SERVICE INSTRUCTIONS

SLOT-THREADING FILMOSOUND® PROJECTOR

Models 2580, 2582

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

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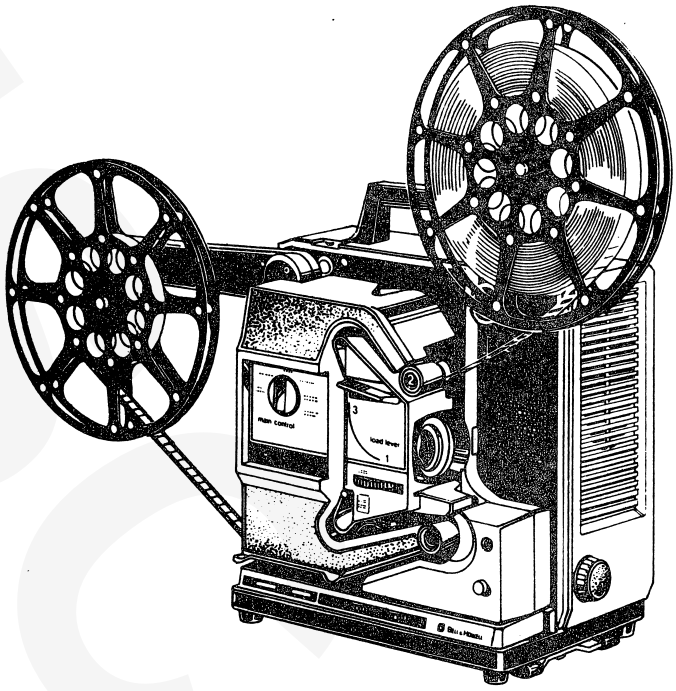


16mm Slot-Threading Projectors

FEATURE DESCRIPTION LIST

Color	Charcoal grey/black
Input Voltage:	
2580A and 2582A	120V, 60Hz
2580AX	120/220/240V, 50/60Hz
Line Cord:	
2580A and 2582A	3-wire, internally connected
2580AX	3-wire, international plug provided
Projector Controls:	
2580A and 2580AX	Forward and Reverse
2582A	Forward, Reverse and Run-Still
Projection Lens:	
2580A	2-inch, f/1.6
2580AX and 2582A	2-inch, f/1.2
Projection Lamp	Type ELC, 24V, 250W, 50 hour
Exciter Lamp	Type BAK, 4VDC
Shutter:	
2580A and 2582A	Rotating three-blade
2580AX	Rotating two-blade
Amplifier	Plug-in PC board, 20W RMS
Amplifier Controls:	
2580A and 2580AX	Volume/Tone controls
2582A	Volume/Bass/Treble controls

INTRODUCTION

1. GENERAL.

This Service Manual provides the necessary information for the repair and adjustment of Bell & Howell Company 16mm Slot-Threading Projectors, Models 2580 and 2582. Design 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 manual to identify replacement parts and to assist in the disassembly and reassembly of these projectors.

2. GENERAL DESCRIPTION.

As noted in the following chart, this manual covers several variations of the 2500-series projector. Each model has been "letter-coded" in the Parts Catalog so that replacement parts which are peculiar to a specific model or models can be readily identified. Parts peculiar to Canadian versions are so indicated in the parts lists.

MODEL	CODE
2580A	A
2580AX	B
2582A	C

Basically, all models covered in this service manual are physically identical. Model 2580AX is readily identified by the presence of a line cord receptacle and voltage selector switch located above the cord wrap on the rear cover. The voltage selector switch provides a means for supplying input voltages to match those of varying available global voltages. In the 2580A and 2582A models, the line cord is wired into the projector. In the 2580AX model, a male plug is supplied to mate with the female receptacle in the unit for accommodation of International requirements.

The most obvious physical difference between the 2580 and 2582 models is in the sound system controls, the knobs of which are located on the operating side of the base. The 2580 models are equipped with a volume control and a single tone control. Model 2582A is equipped with a volume control and two tone controls; one for treble and one for bass.

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.

NOTE: Projectors equipped with the run-still feature cannot be threaded when the run-still lever is in the "still" position. Because the flywheel is locked in the "still" position, these units must be in the "run" position to thread film.

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 position "3." 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

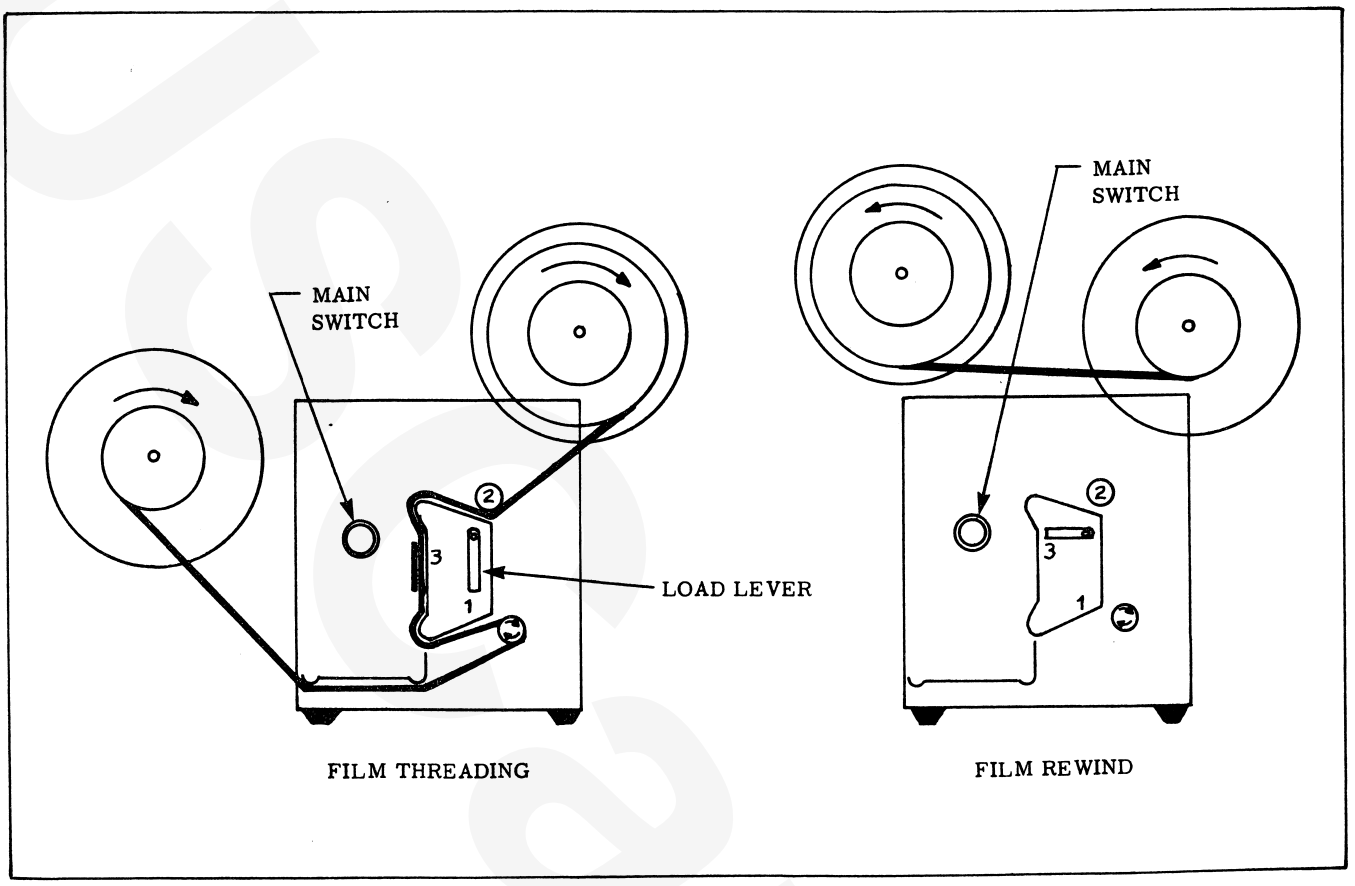


Figure A. Slot-Threading System

ejected from the lower portion of the film path. If this should occur, 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, and the load lever is in position "3," 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 counterclockwise direction during rewinding and that the load lever is in position "3." 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 found in an audio-visual equipment repair shop. Although most wiring connections are made by quick disconnects, a soldering gun should be available for some repairs. Special tools and gages necessary for projector alignments and adjustments are illustrated and listed in Figure B and its accompanying chart. The setscrew wrenches listed in the chart are not shown in Figure B.

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 lubricating wick, the wick 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.

Parts and areas that require lubrication are shown 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. Wipe away excess grease before installing these felt parts.

7. GENERAL REPLACEMENT DATA.

These projectors are designed for easy accessibility, removal 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 quick disconnect 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 C). 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.

a. Models 2580A and 2582A. The amplifier power input circuit and audio system of these models is protected by a 0.75 amp Slo-Blo fuse. This fuse is located adjacent to the rotary switch on the gear side of the mainplate. The rear cover must be removed (paragraph 11) to gain access to this fuse.

b. Model 2580AX. The amplifier power input circuit of this model is protected by a 4 amp Slo-Blo fuse. This fuse is located adjacent to the rotary switch on the gear side of the mainplate. The audio system of this model is protected by three 2 amp Slo-Blo fuses that are mounted on a fuseboard/support assembly attached to the power transformer assembly. To gain access to these fuses remove the rear cover as instructed in paragraph 11.

c. All Models. The electrical system of all projectors is protected against accidental overheating by a special thermal fuse. This fuse is installed on the tongue of the capacitor bracket just above the drive motor and can be replaced by disconnecting the wire nuts at the ends of its leadwires. The rear cover must be removed (paragraph 11) to gain access to the thermal fuse.

9. LAMP REPLACEMENT.

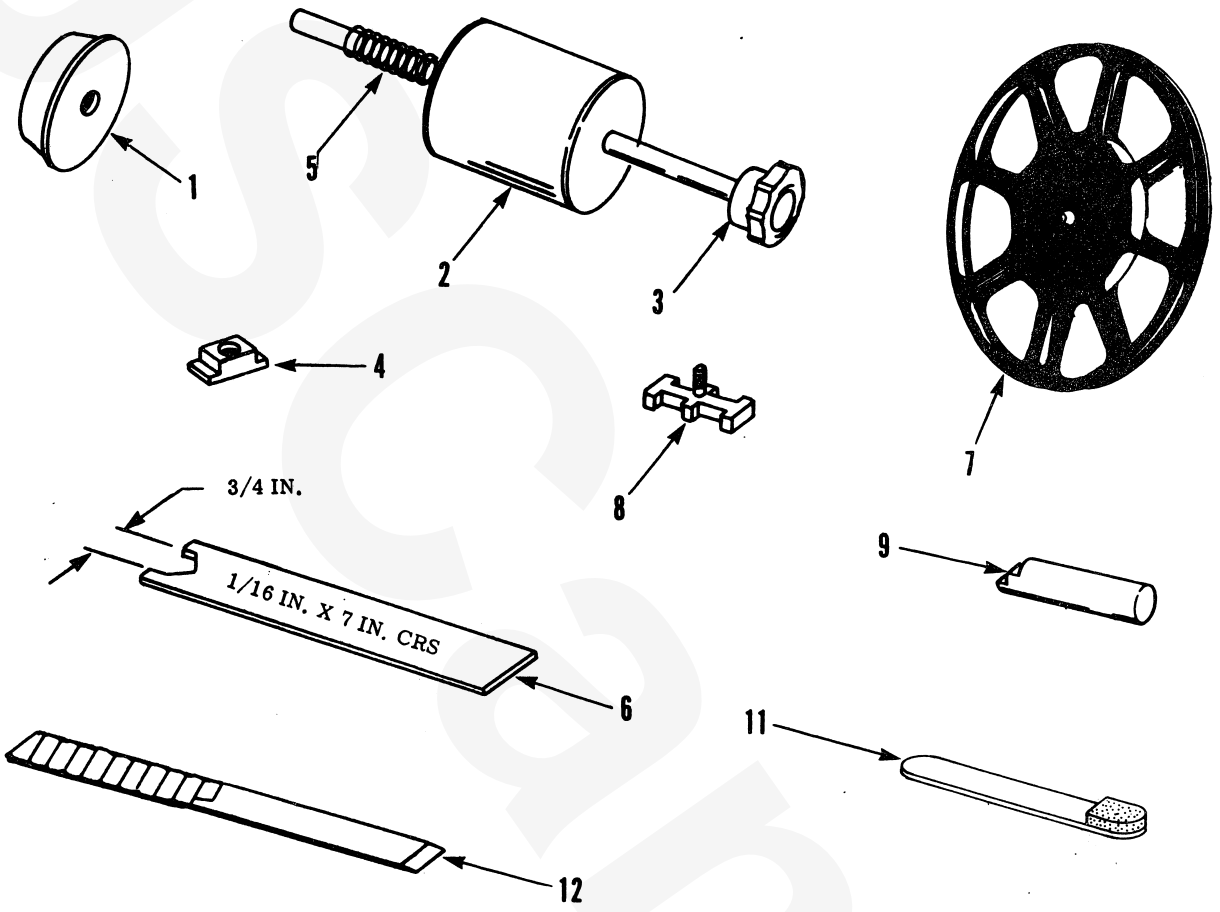
Projection Lamp. Disconnect the line cord and remove the front cover. Swing open the lamphouse and snap down the lamp retainer spring that holds the projection lamp in place. Pull the lamp straight out from its socket (do not twist or wiggle the lamp during removal). Check the lamp socket leadwires for fraying or poor connections. Assemble the new lamp into the lamp 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.

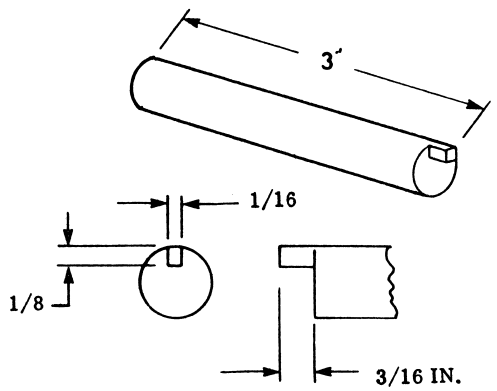
Exciter Lamp. Disconnect the line cord and remove the front cover. Loosen the thumbscrew on the exciter lamp cover and remove the cover. Rotate the lamp release ring until the exciter lamp can be turned and lifted from the lamp socket pins. Install the new lamp in the lamp socket. Then press down on the 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.

SERVICE TOOLS AND SUPPLIES CHART

Figure B Index No.	Tool No.	Tool Description	Tool Usage
1	S-078175-6F-1	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 44507	Tension Spring	Optcial system alignment (Fig. S).
6	Make in Shop	Torque Wrench	Adjust rewind torque (para. 31).
7	P/N 710365	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).
8	S-09701-35-N2	Shuttle Height Gage	Check shuttle protrusion (Fig. V).
9	S-550-8-N1	Alignment Tool	Align sound drum (Fig. R).
10	Make in Shop	Adjustment Tool	Remove play from sprocket plate.
11	P/N 48478	Cleaning Tool	Clean film path area.
12	Make from 707588	Decal Removal Tool	Remove decals.
	G1271-F1	Setscrew Wrench and Handle	For 4-40 Bristol-type setscrews.
	G1271-X2	Setscrew Wrench	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 Parts Catalog illustrations.
	P/N 07003	Lubricating Oil	See Parts Catalog illustrations.
	P/N 08963	Lubricating Oil	See Parts Catalog illustrations.
	P/N 070032	Lubricating Oil	See Parts Catalog illustrations.
	P/N 078215	Lubricating Oil	See Parts Catalog illustrations.
	P/N 070034	General Purpose Grease	See Parts Catalog illustrations.
	P/N 070043	Special Grease	See Parts Catalog illustrations.
	P/N 70910	Heat Sync Compound	See paragraphs 24 and 25.
	P/N 70507	Adhesive	See paragraph 10, step b.
	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 7000Hz azimuth.
	TFL-D1580-NX5	Test Film Loop	Check 400Hz power output.
	TFR-D550-NX5	Test Film Roll	Final audio/centering/ framing test.

these for both slot and auto-load units

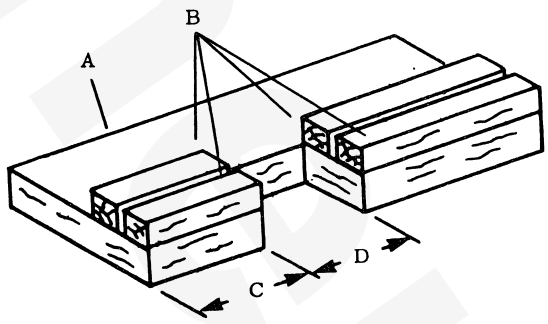




(10) SPROCKET PLATE ADJUSTING TOOL

MAKE FROM ALUMINUM ROD (5/16 IN. OD BY 3 IN. LONG)

MAINPLATE HOLDING FIXTURE



A - PLYWOOD BASE (1-1/2 IN. THK. X 9 IN. X 14-1/2 IN.)
B - 1 IN. BY 2 IN. WOOD STRIPS (CUT TO FIT)
C - DISTANCE FROM EDGE OF MAINPLATE TO PC BOARD
D - BASE CUT-OUT TO PROVIDE CLEARANCE FOR PC BOARD

Figure B. 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 C).

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.

a. Remove the projector rear cover (paragraph 11), top cover (paragraph 13) and rear end cap (paragraph 15, step b).

b. If the drive belt is badly worn or frayed and in need of replacement, cut the belt and remove it. Clean both belt pulleys with isopropyl alcohol.

c. Remove the right-hand blower housing and the blower fan (paragraph 16). Insert one end of the new drive belt through the opening in the left-hand blower housing until it can be slipped over the fan end of the drive motor shaft. Bring the belt back and loop it around the motor drive pulley. Engage the upper end of the belt around the upper (mechanism) pulley with as little stretching as possible.

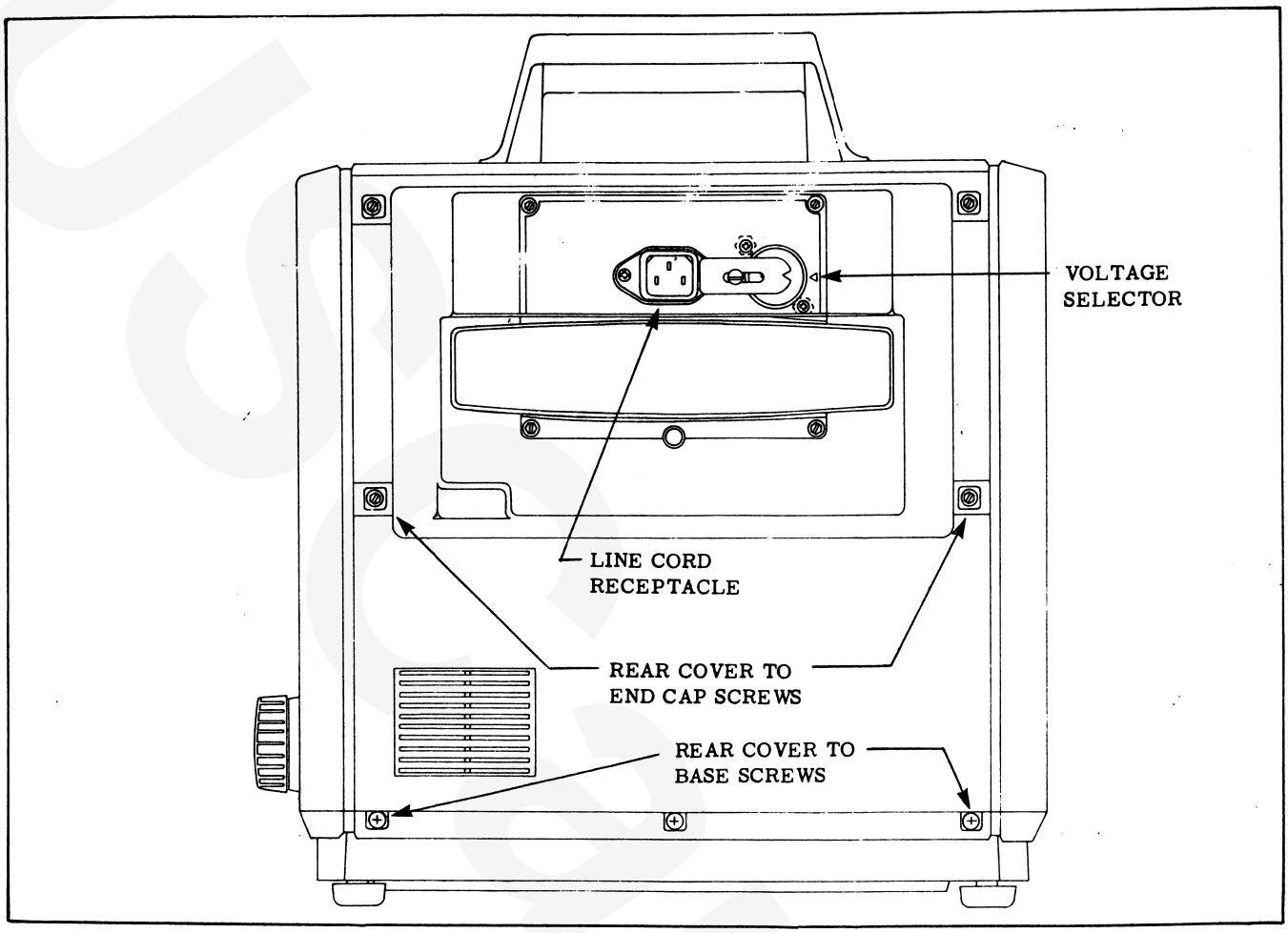


Figure C. Projector Rear Cover (Model 2580AX Shown)

d. Reassemble the blower fan and right-hand blower housing (paragraph 16) centering the fan as instructed. Reinstall the rear end cap and projector covers.

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.

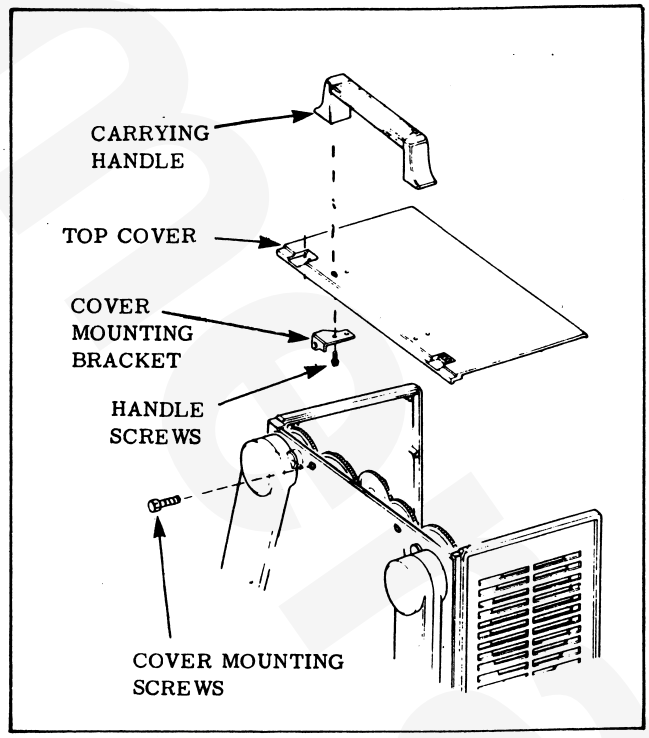


Figure D. Removing Top Cover and Handle

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 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 the front or rear end caps 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 until its setscrew is visible through the cutout in the collar surrounding the tilt knob. Loosen this setscrew and withdraw the tilt knob. Disassemble the screw and washer from the tilt bar assembly and from the projector rubber foot and remove these parts from the base. 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. Remove the two screws that are inserted through the mainplate and threaded into the Tinnerman nuts assembled to the front edge of the end cap. Reinstall the end cap in reverse fashion and reconnect the speaker leads to the speaker terminals. Reassemble the top and rear covers 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

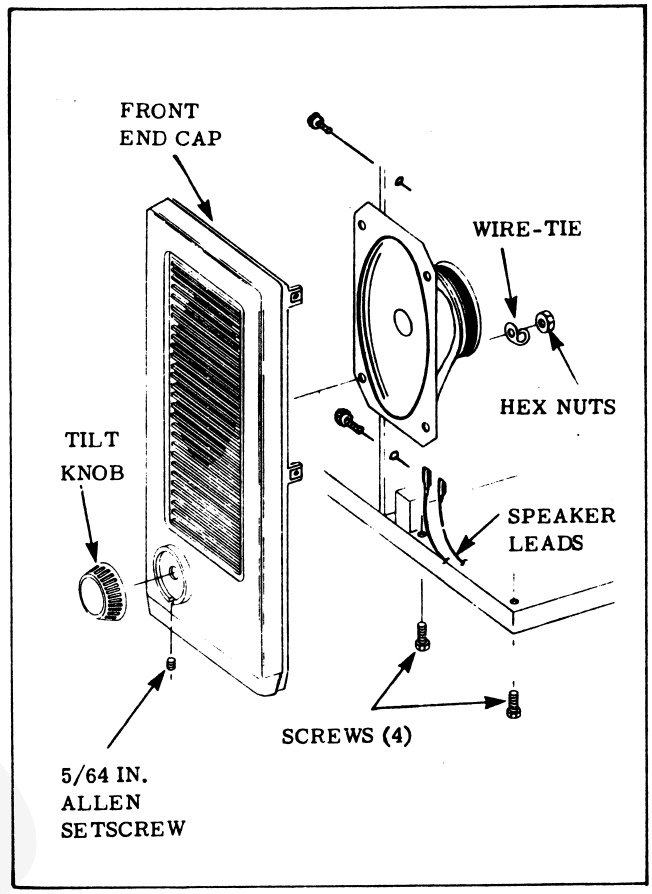


Figure E. Front End Cap and Speaker Removal

through the base and threaded into the lower Tinnerman nuts assembled to the underside of the end cap. Remove the two screws that are inserted through the mainplate and threaded into the Tinnerman nuts assembled to the front edge 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).

Remove the rear cover (paragraph 11), top cover (paragraph 13) and the rear end cap (paragraph 15, step b) from the projector, moving the end cap far enough away to clear the blower housing without placing strain

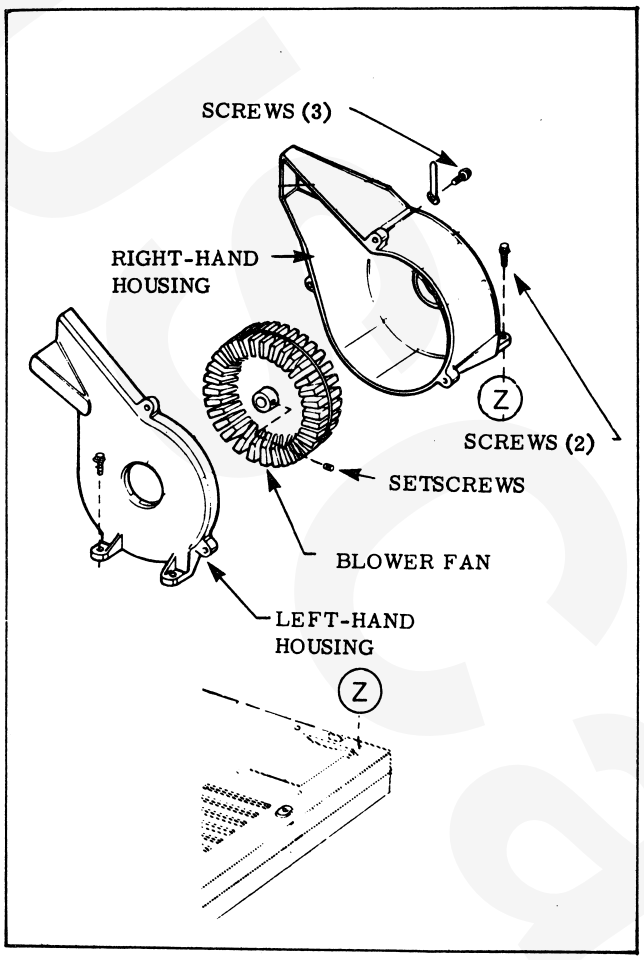


Figure F. Blower Repairs

on the 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 projector top and rear covers.

17. MAIN SWITCH REPLACEMENT (Figure G).

Remove the rear cover (paragraph 11), top cover (paragraph 13) and rear end cap (paragraph 15, step b) from the projector to expose the switch. Swing open the lamphouse and remove the switch knob, heat shield 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: Some units have capacitors wired across the switch terminals (see inset, Figure G) which 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.

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 heat shield, grip ring and switch knob to the end of the switch shaft and close the lamphouse. Reinstall the rear end cap and projector top and rear covers.

18. DRIVE MOTOR REPLACEMENT (Figure H).

Remove the projector rear cover (paragraph 11), top cover (paragraph 13) and rear end cap (paragraph 15, step b) and disconnect the motor leads. Remove the

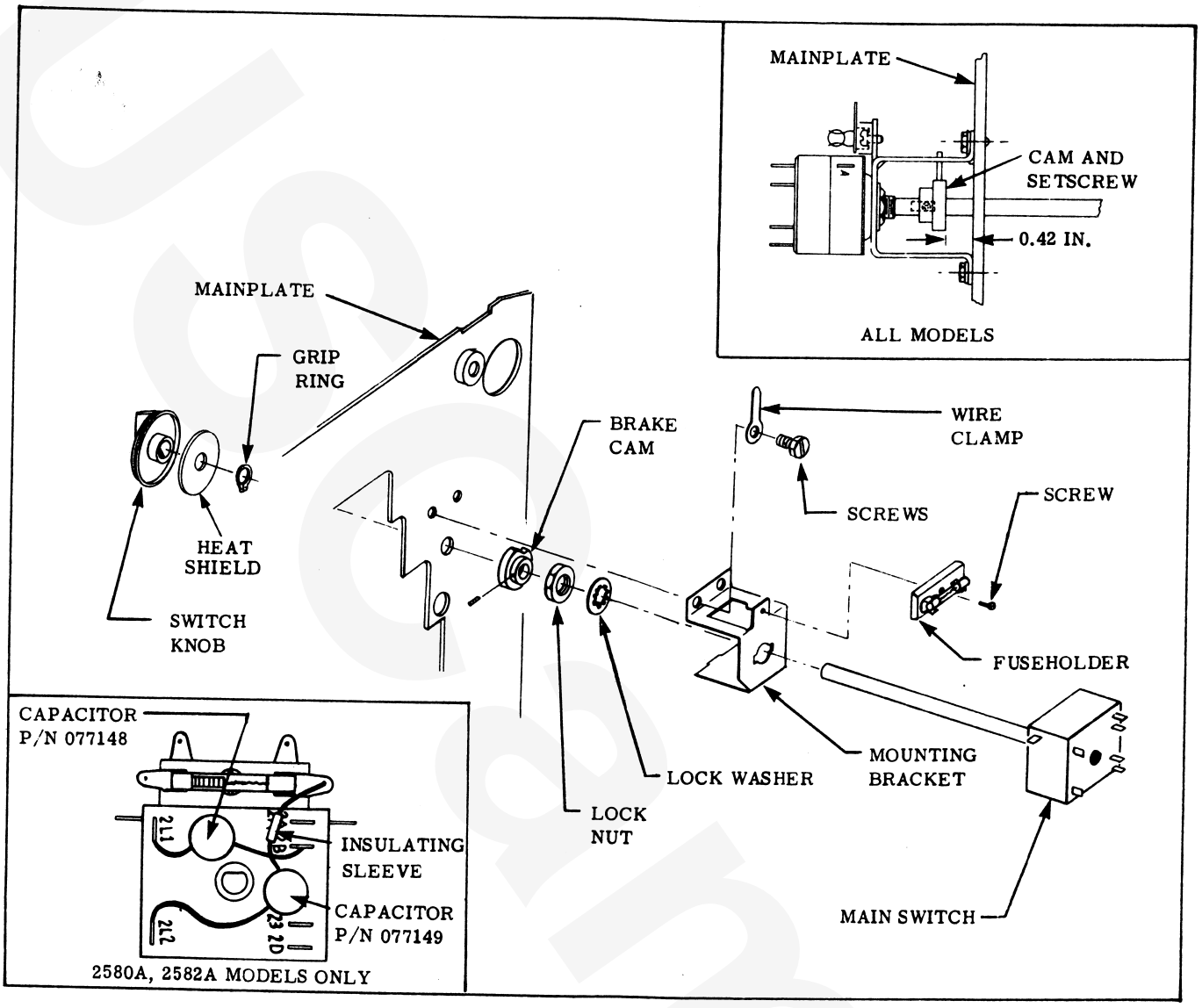


Figure G. Replacing the Main Switch

blower right-hand housing and blower fan (paragraph 16). Loosen the screw in the upper ears of each motor bracket strap and disengage the straps 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 drive motor is to be replaced, remove the pulley from the motor shaft. Assemble the new motor and left-hand bracket to the 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 motor bracket straps to the end bells and mounting bracket ears and tighten the strap screws. Insure that the thermal fuse and sleeve assembly is properly positioned and retained against the motor. 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 the drive pulley and mechanism pulley. Then tighten the two pulley setscrews securely and reconnect the motor leads. Replace the rear end cap and projector top and rear covers.

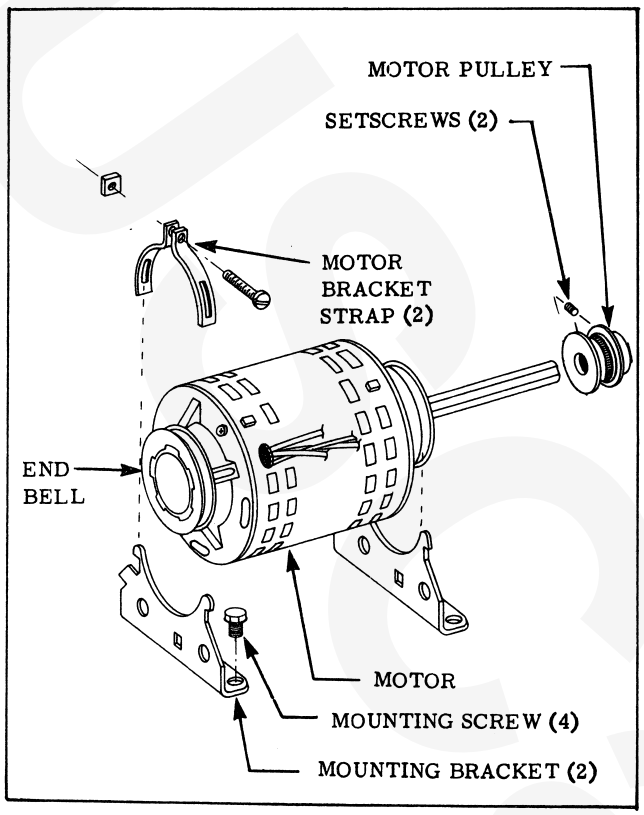


Figure H. Replacing the Drive Motor

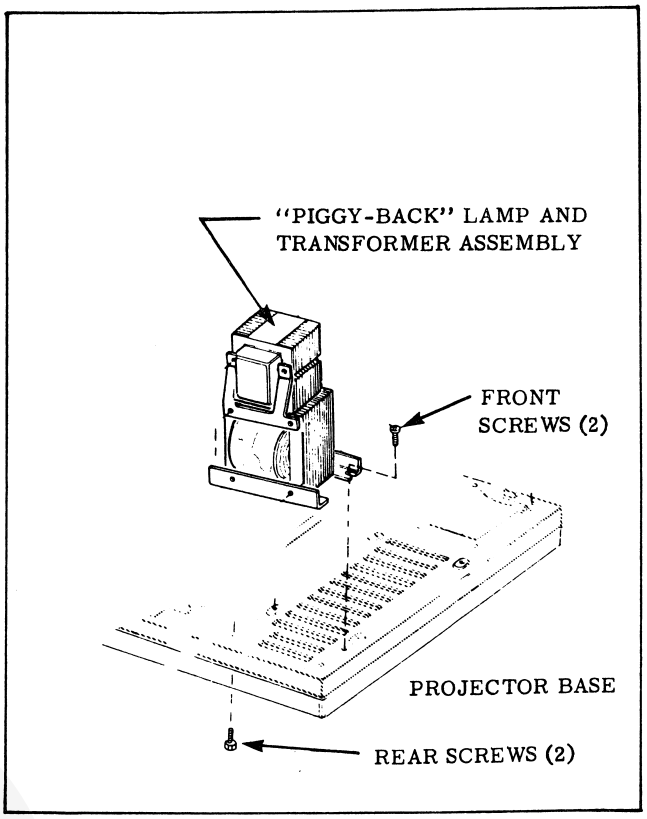


Figure J. Replacing the Transformer (Models 2580A, 2582A Shown)

19. TRANSFORMER REPLACEMENT (Figure J).

a. Models 2580A/2582A. These models are equipped with a "piggy-back" power and lamp transformer assembly. To gain excess to the "piggy-back" transformer remove the rear cover (paragraph 11), top cover (paragraph 13) and rear end cap (paragraph 15, step b). To replace the transformer, first remove the two screws closest to the mainplate installed from the underside of the projector base. Then remove the two remaining screws installed from the top of and down into the left-hand and right-hand transformer brackets into the projector base. See Parts Catalog Figure 10 if further breakdown of the transformer is required. Reinstall the transformer by reversing the removal procedure. Refer to the appropriate wiring diagram in the Parts Catalog for proper wiring connections. Replace the rear end cap and projector covers.

b. Model 2580AX. This model is equipped with a power transformer only. To replace the power transformer remove the rear cover (paragraph 11), top cover (paragraph 13) and rear end cap (paragraph 15, step b). Next remove the four screws that are installed from the top of the transformer mounting bracket and down into the projector base. Remove the two hex nuts to disassemble the fuseboard support from the transformer. Reverse the removal procedure to reinstall the transformer. Refer to the appropriate wiring diagram in the Parts Catalog for proper wiring connections. Replace the rear end cap and projector covers.

20. REWIND CORD REPLACEMENT AND ADJUSTMENT (Figure K).

a. Replacing the Rewind Cord. Remove the projector rear cover (paragraph 11) and top cover (paragraph 13) and proceed in the following manner. Remove the grip ring from the formed tab of the rewind disc and

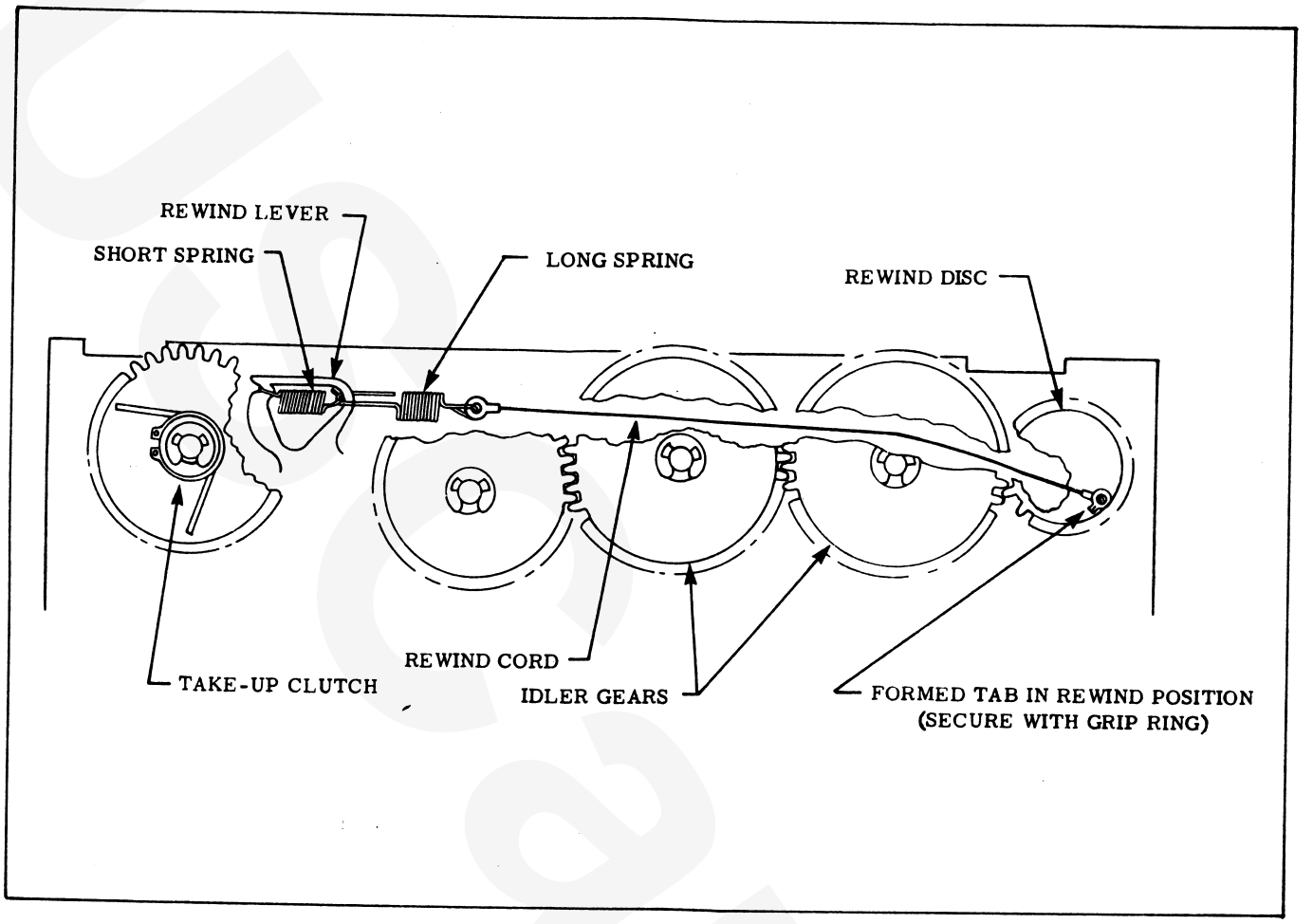


Figure K. Replacing the Rewind Cord

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.

b. Adjusting the Rewind Cord. 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.

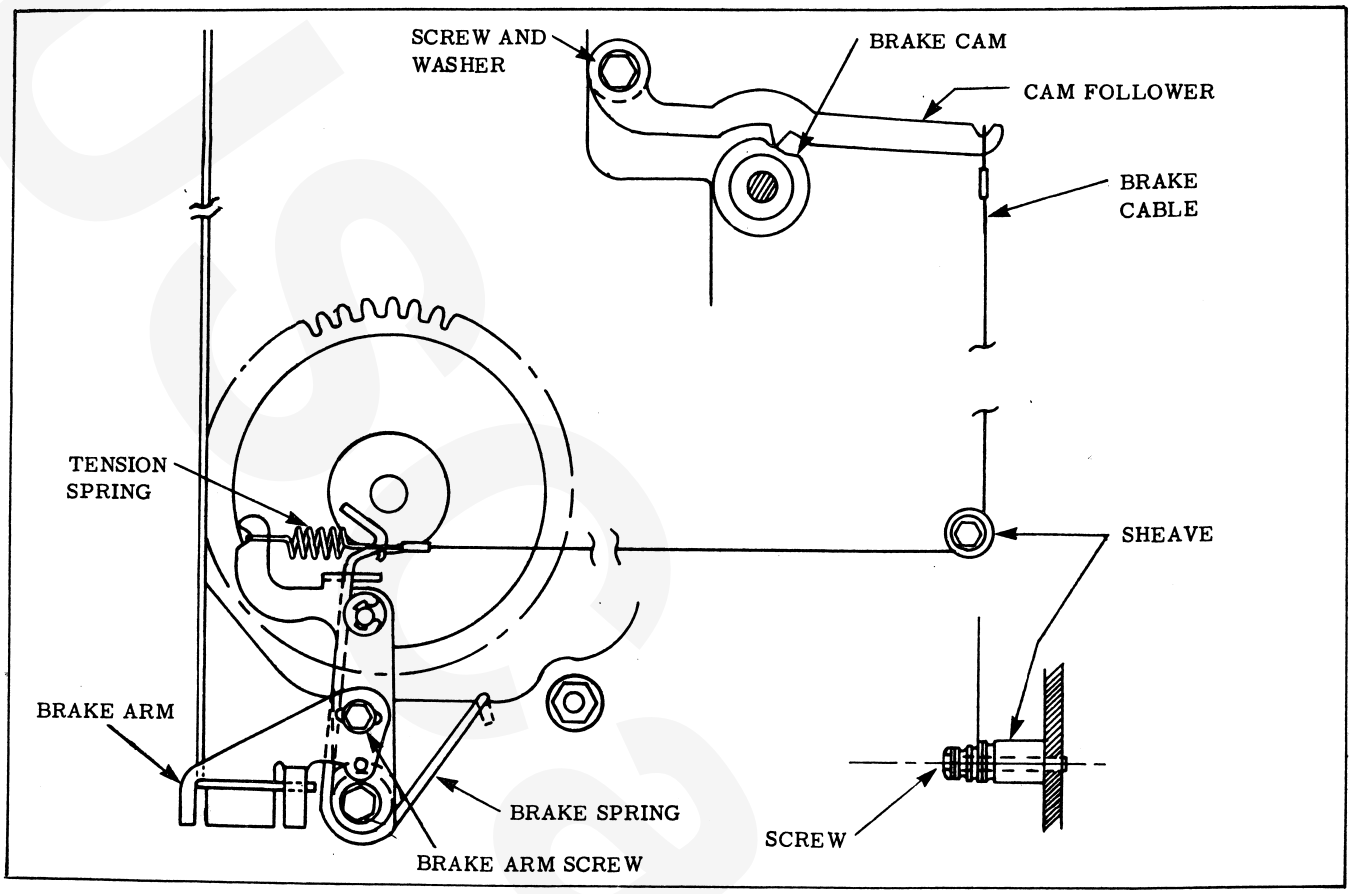


Figure L. Brake Release System

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 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.

22. REEL ARM REPLACEMENT.

a. Rear Reel Arm (Figure M). Remove the retaining rings that secure the gear assembly to the shaft of the rear reel arm. Disassemble the gear assembly and washer from the shaft. Disengage the rewind cord from the rewind cord disc. Note the manner in which the rear reel arm disc is oriented. Remove three screws and disassemble the reel arm disc and rear reel arm from the mainplate. Refer to Figure 12 of the Parts Catalog section if further disassembly of the rear reel arm is required.

b. Front Reel Arm (Figure N). At the rear (gear side) of the mainplate, remove the retaining ring, reverse take-up clutch assembly, take-up clutch gear, rewind gear and the retaining ring. Remove the three screws from the reel arm disc and disassemble the front reel arm assembly and the disc from the mainplate. Refer to Figure 13 of the Parts Catalog if further disassembly of the front reel arm is required.

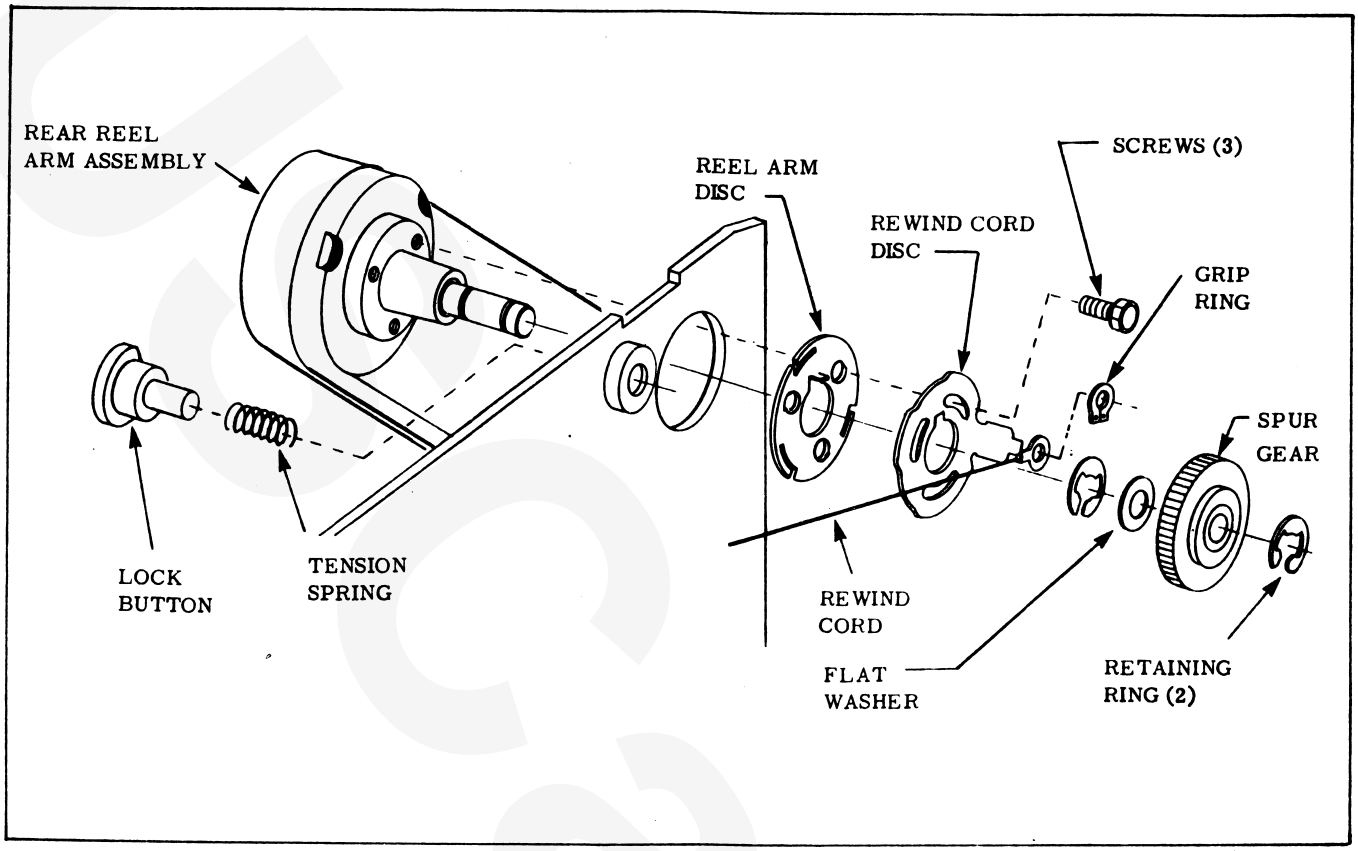


Figure M. Replacing the Rear Reel Arm

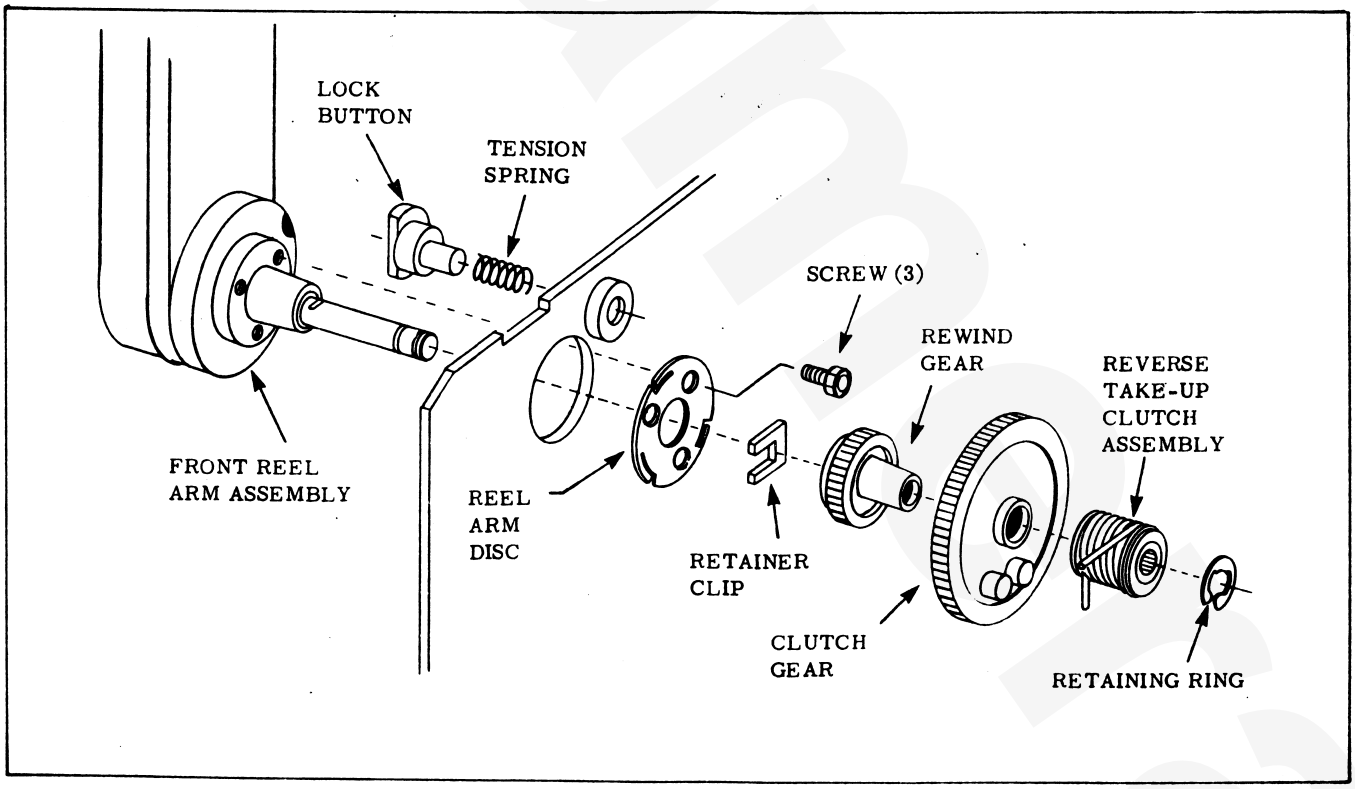


Figure N. Replacing the Front Reel Arm

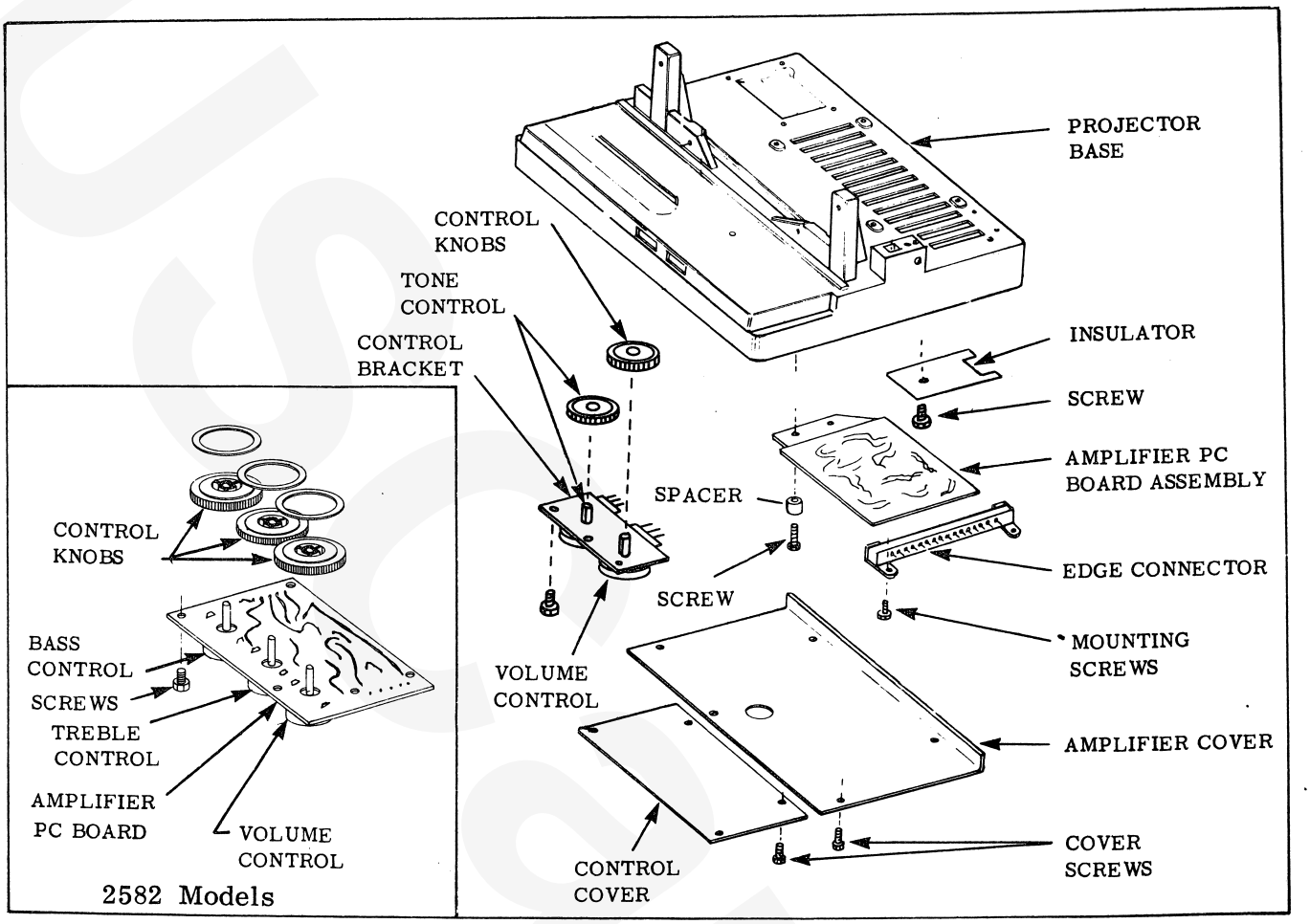


Figure P. Amplifier and Controls Repair

23. RUN-STILL LINKAGE REPAIR.

The run-still linkage is shown assembled at the rear (gear side) of the mainplate in Figure AF. Except for the possible breakage and/or weakening of springs, it is doubtful that any parts replacement will be required. It may, however, be necessary to adjust the run-still linkage or the heat shutter linkage. These adjustment procedures are covered in paragraph 44 in the Adjustments section of this manual.

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 tracked to the amplifier, replace the complete assembly. See Parts Catalog Figure 6 for NEW and rebuilt amplifier policy.

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 three 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 apply a fresh coating of heat sink compound 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 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.

25. MAINPLATE REMOVAL AND INSTALLATION.

The following instructions provide the method whereby the complete mainplate 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 manual and are usually followed by the index number of the referenced part. For example, "(Figure 5-1)" refers to indexed item 1 in Parts Catalog Figure 5. A Mainplate Holding Fixture, illustrated in Figure B, should be made so that the mainplate can be set in an upright position while performing inspection and maintenance procedures.

MAINPLATE 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 mainplate. These screws (Figure 2-12) 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). Disconnect the edge connector from the mechanism assembly. Return the projector to the upright position.

c. Swing open the lamphouse door and pull the main switch control knob (Fig. 2-3), heat shield (2-3B) and its grip ring (Fig. 2-3A) from the switch shaft. Using a rubber band secure cam follower (Fig. 4-18) in its upward position. At the rear of the mainplate, remove the three screws (Fig. 3-4) that attach the switch and bracket assembly (Fig. 3-5) to the mainplate. Carefully disassemble the switch and bracket assembly from the mainplate.

d. With the lamphouse door open, remove the two hex head screws (Fig. 7-18) that secure the mainplate to the rear support posts of the base. Remove the exciter lamp cover and the exciter lamp and place the load lever in position "1." Remove the two screws (Fig. 7-17) and (Fig. 7-18) that secure the mainplate to the front support post of the base.

e. Disconnect the leads from the terminals of all electrical components mounted to the mainplate (lamp leads, interlock switch leads, speaker leads). Make certain that the wire straps used to dress leadwires to the mainplate are opened to free the wires. Grasp the mainplate and lift it straight up from the base, spreading the end caps if necessary. Place the mainplate in the holding fixture (see Figure B) with the soundhead printed circuit board positioned in the notched-out area of the fixture.

MAINPLATE INSTALLATION.

a. Push the front and rear end caps outward slightly to facilitate the installation of the mainplate. Lift the mainplate 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 mainplate in its receiving slot until the holes in the mainplate 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. 4-15) 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 position "1." At the front support post, hold the spring behind the exciter lamp location to the left and install one screw (Fig. 7-17) through the exposed opening. Install the second screw (Fig. 7-18) in the opening just below the lower sprocket plate (Fig. 15-25). Open the lamphouse door and install the remaining two screws (Fig. 7-18) through the mainplate 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 two screws (Fig. 2-12) through the rear edge of the mainplate and into the nuts of the rear end cap. Install the remaining two screws through the front edge of the mainplate 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 leads, interlock switch leads and speaker leads and dress all leadwires in the same manner as they were before the mainplate was removed. Reassemble the drive belt to the pulleys (paragraph 12).

f. Reinstall the assembled switch and bracket assembly as follows: Guide the switch shaft through its opening in the mainplate. Remove the rubber band securing the cam follower (Fig. 4-18) in the upright position. 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 mainplate. Secure the switch bracket to the mainplate with the three screws and tighten all screws securely.

NOTE: The upper left-hand screw is inserted through a wire clamp when assembling the switch and bracket assembly to the mainplate.

g. Assemble the heat shield (Fig. 2-3B), grip ring (Fig. 2-3A) and 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.

h. Reassemble the top cover (paragraph 12) and rear cover (paragraph 11) to the projector. 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 to the mechanism assembly. At the rear bottom edge of the mainplate, reconnect the edge connector to the soundhead printed circuit board (Figure 14-26) and reinstall the volume/tone controls cover to the base with four screws.

i. Check to make certain that the torsion spring (Fig. 15-21) is still assembled to the projector mechanism assembly. This spring is installed on the shaft which protrudes through the retention pawl (Fig. 15-34). The straight end rests on the projector base while the hooked end is engaged behind the left edge of the retention pawl.

26. COMPLETE MECHANISM REPLACEMENT (Figure Q).

a. Removal. Remove the projector rear cover (paragraph 11), top cover (paragraph 13) and rear end cap (paragraph 15, step b). Remove the transformer (paragraph 19) to expose the flywheel. Remove the retaining ring from the rear end of the sound drum shaft. Carefully remove the flywheel from the sound drum shaft, guiding it out from behind the drive motor. Remove the flat washers and bowed washers from the shaft. Unplug the small edge connector from the printed circuit board mounted at the bottom of the mechanism casting.

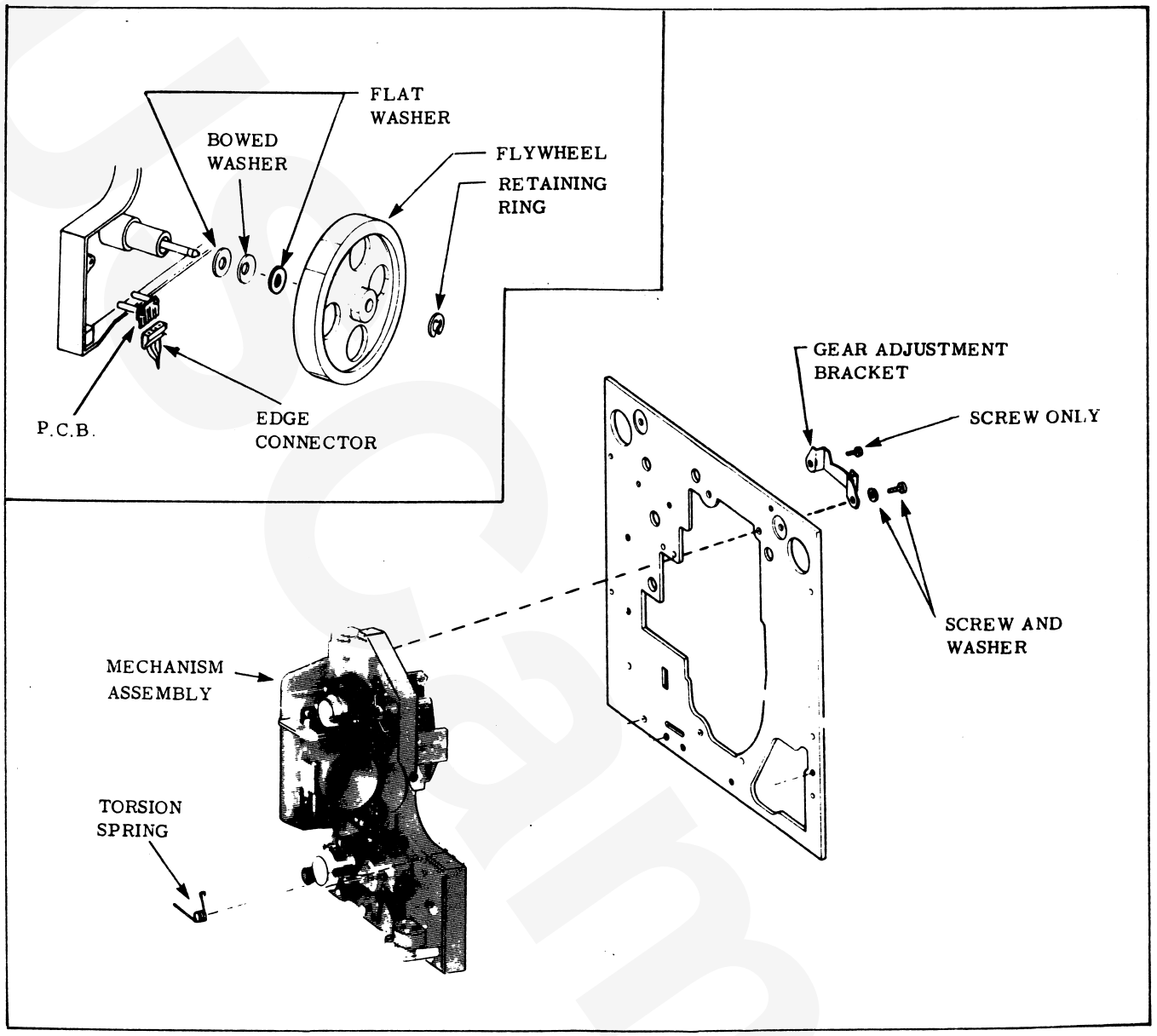


Figure Q. Replacing Complete Mechanism Assembly

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.

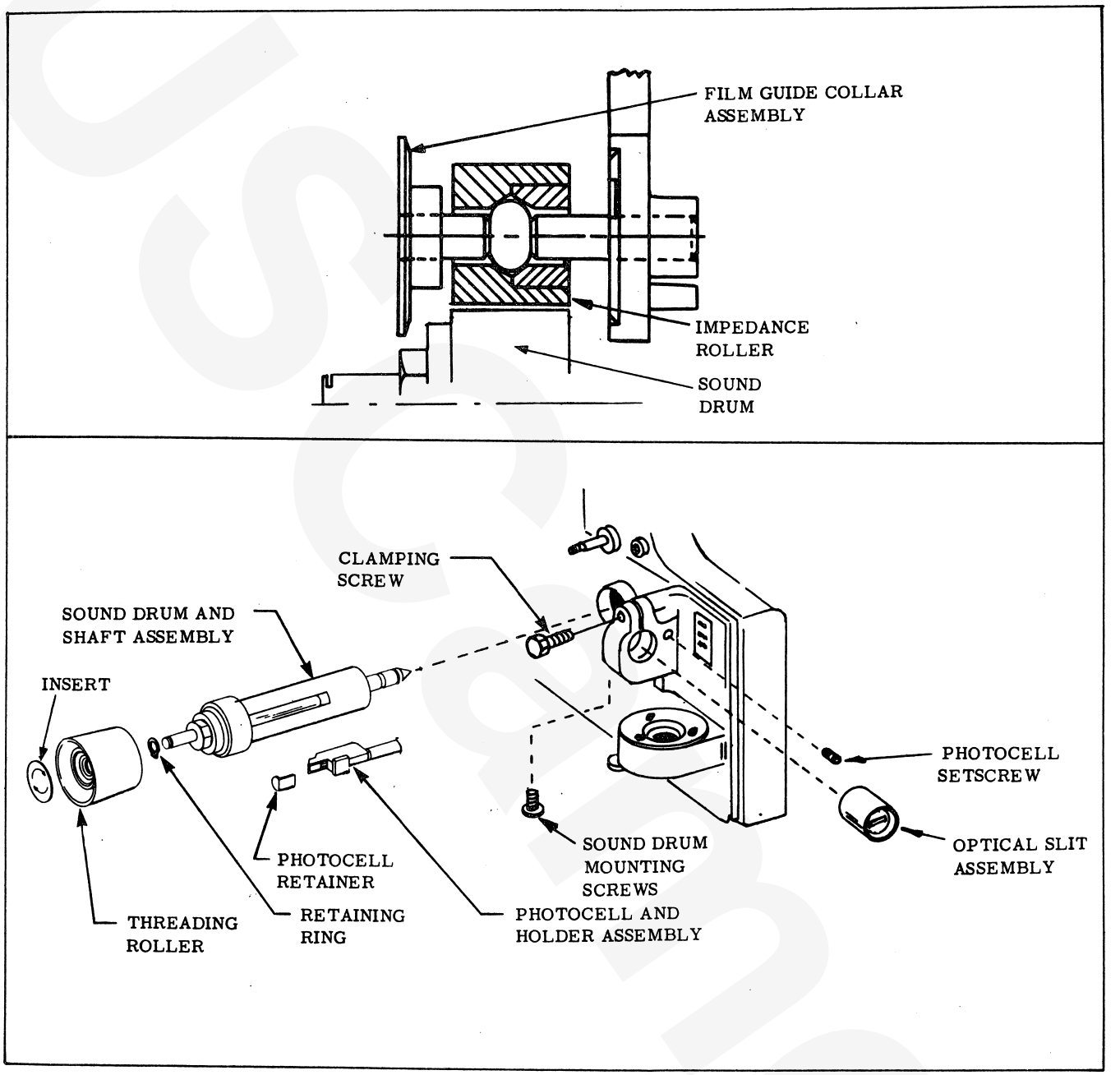


Figure R. Sound System Repairs

27. 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 mechanism must be removed from the mainplate (paragraph 26) to expose the attaching parts. Then the two sound drum mounting screws and photocell setscrew must be loosened enough to permit the withdrawal of the sound drum, photocell and photocell retainer. To reassemble the new components, proceed as follows:

c. 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. Refer to paragraph 32 for sound system adjustments. 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 of the photocell leads. Secure 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.

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.

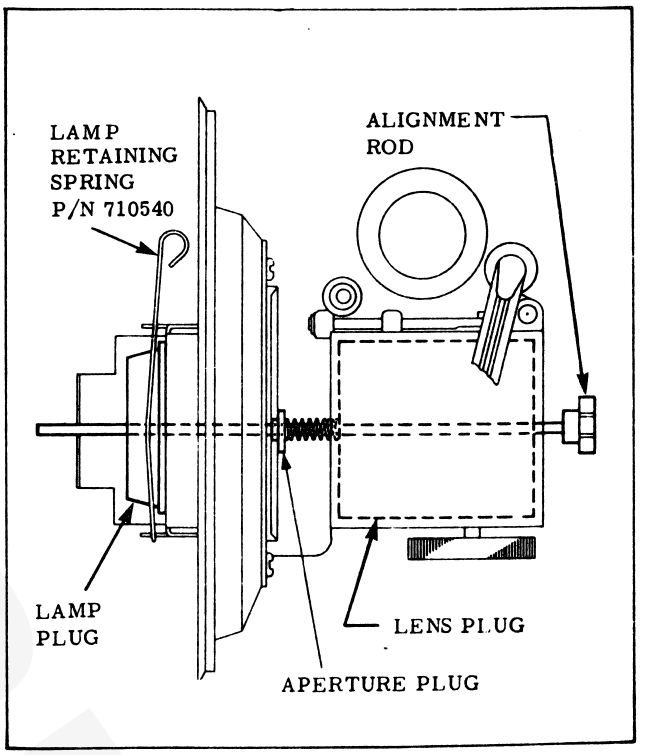


Figure S. Aligning the Optical System

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

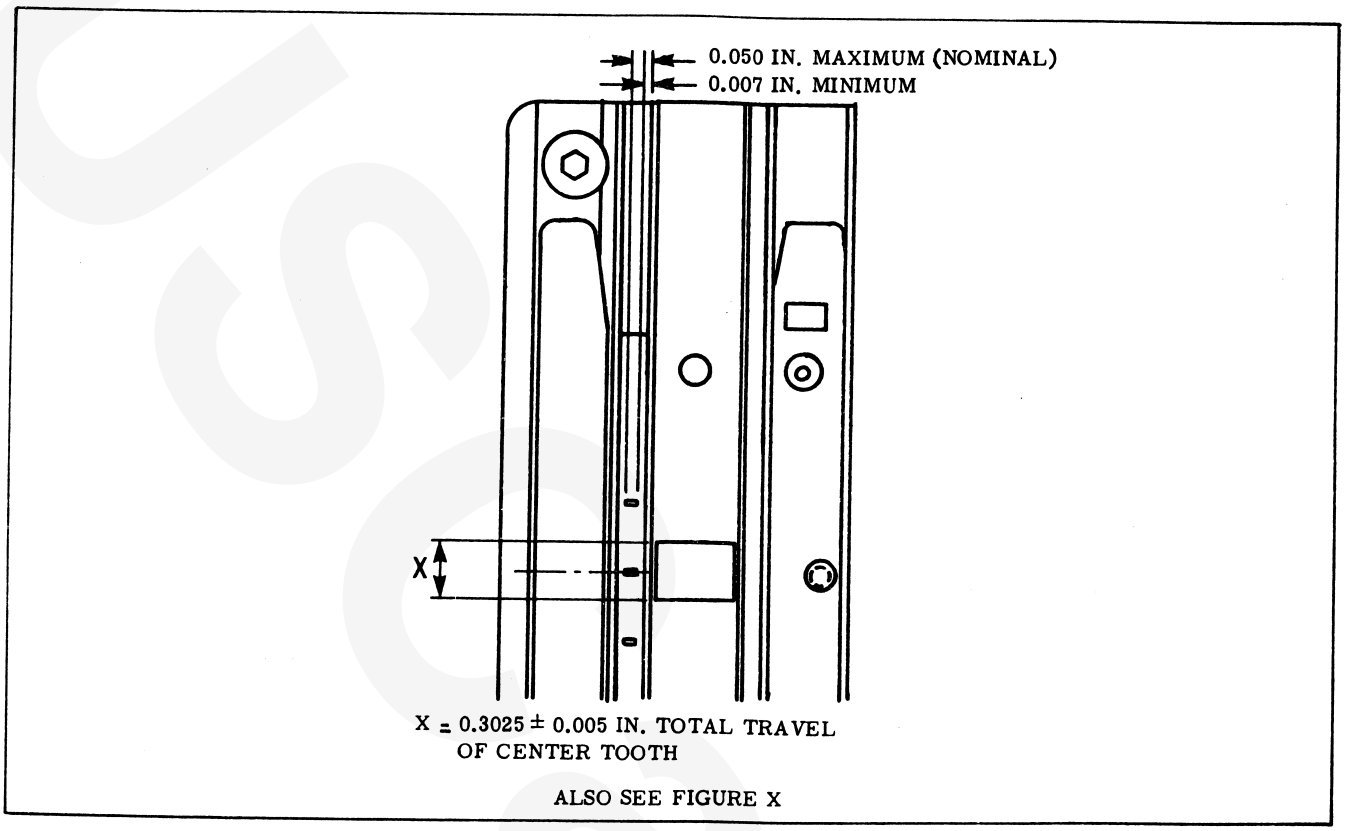


Figure T. Aperture Plate and Shuttle Tooth Clearance

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.

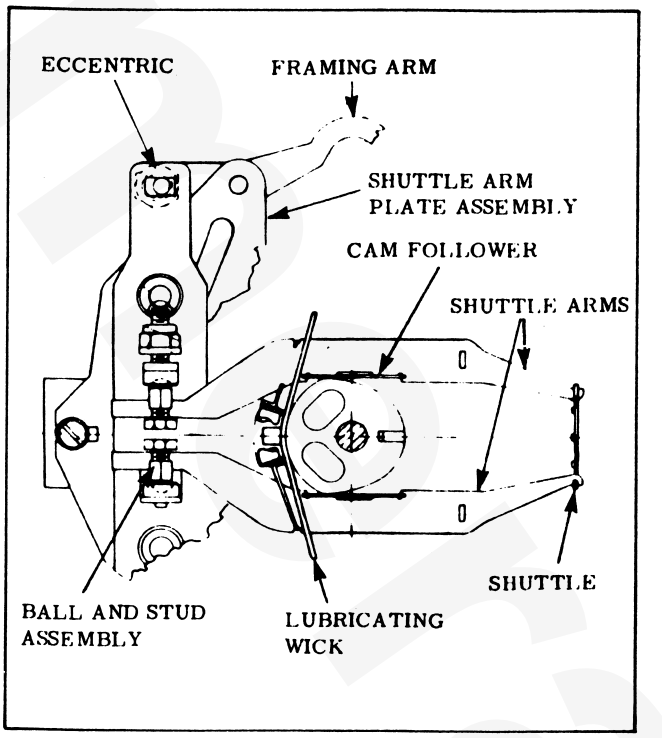


Figure U. Shuttle Arms and Cam Assembly

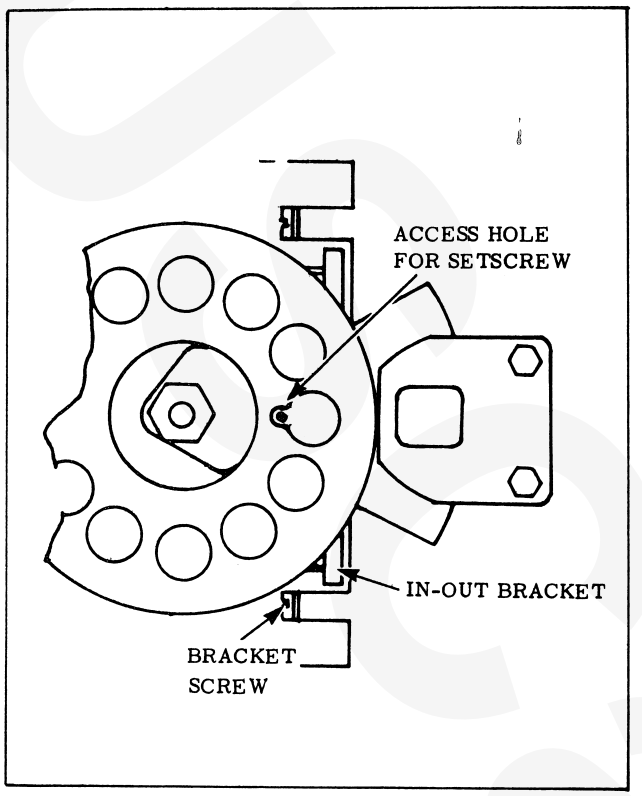


Figure V. Adjusting Shuttle Tooth Height

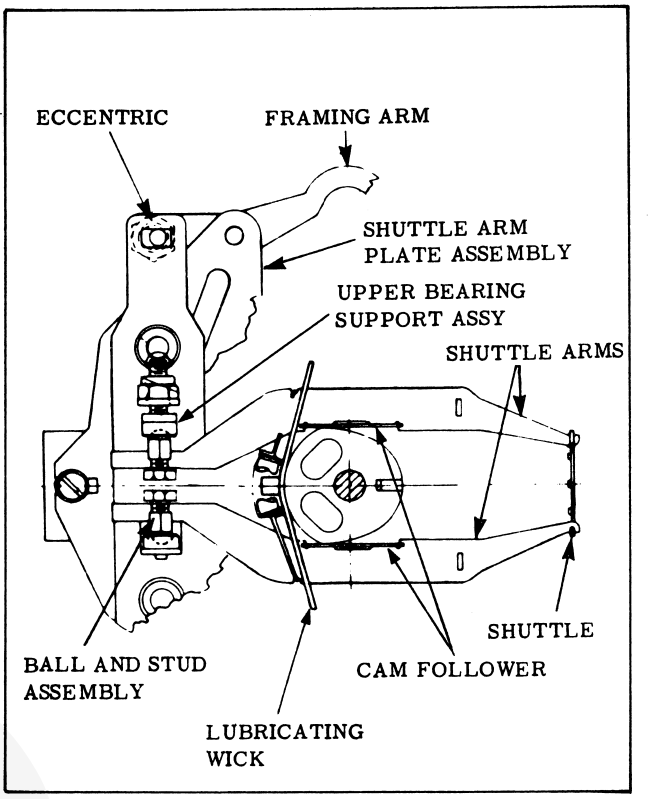


Figure W. Adjusting Fit of Shuttle Arms to Pull Down Cam

(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.

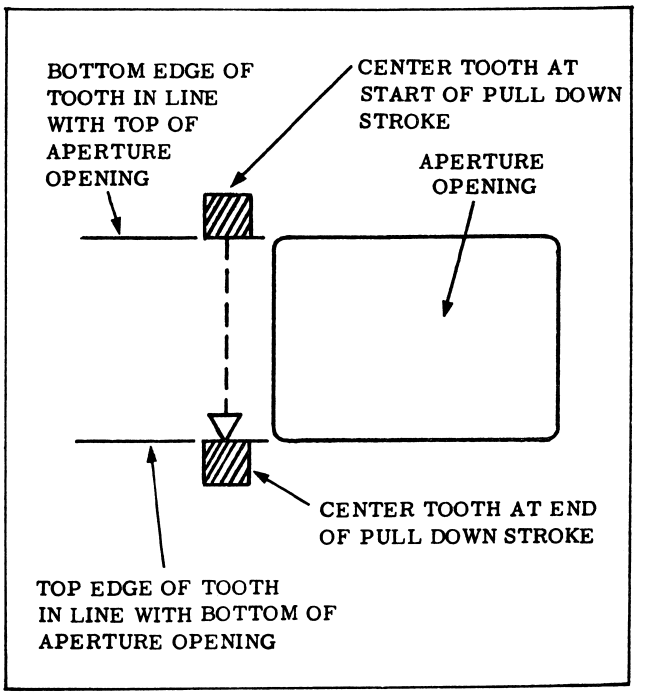


Figure X. Center Shuttle Tooth Travel Adjustment

(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.

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.

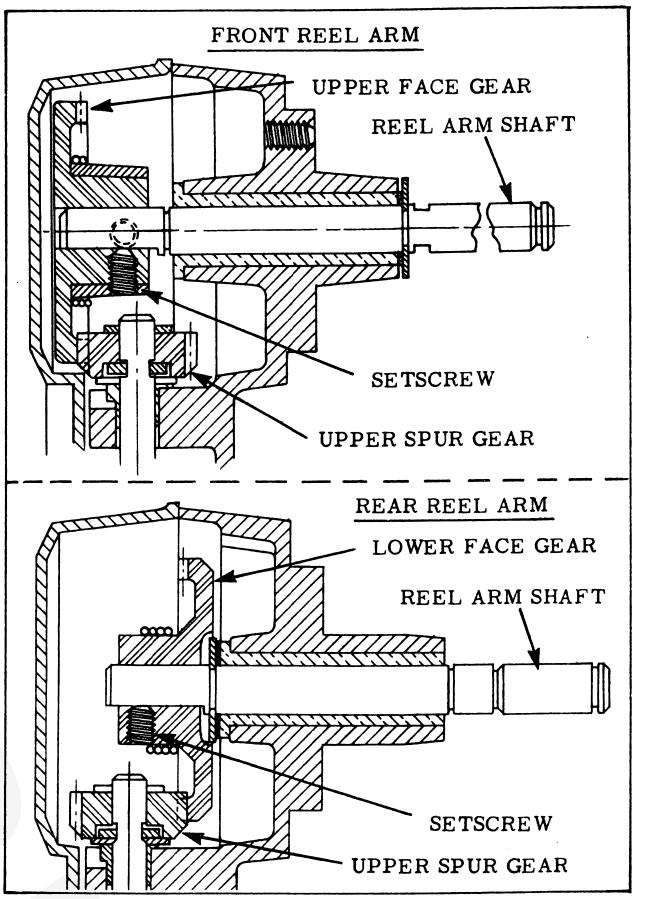


Figure Y. Adjusting Reel Arms

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.

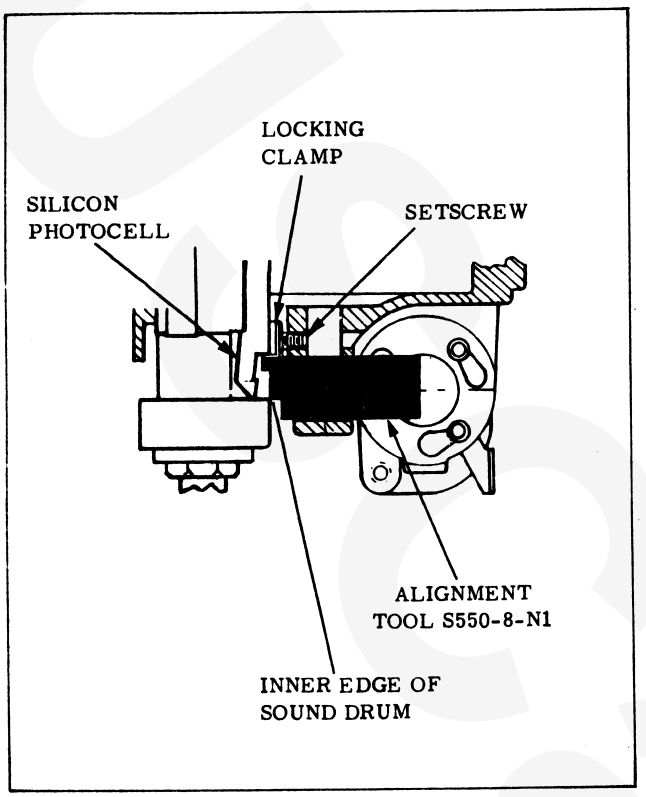


Figure Z. Positioning the Sound Drum and Silicon Photocell

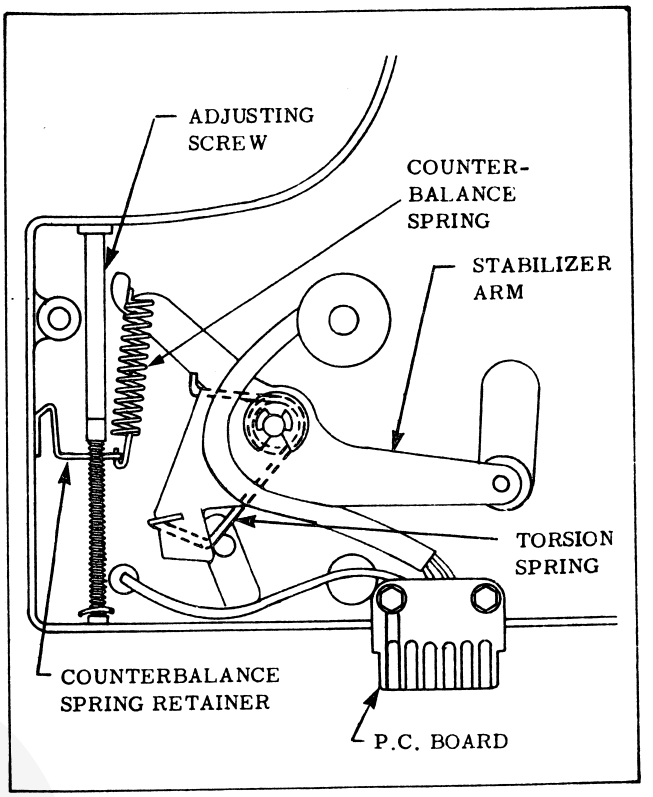


Figure AA. Arms and Counterbalance Spring Installed (Rear View)

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	-	24 FPS ±2%
Shutter	-	1440 RPM ±2%
Sprocket	-	102.86 RPM ±2%

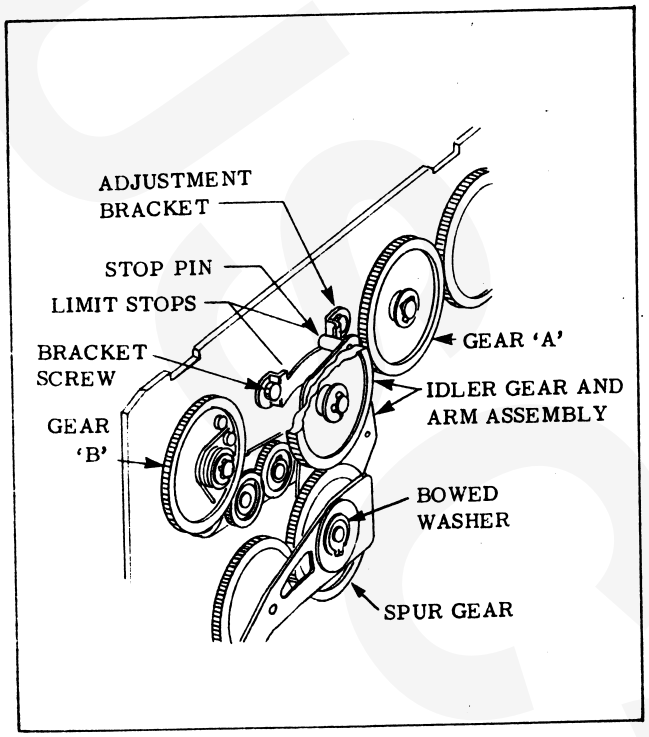


Figure AB. Adjusting Gear Shift Tension and Backlash

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.

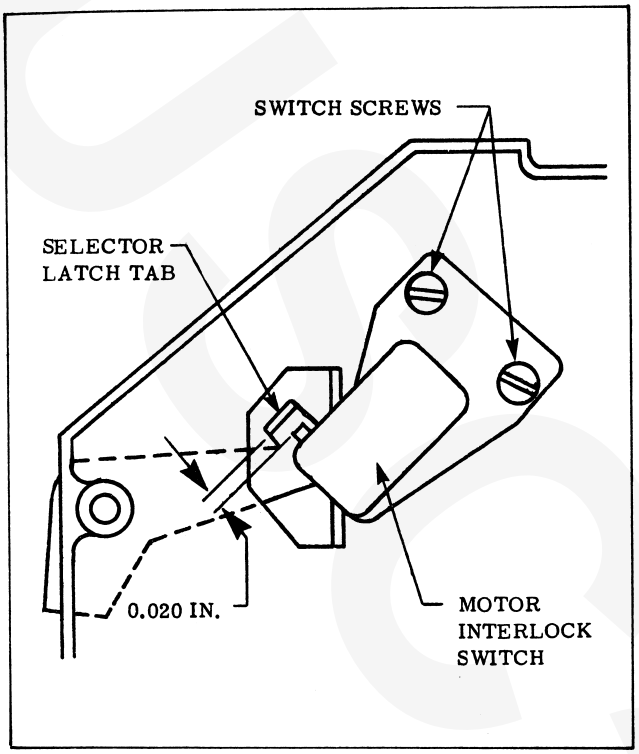


Figure AC. Adjusting Motor Interlock Switch

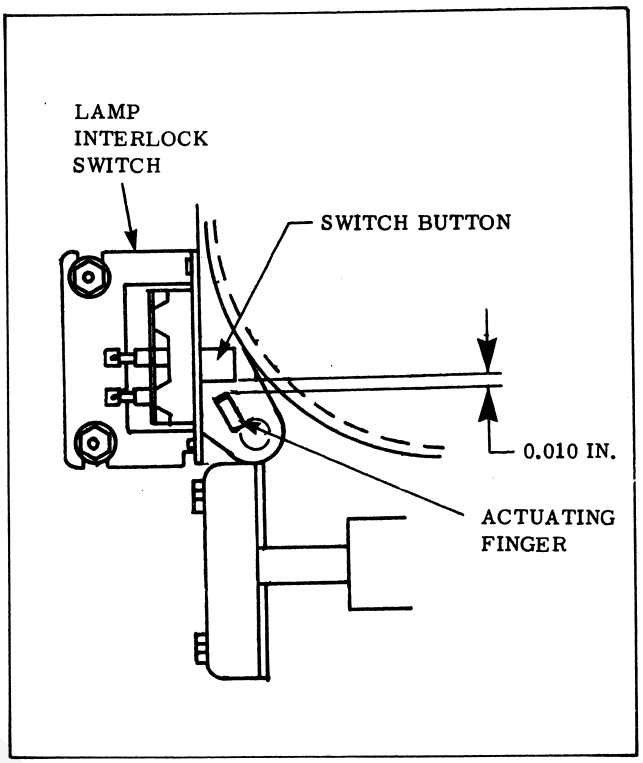


Figure AD. Adjusting Lamp Interlock Switch

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

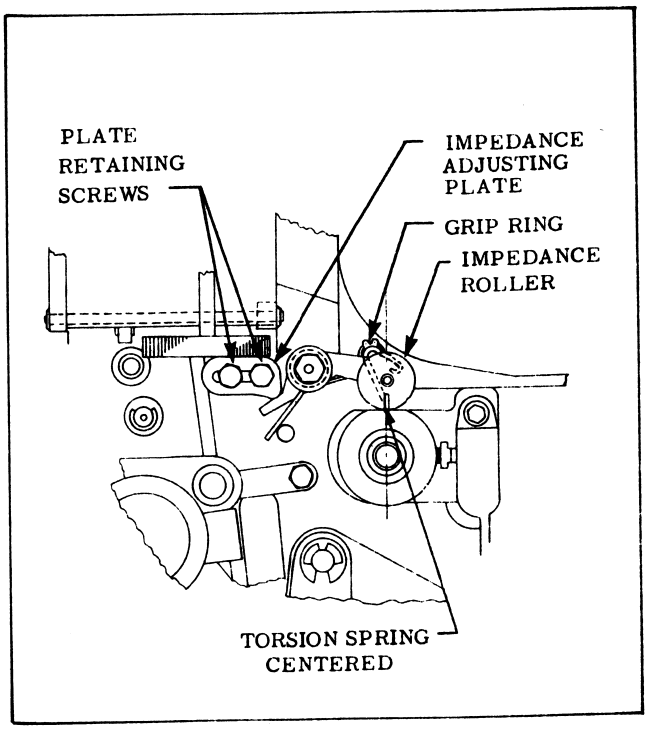


Figure AE. Adjusting the Torsion Spring

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.

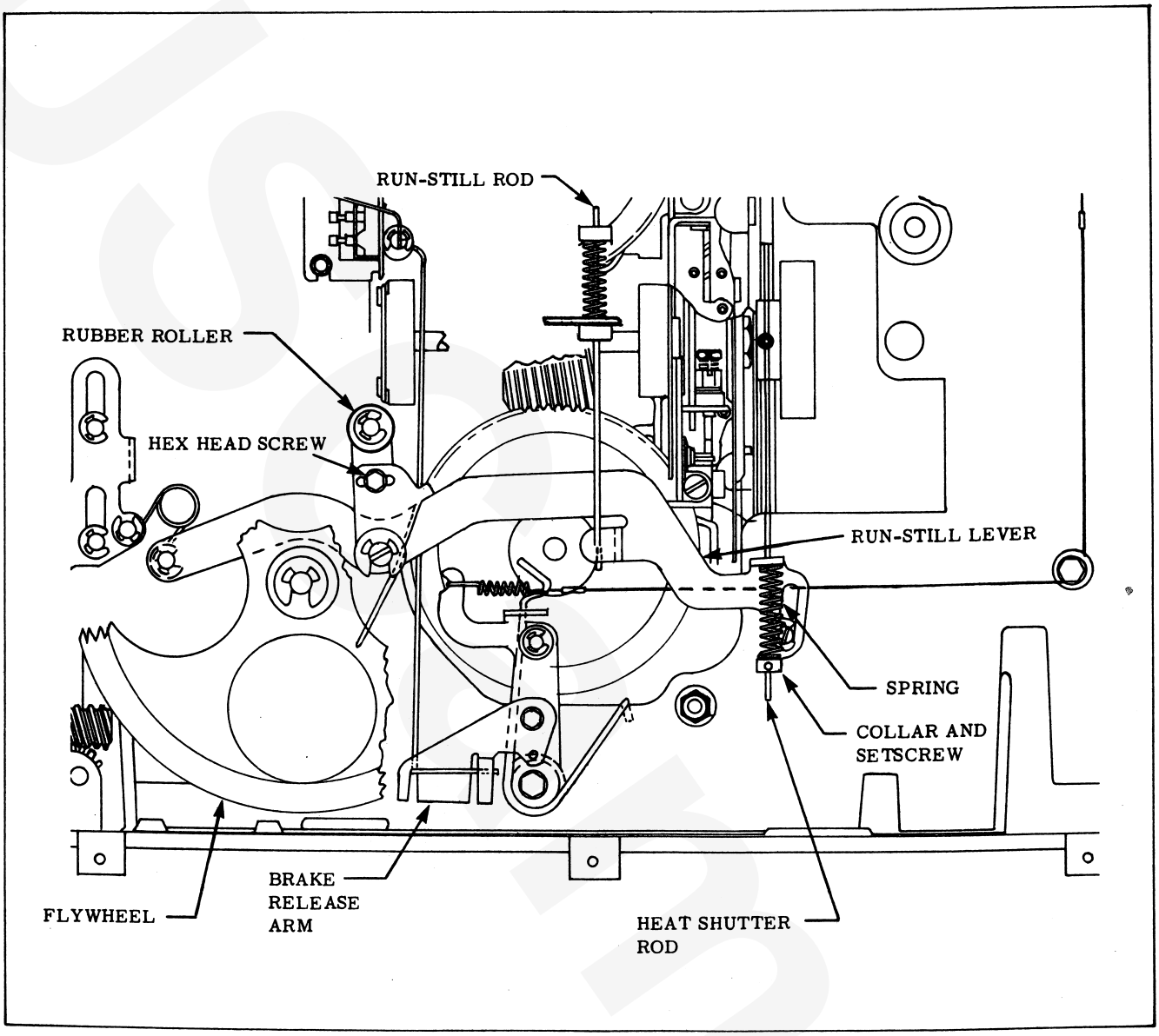


Figure AF. Adjusting Run-Still Brake and Heat Shutter

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. Refer to paragraph 45, step c(3) for stop bracket adjustment.

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

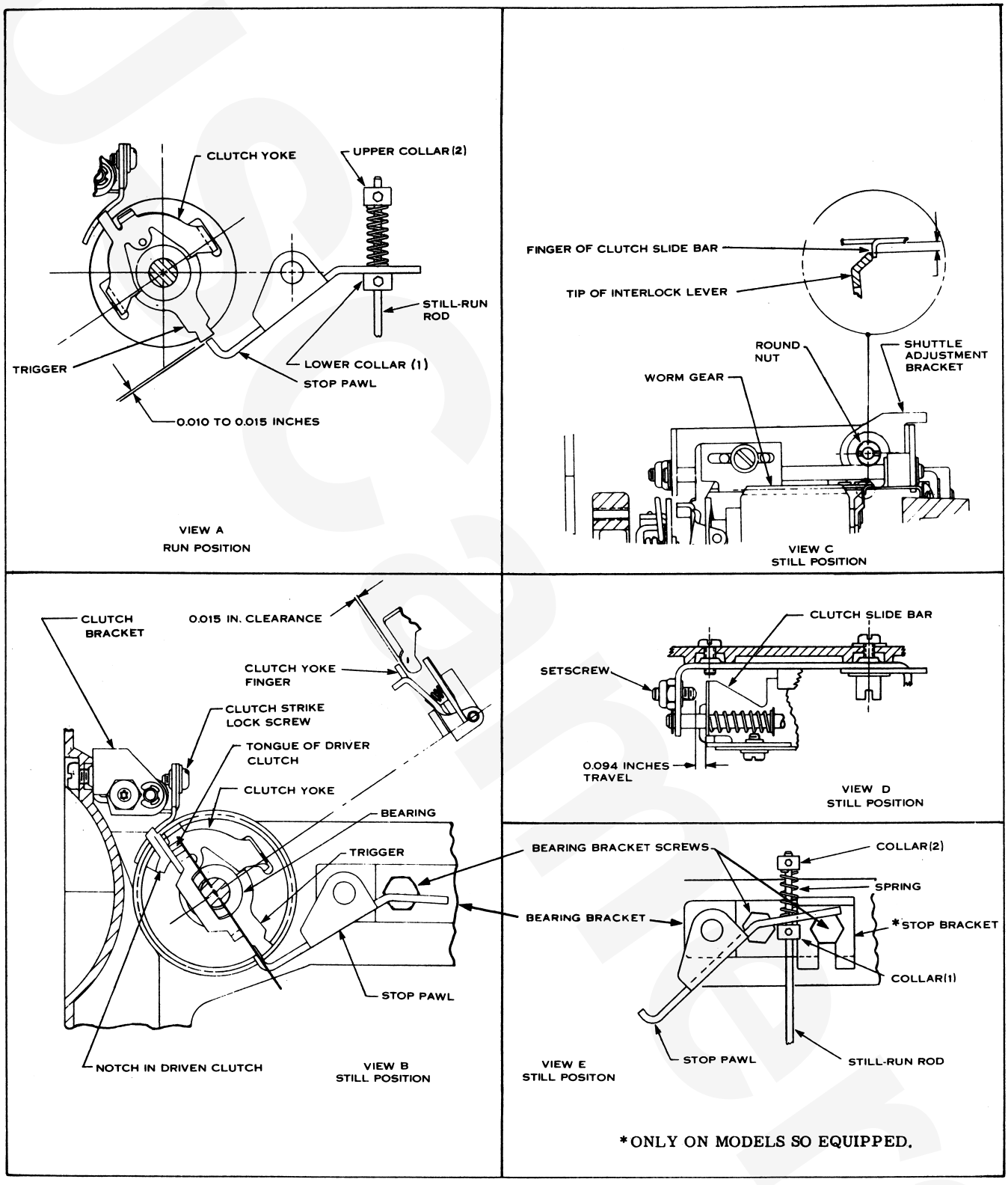


Figure AG. Run-Still Clutch Adjustments

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.

(3) Loosen the bearing bracket screw retaining the stop bracket and set the stop bracket to touch the stop pawl preventing over-ride. Retighten screw securely.

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.

TROUBLE SHOOTING

47. MISCELLANEOUS TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Nothing runs	1. Defective main switch.	1. Replace main switch (para. 17).
	2. Damaged line cord.	2. Repair or replace line cord.
	3. Loose connections.	3. Repair connections.
	4. Load lever latch not deactivating motor interlock switch.	4. Reposition load lever latch and/or adjust motor interlock switch (para. 37).
	5. Blown thermal fuse.	5. Replace thermal fuse (para. 8, step c) and check drive motor for proper operation.
	6. Voltage selector knob in wrong voltage setting causing the power input fuse to blow (AX models only).	6. Replace blown fuse (para. 8, step b) and place voltage selector knob at correct voltage setting.
Motor hums but does not run	1. Starting circuit open or shorted.	1. Replace loose or transposed connections.
	2. Defective capacitor or drive motor.	2. Replace defective capacitor or drive motor (para. 18).
	3. Voltage selector knob in wrong setting (AX models only).	3. Place voltage selector knob at correct setting.
Motor runs but mechanism does not run	1. Drive belt broken or unhooked from pulley.	1. Reinstall or replace drive belt (para. 12).
	2. Motor pulley loose on shaft.	2. Reposition motor pulley and tighten setscrews.
	3. Run/still clutch spring may lost or broken.	3. Replace run/still clutch spring.
Rewind does not operate	1. Run/still lever is in the "still" position causing the flywheel to be locked.	1. Reset the run/still lever in the "run" position.
	2. Rewind gears not engaging or clutch slipping.	2. Adjust (para. 31, step b).
	3. One bearing in rewind clutch slipping.	3. Replace rewind clutch and adjust rewind cord (para. 20).

47. MISCELLANEOUS TROUBLES AND REMEDIES (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Take-up does not rotate	1. Take-up sprocket damaged.	1. Replace sprocket.
Feed spindle does not rotate	1. Dirt in reverse take-up clutch.	1. Clean clutch.
	2. Idler arm not functioning.	2. Clean idler arm and adjust.
Short lamp life	1. Line voltage too high.	1. Check for proper lamp use.
	2. Dirt and lint clogging blower housing.	2. Clean blower housing.
	3. Blower fan loose on drive motor shaft.	3. Tighten or replace blower fan setscrew (para. 16).
	4. Contacts burned in lamp connector.	4. Replace lamp connector.
	5. Voltage selector knob in wrong setting (AX models only).	5. Place voltage selector knob at correct setting.
Projector speed slow	1. Binding in mechanism.	1. Free binding condition.
	2. Drive belt slipping.	2. Clean or replace drive belt (para. 12).
	3. Defective capacitor or motor.	3. Replace defective component.
	4. Voltage selector knob in wrong setting (AX models only).	4. Place voltage selector knob in correct setting.
Projector noisy in "reverse"	1. Projector not equipped with retractor lever and torsion spring.	1. Install new idler gear and retractor parts (items 5 through 6C, Figure 15).
	2. Malfunctioning flywheel drive mechanism.	2. Check and adjust.
Projector runs fast or slow	1. Drive belt incorrectly placed on pulley.	1. Align and adjust (para. 18).

48. 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).
	7. Lost loop in entire system.	7. Open and close load lever.
Double image	1. Incorrect shuttle stroke.	1. Adjust (para. 30, step d).
	2. Excessive shuttle protrusion.	2. 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 edge guide.
	3. Fixed edge guide out of position.	3. Reposition edge guide.
Poor illumination	1. Optics out-of-line.	1. Realign (para. 29).
	2. Projection lamp wearing out.	2. Replace projection lamp.
	3. Improper voltage setting (AX models only).	3. Place voltage selector knob in correct setting.
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 pressure plate spring.
	4. Bent pressure plate.	4. Replace pressure plate.
	5. Pressure plate out-of-line.	5. Realign pressure plate.
	6. Defective lens.	6. Replace lens.
Frame line creeps	1. Framer eccentric loose.	1. Align and tighten (para. 30, 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 threading	1. Film catching on lower film stripper.	1. Loosen stop post (Fig. 15-32), push down stripper and tighten post.
	2. Film catching on spring (Fig. 14-21).	2. Adjust impedance roller and spring (para. 42).

49. FILM TRANSPORT TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
Film cannot be threaded into the system	1. Run/still lever in the "still" position causing the flywheel to be locked.	1. Reset run/still lever to the "run" position.
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 and adjust.
	7. In-out bracket spring broken.	7. Replace in-out bracket spring.
	8. Supply reel too small.	8. Use 400 foot reel with hub 2-1/2 inches in diameter (minimum).
Excessive film slap	1. Damaged film.	1. Recondition or replace film.
	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.
Shuttle runs but sprockets do not revolve	1. Run/still clutch spring may be weak or broken.	1. Replace run/still clutch spring.
Run/still clutch will not operate	1. Excessive stop pawl clearance.	1. Adjust stop pawl clearance (para. 45, step a).
Run/still clutch stops the sprocket but shuttle continues to pull film	1. Shuttle not retracting properly.	1. Adjust shuttle for proper retraction (para. 45, step b).

50. SOUND SYSTEM TROUBLES AND REMEDIES.

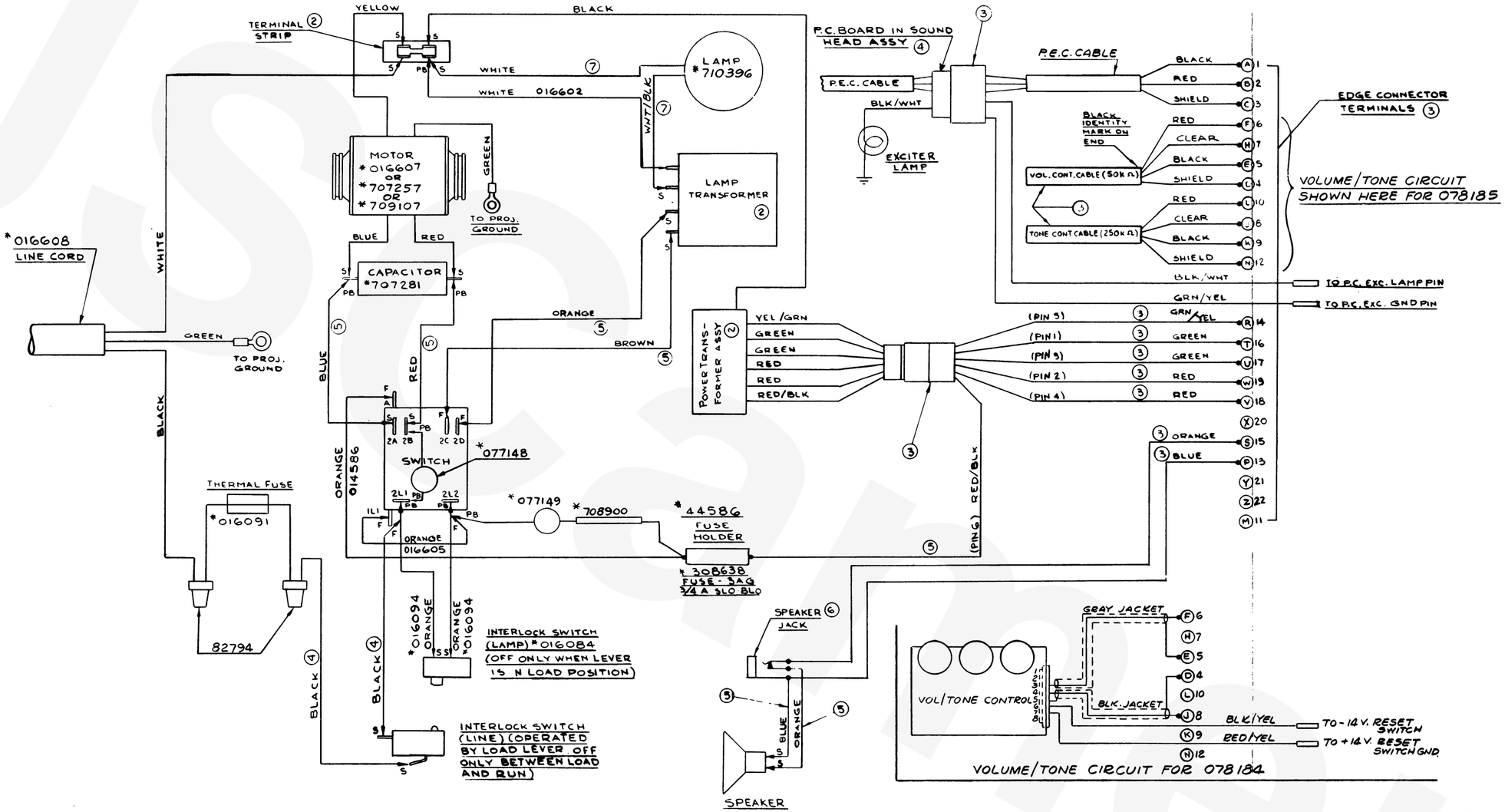
TROUBLE	PROBABLE CAUSE	REMEDY
Projector runs, no voltage at PC board	1. Loose connection.	1. Repair connection.
	2. Blown fuse(s) on fuseboard (AX models only).	2. Replace blown fuse(s).
Projector runs, voltage at PC board, but exciter lamp does not light	1. Exciter lamp cable disconnected.	1. Connect cable.
	2. Wrong exciter lamp used.	2. Replace with correct lamp.
	3. Projector main switch open or leads disconnected.	3. Replace main switch or connect leads (para. 17).
	4. Defective amplifier.	4. Repair per para. 46 or replace (see Figure 6 for replacement policy).
	5. Shorted speaker or shorted speaker jack wires.	5. Repair or replace speaker (para. 14).
Voltage at PC board, exciter lamp lights, but no sound	1. Speaker jack disconnected or speaker jack switch open.	1. Connect leads. Repair or replace jack.
	2. Photocell cable disconnected.	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.
	6. Defective amplifier.	6. Repair per para. 46 or replace (see Figure 6 for replacement policy).
Low volume	1. Trouble in amplifier PC board.	1. Check out the circuit board; (para. 46), replace if faulty (see Figure 6 for replacement policy).
	2. Wrong exciter lamp used.	2. Replace with correct lamp.
	3. Photocell out-of-line.	3. Realign (para. 32, step a).

50. SOUND SYSTEM TROUBLES AND REMEDIES (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Low volume (continued)	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).
	7. Low exciter lamp voltage.	7. Adjust (para. 46).
Distortion at all volume levels	1. Wrong exciter lamp used.	1. Replace with correct lamp.
	2. Trouble in amplifier PC board.	2. Repair (para. 46) or replace (see Figure 6 for replacement policy).
	3. Improper film loops.	3. Rethread film.
Crackling noises	1. Buzz track out-of-line.	1. Realign (para. 32, step d).
	2. Broken cable shield.	2. Repair shield or replace cable.
	3. Defective amplifier.	3. Repair (para. 46) or replace (see Figure 6 for replacement policy).
	4. Poor exciter lamp contact.	4. Clean contacts or replace lamp.
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 (para. 27).
	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.

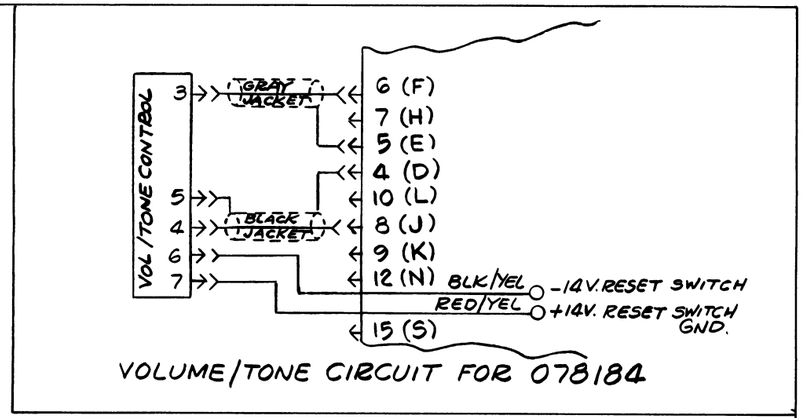
50. SOUND SYSTEM TROUBLES AND REMEDIES (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Wow or flutter (continued)	7. Chips or dirt in take-up sprocket gear teeth.	7. Remove and clean sprocket gear.
	8. Bent take-up reel.	8. Replace take-up reel.
	9. Dirt on sound drum or impedance roller.	9. Clean sound drum and impedance roller.
	10. External drags on flywheel such as braking rollers or reverse drive roller.	10. Repair and adjust as required.
Clicking noises	1. Dirt on sound drum.	1. Clean sound drum.
High frequencies fade (jumps focus)	1. Warped film.	1. Recondition or replace film.
	2. Dirt on sound drum.	2. Clean sound drum.
	3. Slit lens out-of-focus or dirty.	3. Clean and/or adjust.
Hum	1. Ground wiring.	1. Correct grounded condition.
	2. Trouble in amplifier PC board.	2. Repair (para. 46) or replace (see Figure 6 for replacement policy).
	3. Broken cable shield.	3. Repair or replace cable shield.



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:
   - ○ _____
   - (2) TRANSFORMER ASSY * 016581
   - (3) CONNECTOR & LEAD ASSY * *078567 FOR *078184, *078592 FOR *078185
   - (4) MECHANISM & SOUND HEAD ASSY *078161 FOR *078184, **078153 FOR *078185
   - (5) HARNESS ASSY *078591
   - (6) END CAP ASSY, REAR **078138 OR *078139
   - (7) LAMP SOCKET **710507
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 20A. Pictorial Wiring Diagram — Models 2580A and 2582A



VOLUME/TONE CIRCUIT FOR 078184

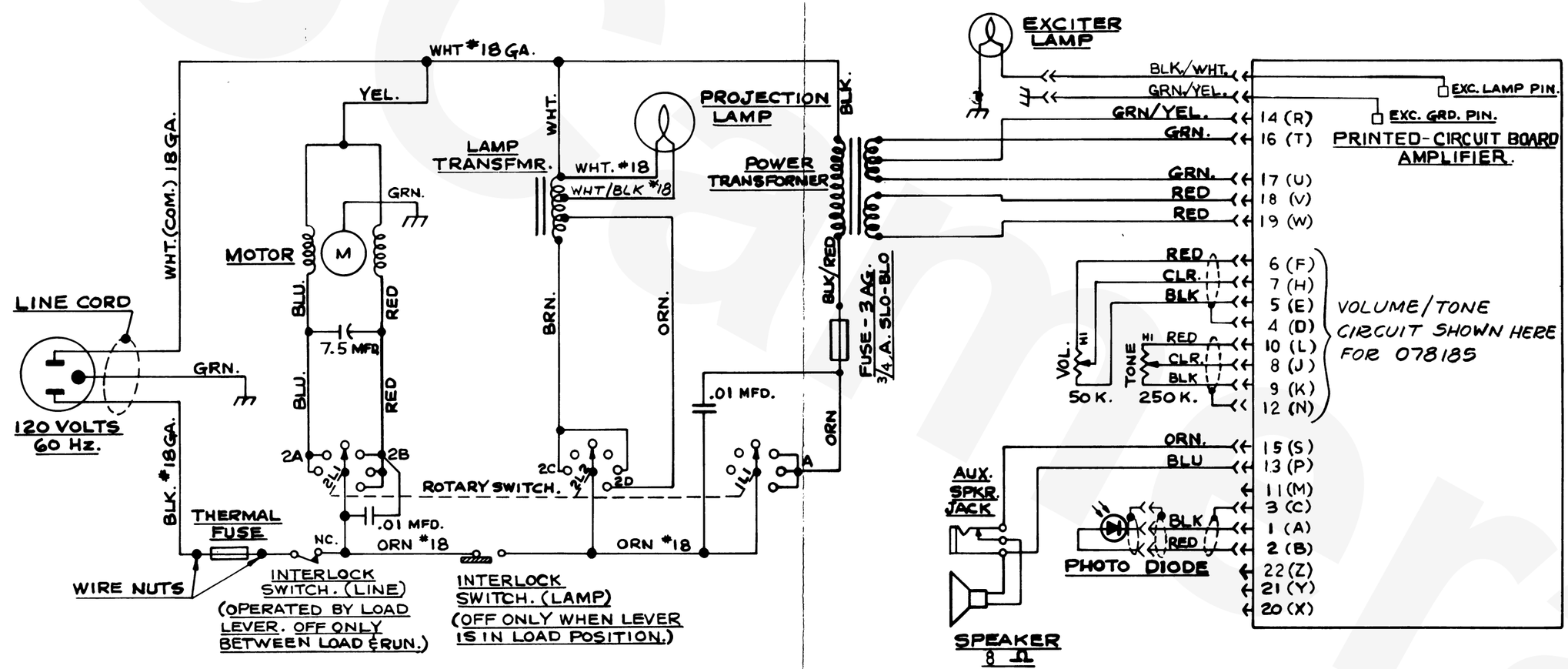
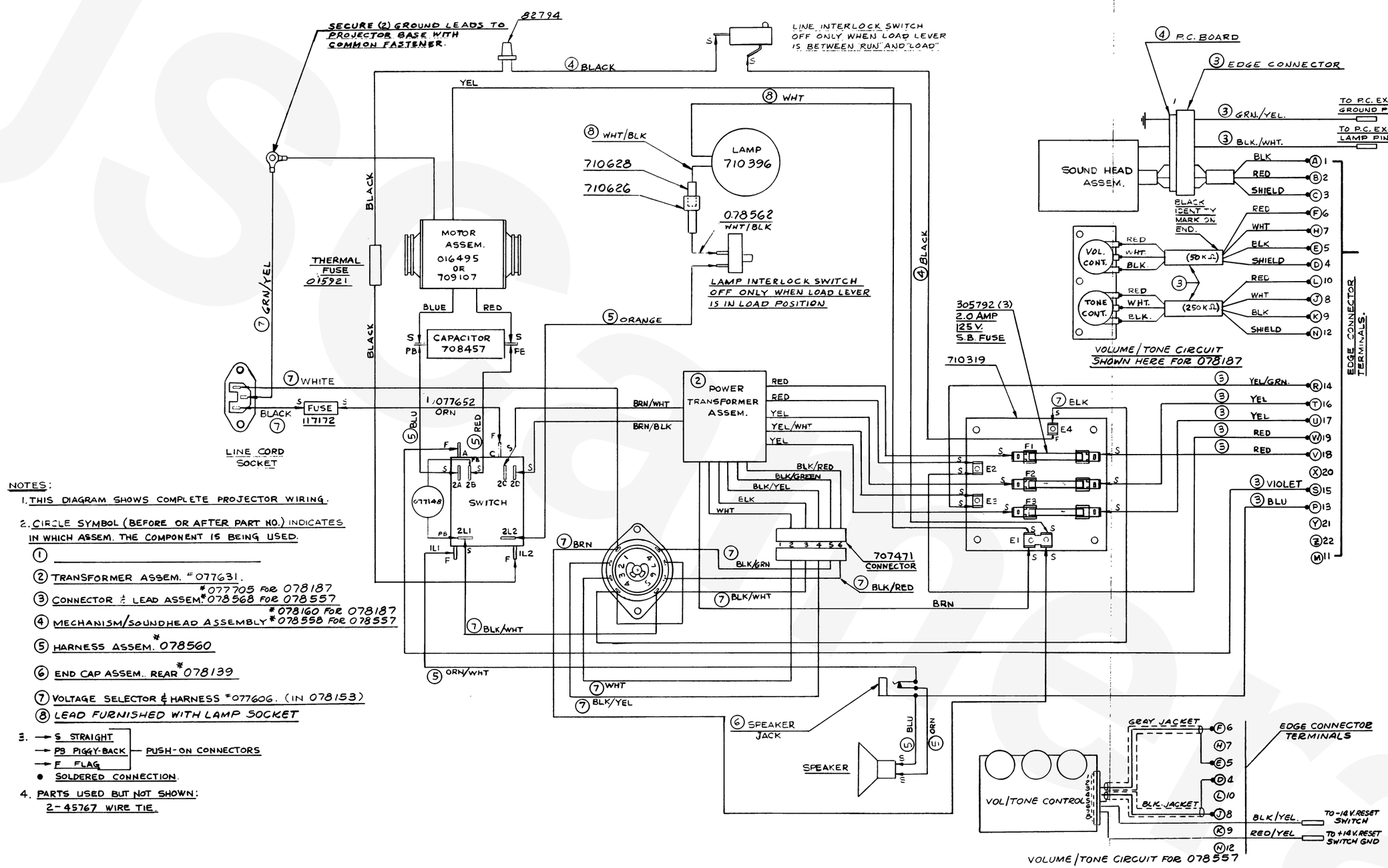


Figure 20B. Schematic Wiring Diagram — Models 2580A and 2582A



NOTES:

1. THIS DIAGRAM SHOWS COMPLETE PROJECTOR WIRING.
2. CIRCLE SYMBOL (BEFORE OR AFTER PART NO.) INDICATES IN WHICH ASSEM. THE COMPONENT IS BEING USED.
   - (1) _____
   - (2) TRANSFORMER ASSEM. #077631.
   - (3) CONNECTOR & LEAD ASSEM. *077705 FOR 078187 *078568 FOR 078557
   - (4) MECHANISM/SOUNDHEAD ASSEMBLY *078160 FOR 078187 *078558 FOR 078557
   - (5) HARNESS ASSEM. *078560
   - (6) END CAP ASSEM., REAR *078139
   - (7) VOLTAGE SELECTOR & HARNESS #077606. (IN 078153)
   - (8) LEAD FURNISHED WITH LAMP SOCKET
3. → S STRAIGHT
   → PB PIGGY-BACK — PUSH-ON CONNECTORS
   → F FLAG
   • SOLDERED CONNECTION.
4. PARTS USED BUT NOT SHOWN:
   2-45767 WIRE TIE.

Figure 21A. Pictorial Wiring Diagram — Models 2580AX and 2582AX

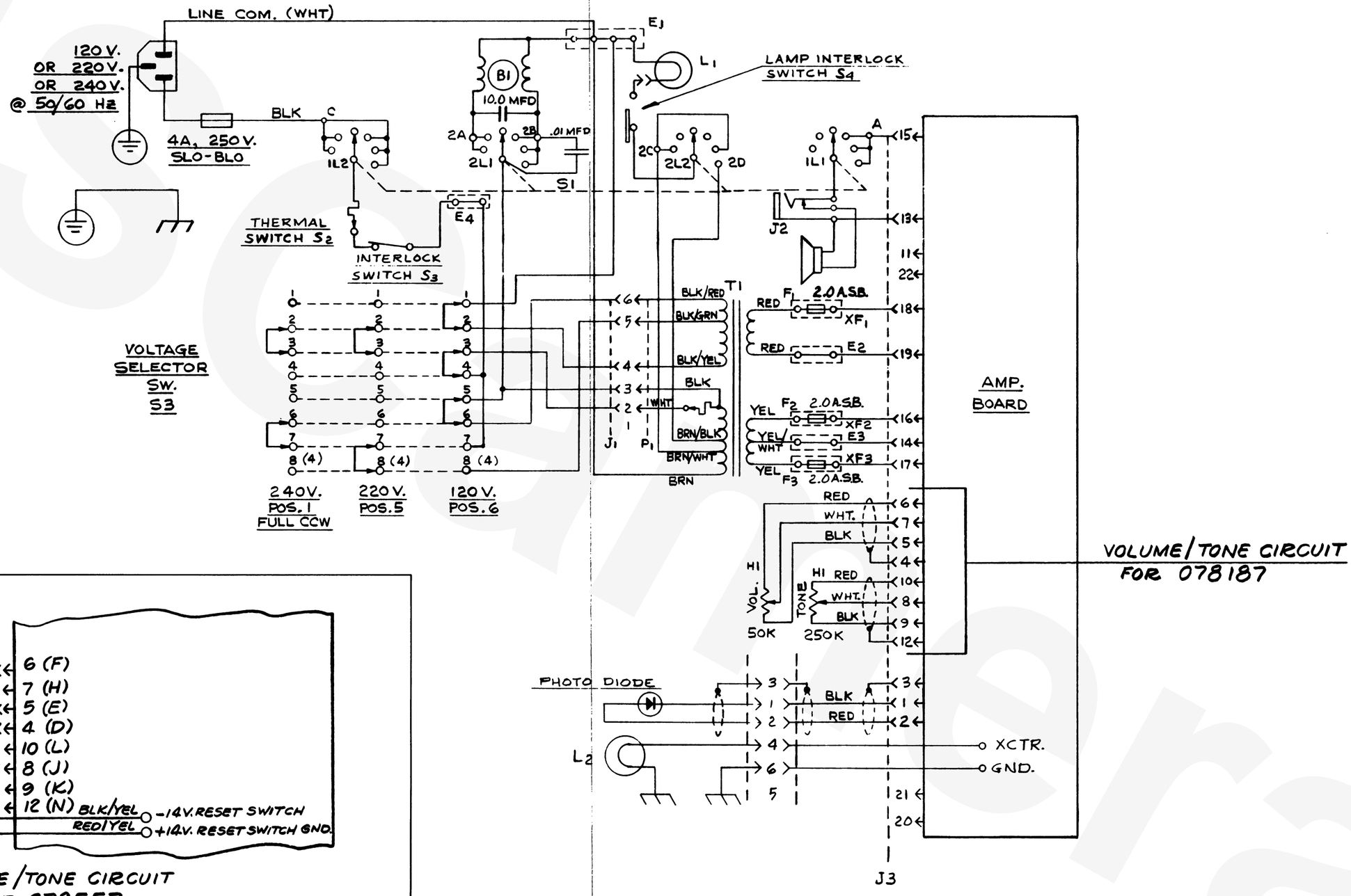


Figure 21B. Schematic Wiring Diagram — Models 2580AX and 2582AX

C15, C16, R27, R28 Models 2580A and 2582A

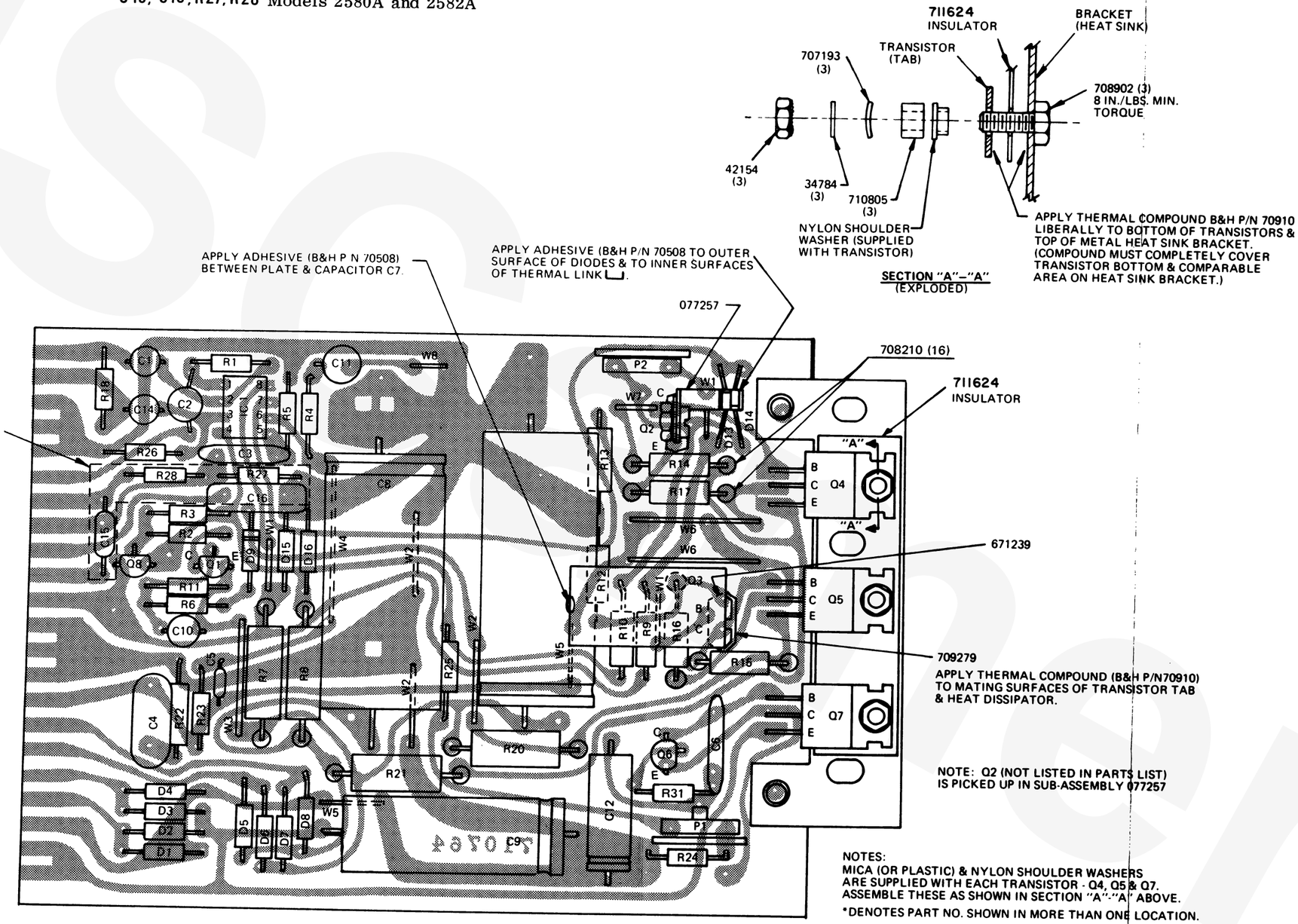
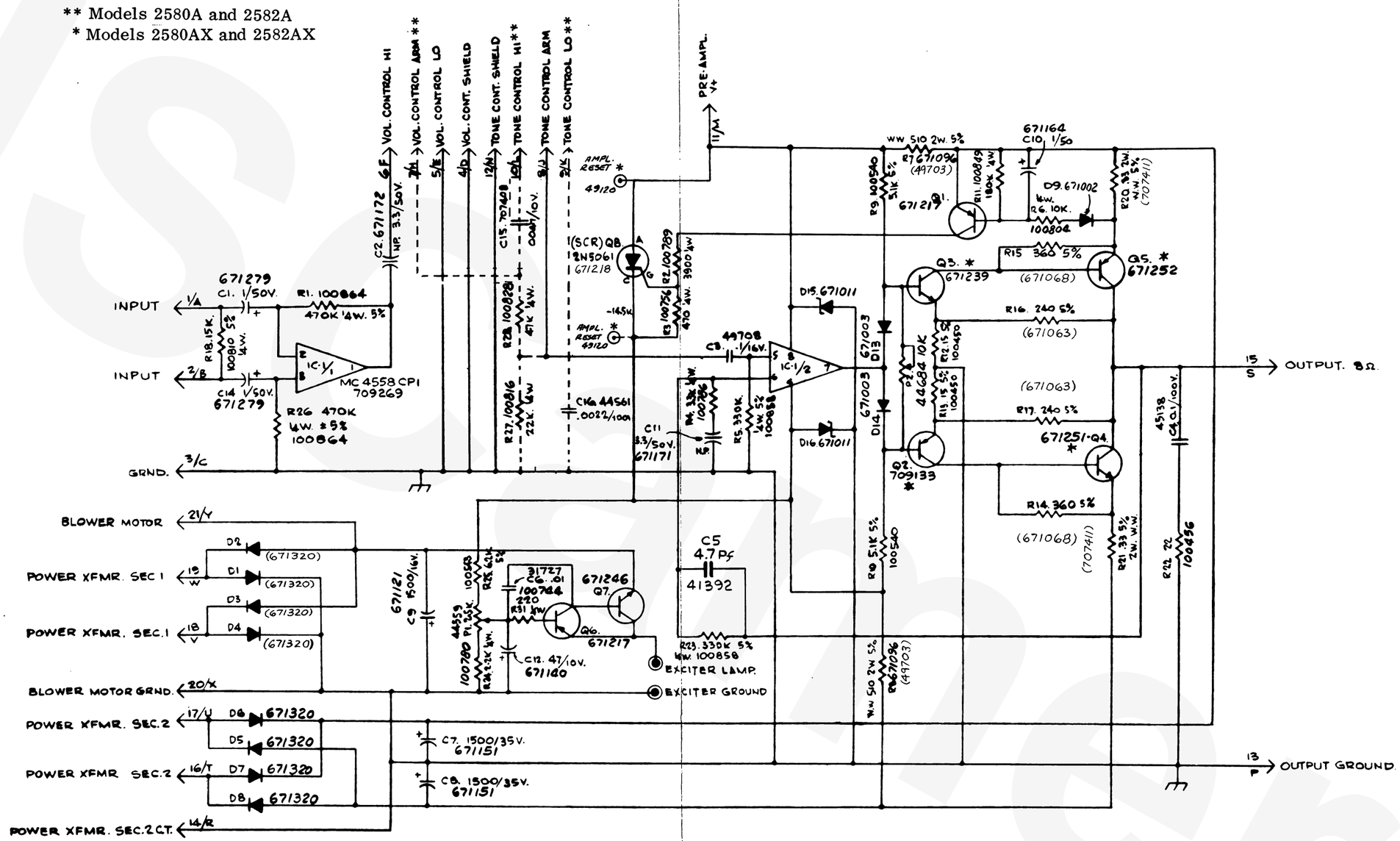


Figure 22A. Amplifier Pictorial Wiring Diagram –

** Models 2580A and 2582A
* Models 2580AX and 2582AX



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 22B. Amplifier Schematic Wiring Diagram —