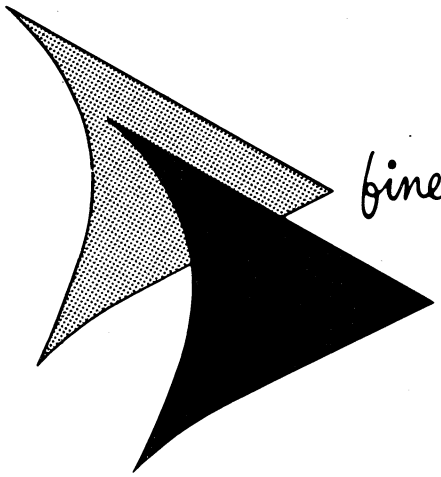
SERVICE INSTRUCTIONS

FILMOSOUND PROJECTOR

DESIGN 540 AND 542



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Bell & Howell

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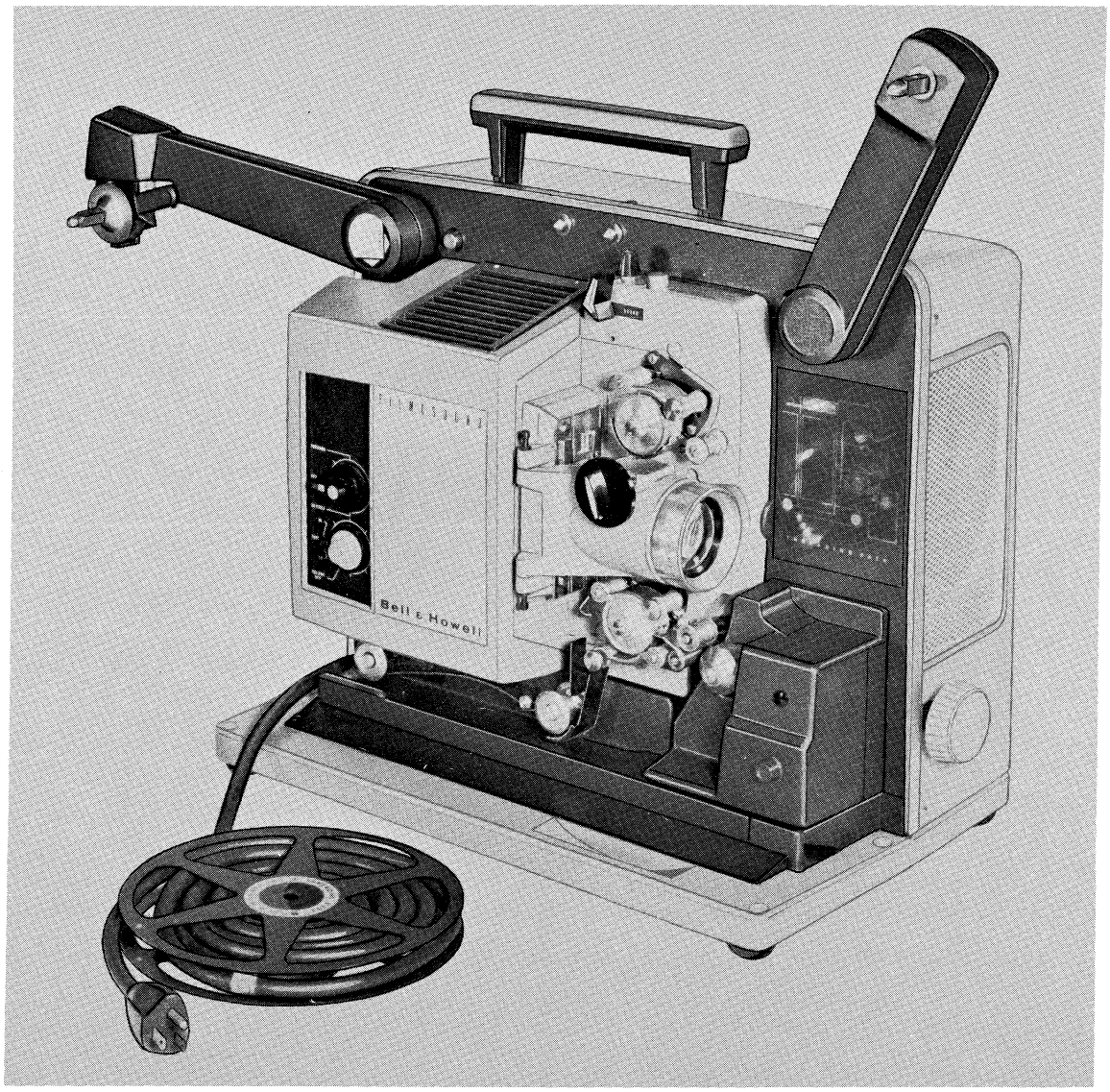


Design 540 Filmosound Projector

NOTE

The castings for Design 540 and 542 projectors are magnesium. Adhere to standard shop safety practices when machining or drilling castings.

Introduction

GENERAL.

This manual has been prepared to aid in servicing the Bell & Howell Design 540 and 542 Filmosound 16-mm motion picture projectors. An illustrated Parts Catalog is included at the rear of the manual to identify replacement parts and to aid the serviceman in the disassembly and reassembly of the projector.

All parts in Parts Catalog illustrations are indexed, as much as possible, in a suggested order of disassembly, and with attaching parts immediately preceding thos parts which they attach. Where disassembly and reassembly procedures are quite obvious, no attempt has been made to elaborate on removal or installation instructions. When making specific projector repairs and replacements, the serviceman must use his own judgement in eliminating unnecessary steps of procedure.

Before proceeding with repairs, refer to the following Trouble Shooting guide for possible causes and remedies of specific customer complaints.

Cleaning and Lubrication

1. CLEANING.

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

2. LUBRICATION.

a. GENERAL. Unless otherwise specified, apply one or two drops of oil (Spec. 1548) to all shafts, sleeve bearings, and sliding parts before assembly. Place felt pads in a shallow container of specified oil until saturated; then allow to drain before installation.

b. LUBRICATION OF SPECIFIC PARTS. See the following table for lubrication of specific parts and lubricant to be used.

LUBRICATION CHART

PARTS TO BE LUBRICATED	TYPE OF LUBRICANT	B & H SPEC NO.
Shuttle pivot bearings	Grease	1926
Pull down cam, oil storage pads and shoes	Oil	1705
Shuttle guides and guide bearings	Oil	1548
In-out cam and follower	Grease	1926
Motor bearings	Oil	1548
All rollers and spindles	Oil	1548
Tilt rack and pinions	Grease	1516
Machined surfaces of castings (non-bearing)	Oil	1918
Nylon gears	Grease	1926

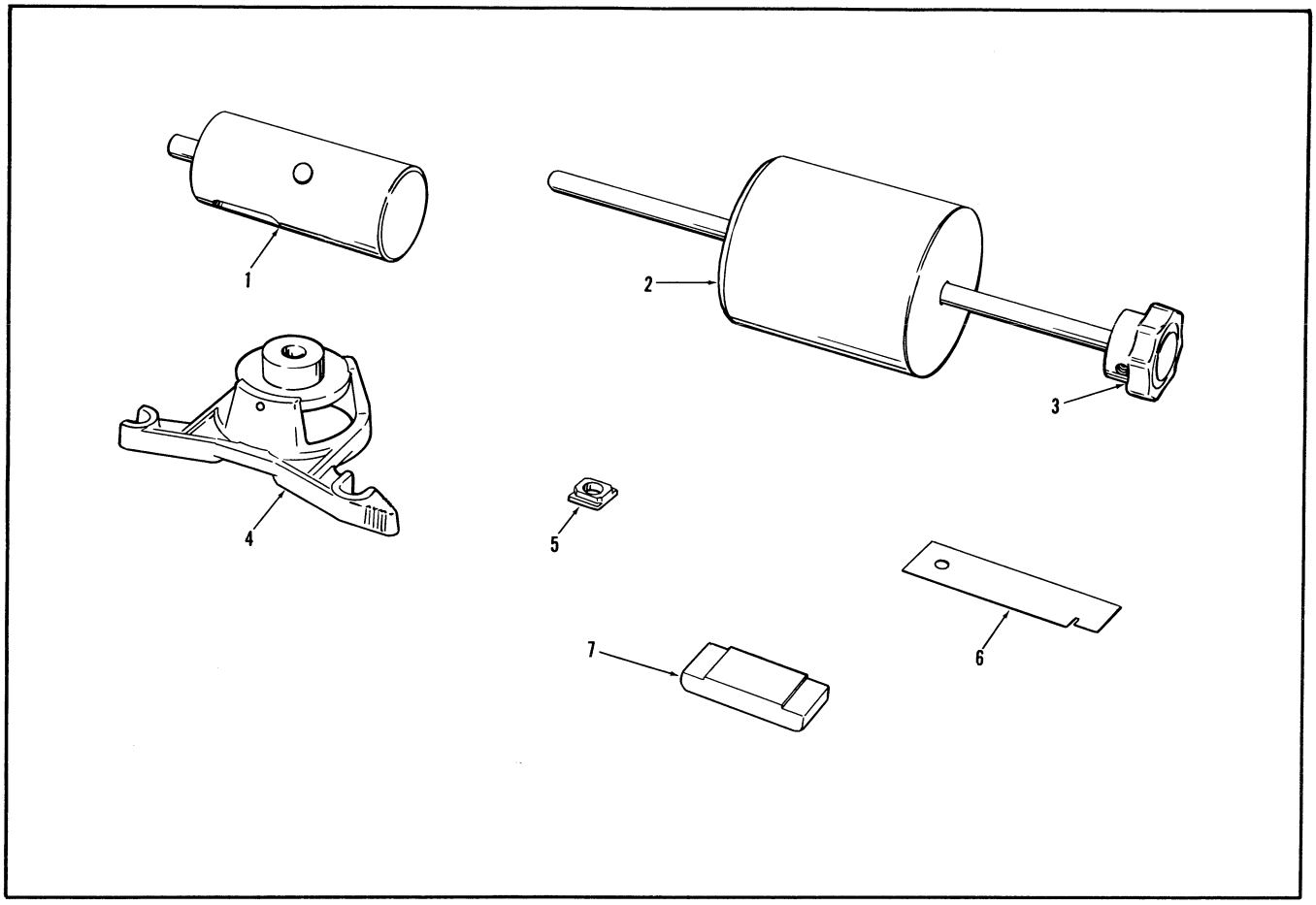


Figure A. Special Service Tools

INDEX NO.	TOOL NO.	NOMENCLATURE	TOOL APPLICATION
1	SER-550-N5	Lamp Plug	Alignment of optical system
2	SER-550-N1	Lens Plug	
3	SER-550-N2	Alignment Rod	
4	SER-550-N4	Condenser Plug	
5	SER-550-N3	Aperture Plug	
6	SER-550-5	Stroke Gauge	Measurement of shuttle stroke
7	SER-550-6	Shuttle Height Gauge	Check shuttle protrusion

NOTE: Tools illustrated in Figure B, are identified by the index numbers in this key

Trouble Shooting

3. MISCELLANEOUS TROUBLES AND REMEDIES

TROUBLE	PROBABLE CAUSE	REMEDY
a. Nothing runs	Protective switch not operating	Use correct screw in lower left rear corner of case.
		Replace switch.
	Damaged power cable	Repair or replace cable.
	Loose connections	Repair.
b. Motor hums but does not run	Starting circuit open or shorted	Repair loose or transposed connections.
		Replace starting capacitor.
		Replace starting relay.
c. Motor runs but mechanism does not run	Damaged switch	Replace switch.
	Transposed leads on main switch	Connect leads to proper terminals.
	Drive belt off of pulley	Reinstall belt.
	Motor or driven pulley loose on shaft	Position pulley and tighten setscrews.
	Damaged belt	Replace belt.
	Animation clutch spring broken (Des. 542 only)	Replace spring.
d. Rewind does not operate	Rewind clutch not engaging	Adjust (para. 48).
	Rewind clutch slipping	Adjust (para. 48).
e. Takeup does not operate	Clutch balls or spring lost	Replace.
f. Feed spindle does not revolve in reverse	Dirt in feed spindle clutch	Clean.
	Clutch spring lost	Replace.
g. Gate will not lock	Latch spring set too close to lens mount stop	Adjust.
	Pressure shoe out of line	Realign.
h. Shuttle runs but sprockets do not revolve	Animation clutch spring broken or lost (Des. 542 only)	Replace.

3. MISCELLANEOUS TROUBLES AND REMEDIES (CONT)

TROUBLE	PROBABLE CAUSE	REMEDY
i. Short lamp life	Line voltage in excess of lamp voltage	Use lamp of correct voltage rating.
	Blower belt off of pulley	Replace.
	Dirt in blower	Clean.
j. Speed changer does not work	Knob or shifter crank loose	Tighten setscrew.
k. Speeds slow	Binding in mechanism	Free binding condition.
	Slipping belt	Clean or replace.
l. Runs at speed between 18 and 24 F.P.S.	Pulleys out of line	Realign.
	Belt shifter out of adjustment	Adjust.
	Belt shifter toggle spring broken	Replace.
	Power line frequency other than 60 cycles	Use proper voltage and frequency.
m. Solenoids buzz	Plungers not seating (Des. 542 only)	Adjust (para. 46c and 47b).

4. PICTURE TROUBLES AND REMEDIES.

TROUBLE	PROBABLE CAUSE	REMEDY
a. Film jump	Damaged film	Replace or repair.
	Loose shuttle	Tighten (para. 43d).
	Dirty gate	Clean.
	Damaged or lost pressure shoe spring	Replace.
	Pressure shoe misaligned	Realign.
	Incorrect shuttle stroke	Adjust (para. 43e).
b. Double image	Incorrect shuttle stroke	Adjust (para. 43e).
	Excessive shuttle protrusion	Adjust (para. 43c).
c. Weave	Sticking edge guide	Clean.
	Side tension spring lost	Replace.
	Fixed edge guide out of position	Reposition.
d. Poor illumination	Optics out of line	Realign (para 42).
	Fire shutter sticking	Free solenoid or linkage (para. 47).
	Front condenser reversed	Reassemble correctly.
e. Poor focus	Dirty lens	Clean.
	Dirty aperture	Clean.
	Warped film	Recondition or replace.
	Projector lens mount out of line	Realign (para. 45).
	Pressure shoe spring lost	Replace.
	Bent pressure shoe	Replace.
	Pressure shoe out of line	Realign.
f. Frame line creeps	Framer eccentric loose	Align and tighten (para. 43f).
g. Insufficient framing	Framer eccentric out of adjustment	Adjust (para. 43f).
h. Trailer ghost	Shutter out of time	Reassemble properly.

5. FILM TRANSPORT TROUBLES AND REMEDIES

TROUBLE	PROBABLE CAUSE	REMEDY
a. Loss of loops	Damaged film	Repair or replace.
	Inadequate shuttle protrusion	Adjust (para. 43c).
	Inadequate or excessive shuttle stroke	Adjust (para. 43e).
	Pressure shoe spring lost	Replace.
	Pressure shoe mounting plate screws loose	Tighten.
	Sprocket shoes out of line	Realign (para. 44).
	Sprocket shoe locks not closing	Clean or adjust.
	Sprocket drive gear loose on shaft	Retime and tighten
	In-out bracket spring broken	Replace.
b. Shuttle operates but sprockets do not revolve	Animation clutch spring broken or lost (Des. 542 only)	Replace.
c. Lower loop not restored	Loop restorer stroke too short	Adjust (para. 52b).
	Loop restorer does not engage restorer cam	Adjust (para. 52b).
d. Film rubs on loop restorer arm	Restorer arm out of position	Reposition (para. 52b).
e. Excessive film slap	Damaged film	Recondition or replace.
	Green film	Age or buff.
	Dirty gate	Clean.
	Pressure shoe rubbing on edge guides	Realign.
	Incorrect shuttle stroke	Adjust (para. 43e).
f. Animation clutch does not operate (Des. 542 only)	Open circuit	Repair.
	Solenoid plunger set too high or too low	Adjust.
	Stop pawl clearance excessive	Adjust (para. 46a).
g. Animation clutch stops sprocket but shuttle pulls film (Des. 542 only)	Insufficient shuttle retraction	Adjust (para. 46b).
h. Splices jam in sprocket shoes	Bad splices	Replace.
	Sprocket shoes set too close	Adjust (para. 44).

6. SOUND SYSTEM TROUBLES AND REMEDIES

TROUBLE	PROBABLE CAUSE	REMEDY
a. Projector runs, tubes do not light	Loose connection	Repair.
	Tube burned out	Replace.
	Amplifier switch damaged	Replace.
	Heater series resistor open	Replace.
b. Tubes light, exciter does not light	Exciter lamp cable disconnected	Connect cable.
	Wrong exciter lamp used	Replace with correct lamp.
	Damaged oscillator tube	Replace.
	Projector switch open or leads disconnected	Replace switch or connect leads.
c. Tubes and exciter light, but not sound	Speaker jack disconnected	Connect leads.
	Speaker jack switch open	Repair or replace jack.
	Photocell cable disconnected	Connect cable.
	Photocell cable leads reversed	Connect to proper terminals.
	Damaged tubes	Replace.
	Photocell out of line	Realign (para. 49b).
	Dirt on end of light pipe	Clean.
	Wrong exciter lamp used	Replace with correct lamp.
d. Low volume	Damaged tubes	Replace.
	Wrong exciter lamp used	Replace with correct lamp.
	Photocell out-of-line	Realign (para. 49b).
	Dirt on light pipe or slit	Clean.
	Slit misaligned	Realign (para. 49d).
	Buzz track misaligned	Realign (para. 49e).
e. Distortion at all volume levels	Wrong exciter lamp used	Replace with correct lamp.
	Inverter or output tubes damaged	Replace.
	Open element in one output tube	Replace.
f. Crackling noises	Damaged tubes	Replace.
	Broken ground lead to mechanism or blower housing	Repair.
	Sound drum grounding spring loose, bent or lost	Repair or replace.
	Buzz track out of line	Realign (para. 49e).
	Broken cable shield	Repair.

6. SOUND SYSTEM TROUBLES AND REMEDIES (CONT)

TROUBLE	PROBABLE CAUSE	REMEDY
g. Wow or flutter	Guide roller sticking	Clean.
	Guide roller spring broken, unhooked or lost	Repair or replace.
	Film edge guide (sound head) out of line	Realign (para. 49e).
	Loose flywheel	Tighten.
	Damaged sound drum bearing	Replace.
	Dirt causing guide roller arm pivot bearing to bind	Clean and polish.
	Photocell or exciter cable rubbing against flywheel	Reposition.
	Chip or dirt in takeup sprocket gear teeth	Remove.
	Loop restorer stroke is too short or restorer set too low	Adjust (para. 52b).
h. Clicking noises	Dirt on sound drum	Clean.
	Broken ground lead to mechanism or blower housing	Repair.
	Sound drum grounding spring loose, bent or lost	Repair or replace.
i. High frequencies fade (jumps focus)	Warped film	Recondition or replace.
	Film edge guide (sound head) out of line	Realign (para. 49e).
	Dirt on sound drum	Clean.
j. Hum	Tube shield lost	Replace.
	Screws holding amplifier base shield to PC board loose or lost	Tighten or replace.
	Frame by-pass condenser open or disconnected	Replace or repair.
	Amplifier not at same potential as test equipment (TEST CONDITION)	Operate amplifier from isolation transformer.
	Grounded wiring	Correct grounded condition.

Disassembly Procedure

7. GENERAL INSTRUCTIONS.

a. Remove "breakage" items (optical parts, lamps, etc.) before proceeding with projector repairs. Wrap such items in tissue paper to protect them from damage.

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

8. DISASSEMBLING FIGURE 1 PARTS. Remove parts, as necessary, in their indexed order of disassembly. When removing reel arms, note carefully the manner in which the clutch parts (22 thru 36) are installed. Be careful not to lose the steel balls.

9. DISASSEMBLING FIGURE 2 PARTS. Insert 1/16 in. punch through hole in sound drum shaft housing and into hole in shaft. Hold the shaft firmly while loosening sound drum nut (37).

10. DISASSEMBLING FIGURE 2 PARTS. Remove parts, as necessary, in their indexed order of disassembly noting the following special precautions.

a. Items 1 thru 14 apply only to the Design 542 projector.

b. Note carefully the installation of motor and belt shifter parts (36 thru 48) before disassembling parts for replacement.

11. REMOVING FIGURE 4 PARTS. Remove parts, as necessary, in their indexed order of disassembly. Note that fiber insulator (23) covers the interlock switch and terminal parts in the recess of the base (36).

12. DISASSEMBLING FRONT REEL ARM. Remove Figure 5 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Be careful not to damage the teeth of nylon gears (20) and (20A) during disassembly.

b. Unless necessary for replacement, needle bearings (30A), (33A) and (33B) should not be pressed out.

13. DISASSEMBLING REAR REEL ARM. Remove Figure 6 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Be careful not to lose springs (1) and (18).

b. Unless necessary for replacement, needle bearings (5A) and (28A) should not be pressed out.

c. Be careful not to damage the teeth of nylon gears (23) during disassembly.

14. DISASSEMBLING LAMPHOLDER. Remove Figure 7 parts, as necessary, in their indexed order of disassembly.

15. DISASSEMBLING LAMPHOUSE. Remove Figure 8 parts, as necessary, in their indexed order of disassembly.

16. DISASSEMBLING SOUND HEAD. Remove Figure 9 parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Do not remove optical slit assembly (4) unless in need of replacement or cleaning.

b. The sound drum shaft (22) must be handled carefully to avoid damage to the drum. To remove, loosen clamping screw (18) in holder (19). Loosen setscrews (20) and (21) and press shaft from sound head housing. As shaft is withdrawn, note the manner in which light pipe (24) and retainer (23) are installed in slot of sound drum shaft.

c. Note the manner in which springs (30) and (36) are engaged before removing the related parts.

17. DISASSEMBLING FIGURE 10 PARTS. Remove Figure 10 mechanism assembly parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Pry out the hinge pins (1) with a wire cutter or similar implement to free the lens carrier.

b. When removing speed change knob parts (5 thru 10), note the manner in which spring (9) is installed.

c. Remove three screws (16) and washers (17), two retaining rings (18) and the clutch lever shaft (19) to free the outboard bearing assembly (20) and rewind clutch lever (21). As the clutch lever is removed, the rewind button (22) and spring (23) will be released.

d. When sprocket assemblies (37) and (38) are removed, be careful not to damage sprocket teeth.

18. DISASSEMBLING FIGURE 11 PARTS. Remove Figure 11 mechanism assembly parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Note carefully the manner in which the overcenter springs (6) are installed before removing related parts.

b. When screw (7) is loosened, the assembled cam

follower support (8A thru 8D) can be withdrawn from the restoring arm (9). Do not disassemble the cam follower support assembly unless parts are in need of replacement.

19. DISASSEMBLING FIGURE 12 PARTS. Remove Figure 12 mechanism assembly parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Be careful not to bend the blades of the shutter (9) during disassembly.

b. The shuttle link bearings (12) are secured in place within the notches of the shuttle arms (13) and should not be pressed out. Also, do not remove ball and stud assemblies (16) from shuttle arms (13).

c. Inspect the pull-down cam followers (14) for wear. These followers, or shoes, can be turned end for end or reversed if they appear badly worn.

d. The felt wicks (18) should be pressed from the pull-down cam (17) and replaced with new wicks if they appear unusually dirty. New wicks should be lubricated as instructed in paragraph 2.

e. Note that the upper forked end of the shuttle arm plate (26) engages the framer knob shaft (27). The framer knob and shaft unscrews from the casting.

f. Items 28 thru 37 are used only in the Design 542 projector. When disassembling these parts, note the manner in which the torsion spring (30) is engaged.

20. DISASSEMBLING FIGURE 13 PARTS. Remove Figure 13 mechanism assembly parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Except for the worm gear (24), items 1 thru 7L and 13 thru 26 are used only in the Design 542 projector.

b. The animated clutch bracket assembly (7) can be freed by removing two screws (1 and 2), lock washers (3), round nut (4), flat washer (5) and adjustment bracket (6). Before disassembling the clutch bracket assembly (7), note carefully the manner in which parts are assembled.

c. Remove retaining ring (8), screws (9) and bearing loading spring (10). Loosen the setscrew (11) in the loop restoring cam (27) and force the bearing (12) from its seat by pressing the camshaft (30) in that direction. With the bearing (12) removed, shift the camshaft (30) to the right until the clutch parts (13 thru 28) can be removed. Be sure to note the manner in which clutch parts are assembled.

21. DISASSEMBLING LENS CARRIER. Remove Figure 14 parts, as necessary, in their indexed order of disassembly, and wrap the pressure plate (6) in tissue paper to prevent damage to the film contact surface.

22. DISASSEMBLING SPROCKET GUARDS. Remove Figure 15 parts, as necessary, in their indexed order of disassembly. All sprocket guard assemblies are identical except that the upper guard for the lower sprocket has a slightly different configuration in the plate.

23. DISASSEMBLING APERTURE PLATE. Remove Figure 16 parts, as necessary, in their indexed order of disassembly. Wrap these parts in tissue paper to prevent damage to the film contacting surfaces.

24. DISASSEMBLING FIRE SHUTTER (DES. 542 ONLY). Remove Figure 17 parts, as necessary, in their indexed order of disassembly. The retaining prongs, or ears, must be carefully straightened to free the heat filter (5).

25. DISASSEMBLING WORM GEAR (DES. 542 ONLY). Remove Figure 18 parts, as necessary, in their indexed order of disassembly.

26. DISASSEMBLING BLOWER. The two halves of the blower housing (8, figure 19) are assembled with eyelets (6) which are staked over. If disassembly is necessary, the eyelets must be discarded and new ones used in reassembly. Also note that the bronze bearings (15) in either housing are secured with retaining rings (13).

27. AMPLIFIER REPAIR. Amplifier replacement parts are illustrated and listed in Figure 20. Check amplifier per normal practices, referring to the amplifier schematic wiring diagram for proper resistances, voltages and capacitances.

Reassembly Procedure

28. GENERAL INSTRUCTIONS.

a. When the reassembly procedure includes the staking of rivets or similar parts, all staking and riveting should be done in the early stages of reassembly to avoid damage to other parts. Be sure to support the main casting solidly when riveting or staking.

b. Parts which require lubrication are listed in paragraph 2 (page 1). Lubricate sparingly and wipe away excess lubricant with a clean cloth. Use only the specified Bell & Howell lubricants. During assembly, place a drop of oil in each tapped hole to facilitate screw installation.

c. The following component assemblies require no adjustment and can be reassembled by reversing the disassembly procedure.

Amplifier Assembly, Figure 20
Worm Gear Assembly, Figure 18 (Des. 542 only)
Fire Shutter Assembly, Figure 17 (Des. 542 only)
Aperture Plate Assembly, Figure 16
Sprocket Guard Assembly, Figure 15
Lens Carrier Assembly, Figure 14
Lamphouse Assembly, Figure 8
Lampholder Assembly, Figure 7

29. REASSEMBLING THE BLOWER. (Figure 19). Reassemble the blower in reverse order of disassembly, noting the following special precautions.

a. Insert bearings (15) and nylon washers (14) into housings and press retaining rings (13) in until they snap into the ring grooves.

b. Install collar (4) so that shaft (12) has a barely perceptible amount of end play (0.002 to 0.005 inch).

c. After the blower housings have been assembled with the eyelets, loosen the setscrew (10) through the blower opening and shift the blower wheel (11) until it is accurately centered between the inner surfaces of the housings.

30. REASSEMBLING THE MECHANISM (Figure 13).

NOTE

Except for the worm gear (24), items (1) through (7L) and (13) through (26) are used only in Design 542 projectors. When reassembling Design 540 projectors, disregard all references to those parts.

a. (540 and 542). Press bearing (12) into mechanism housing. Install bearing (29) onto camshaft until it is seated against the shoulder of the shaft. Install retaining ring (30) onto camshaft with convex side of ring away from bearing (29).

b. (542 only). Assemble the animated clutch bracket parts (7A through 7L). Attach the clutch bracket assembly (7) with screws (1 and 2) and washers (3). Install shuttle adjustment bracket (6), washer (5) and round nut (4); then press down on bracket assembly (7) with fingers and tighten screws (1) and (2) securely.

c. (542 only). Assemble bushings (25) into each of the three holes in the worm gear (24). Assemble the bearing assembly (23) to the worm gear so that the ears of the bearing assembly are in line with the notches in the worm gear. Assemble the two shoulder pins (20) into the bearing assembly. Insert ears of clutch yoke (21) through the slots in the bearing assembly, and press the pins (20) in to engage the holes in the clutch yoke ears. Install the spring (22) over the protrusion of the clutch yoke and into hole in bearing assembly. Assembly bearing (18) and trigger (19) to bearing assembly.

NOTE

When assembling Design 540 projectors, only the cam (27) and worm gear with hub and setscrew (24A and 24B) are installed on camshaft. Actual camshaft installation procedure is the same.

d. (542 only). Apply a light film of grease to bearing hole in the cast arm of the mechanism housing and insert unthreaded end of camshaft through bearing hole. Install cam (27), washer (26) and assembled worm gear parts (step c) over the end of the camshaft. Assemble spring (14) over hub of driven clutch (15), spreading legs of spring so that they straddle the bent ear of the clutch. Insert hub of driver clutch (13) into hub of driven clutch, spreading legs of spring still further until one of the lugs of the driver clutch is straddled. Install washer (17) and assembled clutches onto camshaft. The driver clutch must fit over the flats of the camshaft in such a manner that the bent ear of the driven clutch is parallel with the flat for the loop restorer cam (27).

e. (542 only). Insert free end of camshaft into bearing (12) and press camshaft in place until bearing (29) is seated. Install the two retaining rings (16). Check to make certain that the actuating ear of the clutch yoke (21) extends past the inside edge of the strike (7K). Adjust by bending this ear as necessary.

f. Secure bearing loading spring (10) with screws (9). Install large retaining ring (8) over camshaft and into groove in housing. The convex side of the retaining ring

must be against the bearing.

g. (Des. 540 and 542) Insert a 0.15 feeler gage between the loop restoring cam (27) and the cast arm of the mechanism housing. Press against cam to hold feeler gage against cast arm, and tighten the setscrew (11) against flat in camshaft. Remove the feeler gage. Screw the rewind adjustment stud (33) down into place so that the top of the stud is approximately 1/16 inch below the surface of the housing.

31. REASSEMBLING THE MECHANISM (Figure 12).

NOTE

Clutch parts (28) through (37) are used only in the Design 542 projector. When servicing 540 projectors, disregard reference to these parts.

a. Assemble bearing support (10) to the shuttle arm plate (26) so that the nylon pads face one another. Thread in the support to the full length of its thread. Install the framer knob and shaft (27) so that prongs of shuttle arm plate framing arm can be engaged with groove in framer shaft. Secure plate (26) to cast arm of mechanism housing with screws (23), washers (24) and round nuts (25). The flatted portion of the nuts (25) must fit into the notches of the plate.

b. Assemble the in-out cam (21) to the in-out bracket assembly (22) so that the nylon pad of the cam follower (22D) will ride against the polished surface of the cam. Install this assembled group over the end of the camshaft and fasten the bracket assembly to the mechanism housing with two screws (19) and washers (20).

c. At this point, refer to Figure 11 and install aperture plate (11) with screws (10). Adjust aperture plate as instructed in paragraph 42, step a. Then return to Figure 12 and continue with the reassembly procedure.

d. Check the ball and stud assemblies (16) to make certain that the locking hex nuts (15) are tightened. Press the link bearings (12) into notches at the front of each shuttle arm. Assemble cam followers (14), burr side down, into the notched center section of each shuttle arm (13). Insert front end of upper shuttle arm between the two phenolic guide shoes of the bracket assembly (22) until the ball of item (16) rests in the socket of the nylon pad on the shuttle arm plate. Hold temporarily in place with a rubber band. Hang the shuttle (11) in the slot of the shuttle arm so that the shuttle teeth extend through the slot in the aperture plate and back toward the camshaft.

e. Insert front end of lower shuttle arm between the two phenolic guide shoes of the bracket assembly (22). Engage the slot of the arm with the shuttle (11) and rest the ball of item (16) in the socket of the nylon pad on the shuttle arm plate. Saturate oiler wicks (18) with oil and insert wicks into pull-down cam (17). Position the in-out cam (21) so that the tongue on the unpolished side of the cam rests in the slot in the shoulder of the camshaft. Install pull-down cam (17) onto camshaft so that the groove nearest the oiler wicks fits over the protrusion of the in-out cam (21). Temporarily install the shutter nut (7). Tighten the bearing support (10) just enough to hold all parts securely in place. Then remove the rubber band from around the shuttle arm.

NOTE

At this point, adjust the shuttle as instructed in paragraph 43 and the clutch (Des. 542 only), as instructed in paragraph 46, steps a and b).

f. Remove shutter nut (7). Install fiber washer (9A) over camshaft and up against the pull-down cam so that the slot in the washer is alined with the slot in the cam. Assemble the shutter (9) to the camshaft and install counterbalance weight (8) so that pin of weight enters the slots in shutter and pull-down cam. Install nut (7) so that its shoulder enters center hole in weight (8) and tighten nut securely, holding the end of the camshaft with an open-end wrench.

g. (Des. 542 only). Assemble grommets (34) into bracket (33). Install retaining ring (28) into groove nearest the end of the shaft (29), and assemble the bracket (37), stop pawl (31) and remaining retaining ring (28) onto the shaft. Attach clutch stop (36) and bracket (37) loosely to the cast arm of mechanism housing with screws (35). Install torsion spring (30) and mounting bracket (33) to shaft. The spring must be hooked to the stop pawl (31) and bracket (33) in such a manner that the stop pawl will be spring-loaded against the clutch stop. Secure the bracket (33) with screws (32). Loosen screws (35) slightly and adjust the clutch stop (36) to obtain 0.010-inch clearance between the stop pawl (31) and the trigger (19, Figure 13). It may be necessary to rotate the worm gear until the trigger is positioned below the stop pawl.

h. Slip the rounded end of the heat baffle (6) under the shutter and secure the baffle with screws (3). Install pulley (2) on camshaft and tighten setscrews (1). Secure the fire shutter assembly (5) of the Design 542 projector or support bracket (5A) of the Design 540 projector with two screws (3). Special screw (4) is the lower supporting post for the condenser lens assembly (item 3, Figure 2). Install this screw. Then refer to Figure 13 and install the screw (34), holder (35), washer (36) and spring (37) that make up the upper supporting post.

32. REASSEMBLING THE MECHANISM (Figure 11).

a. Assemble stop screw (15) into mechanism housing until only one thread is visible. Attach eccentric anchor (5) to housing with screw (4). Insert shaft of loop restoring arm (9) through housing and install assembled cam follower support (8) onto the shaft. Tighten screw (7) finger tight. Install springs (6). One spring must fit through the rectangular opening in the cam follower, under the bottom of the loop restorer shaft, and over the top of the eccentric anchor hub. The other spring must fit into the notch at the lower end of the cam follower, over the top of the loop restorer shaft and below the underside of the eccentric anchor hub. Loosen screw (4) and rotate the eccentric anchor until

the cam follower (8C) barely touches the cast arm of the mechanism housing. Then tighten screw (4) securely. The loop restorer must be adjusted as outlined in paragraph 52.

b. Install sprocket guards (3) and (3A) with the screws (1). Do not tighten screws, and note that the threading guide is held in place with the lower attaching screw of the upper guard (3A). Fasten lens carrier catch (14) in place with screw (12) and washer (13). The sprocket guards and lens carrier catch will be adjusted in subsequent procedures.

33. ASSEMBLING THE MECHANISM (Figure 10).

a. Assemble two retaining rings (8) to belt shift crank (10), and insert long end of crank into opening in housing. Install end of spring (9) with the least amount of coils over end of crank and the opposite end over the spring anchor post. The large center coil of the spring must project toward the rear edge of the housing. Secure the spring to the crank and anchor post with two more retaining rings (8).

b. Install thrust washer (39) over shaft of upper sprocket assembly (37) and insert sprocket shaft through bearing hole in housing until shaft protrudes about 1/8 inch from rear of housing. Install tension washer (36) and sprocket gear (35), alining either setscrew (34) with flat on sprocket shaft. Carefully mesh the sprocket gear with the worm gear; then slide the shaft through the sprocket gear until the sprocket rests against the bearing in the housing. Tighten both setscrews (34). Install the take-up drive sprocket (31) on sprocket shaft, and tighten setscrews (30).

c. Install rewind button (22) and spring (23). Depress the button while assembling the rewind clutch lever (21) to the mechanism. The small forked end engages a groove in the button shaft; the large forked end encircles the sprocket shaft. Install the spline driver (29) on the sprocket shaft with the spline fitting through the forked end of the clutch lever and meshing with the drive sprocket (31). Install spring (28), washer (27), retaining rings (25) and rewind drive sprocket (26). Install the timing belt (24) over the rewind drive sprocket (26). Assemble the outboard bearing assembly (20) onto the sprocket shaft and install clutch lever shaft (19) and retaining rings (18). Secure the outboard bearing assembly to the mechanism housing with three screws (16) and washers (17).

d. Refer to Figure 13 and turn the rewind adjusting stud (33) in or out to obtain 0.010-inch clearance between the rewind clutch lever (21, Figure 10) and the spline driver (29, Figure 10). Then tighten the setscrew (32, Figure 13) securely against the adjusting stud. Remove the paper backing from new rewind nameplate (31, Figure 13) and press nameplate in place.

e. Assemble thrust washer (39) onto lower sprocket assembly (38) and insert sprocket shaft through bearings in mechanism housing. Install tension washer (36) and sprocket gear (35) onto shaft, meshing teeth of sprocket gear with worm gear. Tighten setscrews (34) securely so that sprocket shaft turns freely but without noticeable end play. Attach upper sprocket guards (41) and (33) with screws (40) and (32). Adjust all sprocket guards as instructed in paragraph 44.

f. Install roller post (15). Press nylon bearings (14) into roller (13) and assemble roller to post with screw (11) and washer (12). Install speed change knob (6) onto belt shift crank (10), and hold knob against the mechanism housing while tightening setscrew (5). Hold the knob firmly and push spring (9) toward the sprocket gear; then hold spring in this position and switch the knob to the SILENT setting.

g. Hold the lens carrier (4) between the hinge bosses of the mechanism housing. Insert washers (2) and (3) between the lens carrier hinge ears and mechanism housing hinge bosses and press hinge pins (1) into place. The lens carrier catch installed in paragraph 32, step b, must be adjusted as necessary to permit the lens carrier to be opened freely; yet must hold carrier firmly against the stop screw (15, Figure 11) in the closed position.

34. REASSEMBLING THE SOUND HEAD (Figure 9). Reassemble sound head parts in reverse order of disassembly, noting the following special precautions.

a. Apply a light film of oil to all roller shafts before installing rollers. Do not over-lubricate.

b. Assemble light pipe (24), retainer (23) and sound drum shaft (22) loosely before inserting shaft into sound head housing. Setscrew (20) bears against the retainer (23), while two setscrews (21) secure the sound drum shaft.

c. Refer to paragraph 49 for all sound head adjustments to be performed.

35. REASSEMBLING REAR REEL ARM (Figure 6). Reassemble rear reel arm parts in reverse order of disassembly, noting the following special precautions.

a. Make certain that all gear teeth are meshing properly (without binding, but with no obvious looseness).

b. Lubricate all gear teeth sparingly with grease, and check gear action before installing reel arm cover (8).

36. REASSEMBLING FRONT REEL ARM (Figure 5). Reassemble front reel arm parts in reverse order of disassembly, noting the following special precautions.

a. Make certain that all gear teeth are meshing properly (without binding, but with no obvious looseness).

b. Lubricate gear teeth sparingly with grease, and check gear action and clutching action before installing reel arm cover (3).

37. REASSEMBLING THE PROJECTOR (Figure 4). Reassemble Figure 4 parts in reverse order of disassembly, except as noted in the following special precautions.

a. All wiring connections are to be made in accordance

with Figure D (540 projector) or with Figure E (542 projector).

b. After tilt mechanism (20) is installed, rotate knob (14) to retract tilt bar (17) up against base.

c. Do not tighten blower screws (5) until rear mechanism plate parts are assembled and blower pulley can be alined with motor pulley.

38. REASSEMBLING THE PROJECTOR (Figure 3). Reassemble Figure 3 parts in reverse order of disassembly, noting the following special precautions.

NOTE

Items 1 through 14 are used only on the Design 542 projector.

a. Slip one ear of bracket (37) onto belt shifter (42). Position the stop (46) between ears of bracket (37) so that setscrew (45) is accessible through center hole in bracket. Assemble stop and bracket onto belt shifter. Then assemble bar bracket (44) to belt shifter and tighten setscrew (43) enough to hold. Insert spring (38) between the stop (46) and stop bracket (37), alining holes in spring and bracket. Temporarily put this assembly aside until the assembled mechanism (47, Figure 2) has been installed (step b, following).

b. Refer to Figure 2. Press the four resilient mounts (46) into the projector main plate. Fasten the mechanism assembly (47) in place with screws (44) and washers (45). The lower right screw (toward rear of main plate) also secures the ground lead of the blower assembly.

c. Refer to Figure 3. Position the bar bracket (44) over the belt shift crank of the mechanism assembly. Attach the assembled shift lever parts to mechanism assembly with two screws (36). Do not install reel arm lock plunger parts (items 31 through 34) until the reel arms have been installed.

d. After installing motor mounting brackets (52), assemble pulley (48) to motor shaft with setscrew (47). Install belt (41) over small diameter of mechanism assembly pulley and thread free loop of belt through belt shifter (42). Engage other end of belt with motor pulley (48). Hook large belt (35) between motor and blower pulleys and install the motor, positioning the grooves of the motor cushion supports (40B) in the brackets (52). Then install motor bracket straps (39).

e. Install idler assemblies (29 and 30), but do not tighten the attaching screws at this time.

f. (Des. 542 only). When assembling clutch solenoid (5), install one collar (2), tapered end up, onto clutch rod. Insert rod through the stop pawl (31, Figure 12) before securing solenoid with screws (4). Assemble spring (3) and remaining collar (2), tapered end down, onto rod. Set lower collar so that the solenoid plunger protrudes approximately 3/16 inch from solenoid and tighten setscrew (1). Adjust upper collar so that distance from top of upper collar to bottom of lower collar is approximately 7/8 inch, and tighten setscrew (1).

39. REASSEMBLING THE PROJECTOR (Figure 2). Reassemble Figure 2 parts in reverse order of disassembly, noting the following special precautions.

NOTE

Items 14 through 16 apply only to the Design 542 projector.

a. All wiring connections are as illustrated in Figure D (540 projector) or Figure E (542 projector).

b. The end of the grounding spring (36) must apply tension to the end of the sound drum shaft. Bend spring if necessary.

c. Spring (29) hooks between film exit guides (33) and (34). Spring (25) is installed so that straight end lays flat against snubber roller frame and points toward roller. Formed end of spring hooks around front end of roller bracket.

d. After installing pilot light bracket (22) and lamphouse assembly (20), adjust the pilot light bracket so that the contour of the lamphouse matches with the mechanism housing and the lamphouse opens and closes without binding. If necessary, adjust the lamphouse latch (Figure 8) so that the lamphouse is held securely against the projector main plate.

e. Install knobs (11) so that there is approximately 1/32-inch clearance between knob and nameplate.

f. Perform the optical alinement procedure outlined in paragraph 42.

40. REASSEMBLING THE PROJECTOR (Figure 1). Reassemble Figure 1 parts in reverse order of disassembly, noting the following special precautions.

a. Assemble washer (44) over spline of each reel arm, and install reel arms to main plate. Install black lock disk (41) over spline of front reel arm so that notch in outer circle of disc is at approximately 10 o'clock position (when viewing rear of main plate). Install nickel-plated lock disc (41A) over spline of rear reel arm so that the smallest notch is centered at the 3 o'clock position. Install speed nuts (39) over reel arm bearings with the convex side of the nuts away from the main plate. Press speed nuts in place.

b. Assemble reverse take-up sprocket (36) and washers (37) and (38) onto front reel arm shaft. Install retainer (35), formed legs out, over reel arm shaft and into counterbore of sprocket. Assemble clutch cam (34) against retainer so that the three notches in the cam straddle the three legs of the retainer. The shallow end of the notches must point in a counterclockwise direction. Rotate cam counterclockwise against legs of retainer and insert a steel ball (33) between each of the three pairs of legs on the retainer. Insert spring (32) into the radial slot of the cam so that the spring tends to rotate the cam in a

clockwise direction. Install rewind sprocket (30) and collar (29) onto reel arm shaft so that tongue of collar enters groove of sprocket. Insert a 0.003 inch shim stock between washers (38) and (37). Press all parts together and tighten setscrews (28). Remove shim stock.

c. Assemble rear reel arm parts in a manner similar to the front reel arm parts (step b) except that the shallow end of the notches in cam (24) should point in a clockwise direction and the spring (22) must be installed so that it tends to rotate the cam in a counter-clockwise direction.

d. Refer to Figure 3. Install reel arm lock plungers (34), springs (33) and brackets (32) with screws (31). The narrow portion of each lock plunger bar must rest on the flange of the reel arm lock discs. The groove in each bracket (32) must straddle the narrow portion of the bar.

e. Install timing belt over small sprocket of mechanism assembly, around large sprocket of front reel arm, and around reel arm sprocket. Adjust roller tension as instructed in paragraph 50.

f. Perform all necessary adjustments and alinements as directed in the Adjustment section.

Adjustments

WARNING

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

41. INTRODUCTION.

The adjustments listed in this section are those which either require special tools, are of such nature as to require tolerances or sequential adjustments not readily determinable by inspection or which differ radically from service procedures applicable to prior Filmosound designs. Routine adjustments such as those applicable to sliding fits, bearing clearances and end-play (within normal shop practices) have not been listed. All special tools required to perform adjustment procedures are illustrated in Figure A.

42. OPTICAL ALIGNMENT (See Fig. B) (Proceed in sequence listed).

a. APERTURE PLATE. Remove projection lens, condensing lens, projection lamp and pressure shoe assembly. Turn mechanism until shutter is opened. Loosen two screws (10, Fig. 11) enough to permit free movement of aperture plate. Tip projector over on its back, open lens mount and insert aperture plug (Ser-550-2-N3) into aperture opening. Close lens mount and insert lens plug (Ser-550-2-N1) into lens mount. Insert alignment rod (Ser-550-2-N2) into hole in lens plug. Lower rod carefully and shift aperture plate as required until rod enters hole in aperture plug. Tighten aperture plate retaining screws securely.

b. CONDENSING LENS ASSEMBLY. Withdraw alignment rod, if necessary, so that end of rod will not interfere with installation of condenser plug. Install condenser plug (Ser-500-2-N4) on condensing lens holder mounting screws. Carefully push alignment rod through hole in condenser plug. If rod strikes top or bottom of hole, tighten or loosen screw (34, Fig. 13) as required, to bring plug into alignment with rod. NOTE: Due to overhung suspension, plug may shift slightly from side to side as rod is inserted. This is not of any importance.

c. LAMP SOCKET. Tip projector forward onto its base. Loosen two screws (4, Fig. 2) which hold lampholder assembly to main frame. Insert lamp plug (Ser-550-2-N5) into projection lamp socket and rotate plug until hole lines up with alignment rod. Push rod through hole in plug. Place thumb under lamp socket mounting casting and second finger on top of lamp plug. Push mounting upward until socket bears evenly against base of plug. Slide complete holder assembly forward along rod until lamp plug comes in contact with condenser plug. Insert screwdriver through slot in lamp plug and tighten lampholder retaining screw until resistance is noted. Remove screwdriver and tighten retaining screw at rear of lampholder; then tighten screw which is accessible through slot in lamp plug.

d. FINAL CHECK. Slide alignment rod back and forth in alignment plugs. Since rod is a lapped fit in holes, light resistance should be felt. Make sure that lamp plug does not rise in socket. If rod binds, determine point of binding and relocate the mis-aligned part. Tip projector over on its back and remove the alignment rod with plugs. Be careful not to lose aperture plug. Install pressure shoe assembly and visually center in aperture plate before tightening retaining screws.

43. INTERMITTENT ADJUSTMENTS (See Fig. 12).

a. SHUTTLE TOOTH SIDE CLEARANCE. When shuttle is at center of stroke, clearance between sides of shuttle teeth and edge of shuttle slot in aperture plate should be approximately 0.009 in. Use a feeler gauge. If clearance varies from top to bottom of shuttle and is less then 0.005 in. at either end, aperture plate is probably out of alignment (see para.42a). Side clearance is related to stroke; therefore, make sure that stroke is correct (see para. 43e) if clearance is inadequate. If stroke is correct, but clearance is inadequate, it is probable that a link bearing (12) is missing. It is possible though not very prob-

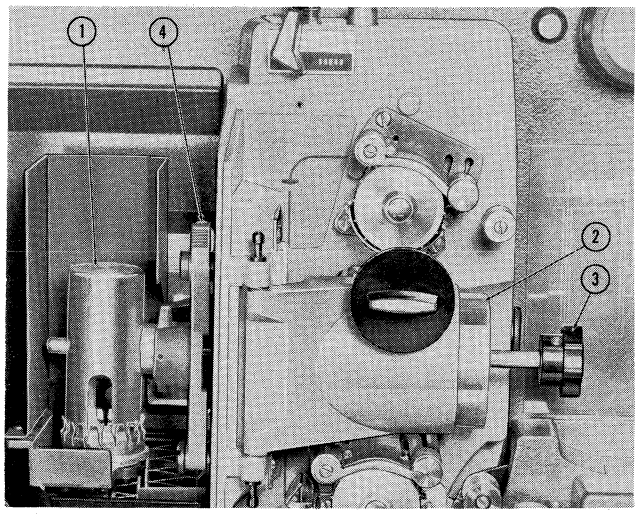


Figure B. Optical Alignment Adjustment

able that a ball and stud assembly (16) could have slipped on a shuttle arm (13).

b. GUIDE SHOE CLEARANCE. Proper clearance between guide shoes (22B) and bearing in shuttle arm is approximately 0.001 in. If shuttle slides freely between guides and a 0.002 in. feeler cannot be inserted between the bearing and guide at any point in the stroke, the clearance is satisfactory. If clearance is excessive, loosen retaining screws (22A) and move guide (22B) toward shuttle arm bearing to obtain proper clearance.

CAUTION

Do not set guide snug against bearing as this would decrease life of pivot bearings and cam.

c. SHUTTLE TOOTH PROTRUSION. If transport mechanism has been removed from main frame, turn mechanism drive pulley until shuttle is near mid-stroke and notched hole in shutter blade (9) is aligned with access hole in fire shutter mounting plate (5). If transport is assembled to main frame, remove condenser assembly, lampholder assembly (5, Fig. 2), and pulley shield (7, Fig. 2). Access hole in fire shutter mounting plate can now be reached through lamphouse. After turning drive pulley to align notched hole in shutter with access hole, insert short end of #4 Bristo Wrench and engage in-out cam follower screw. Open film gate and check shuttle tooth protrusion with height gauge (Ser-550-6). If "NO-GO" step passes over shuttle tooth, turn cam follower screw counter clockwise to increase protrusion. If "GO" step will not pass over tooth, turn follower screw clockwise to decrease protrusion.

d. FIT OF SHUTTLE TO PULL-DOWN CAM. Remove blower belt and projection lamp. Insert wrench in screw in top shuttle arm pivot. Run projector at sound speed, without film, and tighten screw just enough to stop tapping noise produced by cam shoes on pull down cam, then tighten screw 1/8 to 1/4 turn. If in doubt about source of noise, loosen screw until shuttle hammer is pronounced, then tighten down to reduce this noise. After making adjustment, disconnect projector from power source, discharge motor starting capacitor and disengage drive belt. Turn drive pulley by hand through one complete revolution. Load will normally increase slightly as stroke starts. If shuttle is tight during stroke but loose and noisy during backstroke, check for missing shuttle link bearing (12).

CAUTION

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

e. SHUTTLE STROKE. Normal shuttle stroke (vertical travel of shuttle teeth) is 0.3025 in. The most convenient means of measuring the stroke is to use the projector as an optical comparitor. The step on stroke gauge (Ser-550-5) is the length of the nominal stroke. When it is inserted in the aperture and projected, it provides a reference dimension with which the actual stroke can be compared. Figure C is a sketch of a target. The A to B section is a 100 to 1 enlargement of the gauge. The C and D lines represent 100 to 1 enlargements of the limits of tolerance.

(1) PROCEDURE FOR MEASURING SHUTTLE STROKE.

(a) Remove pressure shoe assembly, condensing lens assembly and drive belt.

(b) Reinstall blower belt and set framer at mid-point.

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

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

(e) Insert stroke gauge (Ser-550-5) in aperture plate and push down against top tooth of the claw. Close film gate.

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

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

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

(2) PROCEDURE FOR ADJUSTING SHUTTLE STROKE. Loosen two screws (23, Fig 12) just enough to permit movement of the shuttle arm plate (26). When adjusting Des. 542 projectors, it will be necessary to remove two screws (35) and permit clutch stop (36) and bracket (37) to drop to expose screws (23).

(a) To lengthen the stroke, move shuttle arm plate (26, Fig. 12) toward pull-down cam.

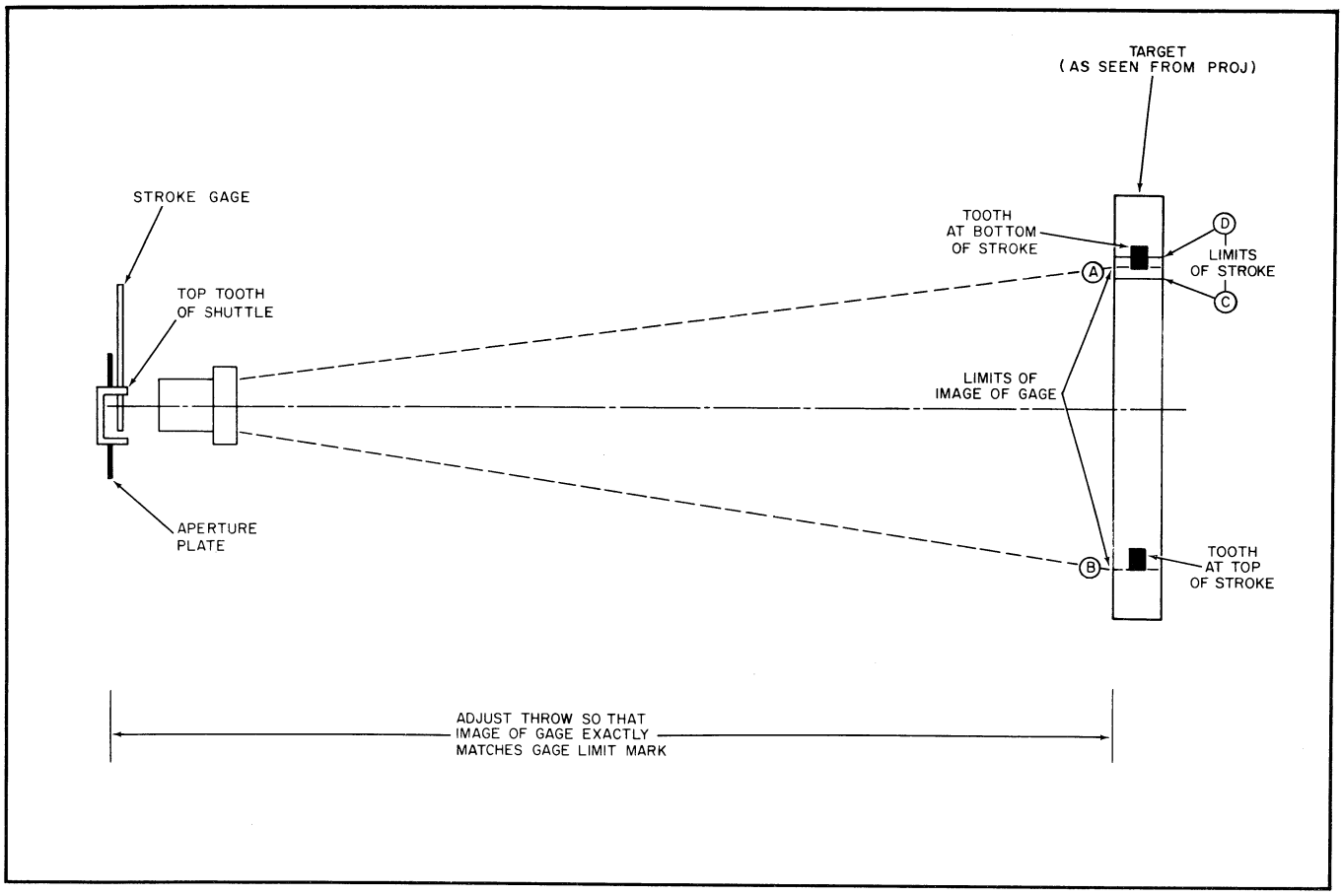


Figure C. Checking and Adjusting the Shuttle Stroke

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

(c) After adjusting stroke, recheck shuttle tooth side clearance as instructed in paragraph 43a, and readjust if necessary.

CAUTION

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

f. FRAMING ADJUSTMENT. Thread projector with film having proper frame line position. Project film and turn framing knob from one limit to the other. If at one limit a frameline is not visible, loosen nut on framing eccentric (located at top of shuttle arm plate assembly (26, Fig. 12) and turn eccentric until the frame line appears. Hold eccentric while tightening nut. Check adjustment by again turning framing knob from limit to limit while observing picture. When 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.

44. SPROCKET SHOE ADJUSTMENT. Loosen two screws which hold sprocket shoe assembly to mechanism. Place two thicknesses of film on sprocket and close shoe. Lightly press shoe against film and shift shoe sidewise, if required, to insure full and even bearing of shoe against film. Tighten retaining screws. NOTE: If shoe does not bear evenly against film through the whole contact area, jamming at splices or pull-through (with 100 foot reels) may be encountered.

45. LENS MOUNT ADJUSTMENT. Angular relationship between projection lens mount and aperture plate is controlled by lens mount stop screw (15, Fig. 11). Thread projector with roll title or target film having sharp images in corners and project a picture approximately 30 in. high onto a matte surface. NOTE: Projector must be square with screen. Focus the picture and compare resolution of the two sides of the image when viewed from a distance of approximately twice the width of the picture. If one side appears to be soft, refocus to sharpen that edge of the picture and note whether the lens is moved toward or away from the aperture. For example, if image at right hand edge of screen is soft until lens is moved toward aperture, then lens stop screw is set too far forward and should be turned clockwise.

CAUTION

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

46. ANIMATION CLUTCH ADJUSTMENTS. DESIGN 542 ONLY.

a. CLEARANCE BETWEEN STOP PAWL AND TRIGGER. Correct clearance between the stop pawl (31, Fig. 12) and trigger (19, Fig. 13) is 0.010 to 0.015 in. Adjust by loosening screws (35, Fig. 12) and moving stop (36, Fig. 12) up or down, as required, to establish correct clearance.

b. SHUTTLE RETRACTION (Fig. 13). Depress stop pawl and turn mechanism by hand until clutch latches. Check to make sure that clutch stop engages stop retainer on rear end of retainer by approximately 0.040 in.

(1) Loosen Allen nut (4) at upper rear corner of slide bar, and slide bracket (6) toward shuttle until shuttle teeth are retracted below level of aperture rails. Tighten nut.

(2) Adjust setscrew (7A) at front end of slide bar bracket so that slide bar assembly (7G) clears end of setscrew by 0.080 to 0.082 in.

(3) Turn mechanism manually until clutch engages and clutch yoke (21) is in line with strike (7K). Loosen screw (7H) and move strike (7K) until clearance between yoke and strike is 0.040 in.

(4) Loosen screw in adjusting bracket (6). Insert 0.040 in. feeler gauge between bracket and the ear on the clutch yoke (21). Push bracket against gauge and tighten retaining screw.

c. SOLENOID LINKAGE (See Fig. 3). Loosen setscrews (1) so that collars (2) slide freely on link of solenoid (5). With clutch stop pawl disengaged, lift solenoid plunger by means of link until top of plunger extends approximately 3/16 in. out of top of solenoid frame. Slip lower collar up against bottom of stop pawl and tighten setscrew. Hold lower collar against bottom of stop pawl and depress upper collar just enough to provide sufficient compression of spring (3) to prevent rattling. Tighten the setscrew in the upper collar. Start projector and check operation of clutch. If solenoid is sluggish in pull-in, plunger is set too high. If solenoid produces buzzing noise, plunger is either set too high or spring (3) is compressed too much. If plunger seats and stop pawl is not fully engaged, the plunger is set too low or spring (3) is not sufficiently compressed.

47. FIRE SHUTTER ADJUSTMENTS (See Fig. 3). DESIGN 542 ONLY.

a. LINKAGE CLEARANCE. Turn mechanism pulley until one blade of interrupter shutter is adjacent to fire shutter link (10). Check that link clears interrupter shutter by at least 3/32 in. If clearance is less than 3/32 in., remove solenoid (12) and loosen two bracket retaining screws (13). Shift bracket to provide minimum link clearance of 3/32 in.; then tighten retaining screws securely.

b. ALIGNMENT. Open film gate and turn mechanism pulley until interrupter shutter clears aperture. Loosen two screws (11) which secure solenoid (12) to bracket (14). Place thumb of right hand against outer end of solenoid frame and index finger on clevis at end of solenoid plunger. NOTE: Be sure to press on clevis; not on the linkage. Press solenoid against plunger. While looking straight into the aperture, position solenoid so that fire shutter covers aperture; then tighten screw (11) at outer end of solenoid bracket enough to hold solenoid in place. Release solenoid plunger and trip rocker arm several times to make sure that plunger slides freely in solenoid. Tip solenoid if necessary to free plunger, then tighten both retaining screws (11) securely.

48. REWIND CLUTCH ADJUSTMENT (See Fig. 1). The rewind clutch should be adjusted to produce a supply spindle torque of 5-1/2 to 6 in.-oz. when rewind button is depressed. Use standard reel and spring balance method of measuring torque. Clutch is adjusted by means of hex nut on outer end of clutch (30). Tighten nut to increase torque. Loosen to decrease torque.

49. SOUND HEAD ADJUSTMENTS.

a. REMOVAL. Due to the ease with which the head can be removed and the greater accessibility thereby obtained, time will be saved by removing the head if major work is required.

(1) Remove the projection lens assembly from the projector. Note that the rear lens element is held in place with a retaining ring and can be replaced if necessary. Wrap lens in tissue paper.

(2) Disconnect photocell and exciter lamp cable from amplifier and release cables from retaining clips.

(3) Remove grounding spring (36, Fig. 2). Insert the end of an Allen wrench or short steel pin in hole in sound drum bearing housing directly behind flywheel until wrench or pin drops through hole in sound drum shaft. Remove flywheel retaining nut (37, Fig. 2) and flywheel (38, Fig. 2).

(4) With a sharp pencil, draw a line on the main frame where the front edge of the soundhead meets the frame. This will provide a reference mark when reassembling.

(5) Take out the three screws (39 and 40, figure 2) which tap into the sound head from the rear of the main frame, and carefully withdraw the sound head.

b. LIGHT PIPE AND PHOTOCELL.

CAUTION

Do not scratch light pipe - clean only with Opti-Kleen.

(1) Light pipe must be positioned under edge of

sound drum so that the full length of the beam falls on the inclined surface of the pipe. This will insure reflection of the beam. Make sure that the end of the pipe extends under the edge of the drum and that the pipe is not pushed so far under the drum that the inner end of the beam misses the inclined surface.

(2) Position of the photocell is critical with respect to the pipe. To adjust, connect a 16-ohm, 10-watt resistor and output meter to the speaker jack. Thread the projector with constant frequency film (preferably 400 CPS). Remove flywheel and loosen two screws (7, Fig. 9) which hold the photocell assembly (8, Fig. 9) to the holder (19, Fig. 9).

(3) Start projector and adjust volume control to a convenient level. Position photocell for maximum output; then tighten the retaining screws.

c. TENSION ROLLERS (See Fig. 9). Arms upon which rollers (28 and 29) are mounted are linked by torsion spring (36). Therefore, roller arms move as a pair. Counterbalance spring (30) offsets the weight of the rollers and arms. Place soundhead on a level surface and move roller arms (as a set) to various positions. If spring tension is incorrect, roller arms will not remain in the position in which placed. If roller arms swing downward, loosen retaining screw for anchor (32) and move anchor downward until weight of arms is counterbalanced. If roller arms move upward, move anchor upward to reduce counterbalancing force.

d. OPTICAL SLIT ASSEMBLY (See Fig. 9).

(1) Loosen clamping screw (3). If slit does not slide freely in holder, insert bit of small screwdriver in slot in clamp and wedge clamp open to free slit assembly. Thread projector with 7000 CPS optical setting film and connect 16-ohm, 10-watt load resistor and output meter to speaker jack.

NOTE

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

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

e. BUZZ TRACK ADJUSTMENT (See Fig. 9). Lateral position of the film in the sound head is controlled by the flanged roller (28) and edge guide screw (25). Unless the adjustment has been disturbed, it is not probable that the edge guide screw (25) will require resetting. Thread the projector with buzz track film and adjust volume control to a suitable listening level. Turn positioning sleeve (6) to move flanged roller laterally.

NOTE

There are two type of buzz track in use. On one, the track spacing exceeds the length of the scanning beam. This track can be positioned so that little or no signal is reproduced. On the other type of track, spacing is less than the length of the beam. This track should be positioned so that both tones are reproduced at approximately the same volume level. If, after adjustment of guide roller position, signal levels cannot be balanced (or eliminated on wide track), or level of tones fluctuates, adjust edge guide screw (25) to clear up the condition. If edge guide screw is far out of adjustment, turn it clockwise until it clears edge of film, adjust rollers and then set guide screw to stop side weave of film.

50. TIMING BELT IDLER ADJUSTMENT. Belt tension is not critical, although excessive tension will reduce belt life. Set rewind belt idler so that midpoint of slack side of belt can be pushed inward approximately 1/8 in. by light pressure. Set takeup belt idler so that belt can be pushed down against motor relay mounting bracket by light pressure.

51. 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) "STROBOTAC" or similar strobe light. Usually synchronized with interrupter shutter or shuttle. Shutter makes one revolution per frame. Shuttle makes one stroke per frame.

(3) TACHOMETER (perferable having a speed range with a maximum speed of 150-200 RPM). Used to measure RPM of sprocket.

(4) STROBE DISC. Attached to sprocket by means of suction cup or rubber foot. For viewing with light from 60 CPS source, disc should

have 70 dots for sound speed, 93 dots for silent speed. Count number of apparent revolutions of pattern for one minute. If pattern drifts in direction of rotation, add to design speed to obtain true speed. If pattern drifts against rotation, subtract from design speed to obtain true speed.

(5) TIMED LOOP. Make loop of exactly 120 frames. At sound speed splice will pass aperture 12 times per minute ± the permissible variation in speed and the timing error.

b. SPEEDS AT 120 VOLTS 60 CPS AC.

(1) SOUND SPEED.
Shutter - 1440 RPM ± 2%
Sprocket - 102.86 RPM ± 2%

(2) SILENT SPEED
Shutter - 1080 RPM ± 5%
Sprocket - 77.1 RPM ± 5%

52. LOOP RESTORER ADJUSTMENTS.

a. TEST FILM. Since film is transported by means of the sprocket holes and the shuttle and sprockets are synchronized by the gear train, there will always be the same number of frames in the lower loop, when the shuttle is at top of stroke position. The size of the loop, however, is dependent upon the actual length of the film in the loop. If the film is either stretched or shrunk, the size of the loop will change. This possible variation in the size of the loop, due to film condition, must be recognized and allowance made for it in adjusting the loop restorer. Therefore, it is necessary to measure the stretch or shrinkage of the piece of film which is to be used in adjusting the loop restorer in order that the adjustment can be made with the highest possible degree of accuracy. Proceed as follows:

(1) Count 40 frames of film and mark the first and last sprocket holes.

(2) Place the trailing edge of the first sprocket hole at one end of a 12 in. steel rule.

(3) Smooth the film along the rule. Do not apply more than 2 to 3 oz. tension to the film as this might produce an erroneous measurement.

(4) If there is zero shrinkage in the film, the trailing edge of the last sprocket hole will register exactly with the end of the rule.

(5) If the leading edge of the last sprocket hole registers with the end of the rule, the film has approximately 0.4% shrinkage. Since the variation is usually linear, a film which had shrunk 1/2 the height of a sprocket hole would have approximately 0.2% shrinkage.

(6) If the trailing edge of the last sprocket hole overshoots the end of the rule, the film is stretched. Generally you will find that the film will have some shrinkage. If the film is shrunk more than 0.5% (height of 1-1/4 sprocket holes), do not use for adjustments.

b. ADJUSTMENTS (See Fig. 11).

(1) Loosen retaining screw (4) and rotate adjusting cam (5) so that end of cam follower (8C) clears end of restorer cam by approximately 0.015 in. NOTE: If cam follower strikes casting before proper clearance is obtained, move cam away from casting.

(2) Thread projector with film of known shrinkage. Turn framer to maximum CCW position. Turn mechanism by hand until shuttle has engaged perforations at top of stroke but stroke has not begun.

(3) Loosen screw (7) which holds cam follower support bracket (8D) to shaft.

(4) Position loop restorer (9) as follows:

(a) Film shrinkage 0 to 0.2%: set restorer 0.015 to 0.020 in. above loop (use piece of #26 gauge wire as a feeler gauge).

(b) Film shrinkage 0.2% to 0.5%: set restorer 0.010 to 0.012 in. above loop (use piece of #30 gauge wire as a feeler gauge).

(5) After establishing correct clearance, tighten screw (7) securely.

(6) Turn mechanism by hand until lobe of restorer cam is on top dead-center.

(7) Push cam follower (8C) forward until it passes under cam. If end of follower does not clear cam by 0.018 to 0.020 in., loosen two screws (8A) and move follower downward to establish correct clearance.

(8) Turn mechanism by hand until shuttle reaches end of stroke. Open gate and pull out the loop.

(9) Hold film lightly against aperture and turn mechanism to restore loop. Observe shuttle teeth as they re-enter perforations. Adjust as follows:

(a) If bottom edge of shuttle teeth does not clear bottom edge of sprocket holes, move cam follower upward.

(b) If top edge of shuttle teeth does not clear top edge of sprocket holes, move cam follower downward.

(10) Run projector and check operation either by pulling out lower loop or opening and closing gate. After loop has been restored, place tip of finger on top of restorer and check for pulse at loop frequency. If pulse is detected, increase restorer clearance as instructed in Step (4) (a), preceding.

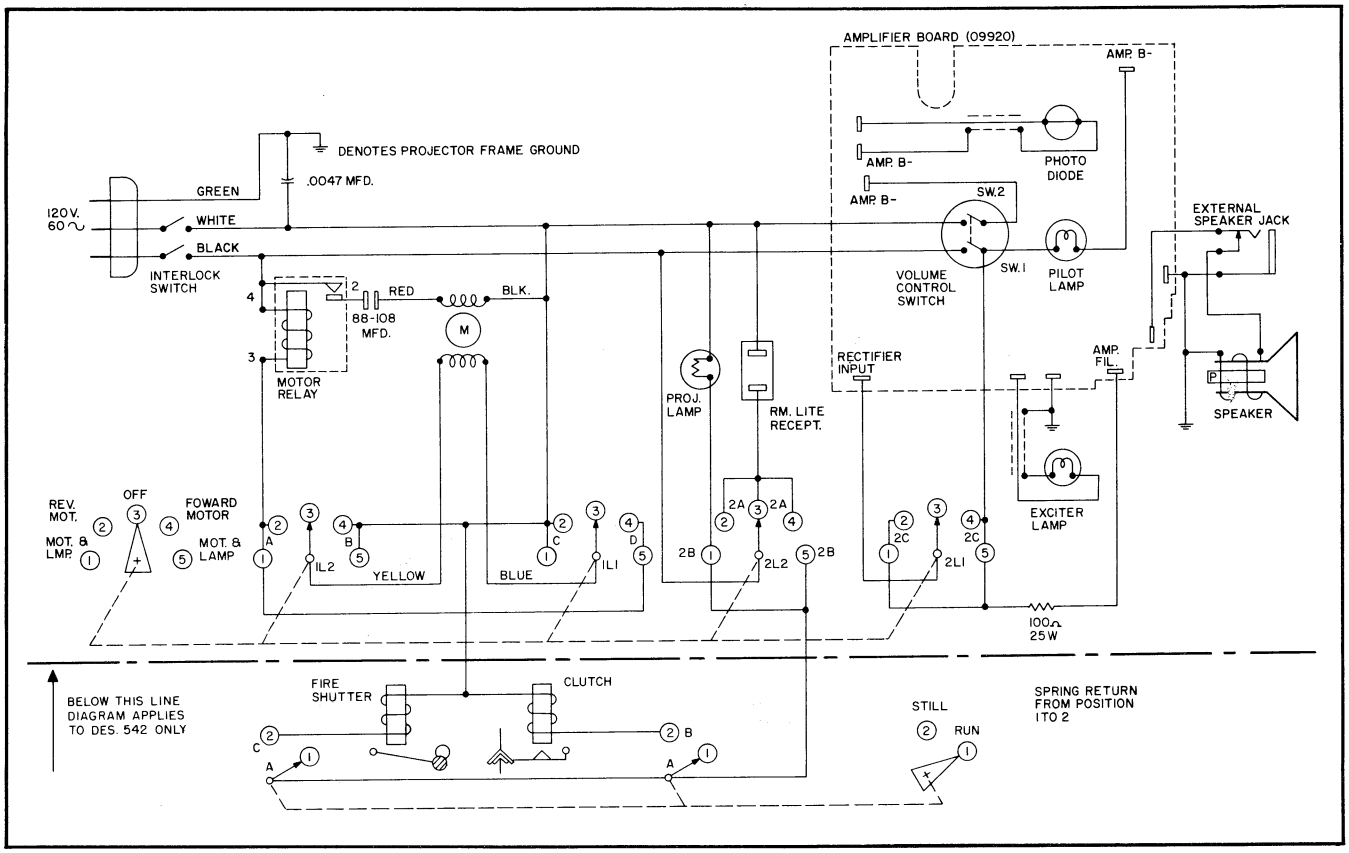


Figure F. Filmosound Projector Schematic Wiring Diagram

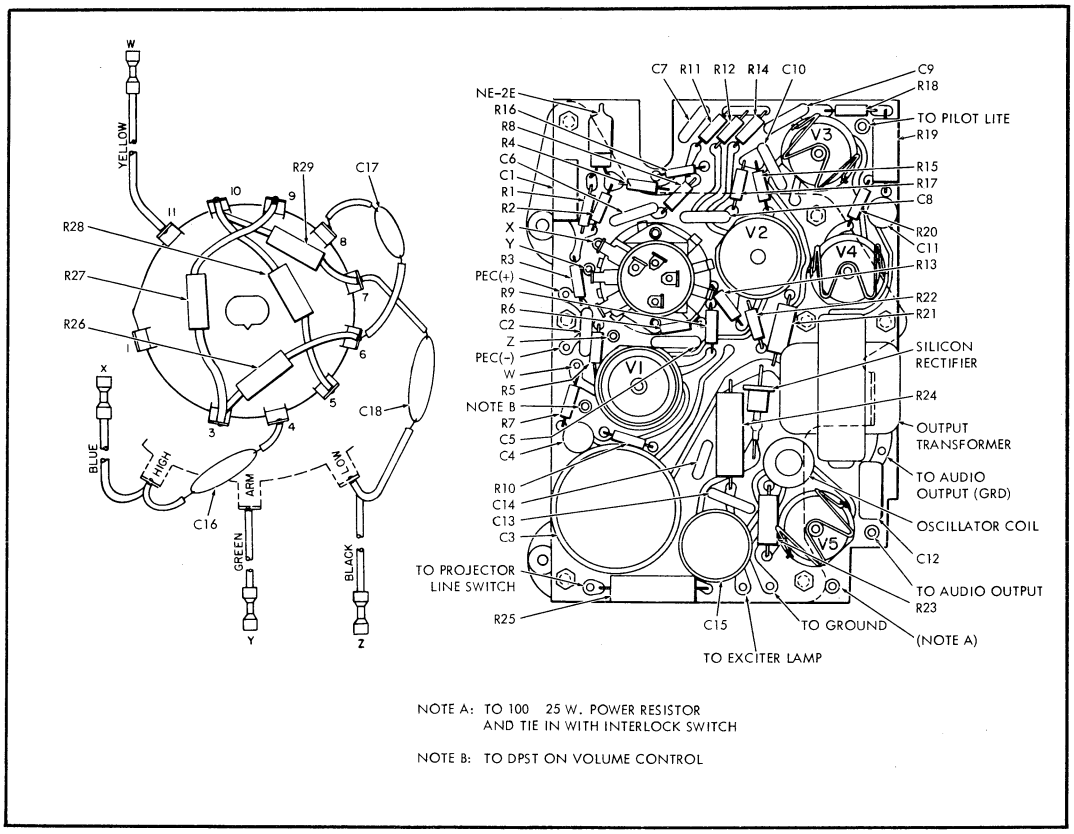


Figure G. Amplifier Assembly Reference Designators

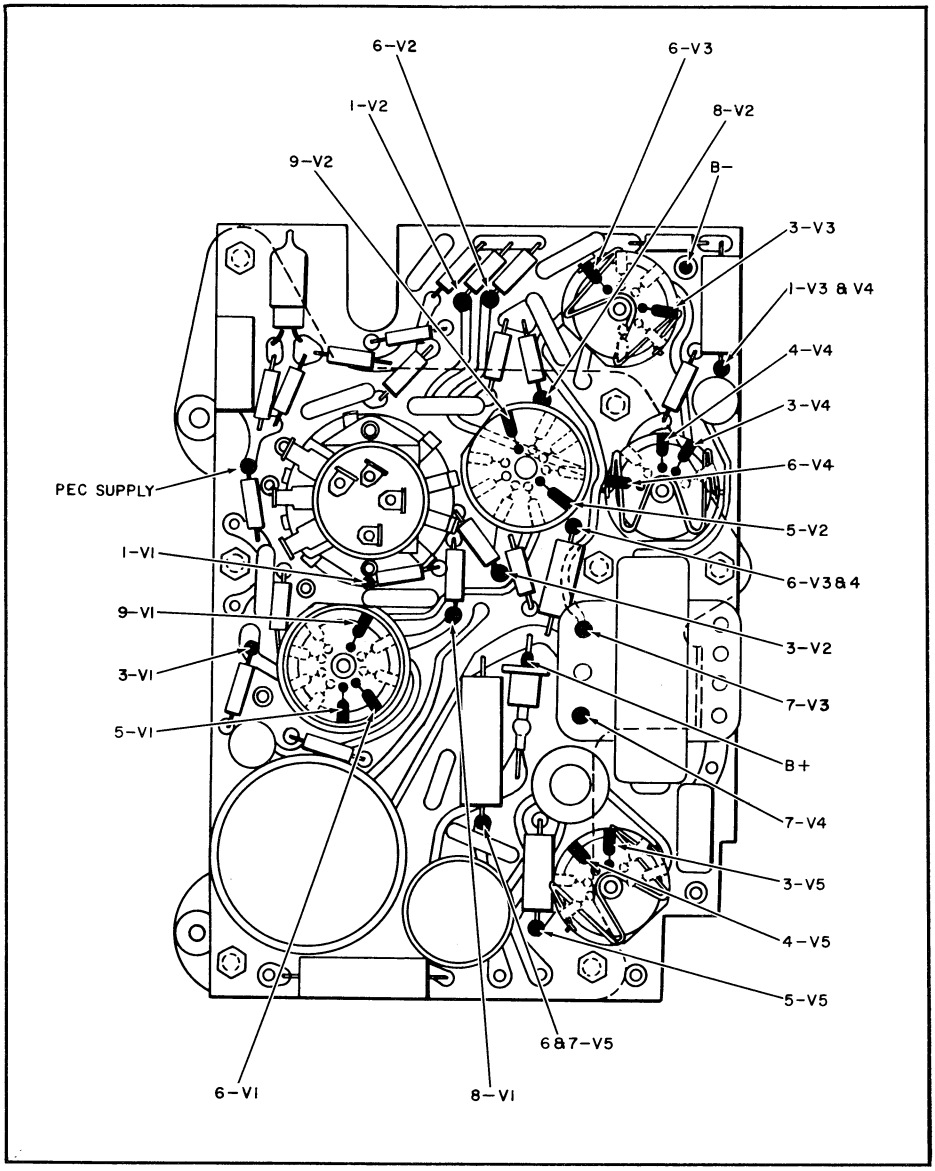
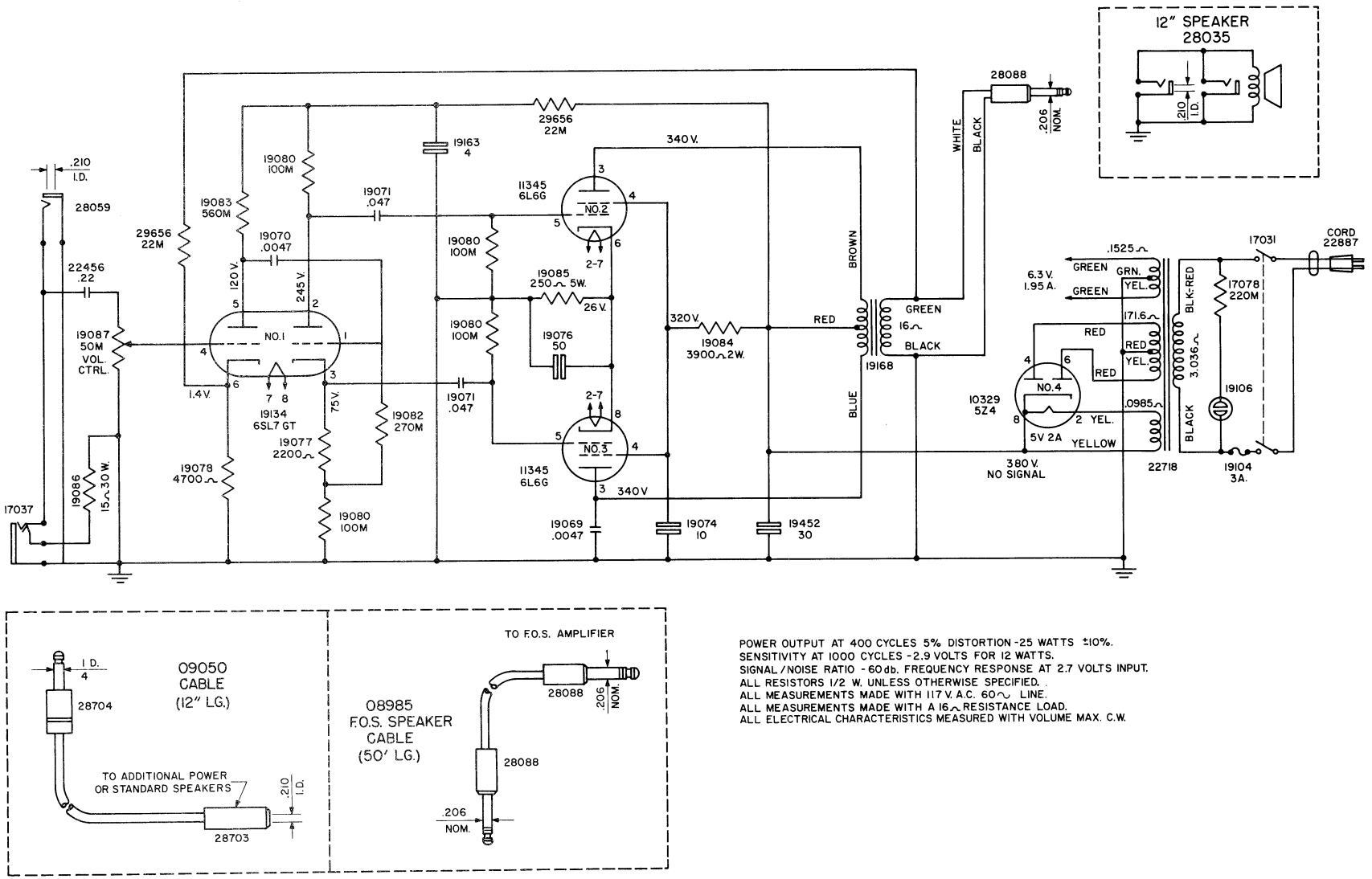


Figure H. Location of Amplifier Test Points



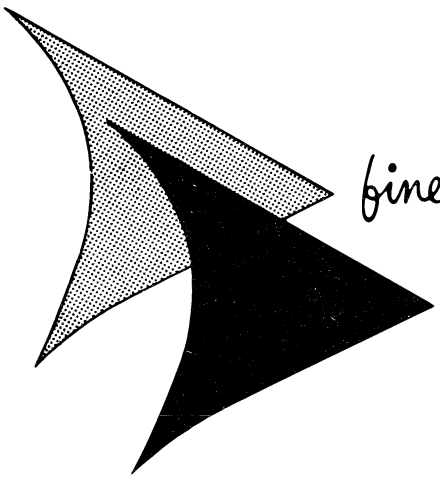
POWER OUTPUT AT 400 CYCLES 5% DISTORTION -25 WATTS ±10%.
SENSITIVITY AT 1000 CYCLES -2.9 VOLTS FOR 12 WATTS.
SIGNAL/NOISE RATIO -60 db. FREQUENCY RESPONSE AT 2.7 VOLTS INPUT.
ALL RESISTORS 1/2 W. UNLESS OTHERWISE SPECIFIED.
ALL MEASUREMENTS MADE WITH 117 V. A.C. 60 ~ LINE.
ALL MEASUREMENTS MADE WITH A 16 ~ RESISTANCE LOAD.
ALL ELECTRICAL CHARACTERISTICS MEASURED WITH VOLUME MAX. C.W.

Figure K. 25-Watt Power Speaker Schematic Diagram

PARTS CATALOG

FILMOSOUND PROJECTOR

DESIGN 540 AND 542



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Bell & Howell

GENERAL SERVICE DEPT.
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CHICAGO 45, ILLINOIS

PART NO. 70341-A PRINTED IN U.S.A. APRIL 1961

Replacement Parts

The following pages illustrate and list, by part number and part name, all replacement parts for the Bell & Howell Filmosound Projectors, Design 540 and 542. Be sure to check the "Usable on Code" column for the proper application of replacement parts. Code letter "A" is used to identify parts applicable only to the Design 540 projector; code letter "B" identifies parts applicable only to the Design 542 projector. Where the "Code" column is blank, those parts are used on both projectors.

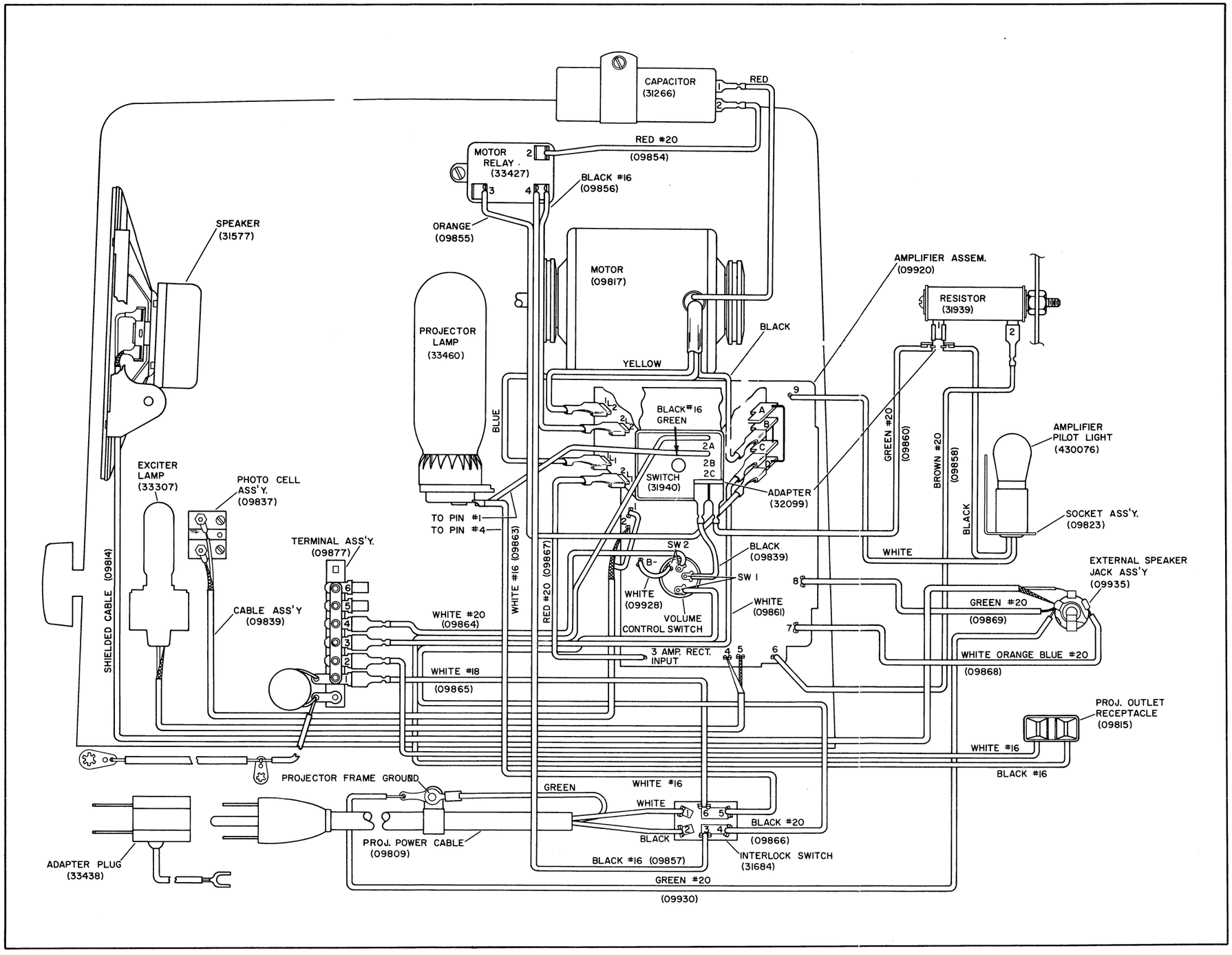


Figure D. Design 540 Projector Pictorial Wiring Diagram

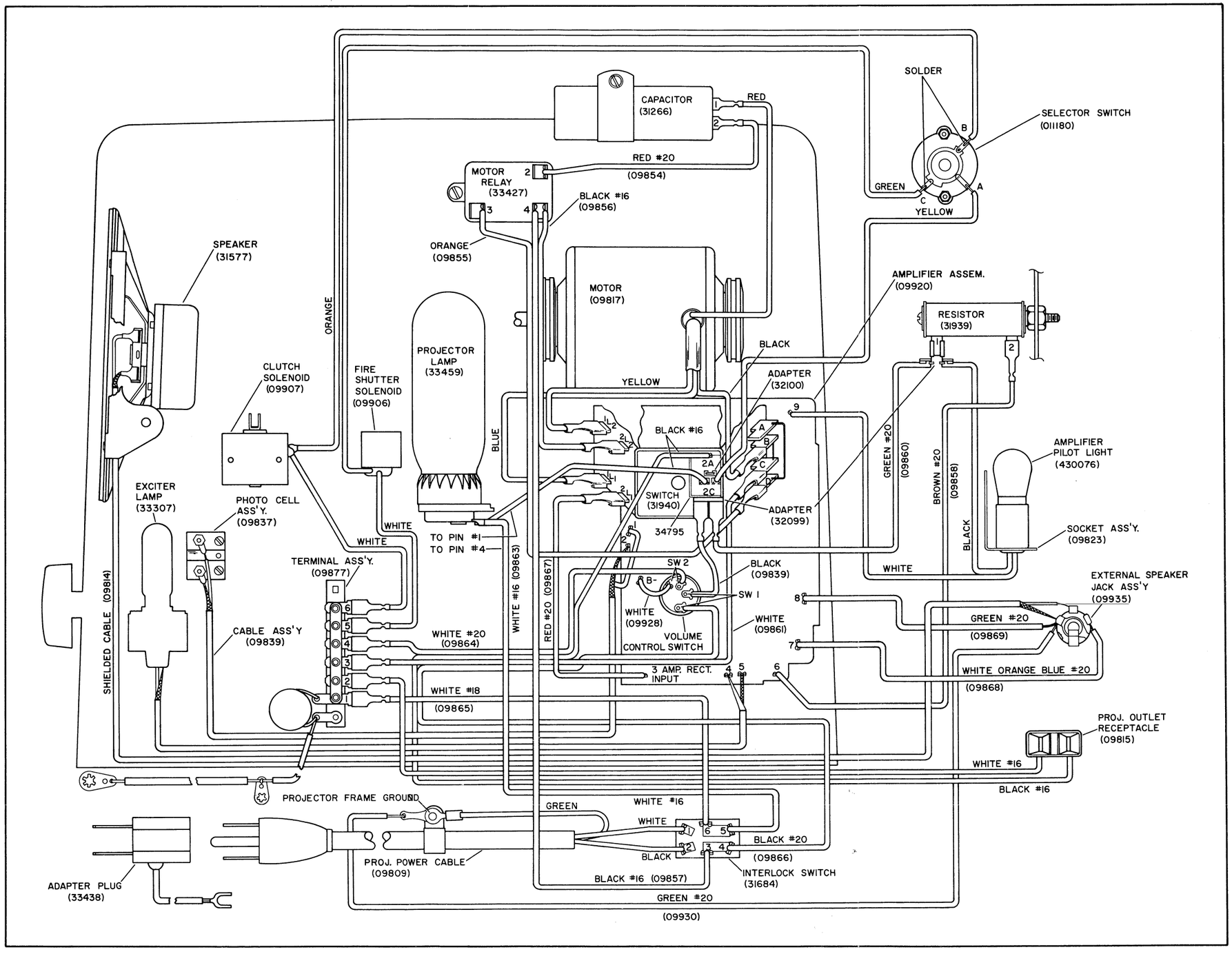
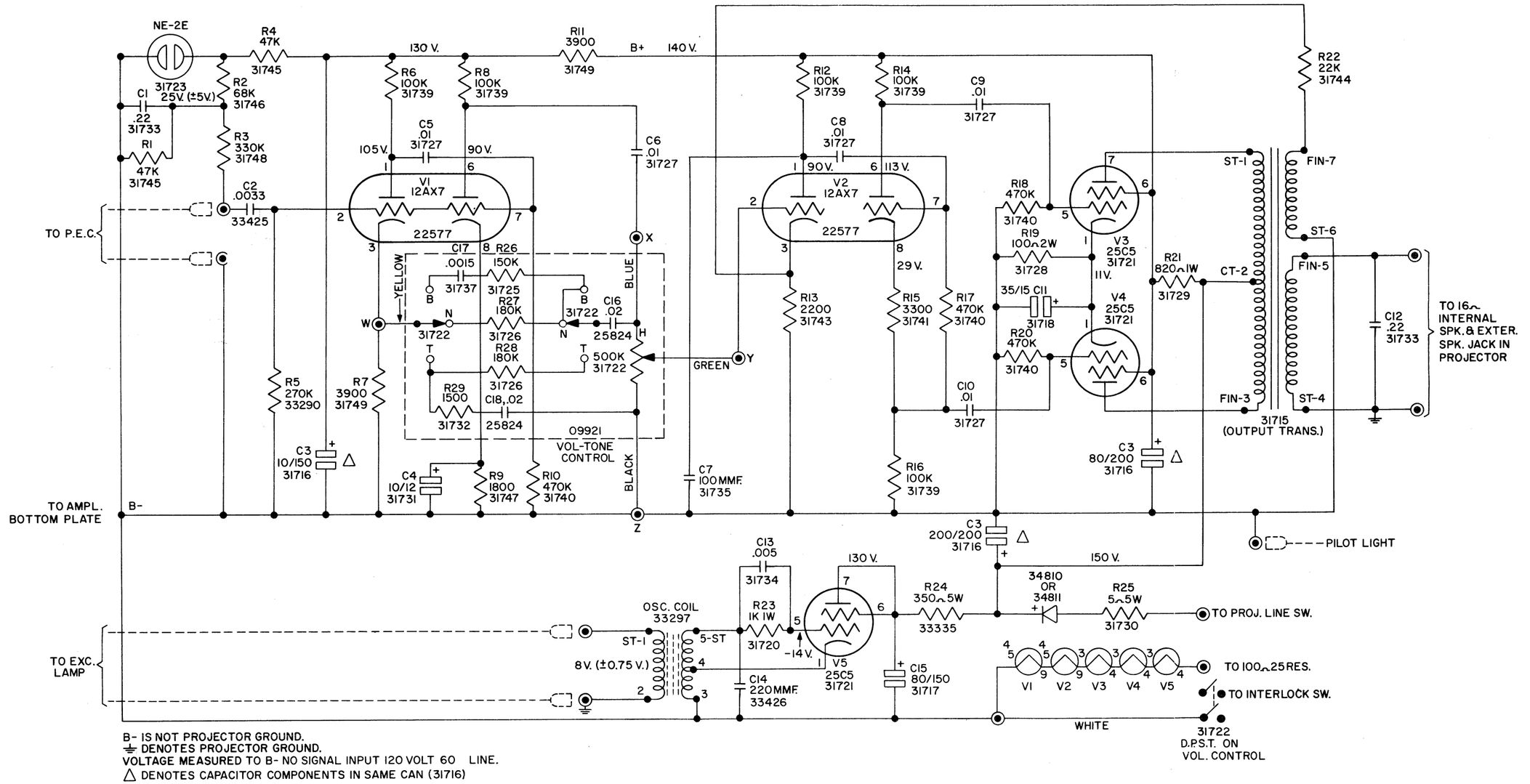


Figure E. Design 542 Projector Pictorial Wiring Diagram



B- IS NOT PROJECTOR GROUND.
⏚ DENOTES PROJECTOR GROUND.
VOLTAGE MEASURED TO B- NO SIGNAL INPUT 120 VOLT 60 LINE.
△ DENOTES CAPACITOR COMPONENTS IN SAME CAN (31716)

Figure J. Amplifier Schematic Wiring Diagram

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR MAIN PLATE		
1-1	011176	COVER ASSY, Front	1	
-1A	33388	. SCREW, Cover latch plate	2	
-1B	33390	. SPEED NUT, Cover latch plate	2	
-1C	33383	. PLATE, Latch	1	
-1D	33373	. SCREW, Cover foot	4	
-1E	33372	. FOOT, Cover	4	
-1F	34826	. PLATE, Operating instructions	1	
-1G	09909	. PANEL, Front cover	1	
-1H	400422	. NAMEPLATE, Bell & Howell	1	
-1J	400479	. NAMEPLATE, Specialist	1	
-2	33388	SCREW, Rear cover attaching	7	
-3	09914	COVER ASSY, Rear	1	
-3A	33494	. GUARD, Rubber (ventilation grille)	2	
-3B	011175	. GRILLE, Ventilation (front)	1	
-3C	09946	. GRILLE, Ventilation (rear)	1	
-3D	33374	. BEZEL, Speaker receptacle	1	
-4	33438	ADAPTER, Grounding, 3-wire	1	
-5	09809	CABLE ASSY, Power	1	
-6	400476	MOLDING, Main plate	1	
-7	33391	SCREW, Carrying handle cap	2	
-8	33371	CAP, Carrying handle	1	
-9	33368	BODY, Carrying handle	1	
-10	33370	GRIP, Rubber	1	
-11	33392	SCREW, Carrying handle strap	4	
-12	33369	STRAP, Carrying handle	1	
-13	33300	SPACER, Handle strap (front end only)	2	
-14	33299	RING, Retaining (cover latch stud)	2	
-15	33301	STUD, Cover latch	2	
-16	09910	LEVER ASSY, Cover release	1	
-17	33302	SPRING, Release lever	1	
-18	31342	BELT, Take-up timing	1	
-19	24047	BELT, Take-up	1	
-20	24049	SETSCREW, Rear reel arm bearing	2	
-21	09772	BEARING, Rear reel arm	1	
-22	10750	SPRING, Clutch cam	1	
-23	5238	BALL, Steel	3	
-24	31338	CAM, Clutch	1	
-25	31237	WASHER, Nylon	1	
-26	31351	RETAINER, Clutch ball (rear arm)	1	
-27	09771	SPROCKET ASSY, Rear arm	1	
-28	24049	SETSCREW, Front reel arm collar	2	
-29	31345	COLLAR, Front reel arm	1	
-30	09770	SPROCKET ASSY, Rewind	1	
-31	31237	WASHER, Nylon	1	
-32	10750	SPRING, Clutch cam	1	
-33	5238	BALL, Steel	3	
-34	31338	CAM, Clutch	1	
-35	31346	RETAINER, Clutch ball (front arm)	1	
-36	09765	SPROCKET ASSY, Reverse take-up	1	
-37	31237	WASHER, Nylon	1	
-38	31372	WASHER, Brass	2	
-39	33436	SPEED NUT, Reel arm	2	
-41	31358	DISC, Reel arm lock (front)	1	
-41A	34765	DISC, Reel arm lock (rear)	1	
-42	09849	ARM ASSY, Front (See Figure 5 for breakdown)	1	
-43	09850	ARM ASSY, Rear (See Figure 6 for breakdown)	1	
-44	31370	WASHER, Bronze	2	

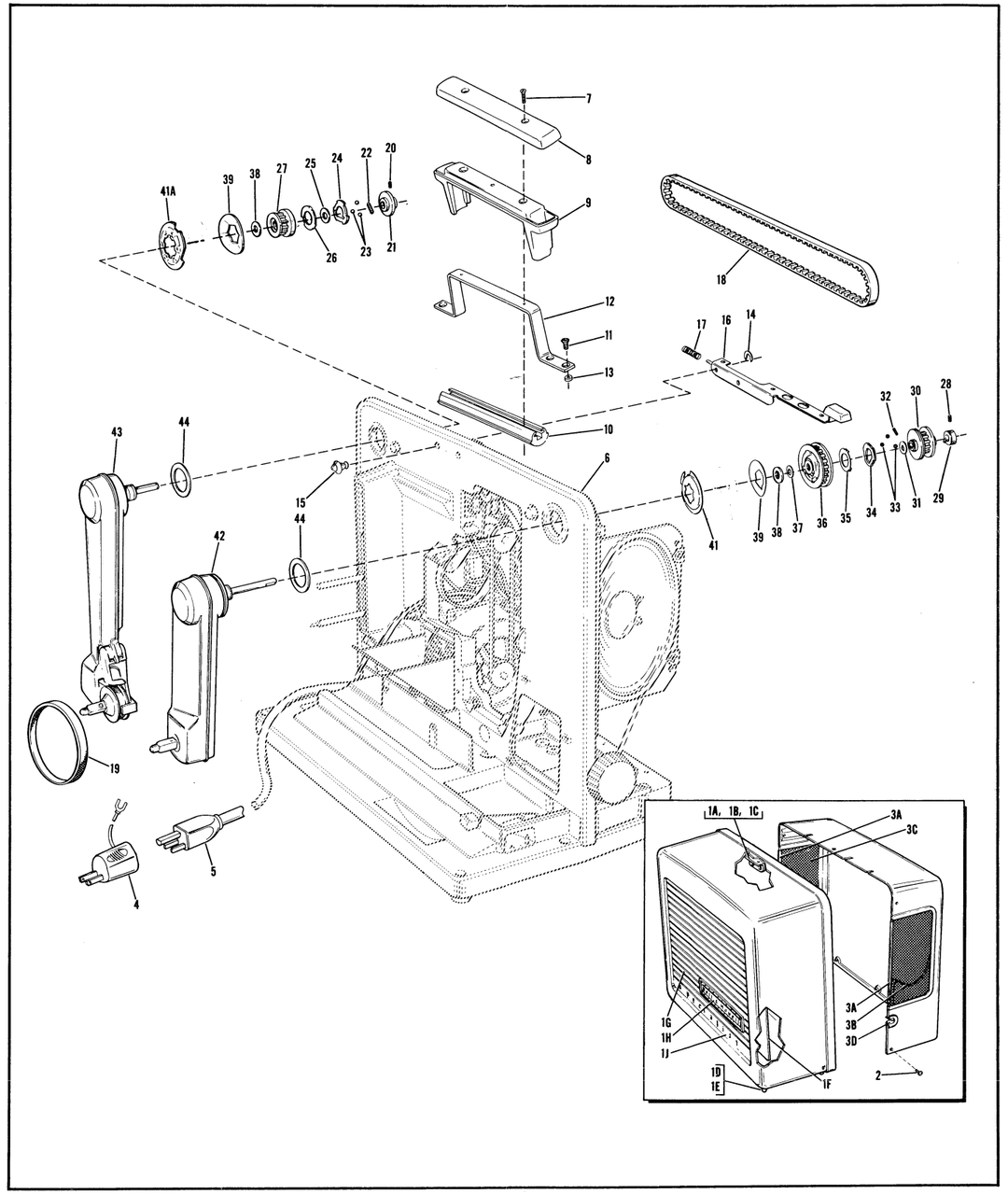


Figure 1. Filmosound Projector Main Plate Exploded (Sheet 1)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR MAIN PLATE (CONT)		
2-1	34780	NAMEPLATE, Threading guide	1	
-2	33460	LAMP, Projection, 750 watt	1	A
-2	33459	LAMP, Projection, 1000 watt	1	B
-3	09811	CONDENSER LENS ASSY	1	
-3A	31583	. SPRING, Condenser retaining	1	
-3B	200454	. LENS, 2nd condenser	1	
-3C	31584	. SPRING, Condenser	1	
-3D	200453	. LENS, 1st condenser	1	
-3E	31582	. HOUSING, Condenser lens	1	
-4	31930	SCREW, Projection lampholder attaching	2	
-5	09759	LAMPHOLDER ASSY, Projection (See Fig. 7 for breakdown)	1	
-6	30164	SCREW, Pulley shield attaching	2	
-7	31340	SHIELD, Pulley	1	
-8	09896	KNOB, Volume control	1	
-9	09887	KNOB, Tone control	1	
-10	34793	SETSCREW, Projector control knob (one req'd Design 540)	2	
-11	09813	KNOB, Projector control (one req'd Design 540)	2	
-12	31943	SCREW, Switch nameplate	3	
-13	09821	NAMEPLATE, Switch	1	A
-13	011179	NAMEPLATE, Switch	1	B
-14	98757	SCREW, Lamp designation nameplate	2	B
-15	31622	NAMEPLATE, Lamp designation	1	B
-16	011180	SWITCH ASSY, Selector (includes the following 3 items)	1	B
	34829	. SWITCH, Selector	1	B
	33279	. GUARD, Switch	1	B
	33280	. BRACKET, Switch mounting	1	B
-17	09819	BAFFLE, Pilot lamp	1	
-18	430076	LAMP, Pilot	1	
-19	30164	SCREW, Lamphouse attaching	3	
-20	011160	LAMPHOUSE ASSY (See Fig. 8 for breakdown)	1	
-21	31930	SCREW, Pilot lamp bracket attaching	2	
-22	09822	BRACKET ASSY, Pilot lamp	1	
-22A	19025	. RIVET, Pilot lamp socket	1	
-22B	09823	. SOCKET ASSY, Pilot lamp	1	
-23	31632	STUD, Snubber roller	1	
-23A	34809	SCREW, Film guide	1	
-23B	2843	NUT, Hex	1	
-24	09805	SNUBBER ROLLER ASSY	1	
-25	31644	SPRING, Snubber roller	1	
-26	31634	WASHER, Plain	1	
-27	31633	DETENT, Snubber roller	1	
-28	33487	TUBING, Extruded	1	
-29	31918	SPRING, Film exit guide	1	
-30	605222	SCREW, Idler roller	1	
-31	09747	ROLLER, Idler	1	
-32	31915	SHAFT, Idler roller	1	
-33	31917	GUIDE, Film exit (outer)	1	
-34	31916	GUIDE, Film exit (inner)	1	
-35	301502	SCREW, Grounding spring	1	
-36	33418	SPRING, Grounding	1	
-37	31476	NUT, Flywheel	1	
-38	31592	FLYWHEEL	1	
-39	31491	SCREW, Bdg hd, sound head attaching (rear)	2	
-50	31491	SCREW, Bdg hd, sound head attaching (front)	1	
-41	011172	SOUND HEAD ASSY (See Fig. 9 for breakdown)	1	
-44	399026	SCREW, Mechanism assembly attaching	4	
-45	31243	WASHER, Steel	4	
-46	31219	MOUNT, Resilient	4	
-47	011168	MECHANISM ASSY (See Fig. 10 for breakdown)	1	A
-47	011169	MECHANISM ASSY (See Fig. 10 for breakdown)	1	B

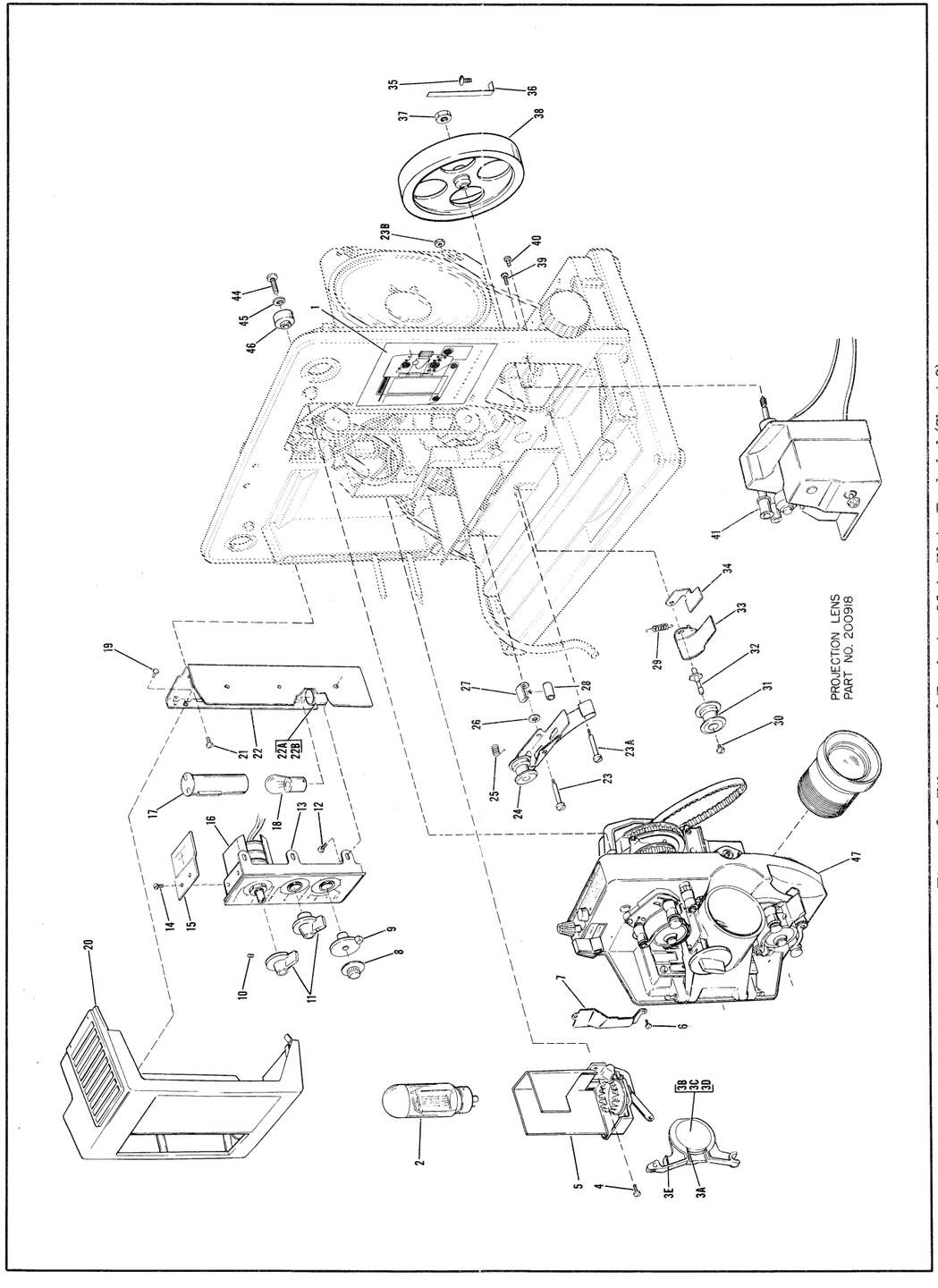


Figure 2. Filmosound Projector Main Plate Exploded (Sheet 2)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR MAIN PLATE (CONT)		
3-1	11445	SETSCREW, Collar	2	B
-2	31481	COLLAR, Clutch rod	2	B
-3	31482	SPRING, Clutch rod	1	B
-4	399019	SCREW, Clutch solenoid	2	B
-5	011162	SOLENOID AND ROD ASSY, Clutch	1	B
-6	301366	SCREW, Solenoid bracket	3	B
-7	33285	BUSHING	3	B
-8	31489	GROMMET, Rubber	3	B
-9	33281	BRACKET, Solenoid mounting	1	B
-10	33283	ROD, Fire shutter solenoid	1	B
-11	80969	SCREW, Fire shutter solenoid	2	B
-12	011163	SOLENOID ASSY, Fire shutter	1	B
-13	31943	SCREW, Solenoid bracket	2	B
-14	09879	BRACKET, Solenoid	1	B
-15	31493	SCREW, Speaker bracket	1	
-16	31499	SCREW, Speaker mounting	2	
-17	31936	NUT, Push-on	2	
-18	09810	SPEAKER ASSY	1	
-19	31928	SCREW, Starting capacitor	1	
-20	601190	NUT, Hex	1	
-21	31503	CLAMP, Starting capacitor	1	
-22	31266	CAPACITOR, Starting	1	
-23	31697	SCREW, Motor relay	2	
-24	601190	NUT, Hex	2	
-25	33427	RELAY, Motor	1	
-26	31049	SCREW, Relay bracket	2	
-27	31914	BRACKET, Relay	1	
-28	31049	SCREW, Idler assembly attaching	4	
-29	09768	IDLER ASSY	1	
-29A	614240	. RING, Retaining	1	
-29B	611107	. ROLLER, Idler	1	
-30	09769	IDLER ASSY	1	
-30A	614240	. RING, Retaining	1	
-30B	611107	. ROLLER, Idler	1	
-31	31493	SCREW, Lock bracket	4	
-32	31232	BRACKET, Reel arm lock	2	
-33	31231	SPRING, Reel arm plunger	2	
-34	09888	PLUNGER ASSY, Reel arm lock	2	
-35	31687	BELT, Blower	1	
-36	31550	SCREW, Bar stop bracket	2	
-37	31919	BRACKET, Bar stop	1	
-38	31921	SPRING, Belt shift	1	
-39	31265	STRAP, Motor bracket (includes screw and nut)	2	
-40	09817	MOTOR ASSY, Drive (includes 40A thru 40D)	1	
-40A	33428	. MOTOR, Drive	1	
-40B	70345	. SUPPORT, Cushion (motor)	2	
-40C	28820	. TERMINAL, Tab snap-on	1	
-40D	32093	. TERMINAL, Flag snap-on	2	
-41	31341	BELT, Flat	1	
-42	31339	SHIFTER, Belt	1	
-43	33348	SETSCREW, Bar bracket	1	
-44	34817	BRACKET, Bar	1	
-45	31909	SETSCREW, Belt shift stop	1	
-46	31920	STOP, Belt shift	1	
-47	31907	SETSCREW, Motor pulley	1	
-48	31334	PULLEY, Motor (See Note on facing page)	1	
-49	31939	RESISTOR (with mounting parts)	1	
-49A	99301	WASHER, Shakeproof	1	
-50	31690	SCREW, Mounting plate and motor bracket	4	
-51	31698	PLATE, Resistor mounting	1	
-52	31263	BRACKET, Motor mounting	2	

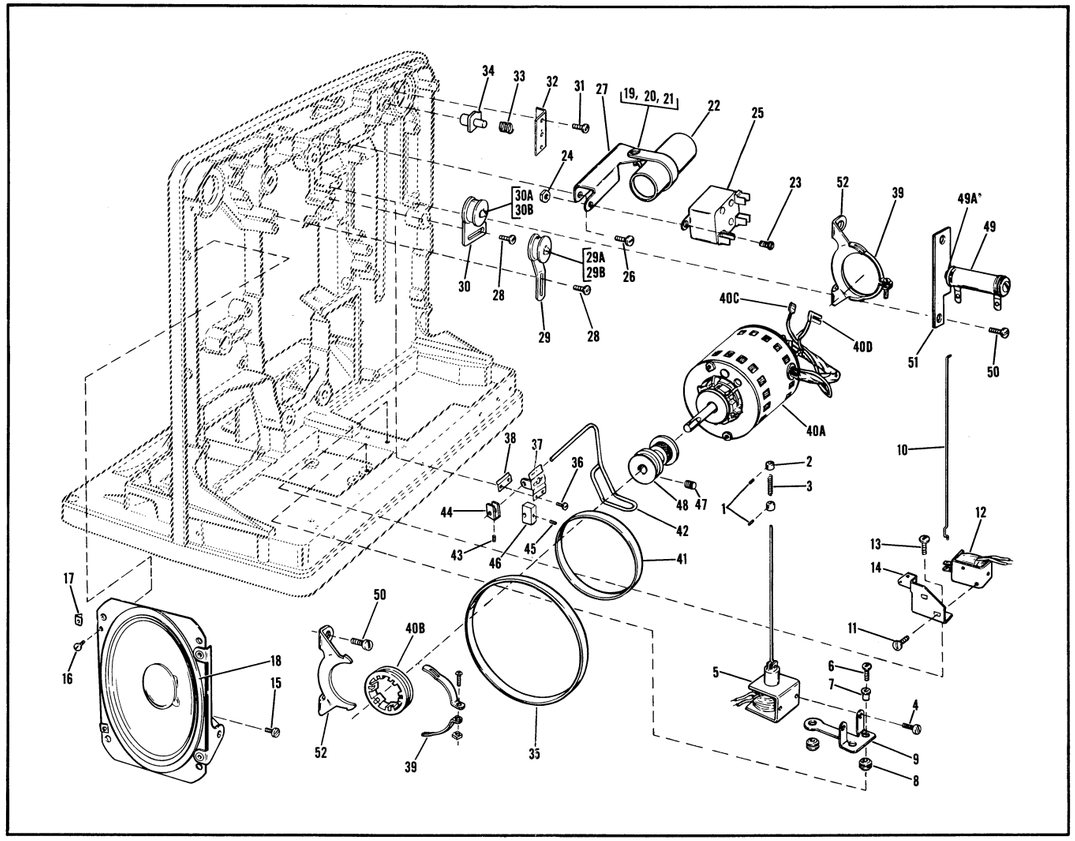


Figure 3. Filmosound Projector Main Plate Exploded (Sheet 3)

NOTE: When replacing the pulley (item 48), note the color and replace with a like pulley.

Blue pulley, part no. 34802
Black pulley, part no. 34803
Plain pulley, part no. 34804
Red pulley, part no. 31334

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR MAIN PLATE (CONT)		
4-1	600803	. SCREW, Switch bracket	2	
-2	24436	. WASHER, Lock	2	
-3	31923	. BRACKET, Rotary switch.	1	
-4	31940	. SWITCH, Rotary.	1	
-5	31499	. SCREW, Blower bracket	4	
-6	14175	. WASHER, Lock	4	
-7	31692	. BRACKET, Blower	2	
-8	09762	. BLOWER ASSY (See Fig. 19 for breakdown)	1	
-9	011174	. DEFLECTOR, Air	1	
-10	31691	. SCREW, Amplifier mounting	3	
-11	31977	. WASHER, Flat	3	
-12	09920	. AMPLIFIER ASSY (See Fig. 20 for breakdown)	1	
-13	12636	. SETSCREW, Tilt knob	1	
-14	09902	. KNOB, Tilt	1	
-15	31699	. SCREW, Tilt bar	1	
-16	8179	. WASHER, Lock	1	
-17	09802	. BAR ASSY, Tilt	1	
-17A	31561	. . FOOT, Rubber	2	
-18	31694	. SCREW, Tilt mechanism	2	
-19	25266	. WASHER, Lock	2	
-20	09803	. MECHANISM ASSY, Tilt	1	
-20A	31567	. . PIN, Spring	2	
-20B	31559	. . RACK, Tilt	1	
-20C	31568	. . PIN, Spring	1	
-20D	31565	. . PINION, Tilt	1	
-20E	21736	. . RING, Retaining	1	
-20F	31039	. . WASHER, Flat	1	
-20G	34822	. . WASHER, Spring	1	
-20H	31564	. . GEAR, Tilt worm	1	
-20J	31039	. . WASHER, Flat	1	
-20K	31563	. . HOUSING, Tilt	1	
-21	09935	. JACK ASSY, Speaker (incl. mtg. parts)	1	
-22	34814	. NAMEPLATE, Speaker jack	1	
	25368	. WASHER, Lock (between jack and casting)	1	
-23	31931	. INSULATOR, Upper	1	
-24	31550	. SCREW, Terminal strip	1	
-25	09877	. STRIP ASSY, Terminal	1	
-25A	33268	. . BY-PASS, Line.	1	
-26	33421	. INSULATOR, Terminal strip	1	
-27	31684	. SWITCH, Interlock (incl. mtg. parts)	1	
-28	31928	. SCREW, Interlock switch bracket	2	
-29	601190	. NUT, Hex	1	
-30	31695	. BRACKET, Interlock switch	1	
-31	31696	. SPRING, Leaf (between bracket and casting)	1	
-32	34788	. SCREW, Interlock switch adjusting	1	
-33	31938	. INSULATOR (Below interlock switch)	1	
	09815	. RECEPTACLE, Room lamp (rear of projector base)	1	
-34	18086	. FOOT, Rubber.	4	
-35	33296	. PLATE, Main	1	
-36	33360	. BASE, Projector	1	

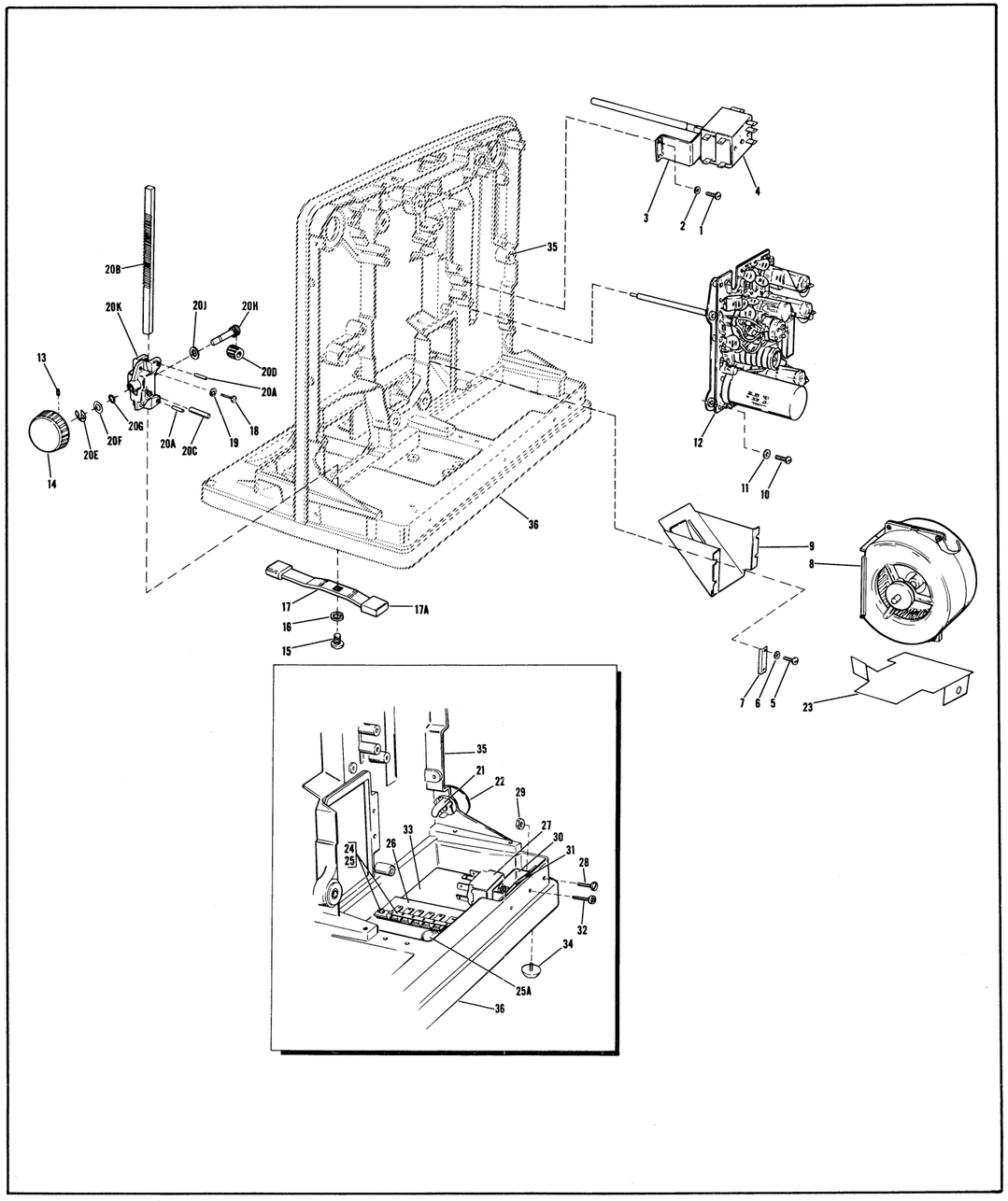


Figure 4. Filmosound Projector Main Plate Exploded (Sheet 4)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		FRONT REEL ARM ASSY		
5-	09849	REEL ARM ASSY, Front	REF	
-1	24270	. SCREW, Reel arm cover	2	
-2	14175	. WASHER, Lock	2	
-3	31361	. COVER, Front reel arm	1	
-4	31366	. PIN, Spring	1	
-5	31363	. COLLAR, Feed spindle	1	
-6	31365	. PIN, Straight	1	
-7	31364	. SPRING, Torsion	1	
-8	09776	. GEAR ASSY, Lower	1	
-9	31371	. WASHER, Brass	2	
-10	09774	. SPINDLE ASSY, Feed	1	
-11	31359	. WASHER, Steel	1	
-12	24049	. SETSCREW, Upper gear	2	
-13	09754	. GEAR ASSY, Upper	1	
-14	31369	. SPRING, Clutch	1	
-15	24903	. RING, Retaining, clutch disc	2	
-16	09779	. DISC ASSY, Clutch	1	
-17	31372	. WASHER, Brass	2	
-18	31245	. RING, Retaining	1	
-19	31241	. CLIP, Gear retaining	2	
-20	31239	. GEAR, Spur (lower)	1	
-20A	33385	. GEAR, Spur (upper)	1	
-21	31243	. WASHER, Steel	1	
-22	31360	. SHAFT, Drive	1	
-23	31236	. BEARING, Nylon	2	
-24	17639	. RING, Retaining	2	
-25	31367	. SHOE, Friction	1	
-26	09778	. BRACKET ASSY, Friction shoe	1	
-27	09777	. DISC ASSY, Spline bearing	1	
-28	31370	. WASHER, Bronze	1	
-29	31356	. SHAFT, Front reel arm	1	
-30	09752	. BEARING ASSY, Splined	1	
-30A	31911	. . BEARING, Needle	2	
-31	30171	. SCREW, Eccentric stop	1	
-32	31368	. STOP, Eccentric	1	
-33	09775	. ARM AND BEARING ASSY, Front	1	
-33A	31911	. . BEARING, Needle	1	
-33B	31375	. . BEARING, Needle (closed end)	1	

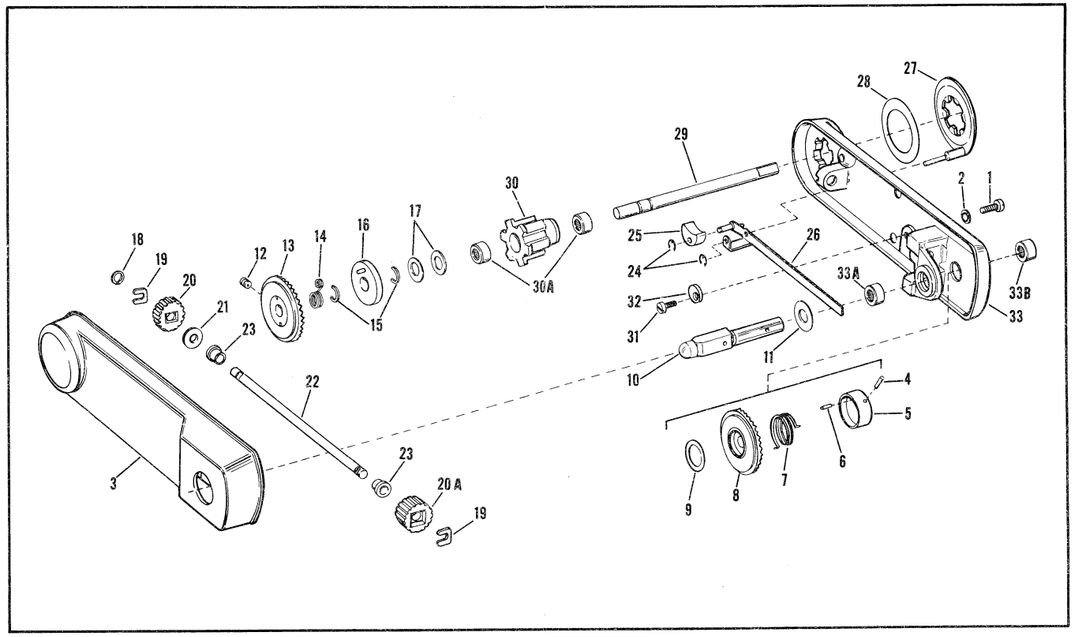


Figure 5. Front Reel Arm Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		REAR REEL ARM ASSY		
6-	09850	REEL ARM ASSY, Rear	REF	
-1	31240	. SPRING, Tension (take-up arm)	1	
-2	31247	. SCREW, Socket head	1	
-3	09753	. SPINDLE AND PULLEY ASSY, Take-up	1	
-4	24043	. PIN, Take-up arm	1	
-5	09755	. ARM ASSY, Take-up	1	
-5A	31911	. . BEARING, Needle	2	
-6	24270	. SCREW, Reel arm cover	2	
-7	14175	. WASHER, Lock	2	
-8	31251	. COVER, Rear reel arm	1	
-9	31245	. RING, Retaining (upper spur gear)	1	
-10	31241	. CLIP, Gear retaining	2	
-11	31239	. GEAR, Spur (lower)	1	
-12	33385	. GEAR, Spur (upper)	1	
-13	31243	. WASHER, Steel	1	
-14	614240	. RING, Retaining (lower gear assy)	1	
-15	09756	. PULLEY AND GEAR ASSY, Lower	1	
-16	31235	. BEARING, Nylon	2	
-17	31242	. PLUNGER, Spring	1	
-18	31246	. SPRING, Compression	1	
-19	31244	. RING, Retaining	1	
-20	31907	. SETSCREW, Rewind drive shaft	1	
-21	31234	. SHAFT, Rewind drive	1	
-22	31238	. SHAFT, Drive	1	
-23	31236	. BEARING, Nylon	2	
-24	24049	. SETSCREW, Upper gear assembly	2	
-25	09754	. GEAR ASSY, Upper	1	
-26	31372	. WASHER, Brass	1	
-27	31233	. SHAFT, Rear reel arm	1	
-28	09752	. BEARING ASSY, Splined	1	
-28A	31911	. . BEARING, Needle	2	
-29	31249	. ARM, Rear	1	
		PROJECTION LAMPHOLDER ASSY		
7-	09759	LAMPHOLDER ASSY, Projection	REF	
-1	31943	. SCREW, Heat shield attaching	3	
-2	31273	. BAFFLE, Lamp	1	
7-	011280	. SOCKET AND BRACKET ASSY (includes 3 thru 8)	1	
-3	31604	. . PIN, Lamp release lever	1	
-4	31605	. . LEVER, Lamp release	1	
-5	31019	. . WASHER, Tension	1	
-6	700816	. . RIVET, Lamp socket attaching	2	
-7	30707	. . SOCKET, Projection lamp	1	
-8	31602	. . BRACKET, Lamp socket	1	
		LAMPHOUSE ASSY		
8-	011160	LAMPHOUSE ASSY	REF	
-1	31971	. NAMEPLATE, Specialist	1	
-2	34812	. SCREW, Reflector attaching	2	
-3	31933	. SHIELD, Lamp	1	
-4	34753	. WASHER	4	
-5	34751	. BUSHING	2	
-6	31937	. REFLECTOR, Heat	1	
	011160	. LAMPHOUSE SUBASSY	1	
-7	31922	. . SCREW, Latch attaching	1	
-8	09806	. . LATCH, Lamphouse	1	
-9	83234	. . SCREW, Drive	2	
-10	33306	. . GRILLE, Lamphouse	1	
-11	33488	. . GUARD, Film	1	

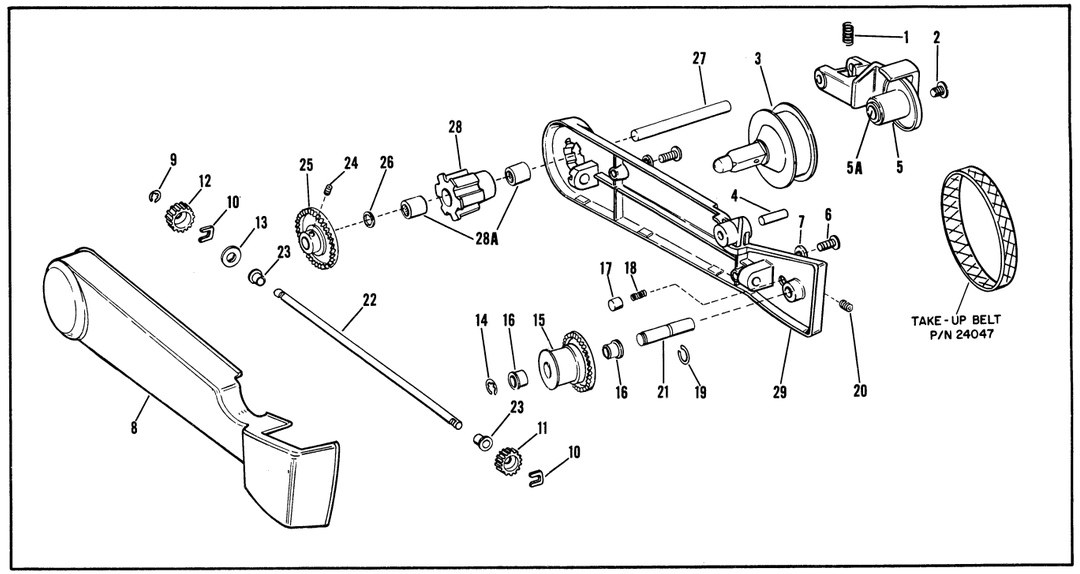


Figure 6. Rear Reel Arm Assembly

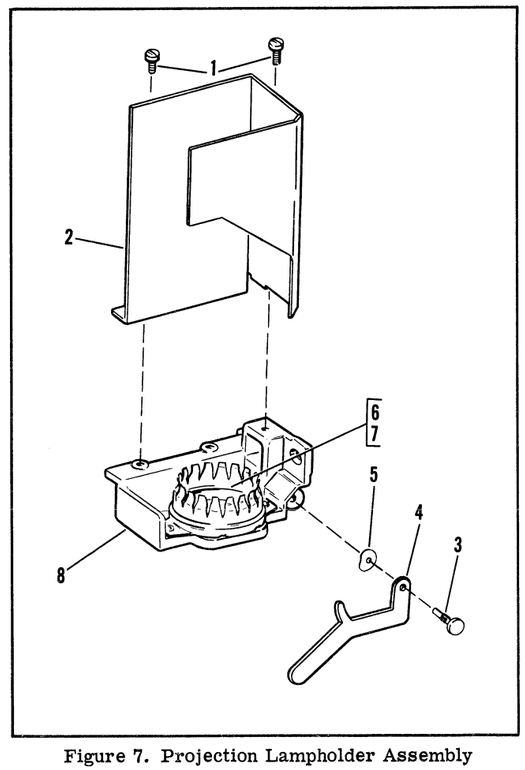


Figure 7. Projection Lampholder Assembly

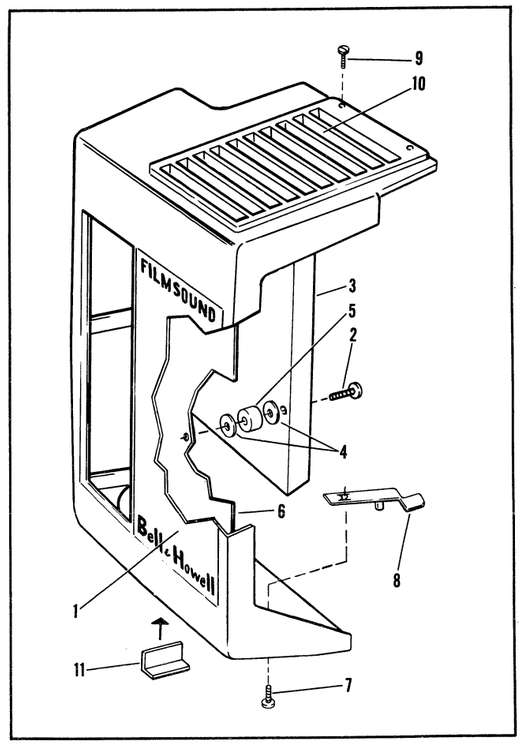


Figure 8. Lamphouse Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		SOUND HEAD ASSEMBLY		
9-	011172	SOUND HEAD ASSY	REF	
-1	011167	. COVER ASSY, Exciter lamp	1	
-1A	20808	. . RING, Retaining	1	
-1B	09829	. . SCREW, Cover retaining	1	
-1C	34787	. . RUBY, Indicating	2	
-1D	34773	. . COVER, Lamp	1	
-2	33307	. LAMP, Exciter	1	
-3	24271	. SCREW, Optical slit clamping	1	
-4	*020240	. OPTICAL SLIT ASSY (Bell & Howell)	1	
-4	*200828	. OPTICAL SLIT ASSY (Simpson)	1	
-5	31671	. RING, Retaining	1	
-6	31630	. SCREW, Guide roller adjusting	1	
-7	29558	. SCREW, Photocell attaching	2	
-8	09836	. PHOTOCELL ASSY	1	
-9	31667	. NUT, Hex, photocell terminal post	2	
-10	09839	. CABLE ASSY, Photocell	1	
-11	31638	. SCREW, Lamp contact attaching	2	
-12	11521	. SETSCREW, Ground lead locking	1	
-13	09828	. CONTACT ASSY, Exciter lamp	1	
-14	09840	. LEADWIRE ASSY, Lamp contact	1	
-15	31636	. RING, Lamp release	1	
-18	301435	. SCREW, Photocell holder clamping	1	
-19	31663	. HOLDER, Photocell	1	
-20	11521	. SETSCREW, Light pipe locking	1	
-21	12636	. SETSCREW, Sound drum shaft locking	2	
-22	09831	. SHAFT ASSY, Sound drum	1	
-23	31669	. RETAINER, Light pipe	1	
-24	200526	. LIGHT PIPE	1	
-25	09826	. SCREW ASSY, Edge guide	1	
-26	30163	. SCREW, Film guide roller	2	
-27	31674	. WASHER, Steel	2	
-28	09834	. ROLLER, Flanged	1	
-29	09835	. ROLLER, Plain	1	
-30	31673	. SPRING, Extension	1	
-31	30164	. SCREW, Spring terminal	1	
-32	31675	. TERMINAL, Spring	1	
-33	30164	. SCREW, Stabilizer arm	2	
-34	09833	. ARM, Stabilizer	1	
-35	09832	. ARM ASSY, Stabilizer (lower)	1	
-36	31672	. SPRING, Stabilizer arm	1	
-37	09838	. ARM ASSY, Stabilizer (upper)	1	
-38	31596	. HOUSING, Sound head	1	

*NOTE: Optical slit assemblies 020240 and 200828 are interchangeable.

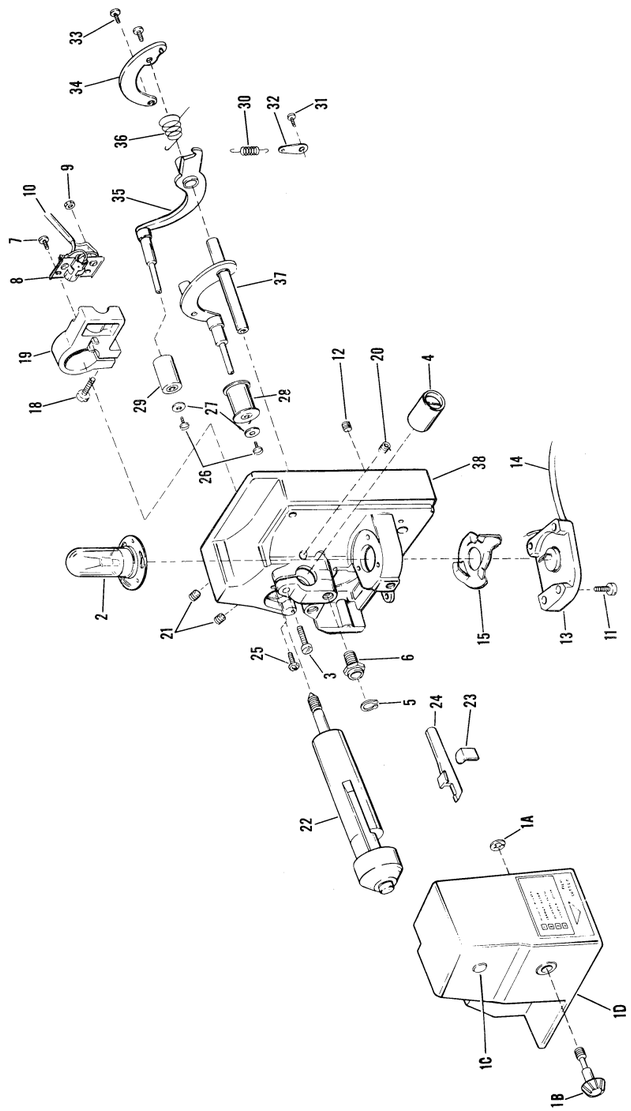


Figure 9. Sound Head Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY, COMPLETE		
10-	011168	MECHANISM ASSY, Complete	REF	A
10-	011169	MECHANISM ASSY, Complete	REF	B
-1	31957	. PIN, Hinge (upper)	2	
-2	31019	. WASHER, Spring	1	
-3	31020	. WASHER, Flat	1	
-4	09899	. LENS CARRIER ASSY (See Fig. 14 for breakdown)	1	
-5	620899	. SETSCREW, Speed change knob	1	
-6	09844	. KNOB, Speed change	1	
-7	31956	. NAMEPLATE, Silent-Sound	1	
-8	31038	. RING, Retaining	4	
-9	31012	. SPRING, Belt shift lever	1	
-10	31014	. CRANK, Belt shift	1	
-11	31473	. SCREW, Guard roller	1	
-12	34784	. WASHER	1	
-13	34825	. ROLLER, Sprocket guard	1	
-14	31164	. BEARING, Nylon	2	
-15	34824	. POST, Roller	1	
-16	24270	. SCREW, Outboard bearing	3	
-17	14175	. WASHER, Lock	3	
-18	17639	. RING, Retaining	2	
-19	31045	. SHAFT, Clutch lever	1	
-20	09721	. BEARING ASSY, Outboard (includes following parts)	1	
	31906	. . RIVET	3	
	31121	. . RETAINER, Bearing	1	
	7994	. . BEARING	1	
	31120	. . RING, Felt	1	
-21	31041	. LEVER, Rewind clutch	1	
-22	31044	. BUTTON, Rewind	1	
-23	31042	. SPRING, Rewind button	1	
-24	31023	. BELT, Rewind timing	1	
-25	614240	. RING, Retaining	2	
-26	09724	. SPROCKET ASSY, Rewind drive	1	
-27	31039	. WASHER, Flat	1	
-28	31040	. SPRING, Compression	1	
-29	09730	. DRIVER ASSY, Spline	1	
-30	24049	. SETSCREW, Take-up drive sprocket	2	
-31	09723	. SPROCKET ASSY, Take-up drive	1	
-32	25837	. SCREW, Sprocket guard	2	
-33	34774	. GUARD, Sprocket	1	
-34	620901	. SETSCREW, Sprocket gear	4	
-35	09757	. GEAR ASSY, Sprocket	2	
-36	31015	. WASHER, Sprocket tension	2	
-37	09719	. SPROCKET ASSY, Upper	1	
-38	09716	. SPROCKET ASSY, Lower	1	
-39	31017	. WASHER, Sprocket thrust	2	
-40	31551	. SCREW, Sprocket guard assy	2	
-41	09731	. GUARD ASSY, Sprocket (see Fig. 15 for breakdown)	1	

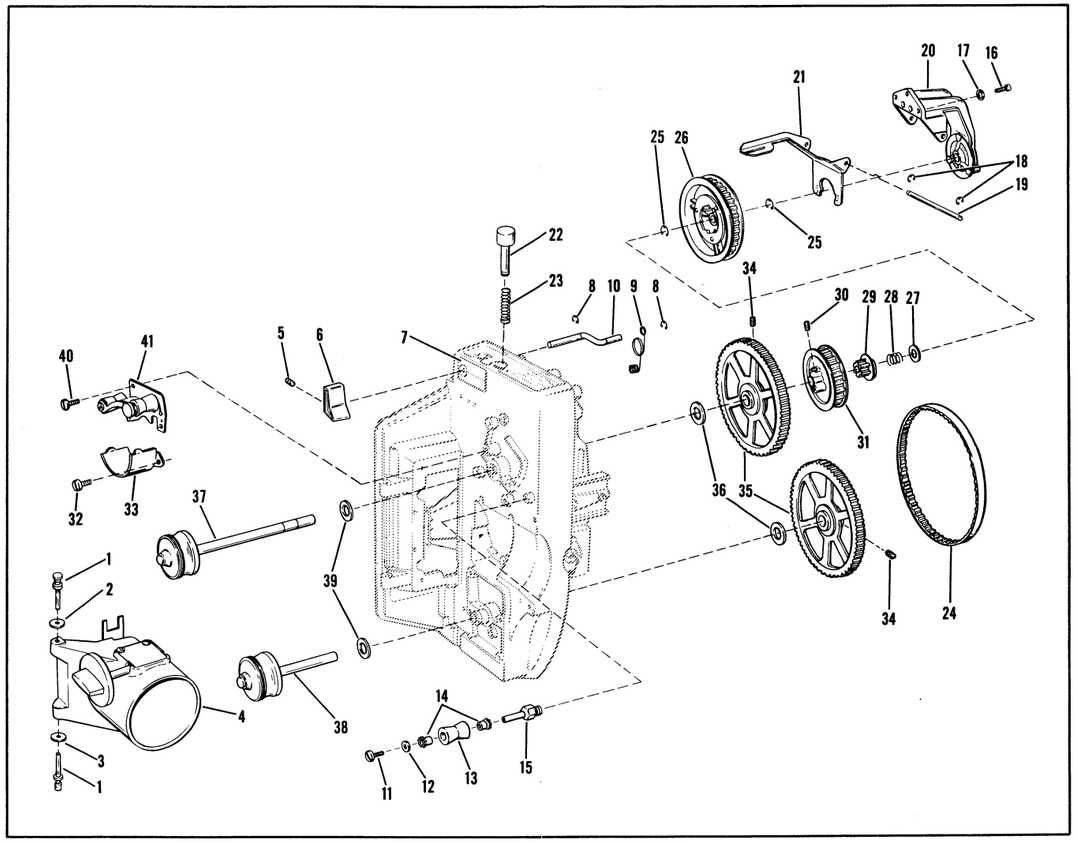


Figure 10. Mechanism Assembly (Sheet 1)

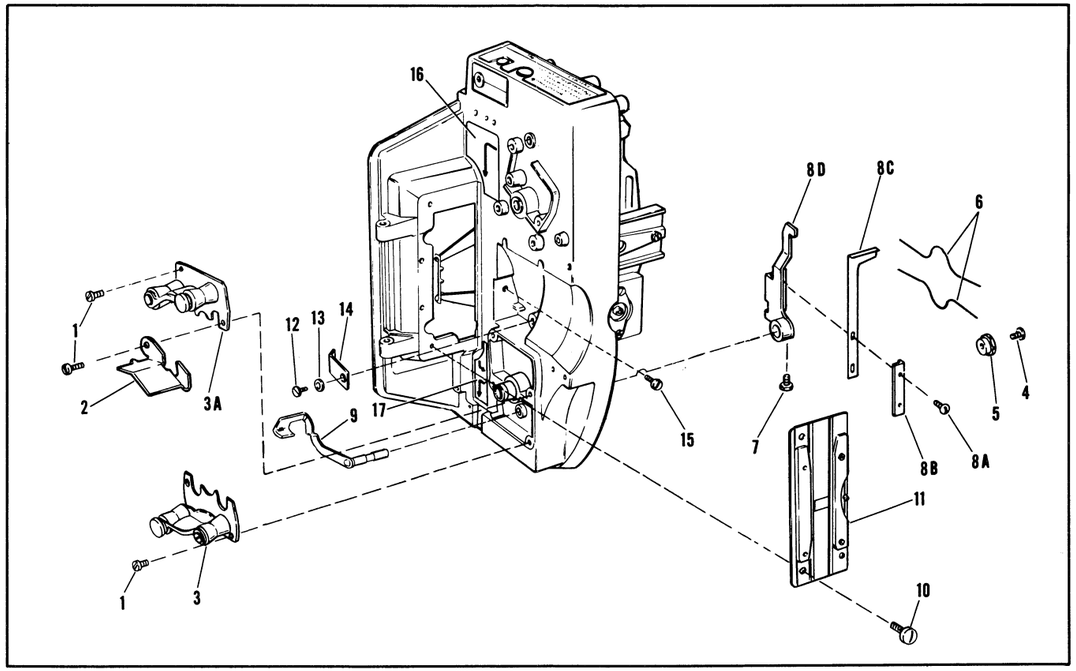


Figure 11. Mechanism Assembly (Sheet 2)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY, COMPLETE (CONT)		
11-1	31551	. SCREW, Sprocket guard	4	
-2	34775	. GUIDE, Threading	1	
-3	09731	. GUARD ASSY, Sprocket (see Fig. 15 for breakdown)	1	
-3A	011178	. GUARD ASSY, Sprocket (see Fig. 15 for breakdown)	1	
-4	31499	. SCREW, Eccentric anchor	1	
-5	31470	. ANCHOR, Eccentric	1	
-6	31469	. SPRING, Overcenter	2	
-7	33347	. SCREW, Cam follower support (p/o item 8)	1	
-8	09843	. SUPPORT ASSY, Cam follower	1	
-8A	31555	. . SCREW, Cam follower	2	
-8B	31474	. . BRACKET, Follower alinement	1	
-8C	31425	. . FOLLOWER, Cam	1	
-8D	09786	. . SUPPORT	1	
-9	09797	. ARM ASSY, Restoring	1	
-10	31049	. SCREW, Aperture plate	2	
-11	09873	. PLATE ASSY, Aperture (see Fig. 16 for breakdown)	1	
-12	31943	. SCREW, Lens carrier catch	1	
-13	14175	. WASHER, Lock	1	
-14	33261	. CATCH, Lens carrier	1	
-15	33260	. SCREW, Lens stop	1	
-16	34778	. NAMEPLATE, Threading (upper)	1	
-17	34779	. NAMEPLATE, Threading (lower)	1	

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSEMBLY, COMPLETE (CONT)		
12-1	12636	. SETSCREW, Mechanism pulley	2	
-2	31021	. PULLEY, Mechanism	1	
-3	31943	. SCREW, Fire shutter and heat baffle	4	
-4	31960	. SCREW, Condenser	1	
-5	09729	. SHUTTER ASSY, Fire (see Fig. 17 for breakdown)	1	B
-5A	31154	. BRACKET, Support	1	A
-6	31022	. BAFFLE, Heat	1	
-7	31005	. NUT, Shutter	1	
-8	31037	. WEIGHT, Counterbalance	1	
-9	31004	. SHUTTER, Three-blade	1	
-9A	34797	. WASHER, Fiber	1	
-10	09712	. SUPPORT ASSY, Bearing	1	
-11	31557	. SHUTTLE	1	
-12	31011	. BEARING, Shuttle link	2	
-13	09706	. ARM ASSY, Shuttle	2	
-14	31003	. FOLLOWER, Pull-down cam	2	
-15	31010	. NUT, Stud assembly	2	
-16	09703	. BALL AND STUD ASSY	2	
-17	33346	. CAM, Pull-down	1	
-18	31025	. WICK, Cam oiler	2	
-19	31049	. SCREW, In-out bracket	2	
-20	14175	. WASHER, Lock	2	
-21	31001	. CAM, In-out	1	
-22	09715	. BRACKET ASSY, In-out	1	A
-22	09878	. BRACKET ASSY, In-out	1	B
-22A	30163	. . SCREW, Shuttle guide shoe	2	
-22B	31901	. . SHOE, Shuttle guide	1	
-22C	31558	. . PLATE, Cam bracket	1	
-22D	09702	. . FOLLOWER, Cam	1	
-22E	31100	. . SPRING, In-out	1	
-23	24452	. SCREW, Shuttle arm plate	2	
-24	14175	. WASHER, Lock	2	
-25	31032	. NUT, Round	2	
-26	09705	. PLATE ASSY, Shuttle arm	1	
-26A	98763	. PIN, Roll	1	
-27	09732	. KNOB AND SHAFT ASSY, Framer	1	
-28	20808	. RING, Retaining	2	B
-29	31396	. SHAFT, Stop pawl	1	B
-30	33258	. SPRING, Torsion	1	B
-31	31026	. PAWL, Stop	1	B
-32	24851	. SCREW, Shoulder	2	B
-33	31027	. BRACKET, Stop pawl shaft	1	B
-34	24852	. GROMMET, Rubber	2	B
-35	31049	. SCREW, Clutch stop	2	B
-36	33259	. STOP, Clutch	1	B
-37	31398	. BRACKET, Bearing	1	B

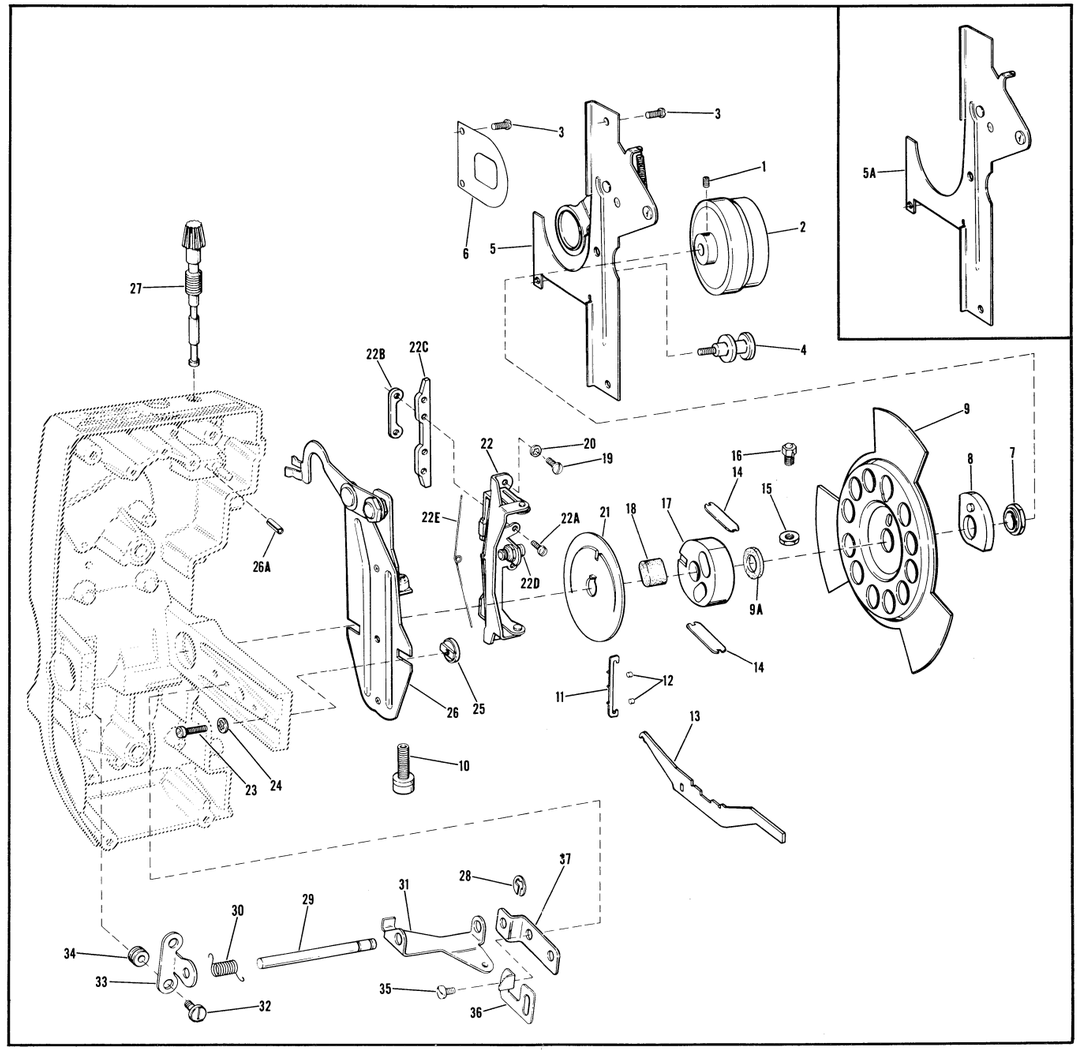


Figure 12. Mechanism Assembly (Sheet 3)

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM ASSY, COMPLETE (CONT)		
13-1	31976	. SCREW, Clutch bracket (short)	1	B
-2	30162	. SCREW, Clutch bracket (long)	1	B
-3	31977	. WASHER, Lock	2	B
-4	31397	. NUT, Round	1	B
-5	31457	. WASHER, Flat.	1	B
-6	31048	. BRACKET, Shuttle adjustment	1	B
-7	09870	. BRACKET ASSY, Animated clutch	1	B
-7A	31405	. . SETSCREW, Slide bar adjusting	1	B
-7B	17639	. . RING, Retaining	3	B
-7C	31403	. . SHAFT, Clutch bracket	1	B
-7D	31399	. . BUMPER, Slide	1	B
-7E	31456	. . WASHER, Flat	1	B
-7F	31036	. . SPRING, Compression	1	B
-7G	09886	. . BAR ASSY, Clutch slide	1	B
-7H	31555	. . SCREW, Strike	1	B
-7F	31451	. . WASHER, Flat	1	B
-7K	31050	. . STRIKE	1	B
-7L	09885	. . BRACKET ASSY, Clutch mounting	1	B
-8	31009	. RING, Retaining	1	
-9	31094	. SCREW, Loading spring	2	
-10	31553	. SPRING, Bearing loading	1	
-11	31433	. SETSCREW, Loop restorer cam	1	
-12	31007	. BEARING, Ball	1	
-13	09710	. CLUTCH ASSY, Driver	1	B
-14	31035	. SPRING, Clutch torsion	1	B
-15	09711	. CLUTCH ASSY, Driven	1	B
-16	21736	. RING, Retaining	2	B
-17	31029	. WASHER, Flat	1	B
-18	31400	. BEARING, Sleeve	1	B
-19	31145	. TRIGGER	1	B
-20	31149	. PIN, Shoulder	2	B
-21	31147	. YOKE, Clutch	1	B
-22	31148	. SPRING, Compression	1	B
-23	09728	. BEARING ASSY	1	B
-24	09709	. GEAR ASSY, Worm (See Fig. 18 for breakdown)	1	B
-24A	620905	. SETSCREW, Worm gear	2	A
-24B	09852	. GEAR, Worm	1	A
-25	31031	. BUSHING, Rubber	3	B
-26	31029	. WASHER, Flat	1	B
-27	31424	. CAM, Loop restorer	1	
-28	31078	. RING, Retaining	1	
-29	31006	. BEARING, Ball	1	
-30	31967	. CAMSHAFT	1	A
-30	31008	. CAMSHAFT	1	B
-31	31954	. NAMEPLATE, Framer-Rewind	1	
-32	31907	. SETSCREW, Rewind adjustment stud	1	
-33	31043	. STUD, Rewind adjustment	1	
-34	33490	. SCREW, Condenser holder		
-35	33489	. HOLDER, Condenser	1	
-36	31962	. WASHER, Special	1	
-37	31959	. SPRING, Condenser holder	1	
-38	011165	. HOUSING ASSY, Mechanism	1	A
-38	011166	. HOUSING ASSY, Mechanism	1	B

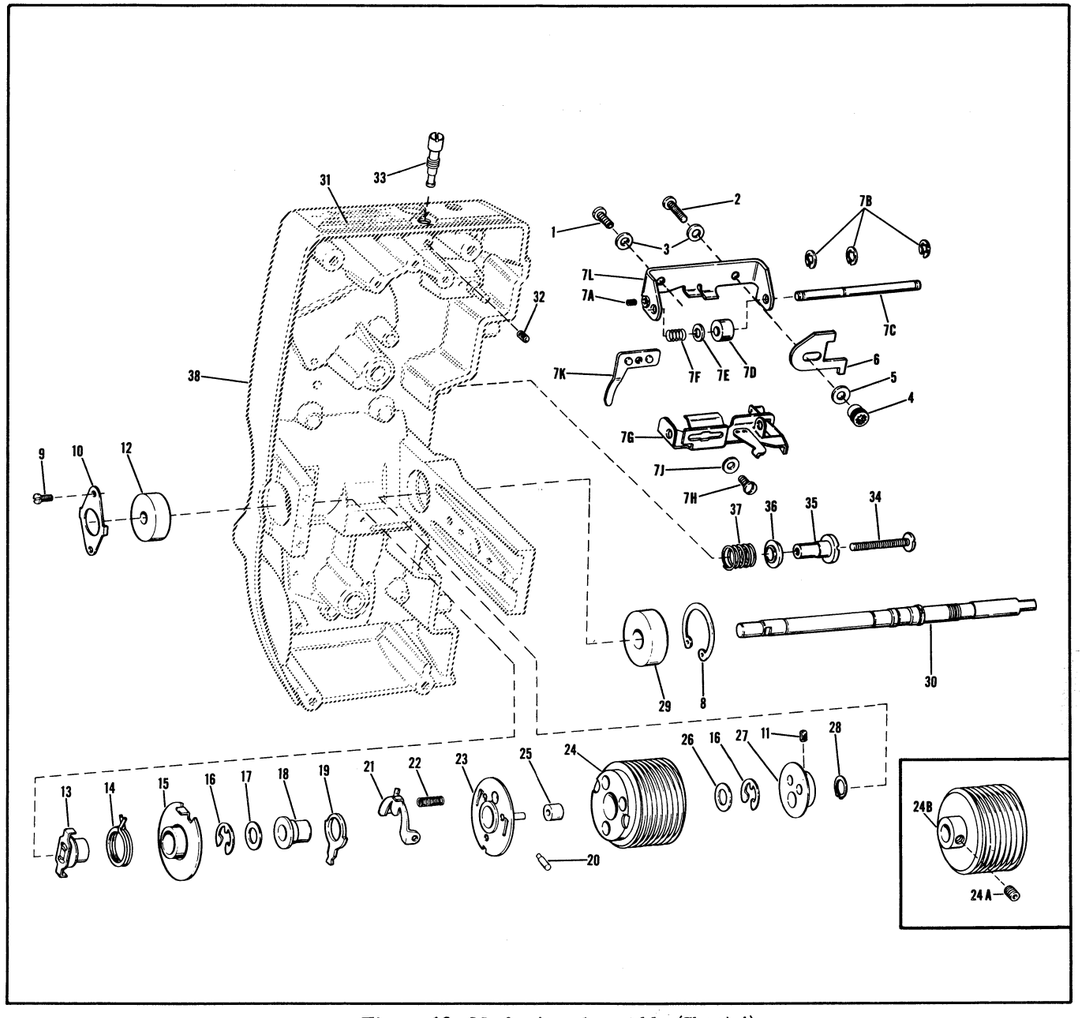


Figure 13. Mechanism Assembly (Sheet 4)

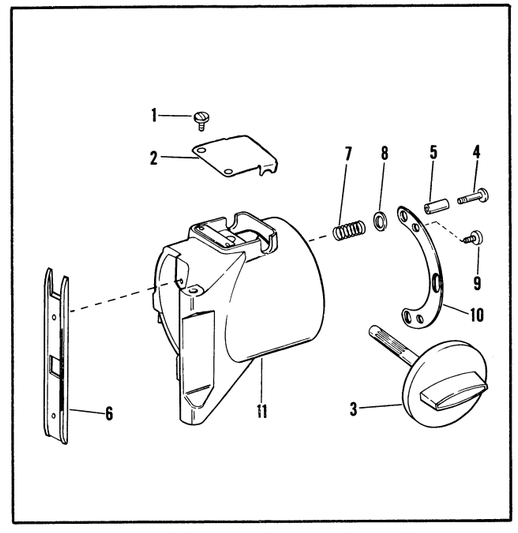


Figure 14. Lens Carrier Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		1 2 3 4 5 6 7		
		LENS CARRIER ASSEMBLY		
14-	09899	LENS CARRIER ASSY	REF	
-1	31094	. SCREW, Hold-down	2	
-2	31093	. SPRING, Pinion hold-down	1	
-3	09847	. KNOB ASSY, Focus	1	
-4	31098	. SCREW, Pressure plate	2	
-5	31097	. BUSHING, Spacer	2	
-6	31092	. PLATE, Pressure	1	
-7	31096	. SPRING, Compression	2	
-8	24366	. WASHER, Flat	2	
-9	31905	. SCREW, Adjustment plate	2	
-10	31095	. PLATE, Adjustment	1	
-11	09898	. CARRIER, Lens	1	

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		SPROCKET GUARD ASSEMBLY		
15-	011178	SPROCKET GUARD ASSY (item 11-3A)	REF	
15-	09731	SPROCKET GUARD ASSY (items 10-41 and 11-3)	REF	
-1	17639	. RING, Retaining	1	
-2	31460	. STUD, Shoulder	1	
-3	09793	. LATCH ASSY	1	
-4	31165	. STUD, Detent	1	
-5	30164	. SCREW, Sprocket guard	1	
-6	34762	. GUARD, Sprocket	1	
-7	31163	. ROLLER, Sprocket guard	2	
-8	31164	. BEARING, Nylon	4	
-9	31435	. SPRING	1	
-10	09722	. PLATE ASSY (for 09731 sprocket guard)	1	
-10	011177	. PLATE ASSY (for 011178 sprocket guard)	1	
		APERTURE PLATE ASSEMBLY		
16-	09873	APERTURE PLATE ASSY	REF	
-1	31978	. SCREW, Guide rail	2	
-2	33257	. RAIL, Film guide	1	
-3	31555	. SCREW, Tension rail	2	
-4	34820	. COVER, Spring retaining	1	
-5	10689	. WASHER, Spacing	2	
-6	33256	. RAIL, Film tension	1	
-7	31135	. SPRING, Side tension	1	
-8	011161	. PLATE, Aperture	1	
		FIRE SHUTTER ASSEMBLY		
17-	09729	FIRE SHUTTER ASSY	REF	B
-1	31143	. SPRING, Extension	1	B
-2	34823	. SPRING, Filter retainer	1	B
-3	31153	. RETAINER, Heat filter glass	1	B
-4	31407	. DISC, Fire shutter	1	B
-5	200508	. FILTER, Heat	1	B
-6	011282	. BRACKET ASSY, Fire shutter	1	B
		WORM GEAR ASSEMBLY		
18-	09709	GEAR ASSY, Worm	REF	B
-1	31081	. RETAINER, Shuttle interlock	1	B
-2	30163	. SCREW, Interlock retainer	2	B
-3	31083	. SETSCREW	1	B
-4	31082	. BANC-LOK	1	B
-5	09784	. GEAR, Worm	1	B

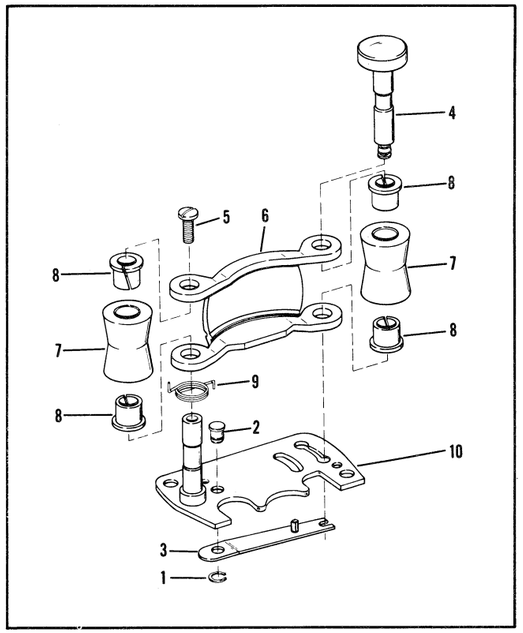


Figure 15. Lower Sprocket Guard Assembly

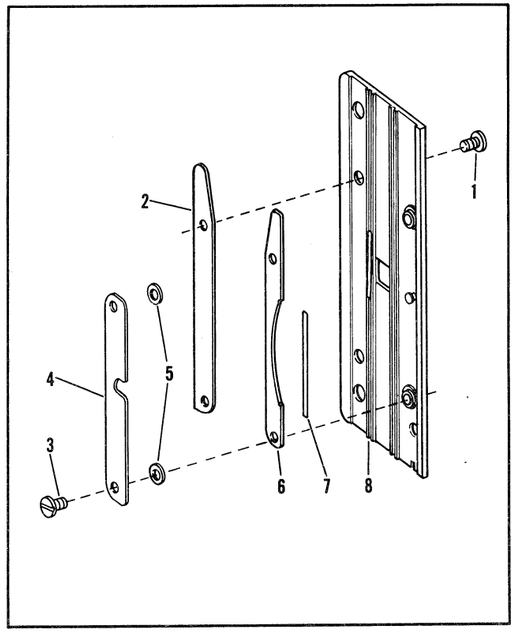


Figure 16. Aperture Plate Assembly

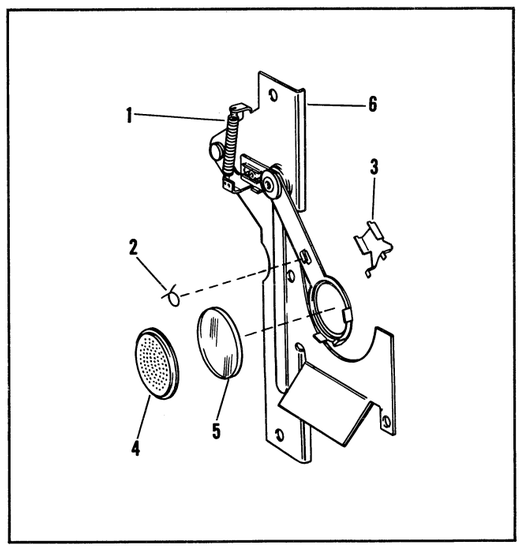


Figure 17. Fire Shutter Assembly
(Des. 542 only)

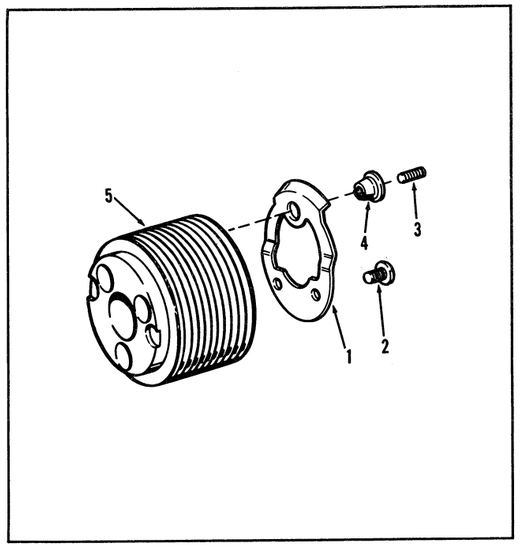


Figure 18. Worm Gear Assembly
(Des. 542 only)

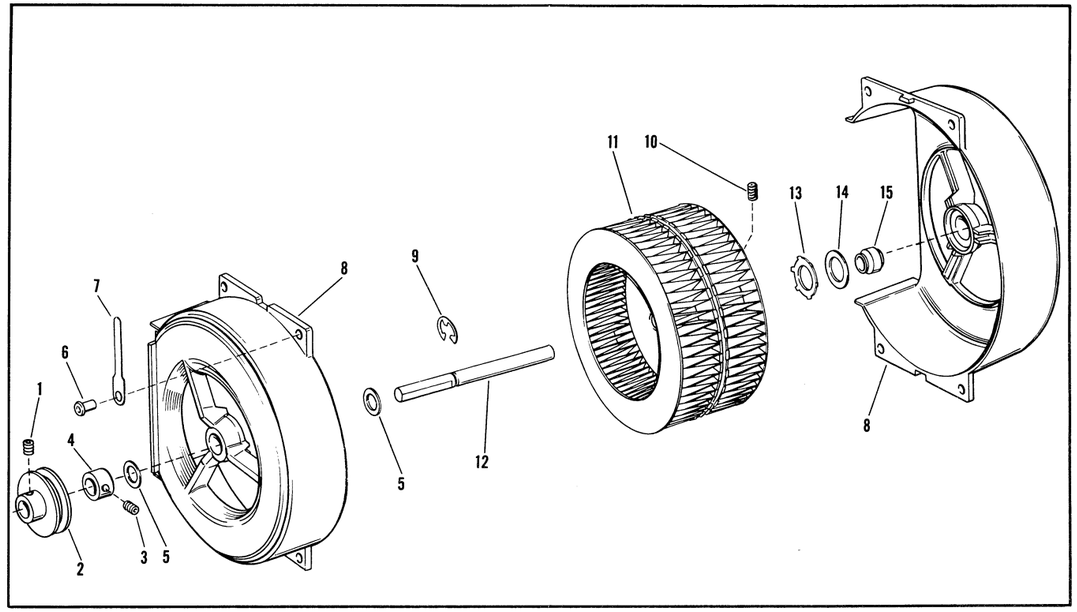


Figure 19. Blower Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		BLOWER ASSEMBLY		
19-	09762	BLOWER ASSY	REF	
-1	24084	. SETSCREW, Pulley	2	
-2	31586	. PULLEY, Blower	1	
-3	21793	. SETSCREW, Collar	1	
-4	82655	. COLLAR, Spacing	1	
-5	31029	. WASHER, Bronze	2	
-6	31588	. EYELET	3	
-7	31585	. CLAMP, Leadwire	1	
-8	31948	. HOUSING, Blower fan	2	
-9	21736	. RING, Retaining	1	
-10	24084	. SETSCREW, Blower fan	2	
-11	09783	. WHEEL ASSY, Blower	1	
-12	31590	. SHAFT, Blower wheel	1	
-13	31589	. RING, Internal retaining	2	
-14	33422	. WASHER, Nylon	2	
-15	31587	. BEARING, Bronze	2	

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PROJECTOR AMPLIFIER ASSEMBLY		
20-	09920	AMPLIFIER ASSY, Projector (see *NOTE)	REF	
-1	31723	. LAMP, Glow, Type NE-2E	1	
-2	31745	. RESISTOR, Carbon, 47,000 ohm 1/2 watt (R4)	1	
-3	31739	. RESISTOR, Carbon, 100,000 ohm 1/2 watt (R6, R8, R12, R14, R16)	5	
-4	31735	. CAPACITOR, Ceramic disc 100 mmfd (C7)	1	
-5	31740	. RESISTOR, Carbon, 470,000 ohm 1/2 watt (R10, R17, R18, R20)	4	
-6	31741	. RESISTOR, Carbon, 3300 ohm 1/2 watt (R15)	1	
-7	31727	. CAPACITOR, Ceramic disc 0.01 mfd (C5, C6, C8, C9, C10)	5	
-8	31728	. RESISTOR, Carbon 100 ohm 2 watt (R19)	1	
-9	*31721	TUBE, Type 25C5 (V3, V4, V5)	3	
-10	31758	. SOCKET, Tube (with retainer clip)	3	
-11	31718	. CAPACITOR, Electrolytic, 35 mfd (C11)	1	
-12	*22577	TUBE, Type 12AX7 (V1, V2)	2	
-13	31757	. SOCKET, Tube	1	
-14	31743	. RESISTOR, Carbon, 2200 ohm 1/2 watt (R13)	1	
-15	31744	. RESISTOR, Carbon, 22,000 ohm 1/2 watt (R22)	1	
-16	31729	. RESISTOR, Carbon, 820 ohm 1 watt (R21)	1	
-17	31715	. TRANSFORMER, Output	1	
-18	34810 or 34811	. RECTIFIER, Silicon	1	
-19	33335	. RESISTOR, Wire-wound 350 ohm 5 watt (R24)	1	
-20	33426	. CAPACITOR, Ceramic disc 220 mmfd (C14)	1	
-21	33297	. COIL, Oscillator	1	
-22	31733	. CAPACITOR, Mylar 0.22 mfd (C1, C12)	2	
-23	31734	. CAPACITOR, Ceramic disc 0.005 mfd (C13)	1	
-24	31720	. RESISTOR, Carbon 1000 ohm 1 watt (R23)	1	
-25	31717	. CAPACITOR, Electrolytic 80 mfd (C15)	1	
-26	31730	. RESISTOR, Wire-wound 5 ohm 5 watt (R25)	1	
-27	31716	. CAPACITOR, Electrolytic, 3-section (C3)	1	
-28	31731	. CAPACITOR, Electrolytic, 10 mfd (C4)	1	
-29	31756	. SHIELD, Tube (beaded)	1	
-30	31759	. SOCKET, Tube	1	
-31	31749	. RESISTOR, Carbon 3900 ohm 1/2 watt (R7) (R11)	2	
-32	31747	. RESISTOR, Carbon 1800 ohm 1/2 watt (R9)	1	
-33	33290	. RESISTOR, Carbon 270,000 ohm 1/2 watt (R5)	1	
-34	33425	. CAPACITOR, Ceramic disc 0.0033 mfd (C2)	1	
-35	09921	CONTROL ASSY, Volume and tone (see inset)	1	
-35A	31722	. . CONTROL, Volume and tone (with line switch)	1	
-35B	34799	. . VARIABLE RESISTOR AND LINE SWITCH	1	
-36	31748	. RESISTOR, Carbon 330,000 ohm 1/2 watt (R3)	1	
-37	31746	. RESISTOR, Carbon 68,000 ohm 1/2 watt (R2)	1	
-38	31745	. RESISTOR, Carbon 47,000 ohm 1/2 watt (R1)	1	
-39	31705	. BOARD, Printed circuit	1	
-40	09922	. SUBPLATE ASSY, Amplifier	1	
-41	31726	. RESISTOR, Carbon 180K ohm 1/2 watt (R27, R28)	2	
-42	31732	. RESISTOR, Carbon 1500 ohm 1/2 watt (R29)	1	
-43	31737	. CAPACITOR, Ceramic disc 0.0015 mfd (C17)	1	
-44	31725	. RESISTOR, Carbon 150K ohm 1/2 watt (R26)	1	
-45	25824	. CAPACITOR, Ceramic disc 0.02 mfd (C16, C18)	2	
-46	28019	. TUBING, Vinyl	1	

*NOTE: For amplifier less tubes V1 thru V5 and volume control 09921, order part no. 011164

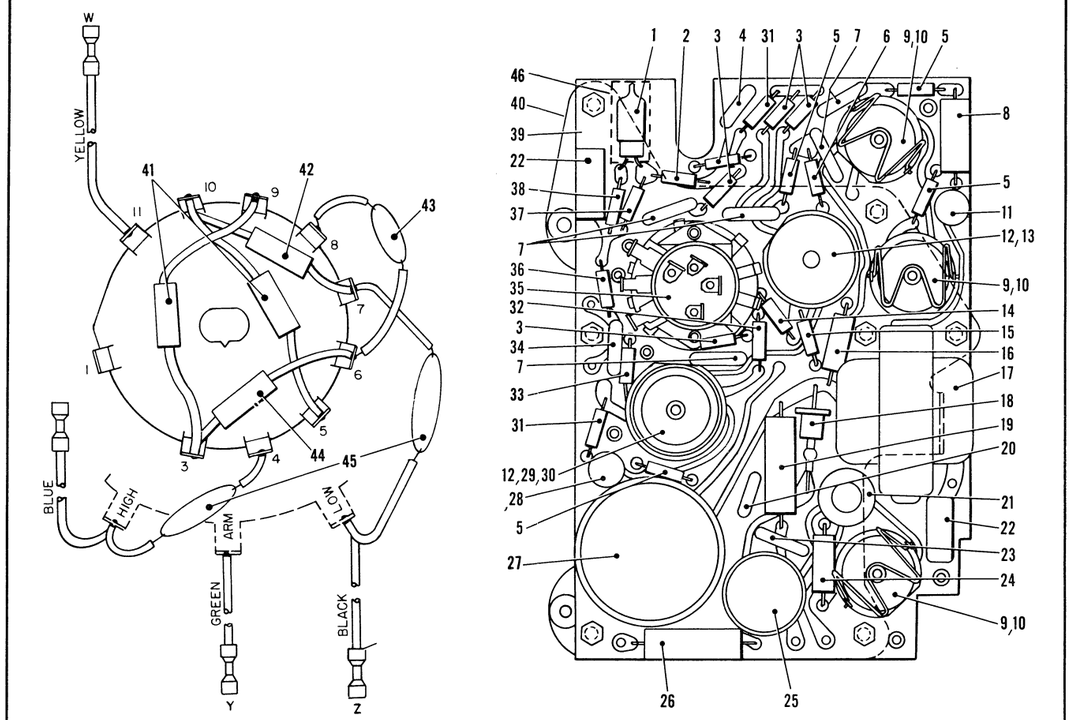


Figure 20. Amplifier Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		25-WATT POWER SPEAKER		
21-	040322	POWER SPEAKER, 25-watt	1	
	01873	. REEL, 1600 foot (not shown)	1	
	08985	. CABLE ASSY, 50-foot (not shown)	1	
-1	82034	. SCREW, Amplifier cover	4	
-2	620004	. WASHER	4	
-3	22045	. NUT, Speed	4	
-4	23736	. COVER, Amplifier	1	
-5	08995	. AMPLIFIER ASSY	1	
-6	23336	. . KNOB, Volume control	1	
	040323	. CASE ASSY, Speaker	1	
-7	28037	. . SCREW, Speaker attaching	4	
-8	28035	. . SPEAKER	1	
-9	1973	. . SCREW, Wood	1	
-10	17455	. . CLAMP, Cable	1	
-11	09050	. . CABLE ASSY, 12-inch	1	
-12	23414	. . SCREW, Reel clip attaching	4	
-13	23619	. . CLIP, Reel	1	
-14	28048	. . RIVET, Tubular	20	
-15	400304	. . HINGE	1	
-16	28042	. . DRAWBOLT	2	
-17	28043	. . CATCH, Drawbolt	2	
-18	18086	. . FOOT, Rubber	4	
-19	18087	. . NUT, Tee	1	
-20	23414	. . SCREW, Wood, guide bracket	2	
-21	28026	. . BRACKET, Guide	1	
-22	430145	. . SCREW, Machine, handle top	2	
-23	24736	. . NUT, Tinnerman	2	
-24	430062	. . HANDLE, Top	1	
-25	21736	. . RING, Retaining	2	
-26	430142	. . WASHER, Flat	2	
-27	430144	. . CUSHION	2	
-28	430193	. . SPRING	2	
-29	430192	. . SLEEVE, Stop	2	
-30	430097	. . PIN, Roll	2	
-31	430189	. . POST, Handle	2	
-32	430037	. . CHANNEL, Handle	1	

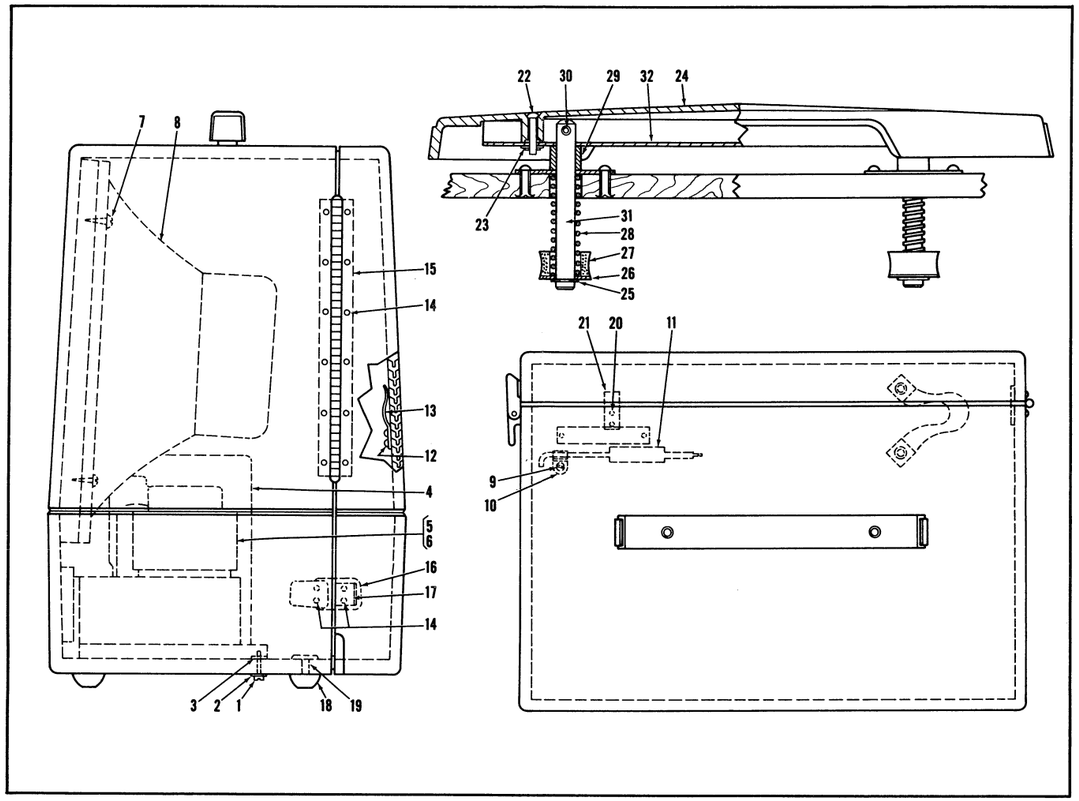


Figure 21. 25-Watt Power Speaker Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		DUAL AV SPEAKER		
22-	09941	SPEAKER ASSY, Dual AV	1	
-1	33479	. SCREW, Front cover	9	
-2	33486	. SCREW, Front cover	2	
-3	33481	. NUT, Tinnerman, front cover	2	
-4	09942	. COVER ASSY, Front	1	
	09943	. COVER ASSY, Rear (not shown)	1	
-5	18086	. FOOT, Rubber	4	
-6	33482	. SCREW, Speaker attaching	8	
-7	33442	. SPEAKER, Woofer	1	
-8	33444	. SPEAKER, Tweeter	1	
-9	33485	. SCREW, Handle bracket	4	
-10	33483	. SPEEDNUT, Twin	4	
-11	33471	. BRACKET, Handle	2	
-12	33484	. SCREW, Handle attaching	4	
-13	33369	. STRAP, Handle	1	
-14	33368	. BODY, Handle	1	
-15	33391	. SCREW, Handle cap	2	
-16	33371	. CAP, Handle	1	
-17	33370	. GRIP, Handle	1	
-18	33446	. RESISTOR	1	
-19	33445	. CAPACITOR	1	
-20	19010	. NUT, Input jack	1	
-21	25368	. WASHER, Key	1	
-22	400449	. WASHER	1	
-23	28059	. INPUT JACK	1	
-24	28088	. PLUG, Jack-type	1	

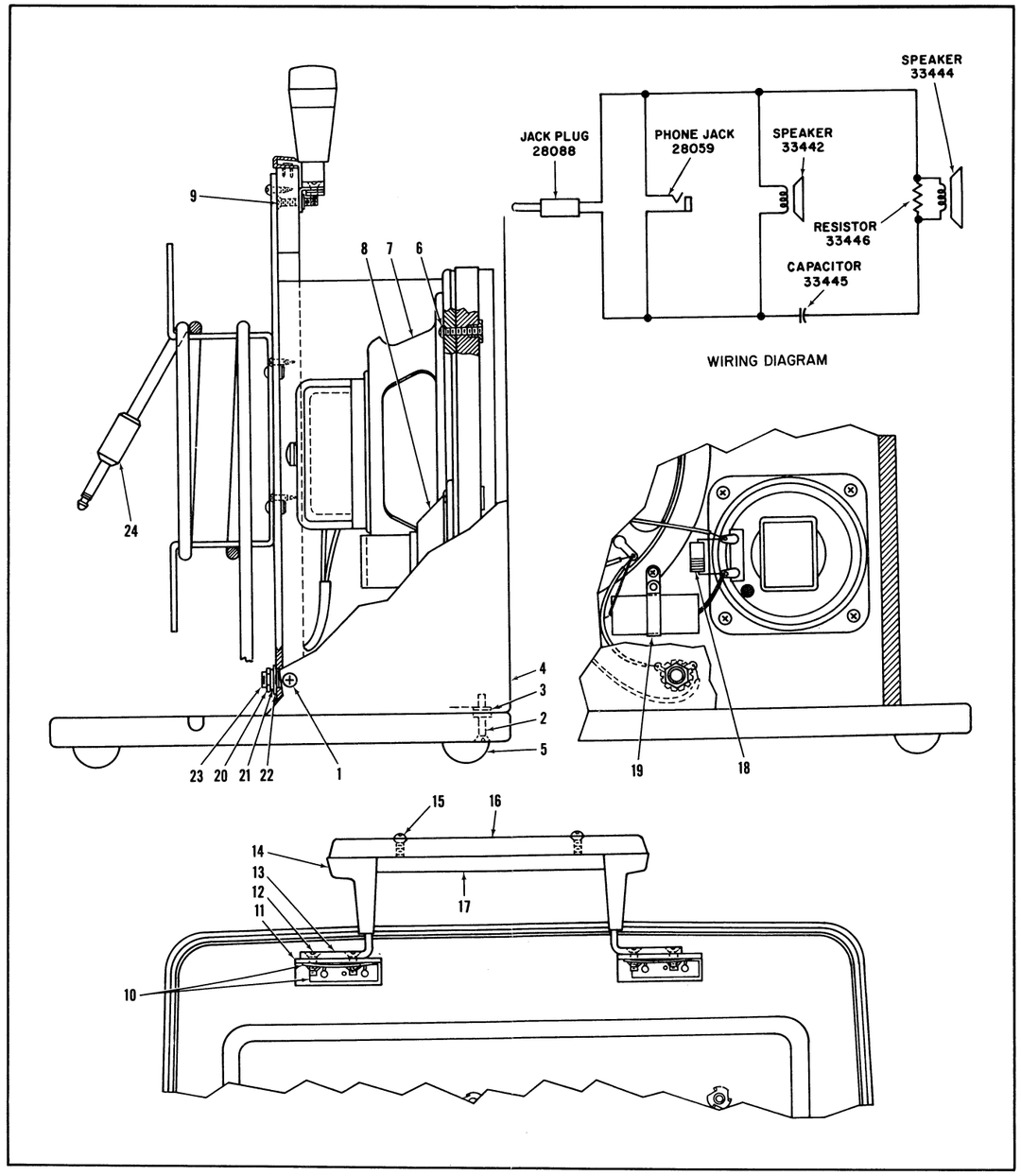


Figure 22. Dual AV Speaker Assembly