DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

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TO 16-30FNW3-5

DUPLICATE COPY

SOUND RECORDER REPRODUCER SETS

AN/FNQ-3 AND AN/FNQ-3A

(SOUNDSCRIBER MODEL NO. 5R)

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

MAY 1953

SOUND RECORDER REPRODUCER SETS

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DEPARTMENTS OF THE ARMY AND
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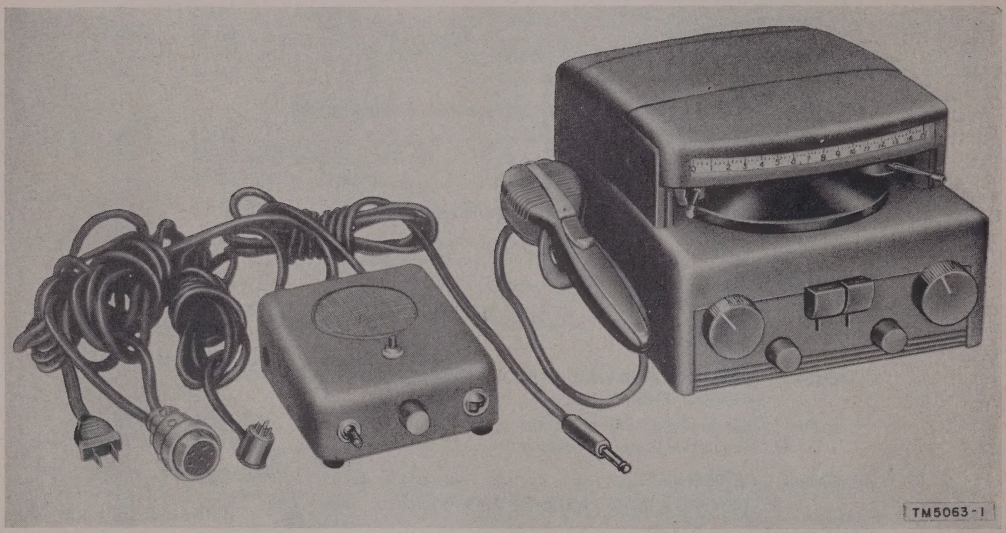


Figure 1. Sound Recorder-Reproducer Set AN/FNQ–3 with speaker and telephone control unit.*

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual is published for the information and guidance of the personnel to whom this equipment is issued. It contains a physical description of the equipment, operating instructions, organizational maintenance information, the theory of operation, repair instruction, repacking instructions for shipment or limited storage, and instructions for demolishing the equipment to prevent enemy use. This manual applies only to Sound Recorder-Reproducer Sets AN/FNQ–3 and AN/FNQ–3A.

b. Appendix I contains a list of current references, including supply manuals, technical manuals, and other available publications applicable to the equipment. Appendix II contains an identification table of parts.

c. Official nomenclature followed by an asterisk (*) is used to indicate all models of equipment included in this manual. Thus Sound Recorder-Reproducer Set AN/FNQ–3(*) represents Sound Recorder-Reproducer Sets AN/FNQ–3 and AN/FNQ–3A.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army equipment and in performing preventive maintenance:

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army) and AFR 71–4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700–45–5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AFR 65–26.

d. DA Form 11–250, Operator First Echelon Maintenance Check List for Signal Corps Equipment—Public Address, Recorder, Reproducer, will be prepared in accordance with instructions on the back of the form.

e. DA Form 11–251, Second and Third Echelon Maintenance Check List for Signal Corps Equipment—Public Address, Recorder, Reproducer, will be prepared in accordance with instructions on the back of the form.

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. General

Sound Recorder-Reproducer Set AN/FNQ–3(*) is a portable sound recorder and reproducer designed to record sound on disks and reproduce sound from disks. When used with a speaker and telephone control unit, the AN/FNQ–3(*) records conferences, telephone conversations, or radio programs.

Note.—Soundscriber Model No. 5R appears on the nameplates of Sound Recorder-Reproducer Sets AN/FNQ–3 and AN/FNQ–3A. Serial numbers 400,001 through 400,550 designate the AN/FNQ–3. Serial numbers from 400,551 through 401,050 designate the AN/FNQ–3A.

4. Technical Characteristics

Amplifier:

Frequency response.	Uniform from 200 to 3,000 cps (cycles per second) ±3 db (decibels).
Gain	90 db.
Hum level	40 db below normal level.
Noise level	35 db below normal level.

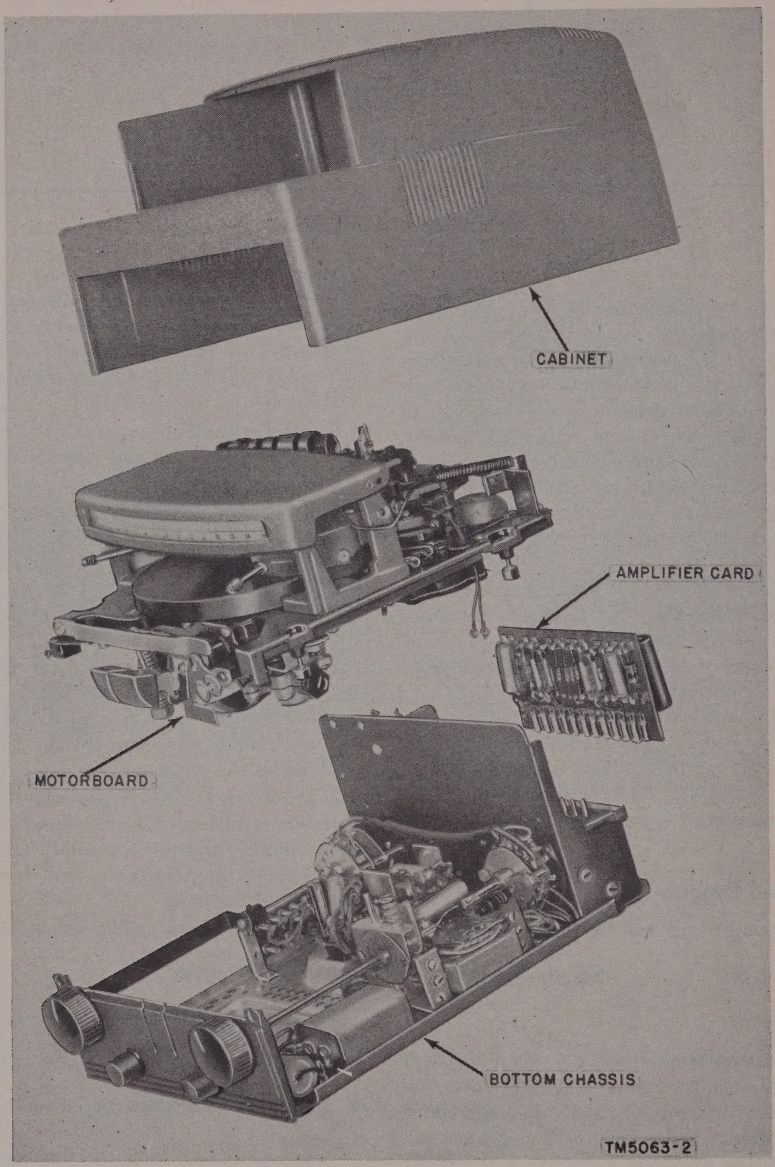


Figure 2. Sound Recorder-Reproducer Set AN/FNQ-3 (*), major assemblies.

Amplifier—Continued
Tubes, types and functions. 6BA5(V1)—First voltage amplifier.
6AD4(V2)—Second voltage amplifier.
6AD4(V3)—Third voltage amplifier.
50C5(V4)—Power amplifier (½ push-pull).
50C5(V5)—Power amplifier (½ push-pull).
Input impedance:
Microphone..... 10 ohms.
Line (P1)..... 30 ohms.
Reproducer head.. 30 ohms.
Output impedance:
Speaker..... 4 ohms.
Recorder head.... 4 ohms.
Power output..... 2 w.
Power requirements.... 60 w (115 V, 50 to 60 cps, single phase).
Turntable motor..... Capacitor-type induction.
Turntable..... 5½-inch dia.
Turntable speed..... 33⅓ rpm (revolutions per minute).
Recorder head..... Magnetic type, 4-ohm impedance.
Recording time..... 15 minutes.
Groove feed..... 260 grooves per inch.
Stylus pressure..... 1¾ to 2¼ oz.
Stylus radius..... 0.062 inch.
Microphone..... Dynamic type, 10-ohm impedance.
Reproducer head..... Dynamic type, 30-ohm impedance.
Speaker..... Permanent-magnet type.

5. Table of Components

Quantity	Component	Dimensions (in.)			Weight (lb)
		Length	Width	Height	
1	Recorder-reproducer	8½	11¾	6	14¾
1	Speaker and telephone control unit complete with interconnecting cords	7¼	5	2½	3¾
1	Power cord	120			½
1	Hand microphone with 9-foot cord	7½	2¼	1⅝	¾
1	Hand microphone bracket	3	2	3¼	⅛
1	Cover	8¾	13	7	
200	Recording disks	5⅞	5⅞	2½	3
200	Filers for disks	6	6	3½	1¾
	Tools				

Note.—This list is for general information only. See appropriate supply publications for information pertaining to requisition of spare parts.

6. Packaging Data

(fig. 3)

a. General. Sound Recorder-Reproducer Set AN/FNQ–3* is packed in three corrugated cardboard boxes when domestic packed and three corrugated cardboard boxes and an outside wooden box when export packed. One carton contains the recorder-reproducer set and a second carton contains the accessory parts including extra disks. These two cartons are packed in a third carton which also holds a packing list and necessary packing inserts. For export, each inside box is put into a heat-sealed bag (MIL–B–131A) with a package of desiccant for moisture absorption. These two boxes are placed in the outside carton which is wrapped with waterproof paper. The package then is put in a wooden box.

b. Domestic Packaging.

Box No.	Item	Dimensions (in.)			Volume (cu ft)	Weight (lb)
		Height	Width	Length		
1/3	Recorder-Reproducer	13	18	20½	2. 8	15
2/3	Power cord, microphone, cover, speaker, and telephone control unit, extra disks, filers for disks.	13	18	6	. 81	13½
3/3	Contains ⅓ and ⅔	15	21¼	29	5. 3	29

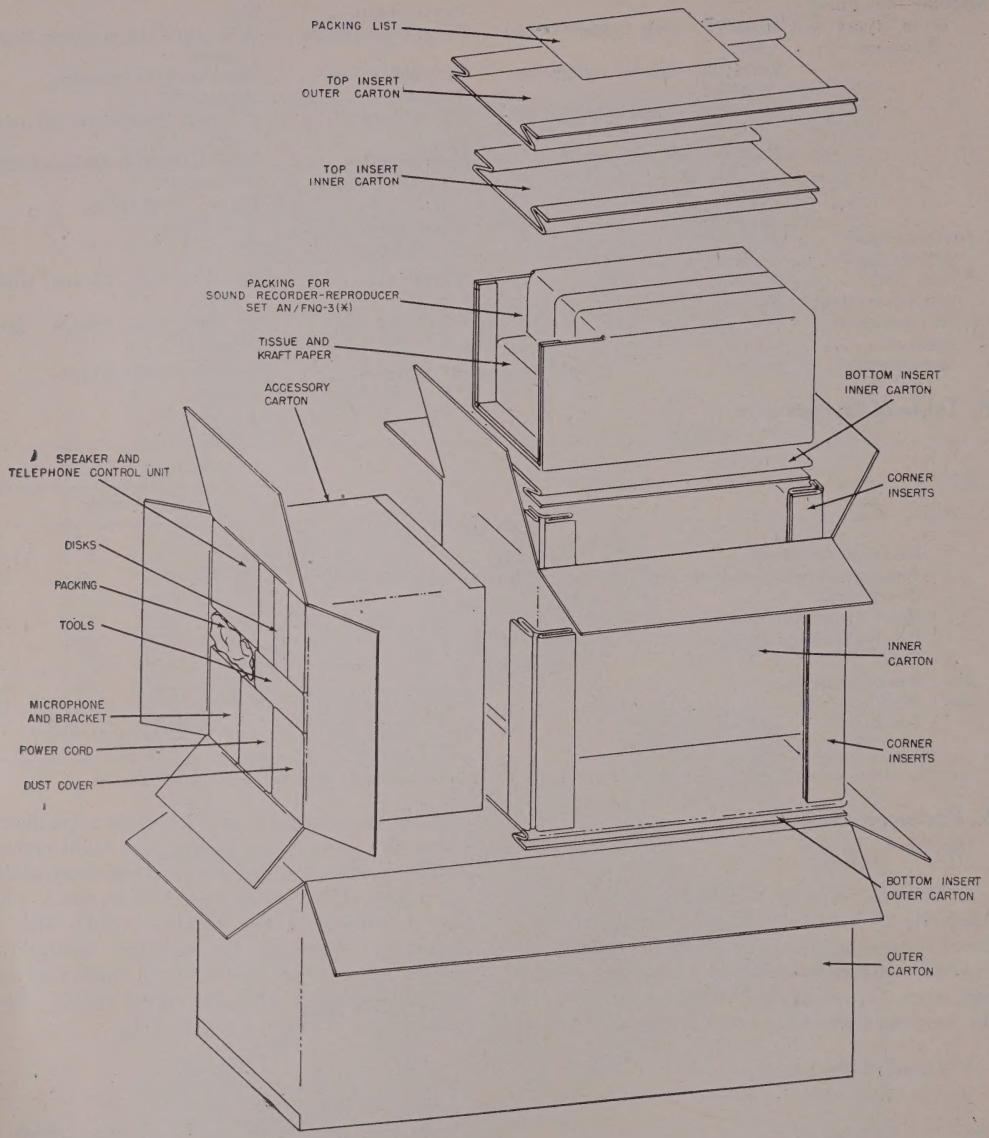


Figure 3. Shipping container, exploded view. For export, the outer container with its contents is placed in a wooden packing case.

c. Export Packaging.

Box No.	Item	Dimensions (in.)			Volume (cu ft)	Weight (lb)
		Height	Width	Length		
1/4	Recorder-Reproducer	13	18	20½	2. 8	15
2/4	Power cord, microphone, cover, speaker and telephone control unit, extra disks, filers for disks.	13	18	6	. 81	13½
3/4	Contains ¼ and ¾	15	21¼	29	5. 3	29
4/4	Contains ¾	16	22	30	6. 1	69

7. Sound Recorder-Reproducer Set AN/FNQ–3 (*)

(fig. 2)

Sound Recorder-Reproducer Set AN/FNQ–3* consists of a cabinet, an amplifier card, a bottom chassis, and a motorboard.

a. Cabinet. The cabinet is a die casting of magnesium. A ventilating louver across the top of the cabinet at the back permits the heat generated from the vacuum tubes to escape. Louvers on each side of the cabinet permit ventilation of the turntable motor.

b. Amplifier Card. The amplifier card mounts the input transformer, the three voltage amplifier tubes, all electrolytic capacitors, and the resistors and capacitors of the voltage amplifier stages. This is a plug-in card which facilitates trouble shooting and permits compact design.

c. Bottom Chassis. The bottom chassis contains the output stage, the remote control relay, the reproducer relay, the selector switch, the LISTEN—TALK switch, and the switching circuits.

d. Motorboard.

(1) The motorboard consists of the motor, the turntable, the sealed-in gear mechanism, the reproducer arm and head, the recorder arm and head, and the light beam parts.

(2) The turntable is a heavy white-metal die casting, and the top outer edge mounts a rubber ring. A hard bakelite shell covers the turntable and rests on this rubber ring. The rubber ring helps to prevent vibration from reaching the recording disk. The top surface of the shell is protected by a black disk.

(3) There are two sealed-in reduction worm gears. One gear rotates the turntable shaft, and the other, at the back, turns the shafts on which the recorder and reproducer arms are mounted. An overdrive shaft, which operates in conjunction with the END and COR buttons, is also part of this gear mechanism.

(4) The reproducer arm is hinged at the back to permit raising and lowering of the head. It is connected to the feed shaft by a friction clutch to permit movement across the disk which has 260 grooves per inch. The head is removable for replacement of the reproducer armature. This armature consists of an Alnico permanent magnet and a 30-ohm movable coil to which is fastened a permanent sapphire-tipped stylus.

(5) The recorder arm is mounted similarly, and its head also is removable. The recorder armature consists of an Alnico permanent magnet, and a 4-ohm coil to which is fastened a permanent diamond-tipped stylus.

(6) Light beams on the index scale show the positions of the recorder and reproducer arms. A lamp—reflector—lens system (fig. 23) projects a beam of light through a slit onto two small mirrors located on the recorder-head mount. One mirror rotates with the recorder arm, and the other rotates through a gear sector on the reproducer arm. These mirrors reflect the beams onto the index scale to denote the position of each head. The 15-minute recording time is divided into ¼-minute intervals on the index scale.

8. Accessories

a. Power Cord. The power cord is a two-conductor cord, 10 feet long and encased in a rubber jacket. One end terminates in a standard two-contact socket into which fits the plug on the bottom of the recorder-reproducer set.

b. Hand Microphone. The hand microphone consists of a dynamic microphone element, and neon lamps I 201 in a plastic case formed to fit in the palm of the hand. Neon lamp I 201, when on, indicates that the equipment is ready for dictation or quick review. A plastic button on the case permits remote starting and stopping of the turntable and permits switching to provide playback through the microphone element. One end of a 9-foot cord is fastened to terminals within the plastic case, and the opposite end of the cord has a seven-contact plug molded to it. This cord consists of one conductor within a shield and three conductors outside the shield, all encased in a rubber jacket.

c. Hand Microphone Holder (fig. 9). The hand microphone holder consists of a cast-steel mounting bracket and a U-shaped cradle. The mounting bracket can be fastened to the bottom on either side of the recorder-reproducer set. When not in use, the cradle can be folded back so that the equipment may be moved or placed easily in a carrying case.

d. Dust Cover. The dust cover is made of .007-inch translucent vinylite. When the recorder-reproducer is not in use, the dust cover protects it from dust.

e. Recording Disks. The recording disk is made of green colored vinylite which is .010-inch thick. A square hole in the center of the disk fits the spindle on the turntable.

f. Filer. The filer is a square yellow envelope for filing recorded disks. Both sides are imprinted with a log scale, and there is space for pertinent information. It permits accurate logging and filing of the recorder disks.

g. Speaker and Telephone Control Unit. The speaker and telephone control unit contains a 3-inch permanent-magnet loudspeaker, isolating transformer T301, coupling capacitor C301, DICT—TEL switch S302, switch S301, speaker switch S303, volume control R301, and the necessary interconnecting cords. The speaker and telephone control unit is used when recording a telephone conversation, or when the speaker is employed for listening.

Note.—When the speaker and telephone control is used in recording interstate telephone conversations, its use comes under the regulations of the Federal Communications System. These regulations require that a telephone recorder connector (tone warning generator) be used. This is an audio oscillator which generates a note every 15 seconds to warn persons on the line that the conversation is being recorded. In military installations, Tone Warning Generator O–93/GT is available usually through the division that handles telephone equipment installations.

h. Spare Parts. No spare parts are supplied with the AN/FNQ–3. The following is the list of running spare parts supplied with the AN/FNQ–3A.

Quantity	Description
1	Tube 6BA5
2	Tube 6AD4
1	Tube 50C5
5	Fuse (1.5 amp)
1	Glow lamp (I 1)
1	Index lamp (I 2)

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

9. General

Sound Recorder-Reproducer Set AN/FNQ-3(*) may be shipped in an oversea packing case or in a domestic packing case, as described in paragraph 6. Two hundred disks are domestic packed in 8 cartons, each carton containing 25 disks.

10. Uncrating, Unpacking, and Checking (fig. 3)

To unpack the equipment, use the following procedure:

a. Open the outer carton.

b. Remove the top insert.

c. Remove the four corner inserts.

d. Remove and open the carton containing the accessory parts.

e. Lift out and open the carton containing the equipment.

f. Lift out the equipment and remove the corrugated packing from around the unit. When cutting the sealing tape, do not let the cutting edge of the tool scratch the cabinet.

g. Remove the tissue and kraft paper from around the equipment.

h. Open the front cover of the recorder-reproducer and remove the head packing by squeezing the packing down and sliding it out.

i. Lightly press down on the turntable shell, at its center, to be sure it is resting on the turntable.

11. Equipment Location

The ideal site for the equipment is a room where there are no extremes of temperature or humidity and where extraneous noise is at a minimum. The equipment may be used in transit in mobile units provided the proper power source is available and the equipment is not subjected to severe shock.

12. Installation and Connections

a. Installation. Turn the sound recorder-reproducer set upside down and fasten the microphone holder at either position 1 or position 2 (fig. 5). Hardware is provided in an envelope along with the holder. Place two flat washers H51, one on top of the other, under the microphone holding bracket. Then install lockwasher H50 and screws H49 (fig. 4). Before tightening screws H49, pull the bracket away from the side of the cabinet as far as the elongated holes will permit. This will allow clearance so that the side of the cabinet will not be scratched when the cabinet is removed for service.

b. Microphone Connection. To use the equipment for recording dictation, interviews, and copies, and for reproducing disks, only the microphone and the recorder-reproducer need be used. To connect the equipment to perform these functions, proceed as follows:

(1) Place the recorder-reproducer bottom-side up, and unhook cord clamp H88 (fig. 5).

(2) Connect the eight-pin receptacle on the end of power cord W101 to plug P1. Insert the two-prong plug on the other end of the cord into a wall outlet.

(3) To plug in the microphone, push the plug on one end of microphone cord W201 into socket X1.

(4) Lay cords W201 and W101 in the channel grooves in the bottom of the unit and secure them with clamp H88.

(5) Turn the recorder-reproducer set on its feet.

c. Speaker and Telephone Control Unit Connection. To use the equipment for recording telephone conversations, the speaker and telephone control unit must be used in conjunction with the recorder-

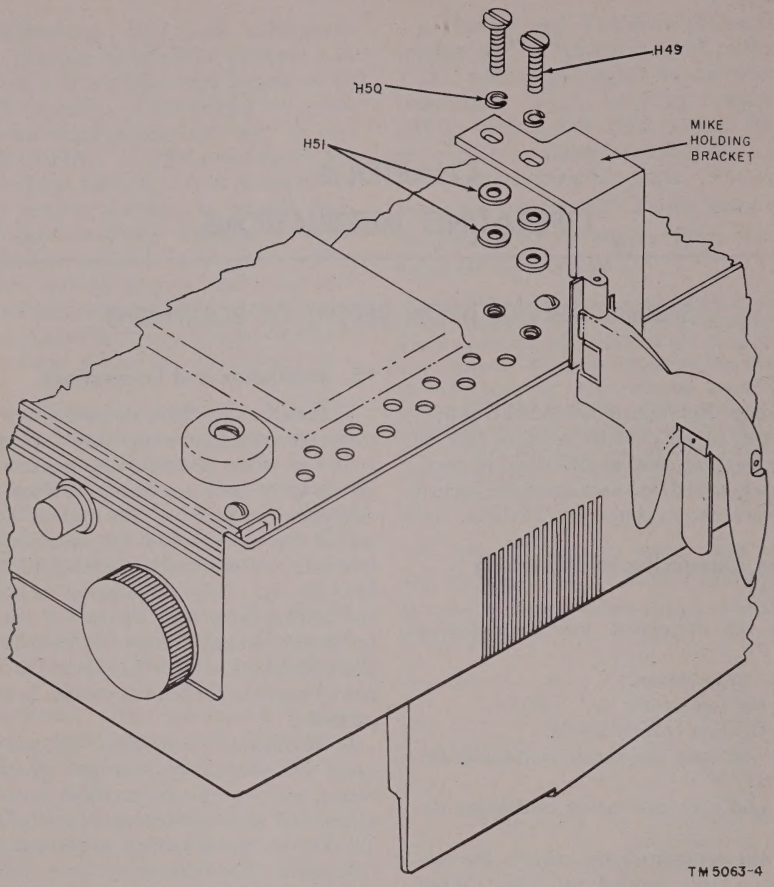


Figure 4. Installation of microphone holder

reproducer. With the control unit connected to the recorder-reproducer, the loudspeaker may be used for listening during play-back. The microphone also may be connected to the control unit for recording dictation, interviews, and copies, and for reproducing disks (*b* above). To interconnect the microphone, the control unit, and the recorder-reproducer, proceed as follows:

(1) Turn the recorder-reproducer set upside down and unhook cord clamp H88 (fig. 5).

(2) Connect the receptacle on one end of power cord W101 to plug P1. Insert the two-prong plug on the other end of the cord into a wall outlet.

(3) Connect the plug on one end of cord W302 from one side of the control unit into socket X1 on the bottom of the sound recorder-reproducer.

(4) Lay cords W302 and W101 in the channel grooves in the bottom of the unit and secure them with clamp H88. Turn the recorder-reproducer set upright on its feet.

(5) Connect the telephone plug on one end of cord W303 into jack J1 located on the back of the recorder-reproducer (fig. 6).

(6) Cord W301 from the control unit plugs into a telephone recorder connector (tone warning generator).

(7) The telephone recorder connector is connected to the telephone line by the proper military authority.

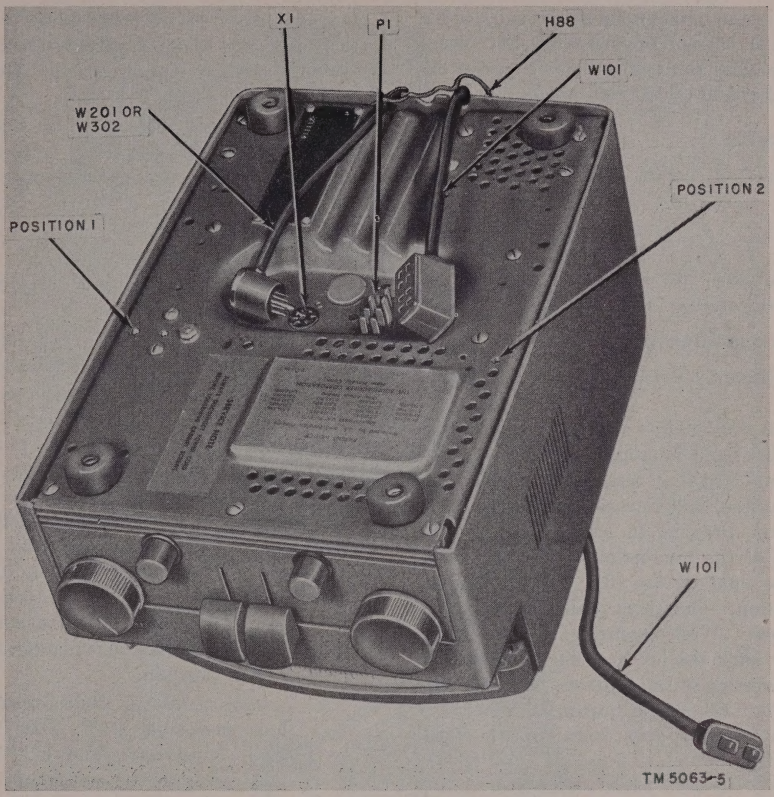


Figure 5. Sound Recorder-Reproducer Set AN/FNQ–3 (*), bottom view, connections.

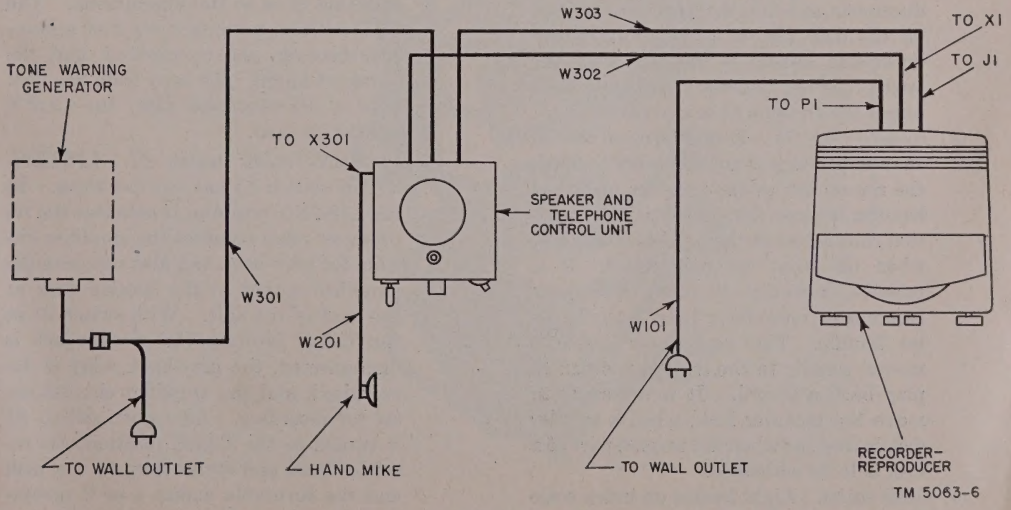


Figure 6. Sound Recorder-Reproducer AN/FNQ–3 (*), connection diagram.

(8) Plug in the microphone by connecting the plug on one end of cord W201 into receptacle X301 located on the left side of the speaker and telephone control unit.

13. Repackaging

a. Disconnect all cables and cords from the equipment.

b. Wind up all cables for convenient storage.

c. Make sure that the recorder head is secure and reproducer-arm handle is in its latch. Secure it with a rubber band.

d. Close the cover and install the dust cover.

e. If the equipment is to be transported over rough terrain, repack in accordance with paragraph 10 and figure 3.

Section II. CONTROLS

Note. This section describes, locates, and illustrates the various controls provided for the proper operation of the equipment; it also furnishes the operator with sufficient information pertaining to these controls.

14. Controls and Their Uses

a. Sound Recorder-Reproducer Set AN/FNQ–3 (*).

(1) *Microphone button* (fig. 8). The button on the hand microphone has three positions. Pressing straight in starts the turntable, and releasing stops the turntable. Pressing in and up toward the face of the microphone starts the turntable and locks the button in this position. The third position is for quick review. While recording, it is possible to play back the last few lines of dictation by pressing the microphone button in and down. When the button is released, it automatically goes back to the OFF position.

(2) *Reproducer-arm latch.* The reproducer-arm latch holds the handle of the reproducer arm, and thus the reproducer stylus, off the disk (fig. 37). Once the reproducer-arm handle is released from the latch, it is not necessary to put it back unless the equipment is moved.

(3) *Handles* (fig. 7). During normal use of the equipment it is not necessary to touch the reproducer or the recorder head and handles because they automatically position themselves at the outside of the disk when the front cover is raised. It is possible, however, to move either the recorder or reproducer head laterally by its handle. The reproducer head is moved usually to the desired position to play back a record. It is necessary to move the recorder head when a smaller disk is used, or when the unused part of a disk is to be embossed.

(4) *Index scales.* Light beams on index scale N1 of front cover A9 show the positions of both recorder and reproducer heads E2 and E1. During normal dictation both the reproducer and recorder heads feed across the disk and the light beams appear as one. When one of the heads is moved, two light beams show, one for the recorder head and one for the reproducer head. When both heads feed across the disk as in normal dictation, the reproducer head is slightly behind the recorder head making it possible to listen to the last few phrases of dictation when the microphone button is placed in the quick-review position.

(5) *Selector switch S2.* Selector switch S2 has four positions, OFF, DICT (dictate), INT (interview), and COPY. In the OFF position the equipment is inoperative. The DICT position is used when dictating close to the microphone. The INT position permits a few feet separation between the microphone and the source of sound. To copy from one disk onto a different size disk, the COPY position is used.

(6) *LISTEN-TALK switch S1.* LISTEN-TALK switch S1 has two positions. In the LISTEN position, it actuates the reproducer relay to select the amplifier circuits for play-back and also connects the amplifier output to the speaker jack at the back of the unit. With switch S1 in the TALK position, the speaker jack is disconnected, the play-back relay is de-energized, and the amplifier circuits are set for recording. Also when switch S1 is turned to the TALK position, the recorder head and stylus drop to the disk and the turntable makes 1 or 2 revolutions to emboss a starting groove before

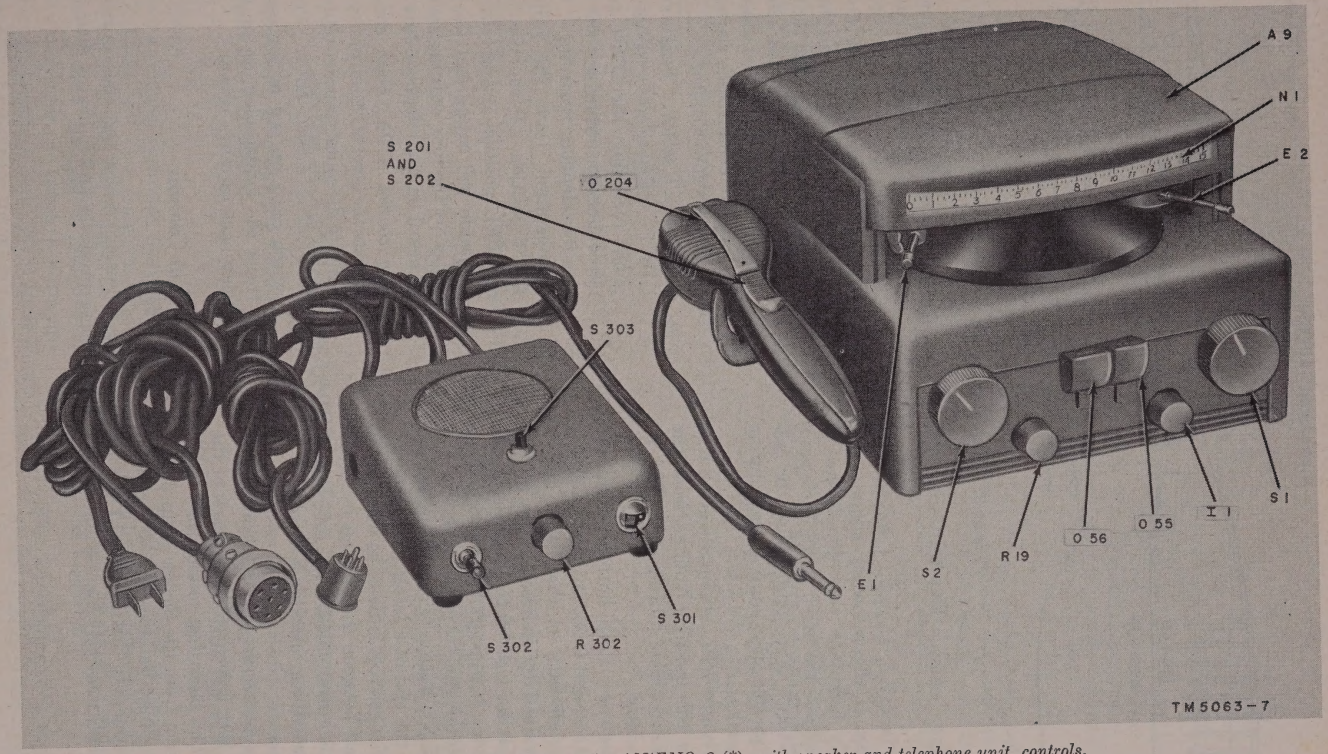


Figure 7. Sound Recorder-Reproducer Set AN/FNQ-3 (*), with speaker and telephone unit, controls.

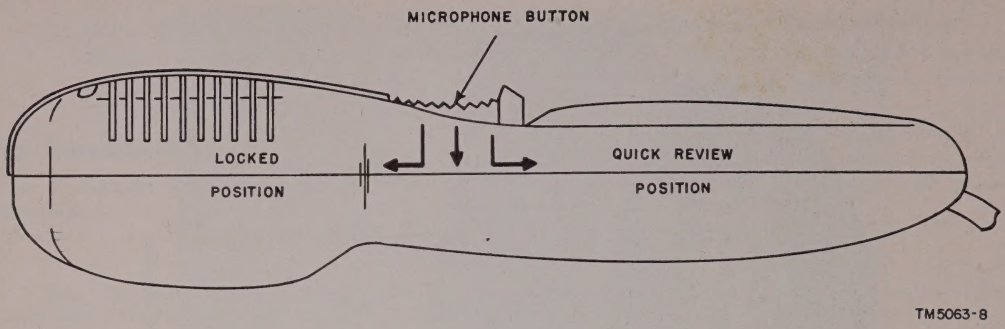


Figure 8. Microphone button operation.

recording begins. The turntable then stops.

(7) *Flasher lamp I 1.* Lamp I 1 indicates the intensity of the recording single. Excessively bright or very dim flashes of light indicate too much or too little gain, respectively. The gain should be adjusted so that the lamp flashes during sound peaks.

(8) *Volume control R19.* Volume control R19 controls the listening volume from the hand microphone during LISTEN or quick review.

(9) *Index buttons.* Push buttons COR and END, O 56 and O 55, provide automatic indexing directly on the disk. This is accomplished by increasing the rate of speed of the feed of the recorder head, thus giving an appearance of a wide space between the grooves on the disk (fig. 11). When END button O 55 is depressed, to denote the end of a letter, the space between the grooves is twice as wide as the space left between the grooves by pressing COR button O 56 which indicates to the transcribing operator a correction in dictation.

(10) *Gain control R18 (rear)* (fig. 43). Gain control R18 is located at the back of the unit. The recording volume and the illumination from the flasher lamp during recording may be increased or decreased by adjustment of this control. This control is made relatively inaccessible to prevent it from being moved inadvertently once it is set for the dictation technique of the user.

b. Speaker and Telephone Control Unit (fig. 7).

(1) *On-off switch S301.* For telephone recording, operate switch S301 to the on position approximately 20 seconds before recording. This switch connects the telephone recorder connector (tone warning generator) to the power source.

(2) *DICT—TEL switch.* Toggle switch S302 (DICT—TEL) selects telephone or microphone recording, the DICT position for microphone recording and the TEL position for telephone recording. For stand-by operation, leave the switch in the DICT position. If the switch is left in the TEL position during stand-by, the turntable will rotate and the tone generated by the tone warning generator will be heard on the telephone line.

(3) *Gain control R301.* Gain control R301 adjusts the level of the incoming telephone signal to the sound recorder-reproducer set.

(4) *Push-button switch S303.* Push-button switch S303 on top of the control unit turns the loudspeaker on or off during play-back or quick review.

15. Table of Controls
(fig. 7)

The following tables list the controls of the recorder-reproducer and indicates their functions:

a. Recorder-Reproducer.

Control	Location	Function
1. Microphone button O 204 (switches S201 and S202).	On hand microphone	Starts and stops turntable and permits quick review.
2. Reproducer latch (fig. 37)	Under front left corner of front cover.	Holds reproducer-head handle to prevent damage to reproducer head when the equipment is moved.
3. Recorder- and reproducer-head handles (fig. 7).	Under front cover. End of recorder-head handle is painted red. End of reproducer-head handle is painted green.	Permit manual movement of recorder and reproducer heads.
4. Index scale N1	On front of cover A 9	Permits logging of recorded material. Light beams on index scale N1 denote positions of recorder and reproducer heads E2 and E1.
5. LISTEN—TALK switch S1	Front panel	Selects play-back (LISTEN) or recording (TALK).
6. Selector switch S2	Front panel	Connects set to a-c power. Also selects dictation recording, interview recording, and copying.
7. Recording indicator I 1	Front panel	Indicates recording volume.
8. Recording gain control R18	At rear	Regulates recording volume (use screw driver to regulate).
9. Volume control R19	Front panel	Regulates volume during play-back, quick review, or copying.
10. Index buttons O 55 (COR) and O 56 (END).	Front panel	Depressing COR button O 56 registers correction on disk. Depressing END button O 55 registers end-of-letter on disk.

b. Speaker and Telephone Control Unit.

Controls	Location	Function
1. On-off switch S301	Front panel	Connects the tone warning generator to the a-c power source.
2. DICT—TEL switch S302	Front panel	Selects microphone or telephone recording.
3. Gain control R301	Front panel	Regulates level of telephone signal to unit.
4. Push-button switch S303	Top	Turns loudspeaker on and off.

Section III. OPERATION UNDER USUAL CONDITIONS

16. Operation with Microphone Connected to Recorder-Reproducer

(fig. 7)

a. Preparation.

(1) Turn on Sound Recorder-Reproducer Set AN/FNQ-3(*) by operating selector switch S2 to the DICT position. When first turned on, allow approximately 30 seconds for the tubes to warm up.

(2) Release reproducer-head (E1) handle from the latch by pushing the clasp under the handle toward the outside of the unit (fig. 37). Gently lower the head and stylus to the turntable.

Note. Whenever the set is moved, snap the handle back into its latch.

(3) Raise cover A 9 as far as it will go (fig. 7). This causes reproducer and recorder heads E1 and E2 to move to the outer edge of the turntable.

(4) Flex a recording disk and place it on the square spindle of the turntable (fig. 9).

(5) Lower cover A 9 (fig. 7).

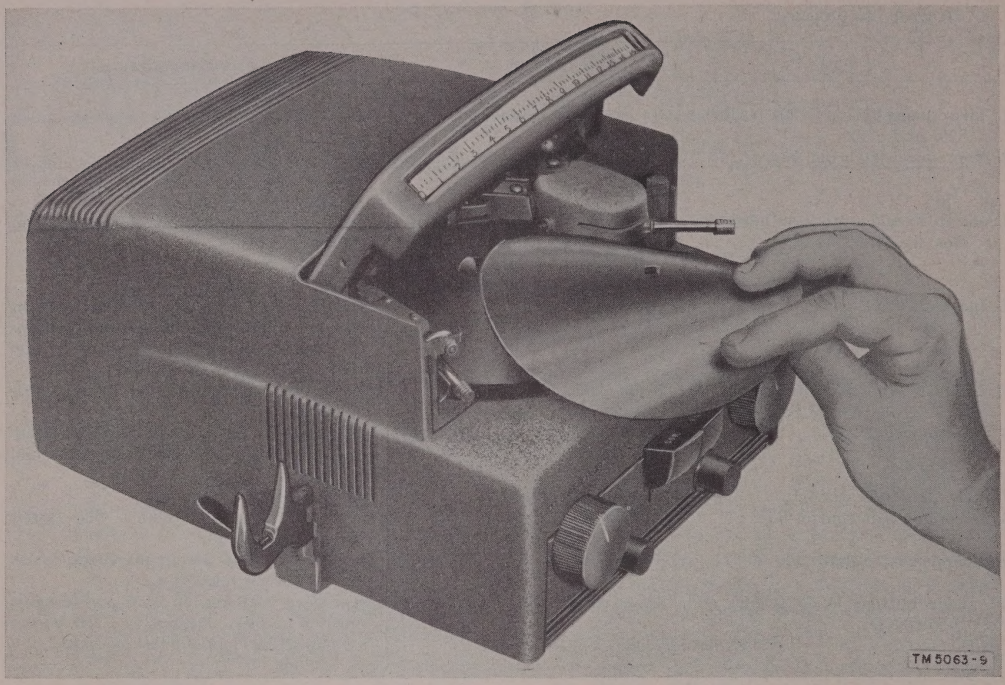


Figure 9. Flexing disk to place on turntable.

(6) Only one light beam should appear at zero on the index scale. If the beam is not on zero or if two beams can be seen, cover A 9 was not opened as far as it goes. Raise and lower the cover again.

(7) Operate LISTEN—TALK switch S1 to the TALK position. The turntable will make 1 or 2 revolutions which provide a lead-in groove. The equipment is now ready for recording.

b. Microphone Dictation (fig. 8).

(1) For microphone dictation, connect the equipment as indicated in paragraph 12*b*.

(2) Follow the instructions outlined in *a* above.

(3) Hold the microphone button in, or lock it in position, and begin dictation. For best recording results, hold the microphone so that the voice travels across its face (fig. 10). Lamp I 1 should flash during dictation. If it does not flash properly, speak louder and closer to the microphone or adjust gain control R18 (fig. 43) with a screw driver. The control should be turned clockwise until lamp I 1 flashes on sound peaks during dictation. The intensity of the light does not increase beyond a certain point as the control is turned. If the control is set too high, avc (automatic volume control) action can be heard, compressing the voice signal when the recording is played back. Better results are obtained when the gain control is set as low as possible. Once this control is set for any one operator, it requires no further adjustment.

(4) To pause during dictation, release or return the microphone button to the OFF position (fig. 8). Resume dictation by depressing or returning the microphone button to the ON position.

(5) At the beginning of each letter or report, dictate the number of carbons required and their distribution.

(6) If an interruption occurs during dictation, the last few words can be reproduced by pressing the microphone button in and down (fig. 8). Listen to the last few

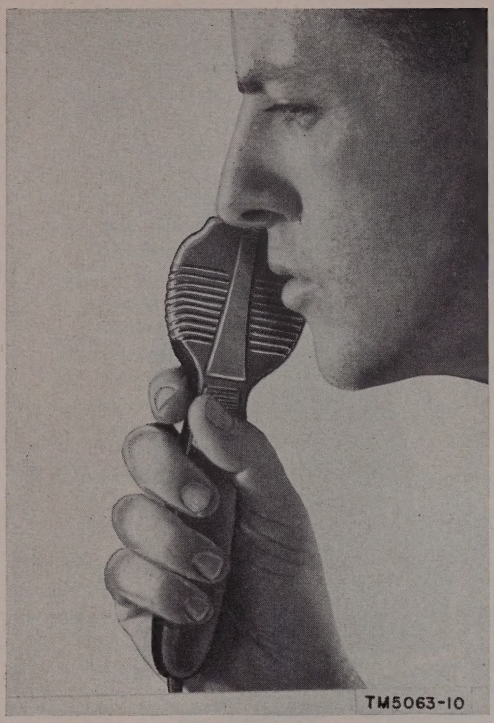


Figure 10. Microphone position for dictation.

words through the microphone (now used as a speaker). Regulate the gain with volume control R19. To resume dictation, push the microphone button up and in.

(7) To review more than the last few words, turn switch S1 to the LISTEN position and with reproducer head E1 scan the disk for review (fig. 7). The single light beam on index scale N1 will separate into two beams as head E1 is moved. The stationary beam indicates the position, in minutes, of recorder head E2 which remains at that position. As the reproducer arm moves, a separate light beam moves with it. To resume dictation, superimpose the reproducer light beam onto the recorder light beam and turn switch S1 to the TALK position.

c. Indexing (fig. 11).

(1) The recorder-reproducer does not require index slips. The indexing is done on the recording disk.

(2) To indicate a correction, press COR (correction) button O 56 on the front panel momentarily and then dictate the correction. Correction marks appear as a narrow space between the grooves on the disk.

(3) To indicate the end of a letter or report, press END button O 55. End of letter indications appear on the disk as a wider space between grooves than the correction indication and permit the operator to estimate the length of a letter or report for proper spacing on stationery.

(4) To insert an afterthought in the course of dictation, press both the COR and END buttons at the same time. This makes an extra wide space between the grooves. This indicates to the operator that a correction is to be inserted during play-back.

d. Interview.

(1) To record an interview between several people, connect the equipment as indicated in paragraph 12*b* and perform the operations described in *a* above.

(2) Turn selector switch S2 to the INT (interview) position.

(3) Push the microphone button in and up to lock it in the ON position (fig. 8).

(4) Place the microphone between the persons being interviewed.

(5) Satisfactory records are obtained only when the speakers are close to the microphone, or talk loud enough to cause light I 1 to flash.

e. Play-back.

(1) Raise cover A 9, place a disk on the turntable, and lower the cover.

(2) Turn on the recorder-reproducer by operating selector switch S2 to the DICT position.

(3) To reproduce a record, operate switch S1 to the LISTEN position.

(4) Place reproducer head E1 on the portion of the disk to be heard.

(5) Start the turntable by pressing the microphone button. This button must be held in, or pushed in and up to be locked (fig. 8).

(6) Control R19 regulates the volume of playback. For confidential listening, use the hand microphone as a speaker. For group listening, use the loudspeaker in

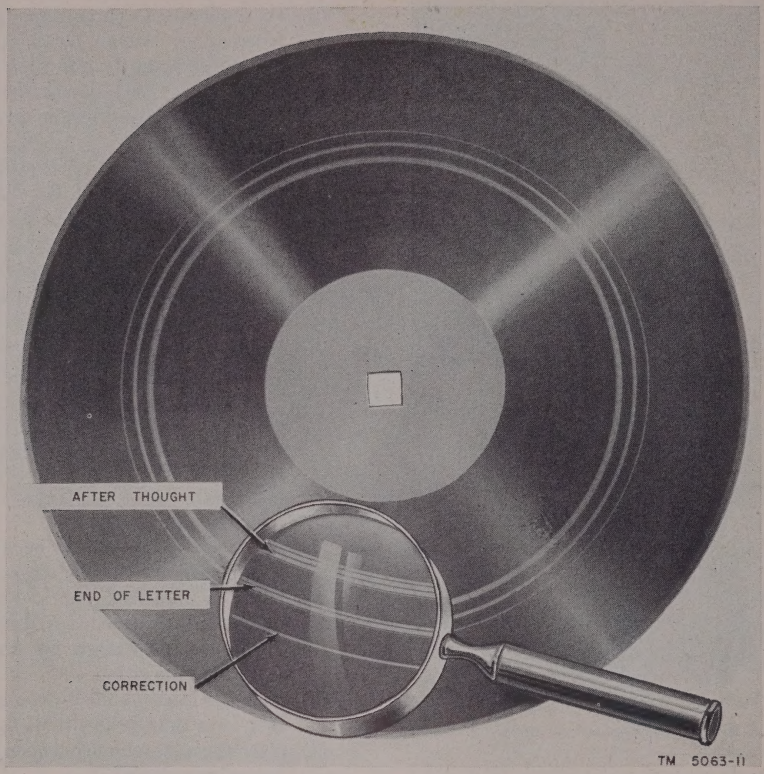


Figure 11. Spacing between grooves.

the speaker and telephone control unit. Push-button switch S303 on top of the speaker and telephone control unit turns the loudspeaker on or off (par. 17).

f. Copying. A recording on the first half of a standard diameter disk (same diameter as turntable) can be copied on a 3⅞-inch diameter disk. Use the following procedure to copy a 7-minute record from a standard diameter disk to a 3⅞-inch diameter disk.

(1) Turn on the unit by operating selector switch S2 to the COPY position.
(2) Raise cover A 9.
(3) Place the disk to be copied on the turntable and place a blank 3⅞-inch diameter disk on top of the disk to be copied.
(4) Lower cover A 9.
(5) Operate switch S1 to the LISTEN position to lift the recorder arm.
(6) Move recorder head E2 by its handle until the light beam for the recorder head lines up with the arrowhead underneath the 7¾-minute mark on index scale N1.
(7) Move reproducer head E1 to where it is desired to start copying.
(8) Operate switch S2 to the TALK position. The turntable automatically makes 1 or 2 revolutions to provide a lead-in groove.
(9) To rotate the turntable, press the microphone button in and up.
(10) Adjust volume control R19 to provide moderate flashes of lamp I 1. Do not turn the control any higher than necessary to flash lamp I 1 moderately.
(11) It is possible to listen to the sound through the microphone as copying is taking place.

(12) When copying is completed, shut off the equipment by operating selector switch S2 to the OFF position.

g. Stopping Procedure.

(1) When the recorder head reaches the 14/34-mark on the index scale, a bell rings to indicate that there is one-fourth of a minute recording time left on the disk. At this time the disk should be changed, or the equipment stopped.

(2) To stop the equipment, turn selector switch S2 to the OFF position and operate switch S1 to the LISTEN position.

(3) Release the microphone button.

(4) Place the dust cover over the recorder-reproducer. *Do not* place the dust cover over the unit while the unit is on.

17. Operation with Speaker and Telephone Control Unit

(fig. 7)

a. Preparation. Connect the microphone, the speaker and telephone control unit, and the recorder-reproducer as indicated in paragraph 12*c*.

Note. The speaker and telephone control unit must be hooked up to the telephone line through a telephone recorder connector (tone warning generator) by the proper authorities.

b. Telephone Recording.

(1) Connect the tone warning generator to the power line by operating switch S301 located on the front of the speaker and telephone control unit to the ON position. A white dot shows on the knob of the switch when in the ON position.

(2) Operate selector switch S2 to the DICT position. The recorder-reproducer now is connected to the power line.

(3) Raise cover A9. Place a blank disk on the turntable and lower the cover.

(4) Operate switch S2 to the TALK position. The turntable automatically makes 1 or 2 revolutions to provide a lead-in groove.

(5) Operate switch S302 to the TEL position. The turntable will rotate.

(6) Pick up the telephone and carry on conversation.

(7) Adjust gain control R301 so that the distant voice causes lamp I1 to flash. If the distant voice does not cause the lamp to flash when recorder volume control R301 is turned fully clockwise, operate selector switch S2 to the INT position and readjust R301 so that the distant voice causes lamp I 1 to flash.

(8) To pause during telephone recording, operate switch S302 to the DICT position. To resume telephone recording, operate the switch to the TEL position.

(9) At the end of the telephone conversation, return switch S302 to the DICT position and operate switch S301 to the OFF position.

c. Play-Back and Recording.

(1) Operate switch S302 to the DICT position.

(2) For recording dictation, interviews, and copies, and for reproducing records, follow the instructions outlined in paragraph 16.

d. Stopping Procedure.

(1) Follow the instructions in paragraph 16*g*.

(2) Turn off the power to the telephone recorder connector (tone warning generator) by operating switch S301 on the speaker and telephone control unit to the OFF position.

18. Purpose and Use of Equipment Performance Checklist

a. General. The purpose of the checklist (par. 19) is to provide the operator with a means of knowing whether the performance of the equipment is normal or abnormal. The checklist gives the items to be checked, the conditions under which the item is checked, normal indications (should the equipment be satisfactory), and what to do to correct faulty operation. To use this list, follow the items in numerical sequence. Check item 1 (after the initial installation) and item 2 when starting the equipment. Check items 3 to 8 daily to determine whether the recorder-reproducer is functioning properly.

b. Action or Condition. For some items, the information given in action or condition column consists of the setting of various switches and controls under which the item is to be checked. For other items, it represents an action that must be taken in order to produce normal indication.

c. Normal Indication. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If indications are not normal, the operator should

apply the recommended corrective measures described in the remedy column.

d. Remedy. The corrective measures listed in the remedy column are those that the operator can make without turning in the equipment for repairs. Reference to chapter 4 indicates that trouble shooting and servicing by an experienced repairman may be required.

e. Preparatory Items. All items which are designated as preparatory should be checked every time the equipment is put into operation.

f. Start and Operation Items. These items represent starting and general operating conditions of the equipment. The operator must become familiar with the characteristics of the equipment during normal operation; he must use that knowledge as a basis for recognizing changes in audible and visual indications when the equipment is not operating properly.

g. Stop Items. Check the stop items whenever the equipment is taken out of operation. Abnormal indications at this time are probably caused by trouble in the equipment and should be corrected before the next period of operation.

19. Equipment Performance Checklist

a. Checklist for Microphone Connected to Recorder-Reproducer

	Item No.	Item	Action or condition*	Normal indication	Remedy
PREPARATORY	1	Cords	Make all connections as described in paragraph 12*b*.	All connectors secure in place.	Push connectors firmly into receptacles.
	2	Reproducer head E1	Remove handle from clasp.	Reproducer head E1 can be lowered to turntable.	
	3	LISTEN—TALK switch S1.	Turn to LISTEN position.	Recorder head E2 rises from disk.	
	4	Cover A 9	Open cover A 9 as far as possible.	Recorder and reproducer heads E2 and E1 retract to outside of turntable.	Be sure cover is raised as far as possible. There is a link mechanism at the back end of the cover. Cover should be raised to the point where the overtravel springs take hold and retract the heads.
	5	Disk	Place disk on turntable.		
	6	Cover A 9	Lower cover.		
	7	LISTEN—TALK switch S1.	Turn to TALK position	Recorder head E2 and stylus lower to disk, and turntable automatically turns 1 or 2 revolutions and then stops.	
	8	Reproducer head E1	Stylus should rest normally on disk while recording takes place.	Makes possible quick review.	
START	9	Selector switch S2	Turn set on by turning to DICT, INT, or COPY position.	Tubes and lamps light up. Light beams appear at zero on index scale N1, as one beam.	Check index bulb and cable connection. If light beams are not at zero, cover A 9 has not opened far enough.

19. Equipment Performance Checklist—Continued

a. Checklist for Microphone Connected to Recorder-Reproducer—Continued

	Item No.	Item	Action or condition	Normal indication	Remedy
RECORDING OPERATION	10	Selector switch S2	Turn to DICT position	Equipment is now ready for dictation.	
	11	Microphone button O 204.	Push straight in and up	Turntable rotates continuously. Microphone button locks in position.	
	12	Gain control R18	Adjust for proper recording level.	Talking across face of microphone causes lamp I 1 to flash.	Turn screw driver-slotted shaft of control at rear of unit so that lamp I 1 flashes. Turn control no higher than necessary. Once control is adjusted for any one operator, it does not require readjustment.
	13	COR button O 56	Depress to indicate on disk that a correction is inserted. Turntable must rotate to emboss correction groove.	This produces a space between the grooves on disk, indicating to the typing operator a correction in the dictation.	
	14	END button O 55	Depress to indicate the end of dictation.	This produces a space between the grooves on the disk that is twice as wide as that obtained by depressing COR button O 56, indicating to the operator the end of a letter or telephone conversation.	
	15	Microphone button O 204.	Push in and down	Last few words of dictation are heard through the microphone.	Adjust volume control R19.
PLAY-BACK OPERATION	16	Disks	Raise cover A 9, remove used disk, insert recorded disk, and lower front cover.		
	17	Selector switch S2	Leave at DICT, INT, or COPY position.		
	18	LISTEN—TALK switch S1.	Turn to LISTEN position.	Recorder head and stylus rise from disk.	
	19	Reproducer-head E1 handle.	Use handle to place play-back head on disk.	Record will be heard through microphone.	
	20	Microphone button O 24.	Push in and up	Turntable rotates.	
	21	Reproducer volume control R19.	Turn clockwise and counterclockwise.	Increases and decreases play-back volume.	
STOP	22	Microphone button O 204.	Release	Turntable stops rotating.	
	23	Selector switch S2	Turn to OFF position	Light beams on index scale N1 extinguish.	

19. Equipment Performance Checklist—Continued

b. Checklist for Control Unit Recording.

	Item No.	Item	Action or condition	Normal indication	Remedy
PREPARATORY	1	Cords	Make all connections in accordance with figure 6 and paragraph 12*c*.		
	2	Reproducer head E1	Remove handle from clasp.	Reproducer head E1 can be lowered to turntable.	
	3	LISTEN—TALK switch S1.	Turn to LISTEN position.	Recorder head E2 rises from turntable.	
	4	Cover A 9	Open cover A 9 as far as possible.	Recorder and reproducer heads E2 and E1 retract to outside of turntable.	Be sure cover is raised as far as possible. Cover should be raised until link mechanism takes hold and retracts the heads.
	5	Disk	Place disk on turntable.		
	6	Cover A 9	Lower cover.		
	7	LISTEN—TALK switch S1.	Turn to TALK position.	Recorder head E2 and stylus lower to disk, and turntable automatically makes 1 or 2 revolutions and then stops.	
START	8	Selector switch S2	Turn to DICT position.	Tubes and lamps light up. Light beams appear at zero on index scale N1 as one beam.	Check index bulb and cable connections. If light beams are not at zero, cover A 9 has not been opened far enough.
	9	Power switch S301	Flip to right. White dot will show.	Turns on filament circuit of telephone recorder connector (tone warning generator).	
TELEPHONE OPERATION	10	DICT—TEL switch S302.	Operate to TEL position.	Turntable revolves.	
	11	Telephone	Carry on conversation	Recording of telephone conversation takes place. The warning tone will be heard in the telephone. The voice signal flashes lamp I 1.	If voice on other end of telephone line does not cause lamp I 1 to flash, turn switch S2 to INT position.
	12	Gain control R301	Turn clockwise or counterclockwise.	Increases or decreases recording volume.	Adjust control R301 so that lamp I 1 flashes, but turn no higher than necessary, otherwise, record will be distorted. Once this control is set for any one operator, it requires no readjustment.

19. Equipment Performance Checklist—Continued

b. Checklist for Control Unit Recording.—Continued

	Item No.	Item	Action or condition	Normal indication	Remedy
MICROPHONE OPERATION	13	Power switch S301	Operate to OFF position	Disconnects tune warning generator from power line.	
	14	DICT—TEL switch S302.	Flip to DICT position to use microphone plugged into control unit. Refer to *a* above.		
	15	Loudspeaker button S303.	Push in for use during play-back.	Recordings can be heard through loudspeaker.	
STOP	16	Power switch S301	Operate to OFF position	Warning tone is not heard through the telephone.	
	17	DICT—TEL switch S302.	Operate to DICT position.	Turntable stops rotating (provided microphone button O 204 is released).	
	18	Microphone button O 204 (perform only if switch S302 is in DICT position).	Release	Turntable stops rotating	
	19	Selector switch S2	Operate to OFF position	Light beams on index scale N1 extinguish.	

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

20. Unusual Conditions

Operation of Sound Recorder-Reproducer Set AN/FNQ-3 (*) in tropical, arctic, or desert regions, where extremes of temperature and humidity often occur, involves problems which require special care of the equipment. In most cases, this special care must be determined by the particular installation and resultant degree of exposure to these conditions. For information covering the special treatment of equipment subject to these conditions, refer to paragraphs 21, 22, and 23.

21. Operation in Arctic Climates

Extreme cold followed by warmth causes moisture condensation to form on the unprotected parts of components located within the recorder-reproducer. The application of B voltage (approximately 120 volts) across terminals which are wet with condensed moisture causes current to flow between the terminals, with the possibility of a short circuit causing damage to the equipment. In cases of extreme cold followed by warmth, such as moving equipment inside from outdoors, let equipment dry out and warm up to room temperature before turning it on.

22. Operation in Desert Climates

Dust and very high temperatures are encountered in desert areas. To protect the equipment, make the operation shelter as impervious to dust as possible. Cover the equipment when it is not in use. Avoid long operating periods to insure lower temperature of parts.

23. Operation in Tropical Climates

Condensation of moisture and fungi form electrical paths which divert current and cause damage. Cover the equipment as tightly as possible after each day of operation to prevent moisture from entering it.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. GENERAL

24. Tools and Materials

The following tools and materials are required in addition to common hand tools for organizational maintenance of the sound recorder-reproducer set.

Sig C stock No.	Name and description	Used to
6Z7500–0000	Abrasive, sheet: sandpaper; No. 0000; 9″ x 11″ sheet.	Remove rust and corrosion from metal parts.
6Z1415.8	Brush, cleaning	Remove dust, dirt, and lint from interior of equipment.
6Z1401	Brush, paint: soft hair, flat; 1″ wide	Apply paint.
6Z1989	Cloth, textile: cheesecloth; lint-free; 36″ wd.	Clean various parts of equipment.
(Quarter master) QMC51–S–4385–1	Solvent, dry cleaning (SD)	Remove grease, oil, and corrosion from equipment.
6Z7360	Stick, orange	Remove fungus growth from equipment.

25. Special Tools Supplied

(fig. 14

A number of special tools also are required and these are listed with their specific uses as follows:

Sig C stock No.	Name and description	Used to
6Q188–20	Adjuster	Aline log light beam.
6Q44623	Gage	Adjust height of recorder head above disk.
6Z8078	Scale, postal	Adjust pressure of styluses.
6R38635–3	Lifting tool, amplifier card	Raise amplifier card.
6Z9444–1	Test weight: 5 oz	Calibrate postal scale.
6R55209.3	Wrench, box	Lock ½ hex nuts on recorder and reproducer arms.
6R57549–1	Wrench, spanner: .312″ between pins	Tighten head of arm-lifing mechanism.
6R57549–2	Wrench, spanner: ½″ between pins	Remove volume control bushing.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
PUBLIC ADDRESS, RECORDER, REPRODUCER

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; I Adjustment, repair or replacement required; Ⓧ Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	W	T	W	T	F	S
①	INSPECT UNIT FOR COMPLETENESS - MICROPHONE, HEADSET, CORDS, CABLES, ACCESSORIES, RUNNING SPARES. PAR.5							
②	CLEAN EXTERIOR OF COMPONENTS OF DIRT, GREASE, GRIME, CORROSION, OIL. PAR.29 a(2)							
③	CLEAN PLUGS AND ELECTRICAL CONNECTIONS OF CORROSION, TARNISH, DIRT, DUST, GREASE, OIL. PAR.29a(3)							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
④	INSPECT EXTERIOR OF COMPONENTS FOR RUST, CORROSION, LOOSE OR MISSING SCREWS, CHIPPED PAINT, CRACKS. PAR.29 b(1)		⑦	INSPECT ELECTRICAL CONNECTIONS FOR FIRMNESS OF SEATING, PROPER CONTACT, TIGHTNESS, CORROSION, GREASE, OIL, DIRT. PAR. 29 b(4)	
⑤	INSPECT CORDS AND CABLES FOR LOOSE TERMINALS, FRAYED, CUT OR GOUGED INSULATION OR JACKETING, BROKEN CONDUCTORS. PAR.29 b(2)		⑧	INSPECT PLUGS FOR CHIPS, CRACKS, CORROSION, TARNISH, ROUGHNESS, BENDS. PAR.29 b(5)	
⑥	TIGHTEN - LOOSE EXTERIOR SCREWS, BOLTS, FASTENINGS, MOUNTINGS. PAR. 29 b(3)		⑨	OPERATE UNIT AND CHECK FOR SMOOTHNESS, UNUSUAL NOISES, SQUEAKS, VIBRATIONS, CORRECT OPERATION. PAR. 29 b(6)	

10 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA AGO FORM 1 MAY 51 **11-250** REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 5063-44

Figure 12. DA AGO Form 11–250, facsimile of front of form.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
PUBLIC ADDRESS, RECORDER, REPRODUCER

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE | EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
1	INSPECT UNIT FOR COMPLETENESS - MICROPHONE, HEADSET, CORDS, CABLES, ACCESSORIES, RUNNING SPARES. PAR. 29 a (1)		13	SOLDER ANY BROKEN OR LOOSE SOLDERED CONNECTIONS. PAR.29 b (2)8(a)	
2	CLEAN EXTERIOR OF COMPONENTS OF DIRT, GREASE, GRIME, CORROSION, OIL. PAR.29a (2)		14	INSPECT INTERNAL WIRING AND CABLING, WHERE ACCESSIBLE FOR LOOSE TERMINALS, FRAYED, CUT, OR GOUGED INSULATION OR JACKETING,BROKEN CONDUCTORS. PAR.29b(10)	
3	CLEAN PLUGS AND ELECTRICAL CONNECTIONS OF CORROSION, TARNISH, DIRT, DUST, GREASE, OIL. PAR. 29 a (3)		15	INSPECT MOTORS FOR CONDITION OF BRUSHES, EVIDENCES OF OVERHEATING, END PLAY, SIDE PLAY. PAR.29 b(11)	
4	INSPECT EXTERIOR OF COMPONENTS FOR RUST, CORROSION, LOOSE OR MISSING SCREWS, CHIPPED PAINT, CRACKS. PAR.29b(1)		16	INSPECT REPRODUCER AND/OR RECORDER HEADS FOR GENERAL CONDITION. PAR.29b(12)	
5	INSPECT CORDS AND CABLES FOR LOOSE TERMINALS, FRAYED, CUT OR GOUGED INSULATION OR JACKETING, BROKEN CONDUCTORS. PAR 29b(2)		17	CLEAN CIRCUIT ELEMENTS, LOUD-SPEAKERS, TURNTABLES, REELS, MOTORS OF DIRT, DUST, GREASE, OIL, GRIME, WHERE ACCESSIBLE. PAR.29b(13)	
6	TIGHTEN - LOOSE EXTERIOR SCREWS, BOLTS, FASTENINGS, MOUNTINGS. PAR 29 b(3)		18	INSPECT CAPACITORS, POTENTIOMETERS, AND RESISTORS FOR LOOSE TERMINALS, CORROSION, LEAKS, BULGES, BLISTERING, DISCOLORATION. PAR.29 b(14)	
7	INSPECT ELECTRICAL CONNECTIONS FOR FIRMNESS OF SEATING, PROPER CONTACT, TIGHTNESS, CORROSION, GREASE, OIL, DIRT. PAR 29 b(4)		19	INSPECT INKING UNITS FOR CLOGGING, GUMMY DEPOSITS, DIRT, GREASE.	
8	INSPECT PLUGS FOR CHIPS, CRACKS, CORROSION, TARNISH, ROUGHNESS, BENDS. PAR 29 b(5)		20	INSPECT ALL LABELS, ENGRAVINGS, PLATES FOR LEGIBILITY.	
9	OPERATE UNIT AND CHECK FOR SMOOTHNESS; UNUSUAL NOISES, SQUEAKS, VIBRATIONS; CORRECT OPERATION. PAR. 29 b (6)		21	CLEAN, TIGHTEN, AND WHERE APPLICABLE, LUBRICATE AIR FILTER.	
10	INSPECT ALL VISIBLE MOVING PARTS FOR BINDING, SCRAPING, SQUEAKING, EVIDENCES OF WORN BEARINGS, SHAFTS, GEARS.		22	LUBRICATE UNIT IN ACCORDANCE WITH LATEST DEPARTMENT OF THE ARMY LUBRICATION ORDER OR INFORMATION PUBLISHED IN APPROPRIATE TECHNICAL MANUAL.	
11	INSPECT TUBE SOCKETS FOR CRACKS, CHIPS, LOOSE SOLDER CONNECTIONS. PAR.29b(7)		23	INSPECT MOISTURE AND FUNGUS PROOFING	
12	INSPECT TUBES FOR SEATING, LOOSE ENVELOPES. PAR.29 (8)		24	INSPECT FOR PROPER SEASONAL MAINTENANCE WHERE APPLICABLE.	
			25	INSPECT CONTROLS FOR BINDING, SCRAPING, POSITIVE ACTION.	

26 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA AGO FORM 1 MAY 51 11-251 REPLACES DA AGO FORM 419, 2 DEC 50, WHICH IS OBSOLETE.

TM 5063-45

Figure 13. DA AGO Form 11-251, facsimile of front of form.

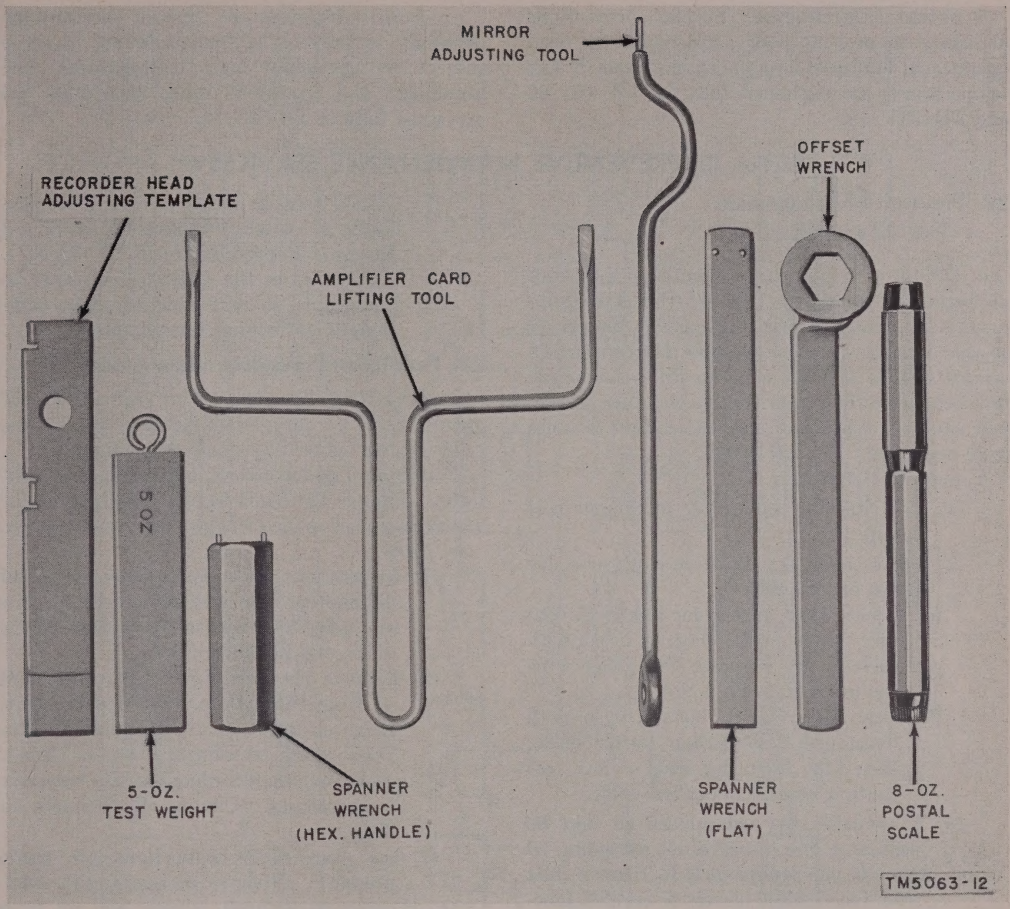


Figure 14. Special tools.

Section II. LUBRICATION AND PRESERVATION

26. Lubrication

No lubrication is needed because gears and bearings are lubricated and sealed by the manufacturer. Other moving parts such as gear segments and arm mounts must not be lubricated as this attracts unwanted dust and dirt. Excess lubricant may cause shorts, get onto the disks, and otherwise interfere with the operation of the equipment.

27. Weatherproofing

a. General. Sound Recorder-Reproducer Set AN/FNQ–3(*), when operated under severe climatic conditions, such as prevail in arctic, tropical, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most of the materials used in the construction of the equipment.

b. Tropical Maintenance. The recorder-reproducer is not moistureproofed and fungiproofed. However, treatment may be required in the field as a result of damage to the protective varnish film due to moisture or fungus. A special moistureproofing and fungiproofing treatment has been devised, which, if properly applied, provides a reasonable degree of protection. This treatment is explained fully in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained fully in TB SIG 66 and TB SIG 219.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained fully in TB SIG 75.

Section III. PREVENTIVE MAINTENANCE SERVICES

28. Preventive Maintenance
(figs. 12 and 13)

a. Definition. Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain troubles from occurring. See AR 750–5.

b. General Techniques.

(1) Use No. 0000 sandpaper to remove corrosion.

(2) Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(*a*) If necessary, except for electrical contacts, moisten the cloth or brush with solvent, dry cleaning (SD); then wipe the parts dry with a cloth.

(*b*) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a cloth (see caution note in paragraph 29*b*).

(3) If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

(4) For further information on preventive maintenance techniques, refer to TB SIG 178.

c. Use of Forms (figs. 12 and 13).

(1) The decision as to which items on DA Forms 11–250 and 11–251 are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

(2) Circled items in figures 12 and 13 are partially or totally applicable to Sound Recorder-Reproducer Set AN/FNQ–3(*). References in the ITEM block refer to paragraphs in text which contain additional maintenance information.

29. Performing Preventive Maintenance

Perform the following preventive maintenance operations at the intervals indicated, unless these intervals are reduced by the local commander.

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

a. Daily.

(1) Inspect unit for completeness—set, hand microphone with hardware, cords, speaker and telephone control unit, dust cover, disks, and filers for disks.

(2) Remove dirt, grease, grime, corrosion, and oil from the exterior of the equipment. Brighten the cabinet with a damp cloth. Dust disks thoroughly before using. Never expose recording disks to excessive temperatures. Use no oily cleaners on disks.

(3) See that cable connections are made properly. Remove moisture, dirt, dust, corrosion, tarnish, grease, and oil from plugs and electrical connectors. Make sure that each plug is seated firmly and that the cord is securely attached to the plug.

b. Weekly.

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.

(1) Inspect exterior of parts for rust, corrosion, loose or missing screws, chipped paint, and cracks.

(2) Inspect cords and cables for loose terminals, frayed, cut or gouged insulation or jacketing, and broken conductors. Check soldered joints for cold solders, dust or rosin, and accumulated dirt.

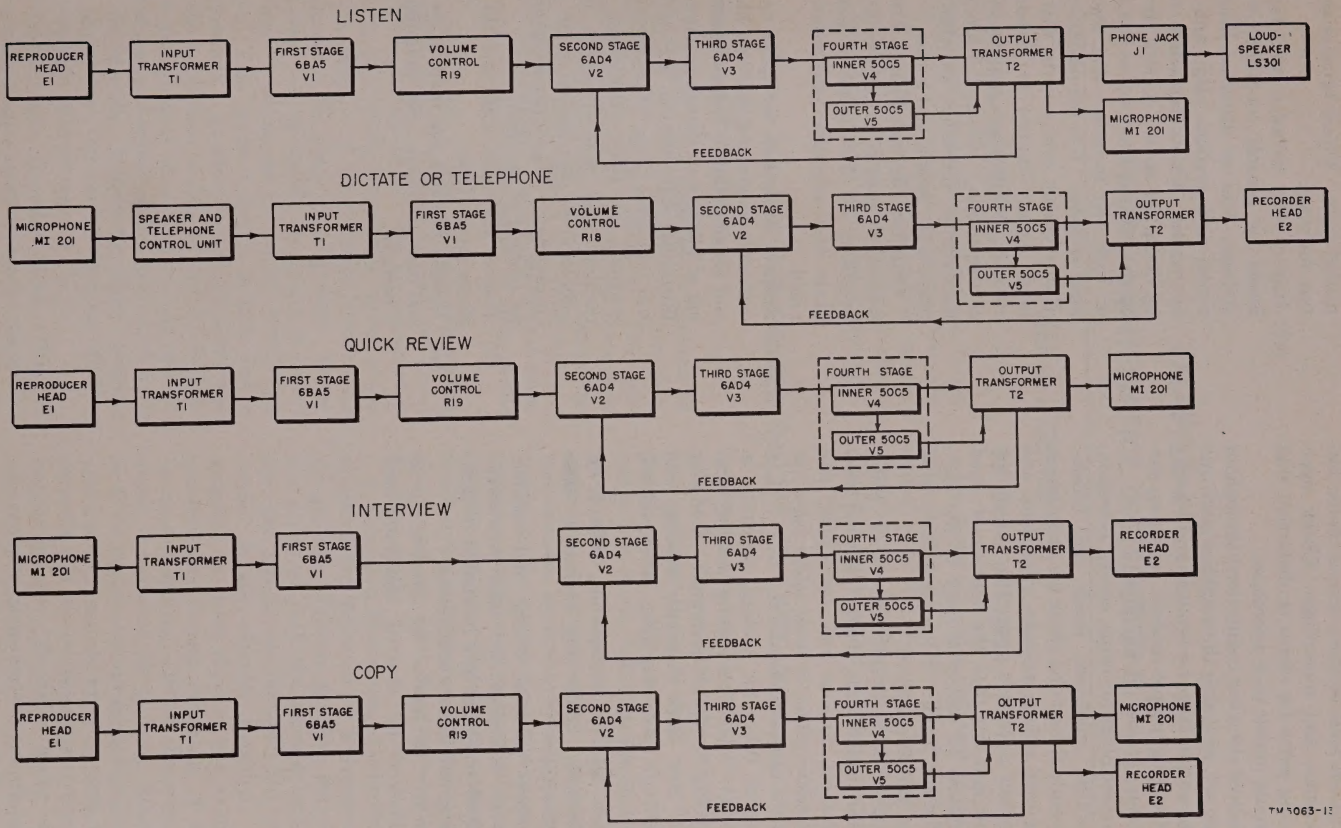


Figure 15. Sound Recorder-Reproducer Set AN/FNQ-3 (*), block diagram.

(3) Tighten loose exterior screws, bolts, fastenings, and mountings. Check operating parts for strain or distortion that would impair their operation.

(4) Inspect electrical connections throughout the set, including the amplifier card, and the output stage for firmness and security of seating, proper contact, tightness, corrosion, grease, oil, and dirt.

(5) Inspect plugs for chips, cracks, corrosion, tarnish, roughness, bends, and breaks.

(6) Operate the set and check for smoothness, unusual noises, squeaks, vibrations, and correct operation (par. 19). Open the top and see that the reproducer head retracts to the outer edge of the disk. Try the handle of the reproducer head for proper operation.

(7) Inspect tube sockets for cracks, chips, loose connections, badly soldered connections, broken and bent pins, and excessive solder or loose solder lugs that might cause shorts.

(8) Inspect tubes for seating, tightness in socket, solder preventing seating, and missing, bent, or broken pins. A missing pin may cause improper seating, and although tubes may light, the circuit will be inoperative.

(9) Probe soldered connections. Check for looseness. Solder any broken or loose connections.

(10) Inspect internal wiring and cabling, where accessible, for loose terminals; frayed, cut, or gouged insulation or jacketing; and broken conductors.

(11) Inspect the motor for overheating as evidenced by charred insulation and melted rosin. Check brushes and armature for wear.

(12) Inspect the recorder and reproducer heads for general condition, worn out styluses, bent or distorted heads, horizontal and vertical play, and ease of movement. Check retraction of heads by lifting the cover. Check the tension on the recorder head stylus and the drag of both the recorder- and reproducer-head styluses. Use the postal scale.

(13) Clean circuit components with a soft brush lightly dipped in carbon tetrachloride. (Never use gasoline, kerosene, or turpentine.) Clean the loudspeaker, microphone, turntable, switches, relays, index scale, lamps, and lenses.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

(14) Inspect capacitors for loose terminals, corrosion, bulges, melting wax, blistering, and discoloration. Bulges denote warping of plates and change in capacitance. Blistering, discoloration, and melting of wax indicate a short, or proximity to hot resistors, or poor ventilation. Check resistors and potentiometers for discoloration as this indicates too high a current flow. Check potentiometers also for binding of the shaft.

(15) Inspect the index scale and the nameplates for legibility.

(16) Inspect controls for binding, scraping, and ease of action. See that the action is positive.

CHAPTER 4
FIELD MAINTENANCE INSTRUCTIONS

Section I. GENERAL

30. Field Maintenance Service

The repair instructions that follow are intended for use by field maintenance personnel who are trained and equipped to handle complex repairs. Special equipment is required that is not available generally to organizational maintenance personnel.

31. Scope of Repairs

The scope of repairs that may be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of assigned personnel. Facilities for handling intermittent troubles also are required.

Section II. CONDENSED THEORY OF OPERATION

32. Operation of Turntable

a. Main Drive. The turntable is rotated at 33⅓ rpm by a capacitor-type motor through a reduction gear and a flexible coupling. The turntable shaft is connected by a reduction worm gear to the drive-shaft. The drive-shaft enters the rear gear boxes which contain one worm and two reduction gears connected to the shafts that cause the recorder and reproducer heads to move across the disk.

b. Groove Structure. The groove is embossed in the plastic disk by a permanent diamond-tipped stylus on the recorder head. The groove starts at the outside and spirals toward the center of the disk. The pressure of the recorder head on the disk determines the width of the groove. Excessively heavy pressure causes the groove to be too wide, which results in one groove interfering with the next. This causes echo-like sounds and is called cross talk. Excessively heavy pressure also causes the reproducer stylus to ride in the land between the grooves instead of in the groove. This produces two sounds at the same time and is called double-talk. Extremely light pressure makes the groove too narrow and too shallow which results in mistracking.

c. Reproducer and Recorder Heads. The reproducer and recorder heads are moved toward the center of the disk by the gear train at the same rate of speed. By adjusting the position of the reproducer head it can be made to trail behind the recorder head. The amount of trailing determines how much dictation can be heard during quick review without manually moving either the reproducer or recorder arm. The recorder stylus and armature are fastened rigidly within the head. However, the reproducer stylus is mounted to a cartridge which is free to move laterally within the reproducer head. This design permits the reproducer stylus to track any eccentricity in the spiral groove and also track the groove embossed across an index mark.

d. Correction Mechanism. Corrections and ends of letters are indicated by wider spaces between the grooves. Friction clutches, that form part of the drives of both the recorder and reproducer systems, slip in one direction but engage when turned in the opposite direction. Two arms attached to these clutches are actuated by an overdrive mechanism consisting of a system of levers and springs. When this overdrive mechanism is actuated by pressing either the COR or END button, one spring applies pressure to the clutches momentarily to cause them to move the recorder and reproducer arms at four times their regular speed. The other spring then acts to relieve this pressure and restores the normal speed

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When the COR button is depressed, the turntable makes 1 revolution while the recorder and reproducer arms move at the higher speed. When the END button is depressed, the turntable makes 2 revolutions while the recorder and reproducer arms move at the greater speed, thus forming a blank twice the width of the correction blank. These wider spaces give visual indication to the operator of corrections and ends of letters.

e. Index Scale. Light beams moving on an index scale on the front cover indicate the positions of the recorder and reproducer heads. A lamp, reflector, and optical system are used to focus a single light beam onto two small mirrors located on top of the mount of the reproducer head. Each mirror reflects a light beam onto the index scale. One mirror is fixed to the mount so that as the reproducer head and mount move, the mirror and light beam move with them. The other mirror is fastened to a gear segment which is rotated by a mating gear segment attached to the recorder arm and similarly indicates on the index scale the position of the recorder head. The index scale is graduated in minutes, and each minute is graduated in four parts so that each graduation represents 15 seconds of time. This system of light beams moving on a scale permits logging of the recorded material. An accurately logged file may be made up of the recorded material by using a china marking pencil to write on the disks and by using filer envelopes on which to keep the logs.

33. Microphone and Recorder Head

a. Microphone Operation. For recording, the dynamic microphone converts sound into electrical energy by means of a voice coil suspended in an intense magnetic field, the flux of which is supplied by a permanent magnet. The coil is attached to the diaphragm, and sound waves striking the diaphragm cause both to vibrate. This vibration of the voice coil in the magnetic field generates a voltage across the voice coil, and this voltage rises and drops with the diaphragm and coil movement. Since the microphone is connected across the taps of the amplifier input transformer, a circuit exists with a varying current flow. The transformer primary voltage then is induced into the secondary winding of the transformer and, since the step-up ratio of primary to secondary is very high, the small microphone output voltage is increased to usable levels and applied to the control grid of the first audio amplifier tube to be amplified further.

b. Recorder-Head Operation. The electrical energy thus induced and amplified is fed to a coil-wound armature riding in the magnetic field of a permanent magnet within the recorder head and is reproduced as vibrations in the armature and the diamond stylus. The stylus embosses a groove in the revolving disk and these vibrations are reproduced in the groove as undulations.

34. Reproducer Head and Speaker

a. Reproducer-Head Operation. For reproduction, the sapphire stylus of the reproducer head is lowered into the groove, and is forced to move laterally as the disk rotates. The stylus transmits movement due to the groove undulations to the coil holder of the moving coil within the reproducer head. Since the coil is located in a magnetic field produced by a permanent magnet, any movement of this coil generates a voltage corresponding in magnitude and frequency to the stylus movement. Movement of the stylus caused by the undulations in the groove therefore generates an audio voltage which is amplified and fed to the speaker.

b. Speaker Operation. The microphone may be used as a loudspeaker. The output of the amplifier is applied to the coil in the magnetic field of the microphone and causes the coil and diaphragm to vibrate. This action transforms electrical energy into sound energy.

35. Input Circuits

(figs. 15 and 47)

a. Microphone.

(1) Microphone MI 201 is a dynamic type with an impedance of 10 ohms. One terminal of the element is connected to the shield and the other terminal is connected to the white conductor inside the shield. The white conductor is connected to terminal 2 and the shield to terminal 1 on the molded plug. These contacts are connected to the amplifier input through the speaker and telephone control unit and socket X1 located on the bottom of the equipment. Microphone cord W201 has a seven-pin miniature plug molded on one end. The cord has one conductor within a shield and three conductors outside the shield.

(2) The microphone contains two normally open switches S201 and S202. Switch

S201 controls the operation of the turntable motor through remote-control relay K2. Switch S202 operates reproducer relay K1. Neon lamp I 201 is connected in series with current limiting resistor R201. This series combination is wired across the contacts of switch S202. When switch S202 is actuated, lamp I 201 extinguishes, indicating that the amplifier circuits are connected for reproduction (quick review). When switch S202 is open (and switch S2 is in the DICT position), the neon lamp glows, indicating that the amplifier circuits are connected for recording dictation.

b. Speaker and Telephone Control Unit.

(1) The speaker and telephone control unit permits connection from a telephone to the recorder-reproducer. The unit also houses a loudspeaker which may be used during reproduction of records.

(2) Cord W301 is a six-conductor cord that terminates in a seven-contact receptacle. This connector receives the plug from the telephone recorder connector (tone warning generator). A two-conductor cord from cord W301 terminates in a standard two-contact wall plug. This cord connects the telephone recorder connector to the power line through on-off switch S301 of the speaker and telephone control unit. When switch S302 is in the TEL position, terminals 2 and 7 are connected together to complete the plate supply circuit of the two tubes within the telephone recorder connector. The telephone recorder connector generates the tone signal which indicates to the parties on the telephone that the call is being recorded. The telephone signal is applied to the speaker and telephone control unit through terminals 3 and 4 of cord W301.

(3) Capacitor C301 and transformer T301 provide coupling and isolation between the telephone recorder connector and the input of the recorder-reproducer. Potentiometer R301 varies the telephone signal level input to the recorder-reproducer.

(4) DICT—TEL switch S302 is a three-pole, double-throw switch. In the TEL position, the switch connects the turntable to the power line through relay K2. Connection is made also between the telephone circuit and the input of the recorder-reproducer. The plate supply circuits of the telephone recorder connector are completed. In the DICT position, the switch connects the microphone to the input circuit of the recorder-reproducer.

(5) Loudspeaker LS301 connects to the output of the recorder-reproducer through switch S303 and cord W303. Cord W303 terminates in a speaker plug that fits into jack J1 on the rear of the sound recorder-reproducer set. Switch S303 turns the loudspeaker on and off.

36. Voltage and Power Amplifiers

a. First Amplifier Stage.

(1) The input signal for the recorder-reproducer may be obtained from the hand microphone, the telephone line, or the reproducer head. The signal is stepped up through transformer T1 and applied to V1 control grid. Capacitor C6 places the lower terminal of transformer T1 at a-c (alternating-current) ground potential. Capacitor C10 rejects undesirable high frequency disturbances. Plate load resistor R3 and resistor R1 connect the plate to the B supply. The screen grid is connected to the B supply through dropping resistor R5. Capacitor C11 bypasses the screen grid to B—. The audio output signal from this stage is coupled to volume control R18 by capacitor C1 through terminal 4 of the amplifier card.

(2) Potentiometer R19 is the play-back volume control and potentiometer R18 is the recording gain control. Resistor R17, connected between pin 4 of the amplifier card and volume control R19, decreases the audio signal applied to volume control R19. Resistor R21 determines the minimum play-back volume. Reproducer relay contacts K1d select the play-back or recording volume control. In the playback position, relay K1 connects volume control R19 to V2 control grid; in the record position, relay K1 connects volume control R18 to V2 control grid.

(3) Capacitor C15 is a tone control. When relay contacts K1b are in the play-back position, the low end of this capacitor is connected to B— to reduce high frequencies. When relay contacts K1b are in the record position, this capacitor is disconnected from B—. Resistor R20, in conjunction with capacitor C17, comprises a bypass circuit and is connected in parallel with resistor R12 in the cathode circuit of the second voltage amplifier tube, V2. This network partially eliminates the higher frequencies from the inverse feedback and increases the higher frequency response while recording.

b. Second Amplifier Stage. Second voltage amplifier tube V2 is biased by cathode resistors R6 and R12. Cathode resistor R6 is bypassed by capacitor C8. The inverse feedback voltage from terminals 4 and 5 of output transformer T2 is developed across cathode resistor R12. Resistor R22 determines the amount of inverse feedback voltage applied to resistor R12. The output signal is developed across plate load resistor R4. Both the first and second voltage amplifier stages have their plate circuits decoupled from the B supply by resistor R7 and capacitor C12. The plate of second voltage amplifier tube V2 is coupled to the grid of third voltage amplifier tube V3 by coupling capacitor C2.

c. Third Amplifier Stage.

(1) Resistor R8 is the grid resistor for the third voltage amplifier stage. This stage receives its bias from cathode resistor R9. The plate receives its B voltage through plate load resistor R10. Capacitor C5 bypasses plate load resistor R10 to reduce some of the undesirable high frequencies. Capacitor C3, connected to the plate of amplifier tube V3, couples the signal to the grid of driver-output tube V4.

(2) The impedance of varistor E16 changes with voltage changes. Increased voltage causes decreased impedance, and vice versa. This varistor provides instantaneous avc action. The greater the voltage output of this stage, the less the resistance of E16, and therefore the greater the avc voltage developed. Resistor R2 in parallel with the varistor determines the effectiveness of the varistor since it determines the voltage and therefore the impedance range in which the varistor operates. The varistor is not used in Sound Recorder Reproducer Set AN/FNQ–3A.

(3) Capacitor C4, germanium rectifiers CR1 and CR2, capacitor C9, and resister R15 comprise a voltage doubler, rectifier, and filter circuit. (In the AN/FNQ–3A, selenium rectifiers for CR1 and CR2 are used.) The voltage output from this network is applied, through the decoupling circuit consisting of resistor R14 and capacitor C7 and through the secondary of transformer T1, as negative bias on V1 control grid. Increased voltage or gain at the output increases the negative bias at the first tube and thus decreases the gain of the amplifier. This prevents overload distortion.

d. Power Output Stage.

(1) The output stage consists of two 50C5 tubes (V4 and V5) connected in push-pull. The circuit is arranged to provide self-inversion. Tube V4 located nearest the center of the equipment is the driven tube. Resistor R11 located on the card is the grid resistor for output tube V4. Tube V5, the outer 50C5, is connected as a grounded grid amplifier. When tube V4 amplifies a signal, a portion of the output voltage is developed across resistor R16 which is common to both cathodes. This voltage is used as the input signal voltage for tube V5. The screen grids of the output tubes are connected together and to the B supply through remote control relay K2. When K2 is energized, the turntable rotates, and the screen grids are connected to the B supply through contacts K2b. When relay K2 is not energized, the turntable is stopped and the screen grids are connected to B—. This causes the output stage to draw less current and therefore consume less power.

(2) The output transformer contains two secondary output windings. The 500-ohm winding supplies inverse feedback voltage and 4-ohm winding drives the recorder head, microphone, or speaker. When switch S1 is in the LISTEN position, speaker jack J1 is connected to the 4-ohm winding. When switch S1 is in

the TALK position, jack J1 is disconnected. Terminal 7 of the 4-ohm winding is connected to one side of the recorder head, the reproducer head, the microphone and the input transformer. Terminal 6 is switched by reproducer relay K1. When this relay is in the record position (relay not energized), the output winding is connected to recorder head E2. In the play-back position, the relay connects the output winding to the microphone. Flasher lamp I1 is connected directly across the recorder head to indicate the recording level visually.

37. Switching Circuits

a. LISTEN—TALK SWITCH.

(1) LISTEN—TALK switch S1 is a two-position rotary-wafer switch. When switch S1 is in the LISTEN position, front contacts 3 and 12 complete the circuit which operates reproducer relay K1 for play-back. In this position, rear contacts 4 and 5 connect jack J1 to output transformer T2.

(2) When switch S1 is operated from the LISTEN to the TALK position, front contacts 7 and 8 close the circuit which momentarily operates remote control relay K2. During this time, the charging time of capacitor C22 and resistor R29, the turntable makes 1 or 2 revolutions to provide a lead-in groove for recording. Resistor R28 provides a discharge path for C22.

b. Selector Switch.

(1) Selector switch S2 is a four-position rotary switch with the on-off snap-action switch ganged to it. The on-off switch section operates when switch S2 is turned from the OFF to the DICT position. The on-off switch section stays in the "on" position for the INT and COPY positions.

(2) Front contacts 4, 5, 6, and 7 connect microphone M1 201, the telephone line, and reproducer head E1 to input transformer T1. In the DICT and INT positions, input transformer T1 is connected to reproducer relay contacts K1c. When relay contacts K1c are in the record position, the microphone or telephone line is connected to the input transformer. When relay contacts K1c are in the play-back position, the reproducer head is connected to the input transformer. When switch S2 is in the COPY position, the reproducer head is connected directly to the input transformer.

(3) Front contacts 1, 2, 11, and 12 connect the required volume control V2 control grid through reproducer relay K1. When switch S2 is in the DICT position, the grid is connected to recording gain control R18. With the switch in the INT position, the grid is connected to the high side of recording gain control R18. This provides maximum gain in the INT position. With the switch in the COPY position, V2 control grid is connected to reproducer volume control R19. This permits use of the reproducer volume control for adjustment of lamp I 1 while copying.

(4) Rear contacts 1 and 12 determine the amplifier response while recording. When switch S2 is in the DICT or INT position, the high-frequency bypass section of the feedback circuit (consisting of resistor-capacitor network R20 and C17) is connected to relay K1. When relay K1 is in the record position, resistor-capacitor network R20 and C17 is connected to B—. With switch S2 in the COPY position, this network is disconnected. With this circuit disconnected, a copy results that has practically the same tonal quality as the original recording.

(5) Rear contacts 4 and 5 connect the output of the amplifier to the microphone when selector switch S2 is in the COPY position. The microphone permits monitoring during the copying process. Resistor R24 and choke L1 attenuate the high-frequency input to the microphone.

(6) Rear contacts 6 and 7 connect reproducer relay K1 coil to the microphone quick-review button (S202) only when switch S2 is in the DICT position. Relay K1 does not operate when the microphone quick-review button is pressed (accidentally) during interview or copy.

38. Power Supply Circuit

a. Power Input.

(1) Line voltage is applied through power cord W101 and terminals 1 and 2 of power plug P1 located on the bottom of the recorder-reproducer. Fuse F1 in the low side of the line protects the equipment from overload damage. The on-off switch is connected in the low side of the line. This switch is ganged mechanically to selector switch S2. Across the power line is capacitor C20 which prevents audio frequencies from entering or leaving the equipment through the power line. The filaments of the vacuum tubes are connected in series across the power line. Connected in series with the filaments is negative temperature-coefficient resistor R23. Its resistance when cold is approximately 400 ohms, and its resistance when hot is 65 ohms. The higher resistance protects the filaments of the tubes from initial current surges since the filament resistance is low when the tubes are cold or first turned on.

(2) The a-c input is rectified by selenium rectifier CR3 to supply d-c (direct-current) power to the relays and the plates of the amplifier tubes. Resistor R25 (33-ohms, 5-watts) protects rectifier CR3 from line voltage surges. Resistor R13, capacitor C13, and capacitor C14 on the amplifier cord, filter the ripple voltage from the rectified output of rectifier CR3.

b. Motor Circuit. Power to operate motor B1 is conducted through terminals 3 and 4 of power plug P1. The leads from these terminals are connected to the motor through terminal strip TB2. Capacitor C21 is the phase shift motor starting capacitor. The low side of the motor power line which connects to terminal 4 of plug P1 is connected to terminal 6 by a jumper lead. Terminal 6 of plug P1 is connected to the low side of the power line through remote control relay K2. When remote control relay K2 operates, contacts K2A close and start the motor. Switch S3 is actuated by the index buttons. When the COR or END button is depressed (or both are depressed simultaneously), this switch closes to operate the motor and turntable during the indexing cycle. Index lamp I 2 is connected to the power line through terminal strip TB2. The leads from this lamp terminate in plug TB3 which fits into the terminal strip TB2.

Section III. PREREPAIR PROCEDURES

39. General

To service Sound Recorder-Reproducer Set AN/FNQ–3 (*) properly, test equipment listed in paragraph 40 is essential. No test equipment is furnished with the recorder-reproducer.

40. Test and Repair Equipment

Signal Corps stock No.	Item	Used for
3F4325–297	Multimeter TS–297/U.	Checking against voltage resistance charts.
3F3559	Oscillator I–151 or equal.	Audio tests.

Section IV. TROUBLE LOCATION

41. General Trouble-Shooting Information

a. General. When faults occur in service, the repairman must locate and correct them as rapidly as possible. This section contains information to aid personnel engaged in the important duty of trouble shooting.

b. Trouble-Shooting Data. Take advantage of the information supplied in this manual, to help in the rapid location of faults. Consult the following trouble-shooting data when necessary.

(1) Simplified block diagram (fig. 15).

(2) Complete schematic diagram (fig. 47). This diagram includes the values of all the resistors and capacitors.

(3) Tube-socket voltage and resistance measurements (fig. 16).

(4) Resistor and capacitor color codes (figs. 45 and 46).

(5) Illustrations of equipment (figs. 42, 43, and 44) with reference symbols which aid in locating and identifying parts.

(6) Pin connections on sockets and connectors numbered or lettered on the various diagrams. Locate pin numbers as follows:

(*a*) The pins are numbered clockwise. Viewed from the bottom, the first pin clockwise from the largest opening between the pins is the No. 1 pin. For quick identification, the leads from the subminiature tubes are covered with colored insulators. Blue is for the plate leads, brown for the heater leads, green for the grid leads, yellow for the cathode leads, and orange for the screen grid leads.

(*b*) Individual pine on connectors are identified by numbers which are stamped directly on the connector insulator.

c. Trouble-Shooting Steps. The first step in servicing a defective unit is to sectionalize the fault. Sectionalization means tracing the fault to the circuit responsible for the abnormal operation of the equipment. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, can be located by sight or smell. Most faults, however, must be located by checking voltages and resistances.

(1) *Sectionalization.* Careful observation of the performance of the equipment often enables the repairman to sectionalize the fault to a particular part (par. 42*c*).

(2) *Localization.* Paragraph 42*d* describes a method of localizing faults. Paragraph 44 contains a trouble-shooting chart which lists abnormal symptoms and their probable causes. Refer to paragraph 46 for instructions on removing units from the cases.

d. Voltage Measurements. Voltage measurements are an indispensable aid to the repairman, because most troubles either result from abnormal voltages or produce abnormal voltages. Voltage measurements are taken easily, because they always are made between two points in a circuit and the circuit need not be interrupted.

(1) Start voltage measurements by setting the voltmeter on the highest range to avoid overloading. Then, if increased accuracy is necessary, set the voltmeter on the lower range.

(2) When checking cathode voltage, a reading can be obtained when the cathode resistor is actually open. The resistance of the meter may act as a cathode resistor. Thus, the cathode voltage may be approximately normal only as long as the voltmeter is connected between cathode and B—. Before the cathode voltage is measured, make a resistance check with the power turned off to determine whether the cathode resistor is normal.

e. Voltmeter Loading. It is essential that the voltmeter resistance be at least 10 times as large as the resistance of the circuit across which the voltage is measured. If the voltmeter resistance is comparable to the circuit resistance, the meter will indicate a voltage lower than the actual voltage present when the meter is removed from the circuit.

(1) The resistance of the voltmeter on any range can be calculated by the following simple rule: resistance of the voltmeter equals the ohms-per-volt multiplied by the full-scale range in volts. For example, the resistance of a 1,000-ohms-per-volt meter on the 300-volt range is 300,000 ohms (R=1,000-ohms-per-volt $\times$300 volts=300,000 ohms).

(2) If a voltmeter is loading a circuit, the effect can 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 that on the lowest range. If the voltmeter is loading the circuit heavily, the deflection of the pointer will remain nearly the same when the voltmeter is shifted from one range to the other.

f. Resistance Measurements.

(1) *Normal values.* When a fault develops in a circuit, its effect will show up very often as a change in the resistance values. The normal resistance values at any point may be determined by referring to the resistance values shown in the schematic diagram (fig. 47).

(2) *Precautions.* Turn off the power before making any resistance measurements. 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 deflected off scale and the meter movement may be burned out. Always discharge large filter capacitors before applying ohmmeter leads. If a bleeder circuit is open, the capacitors may be charged.

(3) *Correct use of low and high ranges.* It is important to know when to use the low-resistance range and when to use the high-resistance range of an ohmmeter. When checking circuit continuity, set the ohmmeter 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, use the highest range. If a low range is used, the pointer will indicate infinite ohms even though the actual resistance is less than a megohm.

(4) *Parallel resistance connections.* In a parallel circuit, the total resistance is less than the smallest resistance in the circuit. This is important to remember when trouble shooting with the aid of a schematic diagram. When a resistance is measured and the value is found to be less than expected, make a careful study of the schematic diagram 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 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.

(5) *Checking grid resistance.* When checking grid resistance, a false reading may be obtained if the tube is warm and the cathode is emitting electrons. Allow the tube to cool, or reverse the ohmmeter test leads so that the negative ohmmeter test lead is applied to the grid.

(6) *Tolerance values.* Tolerance means the normal difference that may be expected between the rated value of a resistor and its actual value. Most resistors have a tolerance of at least 20 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 .8 and 1.2 megohms, it would be considered normal. Ordinary resistors are not replaced unless their values are off more than 20 percent. Tolerance values for transformer windings are generally between 1 and 5 percent. It is advisable to suspect transformers which show resistances deviating more than 5 percent from the rated value. Allow the transformer to cool before a resistance test is made.

g. Capacitor Tests.

(1) *Capacitor defects.* It is often necessary and desirable to check capacitors for leakage and open or short circuits. Sometimes open circuits occur in paper-type capacitors, because of the metal tab pulling away from the tinfoil plates. The usual trouble in a capacitor is a short circuit or leakage caused by the breakdown of the dielectric between the plates.

(2) *Open capacitor.* A capacitor suspected of being open can be checked by shunting a good capacitor across it. In a-f (audio-frequency) circuits, the test capacitor leads may be several inches long without materially affecting the circuit of which the capacitor is a part.

(3) *Kick indication.* Use a high-resistance voltohmmeter to check for the leakage in a paper or mica capacitor, and to test for an open or short circuit. (Suitable voltohmmeters usually are available in the field and are recommended for checking capacitors by using the kick-indication method.) The ohmmeter circuit of the test unit is used to make the check. Proceed as follows:

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

(*b*) Set the ohmmeter on its highest range, and place the ohmmeter leads across the capacitor.

(*c*) A good capacitor causes the needle to kick up the scale and fall back to infinity.

(*d*) A leaky capacitor will cause the needle to remain at some point on the scale other than infinity.

(*e*) An open capacitor will cause no deflection of the needle.

(*f*) 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 50,000 $\mu\mu$f (micromicrofarads) do not indicate a measurable kick. Replace defective capacitors.

42. Trouble-Shooting Procedures

a. Use of Data. The accompanying trouble-shooting charts and data simplify trouble shooting. By proper use of these charts, the operator can isolate the trouble to one particular part of the equipment and thus save time that otherwise might be lost in checking circuits that are free of trouble.

b. Visual Inspection. Before starting an elaborate test procedure, make a thorough visual inspection in an attempt to locate the fault. A drop of solder, a faulty socket or plug, a corroded fuseholder, a loose connection, or an accidentally grounded tie point may render the amplifier inoperative. If these faults do not show up in a visual inspection, their presence will be determined in a resistance analysis.

c. Sectionalization.

(1) *Power.* If index lamp I2 lights up, it indicates that power is reaching the machine, that fuse F1 is not blown, and that on-off switch S2 is functioning properly. If a good index lamp does not light, it indicates trouble in the power section. Sectionalizing in this manner expedites trouble shooting.

(2) *Amplifier card.* Replace the amplifier card with a good card. Be sure the card contacts are tight enough to insure proper contact. If the trouble is in the card, place the defective card back in the equipment and localize the failure.

(3) *Output tubes.* Replace tubes V4 and V5 with good tubes to eliminate possible tube trouble.

(4) *Defective play-back.* Make a record on the equipment under test and play it back on another recorder-reproducer. If it does not play back on the equipment under test but plays back well on another equipment, the recording process is functioning properly and the defect is therefore in the play-back process. The defect is most likely in reproducer relay K1, the reproducer volume control circuit, the tone control circuit, or reproducer head E1.

(5) *Defective recording.* Play a good record on the equipment under test. If the good disk plays back well, then the play-back process is functioning properly and the recording process is at fault. The defect is most likely in reproducer relay K1, the recorder gain control circuit, the feedback circuit, or recorder head E2.

(6) *Defective recording and reproducing.* This may be caused by any of the other common parts which have to be localized. Before attempting to localize the trouble, substitute a good microphone. The microphone is common to both the recording and reproducing process.

(7) *Turntable.* If the turntable fails to rotate, the trouble is most likely motor B1 and its associated circuit, in the adjustment of switch S3, in remote control relay K2, in the B supply or in the mechanical drive system.

d. Hints for Localizing Troubles.

(1) *Hum.* If hum occurs in the amplifier, short-circuit the grids of the tubes one at a time to B— (not chassis) while listening to determine in which stage the hum disappears. Start with the grid of the first stage and end with the output stage. The hum stops when the grid of the stage immediately following the faulty stage is shorted to B—.

(2) *No output.* When the amplifier is inoperative, test the grids for sensitivity by touching each grid terminal with a screw driver blade grounded to the body until one is found which will produce a hum or click in the microphone during playback. This indicates that the signal is blocked in the stage immediately preceding the first grid which is sensitive. Turn the reproducer volume control to full volume for this test.

(3) *Open cathode bypass capacitor.* An open

cathode bypass capacitor causes degenerative feedback and results in a weak output. The best method for checking the suspected capacitor is to shunt another capacitor across it and note the effect.

(4) *Low screen or plate voltage.* Low screen or plate voltage causes the amplifier to become weak. This type of fault can be localized by resistance and voltage measurements.

(5) *Open coupling capacitor.* When the coupling capacitor between the plate of one stage and the grid of the next stage opens, the signal is blocked. The capacitor can be localized as described in (2) above. Check the suspected capacitor by shunting another across it and note the effect.

(6) *Shorted coupling capacitor.* When the coupling capacitor between the plate of one stage and the grid of the next stage shorts out or develops leakage resistance, it causes hum and signal distortion. A positive voltage reading appearing on the control grid of a tube indicates the presence of this fault. The defective capacitor must be replaced.

(7) *Open grid circuit.* An open grid resistor in the grid circuit may cause hum or oscillation. An open grid circuit can be localized as explained in (1) above.

(8) *Open transformer.* An open transformer can be localized by resistance measurements. When making measurements, be sure that no circuits are in parallel with the suspected transformer. In the input transformer, an open secondary causes hum.

(9) *Shorted transformer.* Shorted turns in a transformer winding cause the amplifier to become weak. Localize the fault by resistance measurements.

43. Voltage and Resistance Measurements

For voltage and resistance measurements, refer to figure 16, tube-socket layout. Here the tubes are shown from left to right according to the chassis layout. Refer to figure 47 for a schematic diagram of the amplifier and for continuity of circuits.

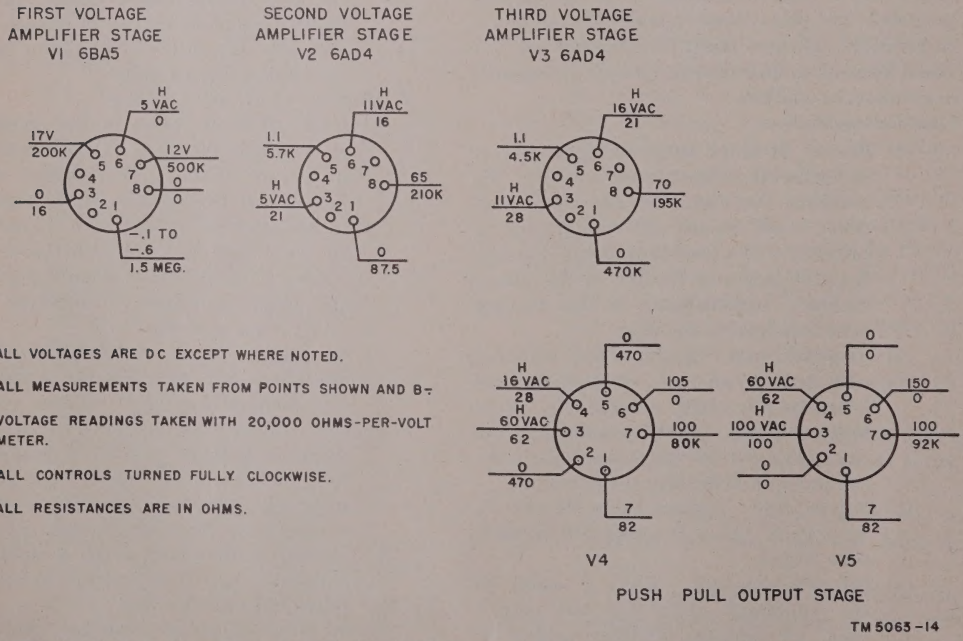


Figure 16. Sound Recorder-Reproducer Set AN/FNQ-3 (*), tube socket voltage and resistance measurements.

44. Trouble-Shooting Chart

The trouble-shooting chart provides a general step-by-step procedure for localizing trouble.

Symptom	Probable trouble	Correction
1. Tubes do not light, turntable does not rotate, index lamp I 2 does not light.	*a.* Defective power cord W101	*a.* Repair or replace.
	b. Fuse F1 blown	*b.* Replace. Do not replace with a fuse having a greater current rating than that of fuse F1 (1.5 amp).
	c. Fuse F1 loose in holder	*c.* Replace fuse or fuseholder.
	d. Defective on-off switch S2	*d.* Replace.
2. Tubes do not light, turntable rotates, index lamp I 2 lights.	*a.* Tube filament or filament circuit open.	*a.* Replace defective tube, repair broken leads.
	b. Resistor R23 open	*b.* Replace.
	c. Defective card contacts	*c.* Clean and tighten card contacts. Check soldered joints.
3. Tubes light, turntable does not rotate, index lamp I 2 lights	*a.* Open coil on motor B1	*a.* Clean and resolder connections at motor terminal strip and plug TB1. Replace motor if necessary.
	b. Defective motor capacitor C21	*b.* Replace.
	c. Defective rectifier CR3	*c.* Replace.
	d. Open resistor R25	*d.* Replace.
	e. Open relay coil K2	*e.* Replace.
	f. Defective microphone switch S201	*f.* Check operation of switch. Replace.
	g. Defective relay contacts K2a	*g.* Burnish contacts; adjust if necessary.
4. Tubes light, index lamp I 2 lights, turntable will not stop rotating.	Switch S3 defective or out of adjustment.	Adjust or replace.
5. Tubes light, index lamp I 2 lights, turntable rotates, no output during recording but good on play-back.	*a.* Poor relay K1	*a.* Burnish relay contacts, adjust if necessary, replace relay if necessary.
	b. Defective recorder head E2	*b.* Check and replace if defective.
	c. Shorted flasher lamp I 1	*c.* Replace.
	d. Open recorder volume control R18	*d.* Repair broken leads or replace defective control.
	e. Defective switch S2	*e.* Clean contacts, replace if necessary.
6. Tubes light, index lamp I 2 lights, turntable rotates, machine good on recording, but inoperative on play-back (LISTEN—TALK knob in LISTEN position).	*a.* Poor relay contacts on K1	*a.* Burnish contacts, adjust or replace relay if necessary.
	b. Open relay coil K1	*b.* Replace relay.
	c. Defective switch S1	*c.* Clean and adjust contacts, replace if necessary.
	d. Open play-back volume control R19 or associated circuit.	*d.* Repair broken leads or replace defective control.
	e. Defective reproducer head E1	*e.* Repair broken leads or replace if necessary.
7. Tubes light, index lamp I 2 lights, turntable rotates, machine good on recording and play-back (LISTEN—TALK knob in LISTEN position), but inoperative during quick review (LISTEN—TALK knob in TALK position).	Defective microphone switch S202 or associated wiring.	Replace defective switch or repair defective wiring.

44. Trouble-Shooting Chart—Continued

Symptom	Probable trouble	Correction
8. Tubes light, index lamp I 2 lights, turntable rotates, but equipment inoperative on both recording and playback.	*a.* Defective microphone M1–201	*a.* Replace.
	b. Defective input transformer T1	*b.* Check resistance, replace if open.
	c. Defective output transformer T2	*c.* Check resistance, replace if necessary.
	d. Shorted tubes	*d.* Replace output tubes, find defective tube by sensitivity test (par. 42*d* (2)).
	e. Defective relay contacts K2b	*e.* Burnish and adjust contacts, replace if necessary.
	f. Defective switch S2	*f.* Clean contacts, replace.
	g. Poor card contacts	*g.* Clean card contacts, and pinch together. Check soldered connections.
	h. Open coupling capacitors C1, C2, or C3.	*h.* Localize by sensitivity test and replace.
9. Tubes light, index lamp I 2 lights, turntable rotates but hum is present.	*a.* Defective filter capacitor or cathode bypass capacitor.	*a.* Check capacitors C8, C12, C13, C14 by shunting with a good capacitor. Observe polarity. Replace defective capacitor.
	b. Open secondary of input transformer T1.	*b.* Check resistance, replace.
	c. B—grounded to chassis	*c.* Resistance between chassis and B— should be greater than 1 megohm. If not, locate grounded component such as motor, recording head, or stray piece of solder that may be connecting B— to chassis.
10. Tubes light, turntable rotates, but amplifier is weak or inoperative on both recording and play-back.	*a.* Low plate voltage	*a.* Replace defective resistor or capacitor causing low plate voltage.
	b. High d-c voltage on grid	*b.* This condition is likely to be caused by leakage in coupling capacitor.
	c. No cathode voltage	*c.* May be caused by shorted cathode bypass capacitor. Check and replace.
11. Low pitched (tone) on recording and play-back.	*a.* Defective relay contacts K1B	*a.* Burnish and adjust contacts, replace if necessary.
	b. Defective switch contacts S2C	*b.* Clean contacts, replace.
12. High pitched (tone) on play-back	Defective relay contacts K1B	Burnish and adjust contacts, replace if necessary.
13. No lead in groove; otherwise equipment operates satisfactorily.	*a.* Open coil on relay K2	*a.* Replace relay.
	b. Open resistors R26, R28, R29, or capacitor C22 in series with relay coil K2.	*b.* Locate and replace defective component.
14. Copying not audible; otherwise equipment operates satisfactorily.	*a.* Defective contacts on switch S2	*a.* Clean contacts, or replace switch.
	b. Open resistor R24	*b.* Replace.
15. Correction space hardly visible	Adjustment of switch S3 (COR)	Adjust properly (par. 48*f*).
16. Motor rumble	No clearance in flexible coupling between motor shaft and turntable shaft.	Adjust height of motor so that shafts do not butt and motor does not strike bottom chassis.
17. Short term light beam separation. Light beams are together at zero when recording starts but separate during recording and line up together again when arms are retracted.	*a.* Defective gear sectors	*a.* Clean teeth of gear sectors, remove any burrs, replace if necessary.
	b. Insufficient reproducer-arm drag	*b.* Adjust reproducer-arm drag (par. 48*b*(5)).

44. Trouble-Shooting Chart—Continued

Symptom	Probable trouble	Correction
18. Long term light beam separation. Light beams are together at zero when recording starts but separate after recording a period of time and the light beams do not line up together again when arms are retracted.	*a.* Arms are not against their outside stop.	*a.* Check retracting linkage and outside stops to be sure arms are against their respective stops.
	b. Recorder- and reproducer-arm drive shafts are turning so that they are not always parallel with one another.	*b.* Replace.
19. Crosstalk, doubletalk, or torn disk	*a.* Recorder-head insert not level	*a.* Level insert (par. 48*a*(2)).
	b. Incorrect recorder-head pressure	*b.* Adjust recorder-head pressure (par. 48*a*(3)).
	c. Defective recorder-head	*c.* Replace.
20. Acoustic feedback	*a.* Microphone too close to equipment.	*a.* Locate microphone to minimize feedback.
	b. Leads improperly dressed	*b.* Dress input leads from microphone socket away from output transformer.
21. Intermittent operation	*a.* Poor card contact	*a.* Check by moving card back and forth. Pinch contacts of card together.
	b. Poor connection at solderless connectors.	*b.* Check solderless connectors on leads of reproducer insert.
	c. Poorly soldered joints	*c.* Check all soldered joints, particularly those on amplifier card. Resolder where necessary.
22. Poor quality	Defective microphone, recorder-head, reproducer-head, or tube.	Localize and repair or replace defective component.

Section V. REPAIRS

45. General Repair Instructions

a. Use of Proper Tools. Handle tools carefully and always use screw drivers and pliers of the correct size for removing or replacing parts in the equipment.

b. Leads.

(1) When a part is removed (such as a relay) which has several lead-in connections, tag each lead to insure that the part can be replaced correctly and quickly.

(2) Be careful not to damage leads adjacent to parts being removed pulling on them or pushing them out of the way.

c. Soldering. It is important to make good solder joints because poorly soldered connections cause trouble which is difficult to find. Use the soldering iron carefully so that insulation on wiring and other adjacent parts will not be damaged by overheating. Use only enough solder to make a good solder joint. Do not permit drops of solder to fall inside the amplifier chassis. Solder drops may cause short circuits and damage the equipment.

d. Defective Part Caused by Another Part. When a defective part such as a burned-out resistor is located, check the associated circuit thoroughly to determine whether this condition is caused by another faulty part. For example, a burned-out 33-ohm resistor R25 (fig. 47) may be caused by defective rectifier CR3. A defective capacitor C13 could be the cause of both burned out 33-ohm resistor R25 and defective rectifier CR3. If the resistor is replaced without replacing the other defective parts, the new part will be burned out in the same way. Careless replacement of parts often causes new faults.

46. Disassembly and Repair of Equipment

a. Microphone (fig. 17).

(1) To repair or replace any of the components within the microphone housing, remove front housing A 201. Remove screws H201 at the top of the front face of the microphone and screw H202 at the bottom of rear housing A202. Then lift off front housing A201.

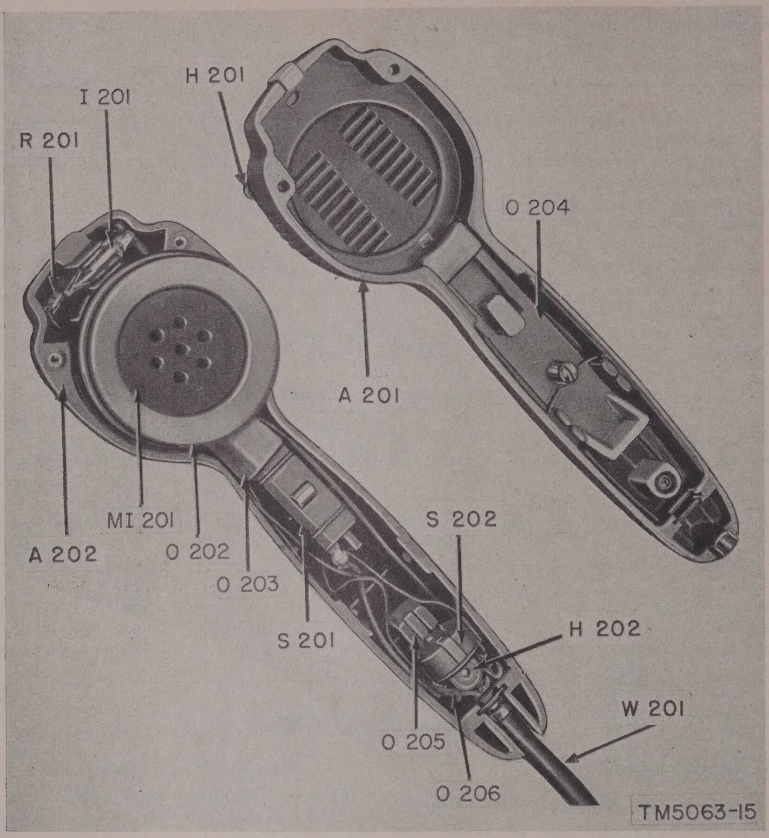


Figure 17. Microphone parts.

(2) All the parts rest in cavities molded in rear housing A202. Rubber cushion O 202 on the face of microphone element MI 201 must be replaced when element MI 201 is replaced. Quick-review switch S202 is held in position by small spring retainer O 205 on its top side and fiber spacer O206 on its under side. Be sure all the wires are dressed down into rear housing A202 so that they do not interfere with putting on front housing A 201 or with the operation of microphone actuating button O 204.

(3) An Allen setscrew located on the back of the rear housing adjusts the position of switch S201. It is adjusted so that the switch is on when the actuating button is in the locked position. This screw is adjusted at the factory and its head is sealed. Readjustment is seldom necessary.

b. Index Scale Replacement (fig. 18).

(1) Remove two screws H53. This removes index scale retainer A 10.

(2) Slide out index scale N1. There are two cellulose shields O 69 that protect the scale, one on each side.

(3) To replace scale N1, place a cellulose shield O 69 on each side of the scale and slide the scale into the slot in the front cover.

(4) Replace index scale holder A 10 and fasten with two screws H53 and lockwashers H52.

(5) Adjust light beams if necessary (par. 48*c*(6)).

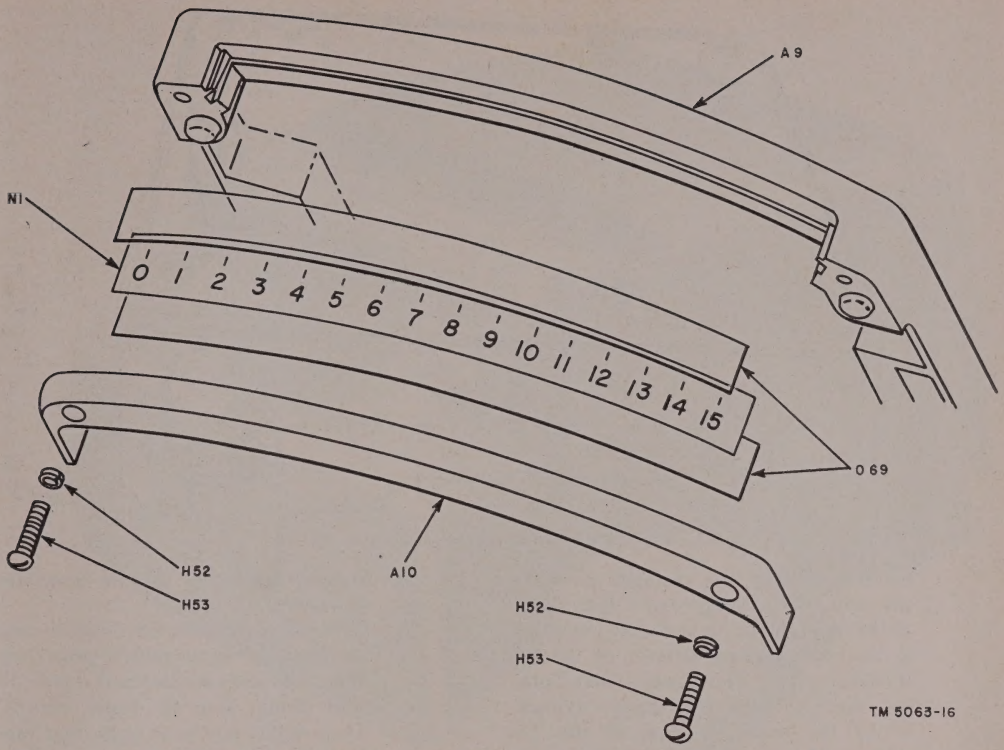


Figure 18. Index scale, exploded view.

c. Cabinet Replacement (fig. 19).

(1) To remove the cabinet, operate the LISTEN—TALK knob to the LISTEN position, put the reproducer arm in its latch, and turn the equipment upside down, preferably on a soft cloth to prevent the cabinet finish from becoming marred.

(2) Remove the power cord from the wall outlet.

(3) Push a screw driver with a blade 5/32-inch wide, 5-inches long down through the holes (A). Do not damage the wiring.

(4) Loosen the four screws (H24).

(5) The cabinet is now loose. When turning the equipment upright, hold one hand on bottom and one on top.

(6) Move both the recorder and reproducer arms toward the center of the disk as far as they will go.

(7) Raise the front cover slightly, hold the playback latch out of the way, and lift off the cabinet (fig. 20).

(8) Replace the cabinet by following the reverse procedure.

d. Front Cover Replacement (fig. 21).

(1) Remove the cabinet (*c* above).

(2) Remove C-washer H54 from retracting link.

(3) Unhook spring O 46.

(4) Remove screws H29 and H30. H30 is longer than H29 and care must be taken to replace it in its proper hole.

(5) Replace cover A 9 by following the reverse procedure. Be sure the cams operating the lifting rod are under the cover and are not caught behind it.

e. Recorder-Head Cartridge and Arm Replacement (fig. 22).

(1) *General.* Recorder-head cartridge (front part of recorder arm) is replaced as a complete assembly. When replacing,

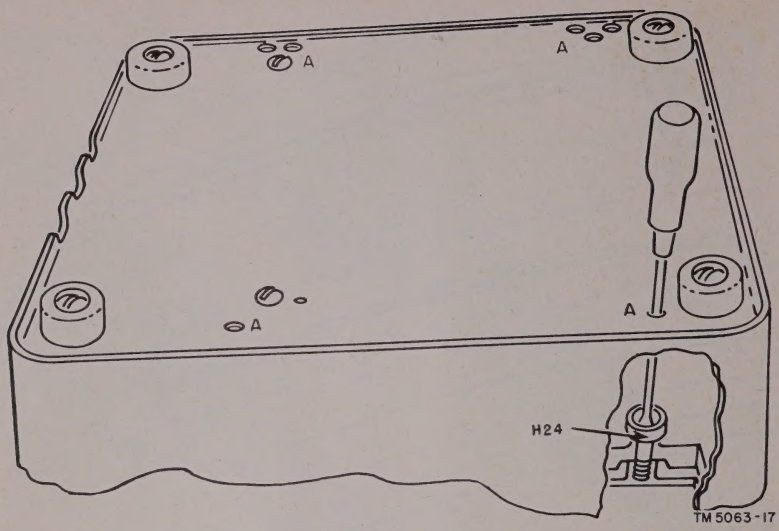


Figure 19. Cabinet removal, cutaway view.

make sure that the distance between the center of the recorder-arm drive shaft to the tip of the stylus is exactly the same as the corresponding distance on the reproducer arm. This insures that both the recorder and reproducer styluses travel the same distance in the 15 minutes of recording time.

(2) *Replacement of recorder-head cartridge.* To replace the recorder-head cartridge, proceed as follows:

(*a*) Remove cabinet (*c* above).

(*b*) Remove the recorder-head leads from terminal board TB5 on the chassis (fig. 25) and pull the leads through the grommet in the motorboard.

(*c*) Operate the LISTEN—TALK knob to the LISTEN position.

(*d*) Loosen the cord clamp (fig. 22) and remove the leads.

(*e*) Remove screw H58.

(*f*) Raise the front cover.

(*g*) Lift the recorder-head cartridge upward with a gentle rocking action to free the dowel pins which hold the case to the arm. Apply this rocking action with the left hand on the handle of the cartridge and a screw driver slid in between the casting of the cartridge and the arm. When the cartridge is free of the dowel pins, pull it out.

(*h*) Remove the handle and its associated C-washer.

(*i*) To install a replacement recorder-head cartridge, follow the reverse procedure. When the leads are fastened under the cord clamp, loop the leads slightly. They should not be so tight that they limit the up and down movement of the cartridge within its case. They should not be so loose that they drag on the turntable.

(*j*) Adjust the cartridge as described in paragraph 48*a*.

(3) *Replacement of complete recorder arm* (fig. 22).

(*a*) Remove the cabinet (*c* above).

(*b*) Remove the front cover (*d* above).

(*c*) Remove the C-washer that holds the head-lifting rod O 47 (fig. 35). This washer is on the right of the unit.

(*d*) Slide lifting rod O 47 to the left so that it is not above the recorder arm.

(*e*) Unhook the antibacklash spring O 21 (fig. 35) to get it out of the way.

(*f*) Mark each gear sector and its mating gear sector so that they may be assembled in the same mesh as when they were disassembled.

(*g*) Remove the three gear sector mounting screws (H18, fig. 22) on the recorder arm. Remove the flat and curved

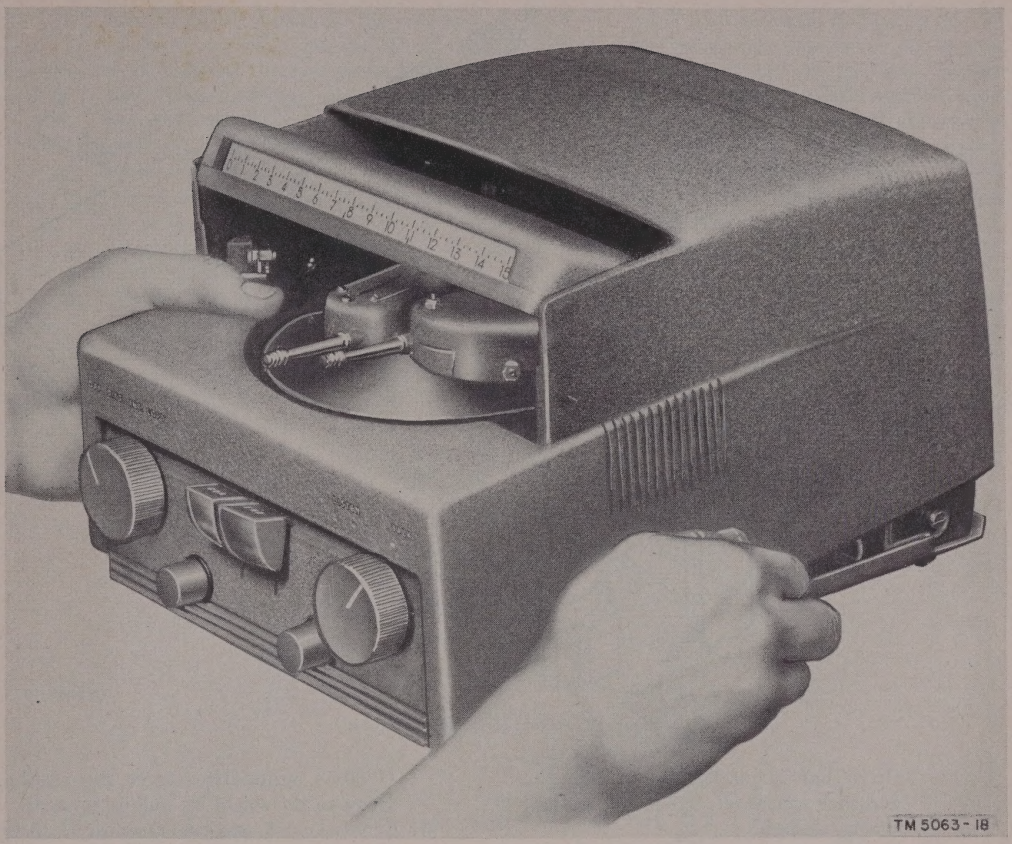


Figure 20. Cabinet removal.

spring washers H22 and H20 that are under the head of each of these screws.

(*h*) Rotate the gear sectors so that the gear teeth unmesh; then lift gear sector O 30 off the recorder arm drive shaft.

(*i*) Remove screw H27 which holds the retracting arm to the rear of the recorder arm, and slide the retracting arm off the top of the recorder arm.

(*j*) Unscrew lifter head H15 (fig. 33) with the flat spanner wrench. Also remove the two washers, one on each side of the clamping plate.

(*k*) Remove locknuts H55 and H56 (fig. 22) which hold the recorder arm to its drive shaft. Hold bottom nut H56 with the offset wrench and loosen top nut H55 with a standard $\frac{7}{16}$-inch spin-type wrench.

(*l*) Remove the three washers under nut H56. When these washers are installed, top and bottom steel washers H23 must be free from lubricant. Bronze washer H24 between them should have a light film of grease.

(*m*) Remove pressure spring O 33. The top surface of this spring should be dry when reassembled.

(*n*) Remove the leads from terminal strip TB5 on the chassis and pull the leads through the grommet in the motorboard (fig. 25).

(*o*) Lift the recorder arm off the recorder-arm drive shaft. The recorder-arm

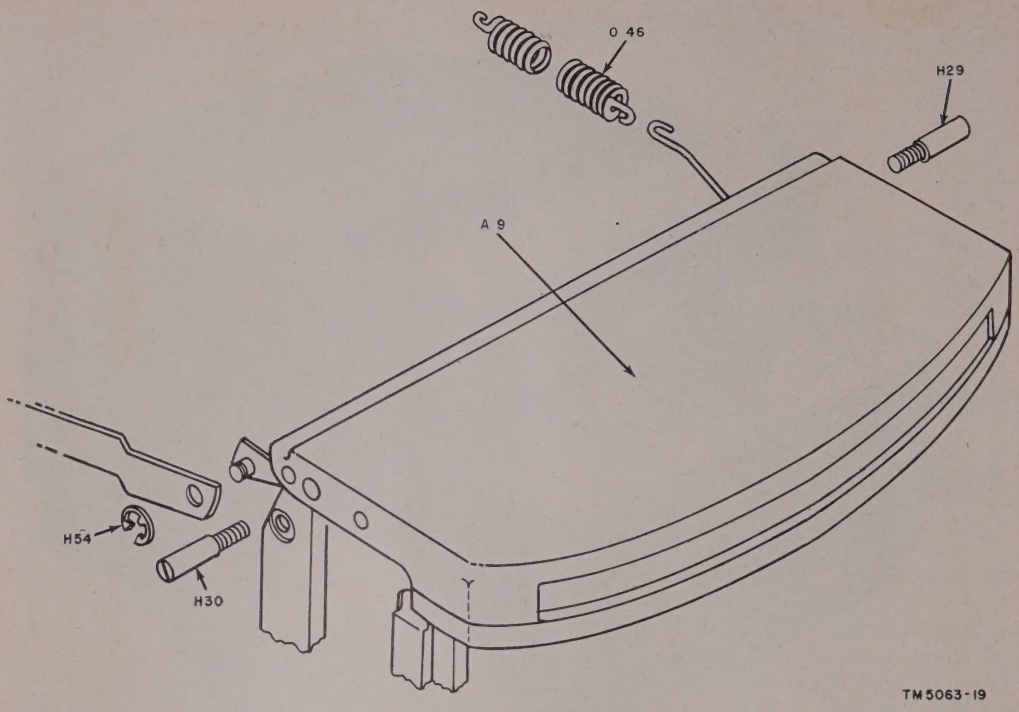


Figure 21. Front cover, exploded view

drive shaft is normally loose when the recorder arm is off, but it will tighten during assembly.

(*p*) To assemble the recorder arm, follow the reverse procedure.

Caution: When the recorder arm is set on the drive shaft, pull the warning bell arm out so that the recorder arm seats on the ball race in the chassis.

f. Light Beam Indexing System Replacement (fig. 23).

(1) Remove the cabinet (*c* above).

(2) Remove the complete light beam system by disconnecting plug TB3 and removing screw H59. Pull out the complete unit.

(3) Remove index lamp I 2 by loosening screw H62 and pushing lamp socket X2 up. Replace the lamp and the socket. Tighten setscrew H62. Adjust lamp I 2 in accordance with instructions in paragraph 48*c*(2).

(4) Shield O 60 has an internal reflector (O 61) held in position by folded clips. Shield O 60 is spring-fitted over the casting. Remove the shield by pulling upward.

(5) Remove condenser lens assembly I 10 by removing screw H60 and sliding out the assembly.

(6) Remove projection lens assembly I 11 by loosening screw H61 and sliding out the lens assembly.

(7) Adjust the complete light beam index system as instructed in paragraph 48*c*.

g. Reproducer-Head Cartridge and Arm Replacement (fig. 24).

(1) *General.* Reproducer-head cartridge is replaced as a complete assembly. The reproducer-head cartridge is on the front part of the reproducer arm.

(2) *Replacement of reproducer-head cartridge.* To replace the reproducer-head cartridge, proceed as follows:

(*a*) Remove the cabinet (*c* above).

(*b*) Disconnect the leads from terminal strip TB4 on the right side of the chassis (fig. 25).

(*c*) Pull the leads up through the grommet in the motorboard and pull them out from between the gear sectors. Note how these leads are dressed through the gear sectors so that they can be replaced in the same manner on the replacement unit.

(*d*) Loosen the cord clamp and remove the leads (fig. 24).

(*e*) Remove screw H64.

(*f*) Raise the front cover.

(*g*) Lift the reproducer-head cartridge upward with a gentle rocking action to free the dowel pins which hold the case of the cartridge to the arm. Apply this rocking action with the left hand on the handle of the cartridge and a screw driver slid in between the casting of the cartridge and the arm. When the cartridge is free of the dowel pins, pull it out.

(*h*) Remove the handle and its associated C-washer.

(*i*) To assemble the reproducer-head car-

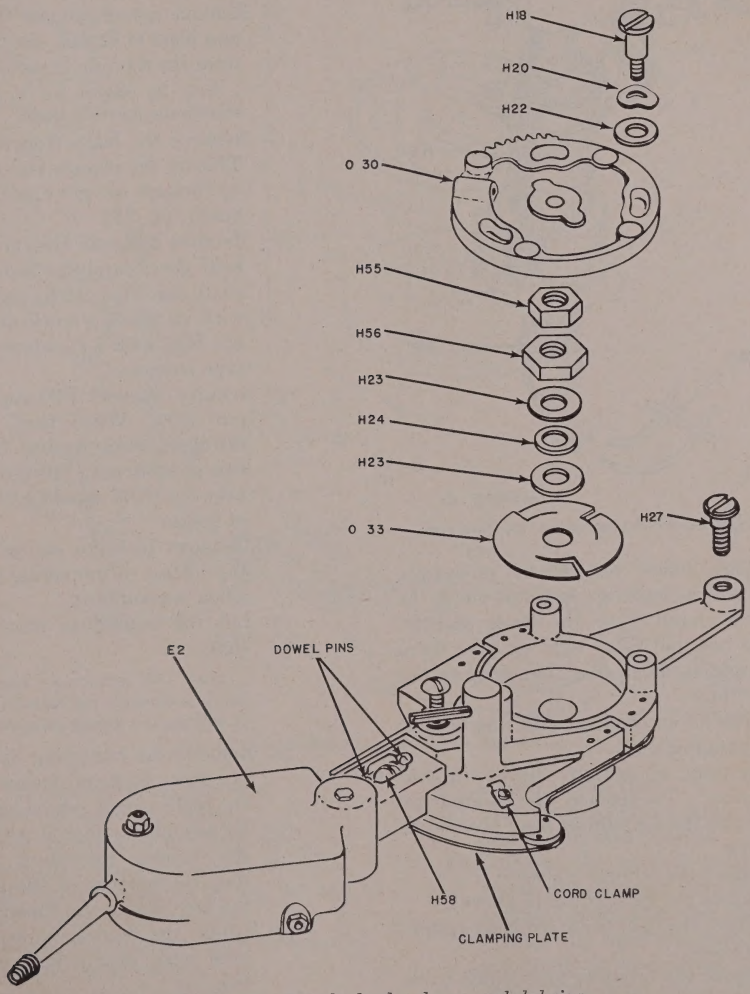


Figure 22. Recorder head and arm, exploded view.

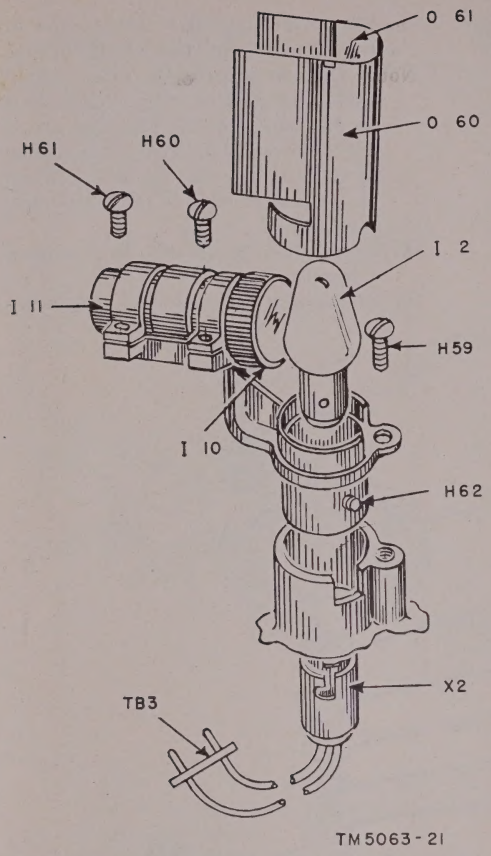


Figure 23. Light beam indexing system, exploded view.

tridge, follow the reverse procedure. When the leads are fastened under the cord clamp, loop the leads slightly. Do not pull them tight or have them looped so much that they drag on the turntable.

(*j*) Adjust in accordance with instructions in paragraph 48*b*.

(3) *Replacement of complete reproducer head and arm.* To replace the reproducer head and the reproducer arm, proceed as follows:

(*a*) Remove the cabinet (*c* above).

(*b*) Remove the front cover (*d* above).

(*c*) Remove the light beam indexing system (*f* above).

(*d*) Remove the retaining ring which holds head-lifting rod O 47 (fig. 35) on the left side of unit.

(*e*) Slide lifting rod O 47 to the right so that it is not above the reproducer arm.

(*f*) Unhook antibacklash spring O 21.

(*g*) Unscrew, but do not lift out, the three mounting screws (H17) of the mirror mounts (fig. 24).

(*h*) Mark gear sector O 41 and its mating gear sector so that they may be assembled in the same mesh as they were when disassembled.

(*i*) Remove mirror mounts O 39 and O 41 and plate O 32 as a complete assembly from the reproducer-arm drive shaft.

Note. Be careful not to finger mark or scratch the mirror surfaces.

(*j*) Remove the leads from terminal strip TB4 on the chassis and pull the leads up through the grommet in the motorboard (fig. 25).

(*k*) Remove locknuts H55 and H56 which hold the reproducer arm to its drive shaft (fig. 24). Hold bottom nut H56 with an offset wrench and loosen top nut H55 with a standard $\frac{7}{16}$-inch spin-type wrench.

(*l*) Remove washers H23 and H24 under nut H56. When these washers are installed, steel washer H23 must be free of lubricant. Bronze washer H24 between them should have a light film of grease.

(*m*) Remove pressure spring O 33. The top surface of this spring should be dry when reassembled.

(*n*) Lift the reproducer arm off its drive shaft.

Note. The reproducer arm shaft is normally loose when the reproducer arm is off. It will tighten during assembly.

(*o*) Remove the retracting link by removing screw H28 and fasten the screw to the replacement reproducer arm.

(*p*) To assemble a reproducer arm, follow the reverse procedure. Make sure that the bottom of the arm seats on the ball race in the chassis.

(*q*) Adjust the reproducer arm in accordance with instructions in paragraph 48*b*.

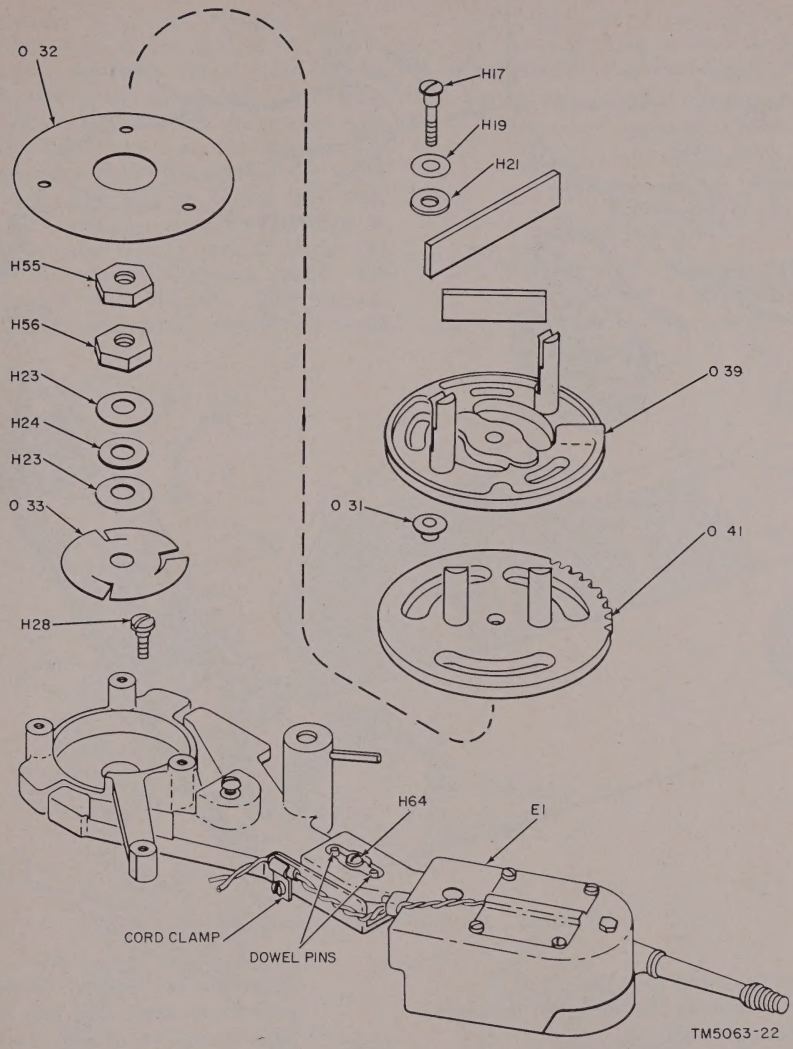


Figure 24. Reproducer head and arm, exploded view.

h. Bakelite Turntable Shell Replacement.

(1) Remove the cabinet (*c* above).
(2) Remove the recorder arm (*e* above).
(3) Remove the reproducer arm (*g* above).
(4) Lift off turntable shell O 34 (fig. 26) and replace it with a new shell.
(5) Reassemble the turntable shell by following the reverse procedure.

i. Motorboard Replacement (fig. 25).

(1) Remove the cabinet (*c* above).
(2) Loosen screws H67.
(3) Unscrew head-lifting screw H68 from the nut in the cam bracket.
(4) Unfasten the recorder-head and the reproducer-head leads from their respective terminal strips TB5 and TB4.
(5) Unplug the amplifier card by inserting the amplifier card lifting tool under the card. Be careful not to spread the card contacts any more than necessary.

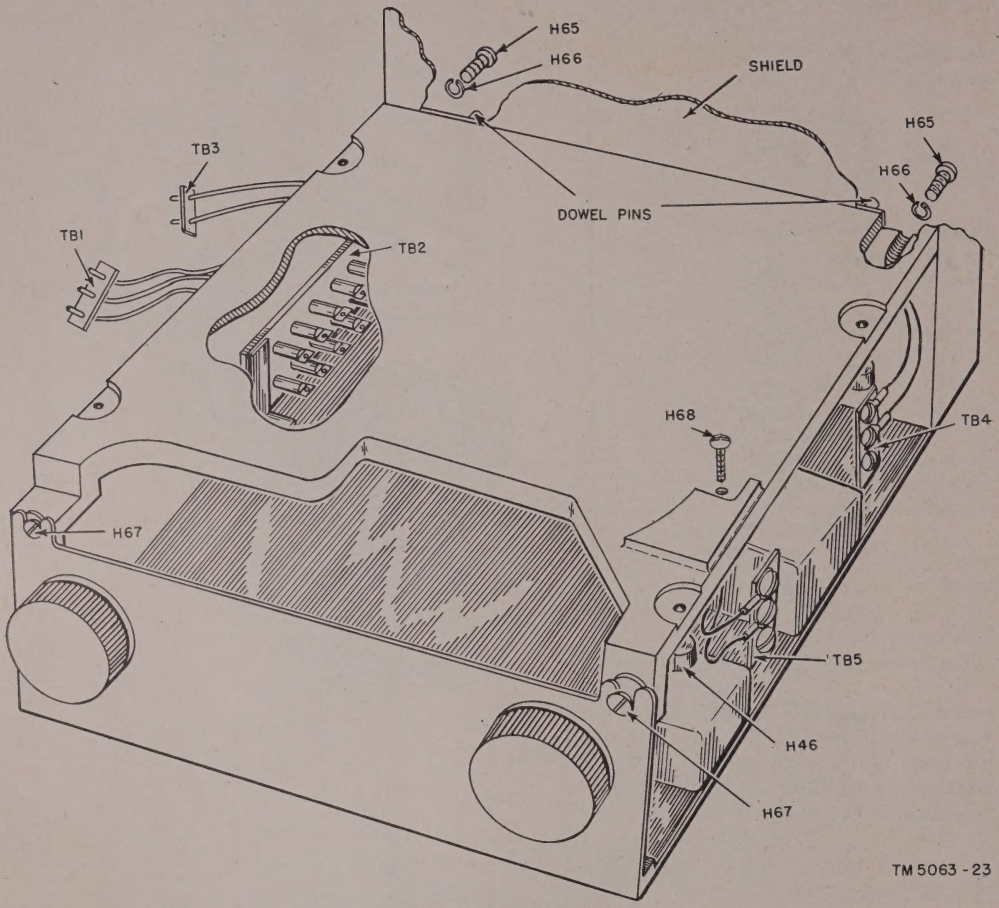


Figure 25. Motorboard removal, cutaway view.

(6) Remove output tube V5.
(7) Remove screws H65 and their associated lockwasher H66.
(8) Unplug index-lamp plug TB3 and motor plug TB1 from terminal strip TB2.
(9) Depress the end-of-letter key (END).
(10) Lift off the motorboard by raising the front end and pulling.
(11) To reassemble the motorboard, follow the reverse procedure. The end-of-letter key must be depressed before setting the motorboard on the bottom chassis.

j. Gear Mechanism (figs. 26 and 27).

(1) The gear mechanism is lubricated and sealed for the life of the equipment. There are two possible troubles in the gear mechanism. The first is improper grooving and the second is erratic overdrive mechanism.
(2) Improper grooving results in grooves being closer together or further apart than normal. This results in crosstalk that occurs periodically across the disk at the time the grooves are closer together than normal. This is caused by nicks, dirt or chips in the worm gears. Be sure the recorder-head cartridge is not at fault and that it is adjusted properly before trying to correct periodic crosstalk by changing the worm gears.

(3) A sticky or jumpy overdrive causes a sharp jump in the feed of the groove during the index cycle. This will be evident by the failure of the reproducer stylus to track through the index groove. This failure can be seen by watching the overdrive shaft O 3 during the index cycle. The motion during the index cycle should be smooth. Lubricant in the clutches O 2, O 8 and O 12 (fig. 27) of the overdrive system causes the clutches to be sluggish. This presents itself as excessive crosstalk after the index cycle. The sluggish clutches do not take over on time thus causing the grooves to be closer together than normal.

(4) To disassemble the gear mechanism (figs. 26 and 27), proceed as follows:

(*a*) Remove the cabinet (*c* above), the reproducer arm (*g* above), the recorder arm (*a* above) and the motorboard (*i* above).

(*b*) Remove rear gear box cover O 37 and gasket O 36 by removing screws H90.

(*c*) Remove rear gears O 29 and O 30 and

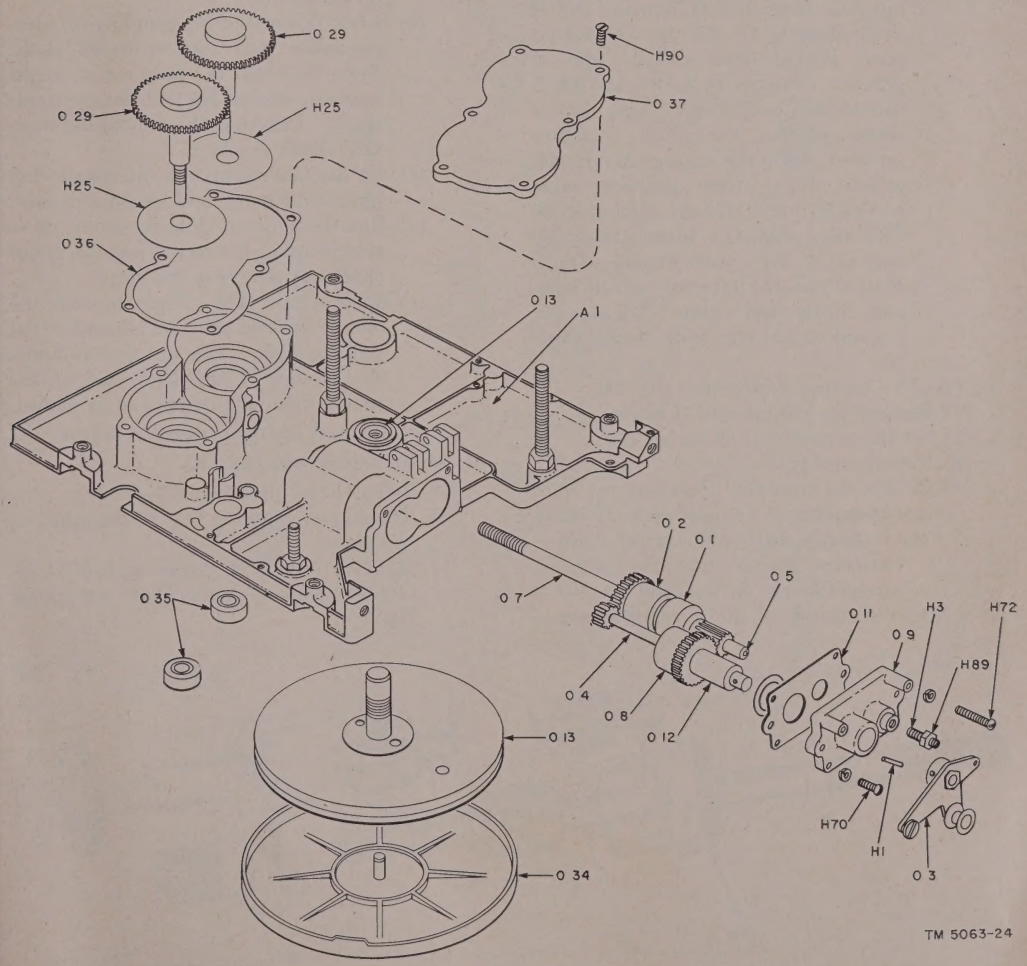


Figure 26. Gear mechanism, cutaway view.

flat washers H25 by pulling them down.

(*d*) Remove the two springs from lever O 3.

(*e*) Depress the END button and remove the two G-hooks that fasten to the END and COR buttons.

(*f*) Remove front gear-box cover O 9 and plate O 10 by removing screws H70, screws H72, and lockwashers H69 and H71.

(*g*) Pull out jack shaft O 4.

(*h*) Pull out drive shaft O 7.

(*i*) Reassemble the gear mechanism by following the reverse procedure. Do not lose thrust ball O 5 on the end of drive shaft O 7. All the worms and gears should have a light film of grease. Clutches O 2, O 8, and O 12 should have only a very light film of grease so that the grease does not interfere with the spring and clutch action. When front gearbox cover screws H70 and H72 are tightened, be sure drive shaft O 7 rotates freely by moving it with your fingers. Drive shaft O 7 should have only a little back and forth end play. Adjust the amount of end play with thrust screw H3.

k. Flexible Coupling Replacement (fig. 28).

(1) Remove the motorboard (*i* above).

(2) Set the motorboard on its left side.

(3) Remove nut H78.

(4) Rotate the turntable clockwise by hand until coupling O 6 unscrews from either the turntable shaft or the motor shaft.

Caution: Do not rotate the turntable counterclockwise as this will force the friction clutch of the overdrive system to slip in the direction in which it should hold.

(5) Unscrew coupling O 6 from the motor on the turntable shaft, whichever one is still holding. The coupling has left-hand threads and must be turned clockwise for removal.

(6) Remove washer H6. There also may be a thin shim washer on top of washer H6.

(7) To replace coupling O 6, follow the procedure outlined below:

(*a*) Place washer H6 on the coupling. If there is a shim washer, place it on top of washer H6.

(*b*) Screw this end of the coupling counterclockwise into the turntable shaft. Make sure that the shim is not caught between washer H6 and the turntable shaft. This shim fits around the turntable shaft shoulder.

(*c*) Set the motorboard on the chassis and plug in the motor and the booster card.

(*d*) Run the motor. Hold the motor up so that coupling O 6 screws into the motor shaft and then stop the motor.

(*e*) Replace nut H78. Tighten until the end of the bolt and the bottom of the nut are flush. This nut merely limits the motion of the back end of the motor when the equipment is moved.

(*f*) Replace the motorboard (*i* above).

l. Motor Replacement (fig. 28).

(1) Remove the motorboard (*i* above).

(2) Disconnect coupling O 6 as described in *k* above.

(3) Remove nuts H77, lower springs O 19, rubber shock absorbers O 18, and motor B1.

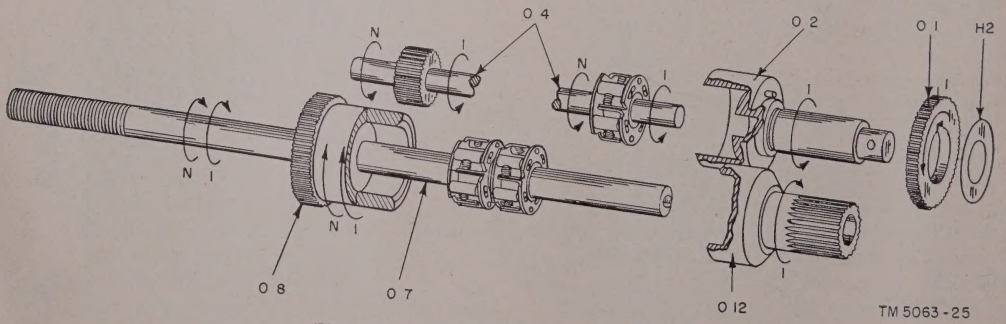


Figure 27. Gears and clutches, exploded view.

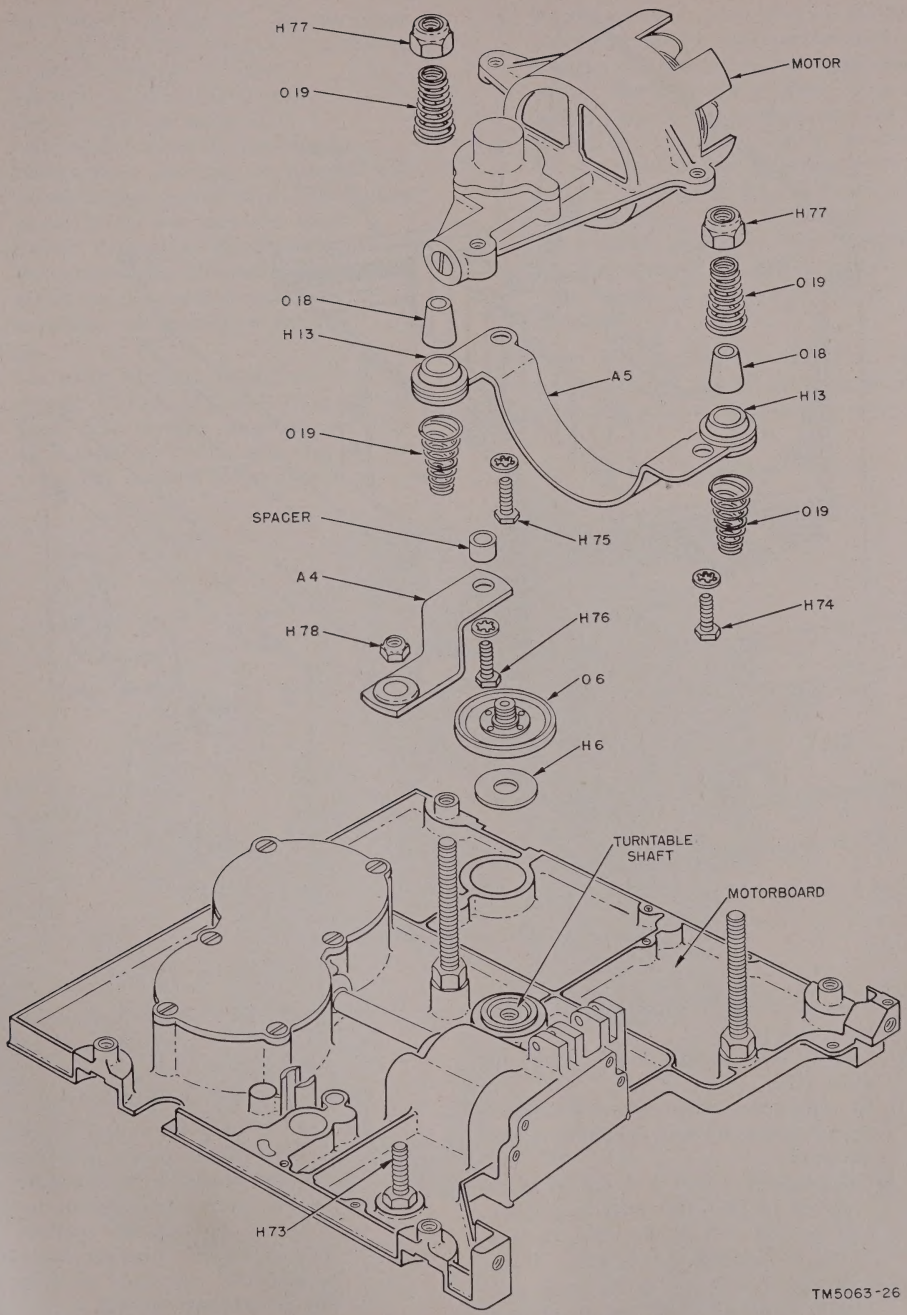


Figure 28. Motor mount and flexible coupling, exploded view.

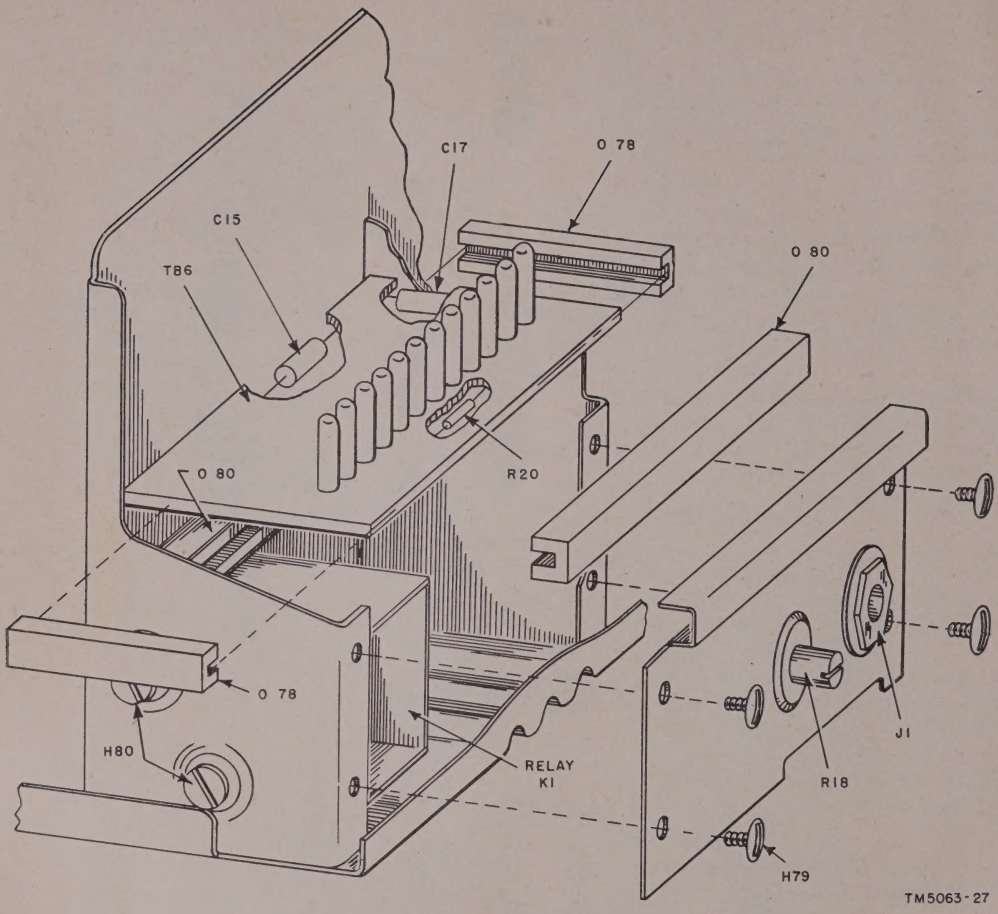


Figure 29. Relay compartment, exploded view.

(4) Remove screws H74 and H75 to remove bracket A 5.

(5) Remove rear bracket A 4 by removing screw H76.

(6) To replace the motor, follow the reverse procedure and observe the following precautions:

(*a*) Brackets A 5 and A 4 should be replaced in the same relative position. If bracket A 5 is off-center, the coupling will wobble as it rotates. If rear bracket A 4 is not in the same position, screw H73 will not fit through grommet H11 on A 4.

(*b*) Be sure that the two lower springs O 19 fit over the two grommets H13 in bracket A 5.

(*c*) Replace coupling O 6 (*k* above).

(*d*) Tighten mounting nuts H77 until the bottom of the motor just clears the bottom chassis. Do not tighten so that the turntable shaft and the motor shaft are butting one another. The best method is to replace them in approximately the same positions they occupied before removal.

(7) Replace the motorboard (46*i*).

m. Relay Compartment (fig. 29). To gain access to reproducer relay K1, recorder gain control R18, and phone jack J1, proceed as follows:

(1) Remove the cabinet (*c* above).
(2) Remove the four screws H79.
(3) Pull out and up on the rear panel.
(4) The amplifier card may be removed and its mounting terminal board TB6 pushed up out of the way for easier access.
(5) Replace the rear panel by following the reverse procedure. Replace rubber shock-mounting gaskets O 80 and O 78 for the amplifier card terminal board TB6.

n. Relays.

(1) The relay contacts usually can be burnished or adjusted to give proper operation. The contact terminals are very close together. Make sure they do not touch one another or the chassis.

(2) To replace either relay, remove the complete relay with its mounting bracket and transfer the bracket to the replacement relay. Replacement of either relay requires removal of the rear panel as described in *m* above. This is necessary to gain access to the mounting screw of remote control relay K2 and to get at reproducer relay K1. Reproducer relay K1 is held in position by two screws H80 (fig. 29) through the side of the chassis. The screws are mounted in rubber grommets.

o. Indicator Lamp. Replace indicator lamp I 2 by unscrewing lens cap E15 and unplugging lamp I 2. The lamp has a miniature bayonet type base.

p. Knobs, Volume Controls, and Jacks. The

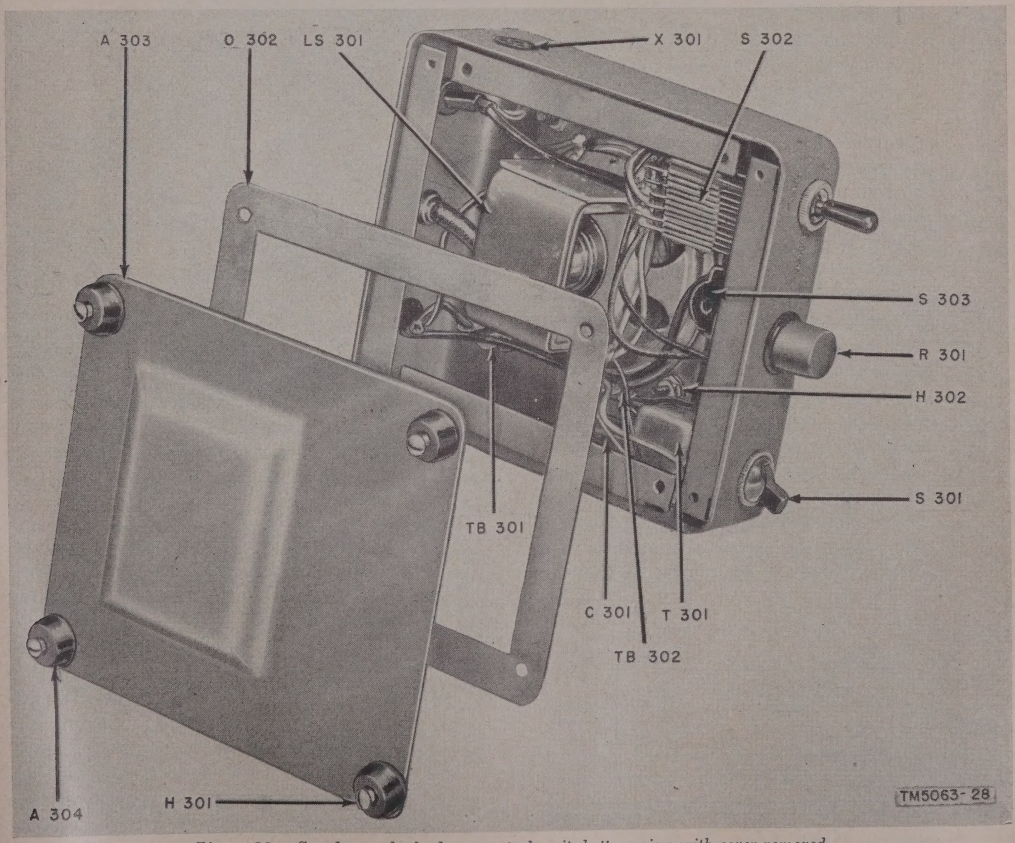


Figure 30. Speaker and telephone control unit, bottom view with cover removed.

LISTEN—TALK switch knob and the selector switch knobs are held by No. 8 Allen setscrews. The volume control knob is friction-held on its shaft. The volume controls and jacks are all insulated from the chassis. To remove any one of these, it is necessary to use the spanner wrench with a hexagonal handle to unscrew the mounting ring.

q. Speaker and Telephone Control Unit. To gain access to the components within the speaker and telephone control unit, base A 303 must be removed by removing the four screws H301 that hold it in place (fig. 30). First be sure both the wall plugs from the sound recorder-reproducer set and the speaker and telephone control unit are removed from their wall outlets.

Section VI. ADJUSTMENTS

47. General

The adjustment techniques described in the following paragraphs require the use of some of the special tools listed in paragraph 25. These tools are furnished with the AN/FNQ–3(*).

48. Adjustment Procedures

a. Recorder Head.

(1) *Lifting nut* (fig. 31). Bolt of assembly H81 screws into the recorder head cartridge to prevent it from dropping out when the recorder head is lifted. The turntable has some rise and fall during its rotation. Adjust the nut so that its bottom just clears the top of the recorder-head case when the cartridge falls to its lowest point. Because the rise and fall is greatest at the outside of the disk, this adjustment should be made at the outside of the disk while the turntable is rotating.

(2) *Leveling of cartridge.* Screw H89 (fig. 35) raises and lowers the recorder arm. With a protective and a recording disk on the turntable, move the recorder head to the inside of the recording area and lower the stylus to the disk. Place the recorder-head adjusting template under the cartridge (fig. 31). The front and rear of the base of the cartridge should be equidistant from the template. If they are not the same distance from the template, raise or lower the arm by turning screw H89 (fig. 35) until they are. Turning the screw clockwise raises the arm. Turning the screw counterclockwise lowers the arm.

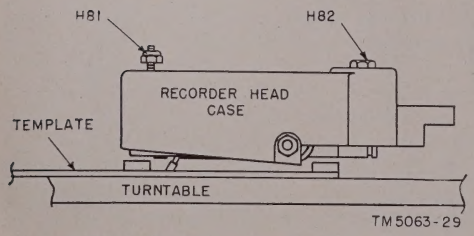


Figure 31. Recorder head, adjustment.

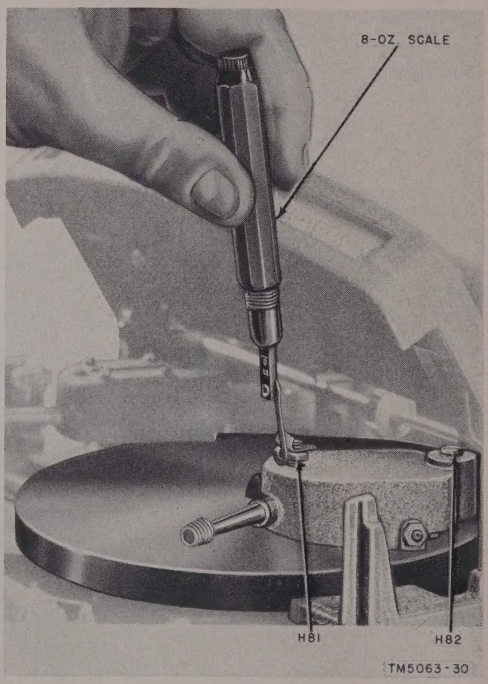


Figure 32. Recorder head, stylus pressure test.

(3) *Stylus pressure* (fig. 32). Screw H82 adjusts the stylus pressure. Turning the screw clockwise increases the pressure. Turning the screw counterclockwise decreases the pressure. To measure the head pressure, raise the cover. Snap a clip onto the screw threads just above

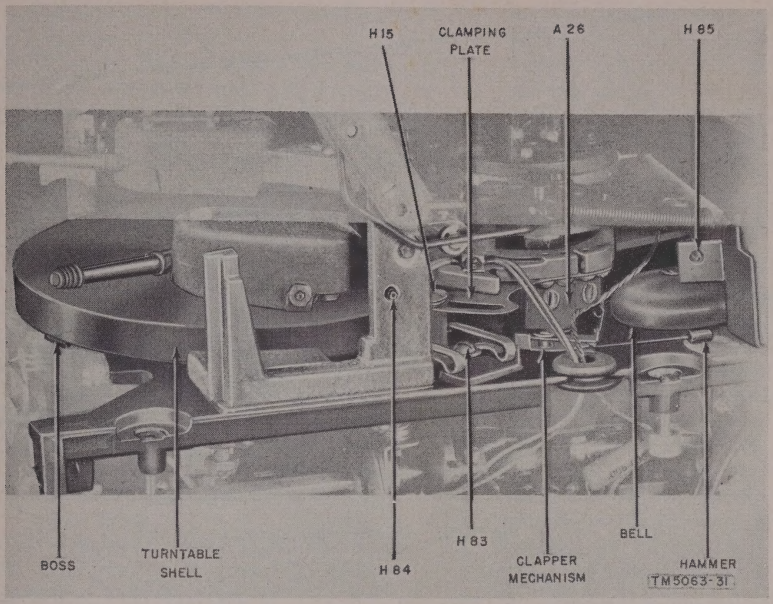


Figure 33. Recorder-arm adjustment.

assembly H81. Hook the 8-ounce postal scale onto the clip and lift the scale straight up. The scale should read between 1¾ and 2¼ ounces just as the lifting nut of assembly H81 leaves the recorder-head case. Adjust screw H82 to place the stylus pressure within these limits.

(4) *Outside stop* (fig. 33). Screw H84 is the outside stop. When the cover is raised, the recorder head moves toward the outer edge of the disk. The stylus is positioned at the outside of the disk when the side of the head strikes screw H84. Turning screw H84 counterclockwise places the stylus closer to the outside of the disk. Turning screw H84 clockwise positions the recorder arm and stylus nearer the center of the disk. A No. 4 Allen wrench is required to turn screw H84. This screw has a self-locking nut and should be adjusted so that the diamond stylus will fall in the groove on the recorder-head adjusting template. To make this adjustment, proceed as follows:

(*a*) Operate the LISTEN—TALK knob to the TALK position, raise the cover, set the template on the turntable shell and slide the template under the recorder stylus.

(*b*) Lower the cover. Adjust screw H84 until the recorder stylus falls into the groove in the template.

(5) *Inside stop* (fig. 33). The light beam must be adjusted before the inside stop (screw H85) is adjusted (*c* (6) below). The back end of the recorder arm strikes this screw at the end of the 15-minute recording time and prevents the arm from traveling further toward the center of the disk. This screw requires a No. 4 Allen wrench for adjustment. It should be adjusted so that the recorder-arm light beam is on the 15-minute mark on the index scale.

(6) *Warning bell* (fig. 33).

(*a*) Before the clapper of the warning bell is adjusted, the light beam must be adjusted (*c* (6) below). This warning bell should ring when the index beam is between the 14½ and 14¾ marks. The clapper mounts rest against bracket A 26, which rotates with the recorder arm. When the light beam is at the 14½ mark, bracket A 26 releases the clapper mount, and spring

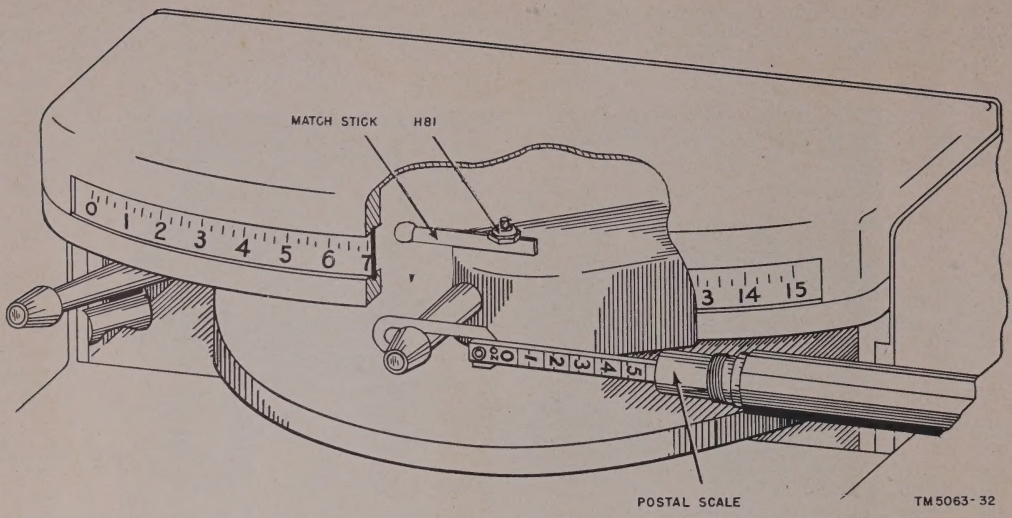


Figure 34. Recorder-arm drag test.

action causes the clapper to strike the bell. Bracket A 26 has elongated mounting holes which permit adjustment of its position.

(*b*) If the warning bell sounds later than 14¾ minutes, loosen the mounting screws of bracket A 26 and slide the bracket to the left. If the warning bell sounds before 14½ minutes, slide the bracket to the right.

(*c*) The clapper should not touch the chassis or the bell. Bend the arm of the clapper if necessary. If the clapper rests against the bell, a thud will be heard instead of a clear bell tone. When the clapper is actuated, it should snap in to strike the bell and come to rest just clear of the bell.

(7) *Recorder-arm drag* (fig. 34). The recorder-head drag determines the amount of friction which must be developed in the friction clutch between the recorder arm and its drive shaft. This friction permits movement of the recorder head to any position within the recording area of the disk. The friction must be great enough to transmit driving force from the drive shaft to the recorder arm.

(*a*) To measure the recorder-arm drag, follow this procedure:

1. Operate the selector switch to the OFF position.
2. Operate the LISTEN–TALK switch to the TALK position.
3. Place a spacer, such as a match stick, between the lifting nut of assembly H81 and the top of the recorder-head case to lift the stylus clear of the disk.
4. Lower the cover and move the recorder head to the inside of the recording area.
5. Apply the 8-ounce postal scale to the end of the handle of the recorder head and pull the head toward the outside of the disk. Hold the scale as nearly horizontal as possible and at right angles to the recorder-head handle. The scale should read between 5 and 8 ounces.

(*b*) To adjust recorder-arm drag, use the following procedure:

1. Remove the gear sector by following steps (*a*), (*b*), (*e*), (*f*), (*g*), (*h*), and (*i*) in paragraph 46*e*(3).
2. Instead of removing the locked nuts as described in paragraph 46*k*, unlock nuts H55 and H56 and then tighten bottom nut H56 to increase recorder-arm drag, or loosen nut

H56 to decrease recorder-arm drag (fig. 22).

3. Lock nuts H55 and H56 together before checking drag. It is not necessary to reassemble all the parts to test the drag.

4. If recorder-head drag is jerky or uneven, the washers are not lubricated properly (pars. 46*e*(3)(*l*) and (*m*)).

5. After reassembling the parts to the recorder arm, the drag should remain about the same. If recorder-head drag increases when the parts are reassembled, the gear teeth of the gear sectors are binding, the gear sector is tight on the recorder-arm drive shaft, or the retracting arm is binding on the recorder arm. These parts must move freely, otherwise they prevent the arm from feeding across the disk.

(8) *Height of stylus in LISTEN position* (fig. 35). The position of screw H89 determines how high the recorder head and stylus lifts off the disk when the LISTEN—TALK switch is in the LISTEN position (lifting nut of assembly H81 (fig. 31) remaining unchanged).

(*a*) Be sure the lifting nut of the cartridge are adjusted properly (*a*(1) and (2) above).

(*b*) Operate the LISTEN—TALK switch to the LISTEN position.

(*c*) Adjust screw H89 so that the stylus just clears the disk with the turntable rotating. (Protective and recording disks must be on the turntable.) Turn screw H89 clockwise to raise the stylus and turn it counterclockwise to lower the stylus toward the disk.

(*d*) Check the stylus position with the recorder head at the outside of the disk and at the inside of the disk. Be sure that the stylus clears the disk but that it is not higher than necessary.

b. Reproducer Arm.

(1) *Leveling of insert* (fig. 35). Screw H86 raises and lowers the reproducer arm. Turning the screw clockwise raises the arm and head; turning the screw counterclockwise lowers the arm and head. Adjust the height of the arm and head so that the base of the cartridge (not the housing casting) is approximately level with the top of the turntable. When the height of the arm is adjusted properly, the reproducer handle must be lifted a small amount (approximately ⅛ inch) before the stylus lifts off the disk.

(2) *Trailing* (fig. 35). Screw H87 is the reproducer-head outside stop. It not only determines how far the reproducer head travels toward the outside of the disk, but it also determines how far the reproducer head will trail behind the recorder head while recording. That is, it determines how much of the record is heard during quick review. When the cover is raised, the reproducer head retracts to the outside of the disk and the side of the head strikes the head of screw H87. After indexing, the trailing at the outside of the disk usually will be 3 to 5 grooves, and the trailing at the inside of the disk will be 2 to 6 grooves.

(*a*) To check the trailing at the outside of the disk, proceed as follows:

1. Operate the selector switch to the DICT position.

2. Raise the front cover.

3. Operate the LISTEN—TALK switch to the TALK position. The turntable will rotate several times.

4. When the turntable comes to rest, put on a blank disk.

5. Raise the front cover as far as possible. Lower the front cover. Start dictating. Listen to the dictation in quick-review position. Press END button.

6. Dictate the count of the turntable revolutions backward, that is, each time the turntable makes a complete revolution, dictate a single number beginning with 7 and counting backwards with each revolution until zero is reached. Immediately after zero is reached, place the microphone button in the quick-review position. The first number heard should be 3, 4, or 5.

7. If the number heard is greater than 5, the trailing is too much and stop screw H87 should be turned counterclockwise. If the number heard is less than 3, the trailing is too

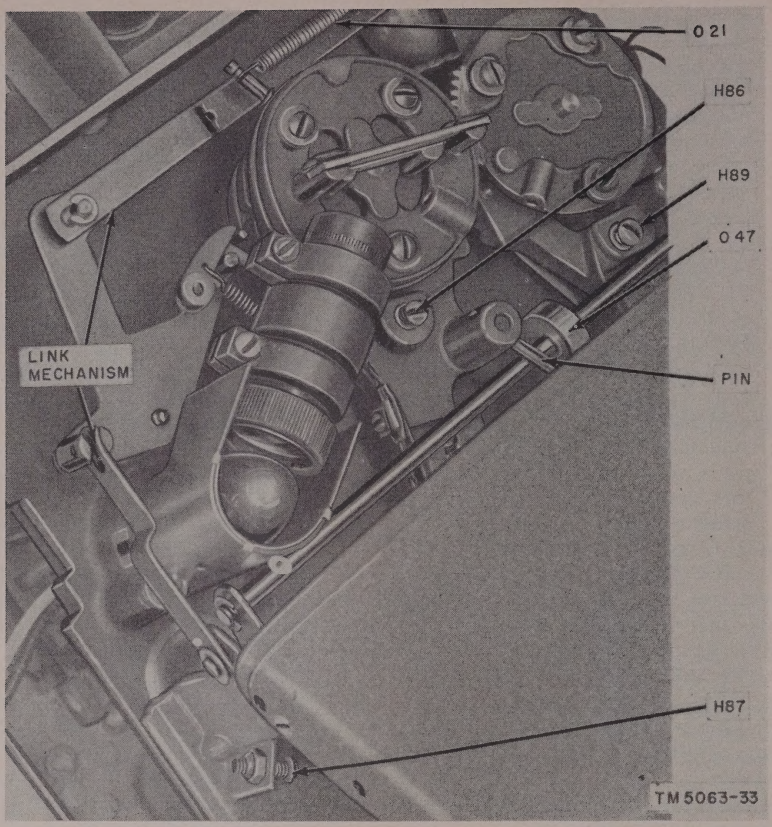


Figure 35. Reproducer-arm adjustment.

little and stop screw H87 should be turned clockwise. Approximately one-fourth turn of screw H87 changes the trailing by one groove.

8. Adjust the light beams as in *a*(6) above after screw H87 has been adjusted for proper trailing.

(*b*) To check the trailing at the inside of disk, proceed as follows:

1. Be sure the light beams are adjusted as in *a*(6) above.

2. With the LISTEN—TALK switch in the TALK position, lift and move the recorder head to approximately 11 on the index scale.

3. Move the reproducer arm so that its light beam is on the recorder-head light beam. Only one light beam should be visible. Start dictating. Listen to the dictation in quick-review position. Press the END button.

4. Dictate the count of the turntable revolutions backwards; that is, each time the turntable makes a complete revolution, dictate a single number beginning with 7 and count backwards with each revolution until zero is reached. Immediately after zero is dictated, place the microphone button in the quick-review position. The first number heard should be 2, 3, 4, 5, or 6.

(3) *Tracking through indexing.* Tracking through indexing is the ability of the reproducer stylus to track the groove

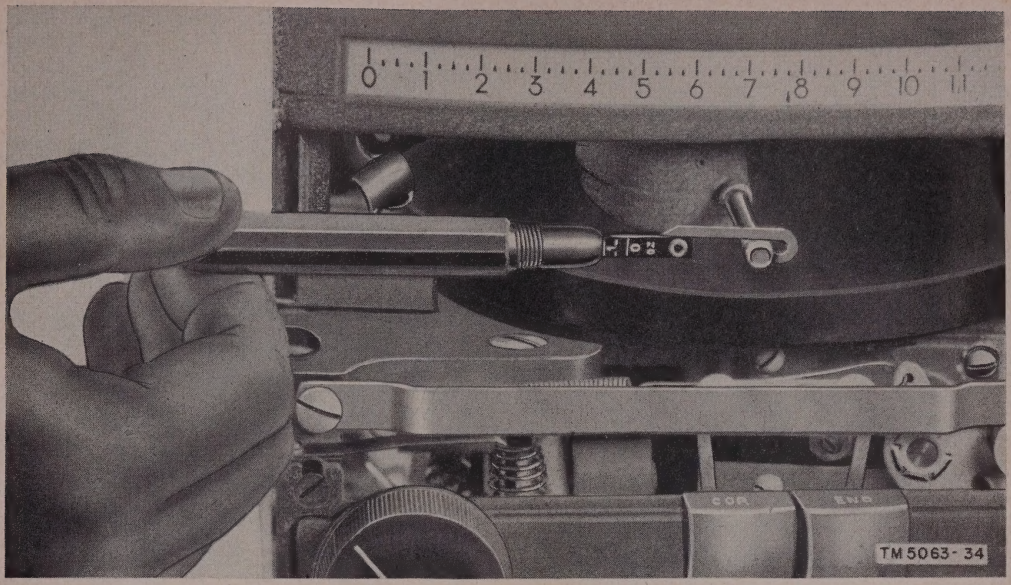


Figure 36. Reproducer-arm drag test.

across an index space without mistracking. The reproducer stylus will not track across the first index space but, after the first indexing, the reproducer stylus should track across the index space and the trailing should be constant from that point on provided there is no break in the groove. A convenient time to check tracking through indexing is right after the trailing at the outside of the disk has been checked.

(*a*) After completing step 7 of *b*(2)(*a*) above, continue dictating.

(*b*) Dictate and depress the END button.

(*c*) As soon as the END cycle is completed, place the microphone button in the quick-review position and listen to the dictation of the groove made during the END cycle. When the END cycle is completed, all the play will be taken up in the END button.

(*d*) If the reproducer stylus does not track during the END cycle, be sure the recorder-head stylus pressure is adjusted properly (*a*(3) above). If this does not correct the tracking through indexing, the reproducer cartridge must be replaced (par. 46*g*(2)).

(4) *Inside stop* (fig. 35). Collar O 47 on the lifter bar is the inside stop for the reproducer head. A pin on the head strikes the collar and this prevents further travel of the head toward the center of the disk.

(*a*) Make sure light beams are adjusted properly (*a*(6) above).

(*b*) Move the reproducer head to the inside of the disk but do not lift the reproducer head by the handle; otherwise the curved edge of the collar will allow overtravel of the pin and head. (The stylus should be in contact with the disk.)

(*c*) Observe the position of the light beam. The collar should allow the light beam of the reproducer head to go slightly beyond the 15-minute mark on the index scale.

(*d*) If the reproducer head goes in too far, loosen the setscrew with a No. 6 Allen wrench, slide collar O 47 toward the reproducer arm, and tighten the setscrew.

(5) *Reproducer-head drag* (fig. 36). The reproducer-head drag adjustment, which is similar to that of the recorder-head drag adjustment (par.48*a*(7)), determines

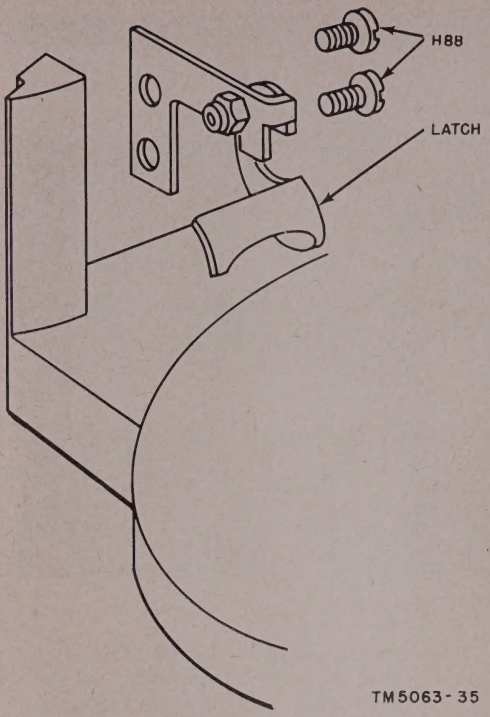


Figure 37. Latch for reproducer-arm handle.

the amount of friction that must be developed between the friction clutch and its drive shaft. This friction permits movement of the reproducer-head to any portion of the recording area on the disk. The friction must be great enough to transmit the driving force from the drive shaft to the reproducer head.

(*a*) To measure reproducer-head drag, proceed as follows:

1. Operate the selector switch to the OFF position.

2. Move the reproducer arm to the inside of the recording area.

3. Apply the 8-ounce postal scale to the end of the handle of the reproducer head and pull the reproducer head toward the outside of the disk. Hold the scale as nearly horizontal as possible and at right angles to the reproducer head. The scale should read between 4 and 7 ounces.

(*b*) To adjust the reproducer-head drag follow this procedure:

1. Remove the mirror mounts by following steps (*a*), (*f*), (*h*), (*i*), in paragraph 46*g*(3).

2. Instead of removing locknuts H55 and H56 (fig. 24) as in step (*k*) of paragraph 46*g*(3), unlock the nuts and then tighten bottom nut H56 to increase the reproducer-arm drag, or loosen nut H56 to decrease the reproducer-arm drag.

3. Lock nuts H55 and H56 together before checking the drag. It is not necessary to reassemble all the parts to test the drag.

4. If the reproducer-arm drag is jerky or uneven, the washers are not lubricated properly (pars. 46*g*(3)(*l*) and (*m*)).

5. After reassembling the parts of the reproducer arm, the drag should remain about the same. If the drag increases considerably, some of the moving parts are binding.

(6) *Latch* (fig. 37). The handle of the reproducer head should be placed in the latch whenever the equipment is moved. The handle should snap in easily. The latch has elongated mounting holes which make it possible to shift the position of the latch after loosening nuts H88. Check reproducer-arm trailing for adjustment as in *b*(2) above before adjusting the position of the latch.

c. Light Beam Index System (fig. 23).

(1) *Complete assembly.* The mounting hole of the complete light beam system is elongated, and it is possible to turn the assembly when mounting screw H59 is loosened. This assembly should be set so that the image of the lamp filaments strikes the mirrors approximately over the reproducer-arm drive shaft. Hold a piece of paper in front of the mirrors, to see clearly the image of the lamp filament.

(2) *Lamp.* Whenever lamp I 2 is replaced, adjust its vertical and rotational position as follows: Loosen screw H62. Rotate the lamp socket so that the lamp filament forms a single image on the mirrors. If a filament is W-shaped, rotate the lamp

so that a single W is seen. If the filament is V-shaped, rotate the lamp so that a single V is seen. Adjust the height of lamp I 2 so that there is an equal amount of filament image (or light) on the top and the bottom mirrors. Tighten screw H62 when the adjustment is completed.

(3) *Condenser lens.* Condenser lens assembly I 10 contains the slit which gives a line image at the index scale. To adjust this assembly loosen screw H60. Rotate the assembly so that the line image is straight up and down on the index scale. Locate assembly I 10 as closely as possible to index lamp I 2. Tighten mounting screw H60.

(4) *Focusing lens.* Adjust as follows: Move the recorder and reproducer arms so that their light beams are side-by-side at approximately 4 on the index scale. Loosen mounting screw H61. Slide focusing lens assembly I 11 back and forth until the sharpest possible image of the light beams is obtained on the index scale. Tighten screw H61.

(5) *Mirrors.* The reflecting mirrors are front surface mirrors. Fingers or other objects contacting these surfaces may destroy their reflecting properties. These surfaces should be cleaned only when necessary. Clean with a good grade of eyeglass or lens tissue. There should be a slight clearance between the two mirrors so they do not rub one another as they rotate. These mirrors are mounted on spring clips which make it possible to slide the mirrors up or down.

(6) *Scale adjustment.* After the cover is raised and lowered, both the recorder and reproducer heads are against their respective outside stops. The light beams of both heads should be superimposed so that they appear as one light beam on the zero mark of the index scale. If it is necessary to adjust the light beam position, perform the following steps:

(*a*) See that the outside stop of the recorder head is adjusted properly (*a*(4) above).

(*b*) See that the outside stop (trailing) of the reproducer arm is adjusted properly (*b*(2) above).

(*c*) Move the reproducer head toward the center of the disk.

(*d*) Insert the mirror adjusting tool in the hole provided on the gear sector on the recorder arm (fig. 38).

(*e*) While holding the recorder head against its outside stop, move the mirror adjusting tool to one side or the other until the light beam moves onto the zero mark of the index scale.

(*f*) Leave the recorder head against its outside stop.

(*g*) Insert the mirror adjusting tool in the hole provided on the mirror mount of the reproducer arm (fig. 39).

(*h*) Hold the reproducer arm against its stop while moving the adjusting tool to one side or the other until the reproducer-head light beam is superimposed on the recorder-head light beam.

d. Clamping Mechanism (fig. 33). The clamping mechanism lifts and clamps the recorder head by exerting friction pressure on the clamping plate which is fastened to the recorder head. The purpose of the clamping friction is to prevent the recorder head from feeding toward the center of the disk when the LISTEN—TALK switch is in the LISTEN position. The amount of friction applied by the clamping mechanism to the clamping plate can be adjusted by screw K83. Turning the screw clockwise increases the amount of friction, and turning it counterclockwise decreases the friction. There should be enough pressure to prevent the recorder arm from feeding toward the center of the disk but not enough to make it practically impossible to move the recorder arm laterally when the LISTEN—TALK knob is in the LISTEN position. To check clamping friction proceed as follows:

(1) Turn the equipment on by operating the selector switch in the DICT position.

(2) Operate the LISTEN—TALK switch to the LISTEN position.

(3) Rotate the turntable by depressing the hand mike button.

(4) Apply the postal scale to the end of recorder-head handle and pull the recorder head toward the center of the disk. Hold the scale horizontally and at right angles to the recorder head. When the light beam of the recorder head starts to move, the scale should

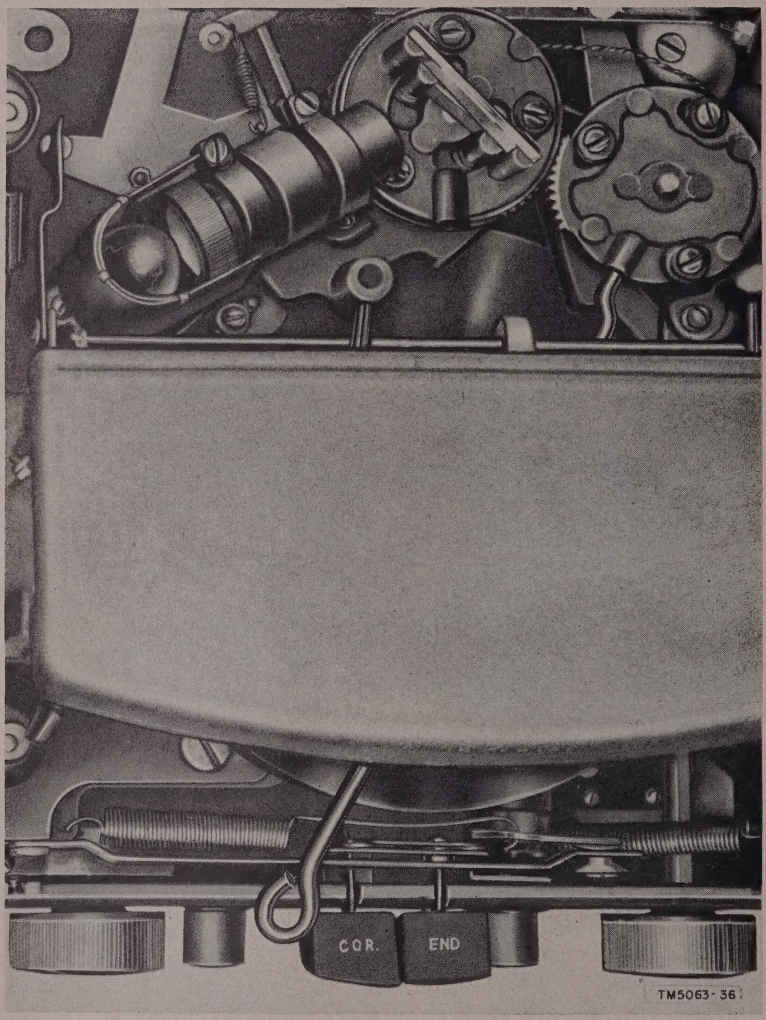


Figure 38. Index mirror adjustment, recorder arm.

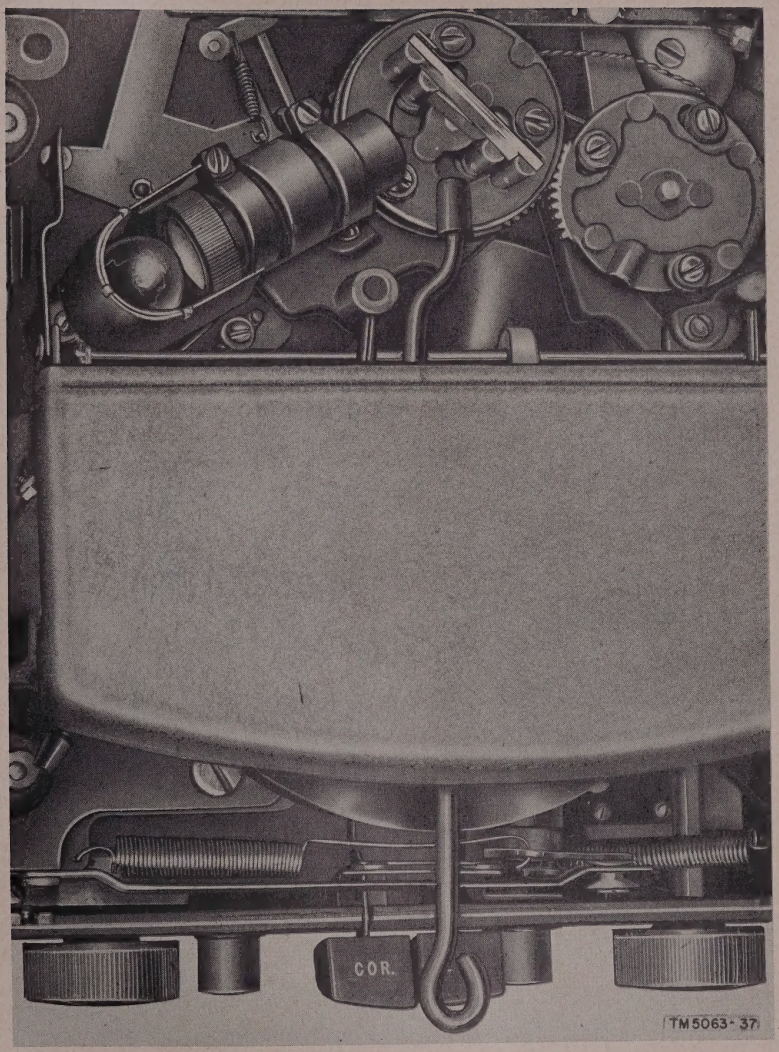


Figure 39. Index mirror adjustment, reproducer arm.

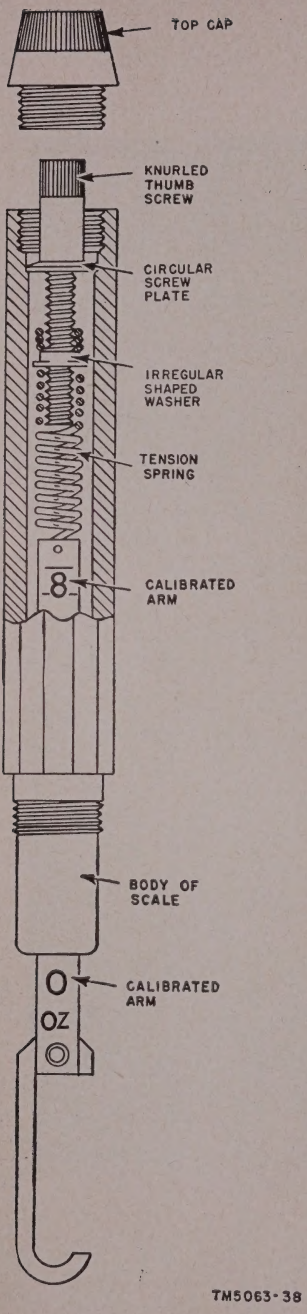


Figure 40. Postal scale, cutaway view.

read between 2 and 8 ounces. Adjust screw H83 until this reading is obtained.

e. Eight-Ounce Postal Scale (fig. 40). The 8-ounce postal scale is used for a number of adjustments and must be accurate. Under no-load conditions, the zero line of the calibrated arm should be visible just below the body of the scale. When the 5-ounce test weight (special tool) is hung on the hook of the scale, the 5-ounce division line should be visible just below the body of the scale. If the scale does not meet these requirements, hold the scale up (hook down), remove the small top cap, and adjust as follows:

(1) *Zero adjustment.* The knurled thumbscrew under the top cap adjusts the zero position of the calibrated arm. Turn the thumbscrew so that the zero line of the calibrated arm is visible just below the body of the scale. Turning this screw counterclockwise lowers the calibrated arm and thus the zero line.

(2) *Weight adjustment.*

(*a*) Check the zero adjustment ((1) above).

(*b*) Check the weight adjustment by hanging the 5-ounce test weight on the hook of the scale. Note whether the calibrated arm reads more or less than 5. Remove the test weight.

(*c*) Pull out the knurled thumbscrew carefully. The circular screw plate of this knurled thumbscrew is held in the body of the scale by a slight flashing or lip in the plastic molding. The flashing must be removed by scraping around the circular screw plate. When pulling out the knurled thumbscrew, do not pull hard, as this pulls out the tension spring. If the flashing should suddenly let go, the spring will be distorted.

(*d*) Note the small irregular-shaped washer inside the spring that has a lip which protrudes through the coils of the spring. This washer adjusts the tension of the spring and therefore controls the accuracy of the scale. Turn this washer counterclockwise if the scale reads more than 5 or clockwise if the scale reads less than 5.

(*e*) Put the knurled thumbscrew back in place at the top of the scale. Make sure it is held there firmly.

(*f*) Check and readjust the zero adjustment if necessary.

(*g*) Check the weight adjustment in accordance with (*b*) above.

(*h*) Repeat the instructions in (*a*) through (*g*) above until the zero and weight adjustments are correct.

(3) When the postal scale is adjusted completely, replace the top cap. Always keep the scale in good condition and in proper adjustment.

f. Switch S3 Adjustment (fig. 41). When either of index keys COR or END is depressed, switch S3, actuated by the index lever, connects the turntable motor to the power line. The turntable should speed up as soon as the index key is struck; if it does not, spring O 54 will exert too much pressure and the overdrive will fail to move the recorder arm at a faster rate. The switch must shut off at the end of the index cycle, or it will be impossible to control the start and stop of the turntable by the hand microphone button. To start and stop the motor, adjust switch S3 as follows:

(1) Remove the cabinet (par. 46*c*).

(2) Turn the eccentric screw so that switch S3 shuts off when the wider mark is made.

(3) Replace the cabinet.

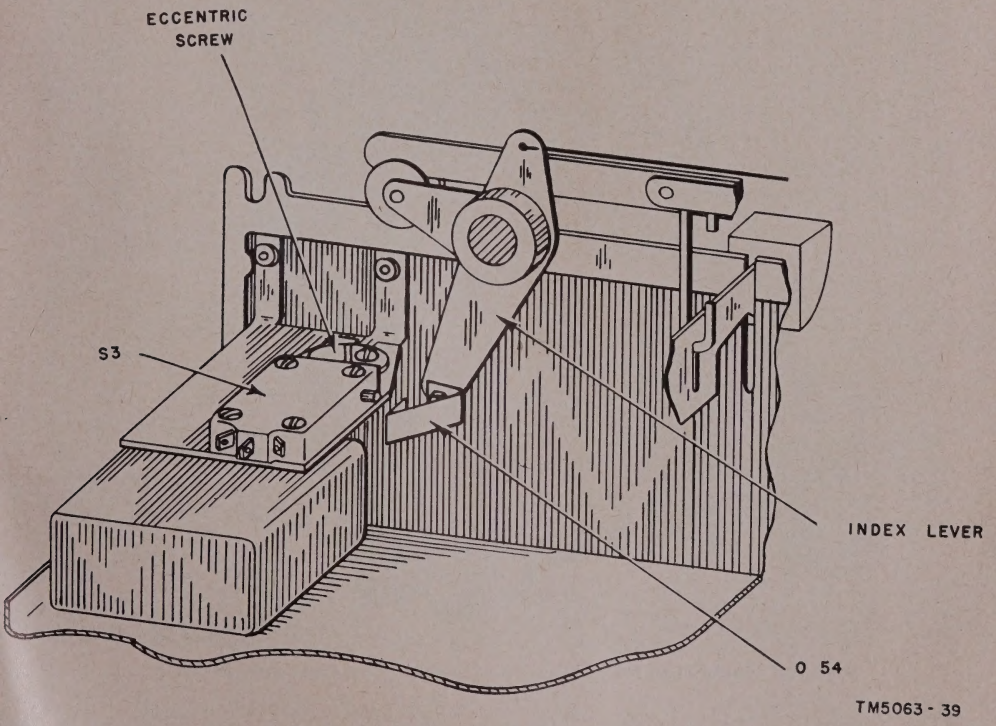


Figure 41. Index switch adjustment, cutaway view.

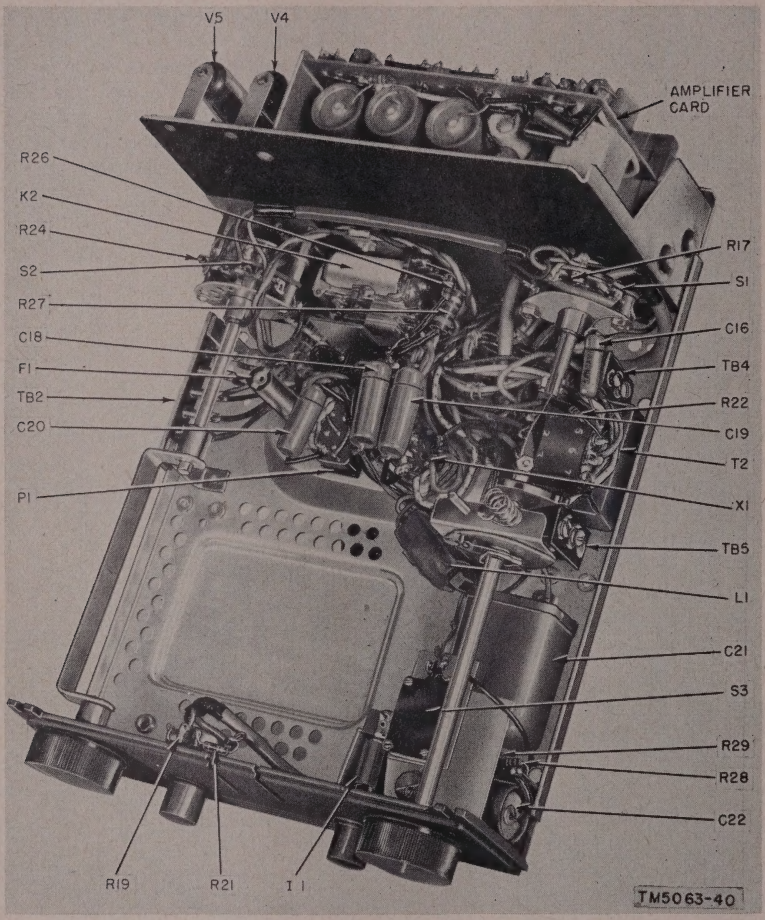


Figure 42. Sound Recorder-Reproducer Set AN/FNQ-3 (*), top view of bottom chassis.

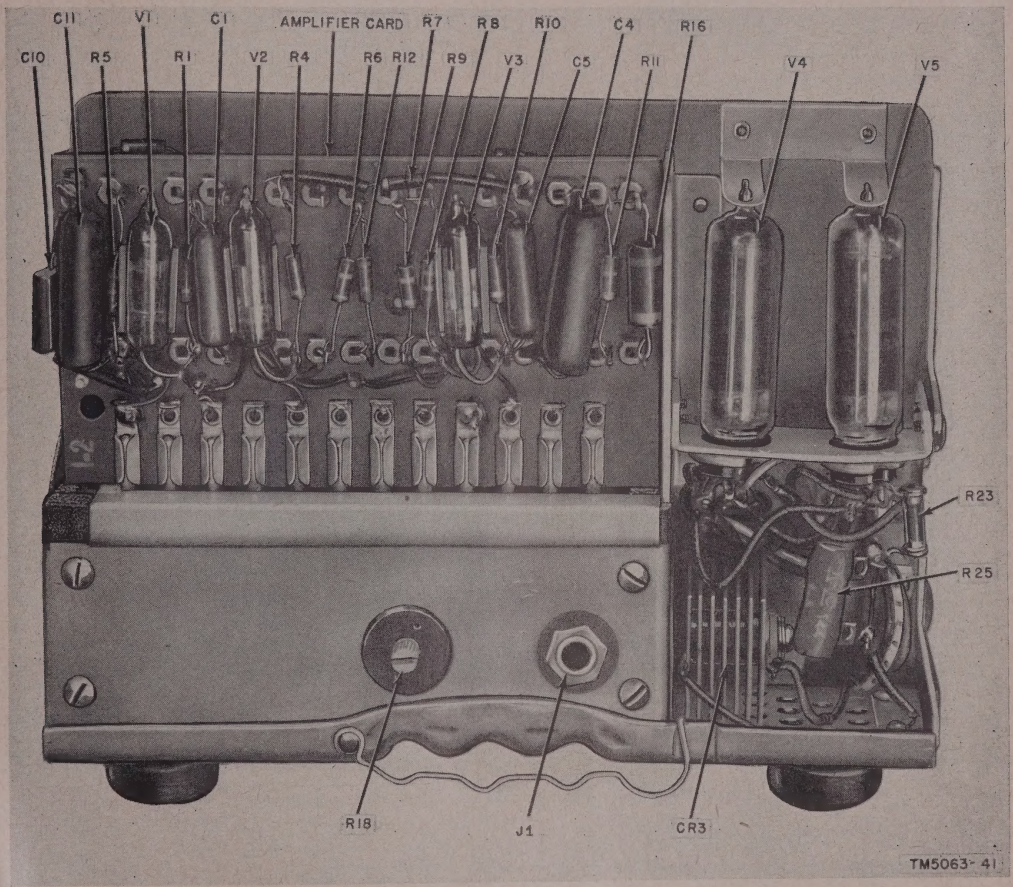


Figure 43. Sound Recorder-Reproducer Set AN/FNQ-3 (*), rear view of bottom chassis.

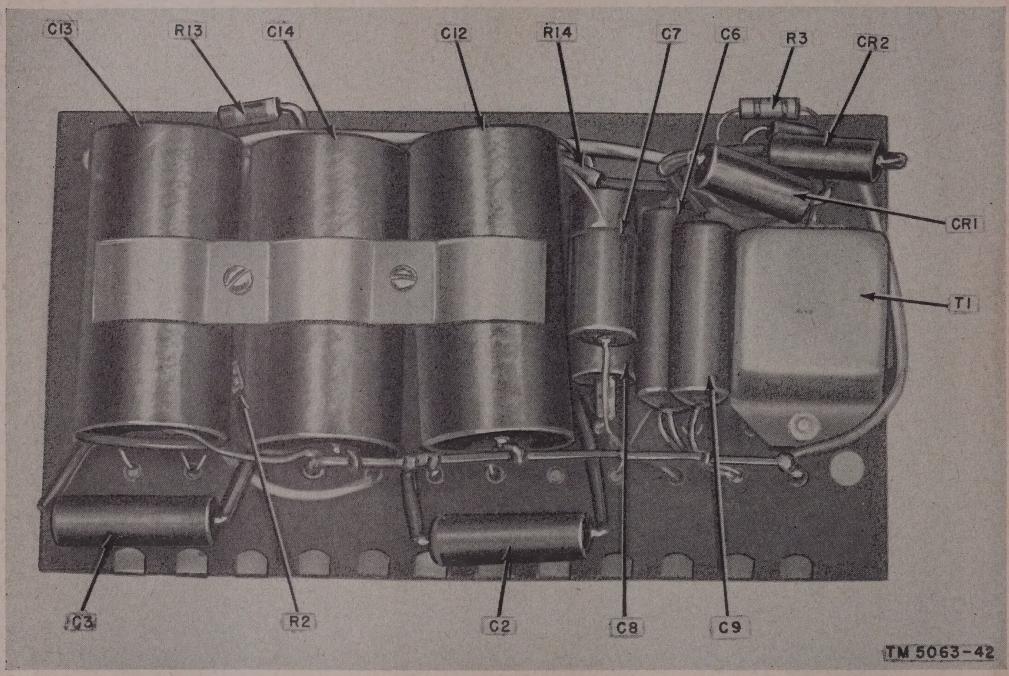
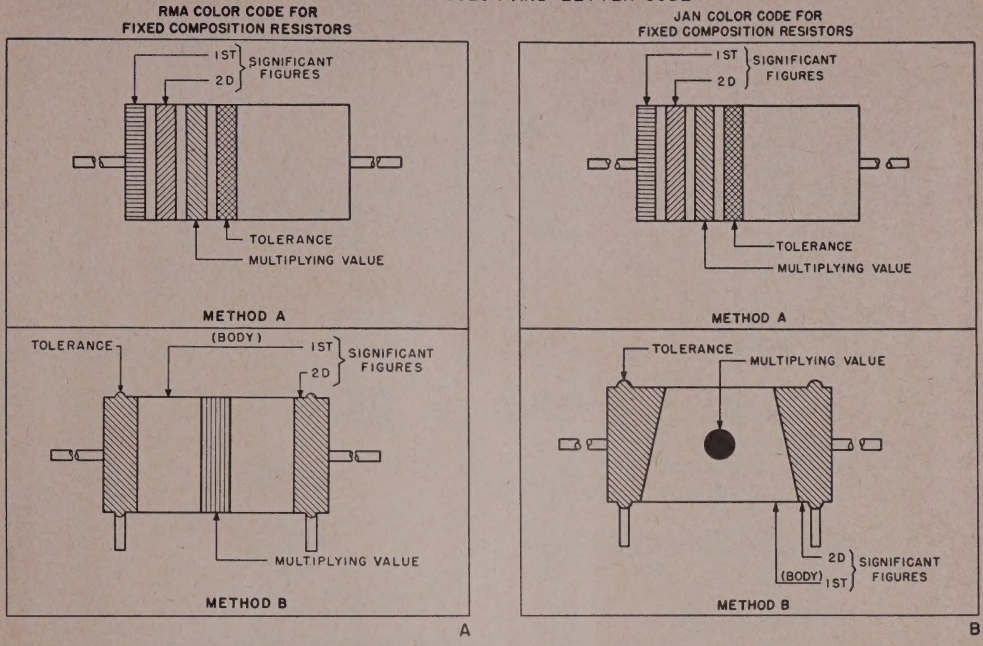


Figure 44. Amplifier card, rear view.

RESISTOR COLOR AND LETTER CODE



STANDARDS				
COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)	JAN LETTER TOLERANCE
BLACK	0	1	—	—
BROWN	1	10	± 1	F
RED	2	100	± 2	G
ORANGE	3	1,000	± 3	—
YELLOW	4	10,000	± 4	—
GREEN	5	100,000	± 5	—
BLUE	6	1,000,000	± 6	—
VIOLET	7	10,000,000	± 7	—
GRAY	8	100,000,000	± 8	—
WHITE	9	1,000,000,000	± 9	—
GOLD	—	0.1	± 5	J
SILVER	—	0.01	±10	K
NO COLOR	—	—	±20	M

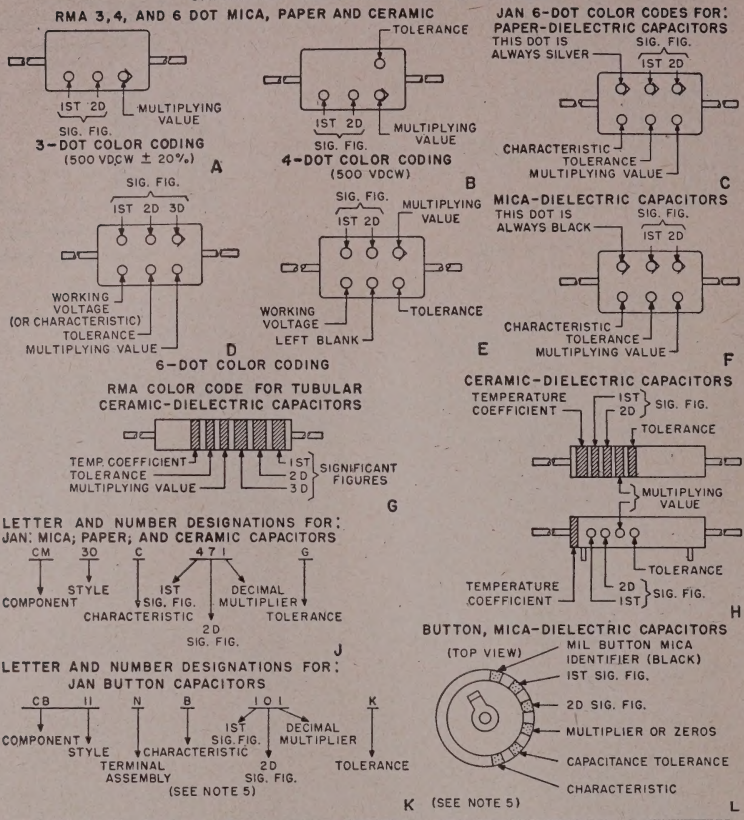
NOTES:

1. RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.
2. RMA: RADIO MANUFACTURERS ASSOCIATION.
3. JAN: JOINT ARMY-NAVY.
4. THESE COLOR AND NUMBER CODES GIVE ALL RESISTANCE VALUES IN OHMS.
5. RESISTIVE COMPONENTS USED FOR LETTER TOLERANCES ARE: RC, RN, AND RU.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

TM RC

Figure 45. Resistor color and letter codes.

CAPACITOR COLOR AND LETTER CODES



- STANDARDS -					JAN MICA-CM		JAN PAPER-CM		JAN CERAMIC-CC					
									CAP. TOL. FOR MORE THAN 10 UUF		CAP. TOL. FOR 10 UUF OR LESS			
COLOR	SIG. FIG.	DECIMAL MULTIPLIER	% TOL.	VDCW	LETTER TOL.	CHARAC-TERISTIC	LETTER TOL.	CHARAC-TERISTIC	DEC. MULT.	%	LETTER DESIG-NATION	UUF	LETTER DESIG-NATION	CHARAC-TERISTIC
BLACK	0	1	±20	500	M	A	M	A	1	±20	M	±2.0	G	C
BROWN	1	10	± 1	100	-	B	-	E	10	± 1	F	-	-	H
RED	2	100	± 2	200	G	C	-	H	100	± 2	G	-	-	L
ORANGE	3	1,000	± 3	300	-	D	N*	J	1,000	-	-	-	-	P
YELLOW	4	10,000	± 4	400	-	E	-	P	-	-	-	-	-	R
GREEN	5	100,000	± 5	500	-	F	-	R	-	± 5	J	±0.5	D	S
BLUE	6	1,000,000	± 6	600	-	G	-	S	-	-	-	-	-	T
VIOLET	7	10,000,000	± 7	700	-	-	-	T	-	-	-	-	-	U
GRAY	8	100,000,000	± 8	800	-	-	-	-	0.01	-	-	±0.25	C	B
WHITE	9	1,000,000,000	± 9	900	-	-	-	-	0.1	± 10	K	±1.0	F	SL
GOLD	-	0.1	± 5	1,000	J	-	-	-	-	-	-	-	-	A
SILVER	-	0.01	±10	2,000	K	-	K	-	-	-	-	-	-	-
NO COLOR	-	-	±20	500	-	-	-	-	-	-	-	-	-	-

* THE TOLERANCE OF THIS CAPACITOR IS ±30%, NOT ±2%

NOTES

JAN: JOINT ARMY-NAVY
RMA; RADIO MANUFACTURERS ASSOCIATION

1. THESE COLOR AND LETTER CODES GIVE CAPACITANCES IN MICROMICROFARADS
2. THIS TABLE IS ADAPTED FOR JAN AND RMA COLOR AND JAN LETTER TYPE DESIGNATIONS
3. CERAMIC AND MICA CAPACITORS, BOTH JAN AND RMA, ARE GENERALLY 500 VDCW
4. BUTTON CAPACITORS ARE GENERALLY 300 VDCW
5. READ BUTTON CAPACITOR TOLERANCE UNDER CERAMICS OF MORE THAN 10 UUF
6. CHARACTERISTICS ARE AVAILABLE IN JAN CAPACITOR SPECIFICATION MANUALS
7. THE COMPONENTS USED ABOVE FOR JAN LETTER TYPE DESIGNATIONS ARE:
   CB MICA BUTTON; *CC* CERAMIC; *CM* MICA MOULDED; *CP* PAPER MOULDED

TM CC

Figure 46. Capacitor color and letter codes.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

49. Repackaging

a. Clean and dry the equipment.

b. Use as much of the original packing material as is available.

c. Repackage the equipment as shown in figure 3.

d. Place each component in a corrugated-fiberboard carton.

e. Store the packaged equipment in a dry place; maintain an even temperature if possible.

50. Marking

a. Interior Marking. Mark the interior package with the Signal Corps stock number, quantity, description, Signal Corps order number, and technical markings where they apply, in accordance with the requirements of Signal Corps Instructions No. 726–15.

b. Exterior Marking. Mark shipping containers that have identical items in accordance with the requirements of MIL–STD–129.

Section II. DEMOLITION TO PREVENT ENEMY USE

51. Method of Demolition

a. Smash. Use sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. Cut. Use axes, handaxes, or machetes.

c. Burn. Use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Explode. Use firearms, grenades, or TNT.

e. Dispose. Bury in slit trenches, fox holes, other holes. Throw into streams. Scatter.

Note. Use anything immediately available for destruction of this equipment.

52. Destruction of Components

When ordered by your commander, destroy all equipment to prevent its being used or salvaged by the enemy.

a. Smash (par. 51*a*) the cases, panels, controls, connectors, switches, tubes and all other electrical or mechanical parts, moving or fixed.

b. Cut (par. 51*b*) all cases, cords, and cables.

c. Burn (par. 51*c*) all cases, cords, diagrams, and technical manuals.

d. Bury or scatter (par. 51*e*) all remaining parts of the equipment.

e. Destroy everything.

APPENDIX I

REFERENCES

Note. For availability of items listed, check Special Regulations in the 310–20 series, and Department of the Army Supply Manual SIG 1.

1. Army Regulations

AR 380–5_____ Military Security (Safeguarding Military Information).
AR 750–5_____ Maintenance Responsibilities and Shop Operation.

2. Auxiliary Equipment and Test Equipment

TM 11–2526___ Oscilloscope BC–1060–A.
TM 11–2613___ Voltohmmeter I–166.
TM 11–2624B_ Voltohmmeters TS–294/U, TS–294B/U, and TS–294C/U.
TM 11–2626___ Test Unit I–176, I–176–A, and I–176–B.
TM 11–2627___ Tube Tester I–177 and I–177–A.
TM 11–4700___ Electrical Indicating and Measuring Instruments. Repair Instructions.
TM 11–5500___ Multimeter TS–297/U.
TM 11–5511___ Electronic Multimeter TS–505/U.
TM 11–5527___ Multimeter TS–352/U.

3. Painting, Preserving, and Lubrication

TB SIG 13____ Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69____ Lubrication of Ground Signal Equipment.
TM 9–2851____ Painting Instructions for Field Use.

4. Camouflage, Decontamination, and Demolition

FM 5–20_____ Camouflage, Basic Principles.
FM 5–25_____ Explosives and Demolitions.
TM 3–220_____ Decontamination.

5. Other Publications

SR 310–20–3___ Index of Training Publications.
SR 310–20–4___ Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
SR 310–20–5___ Index of Administrative Publications.
SR 700–45–5___ Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 725–405–5__ Preparation and Submission of Requisitions for Signal Corps Supplies.
SR 745–45–5___, AFR 71–4_____, TB ORD 313__ Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army) and AF–MC–U2 (Air Force)).
TB SIG 4_____ Spark Plugs.
Methods for Improving the Effectiveness of Jungle Radio Communication.
TB SIG 25____ Preventive Maintenance of Power Cords.
TB SIG 54____ Working through Jamming with Frequency Modulated Radio Sets.
TB SIG 66____ Winter Maintenance of Signal Equipment.
TB SIG 72____ Tropical Maintenance of Ground Signal Equipment.
TB SIG 75____ Desert Maintenance of Ground Signal Equipment.
TB SIG 219___ Operation of Signal Equipment at Low Temperatures.
TM 11–455____ Radio Fundamentals.
TM 11–486____ Electrical Communication Systems Engineering.
TM 11–496____ Training Text and Applicatory Exercises for Amplitude-Modulated Radio Sets.
TM 11–661____ Electrical Fundamentals (Direct Current).
TM 11–681____ Electrical Fundamentals (Alternating Current).
TM 11–4000___ Trouble Shooting and Repair of Radio Equipment.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Note.—The fact that a part is listed in these tables is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O & E, T/A, SIG 7–8–10–, SIG 10, list of allowances of expendable materials, or another authorized supply basis. The Department of the Army Supply Manual applicable to the equipment covered in this manual is SIG 7 & 8–AN/FNQ–3. For an index of available supply manuals in the Signal portion of the Department of the Army Supply Manual, see the latest issue of SIG 1.

1. Sound Recorder-Reproducer Set AN/FNQ–3

(Sig C stock No. 4A2367)

Note.—See paragraph 2 of this appendix for list of parts for Sound Recorder Reproducer Set AN/FNQ–3A.

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
O 18	ABSORBER, shock: motor mtg; 3 1/64" dia x 1/2" lg.	Prevents vibration of turntable	2Z141–2
O 202	ABSORBER, shock: front cushion and spacer for mike unit; 1 15/16" OD x 1 1/2" ID x 1/8" thk o/a.	Protects microphone unit from shock	2Z142–9
O 5, O 24	BALL, bearing: .125" dia o/a	Used as thrust bearing for drive shaft	3H230–14
O 35	BEARING, ball: single row radial; .3750" bore, .8750" OD, .2812" wd.	Used in mounting of recorder and reproducer arms.	3H304–11
TB3	BOARD, terminal: general purpose; 2 prong type term.; 1 1/16" lg x 1/2" wd x 7/16" h o/a; Cinch #2–98.	Connects to terminal board TB2	3Z770–2.114
TB1	BOARD, terminal: general purpose; 3 prong type term.; 1 1/16" lg x 1/2" wd x 7/16" h o/a; Cinch #3–98.	Connects to terminal board TB2	3Z770–3.78
TB6	BOARD, terminal: 7 swaged studs and 12 prong type term.; 5 1/4" lg x 2" wd x 1 5/16" h o/a.	Receives amplifier card	3Z770–19.10
A 11	BUMPER: 3/8" dia x 31/32" lg o/a	Prevents shock between cover and mounting brackets.	6Z1650–15
W303	CABLE ASSEMBLY, power: electrical; two #18 AWG stranded cond; 9 ft o/a lg.	Interconnects speaker to recorder	3E7350.1–20.17
W301	CABLE ASSEMBLY, power: electrical; six #18 AWG stranded cond; 9 ft o/a lg.	Interconnects control unit to the tone warning generator.	3E7350.1–20.16
W101	CABLE ASSEMBLY, power: electrical; two #18 AWG stranded cond; 123–3/4" o/a lg.	Connects the recorder-reproducer to the power line.	3E7350.1–20.18
W201	CABLE ASSEMBLY, special purpose: electrical; four #23 AWG stranded cond; 9 ft o/a lg.	Connects the microphone to the recorder-reproducer.	3E7350–1.83
W302	CABLE ASSEMBLY, special purpose: electrical; four #23 AWG stranded cond; 9 ft o/a lg.	Interconnects the control unit to the recorder-reproducer.	3E7350–1.76
E15	CAP, lamp: cover for flasher lamp; 5/8" dia x 3/4" lg.	Covers the flasher lamp	4A332–3
C10	CAPACITOR, fixed: mica dielectric; 470 μf ±10%; 500 vdcw; JAN type CM20B471K.	Prevents oscillation	3K2047121

1. Sound Recorder-Reproducer Set AN/FNQ-3—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C5, C16	CAPACITOR, fixed: paper dielectric; 5000 μf ±20%; 600 vdcw; ⅜″ dia x 1⅜″ lg.	C5—Reduces high-frequency response of third voltage amplifier. C16—Prevents noise pick-up from ground and isolates B— from chassis.	3DA5–242
C1, C2, C3, C15	CAPACITOR, fixed: paper dielectric; 10,000 μμf ±20%; 200 vdcw; 5/16″ dia x 1⅛″ lg.	C1—Couples signal from V1 plate to volume control. C2—Couples signal from V2 plate to V3 grid. C3—Couples signal from plate of V3 to grid of V4. C15—Eliminates high frequency in playback.	3DA10–587
C6, C20	CAPACITOR, fixed: paper dielectric; 10,000 μμf ±20%; 600 vdcw; JAN type CP26A1EF103M.	C6—Places low end of transformer T1 at a-c ground potential. C20—Filters noise from a-c power line.	3DA10–388
C4, C11	CAPACITOR, fixed: paper dielectric; 50,000 μμf ±20%; 200 vdcw; 7/16″ dia x 1⅜″ lg.	C4—Used as part of avc voltage doubling circuit. C11—Used as V1 screen bypass capacitor.	3DA50–479
C18, C19	CAPACITOR, fixed: paper dielectric; 50,000 μμf ±20%; 400 vdcw; ½″ dia x 1⅜″ lg.	Filters current to K2 relay	3DA50–478
C9, C17	CAPACITOR, fixed: paper dielectric; 250,000 μμf ±10%; 200 vdcw; 15/32″ dia x ⅝″ lg.	C9—Used as part of avc voltage doubling circuit. C17—Filters noise from feedback from T2.	3DA250–502
C7, C301	CAPACITOR, fixed: paper dielectric; 1 μf ±20%; 200 vdcw; 9/16″ dia x 1 17/32″ lg.	C7—Completes grid circuit to B—. C301—Couples telephone circuit to input transformer.	3DB1–390
C21	CAPACITOR, fixed: paper dielectric; 2 μf ±10%; 220 vdcw; 3 1/16″ lg x 1 11/16″ wd x 1 3/16″ h.	Splits phase of 60-cycle input to induction motor.	3DB2–287
C8	CAPACITOR, fixed: electrolytic; 50 μf; 6 vdcw; ⅜″ dia x 1 1/16″ lg.	Bypasses cathode resistor R6 of V2	3DB50–105
C12, C13, C14, C22	CAPACITOR, fixed: electrolytic; 50 μf; 150 vdcw; 15/16″ dia x 1⅞″ lg.	C12, C13, and C14—Filter plate circuits of V1 and V2. C22—Part of charging circuit R29, R28 and C22.	3DB50–104
P1	CONNECTOR, receptacle: 8 flat male pol cont; straight type; 1 3/16″ lg x 1 1/16″ wd x ¾″ h excluding cont.	Connects a-c power to recorder-reproducer.	2Z3028–74
O 6	COUPLING, flexible: approx 1 13/32″ OD x 2 1/32″ h.	Couples motor to turntable	2Z3295–182
O 81	COUPLING, flexible: 1⅝″ lg x ¼″ wd o/a.	Connects cam shaft to LISTEN-TALK switch assembly.	2Z3295–183
A 25	COVER: 5.800″ OD x .010″ thk o/a	Protects turntable shell from stylus	4A444–5
CR1, CR2	CRYSTAL UNIT, rectifying: germanium type; 9/32″ dia x ¾″ lg; Sylvania Prod #1N54.	Parts of voltage doubler network	2J1N54
O 78	CUSHION: approx 1⅝″ lg x 5/16″ wd x 9/32″ h o/a.	Used as shock absorber for amplifier terminal board.	4A450
O 79	CUSHION: approx 5⅜″ lg x 5/16″ wd x 9/32″ h o/a.	Used as shock absorber for amplifier terminal board.	4A450–1
A 16	FOOT, mounting: 1 1/32″ dia x ⅜″ thk o/a	Provides mounting for the recorder-reproducer set.	4Z4100–3
F1	FUSE, cartridge: 1.5 amp 250 v; 1¼″ lg x ¼″ dia.	Protects equipment from overload damage.	3Z2601.5

1. Sound Recorder-Reproducer Set AN/FNQ-3—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
X 3	FUSEHOLDER: extractor post type; for single 3AG cartridge fuse; approx 2⅜″ lg x 13/16″ dia o/a.	Mounts fuse	3Z3275–1
O 11	GASKET: brg plate cover; velumoid; 8 holes; rectangular, 2½″ lg x 1¼″ w x 1/32″ thk.	Used as grease retainer for front gearbox.	2Z4868.1185
O 36	GASKET: gearbox cover; velumoid; 7 holes; rectangular w/rounded edges, 4½″ lg x 2 15/16″ wd x 1/32″ thk o/a.	Used as grease retainer for rear gearbox	2Z4868.1184
O 12	GEAR SPUR: shaft driving; 24 teeth; .500″ OD, .250″ bore, .838″ lg gear portion w/roller housing .875″ OD, .634″ bore, .344″ d, o/a lg 1.185″.	Used as pinion gear for overdrive mechanism.	4A700–5
O1	GEAR SPUR: 50 teeth; 1.001″ OD, .4700″ bore, .125″ thk.	Drives clutch	4A700–4
O8	GEAR SPUR: 50 teeth; 1.001″ OD, .2500″ bore, .840″ thk o/a.	Drives main shaft through a clutch	4A700–8
O29	GEAR SPUR: 120 teeth; 1.911″ OD x .158″ thk.	Drives recorder and reproducer arms	4A700–9
O30	GEAR SPUR: a sector of 10 teeth; 2.207″ OD x ⅛″ face.	Drives mirror mount on reproducer arm	4A700–7
H35	GROMMET: rubber, pure gum; fits 19/64″ dia hole; 9/32″ wd x 7/16″ dia o/a.	Protects insulation on wires	6ZK4876–15
H11	GROMMET: rubber; fits 3/8″ dia hole; 9/32″ ID x 1 1/32″ thk x ⅝″ OD, ⅛″ wd groove.	Protects insulation on wires	6Z4876–23
H33, H34	GROMMET: rubber; fits ½″ dia hole; ⅝″ OD x ⅜″ ID x ¼″ thk, 1/16″ wd groove.	Protects insulation on wires	6Z4856–8
H14	GROMMET: Buna S rubber; fits 0.500″ dia hole; ¾″ OD x 5/16″ ID x 5/16″ thk.	Protects insulation on wires	6Z4876–22
H13	GROMMET: fits ½″ dia hole; 13/32″ hole dia x 1/16″ wd groove, 7/16″ wd x ¾″ dia o/a.	Provides seat on motor bracket for mounting springs.	6Z4849–4
E2	HEAD, recorder, sound; magnetic type, 4 ohms impedance; 3⅛″ lg x 1¾″ wd x 1⅛″ h o/a.	Converts electrical energy to mechanical energy.	4A890–2
E1	HEAD, reproducer, sound: magnetic type; 30 ohms impedance; 3¼″ lg x 1⅛″ wd x ⅞″ h o/a.	Converts mechanical energy to electrical energy.	4A890
J1	JACK JK–34: for 2 cond plug, shank 0.250″ dia; 1¼″ lg x 15/16″ wd x 49/64″ h; JAN type JJ–034.	Provides speaker connection to output of amplifier.	2Z5534
E14	KNOB: round; gray cellulose acetate; for ¼″ dia shaft; ⅝″ dia x .562″ lg o/a.	Facilitates rotation of volume control shaft.	2Z5822–666
E13	KNOB: round; gray cellulose acetate; for ¼″ dia shaft; line marking; 1½″ dia x 11/16″ thk o/a.	Facilitates rotation of LISTEN-TALK switch shaft.	2Z5822–669
I1	LAMP, incandescent: 2.2 v, .120 amp; T–3–¼; clear bulb; 1⅛″ lg o/a; miniature bayonet base WemCo type No. 38.	Indicates output level of amplifier while recording.	2Z5877–19
I2	LAMP, incandescent: 115–125 v, 10 w, .083 amp; double cont bayonet base; 2″ o/a h.	Illuminates index scale	6Z6815–41
I201	LAMP LM–54: 105–125 v ac; striking v 65 v ac, 90 v dc, 1/25 w; unbased; 1 1/16″ o/a lg.	Indicates unit is ready for dictation or quick-review.	2Z5954
X2	LAMPHOLDER: double cont bayonet base; 1⅛″ lg x .700″ dia.	Mounts lamp I2	6Z8335–5
X4	LAMPHOLDER: single cont bayonet base; 1¾″ lg x 1″ wd x 1″ h o/a.	Mounts lamp I1	6Z8332–3

1. Sound Recorder-Reproducer Set AN/FNQ–3—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
I 10	LENS, condensing, photographic: .847″ dia, 1 1/16″ f/lg; 1″ dia x 7/8″ lg o/a.	Focuses light	4A1320–1
I 11	LENS, projection: approx .250″ f/lg; 1 1/8″ lg x 13/16″ dia o/a.	Projects spot of light onto index scale	4A1320
LS301	LOUDSPEAKER, dynamic: cone type; PM field; 3 1/2″ sq x 2 1/16″ d.	Converts electrical energy to sound energy.	6C43–179
	MICROPHONE, dynamic: 10 ohms impedance; unidirectional; 7 3/8″ lg x 2 1/4″ wd x 1 3/4″ d.	Converts sound energy to electrical energy.	2B1705–6
I 4	MIRROR: 1 1/16″ lg x 5/16″ wd x .047″ thk o/a.	Indicates position of reproducer arm	4A1668
I 5	MIRROR: 1 1/8″ lg x 5/16″ wd x .047″ thk o/a.	Indicates position of recorder arm	4A1668–1
B1	MOTOR, AC: capacitor induction type; 110 v, 60 cyc, single ph, 20 w 99% pf; 1750 rpm cw rotation; 5 1/4″ lg x 4 1/8″ wd x 2 5/16″ h excluding shaft.	Drives turntable reproducer arm, and recorder arm.	3H3000–195
L1	REACTOR: single sect.; 4 mh; 1.6 ohms dc resistance; open frame; 1 5/8″ lg x 3/4″ wd x 7/8″ h o/a.	Filters high frequencies from hand microphone.	3C557Z2
CR3	RECTIFIER, metallic: selenium type input 130 v ac, 7 ph; output 150 ma dc, 1200 ma max cur, half-wave; 1 13/64″ wd x 1 9/32″ h x 1 1/4″ d.	Rectifies ac to dc	3H4860–190
K1	RELAY, solenoid: single inductive wnd, 6,000 ohms DC resistance; 115 v dc, .02 amp oper cur; 1 17/32″ lg x 1 3/8″ h x 25/32″ wd o/a.	Switches amplifier from recording to playback function.	2Z7593–171
K2	RELAY, solenoid: 2 inductive wnd ea 500 ohms dc resistance; 50 v dc, .010 amp oper cur ea coil; 2 1/8″ lg x 1 1/2″ h x 1 1/8″ wd o/a.	Connects motor to power line and energizes screen grids of V4 and V5.	2Z7593–172
R25	RESISTOR, fixed: wire wound; 35 ohms ±5%; 8 w; JAN type RW30G350.	Limits surge current through rectifier CR 3.	3RW15606
R16	RESISTOR, fixed: composition; 82 ohms ±10%; 2w; JAN type RC42BE820K.	Biases cathode of V4 and V5	3RC42BE820K
R20, R24	RESISTOR, fixed: composition; 100 ohms ±10%; ½ w; JAN type RC20BF101K.	R20—Develops high frequency voltage in feedback network for emphasis in the recording process. R24—Adjusts playback signal level to hand microphone.	3RC20BF101K
R12	RESISTOR, fixed: composition; 620 ohms ±5%; ½ w; JAN type RC20BF621J.	Develops feedback voltage	3RC20BF621J
R21	RESISTOR, fixed: composition; 1,000 ohms ±10%; ½ w; JAN type RC20BF102K.	Determines minimum volume level during playback.	3RC20BD102K
R26	RESISTOR, fixed: composition; 2,200 ohms ±10%; ½ w; JAN type RC20BF222K.	Limits current to coil CD of relay K2	3RC20BD222K
R6, R9, R13, R29	RESISTOR, fixed: composition; 5,100 ohms ±5%; ½ w; JAN type RC20BF512J.	R6—Develops bias boltage for V2 grid. R9—Provides self-bias for third voltage amplifier stage. R13—Part of power supply filter network. R29—Helps to determine time constant of protective groove circuit.	3RC20BF512J
R27	RESISTOR, fixed: composition; 8,200 ohms ±10%; 2 w; JAN type RC42BE822K.	Limits current through coil AB of relay K2.	3RC42BE822K

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R7	RESISTOR, fixed: composition; 10,000 ohms ±10%; ½ w; JAN type RC20BF-103K.	Part of B supply filter	3RC20BD103K
R1	RESISTOR, fixed: composition; 51,000 ohms ±5%; ½ w; JAN type RC20BD-513J.	Reduces gain of first voltage amplifier stage.	3RC20BF513J
R3, R4, R10, R14, R17, R28	RESISTOR, fixed: composition; 100,000 ohms ±10%; ½ w; JAN type RC20BF-104K.	R3—plate load of V1 R4—plate load of V2. R10—plate load of V3. R14—Couples input transformer to voltage double network. R17—Limits playback gain. R28—Discharges capacitor C22 when switch S1 is in the LISTEN position.	3RC20BF104K
R201	RESISTOR, fixed: composition; 150,000 ohms ±10%; ½ w; JAN type RC20BF-154K.	Limits current through lamp I 201	3RC20BF154K
R22	RESISTOR, fixed: composition; 180,000 ohms ±5%; ½ w; JAN type RC20BF184J.	Forms part of voltage feedback network between 500-ohm output winding and cathode circuit of V2.	3RC20BF184J
R2	RESISTOR, fixed: composition; 300,000 ohms ±5%; ½ w; JAN type RC20BF304J.	Reduces avc action at low signal levels.	3RC20BF304J
R5, R8, R11	RESISTOR, fixed: composition; 470,000 ohms ±10%; ½ w; JAN type RC20BD474K.	R5—Drops voltage for screen grid of V1. R8—Used as V3 grid leak resistor. R11—Used as V4 grid leak resistor.	3RC20BF474K
R15	RESISTOR, fixed: composition; 10 meg ±10%; ½ w; JAN type RC20BD106K.	Used as load resistor for voltage doubler network.	3RC20BF106K
R23	RESISTOR, thermal: protects fil from excessive cur surge when equip is first turned on; 400 ohms ±20% 25° C., 65 ohms ±10% at 60° C.; terminal mtd; ¾″ lg x ¼″ dia o/a.	Protects tube filaments against excessive current surges when recorder-reproducer is first turned on.	3Z6925–12
R301	RESISTOR, variable: WW; 25 ohms ±10%; 2 w; JAN type RA20A1Fk250Ak.	Controls input level of telephone signal.	3RA2406
R19	RESISTOR, variable: composition; 100,000 ohms ±10%; ⅛ w; JAN type RV2ATFK104C.	Adjusts playback gain	3RV51050
R18	RESISTOR, variable: composition; 500,000 ohms ±20%; ⅛ w; 15/16″ dia x 3 3/64″ d w/⅜″ lg shaft.	Adjusts recording gain	3Z7498–50.186
H15	SCREW, externally relieved body: spanner wrench drive; Bind H; semifinished; #3–48 NC–2; .360″ lg.	Used as lifter head for cam follower assembly.	6L4763–6.9S
H18	SCREW, externally relieved body: slot drive; Fil H; semifinished; #4–40 NC–2; 15/32″ lg.	Secures gear sector to recorder arm	6L4764–8.3S
H17	SCREW, externally relieved body: slot drive; Fil H, semifinished; #4–40 NC–2; ⅝″ lg.	Secures mirror mounting and gear sector to reproducer arm.	6L4764–10.3S
H96	SCREW, externally relieved body: slot drive; RH, semifinished; #8–32 NC–2; 11/16″ lg.	Fastens cabinet to motor-board	6L4768–11.1S
H31	SCREW, machine: slot drive; RH; #4–40 NC–2; .330″ lg.	Pivot screw for index lever O 53	6L20904–5.1S1
H8	SCREW, machine: slot drive; Bind H; #6–32; .360″ lg.	Pivot for end of recording arm assembly O 15.	6L20906–6.9SB
H36	SCREW, machine: slot drive; Bind H; #6–32 NC–2; ⅜″ lg.	Secures relay cam A 14 to amplifier shield.	6L20906–6.9S

1. Sound Recorder-Reproducer Set AN/FNQ-3—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
H29	SCREW, pivot: slot drive; headless; #10–32 NF–2; $2\frac{5}{32}$″ lg.	Used as right-hand pivot mounting for cover.	6L7930–12
H30	SCREW, pivot: slot drive; headless; #10–32 NF–2; $3\frac{1}{32}$″ lg.	Used as left-hand pivot mounting for cover.	6L7930–13
H3	SETSCREW: slot drive; headless; #8–32 NC–2; ½″ lg.	Used as thrust screw for drive shaft	6L18508–8.76B
O 4	SHAFT: approx $2\frac{21}{32}$″ lg x ⅝″ dia	Used as shaft for overdrive gearing	4A2298.11
O 7	SHAFT: approx $4\frac{9}{16}$″ lg x ⅝″ dia o/a	Drives recorder and reproducer arms	4A2298.12
X1, X301	SOCKET, electron tube: 7 cont miniature; one piece saddle mtg; JAN type TS102P1.	X1—Receives plug on W 302 cable or W 201 cable. X301—Receives plug on end of microphone cable W 201.	2Z8677.94
O 38, O 40	SPRING: flat type; $\frac{9}{16}$″ lg x .072″ h o/a	Retain mirror on mount	2Z8877.710
O 54	SPRING: flat type; ¾″ lg x ⅜″ wd x $1\frac{5}{32}$″ h o/a.	Actuates micro-switch S3	2Z8877.718
O 58	SPRING: flat type; $1\frac{3}{4}$″ lg x ¼″ wd x $\frac{5}{16}$″ h.	Used as return for indexing and retracting mechanism.	2Z8877.719
O 33	SPRING: flat type; $1\frac{13}{16}$″ dia x $\frac{5}{64}$″ h o/a	Used in clutch between drive and recorder arm.	2Z8877.709
O 28	SPRING, helical compression: .190″ OD x $\frac{1}{16}$″ h o/a; 2½ turns.	Increases traction between turntable shell and turntable.	2Z8877.712
O 25	SPRING, helical compression: $\frac{13}{32}$″ lg x .140″ dia; 13 turns.	Provides spring cushion for head lifter	2Z8877.715
O 19	SPRING, helical compression: $2\frac{5}{16}$″ lg x ⅝″ dia o/a; approx 8 to 9 turns.	Cushions motor mount	2Z8877.716
O 42	SPRING, helical, extension: $1\frac{9}{16}$″ lg x $\frac{3}{16}$″ dia; approx 33 turns.	Produces tension between bell crank and linkage in retracting mechanism for recorder arm.	2Z8877.711
O 16	SPRING, helical, extension: $1\frac{13}{16}$″ lg x .140″ dia; approx 87 turns.	Returns bell ringing lever	2Z8877.720
O59	SPRING, helical, extension: 2″ lg x ½″ dia o/a; approx 21 turns.	Motivates overdrive mechanism	2Z8877.721
O46	SPRING, helical, extension: $\frac{5}{16}$″ OD x $2\frac{1}{8}$″ lg; approx 50 turns.	Provides tension on cover latch.	2Z8877.714
O21	SPRING, helical, extension: $\frac{3}{16}$″ OD x $3\frac{3}{16}$″ lg; approx 288 turns.	Produces tension on reproducer arm to prevent backlash.	2Z8877.713
O52	SPRING, helical, extension: $4\frac{1}{4}$″ lg x ⅜″ dia o/a; approx 38 turns.	Motivates overdrive mechanism and spring return for index key lever.	2Z8877.717
S302	SWITCH, lever: pile-up; 2 position locking; $2\frac{29}{64}$″ lg x ⅝″ wd x $1\frac{1}{2}$″ h o/a.	Selects either telephone or microphone recording.	3Z9580–49
S1	SWITCH, section: rotary; $1\frac{7}{8}$″ lg x $1\frac{5}{8}$″ dia x $\frac{9}{16}$″ thk o/a.	Selects reproducing or recording function.	3Z9903E–3.84
S303	SWITCH, push: SPST, push to close, push to open; 1″ lg x ⅝″ wd x ¾″ h o/a.	Turns loudspeaker on and off	3Z9824–105.1
S2	SWITCH, rotary: 4 pole, 4 position; $4\frac{9}{16}$″ lg x $1\frac{5}{8}$″ dia.	Selects dictate, conference, or copy operations.	3Z9825–62.698
S202	SWITCH, sensitive: SPST; plunger type actuator; $\frac{23}{32}$″ OD x $\frac{9}{32}$″ thk, excluding actuator.	Operates quick review through microphone.	3A9823–31
S201	SWITCH, sensitive: SPST; plunger type actuator; $1\frac{1}{4}$″ lg x ½″ sq, excluding actuator.	Switches motor on or off	3Z9823–32
S3	SWITCH, sensitive: SPDT; plunger type actuator; $1\frac{13}{64}$″ lg x $\frac{53}{64}$″ wd x $\frac{9}{32}$″ thk o/a, excluding actuator and term.	Switches motor on or off when indexing	3Z9823–8.1
S301	SWITCH, toggle: SPST; ⅞″ dia x ¾″ h o/a	Closes or opens power circuit to tone warning generator.	3Z9858–24.1
E7	TERMINAL, lug: ring type; for #14 AWG wire; ⅞″ lg x $\frac{5}{16}$″ wd x $\frac{1}{64}$″ thk o/a.	Provides a-c grounding of chassis	3Z12059–56

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
T1, T301	TRANSFORMER, AF: input type; pri 25 ohms, secd 50,000 ohms impedance; steel core, upright steel case; 7/8" lg x 7/8" wd x 1 1/8" h o/a.	T1—Steps up voltage from input device to grid of V1. T301—Input transformer from telephone line.	2Z9631.445
T2	TRANSFORMER, AF: pri 5000 ohms ct; secd #1 4 ohms; secd #2, 500 ohms impedance; steel core, open frame; 2 7/8" lg x 1 5/8" wd x 1 5/8" h o/a.	Matches voice coil to plate resistance of output tubes V4 and V5.	2Z9632.685
V2, V3	TUBE, electron: JAN type 6AD4	Second and third voltage amplifier tubes.	2J6AD4
V1	TUBE, electron: JAN type 6BA5	Used as first voltage amplifier tube	2J6BA5
V4, V5	TUBE, electron: JAN type 50C5	Used as push-pull output stage	2J50C5
E16	VARISTOR: thyrite type; 1/2" dia x 1/4" thk, excluding term.	Regulates amount of avc voltage	4Z6815
H22, H45	WASHER, flat: round, .160" ID, 13/32" OD, .062" thk o/a.	H22—Used as friction washer for recorder arm gear sector. H45—Spacer between front panel and motorboard.	6L58023-67
H7	WASHER, flat: round, 13/64" ID, 7/16" OD, 1/32" thk.	Spacers for mounting end of recorder arm assembly O 15.	6L58024B
H6	WASHER, flat: round, .235" ID, 13/16" OD, .013" thk o/a.	Prevents coupling from entering turntable bearing.	6L58033-4
H24	WASHER, flat: round, .251" ID, 1/2" OD, .031" thk o/a.	Used as friction disks on spindles to control drag of arms.	6L58024-73
H23	WASHER, flat: round, .251" ID, 9/16" OD, .015" thk o/a.	Provides uniform bearing surface for spindle friction disk.	6L58024-72
H25	WASHER, flat: round, .376" ID, 1.734" OD, .015" thk o/a.	Friction washer for rear gear drive assemblies.	6L58026-92
H4	WASHER, flat: round, .484" ID, 13/16" OD, .003" thk.		6L58028-22
H5	WASHER, flat: round, .484" ID, 13/16" OD, .007" thk o/a.	Used as shim for turntable spindle	6L58028.21
H2	WASHER, thrust: for overdrive gear; 3/4" dia x .010" thk o/a.	Used as thrust washer for overdrive gear O 1.	6L75062

2. Sound Recorder-Reproducer Set AN/FNQ–3A

(Sig C stock No. 4A2367)

Note.—The information in paragraph 1 of this appendix is applicable also to Sound Recorder-Reproducer Set AN/FNQ–3A with several exceptions. The AN/FNQ–3A does not use a varistor (E16). In addition, the parts listed below are different in value or composition from the equivalent parts listed in paragraph 1 of this appendix.

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C1, C2, C3	CAPACITOR, fixed: paper dielectric; 5,000 $\mu\mu$f $\pm$20%; 600 vdcw; $\frac{3}{8}$'' lg.	C1—Couples signal from V1 plate to volume control. C2—Couples signal from V2 plate to V3 control grid. C3—Reduces high frequency response during playback.	3DA5–242
C7	CAPACITOR, fixed: paper dielectric; 250,000 $\mu\mu$f $\pm$10%; 200 vdcw; $\frac{15}{32}$'' dia x $\frac{5}{32}$'' lg.	Forms avc decoupling network in conjunction with resistor R14.	3DA250–502
C21	CAPACITOR, fixed: paper dielectric; 1.5 μf +11%, −5%; 220 vacw; $2\frac{1}{8}$'' lg x $1\frac{21}{32}$'' wd x $1\frac{5}{32}$'' h.	Splits phase of 60 cycle input to induction motor.	3DB2–287
I 1	LAMP, glow: 105–120 v, $\frac{1}{25}$ w, .003 amp; striking v 65 v ac, 90 v dc; miniature bayonet base; $1\frac{1}{8}$'' max o/a h.	Indicates output level of amplifier while recording.	2Z5888–5
CR1, CR2	RECTIFIER, metallic: selenium type; input 18 v ac, single ph; output 50 μa, half-wave rectification; $\frac{9}{32}$'' dia x $\frac{11}{16}$'' lg.	Rectify avc voltage	3H4860–219
R14	RESISTOR, fixed: composition; 470,000 ohms $\pm$10%; $\frac{1}{2}$ w; JAN type RC20BF-474K.	Forms avc decoupling network in conjunction with capacitor C7.	3RC20BF474K

3. Special Tools Supplied

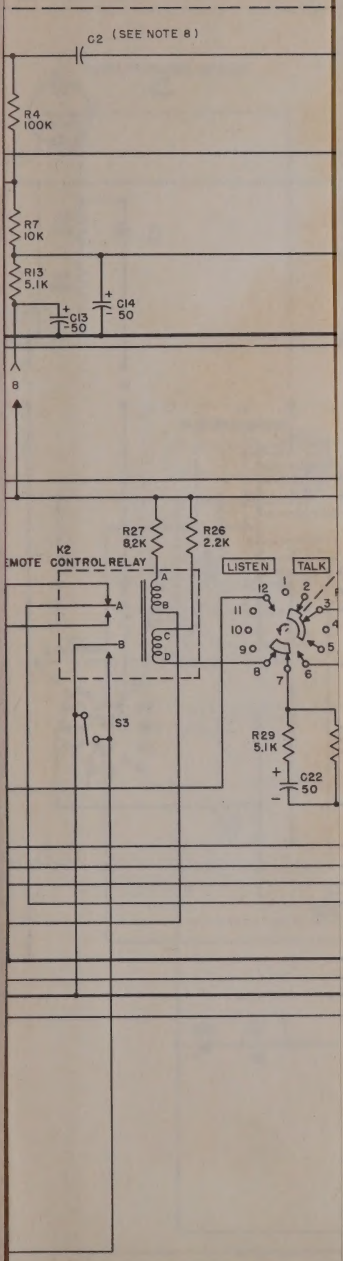
(fig. 14)

Name of part and description	Function of part	Signal Corps stock No.
ADJUSTER, focusing: $7\frac{7}{8}$'' lg x $1\frac{1}{16}$'' wd x $\frac{3}{4}$'' h o/a; (mirror adjusting tool).	Alines log light beam by adjusting mirror.	6Q188–20
GAUGE, height: $4\frac{1}{2}$'' lg x $\frac{3}{4}$'' wd x .156'' thk o/a; (recorder-head adjusting template).	Adjusts height of recorder head above disk.	6Q44623
SCALES, weighing: avoirdupois; 0 to 8 oz in. $\frac{1}{2}$ oz divisions; $\frac{1}{2}$'' sq x $4\frac{7}{8}$'' lg; (postal scale).	Used to adjust tension on recorder and reproducer arms.	6Z8078
TOOL, pick-up: $5\frac{9}{16}$'' lg x $4\frac{3}{4}$'' wd x $1\frac{1}{64}$'' thk o/a; (amplifier-card lifting tool).	Used to lift amplifier card assembly	6R38635–3
WEIGHT, scales: $3\frac{5}{16}$'' lg x $\frac{3}{4}$'' thk o/a; (5-oz test weight)	Used to calibrate scale	6Z9444–1
WRENCH, box: offset, closed hex.; $5\frac{1}{4}$'' lg x 1'' wd x $1\frac{3}{16}$'' h o/a; (offset wrench).	Used for locking $\frac{1}{2}$ hexagonal nut on recorder and reproducer arms.	6R55209.3
WRENCH, spanner, pin: .312'' between pins; $5\frac{1}{2}$'' lg x $\frac{1}{2}$'' wd o/a; (spanner wrench, flat).	Used for tightening head of arm-lifting mechanism.	6R57549–1
WRENCH, spanner, pin: $\frac{1}{2}$'' between pins; $2\frac{9}{32}$'' lg x $\frac{5}{8}$'' wd hex. rod; (spanner wrench, hex. handle).	Used to install or remove volume control bushing.	6R57549–2

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Bottom chassis	7*c*	5
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Motorboard	7*d*	5

	Paragraph	Page
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Minor components (accessories):		
Dust cover	8*d*	6
Filers	8*f*	6
Hand microphone	8*b*	6
Holder, hand microphone	8*c*	6
Power cord	8*a*	5
Recording disks	8*c*	6
Spare parts	8*h*	6
Speaker and telephone control unit	8*g*	6
Special tools	25	22
Switches:		
Listen-talk	37*a*	33
Selector	37*b*	33
Table of components	5	3
Table of controls:		
Recorder-reproducer	15*a*	33
Speaker and telephone control unit	15*b*	33
Technical characteristics:		
Amplifier	4	1
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Uncrating, unpacking, and checking	10	7
Unusual conditions	20	21
Voltage and resistance measurements	43	38
Weatherproofing	27	25



-3, schematic diagram.*

	Paragraph	Page
Sound Recorder-Reproducer Set AN/FNQ–3*—Continued		
Minor components (accessories):		
Dust cover	8*d*	6
Filers	8*f*	6
Hand microphone	8*b*	6
Holder, hand microphone	8*c*	6
Power cord	8*a*	5
Recording disks	8*c*	6
Spare parts	8*h*	6
Speaker and telephone control unit	8*g*	6
Special tools	25	22
Switches:		
Listen-talk	37*a*	33
Selector	37*b*	33
Table of components	5	3
Table of controls:		
Recorder-reproducer	15*a*	33
Speaker and telephone control unit	15*b*	33
Technical characteristics:		
Amplifier	4	1
Input impedance	4	3
Output impedance	4	3
Theory of operation:		
Electronic	33–38	30–34
Mechanical	32	29
Tools and materials	24	22
Trouble-shooting chart	44	39
Trouble-shooting information	41–44	34–41
Tube complement	4	3
Uncrating, unpacking, and checking	10	7
Unusual conditions	20	21
Voltage and resistance measurements	43	38
Weatherproofing	27	25

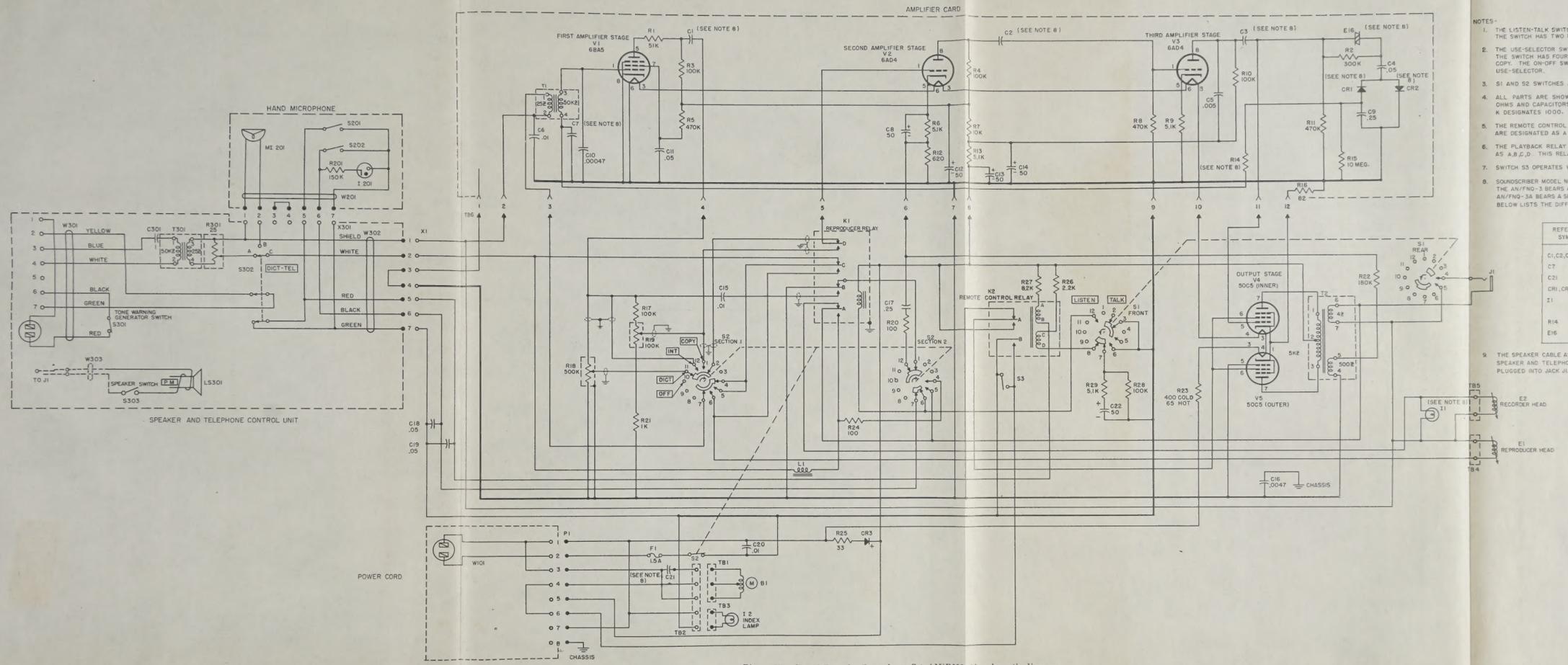


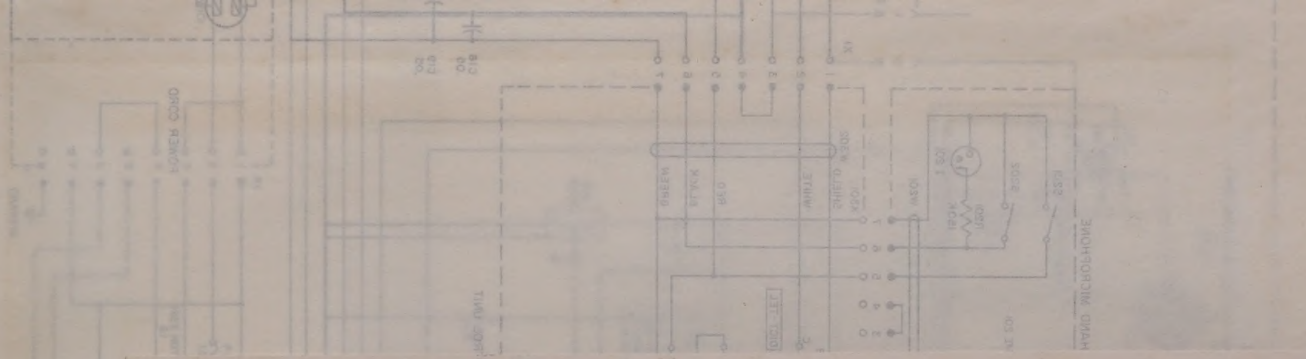
Figure 47. Sound Recorder-Reproducer Set AN/FNQ-3, schematic diagram.*

NOTES:

1. THE LISTEN-TALK SWITCH S1 IS SHOWN IN THE TALK POSITION. THE SWITCH HAS TWO POSITIONS, LISTEN AND TALK.
2. THE USE-SELECTOR SWITCH S2 IS SHOWN IN THE DICTATE POSITION. THE SWITCH HAS FOUR POSITIONS, OFF, DICTATE, INTERVIEW AND COPY. THE ON-OFF SWITCH IS MECHANICALLY GANGED TO THE USE-SELECTOR.
3. S1 AND S2 SWITCHES ARE AS SEEN FROM THE FRONT OF THE RECORDER.
4. ALL PARTS ARE SHOWN WITH THEIR VALUE. RESISTORS ARE GIVEN IN OHMS AND CAPACITORS IN UF UNLESS OTHERWISE DESIGNATED. K DESIGNATES 1000.
5. THE REMOTE CONTROL RELAY IS K2 AND ITS TWO SWITCHING CIRCUITS ARE DESIGNATED AS A AND B. THIS RELAY IS SHOWN IN THE STANDBY POSITION.
6. THE PLAYBACK RELAY IS K1 AND ITS FOUR SWITCHING CIRCUITS ARE DESIGNATED AS A,B,C,D. THIS RELAY IS SHOWN IN THE RECORD POSITION.
7. SWITCH S3 OPERATES WHEN THE INDEX BUTTONS ARE DEPRESSED.
8. SOUNDSCRIBER MODEL NO.5R IS IDENTICAL TO THE AN/FNQ-3 OR THE AN/FNQ-3A THE AN/FNQ-3 BEARS A SERIAL NUMBER FROM 400,001 THROUGH 400,550; THE AN/FNQ-3A BEARS A SERIAL NUMBER FROM 400,551 THROUGH 401,050. THE TABLE BELOW LISTS THE DIFFERENCES IN MODELS.

REFERENCE SYMBOL	AN/FNQ-3	AN/FNQ-3A
C1, C2, C3	.01 UF	.005 UF
C7	1 UF	.25 UF
C21	2 UF	1.5 UF
CR1, CR2	GERMANIUM	SELENIUM
I1	INCANDESCENT LAMP	GLOW LAMP
R14	100K	470K
E16	---	NOT USED

9. THE SPEAKER CABLE ASSEMBLY W303 IS SHOWN IN DOTTED LINES IN THE SPEAKER AND TELEPHONE CONTROL UNIT IN ORDER TO SHOW THIS CABLE PLUGGED INTO JACK J1.



TM 11-5063-1 SIGNAL CORPS 25 JAN 57

PUBLICATION SOUND RECORDER-REPRODUCER SETS MODEL: AN/FNQ-3, AN/FNQ-3A MAINTENANCE MANUAL DATED 27 MAY 1953.

CHARGE OUT RECORD CARD

DATE ISSUED	SIGNATURE OF RECIPIENT	DIVISION SECTION OR OFFICE	DATE RETURNED

EMC 330 (1 NOV 54)

JAN 16 1956

5330-202-3595

TM11-5063-1