-3	707470	. TERMINAL BOARD	1	N
-4	39350	. SCREW, Sems hex head, 6-32 by 1-11/16 inch	2	N
-5	601190	. NUT, Plain hex	2	N
-6	31243	. WASHER, Flat	1	N
-7	707745	. BRACKET, Transformer	1	N
-8	24831	. SCREW, Socket head	4	N
-9	609970	. WASHER, Flat	4	N
-10	44332	. BRACKET, Transformer mounting, L.H.	1	N
-11	44333	. BRACKET, Transformer mounting, R.H.	1	N
-12	016615	. TRANSFORMER, Power	1	N

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		REAR REEL ARM ASSEMBLY (ALL MODELS)		
12-	016263	REEL ARM ASSEMBLY, Rear	REF	A thru E
12-	015819	REEL ARM ASSEMBLY, Rear	REF	F thru M
12-	078107	REEL ARM ASSEMBLY, Rear	REF	N
-1	30879	. SCREW, Slotted pan head, 6-32 by 3/8 inch	2	
-2	45682	. COVER, Rear reel arm	1	A thru M
-2	710406	. COVER, Rear reel arm	1	N
-3	34874	. WASHER, Shim (early models)	AR	
-4	24047	. BELT, Take-up	1	
-5	36038	. SPRING, Tension	1	
-6	31247	. SCREW, Hex socket button head, 10-32 by 1/4 inch	1	
-7	016546	. SPINDLE AND PULLEY ASSEMBLY, Take-up	1	ABCDEN
-7	044178	. SPINDLE AND PULLEY ASSEMBLY, Take-up	1	F thru M
-8	700672	. WASHER, Shim	1	
-9	(Deleted)			
-10	765449	. RING, Retaining, external, 0.188 inch	1	
-11	45580	. WASHER, Flat	1	
-12	45684	. SLEEVE, Face gear	1	
-13	36764	. SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	
-14	45685	. FACE GEAR, Lower	1	
-15	34101	. WASHER, Shim	1	
-16	45683	. SHAFT, Lower face gear	1	
-17	31038	. RING, Retaining, external, 0.156 inch ID	1	
-18	707136	. SPRING, Torsion (Spec. 1545 grease in coils)	1	
-19	31245	. RING, Retaining, grip type, 0.187 inch ID	1	
-20	33385	. SPUR GEAR, Upper (Spec. 1956 grease to teeth)	1	
-21	31241	. CLIP, Gear retaining	2	
-22	31239	. SPUR GEAR, Lower (Spec. 1956 grease to teeth)	1	
-23	34101	. WASHER, Flat	1	
-24	44412	. GEAR SHAFT	1	
-25	31236	. BEARING, Nylon (Spec. 1955 oil to bearing ID)	2	
-26	36764	. SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	
-27	44367	. FACE GEAR, Upper (Spec. 1545 grease to hub)	1	
-28	765777	. RING, Retaining, external, 0.250 inch ID	1	
-29	700672	. WASHER, Spacer	1	
-30	49532	. SHAFT, Rear reel arm	1	
-31	078120	. ARM AND BEARING ASSEMBLY, Rear reel	1	A thru N
-31A	014611	. . BEARING ASSEMBLY, Rear and take-up reel arm	1	A thru N
-31B	078121	. . ARM, Rear reel	1	A thru N
-32	41331	. . PIN, Rear and take-up reel arm assembly	1	A thru N

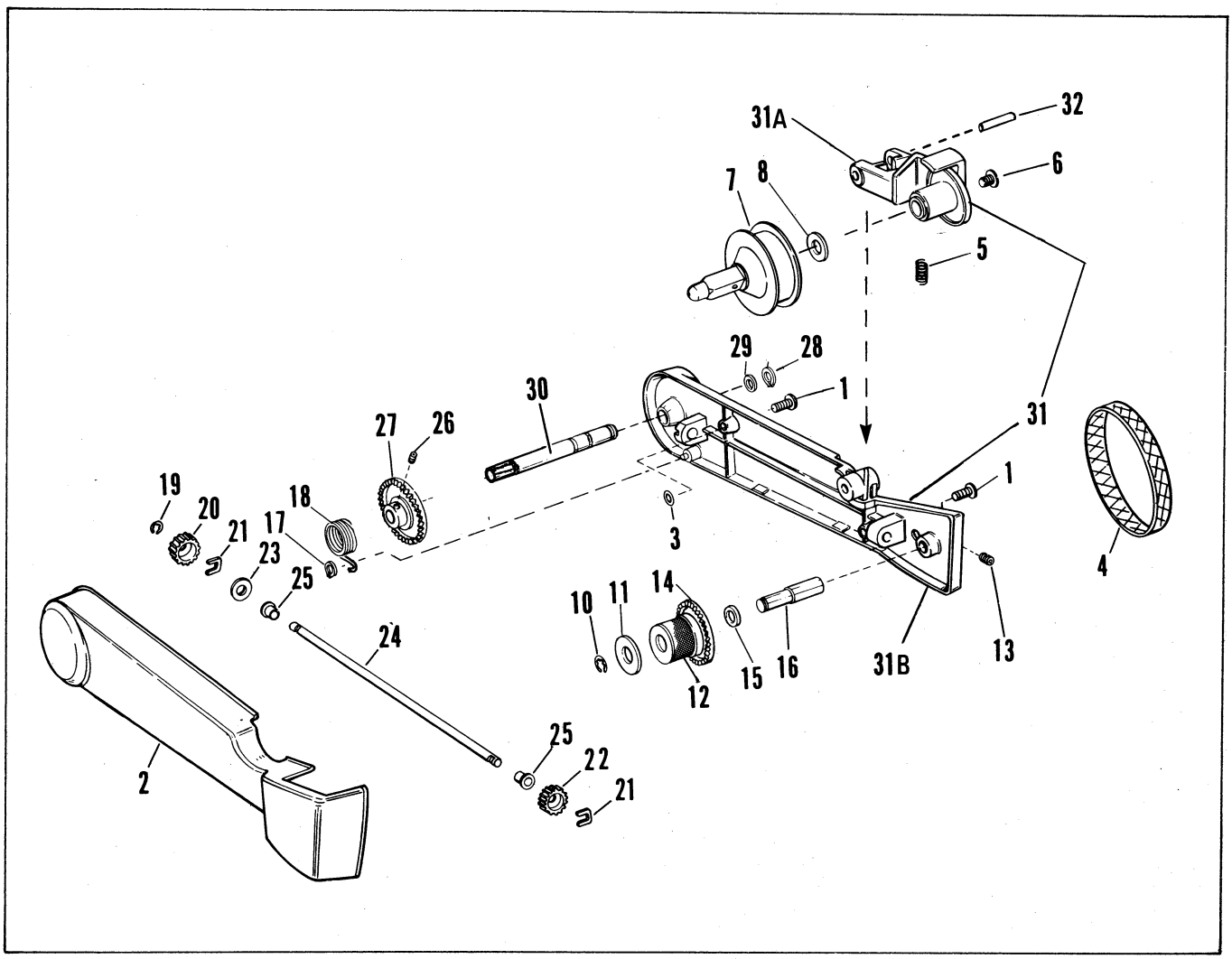


Figure 12. Rear Reel Arm Assembly
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		FRONT REEL ARM ASSEMBLY (ALL MODELS)		
13-	014948	REEL ARM ASSEMBLY, Front	REF	A thru E
13-	015816	REEL ARM ASSEMBLY, Front	REF	F thru M
13-	078106	REEL ARM ASSEMBLY, Front	REF	N
-1	30879	. SCREW, Slotted pan head, 6-32 by 3/8 inch . . .	2	
-2	49696	. COVER, Front reel arm	1	A thru M
-2	710405	. COVER, Front reel arm	1	N
-3	34859	. WASHER, Shim	AR	
-4	31247	. SCREW, Hex socket button head, 10-32 by 1/4 inch	1	
-5	No Number	. SPINDLE ASSEMBLY, Feed	NP	
-5A	36769	. . SETSCREW, Fluted socket cup pt, ... 8-32 by 3/16 inch	2	
-5B	708498	. . FACE GEAR, Lower (early models) (NOTE A)	1	
-5B	709806	. . FACE GEAR, Lower (early models) (NOTE A)	1	
-5C	31359	. . WASHER, Flat (early models) (NOTE A) . . .	1	A thru E
-5C	437461	. . WASHER, Flat (early models) (NOTE A) . . .	1	F thru M
-5D	016952	. . SPINDLE ASSEMBLY, Feed	1	ABCDEN
-5D	043390	. . SPINDLE ASSEMBLY, Feed	1	F thru M
-6	31038	. RING, Grip type, 0.156 inch ID	1	
-7	36764	. SETSCREW, Fluted socket cup pt, ... 6-32 by 3/16 inch	1	
-8	36765	. SETSCREW, Fluted socket cup pt, ... 6-32 by 1/4 inch (secure to flat on index -14)	1	
-9	45577	. FACE GEAR, Upper (B&H 070047 grease to hub)	1	
-10	45578	. SLEEVE, Face gear	1	
-11	45579	. SPRING, Torsion (B&H 070047 grease to coils)	1	
-12	765777	. RING, Retaining, external, 0.250 inch ID	1	
-13	31017	. WASHER, Thrust	1	
-14	707111	. SHAFT, Front reel arm	1	ABCDEN
-14	48901	. SHAFT, Front reel arm	1	F thru M
-15	31245	. RING, Retaining, grip type, 0.187 inch ID	1	
-16	33385	. SPUR GEAR, Upper (B&H 070034 grease to hub)	1	
-17	31241	. CLIP, Gear retaining	2	
-18	31243	. WASHER, Flat	1	
-19	31239	. SPUR GEAR, Lower (B&H 070034 grease to teeth)	1	
-20	44407	. GEAR SHAFT	1	
-21	31236	. BEARING, Nylon (B&H 070041 oil to bearing ID)	2	
-22	014616	. ARM AND BEARING ASSEMBLY, Front reel .	1	A thru M
-22	078119	. ARM AND BEARING ASSEMBLY, Front reel .	1	N
G2	070034	GREASE		
G3	070047	GREASE		
L6	070041	LUBRICATION OIL		

NOTE A: Flat washer (item -5C) used only with early model face gear (item -5B).

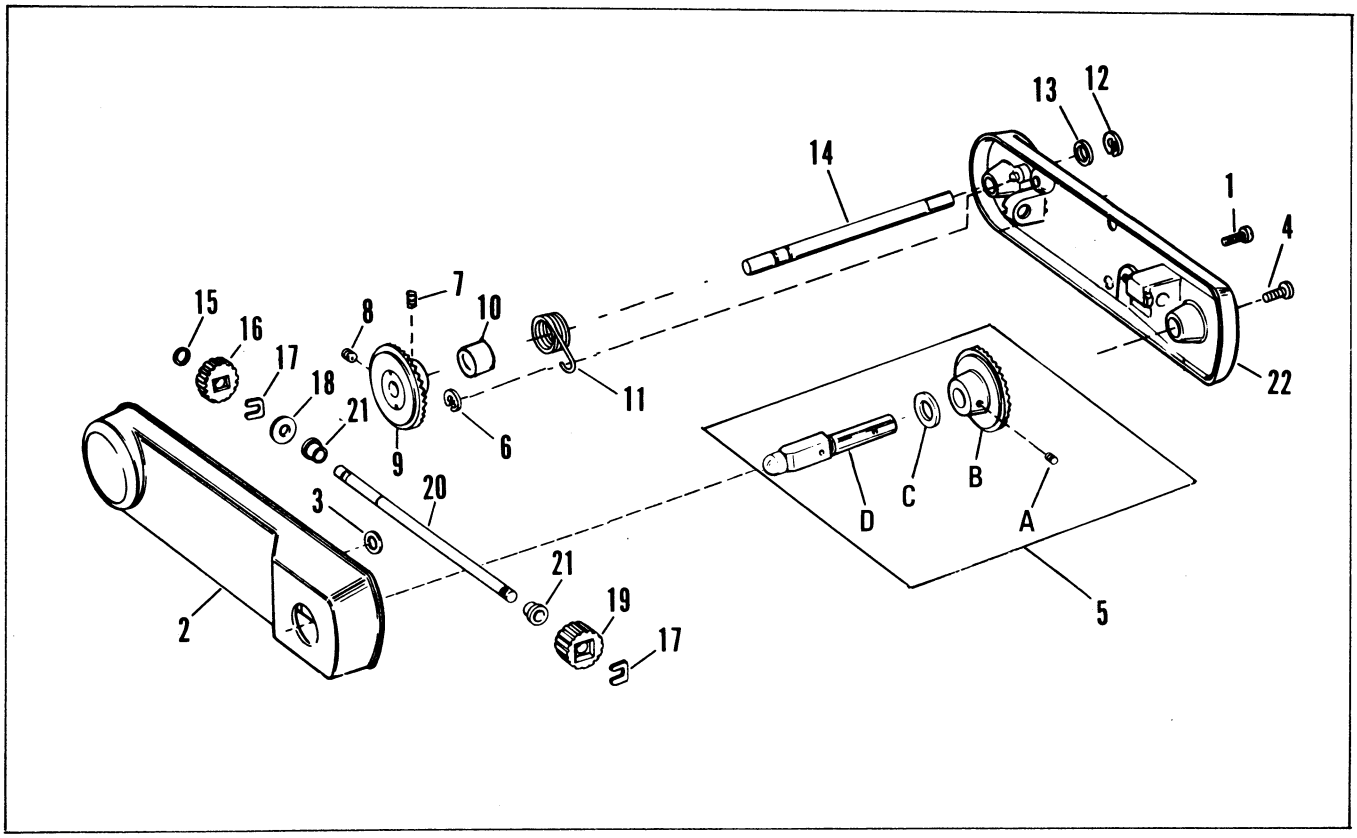


Figure 13. Front Reel Arm Assembly
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY — VIEW I (ALL MODELS)		
14-	No Number	MECHANISM ASSEMBLY, Complete	REF	
-1	30809	. SCREW, Hex washer head, 6-32 by 3/8 inch	4	
-2	48318	. BRACKET, Support	1	
-3	30809	. SCREW, Hex washer head, 6-32 by 3/8 inch	2	
-4	36662	. BAFFLE, Heat	1	
-5	36770	. SETSCREW, Fluted socket cup pt, 8-32 by 1/4 inch	2	
-6	49008	. PULLEY, Mechanism (early models)	1	
-6	709593	. PULLEY, Mechanism (current models)	1	
-7	707809	. SETSCREW, Load lever (early models)	2	
-7	700424	. SETSCREW, Load lever (current models)	2	
-8	48350	. LEVER, Load (early models)	1	A thru M
-8	710035	. LEVER, Load (current models)	1	A thru M
-8	710426	. LEVER, Load	1	N
-9	48450	. RETAINER, Entrance roller	1	A thru M
-9	710420	. RETAINER, Entrance roller	1	N
-9A	710430	. TRIMPLATE, Entrance roller	1	N
-10	48451	. ROLLER, Entrance	1	A thru M
-10	710419	. ROLLER, Entrance	1	N
-11	30163	. SCREW, Slotted binding head, 5-40 by 3/8 inch	1	
-12	31674	. WASHER, Flat	1	
-13	016086	. ROLLER ASSEMBLY, Stabilizer	1	
-14	48367	. STOP, Lamphouse, lower	1	
-15	30804	. SCREW, Hex washer head, 4-40 by 1/4 inch	2	
-16	016755	. LIFTER ASSEMBLY, Impedance roller (early models)	1	A thru M
-17	30803	. . SCREW, Hex washer head, 4-40 by 3/16 inch (early models)	1	A thru M
-18	48453	. . RETAINER, Snubbing spring	1	A thru M
-19	48452	. . SPRING, Torsion (early models)	1	A thru M
-20	077182	. ROLLER ASSEMBLY, Impedance (early models)	1	A thru M
-20A	766183	. . NUT, Hex locking (early models)	1	A thru M
-21	709148	. PLATE, Impedance roller adjusting (current models)	1	
-22	707048	. NUT, Roller assembly (current models)	1	
-23	077181	. ROLLER AND PLATE ASSEMBLY, Impedance (current)	1	
-24	709149	. SPRING, Torsion (current models)	1	
-25	31245	. RING, Grip (current models)	1	
-26	709147	. SPRING, Torsion (current models)	1	
-27	30802	. SCREW, Hex washer head, 4-40 by 1/8 inch	2	
-28	611734	. LOCKWASHER, Internal tooth	1	
-29	48485	. BOARD, Printed circuit	1	
-30	30812	. SCREW, Hex washer head, 6-32 by 3/4 inch	1	
-31	020240	. OPTICAL SLIT ASSEMBLY	1	
-32	36765	. SETSCREW, Fluted socket cup pt, 6-32 by 1/4 inch	1	
-33	31669	. RETAINER, Photocell	1	
-34	016293	. PHOTOCELL AND HOLDER ASSEMBLY	1	
-35	48446	. INSERT, Decorative (adhesive backed)	1	A thru M
-35A	710431	. INSERT, Decorative (adhesive backed)	1	N
-36A	611767	. RING, Retaining	1	
-36B	48454	. ROLLER, Threading	1	A thru M
-36B	710421	. ROLLER, Threading	1	N
-37	36668	. SCREW, Pan head Sems, 6-32 by 5/16 inch	2	
-38	015537	. SOUND DRUM AND SHAFT ASSEMBLY	1	
-39	31638	. SCREW, Fillister head, 6-32 by 7/16 inch	2	
-40	09828	. CONTACT ASSEMBLY, Exciter lamp	1	
-41	31636	. RING, Lamp release	1	
-42	36771	. SETSCREW, Fluted socket cup pt, 8-32 by 3/8 inch	4	
-43	016808	. GEAR ASSEMBLY, Helical, upper (alternate P/N 012126)	1	
-44	015538	. GEAR ASSEMBLY, Helical, lower	1	
-45	31015	. WASHER, Spring tension	2	
-45A	708640	. RING, Grip	1	
-46	015535	. SPROCKET ASSEMBLY, Upper	1	
-47	31017	. WASHER, Thrust	1	
-48	48335	. SHAFT, Helical gear, lower	1	
-49	31017	. WASHER, Thrust	1	
-50	24903	. RING, Retaining, crescent	1	
-51	36764	. SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	2	
-52	015533	. GEAR ASSEMBLY, Lower sprocket	1	
-53	31015	. WASHER, Spring tension	1	
-54	015540	. SPROCKET ASSEMBLY, Lower	1	
-55	31017	. WASHER, Thrust	1	
-56	35910	. FLANGE, Lower sprocket	1	
G1	070043	GREASE		
L2	08963	OIL		
L4	079215	OIL		

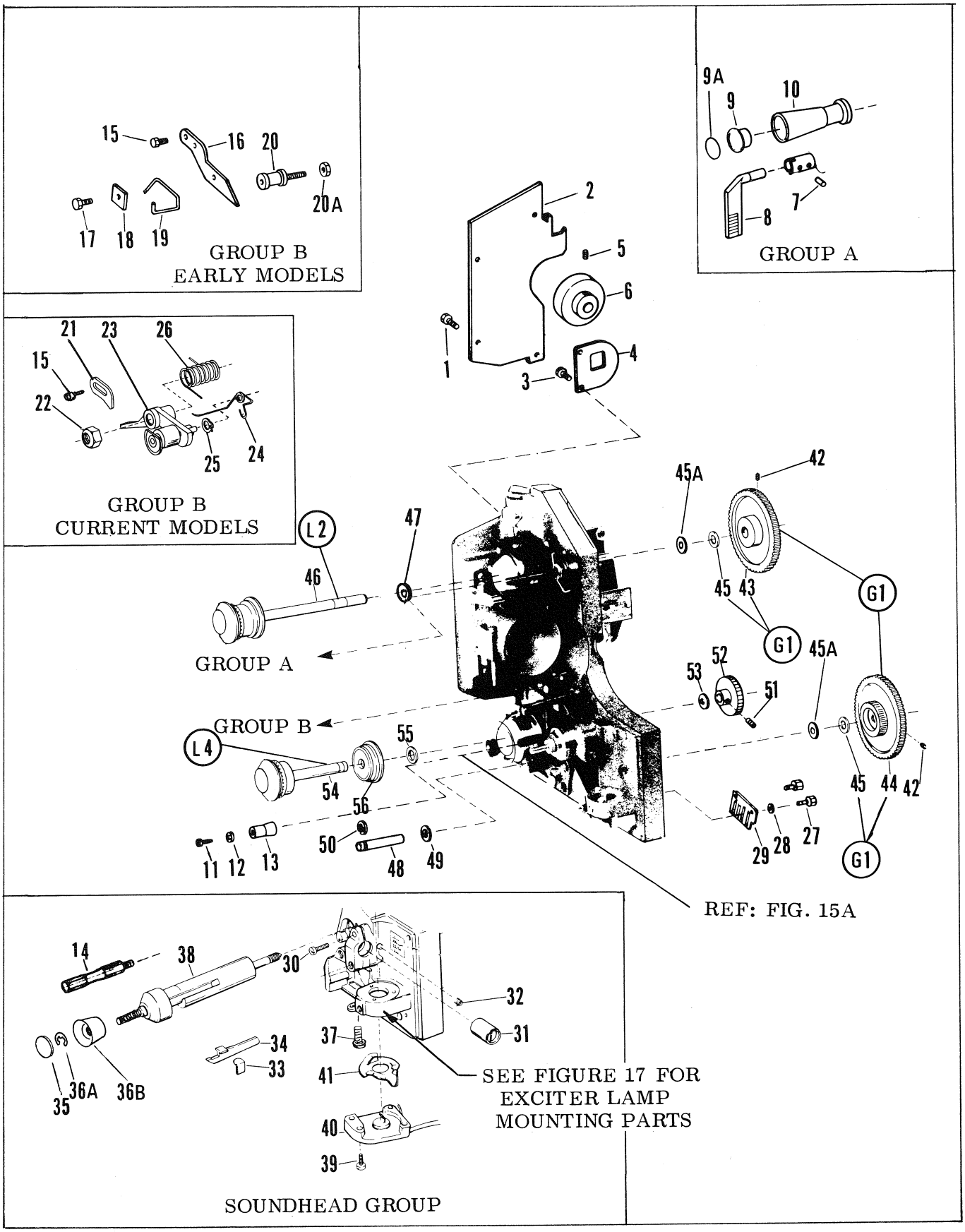


Figure 14. Mechanism Assembly — View I
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY — VIEW II (ALL MODELS)		
15-1	24443	. RING, Retaining, external, 0.140 inch ID	1	
-2	016989	. PLATE ASSEMBLY, Gear disengagement	1	
-2A	765449	. RING, Retaining, 0.188 inch ID	1	
-3	30803	. SCREW, Hex washer head, 4-40 by 3/16 inch	2	
-4	016088	. SWITCH ASSEMBLY, Motor interlock	1	ABCDEN
-4	016285	. SWITCH ASSEMBLY, Motor interlock	1	F thru M
-5	30211	. RING, Grip	1	
-6	707143	. GEAR, Idler	1	
-6A	707812	. SPRING, Torsion (070034 grease to inside diameter)	1	
-6B	707142	. LEVER, Retractor	1	
-6C	31015	. WASHER, Bowed	1	
-7	48492	. SPRING, Counterbalance (early models)	1	A thru M
-7	31673	. SPRING, Counterbalance (current models)	1	
-8	30803	. SCREW, Hex washer head, 4-40 by 3/16 inch (early models)	1	A thru M
-9	48476	. CAP, Stabilizer arm (early models)	1	
-9A	765777	. RING, Retaining, 0.250 inch ID	1	
-10	016073	. STABILIZER ARM ASSEMBLY, Lower (early models)	1	A thru M
-10	016976	. STABILIZER ARM ASSEMBLY, Lower (current models)	1	
-10A	48483	. SPRING, Torsion	1	
-11A	17639	. RING, Retaining, external, 0.125 inch ID (early models)	1	A thru M
-11B	707290	. PLATE, Adjusting (early models)	1	A thru M
-11C	48491	. SPRING, Torsion (early models)	1	A thru M
-12A	31038	. GRIP RING (early models)	1	A thru M
-12B	41605	. WASHER, Flat	1	
-12C	709144	. STUD, Threaded (early models)	1	
-13	016078	. ARM ASSEMBLY, Impedance roller (early models)	1	A thru M
-14	48345	. PIVOT, Impedance roller arm (early models)	1	A thru M
-15	17676	. RING, Retaining, external, 0.156 inch ID	1	
-16	33837	. WASHER, Bowed	1	
-17	44511	. RETAINER, Counterbalance spring	1	
-18	44420	. SCREW, Counterbalance spring adjusting	1	
-19	32232	. RING, Retaining, 0.250 inch ID	1	
-20	48380	. ROLLER, Exit	1	
-21	87030	. RING, Grip	1	
-22	48480	. WASHER, Flat	1	
-23	48414	. STRIPPER, Film	1	
-24	31038	. RING, Grip	1	
-25	30807	. SCREW, Hex washer head, 6-32 by 1/4 inch	1	
-26	765777	. RING, Retaining, external, 0.250 inch ID	1	
-27	48413	. PLATE, Adjusting	1	
-28	765449	. RING, Retaining, external, 0.188 inch	1	
-29	No Number	. PLATE ASSEMBLY, Lower sprocket (see Figure 15A detail parts)	NP	
-30	31245	. RING, Grip	1	
-31	48419	. SPRING, Torsion	1	
-32	17676	. RING, Retaining, external, 0.156 inch ID	1	
-33	86864	. WASHER, Flat	1	
-34	48425	. SPRING, Torsion	1	
-35	016076	. ARM ASSEMBLY, Snubber	1	
-36	48445	. POST, Snubber stop	1	
-37	17676	. RING, Retaining, external, 0.156 inch ID	1	
-38	016079	. PAWL ASSEMBLY, Retention	1	

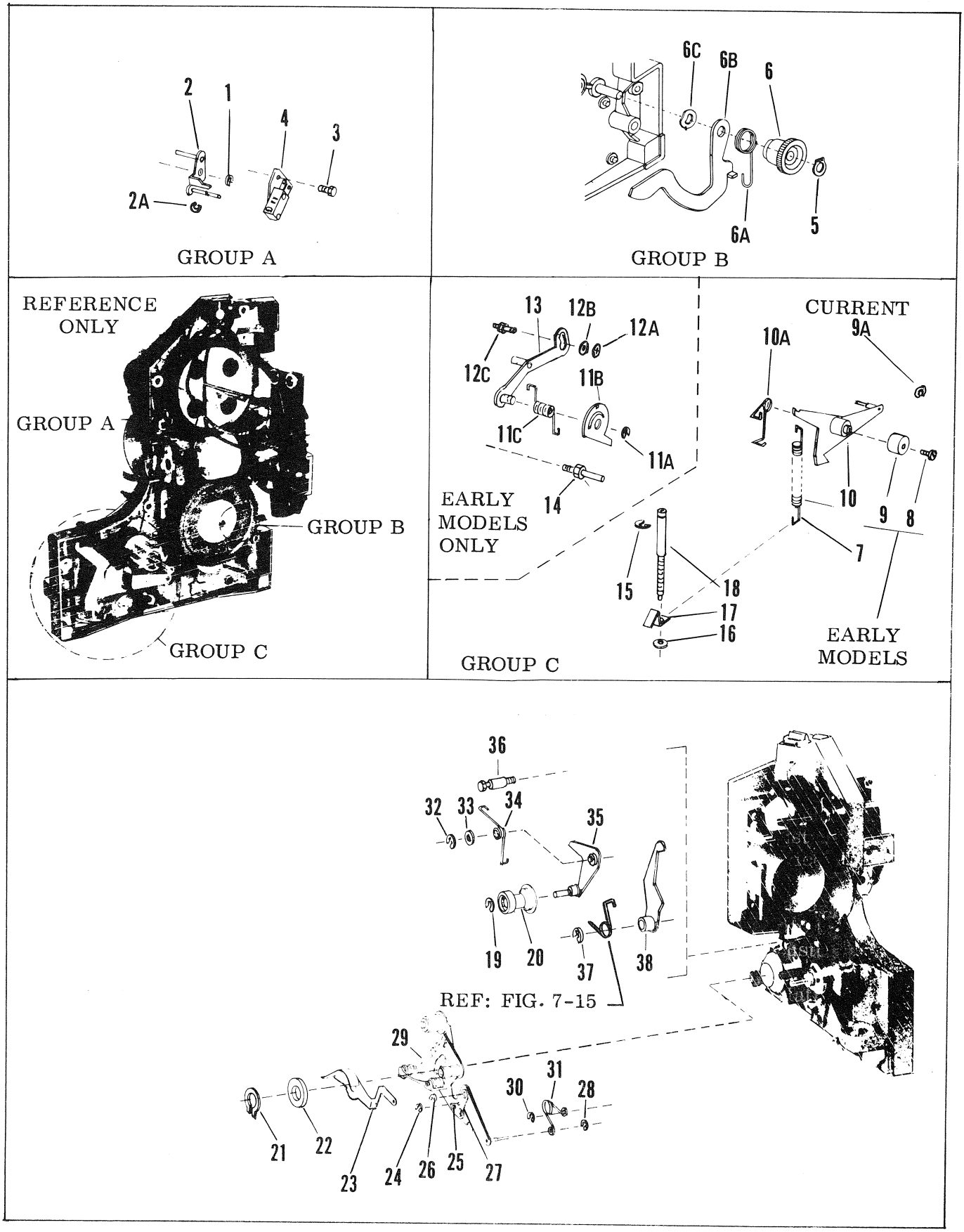


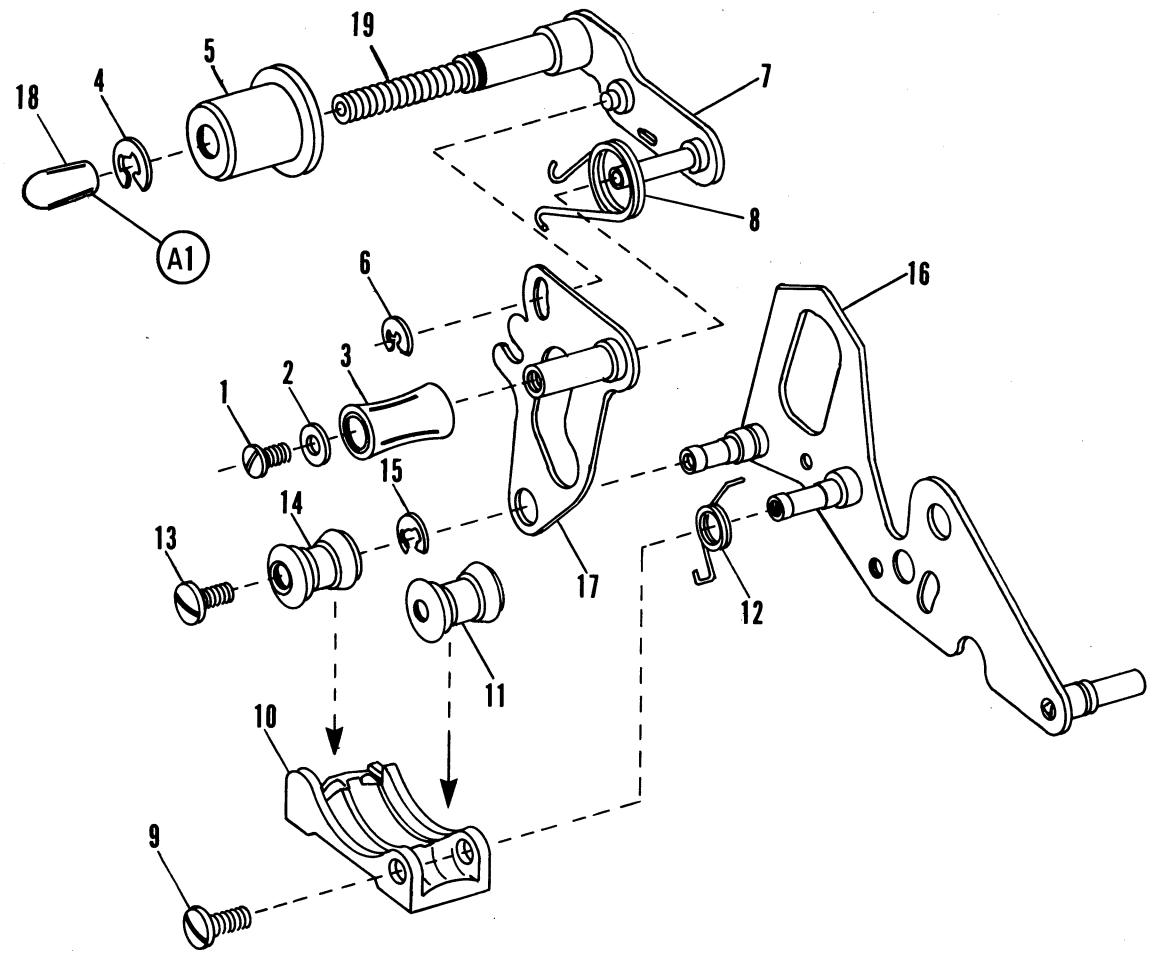
Figure 15. Mechanism Assembly — View II
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		1 2 3 4 5 6 7		

SPROCKET PLATE ASSEMBLY
(ALL MODELS)

15A-	No Number	SPROCKET PLATE ASSEMBLY, Lower	REF
-1	36832	. SCREW, Slotted pan head, 2-56 by 3/16 inch . .	1
-2	33536	. WASHER, Flat	1
-3	48399	. ROLLER, Film guide	1
-4	765777	. RING, Retaining, external, 0.250 inch ID	1
-5	707715	. ROLLER, Idler, lower	1
-6	17639	. RING, Retaining, external, 0.125 inch ID	1
-7	077480	. ARM ASSEMBLY, Loop restorer	1
-8	48403	. SPRING, Torsion	1
-9	30164	. SCREW, Slotted binding head, 4-40 by 3/16 inch .	1
-10	48435	. GUARD, Sprocket	1
-11	48438	. ROLLER, Film guide	1
-12	48463	. SPRING, Torsion	1
-13	30164	. SCREW, Slotted binding head, 4-40 by 3/16 inch .	1
-14	48437	. ROLLER, Film guide	1
-15	705293	. RING, Retaining, 0.182 inch ID	1
-16	016080	. PLATE ASSEMBLY, Adjusting	1
-17	015542	. PLATE ASSEMBLY, Loopformer roller	1
-18	710134	. TIP, Loop reset (secure with adhesive)	1
-19	709793	. SPRING, Loop reset	1
-20	30807	SCREW, Hex washer head, 6-32 by 1/4 inch	1
-21	48413	PLATE, Adjusting	1
A1	70508	ADHESIVE	



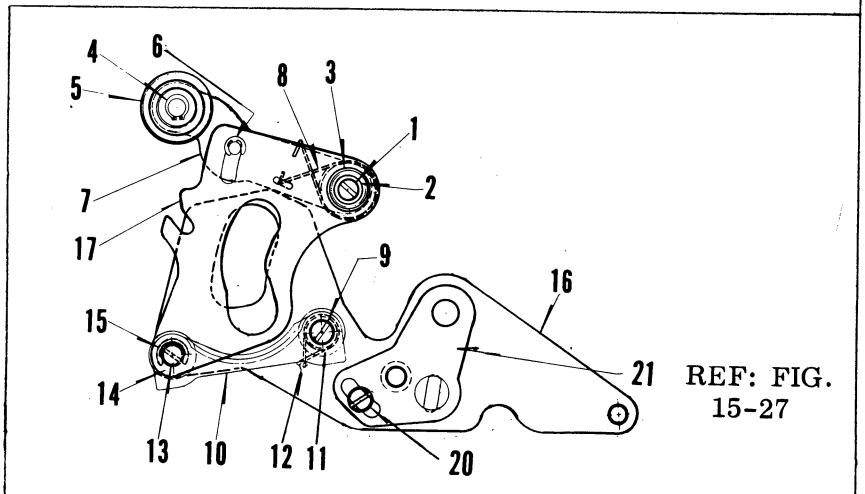


Figure 15A. Sprocket Plate Assembly
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY — VIEW III (ALL MODELS)		
16-1	17639	. RING, Retaining, external, 0.125 inch ID	2	
-2	48322	. PIN, Carrier guide, lower	1	
-3	015529	. CARRIER ASSEMBLY, Lens, complete	1	
-3A	48386	. . SCREW, Pressure plate, special	2	
-3B	34888	. . PLATE, Pressure	1	
-3C	710659	. . SPRING, Tension	2	
-3D	45687	. . SPACER, Pressure plate screw	2	
-3E	30803	. . SCREW, Hex washer head, 4-40 by 3/16 inch	2	
-3F	48466	. . WASHER, Flat	2	
-3G	48431	. . PLATE, Adjustment	1	
-3H	30803	. . SCREW, Hex washer head, 4-40 by 3/16 inch	2	
-3J	31093	. . RETAINER, Focus shaft	1	
-3K	015546	. . KNOB AND SHAFT ASSEMBLY, Focus	1	
-3L	48434	. . BEARING, Nyliner	2	
-3M	015528	. . CARRIER ASSEMBLY, Lens	1	
-4	48412	. LINK, Shifting	1	
-5	17639	. RING, Retaining, external, 0.125 inch ID	2	
-6	48321	. PIN, Carrier guide, upper	1	
-7	48479	. RING, Retaining, 0.250 inch ID (reinforced)	1	
-8	48369	. SPRING, Torsion	1	
-9	31245	. RING, Grip	1	
-10	48447	. SPRING, Torsion	1	
-11	30164	. SCREW, Slotted binding head, 4-40 by 3/16 inch	1	
-12	48435	. GUARD, Sprocket, upper	1	
-13	48438	. ROLLER, Film guide	1	
-14	48463	. SPRING, Torsion	1	
-15	32232	. RING, Retaining, 0.250 inch ID	1	
-16	48373	. ROLLER, Idler, upper	1	
-17	30164	. SCREW, Slotted binding head, 4-40 by 3/16 inch	1	
-18	48437	. ROLLER, Film guide	1	
-19	87030	. RING, Grip	1	
-20	48480	. WASHER, Flat	1	
-21	016072	. PLATE ASSEMBLY, Sprocket and loopformer	1	
-22	34156	. SCREW, Sems pan head, 4-40 by 3/16 inch	1	
-23	48443	. BRACKET, Latch	1	
-24	48341	. LATCH, Mode selector	1	
-25	36837	. SCREW, Pan head, 4-40 by 1/4 inch	1	
-26	48433	. WASHER, Flat	1	
-27	31245	. RING, Grip	1	
-28	015549	. BUSHING ASSY, Mode selector (early models)	1	A thru M
-28	077452	. BUSHING ASSY, Mode selector (current models)	1	
-29	710649	. SPRING, Torsion	1	

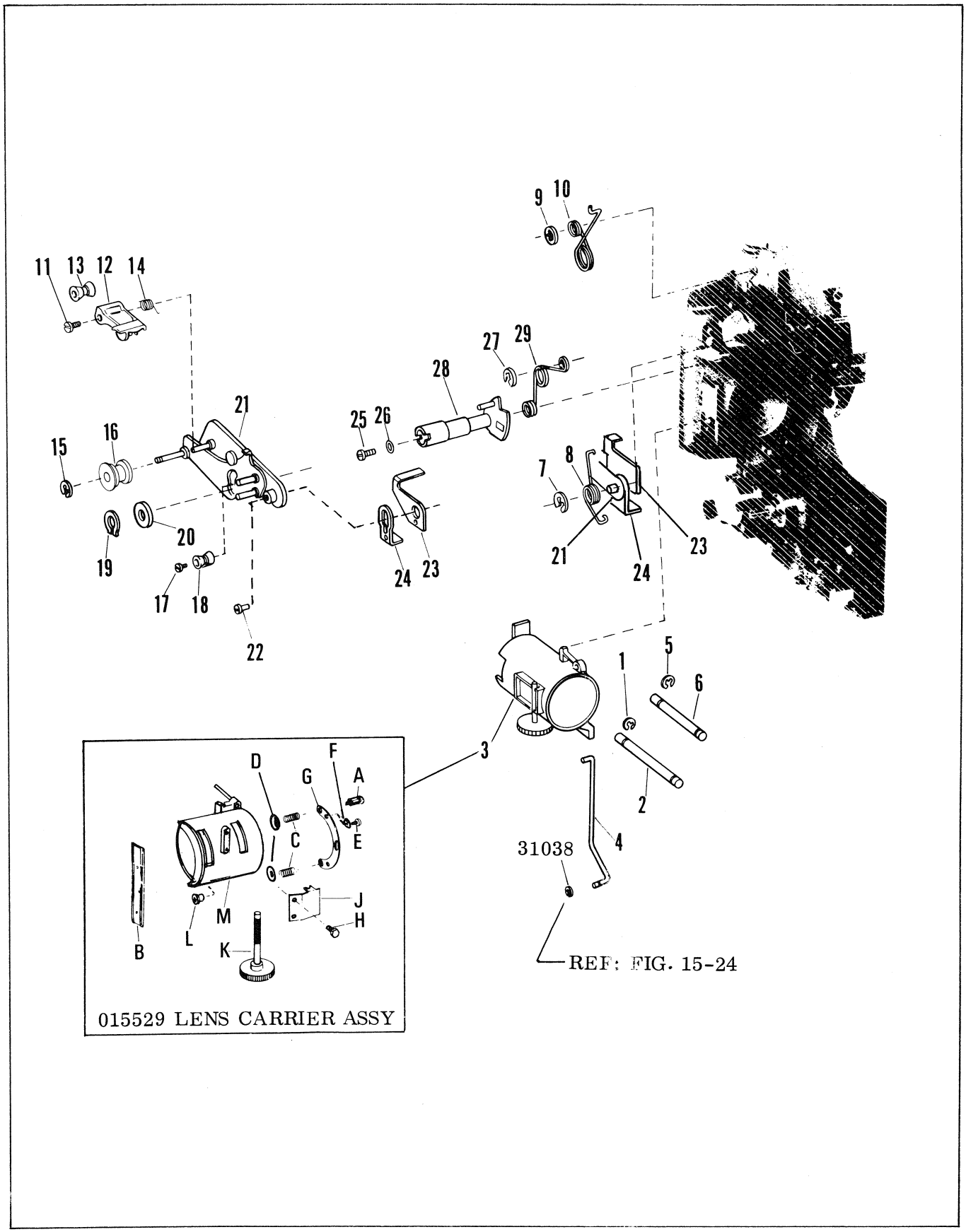


Figure 16. Mechanism Assembly — View III
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY — VIEW IV (ALL MODELS)		
17-1	48482	. SCREW, Special socket head	2	
-2	No Number	. PLATE ASSEMBLY, Aperture	NP	
-2A	31978	. . SCREW, Slotted pan head, 3-56 by 1/8 inch	2	
-2B	48370	. . RAIL, Film guide	1	
-2C	37296	. . SCREW, Slotted pan head, 3-56 by 1/4 inch	2	
-2D	48340	. . COVER, Spring retaining (early models only)	1	
-2E	48432	. . BUSHING, Spacer	2	
-2F	015532	. . RAIL, Film tension	1	
-2G	31135	. . SPRING, Side tension	1	
-2H	012132	. . PLATE AND STUD ASSEMBLY, Aperture	1	
-3	31005	. NUT, Shutter	1	
-4	31037	. WEIGHT, Counterbalance	1	
-5	41308	. SHUTTER, Three-blade	1	A thru E
-5	41309	. SHUTTER, Two-blade	1	F thru N
-6	34797	. GASKET, Shutter	1	
-7	36015	. SPRING, Extension	1	
-8	36014	. WICK, Lubricating	1	
-9	41307	. CAM, Pull-down	1	
-10	31557	. SHUTTLE	1	
17-	No Number	. ARM AND STUD ASSEMBLY	1	
-11	46464	. . NUT, Hex	2	
-12	011886	. . BALL AND STUD ASSEMBLY	2	
-13	36013	. . WICK, Lubricating	1	
-14	011235	. . ARM AND BEARING ASSEMBLY	2	
-14A	31003	. . . FOLLOWER, Pull-down cam	1	
-15	36668	. SCREW, Pan head Sems, 6-32 by 3/8 inch	2	
-16	016693	. BRACKET ASSEMBLY, In-out	1	
-16A	09702	. . FOLLOWER, In-out cam	1	
-16B	707597	. . SPRING, Tension, in-out cam	1	
-17	31001	. CAM, In-out	1	
-18	30817	. SCREW, Hex washer head, 8-32 by 1/2 inch	2	
-19	013917	. PLATE ASSEMBLY, Shuttle arm	1	
-19A	09712	. . SUPPORT ASSEMBLY	1	
-20	31909	. SETSCREW, Fluted socket flat pt, 5-40 by 3/16 inch	2	
-21	436897	. KNOB, Threading	1	F thru M
-22	31009	. RING, Retaining, bowed, 0.866 inch ID	1	
-23	36769	. SETSCREW, Fluted socket cup pt, 8-32 by 1/4 inch	2	
-24	012166	. WORM GEAR ASSEMBLY	1	
-25	077984	. CAMSHAFT AND BEARING ASSEMBLY	1	ABCDEN
-25	077992	. CAMSHAFT AND BEARING ASSEMBLY	1	F thru M
-25A	36065	. . CAMSHAFT	1	ABCDEN
-25A	707071	. . CAMSHAFT	1	F thru M
-26	31078	. . RING, Retaining, bowed, 0.312 inch ID	1	
-27	31006	. . BEARING, Ball, large	1	
-28	30804	. SCREW, Hex washer head, 4-40 by 1/4 inch	2	
-29	710436	. SPRING, Bearing loading	1	
-30	31007	. BEARING, Ball, small	1	
-31	36048	. PIN, Framer shaft stop	1	
-32	078584	. KNOB AND SHAFT ASSEMBLY, Framer	1	
-33	077690	. HOUSING ASSEMBLY, Mechanism	1	A thru M
-33	078117	. HOUSING ASSEMBLY, Mechanism	1	N
-33A	41321	. . PIN, Exciter lamp mounting	3	
-33B	41320	. . BUSHING, Mounting pin	3	
-33C	602339	. . SPRING, Tension	3	
L1	070030	OIL		
L3	04978	OIL		
L5	070032	OIL		
		G1 070043 GREASE		
		G2 070034 GREASE		

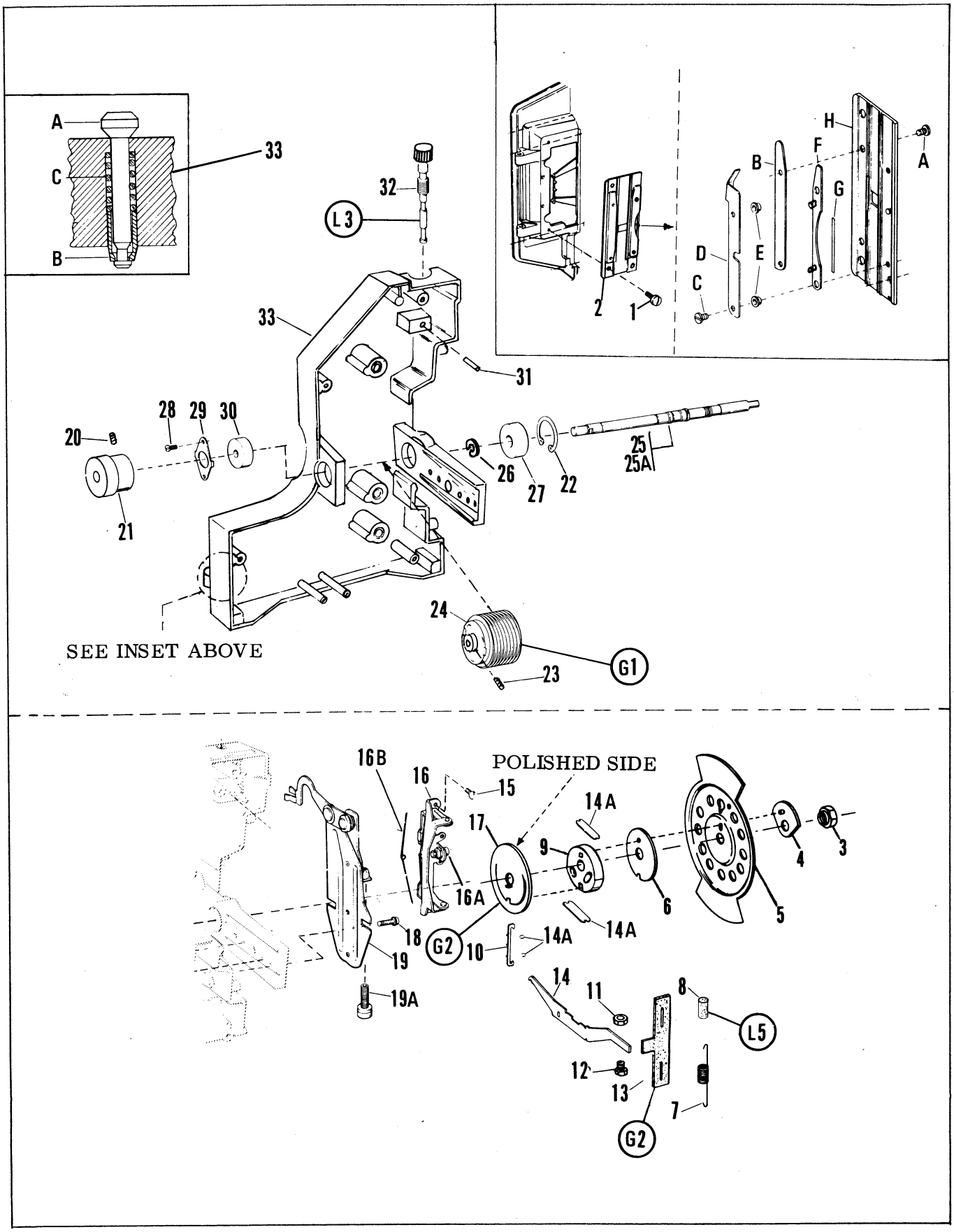


Figure 17. Mechanism Assembly — View IV
(All Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		FRONT COVER AND SPEAKER ASSEMBLY (1580CS, 1680US AND 1680UC MODELS)		
18-	No Number	COVER AND SPEAKER ASSEMBLY, Front	REF	DLM
-1	765460	. RIVET, Semi-tubular	4	DLM
-2	45083	. LATCH, Cover release	2	DLM
-3	707751	. SPRING, Latch	2	DLM
-4	49284	. PLATE, Stiffener	1	DLM
-5	707412	. NAMEPLATE, Front cover (adhesive backed) .	1	DLM
-6	710774	. SCREW, Slotted flat head	1	DLM
-7	309923	. NUT, Hex Sems	1	DLM
-8	707414	. CLAMP, Leadwire	1	DLM
-9	016948	. COVER ASSEMBLY, Front	1	DLM
-10	45102	. NUT, Tinnermann	7	DLM
-11	No Number	. BAFFLE BOARD ASSEMBLY	1	DLM
-12	710810	. . SCREW, Slotted flat head	8	DLM
-13	35164	. . NUT, Plain hex	8	DLM
-14	440662	. . SPEAKER	2	DLM
-15	707415	. . PLUG AND CORD, Speaker (see wiring dia.)	1	DLM
-16	707413	. . NAMEPLATE, Speaker	1	DLM
-17	707769	. . CUSHION	1	DLM
-18	707770	. . CUSHION	1	DLM
-19	710651	. . GRILLE CLOTH (cement in place)	1	DLM
-20	707416	. . SCREW, Slotted flat head	4	DLM
-21	436895	. . CORD WRAP	1	DLM
-22	31561	. FOOT, Rubber (secure with adhesive)	2	DLM
A1	70509	ADHESIVE		

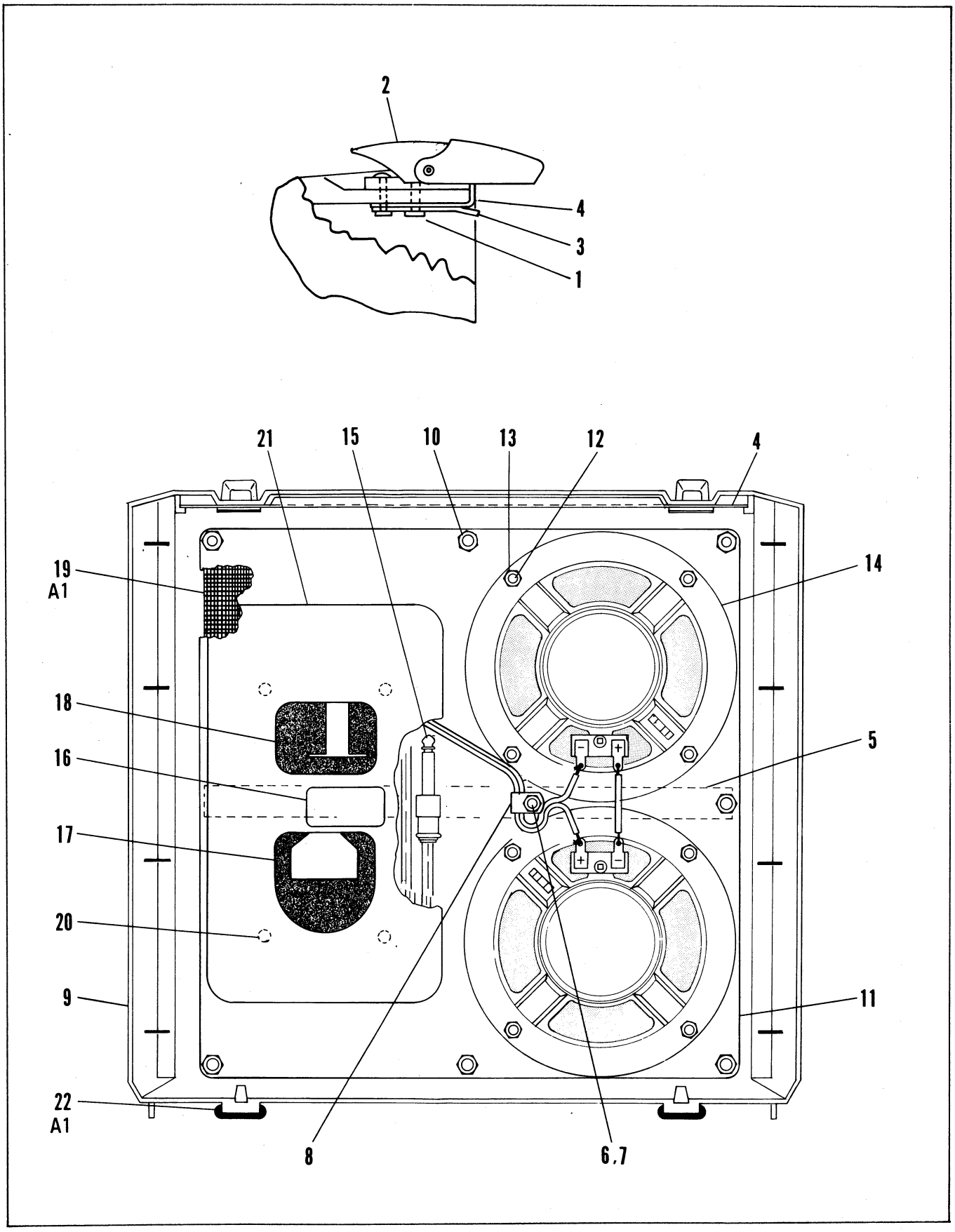


Figure 18. Front Cover and Speaker Assembly
(1580CS, 1680US and 1680UC Models)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE

FRONT COVER AND SPEAKER ASSEMBLY
(1680AC, 1680BC, 1680CC AND 1680EC MODELS)

19-	No Number	COVER AND SPEAKER ASSEMBLY, Front	REF	F2,F4,HK
-1	765460	. RIVET, Semi-tubular	4	F2,F4,HK
-2	45083	. LATCH, Cover release	2	F2,F4,HK
-3	707751	. SPRING, Latch	2	F2,F4,HK
-4	49284	. PLATE, Stiffener	1	F2,F4,HK
-5	707412	. NAMEPLATE, Front cover (adhesive backed) .	1	F2,F4,HK
-6	710774	. SCREW, Slotted flat head	1	F2,F4,HK
-7	309923	. NUT, Hex Sems	1	F2,F4,HK
-8	707414	. CLAMP, Leadwire	1	F2,F4,HK
-9	016948	. COVER ASSEMBLY, Front	1	F2,F4,HK
-10	45102	. NUT, Tinnermann	7	F2,F4,HK
-11	No Number	. BAFFLE BOARD ASSEMBLY	1	F2,F4,HK
-12	710810	. . SCREW, Slotted flat head	8	F2,F4,HK
-13	35164	. . NUT, Plain hex	8	F2,F4,HK
-14	440662	. . SPEAKER	2	F2,F4,HK
-15	043384	. . LINE CORD ASSEMBLY (see wiring diagram)	1	F2,F4,HK
-16	440664	. . NAMEPLATE, Speaker	1	F2,F4,HK
-17	707769	. . CUSHION	1	F2,F4,HK
-18	707770	. . CUSHION	1	F2,F4,HK
-19	710651	. . GRILLE CLOTH (cement in place)	1	F2,F4,HK
-20	707416	. . SCREW, Slotted flat head	4	F2,F4,HK
-21	436895	. . CORD WRAP	1	F2,F4,HK
-22	34053	. . SCREW, Pan head tapping	2	F2,F4,HK
-23	434684	. . JACK, Auxiliary speaker	1	F2,F4,HK
-24	31561	. FOOT, Rubber (secure with adhesive)	2	F2,F4,HK
A1	70509	ADHESIVE		

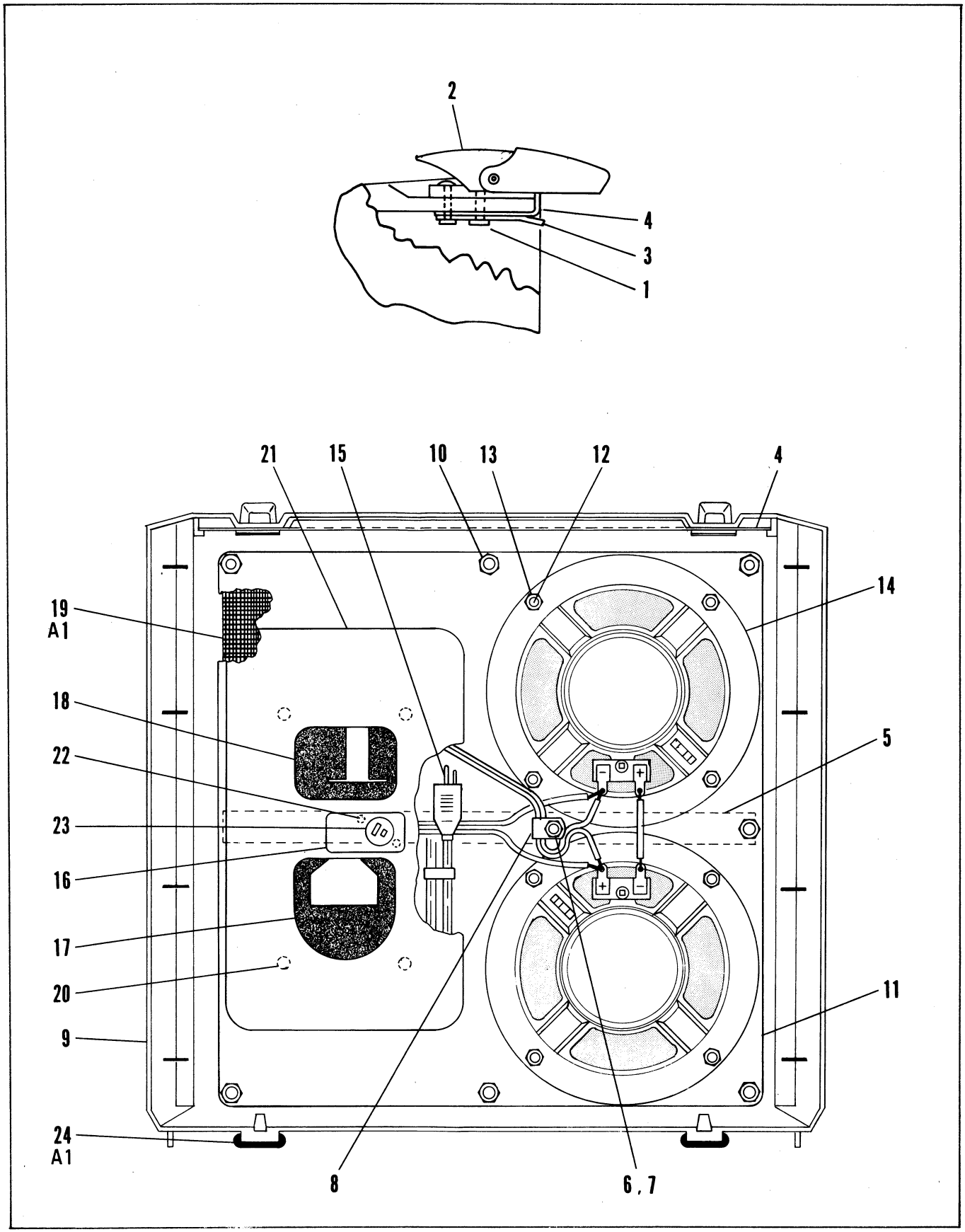


Figure 19. Front Cover and Speaker Assembly
(1680BC and 1680EC Models Only)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

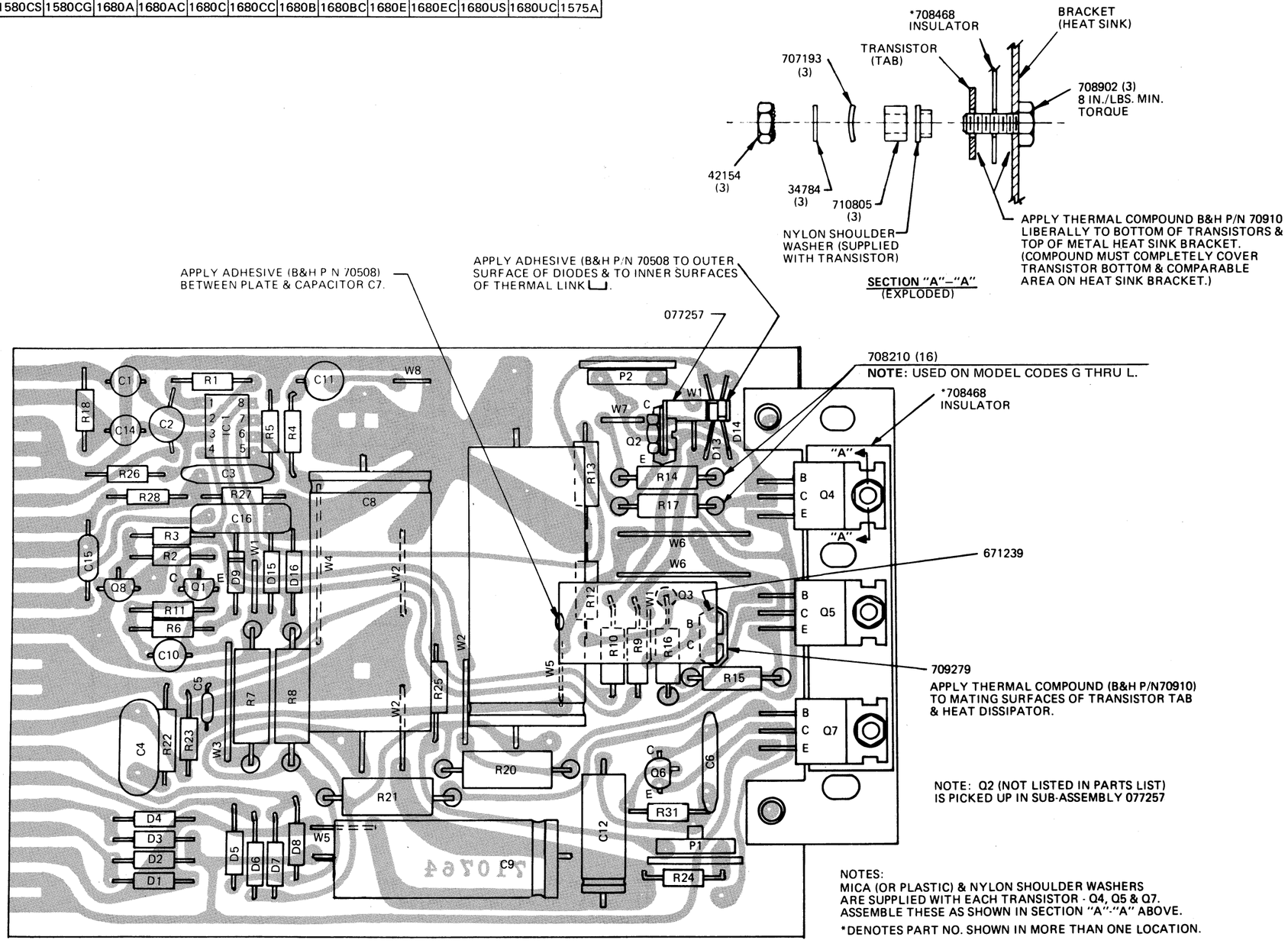
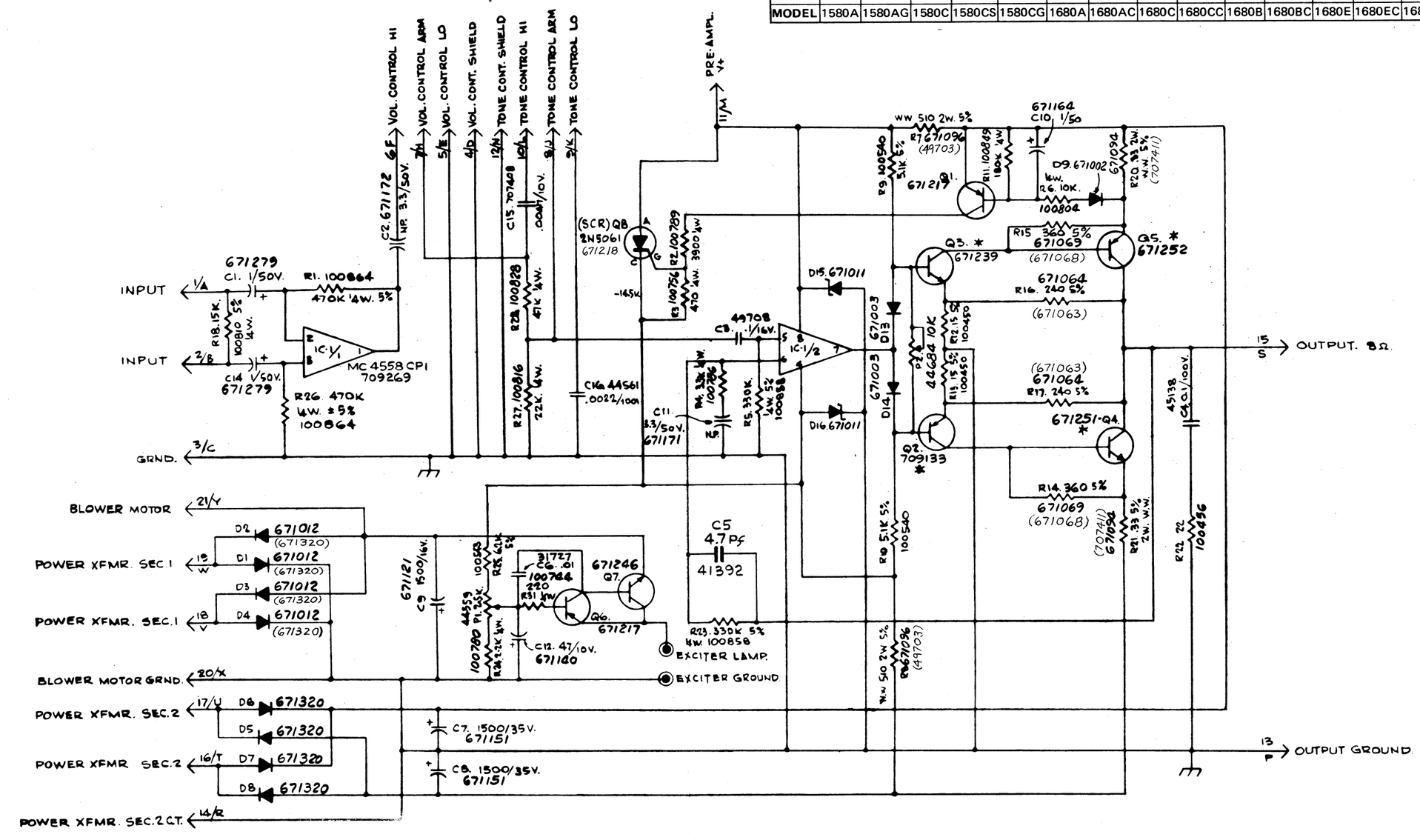


Figure 20A. Audio Amplifier Pictorial Diagram
(Codes A, B, C, D, E, G, H, J, K, L, N)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A



NOTE: ALL PART NUMBERS SHOWN IN PARENTHESIS ( ) ARE FOR MODEL CODES "A" THRU "E" & "N".

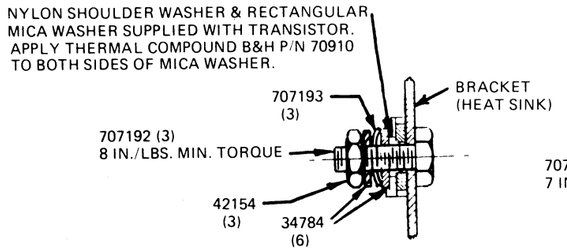
NOTES:

ALL RESISTORS 1/2 WATT CARBON FILM ±10% UNLESS OTHERWISE INDICATED.

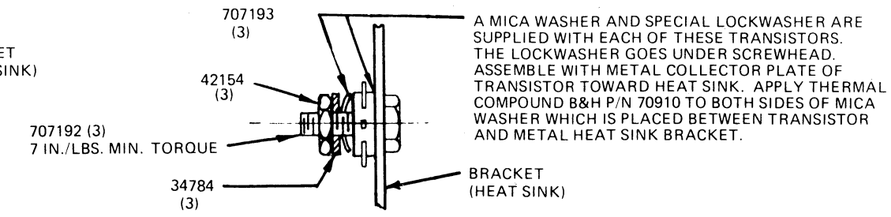
ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE INDICATED

NUMBERS AT CONNECTOR ENDS CORRESPOND TO TERMINAL NUMBERS ON EDGE CONNECTOR TO BE USED; LETTERS DITTO.

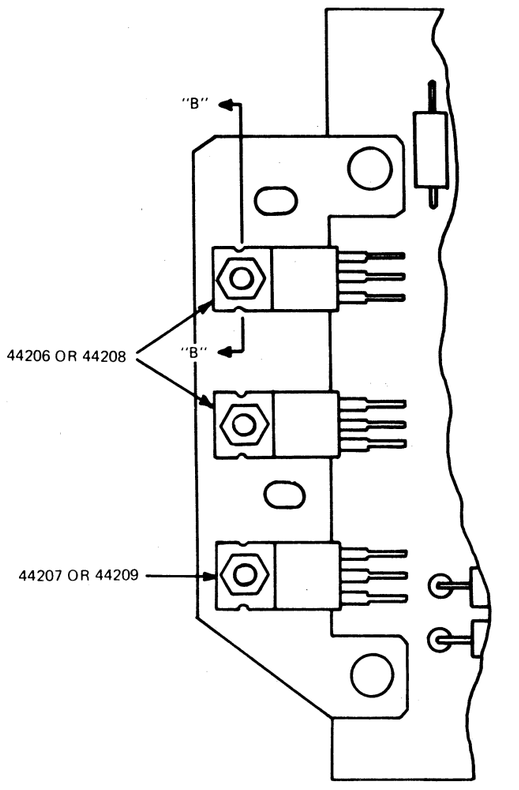
Figure 20B. Audio Amplifier Schematic Diagram
(Codes A, B, C, D, E, G, H, J, K, L, N)



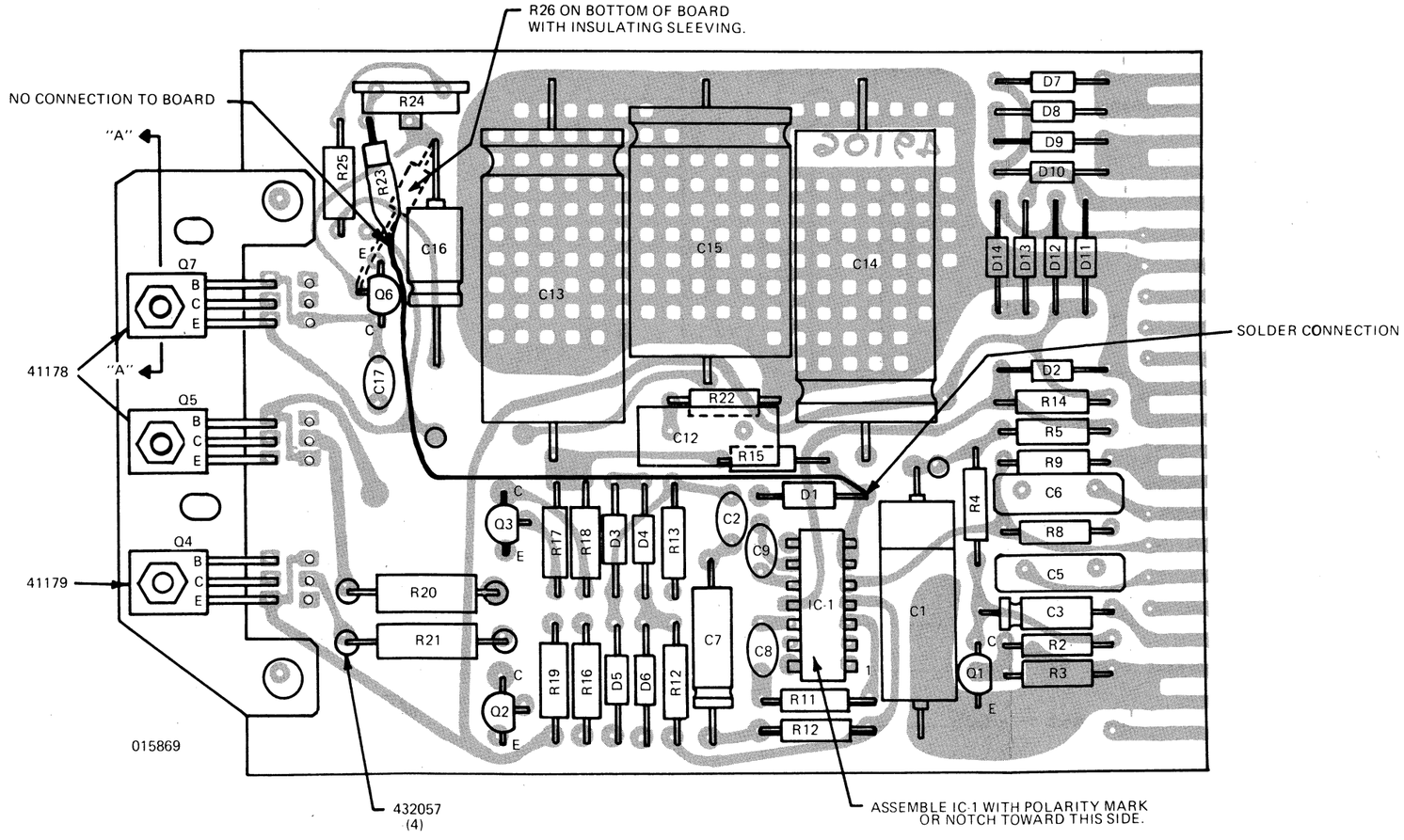
SECTION "B" – "B"
(3 PLACES)



SECTION "A" – "A"
(3 PLACES)

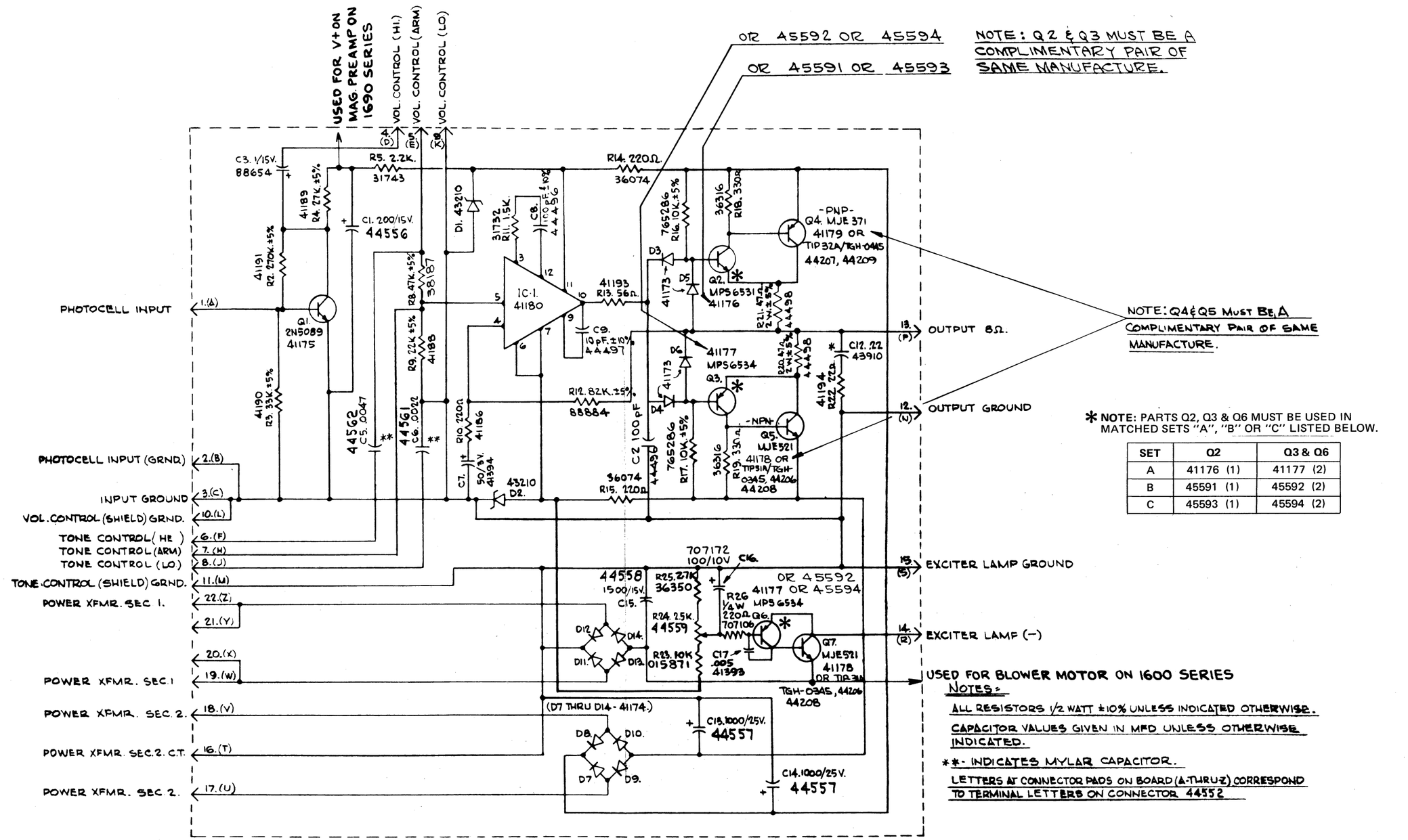


AMPLIFIER ASSEMBLY WITH ALTERNATE POWER TRANSISTORS. (IDENTICAL IN ALL OTHER RESPECTS)



CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

Figure 21A. Audio Amplifier Pictorial Diagram
(Codes F and M Only)

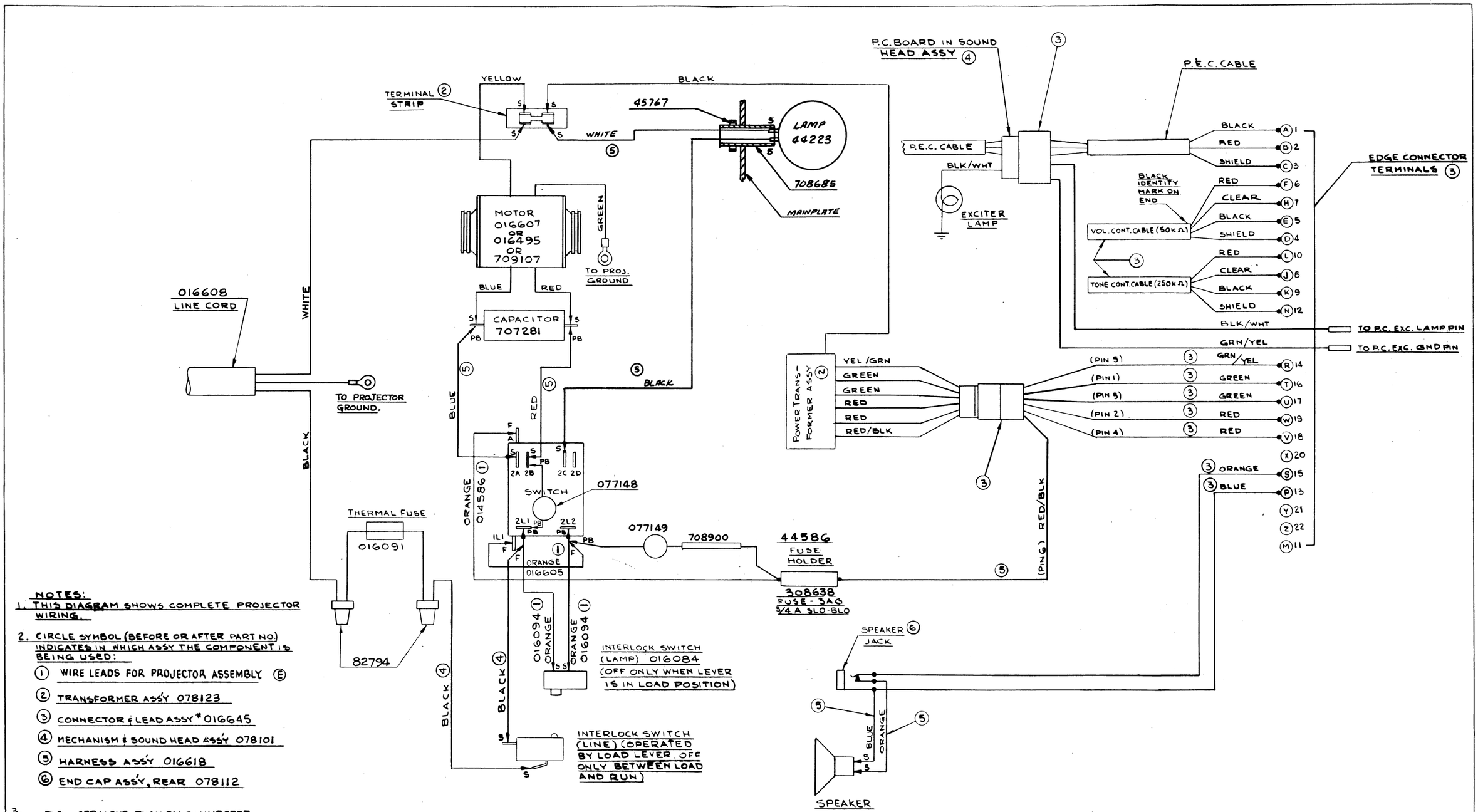


* **NOTE:** PARTS Q2, Q3 & Q6 MUST BE USED IN MATCHED SETS "A", "B" OR "C" LISTED BELOW.

SET	Q2	Q3 & Q6
A	41176 (1)	41177 (2)
B	45591 (1)	45592 (2)
C	45593 (1)	45594 (2)

CODE	A	B	C	D	E	F1	F2	F3	F4	G	H	J	K	L	M	N
MODEL	1580A	1580AG	1580C	1580CS	1580CG	1680A	1680AC	1680C	1680CC	1680B	1680BC	1680E	1680EC	1680US	1680UC	1575A

Figure 21B. Audio Amplifier Schematic Diagram
(Codes F and M Only)



NOTES:

1. THIS DIAGRAM SHOWS COMPLETE PROJECTOR WIRING.
2. CIRCLE SYMBOL (BEFORE OR AFTER PART NO) INDICATES IN WHICH ASSY THE COMPONENT IS BEING USED:
   - (1) WIRE LEADS FOR PROJECTOR ASSEMBLY (E)
   - (2) TRANSFORMER ASSY 078123
   - (3) CONNECTOR & LEAD ASSY * 016645
   - (4) MECHANISM & SOUND HEAD ASSY 078101
   - (5) HARNESS ASSY 016618
   - (6) END CAP ASSY, REAR 078112
3. → S STRAIGHT PUSH-ON CONNECTOR
   → PB PIGGY-BACK PUSH-ON CONNECTOR
   → F FLAG PUSH-ON CONNECTOR
   • SOLDERED CONNECTION
4. PARTS USED BUT NOT SHOWN:
   (4) * 45767 - WIRE TIE

Figure 22A. Projector Pictorial Wiring Diagram
(1575A Models)

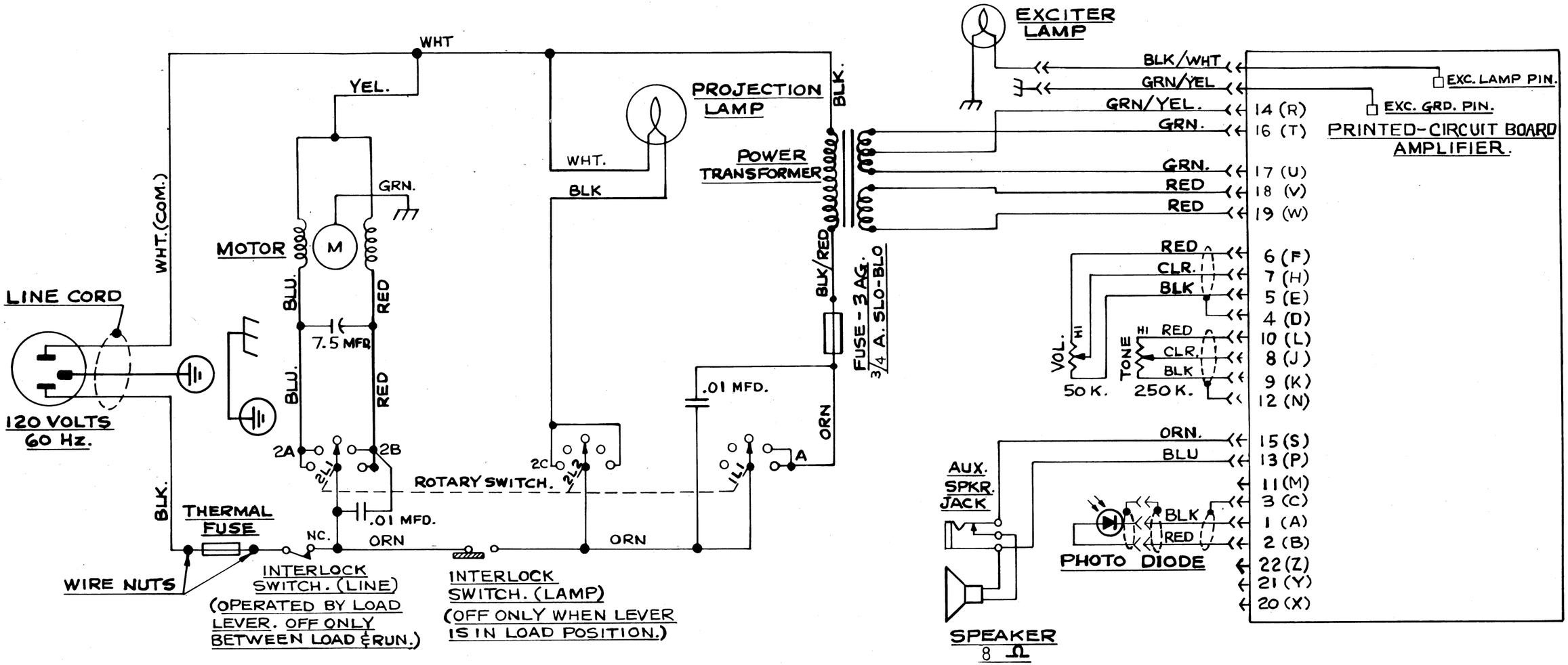
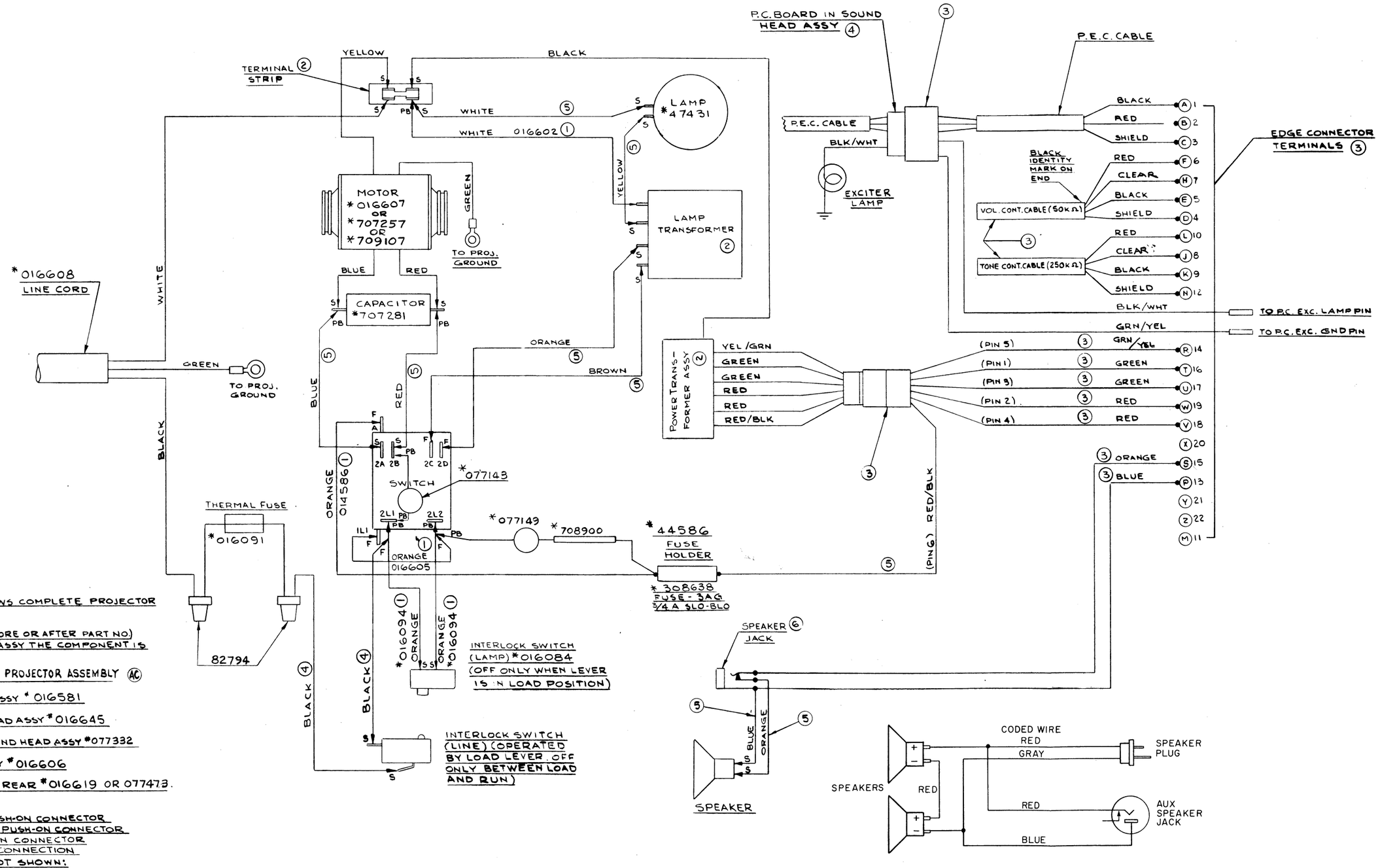


Figure 22B. Projector Schematic Diagram
(1575A Models)



NOTES:

1. THIS DIAGRAM SHOWS COMPLETE PROJECTOR WIRING.
2. CIRCLE SYMBOL (BEFORE OR AFTER PART NO) INDICATES IN WHICH ASSY THE COMPONENT IS BEING USED:
   - (1) WIRE LEADS FOR PROJECTOR ASSEMBLY (AC)
   - (2) TRANSFORMER ASSY *016581
   - (3) CONNECTOR & LEAD ASSY *016645
   - (4) MECHANISM & SOUND HEAD ASSY *077332
   - (5) HARNESS ASSY *016606
   - (6) END CAP ASSY, REAR *016619 OR 077473.
3. → S STRAIGHT PUSH-ON CONNECTOR
   → PB PIGGY-BACK PUSH-ON CONNECTOR
   → F FLAG PUSH-ON CONNECTOR
   • SOLDERED CONNECTION
4. PARTS USED BUT NOT SHOWN:
   (4) *45767 - WIRE TIE

Figure 23A. Projector Pictorial Wiring Diagram
(1580C, 1580CG and 1580CS Models)

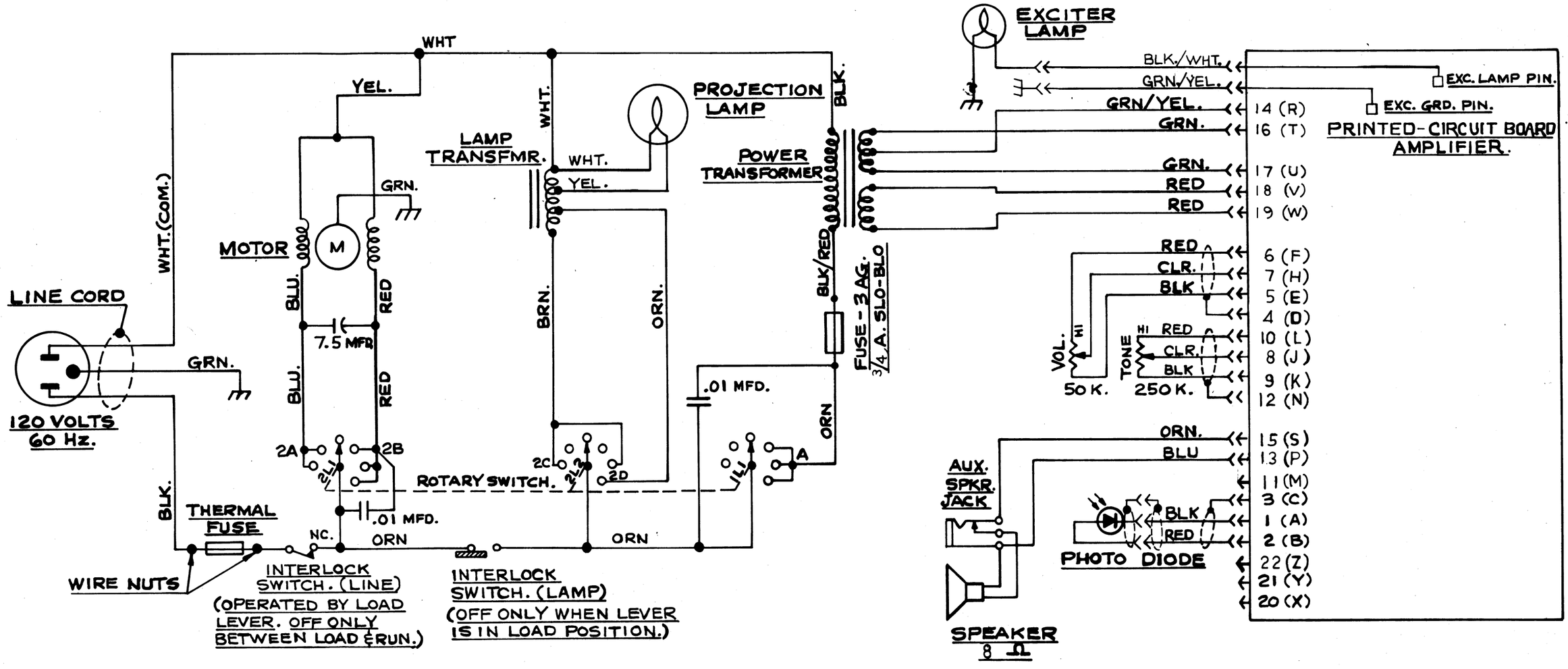
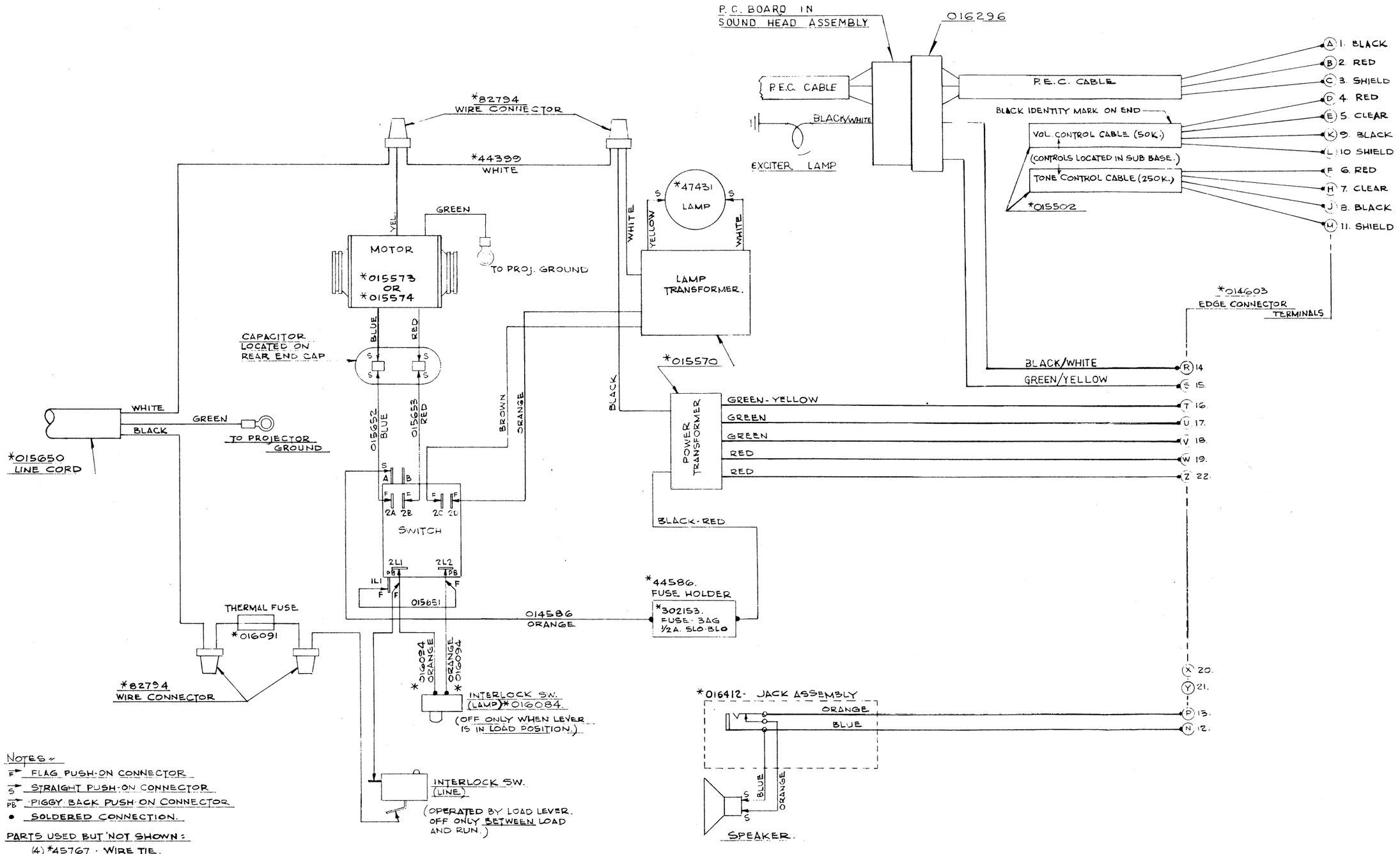


Figure 23B. Projector Schematic Diagram
(1580C, 1580CG and 1580CS Models)



Notes:
- F — FLAG PUSH-ON CONNECTOR
- S — STRAIGHT PUSH-ON CONNECTOR
- PB — PIGGY BACK PUSH-ON CONNECTOR
- • SOLDERED CONNECTION.

PARTS USED BUT NOT SHOWN:
(4) *45767 - WIRE TIE.
(1) *48610 - STRAIN RELIEF

Figure 24A. Projector Pictorial Wiring Diagram
(1580A and 1580AG Models)

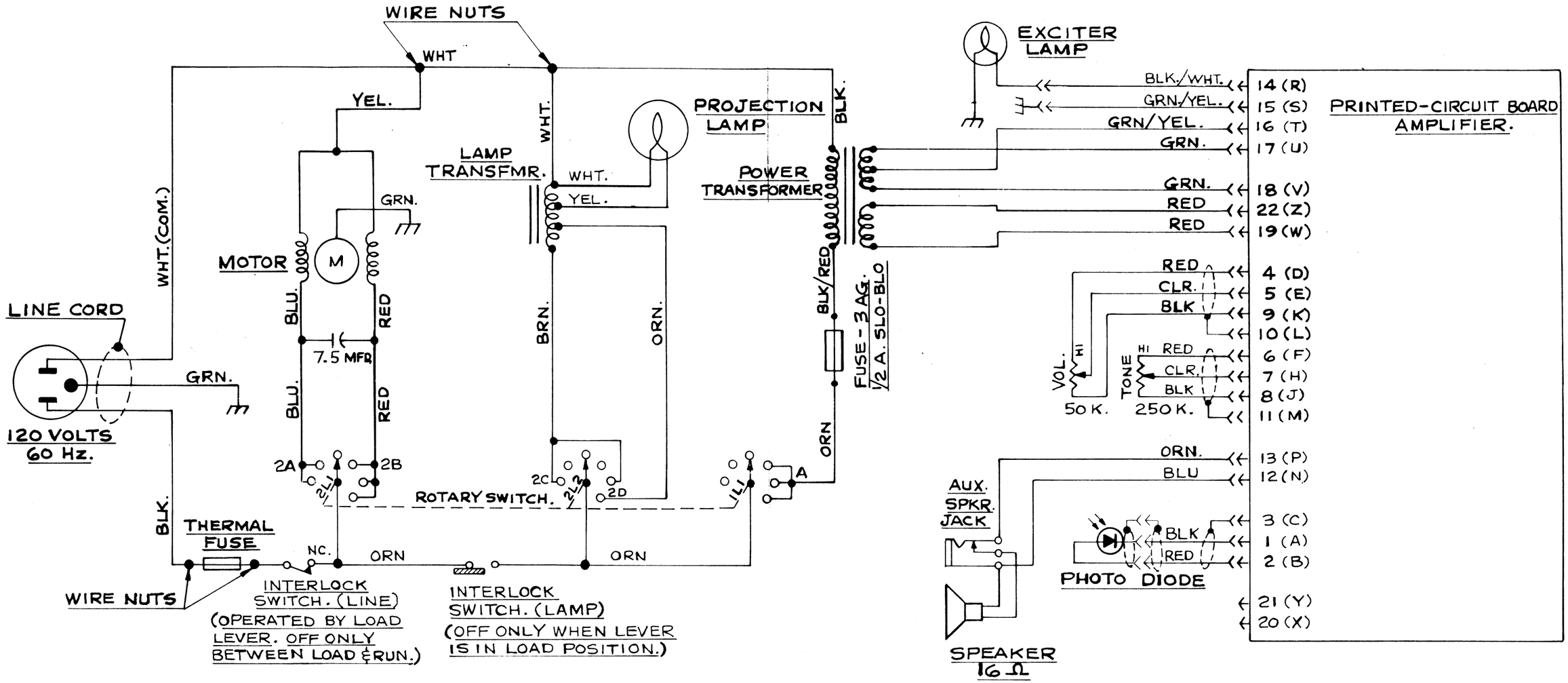


Figure 24B. Projector Schematic Diagram
(1580A and 1580AG Models)

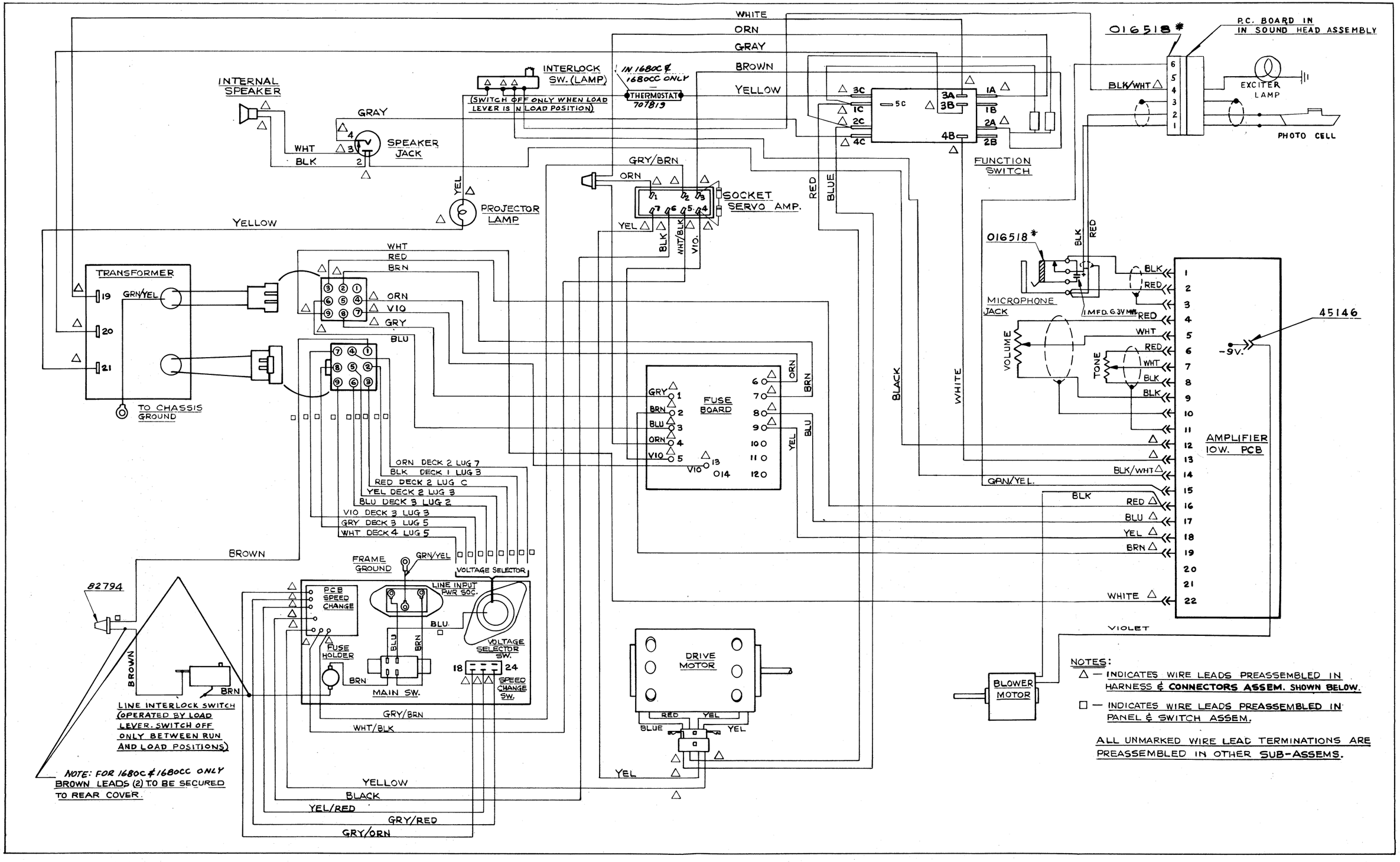


Figure 25A. Projector Pictorial Wiring Diagram
(1680A, 1680AC, 1680C, 1680CC and 1680UC Models)

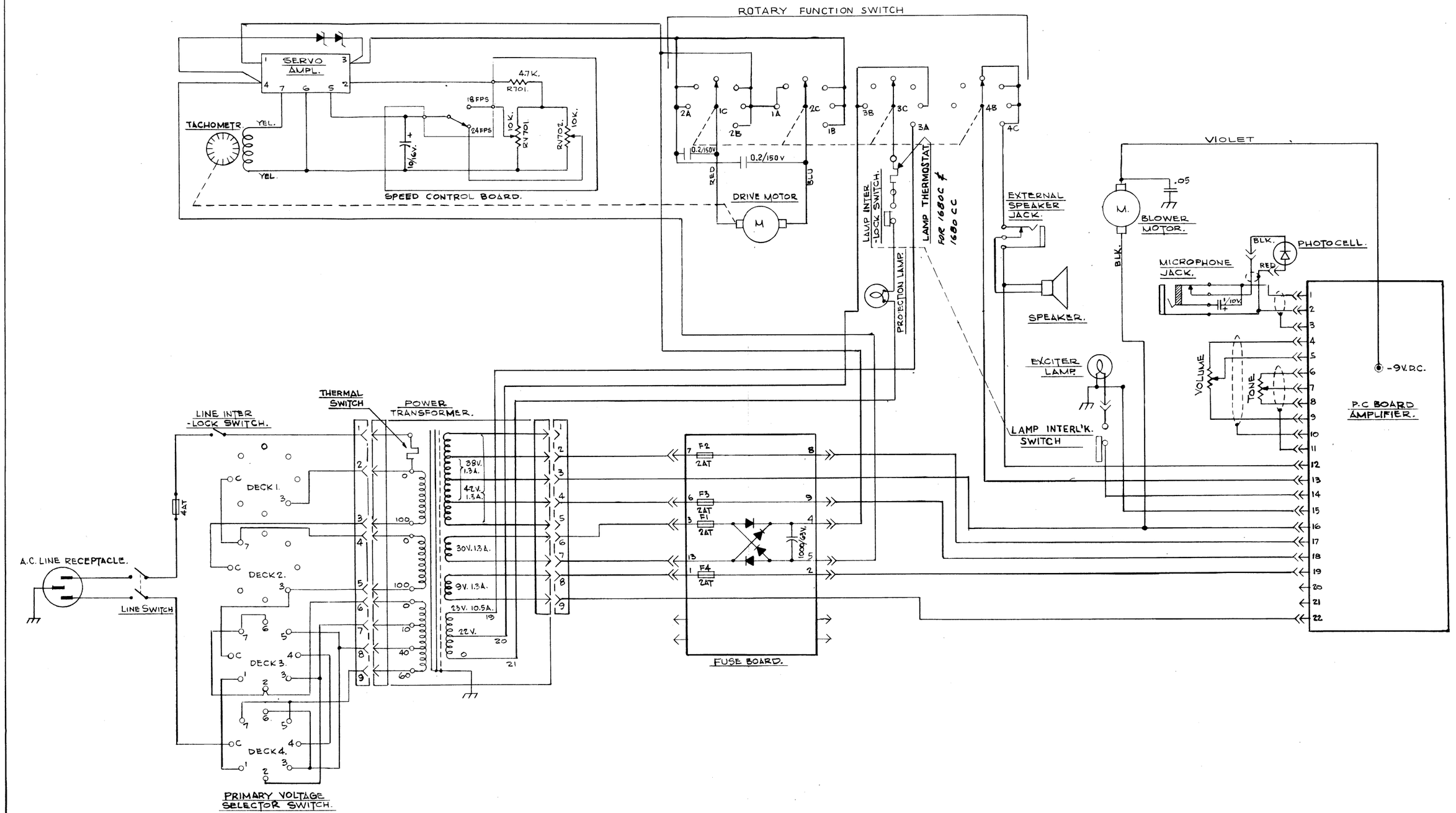


Figure 25B. Projector Schematic Diagram
(1680A, 1680AC, 1680C, 1680CC and 1680UC Models)

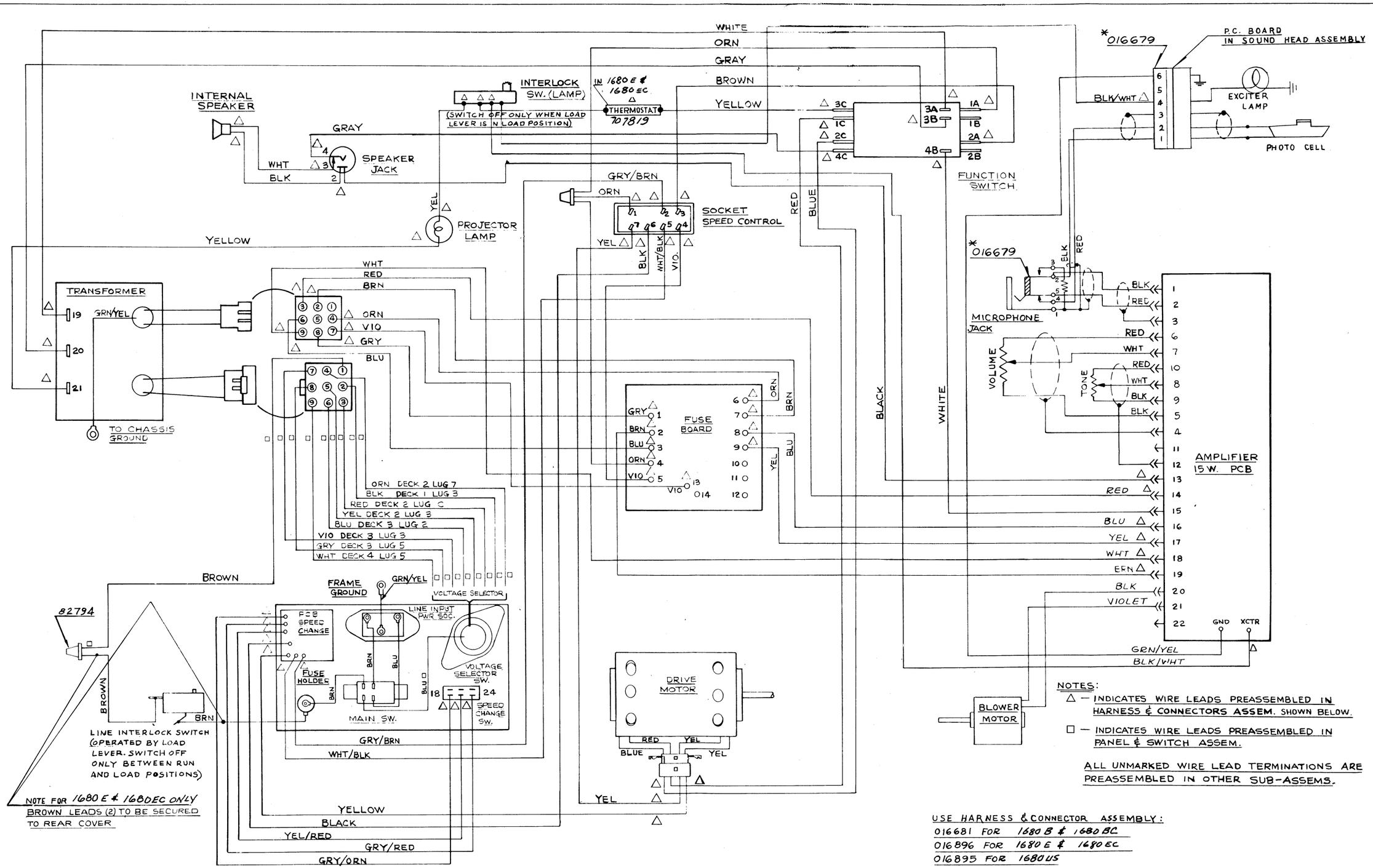


Figure 26A. Projector Pictorial Wiring Diagram
(1680B, 1680BC, 1680E, 1680EC and 1680US Models)

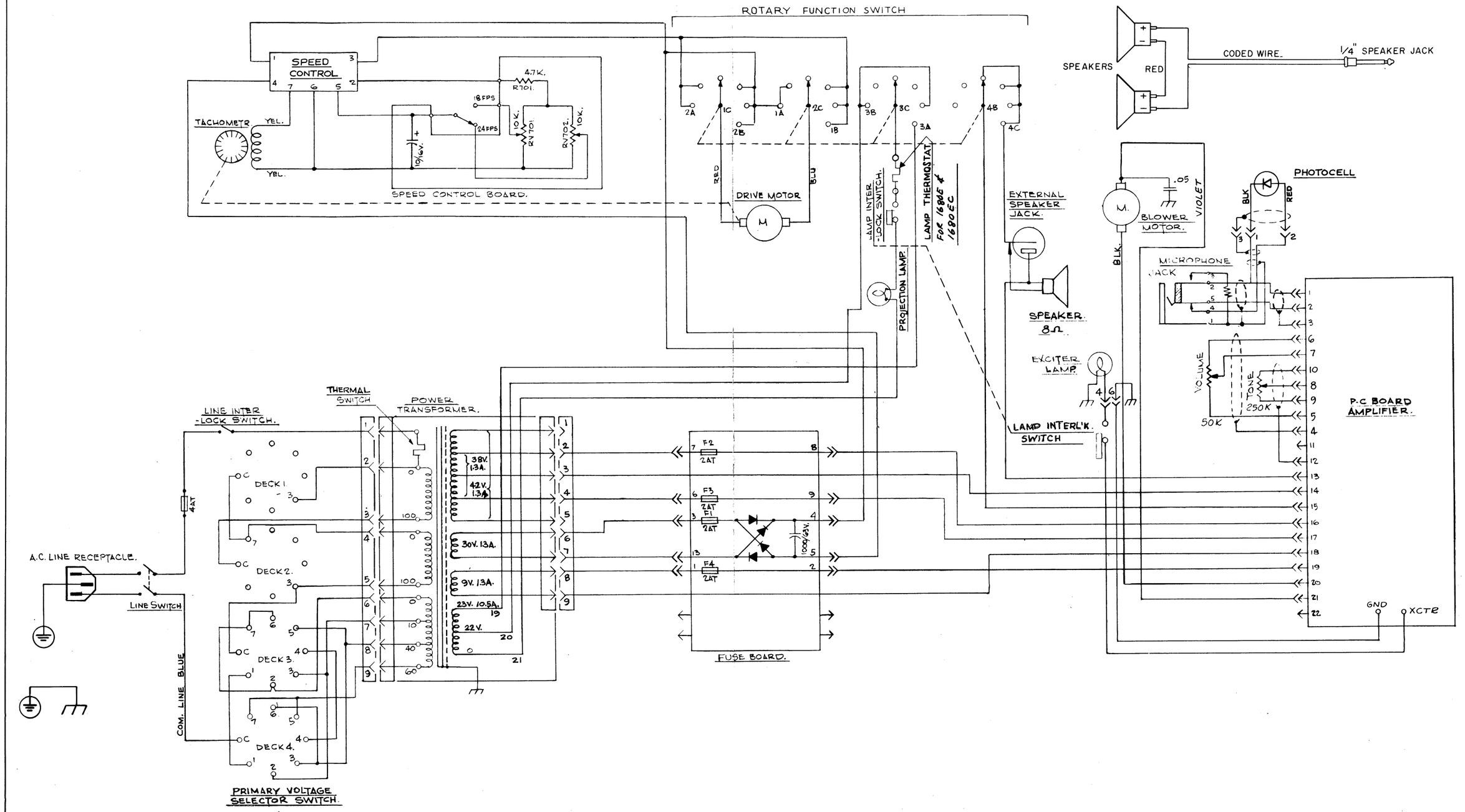


Figure 26B. Projector Schematic Diagram
(1680B, 1680BC, 1680E, 1680EC and 1680US Models)

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09702	17-16A
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09807	2-2
09828	14-40
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011886	17-12
012126	14-43
012132	17-2H
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013917	17-19
014538	3A-14
014603	6-9
014611	12-31A
014616	13-22
014947	4-2
014948	4-33, 13-
014949	4-7
015502	6-12
015528	16-3M
015529	16-3
015532	17-2F
015533	14-52
015535	14-46
015537	14-38
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015540	14-54
015542	15A-17
015544	5-16C
015545	5-16
015546	16-3K
015549	16-28
015552	2-19, 10-
015559	2-19, 10-
015650	3A-21
015662	11A-10E
015663	11A-10
015816	4-33, 13-
015819	4-30, 12-
015827	2-13
015865	8-15
015867	2-19, 10-
015868	6-10
015872	3B-4
015876	3B-18G
016072	16-21
016073	15-10
016074	5-13D
016075	5-13B
016076	15-35
016078	15-13
016079	15-38
016080	15A-16
016081	5-7D
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016088	15-4
016091	3A-23
016096	7-25
016099	4-11
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016283	1B-9B, 8-
016284	5-22
016285	15-4
016293	14-34
016296	6-15
016394	4-7A
016518	6-16
016521	2-17, 9-
016522	1B-21, 9-2, 11A-11
016523	1B-9B, 8-
016526	2-13
016527	1A-1, 1B-1
016534	1B-17D
016546	12-7
016556	1A-4
016557	1A-3, 1B-3
016558	5-7
016559	5-13
016579	11A-10
016580	11A-5
016583	1B-4
016585	4-35
016607	3A-28
016608	3A-21
016613	6-12
016615	11B-12
016619	2-19, 10-
016645	6-9
016660	4-18
016679	6-16
016684	1A-1
016685	2-17, 9-
016693	17-16
016711	7-24
016712	7-24
016716	4-22
016755	14-16
016815	2-6E
016920	2-17, 9-
016948	18-9, 19-9
016952	13-5D
016976	15-10
016989	15-2
020240	14-31
043341	3B-18E
043384	19-15
043385	3B-16C
043390	13-5D
043465	1B-15
043966	8-7
044178	12-7
044230	3B-18
044685	6-19
077182	14-20
072848	8-13, 3A-10, 3B-7, 3B-18B
077142	2-6
077148	3A-5G
077149	3A-5H
077178	1A-16, 1B-19
077181	14-23
077195	6-10
077196	6-10
077327	1A-3, 1B-3
077452	16-28
077473	2-19, 10-
077474	2-17, 9-
077480	15A-7
077690	17-33
077691	1A-4
077692	1B-4
077920	7-21
077957	5-25
077959	3A-29
077965	3B-16
077966	3B-8
077967	1B-9
077968	1B-9
077969	1B-9
077971	3A-5
077984	17-25
077992	17-25
078102	2-13
078105	7-24
078106	4-33, 13-
078107	4-30, 12-
078108	4-35
078109	2-6
078111	2-17, 9-
078112	2-19, 10-
078113	2-2
078114	1A-1
078115	1A-4
078116	1A-3
078117	17-33
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078120	12-31
078121	12-31B
078274	1A-14D
078584	17-32
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8179	7-20
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17676	15-15, 15-32, 15-37
19010	10-4
19037	11A-6, 11A-10A
19327	11A-1
20808	1A-3A, 1B-3A
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24443	15-1
24831	11B-8
24903	14-50
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30164	15A-9, 15A-13, 16-11, 16-17
30211	2-3A, 5-9 15-5
30667	7-7
30802	14-27
30803	5-21, 6-18, 14-17, 15-3, 15-8, 16-3E, 16-3H
30804	14-15, 17-28
30807	15-25, 15A-20

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30812	14-30
30815	3A-7
30816	7-16
30817	3A-6, 17-18
30822	1B-20, 3A-18, 3A-26, 3B-11, 3B-14
30835	7-22
30875	3A-2
30879	12-1, 13-1
31001	17-17
31003	17-14A
31005	17-3
31006	17-27
31007	17-30
31009	17-22
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31017	13-13, 14-47, 14-49, 14-55
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31037	17-4
31038	4-10, 12-17, 13-6, 15-12A 15-24
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31078	17-26
31093	16-3J
31135	17-2G
31236	12-25, 13-21
31237	4-6
31239	12-22, 13-19
31241	12-21
31243	11B-6, 13-18
31245	12-19, 13-15, 13-17, 14-25, 15-30, 16-9,
31245	16-27
31247	12-6, 13-4
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31673	15-7
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33536	15A-2
33837	15-16
34053	19-22
34101	12-15, 12-23
34156	16-22
34784	4-20
34787	1A-3C,1B-3C
34797	17-6
34822	7-25F
34859	13-3
34861	4-3
34874	12-3
34884	6-13
34888	16-3B
34889	7-19
34892	6-14
35164	18-13, 19-13
35910	14-56
36013	17-13
36014	17-8
36015	17-7
36038	12-5
36048	17-35A
36065	5-4, 5-7A
36662	14-4
36668	14-37, 17-15
36763	3B-16A
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36765	13-8, 14-32
36767	3A-5A
36769	2-1, 13-5A, 17-23
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36837	16-25
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37296	17-2Cl
39092	5-10
39350	11B-4
41307	17-9
41308	17-5
41309	17-5
41320	17-33B
41321	17-33A
41323	3A-27A
41331	12-32
41605	15-12B
43878	10-5
44223	2-11
44226	10-2
44297	7-12
44312	4-9, 5-17
44313	4-32
44317	5-18
44332	11A-10C, 11B-10
44333	11A-10D, 11B-11
44345	11A-8
44346	11A-9
44348	7-9
44356	3A-27
44367	12-27
44370	5-2, 5-13C, 5-16B
44372	5-6
44373	5-7C
44376	3A-17, 3B-18C
44377	3A-12
44407	13-20
44412	12-24
44420	15-18
44462	7-18
44467	3A-5C, 3B-8C
44483	3B-3
44507	4-36
44511	15-17
44512	7-5
44532	7-17
44533	7-25H
44546	7-14
44586	3A-3
45083	1A-1C, 1B-1C, 18-2, 19-2
45102	9-1, 18-10, 19-10
45577	13-9
45578	13-10
45579	13-11
45580	12-11
45581	7-2
45598	11A-2
45682	12-2
45683	12-16
45684	12-12
45685	12-14
45687	16-3D
45692	10-3
45718	4-19
45767	8-8
46367	1B-5
46464	17-11
46484	11A-7, 11A-10B
46534	4-8
47137	5-15
47350	10-9
47431	2-11
47698	4-26
47974	2-16, 6-8
48052	1A-14C, 1B-17C
48053	9-5
48055	1A-9, 1B-9C
48058	1A-2, 1B-2
48062	1A-10
48063	1A-14B, 1B-17B
48066	10-7
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48188	10-10
48190	1A-9
48315	5-14
48316	5-11
48318	14-2
48320	3A-25
48321	16-6
48322	16-2
48327	7-3
48335	14-48
48340	17-2D
48341	16-24
48345	15-14
48346	4-28
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48348	4-29
48350	14-8
48351	2-5
48352	2-6D
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48373	16-16
48375	1A-4A, 1B-4A
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48381	7-8
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48403	15A-8
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48413	15-27, 15A-21
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48419	15-31
48425	15-34
48426	7-15
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48432	17-2E
48433	16-26
48434	16-3L
48435	15A-10, 16-12
48437	15A-14, 16-18
48438	15A-11, 16-13
48441	2-10
48443	16-23
48445	15-36
48446	14-35
48447	16-10
48450	14-9
48451	14-10
48452	14-19
48453	14-18
48454	14-36B
48463	15A-12, 16-14
48465	5-12
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48479	16-7
48480	15-22, 16-20
48482	17-1
48483	15-10A
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48491	15-11C
48492	15-7
48493	2-6A
48608	11A-5
48610	3A-20
48901	13-14
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CONSUMER & AUDIO VISUAL PRODUCTS GROUP
7100 North McCormick Road Chicago, Illinois 60645
BELL & HOWELL

General Service Bulletin

A-77-228

Subject: PRODUCT IMPROVEMENTS FOR MODEL 1580 SLOT THREADING PROJECTOR

Date: 12-22-76

Reference: Service Manual #73591

Field reports about the Model 1580 indicate that some users are experiencing film running off of the sound drum which can be corrected by adjusting the lower film guide roller. However, there are four areas of the Model 1580 which can be improved on all projectors with serial numbers lower than 6247001.

These are:

-- film skew on sound drum
-- film threading
-- projector does not turn on
-- noise in reverse mode

Numerical figures pictured in this bulletin are also shown in service manual #73591 on the pages indicated. Keep this bulletin with your service manual for future reference.

Also remember, if this information does not result in proper product operation, call on our hot-line number 800-323-2838 and describe the difficulty so we can be of further help.

GENERAL SERVICE DEPARTMENT

DESIGN 1580

PRODUCT IMPROVEMENT BULLETIN

TOPIC - Correction of film skew.

SYMPTOM - Loss of sound
- Film tracks off of sound drum at any place in the film length.

CORRECTION -

1. Clean sound drum (fig. A No. 4) and impedance roller (fig. A No. 3).

2. Close the film track. Grasp adjusting plate (fig. 9-46) with thumb and forefinger as indicated. Attempt to move the bracket up and down, if it does not move then proceed to stop 3. If it does move then loosen screw (fig. 9-25). Insert the pin end of the sprocket plate adjusting tool (Fig. 9) down into the slot of the sprocket plate and with the large diameter of the tool fitting into the adjustment plate hole above the slot. Slowly rotate the tool clockwise to the point where resistance is noted. Do not use force to rotate the tool beyond the point of resistance. Hold the tool steady while tightening the screw (25) securely. Remove the adjusting tool. Open and close the system, using the load lever. Switch the projector to "forward" and the motor should run. If motor does not run, re-adjust the mode selector latch per Para. 4 under topic "Projector does not run".

3. Open film track. Thread film thru system to take-up reel. Check that film lines up with film track and tuck in where necessary. Close system, turn main control knob to forward only. Open lamphouse, check stabilizer roller (fig. A No. 5) position. It must run centered in its slot. If necessary, adjust its position by turning adjusting screw (fig. A No. 1), clockwise to lower the roller and counter clockwise to raise the roller.

4. The impedance roller adjustment bracket (fig. A No. 2) should be positioned with the notch at approximately "12 o'clock". When adjusting is required push bracket upward before tightening screw, then grasp impedance roller (fig. A No. 3) between thumb and forefinger. Lift straight upward. The system must not bind, if it does readjust bracket up or down until binding is eliminated.

TOPIC - Projector noise in reverse mode.

SYMPTOM - When projector is run in reverse, an objectionable noise occurs.

CORRECTION -

1. Reset the stabilizer and impedance rollers per the procedure for "Correction of film skew".

2. If step #1 does not relieve the noise, return the projector to Chicago factory service center for retrofit of stabilizer retractor system.

TOPIC - Film does not easily enter the film slot.

SYMPTOM - Film will not properly enter film track as it is pulled thru when loading projector.

CORRECTION -

1. Check entire film patch for places where the film is catching on any part of the projector.

2. If film catches on lower sprocket guard, replace the exciter lamp cover P/N 016557. Note the additional tab on current style cover (Arrow in Fig. B).

3. If the film catches on film stripper (Fig. A No. 6) loosen lamphouse stop (fig. A No. 7) push stripper down at arrow and tighten stop.

4. If film catches on spring (Fig. 8-15), readjust the impedance roller lifter (Fig. 8-19). Before adjusting the lifter, cust off rear leg of early style spring as shown in Fig. 8. Open the film gate with load lever (Pos. 1). Loosen lifter mounting screws (8-18) and shift the lifter so screws are latterly centered in the lifter slot and lifter edge above slot is parallel with lens casting. The finger of the spring (8-15) should be located approximately under the center of the impedance roller screw head. Make sure the impedance roller shaft is not touching the mechanism casting. There should now be a gap between the spring (8-15) and sound drum threading roller.

5. If film is not catching anywhere then clean sound drum and impedance roller and proceed with "Correction of film skew" procedure.

TOPIC - Projector does not run.

SYMPTOM - When film is in place and the load lever is turned to No. 3 position to close the film path, then the main control knob is turned to PROJECT, the projector fails to turn on.

CORRECTION -

1. Check that the lens carrier is closed. This can be visually verified by the Mode lever being horizontal.

2. If not closed check for interferences.

3. If closed, check that mode selector latch (fig. 10-24) is seated in notch (locked position). Readjust latch, this will activate interlock switch properly.

4. With the load lever horizontal (locked) position, the mode selector latch (fig. 10-24) can be readjusted after loosening screw (10-22). With the screw loose, position latch into the notch and push latch down until it just contacts the bottom of the notch and tighten the screw. The mode selector latch (10-24) should detent in the upper (locked) and lower (unlocked) notches and the projector motor should run in forward and reverse. If projector motor still will not run, check the motor interlock switch adjustment in Par. 17K on page 14 of repair manual. If the mech adjusting plate (Fig. 9-46) has been adjusted, the mode selector latch should also be readjusted.

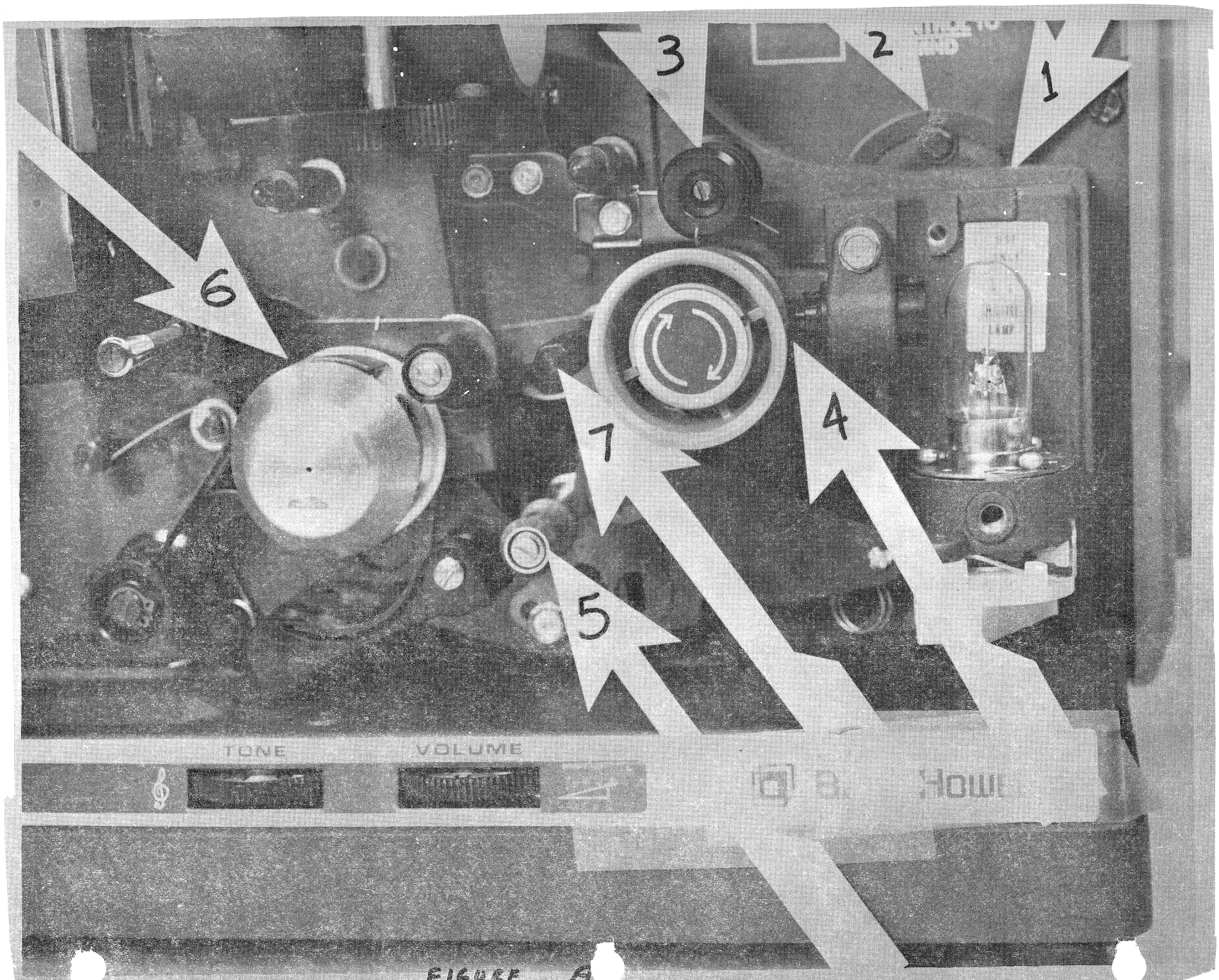


FIGURE A

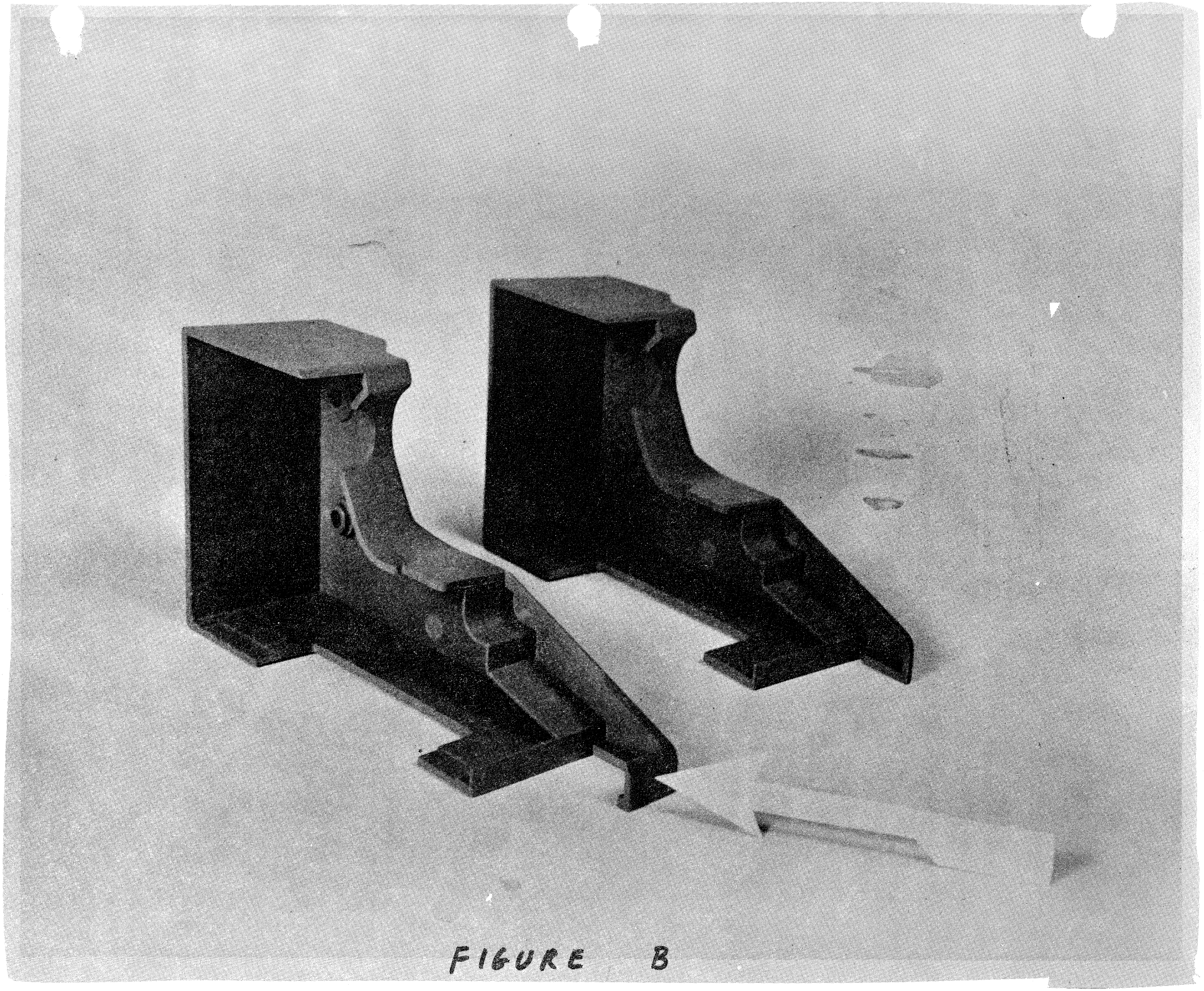


FIGURE B

SPROCKET PLATE ADUSTMENT TOOL

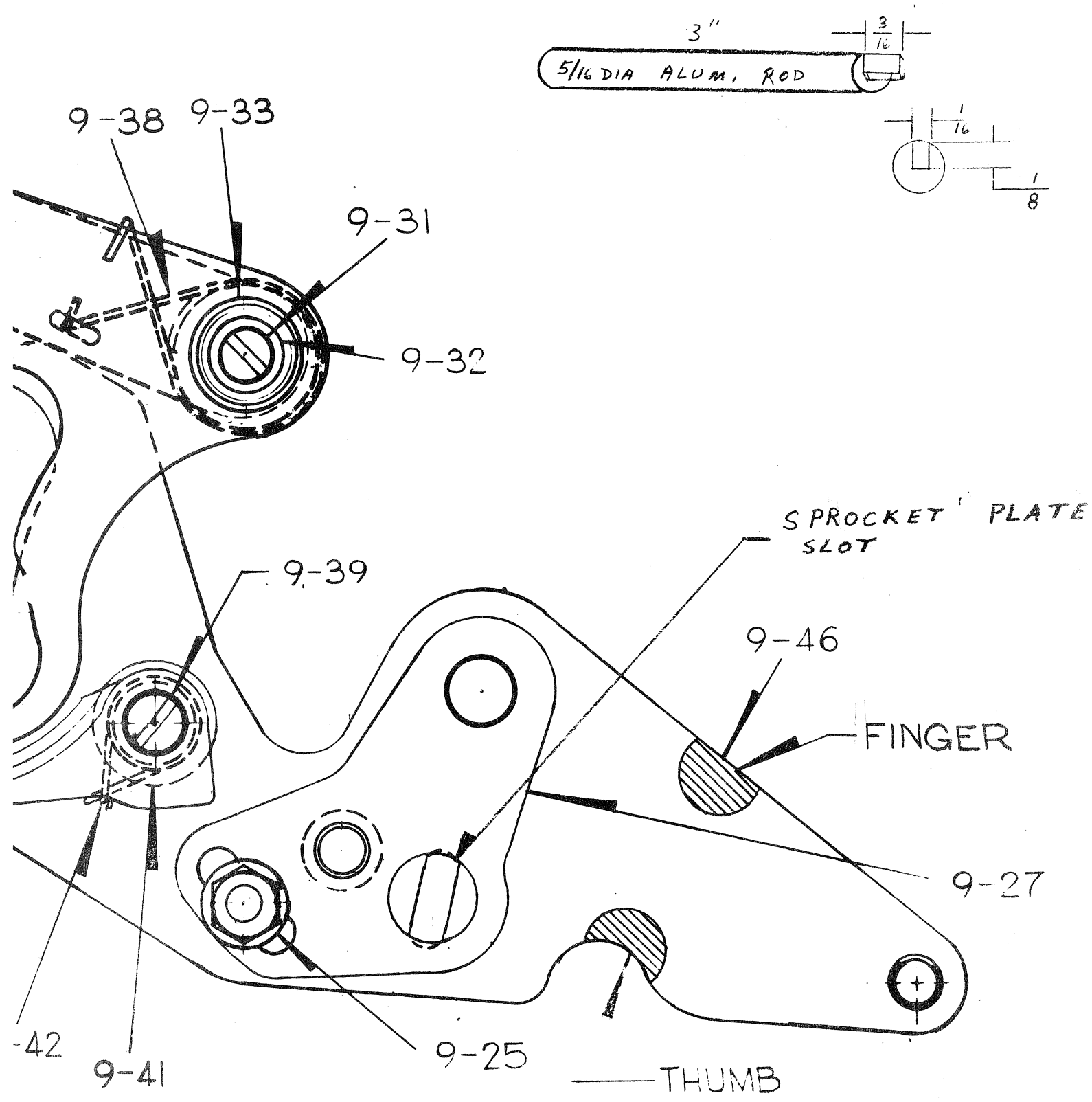
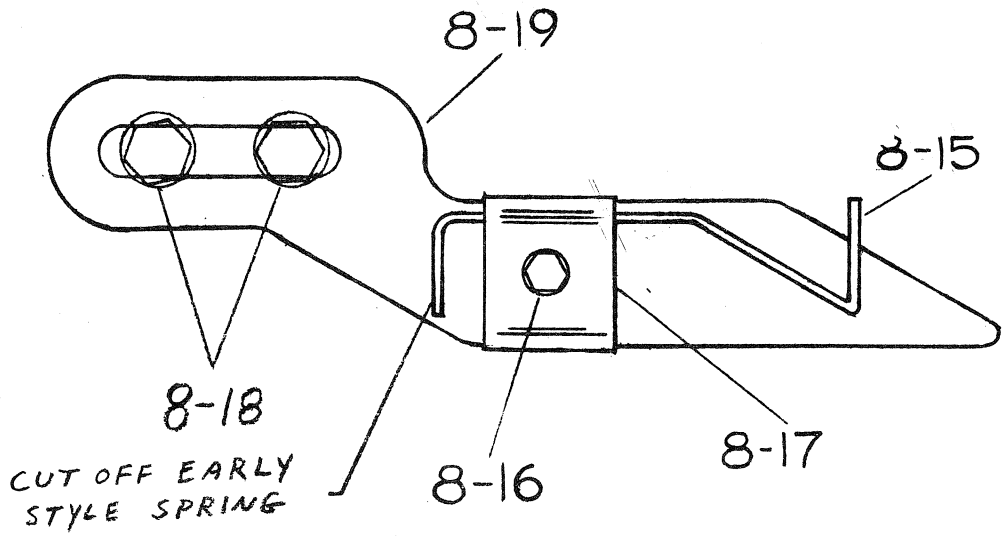


FIGURE 9 (INSET) PAGE 19-20



PAGE 17-18 FIGURE 8 (GROUP B)

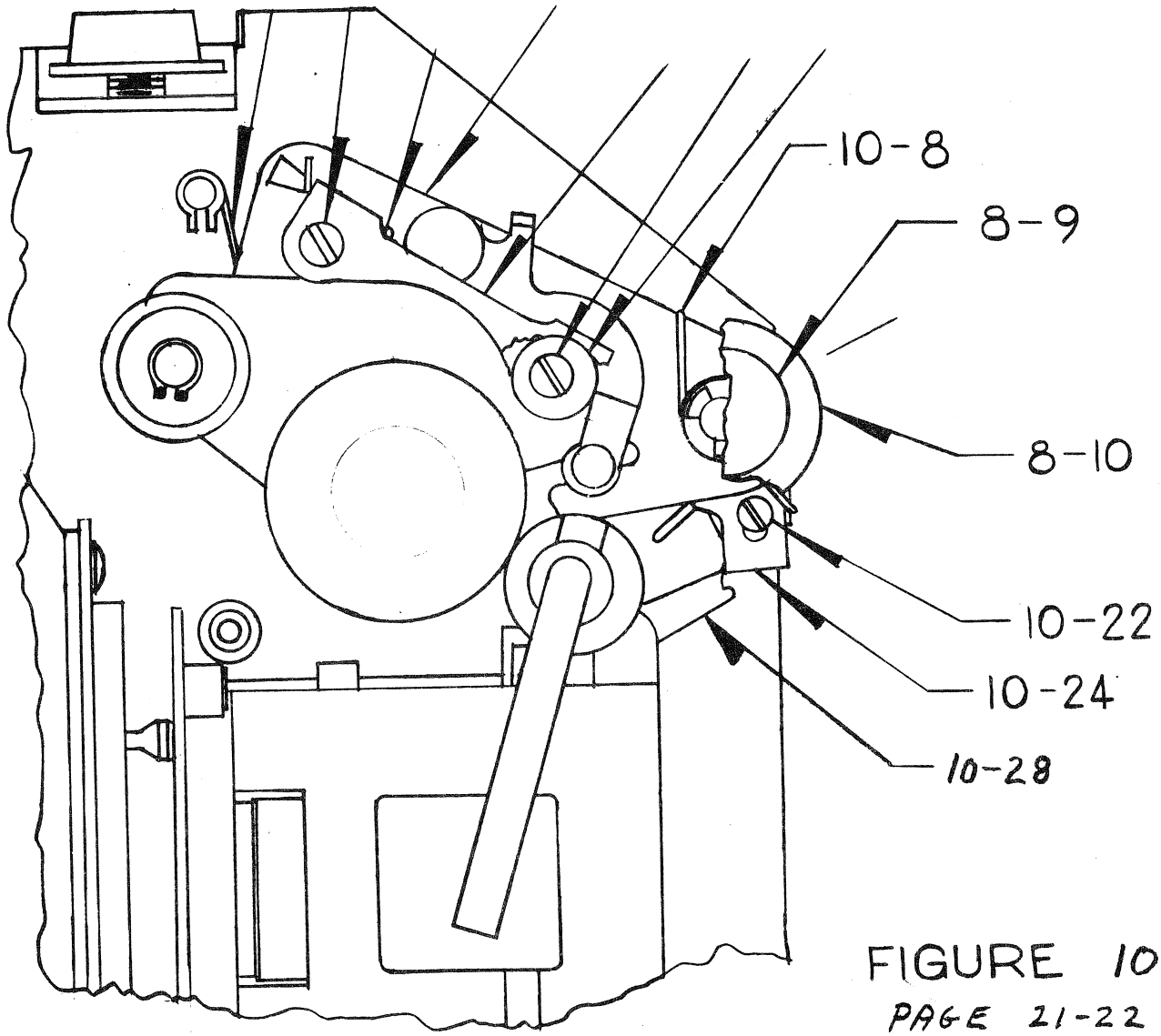


FIGURE 10
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