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DEPARTMENT OF THE ARMY TECHNICAL MANUAL

SOUND RECORDER-REPRODUCER SETS AN/FNQ-2 AND AN/FNQ-2A (SOUNDSCRIBER MODEL NO. 5DR)

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		Paragraphs	Page
CHAPTER 1.	INTRODUCTION		
Section I.	General	1, 2	3
II.	Description and data	3–10	3
CHAPTER 2.	INSTALLATION AND OPERATION INSTRUCTIONS		
Section I.	Service upon receipt of equipment	11–14	
II.	Controls and indicators	15, 16	10
III.	Operation under usual conditions	17–26	12
IV.	Operation under unusual conditions	27–30	17
CHAPTER 3.	ORGANIZATIONAL MAINTENANCE INSTRUCTIONS		
Section I.	Preventive maintenance services	31–34	19
II.	Lubrication and weatherproofing	35–37	22
III.	Troubleshooting at organizational maintenance level	38–41	22
CHAPTER 4.	THEORY		
Section I.	Theory of operation of mechanical parts	42, 43	29
II.	Theory of operation of electrical circuits	44–52	30
CHAPTER 5.	FIELD MAINTENANCE INSTRUCTIONS		
Section I.	General	53–57	40
II.	Troubleshooting at field maintenance level	58–64	46
III.	Repair instructions	65–70	51
IV.	Adjustments	71–75	66
CHAPTER 6.	SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE		
Section I.	Shipment and limited storage	76, 77	74
II.	Demolition to prevent enemy use	78, 79	74
INDEX			77

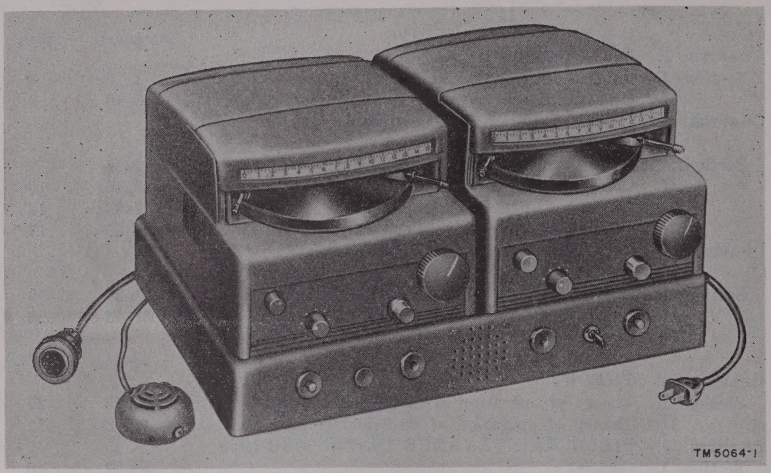


Figure 1. Sound Recorder-Reproducer Set AN/FNQ-2(*) (disks, disk filers, and dust cover not shown).

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This technical manual contains instructions for the installation, operation, maintenance, and repair of Sound Recorder-Reproducer Sets AN/FNQ–2 and AN/FNQ–2A.

b. Basic nomenclature followed by (*) is used to indicate all models of the item of equipment included in this manual. Thus Sound Recorder-Reproducer Set AN/FNQ–2(*) represents Sound Recorder-Reproducer Sets AN/FNQ–2 and AN/FNQ–2A.

Note. Official nomenclature (Sound Recorder-Reproducer Set AN/FNQ–2 or Sound Recorder-Reproducer Set AN/FNQ–2A) does not appear on the nameplates of the equipments. However, the equipment nameplates that bear SOUNDSCRIBER MODEL NO. 5DR, with serial numbers from 950001 through 950201, designate the AN/FNQ–2. The equipment nameplates that bear SOUNDSCRIBER MODEL NO. 5DR, with serial numbers from 950202 through 950591, designate the AN/FNQ–2A.

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, Navy Shipping Guide, Article 1850–4/AFR 71–4.

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. DD Form 535, Unsatisfactory Report, will be filled out and forwarded to the 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 (fig. 10).

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 (fig. 11).

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Sound Recorder-Reproducer Set AN/FNQ–2(*) (fig. 1) is used to record and reproduce sound from disks. The purpose of the equipment is to provide for *continuous* recording or reproducing of office dictation, telephone conversations, or conferences. Recording is accomplished by embossing a vinylite disk. Provision is made to select circuits for telephone or conference recording. A receptacle in the microphone permits several microphones to be connected in parallel for conference recordings. A headset may be used to monitor material that is being recorded. Monitoring of material being recorded also may be done by using the loudspeaker on the equipment.

4. Technical Characteristics of Sound Recorder-Reproducer Set AN/FNQ–2(*)

Power requirements	115 v, 60 cps, single phase.
Power consumption	125 watts.
Impedance, input for:	
Microphone	100 ohms.

Telephone line ..... 25 ohms.
Reproducer heads ..... 25 ohms.
Impedance, output to:
Loudspeaker or PLAY-BACK jack ..... 4 ohms.
Recorder heads and MONITOR jack ..... 4 ohms.
Microphone ..... Carbon-type, 100 ohm impedance.
Reproducer heads ..... Dynamic-type, 30 ohm impedance.
Recorder heads ..... Magnetic-type, 4-ohm impedance.
Loudspeaker ..... Permanent-magnet type, 4 ohm impedance.
Number of vacuum tubes ..... 11.

Recorder or reproducer amplifier:
Frequency response ..... ± 3 db, from 200 to 3,000 cps.
Gain ..... 90 db.
Power output ..... 1 watt.
Turntables ..... 5½-inch dia.
Turntable motors ..... split-phase ac motors.
Recording time ..... 15 minutes each side of disk.
Groove feed ..... 260 grooves per inch.
Stylus pressure ..... 1¾ to 2¼ ounces.
Stylus radius ..... .062 inch.

5. Table of Components

The following table gives the dimensions and weights of the components of Sound Recorder-Reproducer Set AN/FNQ–2(*).

Quantity	Component	Dimensions (in.)			Weight (lb.)
		Length	Width	Height	
1	Recorder-reproducer set	18	12½	9½	38
1	Desk microphone with 5-foot cable	3″ dia.	2	1½	½
1	Cover, dust	18½	13	10	
200	Recording disks	5⅞	5⅞	2½	3
200	Filers for disks	6⅛	6⅛		

6. Running Spares

The following chart lists the running spares supplied with Sound Recorder-Reproducer Set AN/FNQ–2A only. No running spares are supplied with the AN/FNQ–2.

Quantity	Item	Description
1	Vacuum tube	6BA5.
1	Vacuum tube	6AD4.
2	Vacuum tube	5OC5.
5	Fuse	Cartridge-type, 250 v, 3 amp.
1	Lamp	Incandescent, double contact, bayonet base, 115–125 v, 10 w, .083 amp.
1	Lamp	Incandescent, 2.2 v, .12 amp. 105-125 v, .003 amp.
1	Lamp	Neon, miniature bayonet base,
1	Lamp	Neon, unbased, 105-125 v, 1/25 w.

7. Packaging Data

(fig. 2)

a. Domestic Packaging. Sound Recorder-Reproducer Set AN/FNQ–2(*) is packed in three corrugated fiberboard cartons. Carton No. 1 contains the recorder-reproducer. Carton No. 2 contains a microphone with cable, a dust cover, disks, and disk filers (also spare parts for the AN/FNQ–2A only). Carton No. 3 contains cartons No. 1 and 2 (*c.* below). All items are cushioned before they are placed in cartons.

b. Export Packaging. Sound Recorder-Reproducer Set AN/FNQ–2(*) is packed in the same manner as domestic packaging (*a* above), except that a quantity of desiccant is placed in carton No. 3 before it is sealed with gummed tape. Carton No. 3 then is sealed within a moisture-vaporproof barrier and placed in a water-resistant carton that is sealed with waterproof tape. The equipment then is placed in a wooden shipping case reinforced with flat metal straps (*c.* below).

c. Table of Dimensions and Weights. The following table gives the dimensions and weight of the AN/FNQ–2(*) unpacked, packed for domestic shipment, and packed for export shipment.

	Height (in.)	Width (in.)	Depth (in.)	Volume (cu ft)	Unit weight (lb)
Unpacked	9½	18	12½	1.1	38
Packed for domestic shipment	15	26	19	4.6	62
Packed for export shipment	17½	30	21½	6	105

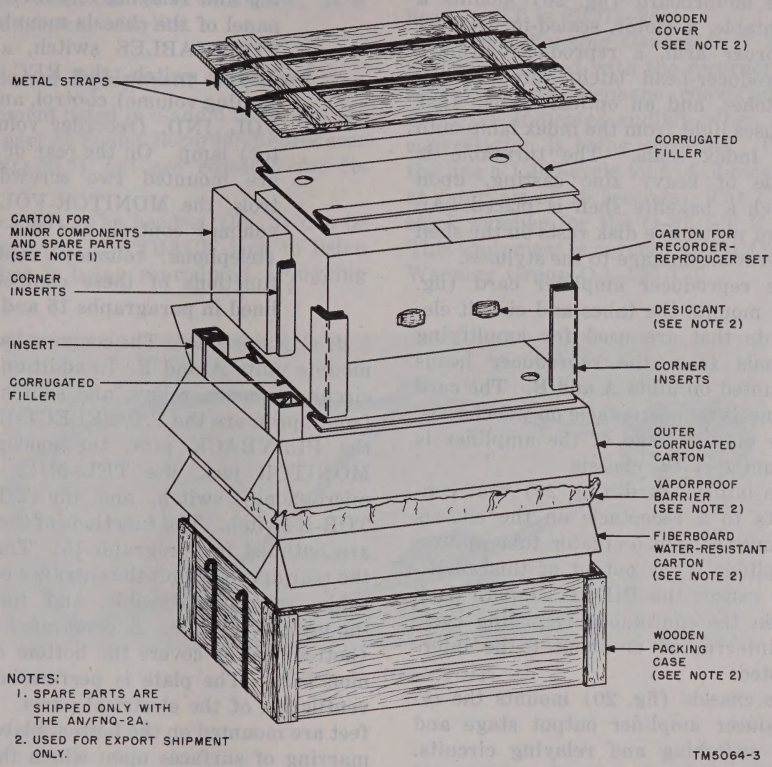


Figure 2. Sound Recorder-Reproducer Set AN/FNQ-2(*), packaging diagram.

8. Major Component of Sound Recorder-Reproducer Set AN/FNQ-2(*), Description

(fig. 1)

a. General. The recorder-reproducer set (the major component) consists of two recorder-reproducers (unit A and unit B) mounted on a common base. Two recorder-reproducers (*b.* and *c.* below) are necessary for *continuous* recording and reproducing.

Note. Throughout this manual the recorder-reproducer mounted on the left side of the common base will be referred to as unit A. The recorder-reproducer mounted on the right side of the common base will be referred to as unit B.

b. Unit A. This unit consists of a cabinet, front cover, motorboard, reproducer amplifier card, blinker card, and chassis ((1) through (6) below).

(1) The cabinet is made of magnesium. Louvers at the top and sides provide ventilation for the motor and the vacuum tubes.

(2) The front cover (fig. 9) is hinged to the motorboard. Raising the front cover automatically positions the recorder and the reproducer heads at the edge of the turntable and raises them from the turntable. With the front cover raised, a disk may be

placed on the turntable. An index scale for timing the recorder and reproducer arms is mounted on the front cover. The index scale is graduated in ¼-minute intervals up to 15 minutes.

(3) The motorboard (fig. 20) mounts a turntable, a motor, sealed-in gears, a recorder arm, a reproducer arm, a reproducer-head latch, three microswitches, and an optical system that focuses light from the index lamp onto the index scale. The turntable is made of heavy zinc casting, upon which a bakelite shell is placed. An extra protective disk rests on the shell to prevent damage to the styluses.

(4) The reproducer amplifier card (fig. 20) mounts the tubes and circuit elements that are used for amplifying signals from the reproducer heads mounted on units A and B. The card connects to a receptacle on the chassis. The output stage of the amplifier is mounted on the chassis.

(5) The blinker card (fig. 20) that connects to a receptacle on the chassis mounts a neon oscillator tube and an amplifier. The output of this amplifier causes the PILOT lamp to flash when the continuous recording cycle is interrupted or about to be interrupted.

(6) The chassis (fig. 20) mounts the reproducer amplifier output stage and the switching and relaying circuits. The front panel of the chassis mounts the OFF-AMPLIFIER switch, a LISTEN-TALK switch, the P.B. VOL. (playback volume) control, and the PILOT lamp. The functions of the switches and controls are outlined in paragraph 15.

c. Unit B. Unit B is similar to unit A. Unit B consists of a cabinet (*b*(1) above), a front cover (*b*(2) above), a motorboard (*b*(3) above), the recorder amplifier card ((1) below), and a chassis ((2) below). Unit B does not contain a blinker card.

(1) The recorder amplifier card mounts the tubes and circuit elements used for amplifying signals from the microphone or the telephone line. The output stage of the amplifier is mounted on the chassis. The card connects to a receptacle on the chassis.

(2) The chassis mounts the recorder amplifier output stage and the switching and relaying circuits. The front panel of the chassis mounts the OFF-TURNTABLES switch, a LISTEN-TALK switch, the REC.-VOL. (recording volume) control, and the REC. VOL. IND. (recorder volume indicator) lamp. On the rear of the chassis are mounted two screwdriver controls, the MONITOR-VOL. (monitor volume) control, and the TEL.-VOL. (telephone volume) control. The functions of these controls are outlined in paragraphs 15 and 16.

d. Common Base. The common base (fig. 20) mounts units A and B. In addition, it mounts circuit elements, relays, and switches. On the front apron are the T.T. SELECTOR-A switch, the PLAYBACK jack, the loudspeaker, the MONITOR jack, the TEL.-MIC. (telephone-microphone) switch, and the T.T. SELECTOR-B switch. The functions of these switches are outlined in paragraph 15. Three slots in the rear apron permit the entrance of the power cable, microphone cable, and tone-warning-generator cable. A perforated metal plate (bottom plate) covers the bottom of the common base. The plate is perforated to permit ventilation of the electrical parts. Six rubber feet are mounted on the bottom plate to prevent marring of surfaces upon which the recorder-reproducer set is placed.

9. Minor Components, Description

a. Microphone. A carbon-type desk microphone (fig. 1) is housed in a circular metal case. One end of a 5-foot cable is fixed to the terminals within the metal case. To connect several microphones in parallel for conference recording, a jack is mounted in the circular case of the microphone.

b. Recording Disks. The disks (fig. 9) are the communication media of the sound recorder-reproducer set. Disks are made of green vinylite .010 of an inch thick. A square hole in the disk center fits over the spindle on top of the turntable.

c. Filer. The filer is a square yellow envelope with a log scale, printed on both sides, that provides for the accurate logging and filing of the recorded disks.

d. Dust Cover. The dust cover protects the set from dust when the set is not in use. It is made of translucent vinylite.

10. Additional Equipment Required

The equipment listed in *a* and *b* below are *not* supplied as part of Sound Recorder-Reproducer Set AN/FNQ–2(*) but are required for its operation.

a. Headset HT. The headset (fig. 3) can be connected into the PLAYBACK jack to listen to a disk that is being reproduced. Plugging the headset into the PLAYBACK jack, automatically disconnects the loudspeaker from the output circuit of the recorder-reproducer set. The headset also can be connected into the MONITOR jack to monitor a disk that is being recorded. The Signal Corps stock number for headset HT is 2B971–24.

b. Tone Warning Generator O–93/GT. The O–93/GT is used with the recorder-reproducer set to record telephone conversations. The O–93/GT indicates audibly when a telephone conversation is being recorded. It applies to the line a 1,400-cycle tone of .2-second duration at intervals of 15 seconds. The Signal Corps stock number for the O–93/GT is 2C2710–93. This equipment is covered in TM 11–2088, Tone Warning Group OA–145/GT.

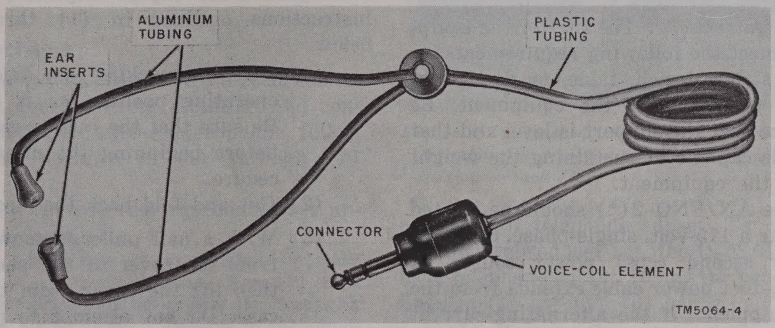


Figure 3. Headset HT.

CHAPTER 2

INSTALLATION AND OPERATION INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

11. Siting

a. General. Locate the AN/FNQ–2(*) in a room away from extremes of temperature and low humidity, and where noise is at a minimum. The equipment may be used in transit if a proper power source is available, and if the equipment is not subjected to severe shock.

b. Site Requirements. The site for the equipment must meet the following requirements:

(1) A strong bench, table, or desk must be provided for the equipment. Be sure that the support is level and that it is capable of sustaining the weight of the equipment.

(2) The AN/FNQ–2(*) should be located near a 115-volt, single-phase, 60 cycles per second (cps) power source. A 9½-foot power cable extends from the equipment; if the alternating-current (ac) power source is located at a greater distance from the equipment, extension cables must be provided.

(3) Adequate lighting for both day and night operation should be provided. The equipment should be positioned so that panel designations can be read easily. Artificial lighting should be installed so that light directly strikes the panels.

12. Uncrating, Unpacking, and Checking New Equipment

(fig. 2)

Note. For used or reconditioned equipment, refer to paragraph 14.

a. General. Be careful when uncrating the equipment. Avoid thrusting tools into the interior of the shipping containers. When unpacking, do not damage packaging materials and containers any more than necessary. Stow the interior packaging materials and cartons inside the outer carton or case.

b. Step-by-Step Instructions for Uncrating and Unpacking. To uncrate, unpack, and check new equipment packed for domestic shipment, follow the instructions in (6) through (12) below. To uncrate, unpack, and check equipment packed for export shipment, follow the instructions outlined in (1) through (12) below.

(1) Place the packing case as close to the operating position as is convenient. Be sure that the case is right side up before beginning the unpacking procedure.

(2) Cut and fold back the steel straps.

(3) With a nail puller, remove the nails from the cover of the packing case; then lift the cover from the packing case. Do not attempt to pry off the cover; the equipment may be damaged as a result.

(4) Open the water-resistant carton and the vaporproof barrier; the corrugated fiberboard carton will be exposed.

(5) Remove the bags of desiccant from the corrugated fiberboard carton.

(6) Cut the seals on the corrugated fiberboard carton carefully so that the equipment will not be damaged; the carton containing the minor components and the carton containing the recorder-reproducer set will be exposed.

(7) Lift out the cartons containing the minor components and the recorder-reproducer set. Cut the seals on these cartons so that the equipment will not be damaged.

(8) Lift the minor components and the recorder-reproducer set from their cartons.

(9) Open the front covers on units A and B. Remove the packing around the recorder heads and the reproducer heads by squeezing the packing down and sliding it out.

(10) Press down lightly on the turntable shells at their centers to make sure they are resting on the turntables.

(11) Inspect the equipment for possible damage incurred during shipment.

(12) Check the contents of the packing case against the master packing slip.

Note. Save all the packaging material. This material can be used again when the equipment is repacked for storage or shipment.

13. Connections

a. Microphone. To connect the recorder-reproducer set for recording dictation and conferences with the aid of the microphone, follow the procedure outlined in (1) through (7) below.

(1) Turn the recorder-reproducer set upside down (fig. 4).

Note. Check fuse F1 to determine whether it is of the proper rating. Fuse F1 is a 3-ampere fuse. Do not replace this fuse with one of higher rating. Damage to the equipment may result.

(2) Unhook cable clamp H68, and loosen the screw on cable clamp H34.

(3) Insert the connector mounted on the free end of the microphone cable into jack J3.

(4) Place the microphone cable under the clamps. Tighten the screw on cable clamp H34, and hook cable clamp H68.

(5) Turn the recorder-reproducer set right side up.

(6) Operate the OFF-AMPLIFIER switch (fig. 6) to the OFF position. Connect the plug of the power cable to a 115-volt, 60-cps power source.

(7) Check the operating condition of the equipment. Refer to the equipment performance check lists (par. 41).

b. Telephone (fig. 5). To record telephone conversations, use the recorder-reproducer set, Tone Warning Generator O–93/GT (par. 10)

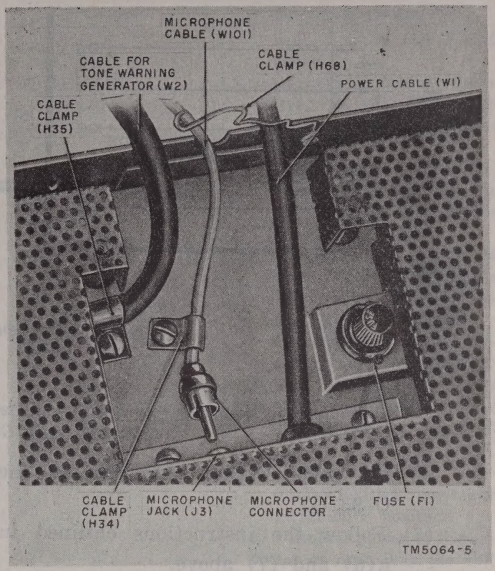


Figure 4. Bottom view of part of recorder-reproducer set, showing position of microphone cable for connection to jack J3.

and a local telephone subset. To connect the recorder-reproducer set, the O–93/GT, and the local telephone subset, follow the procedure outlined in (1) through (6) below.

(1) Remove the cover of Tone Warning Generator O–93/GT by loosening the fasteners and lifting the cover from the chassis.

(2) Connect the telephone line to the terminals marked T and R on the O–93/GT.

(3) Connect the local telephone subset to terminals T1 and R1 on the O–93/GT. When connecting the subset to the O–93/GT, be careful to avoid crossover of wires. When connecting the line to terminal T, be sure that the corresponding subset line is connected to terminal T1. Terminals R and R1 are connected internally.

(4) Connect a lead from terminal G of the O–93/GT to a suitable ground.

(5) Insert the connector on the free end of the tone-warning-generator cable from the recorder-reproducer set into

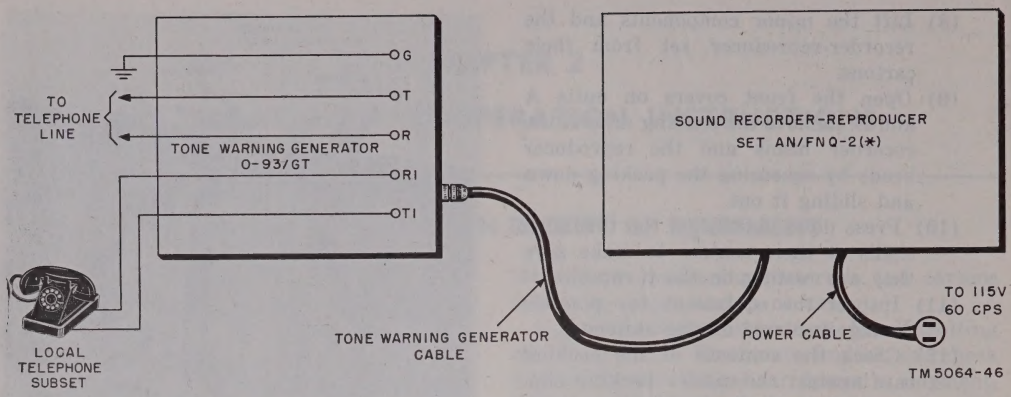


Figure 5. Recorder-reproducer set, local telephone subset, and Tone Warning Generator O–93/GT, connection diagram.

the seven-contact connector on the O–93/GT.

(6) Follow the instructions outlined in *a*(6) and (7) above.

14. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 12 for uncrating, unpacking, and checking the AN/FNQ–2(*).

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes have been made in the wiring, note the changes in this manual, preferably on the schematic diagrams.

c. Perform the installation and connection procedures given in paragraph 13.

Section II. CONTROLS AND INDICATORS

Note. This section describes, locates, and illustrates the various controls provided for the operation of the equipment.

15. Front Panel Controls and Indicators

The chart below lists and describes the functions of the controls and indicators that are located on the front panels of Sound Recorder-Reproducer Set AN/FNQ–2(*). These controls and indicators are shown in figure 6.

Note. See paragraph 16 for information covering the controls located on the rear apron of unit-B chassis (part of the recorder-reproducer set).

Controls	Description and function
1. OFF-AMPLIFIER switch (S7).	A two-position rotary switch. In the AMPLIFIER position, it functions as follows: *a.* Connects power to the power supply. *b.* Connects power to the motor of unit A if the LISTEN-TALK switch of unit A is in the LISTEN position (item 2 below). *c.* Connects power to the motor of unit B if the LISTEN-TALK switch of unit B is in the LISTEN position (item 3 below). In the OFF position, the OFF-AMPLIFIER switch disconnects power from the power supply and from the motors of units A and B.
2. LISTEN-TALK switch (S4, on unit A).	A two-position rotary switch. In the LISTEN position, it functions as follows: *a.* Mechanically raises (cam action) the recorder head of unit A from the turntable. *b.* Connects power to the motor of unit A (turntable rotates).

Controls	Description and function
	c. Connects the PILOT light to the blinker card. That is, the PILOT lamp flashes (or blinks).
	In the TALK position, it functions as follows:
	d. Mechanically lowers (cam action) the recorder head of unit A onto the turntable.
	e. Connects power to the motor of unit A if the T.T. SELECTOR-A switch has been depressed and the OFF-TURNTABLES switch or the TEL.-MIC. switch is in the TURNTABLES or the TEL. position respectively.
	f. Connects the PILOT lamp to the B power supply so that the lamp glows steadily.
3. LISTEN-TALK switch (S3, on unit B).	This switch has the same appearance and serves the same function in unit B as LISTEN-TALK switch (S4) in unit A.
4. OFF-TURNTABLES switch (S1).	A two-position rotary switch. In the TURNTABLES position, it functions as follows:
	a. Connects power to the motor of unit A if the T.T. SELECTOR-A switch has been depressed and the LISTEN-TALK switch of unit A is in the TALK position.
	b. Connects power to the motor of unit B if the T.T. SELECTOR switch has been depressed and the LISTEN-TALK switch of unit B is in the TALK position.
	In the OFF position, it functions as follows:
	c. Disconnects power from the motor of unit A if the TEL-MIC. switch is in the MIC. position and the LISTEN-TALK switch of unit A is in the TALK position.
	d. Disconnects power from the motor of unit B if the TEL.-MIC. switch is in the MIC. position and the LISTEN-TALK switch of unit B is in the TALK position.
5. TEL-MIC. switch (S2).	A two-position, locking lever switch. In the TEL. position, this switch functions as follows:
	a. Connects the output circuit of the telephone to the input circuit of the recorder amplifier.
	b. Connects ac power (115 volts, 60 cps) to Tone Warning Generator O–93/GT.
	c. Connects power to the motor of unit A if the T.T. SELECTOR-A switch has been depressed, the LISTEN-TALK switch of unit A is in the TALK position, and the OFF-TURNTABLES switch is in the OFF position.
	d. Connects power to the motor of unit B if the T.T. SELECTOR-B switch has been depressed, the LISTEN-TALK switch of unit B is in the TALK position, and the OFF-TURNTABLES switch is in the OFF position.
	e. Disconnects the microphone circuit from the input circuit of the recorder amplifier.
	In the MIC. position, the TEL.-MIC. switch functions as follows:
	f. Disconnects the circuits that are connected when the switch is in the TEL. position.
	g. Connects the output of the microphone circuit to the input circuit of the recorder amplifier.
6. T.T. SELECTOR-A switch (S6).	A push-button switch. When depressed, this switch applies power to the motor of unit A, if the LISTEN-TALK switch of unit A is in the TALK position, and the OFF-TURNTABLES switch or the TEL.-MIC. switch is in the TURNTABLES or the TEL. position. When released, this switch does not disconnect power from the motor of unit A (relay con-

Controls	Description and function
	tacts shunt this switch after the switch is initially depressed).
7. T.T. SELECTOR-B switch (S5).	This switch has the same appearance and serves the same function in unit B as the T.T. SELECTOR-B switch in unit A.
8. REC.-VOL. control (R34).	A knob-controlled variable resistor in the recorder amplifier. This control regulates the signal level to the recorder heads.
9. REC. VOL. IND. lamp (I 2).	A lamp which flashes during the recording cycle. The intensity of the light varies with the level of the signal delivered to the recorder heads.
10. P. B. VOL. control (R35).	A knob-controlled variable resistor in the reproducer amplifier. This control regulates the volume output of the speaker or the headset.
11. PILOT lamp (I 1).	A lamp that glows steadily when both LISTEN-TALK switches are in the TALK positions and both recorder heads are *not* at the center of the turntable. The lamp flashes or blinks steadily when both LISTEN-TALK switches are in the TALK position and *both* recorder heads are at the center of the turntables. The lamp blinks steadily when either or both LISTEN-TALK switches are in the LISTEN positions. The blinking of the lamp indicates that the equipment is not set up for continuous recording, or that the continuous recording cycle has been interrupted.
12. Covers (A 9)	When lifted, the cover of each unit raises the recorder and the reproducer heads of its unit from the turntable and retracts the heads to the edge of its turntable.
13. Index scales (N1).	Each cover mounts an index scale. Light beams focused on the index scales indicate the positions of the recorder and reproducer heads. The index scales permit timing of the disks.
14. Handles of recorder and reproducer heads (E1, E2, E3, and E4).	There is a red dot on the end of each recorder-head handle and a green dot on the end of each reproducer-head handle. The handles are used to position the heads on the disks.
15. Reproducer-head latches.	The latches (fig. 7) hold up the reproducer heads from the disks during recording and when the equipment is moved.

16. Controls on Rear of Recorder-Reproducer Set

The chart below lists and describes the functions of the controls that are located on the rear apron of unit-B chassis (part of the recorder-reproducer set). These controls are shown in figure 8.

Controls	Description and function
1. MONITOR-VOL. control (R36).	This is a screwdriver controlled variable resistor in the recorder amplifier. This control varies the sound volume output of the headset connected to the MONITOR jack.
2. TEL.-VOL. control (R49).	This is a screwdriver controlled variable resistor in the recorder amplifier. This control varies the telephone signal-level input to the recorder amplifier.

Section III. OPERATION UNDER USUAL CONDITIONS

17. Preliminary Starting Procedure

Follow the procedures outlined in *a* through *f* below before using the starting procedures described in paragraph 18.

a. Install and connect the equipment as outlined in paragraphs 11 and 13.

b. Operate the OFF-AMPLIFIER switch (fig. 6) to the OFF position.

c. Operate the OFF-TURNTABLES switch to the OFF position.

d. Operate the TEL.-MIC. switch to the MIC. position.

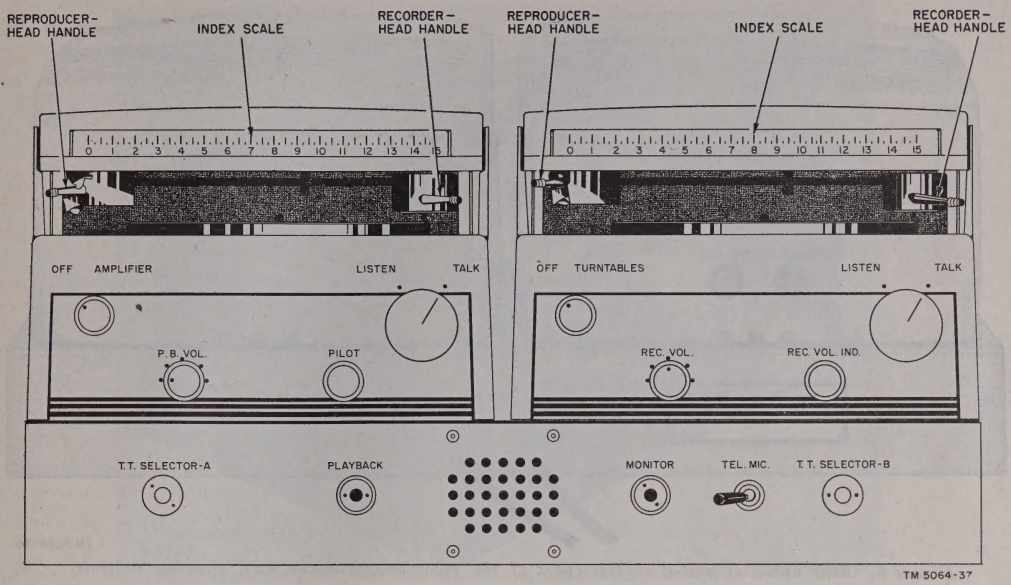


Figure 6. Recorder-reproducer set, front view, showing controls and indicators.

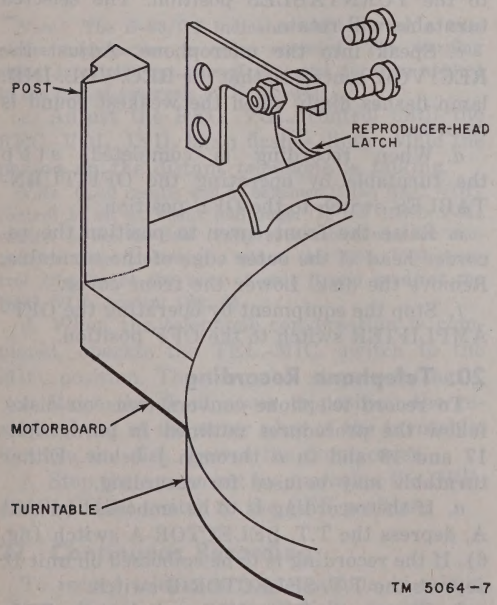


Figure 7. Reproducer-head latch.

e. Operate the LISTEN-TALK switches to the TALK positions.

f. If the AN/FNQ–2(*) is being placed into operation for the first time, operate the P.B. VOL. control, the REC.-VOL. control, the MONITOR-VOL. control (fig. 8), and the TEL. VOL. control to the midrange positions. If the recorder-reproducer set has been operated previously and has been taken out of operation for a short period, leave these controls in the positions obtained in the last satisfactory operation.

18. Starting Procedure

Follow the procedure outlined in *a* through *g* below to place the AN/FNQ–2(*) in operation. If abnormal indications are obtained during the starting procedure, operate the OFF-AMPLIFIER switch to the OFF position, refer to the equipment performance check lists (par. 41), and apply the suggested corrective measures.

a. Raise the front covers high to position the recorder and the reproducer heads at the outer edges of their respective turntables and to provide room to change disks.

b. Place a blank disk on each turntable for continuous recording, one blank disk on one turntable to record for 15 minutes or less, or a recorded disk on one turntable for reproduction. Flex each disk (fig. 9) and place it over the square center pin of the turntable.

c. Lower the front covers to bring the re-

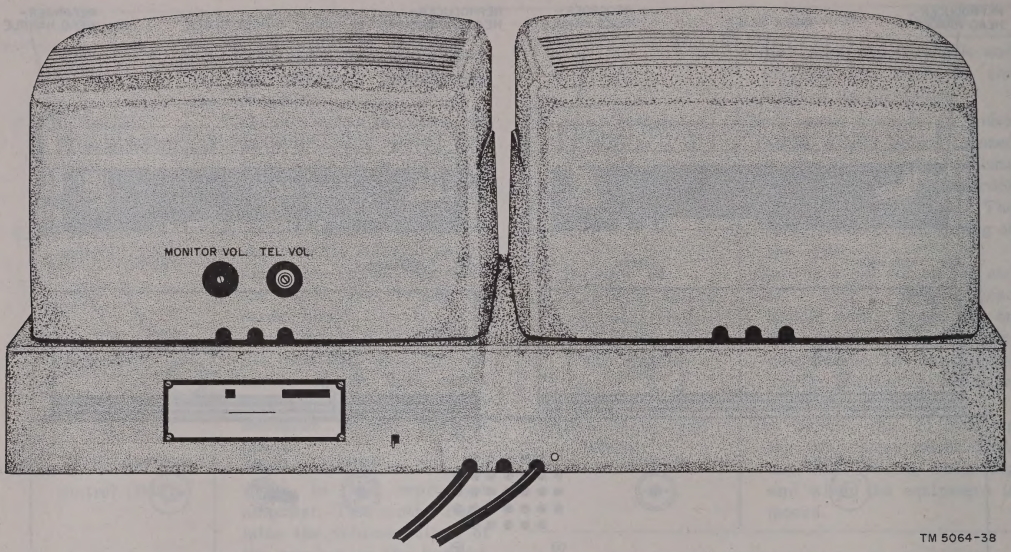


Figure 8. Rear apron of unit-B chassis (part of the recorder-reproducer set), showing controls.

corder and the reproducer heads on to the disks.

d. Operate the OFF-AMPLIFIER switch to the AMPLIFIER position. Allow 1 minute warm-up time.

e. Check the index scales. Note whether the two light beams of each unit merge into one at zero. If the beam is not at zero, or if two separate light beams appear on either scale, raise and lower the front covers again. The light beams will not merge if the front covers are not raised high enough.

f. Place each reproducer-head handle in its latch.

g. To record on or to reproduce from disks, refer to paragraphs 19, 20, 21, 22, and 24. For instructions on monitoring recordings refer to paragraph 23. For instructions on indexing disks, refer to paragraph 25.

19. Microphone Recording

To record on disks with the aid of a microphone, follow the procedures outlined in paragraphs 17 and 18 and in *a* through *f* below. Either turntable may be used for recording.

a. If the recording is to be embossed on unit A, depress the T.T. SELECTOR-A switch (fig. 6). If the recording is to be embossed on unit B, depress the T.T. SELECTOR-B switch.

b. Operate the OFF-TURNTABLES switch to the TURNTABLES position. The selected turntable will rotate.

c. Speak into the microphone. Adjust the REC. VOL. control so that the REC. VOL. IND. lamp flashes dimly when the weakest sound is recorded.

d. When recording is completed, stop the turntable by operating the OFF-TURNTABLES switch to the OFF position.

e. Raise the front cover to position the recorder head at the outer edge of the turntable. Remove the disk. Lower the front cover.

f. Stop the equipment by operating the OFF-AMPLIFIER switch to the OFF position.

20. Telephone Recording

To record telephone conversations on disks, follow the procedures outlined in paragraphs 17 and 18 and in *a* through *f* below. Either turntable may be used for recording.

a. If the recording is to be embossed on unit A, depress the T.T. SELECTOR-A switch (fig. 6). If the recording is to be embossed on unit B, depress the T.T. SELECTOR-B switch.

b. Operate the TEL.-MIC. switch to the TEL. position. This automatically selects the telephone input circuit, connects power to Tone Warning Generator O–93/GT (par. 10), and causes the selected turntable to rotate.

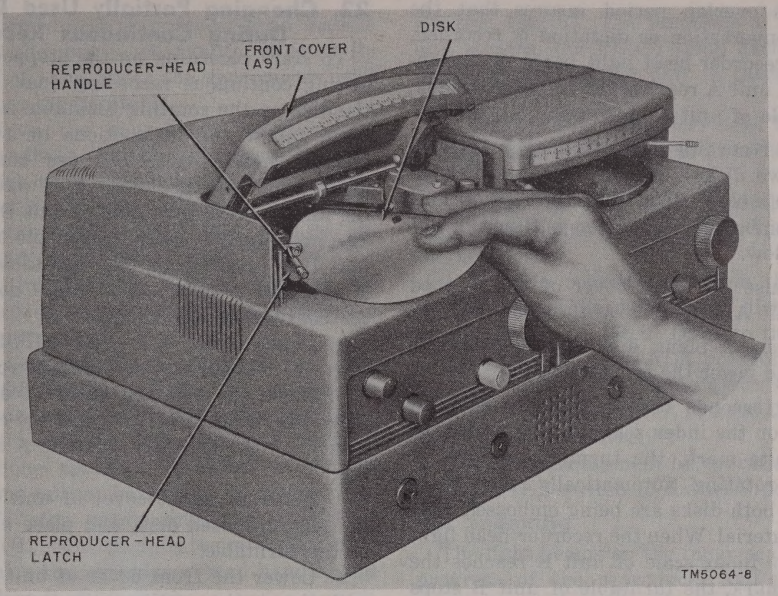


Figure 9. Method of flexing disk for placement on turntable.

Note. The O–93/GT indicates audibly when a telephone conversation is being recorded. The warning signal is a 1,400-cps tone of .2-second duration applied to the line at intervals of 15 seconds.

c. Adjust the REC. VOL. control until the REC. VOL. IND. lamp flashes dimly while the person on the distant telephone is talking.

Note. Good results will be obtained if the REC. VOL. control is set at about midrange. If the REC. VOL. control is set too low (fully counterclockwise or one-quarter-range clockwise), adjust the TEL. VOL. control (fig. 8) at the rear of unit B and readjust the REC. VOL. control (fig. 6).

d. When the telephone conversation is completed, operate the TEL.-MIC. switch to the MIC. position. The turntable stops rotating.

e. Raise the front cover to position the recorder head at the outer edge of the turntable. Remove the disk. Lower the front cover.

f. Stop the equipment by operating the OFF-AMPLIFIER switch to the OFF position.

21. Continuous Recording

To record telephone conversations or microphone dictation on several disks (continuous recording), follow the procedures outlined in paragraphs 17 and 18 and in *a* through *m* below. Continuous recording can be started on unit A or unit B. In the procedures outlined below, it is assumed that continuous recording is started on unit A.

a. Depress the T.T. SELECTOR-A switch (fig. 6).

b. If a telephone conversation is being recorded, follow the instruction in (1) below. If microphone dictation is being recorded, follow the instruction in (2) below.

(1) Operate the TEL.-MIC. switch to the TEL. position. The turntable of unit A will rotate.

(2) Operate the OFF-TURNTABLES switch to the TURNTABLES position. The turntable of unit A will rotate.

c. Adjust the REC. VOL. control so that the REC. VOL. IND. lamp flashes dimly when the weakest sound is recorded.

d. Time the recording by observing the recorder-head light beam on the index scale of unit A.

e. Thirty seconds before the recorder-head light beam on the index scale of unit A reaches the 15-minute mark (the completion of the disk), the turntable of unit B will start rotating automatically. For these 30 seconds, both disks are being embossed with the same ma-

terial. This overlap period insures that the *complete* conversation or dictation is recorded. When the recorder-head light beam on the index scale of unit A reaches the 15-minute mark, the turntable of unit A stops automatically.

f. If the recording is to be longer than 30 minutes (two disks), replace the used disk on unit A with a blank disk while the disk on unit B is being embossed. Proceed as outlined in (1) and (2) below.

(1) Raise the front cover of the stopped unit A, and remove the used disk.

(2) Place a blank disk on the turntable and lower the front cover.

g. Thirty seconds before the recorder-head light beam on the index scale of unit B reaches the 15-minute mark, the turntable of unit A will start rotating automatically. For these 30 seconds, both disks are being embossed with the same material. When the recorder-head light beam on the index scale of unit B reaches the 15-minute mark, the turntable of unit B stops automatically.

h. If the recording is to be longer than 45 minutes (three disks), replace the disk on unit B with a blank disk (*f* (1) and (2) above) while the disk on unit A is being embossed. Continuous recording for an indefinite period can be accomplished in this manner.

i. When both recorder heads are at the center of the disks, the PILOT lamp will flash to indicate that continuous recording has been interrupted. Both turntables stop automatically.

j. If a telephone conversation is being recorded, follow the instruction given in (1) below. If microphone dictation is being recorded, follow the instruction in (2) below.

(1) Operate the TEL.-MIC. switch to the MIC. position.

(2) Operate the OFF-TURNTABLES switch to the OFF position.

k. Raise the front covers to position the recorder heads at the outer edge of the turntable. Remove the disk. Lower the front covers.

l. Stop the equipment by operating the OFF-AMPLIFIER switch to the OFF position.

m. Refer to paragraph 22 for instructions on changing a partially used disk while maintaining continuous recording.

22. Changing Partially Used Disk During Continuous Recording

To start recording on the stopped turntable during continuous recording (par. 21) before the disk on the rotating turntable is completely used, follow the instructions in *a* through *d* below. These instructions are based on the assumption that the turntable of unit A is rotating and that the turntable of unit B is stopped. The procedure is similar when the turntable of unit B is rotating and the turntable of unit A is stopped. This procedure does not interrupt the continuous recording.

a. Depress the T.T. SELECTOR-B switch (fig. 6). The turntable of unit B rotates.

b. Raise the recorder head of unit A, and move the recorder arm toward the center of its disk until the turntable of unit A stops rotating.

c. Raise the front cover of unit A. Remove the partially used disk, and place a blank disk on the turntable.

d. Lower the front cover of unit A. Proceed with the continuous recording according to the instructions in paragraph 21.

23. Monitoring

To monitor the equipment while recording (pars. 19, 20, and 21) use one of the two methods outlined in *a* and *b* below. One method requires the use of headset HT (par. 10). The second method requires the use of the loudspeaker mounted on the common base of the equipment, and the reproducer head of the unit to be monitored.

a. Headset.

(1) Connect headset HT into the MONITOR jack.

(2) Place the ear inserts (on the headset) into the ears and adjust the MONITOR-VOL. control (fig. 8) for the desired sound-volume output.

Caution: Do not adjust the REC. VOL. control for the desired sound-volume output. This control is adjusted to give the proper flash of the REC. VOL. IND. lamp only.

(3) To stop monitoring, disconnect the headset from the MONITOR jack.

b. Loudspeaker.

(1) Turn the P.B. VOL. control fully counterclockwise.

(2) Remove the reproducer-head handle of the unit to be monitored from its latch, and lower the reproducer head onto the turntable.

(3) Move the reproducer head by its handle so that its light beam lines up with the recorder-head light beam on the index scale. The reproducer head automatically will follow slightly behind the recorder head.

(4) Adjust the P.B. VOL. control for the desired sound-volume output from the loudspeaker.

Caution: Do not adjust the P.B. VOL. control so that the sound-volume output from the loudspeaker feeds back into the microphone or the telephone receiver. Keep the sound-volume output as low as possible.

(5) To stop monitoring, turn the P.B. VOL. control fully counterclockwise, raise the reproducer-head handle, and place it in its latch.

24. Reproducing from Disks

To reproduce from disks, follow the procedures outlined in paragraphs 17 and 18 and in *a* through *f* below. Either the loudspeaker mounted on the common base or headset HT (fig. 3) may be used. If headset HT is to be used, connect it into the PLAYBACK jack and place the ear inserts into the ears. The loudspeaker is disconnected automatically from the output of the reproducer amplifier when the headset is connected to the equipment.

a. Operate the LISTEN-TALK switch of the unit selected for reproducing to the LISTEN position (fig. 6). The turntable of the selected unit rotates, the PILOT lamp flashes, and the recorder head of the unit is raised from the disk.

b. Remove the reproducer-head handle from its latch, and lower the repoducer head onto the disk.

c. Adjust the P.B. VOL. control for the desired sound-volume output from the speaker or the headset.

d. To stop reproducing from the disk, lift the reproducer head from the disk, and place the handle in its latch. Operate the LISTEN-TALK switch to the TALK position to stop the turntable (the PILOT lamp glows steadily).

e. Lift the front cover, remove the disk, and lower the front cover.

f. Stop the equipment by operating the OFF-AMPLIFIER switch to the OFF position.

25. Indexing

The light beams on the index scales show the progress of the reproducer and the recorder heads across the disks. Each scale is graduated in ¼-minute divisions for a 15-minute interval. An accurate log of recording can be made by marking the disks and by noting on a pad the subject of the recording for a specific time interval. A wax pencil will write on the disks. Log pads and filers are convenient for logging and for storing disks.

26. Stopping Procedure

To stop the AN/FNQ–2(*), operate the OFF-AMPLIFIER switch to the OFF position. In an emergency, the plug at the end of the power cable may be pulled out of its receptacle to stop the recorder-reproducer set.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

27. General

The operation of Sound Recorder-Reproducer set AN/FNQ–2(*) may be difficult in regions where extreme cold, heat, humidity and moisture, and sand conditions prevail. In paragraphs 28 through 30, instructions are given for minimizing the effect of these unusual operating conditions.

28. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment as warm and dry as possible.

c. Locate the equipment inside a heated inclosure where there is no danger of a cold draft striking the glass tubes when a door is opened. A sudden draft of cold air is often sufficient to shatter the glass envelope of a heated tube. If the inclosure is not constructed to prevent this.

place a blanket, or some other barrier, between the source of the draft and the equipment.

d. Moisture will condense on equipment that has been exposed to the air and then is brought into a warm room; condensation will continue until the equipment reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also may arise when the air warms during the day and the equipment is still cold after exposure during a cold night.

29. Operation in Tropical Climates

When operated in tropical climates, the equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground or when it is set up in swampy areas, moisture conditions are more acute than normal. Ventilation is usually very poor, and the high relative humidity may cause condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than that of the air. To minimize this condition, place lighted electric bulbs near the equipment.

30. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure operation of the equipment.

b. The main problem that arises with equipment operation in desert areas is the large amount of sand, dust, and dirt that enters the moving parts of the equipment. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building would require air conditioning and is seldom available, the next best precaution is to make the building in which the equipment is located as dustproof as possible. Hang wet sacking over the windows and doors. Cover the inside walls with heavy paper. Use sand to secure the outside walls of tents to prevent them from flapping in the wind.

c. Never tie power cables or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls that may jerk the connections loose or break the lines.

d. Keep the equipment as free from dust as possible. Make frequent preventive maintenance checks.

CHAPTER 3
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

31. Definition of Preventive Maintenance

Preventive maintenance is scheduled, systematic work performed on equipment (usually when the equipment is not in use) to keep it in good working condition so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair since its object is to prevent certain troubles from occurring. Refer to AR 750–5, Maintenance Responsibilities and Shop Operation.

32. Tools and Materials

The tools and materials listed in the table below are required in addition to common hand tools for use in performing organizational maintenance. These items are necessary to perform preventive maintenance.

Tools and materials	Sig C stock No.	Used to
Brush, cleaning	6Z1415.8	Remove dust, dirt, and lint from interior of equipment.
Brush, paint; soft hair, flat, 1″ wide	6Z1401	Apply paint.
Carbon tetrachloride	6G184.2	
Cheesecloth, bleached, lint-free	6Z1989	Clean various parts of equipment.
Sandpaper, No. 0000	6Z7500–0000	Remove rust and corrosion from metal parts
Solvent, dry cleaning (SD)	[a]QMC51–S–4385–1	Remove grease, oil, and corrosion from equipment.
Orange stick	6Z7360	Remove fungus growth from equipment.

[a]Quartermaster stock number.

33. General Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If further cleaning is necessary, moisten the cloth or brush with solvent (SD); then wipe the parts dry with a cloth. Do not use solvent (SD) on electrical contacts.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a clean cloth.

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

c. 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 may result.

d. For further information on preventive maintenance techniques, refer to TB SIG 178, Preventive Maintenance Guide for Radio Communication Equipment.

34. Use of Preventive Maintenance Forms

a. The decision as to which items on DA Forms 11–250 and 11–251 (figs. 10 and 11) 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.

b. Circled items in figures 10 and 11 are partially or totally applicable to Sound Recorder-Reproducer Set AN/FNQ–2(*). References in the ITEM block refer to paragraphs in the text that contain additional maintenance information.

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; (X) Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
(1)	INSPECT UNIT FOR COMPLETENESS - MICROPHONE, HEADSET, CORDS, CABLES, ACCESSORIES, RUNNING SPARES. PARS. 5 AND 6							
(2)	CLEAN EXTERIOR OF COMPONENTS OF DIRT, GREASE, GRIME, CORROSION, OIL. PAR. 33							
(3)	CLEAN PLUGS AND ELECTRICAL CONNECTIONS OF CORROSION, TARNISH, DIRT, DUST, GREASE, OIL. PAR. 33							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
(4)	INSPECT EXTERIOR OF COMPONENTS FOR RUST, CORROSION, LOOSE OR MISSING SCREWS, CHIPPED PAINT, CRACKS. PAR. 33		(7)	INSPECT ELECTRICAL CONNECTIONS FOR FIRMNESS OF SEATING, PROPER CONTACT, TIGHTNESS, CORROSION, GREASE, OIL, DIRT. PAR. 33	
(5)	INSPECT CORDS AND CABLES FOR LOOSE TERMINALS, FRAYED, CUT OR GOUGED INSULATION OR JACKETING, BROKEN CONDUCTORS. PAR. 39		(8)	INSPECT PLUGS FOR CHIPS, CRACKS, CORROSION, TARNISH, ROUGHNESS, BENDS. PAR. 33	
(6)	TIGHTEN - LOOSE EXTERIOR SCREWS, BOLTS, FASTENINGS, MOUNTINGS. PAR. 33		(9)	OPERATE UNIT AND CHECK FOR SMOOTHNESS, UNUSUAL NOISES, SQUEAKS, VIBRATIONS, CORRECT OPERATION. PAR. 41	

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

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

TM 5064-47

Figure 10. DA Form 11–250.

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	COND'N	NO.	ITEM	COND'N
1	INSPECT UNIT FOR COMPLETENESS - MICROPHONE, HEADSET, CORDS, CABLES, ACCESSORIES, RUNNING SPARES. PARS. 5 AND 6		13	SOLDER ANY BROKEN OR LOOSE SOLDERED CONNECTIONS. PAR. 57	
2	CLEAN EXTERIOR OF COMPONENTS OF DIRT, GREASE, GRIME, CORROSION, OIL. PAR. 33		14	INSPECT INTERNAL WIRING AND CABLING, WHERE ACCESSIBLE FOR LOOSE TERMINALS, FRAYED, CUT, OR GOUGED INSULATION OR JACKETING, BROKEN CONDUCTORS. PAR. 39	
3	CLEAN PLUGS AND ELECTRICAL CONNECTIONS OF CORROSION, TARNISH, DIRT, DUST, GREASE, OIL. PAR. 33		15	INSPECT MOTORS FOR CONDITION OF BRUSHES, EVIDENCES OF OVERHEATING, END PLAY, SIDE PLAY. PAR. 41	
4	INSPECT EXTERIOR OF COMPONENTS FOR RUST, CORROSION, LOOSE OR MISSING SCREWS, CHIPPED PAINT, CRACKS. PAR. 33		16	INSPECT REPRODUCER AND/OR RECORDER HEADS FOR GENERAL CONDITION. PAR. 41	
5	INSPECT CORDS AND CABLES FOR LOOSE TERMINALS, FRAYED, CUT OR GOUGED INSULATION OR JACKETING, BROKEN CONDUCTORS. PAR. 39		17	CLEAN CIRCUIT ELEMENTS, LOUD-SPEAKERS, TURNTABLES, REELS, MOTORS OF DIRT, DUST, GREASE, OIL, GRIME, WHERE ACCESSIBLE. PAR. 33	
6	TIGHTEN - LOOSE EXTERIOR SCREWS, BOLTS, FASTENINGS, MOUNTINGS. PAR. 33		18	INSPECT CAPACITORS, POTENTIOMETERS, AND RESISTORS FOR LOOSE TERMINALS, CORROSION, LEAKS, BULGES, BLISTERING, DISCOLORATION. PAR. 39	
7	INSPECT ELECTRICAL CONNECTIONS FOR FIRMNESS OF SEATING, PROPER CONTACT, TIGHTNESS, CORROSION, GREASE, OIL, DIRT. PAR. 33		19	INSPECT INKING UNITS FOR CLOGGING, GUMMY DEPOSITS, DIRT, GREASE.	
8	INSPECT PLUGS FOR CHIPS, CRACKS, CORROSION, TARNISH, ROUGHNESS, BENDS. PAR. 33		20	INSPECT ALL LABELS, ENGRAVINGS, PLATES FOR LEGIBILITY.	
9	OPERATE UNIT AND CHECK FOR SMOOTHNESS; UNUSUAL NOISES, SQUEAKS, VIBRATIONS; CORRECT OPERATION. PAR. 41		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. PAR. 41		22	LUBRICATE UNIT IN ACCORDANCE WITH LATEST DEPARTMENT OF THE ARMY LUBRICATION ORDER OR INFORMATION PUBLISHED IN APPROPRIATE TECHNICAL MANUAL. PAR. 35	
11	INSPECT TUBE SOCKETS FOR CRACKS, CHIPS, LOOSE SOLDER CONNECTIONS. PAR. 39		23	INSPECT MOISTURE AND FUNGUS PROOFING.	
12	INSPECT TUBES FOR SEATING, LOOSE ENVELOPES. PAR. 39		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 FORM 1 MAY 52 11-251 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 5064-48

Figure 11. DA Form 11-251

Section II. LUBRICATION AND WEATHERPROOFING

35. Lubrication

No lubrication is needed because gears and bearings are lubricated and sealed by the manufacturer. Other moving parts such as gear segments, recorder- and reproducer-head mounts, retracting assemblies, and head lifting mechanisms must not be lubricated; dust and dirt adhere to the lubricant.

36. Weatherproofing

a. General. Sound Recorder-Reproducer Set AN/FNQ–2(*), when operated under severe climatic conditions, such as those prevailing 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 materials.

b. Tropical Maintenance. The recorder-reproducer set 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 in TB SIG 72, Tropical Maintenance of Ground Signal Equipment, and TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.

Note. Apply the treatment to soldered connections only.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66, Winter Maintenance of Signal Equipment, and TB SIG 219, Operation of Signal Equipment at Low Temperatures.

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 in TB SIG 75, Desert Maintenance of Ground Signal Equipment.

37. Rustproofing and Painting

a. When the finish on the cabinets and common base of the recorder-reproducer set has been badly scarred or damaged, rust and corrosion can be prevented by touching up the bared surfaces. Before touching up the surfaces, use No. 000 or No. 0000 sandpaper to clean the surfaces down to the bare metal; obtain a bright smooth finish, and apply paint with a small brush.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, remove rust from the surface by cleaning the corroded metal with solvent (SD). In severe cases, it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparations for painting. Clean the surfaces down to the bare metal, and then apply paint with a small brush. Paint used will be authorized and consistent with existing regulations.

Section III. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

38. General

a. The troubleshooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) are necessarily limited in scope by the tools, test equipment, and replaceable parts issued. Accordingly, troubleshooting is based on the performance of the equipment and the use of the senses in determining such troubles as a burned-out fuse and cracked insulators.

b. The paragraphs that follow in this section help in determining which of the units (such as unit A, unit B, or the common base), is at fault and in localizing the fault in that unit to the defective stage or item, such as a tube or recorder head.

39. Visual Inspection

a. When operational failure is encountered and the cause is not immediately apparent,

check the items listed in *b* below before starting a detailed examination of the equipment.

b. Failure of the equipment to operate properly may be caused by one or more of the following faults:

(1) Worn, broken, or disconnected cables or connectors.
(2) Improperly connected cables.
(3) Burned-out fuse.
(4) Relay contacts not making properly.
(5) Wires or parts broken because of strain or execessive vibration.
(6) Defective tubes.
(7) Defective switches.
(8) Improperly seated pluck-out parts.
(9) Loose switches, knobs, cable connectors, transformers, capacitors, relays, or indicator lamps.
(10) Defective recorder or reproducer heads.

40. Troubleshooting by Using Equipment Performance Check Lists

a. General. The equipment performance check lists (par. 41*a* through *e*) will help to locate trouble in a recorder-reproducer set. *To use the check lists, follow the items in numerical sequence.* Each check list is divided into four parts: preparatory, starting, equipment performance, and stopping. Each check list also includes the columns described in *b*, *c*, and *d* below.

b. Action or Condition. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For some items, it represents an action that must be taken to check the normal indication given in the normal indications column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator should perceive when checking the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those which the operator can make without turning in the equipment for repairs. A reference in a table to chapter 5 indicates that the trouble cannot be corrected by the operator, and that troubleshooting by an experienced repairman is necessary. If the recorder-reproducer set is completely inoperative, or if the recommended corrective measures do not yield results, troubleshooting is necessary.

41. Equipment Performance Check Lists

a. Microphone Recording.

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	1	OFF-AMPLIFIER switch (S7).	Operate to the OFF position.	Power is not applied to equipment.	
	2	Cable connectors	Make all connections as described in paragraph 13*a*.	Connections securely in place.	Push connectors and plugs firmly into receptacles.
	3	LISTEN-TALK switches (S4 and S3).	Operate to the TALK position.	Recorder heads will lower to disks.	
	4	OFF-TURNTABLES switch (S1).	Operate to the OFF position.	Turntables do not rotate.	
	5	TEL.-MIC. switch (S2)	Operate to the MIC. position.		
	6	Front covers (A 9)	Raise the front covers high.	Reproducer heads and recorder heads will lift from the turntables and retract to the outside of the turntables.	Lift the front covers up as far as they will go if heads are not properly retracted.
	7	Reproducer-head latches	Place reproducer-head handles on their latches.	Latches hold the reproducer heads and styluses up off their disks during recording.	

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	8	Blank disk	Select unit A or unit B for microphone recording and place a blank disk on the selected turntable.	The disk lays flat on the protective disk of the turntable shell.	Seat the turntable shell flat on the turntable and place the protective disk flat on the shell.
	9	Front cover (A 9)	Lower the front cover	The recorder head of the selected unit will lower to the disk.	The LISTEN-TALK switch must be in the TALK position.
STARTING	10	OFF-AMPLIFIER switch (S7).	Operate to AMPLIFIER position.	The PILOT light glows. Light beams strike the index scales.	Check fuse F1 (fig. 4). Check PILOT light. Check index lamps (ch. 5).
	11	Index scale (N1)	Observe light beams on index scale for position of recorder head.	The light beam of the recorder head of the selected unit coincides with the light beam of the reproducer head at zero.	Raise and lower the front cover. Focus the index lamps (ch 5).
	12	T.T. SELECTOR-A switch or T.T. SELECTOR-B switch.	Depress the switch corresponding to the unit selected for recording.	Turntable does not rotate.	
	13	OFF-TURNTABLES switch (S1).	Operate to the TURNTABLES position.	Turntable of selected unit rotates.	Check the OFF-TURNTABLES switch (ch. 5).
EQUIP. PERFORMANCE	14	Microphone	Dictate into microphone	The REC. VOL. IND. lamp should flash.	Adjust the distance between mouth and microphone.
	15	REC.-VOL. control (R34).	Turn clockwise to increase signal level to recorder head.	The REC. VOL. IND. lamp flashes.	Adjust the control until the lamp flashes dimly when the weakest sound is recorded.
	16	Index scale (N1)	Watch light beam on index scale, and observe progress of the recorder head to time the disk.		
STOPPING	17	OFF-TURNTABLES (S1).	Operate to the OFF position.	Turntable stops.	
	18	OFF-AMPLIFIER switch switch (S7).	Operate to the OFF position.	All indicator lamps extinguish.	
	19	Front cover (A 9)	Lift the front cover	Recorder head is positioned at the outside of its disk; the turntable is exposed.	Lift the front cover as high as it will go.
	20	Disk	Remove the recorded disk.		
	21	Front cover (A 9)	Lover the front cover.		

b. Telephone Recording.

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	1	OFF-AMPLIFIER switch (S7).	Operate to the OFF position.	Power is not applied to the equipment.	
	2	Cable connectors	Connect the equipments as described in paragraph 13*b*.	Connections securely in place.	Push connectors and plugs firmly into receptacles.
	3	Repeat items 3 through 9 in *a* above.			
START	4	OFF-AMPLIFIER switch (S7).	Operate to the AMPLIFIER position.	The PILOT light glows. Light beams strike the index scales.	Check fuse F1 (fig. 4). Check PILOT light. Check index lamps (ch. 5).

	Item No.	Item	Action or condition	Normal indication	Corrective measures
STARTING	5	Index scale (N1)	Observe light beams on index scale for position of recorder head.	The light beam of the recorder head of the selected unit coincides with the light beam of the reproducer head at zero.	Raise and lower the front cover. Focus the light beams (ch. 5).
	6	T.T. SELECTOR A or T.T. SELECTOR B switch.	Depress the switch corresponding to the unit selected for recording.	Turntable does not rotate.	
EQUIPMENT PERFORMANCE	7	TEL. MIC. switch (S2)	Operate to the TEL. position.	The selected turntable rotates.	
	8	Local telephone subset	Speak into transmitter	Signal from tone warning generator will be heard in receiver.	Refer to TM 11-2088.
	9	REC.-VOL. control (R34)	Turn control clockwise to increase signal level to the recorder head.	REC. VOL. IND. lamp flashes.	Adjust the REC.-VOL. control until the lamp flashes dimly with the weakest sound recorded.
	10	TEL.-VOL. control (rear of unit B).	Turn control clockwise to increase signal level to recorder heads (par. 20).	REC. VOL. IND. lamp flashes.	When the REC.-VOL. control must be set low (fully counterclockwise to ¼ clockwise), better recording results will be obtained if the TEL.-VOL. c ntrol is turned down so that the REC.-VOL. control can be used at midrange.
	11	Index scale (N1)	Observe light beam on index scale to time desk.	Recorder-head light beam moves across the scale.	Check index lamps (ch. 5).
STOP	12	TEL.-MIC. switch (S2)	Operate to the MIC. position.	Turntable stops rotating.	The OFF-TURNTABLES switch must be in the OFF position.
	13	OFF-AMPLIFIER switch (S7).	Operate to the OFF position.	All indicator lamps extinguish.	
	14	Front cover (A 9)	Lift the front cover	The recorder head is positioned at the outside of the disk. The turntable is exposed.	Raise the front cover as high as it will go.
	15	Disk	Remove the recorded disk.		
	16	Front cover (A 9)	Lower the front cover.		

c. Continuous Recording.

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	1	OFF-AMPLIFIER switch (S7).	Operate to the OFF position.	Power is not applied to equipment.	
	2	Cable connectors	Make connections according to instructions in paragraph 13*a* for continuous recording with a microphone. Follow instructions in paragraph 13*b* to connect the equipment for recording telephone conversations.	Connections securely made	Push connectors firmly into receptacles.

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	3	Repeat instructions in items 3 through 7 in *a* above.			
	4	Blank disk	Place a blank disk on each turntable (fig. 9).	Disks lay flat on the protective disks of turntable shells.	Seat turntable shells flat on turntables, and place the protective disks flat on shells.
	5	Front covers (A 9)	Lower the front covers	Recorder heads will lower to disks.	See that the LISTEN-TALK switches are in the TALK position.
STARTING	6	OFF-AMPLIFIER switch (S7).	Operate to AMPLIFIER position.	PILOT lamp glows steadily. Light beams strike the index scales.	Check fuse F1 Check PILOT light. Check index lamps (ch. 5).
	7	Index scales (N1)	Observe light beams on the index scales for the positions of the recorder heads.	The light beams of the recorder heads should coincide with the light beams of the reproducer heads at zero.	Raise and lower the front covers. Focus the index lamps (ch. 5).
	8	T.T. SELECTOR-A or T.T. SELECTOR-B switch (S5 or S6).	Depress either switch depending on the unit that is selected to start the continuous recording cycle.	Turntable of the selected unit does not rotate.	
EQUIPMENT PERFORMANCE	9	OFF-TURNTABLES switch or TEL.-MIC. switch.	(1) For recording with the aid of a microphone, operate the OFF-TURNTABLES switch to the TURNTABLES position. (2) For recording telephone conversations operate the TEL.-MIC. switch to the TEL. position.	The turntable of the selected unit (item 8 above) rotates.	
	10	Microphone or local telephone subset.	Dictate into microphone or telephone transmitter.	The REC. VOL. IND. lamp flashes.	Adjust distance between mouth and microphone or telephone transmitter.
	11	REC.-VOL. control (R34).	Turn control clockwise to increase signed level to recorder head.	The REC. VOL. IND. lamp flashes. The lamp is bright when sound is loud, dim when soft.	Adjust REC.-VOL. control until the weakest sound to be recorded will cause the lamp to flash dimly. For recording telephone conversations, see item 10 in *b* above.
	12	Index scales (N1) of first operating unit.	Watch recorder-head light beam on index scale and observe progress of the recorder head.	When the light beam of the recorder head is within 30 seconds of the 15-minute mark on the index scale, the turntable of the idle unit rotates. When the same light beam is at the 15-minute mark, the turntable of the unit first used stops rotating.	Checks relays K2 and K3 and overlap switches S8, S9, S11, and S12 (ch. 5).
	13	Index scale (N1) of second operating unit.	Watch recorder-head light beam on index scale to time the recording.	When the light beam is at the 15-minute mark, the turntable stops rotating and the PILOT light	Check blinker switches S10 and S13 (ch. 5).

	Item No.	Item	Action or condition	Normal indication	Corrective measures
EQ'P. PER.				flashes (blinks) to indicate interruption of the recording cycle. Both recorder arms are at center.	
STOP	14	OFF-TURNTABLES switch or TEL.-MIC. switch.	(1) If recording is done with the aid of a microphone, operate the OFF-TURNTABLES switch to the OFF position. (2) If a telephone conversation is recorded, operate the TEL.-MIC. switch to the MIC. position.		
	15	OFF-AMPLIFIER switch (S7).	Operate to the OFF position.	All indicator lamps extinguish.	
	16	Front covers (A 9)_____	Lift the front covers_____	Recorder heads retract to the outside of their respective disks and rise from disks.	Lift the front covers up as far as they will go if heads are not properly retracted.
	17	Disks_____	Remove disks.		
	18	Front covers (A 9)_____	Lower the front covers____	Recorder heads lower to disks.	

d. Monitoring.

Note. Use the following check while recording (*a*, *b*, or *c* above).

	Item No.	Item	Action or condition	Normal indication	Corrective measures
EQUIP. PER.	1	Headset (HT)_____	Plug into MONITOR jack and place ear inserts into ears.	Sound being recorded will be heard.	Check recorder-amplifier card (ch. 5).
	2	MONITOR-VOL. control (R36).	Turn control clockwise or counterclockwise.	Volume to headset will increase or decrease.	Adjust to give best listening level.

e. Reproduction.

Note. Reproduction of disks can be heard either from the built-in loudspeaker or a headset plugged into the PLAYBACK jack. Plugging in the headset automatically disconnects the loudspeaker. The following instructions apply to reproduction on unit A. To use the chart for reproduction on unit B, operate the controls of unit B that correspond to those of unit A.

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	1	OFF-AMPLIFIER switch (S7).	Operate to the OFF position.	Power is not applied to the equipment.	
	2	Power plug_____	Connect to a 115-volt, 60-cps power source.		
	3	LISTEN-TALK switches (S4 and S3).	Operate to the TALK positions.	Recorder heads will lower to disks.	
	4	OFF-TURNTABLES switch (S1).	Operate to the OFF position.		
	5	TEL.-MIC. switch (S2)___	Operate to the MIC. position.		

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	6	Front cover (A 9) of unit A	Raise as high as possible	The reproducer and recorder heads of unit A will retract to the outside of the turntable.	Lift cover as high as possible.
	7	Recorded disk	Place a recorded disk on the turntable (fig. 9).	The disk should lay flat on the protective disk of the turntable.	Seat the turntable shell flat on the turntables and position the disk flat on the protective disk.
	8	Front cover (A 9) of unit A	Lower the front cover	The recorder head of unit A will lower to the disk.	The LISTEN-TALK switch must be in the TALK position.
STARTING	9	OFF-AMPLIFIER switch (S7).	Operate to the AMPLIFIER position.	The PILOT lamp glows and light beams strike the index scales.	Check fuse F1. Check the PILOT lamp. Check the index lamp (ch. 5).
	10	Index scale (N1) of unit A	Observe light beam on index scale for position of reproducer head.	The light beam of the recorder head of unit A should coincide with the light beam of the reproducer head at zero.	Raise and lower the front cover as necessary.
	11	LISTEN-TALK switch of unit A.	Operate to the LISTEN position.	Turntable of unit A rotates. PILOT lamp flashes (blinks). The recorder head rises.	Check the blinker card (ch. 5).
EQT. PER.	12	Reproducer head	Lift the reproducer-head handle from its latch and lower it to the disk.	Reproduction is heard from loudspeaker of set or from headset.	Check the reproducer amplifier (ch. 5).
	13	P.B. VOL. control (R35)	Turn clockwise or counterclockwise.	Increases or decreases volume of reproduction.	Check the P.B. VOL. control (ch. 5).
STOP	14	Reproducer-head handle	When the reproducer-head light beam on the index scale is at the 15-minute mark, raise the reproducer-head handle and place it in its latch.	Reproduction will cease.	
	15	OFF-AMPLIFIER switch (S7).	Operate to the OFF position.	The turntable stops, and all indicator lamps extinguish.	
	16	Front cover of unit A	Lift the front cover	Recorder and reproducer heads rise and retract to outside of turntable.	Lift the front cover up as high as it will go.
	17	Recorded disk	Remove the disk.		
	18	Front cover of unit A	Lower the front cover.		

CHAPTER 4

THEORY

Section I. THEORY OF OPERATION OF MECHANICAL PARTS

42. General

Sound Recorder-Reproducer Set AN/FNQ-2(*) is an electromechanical equipment. For the theory of operation of the mechanical parts, refer to paragraph 43. For the theory of operation of the electrical circuits, refer to paragraphs 44 through 52.

43. Theory of Operation of Mechanical Parts

a. Motor Drive and Gear Mechanism. Each turntable is rotated by a 115-volt, 60-cps, capacitor-type motor that is mounted under each motorboard (fig. 36). Each motor shaft is connected to a reduction gear. The output shaft of the reduction gear rotates at 33⅓ revolutions per minute (rpm). This output shaft is coupled directly to the turntable shaft through flexible coupling O 6 (fig. 37), causing the turntable (O 13) also to rotate at 33⅓ rpm. Each turntable shaft connects to a reduction worm gear (O 71), the shaft of which enters two gear boxes located at the rear of the motorboard. These gear boxes contain one worm gear and two reduction gears (O 29). The first reduction gear connects to the shaft, attached to the recorder arm. The second reduction gear connects to the shaft that is attached to the reproducer arm. As these gears rotate, they cause the recorder and the reproducer arms to move across the turntable.

b. Recorder Heads. Each recorder head embosses a groove in a plastic disk with a permanent diamond-tipped stylus. The groove starts at the outer edge of the disk and spirals toward the center of the disk. The pressure of the recorder-head stylus on the disk determines the width of the groove in the disk. When voice currents pass through the coil in the recorder head, the stylus moves in accordance with the magnitude of the current to modulate the groove.

c. Reproducer Head. The reproducer head moves toward the center of the disk at the same speed at which the recorder head moves. This makes it possible to adjust the position of the reproducer head so that it trails behind the recorder head during monitoring (par. 23). As the reproducer-head stylus moves in the embossed grooves of a recorded disk, voice currents proportional to the modulation of the grooves are induced in the reproducer-head coil that is attached to the stylus. These voice currents induce a signal voltage in the secondary winding of transformer T1. The signal voltage is amplified by the reproducer amplifier (par. 45) and is coupled to loudspeaker LS1 or headset HT.

d. Index System. Two light beams striking each index scale (fig. 6) indicate the positions of the recorder and the reproducer heads. This permits the operator to time the disks. Each unit contains an indexing system. The light rays from the index lamps are condensed and passed through a narrow rectangular slot. The light rays are focused on two mirrors that reflect them onto the index scales. The two mirrors are mounted over the drive shaft of the reproducer arm. The top mirror is fastened directly to the reproducer arm so that, as the arm moves across the disk, the mirror rotates and the reflected light beam moves across the index scale to indicate the position of the reproducer head. The bottom mirror is fastened to a gear sector whose mating gear sector is fastened to the recorder arm. As the recorder arm moves, the bottom mirror is caused to move and the reflected light beam moves across the index scale.

44. Block Diagram Analysis, Recorder and Reproducer Circuits

a. General. The recorder circuits of the AN/FNQ–2(*) convert sound energy into electrical energy (using a microphone), amplify the resultant signal, and couple the signal to a recorder head that converts the electrical energy into mechanical energy to emboss a disk. A general description of the recorder circuits is given in *b* below. The reproducer circuits of the AN/FNQ–2(*) convert mechanical energy into electrical energy (using a reproducer head), amplify the resultant signal, and couple the signal to a loudspeaker that converts the electrical energy into sound energy. A general description of the reproducer circuits is given in *c* below. A detailed analysis of the recorder circuits and the reproducer circuits is given in paragraphs 45 and 46.

b. Recorder Circuits. The input signal to the recorder circuits (fig. 12) is obtained either from a tone warning generator and telephone line or from microphone MI 101. The signal from the microphone is coupled directly to the TEL.-MIC. switch. The signal from the telephone line is coupled through isolating transformer T6 and the TEL.-VOL. control to the TEL.-MIC. switch. This switch selects either the microphone signal or the telephone signal and couples it to input transformer T2. Transformer T2 couples the signal into the first voltage amplifier stage that raises the signal level and couples the signal to the REC.-VOL. control. This control provides attenuation of the signal before the signal is fed to the second and third voltage amplifiers. One portion of the output of the third voltage amplifier is rectified and fed back to the first voltage amplifier for automatic volume control. This prevents overload distortion by strong signals. Another portion of the output of the third voltage amplifier is fed to the recorder output stage that raises the power level of the signal and couples it to transformer T4. One portion of the output of this transformer is fed back to the second voltage amplifier to broaden the overall response of the recorder amplifier. Another portion of the output transformer is coupled to the parallel combination consisting of the MONITOR-VOL. control, the REC. VOL. IND. lamp, and change-over relays K2 and K3. The MONITOR-VOL. control varies the attenuation of the signal fed to a headset that may be connected to the MONITOR jack. The REC. VOL. IND. lamp flashes to indicate the signal level fed to the recorder heads. Change-over relay K2 couples the signal to recorder head E4. Change-over relay K3 couples the signal to recorder head E3.

c. Reproducer Circuits. Reproducer head E1 or E2 (fig. 12) provides the signal to input transformer T1 that couples the signal to the first voltage amplifier stage. This stage feeds the signal to the P.B. VOL. control that varies the signal level before the signal enters the second and third voltage amplifiers. This latter stage feeds the signal to the reproducer output stage, a push-pull power amplifier. This amplifier couples the signal to output transformer T3. A portion of the output of transformer T3 is fed back to the second voltage amplifier to minimize distortion and to broaden the response of the amplifier. Another portion is fed to the PLAYBACK jack and to loudspeaker LS1.

45. Reproducer Circuits, Detailed Analysis

(fig. 49)

a. First Voltage Amplifier Stage. The signal from reproducer head E1 or E2 is stepped up by transformer T1 and is applied to the control grid of tube V1 through capacitor C8. Resistor R3 is the plate-load resistor across which the amplified signal is developed. Capacitor C1 couples the signal from tube V1 through P.B. VOL. control R35 to the control grid of tube V2. The signal voltage coupled through capacitor C1 also is fed back through resistor R1 to the control grid of tube V1. This inverse feedback is used to minimize high-frequency interference. Resistor R1 drops the feedback voltage for the control grid of tube V1. Capacitor C11 filters high-frequency noises from the signal input voltage. Capacitor C10 serves as an ac ground to the primary of T1. Resistor R8 is the grid-leak resistor. Resistor R10 drops the voltage for the screen grid of tube V1 and, with capacitor C15, comprises a decoupling network for the screen grid.

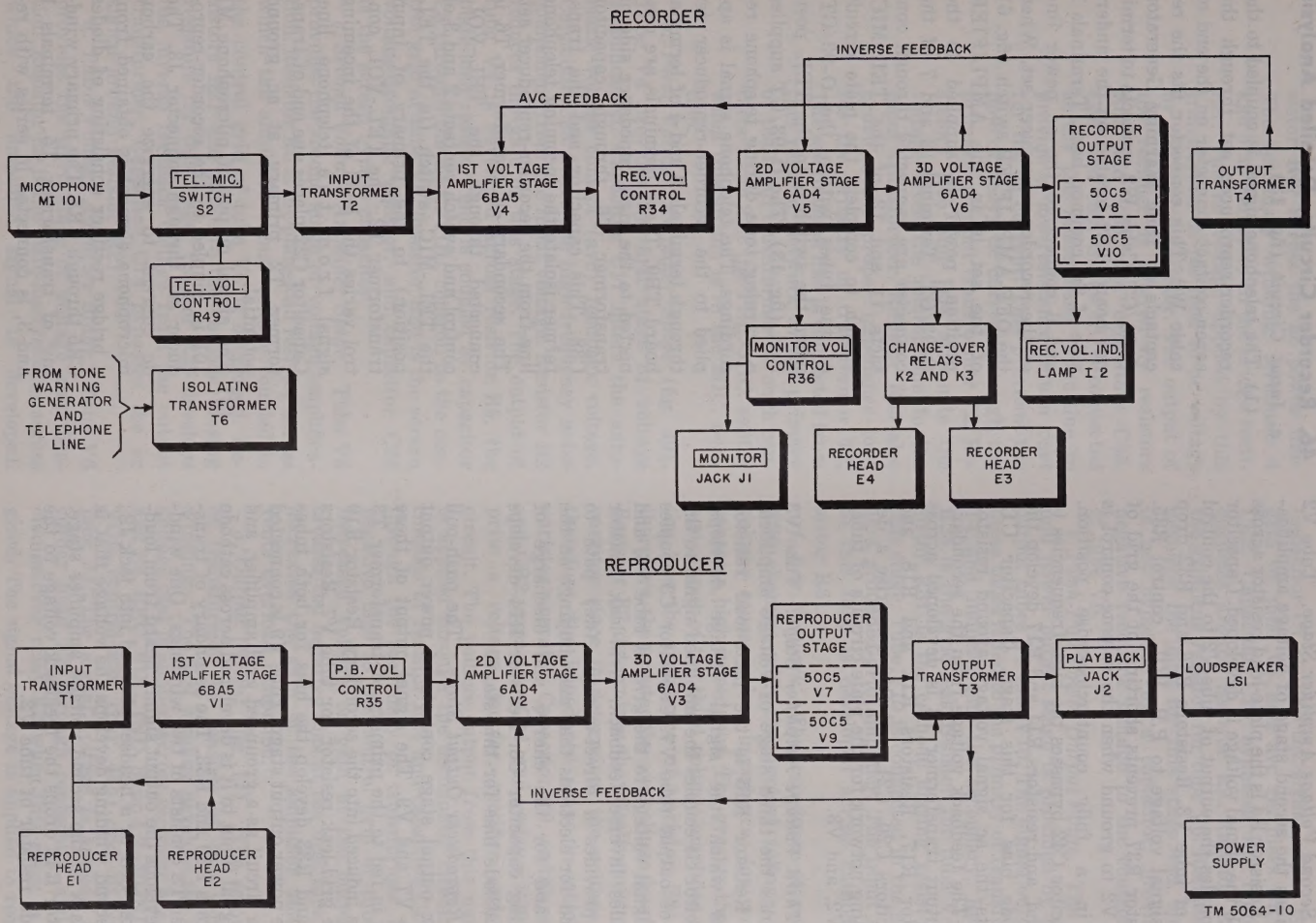


Figure 12. Recorder and reproducer circuits of the AN/FNQ-2(*), block diagram.

b. Second Voltage Amplifier Stage. Tube V2 provides the second stage of voltage amplification. Resistor R4 is the plate-load resistor across which the signal voltage is developed. Capacitor C2 couples the output of tube V2 to the control grid of tube V3. Resistors R16 and R32 drop the signal voltage to P.B. VOL. control R35. Resistor R37 prevents shorting of the grid of tube V2 to ground when the volume control is set in a fully counterclockwise position. Capacitor C42 bypasses the high frequencies to ground, and resistors R11 and R17 develop the cathode bias for this stage. Capacitor C12 shunts the ac signal voltage around resistor R11. The feedback voltage from the secondary of output transformer T3 is developed across resistor R17. Resistors R12 and R18, and capacitors C20, C21, and C16 comprise a decoupling network for the plate circuits of tubes V1, V2, and V3.

c. Third Voltage Amplifier Stage. Tube V3 provides the third stage of voltage amplification. Resistor R15 is the plate-load resistor across which the signal voltage develops. Capacitor C4 couples the amplified signal to the grid of output tube V7. Capacitor C3 couples the signal voltage to the grid of tube V3, and provides inverse feedback. Grid-leak resistor R13 provides a direct-current (dc) path to ground for electrons that may impinge on the grid and for the charge and discharge of coupling capacitor C3. Resistor R14 develops the cathode bias for this stage.

d. Reproducer Output Stage. The push-pull power output stage consists of power output tubes V7 and V9. The signal output of these tubes is fed to the primary of transformer T3 and is induced into the secondary. Resistor R19 is the grid-leak resistor for tube V7. Resistors R30 and R33 develop the bias for both tubes in the power output stage. Tube V9 is connected in the circuit as a grounded grid amplifier, and the signal input to it is developed across cathode resistors R30 and R33. The secondary of transformer T3 consists of two windings: One winding develops the output signal, heard from loudspeaker LS1 or a headset plugged into jack J2; the second winding develops the voltage that is fed back to the second voltage amplifier stage. Resistor R42 drops the feedback voltage to the cathode resistor of tube V2.

46. Recorder Circuits, Detailed Analysis

a. Input Circuit (fig. 13).

(1) The telephone signal is coupled to the recorder-reproducer set through the seven-contact connector on the end of cable W2. This connector fits the receptacle on Tone Warning Generator O–93/GT. Cable W2 connects to terminal board TB9 located on the underside of the common base. Terminals 1 and 6 connect to the ac power line of the recorder-reproducer set. When the OFF-AMPLIFIER switch (fig. 6) of the set is in the AMPLIFIER position, power is supplied to the O–93/GT. Terminals 2 and 7 of the connector are connected through contacts 11 and 12 of the TEL.-MIC. switch to complete the plate circuit of the tubes within the O–93/GT, when the switch is in the TEL. position (fig. 13). The O–93/GT supplies a warning tone during telephone recordings. The telephone signal is applied to the recorder-reproducer set through terminals 3 and 4 of terminal board TB9. These terminals are connected to the high impedance side of transformer T6 through capacitor C38. This capacitor and the transformer isolate the incoming telephone line from the recorder-reproducer set. The secondary of transformer T6 is connected through the TEL.-VOL. control and switch contacts 2 and 3 of the TEL.-MIC. switch (in the TEL. position) to the primary of input transformer T2. The TEL.-VOL. control varies the level of the incoming signal from the telephone line. Capacitor C22 places one end of transformer T2 primary at ac ground potential.

(2) The signal output of microphone MI 101 is coupled to the recorder-reproducer set through connector J3. The dc current to energize the carbon microphone element is obtained from a bridge rectifier consisting of diodes CR5 through CR8. The primary winding of transformer T5, terminals 1 and 3, is connected in series with re-

sistor R47 across the ac power line. The secondary winding, terminals 4 and 5, is connected to the bridge rectifier. The ac voltage applied by this transformer is rectified to dc voltage by the bridge rectifier. The output of the rectifier is filtered by resistors R52 and R53, and capacitors C35, C36, and C37. Choke L1 is connected across the microphone input line to provide a low-resistance return part for the dc current. This prevents the flow of heavy dc current through the primary of input transformer T2. Resistors R55 and R54 attenuate the voltage from the microphone to the input transformer. Resistor R54 also provides the proper impedance load for the primary of transformer T2. The microphone line is connected from this resistor network to the primary of the input transformer through contacts 1 and 2 of the TEL.-MIC. switch when this switch is in the MIC. position.

b. First Voltage Amplifier Stage (fig. 49). Tube V4 provides the first stage of voltage amplification. Capacitor C17 filters the automatic volume control (avc) feedback voltage. Capacitor C23 filters the high-frequency noise component from the input voltage. Resistor R2 reduces the gain of this stage. The output of tube V4 is developed across resistor R5, the plate-load resistor, and is coupled by capacitor C5 through the REC.-VOL. control, to the control grid of tube V5. Resistor R20 is the screen voltage-dropping resistor, and capacitor C24 is the screen bypass capacitor.

c. Second Voltage Amplifier Stage. Tube V5 provides the second stage of voltage amplification. Resistor R6 is the plate-load resistor across which the amplified signal voltage coupled to the control grid of tube V6 is developed. Resistors R21 and R25 are the cathode biasing resistors for this stage; resistor R25 develops the inverse feedback voltage from the output transformer. Capacitor C18 bypasses the ac signal around resistor R21.

d. Third Voltage Amplifier Stage. Tube V6 provides the third stage of voltage amplification. Resistor R9 is the plate-load resistor across which the amplified signal is developed. Capacitor C7 couples the signal to the control grid of tube V8 and avc rectifiers CR1 and CR2. Capacitor C13 bypasses the high frequencies around resistor R9. Resistor R23 is the grid-leak resistor for tube V6. Resistor R24 develops the bias for this stage and, since it is not bypassed by a capacitor, provides a negative feedback voltage to the control grid of tube V6.

e. Push-Pull Power Output Stage. The push-pull power output stage is provided by power output tubes V8 and V10. The signal output of these tubes is fed to the primary of transformer T4 and induced into the secondary. Resistor R28 is the grid-leak resistor for tube V8. Resistor R31 is the cathode biasing resistor for this stage. Tube V10 is connected in the circuit as a grounded-grid amplifier. The input signal to this tube is developed across cathode resistor R31.

f. Avc Network. The impedance of varistor E24 changes with the applied voltage. High voltage causes a low impedance; low voltage causes a high impedance. The greater the voltage output of the third voltage amplifier stage, the less the resistance of varistor E24 and, therefore, the greater the avc voltage developed. Resistor R7 determines the effectiveness of the varistor since it determines the voltage and, therefore, the impedance range in which the varistor operates. Capacitor C9, rectifiers CR1 and CR2, capacitor C14, and resistor R29 comprise a voltage doubler, rectifier and filter circuit. The voltage output from this network is applied through the decoupling circuit that consists of resistor R27 and capacitor C17 and through the secondary of transformer T2 as negative bias to the control grid of tube V4. Increased voltage or gain at the output increases the negative bias at the first tube. This decreases the gain of the amplifier and prevents overload distortion.

g. Output Circuit (fig. 14). The secondary of transformer T4 consists of two separate windings: The first winding develops the signal voltage that is applied across recorder heads E3 and E4, REC. VOL. IND. lamp I 2, MONITOR-VOL. control R36 (par. 44*b*) and MONITOR jack J1. The signal voltage is applied to recorder head E3 through contacts 8 and 9 of change-over relay K2 when this relay is energized. The signal voltage is applied to recorder

head E4 through contacts 8 and 9 of change-over relay K3 when this relay is energized. The second winding develops the voltage that is fed back to the second voltage amplifier stage (fig. 49). Resistors R44 and R25 determine the amount of voltage feedback to the cathode circuit of tube V5. The low-frequency resistor-compensation network consists of resistor R45 and capacitor C27.

47. Blinker Oscillator and Amplifier, Detailed Analysis

The blinker oscillator and the amplifier cause the PILOT lamp to flash when the continuous recording cycle is interrupted or about to be interrupted. A description of the operation of oscillator I 3 is given in *a* below. A description of the operation of amplifier V11 and its connection to the PILOT lamp is given in *b* below.

a. Oscillator I 3. Oscillator I 3 (fig. 15) is a neon lamp that conducts current when the voltage across it is 60 volts or more. The complete oscillator consists of neon lamp I 3, resistors R48 and R46, capacitor C31, and the grid-cathode circuit of tube V11. When B+ power first is applied to the circuit, capacitor C31 charges through resistor R48 and the grid-cathode circuit of tube V11. While capacitor C31 is charging, the control grid of tube V11 remains positive with respect to its cathode, and neon lamp I 3 does not conduct since most of the B+ voltage is dropped across resistor R48. When the capacitor has charged to within 60 volts of the B+ voltage, capacitor C31 draws very little current through resistor R48, and the voltage drop across this resistor is substantially reduced. Consequently, the voltage across neon lamp I 3 rises and causes neon lamp I 3 to conduct. While neon lamp I 3 conducts, capacitor C31 discharges through resistor R46 and causes the control grid of tube V11 to become negative with respect to its cathode. After capacitor C31 has discharged, it starts to charge again and the cycle of charging and discharging repeats.

b. Amplifier V11. The B+ supply is connected to the plate of tube V11 through PILOT lamp I 1 when LISTEN-TALK switch S3 is in the LISTEN position, when LISTEN-TALK switch S4 is in the LISTEN position, or when blinker switches S13 and S10 are operated. Blinker switches S10 and S13 are microswitches that are operated by the recorder arms of unit A and unit B, respectively, when the recorder arms are approximately at the center of the turntables. Tube V11 then amplifies the output of the oscillator and causes the PILOT lamp to flash. Resistor R50 limits the screen-grid current of tube V11. Resistor R51 limits the current through the PILOT lamp when both of the LISTEN-TALK switches are in the TALK position and the blinker switches are in the unoperated position. When the switches are in these positions, the PILOT lamp is connected in series with resistor R50 across the B+ supply; the lamp glows steadily.

48. Remote Control Relay K1

Remote control relay K1 is energized when current from the B+ power supply passes though its coil (fig. 16). The relay-coil circuit is completed through current-limiting resistor R39 when the OFF-TURNTABLES switch is operated to the TURNTABLES position, or when the TEL.-MIC. switch is operated to the TEL. position. The functions of this relay, when it is deenergized, are given in *a* below. The functions of this relay, when it is energized, are given in *b* below.

a. Relay K1 Deenergized. Contacts 1 and 2 (fig. 49) connect the screen grids of the recorder output stage (tubes V8 and V10) to the B— line to squelch the output from this stage when not recording.

b. Relay K1 Energized.

(1) Contacts 3 and 2 connect the screen grids of the recorder output stage (tubes V8 and V10) to the B+ power supply to permit this stage to operate during recording.

(2) Contacts 5 and 6 connect contact 5 of each change-over relay (K2 and K3) to the B— line. When relay K2 or K3 is energized (par. 49 and 50), this connection enables relay K2 or K3 to connect the motor of unit A or unit B, respectively, to the ac power source.

49. Change-Over Relay K2

Change-over relays K2 and K3 (par. 50) automatically switch recording from one turntable to the other during continuous recording. Change-over relay K3 automatically operates

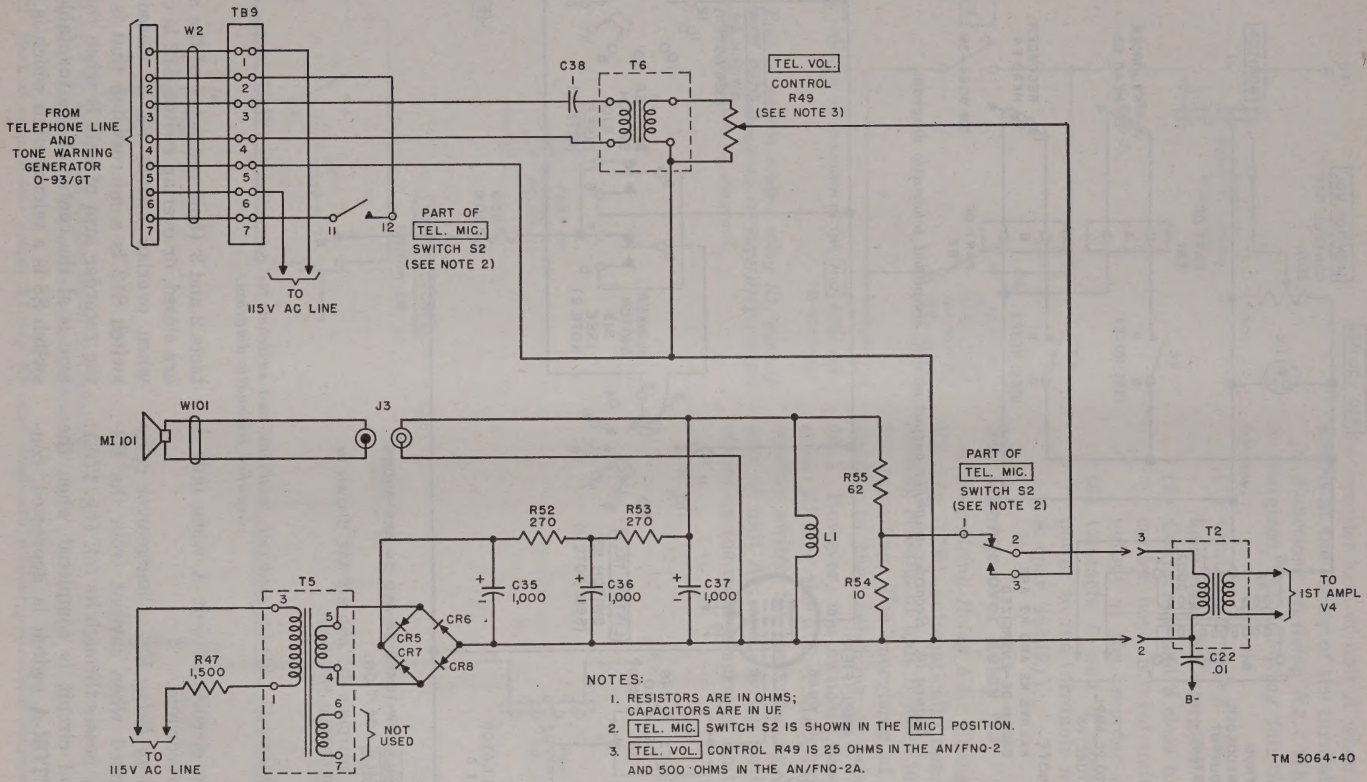


Figure 13. Recorder-amplifier input circuit, simplified schematic diagram.

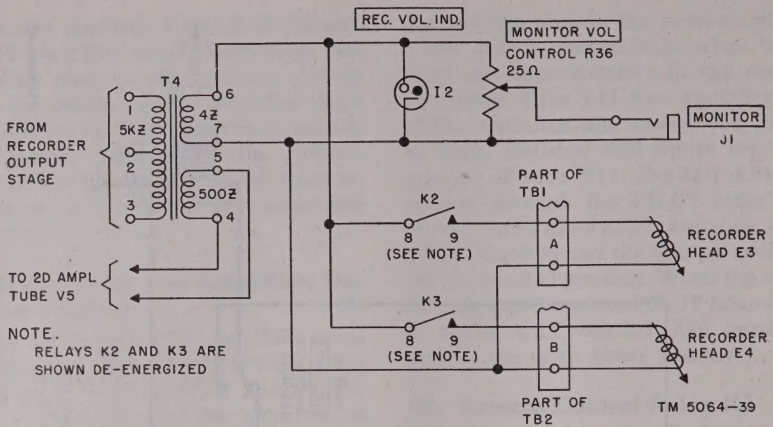


Figure 14. Recorder-amplifier output circuit, simplified schematic diagram.

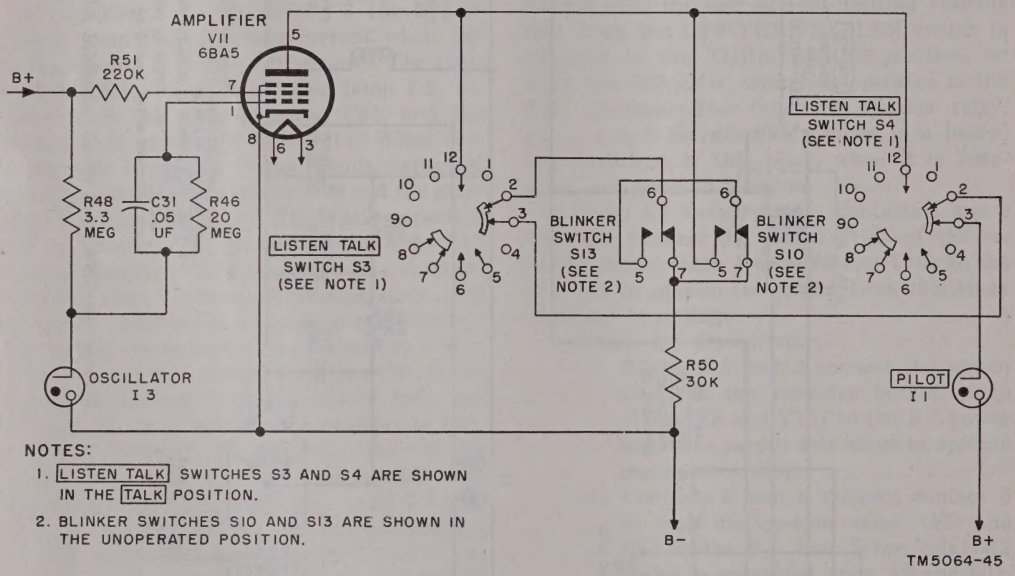


Figure 15. Blinker oscillator, amplifier, and switches for connection to PILOT lamp, simplified schematic diagram.

the recording circuits of unit A when unit A is used for recording.

a. Energizing Relay K2. Change-over relay K2 is energized when current from the B+ power supply passes through its coil (fig. 17Ⓐ). The relay-coil circuit is completed when the T.T. SELECTOR-A switch is depressed, contacts 2 and 3 (hold contacts) of the same relay are closed, or overlap switch S12 is closed, and when overlap switch S8 is closed. Overlap switch S12 is a microswitch that is closed by the recorder arm of unit B when the recorder arm is at the center of the turntable. Overlap switch S8 is a microswitch which is opened by

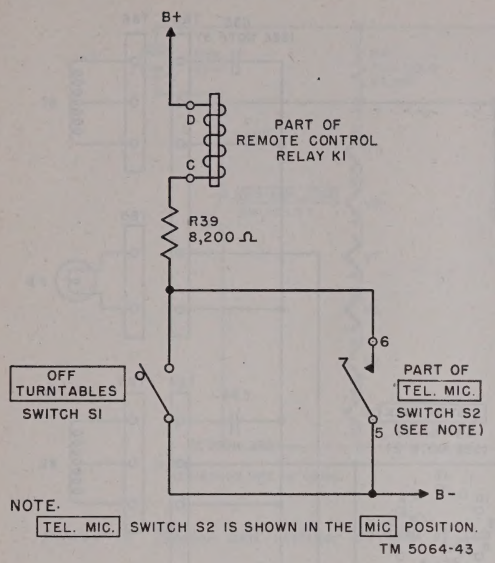


Figure 16. Part of remote control relay K1, part of the TEL.-MIC. switch and the OFF-TURNTABLES switch, simplified schematic diagram.

the recorder arm of unit A when the recorder arm is at the center of the turntable.

b. Functions of Relay K2. When relay K2 is energized, the following functions are performed:

(1) Contacts 2 and 3 (fig. 49) close to keep relay K2 energized.

(2) Contacts 9 and 8 close to connect recorder head E3 (of unit A) to the output of the recorder amplifier.

(3) Contacts 5 and 6 close to connect power to the turntable motor of unit A (par. 48*b*(2)).

50. Change-over Relay K3

a. Energizing Relay K3. Change-over relay K3 (fig. 17®) automatically operates the recording circuits of unit B when unit B is used for recording. The energizing of relay K3 is similar to the energizing of relay K2 (par. 49*a*). However, the switches associated with relay K3 are the T.T. SELECTOR-B switch, overlap switch S9 (operated by the recorder arm of unit A), and overlap switch S11 (operated by the recorder arm of unit B). Capaci-

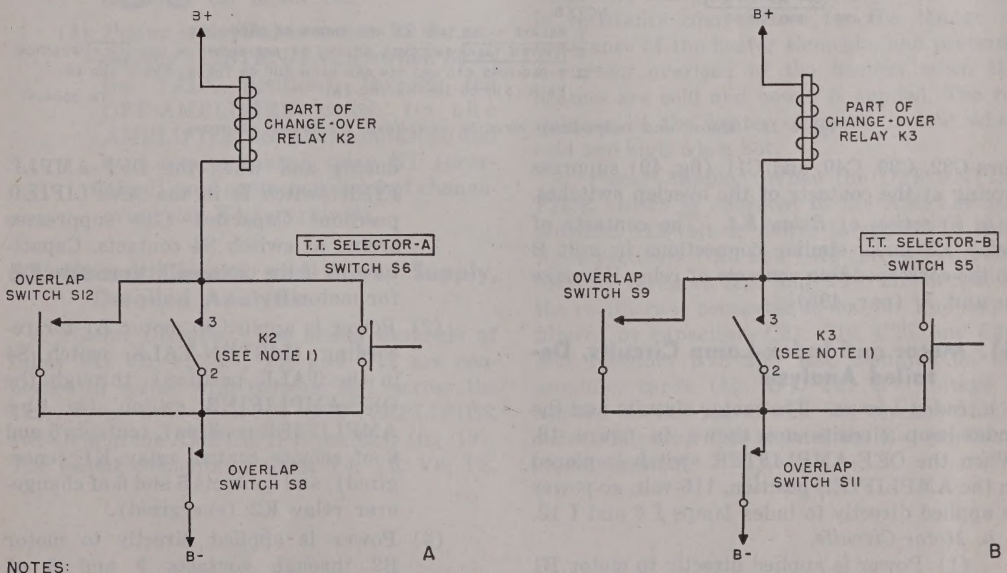


Figure 17. Part of change-over relays K2 and K3 and associated switches, simplified schematic diagram.

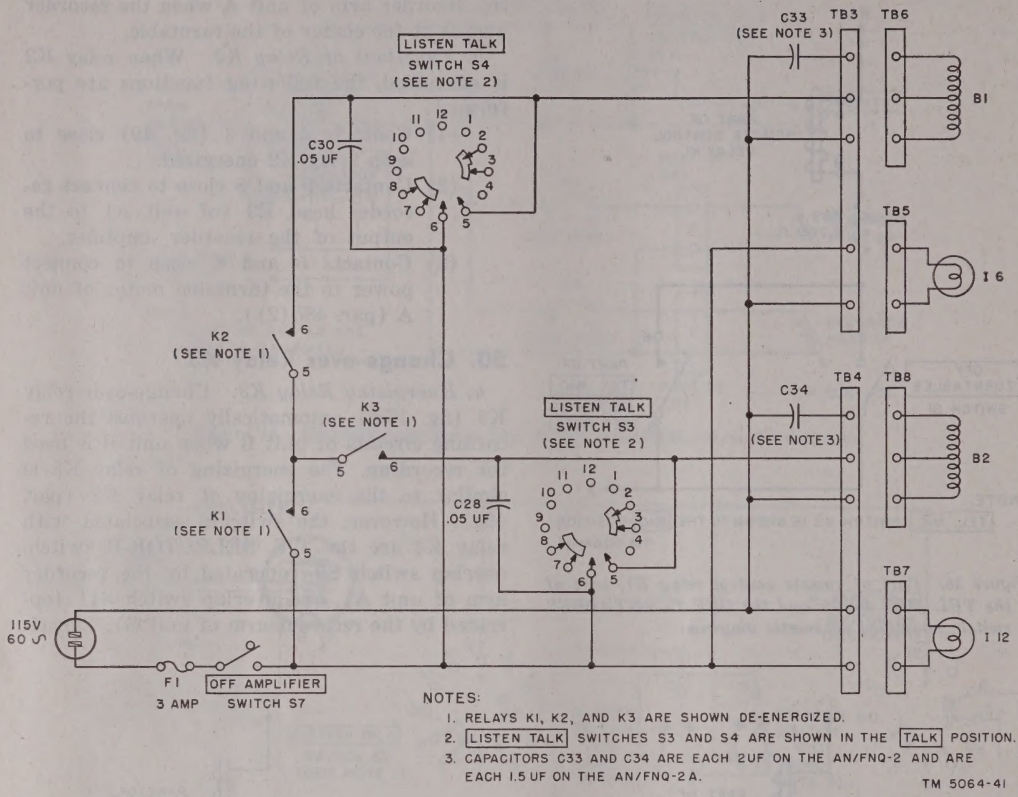


Figure 18. Motor and index-lamp circuits, simplified schematic diagram.

tors C32, C39, C40, and C11 (fig. 49) suppress arcing at the contacts of the overlap switches.

b. Function of Relay K3. The contacts of relay K3 make similar connections in unit B as the corresponding contacts of relay K2 make in unit A (par. 49*b*).

51. Motor and Index-Lamp Circuits, Detailed Analysis

a. Index Lamps. The motor circuits and the index-lamp circuits are shown in figure 18. When the OFF-AMPLIFIER switch is placed in the AMPLIFIER position, 115-volt, ac power is applied directly to index lamps I 6 and I 12.

b. Motor Circuits.

(1) Power is applied directly to motor B1 through contacts 5 and 6 of LISTEN-TALK switch S4 when the switch is in the LISTEN position (for reproducing and when the OFF-AMPLIFIER switch is in the AMPLIFIER position. Capacitor C30 suppresses arcing at switch S4 contacts. Capacitor C33 is the phase-splitting capacitor for motor B1.

(2) Power is applied to motor B1 for recording (LISTEN-TALK switch S4 in the TALK position), through the OFF-AMPLIFIER switch (in the AMPLIFIER position), contacts 5 and 6 of remote control relay K1 (energized), and contacts 5 and 6 of changeover relay K2 (energized).

(3) Power is applied directly to motor B2 through contacts 5 and 6 of LISTEN-TALK switch S3 when the switch is in the LISTEN position (for reproducing) and when the OFF-

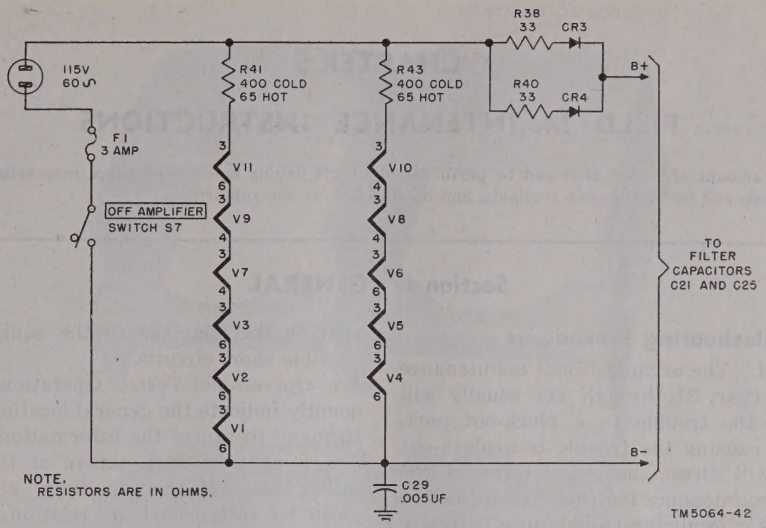


Figure 19. Heater and rectifier circuits of the recorder-reproducer set, simplified schematic diagram.

AMPLIFIER switch is in the AMPLIFIER position. Capacitor C28 suppresses arcing at switch S3 contacts. Capacitor C34 is the phase-splitting capacitor for motor B2.

(4) Power is applied to motor B2 for recording (LISTEN-TALK switch S3 in the TALK position), through the OFF-AMPLIFIER switch (in the AMPLIFIER position), contacts 5 and 6 of remote control relay K1 (energized), and contacts 5 and 6 of changeover relay K3 (energized).

52. Heater Circuits and Power Supply, Detailed Analysis

a. Heater Circuits. The heater elements of tubes V1, V2, V3, V7, V9, and V11 are connected in series with resistor R41 across the 115-volt ac line when the OFF-AMPLIFIER switch is in the AMPLIFIER position (fig. 19). The heater elements of tubes V4, V5, V6, V8, and V10 are connected in series with resistor R43 across the 115-volt line when the OFF-AMPLIFIER switch is in the AMPLIFIER position. Resistors R41 and R43 are 400 ohms when cold and 65 ohms when hot. This change in resistance compensates for the change in resistance of the heater elements, and prevents a current overload of the heaters when the heaters are cold and power is applied. The resistance of the heater elements is low when cold and high when hot.

b. Power Supply. When the OFF-AMPLIFIER switch is operated to the AMPLIFIER position, 115-volt ac power is applied to half-wave rectifiers CR3 and CR4 through current-limiting resistors R38 and R40. The output of the rectifiers is connected to one B+ line and is filtered by capacitors C21, C16, C25, and C26, and resistors R18 and R26 mounted on the amplifier cards (fig. 49). The B+ voltage is applied to the plates and the screens of the tubes. Capacitor C29 isolates the B— line from chassis ground.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

Note. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available, and by the skill of the repairman.

Section I. GENERAL

53. Troubleshooting Procedures

a. General. The organizational maintenance procedures (par. 31 through 41) usually will sectionalize the trouble to a pluck-out part, if the part causing the trouble is a pluck-out part, and will direct the replacement of the part. Field maintenance instructions outline the procedures for localizing trouble to a defective circuit element or mechanical part and direct the replacement of the defective element or part.

b. Sectionalization and Localization of Trouble. The testing methods listed in paragraph 54 will aid in isolating the source of trouble. Follow the procedures in the order given. The servicing operation should cause no further damage to the equipment. Localize the trouble to a single stage or circuit. Then isolate the trouble to a part within that stage or circuit by appropriate voltage, resistance, or continuity measurements.

Note. Before troubleshooting a defective AN/FNQ–2(*), read paragraph 55 on differences in models.

54. Testing Methods

a. Visual Inspection. The purpose of visual inspection is to locate any visible trouble. Through this inspection alone, the repairman frequently may discover the trouble, or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the equipment, which might occur through improper servicing methods, and in forestalling future failures.

b. Checking for Shorts. The B+ and filament supply circuits should be checked for possible shorts before the equipment is tested with power applied. These measurements prevent further damage to the equipment from possible short circuits.

c. Operational Tests. Operational tests frequently indicate the general location of trouble. In many instances the information gained will determine the exact nature of the fault. To utilize this information fully, all symptoms must be interpreted in relation to one another. To make an operational test of the AN/FNQ–2(*), use the equipment performance check lists (par. 41).

d. Troubleshooting Charts. The trouble symptoms listed in this chart will aid in localizing trouble. The field maintenance troubleshooting chart can be used to determine the defective part or circuit (par. 60).

e. Intermittents. If intermittents are present, this type of trouble often may be made to appear by tapping or jarring the suspected part. It is possible that the trouble is not in the equipment itself but in the installation, or it may be caused by external conditions. In this event, test the installation, if possible.

55. Differences in Models

The AN/FNQ–2A is identical in appearance to and performs the same functions as the AN/FNQ–2. However, several circuit elements of the former are missing from or are different from those in the latter (fig. 49). The chart below lists the differences.

Circuit element	AN/FNQ–2	AN/FNQ–2A
Varistor E24		Not used
Capacitors C33 and C34	2 μf	1.5 μf
Capacitors C5, C6, and C7	.01 μf	.005 μf
Capacitor C17	1 μf	.25 μf
Capacitor C14	.25 μf	.02 μf
Rectifiers CR1 and CR2	Germanium	Selenium
Resistor R27	100 K	400 K
TEL.-VOL. control R49	25 ohms	500 ohms
Resistor R56	Not used	33 ohms

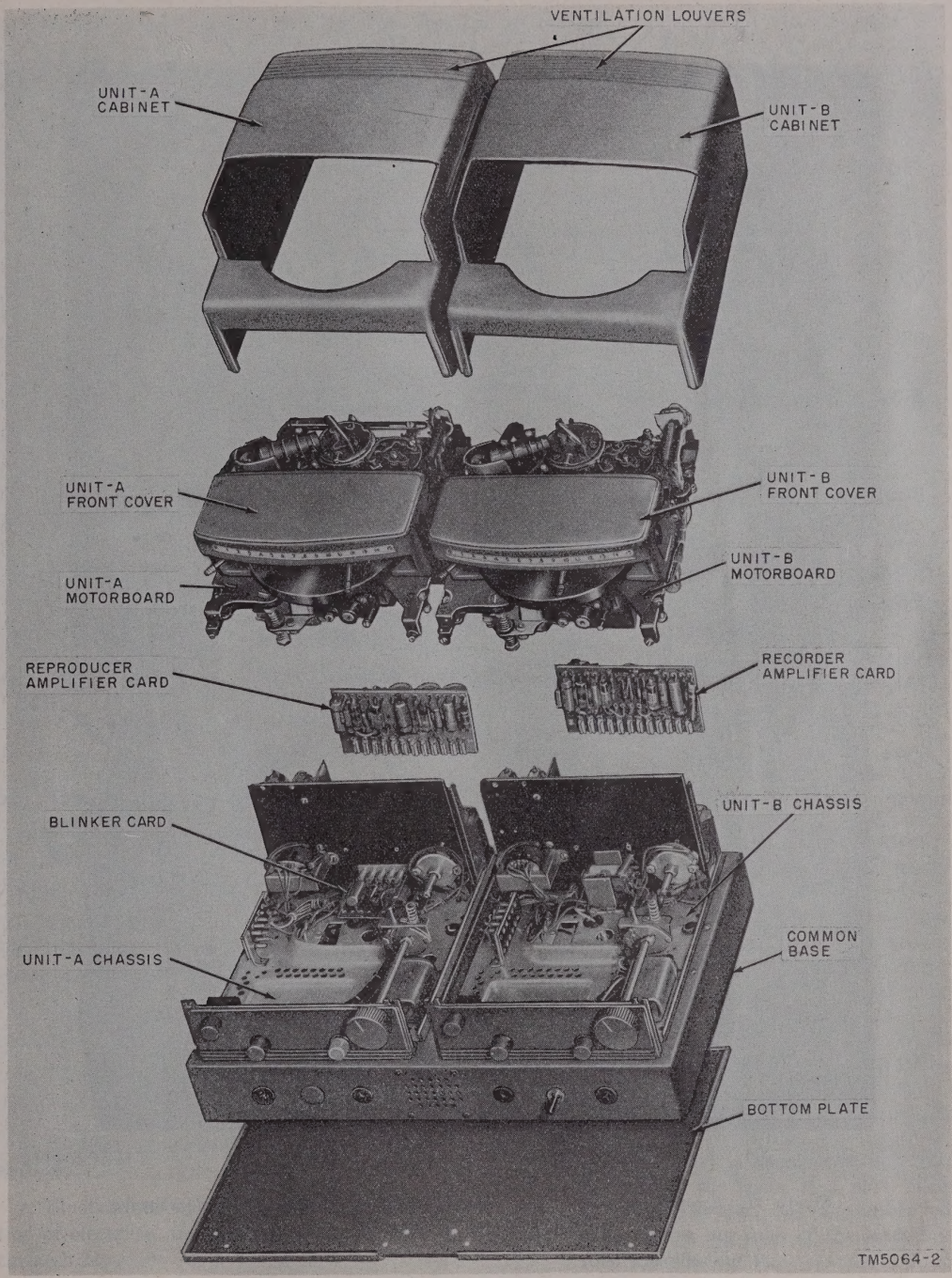


Figure 20. Recorder-reproducer set, exploded view.

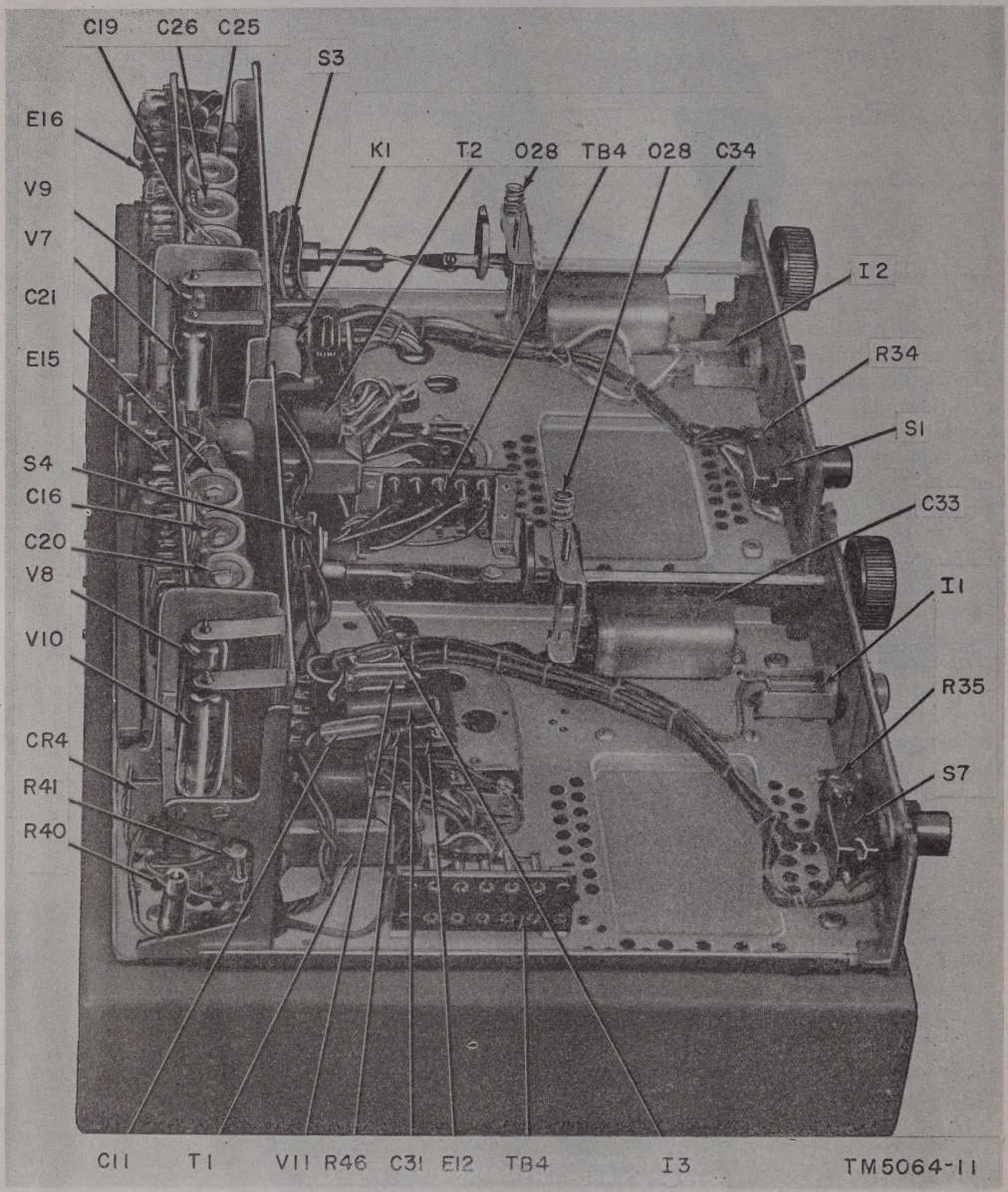


Figure 21. Recorder-reproducer set, cabinets and motorboards removed, showing location of circuit elements.

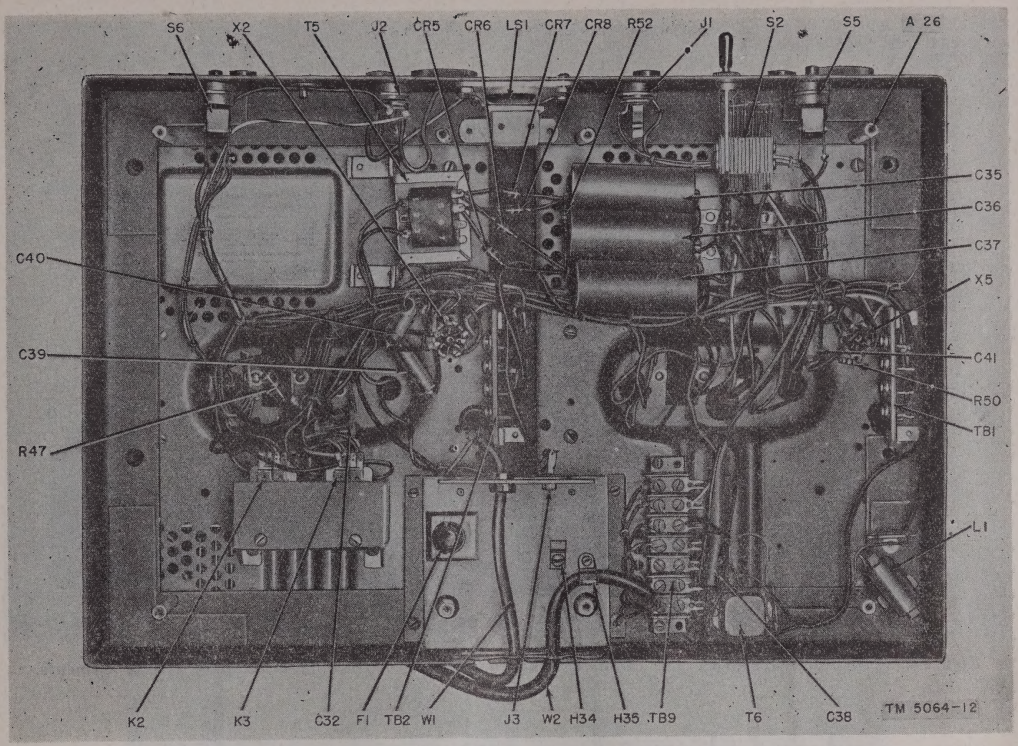


Figure 22. Recorder-reproducer set, bottom plate removed, bottom view, showing location of circuit elements.

56. Troubleshooting Data

Listed in *a* through *e* below are the diagrams and figures that may be used for troubleshooting and locating faults in the AN/FNQ–2(*).

a. Complete schematic diagram (fig. 49). This diagram includes the values of all the resistors and capacitors.

b. Simplified block diagram of the electronic circuits (fig. 12).

c. Tube socket voltage and resistance measurements (fig. 26).

d. Resistor and capacitor color codes (fig. 47 and 48).

e. Illustrations of equipment showing location of electrical and mechanical parts (fig. 20 through 24).

57. General Precautions

Whenever the AN/FNQ–2(*) is serviced, observe the following precautions carefully:

a. Be careful when working on the equipment when the power is on. Even with the OFF-AMPLIFIER switch in the OFF position, line voltage is present in part of the power supply circuits. To remove power from the AN/FNQ–2(*) completely, remove the power plug from the ac supply outlet.

b. Make connections from test equipment to the recorder-reproducer set only when the OFF-AMPLIFIER switch is in the OFF position.

c. Careless replacement of parts often causes new faults. Note the following:

(1) Before a part is unsoldered, note the position of the leads. If a part, such as a transformer, has a number of connections, tag each of the leads before unsoldering it.

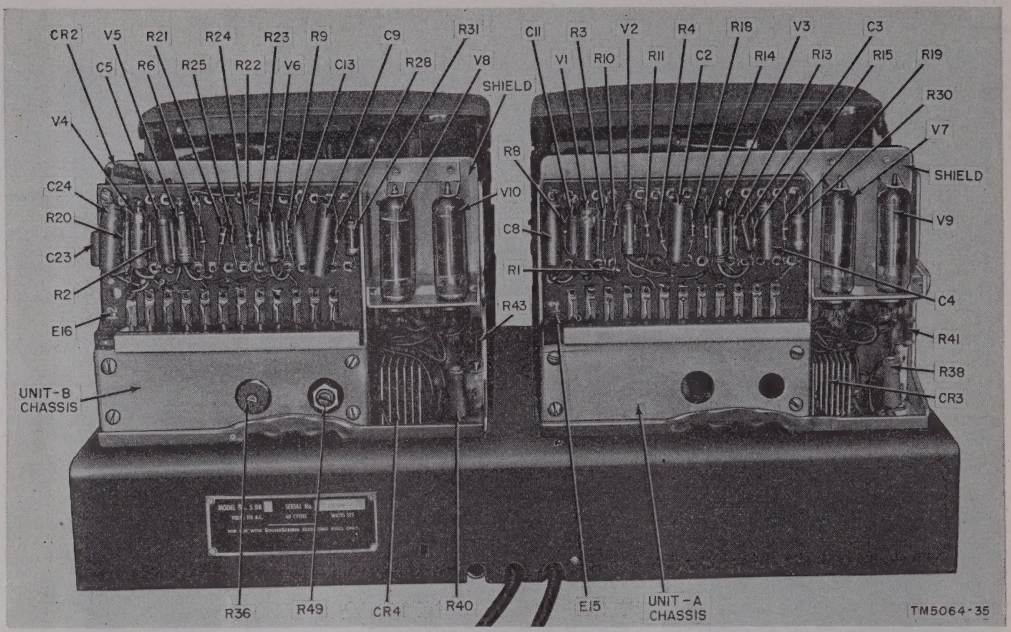


Figure 23. Recorder-reproducer set, cabinets removed, rear view, showing location of circuit elements.

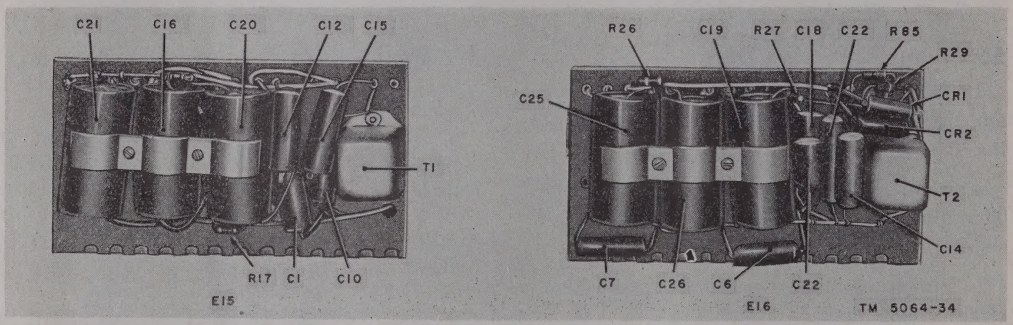


Figure 24. Reproducer amplifier card E15 and recorder amplifier card E16, rear view, showing location of circuit elements.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the equipment because they may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, because a poorly soldered joint is one of the most difficult faults to find.

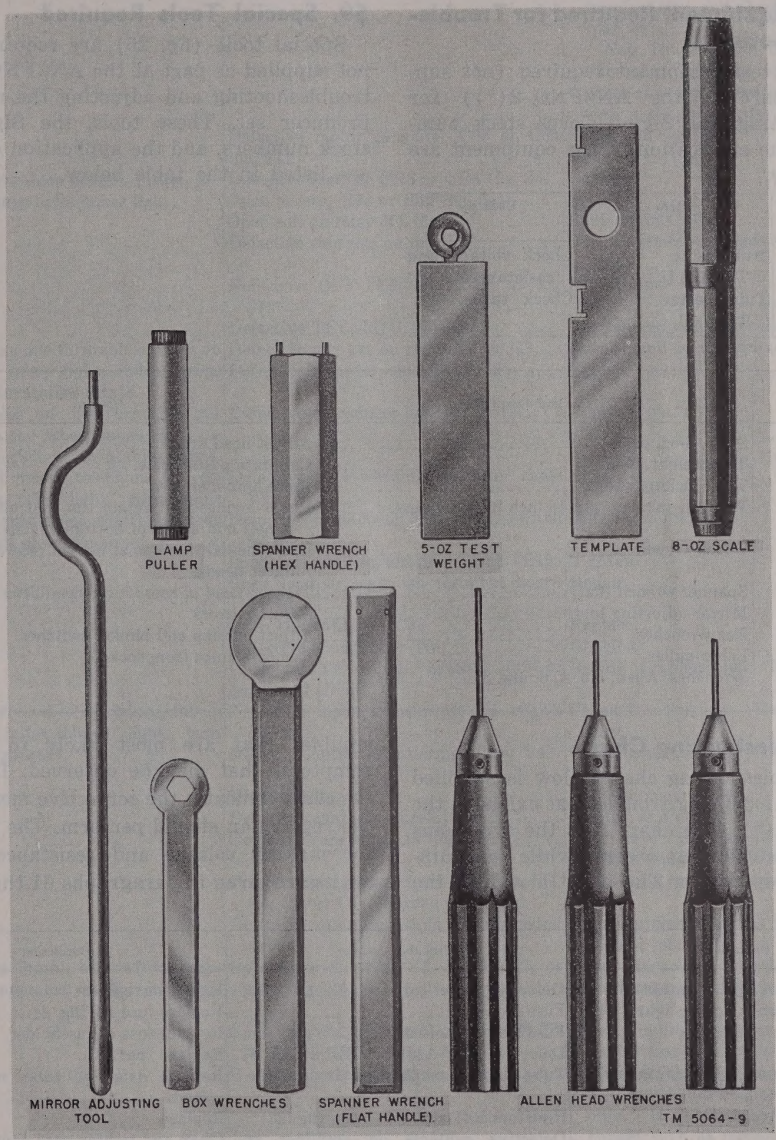


Figure 25. Special tools required for making adjustments and troubleshooting.

Section II. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

58. Test Equipment Required for Troubleshooting

Items of test equipment required (not supplied as part of the AN/FNQ–2(*)) for troubleshooting, the Signal Corps stock numbers, and the application of the equipment are listed below.

Signal Corps stock No.	Item	Used to
3F4325–297	Multimeter TS–297/U	Check voltage and resistance.
3F3952–3	Tube Tester TV–7/U	Check tubes.

59. Special Tools Required

Special tools (fig. 25) are required but are not supplied as part of the AN/FNQ–2(*) for troubleshooting and adjusting the recorder-reproducer set. These tools, the Signal Corps stock numbers, and the application of the tools are listed in the table below.

Signal Corps stock No.	Name and description	Used to
6Z8078	Scale, 8-oz, postal	Adjust head drag.
6Z9444–1	Test weight, 5-oz	Calibrate postal scale.
6R38635–3	Tool, pickup, wedge	Raise amplifier card.
6R57549–2	Wrench, spanner, pin ½ inch between pins	Remove rings that retain the controls on the front panels and apron of bottom chassis.
6R55209.3	Offset wrench	Lock one-half hexagonal nut on recorder and reproducer heads.
6R57549–1	Spanner wrench (flat)	Tighten head of reproducer-head lifter.
	Mirror-adjusting tool	Adjust mirrors.
	Box wrenches	Adjust overlap and blinker switches.
	Lamp puller	Remove lamps from sockets.
	Wrenches, Allen, No. 4, 6, and 8	

60. Troubleshooting Chart

The troubleshooting chart below is supplied as an aid in localizing trouble that exists in the AN/FNQ–2(*). The chart lists the symptoms that the repairman can observe while the equipment is in operation. The chart also lists the troubles that are most likely to cause the symptoms that may be observed. In addition, the chart indicates the corrective measures that the repairman should perform. The procedures for making voltage and resistance measurements are given in paragraphs 61 through 64.

Symptoms	Probable trouble	Correction
1. Tubes do not light, turntables do not rotate, lamps do not light.	Defective power cable	Repair or replace.
	Fuse blown	Replace fuse F1 (fig. 4).
	Fuse loose in holder	Replace fuse or fuseholder.
	Defective OFF-AMPLIFIER switch S7	Replace (par. 70).
2. Tubes do not light, turntables rotate.	Tube filament or filament circuit open	Replace defective tube, repair broken leads.
	Resistors R41 and R43 open (fig. 23)	Replace.
	Defective contacts on amplifier and blinker cards (fig. 20).	Clean and tighten card contacts. Check soldered joints.
3. One turntable operates, the other does not, lamps and tubes light.	Defective coil, relay K2	Replace (par. 69).
	Defective contacts on relay K2 or K3 (fig. 22).	Burnish and adjust contacts.
	Defective T.T. SELECTOR-A or T.T. SELECTOR-B switches (S5 or S6).	Burnish and adjust contacts.

Symptoms	Probable trouble	Correction
	Open motor coil	Clean and resolder connections at motor terminal strip and plug. Replace motor (par. 69). *Note.* If a motor of the AN/FNQ–2 must be replaced, also replace its phase-splitting capacitor (C33 or C34) with a 1.5-μf capacitor.
	Defective motor capacitor C33 or C34 (fig. 21).	Check and replace.
4. Both turntables do not rotate, index lamps light, tubes light.	Defective rectifier CR3 or CR4 (fig. 23)	Replace.
	Open resistor R38 or R40 (fig. 23)	Replace.
	Open coil on relay K1 (fig. 21)	Replace (par. 69).
	Defective contacts on relay K1	Burnish contacts, adjust them if necessary.
	Defective OFF-TURNTABLES switch S1.	Replace (par. 70).
	Defective TEL.-MIC. switch S2	Burnish and adjust contacts.
5. Records on one turntable but not on other, tubes light, index lamps light, turntables rotate.	Defective contact on relay K2 or K3	Burnish and adjust contacts.
	Defective recorder head E3 or E2	Replace (par. 67).
6. Reproduces on one turntable but not on the other, tubes light, index lamps light, turntables rotate.	Defective reproducer head E1 or E2	Replace (par. 68).
7. Does not record telephone conversations, tubes light, index lamps light, turntables rotate, records with aid of microphone.	Defective tone warning generator cable W2.	Repair.
	Defective contacts on TEL.-MIC. switch S2 (fig. 22).	Burnish and adjust.
	Loose terminals on terminal board TB10	Tighten.
	Open lead or leads on terminal board TB10.	Repair.
	Open 1-μf capacitor C38	Replace.
	Defective transformer T6	Replace.
	Defective TEL.-VOL. control R49 or associated circuit.	Repair or replace (par. 70).
8. Does not record or reproduce, tubes light, index lamps light, turn tables rotate.	Defective input transformer T1 or T2 (fig. 21).	Check transformers. Replace, if necessary.
	Defective output transformer T3 or T4	Check transformers. Replace, if necessary.
	Shorted tubes	Replace output tubes.
	Defective contacts on relay K1	Burnish and adjust.
	Defective card contacts (fig. 20)	Clean card contacts and pinch together. Check soldered connections.
	Open coupling capacitor (C1, C2, C4, C5, C6, or C7) between amplifiers.	Localize by test and replace.
	Defective volume controls and associated circuits.	Repair broken leads and replace defective control (par. 70).
9. Excessive hum, otherwise equipment operates satisfactorily.	Open filter capacitor C21, C16, C25, or C26 (fig. 21).	Check capacitors by shunting with a good capacitor. Replace defective capacitor.
	Open secondary of input transformer T1 or T2.	Check winding resistance, and replace defective transformer (par. 63).
	B— line shorted to chassis ground	Resistance between chassis ground and B— line should be greater than 1 megohm. If not, locate grounded component such as motor, recorder head, or stray piece of solder which may be shorting B— line to chassis ground (fig. 26).
	Defective tube	Replace defective tube.

Symptoms	Probable trouble	Correction
10. Weak output while recording or reproducing, but remainder of equipment operates satisfactorily.	Low plate voltage	Replace defective resistor or capacitor causing low plate voltage. Do not stop taking voltage measurements when the first suspicious reading is made. Test all voltages before trying to locate trouble. The fault may be caused by positive voltage on a control grid (par. 62).
	Dc voltage on grid	This condition is caused by a leakage in coupling capacitor C1, C2, C3, C4, C5, C6, or C7. Replace defective capacitor.
	No cathode voltage	May be caused by shorted cathode bypass capacitor. Check and replace defective capacitor.
11. Quality of recorded disk is poor, lower pitched (tone) than normal.	Defective resistor R45, capacitor C27, or associated circuit elements in recorder amplifier (fig. 20).	Replace defective part or repair associated circuit.
12. Quality during reproduction poor, higher pitched (tone) than normal.	Defective capacitor C42 (in parallel with P.B. VOL. control circuit).	Replace defective part or repair associated circuit.
13. Overlap recording time between turntables is too short or too long.	Switch S8, S9, S11, or S12 defective or out of adjustment.	Refer to paragraph 72*h*.
14. 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 touch bottom chassis.
15. Short term light-beam separation Light beams are together at zero when recording starts, but separate during the 15-minute recording time and line up again when the recorder and reproducer heads are brought against their outside stops by raising front cover.	Defective gear sectors on recorder- and reproducer-head arms (fig. 34 and 35).	Clean teeth of gear sectors, remove any burrs, replace if necessary.
	Insufficient reproducer-head drag.	Adjust reproducer-head drag (par. 73*d*).
16. Wide light-beam separation. Light beams are together at zero when recording starts, but separate after recording for a period of time. The light beams do not line up again when the recorder and reproducer heads are brought against their outside stops by raising front cover.	Heads are not against their outside stops.	Check retracting link and outside stops to be sure heads are against their respective stops.
	Drive shafts of the recorder and reproducer heads not always parallel when turning.	Replace motorboard (par. 69*a*).
17. Cross talk	Recorder-head cartridge not level	Level cartridge (par. 72*b*).
	Incorrect recorder-head stylus pressure.	Adjust recorder-head stylus pressure (par. 72*c*).
	Intermittent cross talk caused by poor groove spacing.	Check pattern of groove spacing and change motorboard if required (par. 69*a*).
	Defective recorder-head cartridge	Replace.
18. Double talk	Recorder-head cartridge not level	Level cartridge (par. 72*b*).
	Incorrect recorder-head stylus pressure	Adjust recorder-head stylus pressure (par. 72*c*).
	Defective recorder-head cartridge	Replace.
19. Tearing of disk	Recorder-head cartridge not level	Level cartridge (par. 72*b*).
	Incorrect recorder-head stylus pressure	Adjust recorder-head stylus pressure (par. 72*b*).
	Defective recorder-head cartridge	Replace.

Symptoms	Probable trouble	Correction
20. Acoustic feedback	Microphone too close to recorder-reproducer set.	Relocate microphone to minimize feedback.
	Dressing of leads	Be sure input leads from microphone socket are dressed away from output transformer.
21. Intermittent operation	Poor card contact	Move card back and forth. Pinch contacts of card together.
	Poor connection at solderless connectors	Check solderless connectors on leads of reproducer cartridge.
	Poorly soldered joints	Check all soldered joints, particularly those on amplifier card. Resolder where necessary.

61. Voltage Measurements, General

Voltage measurements are almost an indispensable aid to the repairman, because the source of trouble may be detected by the presence of abnormal voltages. The measurements should be made when checking the power supply circuits of the AN/FNQ–2(*) for possible trouble. In the other circuits of the AN/FNQ–2(*), the measurements should be made only after the trouble has been localized to a particular circuit. Voltage measurements are made without necessitating unsoldering the circuit elements by following the instructions in *a* through *c* below.

a. Use the information given on normal readings in figure 26. Begin by setting the voltmeter on the highest range, so that the voltmeter will not be damaged. Then, if it is necessary to obtain increased accuracy, set the voltmeter to a lower range.

b. A reading can be obtained while checking cathode voltage, although the cathode resistor is 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 the B— line. Before the cathode voltage is measured, a resistance check should be made when the circuit is cold to determine whether the cathode resistor is normal.

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

62. Typical Voltage Measurements

Figure 26 shows typical voltage readings taken at the pins of the tubes of the AN/FNQ–2(*). These readings are useful when localizing trouble to the particular circuit element at fault.

a. Measurements in the AN/FNQ–2(*) being tested which differ from the measurements in the figure, often will indicate trouble that may be localized to a particular circuit element. Small variations in voltage values do not indicate necessarily that trouble exists in the circuit associated with the variant measurement. Readings in a particular circuit of the AN/FNQ–2(*) may vary as much as 10 percent, and the circuit still may operate properly.

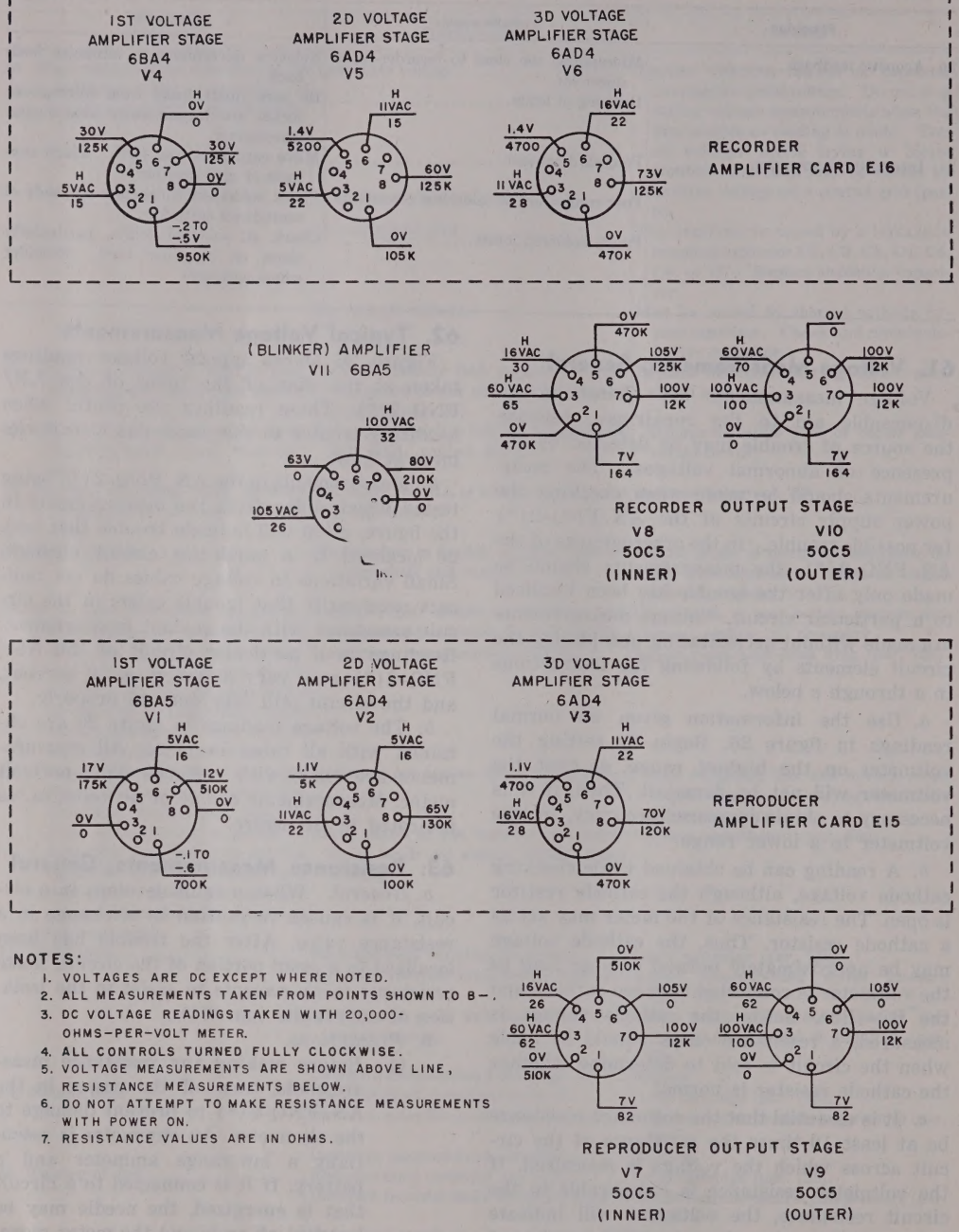
b. The voltage readings in figure 26 are obtained with all tubes in place. All measurements are made with a 20,000 ohms-per-volt meter. Measurements are dc or ac voltages, as indicated in the figure.

63. Resistance Measurements, General

a. General. When a fault develops in a circuit, it is caused very often by a change in a resistance value. After the trouble has been localized to a small portion of the circuit, make resistance measurements to assist in the isolation of such faults (par. 64).

b. Precautions.

(1) Before making any resistance measurements, turn off the power in the AN/FNQ–2(*) to prevent damage to the ohmmeter. An ohmmeter is essentially a low-range ammeter and a battery. If it is connected to a circuit that is energized, the needle may be knocked off-scale and the meter movement may be burned out.



NOTES:

1. VOLTAGES ARE DC EXCEPT WHERE NOTED.
2. ALL MEASUREMENTS TAKEN FROM POINTS SHOWN TO B−.
3. DC VOLTAGE READINGS TAKEN WITH 20,000-OHMS-PER-VOLT METER.
4. ALL CONTROLS TURNED FULLY CLOCKWISE.
5. VOLTAGE MEASUREMENTS ARE SHOWN ABOVE LINE, RESISTANCE MEASUREMENTS BELOW.
6. DO NOT ATTEMPT TO MAKE RESISTANCE MEASUREMENTS WITH POWER ON.
7. RESISTANCE VALUES ARE IN OHMS.

TM 5064-13

Figure 26. Sound Recorder-Reproducer Set AN/FNQ-2(*), tube socket voltage and resistance measurement diagram.

(2) Discharge capacitors before making resistance measurements. This is important when checking power supplies that are disconnected from their load because the discharge of a capacitor through the meter may burn its movement and in some cases may endanger life.

c. Use of Low and High Ranges. When checking circuit continuity, the ohmmeter should be set on the lowest range. If a medium or high range is used, the pointer may indicate zero ohm, even if the resistance is as high as 500 ohms. When checking high resistances or measuring the leakage resistance of capacitors or cables, the highest range should be used.

d. Parallel Resistance Connections.

(1) When a resistance is measured and the value is found to be less than expected, make a careful study of the schematic to be sure that there are no resistors or transformer windings 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 be sure that the low reading does not occur because of parallel connections to the resistor.

(2) Before checking transformer winding resistances, tag and remove all external connections from the terminals of the transformer winding. This permits the measurement of the winding resistance with no parallel path across the winding. Note that the tolerance values for transformer windings are generally between 1 and 5 percent.

e. Checking Grid Resistance. When checking grid resistance, a false reading may be obtained if the tube is still warm and the cathode is emitting electrons. Allow the tube to cool, or reverse the ohmmeter test leads so that the negative test lead of the ohmmeter is applied to the grid.

64. Typical Resistance Measurements

Refer to figure 26 for typical resistance measurements at the pins of the tube sockets.

a. To locate the faulty part, measure the resistance in parts of the circuit other than those given in figure 26. The normal resistance values at any point can be determined by referring to the resistance values shown in the schematic diagram (fig. 49) or by use of the color codes (figs. 47 and 48).

b. Some resistors are connected across capacitors in the circuit. When making resistance measurements, the initial indication on the meter will be lower than the reading when the indicator comes to rest. Wait for the indicator to reach a steady position before taking the reading.

Section III. REPAIR INSTRUCTIONS

65. General

a. Use of Proper Tools. Handle tools carefully; always use screwdrivers and pliers of the correct size to remove or replace parts of the equipment.

b. Leads.

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

(2) Be careful not to damage leads adjacent to parts being removed.

c. Soldering. Make good solder joints; poorly soldered connections can cause trouble that 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 well-soldered joint. Do not permit drops of solder to fall inside the amplifier chassis because they may cause short circuits and damage the equipment.

d. Defective Circuit Element. When a defective circuit element such as a burned-out resistor is located, check the associated circuit thoroughly to determine whether this condition is caused by another faulty element. For example, a burned-out 33-ohm resistor (R38) may be caused by a defective rectifier, CR3 (fig. 49). Still further, a defective 50-μf filter capacitor (C21) could be the cause of both the burned-out 33-ohm resistor (R38) and the defective rectifier (CR3). If the resistor is replaced without replacing the other defective elements, the new

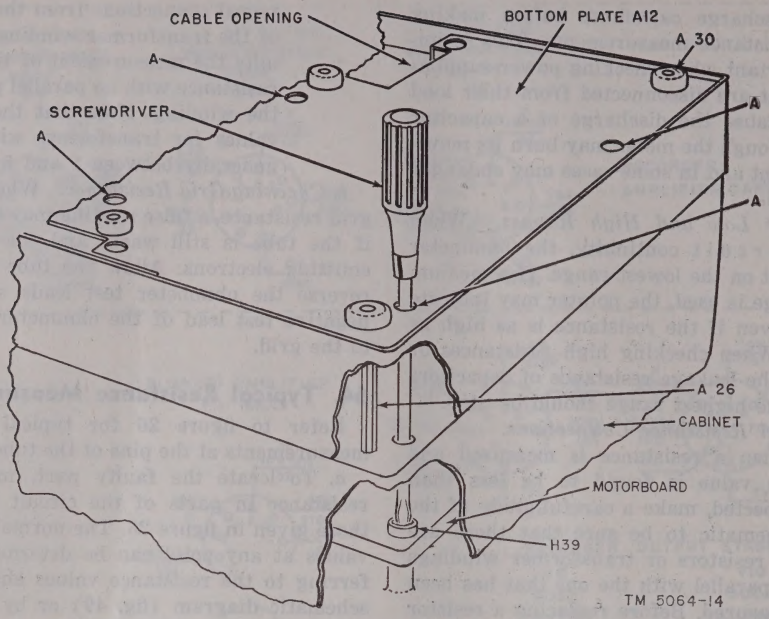


Figure 27. Cutaway view of part of bottom of recorder-reproducer set, insertion of screwdriver for removal of screws that hold cabinet.

resistor will burn out in the same way. Careless replacement of circuit elements often causes new faults.

66. Removal of Cabinet, Front Cover, Index Scale, Bottom Plate, Index Lamp and Retracting Mechanism

a. Cabinets (fig. 27).

(1) Remove the power cable connector from the power source. Operate the LISTEN-TALK switches to the LISTEN position, place the reproducer-head handles in their latches, and turn the set upside down.

(2) Place a 6-inch, $\frac{5}{32}$-inch blade screwdriver through holes A and loosen the four screws (H39).

Note. Cabinet screws H39 are captive in the motorboard (fig. 33). It is possible to unscrew them through the motorboard to remove them, but normally the unthreaded portion of the screw should remain in the threaded portion of the motorboard.

(3) The cabinet now is loose; keep one hand on the bottom and the other on the top, and turn the set right side up.

(4) Move the recorder and reproducer heads to the center of the disks as far as possible. Raise the front cover slightly, hold the reproducer latch out of the way, and lift the cabinet (fig. 28).

(5) To replace the cabinet, reverse the procedure. Be careful of the capacitor (located on the right side of each unit) that is connected to the LISTEN-TALK switch. Dress the leads of these capacitors so that they will not obstruct the cabinet when it is replaced.

b. Front Cover (fig. 29).

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

(2) Remove C washer H54 from the retracting link, and unhook tension spring O 46.

(3) Remove screws H30 and H29, and lift off the front cover.

(4) To replace the front cover, reverse the procedure.

c. Index Scale N1 (fig. 30).

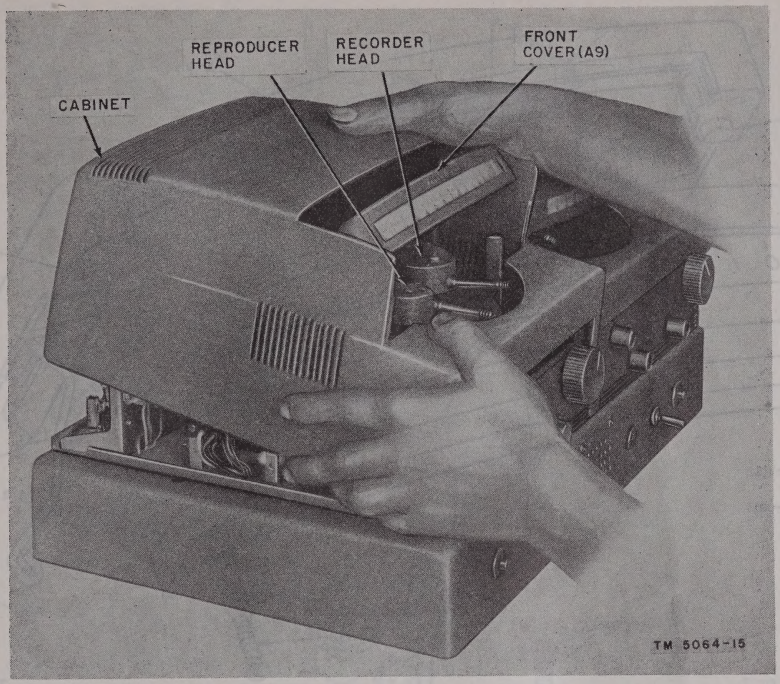


Figure 28. Left-side view of recorder-reproducer set, method of removing cabinet.

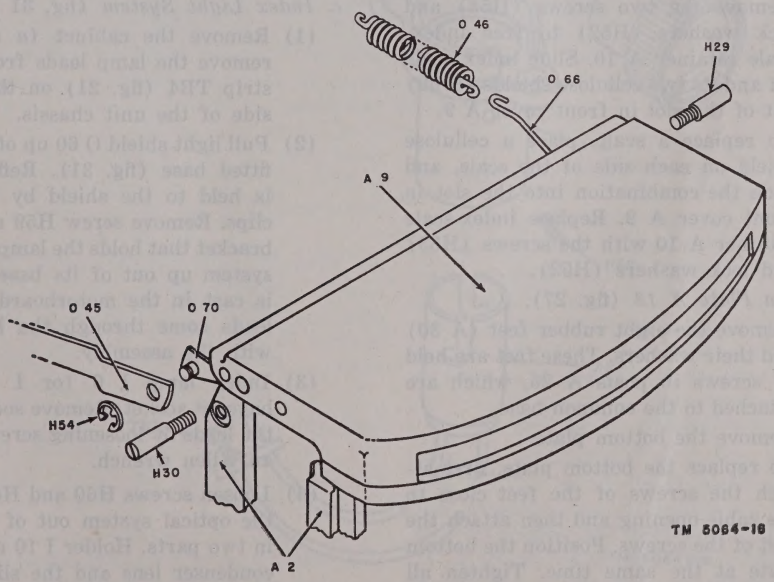


Figure 29. Front cover and its mounting parts (one unit of the recorder-reproducer set), exploded view.

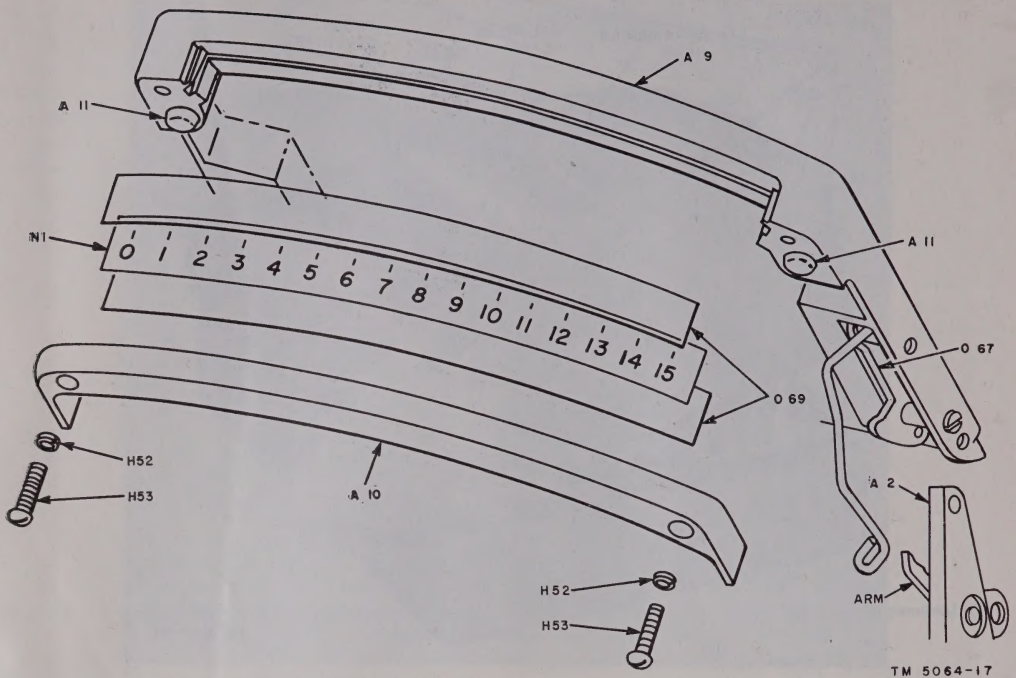


Figure 30. Index scale and its mounting parts, (one unit of the recorder-reproducer set), exploded view.

(1) Remove the two screws (H53) and lock washers (H52) to free index-scale retainer A 10. Slide index scale N1 and its two cellulose shields (O 69) out of the slot in front cover A 9.

(2) To replace a scale, place a cellulose shield on each side of the scale, and slide the combination into the slot in front cover A 9. Replace index-scale retainer A 10 with the screws (H53) and lock washers (H52).

d. Bottom Plate A 12 (fig. 27).

(1) Remove the eight rubber feet (A 30) and their washers. These feet are held by screws in posts A 26, which are attached to the common base.

(2) Remove the bottom plate.

(3) To replace the bottom plate, first attach the screws of the feet close to the cable opening and then attach the rest of the screws. Position the bottom plate at the same time. Tighten all the screws.

e. Index Light System (fig. 31 and 42).

(1) Remove the cabinet (*a* above) and remove the lamp leads from terminal strip TB4 (fig. 21) on the left-hand side of the unit chassis.

(2) Pull light shield O 60 up off its spring-fitted base (fig. 31). Reflector O 61 is held to the shield by four folded clips. Remove screw H59 and pull the bracket that holds the lamp and optical system up out of its base. This base is cast in the motorboard. The lamp leads come through the hollow base with the assembly.

(3) Index lamp I 6 (or I 12) has a bayonet socket. Remove socket X2 and the leads by loosening screw H62 with an Allen wrench.

(4) Loosen screws H60 and H61, and pull the optical system out of its bracket in two parts. Holder I 10 contains the condenser lens and the slit disk, and holder I 11 contains the two lenses

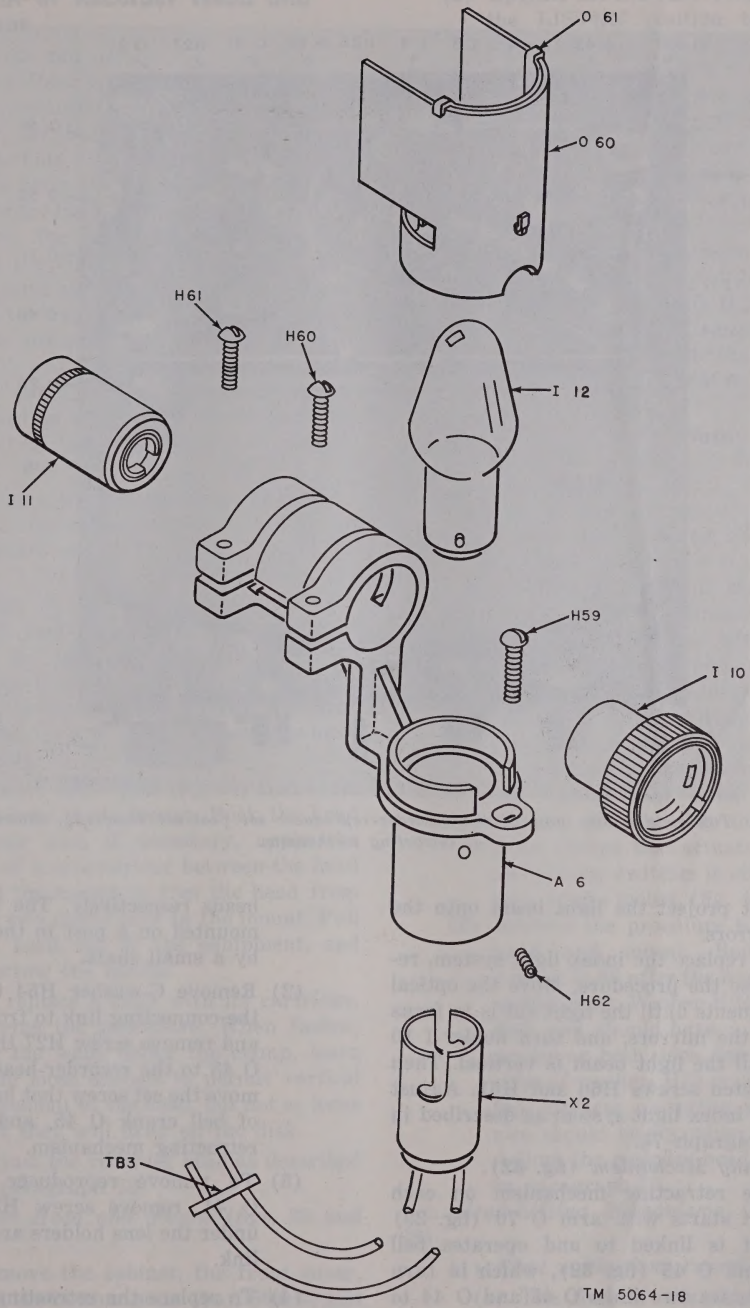


Figure 31. Index light system of one unit of the recorder-reproducer set, exploded view.

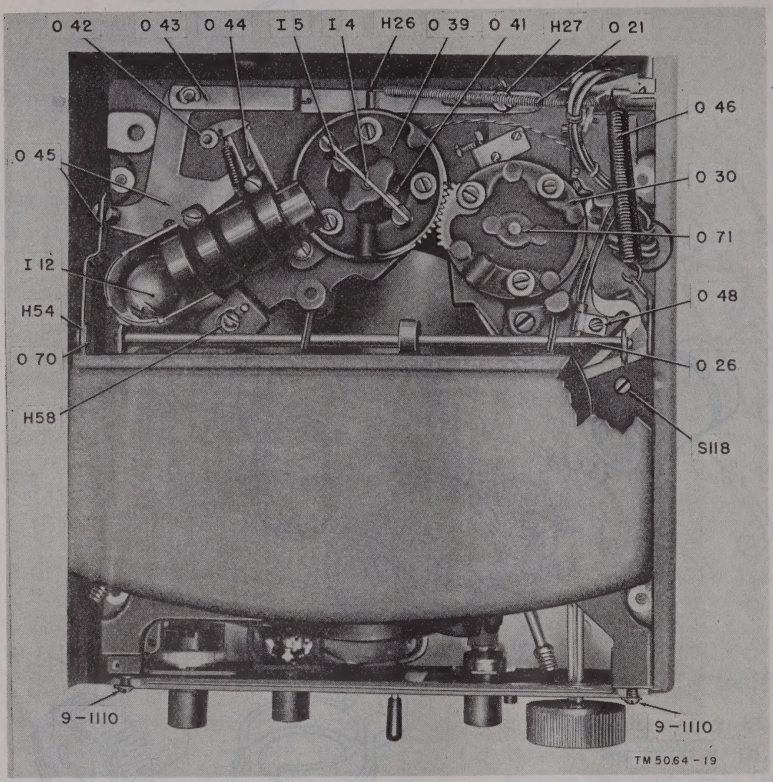


Figure 32. Top view of one unit of the recorder-reproducer set (cabinet removed), showing location of retracting mechanism.

that project the light beam onto the mirrors.

(5) To replace the index light system, reverse the procedure. Move the optical elements until the light slit is in focus on the mirrors, and turn holder I 10 until the light beam is vertical. Then tighten screws H60 and H61. Adjust the index light system as described in paragraph 74.

f. Retracting Mechanism (fig. 32).

(1) The retracting mechanism on each unit starts with arm O 70 (fig. 29) that is linked to and operates bell crank O 45 (fig. 32), which in turn actuates two links O 43 and O 44 to retract the recorder and reproducer heads respectively. The bell crank is mounted on a post in the motorboard by a small shaft.

(2) Remove C-washer H54 that attaches the connecting link to front cover A 9 and remove screw H27 that holds link O 43 to the recorder-head mount. Remove the set screw that holds the shaft of bell crank O 45, and remove the retracting mechanism.

(3) To remove reproducer mount link O 44, remove screw H28 (fig. 35) under the lens holders and lift out the link.

(4) To replace the retracting mechanism, reverse the procedure.

67. Removal of Recorder Head and Mount

(figs. 33 and 34)

a. Recorder Head.

(1) The recorder head, with its cartridge (fig. 38), is supplied as a replacement unit. This unit is fastened to a mount on a drive shaft. When replacing the recorder head, be sure the distance between the center of the drive shaft and the tip of the stylus is exactly the same as the corresponding distance for the reproducer stylus and shaft. This insures that both the recorder stylus and the reproducer stylus travel the same distance in the 15-minute recording time. Therefore, the adjustment of the cartridge pivots is critical.

(2) Remove the cabinet and the bottom plate (par. 66*a* and *d*).

(3) Operate the LISTEN-TALK switch to the LISTEN position to keep the stylus off the disk. Free the recorder-head leads from terminal board TB1 on the unit chassis, pull them up through the hole in the motorboard, and loosen clamp O 48 (fig. 32) that holds them to the recorder-head mount.

(4) Remove screw H58 (fig. 34) that holds the head to its mount. Rock the head gently and, if necessary, apply the tip of a screwdriver between the head and the mount to free the head from the two dowel pins in the mount. Pull the head out of the equipment, and unscrew the handle.

(5) To replace a head with its cartridge, reverse the procedure. When fastening the leads under the clamp, leave them loose enough to permit vertical movement of the head, but not so loose that they will drag on the disk.

(6) Adjust the recorder head as described in paragraph 72.

b. Recorder Head and Mount (figs. 33 and 34).

(1) Remove the cabinet, the front cover, and the bottom plate (par. 66*a*, *b*, and *d*). Remove the leads (*a*(3) above).

(2) Operate the LISTEN-TALK switch to the LISTEN position to keep the stylus off the disk. Slide out the C-washers on both ends of lifting rod O 26 (fig. 32), and remove them. Unhook tension spring O 21. Draw a single line across the two gear sectors so that they can be reassembled in the same position they occupied before disassembly.

(3) Remove the three screws (H18) (fig. 34) and washers, and lift the gear sector off drive shaft O 71 (fig. 32). Remove screw H27 that holds the mount to the retracting mechanism and slide the retracting mechanism out of the way.

(4) Remove screws H83 and head lifter spring O 22 (fig. 33). Unscrew lock nuts H55 and H56 (fig. 34) by holding the bottom nut with the offset wrench and loosening the other with a $\frac{7}{16}$-inch spin-type wrench. Pull the head and mount up off the drive shaft and, at the same time, rock the assembly gently so that lifter head cam follower O 23 will pull up out of its bearing. Three washers (H23 and H24) and pressure disk spring O 33 are disassembled with the mount. The recorder mount loosens on the shaft, but tightens up when it is reassembled. The bracket that holds the three screws that actuate the overlap and blinker switches is attached to the back of the mount (fig. 41).

(5) Reverse the procedure to replace the head and mount. Replace spring washer O 33 after the mount is seated on the shaft. Washer H24 is a friction disk and should have a light film of grease on both sides, but the opposite sides of washers H23 must be dry. The top surfaces of spring washer O 33 also should be dry when reassembled. Adjust the recorder head as described in paragraph 72.

c. Head-Lifting Mechanisms (figs. 30 and 33).

(1) *First mechanism, recorder heads.*

(*a*) The first of the two head-lifting mechanisms is actuated by front

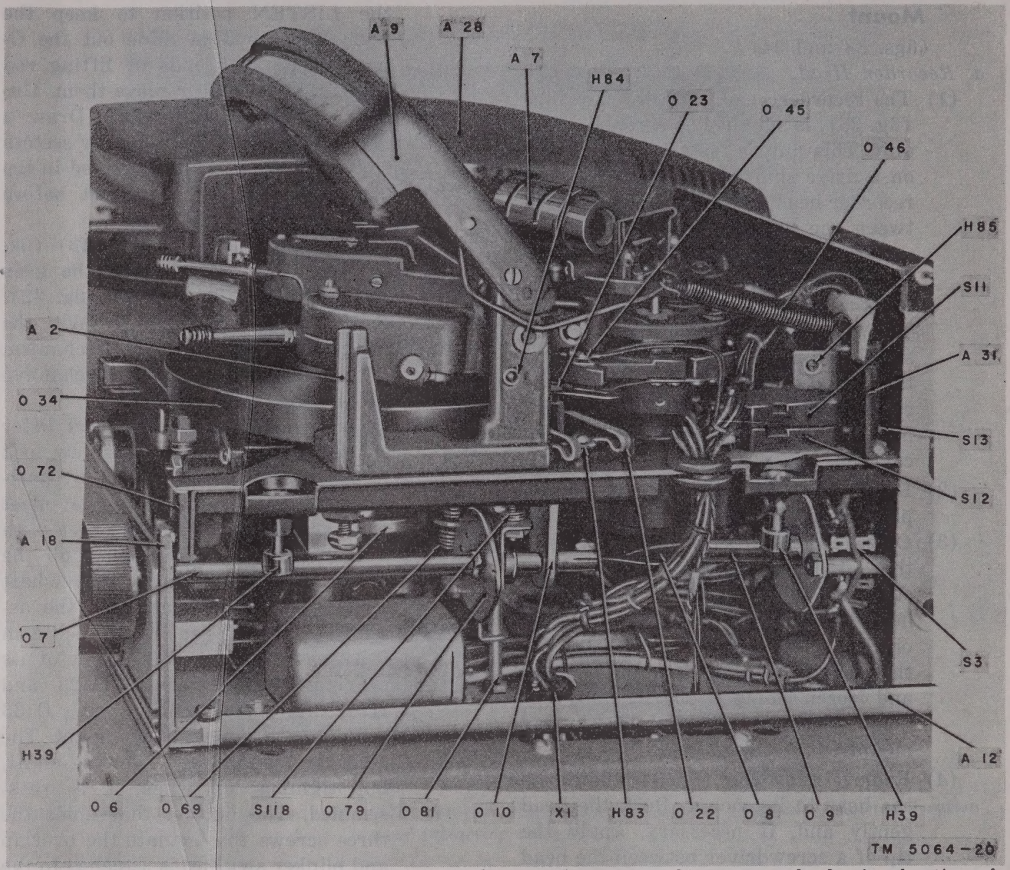


Figure 33. Right-side view of unit B of the recorder-reproducer set, cabinet removed, showing location of parts mounted on the motorboard.

cover A 9 to lift and retract both heads simultaneously. A rib, which holds cams O 67 (fig. 30), is cast in the under side of the cover in each rear corner. When the cover is raised, cams O 67 actuate the arms that are pinned to two uprights A 2 that hold the cover. Rod O 26 (fig. 32) is held between these arms. When the cover is lifted, the cams cause the arms to lift rod O 26 and the rod raises the heads by lifting the pin in a post on each mount.

(*b*) Remove the cabinet and front cover (par. 66*a* and *b*). Remove lifting rod O 26 by sliding out the retaining C-washer on each end.

(2) *Second mechanism, recorder heads.*

(*a*) The second head-lifting mechanism includes cam O 10 on LISTEN-TALK switch shaft O 7, which lifts the recorder head by raising cam follower O 23 (fig. 33).

(*b*) Remove the cabinet, front cover, and bottom plate (par. 66*a*, *b*, and *d*). Remove the LISTEN-TALK knob on the front end of shaft O 7 after loosening the set screw with an Allen wrench. Remove the screw

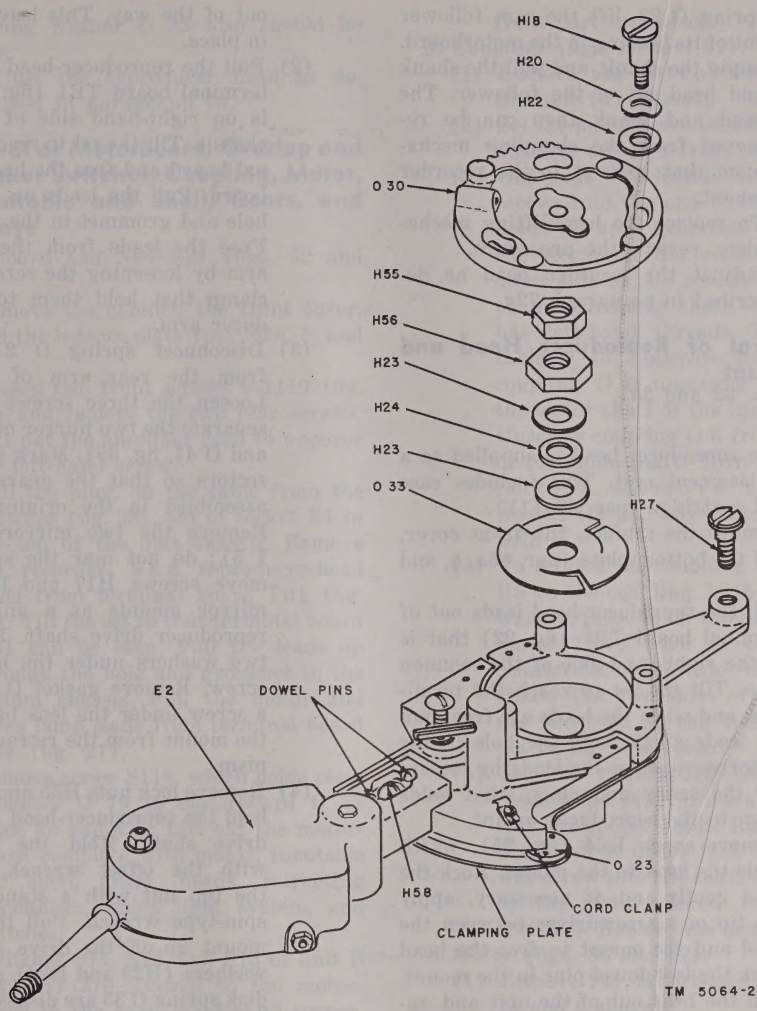


Figure 34. Recorder head and arm, exploded view.

that holds the rear end of the shaft to the flat spring.

(*c*) Shaft O 7 still is held by plate assembly O 79. Remove screw S118, which holds plates O 79 to the under side of motorboard O 72, and the two nuts that hold guide post O 81 to unit chassis A 12. Tilt the set to reach the bottom nut.

(*d*) Shaft O 7 and cam O 10 and their retaining assemblies now are free. To remove them from the unit, remove motorboard O 72 by loosening the two front screws (fig. 32). Remove the amplifier card to uncover the rear left-hand screw, and remove these screws.

(*e*) To remove cam follower O 23 (fig. 33), the entire recorder head and mount assembly must be removed as described in paragraph 67*b*. Remove screw H83 and retaining

spring O 22, lift the cam follower out of its bearing in the motorboard, unpin the shank, and pull the shank and head out of the follower. The head and shank then can be removed from the clamping mechanism that holds it to the recorder mount.

(*f*) To replace the head-lifting mechanism, reverse the procedure.

(*g*) Adjust the recorder head as described in paragraph 72*g*.

68. Removal of Reproducer Head and Mount

(figs. 32 and 35)

a. Head.

(1) The reproducer head is supplied as a replacement unit. This includes case and cartridge (par. 67*a*(1)).

(2) Remove the cabinet, the front cover, and the bottom plate (par. 66*a*, *b*, and *d*).

(3) Pull the reproducer-head leads out of terminal board TB1 (fig. 22) that is on the right-hand side of the common base. Tilt the set to reach the terminals, and when the leads are free, pull the leads up through the hole in the motorboard. Free the leads by loosening the screw and clamp that holds them to the reproducer mount.

(4) Remove screw H64 (fig. 35), which holds the head to the mount. Rock the head gently and, if necessary, apply the tip of a screwdriver between the head and the mount to free the head from the two dowel pins in the mount. Pull the head out of the unit and unscrew the handle.

(5) To replace the head, reverse the procedure. Adjust as described in paragraph 72.

b. Reproducer Head and Mount (figs. 31, 32, and 35).

(1) Remove the cabinet, the front cover, and the bottom plate (par. 66*a*, *b*, and *d*). Remove the lifting rod O 26 (fig. 32) by removing the C-washer from each end. Remove the screw that holds the index lamp assembly, lift the base out of its seat, and tilt the assembly out of the way. This leaves the leads in place.

(2) Pull the reproducer-head leads out of terminal board TB1 (fig. 14), which is on right-hand side of the bottom chassis. Tilt the set to reach the terminal board and free the leads from the board. Pull the leads up through the hole and grommet in the motorboard. Free the leads from the reproducer arm by loosening the screw and cord clamp that hold them to the reproducer arm.

(3) Disconnect spring O 21 (fig. 32) from the rear arm of the mount. Loosen the three screws (H17) and separate the two mirror mounts (O 39 and O 41, fig. 35). Mark the two gear sectors so that the gears can be reassembled in the original positions. Remove the two mirrors (I 4 and I 5); do not mar the surfaces. Remove screws H17 and lift off both mirror mounts as a unit from the reproducer drive shaft. Preserve the two washers under the head of each screw. Remove gasket O 32. Remove a screw under the lens barrel to free the mount from the retracting mechanism.

(4) Remove lock nuts H55 and H56, which hold the reproducer-head mount to its drive shaft. Hold the bottom nut with the offset wrench and loosen the top nut with a standard $\frac{7}{16}$-inch spin-type wrench. Pull the head and mount up off the drive shaft. Three washers (H23 and H24) and pressure disk spring O 33 are disassembled with the mount. The reproducer mount loosens on the shaft, but tightens when it is reassembled with lock nuts H55 and H56.

(5) Reverse the procedure to replace the head and mount. Put spring washer O 33 on after the mount has been seated on its shaft and the other washers on top. Bronze washer H24 is a friction disk and should have a light film of grease on both sides, but the opposite sides of steel washers H23 must be dry. The top surface of

spring washer O 33 also should be dry.

(6) Adjust the reproducer head as described in paragraph 73.

69. Removal of Motorboard, Overlap and Blinker Switches, Coupling, Motor, Turntable and Shell, Gears, and Relays

a. Motorboard and Switches (figs. 32 and 33).

(1) Remove the cabinet, the front cover, and the bottom plate (par. 66*a*, *b*, and *d*).

(2) Loosen two front screws 9–1110 (fig. 32) and remove the two rear screws. Lift out the amplifier card to uncover the left-hand screw.

(3) Pull the plug, on the cable from the switches (fig. 33), out of socket X1 in the top of the unit chassis. Remove the recorder- and reproducer-head leads from terminal board TB1 (fig. 22). Tilt the set so that terminal board TB1 can be seen. Pull the leads up through the hole and grommet in the bottom chassis. Pull the motor and index lamp leads from terminal board TB4 (fig. 21).

(4) Remove screw S118, which holds plate assembly O 79 to motorboard O 72 (figs. 32 and 33). Lift out the motorboard complete with motor, turntable and shell, gears, heads, retracting mechanism, index light system, and switches.

(5) Switches S11, S12, and S13 of unit B (fig. 33) are secured to the motorboard in the rear, right-hand corner. Corresponding switches S8, S9, and S10 occupy the same position in unit A (fig. 41). To remove these switches, remove the holding screws and the switches will be released with the leads still attached. Tag and unsolder the leads from the switch.

(6) To replace the motorboard and switches, reverse the procedure described in (1) through (5) above. Insert the two dowel pins on the rear of the motorboard into the mating holes in the rear shield and lower the front part into place.

b. Coupling (figs. 36 and 37).

(1) Remove the motorboard (*a*(1) through (4) above).

(2) Set the motorboard on its left side and unscrew nut H78 from bolt H73.

(3) One side of flexible coupling O 6 screws into the end of the shaft that holds the spur gear that is driven by the worm on the motor shaft. The other side of O 6 screws into the end of the turntable shaft. The coupling has left-hand threads. Rotate turntable O 13 clockwise by hand until coupling O 6 unscrews from either the motor shaft or the turntable shaft. Unscrew coupling O 6 from the motor or turntable shaft. Turn coupling O 6 clockwise. Remove and preserve washer H6 and any shim that may be with it.

(4) To replace the coupling, place washer H6 on the coupling. If there is a shim washer, place it on top of washer H6. Screw this end of coupling O 6 counterclockwise into the turntable shaft. The two sides of the coupling are identical so the washers can be placed on either side.

(5) Set the motorboard back onto the chassis and plug in the amplifier card and the motor leads. Run the motor and push it up so that coupling O 6 will screw into the shaft that is driven by the motor. Screw nut H78 onto bolt H73. Replace the motorboard.

c. Motor (figs. 36 and 37).

(1) Remove the motorboard and coupling (*a* and *b* above).

(2) Remove nuts H77, springs O 19, and shock absorbers O 18, and lift the motor and its brackets from the three mounting posts. Remove brackets A 5 and A 4 by removing the screws that hold them to the motor frame. Preserve rubber mountings H13 and rubber shock absorbers O 18 between springs O 19 and bracket A 5.

(3) To replace the motor reverse the procedure; be sure to replace the brackets in the original positions. Coupling O 6 will wobble as it rotates if bracket

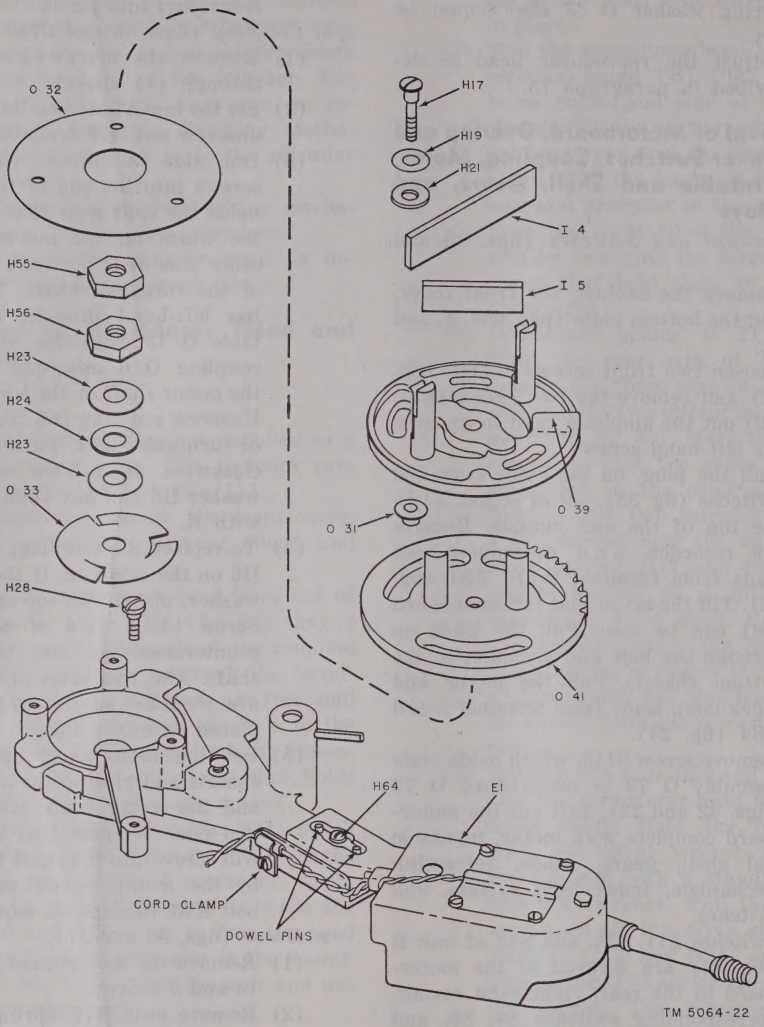


Figure 35. Reproducer head and arm, exploded view.

A 5 is off-center. The mounting hole in bracket A 4 will not fit over its mounting post if the bracket is out of position. Do not tighten nuts H77 so much that the coupling loses its flexibility, or that the back end of the motor frame contacts the motorboard casting.

d. Turntable and Shell (figs. 36 and 37).

(1) Remove the recorder and reproducer heads and mounts (par. 67*b* and 68*b*) and the motorboard (*a* above).

(2) After performing the operations described in paragraphs 67*b* and 68*b*, loosen or remove coupling O 6 (fig. 36) as described in *b* above. This frees turntable O 13 (fig. 37) so that its attached shaft can be pulled out of its

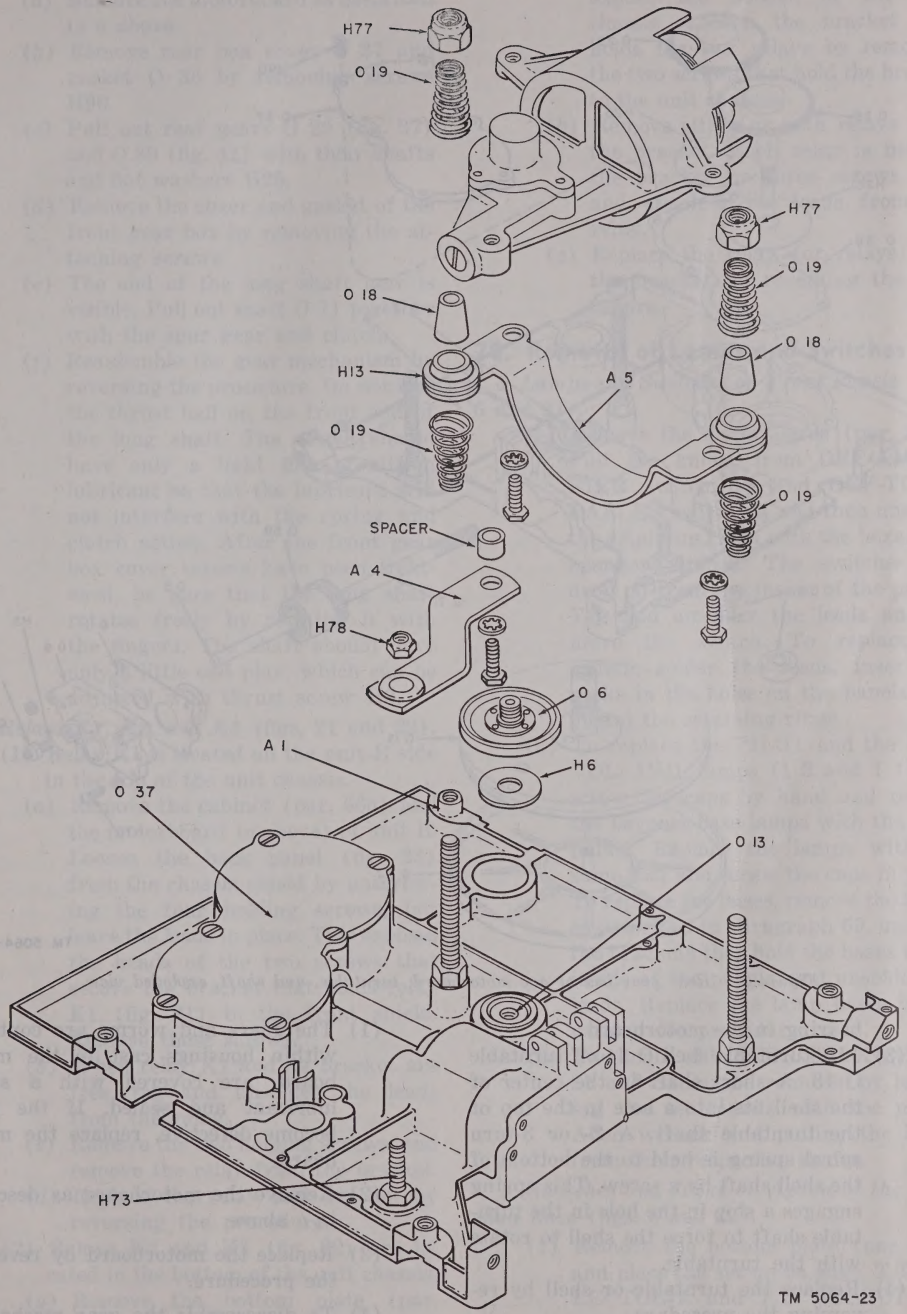


Figure 36. Mounting of motor on motorboard, exploded view.

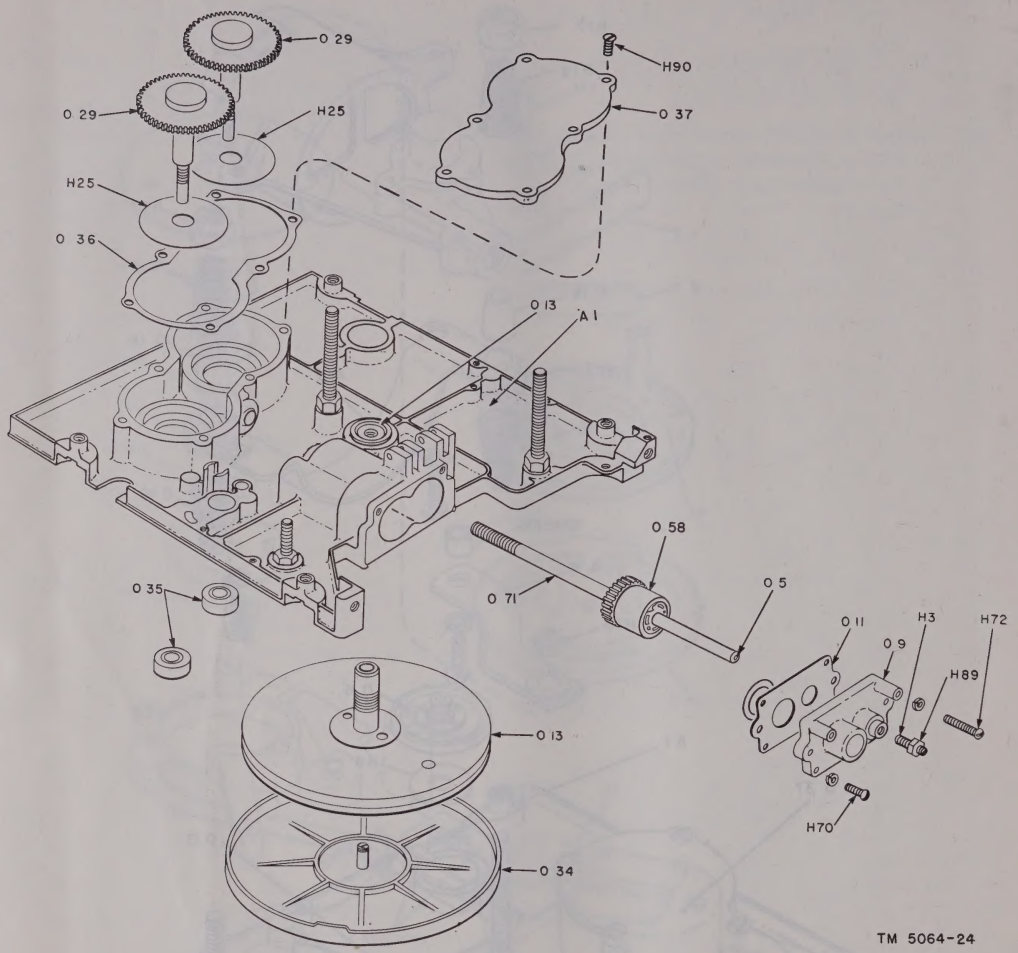


Figure 37. Rear gear box of one motorboard, turntable, and shaft, exploded view.

bearing in the motorboard.

(3) Lift turntable shell O 34 off turntable O 13. A short shaft in the center of the shell fits into a hole in the top of the turntable shaft. A 2- or 3-turn spiral spring is held to the bottom of the shell shaft by a screw. This spring engages a stop in the hole in the turntable shaft to force the shell to rotate with the turntable.

(4) Replace the turntable or shell by reversing the procedure.

e. Gears (figs. 36 and 37).

(1) The gears and worms are contained within housings cast in the motorboard, are covered with a silicon lubricant and sealed. If the gears become defective, replace the motorboard.

(2) Remove the motorboard as described in *a* above.

(3) Replace the motorboard by reversing the procedure.

(4) To disassemble the gear mechanism, proceed as follows:

(*a*) Remove the motorboard as described in *a* above.

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

(*c*) Pull out rear gears O 29 (fig. 37) and O 30 (fig. 41) with their shafts and flat washers H25.

(*d*) Remove the cover and gasket of the front gear box by removing the attaching screws.

(*e*) The end of the long shaft now is visible. Pull out shaft O 71 together with the spur gear and clutch.

(*f*) Reassemble the gear mechanism by reversing the procedure. Do not lose the thrust ball on the front end of the long shaft. The clutch should have only a light film of silicon lubricant so that the lubricant will not interfere with the spring and clutch action. After the front gear box cover screws have been tightened, be sure that the long shaft rotates freely by rotating it with the fingers. The shaft should have only a little end play, which can be adjusted with thrust screw H3.

f. Relays K1, K2, and K3 (figs. 21 and 22).

(1) Relay K1 is located on the unit-B side in the top of the unit chassis.

(*a*) Remove the cabinet (par. 66*a*) and the motorboard (*a* above) of unit B. Loosen the back panel (fig. 23) from the chassis shield by unscrewing the four holding screws, but leave the leads in place. This exposes the heads of the two screws that secure the bracket that holds relay K1 (fig. 21) to the front shield. Remove these screws.

(*b*) When relay K1 and its bracket are free, tag and unsolder the leads from the relay.

(*c*) Remove the two holding screws, and remove the relay from the bracket.

(*d*) Replace the relay and bracket by reversing the procedure.

(2) Relays K2 and K3 (fig. 22) are located in the bottom of the unit chassis.

(*a*) Remove the bottom plate (par. 66*d*). Leave the set up on edge to expose the bottom of the unit chassis. Loosen the bracket that holds the two relays by removing the two screws that hold the bracket to the unit chassis.

(*b*) Remove either or both relays from the bracket. Each relay is held to the bracket by three screws. Tag and unsolder the leads from the relay.

(*c*) Replace the relay (or relays) and the bracket by reversing the procedure.

70. Removal of Lamps and Switches

a. Lamps and Switches on Front Panels (figs. 6 and 21).

(1) Remove the motorboards (par. 69*a*). Pull the knobs from OFF-AMPLIFIER switch S7 and OFF-TURNTABLES switch S1 and then unscrew the retaining rings with the hexagonal spanner wrench. The switches will drop off from the inside of the panels. Tag and unsolder the leads and remove the switch. To replace the switch, solder the leads, insert the necks in the holes on the panels, and mount the retaining rings.

(2) To replace the PILOT and the REC. VOL. IND. lamps (I 2 and I 1) unscrew the caps by hand and remove the bayonet-base lamps with the lamp puller. Replace the lamps with the same tool and screw the caps in place. To replace the bases, remove the lamps as described in paragraph 69, unscrew the brackets that hold the bases to the inside of the panels, and unsolder the leads. Replace the lamp bases by reversing the procedure.

(3) The knobs of LISTEN-TALK switches S3 and S4 can be removed by loosening the set screws with the proper Allen wrench and pulling the knobs from their respective shafts.

b. Switches and Jacks on Apron of the Common Base (figs. 6 and 22).

(1) Remove the bottom plate (par. 66*d*) and place the set up on edge. T.T. SELECTOR-A and T.T. SELECTOR-B switches (S6 and S5), TEL.-MIC.

switch S2, PLAYBACK jack J2, and MONITOR jack J1 all are located on the apron of the common base. To remove these, unscrew the retaining rings on the outside of the apron with the hexagonal spanner wrench. The switches and jacks will drop out from inside of the apron, but the leads will remain in place. Tag and unsolder the leads, and remove the switches and jacks.

(2) To replace the switches, solder the leads onto the switches, restore the washers and insulators (the TEL.-MIC. switch has no insulation), push the shafts through the apron, and mount the retaining rings.

c. MONITOR-VOL. and TEL.-VOL. Controls on Rear of Unit B (fig. 23).

(1) Remove the cabinet (par. 66*a*) and loosen the back panel from the shield by unscrewing the four holding screws. Unscrew the retaining ring of MONITOR-VOL. control R36 with the hexagonal spanner wrench, and the retaining nut of TEL.-VOL. control R49 with the offset box wrench to free them from the back panel. Unsolder the leads.

(2) To replace the controls, solder the leads to the controls, restore the washers and insulators, refasten them to the back panel, and screw the panel in place.

Section IV. ADJUSTMENTS

71. Tools

The adjustments described in paragraphs 72 through 75 require the use of some of the special tools described in paragraph 59. To make the adjustments, remove the cabinet (par. 66*a*). These instructions apply to both units of the equipment.

72. Recorder-Head Adjustments

a. Lifting Nut H81 (fig. 38). The bolt of assembly H81 screws into the recorder-head cartridge to prevent it from dropping out when the recorder head is lifted. Since the turntable rises and falls during rotation, adjust nut H81 to allow free vertical movement of the cartridge. Since the vertical movement is greatest at the edge of the disk, place the recorder head at the edge of the disk. Raise the front cover slightly (not enough to operate the retracting mechanism or raise the stylus from the disk). Loosen nut H81. Start the turntable rotating. Place the LISTEN-TALK switch in the TALK position. Tighten nut H81 until the bottom of the nut is about .032 inch from the top of the recorder head. Do not tighten the nut so that it raises the stylus from the disk.

b. Leveling of Cartridge. The recorder-head cartridge must be level so that the stylus will be at the proper angle to the disk. To level the cartridge, raise the front cover and place a blank disk on the turntable. Operate the LISTEN-TALK switch to the LISTEN position. Move the recorder head to the center of the disk. Place the template under the recorder head (fig. 38). Adjust screw H83 (fig. 33) until the front and the rear of the cartridge are the same distance above the raised prongs on the template (fig. 38).

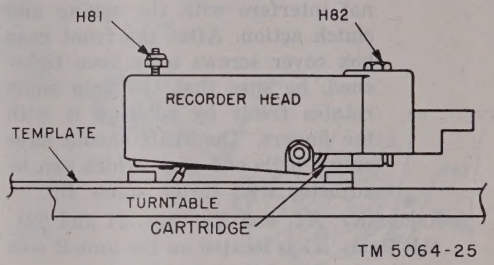


Figure 38. Recorder head, template, and part of turntable, method of leveling recorder-head cartridge.

c. Stylus Pressure. To prevent cross talk and double talk, the recorder-head stylus pressure must be between 1¾ and 2¼ ounces. To check the stylus pressure, place a clip on the screw threads just above nut H81 (fig. 39). Hook the 8-ounce postal scale (par. 75) to the clip and and lift it up until the bottom of nut H81 rises slightly above the recorder head. If the scale does not read between 1¾ and 2¼ ounces, adjust screw H82 (figs. 38 and 39) to bring the stylus pressure within these limits.

d. Outside Stop. Screw H84 (fig. 33) is the outside stop of the recorder head and must be

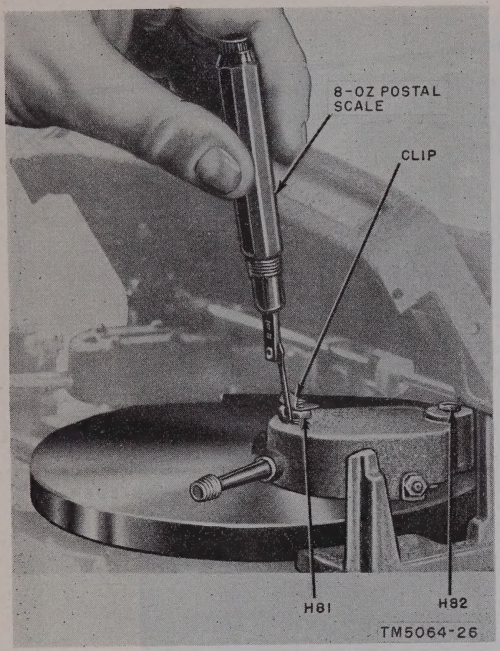


Figure 39. Recorder-head and 8-ounce postal scale used to adjust stylus pressure.

adjusted so that the stylus will be on the disk when the head is lowered. To adjust the outside stop, place the template on the turntable shell with the hole of the template over the turntable spindle. Slide the template until its outer end is under the recorder-head stylus. Operate the LISTEN-TALK switch to the TALK position. Lower the front cover. Adjust screw H84 until the recorder-head stylus falls in the groove in the template. Use an Allen head wrench for this adjustment.

e. Inside Stop. Screw H85 (fig. 33) stops the recorder head at the end of the 15-minute recording time. The light beam on the index scale should be on the 15-minute mark when the recorder head is stopped. Before adjusting the inside stop, adjust the light beam index system (par. 74). Close the front cover and move the recorder head to the center of the turntable. Operate the OFF-AMPLIFIER switch to the AMPLIFIER position. Adjust screw H85 until the light beam is on the 15-minute mark on the index scale.

f. Recorder-head Drag. The recorder-head drive shaft is coupled to the recorder head through a friction clutch. The friction between the drive shaft and the recorder head is called the drag (par. 75). The friction must be great enough to transmit the driving force from the drive shaft to the recorder head. To check the recorder-head drag, operate the OFF-AMPLIFIER switch to the OFF position. Operate the LISTEN-TALK switch to the TALK position. Lower the front cover and move the recorder head to the center of the disk. Place a spacer, such as a match stick, between the bottom of nut H81 and the top of the recorder head. Hook the 8-ounce scale to the recorder-head handle and pull it toward the outer edge of the disk (fig. 40). The scale should read between 5 and 8 ounces. To adjust the recorder-head drag, remove the gear sector (par. 67*b*(1), (2), and (3)). Loosen nut H55 (fig. 34). To increase the drag, tighten nut H56. To decrease the drag, loosen nut H56. Do not check the drag until nut H55 has been tightened. It is not necessary to assemble the other parts to make the drag test. If the recorder-head drag is jerky or uneven, washers H23 are not lubricated properly (par. 67*b*(5)). When reassembled, the recorder-head drag should be the same. If the drag increases when the parts are reassembled, the gear sectors may be binding, the gear sector may be too tight on the recorder-head drive shaft, or the retracting arm may be binding.

g. Height of Stylus During Reproduction. The recorder-head stylus must be raised off the disk when the LISTEN-TALK switch is in the LISTEN position. Before adjusting the height of the stylus, complete the adjustments described in *a* and *b* above. Operate the LISTEN-TALK switch to the LISTEN position. Place a disk on the turntable. Turn the set on so that the turntable rotates. Adjust screw S118 (fig. 32) until the stylus clears the disk.

h. Overlap and Blinker Switches, Adjustments (fig. 41). The overlap and blinker switches are actuated by the recorder arm to change the recording from one turntable to the other during continuous recording. Before adjusting the switches, adjust the light beam index system (par. 74). Prepare the recorder-reproducer set for continuous recording (par. 21). Place the recorder head of the unit requiring adjustment in the center of the disk. Rotate the turntable. Adjust screw S135 so that the

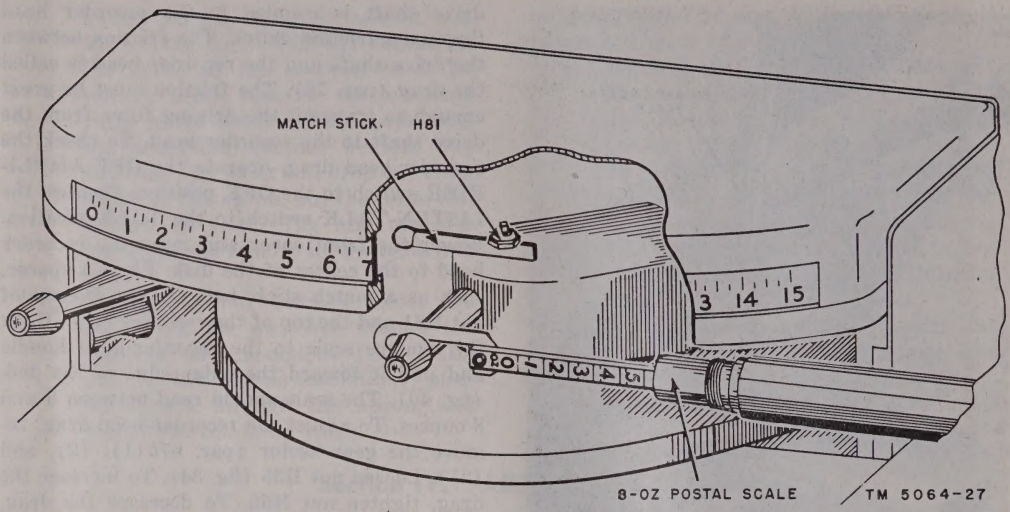


Figure 40. Recorder head and 8-ounce scale, method of adjusting recorder-head drag.

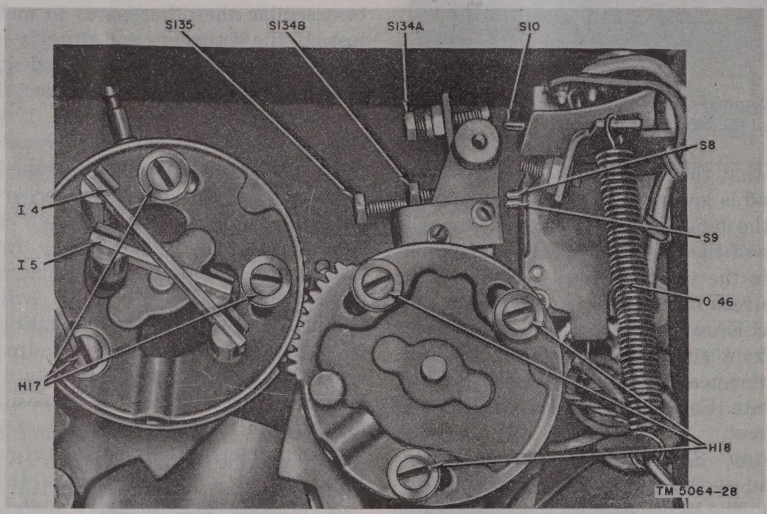


Figure 41. Partial view of one unit of the recorder-reproducer set, cabinet removed, showing the screws used to adjust the overlap and blinker switches.

turntable stops rotating when the light beam is on the 15-minute mark on the index scale. Set the light beam on the 14½-minute mark on the index scale. Adjust screw S134B until the turntable on the other unit rotates. To adjust screw S134A, place the recorder head of the opposite unit at the center of the disk. Leave the recorder head of the unit being adjusted at the center of the disk. Adjust screw S134A until the PILOT lamp flashes.

i. Recorder-head Clamping Mechanism. The clamping mechanism prevents the recorder head from moving during reproduction. To check the clamping mechanism pressure,

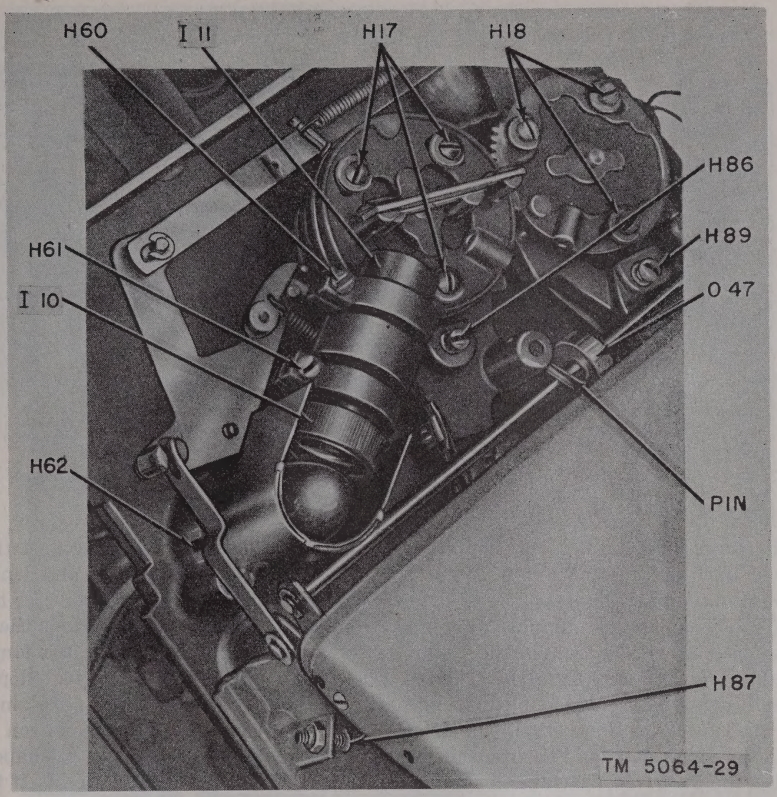


Figure 42. Partial view of one unit of the recorder-reproducer set, cabinet removed, showing the reproducer-head outside stop (H87), the inside stop (O47), and the reproducer head leveling screw (H86).

operate the LISTEN-TALK switch to the LISTEN position. Turn the set on. Hook the 8-ounce postal scale (par. 75) to the recorder-head handle. Hold the scale in a horizontal position and pull the recorder head to the center of the turntable. The scale should read between 2 and 8 ounces. To bring the clamping mechanism pressure within these limits, adjust screw H83 (fig. 33).

73. Reproducer-Head Adjustments

a. Leveling Reproducer Head. The reproducer head must be level so that the stylus will be at the proper angle to the disk. To level the reproducer head, lower the front cover. Adjust screw H86 (fig. 42) until the base of the reproducer head is level with the top of the turntable. When adjusted properly, the stylus should lift from the turntable when the reproducer-head handle is raised approximately one-eighth of an inch.

b. Outside Stop. The outside stop of the reproducer head determines how far the reproducer head will move to the outside of the disk. When the reproducer head is at the outside of the disk, the reproducer-head light beam should be on the zero mark on the index scale. Adjust screw H87 until the reproducer head is on or just before the first groove embossed on a disk by the recorder head.

c. Inside Stop. The inside stop of the reproducer head must stop the reproducer head when the light beam is just past the 15-minute mark on the index scale. Before adjusting the inside stop, adjust the light beam index system (par. 74). To adjust the inside stop, loosen collar O

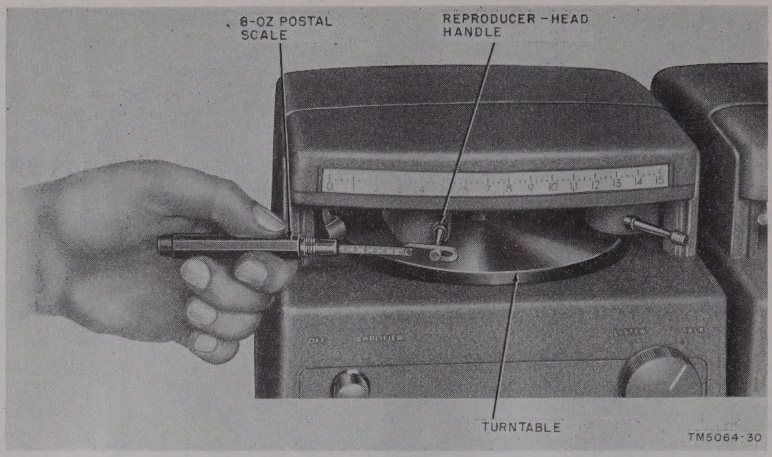


Figure 43. Reproducer head, turntable, and 8-ounce postal scale, showing method of adjusting the reproducer-head drag.

47. Move the reproducer head to the center of the turntable until its light beam is slightly past the 15-minute mark on the index scale. Push collar O 47 until it is against the pin above the reproducer head. Tighten the collar.

d. Reproducer-Head Drag (fig. 43). The reproducer-head drive shaft is coupled to the reproducer head by a friction clutch. The friction between the drive shaft and the reproducer head is called the drag. To measure the reproducer-head drag, operate the OFF-AMPLIFIER switch to the OFF position. Place the reproducer head in the center of the turntable. Hook the 8-ounce scale to the reproducer-head handle and pull it towards the outside of the turntable. The scale should read between 4 and 7 ounces. To bring the drag within these limits, remove the mirror mounts (par. 68*b*(5)) and loosen nut H55 (fig. 35). To increase the drag, tighten nut H56; to decrease the drag, loosen nut H56. Before checking the drag again, tighten nut H55. It is not necessary to reassemble the other parts before making the drag test. If the drag is jerky or uneven, washers H23 and H24 are not lubricated properly (par. 68*b*).

74. Light Beam Index System Adjustment

a. Lamp and Lens Assembly. The light from the index lamp should fall approximately in the center of the index mirrors when the recorder and reproducer heads are against their outside stops. To adjust the lamp and lens assembly, move the recorder and reproducer heads to the outside of the turntable. Turn on the set. Loosen screw H59 (fig. 31). Turn the lamp and lens assembly until they are adjusted properly.

b. Index Lamp. The index lamp filaments should form a single image on the index mirrors. If the filament is W-shaped, a single W should be seen on the mirror. If the filament is V-shaped, a single V should be seen. The light beam should be distributed equally between the top and bottom mirrors. To adjust the index lamps, turn on the set and loosen screw H62 (figs. 31 and 42). Rotate the lamp socket to form a single filament image on the mirrors. Raise or lower the lamp socket to distribute the beam evenly.

c. Condenser Lens. The condenser lens must be set so that the light beam is vertical and focused. To adjust the condenser lens, loosen screws H60 and H61. Turn on the set. Move the recorder and reproducer heads until their light beams are near each other at 4 on the index scale. Turn holder I 10 until the light beams are vertical on the index scale. Focus the light beams by moving holder I 11 back and forth.

d. Index Mirrors. The index mirrors reflect the light beams onto the index scale to indicate the amount of time used in recording and reproducing. Before adjusting the index mirrors,

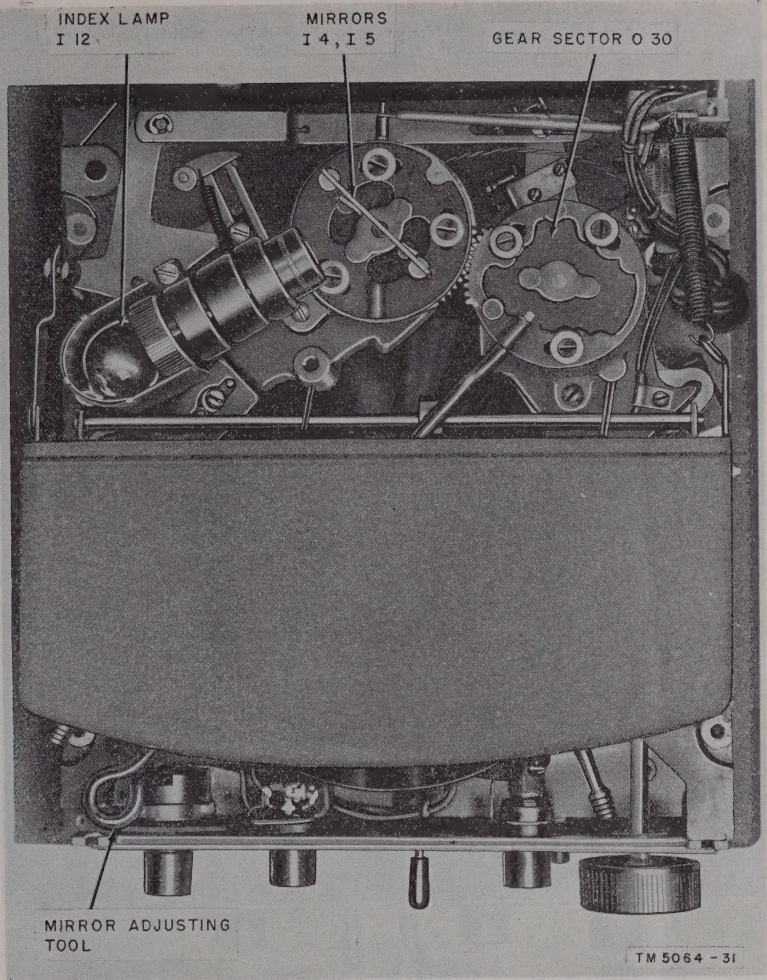


Figure 44. Partial view of one unit of the recorder-reproducer set (cabinet removed) and the mirror-adjusting tool in place for adjusting the position of the recorder-head light beam on the index scale.

the outside stops of the recorder and reproducer heads must be adjusted (par. 72*d* and 73*b*). It is not necessary to remove the cabinet for the adjustment. Place the reproducer head in the center of the turntable. Turn on the set. Place the mirror-adjusting tool in the hole provided in the gear sector on the recorder-head mount (fig. 44). Hold the recorder head against its outside stop. Turn the gear sector until the recorder-head light beam is at zero on the index scale. To adjust the reproducer-head mirror, insert the mirror-adjusting tool in the hole provided in the reproducer-head mirror mount (fig. 45). Turn on the set and hold the reproducer head against its outside stop. Rotate the mirror mount until the reproducer-head light beam is superimposed on the recorder-head light beam.

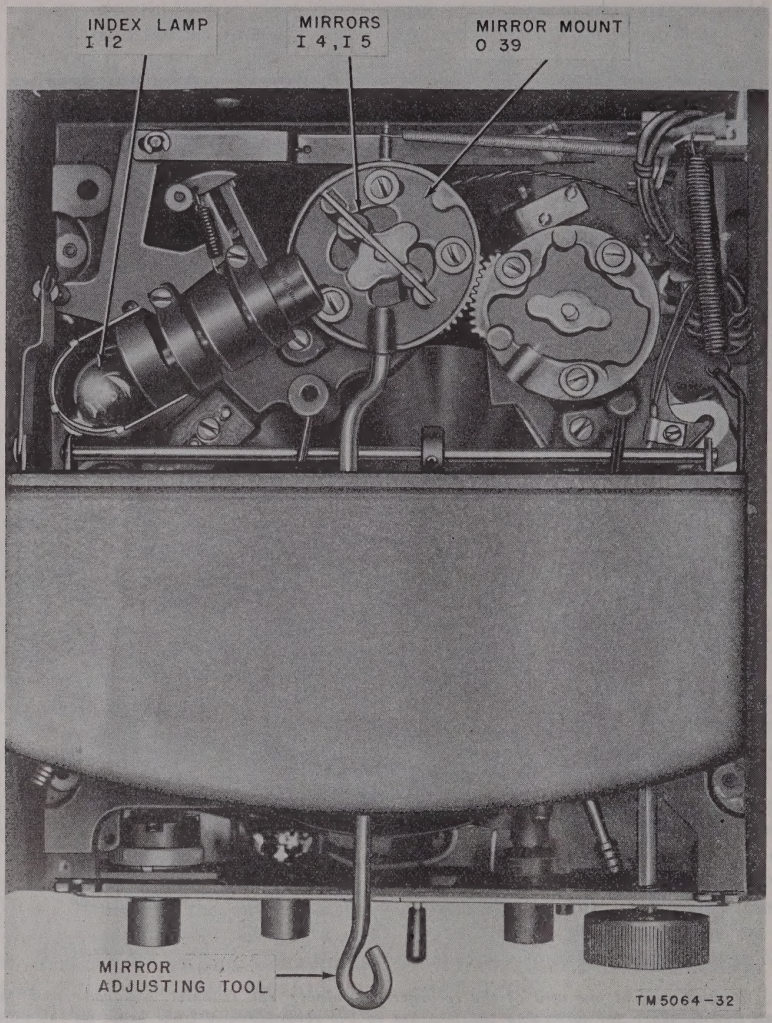


Figure 45. Partial view of one unit of the recorder-reproducer set (cabinet removed) and the mirror-adjusting tool in place for adjusting the position of the reproducer-head light beam on the index scale.

75. Postal Scale Adjustments

(fig. 46)

a. General. The postal scale must be calibrated before making the drag and pressure tests and adjustments. Without a load, the zero line of the calibrated arm should be visible just below the body of the scale. With the 5-ounce test weight on the hook of the scale, the 5-ounce division line should be visible just below the body of the scale. If the measurements are incorrect, make the adjustments described in *b* and *c* below.

b. Zero Adjustment. Remove the top cap. Hold the scale with the hook down. Adjust the knurled thumbscrew until the zero line is visible just below the body of the scale.

c. Weight Adjustment. Before making the weight adjustment, first make the zero adjust-

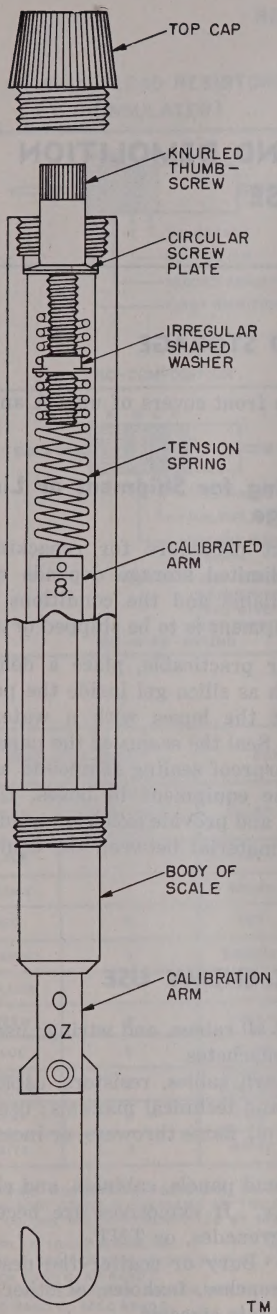


Figure 46. Eight-ounce postal scale, cutaway view.

ment (*b* above). Place the 5-ounce weight on the scale and note whether the scale reads more or less than 5 ounces. Remove the test weight and pull out the knurled thumbscrew carefully. Scrape the molding around the plate of the thumbscrew to facilitate its removal. If the thumbscrew is pulled too hard, it will distort the tension spring. If the scale reads more than 5 ounces with the weight on, turn the irregular-shaped washer counterclockwise. If the scale reads less than 5 ounces, turn the irregular-shaped washer clockwise. Replace the knurled thumbscrew. Repeat the zero adjustment (*b* above) before checking the weight adjustment. These instructions must be repeated if the readings are not correct.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

76. Disassembly

The following instructions are intended as a guide for preparing Sound Recorder-Reproducer Set AN/FNQ–2(*) for shipment and storage. The circumstances involved in shipment and storage vary, therefore, no definite procedure can be given.

a. Remove the microphone cable connector from the jack on the recorder-reproducer set. Fold the microphone cable around the microphone.

b. Fold the power cable and the tone warnning generator cable and place them on top of the equipment.

c. Place the reproducer-head handles in their latches.

d. Operate the LISTEN-TALK switches to the TALK position to lift the recorder-head styluses off the turntables.

e. Place the front covers of unit A and unit B down.

77. Repacking for Shipment or Limited Storage

a. The exact procedure for repacking for shipment or limited storage depends on the materials available and the conditions under which the equipment is to be shipped or stored.

b. Whenever practicable, place a dehydrating agent such as silica gel inside the packing boxes. Protect the boxes with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or with tape. Pack the equipment in boxes. Use interior bracing and provide excelsior padding or some similar material between the equipment and the box.

Section II. DEMOLITION TO PREVENT ENEMY USE

78. Authority for Demolition

The demolition procedures outlined in paragraph 79 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

79. Methods of Destruction

a. Smash. Smash the controls, tubes, coils, switches, capacitors, transformers, headsets; use sledges, axes, pickaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut all cables, and wiring; use axes, handaxes, or machetes.

c. Burn. Burn cables, resistors, capacitors, coils, wiring, and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panels, cabinets, and chassis.

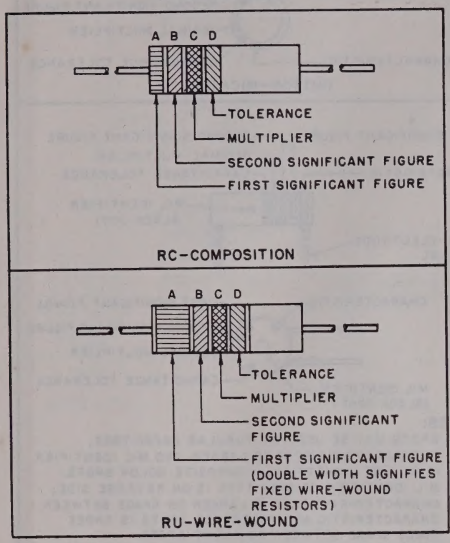
e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Bury or scatter the destroyed parts in slit trenches, foxholes, or other holes, or throw them into streams.

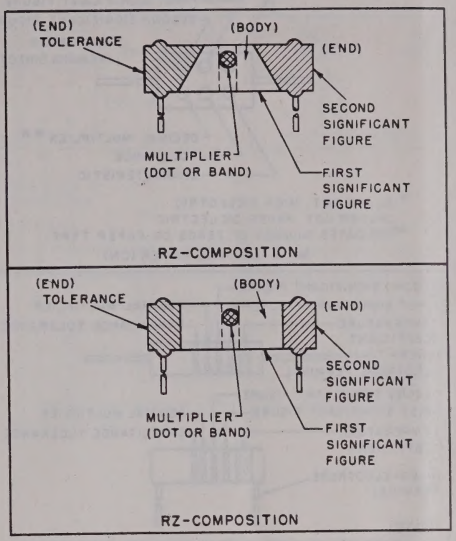
g. Destroy. Destroy everything.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS
(INSULATED)



RADIAL-LEAD RESISTORS
(UNINSULATED)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	±20
BROWN	1	BROWN	1	BROWN	10	SILVER	±10
RED	2	RED	2	RED	100	GOLD	±5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

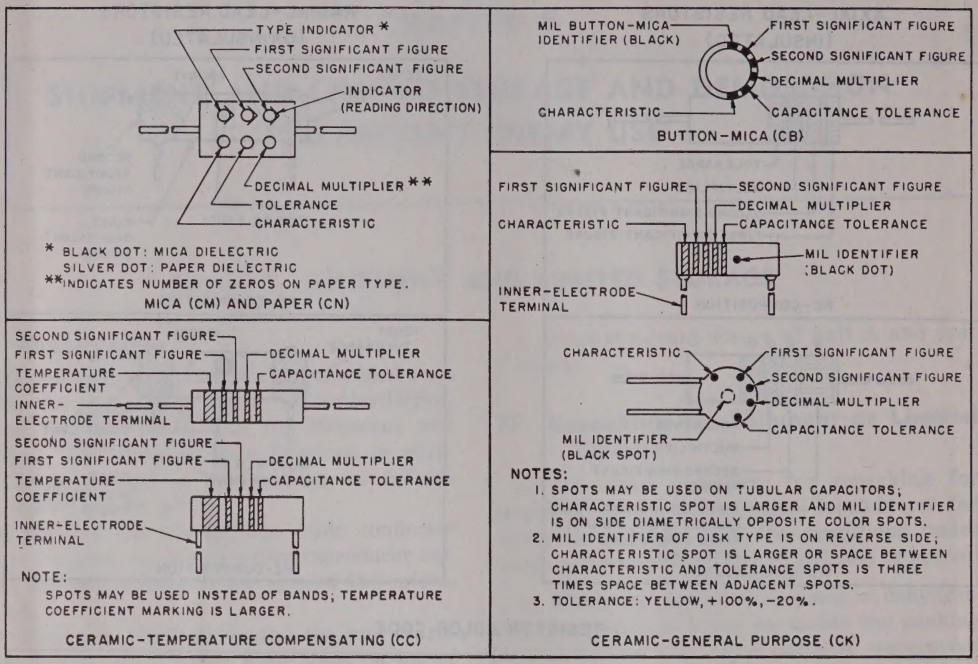
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-RI

Figure 47. Resistor color-code chart.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



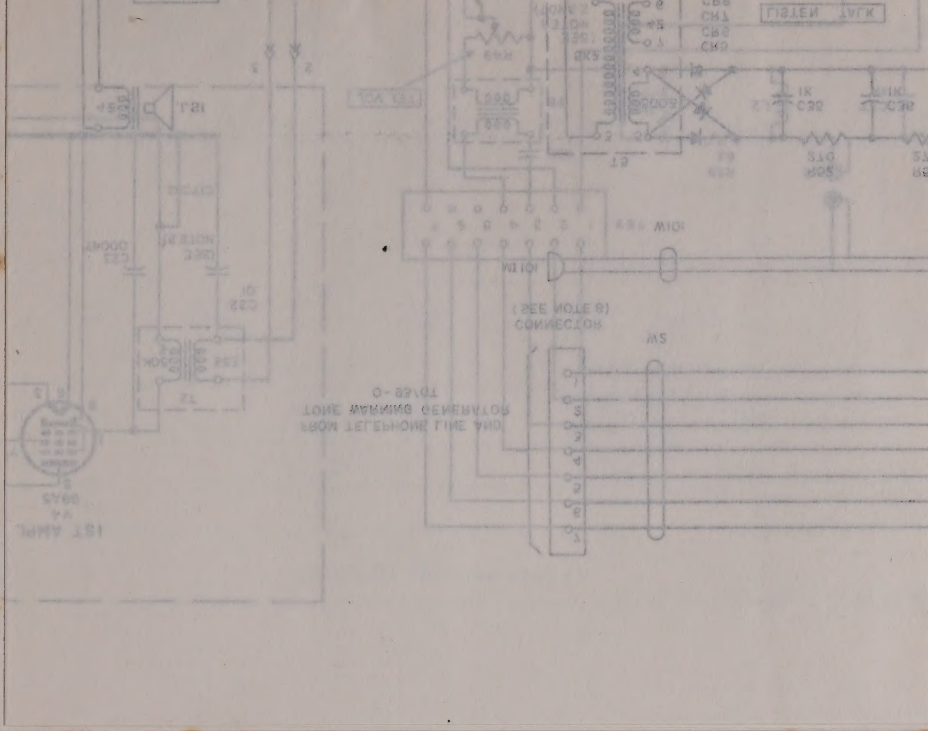
CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE [2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500) [3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-C1

Figure 48. Capacitor color-code chart.



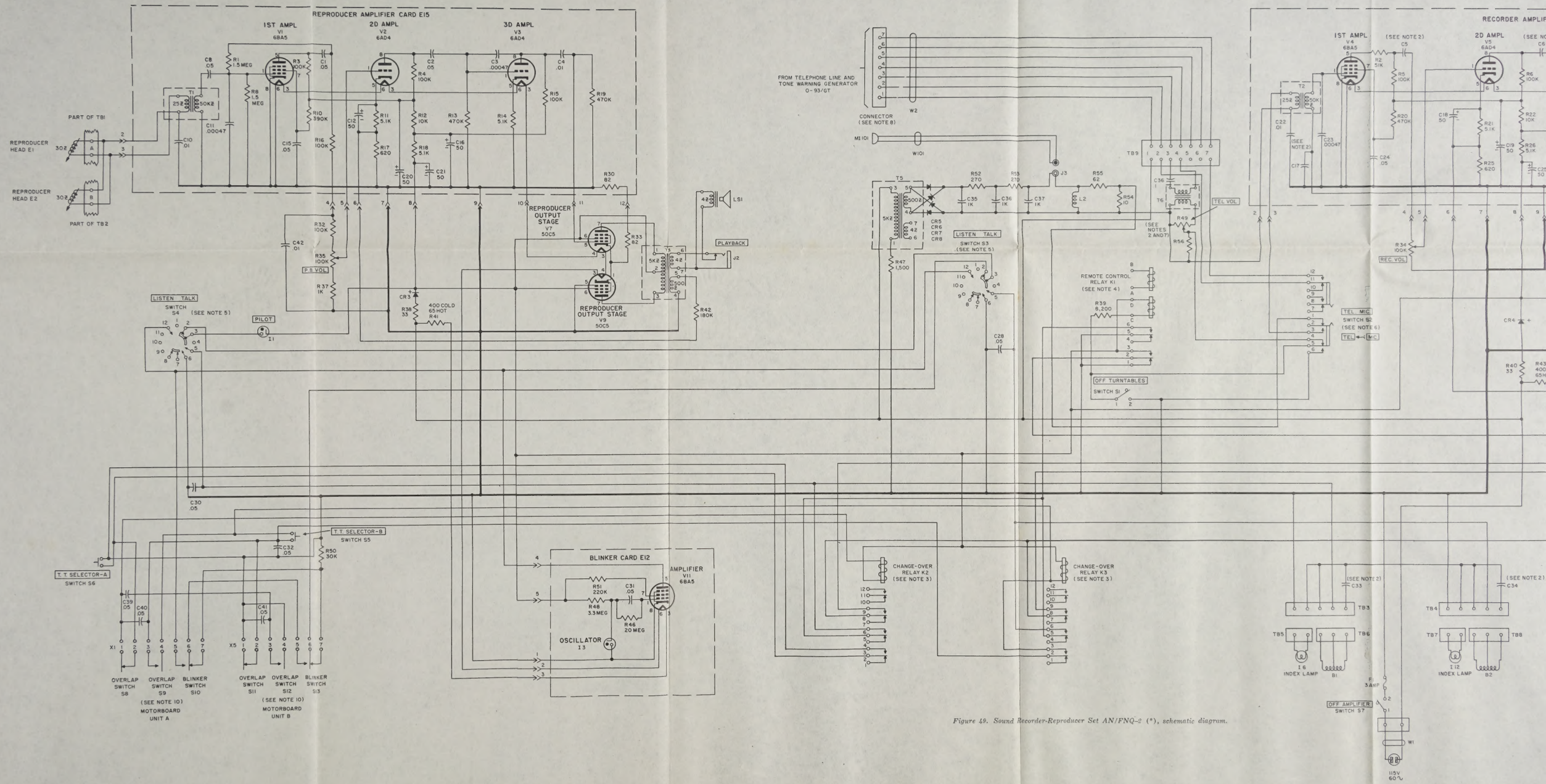


Figure 49. Sound Recorder-Reproducer Set AN/FNQ-2 (*), schematic diagram.

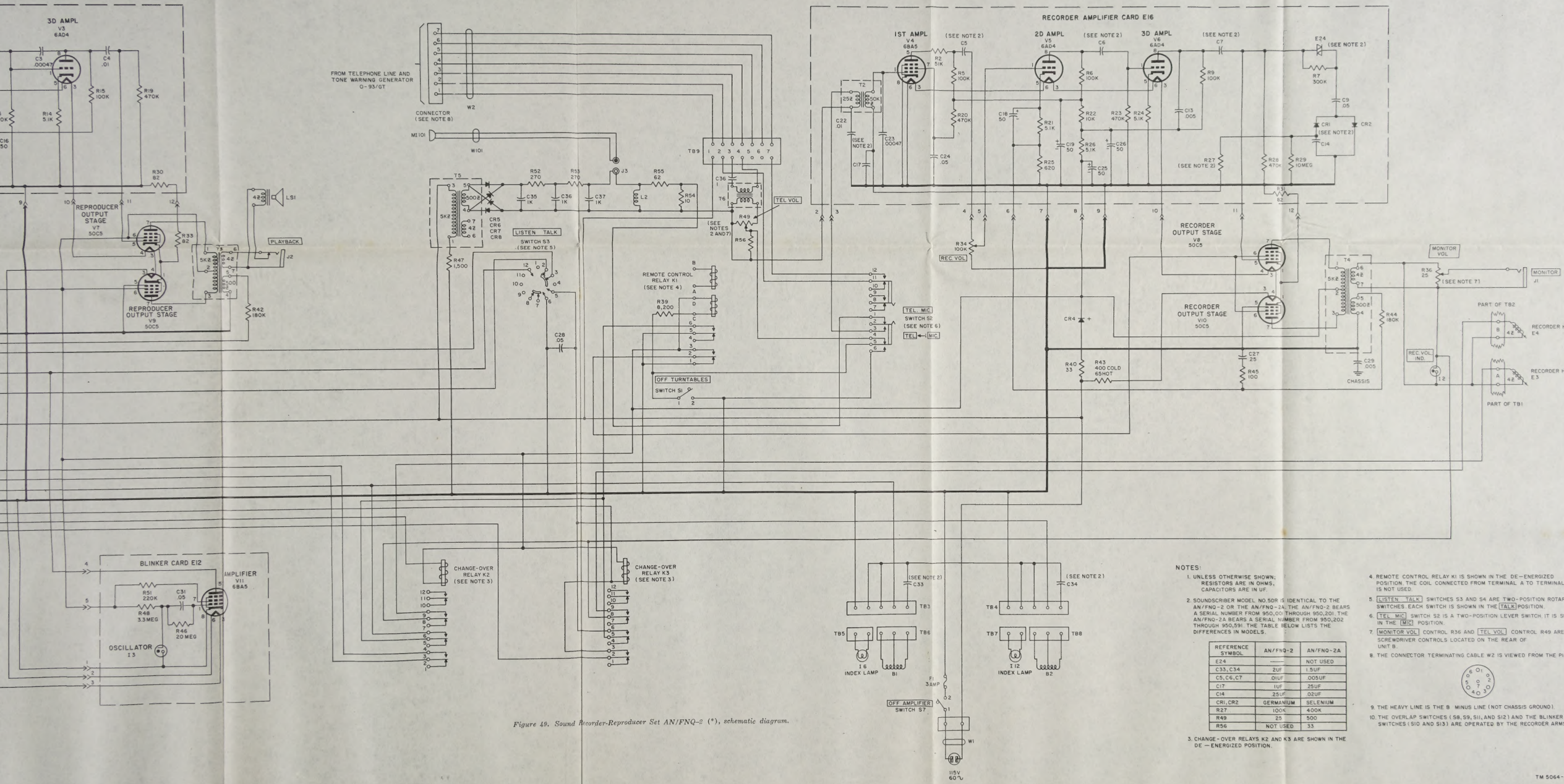


Figure 49. Sound Recorder-Reproducer Set AN/FNQ-2 (*), schematic diagram.

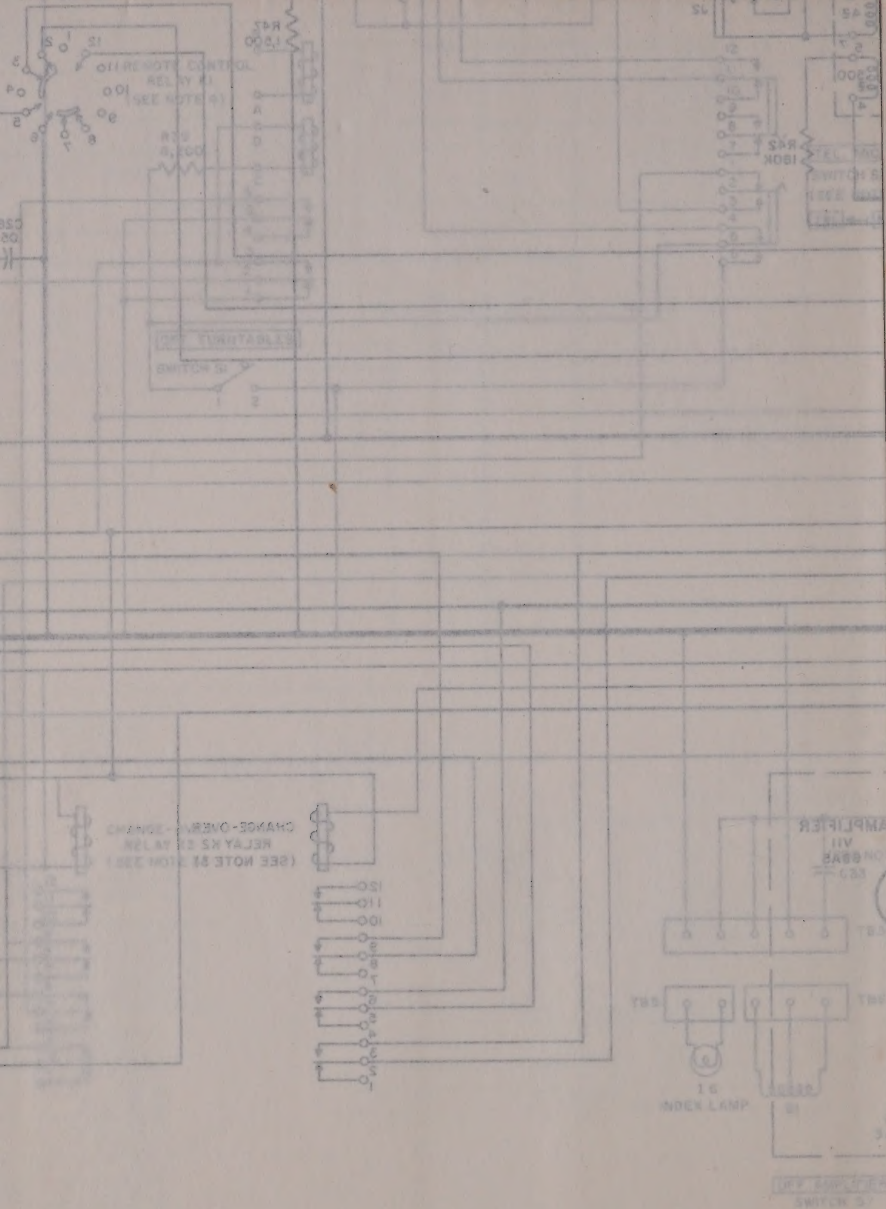
NOTES:

1. UNLESS OTHERWISE SHOWN; RESISTORS ARE IN OHMS, CAPACITORS ARE IN UF.
2. SOUNDSCRIBER MODEL NO.5DR IS IDENTICAL TO THE AN/FNQ-2 OR THE AN/FNQ-2A. THE AN/FNQ-2 BEARS A SERIAL NUMBER FROM 950,001 THROUGH 950,201. THE AN/FNQ-2A BEARS A SERIAL NUMBER FROM 950,202 THROUGH 950,591. THE TABLE BELOW LISTS THE DIFFERENCES IN MODELS.

REFERENCE SYMBOL	AN/FNQ-2	AN/FNQ-2A
E24	——	NOT USED
C33, C34	2UF	1.5UF
C5, C6, C7	.01UF	.005UF
C17	1UF	25UF
C14	25UF	.02UF
CR1, CR2	GERMANIUM	SELENIUM
R27	100K	400K
R49	25	500
R56	NOT USED	33

3. CHANGE-OVER RELAYS K2 AND K3 ARE SHOWN IN THE DE-ENERGIZED POSITION.
4. REMOTE CONTROL RELAY K1 IS SHOWN IN THE DE-ENERGIZED POSITION. THE COIL CONNECTED FROM TERMINAL A TO TERMINAL B IS NOT USED.
5. LISTEN TALK SWITCHES S3 AND S4 ARE TWO-POSITION ROTARY SWITCHES. EACH SWITCH IS SHOWN IN THE TALK POSITION.
6. TEL MIC SWITCH S2 IS A TWO-POSITION LEVER SWITCH. IT IS SHOWN IN THE MIC POSITION.
7. MONITOR VOL CONTROL R36 AND TEL VOL CONTROL R49 ARE SCREWDRIVER CONTROLS LOCATED ON THE REAR OF UNIT B.
8. THE CONNECTOR TERMINATING CABLE W2 IS VIEWED FROM THE PIN SIDE.

9. THE HEAVY LINE IS THE B MINUS LINE (NOT CHASSIS GROUND).
10. THE OVERLAP SWITCHES (S8, S9, S11, AND S12) AND THE BLINKER SWITCHES (S10 AND S13) ARE OPERATED BY THE RECORDER ARMS.



(*), schematic diagram.

INDEX

	Paragraph	Page
Adjustments:		
Eight-ounce postal scale:		
General	75*a*	72
Weight adjustment	75*c*	72
Zero adjustment	75*b*	72
Light beam index system:		
Condenser lens	74*c*	70
Index lamp	74*b*	70
Index mirrors	74*d*	70
Lamp and lens assembly	74*a*	70
Recorder-head:		
Clamping mechanism	72*c*	66
Drag	72*f*	67
Height of stylus during reproduction	72*g*	67
Inside stops	72*e*	67
Leveling of cartridge	72*b*	66
Lifting nuts	72*a*	66
Outside stops	72*d*	66
Stylus pressure	72*c*	66
Adjustments—Continued		
Reproducer-head:		
Drag	73*d*	70
Inside stops	73*c*	69
Leveling of head	73*a*	69
Outside stops	73*b*	69
DD Form 535	2*c*	3
Amplifier:		
Blinker	47	34
Recorder	46	32
Reproducer	45	30
Arctic climate, operation in	46	17
Blinker oscillator and amplifier, analysis	47	34
Blinker switches, removal	69	61
Block diagram analysis	44	30
Bottom plate, removal	66*d*	54
Cabinet, removal	66	52
Changing partially used disk	22	16
Chart, troubleshooting	60	46
Check lists, equipment performance	41	23
Check lists, equipment performance, troubleshooting by using	40	23
Circuit analysis	44–52	30
Connections	13	9
Continuous recording	21	15
Control lamps and switches, removal of	70	65
Controls, tables	15, 16	10, 12
Couplings, removal	69*b*	61
Covers, front, removal	66*b*	52
DA Form 11–250	2*d*	3
DA Form 11–251	2*e*	3
DA Form 468	2*b*	3
Data, troubleshooting	56	43
DD Form 6	2*a*	3
Demolition, authority	78	74
Description:		
Major component	8	5
Minor components	9	6
Desert climate, operation	30	18
Destruction, methods	79	74
Differences in models	55	40
Disassembly	76	74
Dust cover	9	6
Eight-ounce posta scale adjustment	60	46
Equipment:		
Additional required	10	7
Checking new	12	8
Field maintenance	53–75	40
Organizational maintenance	31–41	19
Performance check lists	41	23
Preventive maintenance	31–34	19
Field maintenance	53–57	40
Filers	9	6
Forms and records, general	2	3
Forms, preventive maintenance	34	19
Front covers, removal	66	52
Gears:		
Operation	43	29
Removal	69	61
General, purpose and use	3	3
Headset HT	10*a*	7
Heater circuits, analysis	52	39
Index:		
Scales	66*c*	52
Systems	74	70
Indexing	25	17
Input impedances	4	3
Inspection, visual	39, 54	22, 40
Installation	11, 13	8, 9
Jacks	15	10
Lamps, removal	70	65
Latches, reproducer-head	8	5
Light beam index system adjustments	74	70
LISTEN-TALK switches	15	10
Location, equipment	11	8
Lubrication	35	22
Maintenance:		
Field	53–75	40
Organizational	31–41	19
Preventive	31–34	19
Major component, description	8	5

	Paragraph	Page
Measurements:		
Resistance	64	51
Voltage	62	49
Mechanical parts, theory of operation	43	29
Mechanism, retracting, removal	66	52
Methods of destruction	79	74
Methods of testing	54	40
Microphone	9	6
Microphone recording	19	14
Minor components	9	6
Mirrors, removal	73*d*	70
Models, differences	55	40
Monitoring	23	16
MONITOR-VOL. control	16	12
Motorboards and switches, removal	69	61
Motor:		
Circuits	51	38
Removal	69	61
Motordrive and feed mechanism, theory	43	29
OFF-AMPLIFIER switch	15	10
OFF-TURNTABLES switch	15	10
Ohmmeter, use	63	49
Operation:		
Arctic climate	28	17
Changing partially used disk	22	16
Continuous recording	21	15
Desert climate	30	18
Indexing	25	17
Microphone recording	19	14
Monitoring	23	16
Preliminary starting procedure	17	12
Recording on disks	17–25	12
Reproducing from disks	24	17
Starting procedure	18	13
Stopping procedure	26	17
Telephone recording	20	14
Tropical climate	29	18
Under unusual conditions	27–30	17
Organizational maintenance	31–41	19
Overlap switches, removal	69	61
Packaging data	7	4
Painting	37	22
P.B. VOL. control	15	10
Performance, check lists, equipment	41	23
PILOT lamp	15	10
Plate, bottom, removal	66	52
Postal scale, eight-ounce, adjustment	75	72
Power supply circuits	52	39
Precautions, general	57	43
Preliminary starting procedure	17	12
Preventive maintenance:		
Definition	31	19
Forms	34	19
General techniques	33	19
Tools and materials	32	19
Purpose and use of equipment	3	3
Recorder circuits, analysis	46	32
Recorder heads:		
Adjustments:		
Blinker switches	72*h*	67
Clamping mechanism	72*i*	68
Drag	72*f*	67
Height of stylus during reproduction	72*g*	67
Inside stops	72*e*	67
Leveling of cartridge	72*b*	66
Lifting nuts	72*a*	66
Recorder heads—Continued		
Adjustments—Continued		
Outside stops	72*d*	66
Overlap switches	72*h*	67
Stylus pressure	72*c*	66
Removal	67	57
Recording	17–23	12
Records and forms, general	2	3
REC.-VOL. control	15	10
REC. VOL. IND. lamp	15	10
Relays:		
Change-over	48, 49, 69	34, 61
Remote control	48	34
Removal of parts	65–70	51
Repacking	77	74
Repair instructions, general:		
Defective component	65*d*	51
Leads	65*b*	51
Soldering	65*c*	51
Use of proper tools	65*a*	51
Repairs, disassembly and replacement:		
Bottom plate	66*d*	54
Cabinets	66*a*	52
Controls, lamps, and switches on front panels	70*a*	65
Couplings	69*b*	61
Front covers	66*b*	52
Gears	69*e*	64
Head:		
Lifting mechanism	67*c*	57
Recorder	67*a*	57
Reproducer	68*a*	60
Index scales	66*c*	52
MONITOR-VOL. and TEL.-VOL. controls	70*c*	66
Motorboard and switches	69*a*	61
Motors	69*c*	61
Recorder head and mount	67*b*	57
Relays	69*f*	65
Reproducer head and mount	68	60
Retracting mechanism	66*f*	56
Switches and jacks on apron of common base	70*b*	65
Turntable and shell	69*d*	62
Reproducer circuits, analysis	45	30

	Paragraph	Page
Reproducers heads:		
Adjustments:		
Drag	73*d*	70
Inside stops	73*c*	69
Leveling of heads	73*a*	69
Outside stops	73*b*	69
Removal of head and mount	68	60
Reproducing from disks	24	17
Resistance measurements	63, 64	49, 51
Retracting mechanism, removal	66	52
Rustproofing	37	22
Scale, index, removal	66	52
Scope of manual	1	3
Shell, protective, removal	69	61
Shipment and limited storage:		
Disassembly	76	74
Repackaging and repacking	77	74
Siting	11	8
Sound Recorder Reproducer Set AN/FNQ–2(*) description:		
Major component	8	5
Minor components	9	6
Spare parts listed	6	4
Special tools required	59	46
Starting procedure	18	13
Stopping procedure	26	17
Switches:		
Blinker	69	61
LISTEN-TALK	15	10
OFF-AMPLIFIER	15	10
OFF-TURNTABLES	15	10
Overlap	69	61
Removal	70	65
TEL.-MIC	15	10
T. T. SELECTOR-A and T. T. SELECTOR-B	15	10
Table:		
Components	5	4
Controls	15, 16	10, 12
Technical characteristics	4	3
Telephone recording	20	14
TEL.-MIC. switch	15	10
TEL.-VOL. control	16	12
Test equipment	58	46
Theory:		
Blinker oscillator and amplifier	47	34
Block diagram analysis	44	30
Change-over relay K2	49	34
Change-over relay K3	50	37
Heater circuits	52	39
Index lamp circuits	51	38
Mechanical parts, operation	43	29
Motor circuits	51	38
Power supply	52	39
Recorder circuits	46	32
Remote control relay K1	48	34
Reproducer circuits	45	30
Tone Warning Generator O–93/GT	10*b*	7
Tools and materials	32, 59	19, 46
Tools, use	71	66
Tropical climate, operation	29	18
Troubleshooting:		
Chart	60	46
Data	56	43
Equipment performance check lists, using	40, 41	23
Precautions	57	43
Procedures	53	40
Troubleshooting—Continued		
Resistance checks	63, 64	49, 51
Test equipment required	58	46
Testing methods	54	40
Tools required	59	46
Voltage checks	61, 62	49
T.T. SELECTOR-A and T.T. SELECTOR-B switches	15	10
Turntable and protective shell, removal	69	61
Turntable, operation	43	29
Uncrating, unpacking, and checking	12	8
Unusual conditions, operation under	27–30	17
Used or reconditioned equipment	14	10
Visual inspection	39, 54	22, 40
Voltage and resistance measurements	62, 64	49, 51
Voltmeter, use of	61	49
Weatherproofing	36	22

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For explanation of abbreviations used, see SR 320–50–1.

TM 11-5064-3