Film-Tech

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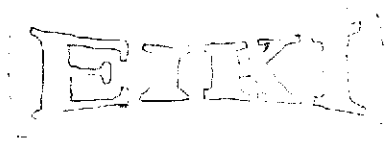
FILMS-ELECTRONICS-SPECIAL EFFECTS

EIKI ST/M SERIES

16mm Sound projectors

SERVICE MANUAL



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TROUBLE SHOOTING CHART FOR EIKI ST/M SERIES PROJECTORS

The following information will help the service technician to analyze the problem and determine the actual SOURCE. It is important that the effect be eliminated by curing the actual CAUSE of the problem.

I. MISCELLANEOUS TROUBLES

SYMPTOM	PROBABLE CAUSE	REMEDY
1. No power for motor or lamp.	1. No power at wall outlet. 2. Defective power cord. 3. Defective motor switch.	1. Check fuse or multi-breaker of power circuit. 2. Repair or replace. 3. Replace.
2. Lamp will not light — motor runs.	1. Lamp burned out. 2. Lamp switch defective. 3. Lamp socket defective. 4. Open circuit between lamp socket and lamp transformer. 5. Lamp transformer defective.	1. Replace. 2. Replace. 3. Replace. 4. Repair. 5. Replace.
3. Film sprockets not turning — motor runs, lamp lights.	1. Stop lever depressed. 2. Motor belt broken. 3. Plate washer ST-11351 loose.	1. Raise lever. 2. Replace. 3. Remove camtank as per S.I.6. and tighten screw.
4. Take-up poor or not at all in FORWARD.	1. Broken or stretched take-up arm belt. 2. Take-up arm belt oily. 3. Improper friction at slip clutch ST-14201. 4. Clutch cam not engaging.	1. Replace. 2. Clean. 3. See S.2.2 for remedy. 4. See S.5.
5. Take-up poor or not at all in REVERSE.	1. Broken or stretched supply arm belt. 2. Supply arm belt oily. 3. Reverse belt broken. 4. Clutch cam not engaging. 5. Reverse belt not slipping smoothly.	1. Replace. 2. Clean. 3. Replace. 4. See S.6.1. 5. Lubricate slightly with graphite. S.6.1.
6. Rewind poor or not at all.	1. Broken rewind belt. 2. Broken or stretched supply arm belt. 3. Supply arm belt oily. 4. Take-up clutch cork too tight or dry. 5. Defective rewind gear. 6. REWIND BELT NOT TIGHT ENOUGH 7. SHUTTER PULLEY CLUTCH SLIPPING. 8. MOTOR BELT SLIPPING.	1. Replace. 2. Replace. 3. Clean. 4. See S.2.2 for remedy. 5. Replace. 6. REPLACE. 7. CLEAN. SEE S.I.7, P,Q,R. 8. CLEAN OR REPLACE. SEE S.I.2

SYMPTOM	PROBABLE CAUSE	REMEDY
7. Main drive belt slips over take-up drive gear when large film reel is full.	1. Take-up clutch cork too tight or dry. 2. Oil on main drive belt or drive gear. 3. Spring on idler gear too weak. 4. Ball bearings seized or binding in take-up arm.	1. See S.2.2 for remedy. 2. Clean and wipe dry. Replace belt if necessary. 3. Replace spring ST-15251. 4. Replace or remove cause of binding.
8. Film spills from supply reel in FORWARD.	1. Clutch collar ST-15501 binding. 2. Clutch cam ST-14071 touching pins in clutch collar ST-15501.	1. Remove, clean and lubricate S.6.1. 2. Trim cam to provide necessary clearance. Replace cam or collar or both.
9. Film spills from take-up reel in REVERSE.	1. Drive gear ST-14501 binding on shaft or clutch collar. 2. Clutch cam ST-14071 touching pins in clutch collar ST-14401. 3. Edge of main drive belt touching shoulder of outer collar ST-14401.	1. Clean, lubricate and provide the necessary clearance. S.5., including fibre washer behind drive gear. 2. Trim cam to provide necessary clearance. Replace cam or collar or both. 3. Remove belt and replace in opposite direction. Replace belt. S.5.
10. Main belt skips over a drive gear when switching from FORWARD to REVERSE.	1. Reverse drive roller ST-41201 out of adjustment. 2. Weak spring ST-15251.	1. Adjust position of pin ST-41161 as per S.15. 2. Replace.
11. Lower loop lost in REVERSE.	1. Reverse drive roller ST-41201 out of adjustment. 2. Reverse drive roller not moving to proper position because bracket ST-41131 is binding. 3. Spring ST-41061 too weak causing insufficient friction.	1. Adjust position of pin ST-41161 as per S.15. 2. Remove cause of binding. 3. Stretch or replace.
12. Upper loop lost in REVERSE.	1. Reverse belt not slipping smoothly. 2. No. 1 sprocket shoe clearance too great. 3. Reverse drive roller out of adjustment. 4. Claw protrusion incorrect. 5. No. 1 sprocket plate loose.	1. Lubricate slightly with graphite S.6.1. 2. Check and adjust as per S.9.1. 3. Adjust as per S.15. 4. Adjust as per S.1.5. 5. Tighten screw in end of shaft.

SYMPTOM	PROBABLE CAUSE	REMEDY
13. Loop setter rotates continually or erratically.	1. Damaged film.	1. Repair or replace.
	2. Insufficient spring tension.	2. Stretch or replace spring ST-18061. See S.10.
	3. Loop setter gear defective.	3. Repair or replace as per S.10.
	4. Sensing roller in wrong position.	4. Readjust as per S.10.
	5. No. 2 sprocket plate loose.	5. Remove lamp house casting ST--32111 and tighten screw in end of shaft. See S.8.1.
	6. No. 1 sprocket plate loose.	6. See S.9.3. for timing instructions and tighten screw.
	7. No. 2 sprocket shoe open ("M" models).	7. Close.
	8. Film touching sensing roller because lower loop too small.	8. See S.10 to adjust.
	9. Insufficient claw protrusion.	9. Adjust as per S.1.5.
	10. Green film.	10. Treat with film conditioner/lubricant.
	11. Worm gear on shutter shaft mounted incorrectly, causing variation in claw protrusion.	11. See S.1.3.
	12. Claw broken.	12. Replace.
14. Excessive noise in film gate in FORWARD (with good, clean, undamaged film).	GREEN FILM 1. Upper loop too small.	1. Increase to proper size.
	2. Film touching loop setter.	2. Adjust as per S.10.
	3. Emulsion build-up on film shoe or gate.	3. Clean and buff.
	4. Claw loose.	4. Tighten.
	5. Inner guide rail binding.	5. Clean and adjust. See S.9.4.
	6. Film shoe binding.	6. Adjust. See S.9.5.
	7. Inner guide pressure spring weak.	7. Bend or replace. See S.9.4.
	8. Film shoe bent.	8. Straighten or replace.
	9. Defective claw	9. Replace. See S.1.1.
	10. Claw position incorrect.	10. Adjust as per S.1.4.
	11. Claw protrusion incorrect.	11. Adjust as per S.1.5.
	12. Curved spring ST-11161 in camtank broken or weak.	12. Replace. See S.1.6. and S.1.7.
	13. Claw stroke incorrect.	13. Replace fibre cam ST-11131. See S.1.6, S.1.7.

SYMPTOM	PROBABLE CAUSE	REMEDY
15. Unsteady picture.	See previous section dealing with noise in film gate.	
16. Excessive noise in gate in REVERSE **only.**	1. Claw position incorrect. 2. Claw angle incorrect. 3. Curved spring ST-11161 bent or broken. 4. Worm gear mounted incorrectly allowing shaft "end play."	1. Adjust as per S.1.4. 2. Adjust as per S.1.1. 3. Replace. See S.1.6, S.1.7. 4. See S.1.3 for adjustment.
17. Insufficient framing.	1. Claw position incorrect.	1. Adjust as per S.1.4.
18. Excessive noise when STOP lever depressed.	1. Motor pulley misaligned. 2. Shutter pulley binding on shaft.	1. Adjust as per S.1.2. 2. Remove camtank assembly and remove pulley. Clean and lubricate. See S.1.6 and S.1.7.
19. Film transport does not stop when STOP lever depressed.	1. Shutter pulley seized. 2. Stop lever shoulder screws ST-11271 loose.	1. Remove camtank, clean and lubricate as per S.1.6 and S.1.7. 2. Remove camtank assembly and tighten. See S.1.6 and S.1.7.
20. Film burns when STOP lever depressed.	1. STOP lever not fully depressed. 2. Heat filter misaligned. 3. Heat filter broken.	1. Depress FULLY. 2. Bend heat filter holder to cover aperature. 3. Replace.
21. Arm locks not entering arms.	1. Pins dirty. 2. Pin not entering hole in arm due to burrs or misalignment.	1. Clean and oil. S.2.3. 2. See S.2.1 to remove arms.
22. Uneven screen illumination.	1. Lamp not seated properly. 2. Foreign object in light path. 3. Lamp not centered horizontally. 4. Defective lamp.	1. Correct. 2. Remove. 3. Turn knurled knob. See S.18. 4. Replace.
23. Uneven focus.	1. Dirty gate. 2. Film shoe binding. 3. Inner guide rail binding. 4. Lens holder misaligned. 5. Defective lens.	1. Clean. 2. Adjust. See S.9.5. 3. Clean and adjust. S.9.4. 4. Adjust. See S.9.6. 5. Replace.
24. Light reflections outside of picture area.	1. Film shoe misaligned. 2. Edge of film shoe aperture reflections.	1. Realign shoe as per F.9.4 and F.9.9. 2. Touch up with matte black paint.

II. SELF-THREADING TROUBLES

SYMPTOM	PROBABLE CAUSE	REMEDY
25. No. 2 Film guide not locking properly.	1. Release bracket ST-17981 not entering hook of horizontal guide bar correctly.	1. See S.9.7 for adjustments.
26. Leader or film dimpled in first few inches by sprocket teeth (on ST models).	1. Insufficient clearance between No. 1 sprocket shoe and lens holder. 2. Improper synchronization between claw and No. 2 sprocket. a) Plastic leader shrunk too much. b) No. 2 sprocket out of adjustment.	1. See S.9.6 to adjust. 2. a) Replace plastic leader with acetate base emulsion type. b) See S.8 for adjustment.
27. End of leader strikes top of guide rail.	1. Film not trimmed properly. 2. No. 1 film guide mounting pin loose or bent.	1. Trim as required or replace trimmer 2. Tighten, straighten or replace as per S.9.2.
28. End of leader goes under top end of inner guide rail.	1. Guide rail bent. 2. Shoulder screws ST-31061 loose.	1. Straighten. 2. Tighten. See S.9.4.
29. End of film does not go through gate.	1. Film not trimmed. 2. No. 1 sprocket shoe too far from sprocket (teeth slip out of perforations). 3. Obstruction or burr in gate. 4. Insufficient side travel clearance of inner guide rail ST-31111. 5. Film shoe or pins binding. 6. Inner guide rail binding.	1. Trim. 2. Adjust as per S.9.1 or replace and check. 3. Remove obstruction. 4. See S.9.4 for checks and remedy. 5. See S.9.5 for remedy. 6. Clean. See S.9.4 and adjust.
30. Excessive clatter during self-threading.	1. No. 1 sprocket-claw timing incorrect.	1. See S.9.3 for adjustment.
31. Film "runs" through gate instead of being pulled by claw.	1. No. 1 sprocket - claw timing incorrect.	1. See S.9.3 for adjustment.
32. End of curled film goes over loop setter roller.	1. Loop setter sensing roller too low.	1. Readjust as per S.10.

SYMPTOM	PROBABLE CAUSE	REMEDY
33. No. 2 film guide not lined up with No. 3 film guide in Self - Thread position.	1. No. 2 film guide broken. 2. No. 2 film guide not mounted correctly. 3. No. 3 film guide defective.	1. Replace. See S.9.7. 2. See S.9.7. 3. Repair or replace. See S.9.8.
34 Film goes under No. 3 film guide.	1. End of No. 2 guide too far from No. 3 guide.	1. See S.9.7 and S.9.8 for adjustment.
35. Film stops at sound drum.	1. No. 4 film guide and lateral guide roller in wrong position. 2. Lateral guide roller ST-17151 binding or seized. 3. Roughness in casting above sound drum.	1. See S.9.9 for adjustments. 2. Remove, clean and lubricate. See S.9.9. 3. Polish with crocus cloth or very fine emery cloth.
36. Film stops just before No. 2 sprocket.	1. Roughness in casting surface.	1. Clean and polish with crocus or fine emery cloth. See S.9.10.
37. Film guides not releasing when last roller is pulled back.	1. Release bracket ST-17981 out of adjustment. 2. Return spring ST-17111 too weak.	1. See S.9.7 for function and adjustment. 2. See S.11 for remedy.
III. SOUND TROUBLES 38. No sound.	1. Amplifier not switched on. 2. Exciter lamp defective. 3. Fuse blown. 4. Speaker not plugged in. 5. Cable connections in amplifier loose. 6. Speaker defective. 7. Speaker cable defective. 8. On-off switch defective. 9. Amplifier defective. 10. Solar cell defective. 11. Foreign object in optical scanning beam. 12. Magnetic head defective. 13. Defective motor winding.	1. Switch on. 2. Replace. 3. Replace. If it blows again check speaker load, must be 8 ohms or more on external speakers. Check output transistors. 4. Plug it in. 5. Plug in or tighten. 6. Replace. 7. Repair or replace. 8. Replace. 9. Repair or replace. 10. Replace. 11. Remove. 12. Replace. 13. Replace motor.

SYMPTOM	PROBABLE CAUSE	REMEDY
39. Low volume.	1. Defective exciter lamp. 2. Dirty optic lens or foreign objects in light beam. 3. Low voltage to exciter lamp. 4. Optic lens misaligned. 5. Amplifier defective. 6. Magnetic head dirty. 7. Magnetic head defective.	1. Replace. 2. Clean. 3. Repair amplifier. 4. Adjust as per S.13. 5. Repair or replace. 6. Clean. 7. Replace.
40. Loud hum.	1. Exciter lamp cover off or not installed correctly. Light from projection lamp reaches solar cell. 2. Light shield ST-32241 off or bent. 3. Input cable shields loose. 4. Amplifier defective.	1. Install on pins correctly. 2. Replace or repair. 3. Repair. 4. Repair or replace.
41. Distorted sound.	1. Defective exciter lamp. 2. Speaker defective. 3. Lateral guide roller seized or binding. 4. Sound drum bearings defective. 5. Reverse drive roller touching flywheel. 6. Flywheel off. 7. Flywheel too loose. 8. Magnetic sound over-recorded. 9. Defective amplifier 10. Optic lens misaligned. 11. Film touching loopsetter. 12. No. 5 film guide rollers binding. 13. Dirt on sound drum.	1. Replace. 2. Replace. 3. Clean, lubricate and adjust. S.9.9. 4. Replace. See S.14. 5. Adjust as per S.15. 6. Install. 7. Adjust. See S.14. 8. Re-record. 9. Repair or replace. 10. Adjust as per S.13. 11. Adjust as per S.10. 12. Clean and check as per S.9.11. 13. Clean.
42. Wow and flutter.	1. Lateral guide roller ST-17151 binding. 2. Sound drum bearings defective. 3. No. 5 film guide rollers binding or spring defective.	1. Clean and lubricate. S.9.9. 2. Replace. S.14. 3. See S.9.11 for adjustments.
43. Sound not stabilized soon enough after starting.	1. Insufficient spring tension on flywheel. 2. Weak spring on lateral guide roller.	1. Bend spring ST-41061 to increase tension. See S.14. 2. Replace spring.

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General Notes on Servicing EIKI ST/M Projectors

A. Metric thread screws, standard throughout the world, are used in all EIKI Projectors. We offer an assortment of screws, nuts, bolts, washers, drills, and taps for your convenience.

B. Most repairs and adjustments can be made on EIKI Projectors using two sizes of Phillips screwdrivers, a blade screwdriver, and standard 16mm film as a thickness gauge. (Most 16mm film is about .005" thick.) To avoid damage to screw heads, it is important to remember the adage, "Use 80 per cent push, 20 per cent turn."

C. Lubrication and Cleaning

Lubrication is normally **not required** for average operation. It is recommended that once a year or every 1000 hours, whichever occurs first, the moving parts be inspected for signs of excessive wear, cleaned and lubricated.

Use methyl hydrate, alcohol or tri-chlorethylene as cleaning agents. We do not recommend carbon terrachloride due to the dangers involved.

Polyurethane belts must be clean and dry. Remove oil and dirt accumulation with cloth moistened with cleaning agent.

Ball bearings should be clean and roll smoothly. If bearings are noisy or do not roll freely, they should be replaced. Shafts without ball bearings should be clean and lubricated with silicone fluid or a light smear of silicone compound. Remove excess.

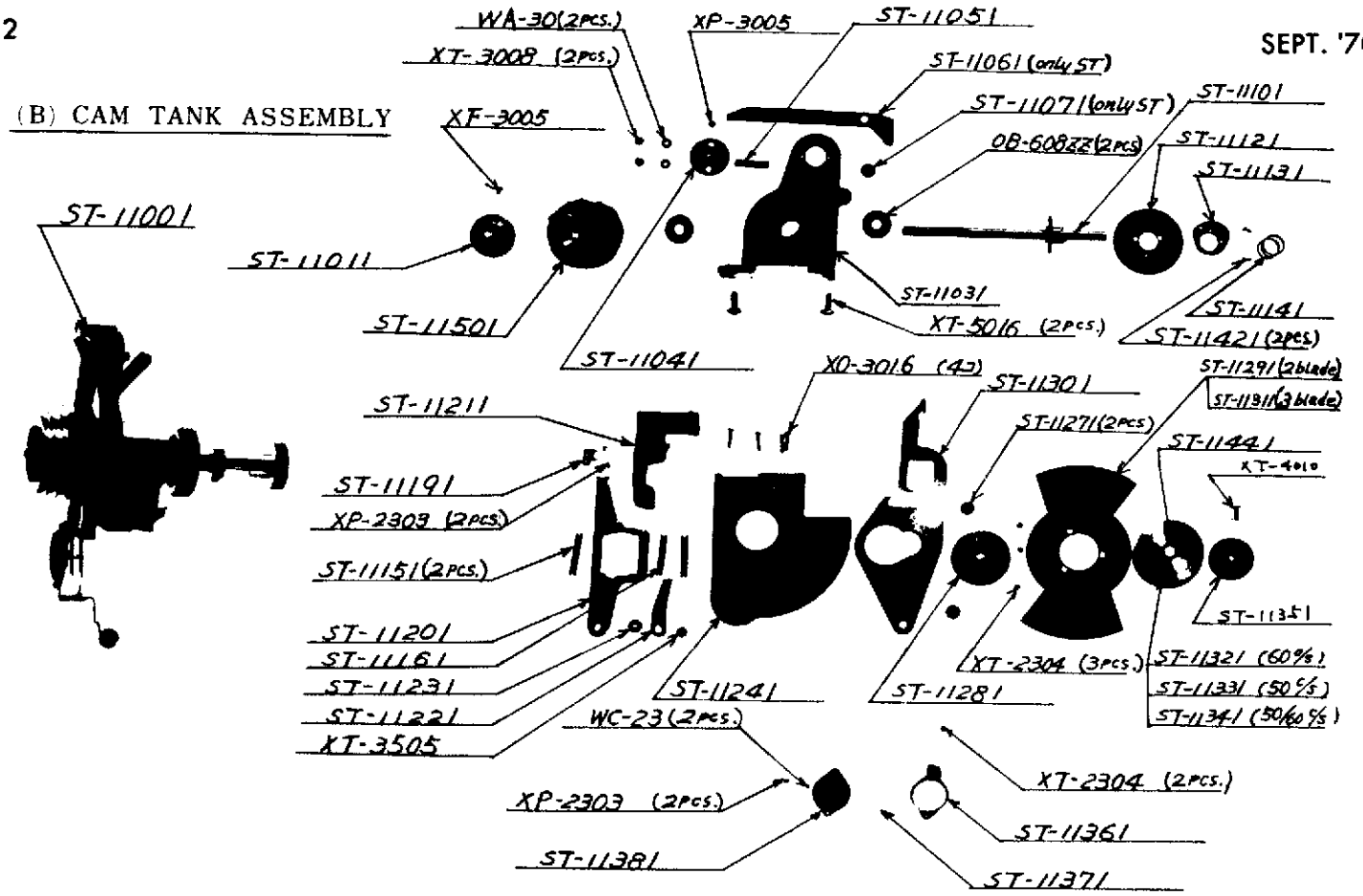
Rollers must rotate freely. Shafts and inside surface of rollers must be clean, free from burrs, scratches or other defects. Lubricate sparingly with a light silicone oil or other fine oil. Remove excess.

Camtank shutter assembly is packed with silicone compound, Dow Corning No. 44 or equivalent. Use approx. ½ teaspoonful around fiber cam.

Shutter pulley cone clutch surface and surface of shutter blade hub should be clean and dry. Surface of pulley and cast iron plate washer should be clean and dry. Use light silicone oil or fluid to lubricate bronze bushing in shutter pulley.

Fiber gears must not be allowed to run dry. Use light silicone oil or other light fine oil and cover all teeth with oil. Wipe off excess. This treatment will generally last many thousands of hours.

(B) CAM TANK ASSEMBLY



S.1 **CAMTANK ASSEMBLY** (Shutter Claw and Clutch) ST-11001

S.1.1 **CLAW ST-11191**

Function: 2 tooth claw is made of extremely hard material, precision ground for maximum efficiency.

Face of claw teeth are ground at a slight angle. Claw then loses contact immediately as it begins to retract. Film then rests undisturbed till next pulldown.

Check: Claw screws must be tight. Do not overtighten! **Claw lever is made of aluminum.**

Adjustment: Holes in claw are slightly oversize. Angle of claw teeth may be adjusted slightly by loosening screws and tilting claw.

Claw angle may be further adjusted if necessary by bending claw lever in flat area. Use a pair of long-nosed pliers with a right angle bend.

S.1.2 **STOP LEVER ST-11301**

Function: When FULLY depressed heat filter assembly is placed between lamp and aperture. This action also moves shutter, compressing spring ST-11141. This releases shutter pulley, allowing it to rotate freely on shaft. Special shoulder screws ST-11271 are used to mount stop lever.

Check: Motor pulley and shutter pulley must be properly aligned.

Depress stop lever.

Switch motor on.

Shutter pulley should ride between shutter blade hub and plate washer, on end of shaft, without undue friction toward either side.

Adjustment: Relocate motor pully as necessary.

S.1.3 **WORM GEAR ST-11501**

Check: Worm gear must be mounted and secured to eliminate any "end play" of shutter shaft.

Camtank assembly must be mounted so that there is a small amount of "play" between worm gear and fibre gear. Rotate fibre gear to check.

Adjustment: Reposition as necessary and tighten screws securely.

S.1.4 CLAW POSITION

Check: Claw must enter film perforation tion, refer to section S.9.4 dealing with gate adjustments.

Claw must not touch sides of perforations at any time during its entry, pull-down or exit.

Claw should leave film so that frame is centered over aperture with framing lever in midway position.

Adjustment: Slightly loosen 2 screws that hold fulcrum collar ST-11041. Holes in collar are oversize. Move fulcrum collar horizontally and/or vertically to correct position.

Check: Check for correct framing with film in projector and operating.

S.1.5 CLAW PROTRUSION

Check: Claw protrusion should be .040" $\pm$ .005". Use gauge to determine.

Adjustment: Open lamp house door fully. Turn inching knob so that claw is fully retracted.

Use a pair of long-nosed pliers with a right angle bend. Carefully bend claw lever. Be sure claw is not touching film gate during bending. Claw breakage could result.

Check: Horizontal position of claw teeth is affected by protrusion adjustment. Recheck and readjust as necessary.

NOTE: Claw protrusion may be affected by camtank position when reinstalling. Check and reposition camtank if necessary.

S.1.6 CAMTANK ASSEMBLY REMOVAL

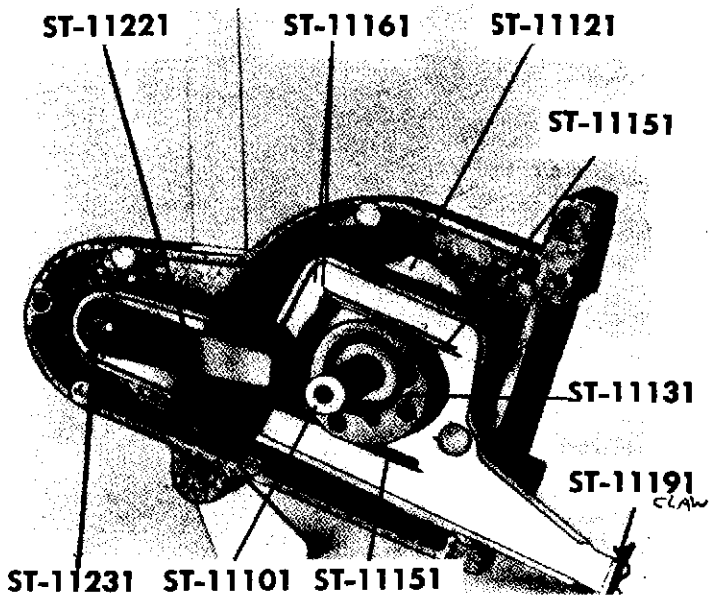
a) Remove reverse belt.
b) Remove main drive belt from No. 1 sprocket drive gear.
c) Remove motor belt.
d) Slide motor pulley toward fan.
e) Remove lamp mounting assembly.
f) Turn inching knob to fully retract claw.
g) Depress stop lever halfway.
h) Remove 2 mounting screws.
i) Remove assembly, being careful not to damage claw.

NOTE: When installing, be sure to:

a) Align motor and shutter pulley.
b) Provide a small amount of "play" between worm gear and fibre gear.
c) Check position of No. 1 guide. See S.9.1.
d) Check timing of No. 1 sprocket and claw. See S.9.3.

S.1.7 CAMTANK DISASSEMBLY

a) Depress stop lever halfway.
b) Remove screw in end of shaft.
c) Remove plate washer ST-11351 and pulley.
d) Raise stop lever and remove shutter blade and hub.
e) Depress stop lever part way to expose 4 heads of cover plate mounting screws and remove screws.
f) Remove cover.
g) Observe location of fibre cam and springs inside claw lever:
—Curved shock absorber spring ST-11161 is at top, in "hump."
—Straight spring ST-11151 is next.
—Cam rotates between this and another ST-11151 at bottom of hole.



h) Felt spring ST-11221 is used to hold felt in place as well as provide side tension to keep claw lever against cam plate.
i) Hole in felt spring fits OVER fulcrum pin. When reassembling be sure that spring is not jammed between end of fulcrum pin and washer ST-11231.
j) Shaft ST-11101 should have no end play. Worm gear must be installed without clearance.
k) Ball bearings must be free from any play. Replace if necessary.
l) 2-bladed shutter is mounted to hub ST-11281 so that raised semicircle of hub

is facing one blade. (3-bladed shutter is automatically correct.) Shutter blade is depressed in centre to offset blades. Hub is inserted into hole of blade from depressed side.

m) Shutter blade has elongated mounting holes. Travel ghost is at minimum normally if blade is mounted with holes centered. If necessary, move blade slightly to overcome travel ghost.

n) Further timing is predetermined by fibre cam mounting screws placed in an "off centre" position.

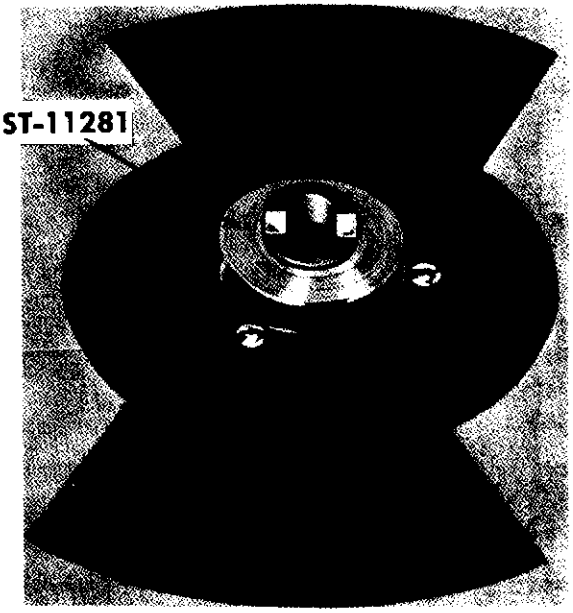
o) Lubricate fibre cam area with silicone grease. Use approximately 1-1½ teaspoonsful.

p) Shutter pulley must be clean and dry on both sides.

q) Shutter shaft must be clean.

r) Lubricate bronze bushing of shutter pulley and shutter shaft with a small amount of silicone oil.

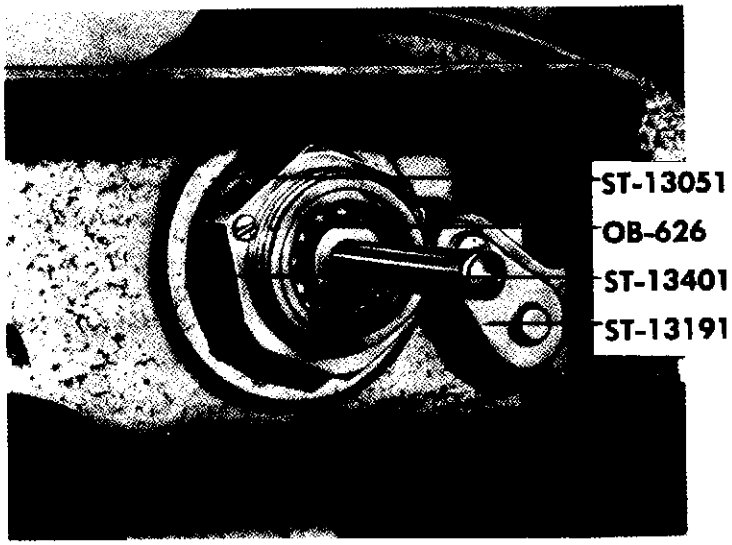
AVOID OVERLUBRICATION



S.2 REEL ARMS

S.2.1 MOUNTING

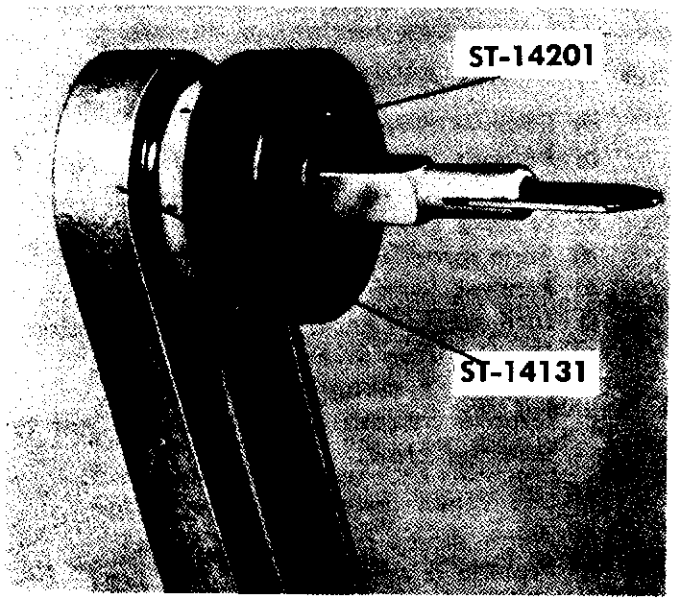
Arm is mounted on chassis and held in place with a special locking nut. The small screw through the split side of the locking nut must be released before attempting to turn the nut. When mounting the arm, tighten the locking nut to provide the proper tension on the arm and then secure the locking nut by tightening the locking screw.



S.2.2 TAKE UP SLIP CLUTCH ST-14201

Function: The cork liner provides the necessary friction for film take-up. The design of this clutch allows for automatic compensation and balance of required torque for empty reel and full reel.

Check: PROPER CLEARANCE between cork liner and steel pulley ST-14131 is important. Install a piece of film 3¾" long on inside circumference of cork liner. This should provide a moderately snug fit when placed in position over pulley. With film removed, a slight amount of "play" should be observed when spindle is moved up and down. Too much clearance will allow rim of 2000' reel to touch arm. Reel and last release roller will also be misaligned causing undue film wear.



Proper friction is checked by using a 2000' reel. (A smaller size reel with same hub diameter is satisfactory.) Thread film and operate projector in "Forward" mode. Release roller ST-17231 should be no more than to the midway point of its allowable travel, providing of course that spring ST-17291 is not defective.

Too much friction at cork liner may cause take-up arm belt to buckle and jam when in "forward" mode. In "rewind" the same problem may occur in supply arm.

Adjustment: Replace defective slip clutch assembly. If cork liner clearance is insufficient, use sandpaper to remove some cork for immediate repair if necessary.

Lubricate cork liner with General Cement Phono-Lub 1223-S.

Lubricate hub of steel pulley ST-14131 and shaft of slip clutch with silicone oil or grease.

NOTE: Do not overlubricate cork liner. Some lubricant will work over to arm belt. Insufficient friction will cause film to wind too loosely on reel.

S.2.3 ARM LOCKS

Function: Arm locks snap into holes in arms when arms are moved into their operating position. Spring ST-13181 provides the necessary tension.

Check: Pin should enter hole in arm freely every time arm is raised. Dirty, gummed pins, broken or weak spring or burrs in hole or on pin will hinder smooth, positive action.

Adjustment: Clean, remove burrs and lubricate with silicone oil.

S.3 SUPPLY ARM DRIVE PULLEY ST-13501

Function: This pulley drives supply spindle when projector is in "Reverse" mode. Reverse belt ST-13161 is used between this pulley and clutch collar ST-15501 located on No. 1 sprocket shaft.
Rewind belt ST-19041 is mounted between rewind gear ST-19201 and drive pulley.

Check: Mount with largest diameter pulley at outer end. No clearance is required between pulley and ball bearing OB-626.

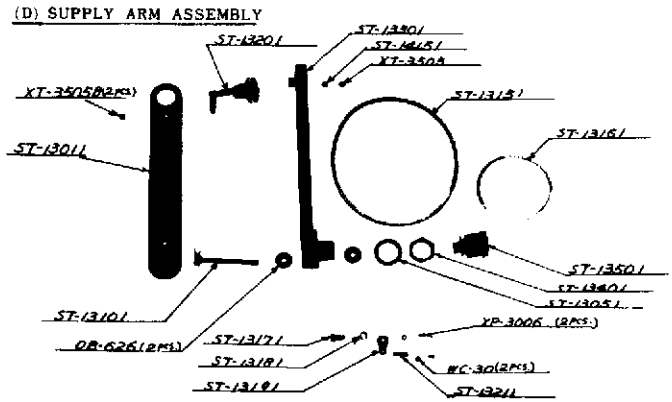
S.4 SUPPLY ARM SPINDLE AND PULLEY ASSEMBLY ST-13201

Lubricate shaft and arm hub with silicone grease.

Belt must be clean and dry.

Pulley grooves must be clean and dry.

Slippage here will result in poor rewind.



S.5 TAKE-UP DRIVE GEAR AND CLUTCH

Function: Drive gear ST-14501 has a protruding pin which holds clutch cam ST-14071. When projector is operated in "Forward" mode, clutch cam engages one of five (5) pins located in outer clutch collar ST-14401. This collar is secured to drive pulley shaft with a set screw.

Check: When projector is operated in "Reverse" without film outer clutch collar and pulley shaft should not turn.

Main drive belt should not touch outer clutch collar.

Adjustment: Drive gear ST-14501 should have a small amount of "end play," .005" or 1 film thickness.

Locate and secure outer clutch collar accordingly.

To disassemble, remove 2 screws in arm cover plate. Drive pulley and shaft may now

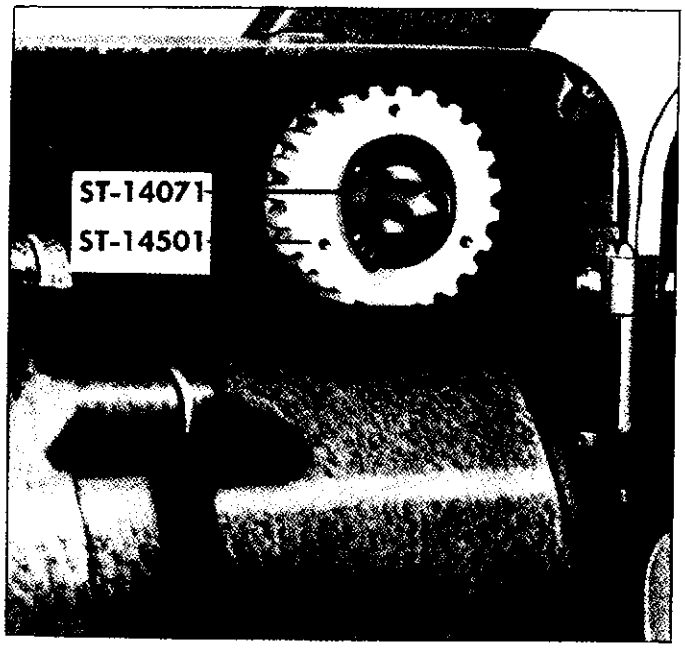
be pushed out to allow removal of outer clutch collar.

Lubricate shaft and hub with silicone grease.

Clutch cam ST-14071 must be clean and dry. Oil or grease on cam may prevent it from engaging pins of outer clutch collar.

To mount clutch cam, rotate drive gear ST-14501 so that pin is at "10:30 o'clock." Hang clutch cam on pin. Carefully slide outer clutch collar on shaft and tighten set screw.

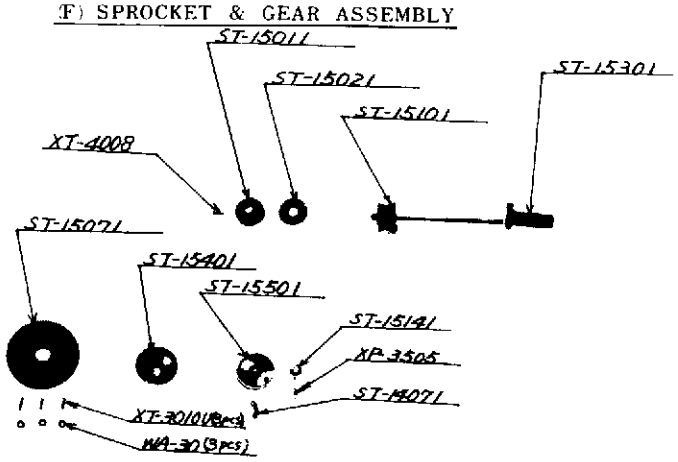
Replace main drive belt if necessary.



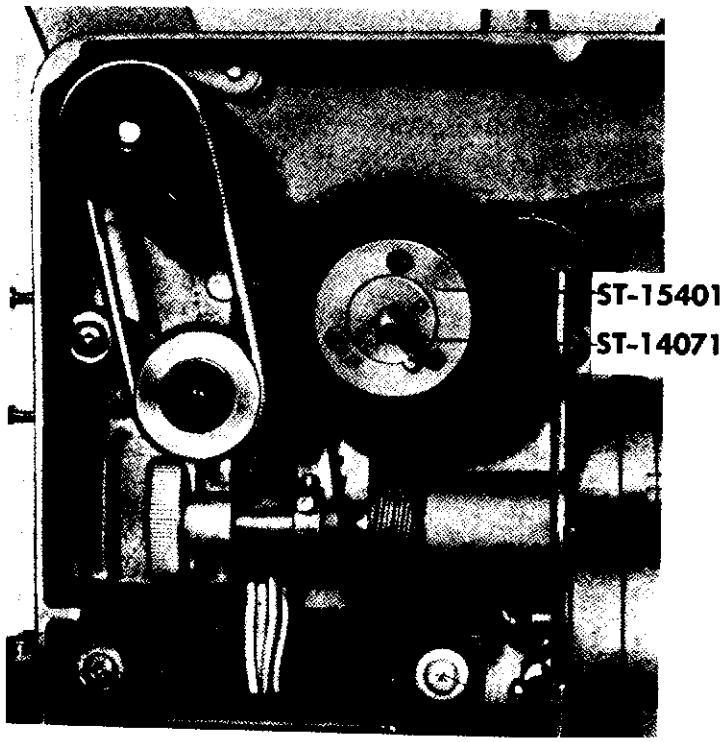
S.6 No. 1 SPROCKET AND GEAR ASSEMBLY

S.6.1

Shaft size in early ST series projectors is 6mm DIA. and shown as part number S-254.



New shaft diameter is 7mm and shown as part number ST-15101. Sprocket drum and shaft are sold as an assembly.



Large size parts may be installed on early models by using the appropriate shaft, hub, drive gear, clutch collar and outer retaining collar.

To mount clutch cam, rotate drive gear so that pin is in "1:30 o'clock" position. Hang cam on pin. Carefully install clutch collar. Install collar ST-15141 allowing a small amount of clearance, 1 film thickness, so that clutch collar does not bind. Clutch cam must be clean and dry.

NOTE: If sprocket plate or gear assembly has been removed, check sprocket-claw timing, S.9.3, after installation.

Lubricate shaft, hub and clutch collar ST-15501 with silicone grease.

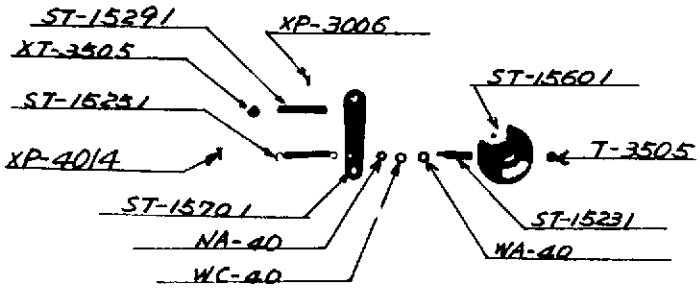
Lubricate reverse belt slightly with graphite or equal. This will reduce extreme tension on film when projector is run in reverse with very small reels.

Lubricate fibre gear with silicone or other fine oil, completely wetting all teeth. Wipe off excess.

S.7 IDLER GEAR ASSEMBLY ST-15601

Function: Maintains proper tension of main drive belt over gears.

Lubricate gear hub and shaft with silicone grease.



S.8 No. 2 SPROCKET AND GEAR ASSEMBLY

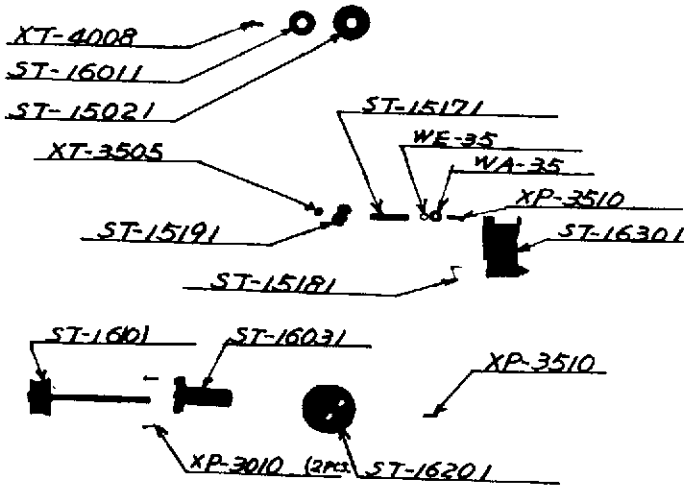
S.8.1

Toothed main drive belt assures proper synchronization between No. 1 sprocket and No. 2 sprocket.

Lubricate shaft and hub with silicone grease.

Assemble drive gear and sprocket shaft with minimum clearance.

(G) SPROCKET & GEAR ASSEMBLY



Check: Observe entry of sprocket teeth into first perforations of film leader. Use acetate base film leader or film for this test. Plastic leader is generally shrunk too much.

Adjustment: Remove lamp house door casting ST-32111. Loosen screw in end of sprocket shaft and rotate sprocket plate to correct position. Tighten screw and replace lamp house door casting.

NOTE: Above adjustment not critical. Film shrinkage will affect synchronization of film perforations and sprocket teeth at No. 2 sprocket.

If main drive belt is removed or skips a tooth or two, readjustment may be required.

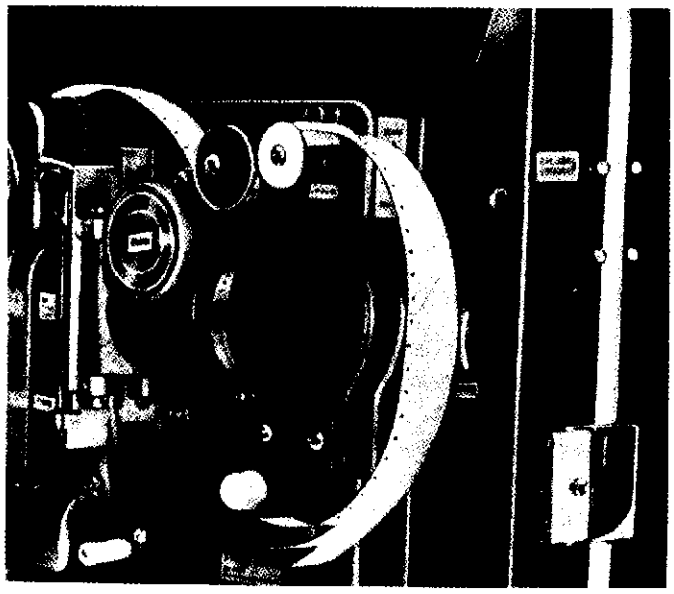
Above adjustment may also be made by repositioning main drive belt over No. 1 sprocket drive gear until satisfactory synchronization is achieved. See also S.10.

S.9 SELF-THREADING PATH

S.9.1 NO. 1 SPROCKET SHOE ST-15201

Function: IN CLOSED POSITION it keeps film engaged with sprocket teeth.

IN OPEN POSITION, film may be easily removed. To open, swing lens out, then depress film shoe. It will remain open. Shoe will close automatically when lens is swung back in to close gate.



Check: Proper clearance between shoe and sprocket is important. Take a piece of film and feed into sprocket at arrow using inching knob, advancing film approx. 2 inches. Add another piece of film over first one and

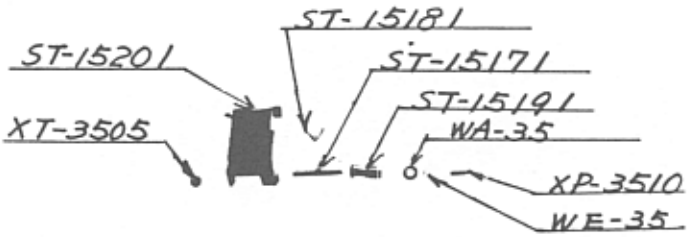
turn inching knob. Shoe should not move when end of second film is fed through. Take a third piece of film and feed through sprocket. Shoe should move when end of film passes between shoe and sprocket drum.

A piece of test film is easy to make by cementing three pieces of film together. Add the second piece to first and third to second in "steps" of 2"-3" long. A narrow strip of Scotch tape may be used in centre of film. Be sure tape does not touch sprocket drum thus adding to thickness of film for test purposes.

Adjustment: A small protrusion located at centre of inner side of shoe contacts hub casting when shoe is closed. If protrusion point is too long, shoe will remain too far away from sprocket drum. If necessary, remove shoe to file protrusion point to provide proper clearance.

Too little or no clearance will cause film damage.

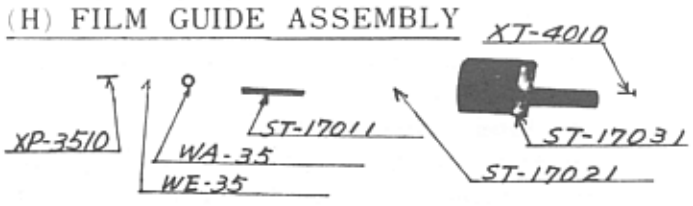
NOTE: Observe small "V" spring ST-15181 used to hold shoe in closed or open position. When replacing shoe, be sure to locate ends of spring in the appropriate holes.



S.9.2 NO. 1 FILM GUIDE ST-17031

Function: IN "SELF-THREAD" POSITION guide is pushed out over gate and becomes an upper loop former while gliding the film into the gate.

In "OPERATE POSITION" guide recedes away from film path into projector body.

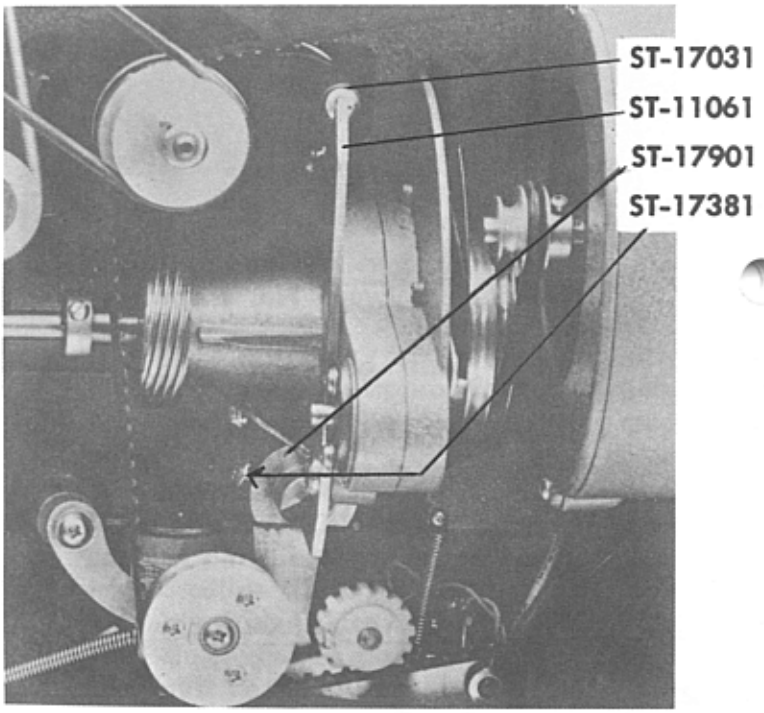


Check: Film guide travels approx. 3/4" from "Operate" position to "Self-Thread" position. In Operate position, end of guide should protrude 1/4" from projector frame casting. This provides 1/8" clearance between end of film guide and inner edge of film. The measurements are not critical. The film guide must recede sufficiently to clear film in "Operate" position.

Film guide must travel freely. Curved hole in casting must provide the necessary clearance.

The mounting pin ST-17011 must be straight and mounted so that it is perpendicular to film gate.

Spring ST-17021 should move guide easily.



Adjustment: Film guide position and movement is controlled by No. 2 Film Guide Control Lever ST-17801. Cam bracket ST-17901 is mounted on control lever shaft. The cam action moves control bar ST-11061 which in turn moves No. 1 Film Guide.

Position of No. 1 Film Guide may be adjusted by one of two methods.

a) Bend control bar below mounting screw with a pair of long-nosed pliers so that cam contacts control bar sooner or later as required.

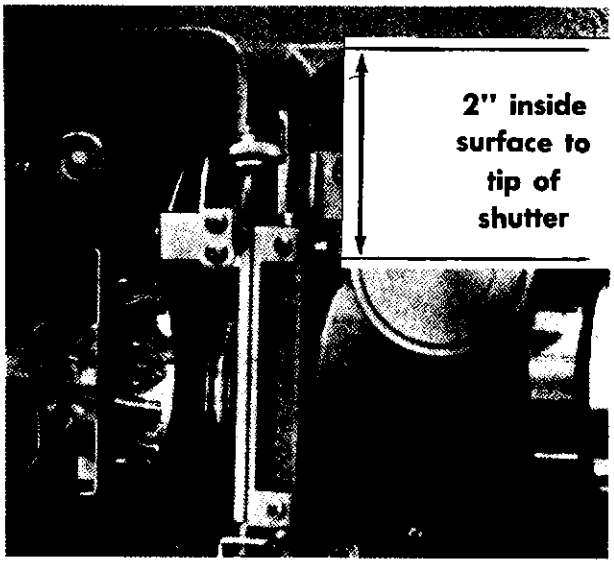
b) Remove screw in end of No. 1 Film Guide and install or remove washers as required.

NOTE: The position of the camtank assembly is slightly variable due to mounting hole clearance. No. 1 Film Guide position is affected by camtank assembly position.

S.9.3 NO. 1 SPROCKET—CLAW TIMING

Function: It is important that the film perforations are in the correct position for claw entry as the film reaches the claw.

Film damage, self-threading failure and excessive clatter during self-threading operation are the result of improper timing.



Check: Move film guides to "Self-Thread," switch motor on and thread a piece of film. Film must travel through gate so that claw pulls film. Misadjustment puts film in a position so that claw strikes film instead of perforation. Film then "runs" through gate.

Adjustment: Push No. 2 film guide to "Self-Thread."

—Install film and inch forward so that film is in gate.

—Turn inching knob so that claw is engaging film ready to pull down,

—Top point of shutter blade must be 2" ± ¼" from top inside surface of lamp house.

—Loosen screw in end of No. 1 sprocket shaft.

—Turn sprocket plate so that film contacts firmly complete inside surface of No. 1 film guide.

—Tighten screw.

NOTE: Check timing if:

a) Camtank has been removed.

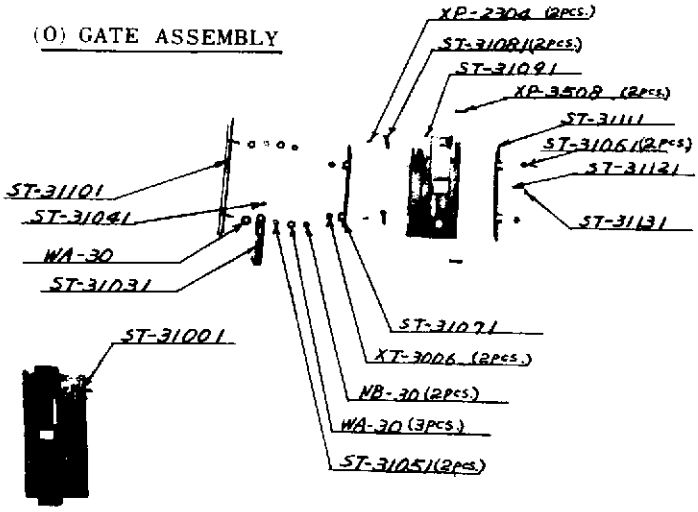
b) No. 1 sprocket or gears have been removed. One tooth will then be in the closest possible position in relation to the bottom edge of No. 1 film guide.

S.9.4 FILM GATE ASSEMBLY ST-31001

Guide Rails:

Outer Guide Rail ST-31071 is secured to gate plate by 2 screws and located against shoulder of film gate ST-31101. This assures proper vertical travel of film, parallel to film gate.

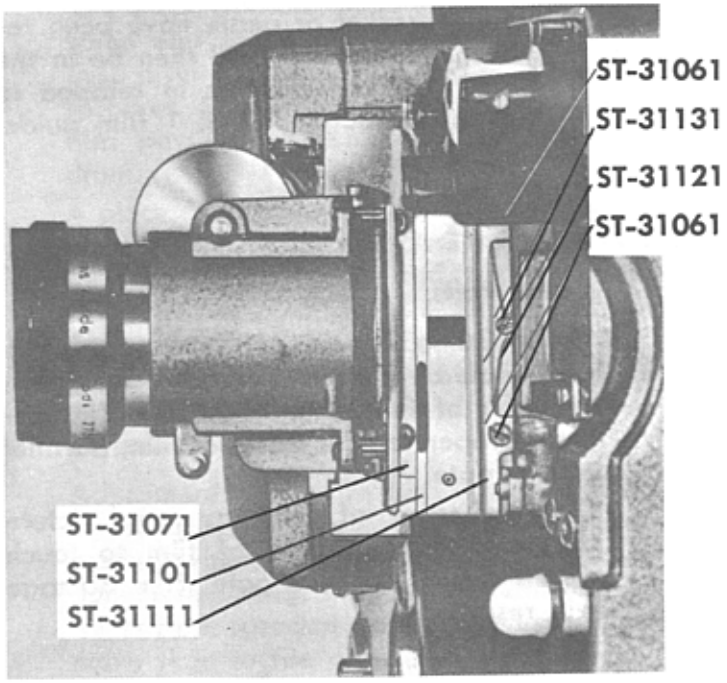
Diagonal travel of film may cause picture or sound track portion of film to touch raised sections of film gate. Film damage will result.



Inner Guide Rail is spring loaded, and held in place by 2 shoulder screws ST-31061. With screws secured, guide rail should be free to travel with a minimum of clearance under screw head. Spring tension must be sufficient to hold film against outer guide rail during operation.

With film in gate, guide rail is moved away from its position against film gate ST-31101, thus establishing side tension on edge of film.

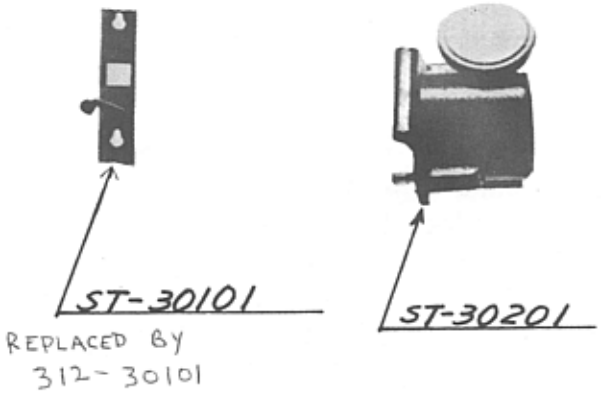
Check for additional clearance of inner guide rail to accommodate wider film or scotch tape wrapped around film.



S.9.5 **FILM SHOE ST-30101** (312-30101)

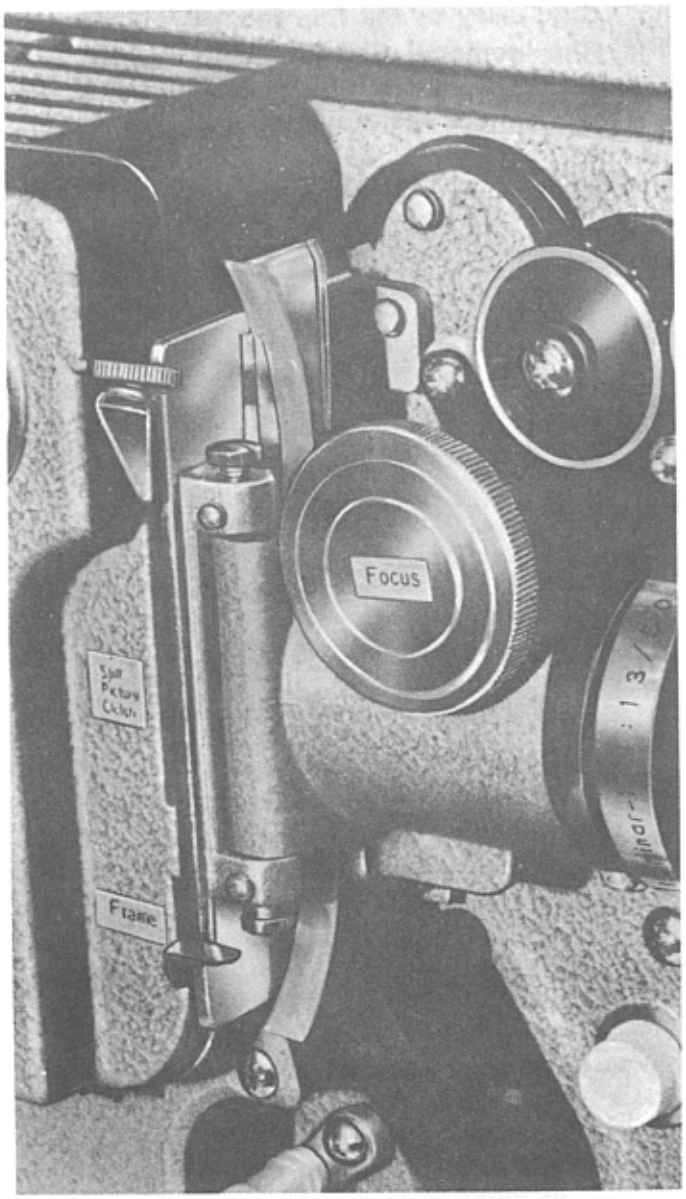
Film shoe is mounted on 2 pins and held in place by a locking lever under lower pin. Retaining plate ST-30041 is secured to lens holder by 2 screws. Holes in lens holder are oversize, allowing for adjustment of film shoe position.

(N) LENS HOLDER ASSEMBLY



Check: Outer guide rail must be snug against shoulder of film gate. Swing lens in to close gate. Clearance between outer guide rail and outer edge of film shoe should be the thickness of 1 film.

Adjustment: Cut a 4" length of 16mm film ¼" wide. Insert between film shoe and outer guide rail. Film shoe should be moderately snug. If adjustment is required, loosen 2 screws that hold retaining plate ST-30041. Reposition plate and tighten screws.



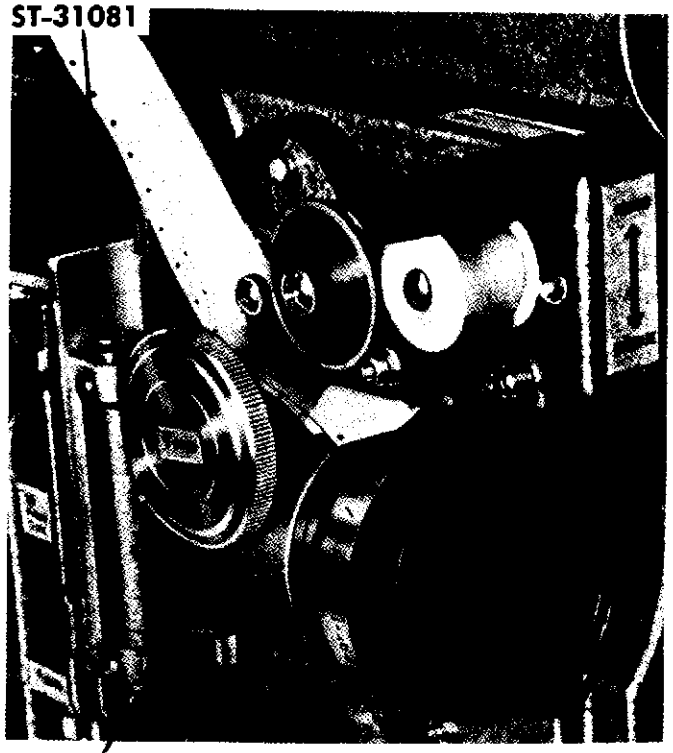
Check: Be sure pins do not bind when fully depressed in lens holder. With gate closed and lens removed, check that hole in film shoe clears the film aperture on all sides.

NOTE: Lower shoe pin spring ST-30071 is longer than upper spring ST-30061. Extra tension is designed to overcome film movement caused by claw action at lower end of film shoe.

S.9.6 LENS HOLDER ASSEMBLY ST-30201

Check: Clearance between top of lens holder and bottom of No. 1 sprocket shoe should be no less than 3 film thicknesses. This provides the clearance necessary to depress sprocket shoe for film removal or insertion. This also helps prevent film damage, should the film jam up in gate area during self-threading.

If lens holder is up tight and no clearance provided, sprocket teeth may puncture film between perforations.



Adjustment: Loosen 2 pivot locking screws and turn 2 pivot screws ST-31081 as required. Pivot screws must be snug against lens holder. Tighten 2 locking screws against pivot screws.

Check: Optical axis of lens must be perpendicular to film plane. Set projector at exact right angles to screen. Without film, project light beam. A 3' wide area is a good size. Both side edges of illuminated area must be focused, equally sharp.

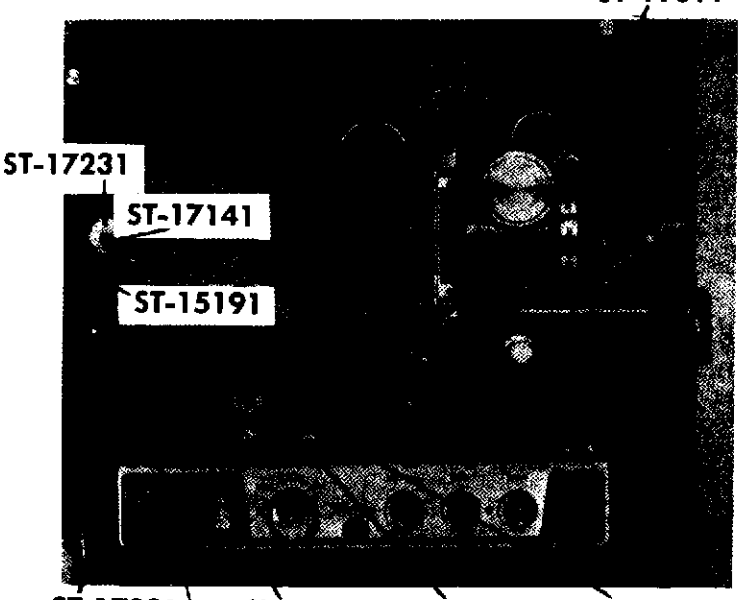
Adjustment: Loosen lock nut and adjust screw located under front of lens holder to achieve optimum equal focus. Tighten lock nut.

NOTE: The Super F1.3 high speed lens has a shallower depth of focus and requires a more accurate adjustment than other slower lenses.

S.9.7 NO. 2 FILM GUIDE ST-17801

Function: Moving this film guide to the left till it locks as you face the projector, prepares the film path for Self-Threading in the following manner:

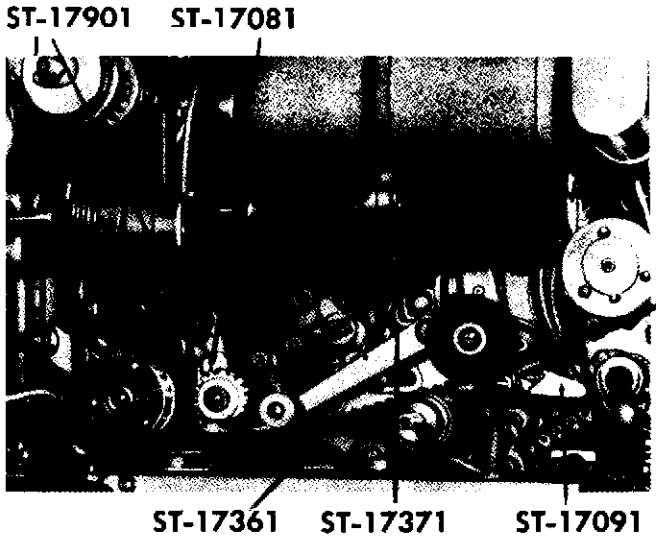
a) No. 1 Film guide is pushed into place above film gate.
b) No. 2 and No. 3 film guides are lined up.
c) Sound drum pressure roller ST-17151 is raised away from sound drum.
d) Main drive belt is depressed away from automatic loop restorer gear.
e) On magnetic models, magnetic sound head is raised clear of film path.
f) System remains locked in position till released by pulling back on last roller.



No. 2 film guide is held in cam bracket ST-17901 by screw ST-17381. A flat spot on shaft provides the seat for the screw.

Cam bracket and horizontal guide bar ST-17091 are connected by shoulder screw ST-17081.

At other end of guide bar is a hook or "catch" that accepts the low end of release bracket assembly ST-17981. Release roller ST-17231 is attached to upper end of this bracket assembly.



Check: When No. 2 film guide is pushed to "Self-Thread" position, release bracket ST-17981 should just fall into hook with minimum clearance.

Too much clearance at this point will allow No. 2 film guide to "back up" and leave too large a gap where No. 2 and No. 3 film guides meet. The film then could go under No. 3 guide.

Adjustment: Use a pair of long-nosed pliers to bend as required, the horizontal section of release bracket ST-17981 that falls into hook.

Lubricate hook area with small amount of silicone grease.

S.9.8 NO. 3 FILM GUIDE ST-17121

Function: Film guide is raised into position by contact of low end of No. 2 film guide to protruding pin of No. 3 guide.

Check: No. 3 guide should drop down as soon as "Self-Thread" system is released.

Adjustment: Clean, remove cause of binding and lubricate sparingly with silicone oil.

S.9.9 NO. 4 FILM GUIDE ST-17991 and Lateral Guide Roller ST-17151

Function: This guide deflects leading end of film up and over sound drum.

In "Self-Thread" position, horizontal guide bar ST-17091 depresses pin ST-17361, raising No. 4 film guide. Lateral Guide roller ST-17151 is attached to film guide.

Check: In "Operate" position, lateral guide roller should rest firmly against sound drum. Spring ST-17371 provides the necessary tension. Clearance between lower edge of horizontal guide bar and pin ST-17361 should be approx. 1/32"

Too much clearance will cause shoulders of lateral guide roller to be pressed against casting when in "Self-Thread" position.

If lateral guide roller does not turn freely, excessive friction may cause film to bind when threading.

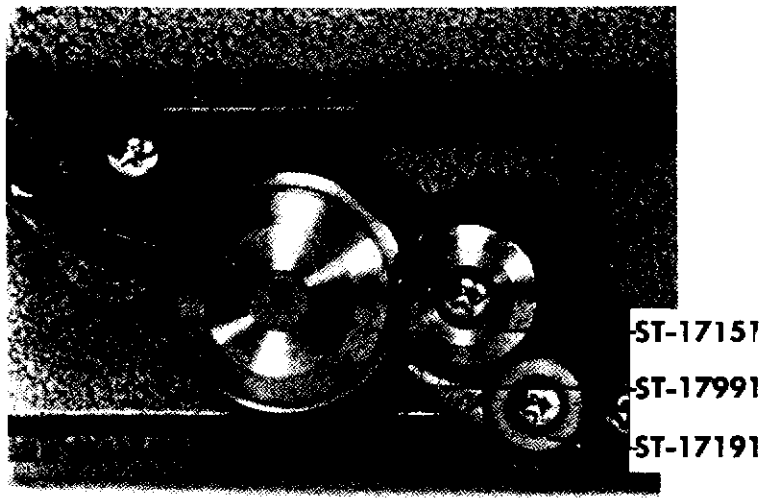
Adjustment: Push No. 2 film guide to "Self-Thread" position.

—Insert 2 layers of 16mm film between shoulders of lateral guide roller and lamp house casting.

—Locate pin ST-17361 so that it touches bottom edge of horizontal guide bar.

—While pressing lateral guide roller toward casting (with film between roller shoulders and casting) tighten screw that holds pin bracket to No. 4 film guide shaft.

NOTE: Clean and lubricate rollers as necessary with silicone oil.



S.9.10 LAMP HOUSE CASTING ST-32111

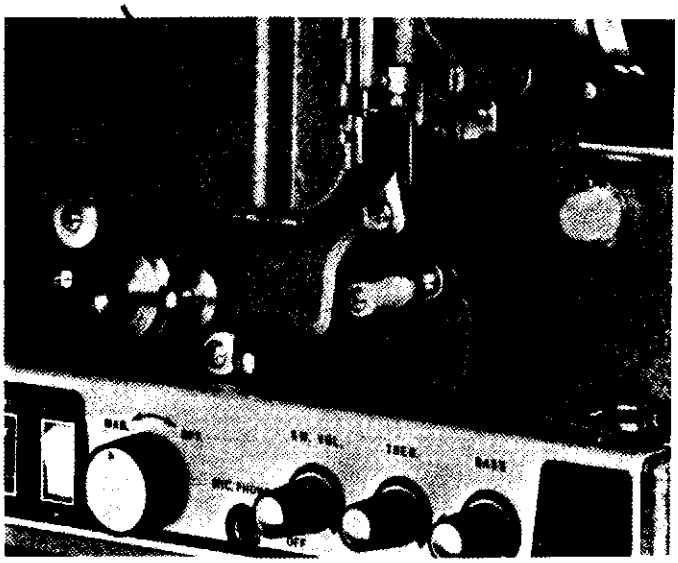
Function: Casting forms part of "Self-Threading guide system."

Check: Areas where leading end of film touches casting must be very smooth and free from any burrs or imperfections that could cause jamming.

Adjustment: Remove imperfections as required and polish with fine sandpaper or emery cloth.

When painting, be sure paint dries to a smooth even surface.

ST-32111



S.9.11 NO. 5 FILM GUIDE ST-17211

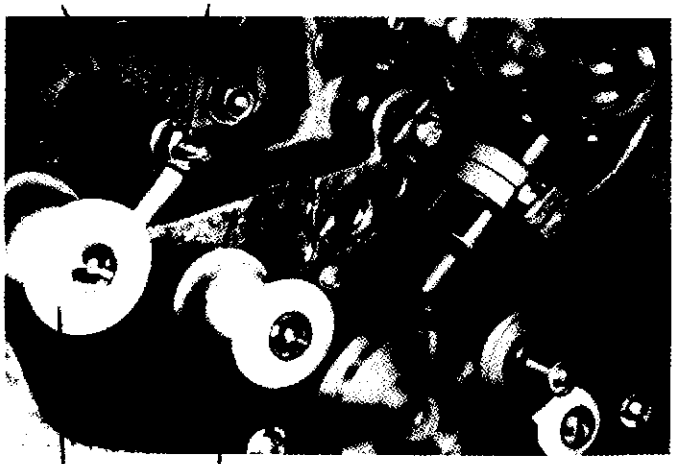
Function: This guide has roller ST-17231 attached to the upper end. Close to upper end also is spring ST-17251.

In proper operation, the spring tension balances the combined resistance of lateral guide roller, sound drum and flywheel and idler roller.

The No. 5 guide then rides midway between its limits. Wow and flutter are minimized.

Check: Thread film and operate in normal manner. After a few seconds of operation, sound drum and flywheel will come up to speed. No. 5 film guide should now ride between lower limit pin and lamp house casting.

ST-17251 ST-10161



ST-17231 ST-17211

Movement of film guide should not be rhythmic. In such a case a roller or sound drum would be binding or out-of-round. An out-of-round No. 2 sprocket drum assembly could also cause the rhythmic motion.

Adjustment: Clean and lubricate sparingly all rollers with silicone oil.

—Remove burrs or imperfections or replace defective parts.

—Clean or replace sound drum ball bearing OB-608Z.

—Replace defective No. 2 sprocket drum assembly.

—Replace spring ST-17251 if necessary.

S.9.12 NO. 2 SPROCKET SHOE ST-16301

Function: In closed position it keeps film engaged with sprocket teeth.

On Self-Thread (ST) models shoe is always closed.

On Manual (M) models shoe will stay open for easier threading.

Check: Proper clearance between shoe and sprocket is important. Take a piece of film and feed into sprocket at arrow using inching knob, advancing film approx. 2 inches. Add another piece of film over first one and turn inching knob. Shoe should not move when end of second film is fed through. Take a third piece of film and feed through sprocket. Shoe should move when end of film passes between shoe and sprocket drum.

A piece of test film is easy to make by cementing three pieces of film together. Add the second piece to first and third to second in "steps" of 2"-3" long. A narrow strip of scotch tape may be used in centre of film. Be sure tape does not touch sprocket drum thus adding to thickness of film for test purposes. See S.9.1.

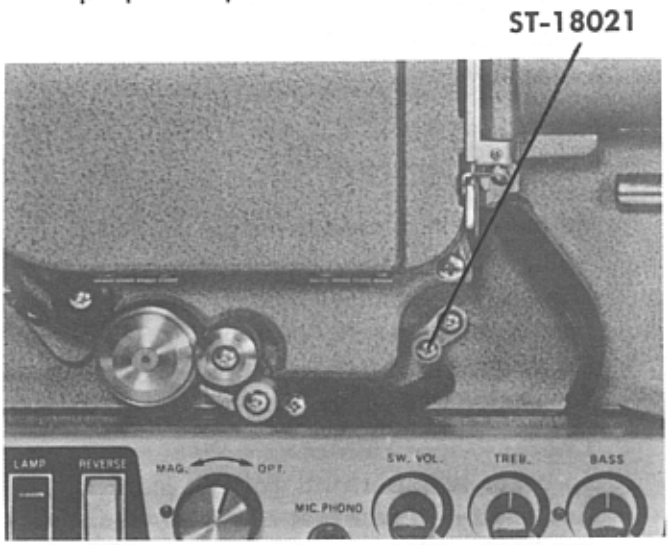
Adjustment: A small protrusion located at centre of inner side of shoe contacts hub casting when shoe is closed. If protrusion point is too long, shoe will remain too far away from sprocket drum. If necessary, remove shoe to file protrusion point to provide proper clearance.

Too little or no clearance will cause film damage.

NOTE: Observe small "V" spring ST-15181 used to hold shoe in closed or open position. When replacing shoe, be sure to locate ends of spring in the appropriate holes.

S.10 LOOP SETTER ASSEMBLY

Function: This device maintains correct lower loop size. If sensing roller ST-18021 is pulled up by film, nylon gear ST-18201 engages toothed main drive belt and rotates one full turn. Tension of spring ST-18061 keeps loop setter stationary during normal projector operation.



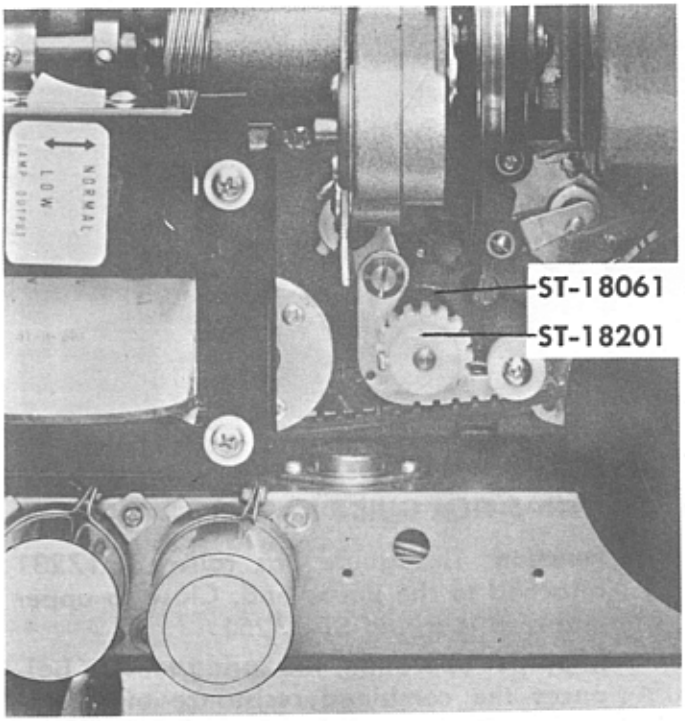
Check: Turn projector on forward mode without film. Touch bottom of sensing roller to cause loop setter to rotate. Loop setter should make 1 complete revolution only. Sensing roller should come to rest at "7:30 o'clock."

Adjustment: Insufficient spring tension could cause loop setter to rotate more than once. Increase tension by repositioning gear ST-18201 closer to hub.

Additional rotation could also be caused by belt engaging a tooth on nylon gear that has not been trimmed properly. Use a sharp knife to remove the offending part if necessary.

To relocate sensing roller loosen screw in end of shaft beside sensing roller. Hold nylon gear with other hand while loosening or tightening this screw. Tighten screw SECURELY when adjustment is completed.

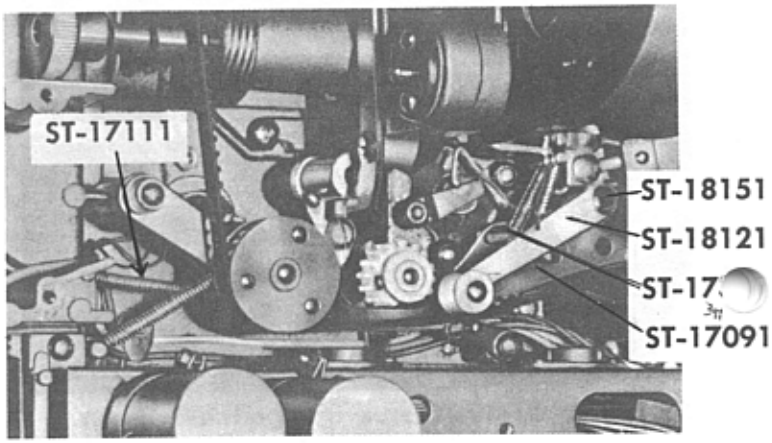
Check: Thread film completely and with projector in "operate" condition turn inching knob. Film should not touch loop setter sensing roller. Double check with projector running.



Adjustment: Remove lamp house casting ST-32111. Loosen screw in end of No. 2 sprocket shaft and rotate sprocket plate counterclockwise as required. Tighten screw. See also S.8.

S.11 BELT DEPRESSING BRACKET ST-18121

Function: When projector is placed in "Self-Thread" position belt is depressed to make loop setter inoperative, thus preventing possible damage to No. 2 film guide. Bracket ST-18121 is pushed down by pin ST-17391 which is attached to horizontal guide bar ST-17091.



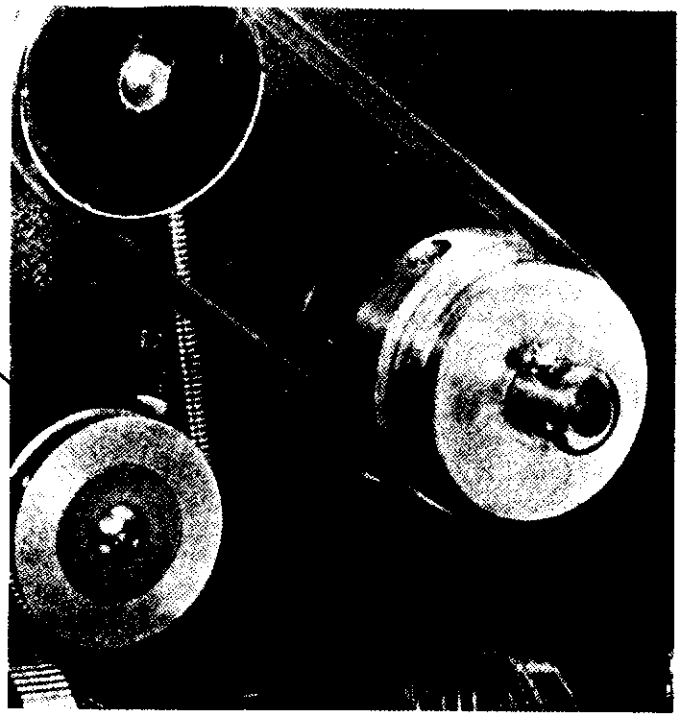
Check: Excessive friction at point where pin ST-17391 touches bracket ST-18121 may not allow release of "Self-Threading" guide system.

Adjustment: Return spring ST-17111 is attached to front end of horizontal guide bar. This spring should be shortened or replaced with a stronger one.

Check: Be sure shoulder screw ST-18151 is securely tightened. Too much clearance may allow bracket ST-18121 to swing out and slip past end of depressing pin ST-17391.

S.12 REWIND CONTROL ASSEMBLY ST-19031

Function: Rewind is accomplished by placing "Operate-Rewind" lever ST-19021 in "rewind" position. The flat part at the end of the shaft ST-19031 allows the fibre rewind gear ST-19201, to engage with the No. 1 sprocket drive gear. The supply arm spindle is driven in reverse via the steel spring belt between the supply arm drive shaft and the fibre rewind gear pulley. The film direction switch on control panel must be in FORWARD position. The cap-screw lock nut on the rewind gear bracket ST-19121 allows adjustment of rewind gear position. When engaged the fibre gears should mesh completely with a slight amount of "play" to avoid undue wear caused by excessive pressure. With lever in "operate" position, gears must disengage completely with approx. 1/32" clearance.



Check: Flat part of rewind contral shaft ST-19031, when rotated to "operate" position, should be approx. "10 o'clock" in relation to flat top of cap screw. This is past the "centre" or "12 o'clock" position. In this position, the shaft will not rotate due to vibration thus possibly putting the projector into rewind accidentally.

Adjustment: To adjust, loosen screw in control lever and rotate shaft as necessary. Be sure that roller is free to turn, before securing screws in control lever.

Adjust cap screw ST-19111 to provide correct clearance.

Lubricate fibre gear teeth with silicone or other fine oil. Wipe off excess.

S.13 SOUND PICK-UP

Function: The focus and azimuth of the optical sound lens are very critical and are adjusted simultaneously. Note position of filament of exciter lamp. It must be in center line of optical lens. The scanning beam must be a sharp thin line focused on the film sound track. The scanning beam must also strike the center of the sound track. In this position it will clear the edge of the sound drum and strike the solar cell.

Check: A frequency test film should provide a good response up to 6000 or 7000 Hz. A normal sound test film should produce enough high frequency tones for a pleasant sound balance.

Adjustment: To adjust optical lens for focus and azimuth it is necessary to use a test film with a 7000 cycle tone. SMPTE PH 22.42—7000 is such a film. A 3-foot length of this film should be spliced to form a loop. Installed in the projector it will provide the necessary signal for accurate adjustment. It is best to remove lamp house door and casting ST-32111 for any adjustments to optical lens.

Lock Screw for Buzz Track Adjustment ST-40011

Lock Screw for Azimuth & Focus Adjustment

Install an 8-ohm 10-watt resistor across speaker output. Connect a low reading AC voltmeter and an Oscilliscope across resistor, with projector operating, set meter and scope for convenient reading with volume control at approx. "9 o'clock" (¼ rotation) and treble control at maximum.

Loosen screw in lens holder bracket ST-40011, thus allowing lens to be moved. Rotate lens for azimuth adjustment. Observe clean sine wave pattern on oscilliscope. Set for maximum reading. Slide lens up or down for focus. Observe meter reading or oscilliscope amplitude. Set for maximum reading. After obtaining maximum reading on both azimuth and focus with simultaneous adjustment, tighten screw to clamp lens. Observe meter or scope. Output should not drop. Seal set screw with paint.

Check: Scanning beam must fall on center of optical sound track of film. Excessive noise will be heard together with distorted sound if scanning beam position is incorrect. Use SMPTE "Jiffy" test film to check. It contains a section of Buzz Track test film.

Adjustment: To adjust, use SMPTE PH 22.57 Buzz Track Test Film. A 3-foot length to form a loop is convenient. (SMPTE "Jiffy" test film may be used.)

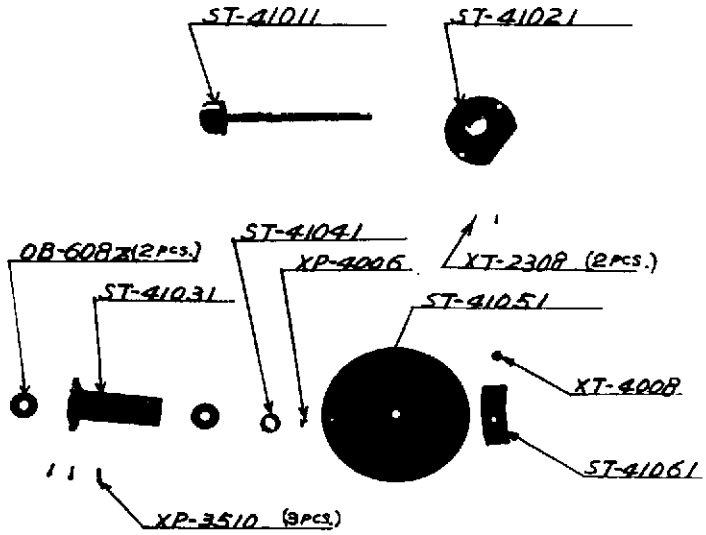
Optical lens bracket is mounted on two pins which slide into holes of main casting. Upper pin is held by a set screw through the casting. Loosen set screw to allow lens bracket assembly to slide. With projector operating, speaker plugged in and volume at approximately "10 o'clock," slide assembly to a position where no sound is heard. Too far in one direction will produce a low tone; too far in other direction will produce a high tone. After proper positioning ed, tighten set screw and seal with paint or sealing wax.

S.14 SOUND DRUM AND FLYWHEEL ASSEMBLY

Function: The sound drum shaft is mounted in the shaft housing with ball bearings. The retaining collar should be installed with minimum clearance. Shaft must not bind in rotation.

Flywheel is held on shaft with plate spring ST-41061 and screw. This arrangement allows the flywheel to slip on sound drum shaft at the moment the film is started in either forward or reverse direction. This assures minimum film damage. Torque required to turn flywheel on shaft in forward direction should be approx. 1.5 in. oz. or 100-110 cent. grams.

(S) SOUND DRUM ASSEMBLY



Check: To check torque use convenient scale and string which may be secured to outer circumference of flywheel with scotch tape. Install film in projector and switch motor on. With projector operating, string at-

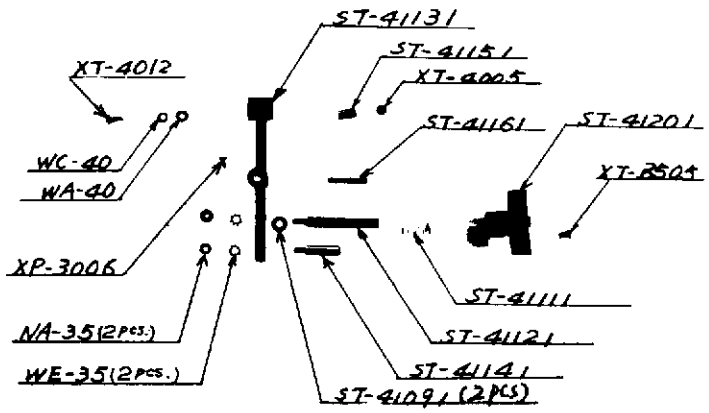
tached to flywheel and scale, a reading of approx. 20-25 grams (1 ounce) should be observed.

Adjustment: To adjust remove spring and bend to provide correct tension. Be sure the edge of spring does not dig into the surface of flywheel. Replace spring if necessary.

Insufficient tension results in longer delay of sound stabilization.

S.15 REVERSE DRIVE ROLLER ST-41201

Function: When projector is operated in "Reverse," roller ST-41201 is carried toward flywheel by the main drive belt. The rubber roller engages the flywheel which in turn rotates the sound drum and pulls the film from No. 2 sprocket. This maintains the lower loop under the gate. The slippage of the flywheel on the sound drum shaft allows film to be transported without damage.

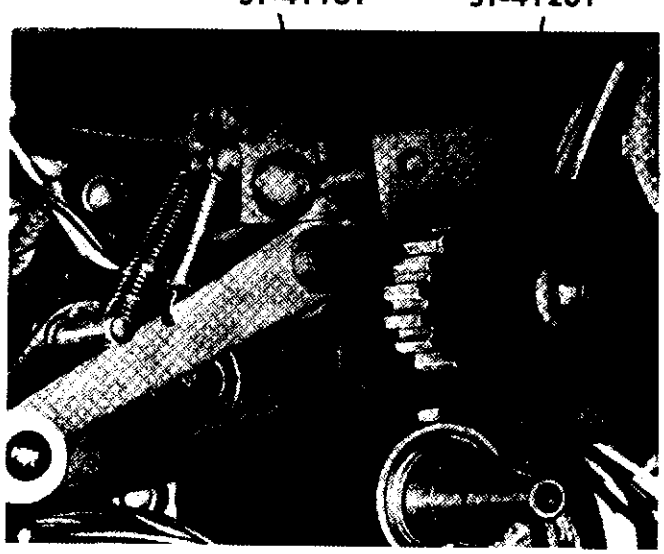


When projector is operated in "Forward," roller is carried away from flywheel, thus allowing it to rotate freely. The rubber roller must not contact flywheel at any time in this mode of operation.

Check: To check, move No. 2 film guide to self-threading position, without film in projector, turn projector on in "Forward" mode. Observe flywheel. It should not move. Switch projector to "Reverse." Flywheel should rotate. Switch projector "off." Observe reverse roller as you turn inching knob clockwise. Roller should be carried away from flywheel toward rear of projector.

Adjustment: Spring ST-41111 provides the resistance required to carry roller along main drive belt. Stretch or replace as necessary.

Check: Pin ST-41161 limits travel of roller when projector operates in "Reverse." Rubber roller should contact flywheel just before pin touches casting. Clearance at this point should be approximate thickness of film.



Adjustment: Loosen set screw and slide pin ST-41161 to correct position.

NOTE: Too much clearance allows roller to be carried toward flywheel too far. This exerts too much pressure and increases resistance of rotation of flywheel, sound drum and roller. Main drive belt may then skip a tooth or two over a drive gear. This results in loss or increase of film loop depending on which drive gear skipped. A "thump" will be heard if skipping occurs. Too little clearance between pin and casting keeps rubber roller from touching flywheel.

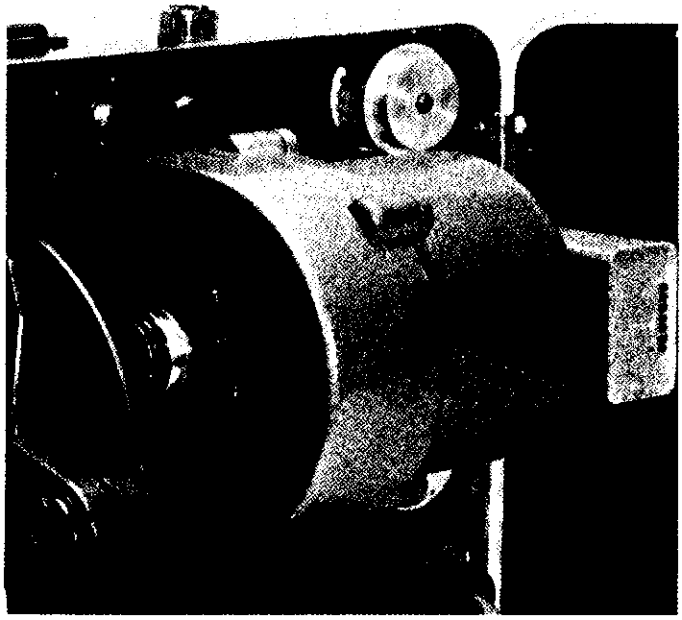
Lubricate roller shaft and hub with silicone grease. Wipe off excess.

S.16 MOTOR AND COOLING FAN

When mounting motor and fan observe the clearance on either side of cooling fan. Tighten set screw securely.

Be sure to install belt pulley with set screw toward motor before mounting motor and fan housing to projector chassis. After se-

curing motor mounting, align the motor belt pulley with the shutter pulley. See S.1.2. Tighten set screw to flat spot on motor shaft.



S.17 SPEED CHANGE

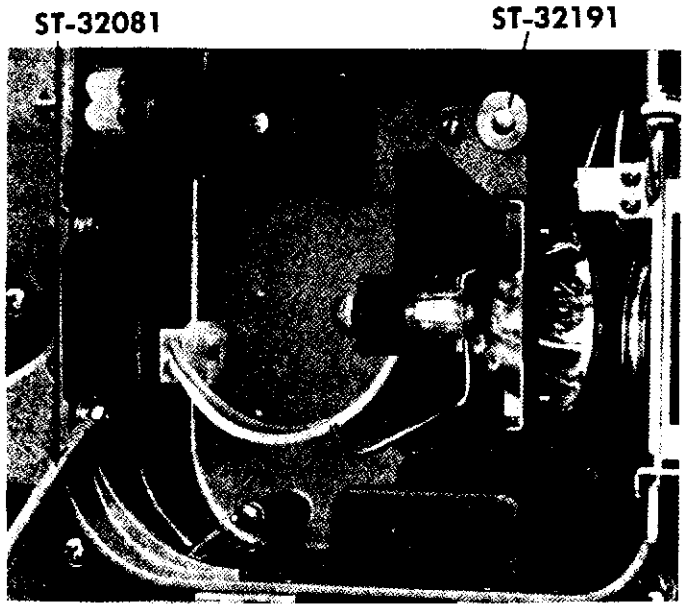
Sound speed (24 frames per sec.) is obtained by placing the belt on the large size motor pulley and the corresponding shutter shaft pulley.

For silent (18 frames per sec.) place the belt on the other pulley set.

S.18 LAMP HOUSE

Open the lamp house by loosening the locking screw located on the left side of the lamp house. The top part of the lamp house door swings out for ready access to projection lamp. The spring loaded stop arm is lifted off the pin to allow the door to be opened fully.

To correct the uneven brightness on right and left, adjust knurled knob ST-32191 right over the inner black lamp cover.



S.19 AMPLIFIER

Removal and replacement of the amplifier is very simple:

a) Disconnect power supply.
b) Remove flywheel.
c) Loosen set screws in control knobs on front panel and remove knobs.
d) Unplug electrical leads.
e) Remove one screw at each end of amplifier chassis with Phillips screwdriver.
f) Remove amplifier.

To replace, reverse above procedure.

S.20 ST-2H, M-2, ST-3H, M-3

This projector has a magnetic head and associated switch and circuit for magnetic playback. In the OPT position, the wafer contacts connect the solar cell circuit and exciter lamp circuit to the amplifier. The head is located 2 frames behind the optical sound lens scanning beam. The magnetic sound head is lifted off the film by the action of the lever attached to the end of the switch shaft. The bracket and shaft assembly is spring-loaded so that when the selector switch is in the MAG. position, the spring pulls the magnetic sound head down in contact with the magnetic sound strip on the film. In the OPT position, the switch lever strikes the sound head shaft bracket, lifting it up.

Observe this action and adjust the position of the switch lever if necessary. This is done by releasing the set screw in the end of the switch shaft. Wafer contacts must make full contact in either selector switch position.

SERVICE BULLETIN

Service Bulletin #4 August 6, 1969

Subject: CLEANING AND LUBRICATION

Lubrication is normally not required for average operation. It is recommended that once a year or every 1000 hours, whichever occurs first, the moving parts be inspected for signs of excessive wear, cleaned and lubricated.

Use methyl hydrate, alcohol or tri-chlorethylene as cleaning agents. We do not recommend carbon tetrachloride due to the dangers involved.

Polyurethane belts must be clean and dry. Remove oil and dirt accumulation with cloth moistened with cleaning agent.

Ball bearings should be clean and roll smoothly. If bearings are noisy or do not roll freely, they should be replaced.

Shafts without ball bearings should be clean and lubricated with silicone fluid or a light smear of silicone compound. Remove excess.

Rollers must rotate freely. Shafts and inside surface of rollers must be clean, free from burrs, scratches or other defects. Lubricate sparingly with a light silicone oil or other fine oil. Remove excess.

Camtank shutter assembly is packed with silicone compound, Dow Corning #44 or equivilant. Use approx. 1/2 teaspoonful around fiber cam.

Shutter pulley cone clutch surface and surface of shutter blade hub should be clean and dry. Surface of pulley and cast iron plate washer should be clean and dry. Use light silicone oil or fluid to lubricate bronze bushing in shutter pulley.

Fiber gears must not be allowed to run dry. Use light silicone oil or other light fine oil and cover all teeth with oil. Wipe off excess. This treatment will generally last many thousands of hours.

AVOID OVER LUBRICATION.

Please be sure to insert this bulletin in your Service Manual.

SERVICE BULLETIN

Service Bulletin #5 December 1, 1969

Subject: SOCKET VOLTAGES FOR EJL (HALOGEN) LAMPS

1. Some customers have been getting less than the rated 25 hours of burning time on EJL Lamps. This could be because the lamps are defective, or because the socket voltages are above 24 volts.

   Lamps are rated at an average of 25 hours if half of them burn longer, and half burn shorter, so some variation is expected. With low-voltage lamps the percentage of voltage variation is much greater when the actual variation fluctuates by only 1 or 2 volts.

2. IAV ROYAL Projectors have the primary of the transformer on the 115v tap. If your part of the country consistently has voltages above 115V, you should change the primary to the 125v tap. Here is a chart of lamp characteristics at various socket voltages:

LINE VOLTAGE	TRANSFORMER - 115v TAP	LIFE	BRIGHTNESS	COLOR TEMPERATURE
110v	Lower socket voltage, 23v	40.00 hours	85%	3945° K
115v	Correct socket voltage, 24v	25.00 hours	100%	4000
120v	Higher socket voltage, 25v	13.75 hours	112%	4045
124v	Higher socket voltage, 26v	8.75 hours	127%	4095
	TRANSFORMER - 125v TAP			
115v	Lower socket voltage, 22v	75.00 hours	74%	3900
120v	Lower socket voltage, 23v	40.00 hours	85%	3945
125v	Correct socket voltage, 24v	25.00 hours	100%	4000

3. Socket voltages should be measured with an accurate voltmeter since inexpensive voltmeters permit a 5% or more inaccuracy. This is the important measurement as far as IAV ROYAL Projectors are concerned, but a customer can call his local power and light company to get information about average line voltages. If line voltages usually run around 120 volts it would be better to shift the primary input to the 125v tap.

4. Defective lamps which burn much less than 25 hours at the rated voltage should be examined and replaced by your local G.E. representative.

SERVICE BULLETIN

Service Bulletin #6 June 4, 1970

Subject: Improvements and Modifications to ST series.

Symptom: Self-threading guides not releasing on projectors with serial numbers over 20,000.

Reason: 1. Bar on release bracket attached to last roller not clearing "catch".

Remedy: Bend bar on release bracket to clear "catch" when release roller is pulled to "release" position.

Reason: 2. Too much friction on pin where it touches main belt depressing bracket.

When projector is put into "self-thread" mode, the main drive belt is depressed away from loop restorer gear. A pin, ST-17391, is mounted horizontally on long guide bar, ST-17091. When this guide bar moves toward rear of projector, the pin depresses bracket, ST-18121. On the lower end of this bracket is a nylon roller which depresses the main drive belt away from the loop setter gear.

The friction of a steel pin riding on a steel edge is too great to be overcome by the return spring, ST-17111, which is attached to front end of guide bar ST-17091.

(NOTE: Part numbers are those found in new ST parts list which you will receive very soon.)

Remedy: Replace "return" spring with a stronger one. About double the tension of existing spring will be adequate. Replacement spring ST-17111 can be used, or you may obtain from a local electronic parts house as General Cement #6455, dial drive tension spring, 2" long-T6)

Additional Suggestion: Users have a natural tendency to try to release the threading guides by pulling back on the tab of the S-366 lever--the same tab used to close the guides. This bends the bar on the release bracket attached to last roller. On current production projectors this tab has been eliminated, and we recommend that it be cut off of projectors that come in for service or that you have in stock. This can be done without removing from the projector, using a small hack-saw blade. A drop of acetone will smooth out the area where the tab was removed.

INTERNATIONAL AUDIO VISUAL, INC., 1419 BLANCHARD STREET, SEATTLE, WASH. 98121 (206) 624-5714

SERVICE BULLETIN

Service Bulletin #7 June 4, 1970

Subject: Improvements and Modifications to ST/M series.

Symptoms: Poor Rewind--Slows down near end of 2000' reel.

Reason: 1. Supply (front) arm belt slipping.

Remedy: Remove supply arm cover plate and inspect belt and pulleys. Clean with alcohol or equivalent and wipe dry. It should be necessary to stretch belt at least 10% when installing. Replace if necessary.

Reason: 2. Take-up clutch too tight, causing too much resistance.

Remedy: (a) Lubricate cork liner with G.C. Phono-Lub 1223-S.*

(b) If diameter of cork liner is too small, above lubrication will not be satisfactory. A very dry tight cork liner may cause take-up arm belt to twist and bind around pulley. It will be necessary to replace complete spindle or increase cork diameter by using sandpaper to remove some of the cork.

To check clearance cut a 3 3/4" length of 16mm film and install on inside of cork liner. This should provide a moderately snug fit when placed on steel drum. With film removed, a slight amount of "play" should be observed when moving spindle up and down.

NOTES: If too much cork is removed, the bottom of a full 2000 ft. reel may touch the arm.

Do not overlubricate cork liner. Some grease may work over to the take-up arm belt. The net result of too much lubrication is insufficient friction and a very poor take-up. Film wound too loosely is apt to be scratched.

Clean and lubricate upper pulley and hub of take-up arm with silicon fluid.

*If you cannot find this locally, we will supply it @ $1.00 for 2 oz. tube.

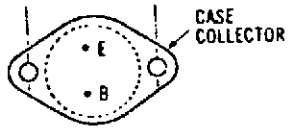
SERVICE BULLETIN

Service Bulletin #15 January 11, 1971

SUBJECT: CHECKING TRANSISTORS

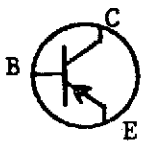
Case outline - (bottom view)

2SA249	PNP	2SB371	PNP	2SC538	NPN
2SB346	PNP	2SB178B	PNP	2SC696	NPN
2SB348	PNP	2SD178B	NPN	2SC644	NPN
				2SA546	PNP

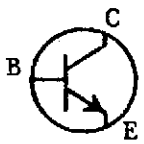


2SB128	PNP
2SC647	NPN
2SC586	NPN
2SB 201	NPN

Schematic



PNP



NPN

	COMPARABLE VACUUM TUBE ELEMENTS:
B - Base	- Grid
C - Collector	- Plate
E - Emitter	- Cathode

To check for shorts or open in transistors use RX10 on ohmmeter.

PNP type - "Plus" lead on Base, "minus" lead on Emitter - 100 ohms to 500 ohms
"plus" lead on Base, "minus" lead on Collector - 100 ohms to 500 ohms

NPN type - "Minus" lead on Base, "plus" lead on Emitter - 100 ohms to 500 ohms
"Minus" lead on Base, "plus" lead on Collector - 100 ohms to 500 ohms

e.g. 2SB128 may read approximately 100 ohms, 2SC647 may read approx. 500 ohms

Reading must be the same in both tests on any given transistor plus or minus 5%. Readings on any other position of tester leads between any two elements of transistor must be infinity or very high resistance.

Preliminary checks may be made with transistor in the circuit, power off. A lower reading will be seen due to relatively low parallel resistance in Base-Emitter circuit. A suspicious transistor reading should be confirmed with transistor removed from the circuit.

A leaky or partially open phase splitter may not be discovered by the above procedure. If the push-pull driver transistors and the output transistors are good, the Collector-Emitter voltage across each of the 2 power output transistors should be equal or nearly equal. A difference greater than 4 - 6 volts should be corrected. The phase-splitter transistor is likely the problem.

Please insert this bulletin into your service manual.

INTERNATIONAL AUDIO VISUAL, INC. 119 BLANCHARD ST. SEATTLE, WASH. 98121 (206) 624-5714

SERVICE BULLETIN

Service Bulletin #16 June 4, 1971

SUBJECT: REVERSING ROLLER ST-41201 BINDING OR SEIZING ON SHAFT

The hub of this roller is made of powdered metal. The spring ST-41111 pushes the roller against the head of screw XT-3505. Over a period of time the powdered metal hub could distort so that the roller binds or seizes on the shaft.

REMEDY:

A. Remove roller, clean and polish shaft ST-41121

B. If necessary, ream hole of roller with "B" size reamer. Roller must rotate freely. Burrs caused by screw head at end of hole may be removed with a small round file. Be careful not to damage rest of hole. To further improve the situation a small taper reamer can be used in end of hole to help overcome any distortion or compression caused by excessive wear or pressure at screw head.

C. Use 1 or 2 drops of silicone oil on shaft and install in sequence the spring - fibre washer - roller. Install fibre washer or brass washer under screw. Tighten securely. (The fibre washer located between spring and bracket may be used under screw head.)

D. Wipe off any excess oil. Oil on rubber roller will cause malfunction.

The factory has remedied the problem by using a different type metal and installing the washer under the screw.

We will replace seized rollers with reversing rollers #ST-41201 which have been modified as outlined, or if you order this part for stock you will receive a modified roller.

All projectors currently delivered by us receive the above recommended treatment.

PLEASE INSERT THIS BULLETIN INTO YOUR SERVICE MANUAL

INTERNATIONAL AUDIO-VISUAL INC., 119 BLANCHARD ST., SEATTLE, WASHINGTON 98121 (206) 624-5744

SERVICE BULLETIN

Service Bulletin #20 January 11, 1972

Subject: ST/M SPROCKET SHOE "V" SPRINGS ST-15181

Problem: #2 sprocket shoe is kept from opening too far by a screw or stopper pin located in the main casting. The screw type was not a positive stop. The shoe may be pushed over screw head and then the "V" spring ST-15181 can come out.

Remedy: "ST" projectors beginning with Serial No. 26925 and "M" projectors from Serial No. 73612 have a stopper pin part No. ST-16091 instead of the screw.

For a field remedy we suggest the addition of some washers under the screw to raise the head approximately 1/8". We will be stocking the stopper pin, so you may order if you wish.

PLEASE INSERT THIS BULLETIN IN YOUR SERVICE MANUAL

FOR FUTURE REFERENCE

SERVICE BULLETIN

Service Bulletin #21 January 11, 1972

Subject: 2SC647 OUTPUT TRANSISTORS

"ST" projectors beginning with Serial No. 29117 and "M" projectors beginning with Serial No. 75180 will have output transistors 2SD201. These are directly interchangeable with the 2SC647.

We expect that this change will also appear on the EX-1510 amplifiers as well as the new solid state EX 3000/EX 5000.

2SD201 = ECG 130

PLEASE INSERT THIS BULLETIN IN YOUR SERVICE MANUAL

FOR FUTURE REFERENCE

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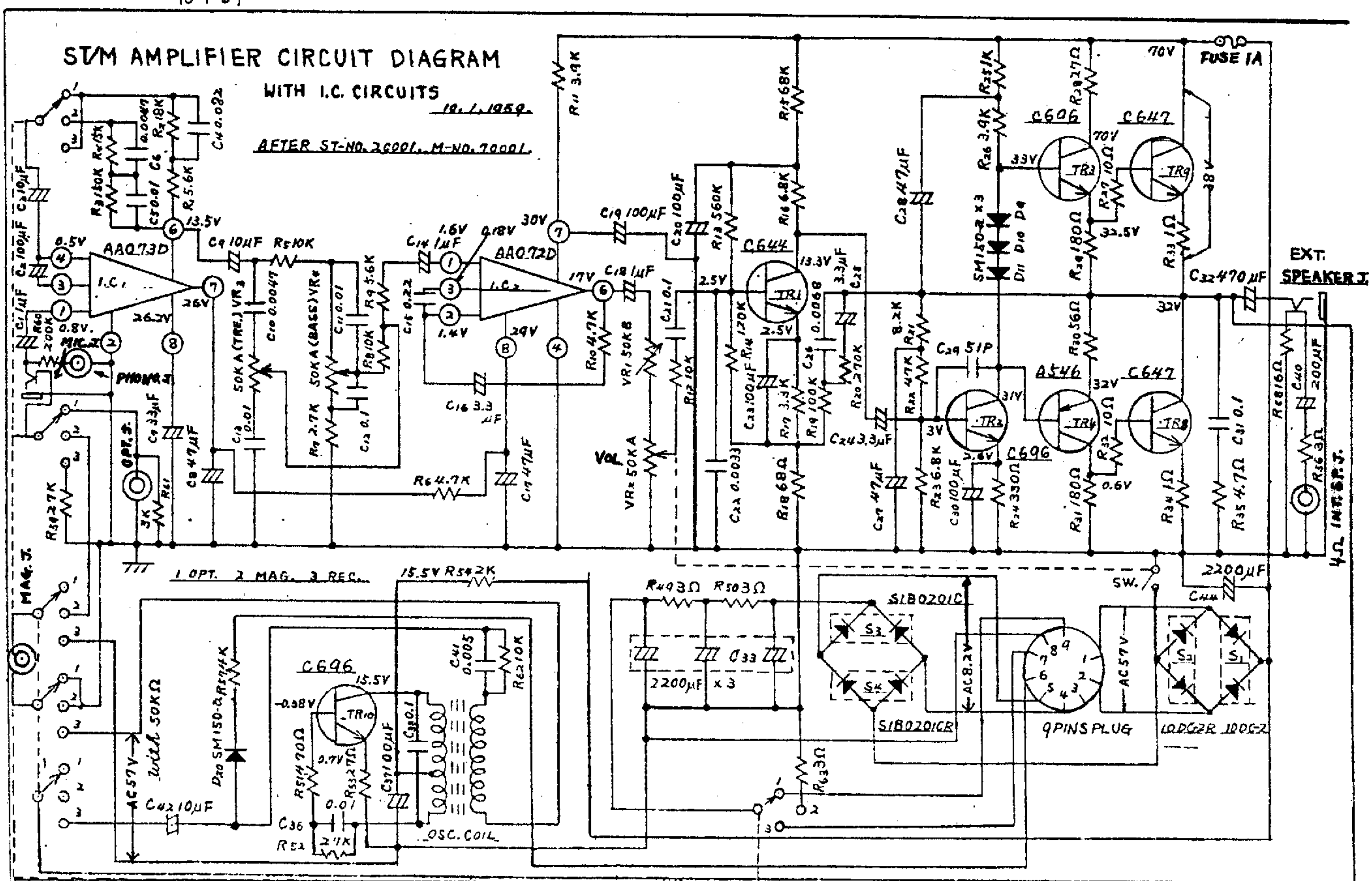
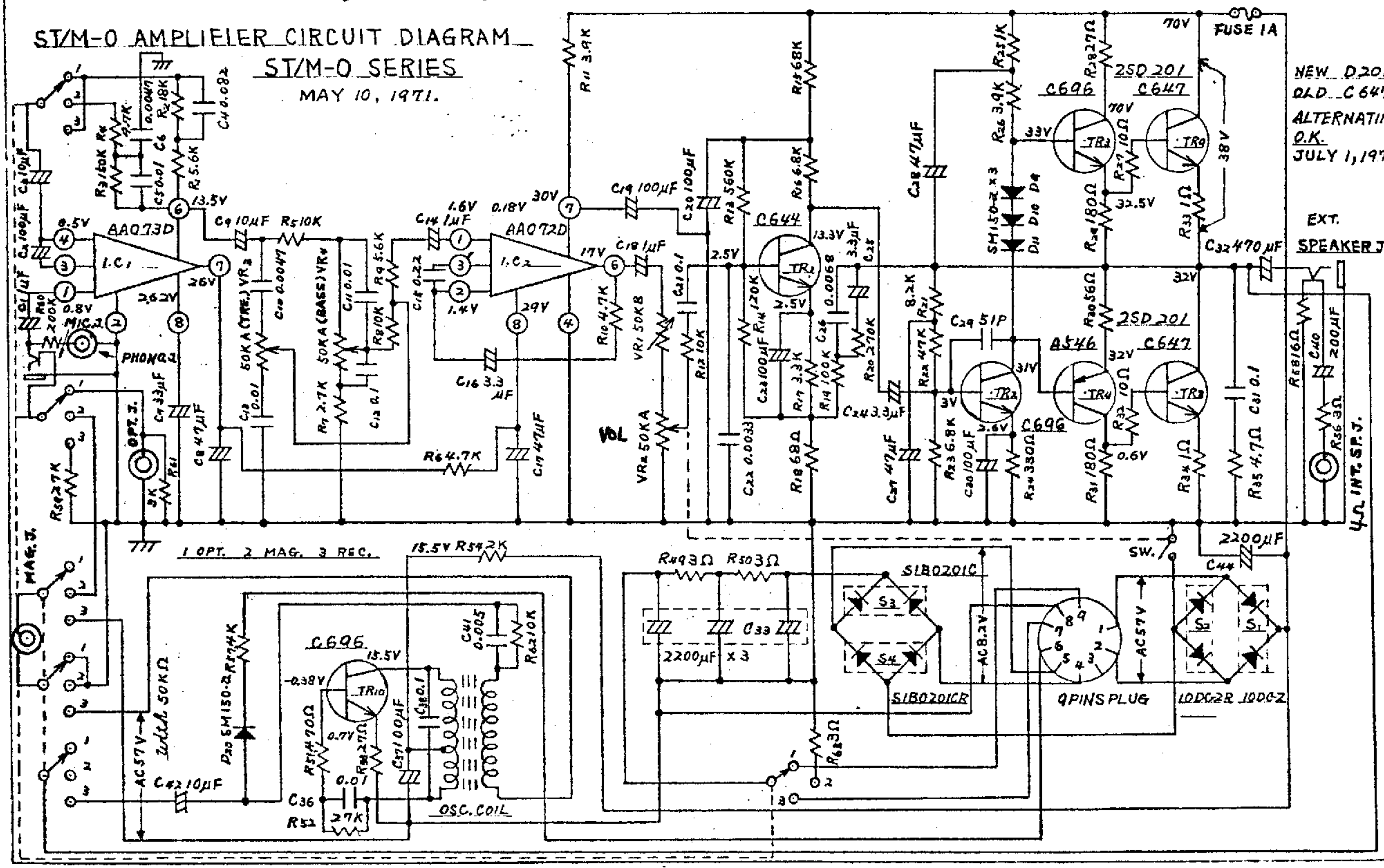
10-1-69


ST/M AMPLIFIER CIRCUIT DIAGRAM
WITH I.C. CIRCUITS
10. 1. 1969.
AFTER ST-NO. 20001, M-NO. 70001.
AA073D
AA072D
I.C.1
I.C.2
FUSE 1A
70V
EXT. SPEAKER J.
4Ω INT. SP. J.
MIC. J.
PHONO J.
OPT. J.
MAG. J.
1 OPT. 2 MAG. 3 REC.
C644
C696
C606
C647
A546
TR1
TR2
TR3
TR4
TR8
TR9
TR10
VOL.
SM150-2 x3
S1B0201C
S1B0201CR
9PINS PLUG
10DC-2R
10DC-2
2200μF x 3
OSC. COIL
AC57V
AC8.2V
SW.
with 50KΩ
C32 470μF
C44 2200μF
50K A (TRE.) VR3
50K A (BASS) VR4
VR1 50K B
VR2 50K A

REVISE
11.10.1971 MAG R4 15KΩ→47K change C6 0.0047 ground.

AFTER ST NO. 20001 M NO. 70001 OCTOBER 1, 1969

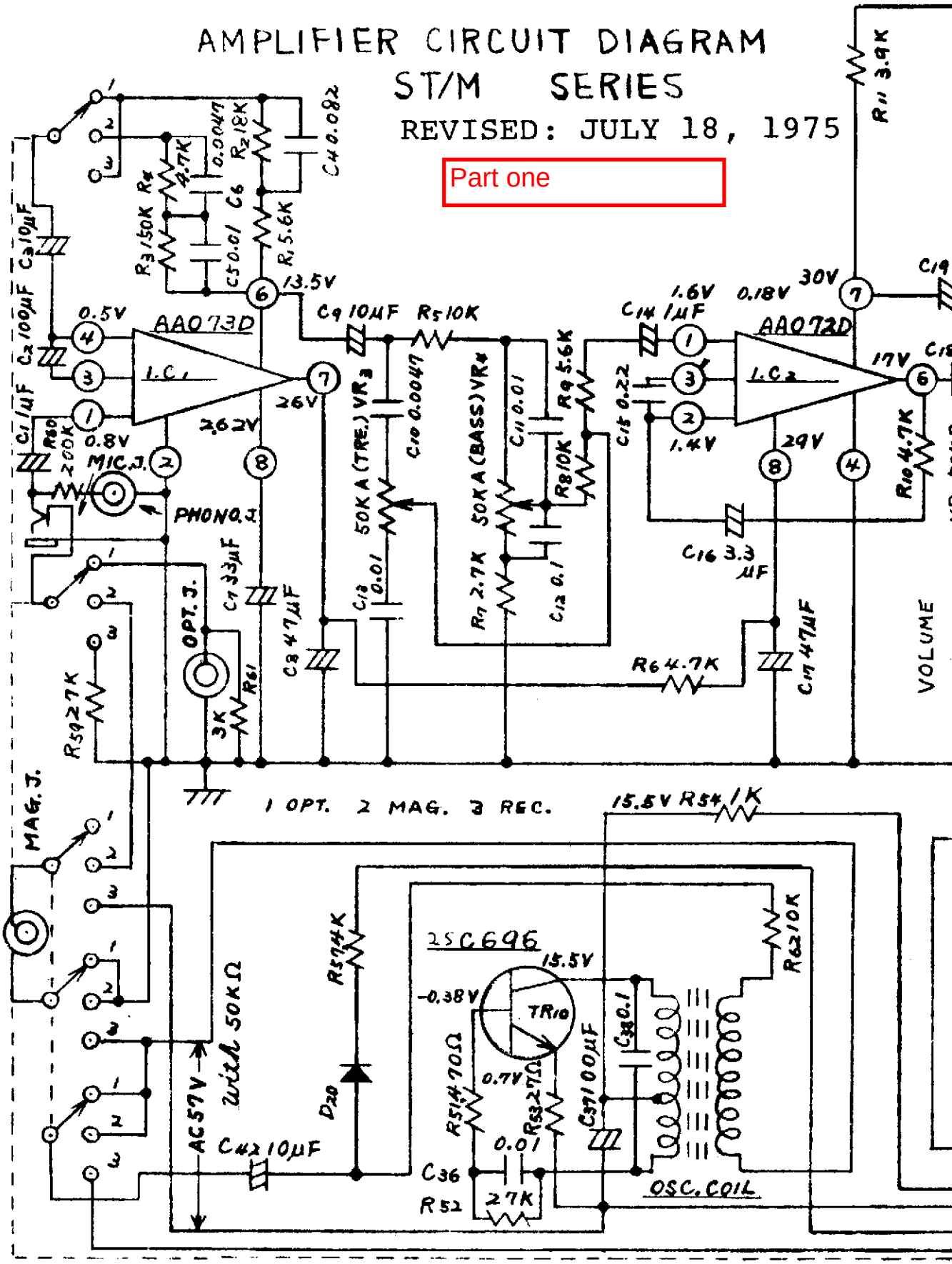


AMPLIFIER CIRCUIT DIAGRAM

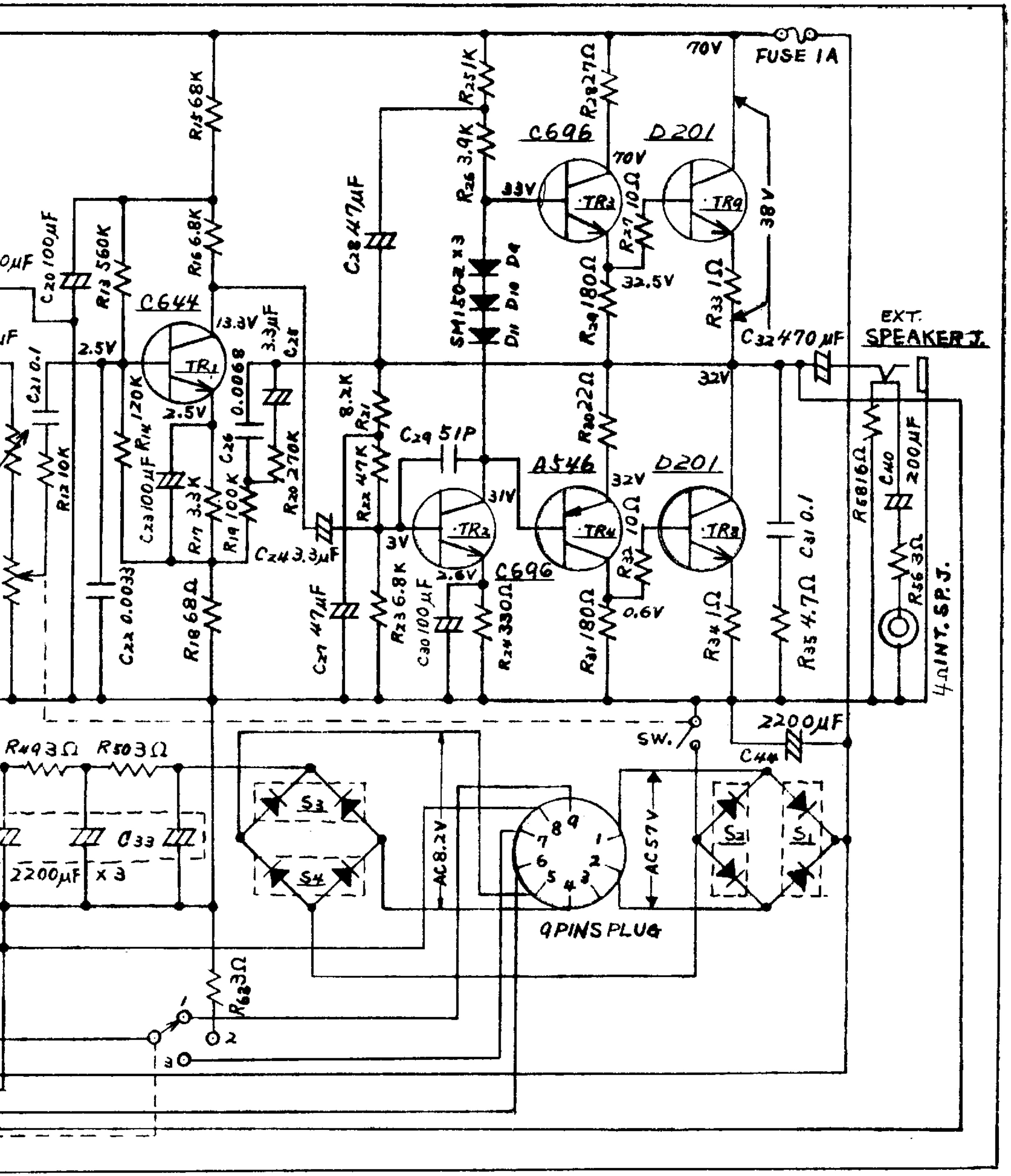
ST/M SERIES

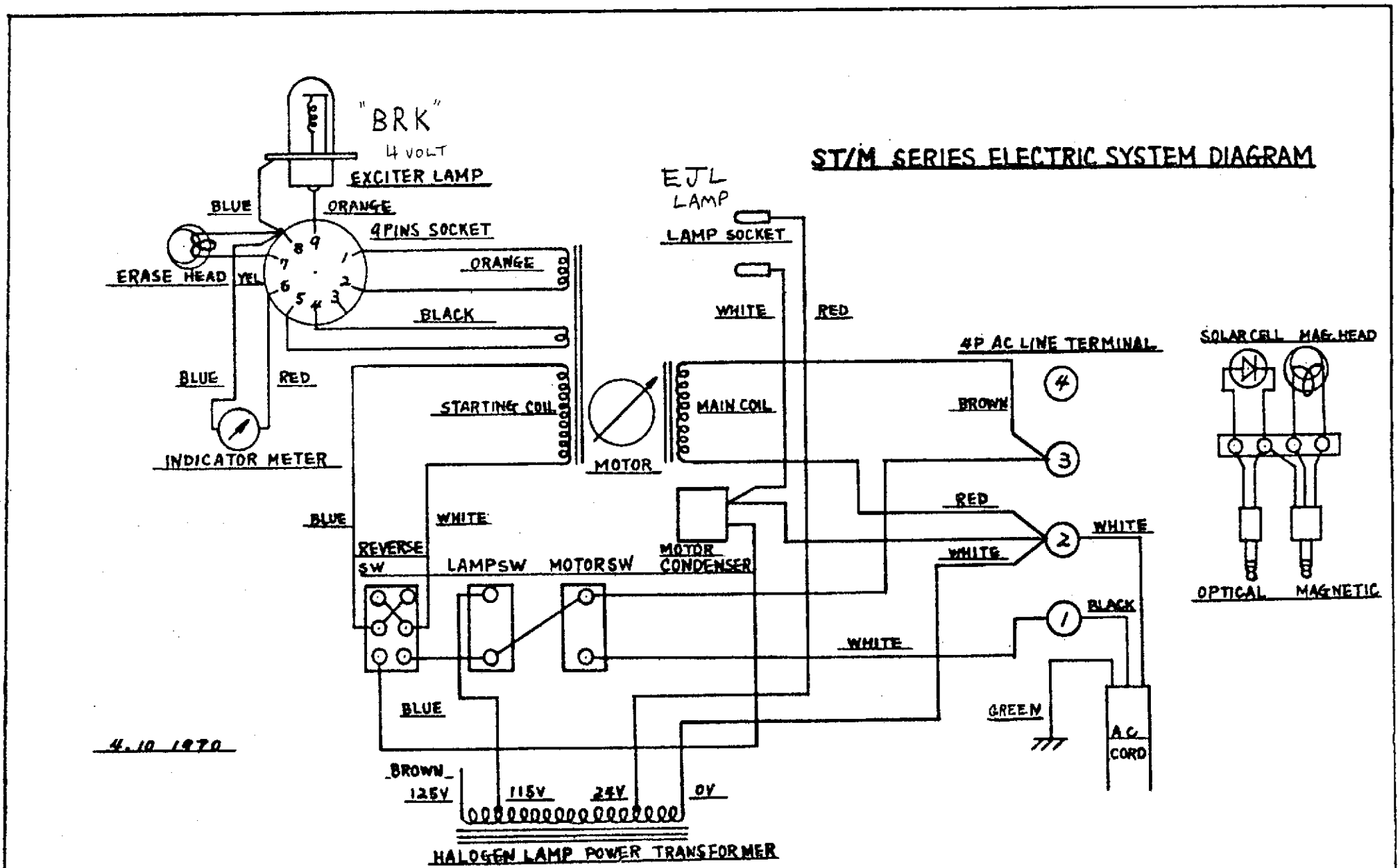
REVISED: JULY 18, 1975

Part one



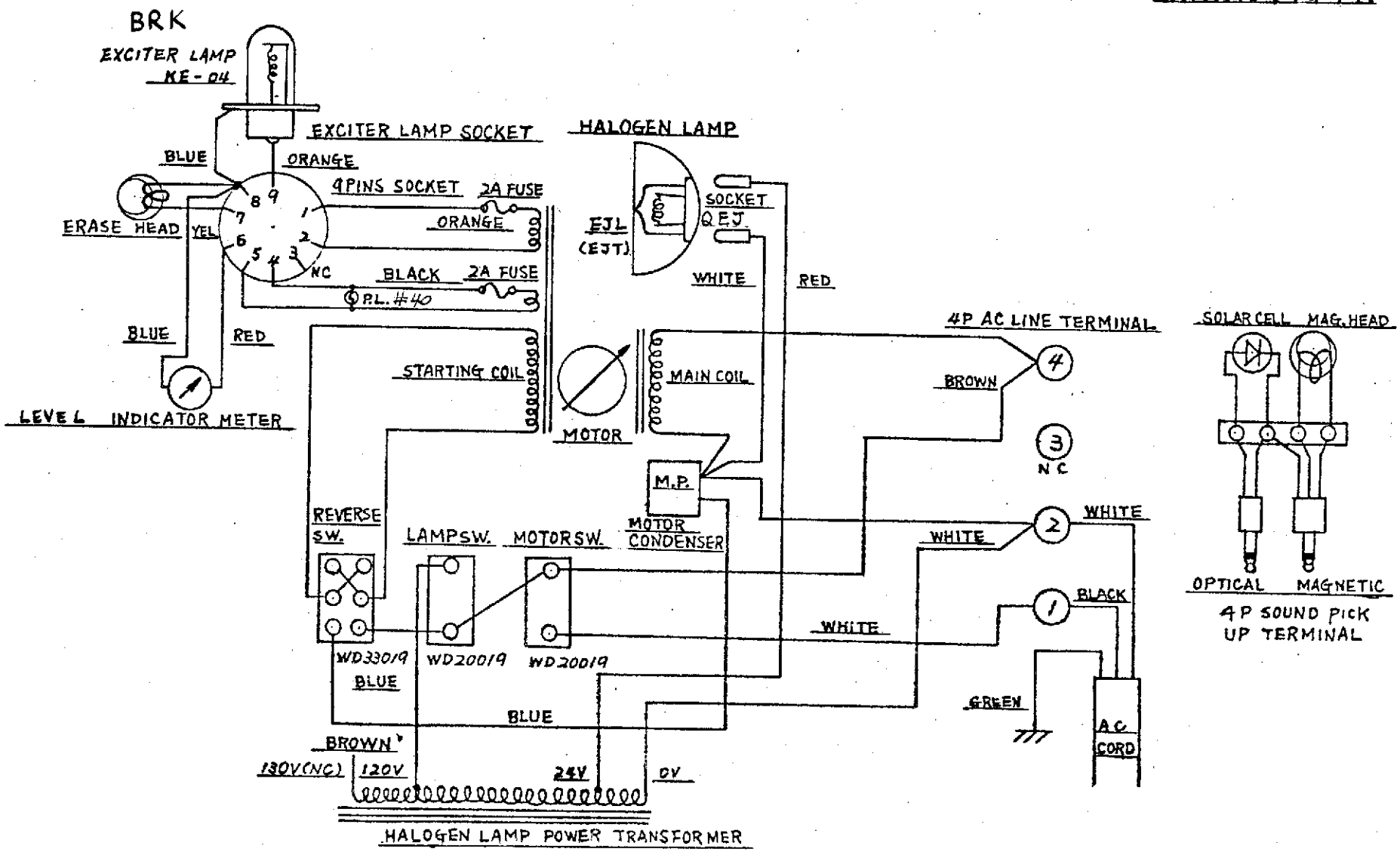
Part Two


FUSE 1A
70V
C696
D201
TR3
TR9
33V
38V
32.5V
C644
TR1
13.3V
2.5V
C28 47μF
SM150-2 x 3
D9 D10 D11
R15 68K
R16 6.8K
R13 560K
C20 100μF
R25 1K
R26 3.9K
R28 27Ω
R27 10Ω
R30 180Ω
R33 1Ω
C32 470μF
EXT.
SPEAKER J.
32V
C21 0.1
R12 10K
R14 120K
C23 100μF
R17 3.3K
R19 100K
C26 0.0068
C25 3.3μF
R20 270K
R21 8.2K
R22 47K
C29 51P
A546
D201
TR2
TR4
TR8
31V
3V
2.6V
0.6V
C24 3.3μF
C22 0.0033
R18 68Ω
C27 47μF
R23 6.8K
C30 100μF
R24 330Ω
C696
R29 22Ω
R32 10Ω
R31 180Ω
R34 1Ω
C31 0.1
R35 4.7Ω
R68 16Ω
C40 200μF
R56 3Ω
4Ω INT. SP. J.
R49 3Ω
R50 3Ω
C33
2200μF x 3
S3
S4
AC 8.2V
9 PINS PLUG
AC 57V
SW.
2200μF
C44
S2
S1
R63 3Ω


ST/M SERIES ELECTRIC SYSTEM DIAGRAM
"BRK"
4 VOLT
EXCITER LAMP
EJL
LAMP
LAMP SOCKET
BLUE
ORANGE
9PINS SOCKET
ERASE HEAD
YEL
ORANGE
BLACK
WHITE
RED
4P AC LINE TERMINAL
SOLAR CELL
MAG. HEAD
BLUE
RED
STARTING COIL
MAIN COIL
BROWN
INDICATOR METER
MOTOR
BLUE
WHITE
RED
WHITE
REVERSE SW
LAMPSW
MOTORSW
MOTOR CONDENSER
WHITE
BLACK
WHITE
BLUE
GREEN
A.C. CORD
OPTICAL
MAGNETIC
4.10 1970
BROWN
125V
115V
24V
0V
HALOGEN LAMP POWER TRANSFORMER

M/ST-0 SERIES ELECTRIC SYSTEM DIAGRAM

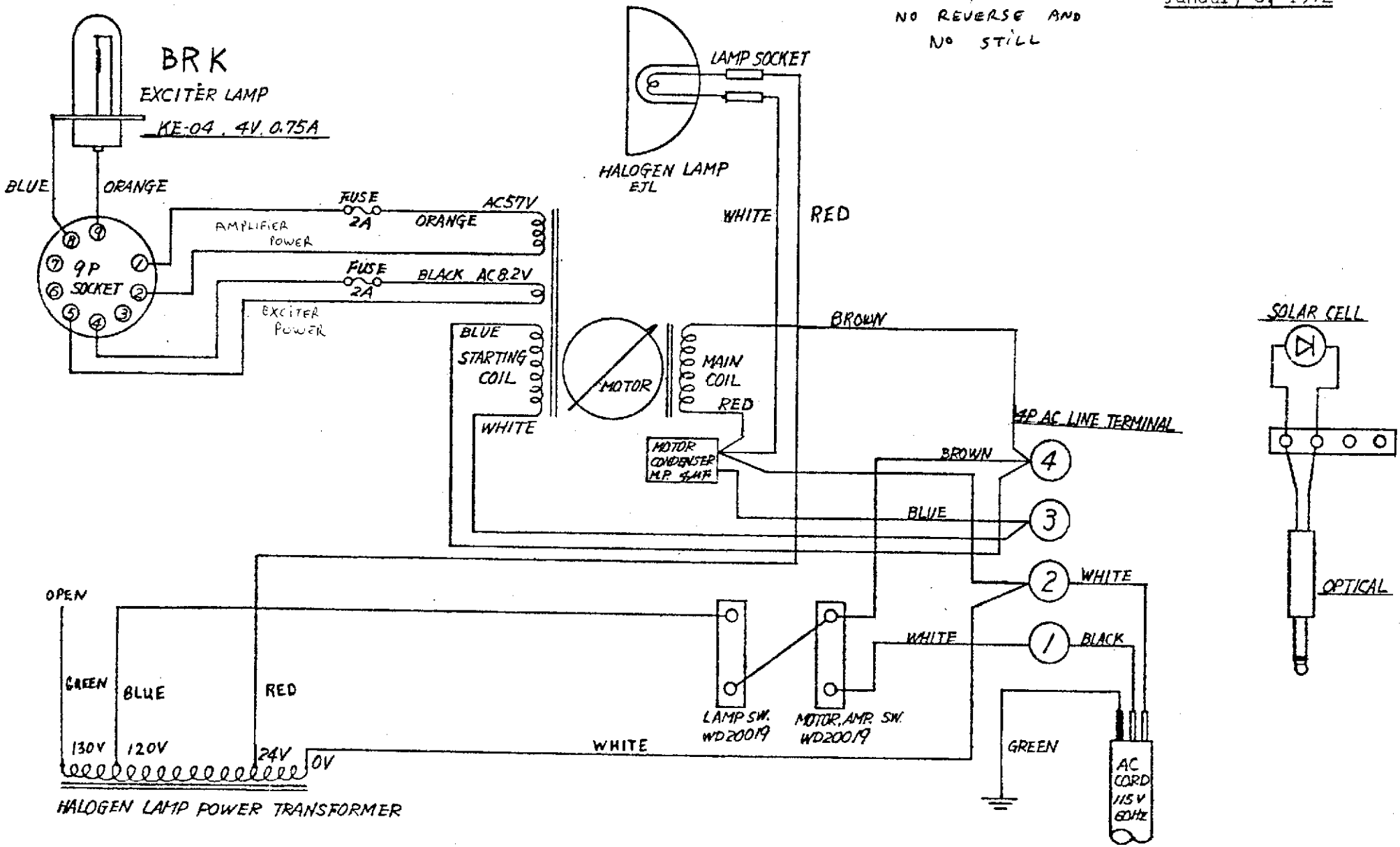
MAY 10, 1971.



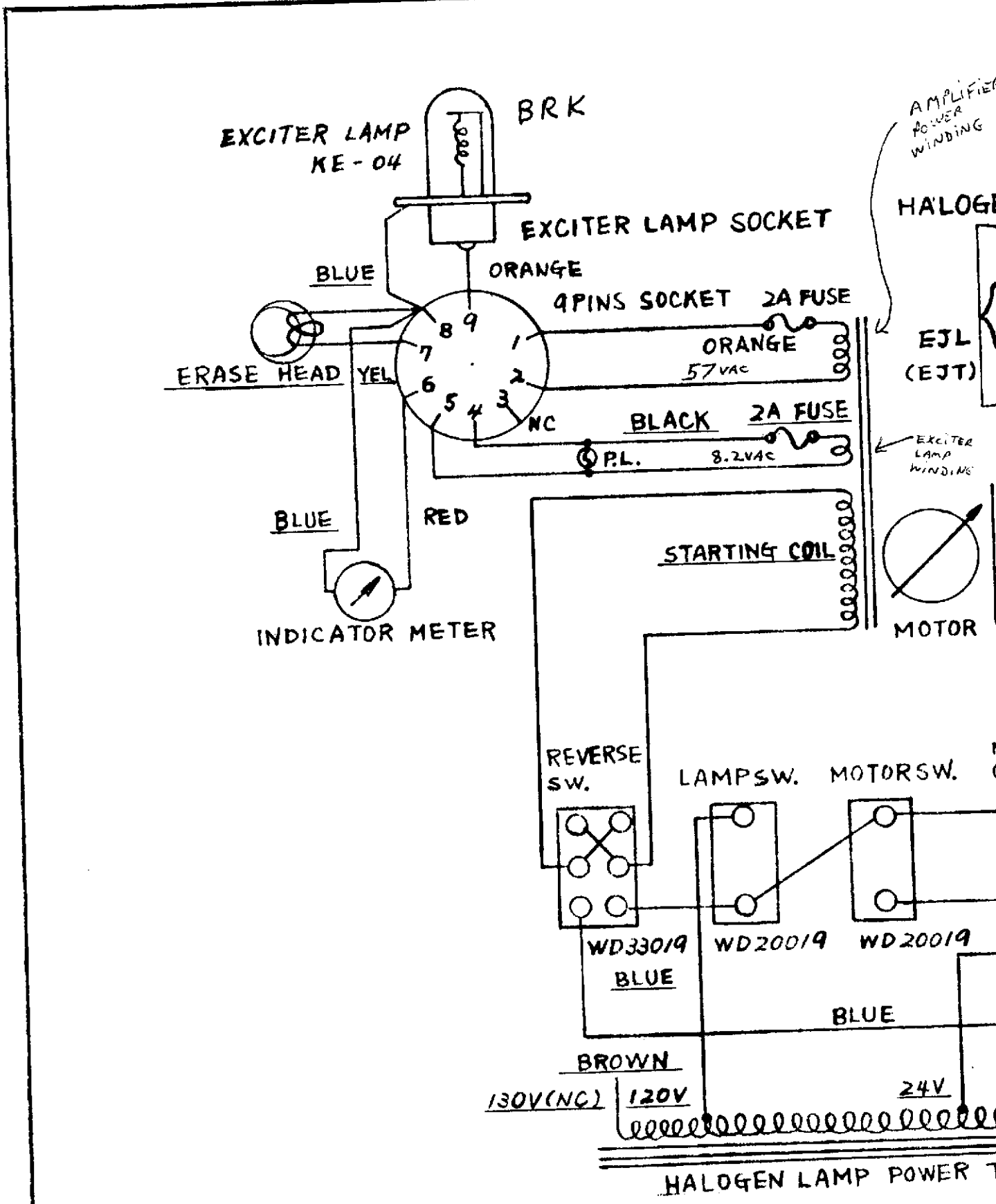
TROJAN ST-OH/MO ELECTRICAL SYSTEM DIAGRAM

ECONOMY MODEL:
NO REVERSE AND
NO STILL

January 3, 1972



Part One


EXCITER LAMP
KE-04
BRK
EXCITER LAMP SOCKET
AMPLIFIER POWER WINDING
HALOGE
BLUE
ORANGE
9PINS SOCKET
2A FUSE
ORANGE
57VAC
EJL
(EJT)
ERASE HEAD
YEL
8
9
7
1
6
2
5
4
3
NC
BLACK
2A FUSE
P.L.
8.2VAC
EXCITER LAMP WINDING
BLUE
RED
STARTING COIL
INDICATOR METER
MOTOR
REVERSE SW.
LAMPSW.
MOTORSW.
WD33019
WD20019
WD20019
BLUE
BLUE
BROWN
130V(NC)
120V
24V
HALOGEN LAMP POWER

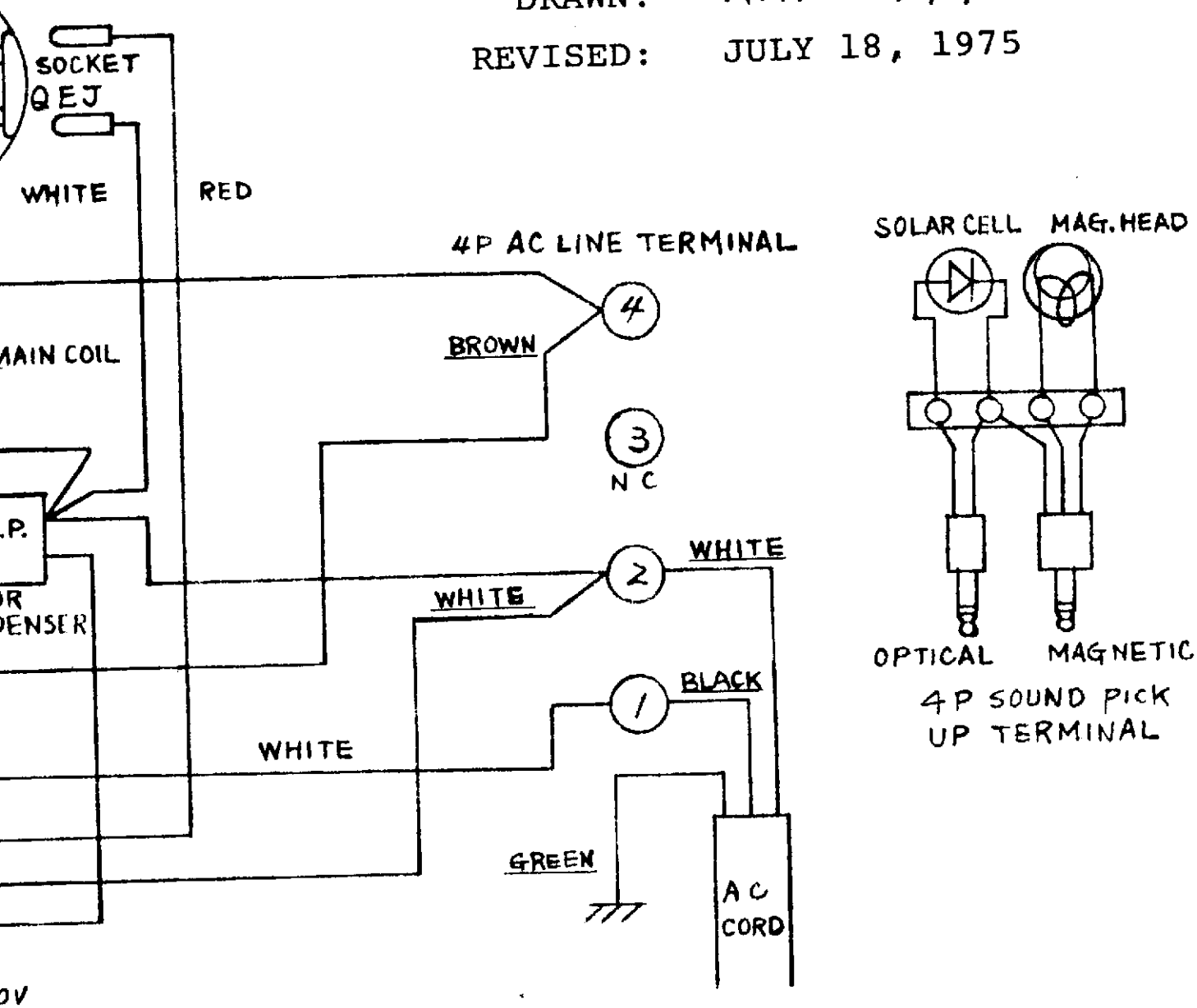
Part Two

LAMP

SERIES ELECTRIC SYSTEM DIAGRAM

DRAWN: MAY 10, 1971.

REVISED: JULY 18, 1975



4P SOUND PICK UP TERMINAL