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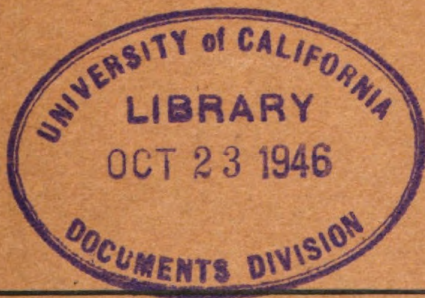
# TM 11-2522

WAR DEPARTMENT TECHNICAL MANUAL

U.S. Dept. of Army

# SOUND RECORDING SETS

AN/UNQ-1 AND  
AN/UNQ-1A



WAR DEPARTMENT

AUGUST 1946



WAR DEPARTMENT TECHNICAL MANUAL  
TM 11-2522

*This manual supersedes TM 11-2522, Sound Recording Set AN/UNQ-1, 30 September 1944; and TB 11-2522-1, January 1945.*

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**SOUND  
RECORDING SETS**

**AN/UNQ—1 AND  
AN/UNQ—1A**



*WAR DEPARTMENT*

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*AUGUST 1946*

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## DESTRUCTION NOTICE

**WHY**—To prevent the enemy from using or salvaging this equipment for his benefit.

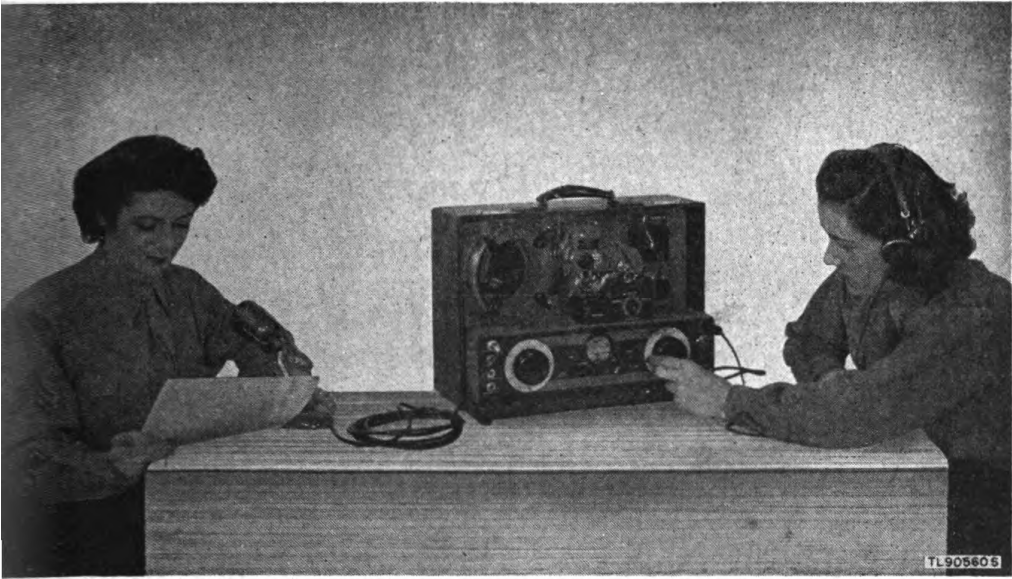
**WHEN**—When ordered by your commander.

- HOW**—
1. Smash—Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.
  2. Cut—Use axes, handaxes, machetes.
  3. Burn—Use gasoline, kerosene, oil, flame throwers, incendiary grenades.
  4. Explosives—Use firearms, grenades, TNT.
  5. Disposal—Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

## USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT

- WHAT**—
1. Smash—Carrying case, amplifier, motor, carriage assembly, tubes.
  2. Cut—All wires, speaker cone, films, cables.
  3. Burn—All smashed and cut material.
  4. Bury or scatter—All of the above material after burning.





*Sound Recording Set AN/UNQ-1A, in operation.*



## PART ONE

### INTRODUCTION

---

#### Section I. DESCRIPTION OF SOUND RECORDING SETS AN/UNQ-1 AND AN/UNQ-1A

##### 1. General

Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A are compact, self-contained, sound recording and playback machines operating on 110-volt, 50-60 cycles, alternating current. The sets are furnished with valise-like cases making portable use convenient. Recording is made on 35-millimeter nonflammable cellulose-acetate film. The recording may be played back immediately. At normal operating speed, continuous recording is possible for about 1½ hours.

##### 2. Application

*a.* RECORDING SOUND. The sound recording sets will record sound within a frequency range of 150 to 4,000 cycles (approximate) when they are operated at a 60-foot-per-minute (fpm) film speed. The frequency response is within a narrower range when the sets are operated at a 40 fpm film speed. At this speed, the sets are usually operated to lengthen the operating time between film changes to 2 hours and 23 minutes. The gain at the microphone terminal is 114 decibels (db). The gain at the radio input terminal is 85 db.

*b.* PLAYBACK. Recorded sound may be played back to cover larger areas with an external speaker. With the use of a booster transformer or amplifier, numerous loudspeakers or earphones may be connected to the recording set output.

*c.* USES. (1) The sound recording sets may be used to record conferences, speeches, radio programs, telephone conversations, or any sound within the frequency range of the sets.

(2) The sound recording sets may be used to pick up and amplify weak sounds and then emit those amplified sounds from its self-contained loudspeaker (public address). With the use of the crystal microphone, the sets may be used to address large audiences (and with additional speakers, even larger audiences in the open air).

### 3. Table of Components

*Note.* The components of Sound Recording Set AN/UNQ-1 are the same as those supplied with Sound Recording Set AN/UNQ-1A. They are listed once in the table of components shown below.

Component	Required number	Height (in.)	Width (in.)	Depth (in.)	Length (in.)	Weight (lb.)
Sound Recording Set AN/UNQ-1, in carrying case.	1	16 over-all (including handle)	19	9.6		53
Sound Recording Set AN/UNQ-1A, in carrying case.	1	16 over-all (including handle)	19	9.6		48
Microphone	1	9.5	5	7		2.35
Crystal earphones	1	1.5	7.5	7.5		0.5
Telephone tap cord	1				144	0.35
Foot operating switch.	1	2.5	2.875	5.625		2.625
Kit of tools	1	5.5	3			0.03

### 4. Shipping Weights and Dimensions of Packed Sets

Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A are each shipped with all their components packed inside one box. Fifty-foot lengths of film are packed in separate cartons. One hundred cartons are packed in a wooden box, the dimensions of which are the same as that used for the set.

*Note.* Two boxes of film (200 cartons of 50-foot lengths) are shipped with Sound Recording Set AN/UNQ-1A.

a. **WEIGHT.** The gross weight of two boxes packed for export (containing equipment and films) is 192 pounds.

b. **VOLUME.** The volume of the two boxes is 14 cubic feet.

c. **DIMENSIONS.** The outside dimensions of each wooden box are as follows:

Height.....	22 inches
Length.....	42½ inches
Width.....	26½ inches

### 5. Description of Major Components

The general appearance of both Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A is the same. All parts are mounted on two main assemblies, namely: the amplifier chassis, and the mechanical-electrical, main-frame assembly. The sets operate on 110-volt 50- to 60-cycle alternating current. Power input is 125 to 130 watts. Both sets may be adapted for use on 110-volt direct current. For this purpose, a rotary converter is used as described

in paragraph 12. The power output of the eight-tube amplifier is 3 watts.

a. **CARRYING CASE** (fig. 14). Carrying cases for both sets are identical. The cases are of wooden construction with a black fabricoid outside surface. Each case consists of three parts: front cover, rear cover, and a bottom section. Both covers are removable. They are attached to the bottom section with split hinges which permit easy detachment. The bottom section is also used to mount the sound recording set. A leather carrying handle is provided. Two machine screws pass through the handle ends to connect the handle with a short, flat bar threaded to receive the two screws. This bar serves to support the weight of the set so that the carrying handle alone is responsible for carrying the set when it is hand-carried. A double-zipper carrying-case cover is furnished.

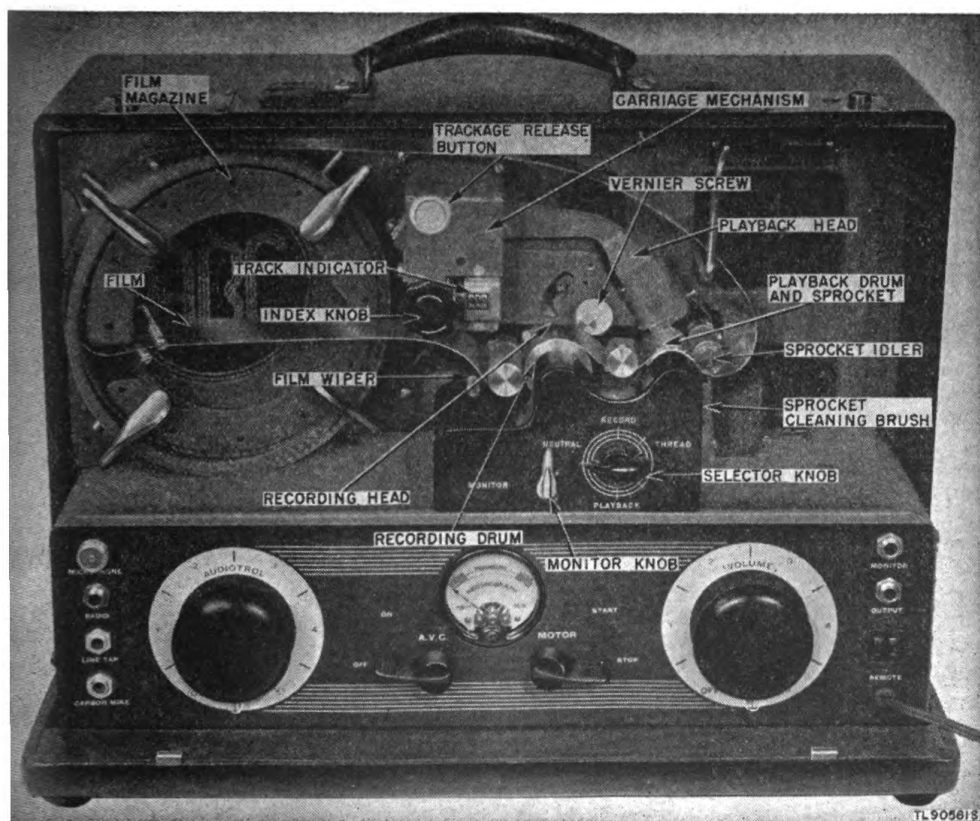


Figure 1. Sound Recording Set AN/UNQ-1, front view.

b. **APPEARANCE OF FRONT OF SOUND RECORDING SETS AN/UNQ-1 AND AN/UNQ-1A.** All operating controls are accessible when the carrying-case cover is removed. The external appearance of both recording sets is similar. The label located under the jack marked LINE TAP (on Sound Recording Set AN/UNQ-1) has

been changed to read LINE-CARBON MIKE. The label under the jack marked CARBON MIKE has been changed to read MIKE BATTERY. The labels appearing on the front of Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A, in addition to the names of parts whose identifications are not indicated by labeling on the set, are shown in figures 1 and 2. Also located on the front of the sound recording set are the film magazine, carriage mechanism with recording and playback heads, and the recording and playback drums with the sprocket and sprocket idler. A cloth film wiper is used to clean the under side of the film. A sprocket cleaning brush is also used. The power cord enters the lower right-hand corner of the lower panel. For a complete description of the functions of the controls, see paragraphs 13 to 21, inclusive.

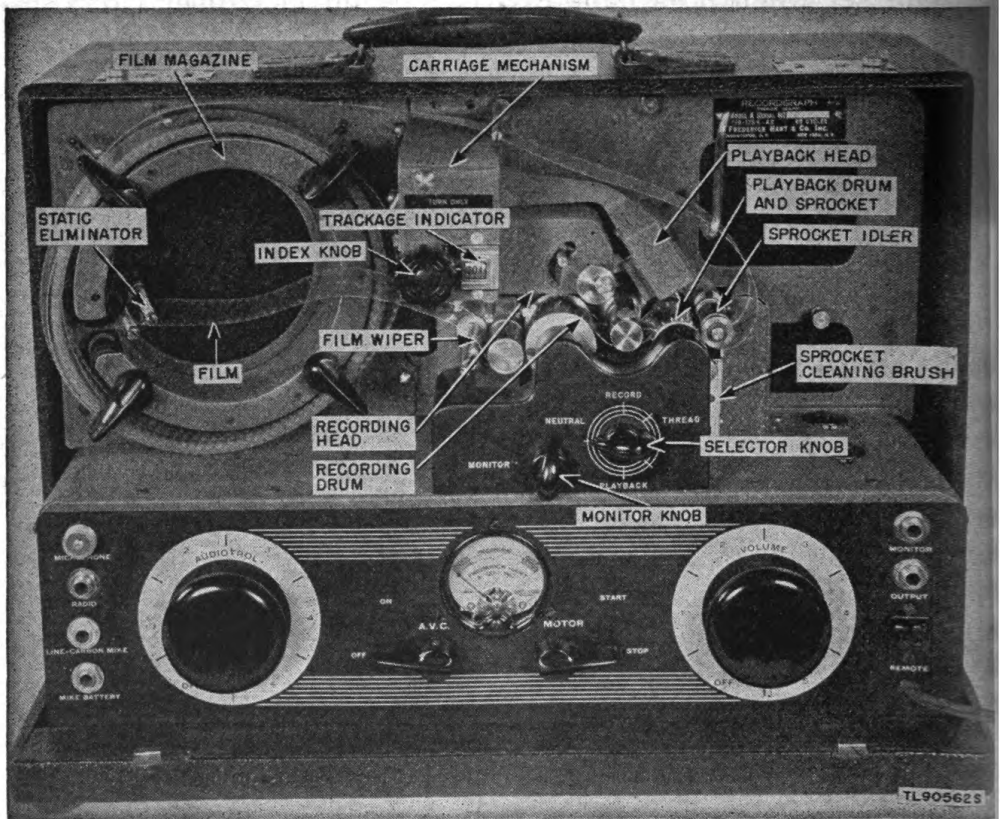


Figure 2. Sound Recording Set AN/UNQ-1A, front view.

c. APPEARANCE OF THE REAR OF SOUND RECORDING SETS AN/UNQ-1 AND AN/UNQ-1A. Some difference exists between the rear of both sets. Descriptions of the rears of both sound recording sets are given below.

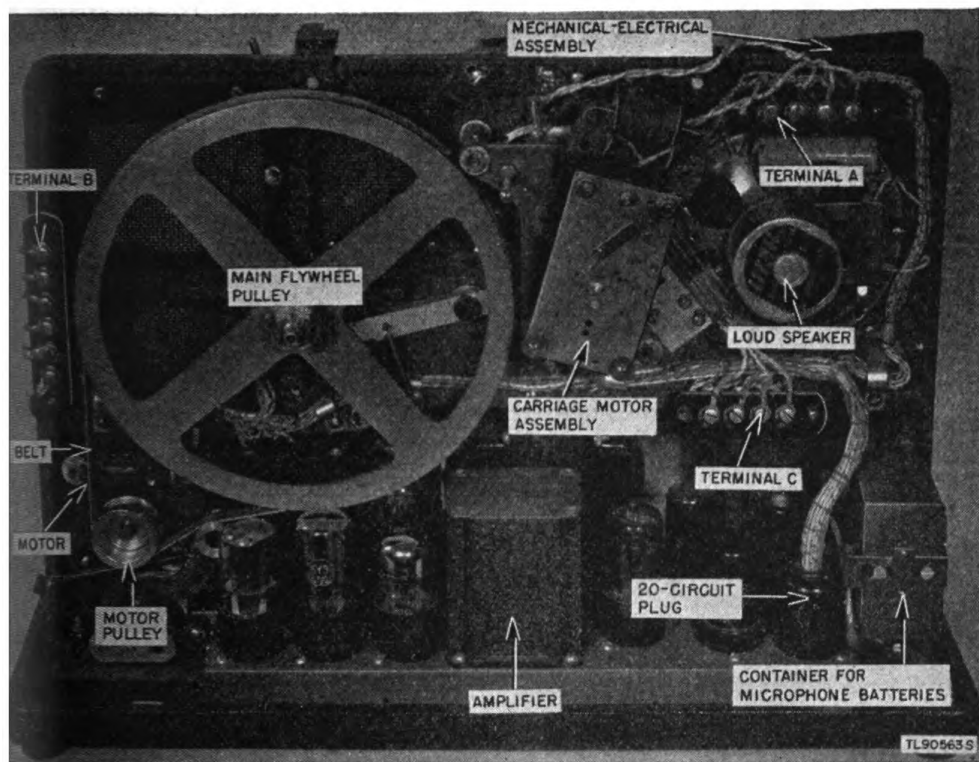


Figure 3. Sound Recording Set AN/UNQ-1, rear view.

(1) *Rear of Sound Recording Set AN/UNQ-1* (fig. 3). The rear consists of two major assemblies, the mechanical-electrical, and the amplifier. On the mechanical-electrical assembly are the loudspeaker, carriage-motor assembly (trackage motor), container for microphone batteries, a 1/75-horsepower shaded-pole motor, main flywheel pulley, belt, and the necessary wiring, switches, terminal strips, and hardware. On the amplifier assembly will be found all the tubes, transformers, capacitors, resistors, chokes, and wiring associated with the amplifier. The receptacle for the 20- or 11-pin male plug (par. 6b) is located on the right side of the amplifier chassis.

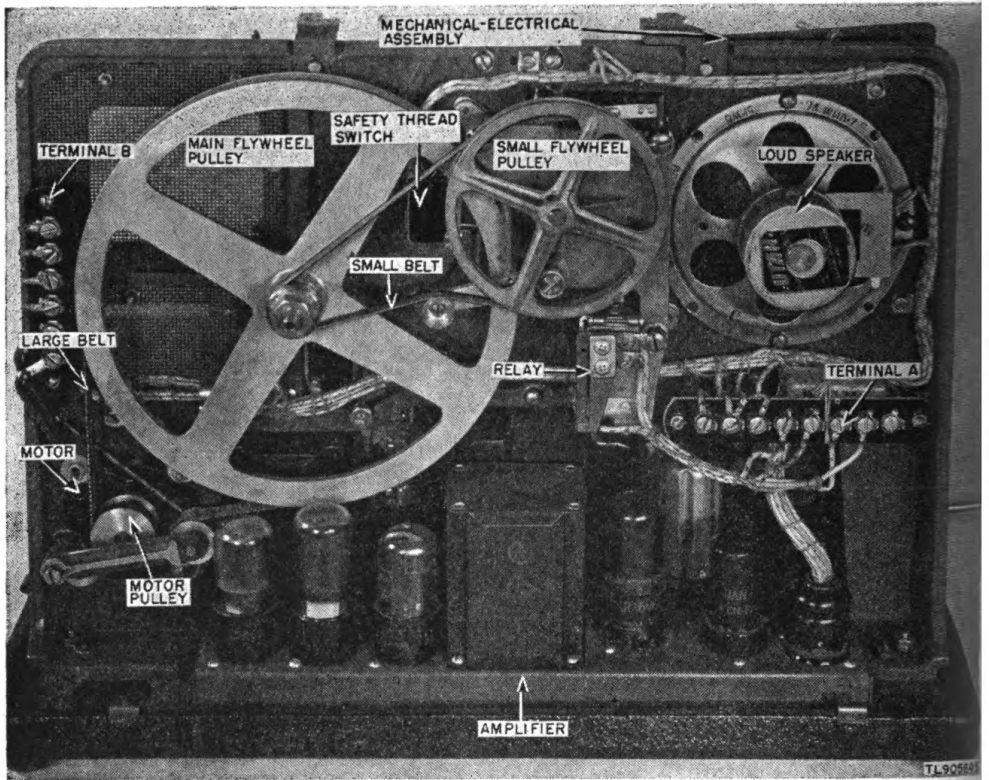


Figure 4. Sound Recording Set AN/UNQ-1A, rear view.

(2) Rear of Sound Recording Set AN/UNQ-1A (fig. 4). The rear consists of two major assemblies, the mechanical-electrical, and the amplifier. On the mechanical-electrical assembly are the loudspeaker, 1/50-horsepower shaded-pole motor, main flywheel pulley, belt, carriage-mechanism assembly, and the necessary wiring, switches, relays, terminal strips, and hardware. On the amplifier chassis are all the tubes, transformers, capacitors, resistors, chokes, and wiring associated with the amplifier. The receptacle for the 11-prong male plug is located on the right-hand corner of the amplifier chassis.





*Figure 5. Crystal microphone and cable.*

*d. MICROPHONE* (fig. 5). One crystal microphone mounted on a table stand is furnished. An 18-foot shielded microphone cable terminating in a female connector is attached to the microphone.

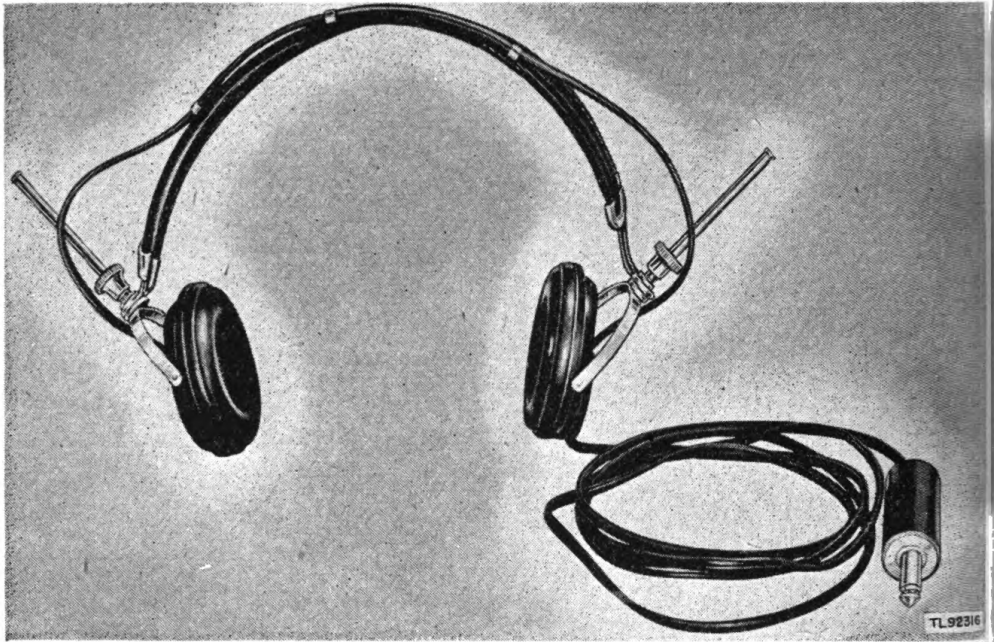


Figure 6. High impedance earphones (crystal type).

e. **EARPHONES** (fig. 6). One set of earphones is furnished with the sound recording set. Equipped with a 6-foot shockproof and moistureproof cord terminating in a phone type male plug, the earphones are used for monitoring or for private reproduction of a recording. The impedance of both phones is 40,000 ohms at 500 cycles. Crystal elements are used.

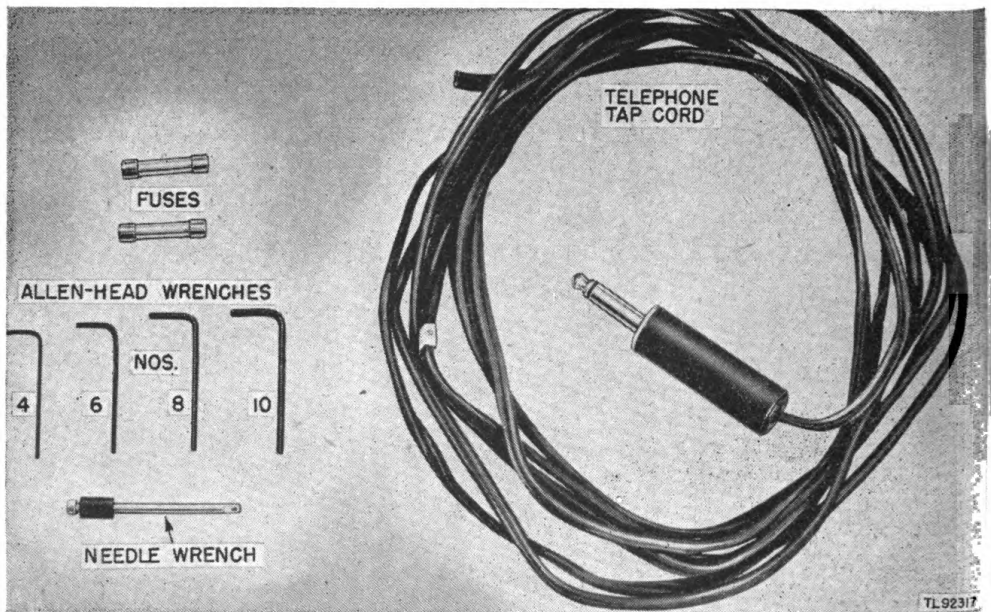


Figure 7. Telephone tap cord and tools.

f. TELEPHONE TAP CORD (fig. 7). A telephone tap cord is supplied in a 12-foot length. It is a rubber-covered, two-wire conductor, one end of which is attached to a phone type plug.

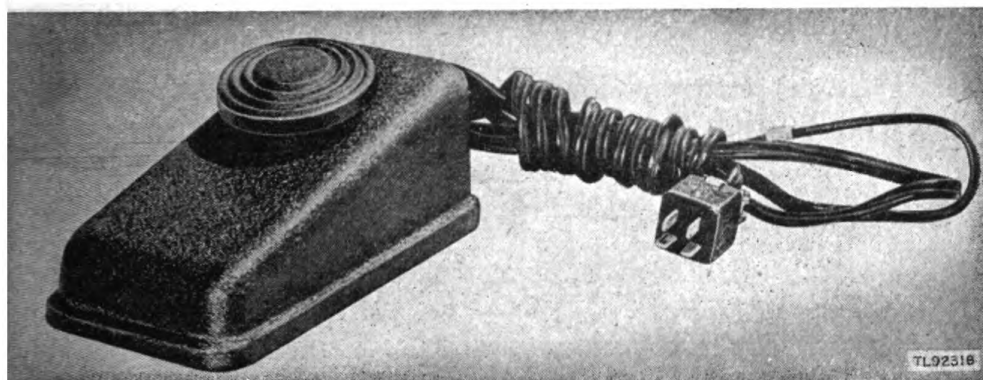


Figure 8. Foot-operating switch.

g. FOOT-OPERATING SWITCH (fig. 8). The foot-operating switch consists of a casting designed for placement on the floor. Inside is a switch operated by a foot button. A four-prong male plug is attached to one end of the 12-foot cord.

h. TOOLS (fig. 7). Contained inside an envelope packed with the equipment are four Allen wrenches sizes 4, 6, 8, and 10. Included also are two 5-ampere, 110-volt fuses and one needle wrench.

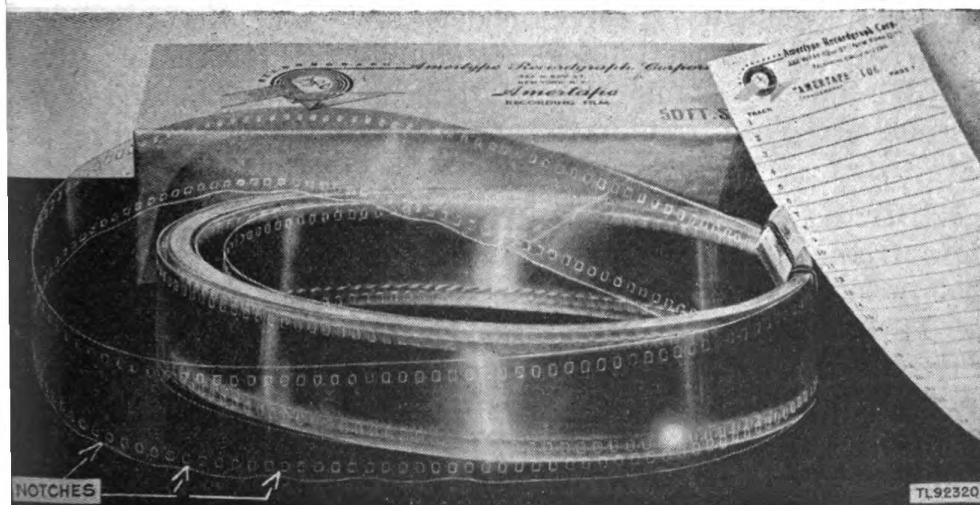


Figure 9. Recording film.

i. RECORDING FILM (fig. 9). Noncombustible, cellulose acetate, straight, recording film is supplied in approximately 50-foot lengths. Reverse recording film is available. The 50-foot straight film provides approximately  $1\frac{1}{2}$  hours recording at the 60-foot-

per-second (fps) speed. The 50-foot, reverse recording film provides approximately 3 hours of recording at the 60-fps speed. Notches, cut on one side of the film, provide the indentations which actuate the film switch.

*j.* PULLEY. A  $\frac{3}{4}$ -inch aluminum pulley is supplied and is packed in a separate envelope. It is used to reduce the recording speed from 60 fpm to 40 fpm.

## 6. Differences in Models

*a.* GENERAL. Differences exist between Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A. These differences are noted in the proper places in this manual. Basic principles of recording, reproduction, and audiotrol operation remain unchanged. Changes in the method of producing the necessary electro-mechanical operations have been made. For example, instead of using the carriage motor to produce the track-over, as is done in Sound Recording Set AN/UNQ-1, use is made of the relay-controlled carriage mechanism driven by a pulley and belt. The dry-cell battery compartment, which houses the two dry cells, is not used with Sound Recording Set AN/UNQ-1A. The batteries are external to this model and, when needed, are plugged into the jack marked MIKE BATTERY. Additional shielded wire is used in Sound Recording Set AN/UNQ-1A. Also, circuit constants have been changed in the amplifier in order to increase over-all efficiency and fidelity. Early models of Sound Recording Set AN/UNQ-1 do not use a film gate and film-static eliminator. (See fig. 2.) Numerous minor modifications and changes in wiring and location of certain parts have been made to Sound Recording Set AN/UNQ-1.

*b.* DIFFERENCES IN SOUND RECORDING SET AN/UNQ-1. (1) *Main frame.* On sets bearing serial numbers 812 and 815 to 1350 inclusive (see note below), a 20-circuit plug (fig. 3) replaces the 11-circuit plug used on previous equipments. The wiring color code is also changed.

(2) *Amplifier.* The electrical circuits of sets bearing serial numbers listed above differ from sets previously produced as follows:

(a) A 20-contact receptacle replaces the 11-contact receptacle.

(b) Contacts 2, 3, and 4 (FRONT) on selector switch SW5 are utilized.

(c) Two 0.01-microfarad (mf) capacitors C24 and C25 replace the 0.05-mf capacitor C12 in the primary circuit of transformer T1.

(d) The physical location of capacitor C13 is changed.

(e) Remote switch S11 has an additional shielded wire connection.

Note. The serial number is the last four digits of the long number appearing on the nameplate of the sound recording set.

## Section II. INSTALLATION OF SOUND RECORDING SETS AN/UNQ-1 AND AN/UNQ-1A

### 7. Siting

Select a sheltered location for the uncrating operation. The sound recording sets are not waterproofed. They are intended for use indoors at moderate temperatures.

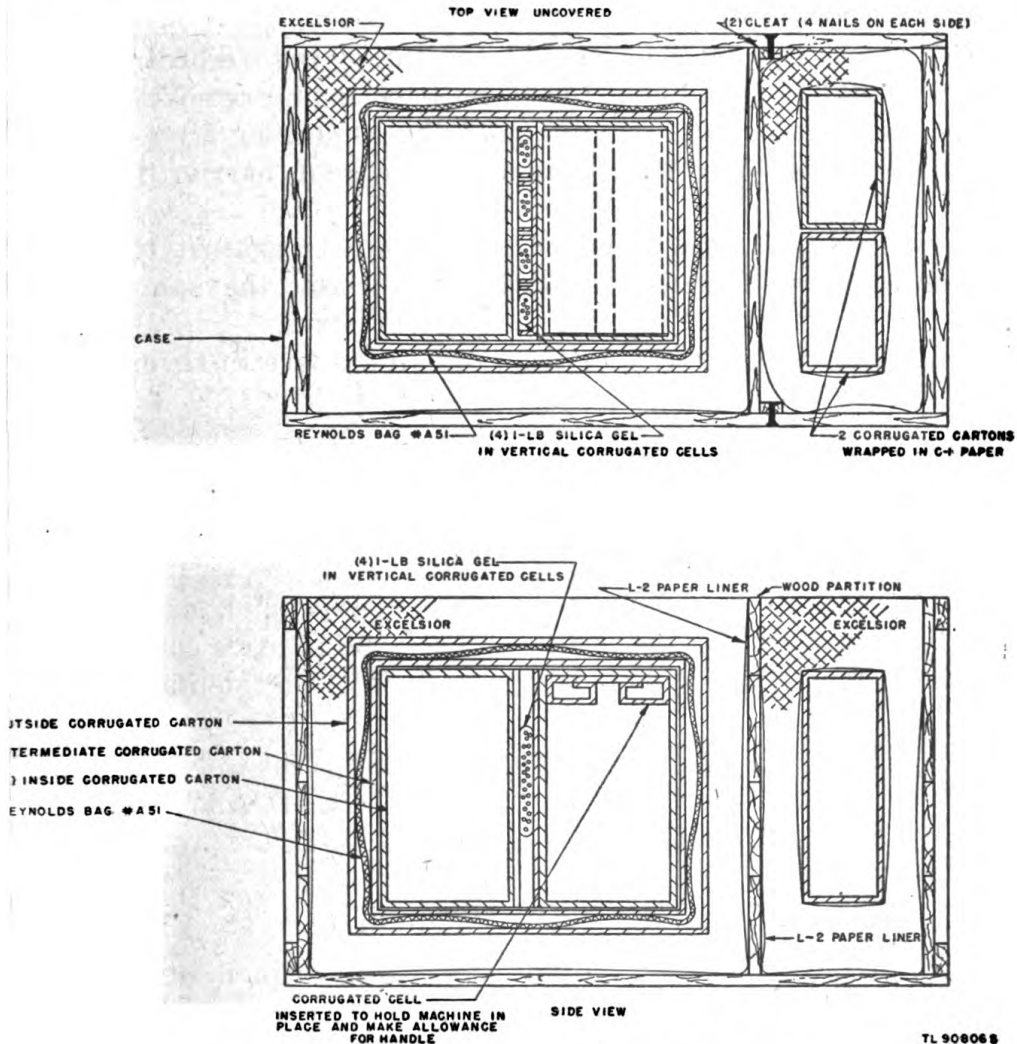


Figure 10. Cutaway view of export package.

### B. Unpacking and Checking

a. UNPACKING (fig. 10). (1) Cut the steel straps.

(2) Remove all nails from the top boards of the wooden crate. Remove boards and excelsior.

(3) Slit the moistureproof barrier down the middle and ends, and fold back.

(4) Open the cardboard carton containing the set, spare parts boxes, etc.

(5) Lift out the carton containing the set and open carton carefully. Lift out the set and place on dry place. Blow excelsior off carrying case preparatory to opening.

(6) Lift out the two spare parts boxes and store in a dry place.

(7) Feel through the remaining excelsior for articles that may have been inadvertently dropped into crates.

(8) Save all material in original wooden crate for possible later repacking.

(9) Open the wooden crate containing the recording film. Cut a small hole in the moistureproof barrier and remove one box of recording tape at a time. Store the remaining boxes in the original wooden box using the moistureproof barrier for protection.

b. CHECKING. Check the package contents against the table of components listed in paragraph 3. Check the spare parts against the list pasted on both spare parts boxes.

c. REPACKING. Follow instructions in *a* above in reverse.

## 9. Opening Carrying Case

a. Place the carrying case on smooth, elevated surface.

b. Push both latch knobs to release latch. Lower front cover to horizontal position.

c. Holding right side of cover with the right hand, slap the left side of the cover with the left hand until split hinges come apart. Place detached cover aside where possibility of accidental damage to the delicate latch mechanism is minimized.

**Caution:** The selector knob (fig. 1) should point to NEUTRAL. This position is set at the factory and SHOULD ALWAYS REMAIN SO WHEN THE SET IS NOT IN USE.

## 10. Installing Recording Film on Magazine

a. Set index knob (fig. 11) to track No. 1 to facilitate loading or removal of film. Track No. 1 appears as 001 on the track indicator.

*Note.* The carriage mechanism normally will not move unless the selector knob is pointing to NEUTRAL or THREAD. Do not force the index knob.

b. Turn all four film magazine latches toward center of magazine.

c. Open box of recording film and remove cellophane-wrapping film. Note manner of packaging and position of film loop.

d. Remove rubber band. Do not remove gate from film so equipped.

e. Turn the selector knob to THREAD.

f. Place the film on the magazine as follows:

(1) If the film roll is equipped with a gate, make sure the eyelet on the gate is placed over the lower post ((A) fig. 11), as the film is placed over the small magazine rollers. Place the inside loop of the film under the large roller (D) and through the gap in the magazine (B). Follow through the coil spring rollers (C) (static eliminator).

(2) Holding the film on the magazine with one hand, snap the film latches back to their original position. Straighten the film on the rollers.

(3) If straight film is used, hold the inside loop of film with the left hand, and with the right hand pull the outside loop at the top of the magazine until enough film is extended for purposes of threading. Place the top loop over or under the carriage bracket film guide pin (E) and then through the bend of the film guide arm. (See fig. 12.) See paragraph 11 for threading instructions.

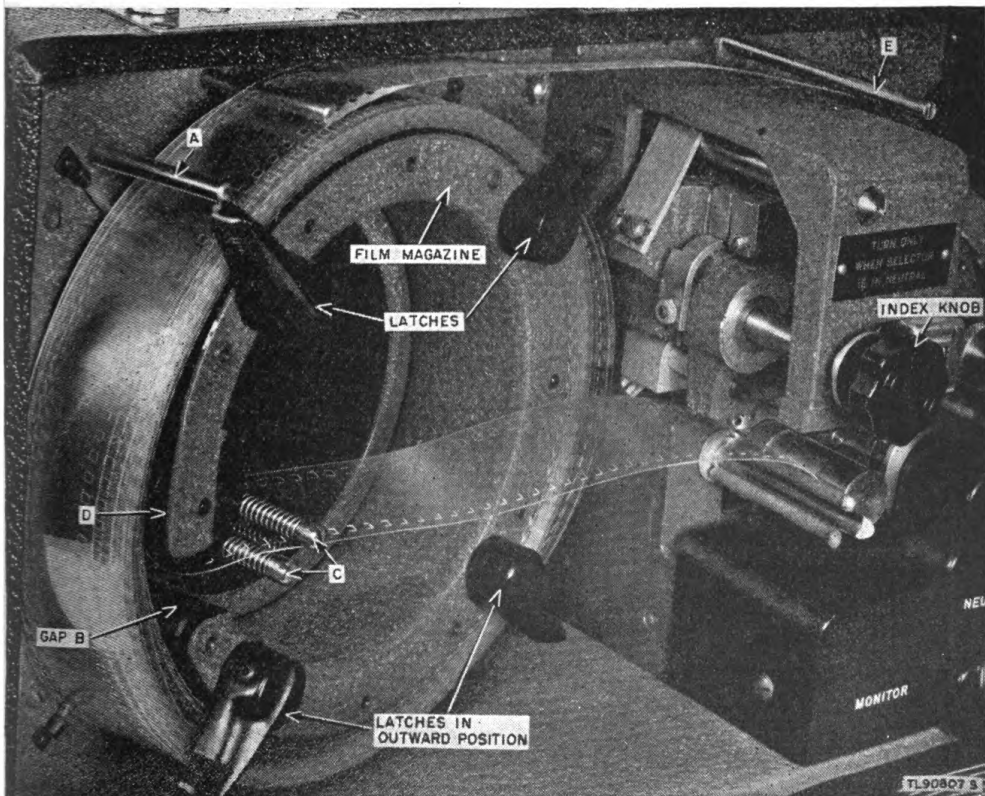


Figure 11. Close-up of film magazine and carriage bracket.

*g.* Place film, not gate equipped, on magazine as follows:

(1) Follow instructions as given in *a* to *e* above.

(2) Place the roll of film over the small magazine rollers in such a position that the green mark on the film is on the latch side of the film magazine. The film notches, which are on the inside of the film opposite to the side of the green mark, will now be in the correct position.

(3) Place the inside loop of the film through the gap (B) in the magazine. Insert film through the two coil spring rollers (C).

(4) If straight film is used, hold the inside loop of film with the left hand, and with the right hand, pull the outside loop at the top of the magazine until enough film is extended for purposes of threading. Place the top loop *over* the carriage bracket film guide pin (E) and then through the bend of the film guide arm. Turn the magazine latches outwardly. See the next paragraph for threading instructions.

*Note.* If reverse film is used, let the reverse in the loop take place at a point between the carriage bracket film guide pin (E) and the film guide arm. Be sure the film is placed *under* pin E. To thread, follow instructions given for straight film.

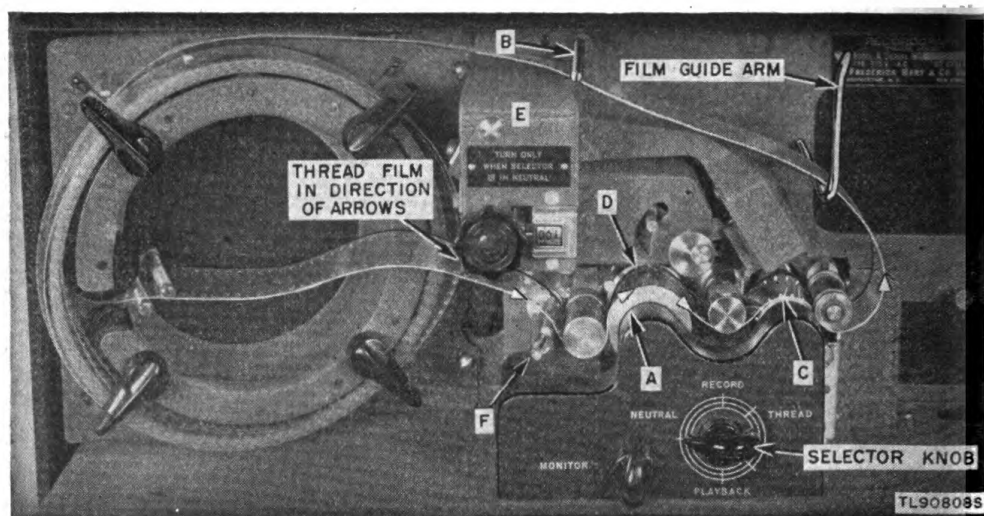


Figure 12. Threading the film.

## 11. Threading Recording Film

With the recording film in place on the film magazine and sufficient film length extending over the carriage mechanism (E) to permit threading, proceed as follows (fig. 12):

*a.* Turn selector knob counterclockwise to **THREAD**.

*b.* Holding the film with the left hand at a point about 1 inch to the left of the film wiper (F), proceed to thread with the right hand following the arrow path shown in figure 12. Follow the procedure carefully.



c. The outside of the recording-drum-spring flange (A) is spring-controlled and must be pulled out slightly to permit the film to lie flat upon the drum (D).

d. Thread reverse film in like manner. Be sure to place the film *under* the carriage bracket film guide pin (B).

**Caution:** Be certain that the sprocket holes on the film are matched with the sprocket teeth (C). Also check the seating of the film on the recording drum (D).

e. Turn the selector knob clockwise to NEUTRAL.

f. Insert the fused power plug into a 110-volt, 60-cycle receptacle.

g. Turn the VOLUME knob clockwise just enough to light the meter.

h. Snap MOTOR switch to OFF and ON about three times to make certain the film is correctly threaded.

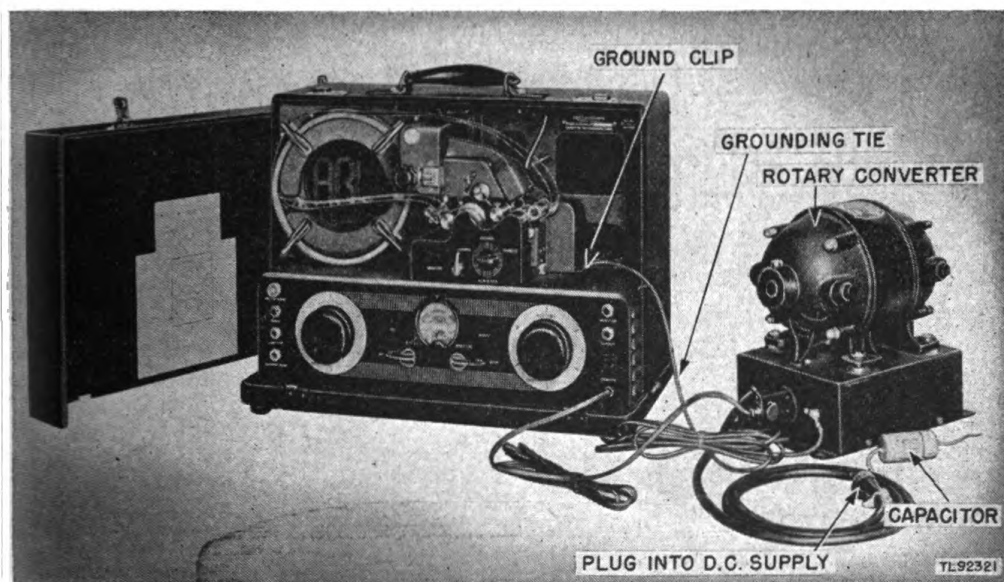


Figure 13. Sound Recording Set AN/UNQ-1 connected to a rotary converter.

## 12. Adapting Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A to 110-Volt D-C Operation

a. EQUIPMENT NEEDED (fig. 13). (1) One rotary converter with a 110-volt, d-c, input motor and a 110-volt, 60-cycle, alternator rated at least 200 watts.

(2) One paper capacitor rated at 1 microfarad and a working voltage of 600 volts.

(3) Two No. 8 tinned soldering lugs.

(4) One 6-foot length of rubber-covered, flexible hook-up wire (#18 stranded).

b. INSTALLATION AND NOISE REDUCTION. (1) Solder the ca-

pacitor across the 110-volt, a-c, output terminals in the converter base.

(2) Connect a suitable length of rubber-covered wire between the converter binding post and the clip or binding post located near the clutch relay housing on the recording set.

(3) Place the converter at least 20 feet away from the sound recording set.

(4) Insert the power plug from the set into the 110-volt, a-c receptacle on the converter.

(5) Plug the line cord from the converter into the nearest 110-volt, d-c receptacle.

(6) The sound recording set is now ready for operation.

## PART TWO

# OPERATING INSTRUCTIONS

*Note.* For information on destroying the equipment to prevent enemy use, see the destruction notice at the front of manual.

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### Section III. CONTROLS AND THEIR USES

#### 13. Volume Control and Switch (SW1)

*a. DESCRIPTION.* The volume control (fig. 1) is a potentiometer designated on figure 54 as R28. It is rated at 0.5 megohm. Attached to the rear of this potentiometer is the power switch which is designated as SW1. It is a double-pole, single-throw (DPST) rotary switch actuated by the same shaft used to control the volume control.

*b. USE.* The volume control is used to vary the sound intensity (or the voltage input) to the sound-recorder amplifier. Rotation of the volume control knob slightly clockwise actuates the power switch SW1. This action energizes the entire sound recording set and readies it for operation on all its circuits. Additional clockwise rotation increases volume.

#### 14. Motor Switch (SW2)

*a. DESCRIPTION.* The MOTOR switch (fig. 1) is a DPST rotary switch actuated by a lever type knob located on the front panel.

*b. USE.* The switch is used to start and stop the film passage manually. This action is accomplished when the switch lever is thrown to START or STOP. However, during the track-over operation, the MOTOR switch is not operative except on equipments bearing serial numbers 812 and 815 to 1350 inclusive. For more details about the use of the MOTOR switch, see paragraph 22.

#### 15. A.V.C. Switch (SW4)

*a. DESCRIPTION.* The A. V. C. (automatic volume control) switch (fig. 1) is a single-pole, single-throw (SPST) rotary switch operated by a lever type knob located on the front panel.

*b. USE.* The A. V. C. switch is used more often in connection with telephone recording. It is sometimes necessary to greatly increase the volume control setting in order to amplify the weak

voice currents up to recording level. In doing so, the stronger voice currents may be distorted beyond intelligibility. By throwing the A. V. C. knob to ON, the weaker signals are made stronger, and the stronger signals are made weaker. Thus, a fairly constant recording level is obtained. For a description of the theory of automatic volume control as used in the sound recording sets, see paragraph 61.

## 16. Audiotrol and Switch (SW3)

*a. DESCRIPTION.* The knob marked AUDIOTROL (fig. 1) controls a potentiometer designated as R6 (1,000 ohms) and a SPST rotary switch designated as SW3.

*b. USE.* When turned to on position, that is, when the knob marked AUDIOTROL is rotated slightly clockwise, the audiotrol circuit is placed into operation. Signals will automatically start recording operations. (See par. 25.) For complete details of the theory, see paragraph 60.

## 17. Selector Switch

*a. DESCRIPTION.* The selector knob (fig. 1) is connected to a camshaft, which, when in any one of the four positions selected by the operator, sets up mechanical and electrical conditions to fulfill operations identified by that position. The positions are marked on the panel in front of the carriage mechanism. When the selector knob is rotated, cams raise and lower the recording and playback heads and also raise the sprocket idler roll to permit threading the film. Four single-pole, triple-throw (SPTT) switches, connected in tandem, are actuated by the selector knob.

*b. USE.* The selector knob is used to select any one of the four operating conditions plainly engraved on the small panel. The use of the selector knob is covered more fully in the operation section of this manual. A brief description of each setting follows:

(1) *NEUTRAL position.* Both recording head and playback head are held up so that their needles do not contact the film. In this position the recorder is used as a public address set in conjunction with the crystal microphone. The NEUTRAL position is also for use during periods of idleness between recording or playbacks. When turning the index knob, the selector knob should be kept in NEUTRAL position.

(2) *PLAYBACK position.* The playback head is brought down upon the film and the recording head is held up so that the recording needle clears the film. This position is used for play-

backs only. The playback head is connected to the input of the amplifier.

(3) *RECORD position.* In this position the recording head needle is brought to bear down on the film surface for recording. The playback head is raised above the film surface so that the playback needle does not contact the film surface. The recording head is connected to the output transformer.

*Note.* The playback head may be brought down to bear upon the film surface by turning the MONITOR knob counterclockwise completely. This is done during the monitoring operation which is more fully described in paragraph 18.

(4) *THREAD position.* This position is used only for threading the film as described in paragraph 10. The recording head and playback head are raised in this position and the sprocket idler is moved away from the sprocket to permit the operator to insert the film. Current for the drive motor is shut off when the selector knob is in THREAD position.

## 18. Monitor Knob

*a. DESCRIPTION.* The MONITOR knob (fig. 1) is attached to a camshaft similar to, but not as complex as, that attached to the selector knob. One of the cams, in contact with the lift arm, is also in contact with the playback arm. When the MONITOR knob is turned a full 180° counterclockwise, the playback head is lowered sufficiently to bring its needle to bear upon the film.

*b. USE.* The monitor knob is used to lower the playback head on the film to pick up the recording a fraction of a second after the recording is made. Monitoring is desirable for aligning the playback head needle with the recording head needle. (See par. 23.)

**Caution:** Always turn the MONITOR knob up when through monitoring to protect the playback needle. Never move the set while the MONITOR knob is pointing downward. Before playing back, remove the monitoring earphone plug from the MONITOR jack.

## 19. Carriage Index Knob

*a. DESCRIPTION.* The carriage index knob (fig. 1) controls the movement of the carriage assembly (when the selector knob is in NEUTRAL position only). The knob is attached to a shaft, part of which is threaded. The threaded shaft passes through a nut contained within the recording carriage. When the carriage index knob is turned, the trackage counter, which is geared to the index knob, indicates numerically the film track which is directly under the recording needle.

*b.* **USE.** The carriage index knob is used to select the desired track for recording or playback operations.

## **20. Playback-Head-Adjustment Knob (Vernier)**

*a.* **DESCRIPTION.** The vernier adjustment knob (fig. 1) is attached to a threaded shaft which, working against spring pressure, controls the position of the wedge (within defined limits) that enters the V slot located on the rear of the playback head. A small locking screw holds the adjustment.

*b.* **USE.** The vernier knob is used to position the playback head needle into the proper groove during playback. It is also used to improve the quality of the reproduction when the distortion is due to the playback needle being slightly out of line with the proper track. Slight variations in alignment of film tracks which were recorded on different sound recording sets sometimes make it necessary to reset the vernier for the first track. The setting will hold for the duration of the playback on that film.

## **21. Trackage Release Button (SW10)**

*a.* **DESCRIPTION.** The trackage release button (fig. 1) is a push-button, SPST, switch connected in parallel with the last track switch SW7 (on Sound Recording Set AN/UNQ-1 only).

*b.* **USE.** This button is pressed to permit the trackage motor to complete its cycle if the motor is stopped by the microswitch (SW7) before the trackage-operating pawl is released from the teeth on the index wheel. This is necessary because it would be impossible to turn the index knob even with the knob in NEUTRAL position. The trackage release button is also used to permit operation after track 115.

# **Section IV. OPERATION**

## **22. Recording**

*a.* **OPERATION** (fig. 1). (1) Plug the a-c cord into the nearest 110-volt, a-c receptacle.

(2) Turn the selector knob to NEUTRAL.

(3) Turn VOLUME knob slightly clockwise to light the meter.

(4) Snap the MOTOR switch a few times to make certain that film is correctly threaded.

(5) With MOTOR switch at STOP and selector knob in NEUTRAL, turn the index knob until the numbers on the trackage counter indicate midway between 000 and 001.

(6) Throw MOTOR switch to START. Allow the film to run until the notches at the side of the film pass the sprocket. (A

series of audible clicks should be heard during this period, such clicks being the result of contact between the small rod on the film switch post and the notches on the side of the film.) When all the notches pass the sprocket, throw MOTOR switch to STOP.

*Note.* If the equipment is Sound Recording Set AN/UNQ-1A, place the selector knob in PLAYBACK position, throw MOTOR switch to START, run until notches pass the sprocket (trackage numbers will change from 000 to 001) and throw MOTOR switch from START to STOP.

(7) Turn selector knob clockwise from NEUTRAL to RECORD. Now turn index knob to track 001 until it locks. Enter title of record into log opposite number 1.

*Note.* If the equipment is Sound Recording Set AN/UNQ-1A, turn selector knob from PLAYBACK to RECORD. (Film may start moving to complete automatic track-over operation, but will stop when cycle is completed.) Check the indicator and if it reads a full 001, the needle is in position to start this track.

(8) Attach the crystal microphone to jack marked MICROPHONE and speak into the front-slotted end of the instrument. Adjust VOLUME knob to bring the fluctuating meter needle within the marks UNDER and OVER (between 2 and 4 on older models).

(9) To record the voice, throw MOTOR switch to START and speak into the microphone. At the end of the track (about 50 seconds) the index knob will turn and the trackage indicator will begin to register the next higher number (002).

(10) During the track change-over, on some models, the film may not stop running even if the MOTOR switch is turned to STOP. The film will stop, however, after the completion of the track change-over and change of number on the trackage indicator.

*b. STOPPING THE RECORDING OPERATION.* Do not turn the MOTOR switch to STOP until the end of that particular track has been reached. The end of the recorded track will be indicated by the first series of clicks that follow the recording operation. The MOTOR switch must be turned to STOP after the notches have passed the sprocket. Make a note of the number on the trackage indicator and enter the title or subject of the recording into log on a line opposite the number noted at the end of the recording. For example:

(1) If at the end of the recording operation the number on the trackage indicator is 010, make a note of that number as you permit the film to run along until the clicks have sounded and the trackage indicator changes over to 011.

(2) When the clicks sound, turn MOTOR switch to STOP. The set is now ready for another recording which will begin on track 011.

(3) The next step is to enter the subject of the last recording in the log opposite the number 010. When it is desired to playback the recording on 010, the index knob is set to 001. At the end of the playback, the trackage indicator should indicate 010. For playback operations, see paragraph 23.

(4) When preparing the set for recording again, the index knob is turned until the trackage indicator number rests between 010 and 011. Follow instructions as given in *a* above.

*c.* RECORDING PRECAUTIONS. (1) Always stop recording with the MOTOR switch. Do not use VOLUME knob (power switch) to stop recording because it may jam the trackage motor (on Sound Recording Set AN/UNQ-1 only). The switch on the volume control knob is to be used only for turning off all the power.

(2) If the carriage mechanism is locked, press the trackage release button (SW10) and hold it in until cycle is completed. Turn the index knob to number desired (Sound Recording Set AN/UNQ-1 only).

(3) A loud howl may result from turning the selector knob from RECORD to NEUTRAL if the volume control is not previously turned counterclockwise to minimum position (without turning off set). This howl is called acoustic feedback and is usually caused by the position of the microphone relative to the recording set. The condition is more annoying than damaging. Shift the microphone position. Move it as far from the set as possible.

*d.* FOOT-OPERATING SWITCH (fig. 8). The foot-operating switch is used to start and stop recording (and playback) operations at a distance up to 12 feet from the set. Insert the plug into the receptacle on the panel marked REMOTE and place the MOTOR knob on STOP. To operate, step on the switch button. To stop, step on switch button again.

## 23. Monitoring the Recording

*a.* Insert the earphones into jack marked MONITOR.

*b.* Turn knob marked MONITOR counterclockwise to end of travel (180°).

*c.* Proceed with recording as described in paragraph 22. If the playback head is lined up with the recording head, the sound being recorded should be heard in the earphones a fraction of a second after it is embossed on the film. If the recording is not heard, turn the vernier screw to the right or left until the recording is heard. The playback head is now lined up with the recording head.

*d.* Always turn the MONITOR knob up after recording to pro-



tect the playback needle. Remove the earphones from the jack before playing back.

## 24. Radio Recording

Recording the output of a radio receiver may be accomplished in two ways. The easiest and quickest way is to place the crystal microphone in front of the radio speaker and record the sound as it is delivered from the radio speaker. The other method, more involved and difficult, is to tap the output circuit of an audio tube in the receiver through a suitable capacitor into the recording set input circuit. This circuit has an impedance of 0.5 megohm. Access to it may be had through the jack marked RADIO. If the quality of the radio receiver output is good, good results should be had, but if the radio output is distorted, the recording on film will be distorted. Connecting the recording-set-input circuit to the output circuit of the radio gives the best results.

## 25. Telephone Recording

*a.* CONNECTIONS. Using the supplied telephone-tap cord and plug, connect the telephone to the recorder as follows:

(1) Remove insulation from ends of the telephone tap cord and thoroughly clean the copper wire. Cut off frayed ends and twist strands together tightly.

(2) Open bell box of telephone and locate the two telephone conductors (line) that enter the bell box. Connect the telephone tap cord across the terminals of the two telephone conductors. Do not connect the telephone tap cord in series with the telephone line.

(3) Plug the telephone-tap cord into jack marked LINE TAP. (ON Sound Recording Set AN/UNQ-1A, this jack is marked LINE-CARBON MIKE.)

*Note.* On telephone instruments not using bell boxes, connect the telephone across the line at a convenient point.

*b.* AUDIOTROL. Automatic starting and stopping of recording is possible with the audiotrol. With the audiotrol connected, incoming signals (voice currents coming over the telephone line) will start the film running and through a delay action circuit, keep the film running through the recorder for several seconds after the signal ceases. The theory of this operation is fully discussed in paragraph 60. Use of the audiotrol for telephone recording is made as follows:

(1) Make all connections for authorized telephone tapping as given above.

(2) Advance the AUDIOTROL knob to about 3 on the dial.

(3) Throw MOTOR knob to STOP.

(4) Turn VOLUME knob to about 3 (experience is necessary to determine this setting, and a test telephone conversation should be made prior to the actual recording).

(5) Set the selector knob to RECORD. Set index knob to desired track number.

(6) Start telephone conversation to determine optimum setting for VOLUME and AUDIOTROL knobs. *Adjust both knobs so that the recording starts when person on other end of telephone commences talking, and so that recording stops approximately 5 seconds after the other person stops talking.* The A. V. C. knob may be turned to ON at this point. (See *c* below for details on A. V. C. operation.)

*c.* A. V. C. OPERATION. Automatic volume control may be necessary when recording telephone conversations. The purpose of the circuit (explained more fully in par. 61) is to build up weak signals and decrease the intensity of excessively strong signals. Since monitoring of telephone conversations is impractical in most cases, and manual control of volume is difficult, automatic volume control becomes necessary. Distortion will occur when strong signals are fed into the input circuit of the recorder when the VOLUME knob is set too high. If the volume control is set lower to reduce distortion, weaker signals may not be recorded. When using automatic volume control, be sure to increase setting of the VOLUME knob accordingly. Monitor a test telephone conversation to line up the playback head with the recording head.

## 26. Using a Carbon Microphone

*a.* SOUND RECORDING SET AN/UNQ-1. (1) Insert the plug of the carbon microphone into jack marked CARBON MIKE. Check the two dry cells in the battery compartment. (See fig. 3.) Insert fresh batteries if necessary.

(2) Position the recorder controls for recording and start recording by speaking into microphone.

*b.* SOUND RECORDING SET AN/UNQ-1A. (1) Insert plug of carbon microphone into jack marked LINE-CARBON MIKE.

(2) Insert plug of dry cells into jack marked MIKE BATTERY.

(3) Set up recorder for recording and speak into microphone.

## 27. Playing Back a Recording

*a.* OPERATION. If a recording was made as outlined in paragraph 22 in which the index knob was set to show 001 on the trackage indicator, then to play back the same recording, the

index knob must be set to 999 (see below). The operation is as follows:

(1) Turn the selector knob from RECORD to NEUTRAL (turn VOLUME knob down to avoid howl).

(2) Turn MONITOR knob to up position (if it was used during the recording process).

(3) Turn index knob until the trackage indicator shows about two numbers below 001 (999) then turn again until the trackage indicator rests at 001. Turning *up* to the desired track number is good practice. Do not *turn down* to the desired track number.

(4) Turn AUDIOTROL to OFF and A. V. C. to OFF.

(5) Turn VOLUME knob to about 2 or 3. If turning on the power causes the film to travel during the track-over cycle, let the cycle be completed without interference.

(6) Turn selector knob to PLAYBACK.

(7) Throw MOTOR switch to START. Adjust volume of the sound coming from the recorder loudspeaker by turning the VOLUME knob.

(8) Adjust the vernier screw (fig. 1) to eliminate distortion caused by the playback needle not being grooved properly. If no playback is heard on track 001, a slight adjustment of the vernier screw will move the playback needle into the track corresponding to number 001. For the duration of the playback, no further adjustment need be necessary. Always tighten the vernier locking screw after adjustment.

b. STOPPING PLAYBACK DURING THE TRACKING CYCLE. On equipments bearing serial numbers 812 and 815 to 1350 inclusive, a modification in the wiring of the amplifier and chassis harness enables the operator to stop the playback operation during the tracking cycle. Turn MOTOR switch to STOP to discontinue playback. To resume playback turn MOTOR switch to START positive again. On recorders other than those indicated by serial numbers given above, it is not possible to stop the playback operation until the track is completed.

## 28. Removing Film From Set

a. Shut off power. Turn selector knob to THREAD.

b. Remove film from sprocket teeth, recording drum, impedance posts, and with the right hand hold the looped film away from the set.

c. Hold a finger of the left hand under the large magazine roller and against the inside of the film.

d. Wind the film in a downward motion until the loop (which is held in the right hand) is taken up and reduced to the size of the film roll on the magazine.

e. Turn the magazine latches inward and remove film from the magazine. Do not damage film gate on film so equipped.

f. Place film back into its box. Use the same packing material and pack in a similar manner. Place the log for that film in the box.

## 29. Using an External Loudspeaker

An external loudspeaker may be used with Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A. Since no provision is made to supply field current for electro-dynamic speakers, permanent-magnet speakers or straight magnetic speakers should be used. The latter type, not in common use, would require an impedance matching transformer for best results. If the permanent-magnet-type dynamic speaker is of the 6-ohm type, no impedance-matching transformer will be needed. The external speaker is plugged into the jack marked OUTPUT. The recorder speaker is cut out of the circuit when an external speaker is plugged into the jack marked OUTPUT.

## 30. Using Set as a Public Address System

Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A may be used as public address sets to cover a limited area; the amplifier output is only 3 watts. An external loudspeaker will extend the range of the set. To use the set as a public address set, proceed as follows:

- a. Turn VOLUME knob to about 1.
- b. Turn selector to NEUTRAL.
- c. Allow set amplifier tubes to warm up (about 10 seconds).
- d. Connect the crystal microphone to jack marked MICROPHONE. Place microphone as far from the set as possible and speak into it.
- e. Adjust volume as desired by turning knob marked VOLUME.

*Note.* A loud howl may emanate from the loudspeaker if the microphone is too close to or in a certain position relative to the recorder loudspeaker. If an external speaker is used, and the microphone position cannot be changed (as on a stage or platform), change the speaker location. Reduce VOLUME knob setting in extreme cases.

## Section V. EQUIPMENT PERFORMANCE CHECK LIST

### 31. Purpose and Use of Check List

The equipment performance check list will help the operator to determine whether Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A are functioning properly. The check list gives the items to be checked under each type of operation, the action to be

performed in connection with the items, normal indication, and some corrective measures that the operator can take to check and adjust the set if indications are abnormal. (See par. 82 for trouble-shooting information.)

## 32. Equipment Performance Check List

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	1	A-c cord.	Plug in a-c outlet.		
	2	Selector knob.	Turn clockwise from <b>THREAD</b> to <b>NEUTRAL</b> .	Sprocket idler pushes against sprocket.	
	3	Volume control.	Turn clockwise until meter is illuminated.	Meter lamp lights. Motor runs; running sound heard.	Check fuses, meter lamp, and power plug connection.
START RECORDING	4	<b>MOTOR</b> switch.	Throw switch to <b>START</b> and <b>STOP</b> positions three times quickly.	Film moves smoothly on <b>START</b> ; stops on <b>STOP</b> .	Thread correctly (par. 11).
	5	Index knob.	Set knob so that numbers rest between 000 and 001.		
	6	<b>MOTOR</b> switch.	Turn to <b>START</b> . Allow film to run until all notches pass sprocket teeth.	Series of audible clicks as notches pass sprocket teeth.	
	7	<b>MOTOR</b> switch.	Turn to <b>STOP</b> .	Film runs until it reaches beginning of track, then stops. (On some models.)	Refer to paragraph 72.
	8	Selector knob.	Turn clockwise from <b>NEUTRAL</b> to <b>RECORD</b> .		
	9	Index knob.	Turn to track 001 (par. 22).	Knob locks in position.	

	Item No.	Item	Action or condition	Normal indication	Corrective measures
MICROPHONE RECORDING	10	Microphone.	Connect to input connection (jack) marked M I C R O - P H O N E . If a carbon microphone is used, connect to C A R B O N M I K E jack (par. 22).		
	11	Volume control knob.	Speak into microphone and set knob to right level.	Meter needle fluctuates between UNDER and OVER or between 2 and 4.	Set VOLUME knob correctly.
	12	MOTOR switch.	Turn to START, begin speaking.	Film moves to end of track.	Same as item 4.
	13	Track-over.	Track-over is automatic when end of track is reached.	Series of clicks at end of track; indicator number changes to 002, recording continues.	Refer to paragraph 72.
RADIO RECORDING	14	Connections.	Connect according to instructions in paragraph 24.		
	15	Volume control knob.	Adjust level with the radio or recorder volume control.	Same as item 11.	Set correctly.
	16	MOTOR switch.	Turn to start.	Same as item 12.	Same as item 4.
	17	Track-over.	Same as item 13.	Same as item 13.	Same as item 13.

	Item No.	Item	Action or condition	Normal indication	Corrective measures
TELEPHONE RECORDING	18	Connections.	Refer to paragraph 25.		
	19	Automatic volume control (A.V.C.).	Turn A. V. C. knob to ON.	Weak signals amplified; strong signals damped.	Refer to paragraph 81.
	20	AUDIOTROL.	Set according to instructions in paragraph 25.	Film starts and stops on voice signal.	Refer to paragraph 81.
	21	Volume control knob.	Same as item 11.	Same as item 11.	Same as item 11.
	22	MOTOR switch.	Same as item 12.	Same as item 12.	Same as item 12.
	23	Track-over.	Same as item 13.	Same as item 13.	Same as item 13.
MONITORING	24	MONITOR knob.	Turn knob to point straight down.		
	25	Earphones.	Connect to MONITOR jack.	Recording is audible in earphones.	Check jack and plug. Adjust vernier screw (par 20).
	26	MONITOR knob.	<i>Always turn knob until it points up when monitoring is done.</i>		
STOP RECORDING	27	MOTOR switch.	Turn to STOP.	Same as item 4 or 7.	Refer to paragraph 72.

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PLAYING BACK	28	Selector knob.	Turn clockwise from RECORD to NEUTRAL.		
	29	Index knob.	Set knob so that numbers rest between 999 and 001.		
	30	Selector knob.	Turn to PLAYBACK.		
	31	Index knob.	Turn clockwise till it locks.		
	32	MOTOR switch.	Turn to START.	Recording is audible over built-in speaker.	Check vernier adjustment (par. 20).
	33	MOTOR switch.	Turn to STOP.	Film runs to end of track, then stops. Refer to paragraph 27b if film stops during tracking cycle during playback.	
SHUT-DOWN	34	Selector switch.	Turn to NEUTRAL.		
	35	Volume control knob.	Turn counterclockwise as far as it will go.	Meter lamp goes out.	



## PART THREE

### MAINTENANCE INSTRUCTIONS

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#### Section VI. PREVENTIVE MAINTENANCE TECHNIQUES

##### 33. Meaning of Preventive Maintenance

Preventive maintenance is a systematic series of operations performed periodically on equipment in order to maintain top efficiency in performance, to minimize unwanted interruptions in service, and to eliminate major break-downs. To understand what is meant by preventive maintenance, it is necessary to distinguish between preventative maintenance, trouble shooting, and repair. The prime function of preventive maintenance is to *prevent* break-downs and the need for repair. The prime function of trouble shooting and repair is to locate and correct *existing* defects. The importance of preventive maintenance cannot be overemphasized. The usefulness of the sound recording set depends upon the equipment being ready to operate at peak efficiency when needed.

*Note.* The operations in paragraphs 37 to 49 are first and second echelon (organization operators and repairmen) maintenance. Some lubrication operations and moistureproofing and fungiproofing procedures are higher echelon maintenance.

##### 34. Description of Preventive Maintenance Techniques

*a. GENERAL.* Many electrical parts used in Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A require routine preventive maintenance. Those requiring maintenance differ in the amount and kind required. Hit-or-miss maintenance techniques cannot be applied. Instead, definite and specific instructions are needed. This section of the manual contains these specific instructions and serves as a guide for personnel assigned to perform the six basic maintenance operations, namely: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the lettering system for the six operations will be as follows:

- F—Feel
- I—Inspect
- T—Tighten
- C—Clean
- A—Adjust
- L—Lubricate

The first two operations establish the need for the other four. The selection of operations is based on a general knowledge of field needs. For example, the dust encountered on dirt roads during cross-country travel filters into the equipment no matter how much care is taken to prevent it. Rapid changes in climatic conditions (such as heavy rains followed by blistering heat) or excessive dampness tend to cause corrosion of exposed surfaces and parts. Without frequent inspections and the necessary performance of tightening, cleaning, and lubricating operations, equipment becomes undependable and subject to break-downs when it is most needed.

b. FEEL (F). The feel operation is used to check rotating machinery such as the drive motor and carriage motor, etc., and to determine if electrical connections, transformer, choke, etc., are overheated. Feeling indicates the need for lubrication or the existence of similar types of defects requiring correction. The maintenance man must become familiar with normal operating temperatures in order to recognize signs of overheating.

*Note.* It is important that the feel operation be performed as soon as possible after shut-down and always before any other maintenance is done.

c. INSPECT (I). Inspection is the most important operation in the preventive maintenance program. A careless observer will overlook the evidence of minor trouble. Although these defects may not interfere with the performance of the equipment, valuable time and effort can be saved if they are corrected before they lead to major break-downs. Make every effort to become thoroughly familiar with the indications of normal functioning, in order to be able to recognize the signs of a defective set. Inspection consists of carefully observing all parts of the equipment, noticing their color, placement, state of cleanliness, etc. Inspect for the following conditions:

(1) Overheating, as indicated by discoloration, blistering, or bulging of the parts or surface of the container; leakage of insulating compounds; and oxidation of metal contact surfaces.

(2) Placement, by observing that all leads and cabling are in their original positions.

(3) Cleanliness, by carefully examining all recesses in the units for accumulated dust, especially between connecting terminals. Parts, connections and joints should be free of dust, corrosion, and other foreign matter. In tropical and high-humidity locations, look for fungus growth and mildew.

(4) Tightness, by testing any connection or mounting which appears to be loose, by slightly pulling on the wire, or by feeling the lug or terminal screw.

d. TIGHTEN (T). Any movement of the equipment caused by

transportation, or by vibration from moving machinery may result in loose connections which are likely to impair the operation of the sound recording set. The importance of firm mountings and connections cannot be overemphasized; however, never tighten screws, bolts, and nuts unless it is known definitely that they are loose. Fittings that are tightened beyond the pressure for which they are designed will be damaged or broken. When tightening, always be certain to use the correct tool of the proper size.

*e. CLEAN (C).* When the schedule calls for cleaning operation, it does not mean that every item which bears that identifying letter must be cleaned each time it is inspected. Clean parts only when inspection shows that it is necessary. The cleaning operation to be performed on each part is described in the paragraph pertaining to that item.

*f. ADJUST (A).* The adjust operation refers to any adjustment which the operator can make to insure proper performance of the equipment.

*g. LUBRICATE (L).* Lubrication refers to the application of grease or oil to motor bearings, rotating shafts, hinges, cams, or other sliding surfaces of the equipment.

## **Section VII. ITEMIZED PREVENTIVE MAINTENANCE**

### **35. Introduction**

For ease and efficiency of performance, preventive maintenance on Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A will be broken down into operations that can be performed at different time intervals. In this section the preventive maintenance work to be performed on the recording set at the specified time interval is broken down into units of work called items. The general techniques involved and the application of the FITCAL operations in performing preventive maintenance are discussed in paragraphs 33 and 34. These general instructions are not repeated in this section. When performing preventive maintenance, refer to paragraphs 33 and 34 if more information is required for the following items. All work is to be performed with the power removed from the recording set unless otherwise directed. After preventive maintenance has been performed, the equipment should be put into operation and checked for satisfactory performance. (See par. 32, Equipment Performance Check List.)

### 36. Preventive Maintenance Tools and Materials

The following preventive maintenance tools and materials will be needed :

Common hand tools.

Clean cloth.

#0000 sandpaper.

Crocus cloth.

File (WECO KS/26662, Signal Corps stock No. 6Q37104).

Dry-cleaning solvent (SD).

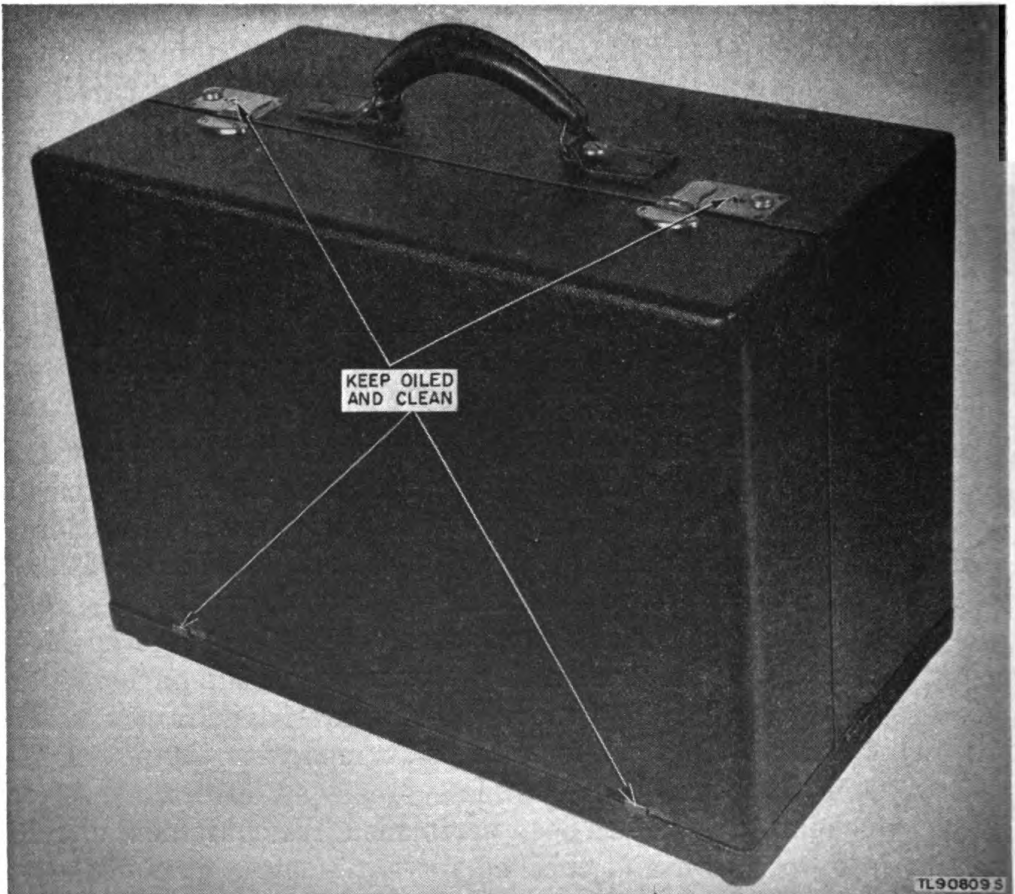
Paste metal polish (Signal Corps stock No. 6G1516).

Contact burnishing tool (WECO 265C, Signal Corps stock No. 6R41065C).

Orange stick (Signal Corps stock No. 6Z7360).

Toothpicks (Signal Corps stock No. 6Z8666).

*Note.* Gasoline will not be used as a cleaning fluid for any purpose.



*Figure 14. Carrying-case parts to be maintained.*

### 37. Item 1, Carrying Case (fig. 14)

a. INSPECT (I). Inspect the fabricoid-covered case for dirt, mold, and fungus growth. Inspect metal hinges and fasteners for

rust, corrosion, loose mountings, and mechanical faults. Examine the screws which pass through the carrying handle and screws at the ends of the rear cover to be sure they are in place and tight.

b. CLEAN (C). Remove loose dirt, dust, and fungus from the covering of the case with a clean, dry cloth. Remove encrusted dirt with dry-cleaning solvent (SD). Remove rust or corrosion from hinges and fasteners with #0000 sandpaper; then clean thoroughly with dry-cleaning solvent (SD) and wipe dry.

c. LUBRICATE (L). Apply PS (par. 51a to locks and hinges. (See fig. 14.)

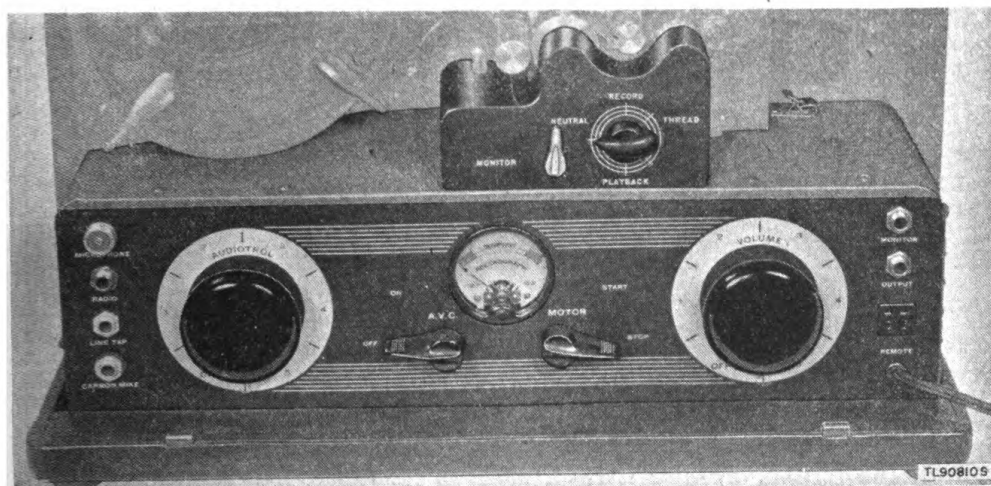


Figure 15. Amplifier panel parts to be maintained.

### 38. Item 2, Amplifier Panel (fig. 15)

a. INSPECT (I). (1) Inspect entire panel and all parts mounted thereon for dirt, dust, rust, and corrosion, for loose mountings, and for cracked meter glass.

(2) Check mechanical operation of switches and controls.

b. TIGHTEN (T). Tighten loose mountings and knob setscrews.

c. CLEAN (C). Clean dust or dirt from the panel, controls, and meter face with a clean, dry cloth. Remove rust and corrosion from the microphone connector on the panel with #0000 sandpaper; clean thoroughly with dry-cleaning solvent (SD).

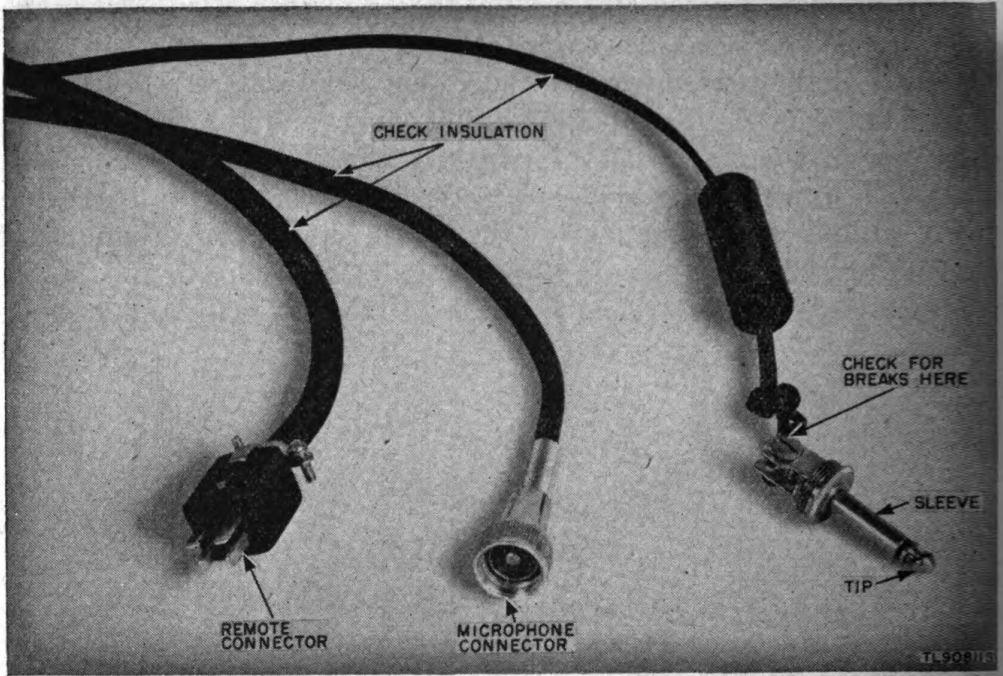


Figure 16. Cords and plugs.

### 39. Item 3, Cords and Plugs (fig. 16)

a. INSPECT (I). Check the condition of insulation on all cords which plug into jacks on the amplifier panel. Look especially for breaks in insulation and cracks at the end of the plugs. Inspect tips and sleeves of the plugs for rust or corrosion. Check the fuses in the a-c plug. Remove the fuses by pushing them out of the plug with a pencil or other small round object.

b. CLEAN (C). Remove dust or dirt from cords with a clean, dry cloth. Do not use solvent or other cleaning agents on rubber-covered cords. Clean plug contacts with paste, metal polish. After cleaning, remove all traces of polish.

### 40. Item 4, Microphone and Earphones (figs. 5 and 6)

a. INSPECT (I). Examine the microphone and earphones for dirt, dust, and other foreign material. Inspect metal parts for rust and corrosion.

b. CLEAN (C). Clean dust and dirt from the surfaces of the microphone and the earphones with a clean, dry cloth. Remove sweat residue which may accumulate on the earphones during warm weather or after long periods of use.

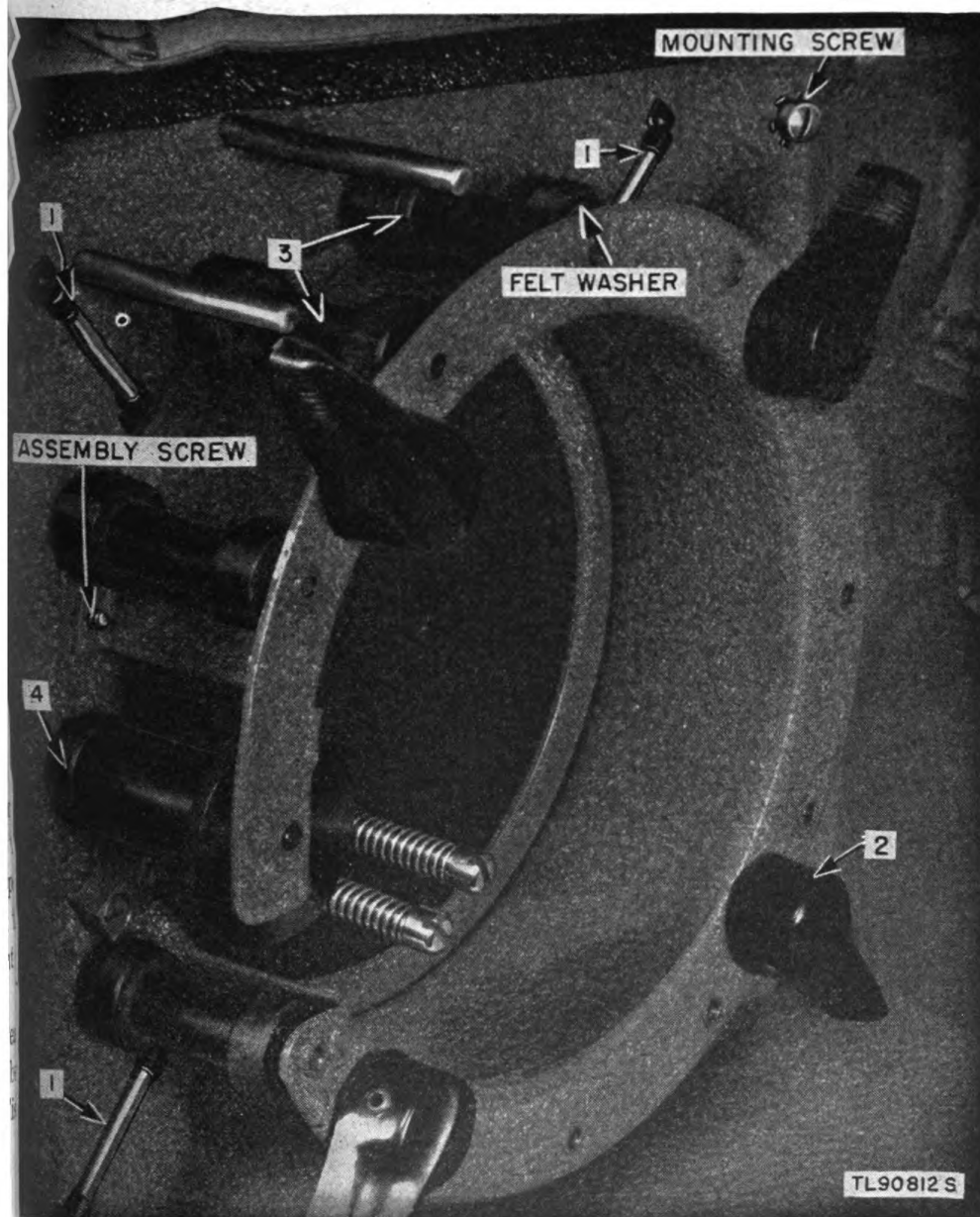


Figure 17. Film magazine parts to be maintained.

#### 41. Item 5, Film Magazine (fig. 17)

a. **INSPECT (I)**. Examine the film magazine for presence of dirt, grease, rust, and corrosion. Check for loose mounting and assembly screws. Inspect the half-round strips (1) and the inner surfaces of the four magazine latches (2) for excessive wear. Examine the film rollers (3) for free movement.

b. **TIGHTEN (T)**. Tighten loose mounting and assembly screws.

c. **CLEAN (C)**. Remove dirt or dust with a clean, dry cloth. Moisten the cloth with dry-cleaning solvent (SD) if dirt is hard to remove. Remove rust and corrosion from metal surfaces with

#0000 sandpaper; then clean thoroughly with dry-cleaning solvent (SD) and wipe dry.

d. ADJUST (A). If the felt washers at the ends of the magazine rollers are too thick, the rollers will not turn. If the washers are too thin or are missing, the rollers can move endwise enough to come out of the bearings. Cut part of the washer away with a sharp knife if it is too thick. If the washer is worn too thin or is missing, construct a new washer from felt material available. The felt washers are not maintenance parts.

e. LUBRICATE (L). Lubricate film rollers (3) and (4) according to instructions in paragraph 51.

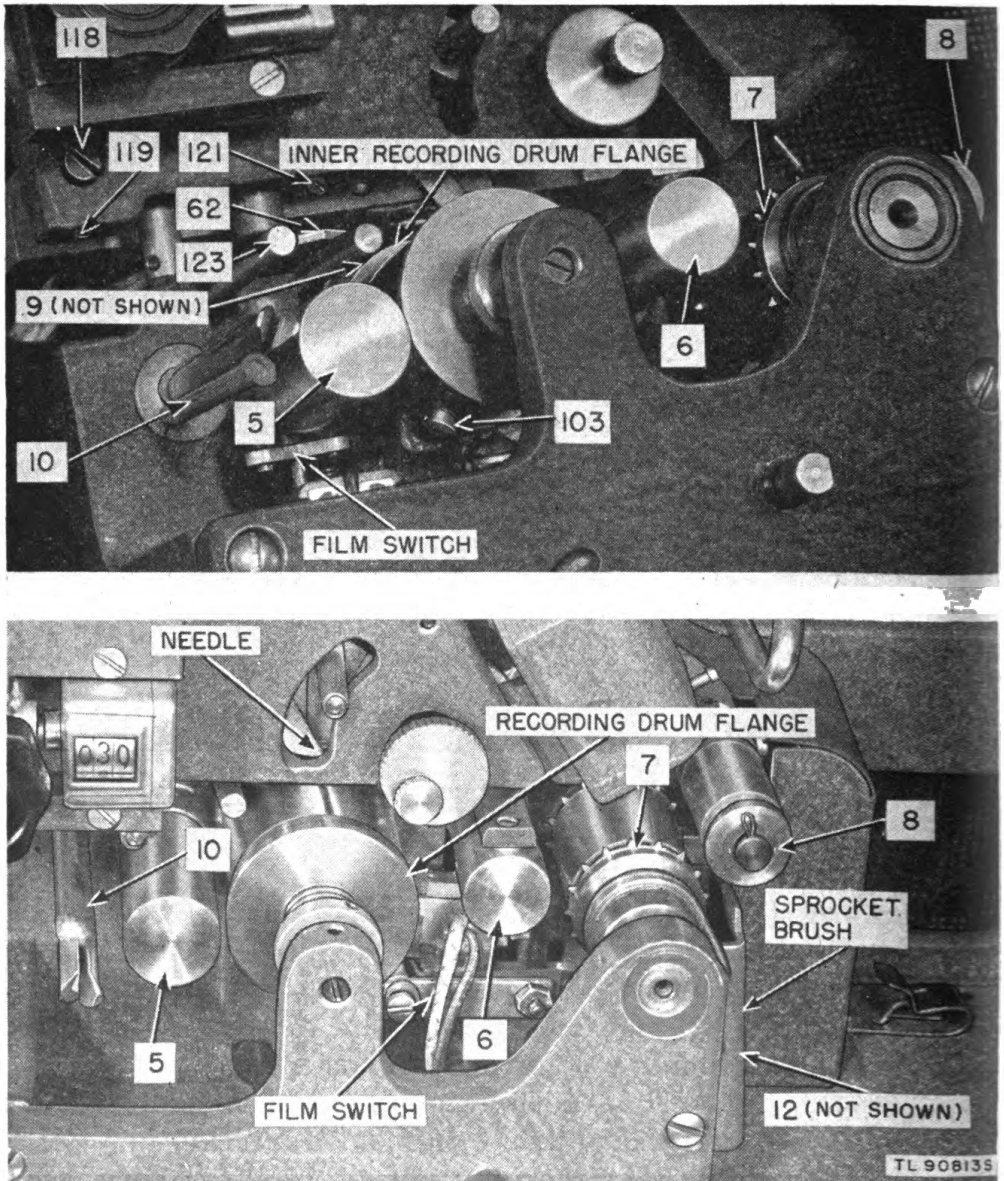


Figure 18. Film-drive and recording-drum assembly parts to be maintained.



## 42. Item 6, Film Drive and Recording Drum Assemblies (fig. 18)

*a.* INSPECT (I). Inspect the film brush or wiper post, film tension posts (5) and (6), film sprocket (7), sprocket idler roller (8), the sprocket brush assembly and recording drum assembly for dirt and other foreign material. Check to see that film threads through the mechanism and operates without binding or catching. Inspect recording drum flanges for burs. Examine the film drive and recording assemblies for loose mountings and damaged parts.

*b.* TIGHTEN (T). Tighten loose mounting and assembly screws.

*c.* CLEAN (C). Remove dust, dirt, rust, corrosion, and other foreign material from the film drive and recording drum assemblies. Use a clean, dry cloth moistened with dry-cleaning solvent (SD) if dirt is hard to remove. Pay particular attention to the area between the inner flange on the recording drum and the face of the bearing (9). Replace the cloth wiper (10) if it is badly soiled. When removing dirt from the slot in the recording drum directly under the recording needle, pull the dirt forward from the back of the slot so that it will not fall into the mechanism of the set.

*d.* ADJUST (A). Adjust the position of the sprocket brush by turning screw (12).

*e.* LUBRICATE (L). Lubricate sprocket brush bearings according to instructions in paragraph 51.

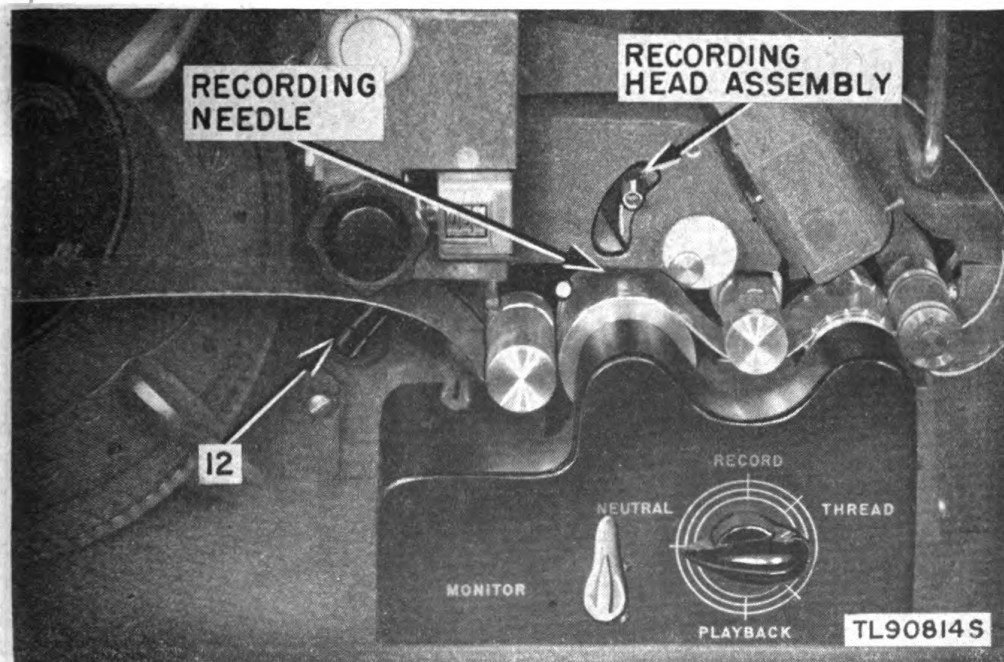


Figure 19. Recording-head-assembly parts to be maintained.

### 43. Item 7, Recording Head Assembly (fig. 19)

a. **INSPECT (I).** Examine the recording head for dirt, dust, or other foreign matter. Examine the head and the recording needle for damage. Inspect the mounting of the recording head to be sure there is no side play in the recording arm, but that free up-and-down motion of the arm is possible. Inspect the three-prong plug (12) and the socket into which it fits to see that good electrical contact is obtained (Sound Recording Set AN/UNQ-1 only).

b. **TIGHTEN (T).** Tighten loose mounting or assembly screws.

c. **CLEAN (C).** Remove dust or dirt from the recording head assembly with a clean, dry cloth. Clean the contacts of the three-prong plug and socket with carbon tetrachloride. Remove corrosion with #0000 sandpaper before cleaning.

d. **ADJUST (A).** Check and adjust the depth of track. (See par. 101.) If the recording needle does not clear the film when the selector switch is turned to any position except RECORD, adjust as directed in paragraph 101.

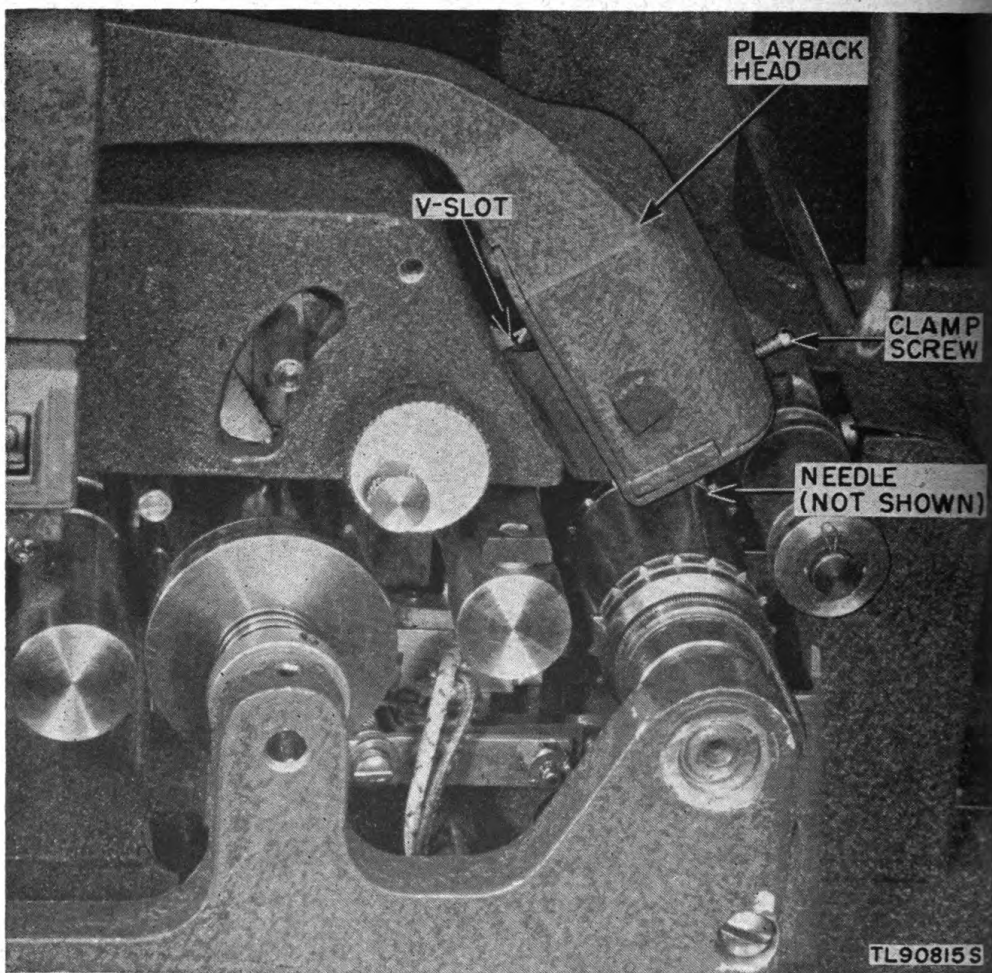


Figure 20. Playback-head parts to be maintained.

#### 44. Item 8, Playback Head Assembly (fig. 20)

a. **INSPECT (I)**. Examine the playback head and playback arm for dirt, dust, and corrosion. Check the playback needle for a damaged point and looseness in its holder.

b. **TIGHTEN (T)**. Tighten the clamp screw of the playback needle.

c. **CLEAN (C)**. Clean dust, dirt, or corrosion from the playback mechanism and V-slot with a clean, dry cloth. Moisten the cloth with dry-cleaning solvent (SD) if the dirt is hard to remove.

d. **ADJUST (A)**. Check playback head adjustments by playing back a known good recording. If adjustment is necessary, follow procedures given in paragraph 100.

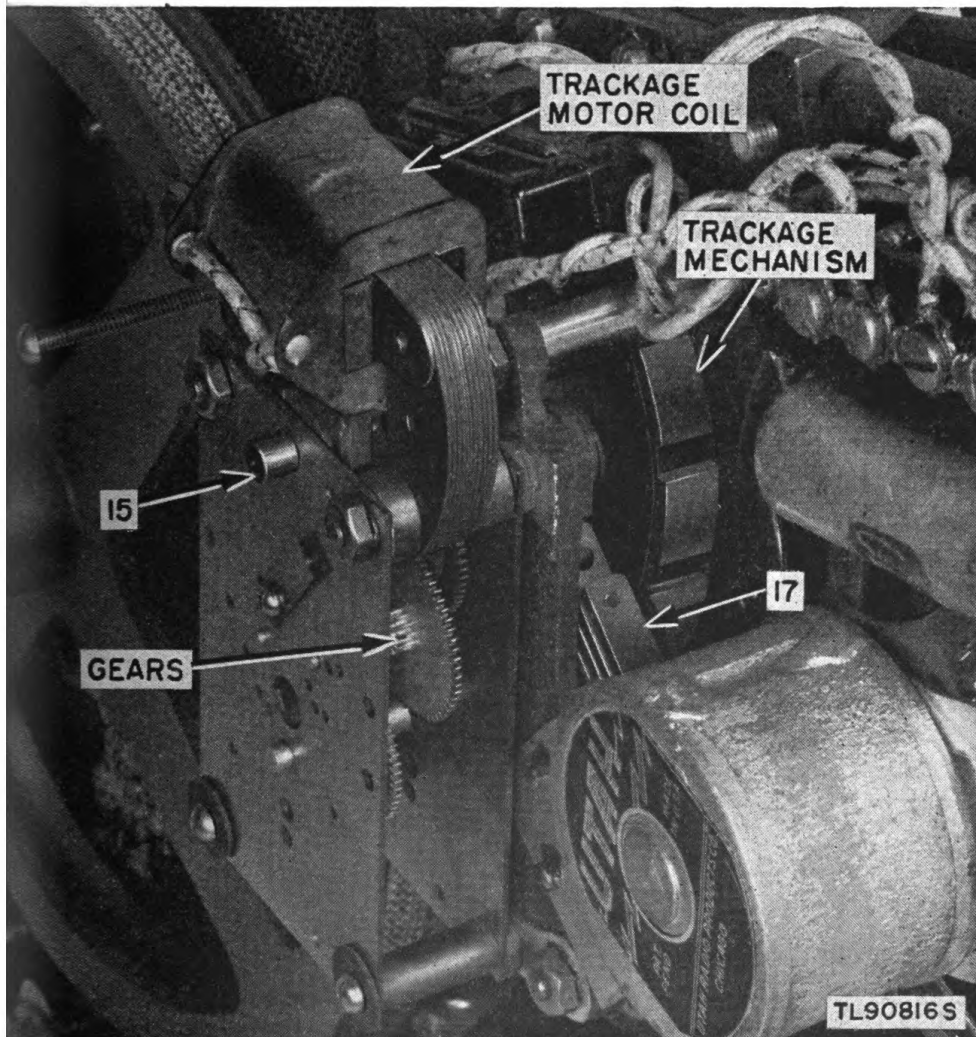


Figure 21. Carriage (trackage-motor) parts to be maintained.

#### 45. Item 9, Trackage Motor and Track Mechanism (fig. 21)

a. **FEEL (F)**. Feel the motor bearings (15) and motor housing (16) for indication of overheating (on Sound Recording Set

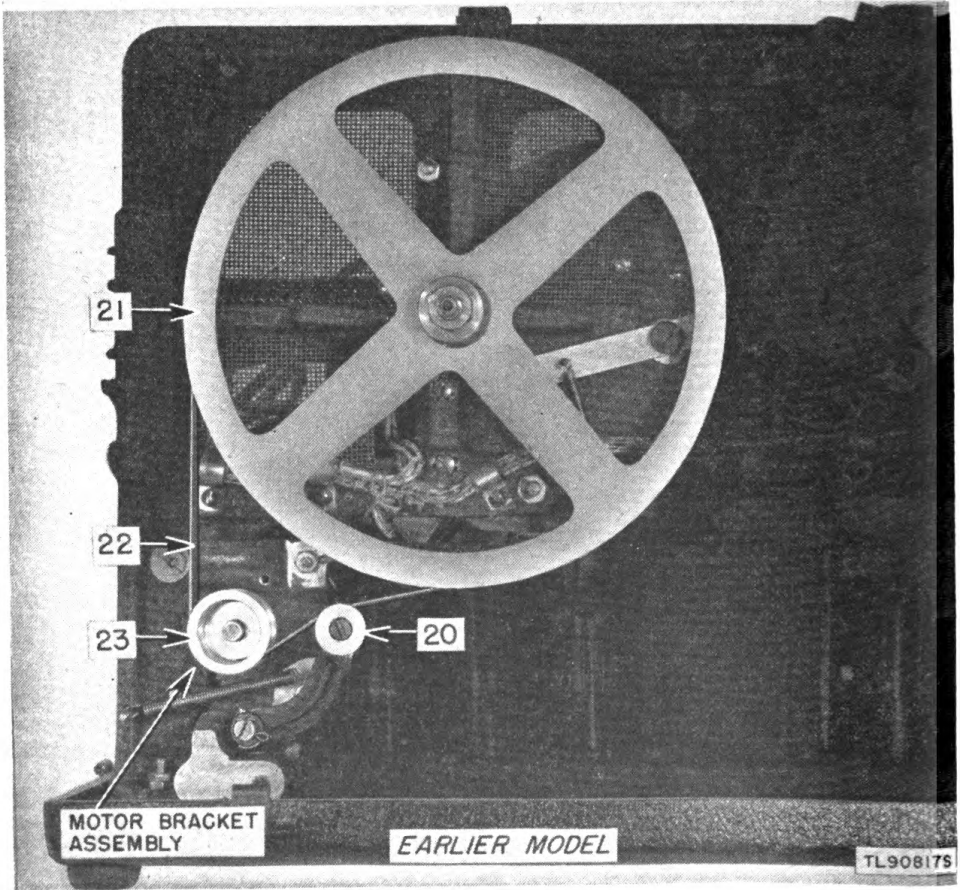
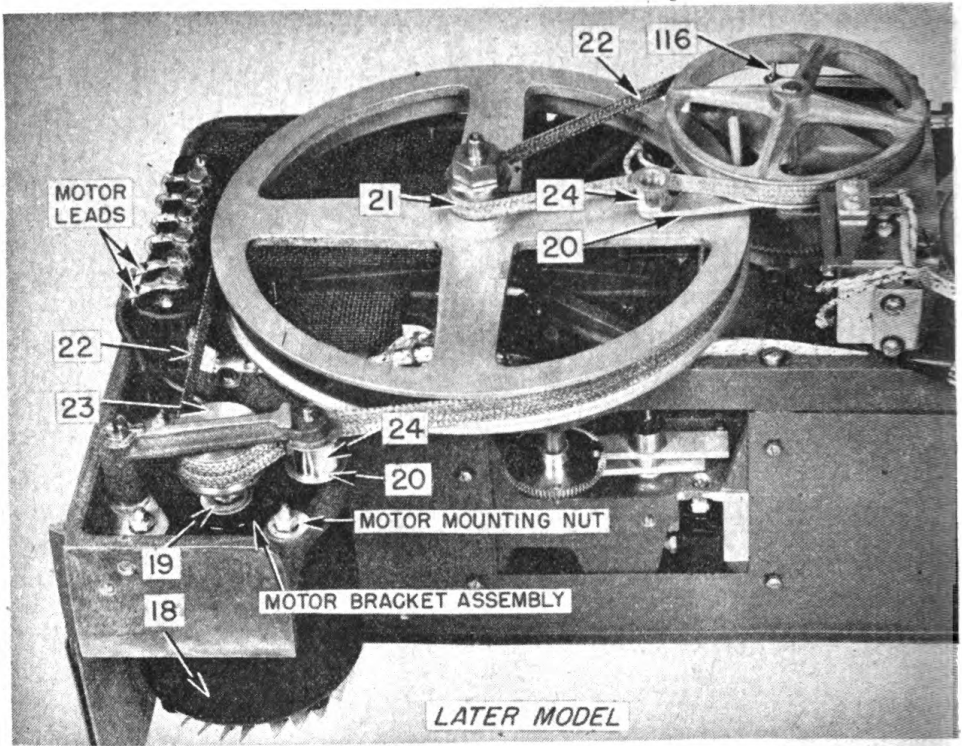


Figure 22. Drive-motor parts to be maintained.

AN/UNQ-1 only). Remove the back cover of the set in order to gain access to the motor and other parts of the mechanical assembly.

b. **INSPECT (I)**. Inspect the motor, clutch mechanism, and trackage switch (17) for dirt, grease, and corrosion.

c. **TIGHTEN (T)**. Tighten loose mounting screws.

d. **CLEAN (C)**. Remove any accumulation of dirt, dust, grease, or corrosion with a clean cloth moistened with dry-cleaning solvent (SD) and wipe dry.

*Note.* Do not disassemble the clutch assembly. This operation must be performed by higher echelon maintenance personnel. (See par. 87.)

#### **46. Item 10, Drive Motor and Drive Assembly (fig. 22)**

a. **FEEL (F)**. Feel the motor housing (18) and bearings (19) for indication of overheating. Remove the base of the set to gain access to the drive motor and to the amplifier. (See par. 86.)

b. **INSPECT (I)**. Inspect drive motor (18), belt idler pulley (20), and main flywheel pulley (21) for dirt, dust, grease, and corrosion. Check tension of drive belt (22). Check to see that there is no contact between the metal parts of the motor bracket assembly and the main frame. Check alignment of the drive belt on the motor pulley (23), idler pulleys, and main flywheel pulley. (See par. 103.)

c. **TIGHTEN (T)**. Tighten loose mountings on the motor bracket assembly and drive assembly pulleys.

d. **CLEAN (C)**. Clean dirt, dust, grease, rust, and corrosion from the motor housing and other metal parts of the drive assembly with a clean cloth moistened with dry-cleaning solvent (SD). Pay special attention to the belt grooves (24) in the pulleys. Remove all traces of dry-cleaning solvent (SD). Do not allow solvent to come into contact with drive belts.

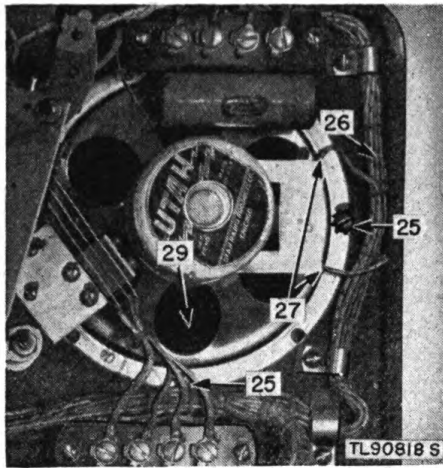


Figure 23. Speaker parts to be maintained.

#### 47. Item 11, Speaker (fig. 23)

a. **INSPECT (I)**. Inspect the speaker assembly for dirt, dust, and corrosion. Check to see that mounting screws (25) are tight. Examine wiring (26) and connections (27) for deteriorated insulation and loose connections.

b. **TIGHTEN (T)**. Tighten speaker mounting screws.

c. **CLEAN (C)**. Remove dust and dirt from the parts of the speaker which are accessible without removing or disassembling the speaker assembly. Blow any loose dirt from the recesses around the speaker cone (29).

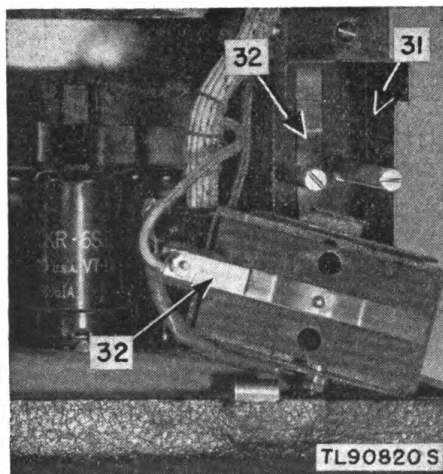


Figure 24. Microphone-battery-box parts to be maintained.

#### 48. Item 12, Microphone Battery Box (fig. 24)

a. **INSPECT (I)**. Examine the battery box (31) for dirt and corrosion, and for looseness of mounting (Sound Recording Set AN/UNQ-1 only). Check batteries on a low-range d-c voltmeter.

The cells are connected in parallel; fresh battery voltage should be 1.5 volts.

b. **TIGHTEN (T)**. Tighten the battery box mounting and assembly screws, if they are loose.

c. **CLEAN (C)**. Remove dust or dirt from the exterior of the battery box with a clean cloth moistened with dry-cleaning solvent (SD). Remove batteries from the box and clean any corrosion from battery cases and spring terminals (32) with #0000 sandpaper and dry-cleaning solvent (SD) if necessary. Wipe dry.

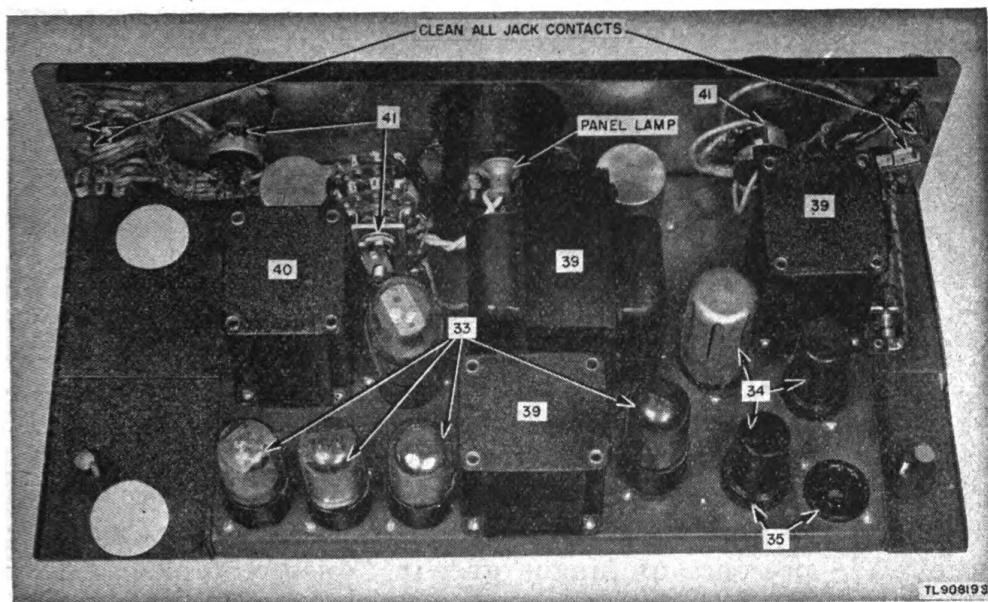


Figure 25. Amplifier-chassis parts to be maintained (top view).

#### 49. Item 13, Amplifier (figs. 25 and 26)

a. **INSPECT (I)**. (1) *Vacuum tubes*. Inspect glass tubes (33) for accumulation of dirt and looseness of the envelope on the tube base. Examine tubes with metal envelopes (34) for dirt, rust, and corrosion. Inspect sockets (35) for presence of dirt and corrosion. Check the firmness of tubes in their sockets by pressing them down into the socket, not by partially withdrawing them and moving them from side to side. If a tube tester is available, test the tubes.

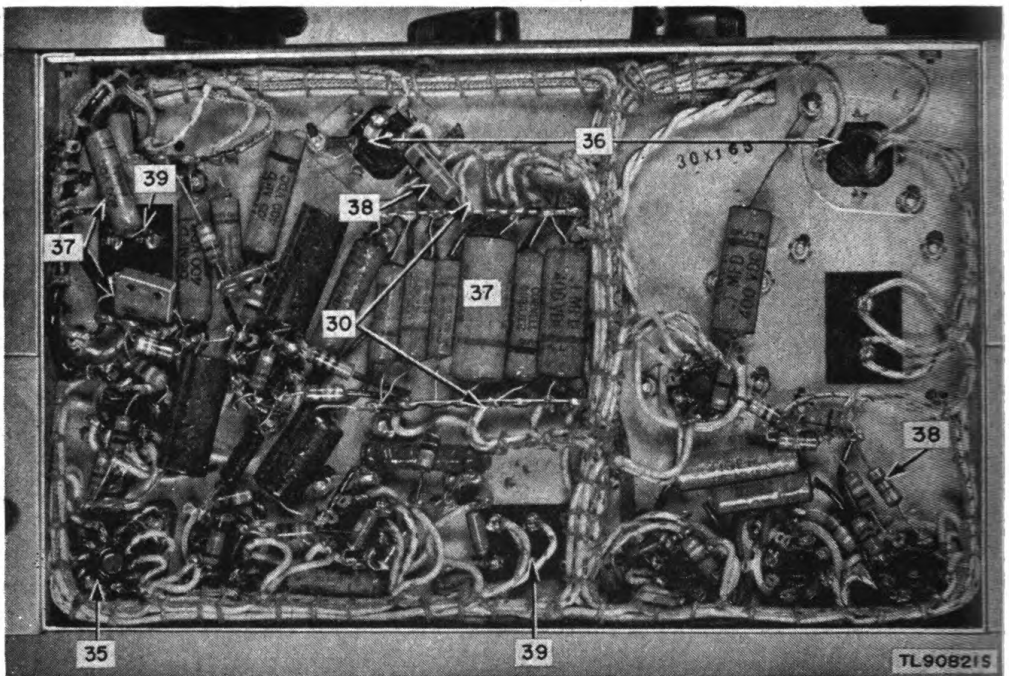


Figure 26. Amplifier-chassis parts to be maintained (bottom view).

(2) *Capacitors.* Inspect large fixed capacitors (36) for dirt, rust, corrosion, and loose connections at the terminals. Inspect cases of large fixed capacitors for leaks, bulges, and discoloration. Examine small paper and mica capacitors (37) for dirt, discoloration, and presence of fungus growth. Inspect capacitor leads for loose connections.

(3) *Resistors.* Inspect the body of each resistor (38) for dirt, discoloration, and blistering. Check condition of connections and insulated leads.

(4) *Transformers and chokes.* Inspect cases of potted transformers (39) and choke (40) for dirt and discoloration caused by leakage of the potting material. Examine condition of insulation on all leads.

(5) *Switches.* Inspect switch mountings (41) for looseness. Examine accessible parts for the presence of dirt and corrosion. Check to see that wiring connections to the switches are tight and that the insulation on the wires is not frayed or cracked.

b. **TIGHTEN (T).** (1) Resolder loose or broken solder connections on tube sockets (35), capacitors (36 and 37), resistors (38), and terminal strips (30).

(2) Tighten loose mounting or assembly screws and nuts.

c. **CLEAN (C).** (1) Remove dust, dirt, or other foreign matter from the recesses of the amplifier compartment. Blow out with compressed air, if available, or wipe out with a clean, dry cloth.



Remove rust or corrosion from metal surfaces with #0000 sandpaper and clean with dry-cleaning solvent (SD).

(2) Clean all parts that are dirty with a clean, dry cloth moistened with dry-cleaning solvent (SD) if dirt or corrosion is hard to remove. Remove all traces of solvent with a clean, dry cloth.

## 50. Preventive Maintenance Check List

The following check list is a summary of the preventive maintenance operation to be performed on Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A. The time intervals shown on the check list may be reduced at any time by the local commander. For best performance of the equipment, perform the operations at least as frequently as called for in the check list. The echelon column indicates which operations are first echelon maintenance and which operations are second echelon maintenance. Operations are indicated by the letters of the word FITCAL. For example, if the letters ITC appear in the *operations* column, the item must be inspected (I), tightened (T), and cleaned (C).

Item No.	Operations Fig.	Item	When performed						Echelon
			Before operation	After operation	Daily	Weekly	Monthly	Semi- annually	
1	IC	Carrying case	X						1st
2	ITC	Amplifier panel	X						1st
3	IC	Cords and plugs			X				1st
4	IC	Microphone and earphones	X			X			1st
5	ITC	Film magazine					X		1st
5	ITCA	Film magazine						X	2d
5	L	Film magazine							2d
6	ITCA	Film drive and recording drum assemblies				X			1st
6	ITCAL	Film drive and recording drum assemblies						X	2d
7	ITCA	Recording head assembly				X			1st
8	ITCA	Playback head assembly				X			1st
9	FITC	Trackage motor and track mechanism				X			2d
10	FITC	Drive motor and drive assembly				X			2d
11	ITC	Speaker					X		2d
12	ITC	Microphone batteries						X	1st
13	ITC	Amplifier						X	2d

Note. "X" indicates when operations are to be performed.

F Feel      I Inspect      T Tighten      C Clean      A Adjust      L Lubricate

## Section VIII. LUBRICATION

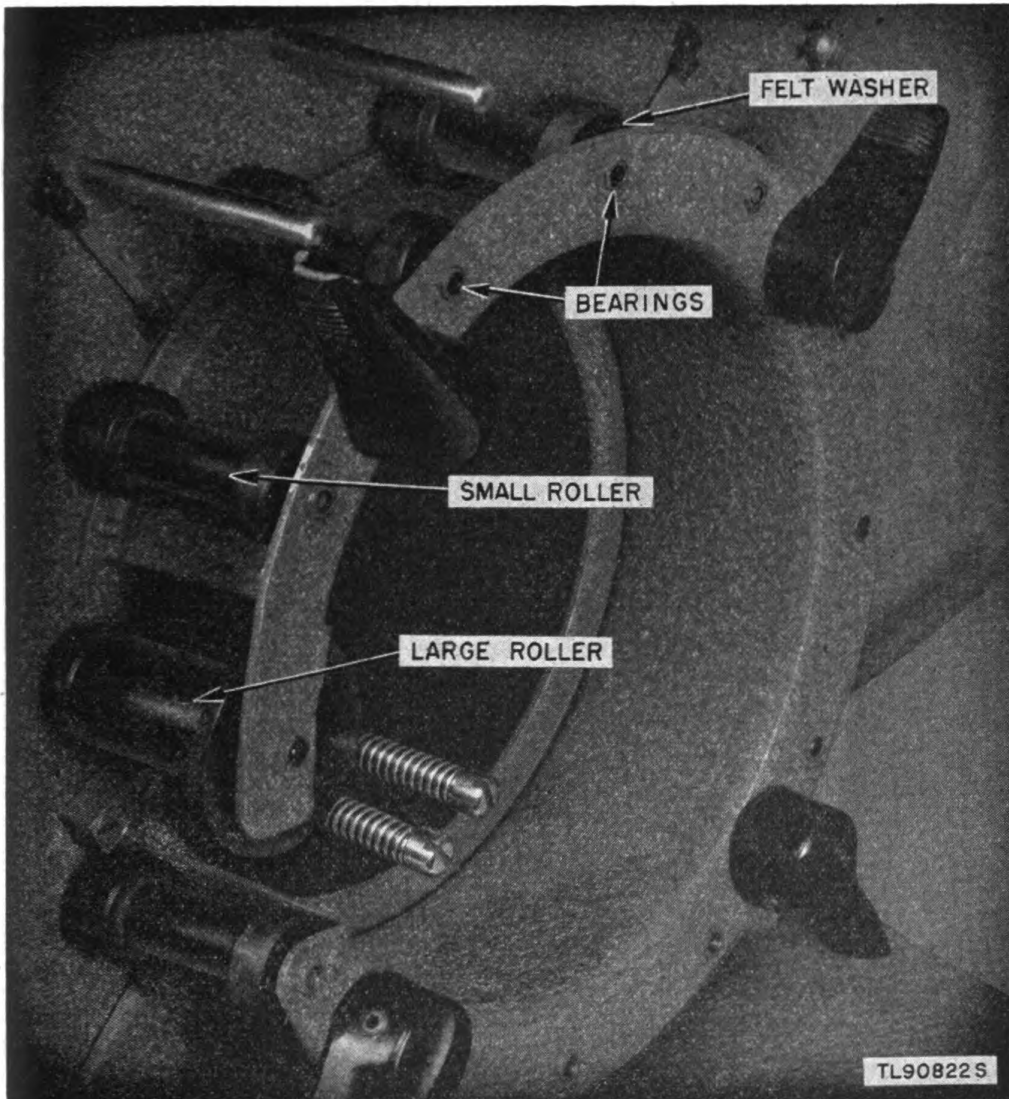


Figure 27. Lubrication points on film magazine.

### 51. Lubrication Instructions

#### a. RECOMMENDED LUBRICANTS AND CLEANER.

Approved symbols	Standard nomenclature
GL-----	Grease, Lubricating, Special.
PS-----	Oil, Lubricating, Preservative, Special.
OE-10-----	Oil, Engine SAE-10.
SD-----	Solvent, Dry Cleaning.

Note. Use OE-10 when high temperature causes PS to run off the parts.

#### b. DETAILED LUBRICATION INSTRUCTIONS FOR LOWER ECHELONS.

(1) *General.* Gasoline will not be used as a cleaning fluid for

any purpose. When unit is overhauled or repairs made, parts should be cleaned with SD. Allow parts to dry thoroughly before lubricating. Apply PS sparingly to latches, hinges, springs and loops of all helical springs to prevent wear and rust.

*Note.* Interval given is maximum for normal 8-hour day operation. For abnormal conditions or activities, interval should be shortened to compensate.

(2) *Preparation for lubricating.* Remove the front cover. (See par. 9.) Remove back cover. (See par. 86a.) Remove the recording-bracket cover (par. 88a) and clutch relay cover.

(3) *Lubricating procedures.* Every 3 months, or more often if conditions warrant, lubricate as follows:

(a) *Film magazine* (fig. 27). Apply 1 or 2 drops of PS to the felt washers on each end of the film rollers.

(b) *Carriage bracket* (fig. 11). Apply a thin film of GL to shaft of carriage-lead screw and carriage-guide sleeve.

(c) *Flywheel-pulley-shaft bearings* (fig. 34 (82 and 84)). Apply 1 or 2 drops of PS to bearing at each end of shaft.

(d) *Camshaft disk and ball bearing* (fig. 39 (88)). Apply a thin film of GL to ball and friction surface of disk.

(e) *Sprocket-brush bearings* (fig. 47). Apply 1 or 2 drops of PS to the felt washers at each end of sprocket-brush bearings. *Do not allow oil to get on brush.* Wipe off excess.

(f) *Sprocket-idler-roll shaft* (fig. 30). Apply 1 drop of PS to each end of idler roll.

(g) *Idler-roll-arm-pivot bearing* (fig. 47). Apply 1 or 2 drops of PS to pivot bearing.

(h) *Playback-locating shaft and spring pivot bearings* (fig. 30). Apply 1 drop of PS to each bearing.

(i) *Drive-motor bearings* (fig. 28). Apply 1 or 2 drops of OE-10 through holes in amplifier cover to the oil tubes mounted in the end shields at each end of the drive motor.

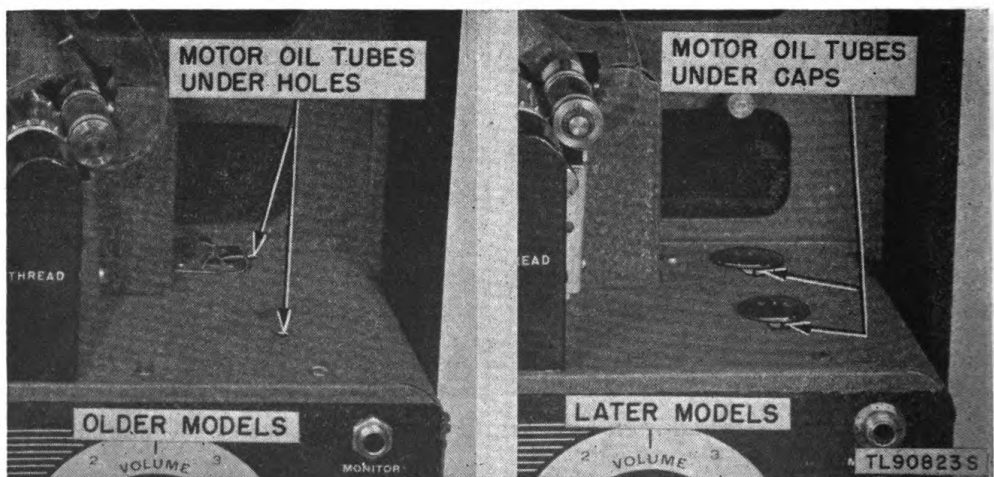


Figure 28. Lubricating points on drive motor.

(j) *Belt-tension arm and idler-pulley-stud bearings* (fig. 22 (20 and 24)). Apply 1 or 2 drops of PS to stud bearings.

(k) *Index-latch-pivot-stud bearing (on Sound Recording Set AN/UNQ-1 only)* (fig. 44). Apply 1 or 2 drops of PS to stud bearing.

(l) *Index cam (on Sound Recording Set AN/UNQ-1 only)* (fig. 58). Apply a thin film of GL to wearing surface of cam.

(m) *Trackage-motor assembly (on Sound Recording Set AN/UNQ-1 only)* (fig. 29).

1. Apply 1 drop of PS to the trackage-motor bearings.
2. Saturate the felt washers at each end of the gear-shaft bearings of the reduction gears with PS.
3. Apply a thin coat of GL to the trackage-motor pinion and reduction-gear teeth.
4. Apply a thin film of GL to the periphery of the lock and index wheel. (See fig. 58.)

(n) *Trackage mechanism (on Sound Recording Set AN/UNQ-1A only)* (fig. 41).

1. Apply 1 or 2 drops of PS to the small pulley shaft bearing.
2. Apply 1 drop of PS to the roller shaft of the index microswitch (SW 10).
3. Apply a thin film of GL to the periphery of the index wheel, teeth of gears, and ratchet disk.

c. **LUBRICATION BY HIGHER ECHELON.** When equipment is disassembled for maintenance purposes, clean and lubricate as follows:

(1) *Drive motor.* If, as in early models, the oil tubes are not accessible for lubricating, drill two  $\frac{3}{8}$ -inch holes through the amplifier cover directly above the oil tubes. *Seal the openings to the oil tubes before drilling to prevent metal filings from entering the tubes.*

(2) *Cam mechanism* (fig. 58). Disassemble amplifier. (See par. 86.) Clean parts with a clean lintless cloth dampened with SD. Allow to dry before lubricating. Apply a thin film of GL to all gear teeth, cam surfaces, and other mechanical parts which are subject to friction. Lubricate all bearing surfaces with PS. Wipe off excess.

(3) *Carriage (trackage) motor assembly (on Sound Recording Set AN/UNQ-1 only)* (fig. 29). Disassemble trackage motor. (See par. 89.) Clean all gears, bearings, and bearing surfaces with a soft brush and SD. Allow to dry before lubricating. In addition to the points indicated in (3) (m) above, lubricate as follows:

(a) *Disk and Pin Assemblies* (fig. 40). Apply a thin coating

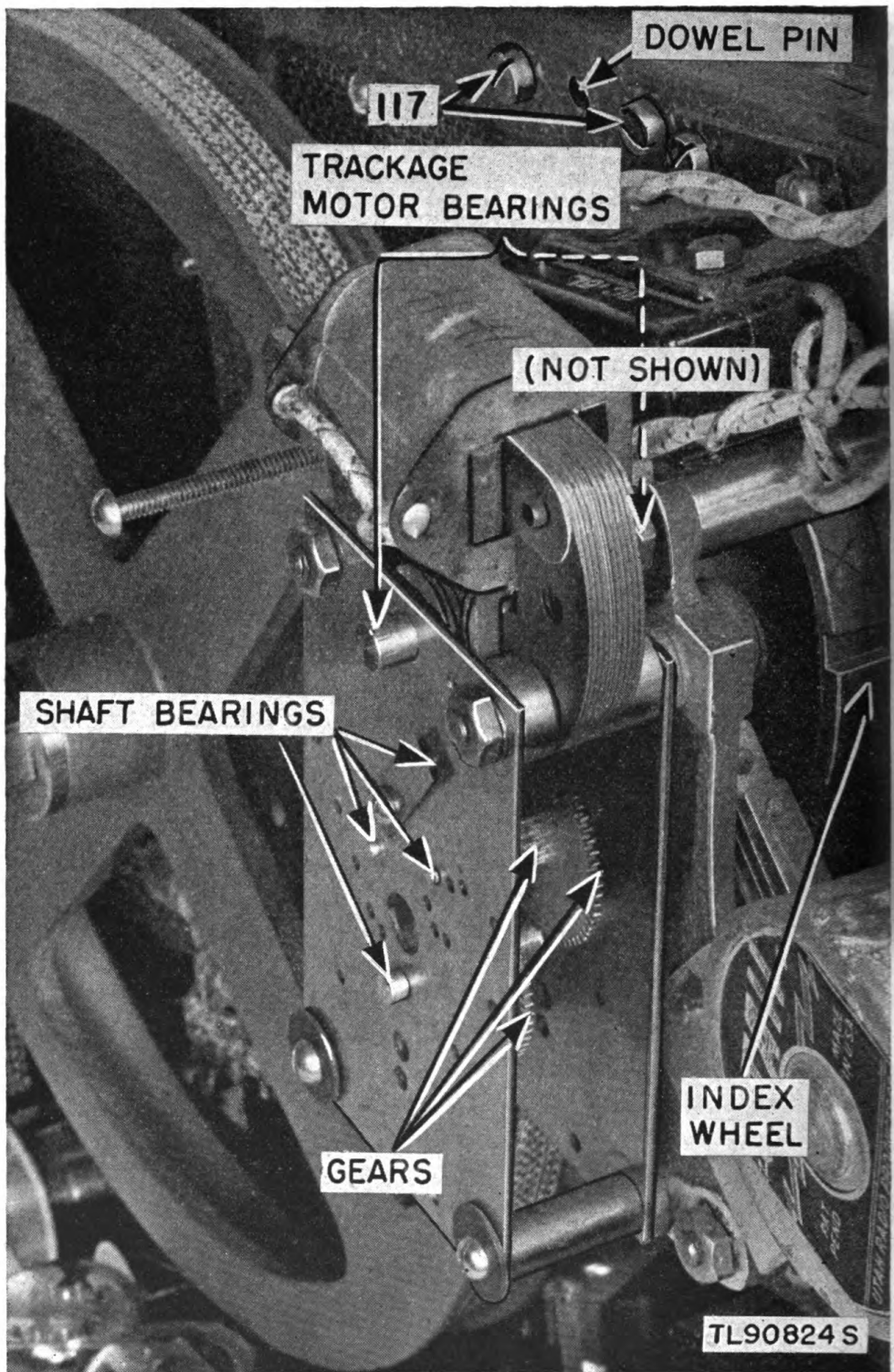


Figure 29. Lubrication points on trackage (carriage) motor.

of GL to the periphery of the trackage-motor disk (107), the carriage-pawl pin (127), the carriage-crank pin and the friction surface of the slotted arm of the carriage-crank arm (130).

(b) *Studs.* Apply 1 or 2 drops of PS to the carriage-pawl-pivot stud and the carriage-crank-arm-pivot stud.

(4) *Trackage mechanism (on Sound Recording Set AN/UNQ-1A only)* (fig. 41). Disassemble as outlined in paragraph 90. Clean all gears, bearings, and cam surfaces with a brush and SD. Allow to dry before lubricating. Lubricate as outlined in paragraph (3) (n) above. Apply 2 drops of PS to wedge-pivot bearing. (See fig. 42.)

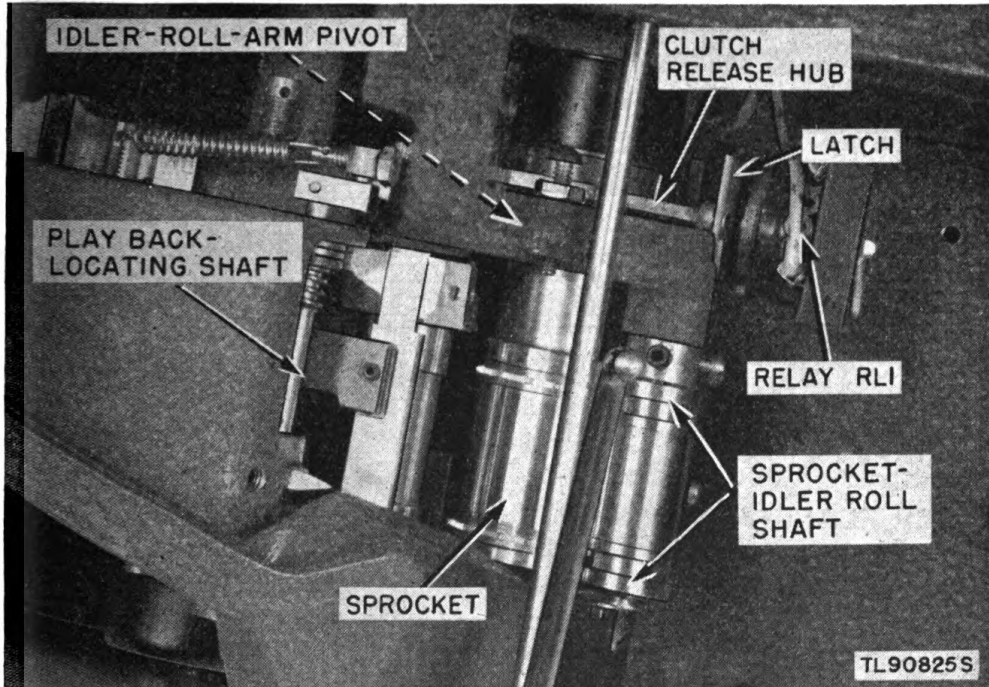
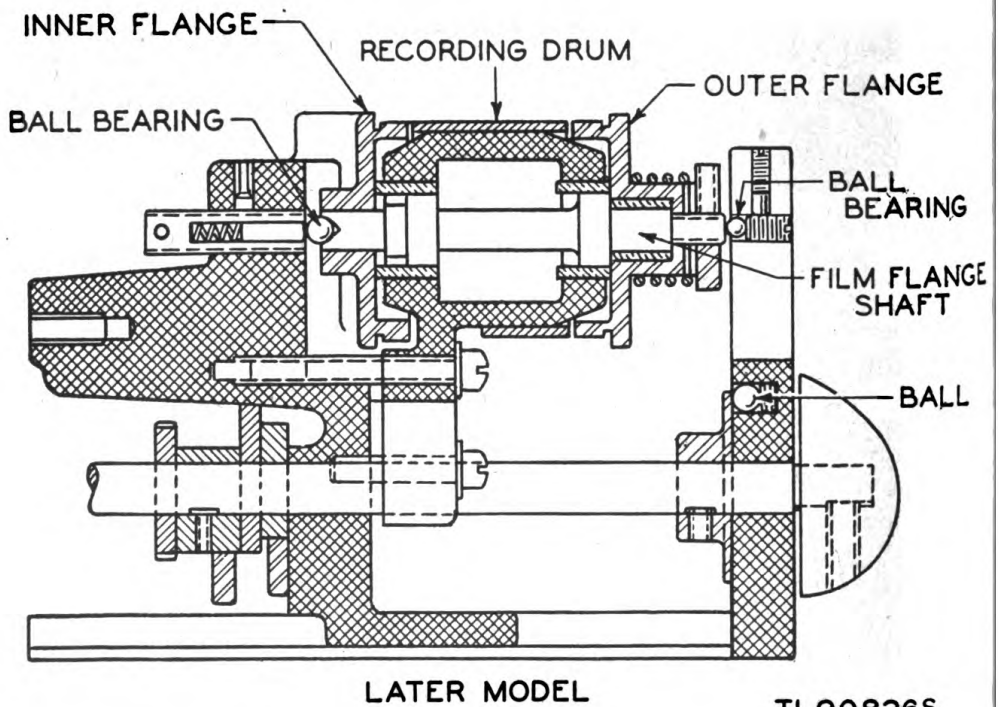
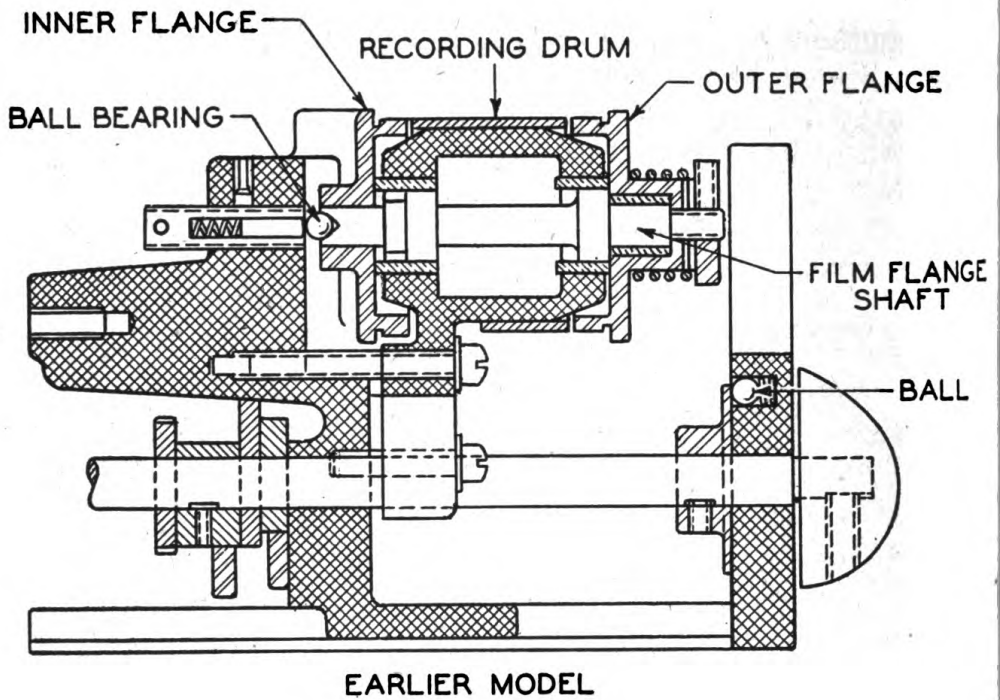


Figure 30. Lubrication points on the sprocket and clutch assembly.

(5) *Sprocket and clutch assembly* (figs. 37 and 38). Disassemble as outlined in paragraph 87. Clean the bearing surfaces of the clutch-release hub by flushing the inside of the clutch-spring assembly with SD. Work the release hub back and forth. Clean the pulley shaft and bearings with a clean lintless cloth dampened with SD. Allow the mechanism to dry thoroughly and lubricate as follows:

(a) *Clutch.* Apply 1 or 2 drops of PS in the clutch-spring recess and between the three-sided cam and the release hub. Work the oil around the bearing surface by moving the release hub back and forth.

(b) *Flywheel-pulley shaft.* Apply a thin film of PS to the friction surface of the flywheel-pulley shaft and the support bearings at each end.



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Figure 31. Lubrication points on the recording-drum assembly.

(6) *Recording-drum assembly* (fig. 31). Disassemble as outlined in paragraph 88. Using a brush, clean all bearing surfaces



with SD. Remove any burrs on the inner surface of the film flanges with crocus cloth. Allow to dry. Before reassembling, lubricate as follows:

(a) *Recording-drum bearings.* Apply 1 or 2 drops of PS to the recording-drum bearings.

(b) *Film-flange shaft.* Apply a thin coat of GL to the shaft center at the rear end (on later models, front and rear end) of the film-flange shaft which holds the ball bearing. (See fig. 31.) Besides providing lubrication, the grease will hold the ball in place while the recording drum is reassembled.

(7) *Playback arm* (fig. 33). Disassemble as outlined in paragraph 92. Apply 1 or 2 drops of PS to hinge-block bearings at the support end of playback arm (69).

(8) *Recording head* (fig. 32). Disassemble as outlined in paragraph 93. Clean and apply a thin film of GL to the recording-head-hinge-pivot pin bearing (64) when reassembling.

(9) *Film-switch roller* (fig. 18). To disassemble, remove the recording-bracket front cover as outlined in paragraph 88. The switch assembly (fig. 49) may be taken off as a complete unit by removing the two screws which hold it to the recording bracket. The connecting wires are long enough to allow the film switch to be brought out to the front. Clean the film-switch roller and shaft with SD. Allow to dry and lubricate with PS.

*Note.* Sapphire rods are used on later models. (See fig. 50.) Do not lubricate the sapphire rods.

## Section IX. MOISTUREPROOFING AND FUNGIPROOFING

### 52. General

*a.* When equipment is operated in highly humid climates, excessive failure of parts and decreased operating efficiency are usually caused by the accumulated effects of moisture, rather than by inferior parts. Rapid temperature changes accompanied by fog, rain, dew, or high humidity promote such failures.

*b.* The effects of moisture on resistors, capacitors, coils, chokes, transformer windings, terminal boards, and insulating strips can be recognized in the form of corrosion, low insulation resistance, and flash-overs. Moisture also accelerates fungus growth which increases these effects.

### 53. Reducing Failures

*a.* A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. The treatment consists of applying a film of moisture-

and fungi-resistant varnish to all susceptible parts of the equipment. This film provides a nonwetting surface. Equipments which have been treated have been marked with the letters MFP and the date of treatment. Equipments not marked should be examined, and if treatment has not been applied, the equipment should be returned to third or higher echelon maintenance units for treatment.

b. TB SIG 13 contains a detailed description of this treatment.

c. Retreatment may be required after a period of use. Need for this retreatment is indicated by excessive failures or by the effects listed in paragraph 52*b*.

#### **54. Treating Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A**

Use the procedure outlined in TB SIG 13 to moistureproof and fungiproof Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A. (See pars. 83 through 96 for disassembly information.)

#### **55. Treating Equipment After Repairs**

If the coating of protective varnish has been punctured or broken during repair and if complete treatment is not needed to reseal the equipment, brush-coat the affected part. Be sure the break is completely sealed.

**PART FOUR  
AUXILIARY EQUIPMENT**

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(Not used)

## PART FIVE

# REPAIR INSTRUCTIONS

*Note.* Failure or unsatisfactory performance of equipment used by Army Ground Forces and Technical Services will be reported on WD AGO Form 468 (Unsatisfactory Equipment Report); by Army Air Forces, on AAF Form 54 (Unsatisfactory Report). If AAF Form 54 is not available, prepare the data according to the sample form shown in figure 46.

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### Section X. THEORY OF EQUIPMENT

#### 56. Amplifier

*a.* GENERAL. Unless otherwise noted, the theory of operation of the amplifier in Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A as given in the following discussion covers both equipments. Outside of a few changes, explained in paragraph 6, the amplifiers used in both models are virtually identical.

*b.* BASIC CIRCUITS. The amplifier section consists of three basic circuits: a straight audio amplifier, an automatic-volume-control circuit, and an audiotrol circuit. In the straight audio amplifier, vacuum tubes are utilized to amplify the feeble electrical energy generated in the playback head, crystal microphone, carbon microphone, telephone lines, and radio audio circuits. The voltage which appears across the secondary of the output transformer T2 is fed to the recorder loudspeaker or to the recording head. The paths taken by these generated currents, from their source and then through the circuits of the recorder amplifier, are explained in the following paragraphs.

#### 57. Microphone Channel (Crystal and Carbon)

*a.* MICROPHONE THEORY (CRYSTAL MICROPHONE). The crystal microphone converts acoustic energy (sound) into corresponding electrical impulses. Crystals, closely clamped together, generate electrical energy when subjected to stress. Air waves striking the surface of these crystals press the elements together with greater and lesser pressure. Voltages corresponding to these pressures are generated. These voltages are very low and must be amplified if they are to be useful.

*b.* PATH TAKEN BY MICROPHONE-GENERATED SIGNAL (figs. 59 and 60). The extremely low voltage generated in the crystal microphone is fed to the control grid of the first amplifier tube JAN 6SJ7 (V1). There it is amplified and appears as a higher

voltage in the plate circuit of that tube. The microphone voltage, now of greater amplitude, is fed to the grid of V2 (Tube JAN 6SK7GT) where it is controlled by the volume control R28 (this potentiometer is controlled by the panel knob marked VOLUME). Further amplification occurs in V2. The signal, now in the plate circuit of V2, is fed to the control grid of V3 (JAN 6SJ7) through the coupling capacitor C1. The plate, screen and suppressor grid of V3 are tied together thus making V3 a triode. Again the microphone voltage is amplified and passed on to V4 (JAN 6V6GT), the next and final tube in the amplifier. This final tube is designed to handle a greater amount of power than the preceding tubes. Close examination of this last stage will disclose a resistor (R25) which is used to convey some of the audio voltage present in the plate circuit of V4 to the grid circuit of the same tube. This audio voltage is  $180^\circ$  out of phase with the audio voltage appearing on the grid and constitutes a negative feedback which reduces distortion. The original microphone voltage, very low and of no use in its original condition, is now of great magnitude. It is ready to either drive the permanent-magnet loud-speaker mounted on the recorder, or to activate the recording-head armature with its attached needle.

*c.* MICROPHONE THEORY (CARBON MICROPHONE). Carbon microphones are classified as either the single-button type or the double-button type. The principle of operation is the same in both types. A carbon microphone consists of a small mass of carbon granules firmly packed between two conductors, one (or both) of which is a diaphragm. Sound waves striking against the diaphragm cause a varying amount of pressure to be exerted on the carbon granules. Since the resistance of the carbon mass decreases with the increase in diaphragm pressure (carbon granules are pressed closer together) and in like manner the resistance of the carbon granules increases with the decrease in diaphragm pressure (carbon granules are relatively loosely bound together), battery current flowing through the microphone will be varied accordingly. The variations in the battery current which flows through the primary of a microphone transformer induce a varying voltage (possessing a similar waveform, but of greater magnitude) to appear across the secondary. This voltage is still low and useless in its present form and requires further amplification.

*d.* PATH TAKEN BY CARBON-MICROPHONE-GENERATOR SIGNAL (figs. 59 and 60). The path taken by signals which are induced in the secondary of transformer T3 is identical to that followed by signals generated in the crystal microphone. (See *b* above.) The carbon microphone is plugged into the jack marked CARBON

MIKE (Sound Recording Set AN/UNQ-1) and into the jack marked LINE-CARBON MIKE on Sound Recording Set AN/UNQ-1A.

## 58. Radio Channel

Two methods of feeding radio-receiver outputs to the input circuit of the recorder are generally used. One method is to place the recorder microphone in front of the radio loudspeaker to pick up the sound; the other is to connect the output of the radio-receiver-audio tube to the input of the recorder amplifier. Both methods are satisfactory.

a. MICROPHONE USED IN RADIO CHANNEL. The signal voltage generated in the crystal microphone follows the same path as that described in paragraph 57b.

b. DIRECT CONNECTION FROM RADIO. The audio voltage taken off the plate of a radio-receiver-audio tube (or the audio signal appearing across the receiver-volume-control potentiometer) is fed through the RADIO jack S14 into the second tube (V2, JAN 6SK7GT) of the recorder amplifier. The path taken by the signal is now identical to that already described. Distortion present in the radio-receiver-audio amplifier will be further amplified in the recorder amplifier. Such distortion will be recorded on the film.

## 59. Telephone Channel

a. GENERAL. Voice currents tapped from the telephone line are not strong enough to be recorded; they must be amplified. The recorder amplifier is used for this purpose. Telephone line currents are treated to maintain as steady a level of intensity as conditions of conversation permit. To accomplish this, the automatic-volume-control circuit is switched into the amplifier. The following discussion traces the path of the telephone-line currents through the recorder amplifier in both models of the sound recorder (because of circuit differences that exist). Following this circuit tracing are discussions of the theory of the audiotrol, and the theory of the automatic volume control. (See pars. 60 and 61.)

b. PATH TAKEN BY TELEPHONE VOICE CURRENTS (figs. 59 and 60). (1) *Sound Recording Set AN/UNQ-1*. Telephone voice currents, fed through the jack marked LINE TAP, appear across the primary of transformer T3 and are induced into and appear across the secondary where they are stepped up substantially. Capacitor C16 in the primary circuit of transformer T3 blocks d-c line voltage from the winding. The stepped up signal is fed

through the LINE TAP jack contacts to the control grid of tube V2. From this point the signal follows the same path described in paragraph 57.

(2) *Sound Recording Set AN/UNQ-1A*. Telephone voice currents, fed through the jack marked LINE-CARBON MIKE, appear across the primary of transformer T3 and are induced into and appear across the secondary where they are stepped up substantially. Capacitor C16 in the primary circuit of transformer T3 blocks d-c voltage from the winding. The stepped up signal is fed through the LINE-CARBON MIKE jack contacts and appears at the control grid of tube V1 (JAN 6SJ7). From this point the signal follows the same path as that described in paragraph 57.

## 60. Audiotrol Operation

*a. THEORY* (fig. 60). Amplifier-output voltage appearing across output transformer T2 is fed into the control grid of the first section of V5 (JAN 6SL7GT) which is a triode. The amplified output of V5 is fed into the second section of V6 (JAN 6H6GT) which rectifies this signal and applies it as a negative bias to the control grid of the second section of V5. Normal plate current through V5 is sufficient to cause a drop of 15 volts across its cathode-biasing resistor (R12). Since the cathode of V5 is connected to the cathode of V7 (JAN 2050), voltage appearing across R12 will also appear as bias voltage in V7 which is then blocked and does not pass current. However, when a negative voltage is impressed on the control grid of V5, thus decreasing the plate current passing through this tube, the voltage developed across bias resistor R12 is reduced accordingly. Bias voltage for V7 is now lower (about 3 or 4 volts) and V7 will conduct and pass enough current to operate the relay (RL1). The sprocket, now engaged to the flywheel through the clutch, rotates and draws the film through the recorder for the recording operation.

*b. DELAYING OPERATION*. The setting of the AUDIOTROL knob determines the duration of the period between the time a signal actuates the audiotrol circuit into operation (sprocket starts turning) and the time the operation ceases (sprocket stops turning). The AUDIOTROL knob setting determines the signal voltage at the control grid of section 1 of tube V6 (the audiotrol knob is connected to the arm of potentiometer R6). The signal voltage, greatly amplified, is impressed on the control grid of section 2 of tube V5 and across the capacitor C11 connected to that control grid. At the stoppage of the incoming signal, the charge on C11 starts to leak off through R35 and R12 to ground, thus

decreasing the negative bias on tube V5. The positive bias (with respect to the grid V5) slowly increases until the voltage drops below the de-ionizing point in V7 at which time the tube ceases to pass current. Relay RL1 now opens to stop the recording operation. The amount of delay is dependent upon the amount of signal, since the greater the voltage charge on this capacitor C11, the longer it will take to discharge to a given value. It will take approximately 5 seconds to discharge a strong signal on capacitor C11.

c. CURRENT FOR AUDIOTROL OPERATION. A special 110-volt winding on transformer T1 (the power transformer for the amplifier) supplies the operating current for the relay clutch RL1. When operating the recorder with the audiotrol, the current from this special winding is shunted around the MOTOR switch SW2 through tube V7 which, when ionized, is used to conduct this current. (V7 is ionized when its bias voltage falls below about 6 volts.)

## 61. Operation of Automatic Volume Control Circuit

a. REASON FOR USE OF A. V. C. Automatic volume control is used to boost weak amplifier input signals to higher levels and to decrease the intensity of extremely strong input signals to lower levels. This is done to better equalize output signal levels. As it is desired in telephone voice recording, the lower-than-recording-level speech is amplified to a level sufficiently high to record. At the same time, the strong signals, which would be distorted because of an extreme clockwise setting of the VOLUME control, are lowered in strength for relative distortion-free recording on film. Automatic volume control is also desirable for recording strong signals which are fed into the microphone in an area with a strong noise background. In this application, the background noise is likely to be absent from the record since the amplifier is made insensitive to that noise level.

b. THEORY OF A. V. C. (figs. 59 and 60). When the A. V. C. switch SW4 is closed, output energy from the last stage of the recorder amplifier is shunted over to the first section of V6 through R16 and C5. This energy, applied to the cathode of V6, controls the amount of current flowing through the diode. This current flows through the two resistors R22 and R33 which are in the cathode and plate circuits, respectively. The voltage drop across R33 constitutes the negative bias voltage which is applied to the control grid of V2. When the output voltage (audio) of the recorder amplifier is higher, the diode V6 conducts more current. A corresponding rise in voltage appears across R33, the plate end of the resistor being negative with respect to the



grounded end. This negative voltage is applied to the control grid of V2, thus reducing its amplification. The output voltage of the recorder amplifier is then lowered. When the output audio voltage of the recorder amplifier is lower, the diode V6 is made less conductive; less current flows through the tube causing a lower voltage to develop across R33. Tube V2, now supplied with a lower bias voltage, amplifies the incoming signal more and raises the amplifier output to a higher level. The action, being automatic and practically instantaneous, results in a nearly level recorder amplifier output.

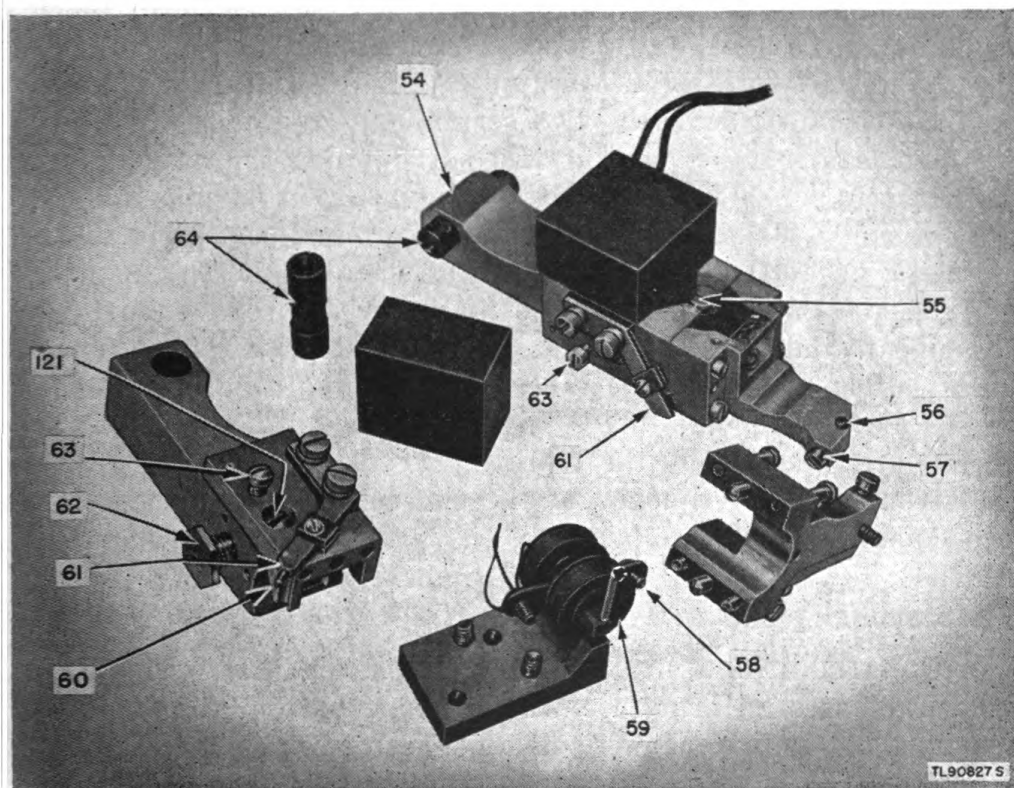


Figure 32. Recording head, disassembled.

## 62. Recording Head

a. CONSTRUCTION AND CHARACTERISTICS (fig. 32). The recording head is of a balanced-armature magnetic type. The armature (the part which holds the recording needle) is rigidly fastened at its center to a flat phosphor piece which is fastened to the casting. The armature (58) operates between the poles of a permanent magnet (55) surrounded by two coils (59) which are connected in series. The d-c resistance of the coils is  $1\frac{1}{2}$  ohms. The impedance is 6 ohms at 1,000 cycles. The frequency range is from 150 to 3,500 cycles per second. The driving power

required for maximum amplitude for recording is from  $\frac{1}{2}$  to 1 watt.

*Note.* The construction and parts used in the recording head on Sound Recording Set AN/UNQ-1A differ slightly from that used in the recording head on Sound Recording Set AN/UNQ-1. The principle of operation is the same. Figure 32 shows the parts of the recording head used on Sound Recording Set AN/UNQ-1A.

**b. OPERATION OF RECORDING HEAD.** With no output voltage across the secondary of the output transformer T2 (in this case, it is the winding attached to the terminals Nos. 3 and 4), no voltage appears across the coils of the recording head. The armature is, under this condition, balanced between the pole pieces (equidistant from each pole piece). With a signal voltage across the secondary winding of the output transformer T2, current begins to flow through the two series-connected coils of the recording head. The magnetic field surrounding the coils is now disturbed in accordance with the varying current flowing through the two coils. It is, in effect, a building up and collapsing of the magnetic field. The armature, positioned in this changing magnetic field, assumes varying positions in accordance with its response to the magnetic push and pull, and the attached needle vibrates from side to side. When the recording head needle rides on the film, a groove is made (or embossed). The sides of this groove are indented by the vibrating needle in accordance with the strength and frequency of the current flowing through the two coils.

## 63. Playback Head

**a. CONSTRUCTION AND CHARACTERISTICS** (fig. 33). The playback head uses an armature which, supported on rubber sleeve bearings, moves in a magnetic field between two pole pieces. The armature (65) is held centered between the pole pieces (66) by a rubber dampening block (67). The magnetic field is supplied by a permanent magnet (68). The playback head is mounted in an aluminum arm (69) which is pivoted on the carriage. The playback head is of the high-impedance magnetic type. Its frequency range is from 150 to 3,500 cycles. The d-c resistance of the coil is 2,000 ohms. The impedance at 1,000 cycles is 10,000 ohms.

**b. OPERATION OF PLAYBACK HEAD** (fig. 33). The manner in which the playback head operates is electrically opposite to the operation of the recording head. In the recording head, the changes in magnetic flux cause the armature to vibrate. In the playback head (also called the pick-up head) the armature vibrates and causes a varying magnetic field which in turn causes a

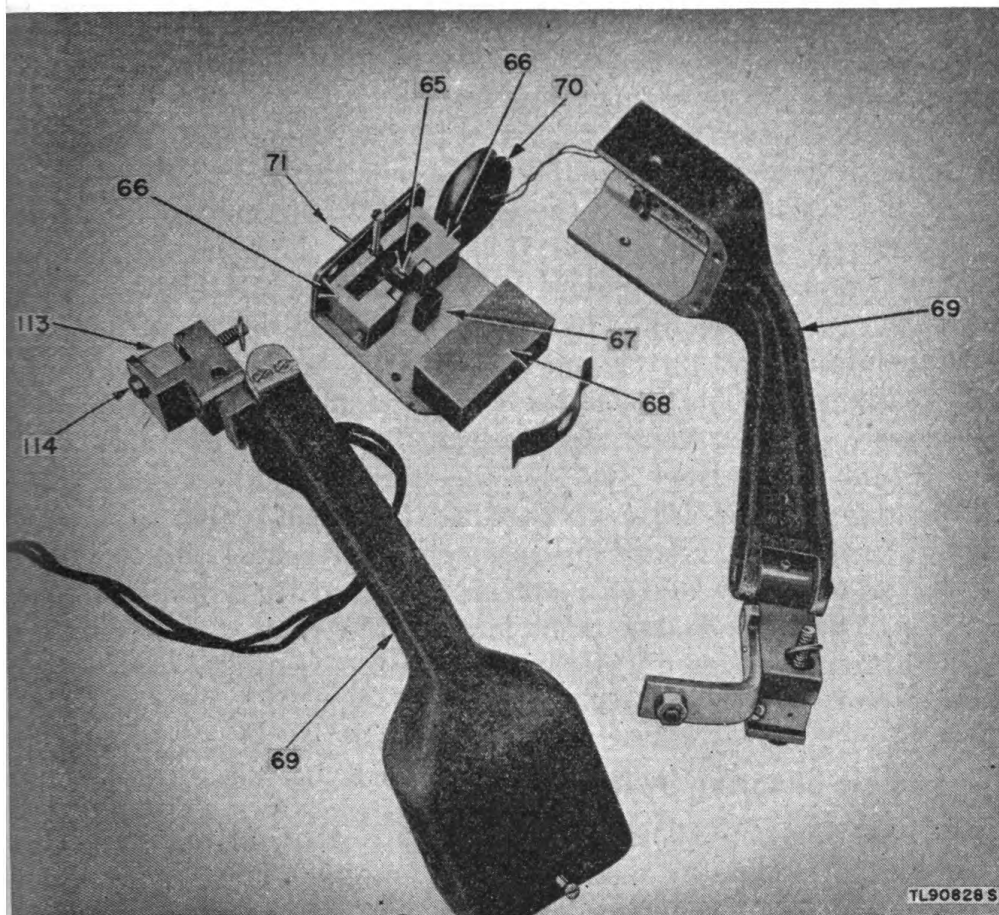


Figure 33. Playback head, disassembled.

varying voltage to be built up across the terminals of the pick-up coil (70). This voltage variation is identical in wave form to that which previously appeared across the recording head coil. The playback needle (71) follows the groove made by the recording head needle. As the film moves under the playback needle, the variations of the groove caused the playback needle to move from side to side. The armature attached to the needle vibrates in accordance with the needle movement. The magnetic field surrounding the coil expands and collapses. Varying voltages are correspondingly built up in the playback coil (70) and are fed to the input of the recorder amplifier where they are amplified for delivery to the speaker or headphones.

## Section XI. TROUBLE SHOOTING

### 64. Introduction

No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman

must locate and correct them as rapidly as possible. This section contains information designed to aid those engaged in the important duty of trouble shooting.

*a. TROUBLE-SHOOTING DATA.* The following material will help the repairman locate the trouble more quickly.

(1) Illustrations showing the location of parts and their reference symbols. (See figs. 54 to 57 incl.)

(2) Wiring diagrams Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A. (See figs. 59 and 60.) Voltage and resistance and capacitance data are given thereon.

(3) The symptoms, probable causes, and remedies given in the trouble-shooting chart. (See par. 82.)

*b. TROUBLE-SHOOTING STEPS.* The first step in servicing the sound recording set is to sectionalize the trouble (if possible) through inspection. *Sectionalization* means tracing the fault to the major assembly of the recorder that is responsible for the trouble. The second step is to localize the fault. *Localization* means tracing the fault to the defective part in the assembly suspected of being responsible for the trouble.

## 65. Trouble Shooting by Inspection

Before starting an elaborate test procedure, attempt to locate the cause of the trouble by inspecting the amplifier and the electro-mechanical assembly. Turn off the power at the knob marked VOLUME. Check immediately so that odors, abnormal signs (which may disappear upon cooling off), and other temporary indications may be readily detected. Look for the following:

*a. OVERHEATED PARTS.* Excessive heat may cause wax to melt and drip from the paper capacitors. Check for a nearby resistor or any part showing signs of excessive heating. Metal parts will usually discolor; resistors will also change in color if subjected to the passage of excessive current over a long period of time. Look for burned insulation on the hook-up wires. The acrid odor of burning insulation or enamel used to insulate the relay coil and motor windings may lead the trouble shooter to the defective part. Smoke arising from any part may indicate the presence of a short circuit, usually between high-voltage wires and ground (B-) in the power supply of the amplifier.

*b. MECHANICAL FAULTS.* Mechanical faults usually reveal themselves through noise other than the usual noises heard during normal operation. If the offending part is not immediately indicated, stop the set and start again. Listen carefully to the sounds coming from each moving part. Consult the normal indication column in the equipment performance check list (par. 32) for the normal indications of recording operations.

(1) The noise resulting from loosened parts-mountings may sometimes be tracked down by feeling the suspected parts. Pressing down on a suspected part may stop the vibration and eliminate the sounds. This type of trouble is not likely to occur if the tightening operations are applied as scheduled in the preventive maintenance check list. (See par. 50.)

(2) Connectors, cables, knobs, switches, terminals, cams (fig. 58) and other parts which are subjected to mechanical wear and tear, usually reveal their condition upon examination. If any of the above parts are suspected, examine them for loose screws, mountings, corrosion, etc. A loose connection between the crystal microphone and the recording set results in erratic operation of the entire recording set.

*c.* OTHER VISIBLE SYMPTOMS OF TROUBLE. Tears in the film, especially near the edge, will cause erratic operation and a possible dislodging of the film from the sprocket. A careful cementing of the injured section may be made if the sound track is not involved. Cement, suitable for use with cellulose acetate film, is recommended. Repeated elongation of the film loop at the sprocket end of the recorder may be an indication of friction or excessive interference with the passage of the film through the recorder. If the position of the magazine latches is not correct, the film may run off the magazine. The correct position of a latch is one in which the latch is in line with an imaginary radius from the center of the magazine.

*d.* SUMMARY. An experienced trouble shooter will always inspect the equipment for visible signs of trouble. The majority of troubles in film recorders is usually the result of either defective tubes, frayed or broken belt, or poor connections into the input circuits of the amplifier. Stuck relays, loose clamps or set-screws, corrosion at critical points, poorly soldered joints, and many other similar visible defects can usually be detected during inspection. The use of test equipment may not be necessary when making such an inspection. Familiarity with the normal signs, conditions, sounds, smells, etc., help the trouble shooter. Study the schematic diagrams (figs. 59 and 60), know the location of the parts by using the illustration (figs. 54 and 57, incl.) and the reference symbols thereon. Learn to trouble shoot by inspection and use the test equipment to confirm the findings if necessary.

## 66. Voltage Measurements

*a.* GENERAL. Voltage measurements aid the repairman because many troubles either result from abnormal voltages or produce abnormal voltages. Voltage measurements are made between two points in a circuit. The circuit need not be interrupted.

(1) Operating voltages are given in figures 59 and 60. Unless otherwise specified, these voltages are measured between the indicated points and ground.

(2) Set the voltmeter on the highest range so that voltmeter will not be overloaded. Then, if it is necessary to obtain increased pointer deflection, set the voltmeter to a lower range.

b. PRECAUTIONS AGAINST HIGH VOLTAGE. Certain precautions must be taken when measuring voltages above a few hundred volts. High voltages are dangerous and under certain conditions can be fatal. When it is necessary to measure high voltages, observe the following rules:

(1) Connect the voltmeter B- lead to B- (or ground) and make the connection secure.

(2) Connect the voltmeter B+ test lead to the hot terminal. Do not touch the metal prod of the voltmeter lead.

c. VOLTMETER LOADING. It is essential that the voltmeter resistance be at least 10 times greater than the resistance of the circuit under measurement. If the voltmeter resistance is comparable to the circuit resistance, the voltmeter will indicate a lower voltage than the actual circuit voltage present with the voltmeter load removed from the circuit.

(1) The resistance of the voltmeter on any range can always be calculated by the following rule: resistance of voltmeter equals the voltmeter ohms per volt multiplied by the full-scale range of the voltmeter in volts. Two examples are shown below:

(a) What is the resistance of a 1,000-ohm-per-volt voltmeter on the 300-volt range?

$$R = 1,000 \text{ ohms per volt} \times 300 \text{ volts} = 300,000 \text{ ohms.}$$

(b) What is the resistance of a 20,000-ohm-per-volt voltmeter on the 300-volt range?

$$R = 20,000 \text{ ohms per volt} \times 300 \text{ volts} = 6 \text{ megohms (6,000,000 ohms)}$$

(2) To minimize voltmeter loading in high-resistance circuits, use the highest voltmeter range. Although only a small deflection will be obtained (possibly only 5 divisions on a 100-division scale), the accuracy of the voltage measurement will be increased. The decreased loading of the voltmeter will more than compensate for the inaccuracy which results from reading only a small deflection on the scale of the voltmeter.

(3) When a voltmeter is loading a circuit, the effect can always be noted by comparing the voltage reading on two successive ranges. If the voltage readings on the two ranges do not agree, voltmeter loading is excessive. The reading (not the deflection) on the highest range will be greater than on the lowest range.

(4) The voltage and resistance data used in this manual are

based upon readings taken with instruments whose sensitivities are given on the schematic diagrams. (See figs. 59 and 60.) The trouble shooter should use a meter having the same sensitivity. If the load of the meter to be used is the same as that of the meter used in previously measuring the voltage, it is not necessary to consider the effect of loading.

## 67. Resistance Measurements

*a.* NORMAL RESISTANCE VALUES. When a fault develops in a circuit, its effect will very often be apparent as a change in the resistance values. To assist in the localization of such faults, trouble-shooting data, including normal resistance values have been provided. The normal resistance values at any point can be determined by referring to the resistance values shown in the schematic diagrams. Values of resistors may be determined with the resistor color code. (See fig. 34 ①.)

*b.* PRECAUTIONS. (1) Before making any resistance measurements, turn off the power. An ohmmeter is essentially a low-range voltmeter and battery. If the ohmmeter is connected to a circuit which already has voltages in it, the needle will be thrown off scale and the voltmeter movement may be damaged.

(2) Capacitors must always be discharged before resistance measurements are made. This is very important when checking power supplies that are disconnected from their load. The discharge of a capacitor through the meter may damage the meter movement.

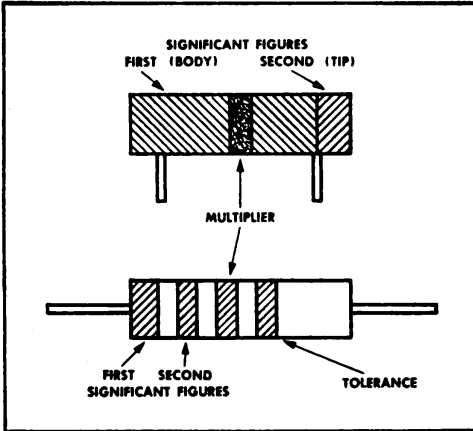
*c.* CORRECT USE OF LOW AND HIGH RANGES. Make certain when to use the low-resistance range and when to use the high-resistance range of an ohmmeter. When checking the circuit continuity, the ohmmeter should be set on the lowest range. If a medium or high range is used, the pointer may indicate zero ohms, even if the resistance is as high as 500 ohms. When checking high resistances or measuring the leakage resistance of capacitors or cables, the highest range should be used. If a low range is used, the pointer will indicate *infinite* ohms, even though the actual resistance is less than a megohm.

*d.* PARALLEL RESISTANCE CONNECTIONS. (1) In a parallel circuit the total resistance is less than the smallest resistance in the circuit. Remember this when trouble shooting with the aid of a schematic diagram.

(2) When a resistance is measured and the value is found to be less than expected, study the schematic diagram carefully to be certain that there are no resistances in parallel with the one that has been measured. Before replacing a resistor because its resistance measures too low, disconnect one terminal from the

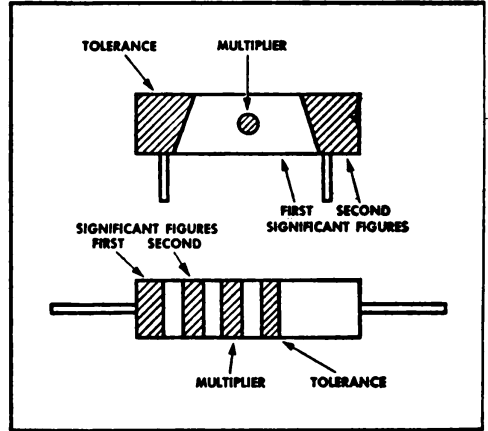
# RESISTOR COLOR CODES

**RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS**



Insulated fixed composition resistors with axial leads are designated by a natural tan background color. Non-insulated fixed composition resistors with axial leads are designated by a black background color.

**JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS**



Resistors with axial leads are insulated. Resistors with radial leads are uninsulated.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1,000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000*	
GRAY	8	100,000,000*	
WHITE	9	1,000,000,000*	
GOLD		0.1*	5
SILVER		0.01*	10
NO COLOR			20

\*JAN ONLY

Example: A 50,000-ohm resistor with a standard tolerance of 20 percent (no color) would be indicated by a green ring (5), a black ring (0), and an orange ring (000)

RMA: Radio Manufacturers Association  
JAN: Joint Army-Navy

TL 12418A

① Resistor color-code chart.

Figure 34.



# JOINT ARMY-NAVY TYPE DESIGNATION CODES FOR ELECTRICAL COMPONENTS

**INTRODUCTION:** Fixed and variable resistors and fixed capacitors manufactured under JAN specifications may be labeled with a *type designation code* instead of a color code or actual electrical value. For resistors and capacitors marked with the JAN type designation code, electrical values and other data can be determined by consulting the following information.

## RESISTORS

FIXED, COMPOSITION

RC 10 AE 153 M  
 COMPONENT STYLE CHARACTERISTIC RESISTANCE TOLERANCE

**COMPONENT:** RC signifies *fixed, composition resistor*.

**STYLE:** A two-digit symbol indicates power rating and physical size.

Resistor style	Wattage
RC10, RC15, RC16	¼ WATT
RC20, RC21, RC25	½ WATT
RC30, RC31, RC35, RC38	1 WATT
RC40, RC41, RC45	2 WATTS
RC65	4 WATTS
RC75, RC76	5 WATTS

**RESISTANCE:** A three-digit symbol indicates the resistance value in ohms. The first two digits give the first two figures of the resistance value; the third digit gives the number of zeros which follow the first two figures.

## RESISTORS

VARIABLE, WIRE-WOUND

RA 15 A 1 RH 103 A K  
 COMPONENT SWITCH TORQUE SHAFT TAPER TOLERANCE

**COMPONENT:** RA signifies *variable, wire-wound resistor*.

**STYLE:** A two-digit symbol indicates power rating and physical size and shape.

**SWITCH:** Symbol A indicates no switch. Symbol B indicates a switch turned ON at start of clockwise rotation.

**RESISTANCE:** A three-digit symbol indicates the resistance value in ohms. The first two digits give the first two figures of the resistance value; the final digit gives the number of zeros which follow the first two figures. The letter *R* may be substituted to represent a decimal point; but when *R* is used, the last digit of the group becomes significant.

## RHEOSTATS

WIRE-WOUND, POWER-TYPE

RP 35 2 FD 252 KK  
 COMPONENT STYLE OFF POSITION RESISTANCE TOLERANCE

**COMPONENT:** RP signifies all *rheostats*.

**STYLE:** Same as for variable, wire-wound resistors.

**OFF POSITION:**

Numeral	OFF position
1	None.
2	At end of counterclockwise rotation.
3	At end of clockwise rotation.

**RESISTANCE:** Same as for variable, wire-wound resistors.

\*Items starred are of interest primarily to depot and higher echelon repair personnel.

TL 18141

② JAN Type designations codes for electrical equipment.

Figure 34—Continued.

circuit and measure its resistance again, to make sure that the low reading does not occur because some part of the circuit is in parallel with the resistor.

*e.* TOLERANCE VALUES FOR RESISTANCE MEASUREMENTS. Tolerance means the normal difference that is expected between the rated value of the resistor and its actual value.

(1) Most resistors used in the circuits have a tolerance of at least 10 percent. For example, the grid resistor of a stage might have a rated value of 1 megohm. If the resistor were measured and found to have a value between 0.8 megohm and 1.2 megohms, it would be considered normal. Usually, the ordinary resistors used in circuits are not replaced unless their values are off more than 10 percent.

(2) The tolerance values for transformer windings are generally between 1 and 5 percent. As a rule, suspect a transformer which shows a resistance deviating more than 5 percent from its rated value. Allow the transformer to cool off before the resistance test is made.

## 68. Capacitor Checks

*a.* CAPACITOR DEFECTS. It is often necessary and desirable to check capacitors for leakage and open or shorted circuits. Although open circuits sometimes occur in paper type capacitors, because of the metal tab (terminal) pulling away from the tinfoil plates, this trouble is unusual. The usual trouble in capacitors is a short circuit or leakage caused by the break-down of the dielectric between the plates. This applies to capacitors of the tin-foil-paper, mica, and the dry-electrolytic type used in Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A.

*b.* OPEN CAPACITOR. A capacitor which is suspected of being open can best be checked by shunting a good capacitor across it. In audio-frequency circuits (such as exist in the recording set), the test capacitor leads may be several inches long without materially affecting the operation of the circuit of which the capacitor is a part.

*c.* KICK INDICATION. Any good high-resistance voltohmmeter may be used to check for leakage in a paper or mica capacitor. Tests for an open and short circuit may be made with the same instrument. (Test Unit I-176 is generally available in the field and is recommended for checking capacitors using the kick indication method.) The ohmmeter circuit of the test unit is used to make the check. Proceed as follows:

(1) Disconnect one end of the capacitor from its shunting circuit.

(2) Set the ohmmeter to indicate on its highest range and place the ohmmeter leads across the capacitor.

(3) A good capacitor should cause the meter needle to kick up the scale and fall back to infinity (zero).

(4) A leaky capacitor will cause the pointer to remain at some point on the scale other than infinity.

(5) An open capacitor will cause no deflection of the meter needle.

(6) The lower the capacitance, the lesser will be the degree of deflection which occurs on the ohmmeter scale. The higher the capacitance, the greater will be the deflection which appears on the ohmmeter scale (if the capacitor is normal). Usually, capacitors lower than 0.05 mf do not indicate a measureable kick. Replace defective capacitors.

d. CAPACITOR COLOR CODE. An illustration of the capacitor color code is given in figure 35 ①.

## 69. Current Measurements

a. Current measurements are not ordinarily required in trouble shooting the set. However, if it is desired to measure the plate current of a tube or rectified current in the power supply, the circuit may be opened and the meter connected in series with the circuit. Observe polarity to keep the meter needle on the meter scale. *A milliammeter must always be connected in series with the circuit under check.*

b. A meter is least protected against damage when it is used to measure current; therefore, always set the current range to the highest value. Then, if necessary, decrease the range to indicate a more accurate reading. Avoid working close to full-scale indication, because this increases the danger of overload.

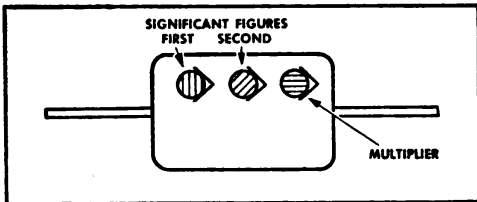
c. Usually the current to be measured flows through a resistance which is either known or can be measured with an ohmmeter. The current flowing in the circuit can be determined by dividing the voltage drop across the resistor by its resistance value.

## 70. Tube Checking

The trouble shooter is mostly concerned with the emission of a vacuum tube. Tube testers do not always indicate noisy tubes. Hand-tapping of the tube envelope usually reveals shorted or poorly welded elements inside the tube. Such tubes, when tapped while under operation in the recorder amplifier, usually result in noise from the recorder speaker. Experience in tapping tube envelopes will teach the trouble shooter how to isolate the defective tube or tubes.

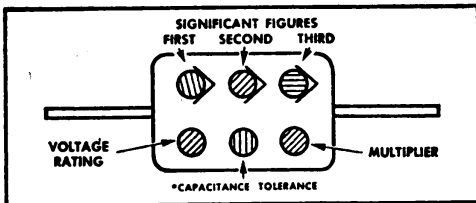
# CAPACITOR COLOR CODES

## RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

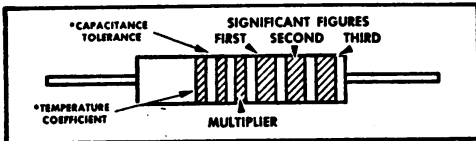


Capacitors marked with this code have a voltage rating of 500 volts.

## RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



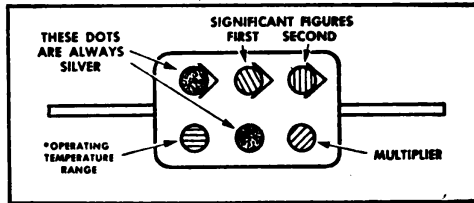
## RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts.

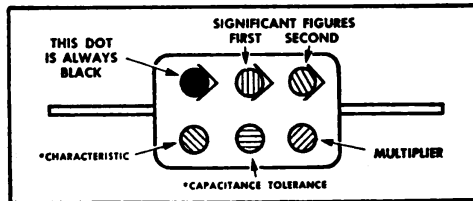
RMA Radio Manufacturers Association      JAN Joint Army-Navy  
 Note These color codes give all capacitances in micromicrofarads.  
 \*Items marked with an asterisk are of interest primarily to depot and higher echelon repair personnel

## JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



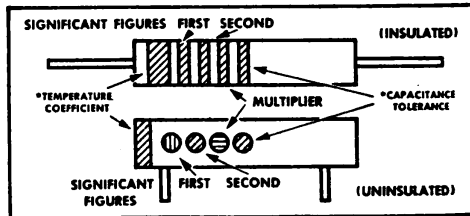
The silver dots serve to identify this marking. For working voltages see JAN type designation code.

## JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



The black dot serves to identify this code. For working voltages see JAN type designation code.

## JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts. Either the band or dot code may be used.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000			400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD		0.1	0.1		1,000
SILVER		0.01	0.01		2,000
NO COLOR					500

FL 12417A

① Capacitor color-code chart.

Figure 35.

## CAPACITORS

FIXED, MICA-DIELECTRIC

CM 20 B 511 K  
 COMPONENT CASE CHARACTERISTIC CAPACITANCE TOLERANCE

**COMPONENT:** CM signifies *fixed, mica-dielectric capacitor*.

**CASE:** A two-digit symbol identifies a physical case size and shape.

**CAPACITANCE:** A three-digit symbol indicates the capacitance value in micromicrofarads. The first two digits give the first two figures of the capacitance value; the final digit gives the number of zeros which follow the first two figures. When more than two significant figures are required, additional digits may be used, the last digit always indicating the number of zeros.

### D-C WORKING VOLTAGE FOR CAPACITANCE RANGE

Case	Capacitance range	V <sub>dcw</sub>
CM20	5-510 mmf	500
CM25	5-1,000 mmf	500
CM30	470-3,300 mmf	500
CM35	470-6,200 mmf	500
	6,800-10,000 mmf	500
CM40	3,300-8,200 mmf	500
	9,100-10,000 mmf	300

NOTE: Working voltages for capacitors above CM40 are stamped on the case.

The d-c working voltage of a capacitor can be determined from the above table when the case size and value of capacitance are known.

## CAPACITORS

FIXED, MOLDED, PAPER-DIELECTRIC†

CN 36 A 302  
 COMPONENT CASE CHARACTERISTIC CAPACITANCE

**COMPONENT:** CN signifies *fixed, molded, paper-dielectric capacitor*.

**CASE:** Same as for fixed, mica-dielectric capacitors.

**CAPACITANCE:** A three-digit symbol indicates the capacitance value in micromicrofarads. The first two digits give the first two figures of the capacitance value; the third digit gives the number of zeros which follow the first two figures.

### D-C WORKING VOLTAGE FOR CAPACITANCE RANGE

Case	Capacitance	V <sub>dcw</sub>
CN35	3,000 mmf	800
	6,000 mmf	600
	10,000 mmf	400
CN36	3,000 mmf	400
	6,000 mmf	400
	10,000 mmf	300
CN40	3,000 mmf	400
	6,000 mmf	300
	10,000 mmf	300
CN41	3,000 mmf	600
	6,000 mmf	600
	10,000 mmf	400

The d-c working voltage of a capacitor can be determined from the above table when the case size and value of capacitance are known.

## CAPACITORS

FIXED, CERAMIC-DIELECTRIC

CC 20 AH 100 G  
 COMPONENT CASE CHARACTERISTIC CAPACITANCE TOLERANCE

**COMPONENT:** CC signifies *fixed, ceramic-dielectric capacitor*.

**CASE:** Same as for fixed, mica-dielectric capacitors.

**CAPACITANCE:** Same as for fixed, molded, paper-dielectric capacitors.

NOTE: All fixed, ceramic-dielectric capacitors have a working voltage of 500 volts, d-c.

\*Items starred are of interest primarily to depot and higher echelon repair personnel.

†This is not a JAN specification. These capacitors are covered by AWS C75/221.

TL 18142

② Capacitor type designations.

Figure 35—Continued.

*a.* Results obtained from a tube checker are not always conclusive because the test conditions are not the same as those under which the tube actually operates in the set. The final test of a tube may have to be its replacement with a tube known to be good. It is often quicker and more reliable to replace a suspected tube with a good one than to check it with the tube checker.

*b.* Tube checkers are usually available in the field. Technical manuals are packed with the instruments and they cover the tube-checker-panel settings for all types of tubes used in the sound recording set except vacuum tube JAN 2050 (V7). Most tube checkers do not test this type. Replace in event of suspected tube failure.

## 71. Replacing Parts

Careless replacement of parts often creates new faults. Note the following points:

*a.* Before a part is unsoldered, note the position of the leads. If the part has a large number of leads, tag each lead.

*b.* Don't damage other leads by pulling or pushing them out of the way.

*c.* Don't allow drops of solder to fall into the set; they may cause short circuits. It is very important to make well-soldered joints. A poorly soldered joint (cold-soldered) is one of the most difficult faults to locate.

*d.* Place the replaced part in the exact position occupied by the original part. A part which has been the same electrical value but a different physical size may cause trouble.

*e.* Pay attention to proper grounding when replacing a part. Use the same ground point as in the original wiring.

## 72. Common Troubles

*a.* GENERAL. Sound-recording-set troubles are usually, in the majority of cases, of a minor nature. Check the following:

(1) Incorrect setting of the recorder controls for the desired operations.

(2) Failure to follow playback or recording procedures carefully. This includes the difficulties in immediately finding the track desired for playing back the last recording.

(3) Careless handling of the selector knob may chip the playback needle. When turning the selector knob from **THREAD** to **NEUTRAL**, hold the playback head.

(4) Distortion on playback of properly recorded sound. This may be due to the incorrect position of the playback needle in the

ilm groove. The use of the vernier screw is indicated. (See par. 20.)

(5) Using the recording set on a moving, unstable, or vibrating surface. This causes the playback needle to wander or drift to tracks on either side of the desired track. Unintelligible playback is the result.

(6) Slippage of the belt on the flywheel. This may be due to oil or excessive belt length. Belts stretch in service and require replacement after long use. (See par. 94.)

(7) Dirt in the recording-drum-flange bearings or drum casting. The smooth running of the film flanges on the recording drum is very important to the proper operation of the set. If the inner or outer flange does not turn regularly, the edge of the film may cut grooves in the face of the flanges. These grooves interfere with the proper register of the film during recording or in some cases cause the film to run off the recording drum. Burs on the flange surface may cause the film to run off. To remove the recording drum for the cleaning operation, see paragraph 88.

b. CORRECTION OF COMMON TROUBLES. Before attempting involved disassembly operations, inspect the recording set for visible signs of abnormalities as explained in paragraph 65. Look for incorrect setting of the controls and improper application of installation information. Check the film magazine for improper loading of the film roll. (See par. 10.) Look for excessive dirt on the film and if present, replace the film wiper. A properly oiled and cleaned recording set will operate with a minimum of trouble.

### 73. Last Track Cut-Off Switch (SW7)

The last track cut-off switch (fig. 48) functions in the same manner on both Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A. The purpose of the switch is to stop the current flow to the drive motor and trackage mechanism (trackage motor on Sound Recording Set AN/UNQ-1). This switch is an added safety feature. When the carriage mechanism reaches track No. 115, the current is shut off to the drive motor thereby stopping further movement of the carriage mechanism and possible damage to the playback and recording needles. If the drive motor fails to shut down when the trackage indicator reads 116, check the microswitch SW7. This may be done by pushing in the tiny button (protruding from the switch surface) while the drive motor is running. If the drive motor stops, proceed to check the action of the rod on the microswitch button. Adjust this rod (par. 98) so that

adequate pressure is made to bear upon the microswitch button when the trackage indicator reads about 115.

#### **74. Carriage Mechanism Jamming (Sound Recording Set AN/UNQ-1 Only)**

a. If the set stops on 115 and in the middle of the change-over cycle, the pawl on the index wheel may be engaged. To free the pawl, press the push-button switch SW10 while the set is still on. Hold in until the pawl is freed from the index wheel. This may be determined by applying a slight turning pressure to the index knob until the knob turns freely. Release the push-button switch.

b. When operating the set on the tracks 115 or over, the carriage may reach the end of its travel and jam the pawl on the index wheel (Sound Recording Set AN/UNQ-1 only). To free the pawl, remove the back cover to expose the rear of the recording set. Lift up the pawl as the index knob is slightly turned with the other hand. Don't lift the pawl more than necessary to free the index wheel.

c. If the index wheel cannot be moved by turning the index knob, insert the tip of the screw driver in one of the notches of the index wheel and smartly tap the index wheel in a clockwise direction (as viewed from the rear of the set).

#### **75. Safety Thread Switch (SW8)**

The safety thread switch is provided to prevent the running of film through the recorder while the selector knob is in THREAD position. Switch SW8 is a microswitch (fig. 4) in Sound Recording Set AN/UNQ-1A. In Sound Recording Set AN/UNQ-1 the switch which is underneath the carriage assembly, is made up of leaves and operated like a jack switch. Both switches serve the same purpose and, under the same conditions, may give rise to identical symptoms. Look for an open safety thread switch when the drive motor fails to start with all panel controls in proper position, pilot light on, trackage indicator below 115, and the amplifier tubes lighted.

#### **76. Clutch Relay RL1**

The clutch relay consists of a 1,500-ohm relay operating the over-running type clutch located on the inside end of the sprocket. (See fig. 30.) A latch (armature on the relay RL1), when attracted by the magnetism of the operating relay, pulls away from the clutch release hub and permits the sprocket to be turned. The film is then drawn through the recording set for recording or



playback purposes. The relay coil is energized with 110 volts supplied by the special winding on the power transformer T1. The circuit to the relay is completed through the MOTOR switch SW2. During operation by the audiotrol feature, the relay coil is fed through a special circuit described in paragraph 60.

*a.* POSSIBLE TROUBLE WITH CLUTCH RELAY RL1. The clutch release pin on the latch may not disengage from the clutch release hub because of a bur or other slight imperfection on the mechanism. This condition will be apparent when repeated throwing of the MOTOR knob to START position does not rotate the sprocket and draw the film. To remedy this condition, file the burs off the clutch release pin or the clutch release hub. An open circuit to the relay should also be suspected if throwing of MOTOR knob to START does not rotate sprocket.

*b.* REASONS FOR CLUTCH RELAY NOT OPERATING SATISFACTORILY. Several reasons for the failure of the clutch to operate are given below.

(1) *Sound Recording Set AN/UNQ-1A.* (*a*) Defective tube V7 (JAN 2050) (figs. 54 and 55). If this tube fails during audiotrol operation, the circuit to the relay coil will be open and unless the MOTOR switch is turned to START, the relay latch pin will remain in contact with the clutch release hub. Change the tube.

(*b*) The audiotrol switch SW3.

(*c*) Failure of the two spring leaf contacts on the trackage relay RL2 (fig. 41) to make. These contacts come together when the trackage relay is energized at the track-over operation. Throwing the MOTOR switch to STOP during the change-over (track-over) does not stop the film from running through the set since the two contacts on the trackage relay are across the MOTOR switch.

(*d*) Defective foot-operating switch. A good check is to operate the MOTOR switch manually. If the recording set operates satisfactorily, check the foot-operating switch and its cable. Also check the male plug for corrosion and broken connections to the contacts on the plug.

(2) *Sound Recording Set AN/UNQ-1.* (*a*) Switch SW6 (fig. 40) the four-leaf switch (trackage-motor switch), is operated by a bent projection which is in continuous contact with the large notched disk. During the track-over operation, the projection which rests upon the periphery of this disk, is pushed upwards to close both the film switch circuit (SW9) and the MOTOR switch circuit (SW2). The clutch relay engages the sprocket during the track-over operation; at this time, the clutch cannot be disengaged by throwing the MOTOR switch to STOP. If the two top

contacts of this leaf switch (SW6) fail to make, the clutch relay will not operate. Check for dirt between the two top contacts.

(b) See (a), (b), and (d) above for Sound Recording Set AN/UNQ-1A.

## 77. Trackage Motor Troubles

a. CLUTCHING MECHANISM (fig. 40). The trackage-motor-clutch mechanism may not operate if the small pinion of the rotor shaft is burred (Sound Recording Set AN/UNQ-1 only). Burring interferes with the mating of this small pinion with its gear train. (See fig. 29.) While the film notches are passing the film switch (SW9), notice whether the pinion makes contact properly. If the trackage is continuous, it is possible that the pinion fails to disengage when the trackage-motor-switch shoe (106) drops into its notch. This failure may be due to burring of the pinion, wear in the first gear bearing, or failure of the spring which acts against the rotor. Any hesitation in breaking contact would cause an overrun of the bakelite disk (107) so that the switch contacts would be closed and another cycle started. If the trackage motor is troublesome, replace the entire assembly.

b. TRACKAGE MOTOR COIL. Disconnect the motor coil leads that are connected to terminals 3 and 4 of terminal strip A. (See fig. 3.) Connect a 110-volt, 50- to 60-cycle current to these two leads. If the rotor rotates, the coil is not open. Proceed to check the gear train for burs or dirt.

c. IMPORTANCE OF ABSOLUTE ALIGNMENT OF PARTS. The track-over operation is absolutely dependent upon a series of actions occurring at time sequences determined by the proper meshing of gears, making contacts, and smooth operation of the clutch on the rotor shaft of the trackage motor. Therefore, when checking the trackage motor, do not loosen nuts, screws, or washers indiscriminately. Be certain that the original placement and alignment of parts are maintained as fixed at the factory. For disassembly and assembly procedures, see paragraph 89.

## 78. Film Switch (SW9) (figs. 49 and 50)

a. SOUND RECORDING SET AN/UNQ-1. Failure of the film switch may be caused by the excessive wearing of the film-switch roller due to the abrasive action of the film or to the incorrect threading of the film. Replacement is indicated in the first case. Rethreading of the film will usually clear up the trouble in the other.

b. SOUND RECORDING SET AN/UNQ-1A. Failure of the film switch in this set is more often due to a defective switch (micro-

switch) than to the vertical rods which contact the film edge. In Sound Recording Set AN/UNQ-1A this assembly is composed of two sapphire rods which resist wear by the edge of the passing film.

## 9. Distortion

The following information applies equally to Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A.

a. **AMPLIFIER.** Distortion *originating in the amplifier* is usually caused by the following:

(1) *Defective tubes.* Tubes with low emission upset the voltage distribution in the amplifier. Tubes with internal shorts may intermittently cause distortion and noise. Tapping usually discloses the shorted tube. (See par. 81.) A weak JAN 5Y3GT (V8) results in low over-all voltages and distortion.

(2) *Capacitors.* Leaky capacitors, especially those used as coupling capacitors (C1, C2, C3, C4, C5, and C6), introduce distortion. (See figs. 59 and 60.) Filter capacitors, C20—C23 inclusive, dry out in service and lose enough capacitance to cease acting as filters of the rectified d-c current. Hum and distortion result. The cathode bias resistors of tubes V1, V2, and V4 are bypassed by low-voltage electrolytic capacitors C19, C18, and C17, respectively. The drying out of these electrolytic capacitors results in loss of capacitance and distortion due to inadequate bypass action. Check these capacitors with a capacitor checker if available. Substitution of good capacitors across suspected ones is standard practice. (See par. 68.)

(3) *Resistors.* Occasionally, carbon resistors change in value. When such changes occur in critical circuits, distortion may result. Resistor R33 in the diode load circuit of the first section of the automatic volume control tube V6 is such a critical point in a circuit. For example, if R33 increases in value from 1 megohm to 2 megohms, the bias voltage applied to V2 will double and either block that tube or decrease its amplification. Only very strong signals will be amplified; signals of a voltage slightly higher than the abnormal bias voltage which was developed across the higher-than-normal avc resistor R33. After long use, this condition may not be uncommon. This trouble will not manifest itself with the A. V. C. knob in the OFF position.

(4) *Miscellaneous.* Several of the wires in the amplifier are shielded. If any of these shields, which are normally grounded, becomes ungrounded for any reason, hum and possibly distortion may result. Especially important are the shielded wires in the input circuits. Leakage between cables, due to high moisture and heat conditions in the tropics, may introduce distortion (if

such leakages exist in critical circuits). Leakages between the tube socket contacts may also produce the same effects.

*b.* **EXTERNAL CAUSES OF DISTORTION.** The playback and recording heads may contribute towards the generation of distortion arising from improper embossing of the film groove (for the depth of track adjustment, see par. 101) and the subsequent playing back of the very same distortion. A defective playback head will introduce distortion when its internal elements are unbalanced. Adjustment of the playback head is covered in paragraph 100. Adjustment of the recording head is covered in paragraph 101. Improper travel of the playback needle in the groove results in distortion of a good recording. The use of the vernier screw to eliminate this cause of distortion is covered in paragraph 20. Rubbing of the loudspeaker voice coil in its air gap, distortion of the cone material, and tears in the paper cone result in rattles, distortion, and other undesirable effects.

## **80. Meter**

The recording meter AM1 (figs. 59 and 60) is connected across the recording head and operates only when the selector knob is in RECORD position. The meter circuit comprises a 0-5 milliammeter connected in series with a copper-oxide rectifier (figs. 54 and 55); this is the part most likely to cause trouble. If the meter needle vibrates, or if the meter reading is low when a sound can be heard coming from the recording head during recording, check the rectifier stack by replacement. Another method to determine the condition of the copper-oxide rectifier is to make a recording and play it back. If the meter indication during the recording process was very low, and if the playback is satisfactory, the copper-oxide rectifier is probably faulty. An open movement in the meter will not interrupt recording. In an emergency, depend upon the characteristic sounds coming from the recording head and the usual position of the VOLUME knob as indications of a proper recording level. Do not attempt to repair the meter. Only authorized personnel should handle adjustments or repairs. Zero adjustment of the needle and meter calibration are covered in paragraph 102.

## **81. Trouble-Shooting Amplifier**

*a.* **SPEAKER.** If the speaker is inoperative during the playback operation, plug the earphones into the OUTPUT jack. If the playback is heard in the earphones, the trouble is either an open speaker voice coil or a faulty contact on the OUTPUT jack. Push and pull the earphone plug in the OUTPUT jack to restore

the jack contacts to normal operation. If unsuccessful, and it is apparent that the speaker voice coil is not open (ohmmeter check made with one side of the voice coil terminals disconnected), open the amplifier-chassis side panel and check condition of OUTPUT jack. Remove corrosion and dirt.

b. **QUICK CHECK FOR AMPLIFIER.** If it is suspected that the amplifier is not operating normally, turn selector knob to NEUTRAL and touch the center contact on the MICROPHONE terminal while the VOLUME knob is turned on to about 3. If a loud buzz is heard, the amplifier is probably satisfactory.

c. **TUBES.** If a tube is suspected of being defective, substitute with a known good tube. Wait about 10 seconds for the substitute tube to warm up. The filament cannot be seen in the metal type tube. If the envelope is warm or hot to the touch, the filament is not open. *Avoid touching hot tubes. Wait until the amplifier cools sufficiently.* Tapping the tubes with the rubber eraser of a pencil sometimes causes sounds in the loudspeaker. These sounds are indicative of several conditions: the output circuit is normal, the power supply is functioning, the stages following the tube that was tapped are alive, etc.

d. **MAIN AMPLIFIER SWITCH (SW5).** A common cause of trouble in this switch may not lie in the switch itself but in the coupling arrangement which permits the attainment of the different switch positions with the changes in selector knob positions. This coupling is made up of a fork like arm (fig. 58) and a pin on the switch gear (SW5). Check the alignment of the fork. At NEUTRAL, the center line of the fork should be on a line approximately through the center of the switch shaft and the gear center. If this fork is slightly out of time, either the RECORD or PLAYBACK position will not be reached. If the RECORD circuit does not operate as indicated by complete lack of action on the recording meter or the absence of sound from the recording head, check the fork position as follows:

(1) Remove the back cover of the carrying case to expose the amplifier. (See par. 86.)

(2) Turn the selector knob in RECORD position.

(3) Adjust the controls for proper recording level. (See par. 22.) Pick up a steady sound through the crystal microphone.

(4) Using a long screw driver, carefully push the fork in a counterclockwise direction (facing the rear of the set). If the meter indicates recording voltage, the trouble has been located.

(5) To make permanent repair, remove the amplifier (par. 86) and tighten the setscrew on the switch fork after making sure the coupling is set properly.

(6) The playback circuit may be checked in a similar manner

as described above. If the set refuses to playback with the selector knob in PLAYBACK position, and it is apparent that the amplifier switch fork position is faulty, check as follows:

(a) Turn the selector knob to PLAYBACK position.

(b) Remove carrying case cover as described above.

(c) Adjust the set for playback (par. 27) and start the film moving.

(d) Using a long screw driver, push the fork in a clockwise direction until the sound of the playback is heard from the speaker. If sound is heard when this is done, the setscrew on the switch fork is loose and must be tightened. Remove amplifier from case and adjust.

## 82. Trouble-Shooting Charts

### a. RECORDER ASSEMBLY.

Symptom	Probable trouble	Correction
1. Failure to track.	1. Open or short circuit in trackage system.	1. Check all connections in the trackage system for loose or broken connections (par. 77).
	Defective coil in trackage motor.	Repair or replace (par. 77).
	Defective trackage motor switch.	Repair, replace, or adjust.
	Defective film switch.	Repair, replace, or adjust.
	Excessive wear on the face of the inner bearing of the first gear shaft.	Repair or replace.
2. Distortion.	2. Defective recording head.	2. Replace (par. 93).
	Excessive playback-head pressure on film.	Refer to paragraph 100.
	Needle too loose in playback head.	Tighten (par. 84).
	Sapphire on playback needle chipped.	Replace needle.
	Playback arm loose.	Tighten (par. 92).

Symptom	Probable trouble	Correction
3. Noise from motor in recording.	3. Loose motor mounting.	3. Refer to paragraph 89.
	Faulty motor filter capacitor.	Replace capacitor (C15).
4. Recording weak or indistinct.	4. Microphone volume control improperly adjusted.	4. Readjust volume control.
	Faulty amplifier.	Repair (par. 81).
	Faulty microphone.	Repair or replace.
	Faulty playback head.	Repair or replace (par. 92).
5. No recording or reproduction.	5. Microphone faulty.	5. Repair or replace.
	Faulty recording head.	Repair or replace (par. 101).
	Faulty tube.	Replace (par. 81).
	Open circuit in amplifier.	Replace (par. 81).
	Open circuit in recorder head.	Repair or replace lead.
	Poor connection in terminal or recorder.	Repair.
6. Thump in machine.	6. Wax on pulley.	6. Remove wax.
	Poor joint in belt.	Replace belt (par. 94).
	Gear teeth poor or dirty.	Repair or clean (par. 89).
7. Vibration.	7. Belt too tight.	7. Readjust belt (par. 94).
	Wax on pulley or belt.	Remove wax.
	Poor joint in belt.	Replace belt (par. 94).
	Armature shaft bent.	Replace motor.
	Motor bearings worn.	Replace motor.
	Open circuit in armature.	Replace motor.
	Loose motor mounting.	Check motor-bracket assembly and rubber washers and bushings.

b. AMPLIFIER ASSEMBLY.

Symptom	Probable trouble	Correction
1. Amplifier inoperative	1. Defective tubes.	1. Replace defective tubes (par. 70 and 81).
	Fuse F1 or F2 blown.	Check and replace defective fuse or fuses.
	Filter choke L1 open.	Repair or replace.
	Open speaker coil.	Repair or replace speaker (par. 81).
	Transformer T2 primary open.	Repair or replace.
	Open resistor R17.	Replace resistor R17.
	Resistor R24 open.	Replace resistor R24.
	Line cord opened or shortage.	Check line cord and repair or replace.
2. Hum in recording of reproduction.	Coupling capacitor C1 open.	Check capacitor C1 and replace.
	2. Noisy tube.	2. Replace defective tube (par. 81).
	Filter capacitor C22 or C23 open.	Replace capacitor.
	Open shield in recorder cable to amplifier chassis.	Repair or replace (par. 65).
3. Motor-boating: feedback howl.	Faulty capacitor C12.	Replace capacitor C12.
	3. Filter capacitor C20, C21, or C22 open.	3. Replace defective capacitor (par. 81).
4. Distortion.	Bypass capacitor C17 or C18 open.	Replace defective bypass capacitor (par. 81).
	4. Leaking coupling capacitor C1 or C4.	4. Replace defective coupling capacitor (par. 81).
	Gassy tube.	Replace tube (par. 70).
	Defective inverse feedback circuit.	Check resistor R25.



Symptom	Probable trouble	Correction
	Defective speaker cone.	Repair or replace.
	Plate or screen-grid voltage too low.	Replace rectifier tube (V8) or correct abnormal a-c voltage supply.
	Defective bias capacitor C17.	Replace defective capacitor C17.
. Lack of avc action.	5. Defective avc tube (V6).	5. Replace defective tube.
	Capacitor C10 or C14 shorted or leaky.	Replace capacitor C10 or C14.
	Open resistor R32.	Replace resistor R32.
. Weak reproduction.	6. Weak JAN-5Y3GT tube.	6. Check and replace if defective (par. 81).
	Defective filter capacitors C22 or C23.	Check and replace if defective.
	Defective coupling capacitors C1, C2, C3, and C4.	Check and replace.

## Section XII. REPAIRS

### 33. Tools

*a.* **TOOLS FURNISHED WITH RECORDING SET** (fig. 7). Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A are provided with four Allen wrenches sizes Nos. 4, 6, 8, and 10. A special needle wrench is also furnished.

*b.* **USE FOR TOOLS.** The four Allen wrenches are used to remove and tighten the various size Allen-head screws found throughout the set. The needle wrench permits the removal and insertion of the recording and playback needles. Full description of the use of the needle wrench is covered in paragraph 85.

*c.* **CARE OF TOOLS.** The proper use of tools is important if tool life is to be extended and maximum use of tools is to be realized. The following information is to be used as a guide:

(1) Place tools back in their proper place as soon as they are used. Always keep them in the same place so that others may find them.

(2) Avoid using a screw driver with a tip width too small for

the screw head. Doing so, burrs the screw head and also distorts the screw driver tip. Avoid substituting a screw driver for a cold chisel.

(3) Do not attempt to cut hard, large diameter wire with an inadequately sized pair of pliers.

(4) Keep the soldering-iron tip clean. Remove all crustations. Tin the tip frequently. Allow the iron to cool sufficiently before placing it back into the tool chest. Avoid contact between the soldering-iron cord and sharp objects contained in the tool chest. Place on top of the other tools to protect cord from fraying.

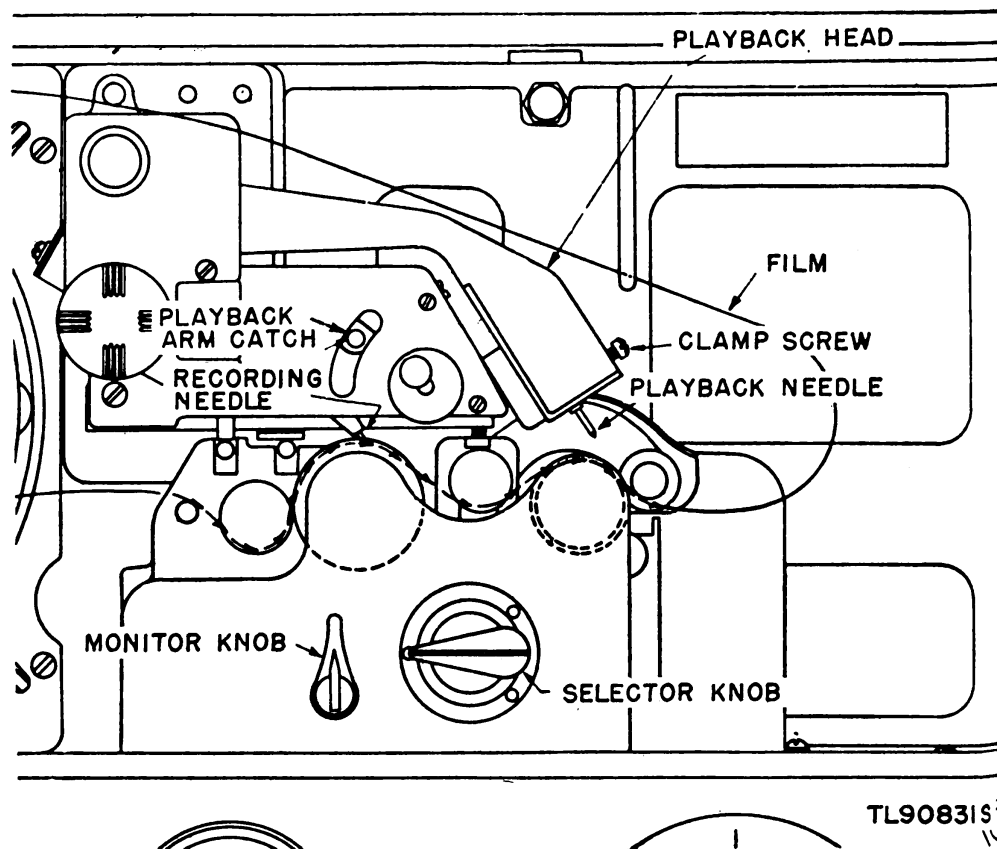


Figure 36. Front view of carriage assembly.

## 84. Removal and Insertion of Playback Needle

a. REMOVAL (fig. 36). (1) Turn selector knob to NEUTRAL. See that MONITOR knob is pointing up.

(2) Loosen the clamp screw sufficiently to release the playback needle.

(3) Remove the needle (needle wrench may be used to facilitate handling). Avoid damaging the needle point.

b. INSERTION (fig. 36). (1) Turn selector knob to NEUTRAL. See that the MONITOR knob is pointing up.

(2) Turn the clamp screw sufficiently to permit insertion of needle into hole at the bottom of the playback head.

(3) Insert needle up as far as it will go (needle wrench may be used to facilitate handling). Hold in that position and tighten the clamp screw firmly. Do not force.

## 85. Removal and Insertion of Recording Needle (fig. 36)

*a.* REMOVAL. (1) Turn the selector knob to NEUTRAL. MONITOR knob should point up.

(2) Turn the index knob to 50 on the trackage indicator.

(3) Push down the playback-arm catch to release the playback head. Move the playback head toward the front of the recording set to expose the end of the recording arm.

(4) Pry up the end of the recording arm with a screw driver or other similar tool.

(5) Turn the clamp screw on the end of the special needle wrench in a counterclockwise direction. Place the holed end of the wrench around the recording needle and push wrench up under the recording arm. Tighten the clamp screw firmly. Push down on the wrench and at the same time twist from side to side. Continue firmly but gently until the needle is released from its holder. Be careful to keep the needle point from hitting the recording drum as the needle leaves the holder.

*b.* INSERTION. (1) Place recording needle into hole on end of needle wrench; tighten the needle wrench clamp screw.

(2) Insert the needle into holder and push up as far as possible. Use twisting and pushing motions. Lower the needle wrench position on the needle shank if necessary for further insertion.

(3) Loosen the clamp screw on end of needle wrench and carefully lower the needle wrench to clear the jeweled needle tip.

(4) Remove the object used to raise the recording arm.

(5) Return the playback head into position to permit placement of the playback-arm catch into the V slot.

(6) Turn selector knob to the desired track and make a test recording and play back to check needle positions.

*Note.* The position of the needle will influence tone quality. Each new set is preset at the factory with a standard needle. The position of the replaced needles in their respective holders should accurately correspond with factory settings in order that depth of track be correct. If in doubt, see paragraph 101 for details.

## 86. Disassembly and Assembly of Amplifier

*a.* DISASSEMBLY. (1) Disconnect set from the 110-volt line.

(2) Turn the selector knob to THREAD position.

(3) Remove the two screws passing through the handle of the

carrying case. Remove the two screws from the two side hinges of the carrying case. Tip the back cover of the carrying case backwards, push to one side and remove.

(4) Remove the two screws which hold the carrying-case base to the feet of the main frame.

(5) Remove the four screws connecting the amplifier cover to the front panel.

(6) Disconnect the 11-circuit (or 20-circuit) plug. Use care when prying plug loose from its receptacle. Do not pull wires entering plug. Use screw driver to pry plug loose. Use a rocking motion; avoid chipping the phenolic material.

(7) Remove the two screws which hold the amplifier chassis to the main frame of the set.

(8) Lift the set upward and gently rock and shake it to allow the amplifier end covers to slip off the amplifier chassis. These end covers are held in place by a clip arrangement and may be somewhat tight.

*b.* ASSEMBLY. The amplifier may be installed by reversing the above directions. However, before installing the amplifier, check the selector knob position to see that it points to **THREAD**. Also check the switch fork position. (See par. 81*d.*) When the amplifier chassis is placed back into position, the switch fork must be in **PLAYBACK** position (clockwise as far as it will go as viewed from the rear). If these instructions are not followed, the switch gear and the switch fork will not mesh properly when the amplifier is installed and jamming will result.

*c.* CHECKING SET AFTER ASSEMBLY. Always check the operation of the recording set after reinstalling amplifier. After tests show the set to be operating normally, assemble the rear cover of the carrying case and the two screws through the handle.

## **87. Disassembly and Assembly of Sprocket and Clutch Assembly**

*a.* DISASSEMBLY (fig. 37). The following disassembly procedures apply to Sound Recording Let AN/UNQ-1 only unless otherwise noted.

(1) Remove the recording bracket front cover (fig. 11), clutch relay, sprocket brush assembly (fig. 36), idler roll (8), and idler roll arm adjusting bar (77).

(2) Slide the idler roll off its supporting shaft; do not remove the shaft or the arm to which it is fastened.

(3) Loosen the setscrew (78, fig. 37) in the retaining collar (79) at the outer end of the sprocket.

(4) Loosen the setscrew (80) in the clutch cup (81) which positions the shaft (82) against the main frame. These two setscrews engage with flats on the shaft which are about  $\frac{1}{32}$  inch

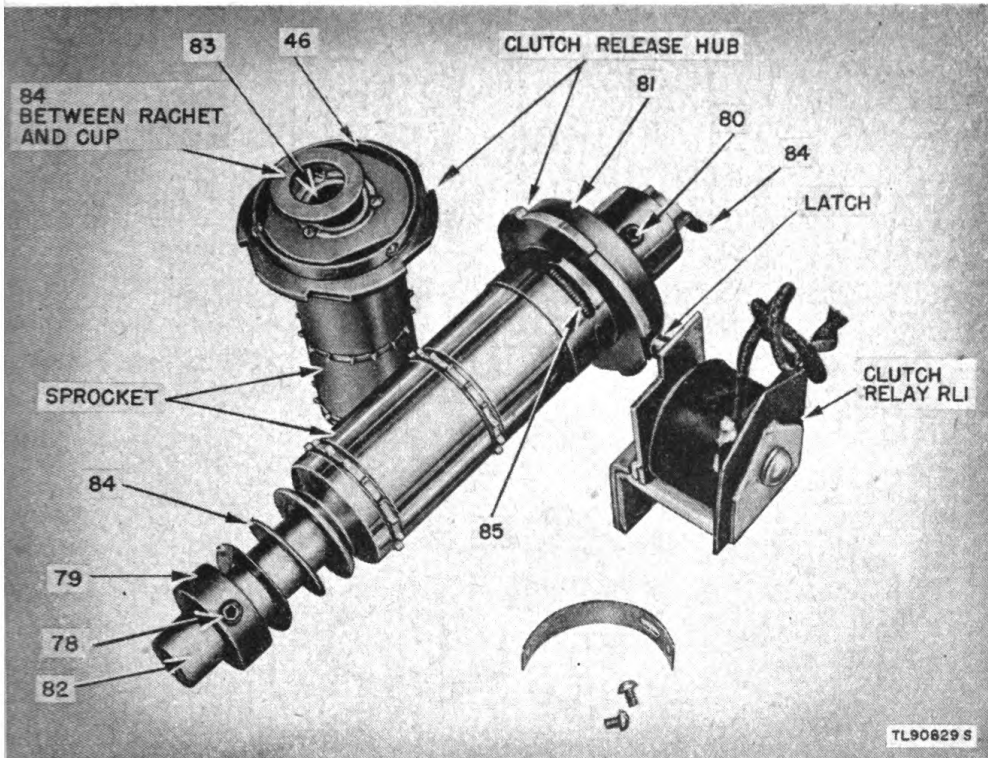


Figure 37. Sprocket and clutch assembly, Sound Recording Set AN/UNQ-1.

deep. Be careful that the setscrews are backed out far enough to clear the shaft. Holding the sprocket assembly and clutch cup together, take hold of the large flywheel (21, fig. 22) on the inner side of the main frame.

(5) Withdraw the flywheel and the shaft out of the bearings (83) in the sprocket and from the clutch cup. Be careful to hold the sprocket assembly and cup together until they are out of the set; otherwise, the three small balls (46, fig. 37) inside the clutch may be lost.

b. ASSEMBLY. (1) Follow the above procedure in reverse order.

(2) In reassembling the flywheel shaft to the sprocket and clutch assembly, secure the washer (84) which lies between the end of the sprocket and the face of the clutch cup. It is sometimes helpful to line up this washer in the assembly by inserting a round rod just under the bearing diameter through the sprocket. Insert the washer into the clutch cup and allow the flywheel shaft to push this rod ahead of it.

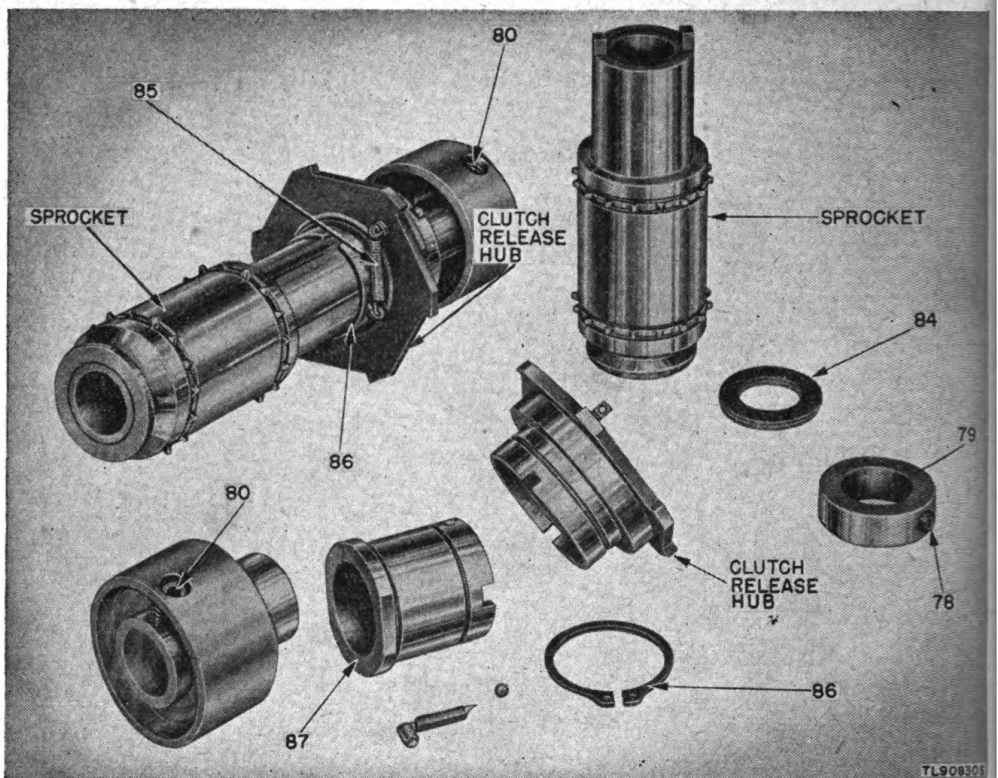


Figure 38. Sprocket and clutch assembly, Sound Recording Set AN/UNQ-1A.

c. CLUTCH DISASSEMBLY FOR SOUND RECORDING SET AN/UNQ-1A (fig. 38). (1) Follow directions, as given in *a* above to remove sprocket.

(2) The clutch and sprocket are not fastened together and may be separated. Remove spring (85) by unhooking its loops. Remove the spring collar (86) by spreading the ears with a screw driver to enlarge the diameter of the collar and clear it from the slot in the cam (87).

(3) Take the entire clutch apart.

d. ASSEMBLY OF CLUTCH FOR SOUND RECORDING SET AN/UNQ-1A. Reverse the above procedure.

## 88. Disassembly and Assembly of Recording Drum

*a.* DISASSEMBLY OF RECORDING DRUM (fig. 39). (1) Remove the selector and MONITOR knobs. Remove the two screws at the ends of the recording bracket cover. Pull cover off the bracket.

(2) Remove the front casting plate (96) from the recording bracket.

(3) In removing the plate, be careful not to lose the seated ball (88) which is sided in a drilled hole in the casting plate.

(4) The recording drum is held in place by two No. 10-32 fillister head screws (89) and two dowel pins. A ball (92)

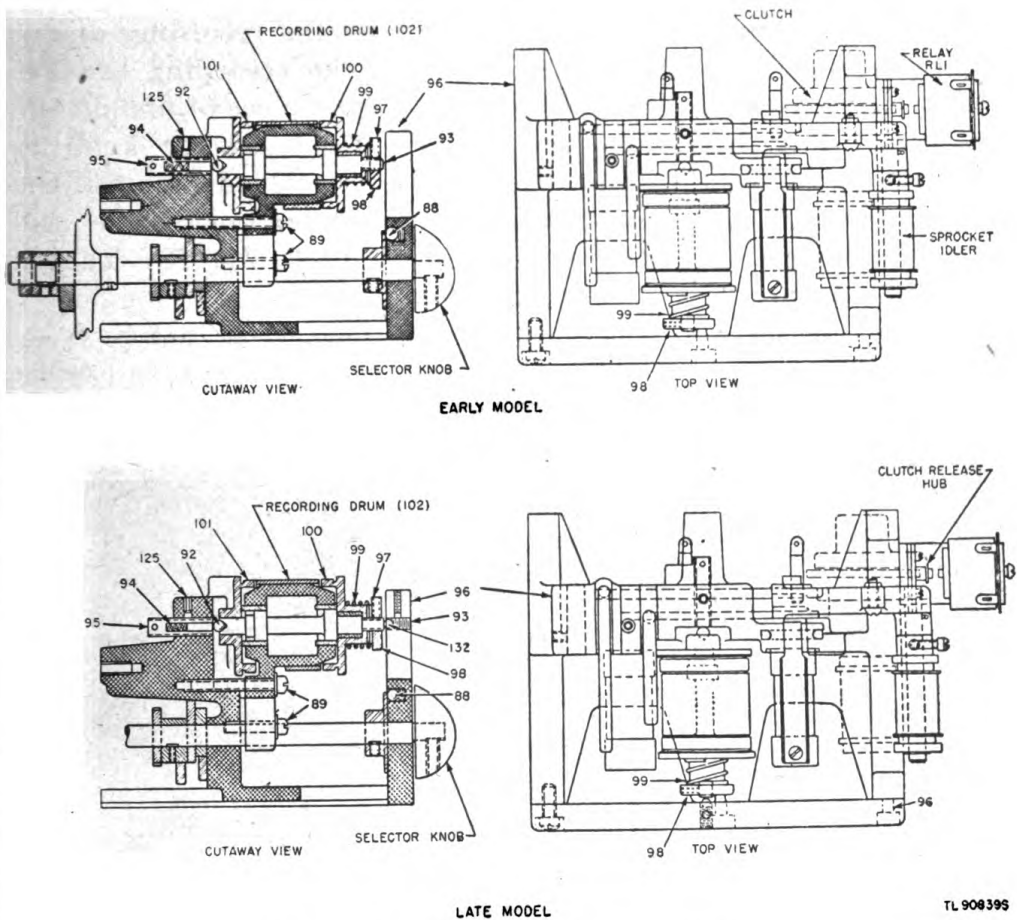


Figure 39. Recording-drum assembly.

passes against the rear center of the film-flange shaft (93) and is held in position by a spring plunger (94) which is inserted in an adjusting screw (95) in the recording bracket.

*Note.* On Sound Recording Set AN/UNQ-1A, another ball will be found pressing against the front of the shaft (132, fig. 39). Remove this ball during the disassembly procedure.

(5) Disassemble the film-flange shaft (93) from the drum by loosening the setscrew (97) in the film-flange adjusting nut (98) and back this nut off the shaft (93).

(6) Remove the spring (99) and the spring flange (100). The inner flange (101) is pinned to the shaft. The shaft may be removed from the back of the drum.

*b. ASSEMBLY.* (1) Reassemble the recording-drum assembly by following the above procedure in reverse order. Then place the drum back into place in the recording-drum-bracket assembly. A bit of refined grease (or vaseline) may be used to hold the ball (92) in place during this reassembly.

(2) Be careful not to disturb the chrome-plated sleeve (102) because the angle of the groove at the top of the sleeve is very critical in relation to the recording needle. If the chrome-plated

sleeve does become loosened while servicing the recording drum, put the recording drum back in place in the recording bracket (96). Attach the selector knob. Run a short piece of film on the drum to protect the recording needle. Turn selector knob to RECORD. Rotate the chrome-plated sleeve on the drum until the recording needle is approximately centered on the groove and relock into place with the locking screw (103, fig. 18) located under the drum.

*Note.* If adjustment of spring pressure on the film-flange shaft is found necessary, see paragraph 97. The film flanges must turn with the passage of film over the recording drum.

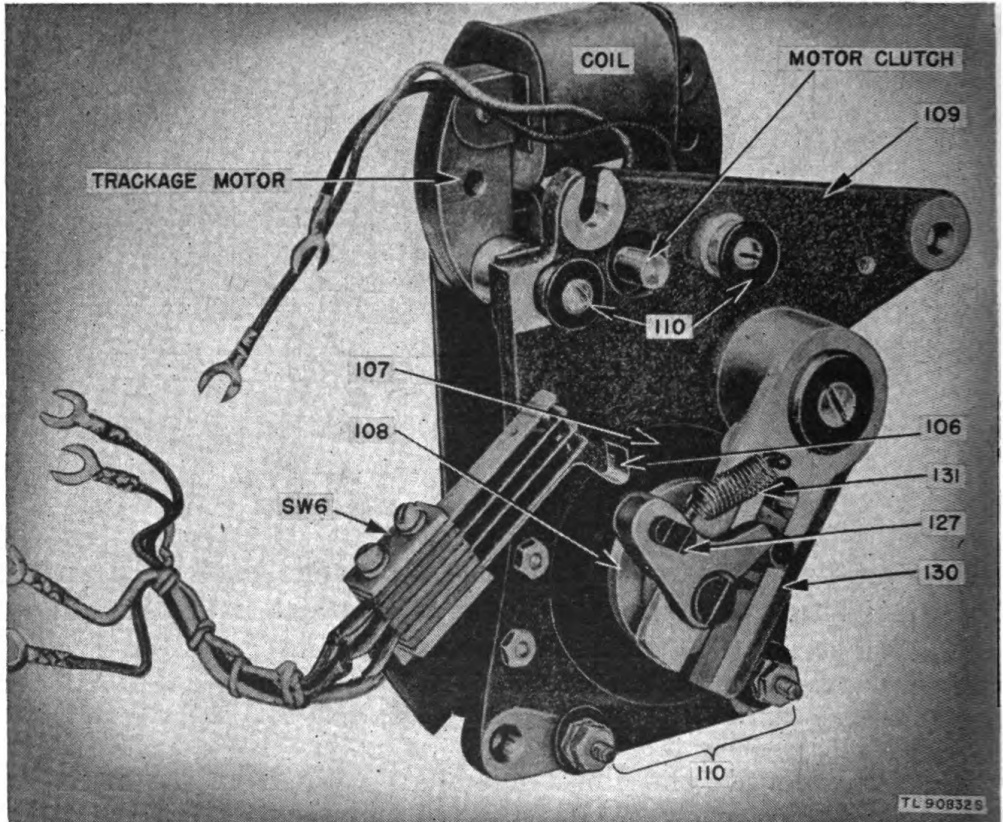


Figure 40. Carriage-(trackage) motor assembly.

## 89. Disassembly and Assembly of Trackage-Motor Assembly

The following procedure applies to Sound Recording Set AN/UNQ-1 only.

a. **DISASSEMBLY** (fig. 40). (1) Disconnect the 110-volt line plug from the receptacle.

(2) Remove the back cover of the carrying case.

(3) Disconnect the two trackage motor leads from terminal strip A (fig. 3). Remove the four switch leads from terminal strip C.



(4) Turn the selector knob to NEUTRAL. (This action disengages the index latch pin from the notch on the motor disk. When removing the motor assembly, hold this latch out of the way.)

(5) Remove the two nuts holding the plate (109) to the supporting posts. Loosen, but do not remove the third nut which lies just under the motor. The assembly can then be removed from the three supporting posts.

b. ASSEMBLY. (1) In reassembly of a new motor, care must be used in setting the trackage-motor switch SW6. The shoe (106) on the bottom of this switch should ride in the bottom of the notch in the bakelite disk (107) which is mounted inside the crank hub (108). To operate correctly, the pin which projects from the index latch (127) should be engaged in the notch on the crank hub at the same time the shoe engages the notch on the bakelite disk. (Since this relationship was correct before the plate was taken off the set, place the new trackage motor to suit the trackage switch which is fastened to the supporting plate rather than change the position of the switch itself.)

(2) The setting of the trackage switch (SW6) should be checked before the trackage motor assembly is placed back onto the three supporting posts. There should be no clearance between the bottom leaf which forms the shoe, the insulating strip, and the bottom leaf of the switch. With the shoe riding on the bottom of the notch, the gap between the contacts of both the upper and lower part of the double switch should be approximately  $\frac{1}{50}$  inch. If a feeler gauge is not available, use the thickness of the cover of a book of safety matches.

(3) If the trackage motor is turned by hand, by turning one of the intermediate gears under the motor coil, the crank hub (108) with its bakelite disk (107) will turn and force the shoe (106) of the switch upwards until it rides on the surface of the disk. At this time, both the upper and lower contacts should be closed and remain closed for the complete rotation of the disk. They should open only when the shoe again drops into the notch of the disk.

(4) When remounting the motor to the supporting plate, do not destroy the resiliency of the rubber washers (110) used to mount the motor to the supporting plate. These washers are used to reduce vibration during motor action. Also level the motor to the plate so that the crank hub (108) which operates the mechanism will be properly aligned. Two nuts are used on each screw which holds the motor to the plate. The outer of these two nuts is used to lock the inner one in proper position after the motor is set.

(5) In replacing the plate and motor assembly, hold the pawl

pin which engages the index wheel (fig. 58) out far enough to clear the disk. Do not use force in replacing this assembly as some part might be misplaced and cause an interference. Set up the three nuts which hold the plate (fig. 40 (109)) to the supporting posts. There must be no interference as these nuts are being tightened; otherwise some part of the mechanism may suffer damage.

c. CHECKING ASSEMBLED MOTOR. Before turning on the power, check the trackage motor as follows:

(1) Turn an intermediate gear of the motor by hand and observe whether the index latch (pawl) contacts the index wheel. (See fig. 58.) Contact must be broken during one complete cycle of the crank hub (108, fig. 40). At the same time note that the shoe (106) on the trackage-motor switch (SW6) and the pin on the index latch (127) must engage their respective notches. If they do engage properly, loosen the three nuts holding the plate to the set and shift the entire assembly on the posts so as to secure proper contact. Retighten the nuts securely.

(2) After lining up the assembly, plug the power cord into the receptacle, turn the MOTOR switch to START, and run the film through the set to check the operation of the trackage motor. Be sure to tighten the four leads to both terminal strips A and C. (See fig. 3.)

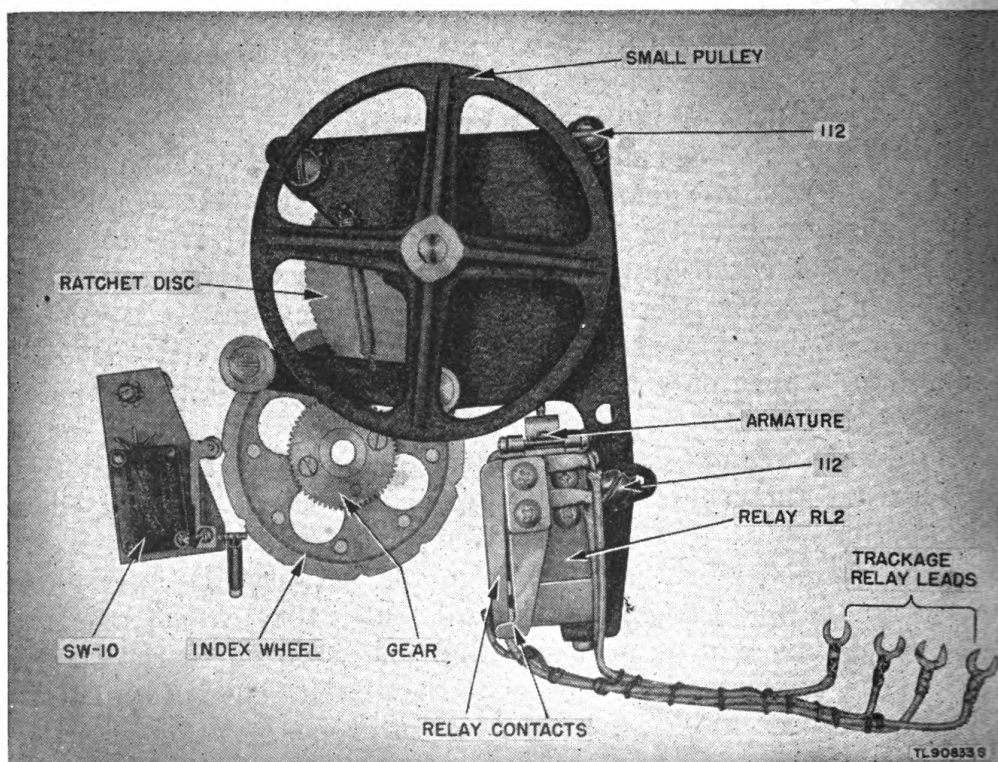


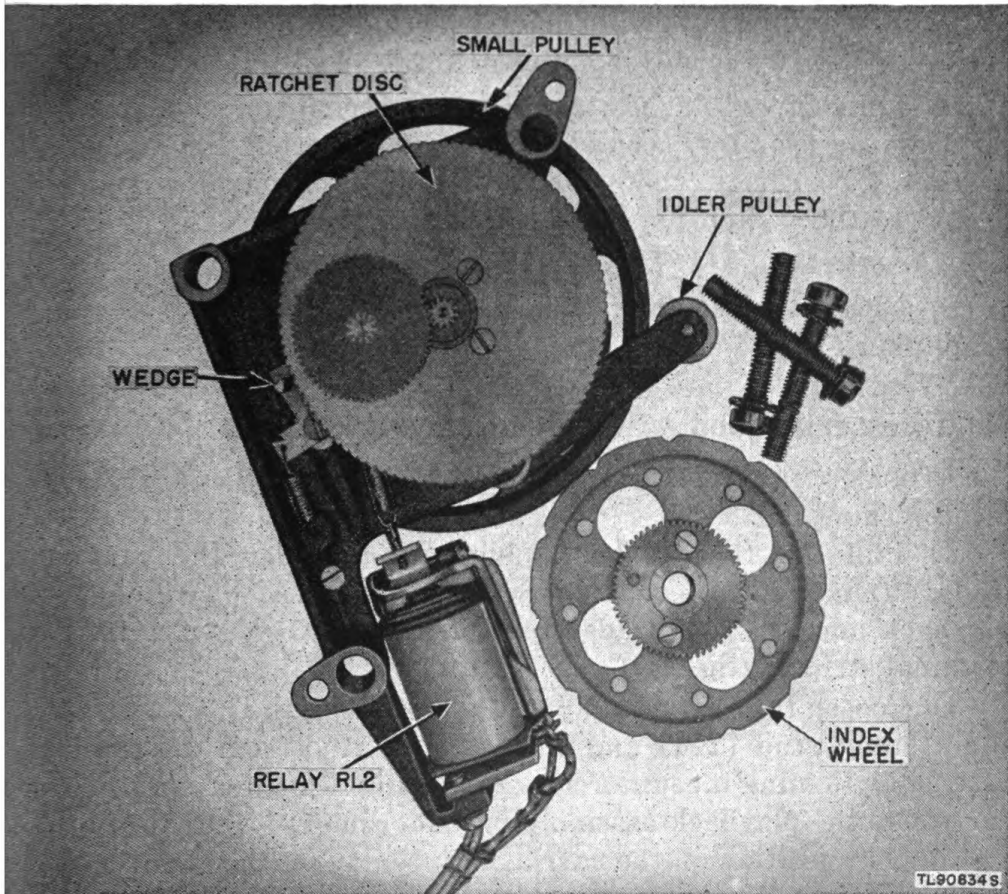
Figure 41. Trackage mechanism, rear view.

## 90. Disassembly and Assembly of Trackage Mechanism

The following information applies to Sound Recording Set AN/UNQ-1A only.

*a.* **DISASSEMBLY** (fig. 41). Remove the entire trackage mechanism assembly as follows:

- (1) Disconnect trackage-relay leads from terminal strip.
- (2) Remove the three screws (112) holding the plate assembly to the main frame. Remove the assembly.



*Figure 42. Trackage mechanism, front view.*

*b.* **ASSEMBLY.** (1) Reverse the above procedure.  
(2) Check the operation of the trackage relay (RL2) as follows:

- (a) Push the armature toward the relay coil.
- (b) The stationary contact should be displaced about  $\frac{1}{32}$  inch by the pressure of the moving contact against it when the armature is as far down as the coil will permit.
- (c) If the distance of travel is more or less than  $\frac{1}{32}$  inch, adjust by bending the leaves of the switch.
- (d) Clean contacts if necessary.

## 91. Disassembly and Assembly of Film Switch (SW9)

a. DISASSEMBLY. (1) Remove the selector and MONITOR knobs.

(2) Remove the recording-bracket front cover. The cover is held by two screws, one at each end.

(3) Remove the front casting plate of the recording bracket. Be careful not to lose the small ball (88, fig. 39) which lies between the locating disk on the camshaft and the pocket in the front plate.

(4) The switch assembly may be removed by loosening and removing the two screws holding it to the recording bracket.

(5) Long wires attached to the switch mechanism permit switch inspection without its complete detachment from the recording bracket. To remove completely, disconnect the two wires connected to the switch lugs.

b. ASSEMBLY. (1) Reverse above procedure.

(2) Check operation. If adjustment is needed, see paragraph 99.

## 92. Disassembly and Assembly of Playback Arm

a. DISASSEMBLY. (1) Turn the index knob until the track indicator shows 001.

(2) Pull out the playback plug and unsolder the playback leads. (On Sound Recording Set AN/UNQ-1A, disconnect the playback and recorder leads from terminals Nos. 1, 2, and 3 on terminal strip A (fig. 4).)

(3) Loosen the clamp collar (113, fig. 33) on the playback horizontal hinge stud (114) and unthread the stud from the carriage casting by turning it counterclockwise using a small wrench. (On early sets the playback assembly may be removed with this hinge stud left in position on the carriage by removing the clamp collar. On later sets, with the replaceable playback heads, this horizontal hinge block (113) is forked to provide a more stable bearing.) Unless the carriage is removed from its supporting bracket the hinge stud and the block assembly must be removed and replaced together.

b. ASSEMBLY. (1) Replace the head by following the above procedure in reverse.

(2) In replacement of the new head assembly, be sure that the threaded end of the hinge stud is entered squarely into the tapped holes in the carriage so that it does not strip its threads.

(3) Set up the clamp collar (113) so the playback arm has freedom to move up and down and also has no side play.

(4) Solder the new leads into the playback and recording plug.

(On Sound Recording Set AN/UNQ-1A, reconnect the leads to terminal strip A (fig. 4).)

(5) Test the new head under actual operating conditions. If adjustment is indicated, see paragraph 100 for instructions.

### 93. Disassembly and Assembly of Recording Head

*a. DISASSEMBLY.* (1) Remove power plug from 110-volt receptacle.

(2) Remove the back cover of set.

(3) Remove the film magazine by unscrewing the four screws holding the magazine to the main frame.

(4) Pull the recording-playback cable plug from its socket. (On Sound Recording Set AN/UNQ-1A, disconnect the recorder and playback leads from terminals 1, 2, and 3 on terminal strip A (fig. 4).)

(5) Loosen the two switch adjustment nuts (fig. 48) on the last track switch rod; push and remove the push rod from the rear.

(6) Turn the selector knob to NEUTRAL and turn the index knob to indicate 010 on the track indicator. Be sure the MONITOR knob is pointing up.

(7) Tie the recording arm up as high as possible to the carriage. This is to prevent the arm from dropping down and damaging the recording needle while removing the carriage assembly.

(8) Remove the push button wires from terminals 1 and 2 on terminal strip A (Sound Recording Set AN/UNQ-1 only).

(9) Remove the three mounting screws (117, fig. 29) from the rear of the main frame. While holding the carriage-bracket assembly in both hands, draw it away from the main frame carefully until it is released from the dowel-pin holes. (See fig. 29.) Place the carriage-bracket assembly on a clean bench. Proceed with adjustments or repairs as indicated by previous checks.

*Note.* If further disassembly of the recorder head is desired, proceed as outlined in the following subparagraphs. Special technique and equipment are required for servicing of the recording head. If these facilities are not available, replace the head.

*b. DISASSEMBLY OF RECORDING HEAD.* (1) Using a straight edge, measure the exact distance from the back of the carriage bracket to the center of the recording needle (with the track indicator showing 001). Use this same distance to locate a new recording arm in the carriage bracket in order to maintain the same recorder-head position for track 1.

(2) Unsolder all four leads from the cable plug.

(3) Release the outer recorder-cone-pivot-bearing lockscrew

(119, fig. 18). Using a screw driver, loosen the outer-cone pivot (118) until the recorder head can be removed. Do not turn the inner-cone pivot; use its fixed position as a reference point for locating the recording head upon reinstallation.

c. ASSEMBLY OF RECORDING HEAD (fig. 32). If a different recording head is installed, proceed as follows:

(1) Set the hinge-pin projection (64) in the new recording head to match that of the hinge-pin projection and position in the old recording head. (If no substitution is made, the hinge-pin position need not be changed.) It is important that the hinge-pin eccentric is in the same angular position.

(2) Loosen the setscrew (121) and turn the adjusting stud (62) as close as possible to the bottom of the recording arm.

(3) Install the new recording head in place and tighten the outer-cone-pivot pin (118, 119, fig. 18 and setscrew).

(4) Measure the distance from the back of the casting to the center of the recording needle.

**Caution:** Carefully avoid touching the sapphire point of the recording needle with the scale (straight edge) while this measurement is made.

(5) If the distance is different from that obtained on the old recording head, release the hinge-pin setscrew (119, fig. 18) and move the recording head on its hinge pin (64) until the correct measurement is attained. Readjust hinge pin (64) if necessary.

(6) With the recording-arm spring removed, adjust the outer-pivot pin (118, fig. 18) until the friction of the cone point (ball) is just enough to support the weight of the recording arm in a horizontal position. This will assure absence of end play, and at the same time, will not apply enough load to offset the pressure of the recording-arm spring. Tighten the pivot setscrew (119, fig. 18).

(7) Raise the recording arm about 45° or higher on its pivot and install the recording-arm spring. Press down until the recording arm is in the carriage casting as far as possible. Tie the arm to the casting. This will hold the recorder in place until the assembly is reinstalled on the main frame.

(8) Adjust the track-adjusting screw (56) until the point of the screw (ball end) projects farther than the adjusting screw projected on the old recording arm. This is done to prevent the recording needle from hitting the recording drum until it is necessary to adjust the recording needle for track depth. (See par. 101.)

(9) Turn the selector knob to NEUTRAL.

d. ASSEMBLY OF CARRIAGE BRACKET ON THE MAIN FRAME

(fig. 18). (1) Place the carriage bracket assembly on the main frame. Replace the three screws into the holes on the rear of the main frame. Proceed to assemble in reverse manner to that used for the disassembly (*a* above).

(2) While placing the carriage bracket on the main frame, do not allow the recording needle to touch any part of the set. It will also be necessary to hold the playback-lift rod (123) in place until the assembly is back on the main frame.

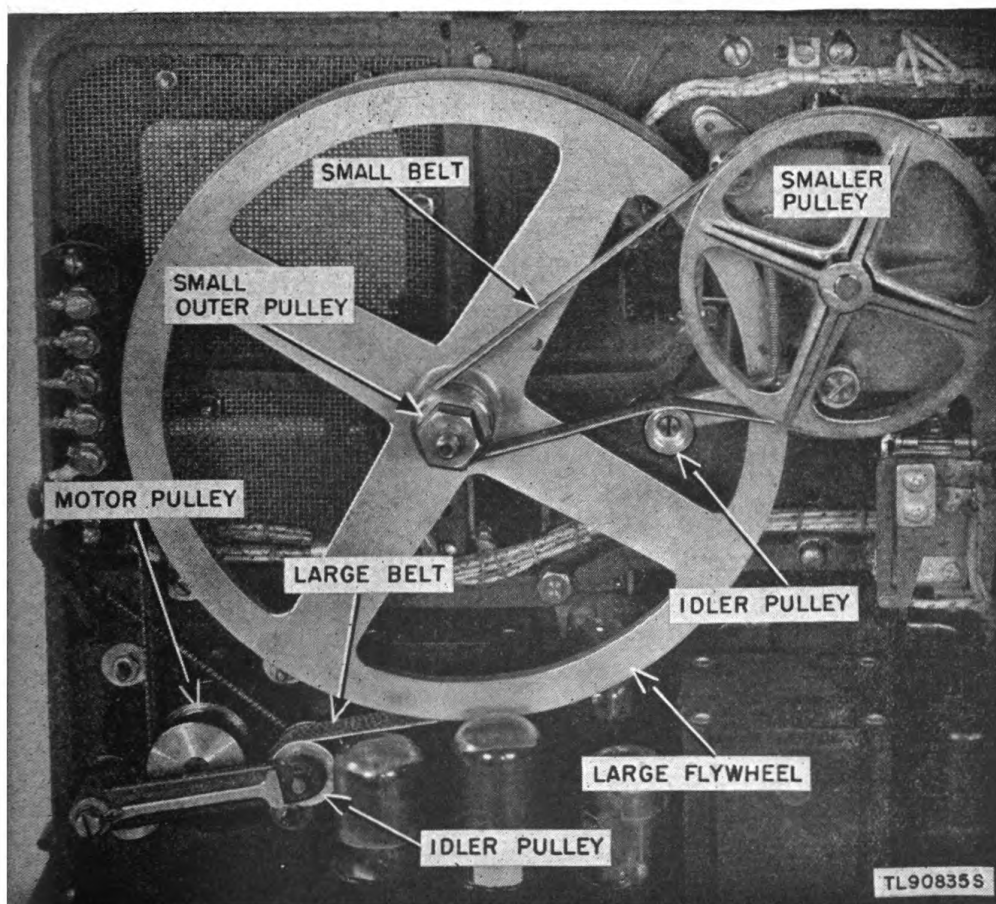
(3) Adjust the recording arm for depth of track (par. 101).

(4) Turn the selector knob to RECORD. Loosen the setscrew (121) and back off the adjusting screw (62) until the surface of the screw clears the recording-arm-lift rod by about 0.010 to 0.015 inch. *This clearance must exist with the recording needle resting on a film.*

(5) After making this adjustment, check whether the recording needle clears the film in all other selector knob positions except RECORD.

#### 94. Disassembly and Assembly of Belts (fig. 43)

*a. DISASSEMBLY.* (1) *Sound Recording Set AN/UNQ-1A* (fig. 43). (*a*) Remove power plug from receptacle.



*Figure 43. Belts and pulleys, Sound Recording Set AN/UNQ-1A.*

(b) Remove the back cover from carrying case.

(c) Pull off small belt from small outer pulley on the flywheel shaft. Remove belt from around the smaller pulley.

(d) Pull off belt from around the motor pulley. Pull off belt from large flywheel.

*Note.* Disassembly of the idler-pulley arm is not necessary. The belt may be squeezed between the idler-pulley arms and the pulley or flywheel (as required).

(2) *Sound Recording Set AN/UNQ-1.* (a) Disconnect power plug from receptacle.

(b) Remove back cover of carrying case.

(c) Pull off belt from motor pulley and then off the flywheel.

b. **ASSEMBLY.** (1) *Sound Recording Set AN/UNQ-1A* (fig. 43). (a) Place new large belt around the large flywheel. Squeeze the belt between the idler-pulley arm and the flywheel.

(b) Place the belt around the motor pulley. Squeeze the belt between the motor pulley and the idler-pulley arm.

(c) Place the small belt around the smaller pulley and then around the small outer pulley on the flywheel shaft.

(d) Rotate the flywheel counterclockwise by hand to check alignment of pulleys. If pulleys are not in line, the belt may run off. Loosen pulley, tap into alignment, and tighten the set-screw. Replace the carrying-case cover.

(2) *Sound Recording Set AN/UNQ-1* (fig. 44). (a) Place the belt around the flywheel.

(b) Force the belt on the motor pulley. Keep the idler pulley under the belt.

(c) Replace the carrying-case cover.

*Note.* For instructions covering the exchange of belts and pulleys and for reducing recording and playback speed from the standard rate of 60 feet per minute (fpm) to 40 feet per minute, see paragraph 103.

## 95. Emergency Repair

In the event of failure of the relay to pull back the clutch latch (fig. 30) from the clutch release hub, thus preventing the transfer of power from the flywheel to the film sprocket, proceed as follows: (It is assumed that steps have been taken to locate the trouble as outlined in paragraph 76.)

a. Remove the cover over the clutch relay.

b. Locate and tie the clutch latch (relay armature) to the relay body or other suitable surface. (See fig. 30.)

c. Operate the set by turning VOLUME knob to start and stop the sprocket rotation. Keep the MOTOR switch in START position.



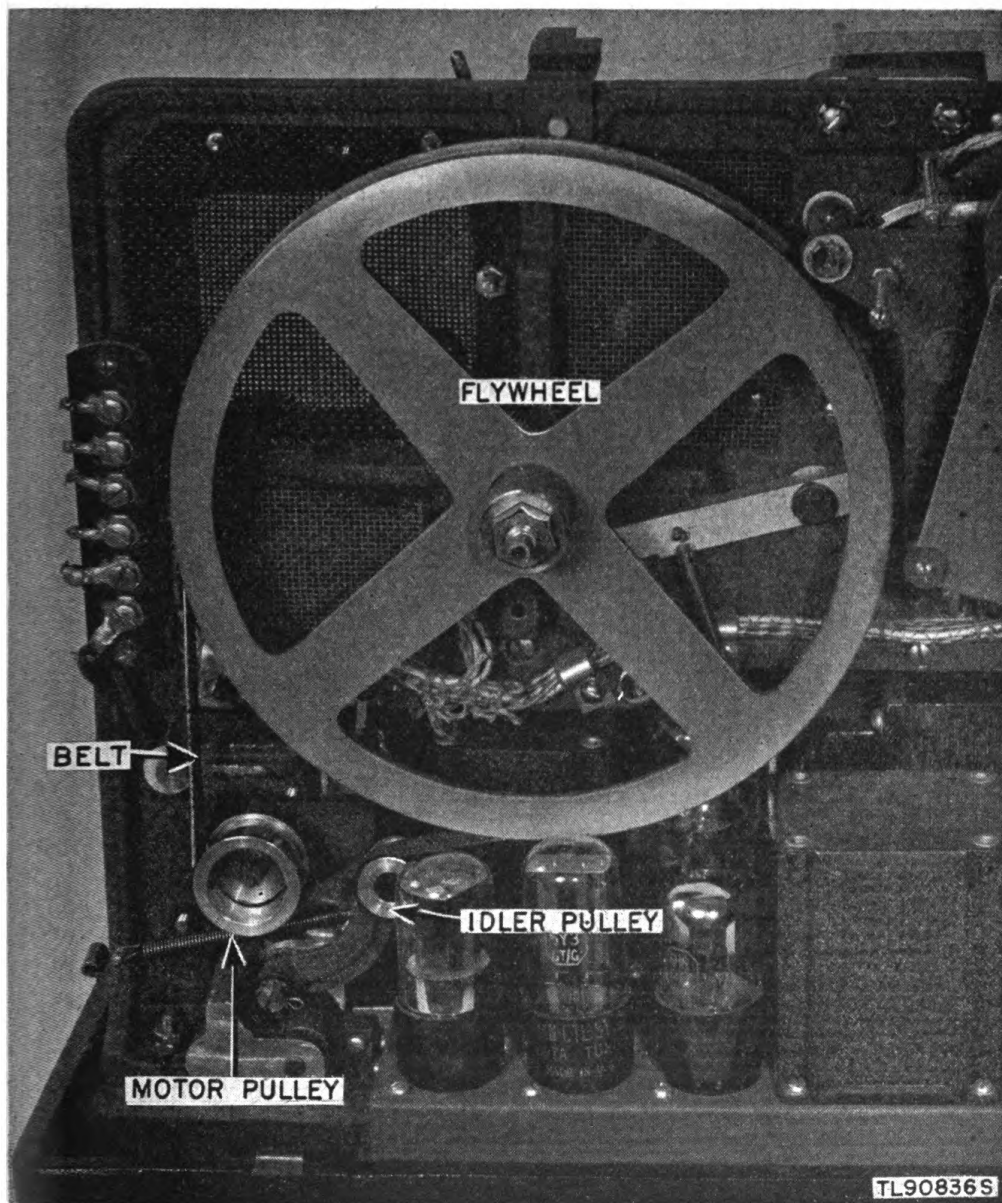


Figure 44. Belt and pulley, Sound Recording Set AN/UNQ-1.

d. Replace the cover over the relay clutch and tighten securely.

## 96. Unsatisfactory Equipment Report

a. When trouble in equipment used by Army Ground Forces or Technical Services occurs more often than repair personnel feel is normal, War Department Unsatisfactory Equipment Report, WD AGO Form 468 (fig. 45) should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C.

b. When trouble in equipment used by Army Air Forces occurs

WAR DEPARTMENT UNSATISFACTORY EQUIPMENT REPORT									
<b>FOR</b>	TECHNICAL SERVICE Signal Corps	<b>MATÉRIEL</b>	DATE 31 May 1945						
<b>FROM</b>	ORGANIZATION 579 Sig Repair Co	STATION APO 111 San Francisco, Cal.		TECHNICAL SERVICE					
<b>TO</b>	NEXT SUPERIOR HEADQUARTERS Signal Officer Tenth Army	STATION APO 311 San Francisco, Cal.							
COMPLETE MAJOR ITEM									
NOMENCLATURE Recorder- Reproducer AN/GNQ-00		TYPE Dual turntable	MODEL						
MANUFACTURER XYZ Company	U. S. A. REG. NO. 9260-P-45-25	SERIAL NO. 397	DATE RECEIVED 1 May 1945						
EQUIPMENT WITH WHICH USED (if applicable) Reproducer AN/GNQ-00									
DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE									
PART NO. 3DA2-147.1	TYPE Capacitor C-118	MANUFACTURER ABC Company	DATE INSTALLED 2 May 1945						
DESCRIPTION OF FAILURE AND PROBABLE CAUSE (If additional space is required, use back of form) Capacitor C-118 shorts out internally.									
DATE OF INITIAL TROUBLE 8 May 1945	TOTAL TIME INSTALLED		TOTAL PERIOD OF OPERATION BEFORE FAILURE						
	YEARS	MONTHS	DAYS	YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
			29			6			
BRIEF DESCRIPTION OF UNUSUAL SERVICE CONDITIONS AND ANY REMEDIAL ACTION TAKEN Hot and humid operating conditions; replaced capacitor from station stock, DOW capacitor shorted after 11 days.									
TRAINING OR SKILL OF USING PERSONNEL		RECOMMENDATIONS (If additional space is required, use back of form)							
POOR	FAIR	GOOD	X			Substitute capacitor designed for tropics.			
ORIGINATING OFFICER									
TYPED NAME, GRADE, AND ORGANIZATION G. S. RAINS, Capt Sig C 579 Sig Repair Co				SIGNATURE <i>G.S. Rains</i>					
FIRST ENDORSEMENT									
<b>TO CHIEF</b>	TECHNICAL SERVICE	OFFICE							
NAME, GRADE, AND STATION	STATION		DATE						
<i>Instructions</i>									
<ol style="list-style-type: none"> <li>1. It is imperative that the chief of technical service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in matériel. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.</li> <li>2. This form will be used for reporting manufacturing, design, or operational defects in matériel, petroleum fuels, lubricants, and preserving materials with a view to improving and correcting such defects, and for use in recommending modifications of matériel.</li> <li>3. This form will not be used for reporting failures, isolated material defects or malfunctions of matériel resulting from fair-wear-and-tear or accidental damage nor for the replacement, repair or the issue of parts and equipment. It does not replace currently authorized operational or performance records.</li> <li>4. Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in AR 780-10 (change No. 3).</li> <li>5. It will not be practicable or desirable in all cases to fill all blank spaces of the report. However, the report should be as complete as possible in order to expedite necessary corrective action. Additional pertinent information not provided for in the blank spaces should be submitted as inclosures to the form. Photographs, sketches, or other illustrative material are highly desirable.</li> <li>6. When cases arise where it is necessary to communicate with a chief of service in order to assure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.</li> <li>7. This form will be made out in triplicate by using or service organization. Two copies will be forwarded direct to the technical service; one copy will be forwarded through command channels.</li> <li>8. Necessity for using this form will be determined by the using or service troops.</li> </ol>									
W. D., A. G. O. Form No. 468 30 August 1944			This form supersedes W. D., A. G. O. Form No. 468, 1 December 1943, which may be used until existing stocks are exhausted.						
U. S. GOVERNMENT PRINTING OFFICE 16-41846-1									
TL 903565									

Figure 45. WD, AGO Form 468, Unsatisfactory Equipment Report.

more often than repair personnel feel is normal, Army Air Forces Form 54 (fig. 46) should be filled out and forwarded to Commanding General, Air Matériel Command, Wright Field, Dayton, Ohio, in accordance with AAF Regulation No. 15-54. If form is not available, prepare the data according to the sample form shown in figure 46.

WAR DEPARTMENT A. F. FORM NO. 54 (Rev. 3-2-43)		WAR DEPARTMENT ARMY AIR FORCES		LEAVE BLANK	
TO BE FILLED IN BY STATION				A. F. C. SERIAL No.	
STATION SERIAL No. 14 PAD 44		DATE SUBMITTED 5 Jan 44		REFER TO	CLASS
<b>UNSATISFACTORY REPORT</b> <small>(See AAF Reg. 15-54 for information on Proper Use of this Form)</small>					
STATION Panama Air Depot			ORGANIZATION 909th Signal Co Depot Avn		
SUBJECT OF REPORT Property Class-Name Radio Set SCR-588-B, U.S. Ser. #50		Manufacturer R.E.L.		AAF Order or Shipping No.	
AIRCRAFT—Model & AAF Serial No.		ENGINE—Model & AAF Serial No.		UNIT OR ACCESSORY—Type, Model and Serial No. Antenna Control KC-388-B	
AIRCRAFT REPORTS ONLY LAST R. L. E.—Depot		Hours Since		Flying Time Since Total Flying Time	
ENGINE REPORTS ONLY LAST OVERHAUL—Depot		Hours Since		Depots and Hours At Each Previous Overhaul	
PART NAME Plate Transformer, R.E.L. #14033		PART DRAWING, SERIAL AND SPECIFICATION No. Item T1, Fig 21, Power Turning Gear Bk			
TIME IN USE 1450 hours		QUANTITY KNOWN DEFECTIVE 3		NO. PREVIOUS FAILURES 2	
DISPOSITION OF EXHIBIT Photographed and Prints Enclosed <input type="checkbox"/>		SENT UNDER SEPARATE COVER <input type="checkbox"/>		REPAIRED AND RETURNED TO SERVICE <input type="checkbox"/>	
HOLD FOR INSTRUCTIONS <input checked="" type="checkbox"/>		SENT IN ATTACHED PACKAGE <input type="checkbox"/>		DISPOSED OF (Explain Below) <input type="checkbox"/>	
				TO OVERHAUL FACILITY (INITIALS) <input type="checkbox"/>	
GIVE COMPLETE DETAILS, PROBABLE CAUSES AND RECOMMENDATIONS BELOW: <small>(Use Only Applicable Spaces Above—Avoid Unnecessary Repetition)</small>				<b>EXPEDITE</b>	
<p>1. This organization has experienced three (3) plate transformer failures in the Thyatron control of an Early Warning Ground Radar Set, SCR-588-B, located in the vicinity of Panama. This set has been in operation for approximately nine (9) months, twenty-four (24) hours a day, except when shut down for brief periods during which time the set was given a complete preventive maintenance check-up. This set has had an inspection by an engineer from the PAD monthly and no abnormal operating conditions were observed.</p> <p>2. While the Thyatron is not equipped with the Thyatron Fan Modification Kit, No. 588B-A2, the operating temperature was not abnormal due to air conditioning of the room and also to the removing of the Thyatron side panels. The operating room was maintained at 72° and humidity at 50%.</p> <p>3. After being in service for about two months, the transformer became very hot, smoke poured out, and antenna became inoperative. Upon investigation, one secondary of the transformer was found to have had shorted turns. The circuit and all relative parts and components were thoroughly checked afterward and proved in proper working condition. This transformer had been impregnated against moisture. This part had been manufactured by the Hammond Company. The two previous defective parts had been manufactured by the Canadian Transformer Company.</p> <p>4. It is the opinion of this organization that the fault lies in improper design of the transformer. As a substitute, four small receiver type transformers were installed externally, which proved operationally satisfactory.</p>					
UR		ROUTING		UR	
<small>SEND ORIGINAL AND TWO COPIES DIRECT TO COMMANDING GENERAL, HQ. AIR SERVICE COMMAND, PATTERSON FIELD, FAIRFIELD, OHIO. * U. S. GOVERNMENT PRINTING OFFICE: 1943 16-34619-1</small>					

TLI9932

Figure 46. AAF Form 54, Unsatisfactory Report.

### Section XIII. ALIGNMENT AND ADJUSTMENT

#### 97. Adjustment of Film Flanges on Recording Drum (fig. 39)

a. GENERAL. The smooth running of the film flanges on the recording drum is very important to the smooth operation of the recording set. If the inner (101) or outer (100) flange does not turn regularly, the edge of the film may cut grooves in the face of the flanges. These grooves interfere with the proper register

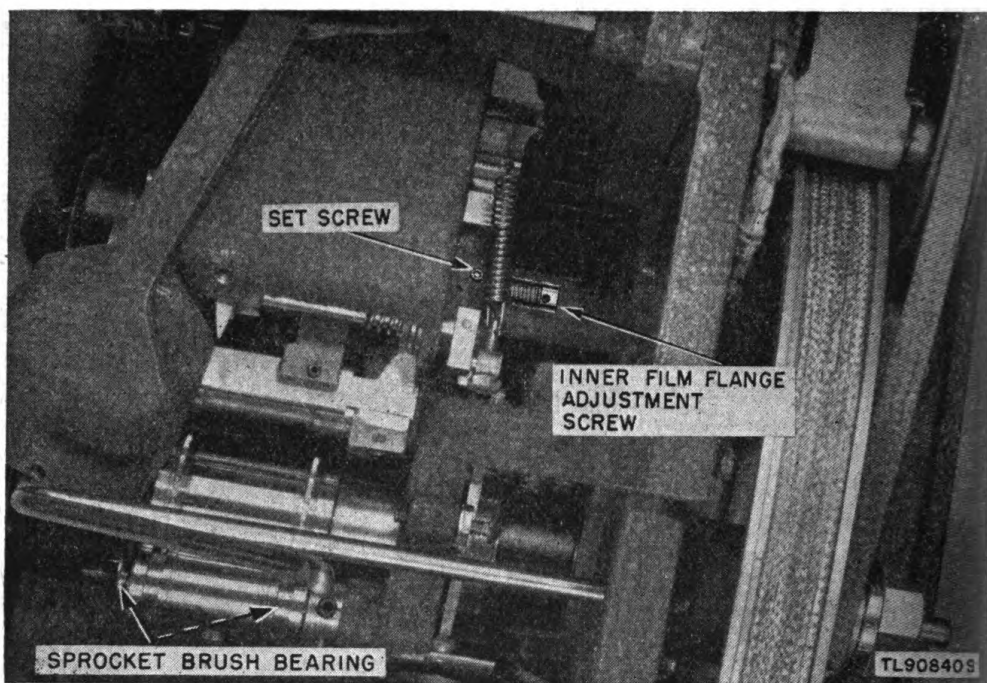


Figure 47. Inner-film-flange adjustment screws.

of the film during recording and in some cases cause the film to run off the drum. Pressure is supplied by springs, the tension of which may require adjustment.

*b.* ADJUSTMENT OF INNER-FILM FLANGE (101). (1) Loosen the setscrew in the top of the recording bracket (fig. 47).

(2) Using the small Allen wrench, turn the adjusting screw counterclockwise until the inner flange stops turning with the film running over the recording drum.

(3) Turn the adjusting screw clockwise until the flange starts to turn.

(4) Lock the adjustment by turning down the setscrew.

*Note.* The inner-film flange is held in position against the rear drum bearing by a spring plunger (94). The spring plunger is mounted in an adjusting screw (95) threaded into the recording bracket. This is set at the factory to a 960 to 1,000 gram pressure.

*c.* ADJUSTMENT OF OUTER-FILM FLANGE (100). (1) The outer spring flange is held in engagement with the outer edge of the film by a spring (99). This spring is backed up by an adjusting nut (98) threaded on the outer end of the film-flange shaft (93). This flange is set to a pressure of 200 to 250 grams. If this pressure is too great, it will cause the film to buckle, resulting in film scoring. If the pressure is not great enough, the film will not be held in position during recording. Be careful that the adjusting nut (98) is not backed out beyond the end of the film-flange shaft, because it would then interfere with the front casting

plate (96) of the recording bracket and stop the rotation of the film flanges (on Sound Recording Set AN/UNQ-1 only). If a gram scale is not available, set the outer face of the adjusting nut (98) to  $\frac{1}{32}$  inch of the end of the shaft.

(2) The spring flange, without film, should come to rest against the outer bearing of the recording drum so that the space between the two flanges is approximately  $\frac{1}{64}$  inch less than the width of the film. This film is  $1\frac{3}{8}$  inches wide.

(3) This space should be watched if the bearing in the drum should be replaced at any time. If the difference is greater than  $\frac{1}{64}$  inch, there will be difficulty in threading the set. If the distance between the flanges is greater than  $1\frac{3}{8}$  inches, the film will not be held in position.

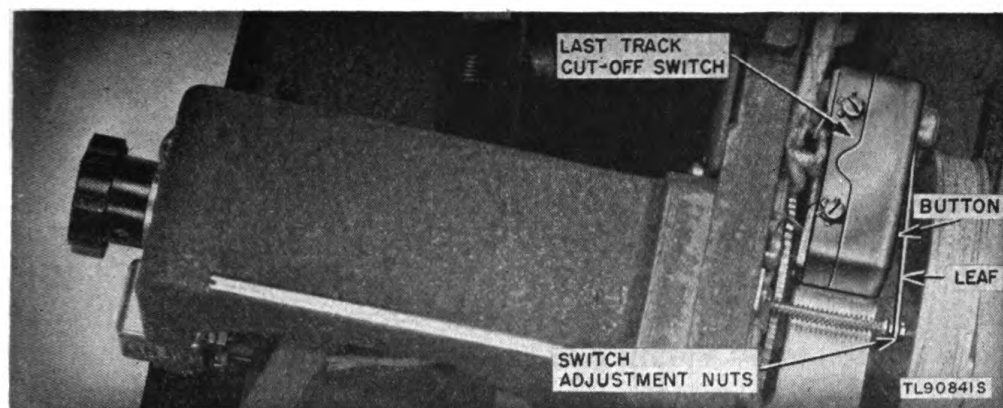


Figure 48. Last track cut-off switch (SW7) adjustments.

## 98. Adjustment of Last Track Cut-Off Switch (SW7) (fig. 48)

*a. GENERAL.* The last track cut-off switch breaks the 110-volt circuit to both the main-drive motor (and the trackage motor on Sound Recording Set AN/UNQ-1). When the carriage mechanism, in advancing across the film, reaches track No. 115, this switch opens the circuit to stop further advance of the carriage mechanism and subsequent damage to the playback needle on the sprocket teeth. If the motor does not cut off at track 115, adjust as follows:

*b. ADJUSTMENT.* (1) Remove power plug from 110-volt receptacle.

(2) Remove the back cover of carrying case.

(3) Adjust the two adjustment nuts at the end of the rod (fig. 48) so that the leaf on the microswitch presses against the small button on the microswitch when the carriage is moved to track No. 115. A faint click should be heard when this small button is pressed in by the leaf.

(4) Check the adjustment by rotating the index knob up to

and past 115 on the track indicator. Listen carefully when 115 is reached. If the click is heard, the two nuts at the end of the rod are set properly. Tighten these nuts to hold the adjustment.

(5) Check the electrical operation of the switch by plugging the 110-volt plug into the a-c receptacle. Start the motor, and with the selector knob in NEUTRAL position, turn the index knob to 115 and beyond. The drive motor should stop running when No. 115 is passed.

## 99. Adjustment of Film Switch (SW9) (fig. 49)

*a. GENERAL.* Film switches used on Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A are different in type and size. Their functions are the same. The film switch used in Sound Recording Set AN/UNQ-1 (fig. 49) consists of contacts on switch leaves. A microswitch (fig. 50) is used in Sound Recording Set AN/UNQ-1A. Both may require adjustment for proper action.

*b. FILM SWITCH ROLLER.* A roller is used on the film switch on early models of Sound Recording SET AN/UNQ-1. If this roller for any reason fails to rotate as the film passes by, a groove may develop on the roller surface. If the groove is deep enough, the switch contacts will make and stay that way. The result will be a continuously running carriage motor. Always check for this condition before attempting to adjust the gap between the contacts on the switch leaves. Sapphire rods are used in Sound Recording Set AN/UNQ-1A and on some later models of Sound Recording Set AN/UNQ-1. These rods should not wear enough to cause the above condition. If wear is present in the sapphire rods, or if the switch fails to break after the notches (on the film) pass by, adjustment may be in order.

*c. ADJUSTMENT (SOUND RECORDING SET AN/UNQ-1).* (1) Remove switch from set (par. 91) after removing film.

(2) If the groove in the roller is deep, remove the roller and clean thoroughly. Replace roller in upside down position to present new surface to film. If the roller is free of groove, and is turning freely, check the contact gap.

(3) Contacts should be closed normally. Bend one blade if necessary to close contacts.

(4) Place the switch back in the set. Replace the film. Run film through set and note action of film switch when notches pass the roller or sapphire rod. (Late models of Sound Recording Set AN/UNQ-1 use only one sapphire rod which rests against the edge of the film.) If the carriage motor fails to start as the

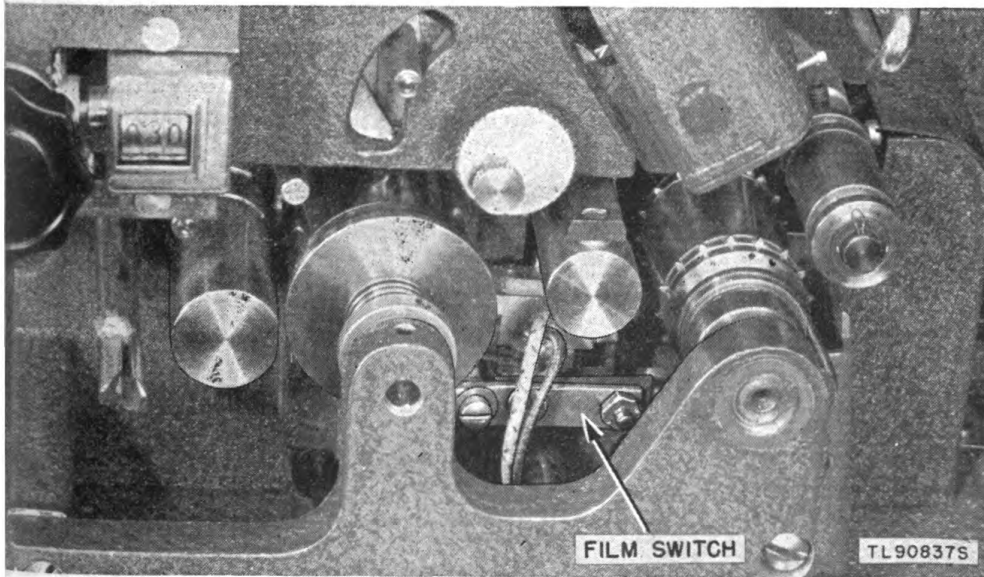
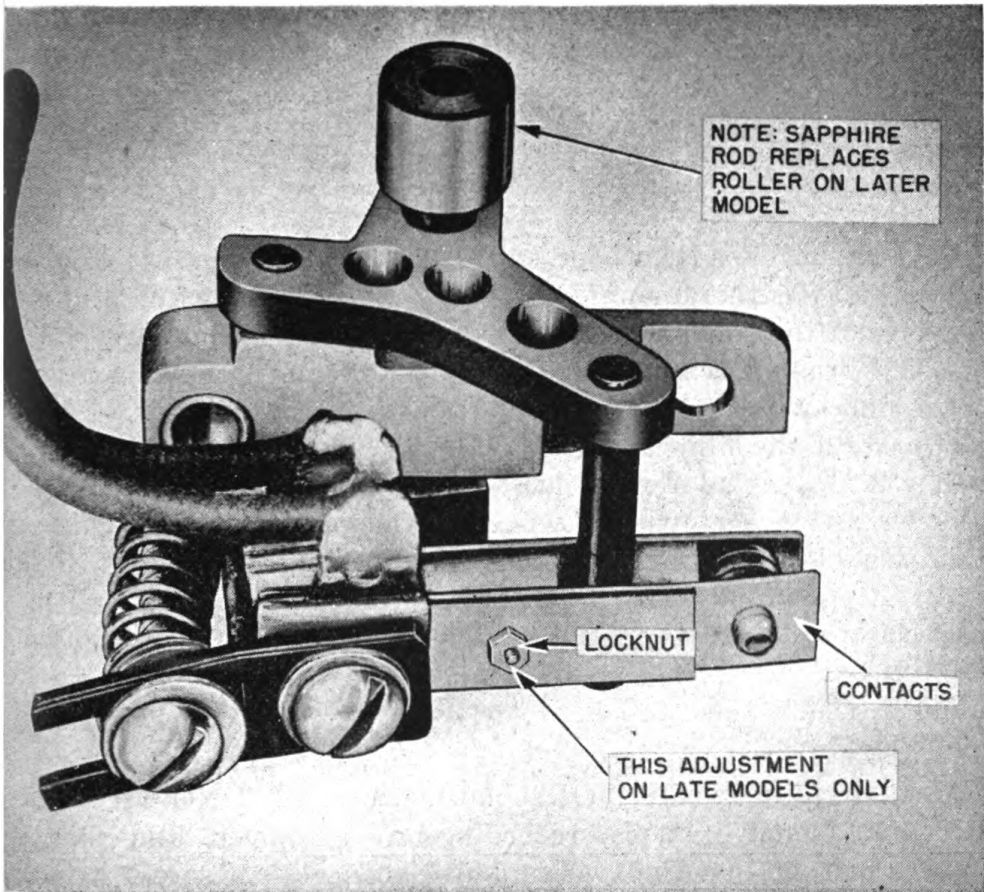


Figure 49. Film switch (SW9) used in Sound Recording Set AN/UNQ-1.

notches pass the film switch, the contacts do not close. Bend the blade a little more. Recheck with the film running through.

*Note.* Film switches on later models of Sound Recording Set AN/UNQ-1 are provided with an Allen-head adjustment screw on the leaf of the switch. (See fig. 49.) Turning this screw clockwise increases the gap between the contacts; turning the screw counterclockwise decreases the gap between the contacts.

(5) The screw adjustment (fig. 49) which acts against a coiled spring governs the amount of opening of the film switch and the pressure of the roller or sapphire rod against the film edge. The sprocket brush assembly (fig. 1) must be removed to gain access to the film switch for checking gap between contacts.

(6) With the film in correct position, the gap should be  $\frac{1}{32}$  inch. If gap is too wide, loosen locknut and turn Allen-head adjusting screw counterclockwise. If the gap is too narrow, turn the screw clockwise to increase it. Tighten the locknut.

(7) Run the film through the set. The carriage motor should start running a fraction of a second after the first notch passes the film switch.

(8) Replace the sprocket-brush assembly, cover plate, and knobs.

*d.* ADJUSTMENT (SOUND RECORDING SET AN/UNQ-1A) (fig. 50). (1) Remove knobs, recording-bracket cover, and film.

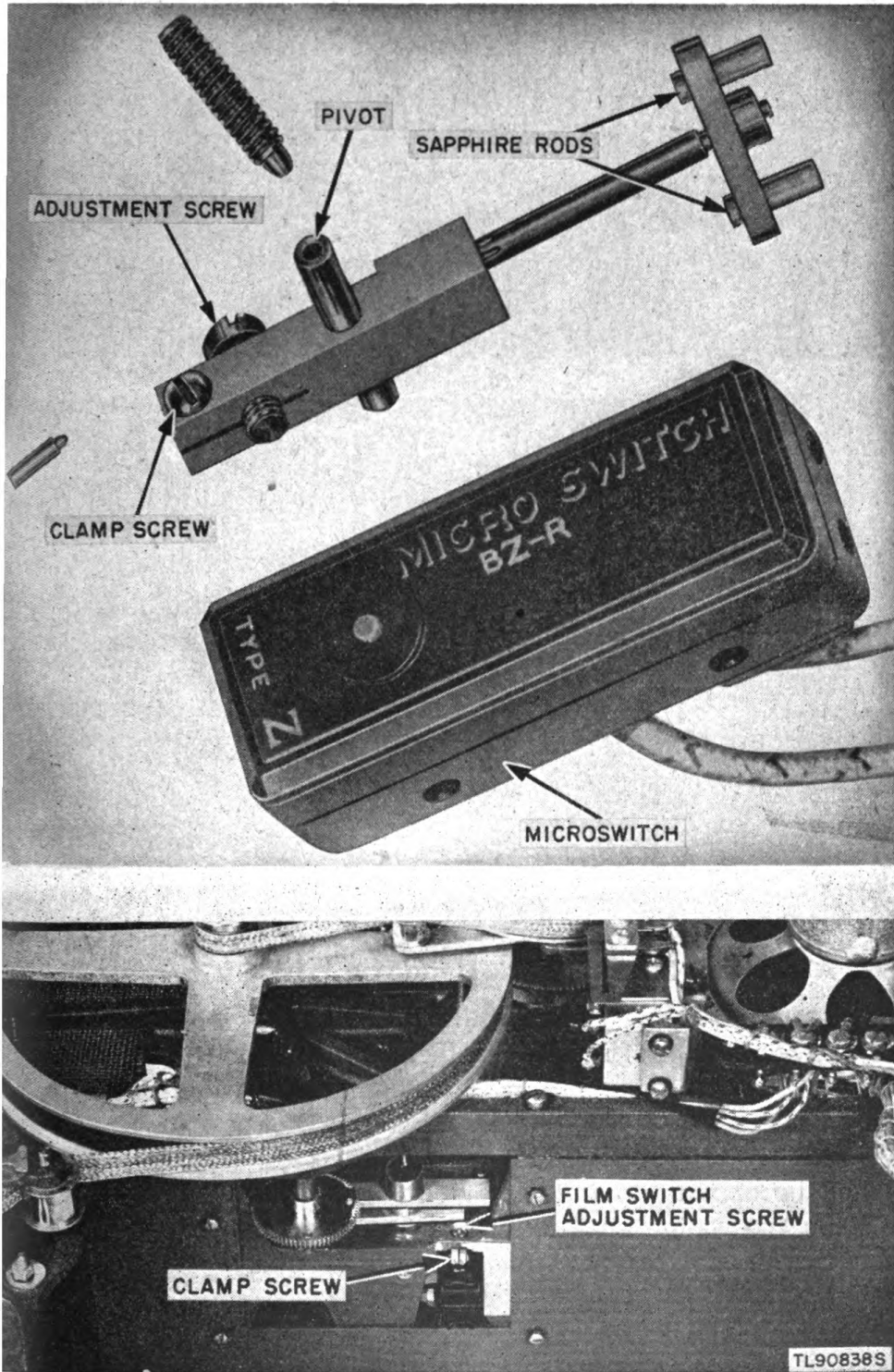
(2) Push against the two sapphire rods with a screw driver. Clicks should be heard in the microswitch when this is done. Tighten the two filmswitch mounting screws at the left side of recording bracket.

(3) Place the film back into the set. Run film through set until notches are opposite the two sapphire rods. With the film in this position, loosen the clamp screw and back out the adjusting screw just enough to operate the switch. (The adjusting screw is reached with a long screw driver from the rear of the set.)

(4) Adjustment is correct if the microswitch (SW9) closes when the two sapphire rods are in the notch. When the sapphire rods rest against the edge of the film (not in the notch) the microswitch should be open. Make a test with the film running through the set.

*Note.* If the microswitch fails to open for any reason, the track-over operation will continue until the last track cut-off switch shuts off the drive motor.





**Figure 50.** *Film switch (microswitch) used in Sound Recording Set AN/UNQ-1A.*

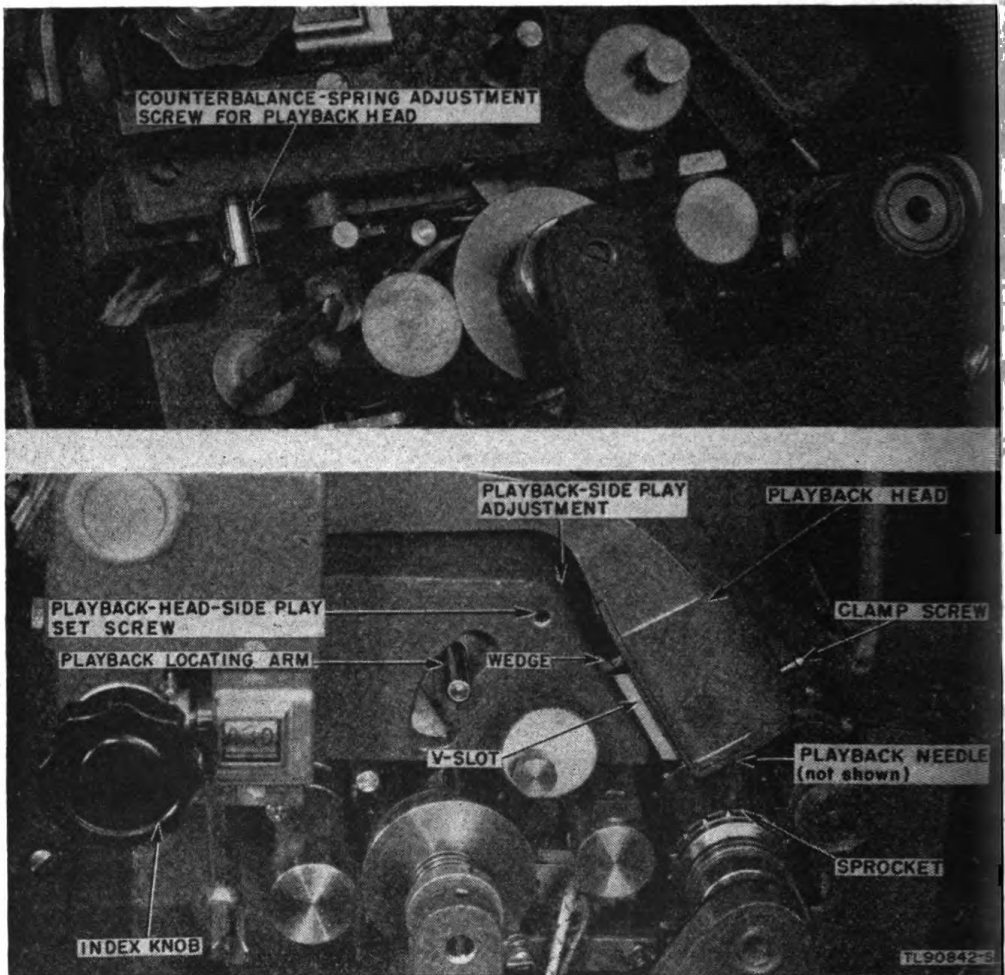


Figure 51. Playback-head adjustments.

## 100. Adjustment of Playback Head (fig. 51)

a. GENERAL. The wedge which fits into the V slot in back of the playback head is inserted sufficiently to permit movement of the playback head one-half track either side of the groove in use (when the selector knob is in PLAYBACK position). If the playback head is permitted to swing more or less than this amount, it may be difficult to index the playback head. Too close a fit between the wedge and the V slot will increase spring pressure and force the playback-head needle into the film.

b. ADJUSTMENT OF SIDE PLAY OF PLAYBACK HEAD (fig. 51).

(1) Loosen the setscrew. Turn adjusting screw clockwise to increase the side movement. Tighten the setscrew.

(2) Check by playing back a good recording. If the playback head swings too much (too much sidewise freedom), loosen the setscrew and turn the adjusting screw counterclockwise. Check by playing back a good recording. Tighten the setscrew.

(3) To check whether too close a setting is a cause of distortion, push down the playback locating arm to disengage the playback head. If distortion disappears, the clearance may be too close and the adjusting screw must be turned in a clockwise direction.

c. CHECKING AND ADJUSTING WEIGHT OF PLAYBACK ARM. (1) Turn selector knob to NEUTRAL. Turn MONITOR knob to point up. Leave film on sprocket.

(2) Turn index knob to indicate 001 on track indicator.

(3) Loosen the setscrew for the counterbalance-spring adjustment screw (fig. 51).

(4) Turn the selector knob to PLAYBACK (be sure that film is on the sprocket).

(5) Hook a gram (or ounce) scale to the needle clamp screw. If needle clamp screw does not protrude (as on later models) hook scale to playback needle. Make allowance for weight of string or wire used.

(6) Lift scale until the playback head needle just clears the sprocket. Observe weight on scale. Normal weight is 62 grams or about  $2\frac{1}{8}$  ounces (about 50 grams or approximately  $1\frac{3}{4}$  ounces for the playback head on Sound Recording Set AN/UNQ-1A). When lowering scale, be very careful to avoid sharp contact between the playback needle and the sprocket surface. Turn the selector knob to NEUTRAL as soon as the weight is obtained.

(7) Turn the counterbalance-spring adjustment screw to left or right as is necessary. Tighten setscrew.

**Caution:** A very little turn on the counterbalance-spring adjustment screw will make a considerable difference in the weight at the point of the playback needle.

## 101. Adjustment of Recording Head

a. GENERAL. A common cause of trouble originating in the recording-head assembly is too shallow or too deep a track made by the recording needle. Too shallow a track permits wandering of the playback needle during the playback operation. Too deep a track splits and ruins the film.

b. DETERMINING DEPTH OF TRACK. Record three or four unmodulated (no sound) tracks and inspect them with a strong reading glass or low-power microscope. The correct depth of track is indicated by its width. For best results the *track* and the *space between tracks* should be about *equal*. The track width must not be greater than the space between the tracks. If the track width is less than between  $\frac{4}{5}$  or equal to the space between the tracks, adjustment is required.

c. ADJUSTING DEPTH OF TRACK. Before adjusting the depth of track, check for tearing or other form of mutilation of the walls

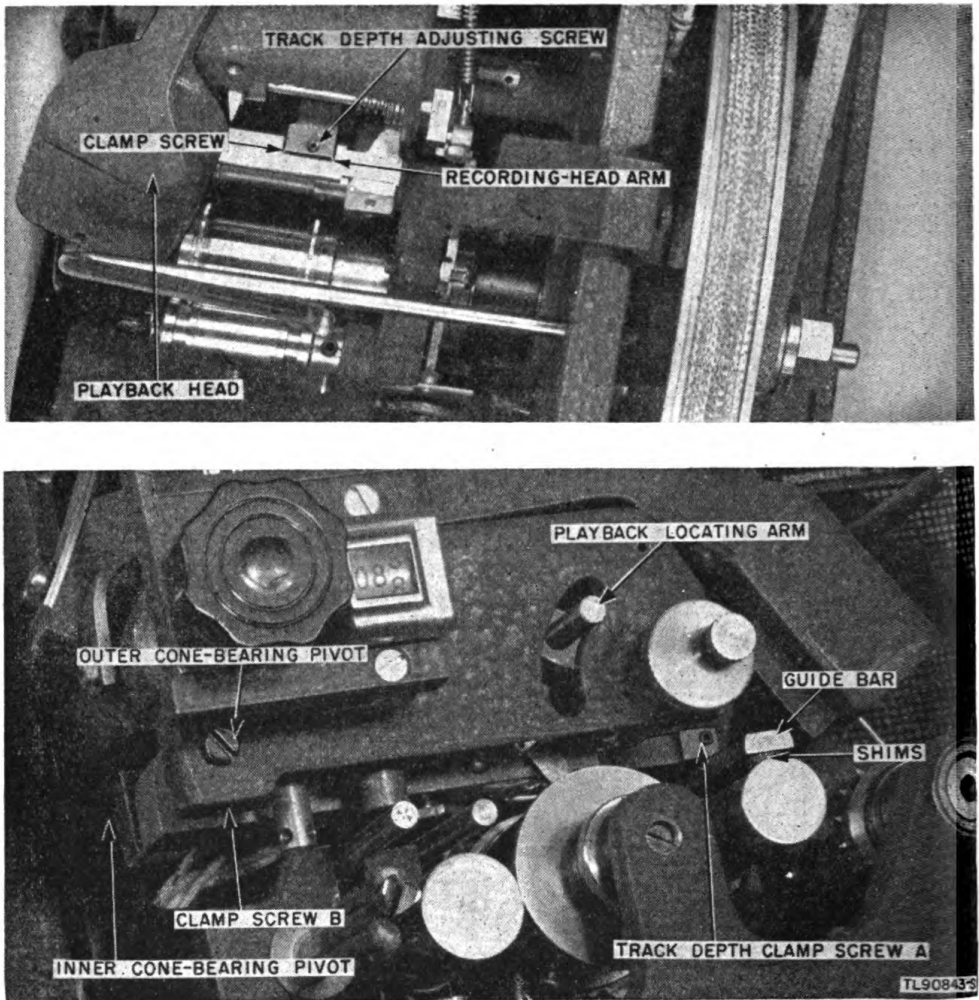


Figure 52. Recording-head adjustments.

of the groove. If mutilation exists, the needle is probably chipped or otherwise damaged. Change the needle and make more unmodulated tracks. Check again for depth. If adjustment is required, proceed as follows (fig. 52) :

(1) Push down the playback locating arm to release the playback head. Move the playback head, to the side to expose the track-depth-adjusting screw. If necessary (with selector knob on NEUTRAL) turn the index knob until the track-depth adjusting-screw clamp screw is more accessible.

(2) Loosen the clamp screw. Turn the track adjustment screw to the right to decrease the depth of the track. Turn to the left, to increase the track depth. A slight turn will affect the depth of the track considerably.

(3) Check the depth of the track as outlined above. Readjust as required. Tighten the clamp screw and lock the playback head in place with the playback locating arm.

(4) Make a recording and playback to check sound.

*d.* CHECKING AND ADJUSTING RECORDING-ARM PIVOT (fig. 52).

If the recording arm is not free to move up and down, the recording needle will not freely reach the depth of track to which it is adjusted. To check for freedom of action at the cone-bearing pivots, insert a screw driver under the recording head arm (fig. 52) (with selector knob in RECORD position) and rock arm a few times. See if the recording head returns to normal rest position freely. Adjust only if necessary. To adjust, proceed as follows (fig. 52) :

(1) Loosen the clamp screw B. Using a screw driver, turn the outer-recorder-cone-pivot-bearing screw slightly counterclockwise and recheck.

(2) Tighten the clamp screw B and make a recording to test for complete freedom of action.

## 102. Calibrating Meter

The meter is connected across the recording head circuit. Failure of the meter to operate is usually due to failure of the copper-oxide rectifier MR1. (See fig. 54.) Failure of the rectifier usually results in a low meter reading (for the input voltage being fed to the amplifier) or a vibrating needle (not corresponding to the output voltage variations). The copper-oxide rectifier is also subject to changing characteristics over a period of time. These changes will affect the meter readings. A variable resistor R2 (fig. 54) is provided for adjusting and compensating for these changes.

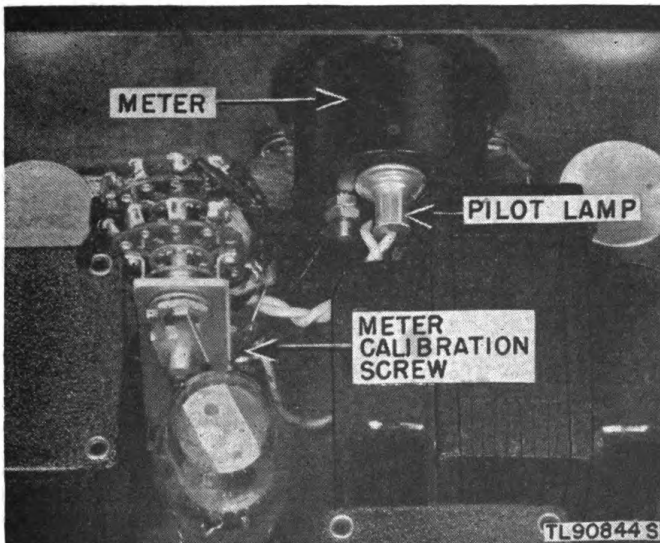


Figure 53. Meter-calibration resistor R2.

a. CALIBRATING METER. (1) Connect a high-resistance voltmeter (at least 1,000 ohms per volt) across the recording-head terminals on the rear of the plug receptacle (underneath trackage-motor assembly) or across the terminals 2 and 3 on terminal strip A (fig. 4) (on Sound Recording Set AN/UNQ-1A).

(2) Turn the selector knob to RECORD.

(3) Turn VOLUME knob to on (clockwise).

(4) Connect the output of an audio signal generator to the RADIO jack through a phone plug. Set the audio generator at 1,000 cycles. Turn VOLUME knob on recorder to right until the external voltmeter reads 2.5 volts.

(5) Turn the meter calibration screw (fig. 53) until the meter needle indicates a point on the scale at the beginning of OVER. Check the meter if it does not respond to adjustment.

b. ADJUSTING ZERO POSITION OF METER NEEDLE. After calibration of the meter as outlined above, shut off set and turn the meter-zero-adjustment screw to right or left to bring the needle to line on meter scale at the beginning of UNDER.

### 103. Changing Recording and Playback Speeds

a. GENERAL. Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A run film through the set at a standard speed of 60 fpm. At this speed, the frequency response is from 150 to 4,000 cycles. However, good results are obtained with the 40-fpm speed. Even at a speed of 20 fpm the set will record and play back intelligible voice (no pulley and belt are furnished for this speed). The 40-fpm speed is used for recording under conditions where long operative time (without changing film) is desired.

b. CONVERSION FROM 60 FPM TO 40 FPM (SOUND RECORDING SET AN/UNQ-1) (fig. 43). (1) Remove the back of the set.

(2) Remove the  $1\frac{1}{8}$ -inch-diameter motor pulley from the motor shaft and replace with the supplied  $\frac{3}{4}$ -inch-diameter pulley. Replace the  $28\frac{1}{16}$ -inch belt with the supplied  $27\frac{2}{32}$ -inch belt.

(3) Adjust the idler pulley to push up under the belt. Be sure to tighten the motor pulley on the drive-motor shaft so that the setscrew is applied against the flat portion of the motor shaft. Also see that the motor pulley and the flywheel pulley are lined up correctly.

c. CONVERSION FROM 60 FPM TO 40 FPM (SOUND RECORDING SET AN/UNQ-1A) (fig. 44). (1) Remove the back cover from the carrying case.

(2) Remove screw holding the idler-pulley arm to frame. Remove spring.

(3) Remove belt connecting large flywheel to motor pulley (pull off belt).

(4) Loosen setscrew on motor pulley with the No. 6 Allen-head wrench. Remove pulley.

(5) Pull off the belt connecting the outer pulley on the large flywheel to the small flywheel (pulley) driving the track-over mechanism.

(6) Place the supplied  $\frac{3}{4}$ -inch pulley on the drive-motor shaft, line up the pulley with the large flywheel, and tighten the setscrew.

(7) Replace the spring on the idler-pulley arm and reinstall the idler-pulley arm.

(8) Place the  $27\frac{2}{3}$ -inch belt over the large flywheel and then over the drive-motor pulley. While doing this, hold down the idler pulley with the right hand. When the belt is securely fitted to both pulleys, release the idler pulley and check its tension. Also check the alignment of the drive-motor pulley with the large flywheel pulley.

(9) Replace the smaller belt on the outer pulley and the track-over pulley. Check the idler-pulley tension.

(10) Check operation of set and before installing the cover of the carrying case, inspect the running of the belts for side friction. Replace cover.

*Note.* The belts are treated to protect them against moisture. Belts may stretch after long use; slippage will then occur. Replace belts that are stretched beyond use.

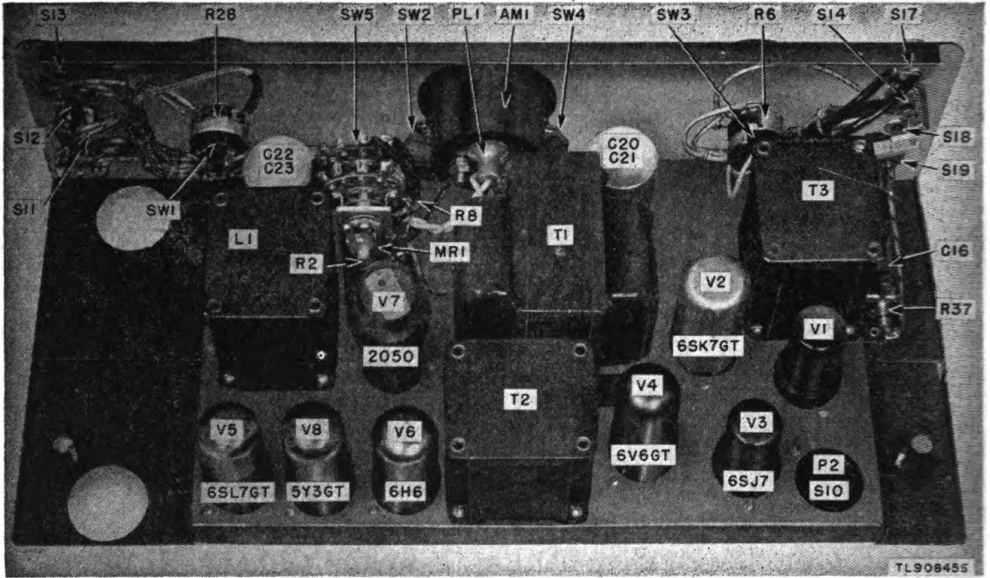


Figure 54. Location of parts on amplifier, Sound Recording Set AN/UNQ-1A.

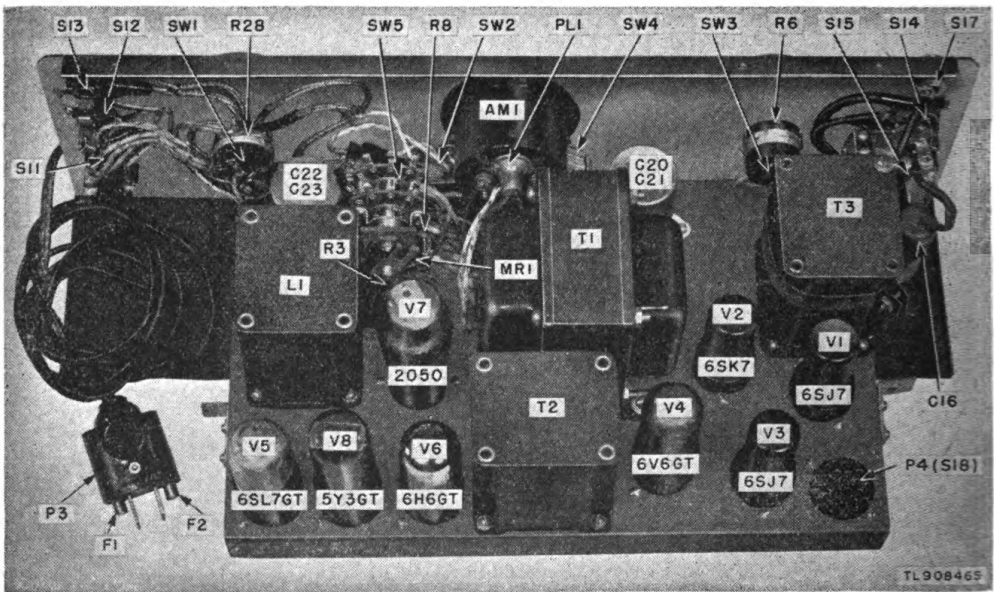


Figure 55. Location of parts on amplifier, Sound Recording Set AN/UNQ-1.



# APPENDIX I

## REFERENCES

*Note.* For availability of items listed, check FM 21-6 and WD Catalog SIG 2. Also see FM 21-6 for applicable Technical Bulletins, Supply Bulletins, Modification Work Orders, and Changes.

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### 1. Parts List

- SIG 1, Introduction to WD Signal Supply Catalog.
- SIG 3, List of Items for Troop Issue.
- SIG 4-1, Allowances for Expendable Supplies for Schools, Training Centers, and Boards.
- SIG 5, Stock List of All Items.
- SIG 10-836.2, Fixed Plant Maintenance List for Recorder Portable AN/UNQ-1.
- SB 11-6, Dry Battery Supply Data.
- SB 11-76, Signal Corps Kit and Materials for Moisture- and Fungi-resistant Treatment.
- S 11-17, Electron Tube Supply Data.

### 2. Technical Manuals on Test Equipment

- TM 11-472, Repair and Calibration of Electrical Measuring Instruments.
- TM 11-2626, Test Unit I-176.
- TM 11-2627, Tube Tester I-177.

### 3. Shipping Instructions

- U. S. Army spec. No. 100-14A. Army-Navy General Specification for Packaging and Packing for Overseas Shipment.

### 4. Decontamination

- TM 3-220, Decontamination.

### 5. Demolition

- FM 5-25, Explosives and Demolitions.

## **6. Other Publications**

FM 21-40, Defense Against Chemical Attack.

TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.

TB SIG 66, Winter Maintenance of Ground Signal Equipment.

TB SIG 69, Lubrication of Ground Signal Equipment.

TB SIG 72, Tropical Maintenance of Ground Signal Equipment.

TB SIG 75, Desert Maintenance of Ground Signal Equipment.

TM 1-455, Electrical Fundamentals.

TM 11-430, Batteries for Signal Communication Except Those Pertaining to Aircraft.

TM 11-453, Shop Work.

TM 11-455, Radio Fundamentals.

TM 11-462, Reference Data.

## **7. Forms**

AAF Form 54.

WD AGO Form 468.

## APPENDIX II

### MAINTENANCE PARTS

The following information was compiled on 8 April 1946. The appropriate pamphlet of the WD Signal Supply Catalog for Sound Recording Sets AN/UNQ-1 and AN/UNQ-1A is:

SIG 10-836.2, Fixed Plant Maintenance List, Recorder Portable AN/UNQ-1. For an index of available catalog pamphlets, see the latest issue of WD Signal Supply Catalog SIG 2.

Ref. symbol	Signal Corps stock No.	Name of part	Used in	
			1	1A
		Accessories group		
fig. 8	1B3018-4	CABLE, power (remote control).	*	*
fig. 5	1B3020-1.1	CABLE, microphone.	*	*
fig. 16	2Z8671.23	CONNECTOR, microphone (female).	*	*
fig. 16	2Z7228.9	CONNECTOR, remote control.	*	*
fig. 5	2B1720-1	MICROPHONE, crystal.	*	*
fig. 8	3Z9580-14.1	SWITCH, push (foot switch).	*	*
fig. 9	6C263/T1	TAPE, recording.	*	*
fig. 7	6R56527	WRENCH, closed end (needle).	*	*
		Amplifier group	*	*
C20, 21, 22, 23	3DB20-100	CAPACITOR, electrolytic.	*	*
S17	2Z7111.28	CONNECTOR, microphone (male).	*	*
P3	6Z7574-2	CONNECTOR, male (power cord).	*	*

Ref. symbol	Signal Corps stock No.	Name of part	Used in	
			1	1A
F1, 2	3Z1925	FUSE FU25, cartridge.	*	*
fig. 2	2Z5761.1	KNOB, bar A.V.C. MOTOR, and magazine latches).	*	*
fig. 2	2Z5824.50	KNOB, round (AUDIO-TROL and VOLUME).	*	*
fig. 6	2Z7112.45	PLUG, telephone earphones.	*	*
V8	2J5Y3G	TUBE, electron (5Y3G).	*	*
V6	2J6H6	TUBE, electron (6H6).	*	*
V3	2J6SJ7	TUBE, electron (6SJ7).	*	*
V2	2J6SJ7	TUBE, electron (6SJ7).	*	*
V5	2J6SL7GT	TUBE, electron (6SL7GT).	*	*
V4	2J6V6	TUBE, electron (6V6).	*	*
V7	2J2050	TUBE, electron (2050).	*	*
Main frame unit				
fig. 43	6C274-1A/19	BELT, flat (small belt).		*
	6C274-1/2	BELT, flat (40 fpm).	*	*
fig. 44	6C274-1/3	BELT, flat (large belt).	*	*
	2Z8877.113	BELT, spring.	*	*
fig. 1	6Z3413-19	COUNTER, mechanical.	*	*
	2Z5821-60	KNOB, bar.	*	
fig. 2	2Z5838	KNOB, bar (selector and MONITOR).		*
fig. 11	2Z5821-92	KNOB, bar (sapphire rod latch).		*
fig. 1	2Z5821-93	KNOB, round (index knob).	*	*
fig. 33 (71)	6C93	NEEDLE, reproducer.	*	*
	6C274-1/4	PULLEY, main drive (40 fpm).	*	*

Ref. symbol	Signal Corps stock No.	Name of part	Used in	
			1	1A
fig. 3 (motor pulley)	6C274-1/5	PULLEY, main drive.	*	*
RL2 (fig. 41)	2Z7593-104	RELAY, trackage.		*
fig. 27	6C274-1/6	ROLLER, film (small).	*	*
fig. 27	6C274-1/7	ROLLER, film (large).	*	*
fig. 36	6C93-1	STYLUS, recording (needle).	*	*
fig. 1	6C274-1A/26	WIPER, film.	*	*

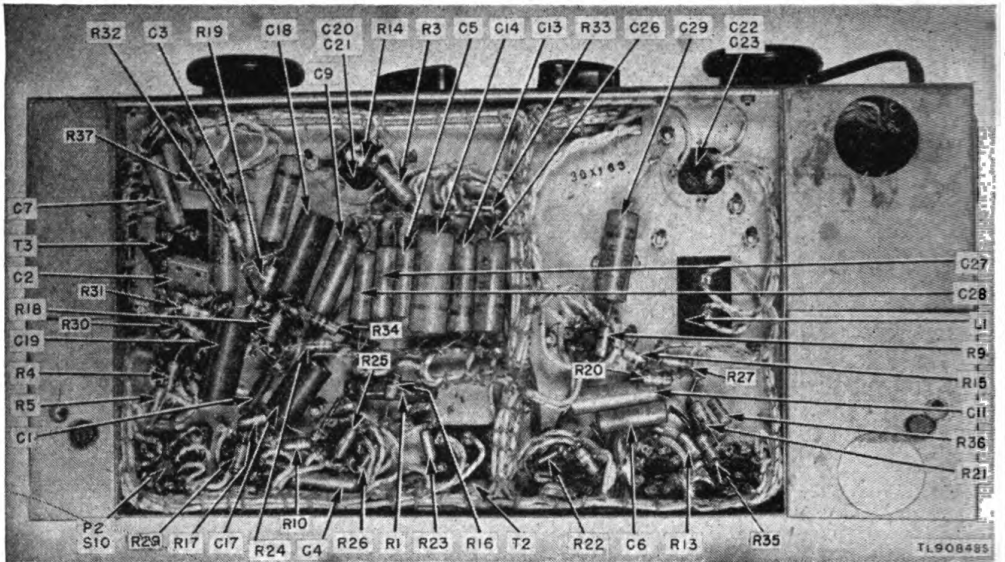


Figure 56. Location of parts underneath amplifier, Sound Recording Set AN/UNQ-1A.

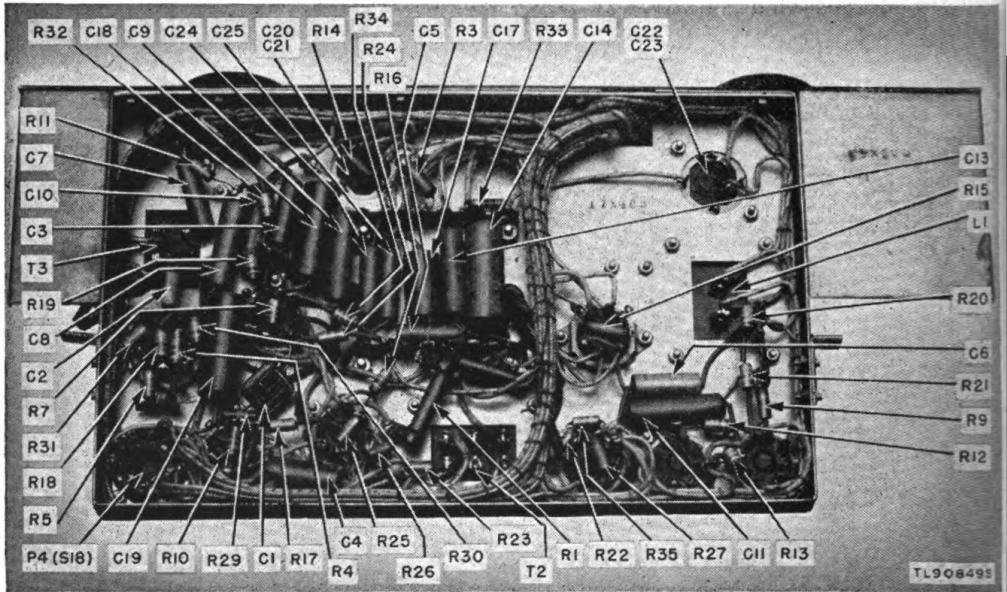


Figure 57. Location of parts underneath amplifier, Sound Recording Set AN/UNQ-1.

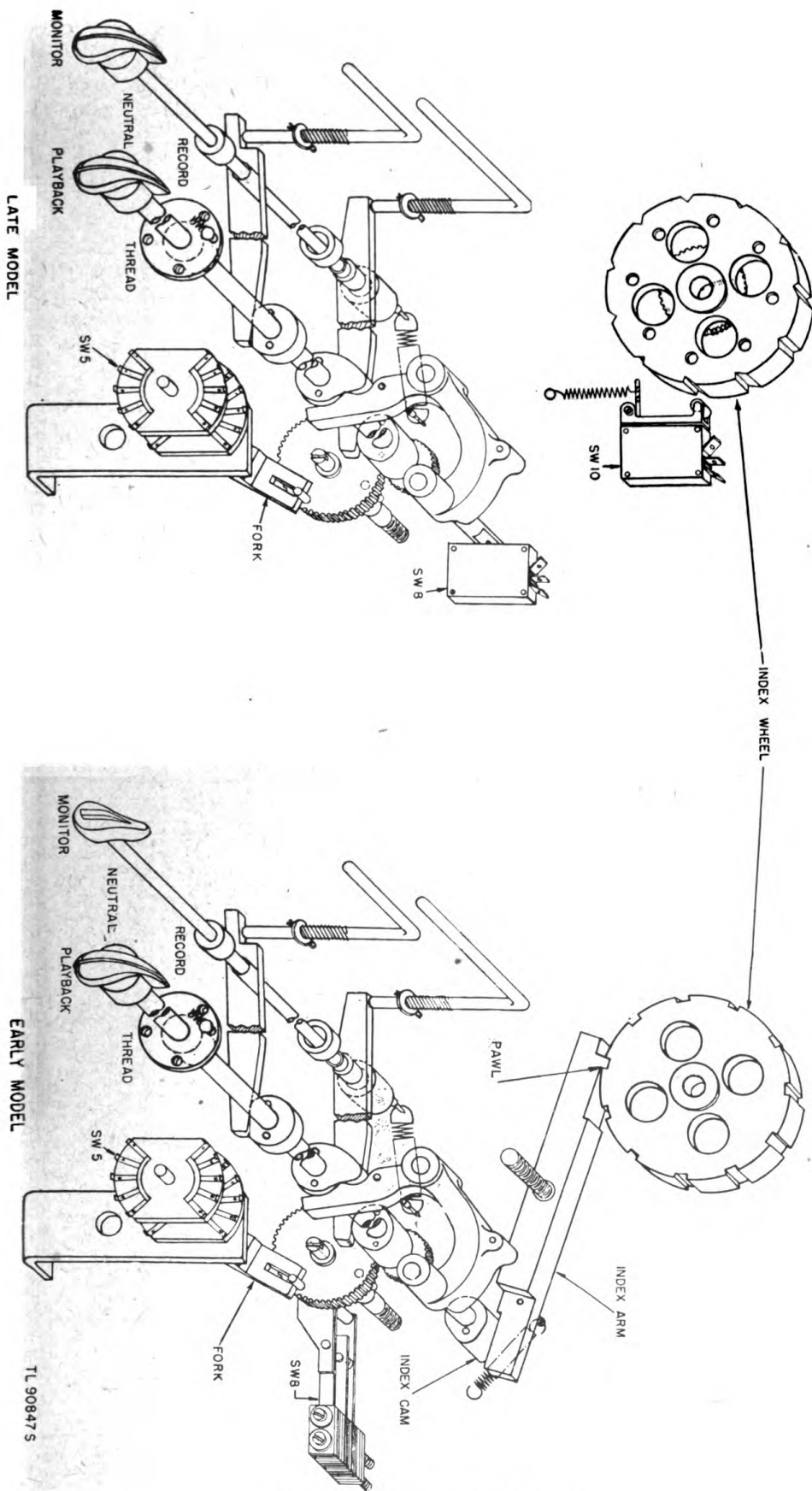
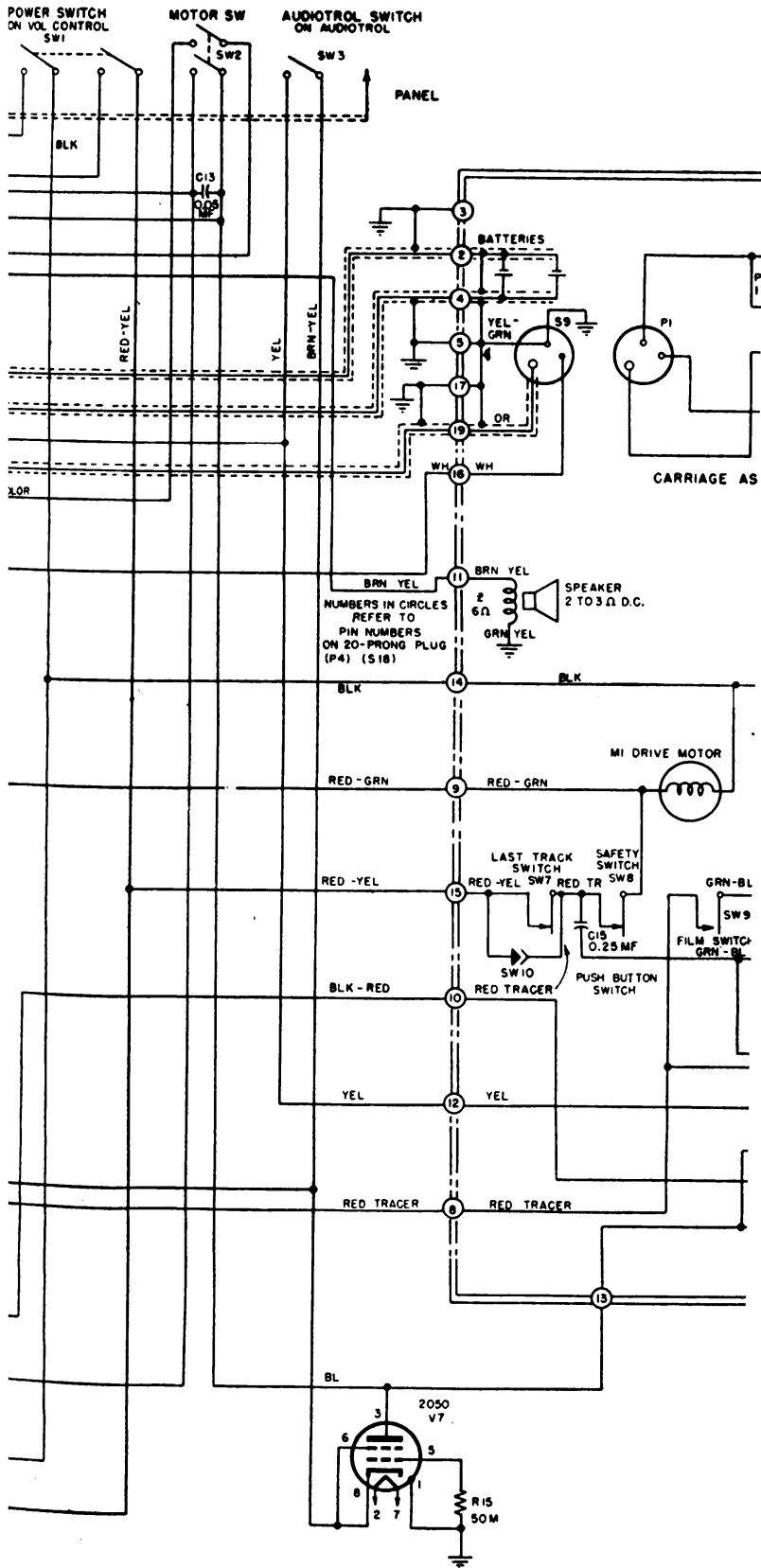


Figure 58. Cam mechanisms.

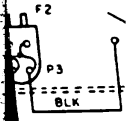




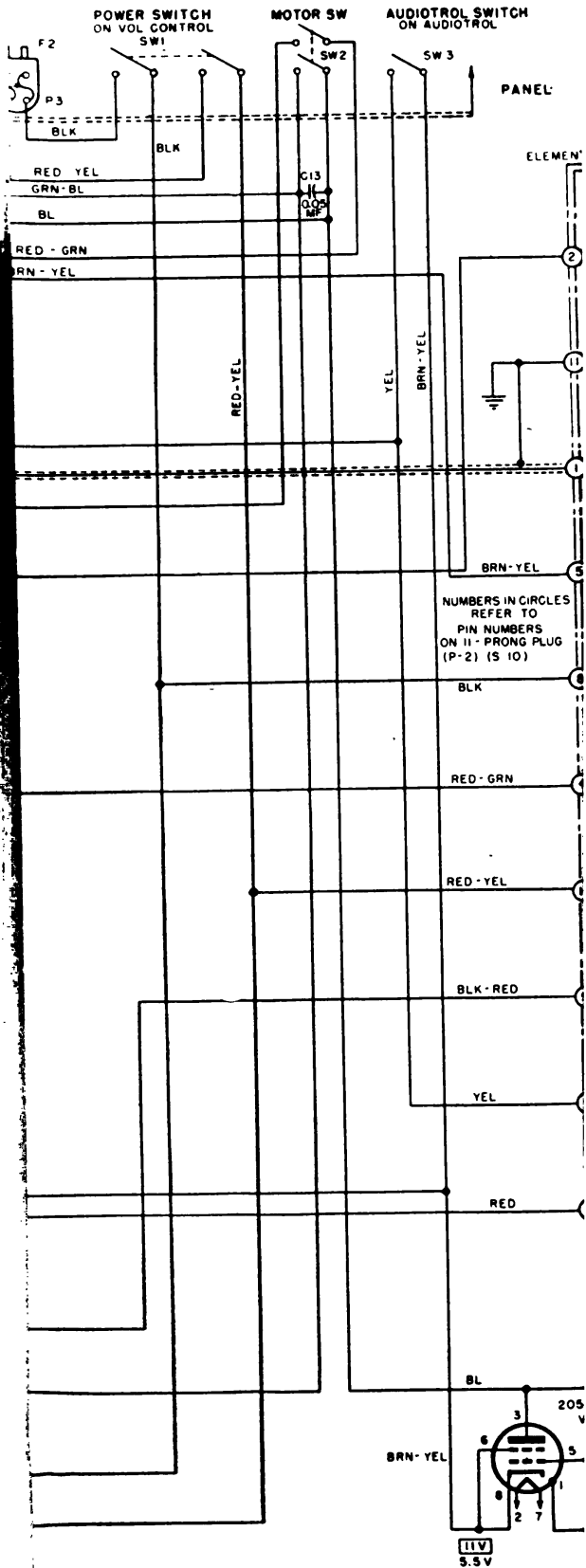


1.

POWER  
ON VI



RED - YEL  
GRN - BL  
BL  
RED - GRN  
BRN - YEL



NUMBERS IN CIRCLES REFER TO PIN NUMBERS ON 11-PRONG PLUG (P-2) (S 10)

UNQ-1A.







