DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TM11-2403

TO 16-30FMQ 1-6

RADIOSONDE RECEPTORS

AN/FMQ-1 AND AN/FMQ-1A

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

JULY 1948

RADIOSONDE RECEPTORS AN/FMQ–1 AND AN/FMQ–1A

CHANGES No. 1

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

WASHINGTON 25, D. C., *29 September 1952*

TM 11–2403/ to 16–30FMQ1–6, 21 July 1948, is changed as follows:

3. Performance data.

* * * * *

d. Amplifier AM–7(*)/FMQ–1.

Number of tubes..... 6.
Thyratron..... Tube JAN–2051 (VT–109).

Note (Added). Tube type 2050 is used in Amplifier AM–7E/FMQ–1 on Order No. 3377–PH–52 and has characteristics similar to Tube JAN–2051.

* * * * *

10. Differences in Models.

* * * * *

c. (Added). Amplifier AM–7E/FMQ–1, Order No. 3377–PH–52, is the same as Amplifier AM–7A/FMQ–1 except for the following changes: Tube type 2050 is used in place of Tube JAN–2051; resistor R205 (1 ohm) is deleted; and an accessory mounting is provided for easy interchangeability of amplifier units in the rack.

88. Amplifier Tube V202

Tube V202 is * * * of thyratron tubes.)

Note (Added). Tube type 2050 is used in Amplifier AM–7E/FMQ–1, Order No. 3377–PH–52, and has characteristics similar to Tube JAN–2051.

* * * * *

89. Amplifier AM–7(*)/FMQ–1, Power Supply

(fig. 86)

* * * * *

Note. Transformer T201 contains * * * the A model. **In Amplifier AM–7E/FMQ–1, Order No. 3377–PH–52, resistor R205 is removed from the 6.3-volt winding of transformer T201.**

Figure 65. The following note is added:

Note. Tube type 2050 is used in Amplifier AM–7E/FMQ–1, Order No. 3377–PH–52, in place of Tube JAN–2051.

Figure 77. The following note is added:

Note. Tube type 2050 is used in Amplifier AM–7E/FMQ–1, Order No. 3377–PH–52, in place of Tube JAN–2051.

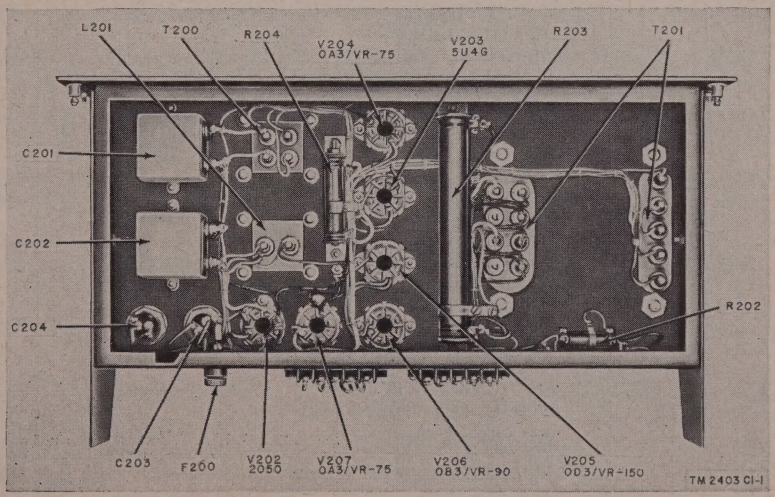


Figure 79.1 (Added). *Amplifier AM–7E/FMQ–1, bottom view.*

APPENDIX III

IDENTIFICATION TABLES OF REPLACEABLE PARTS

* * * * * * *

Table II. (Superseded) *Identification Table of Replaceable Parts for Amplifiers AM–7/FMQ–1, AM–7A/FMQ–1, AM–7B/FMQ–1, AM–7C/FMQ–1, AM–7D/FMQ–1, and AM–7E/FMQ–1.*

Ref symbol	Models						Name of part and description	Function of part	Signal Corps stock No.
	AM–7/FMQ–1	AM–7A/FMQ–1	AM–7B/FMQ–1	AM–7C/FMQ–1	AM–7D/FMQ–1	AM–7E/FMQ–1			
							AMPLIFIER AM–7, –7A, –7B, –7C, –7D, –7E/FMQ–1: one phototube signal input; one signal channel, tapper bar coil energizing signal output; 115 v ac 60 cyc, single ph; 22″ lg x 13″ wd x 10″ h; rack mtd on removable shelf w/camloc.	Builds up pulse received from recorder scanning system to energize recorder tapper coils.	7A46–7
TB201 TB202	---	(*)	(*)	(*)	(*)	(*)	BOARD, terminal: 5 brass, nickel pl screw term.; $2\frac{15}{16}$″ lg x $1\frac{1}{8}$″ wd x ½″ thk o/a.	Electrical terminal for connecting amplifier to recorder and voltage regulator.	2Z9405.1
	(*)	---	---	---	---	---	BOARD, terminal: general purpose; 5 screw term. w/2 solder lugs on ea; $3\frac{3}{4}$″ lg x $1\frac{1}{2}$″ wd x $\frac{3}{8}$″ thk, excl term.	Electrical terminal for connecting amplifier to recorder and voltage regulator.	7A371–6
C201	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: paper; 1 μf ±10%; 600 vdcw; JAN type CP53B1EF105K.	A-f bypass, grid circuit of tube V202.	3DB1–139
C202	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: paper; 1 μf ±10%; 1000 vdcw; JAN type CP53B1EG105K.	Plate voltage source for tube V202 (See paragraph 89.)	3DB1–140
C203	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: paper; 1 μf ±10%; 1000 vdcw; JAN type CP41B1EG105K.	Filter, power supply	3DB1–56
C204	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: paper; 2 μf ±10%; 1000 vdcw; JAN type CP41B1EG205K.	Filter, power supply	3DB2–267
F200	(*)	(*)	(*)	(*)	(*)	---	FUSE FU–50: 3 amp	Overload protection	3Z1950
	(*)	---	---	---	---	---	FUSEHOLDER: block type; accom fuses, 1 fuse, cartridge type, fuse 1¼″ lg x ¼″ dia.	Holds Fuse FU–50	3Z3276
E200	---	(*)	(*)	(*)	(*)	(*)	FUSEHOLDER: extractor post type; one 3AG cartridge fuse 1¼″ lg x ¼″ dia.	Holds Fuse FU–50	3Z3275
L201	---	(*)	(*)	(*)	(*)	(*)	REACTOR: 15 hy at 85 dc; 32 hy at 0 ma dc; 375 ohm dc max; oil filled HS metal case.	Filter, power supply	7A702–6
	(*)	---	---	---	---	---	REACTOR: 32 hy at 0 amp, 15 hy at 85 ma; 375 ohm dc resistance; incl steel case.	Filter, power supply	7A702
F200	---	---	---	---	---	(*)	FUSE FU–27: 2 amp	Overload protection	3Z1927
R205	(*)	(*)	(*)	(*)	---	---	RESISTOR, adjustable: WW; 1 ohm ±5%; 10 w.	Adjustment of voltage for tube heaters.	3Z5991–68

Table II. (Superseded) *Identification Table of Replaceable Parts for Amplifiers AM–7/FMQ–1, AM–7A/FMQ–1, AM–7B/FMQ–1, AM–7C/FMQ–1, AM–7D/FMQ–1, and AM–7E/FMQ–1*—Continued

Ref symbol	Models						Name of part and description	Function of part	Signal Corps stock No.
	AM-7/FMQ-1	AM-7A/FMQ-1	AM 7B/FMQ 1	AM 7C/FMQ 1	AM 7D/FMQ 1	AM 7E/FMQ 1			
R203	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, adjustable: WW; 15,000 ohms ± 10%; 75 w.	Series regulation of B+ voltage.	3Z6615–86
R204	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, adjustable: 25,000 ohms ± 10%; 25 w.	Voltage divider for B— voltage.	3Z6625–76
R202	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 150,000 ohms ± 10%; 2 w; JAN type RC42BF154K.	Charging resistor for capacitor C202.	3RC42BF154K
XV–202 XV–203 XV–204 XV–205 XV–206 XV–207	(*)	(*)	(*)	(*)	(*)	(*)	SOCKET, tube: octal; one piece flat saddle mtg; ea JAN type TSB8T102.	Mounts tube	2Z8678.327
T200	(*)	---	---	---	---	---	TRANSFORMER, AF: plate coupling type; pri 10,000-ohm, secd 90,000-ohm impedance; incl steel case.	Interstage, tubes V401 and V202.	2ZK9717–57A36.
T200	---	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, AF: plate coupling type; pri 10,000-ohm impedance, secd 90,000-ohm impedance, dc resistance pri 1,500 ohm, secd 5,500 ohm, test voltage 2,500 or ac rms between wnd and/or case; HS metal case.	Interstage, tubes V401 and V202.	7A1860–B
T202	(*)	---	---	---	---	---	TRANSFORMER, power: fil type; pri 105/115 v; 50/60 cyc, secd 6.3 v, 5 amps; incl metal case.	Furnishes 8 volts ac to exciter lamp.	2Z9611.16
T201	(*)	---	---	---	---	---	TRANSFORMER, power: fil and plate type; pri 115 v, 50/60 cyc; secd #1, 120 v, 150 ma CT; secd #2, 5 v, 3 amp; secd #3, 6.3 v, 3 amps, CT; secd #4, 7.5 v, 2.5 amps, CT; incl metal case.	Power transformer for equipment.	2ZK9717–19R30
T201	---	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, power: fil and plate type; pri input voltage between term. 1 and 4, 125 v; 1 and 3, 115 v; 1 and 2, 105 v; 60 cyc; single ph; 5 v, 3 amp, term. 12 to 13, 6.3 v, 3 amp, term. 10 to 11, 6.3 v, 5 amp, term. 8 to 9, 1,120 v 150 ma term. 5 to 7, term. 6 ctr top between term. 5 and 7; HS metal case.	Power transformer for equipment.	7A1860.2–6
V204 V207	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN type OA3	Gas voltage regulator	2J0A3
V205	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: type OD3W	Gas voltage regulator	2J0D3W
V202	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: RMA type 2050W.	Thyratron amplifier	2J2050W
V203	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: type 5U4G	Rectifier	2J5U4G
V206	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: type OB3	Gas voltage regulator	2JOB3

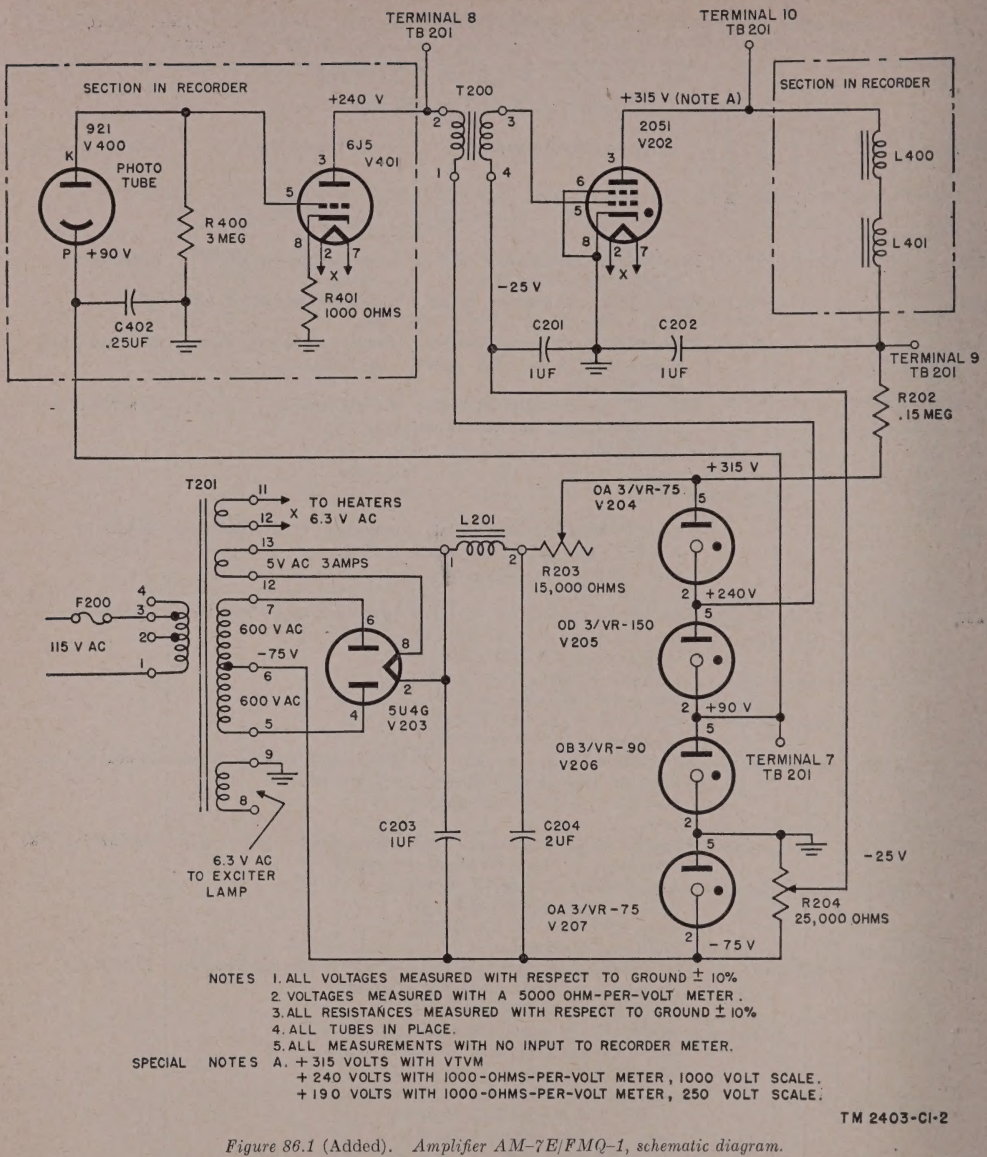


Figure 86.1 (Added). *Amplifier AM–7E/FMQ–1, schematic diagram.*

[AG 300.7 (3 Sep 52)]

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RADIOSONDE RECEPTORS

AN/FMQ-1 AND AN/FMQ-1A





DEPARTMENTS OF THE ARMY AND THE AIR FORCE • JULY 1948

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[AG 300.7 (13 Jan 48)]

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DESTRUCTION NOTICE

WHY — To prevent the enemy from using or salvaging this equipment.

WHEN — When ordered by your commander.

HOW — 1. Smash — Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut — Use axes, handaxes, machetes.

3. Burn — Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives — Use firearms, grenades, TNT.

5. Disposal — Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT — 1. Smash — Receiver, frequency meter, recorder, amplifier.

2. Cut — Coaxial lines, cables, cords.

3. Burn — Technical manuals and equipment.

DESTROY EVERYTHING

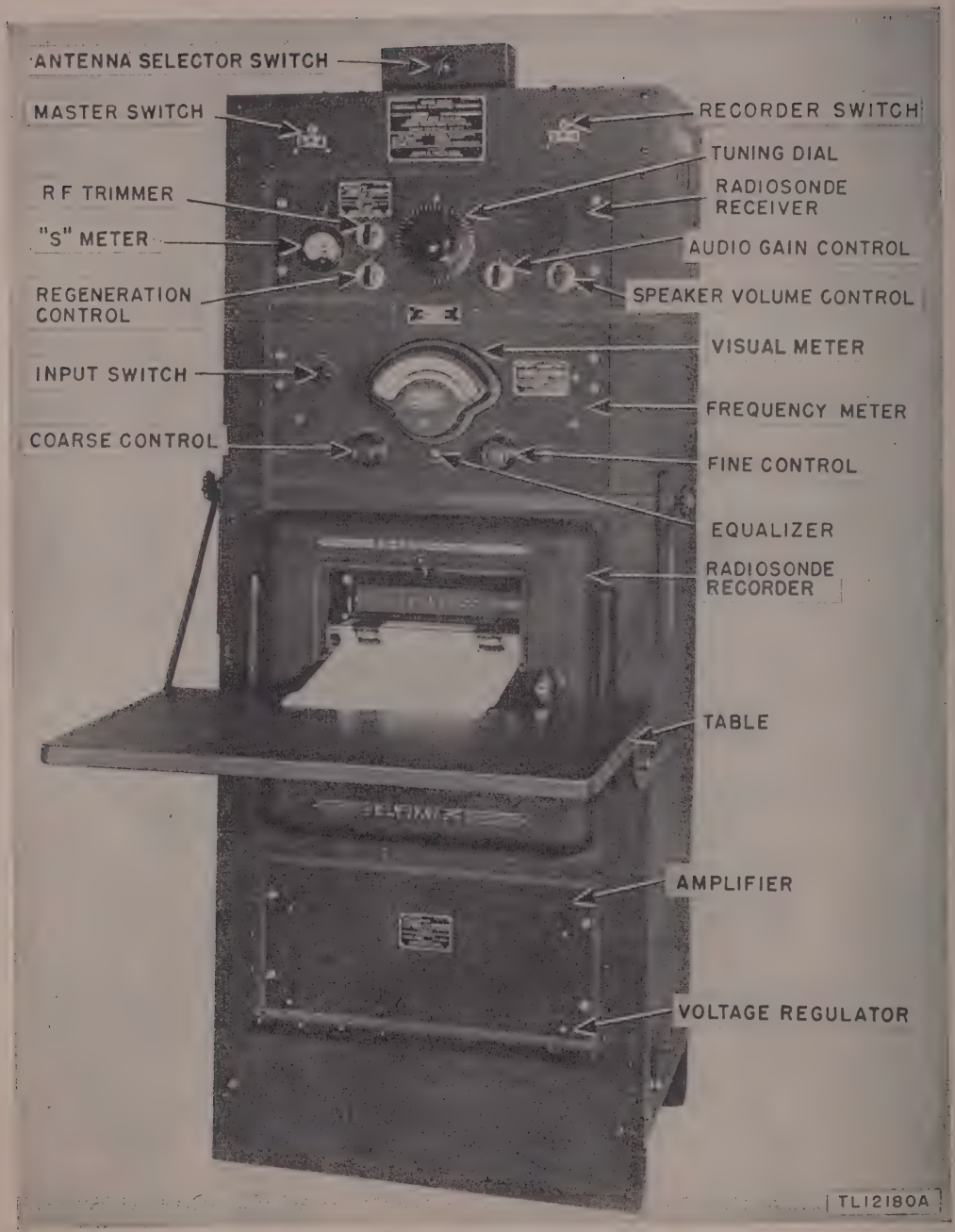


Figure 1. Radiosonde Receptor AN/FMQ–1.

This manual supersedes TM 11–2403, 25 April 1945, and TB SIG 152, January 1945.

PART ONE

INTRODUCTION

Section I. DESCRIPTION

1. General

Radiosonde Receptor AN/FMQ–1 (*) is an electronic, meteorological instrument specially designed for use with audio-modulated radiosondes. The instrument consists of an antenna assembly, a receiver, a frequency meter, a recorder, an amplifier, and a voltage regulator. All these components, excepting the antenna system, are contained in one rack (figs. 1 and 2).

Note. Unless otherwise noted, the nomenclature Radiosonde Receptor AN/FMQ–1(*) refers to both Radiosonde Receptor AN/FMQ–1 and Radiosonde Receptor AN/FMQ–1A.

a. Purpose. The primary purpose of the radiosonde receptor is to record, in printed form, information transmitted by audio-modulated radiosondes such as Radiosondes AN/AMT–1 and AN/AMT–2. This information, conveyed by means of r-f (radio-frequency) signals radiated by the radiosonde transmitter, indicates the weather conditions at the location of the radiosonde. (Information on the theory and operation of Radiosondes AN/AMT–1 and AN/AMT–2 is given in TM 11–2430.)

b. Independent Operation. Figure 3A is a simple block diagram showing the relationship between the various components of the radiosonde receptor during 72.2-mc (megacycle) operation.

(1) A radiosonde, such as Radiosonde AN/AMT–1, transmits a 72.2-mc r-f signal modulated at an a-f (audio-frequency) rate. This transmission is picked up by the antenna system of the radiosonde receptor.

(2) The antenna signals are fed to the radiosonde receiver, which performs the usual functions of amplification and demodulation. In addition, the receiver has special circuits which develop an a-f signal for the frequency meter. The frequency of the audio signal is the same as the modulation frequency of the signal transmitted by the radiosonde.

(3) The frequency meter measures and indicates the frequency of the audio signal.

(4) The radiosonde recorder, in combination with the amplifier, makes a printed record of the frequencies measured by the frequency meter.

(5) The voltage regulator maintains the 115-volt, a-c (alternating-current) supply voltage to the frequency meter and amplifier at a constant level.

c. Combined Operation. Figure 3B is a simple block diagram showing the relationship of components during 403-mc operation when Radio Set SCR–658 is used in conjunction with the radiosonde receptor. (TM 11–1158A gives complete information on Radio Set SCR–658.)

(1) A radiosonde, such as Radiosonde AN/AMT–2, performs the same function as the 72.2–mc radiosonde, the only differences being the frequency of the r-f carrier and the type of modulation. Radiosonde AN/AMT–2 emits frequency-modulated signals.

(2) Because the antenna and receiver of the radiosonde receptor are not capable of receiving 403-mc signals, Radio Set SCR–658 is used to receive, amplify, and demodulate the radiosonde signals.

(3) The audio component of received signals is then fed from Radio Set SCR–658 to the radiosonde receiver and frequency meter in the radiosonde receptor. This audio signal has the same characteristics as the audio output of the radiosonde receiver during 72.2-mc operation.

(4) During 403-mc operation, the only function of the radiosonde receiver is aural monitoring of the audio component at the radiosonde receptor location. For this reason, only the audio output stage and the speaker of the radiosonde receiver are used.

(5) During 403-mc operation, the operation of the frequency meter, radiosonde recorder, amplifier, and voltage regulator is identical with their operation during 72.2-mc operation.

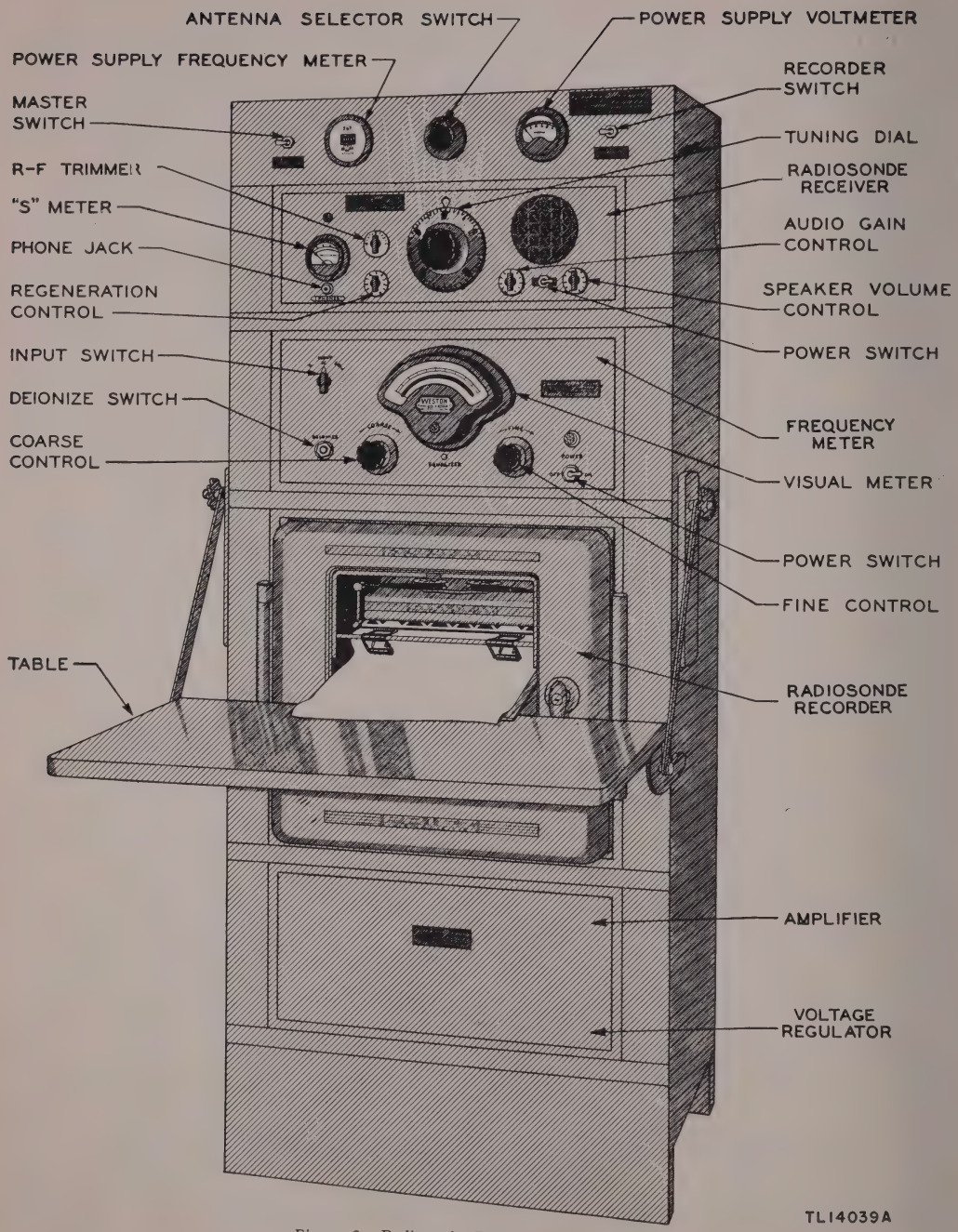


Figure 2. Radiosonde Receptor AN/FMQ-1A.

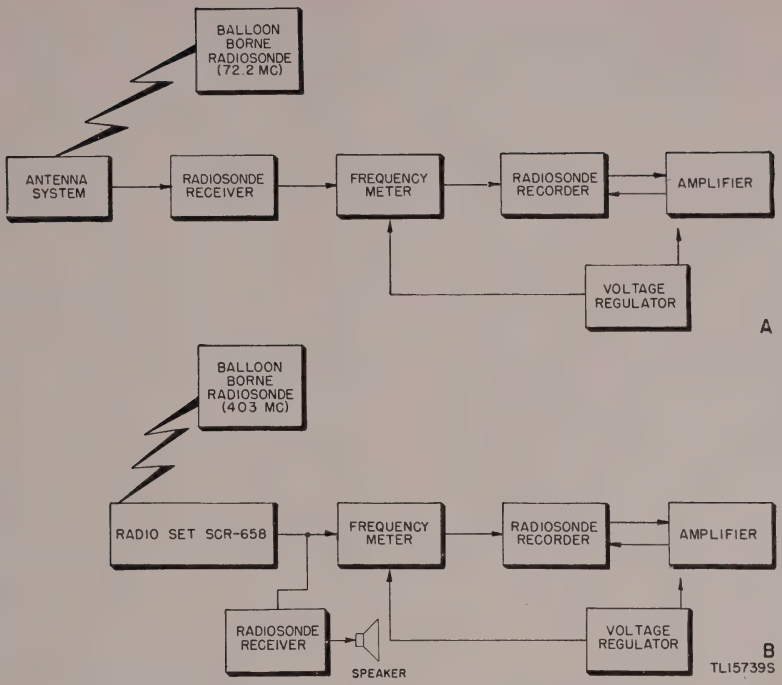


Figure 3. Components for 72.2- and 403-mc operation, block diagrams.

2. Table of Major Components

The table below lists the nomenclature, quantity, dimensions, and weight of the major components. See paragraph 13 for packaging data.

Nomenclature	Sig C stock No.	Dimensions (in.)			Weight	Quan
		Depth	Width	Height		
Antenna Assembly AS-11(*)/FMQ-1.....	7A1326/A1	5-in. diam.	.....	135	20	2
Radiosonde Receiver R-17(*)/1FMQ-1.....	7A8340-17	10	19	7	40	1
Frequency Meter TS-29(*)/FMQ-1.....	7A889-29	10	19	8¾	38	1
Radiosonde Recorder RD-3(*)/FMQ-...	7A1326-3	15	20½	18¾	110	1
Amplifier AM-7(*)/FMQ-1	7A46-7	10	19	8½	40	1
Voltage Regulator CN-2(*)/FMQ-1.....	7A1680	5¾	13	5¾	26	1
Rack Assembly MT-47(*)/FMQ-1.....	7A8337-47	16½	25	60¼	..	1

3. Performance Data

The table below lists the general characteristics and performance data for Radiosonde Receptor AN/FMQ–1(*).

a. Radiosonde Receiver R–17(*)/FMQ–1.

R-f range	56 mc to 85 mc.
Receiver type	superregenerative.
Number of tubes	8.
R-f amplifier	Tube JAN–954 (VT–120).
Superrengenerative detector	Tube JAN–955 (VT–121).
Meter amplifier and vacuum tube voltmeter	Tube JAN–6F8G (VT–99).
A-f amplifier	Tube JAN–6SJ7 (VT–116).
Diode clipper and meter rectifier	Tube JAN–6H6 (VT–90).
Limiter	Tube JAN–6SJ7 (VT–116).
A-f power amplifier	Tube JAN–6F6 (VT–66).
Rectifier	Tube JAN–80 (VT–80).
Power supply	115 v to 125 v, 60 cps ± 2 cps.
Antenna type	coaxial vertical dipole.

b. Frequency Meter TS–29(*)/FMQ–1.

A-f range	0 to 200 cps.
Number of tubes	8.
*A-f amplifier	Tube JAN–6J5 (VT–94).
Two thyratrons	Tube JAN–884 (VT–122).
Pulse rectifier	Tube JAN 6ZY5G.
Two power rectifiers	Tube JAN–80 (VT–80).
Voltage regulator	Tube JAN–0D3/VR150 (VT–139).
Voltage regulator	Tube JAN–0A3/VR75 (VT–260).
Power supply	115 v, 60 cps.

c. Radiosonde Recorder RD–3(*)/FMQ–1.

Current range	0 to 500 microamperes.
Number of tubes	2.
Phototube	Tube JAN–921.
Preamplifier	Tube JAN–6C5 or JAN–6J5.
Exciter lamp	Mazda 87.
Paper feed	0.4 inch per minute.

d. Amplifier AM–7(*)/FMQ–1.

Number of tubes	6
Thyratron	Tube JAN–2O51 (VT–109).
Rectifier	Tube JAN–5U4G (VT–244).
Two voltage regulators	Tube JAN–0A3/VR75 (VT–260).
Voltage regulator	Tube JAN–0B3/VR90 (VT–184).
Voltage regulator	Tube JAN–0D3/VR150 (VT–139).
Power supply	115 v, 60 cps.

e. Voltage Regulator CN–2(*)/FMQ–1.

Input voltage	105 v to 125 v.
Input current	2.3 amps.
Input frequency	60 cps ± 2 cps.
Output voltage	115 v, ± 0.5%.
Output current	1.3 amps.
Output frequency	60 cps ± 2 cps.
Phase	1.

f. Antenna Assembly AS–11(*)/FMQ–1.

Transmission line	Radio Frequency Cable RG–11/U, flexible coaxial (solid dielectric), 75-ohm nominal impedance.
Antenna type	Coaxial vertical dipole.

4. Antenna Assembly AS–11(*)/FMQ–1

The antenna system consists of two dipole type antennas connected to the receptor by a flexible coaxial cable (Radio Frequency Cable RG–11/U).

a. The antenna (figs. 4 and 15) has two sections; one a tapered steel rod, the other a brass tube called a skirt. The steel rod is coated with copper to provide better conductivity and painted olive drab to prevent corrosion.

b. Radio Frequency Cable RG–11/U consists of an inner conductor of 7 strands of #26 tinned copper wire and an outer conductor of interwoven copper strands. The two conductors are separated by a solid plastic insulating material. The outer conductor is protected by a plastic shield. A mounting bracket not shown in figure 4 is used.

*Some equipments use Tube JAN–6C5 (VT–65).

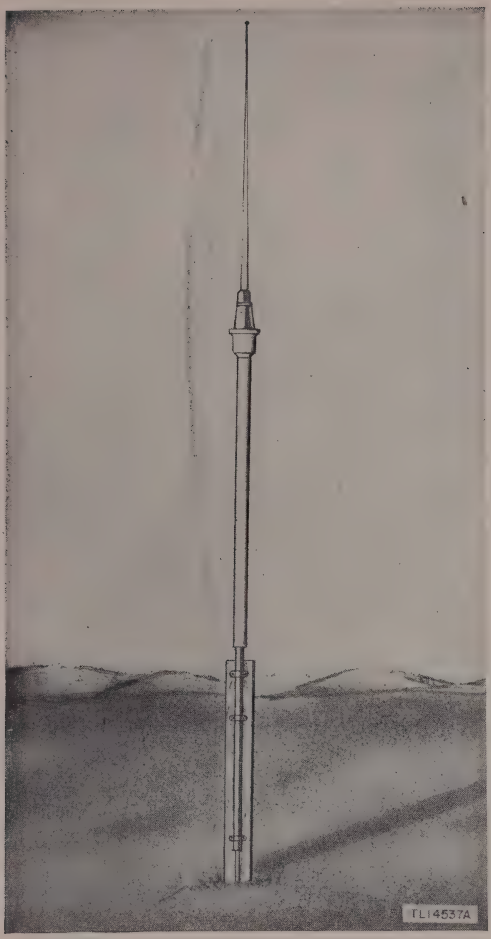


Figure 4. Antenna Assembly AS–11(*)/FMQ–1, installed.

5. Radiosonde Receiver R–17(*)/FMQ–1

The radiosonde receiver is a self-quenching super-regenerative type complete with self-contained power supply and speaker. As shown in figures 1 and 2, the main tuning dial is located at the center of the front panel; the S meter, and the R.F. TRIMMER and REGENERATION controls are at the left of the tuning dial; the speaker, AUDIO GAIN control, and S'P'K'R' VOLUME control are at the right of this dial. The receiver output terminals are located on the rear of the chassis (figs. 5 and 6).

a. Radiosonde Receiver R–17/FMQ–1. On this model, the antenna connections are made to binding posts at the rear of the chassis (fig. 5).

b. Radiosonde Receiver R–17A/FMQ–1. On this model, the antenna connections are made by means of sockets located at the top rear of the rack assembly (fig. 6). In addition, an ON-OFF power switch has been installed on the front panel of the receiver and a PHONES jack has been placed below the S meter. When a headset plug is inserted n the PHONES jack, the speaker is automatically disconnected from the circuit.

6. Frequency Meter TS–29(*)/FMQ–1

The frequency meter converts the a-f output of the radiosonde receiver (or of Radio Set SER–658) to a pulsating direct current, the average value of which is proportional to the output frequency of the radiosonde receiver. This current is measured by the visual meter on the front panel of the frequency meter (figs. 1 and 2) and the recorder meter which is in the radiosonde recorder (fig. 18).

a. The visual meter is graduated into 100 equal divisions with each division representing a frequency of 1 bi-cycle per second (1 bi-cycle equals 2 cps (cycles per second)).

(1) To the left of the visual meter on the front panel are the INPUT switch and the COARSE calibration control.

(2) Directly under the visual meter is a small hole in the front panel through which a screwdriver may be inserted to make adjustments of the EQUALIZER control. During calibration of the equipment, this control is used to produce equal indication of the two meters.

(3) To the right of the visual meter is the FINE calibration control.

b. Frequency Meter TS–29/FMQ–1. On this model, a pilot light is on the left side of the panel and a DEIONIZE switch is on the right side of the panel (fig. 1).

c. Frequency Meter TS–29A/FMQ–1. On this model, the DEIONIZE switch is on the left side and the pilot light is on the right side of the panel directly above a POWER OFF-ON switch.

7. Radiosonde Recorder RD–3(*)/FMQ–1 and Amplifier AM–7(*)/FMQ–1

The radiosonde recorder, in combination with Amplifier AM–7(*)/FMQ–1, comprises an electromech-

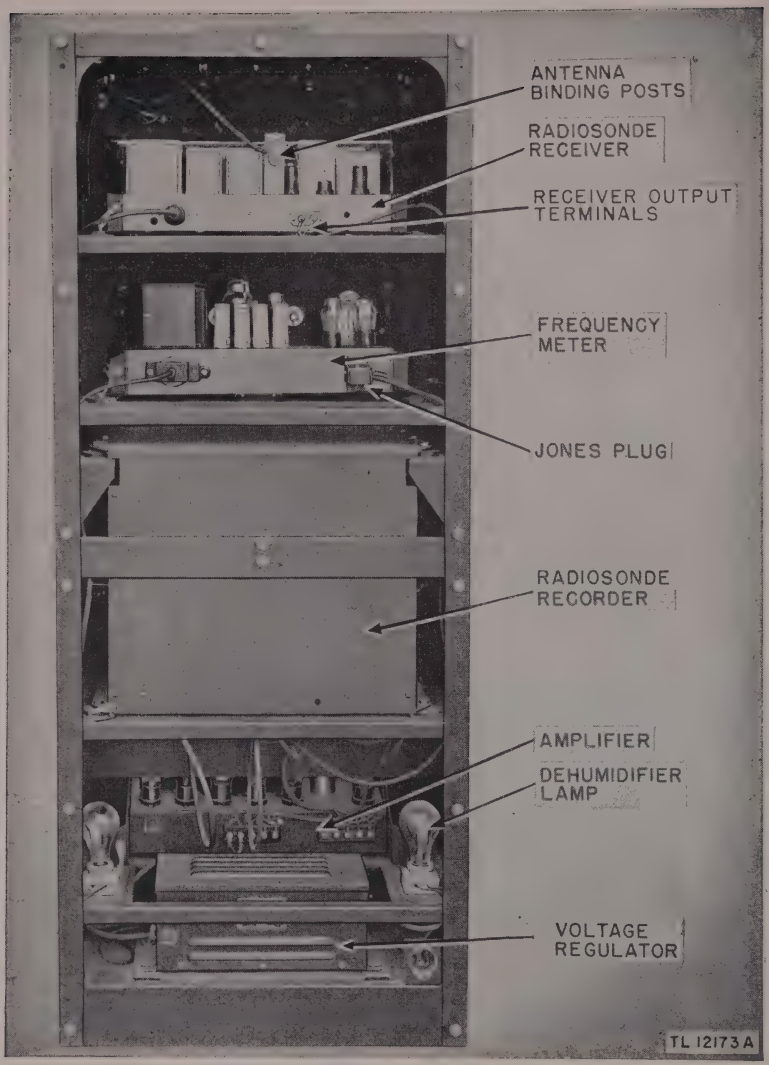


Figure 5. Radiosonde Receptor AN/FMQ–1, rear view.

anical device which makes a printed record of the frequencies measured by the frequency meter. During operation, the recorder paper on which the printed record appears is constantly emitted from the printing mechanism at a rate of 0.4 inch per minute. The emitted paper slides out over a small chute and inclined shelf onto an operations table. The paper moves at such a slow rate that the operator can make notations on the paper during operation. A complete description of the radiosonde recorder is given in section VIII.

8. Voltage Regulator CN–2(*)/FMQ–1

The voltage regulator is in the lower part of the rack assembly (figs. 5 and 6). This unit contains two

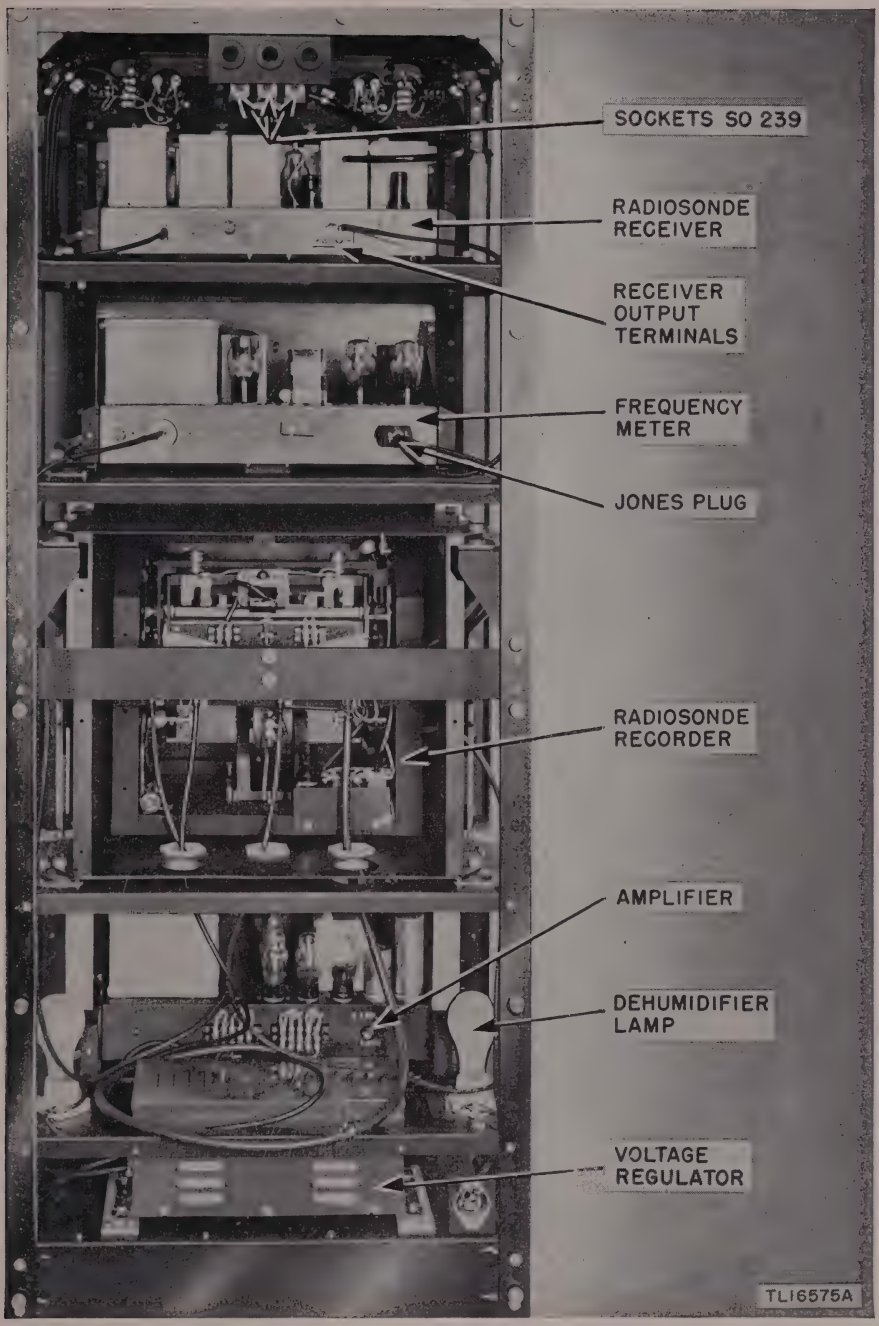


Figure 6. Radiosonde Receptor AN/FMQ-1A, rear view.

specially designed transformers and two capacitors arranged in a circuit to produce a constant output voltage under load, even though the power input voltage may vary over wide limits. The voltage regulator has no front panel operating controls.

9. Rack Assembly MT–47(*)/FMQ–1

a. General. The rack assembly houses all components of the radiosonde receptor except the antenna assembly (fig. 7).

(1) The radiosonde receiver is in the upper part of the rack with the frequency meter, radiosonde recorder, recorder amplifier, and voltage regulator placed in that order beneath the receiver.

(2) Two dehumidifier lamps are in the lower part of the rack (figs. 5 and 6). These lamps may be turned on, when necessary, to prevent deterioration of the equipment because of high humidity or faulty operation and break-down because of low ambient temperature. Their use in humid or cold climates is necessary. The lamps can be turned on and off by means of individual toggle switches located alongside each lamp socket.

(3) Attached to the front of the rack assembly is an adjustable operations table which can be used for evaluation of the record as signals are received.

(4) The rack assembly contains all cabling necessary for interconnection of the various components.

(5) The MASTER and RECORDER ON-OFF switches are located on a panel above the receiver (figs. 1 and 2).

b. Rack Assembly MT–47/FMQ–1. (fig. 1). In addition to the general features given above, this model has a rack made of steel and an antenna selector switch on top of the rack.

c. Rack Assembly MT–47A/FMQ–1. This model has all the features explained in *a* above plus the following:

(1) The rack is made of aluminum.

(2) The panel above the receiver contains a frequency meter of the vibrating-reed type and a 0-150-volt a-c voltmeter for monitoring the frequency and voltage of the power input to the equipment.

(3) The antenna selector switch is between the frequency meter and the voltmeter.

d. Expendable Hardware Item MK–27/FMQ–1. Each radiosonde receptor is supplied with this hardware kit, which consists of electrical and mechanical components necessary for installation of the equipment.

10. Differences in Models

a. Radisonde Receptor AN/FMQ–1A performs the same functions as Radiosonde Receptor AN/FMQ–1. The A model, however, has been moisture-proofed and fungiproofed and contains added features such as hermetically sealed transformers, chokes, and capacitors. In addition, the resistors and capacitors used in the A model have standardized values wherever possible. Other differences in models are noted throughout this manual.

b. Radiosonde Recorder RD–3B/FMQ–1 is the same as Radiosonde Recorder RD–3A/FMQ–1 when the A model has been modified according to MWO SIG 11–2403–3, Modification of Radiosonde Recorders RD–3/FMQ–1 and RD–3A/FMQ–1, to Provide Improved Performance of Ribbon Drive Mechanism, Modification Kit MX–636/FMQ–1.

Section II. INSTALLATION AND ASSEMBLY

11. Selection of Site

a. Antennas. To obtain optimum performance from the equipment, the antennas should be located in the best possible positions.

(1) Choose a location in an open space, as far as practicable from obstacles such as buildings or steel towers, so that the distance from the antenna to an obstruction is at least 10 times the height of the obstruction. Locate the antennas so there is no obstruction directly between them (fig. 8).

(2) The antennas should be at least 200 feet from roads or parking areas to avoid interference from automobile ignition systems. Avoid a location near a radio transmitter. Electrical machinery, high-tension power lines, teletype line and machines, and telephone lines frequently cause interference.

(3) To avoid losses from a long transmission line, the location should be close to the building in which the rack assembly is to be installed. Unless absolutely necessary, the transmission lines should not exceed 200 feet. If it is impossible to locate the antennas near the ground in a favorable position, they may be mounted on a roof or other elevated place. If interference from automobile traffic or

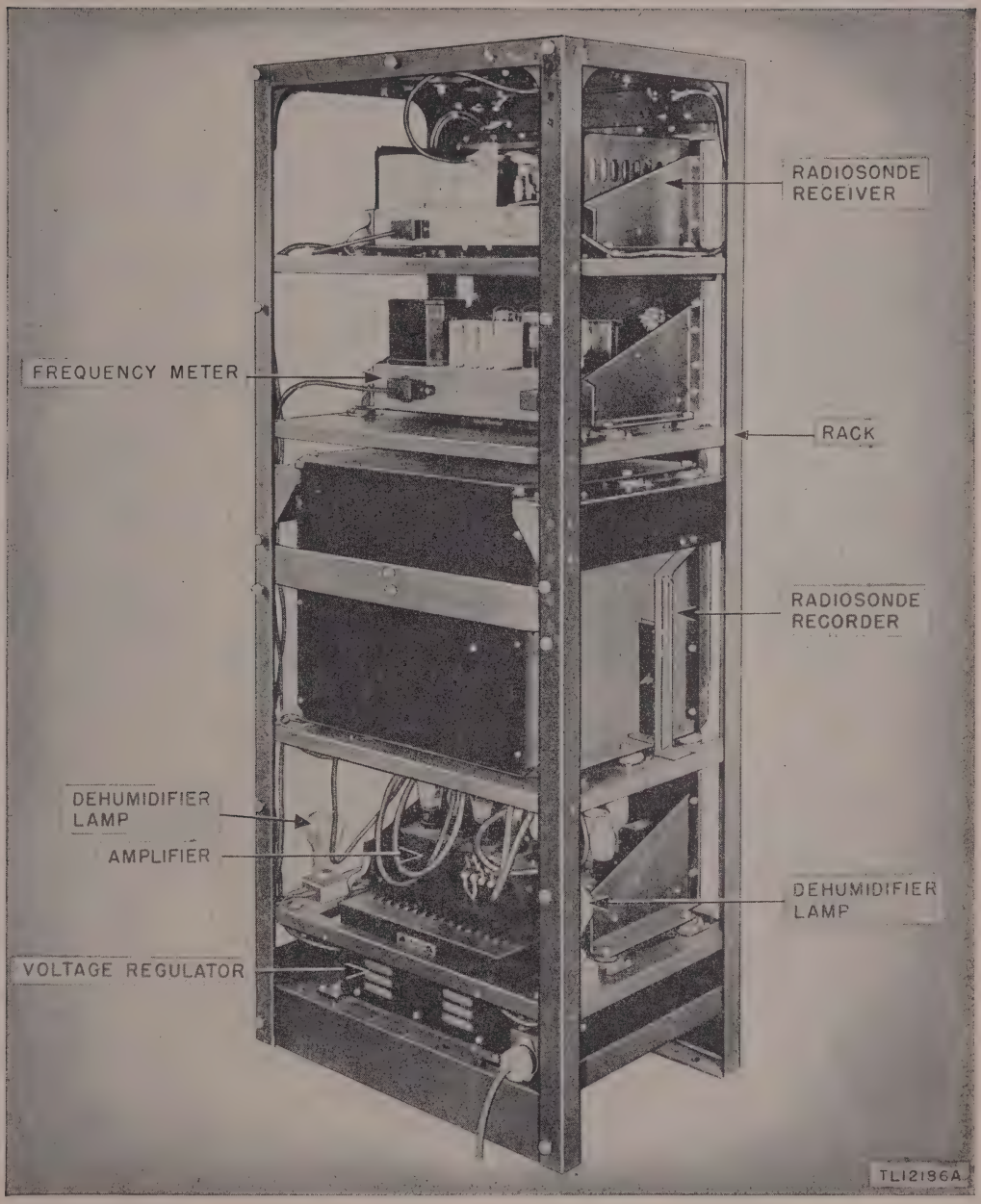


Figure 7. Rack Assembly MT-47/FMQ-1, with components mounted.

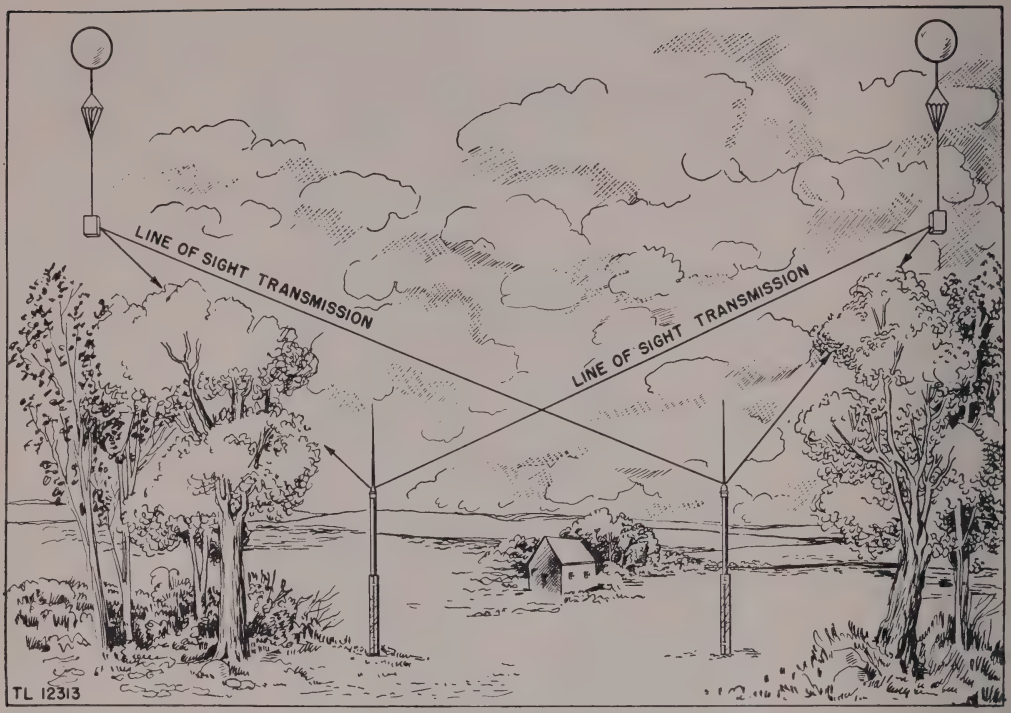


Figure 8. Line of sight transmission.

other sources near the ground is encountered, it may prove better to increase the height of the antennas.

(4) For best results, locate the antennas so that the lower edge of one skirt is ¼ wavelength (41 inches at 72.2 mc) above the ground and the skirt of the other is ¾ wavelength (123 inches) above the ground. When so installed, undesirable directional characteristics in the vertical plane of one antenna will be compensated for by the vertical directional characteristics of the other antenna. Thus, this type of erection will normally permit line of sight from the radiosonde to either one or the other of the antennas regardless of the position of the radiosonde in space.

Note. If the antennas are mounted above a large, metallic surface, such as the roof of a building, the roof will be the reflecting surface.

(5) When the antennas must be mounted high above the reflecting surface, the distance between the skirt and the surface should be a whole number of wavelengths plus ¼ or ¾ wavelength (1 wavelength at 72.2 mc is approximately 13 feet, 6⅔ inches). If, for example (assuming operation at 72.2 mc), the antennas are to be mounted approximately 40 feet above the reflecting surface, the lower edge of one antenna skirt should be 41 feet, 41 inches, or 3¼ wavelengths above the surface. In this case, the second antenna would be placed ½ wavelength lower or higher (2¾ or 3¾ wavelengths above the surface).

b. Rack Assembly. The rack and its components should be installed in any dry indoor location. A reasonably quiet location is desirable because tuning depends to some extent on aural reception. The location should be as free of vibration as possible. The rear of the equipment should be at least 2½ feet from the wall of the building to provide access for servicing.

12. Unpacking, Uncrating, and Checking

The rack assembly, radiosonde recorder, and voltage regulator are shipped assembled; the antenna assembly, radiosonde receiver, frequency meter, amplifier, and spare parts box are packed in separate boxes. See figures 9, 10, and 11 for packaging data. The radiosonde receiver, frequency meter, and amplifier are each packed as shown in figure 10. Seven boxes contain all components. To unpack the equipment, proceed as follows:

a. Unload the seven uncrated boxes and place them near the position where the rack assembly will rest after installation is complete. Remove the lid and one side of the outer box containing the packaged rack. Remove the excelsior and lift out the inner box, placing it in such a way that it rests upon its skidded base. Be careful not to drop or jar the contents. Remove the top, sides, and ends of the inner box, leaving the wrapped unit exposed on the skidded base. Open the outer waterproof wrap by cutting carefully at the seam, taking care not to cut too deeply. Lay the waterproof wrap down around the skid base, thus exposing the moisture-vaporproof inner barrier. Open the moisture-vaporproof barrier by cutting along the heat-sealed seams. Lay the barrier material down, exposing the cushioned rack. Break the straps holding the desiccant and remove the desiccant bags. Break the straps holding the rack to the bolted pallet and ease the rack off the base and into an upright position. Remove all flexible corrugated paper cushioning. Remove the blocking and bracing of the recorder and voltage regulator from within the rack.

b. The radiosonde receiver, frequency meter, and amplifier are each unpacked as follows: Break the straps on the nailed wood shipping container (fig. 10). Remove the top of the box. Remove sufficient excelsior to disclose the inner wrapped package. Lift out the packaged item. Remove the outer waterproof wrap. Remove the outer carton. Cut the moisture-vaporproof barrier along the heat-sealed seam and remove the barrier. Open the inner carton. Remove the desiccant. Lift out the packaged item, removing all blocking and bracing. Install all tubes.

c. Check contents of each box against the packing list to make certain that no parts are missing. Inspect all components for damaged parts.

13. Packaging Data

Radiosonde Receptor AN/FMQ–1 and/or Radiosonde Receptor AN/FMQ–1A is contained in seven boxes as follows:

Component	Box dimensions (in.)			Volume (cu ft)	Weight (lb)
	Length	Width	Height		
a. Packaged for export.					
Antenna Assembly AS–11(*)/FMQ–1	102	7¼	9	3.8	65
Antenna Assembly AS–11(*)/FMQ–1	102	7¼	9	3.8	65
Rack Assembly MT–47(*)/FMQ–1, Radiosonde Recorder RD–3(*)/FMQ–1, and Voltage Regulator CN–2(*)/FMQ–1.	93	45	40	97	750
Radiosonde Receiver R–17(*)/FMQ–1	29	22¼	15¼	5.7	82
Frequency Meter TS–29(*)/FMQ–1	29	19½	16	5.2	80
Amplifier AM–7(*)/FMQ–1	28	17½	16	4.6	67
Spare parts box	48	36	18	18	200
b. Packaged for domestic shipment or for short movements of using troops.					
Antenna Assembly AS–11(*)/FMQ–1	98½	6	8	2.8	30
Antenna Assembly AS–11(*)/FMQ–1	98½	6	8	2.8	30
Rack Assembly MT–47(*)/FMQ–1, Radiosonde Recorder RD–3(*)/FMQ–1, and Voltage Regulator CN–2(*)/FMQ–1.	84	40	35	63	625
Radiosonde Receiver R–17(*)/FMQ–1	20	16	8½	1.6	44
Frequency Meter TS–29(*)/FMQ–1	20	13½	10¼	1.5	42
Amplifier AM–7(*)/FMQ–1	20	11½	9½	1.3	44
Spare parts box	48	36	18	18	200

Note. See paragraph 20.

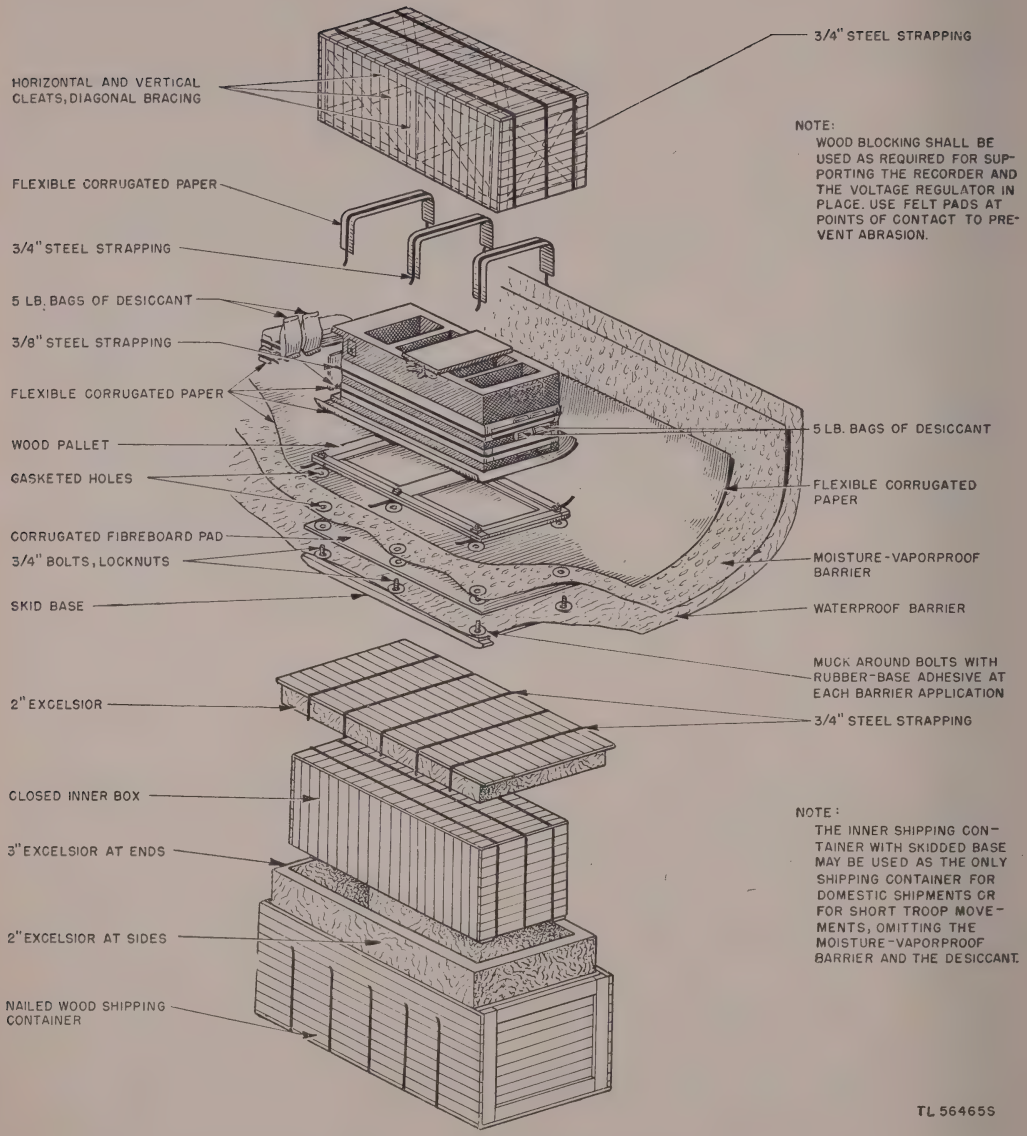


Figure 9. Packaging of rack assembly.

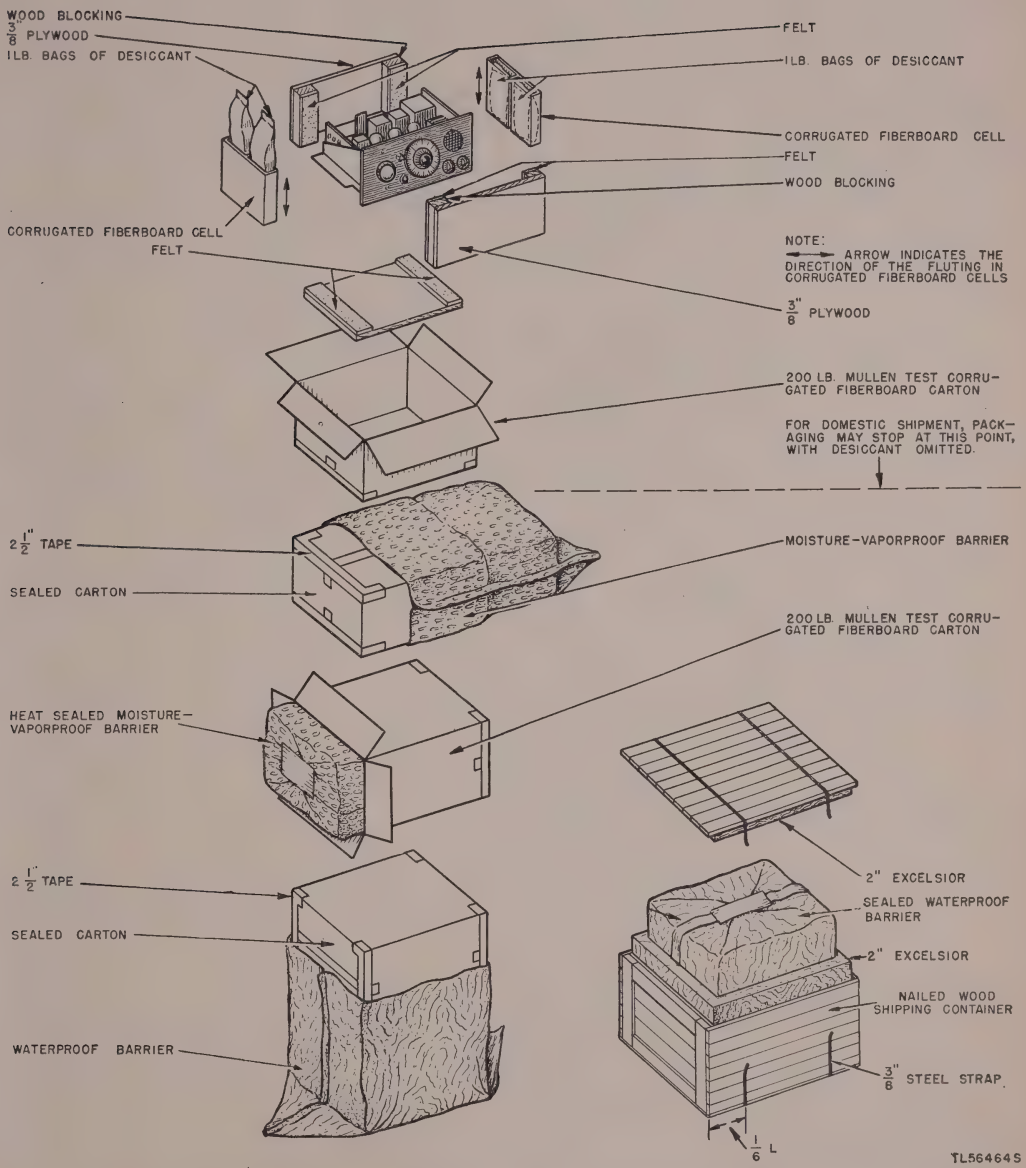


Figure 10. Packaging of radiosonde receiver.

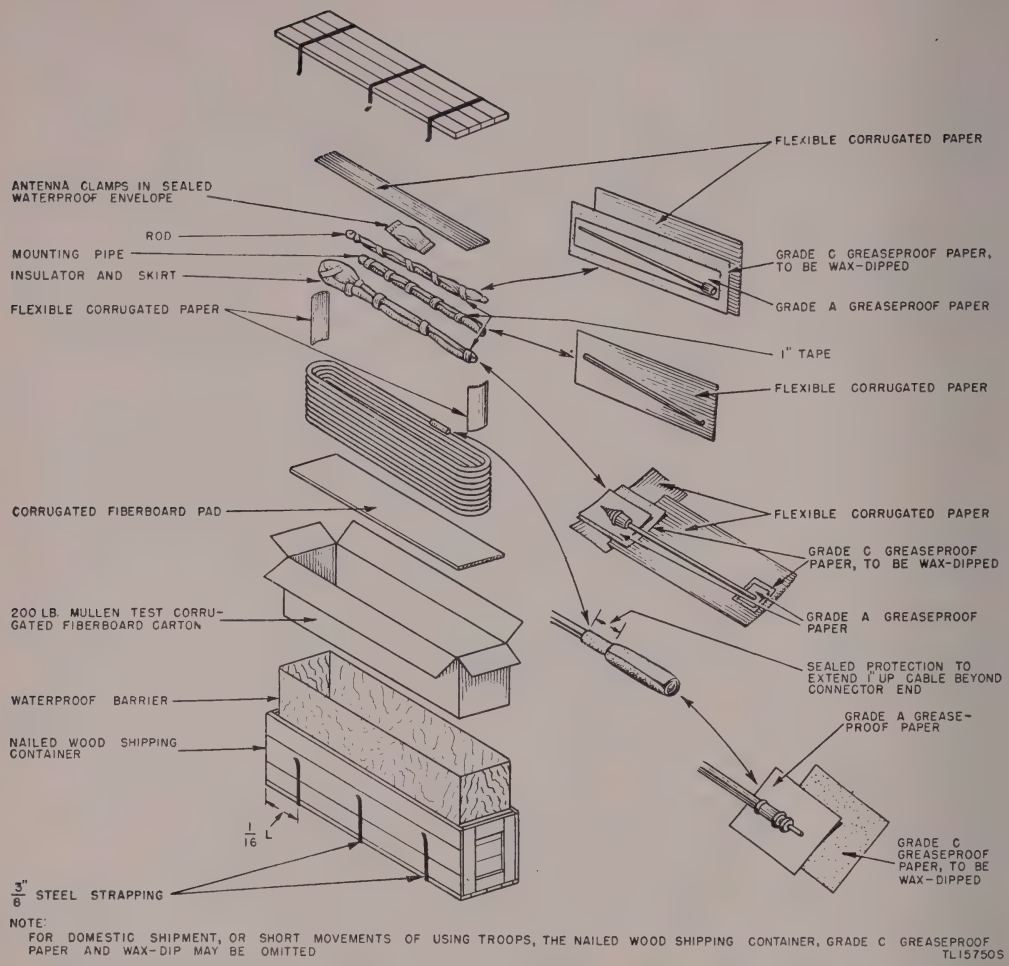


Figure 11. Packaging of antenna assembly.

14. Installation of Rack Assembly Components

After the equipment has been unpacked, the rack assembly components should be placed in position (figs. 1, 2, 5, 6, and 7 and par. 9*d*). The screws for mounting these components will be found in the shock mounts on the rack.

a. Wire Connections. (1) Connect wiring as shown in figures 12 and 13 for Radiosonde Receptor AN/FMQ–1 or as shown in figures 13 and 14 for Radiosonde Receptor AN/FMQ–1A.

(2) When Radio Set SCR–658 is to be used with the radiosonde recorder, plug the adapter on Cord CD–1312 of Radio Set SCR–658 into the receptacle on the frequency meter in place of the Jones plug shown in figures 12 and 14. See TM 11–1158A for data on Cord CD–1312.

b. Installation of Recording Paper. To install a paper chart roll, use the following procedure:

(1) Lower the operations table to a vertical position after loosening the two knurled nuts on the sides of the rack assembly.

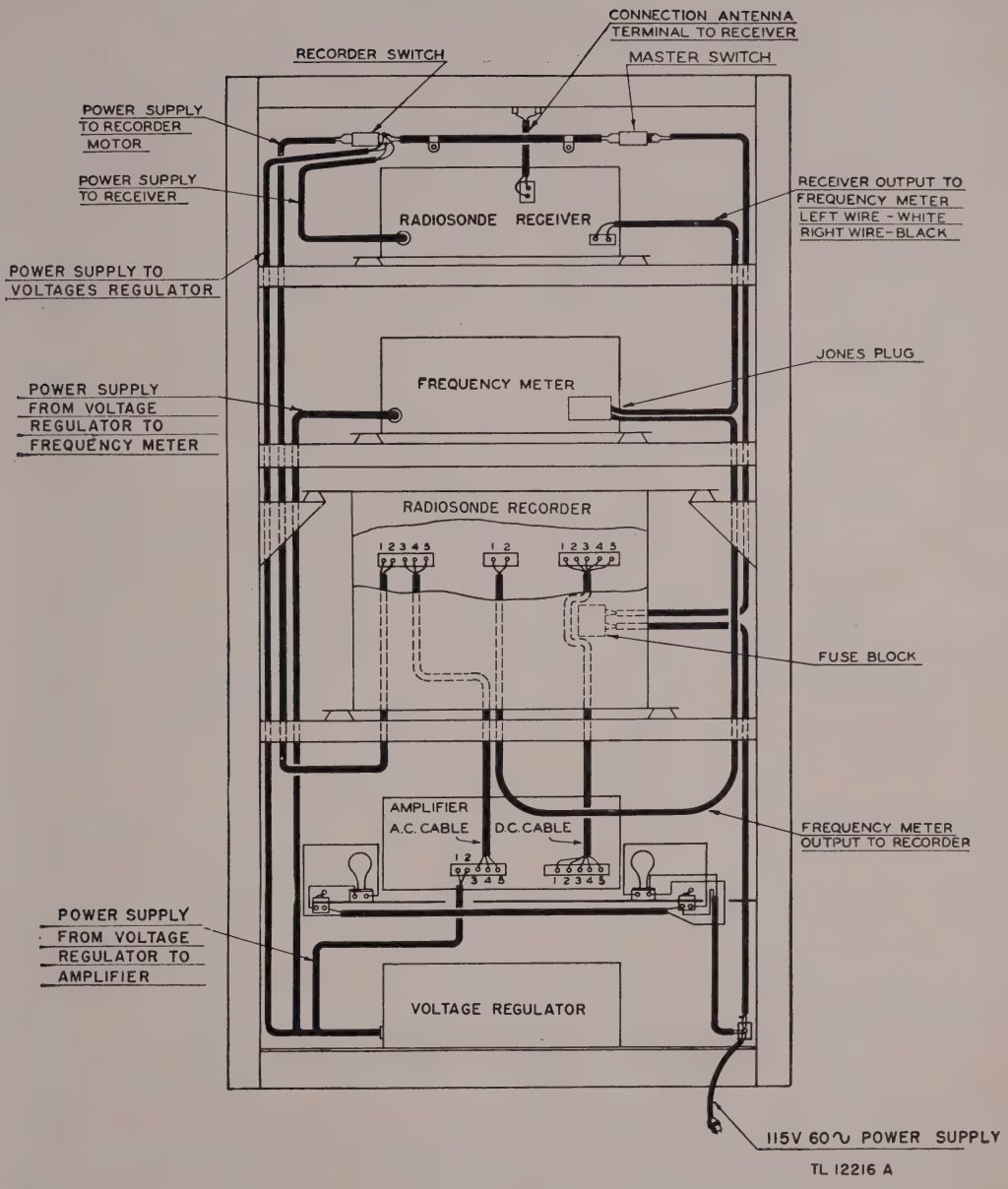


Figure 12. Radiosonde Receptor AN/FMQ-1, interunit cording diagram.

(2) Open the front door of the radiosonde recorder.

(3) The radiosonde recorder assembly shown in figure 18 is pivoted at the lower front corners. Pull the recorder assembly forward from the top and allow it to revolve about its pivots until it has been lowered as far as it will go. In this position, the assembly is self-supporting and the various parts are accessible for installation of the paper chart roll.

(4) Raise the pull out arm catch (fig. 49).

(5) By means of the pull out arm (fig. 18), raise the ribbon drive and tapper bar units.

(6) Release the pressure of the friction fingers on the spiral drum by pulling out on the friction finger rod.

(7) Place the flat end of the paper chart roll into its normal position over the spring-loaded pivot point and push the roll to the right to allow the left end of the roll to fit into its bearing.

(8) Feed the paper over the spiral drum and under the friction fingers (fig. 18).

(9) Lower the ribbon drive and tapper bar units by returning the pull out arm to its original position where it will be engaged with and retained by the pull out arm catch.

(10) Restore the pressure of the friction fingers against the paper on the spiral drum by pushing in on the friction finger rod.

(11) Push the recorder back into the rack.

(12) Feed the paper under the paper set pointer on the left side of the recorder (fig. 18).

(13) Close recorder front door and raise the operations table.

c. Installation of New Ribbon. When it be-

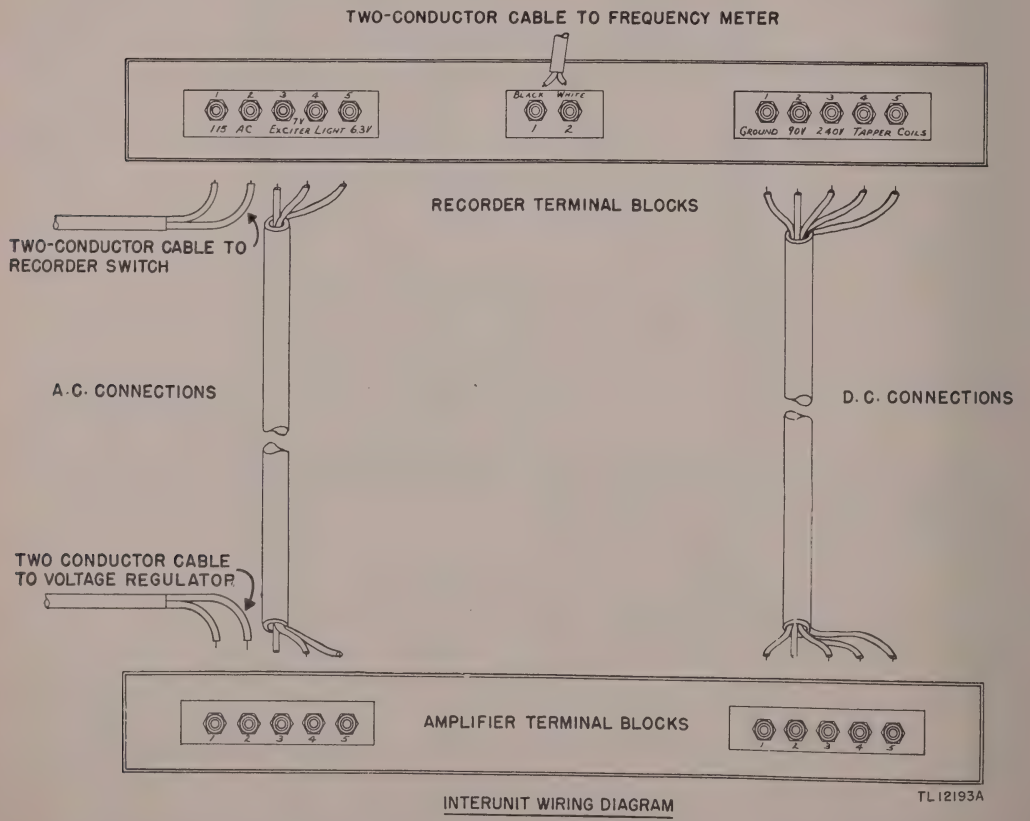


Figure 13. Interunit wiring between Radiosonde Recorder RD–3(*)/FMQ–1 and Amplifier AM–7(*)/FMQ–1.

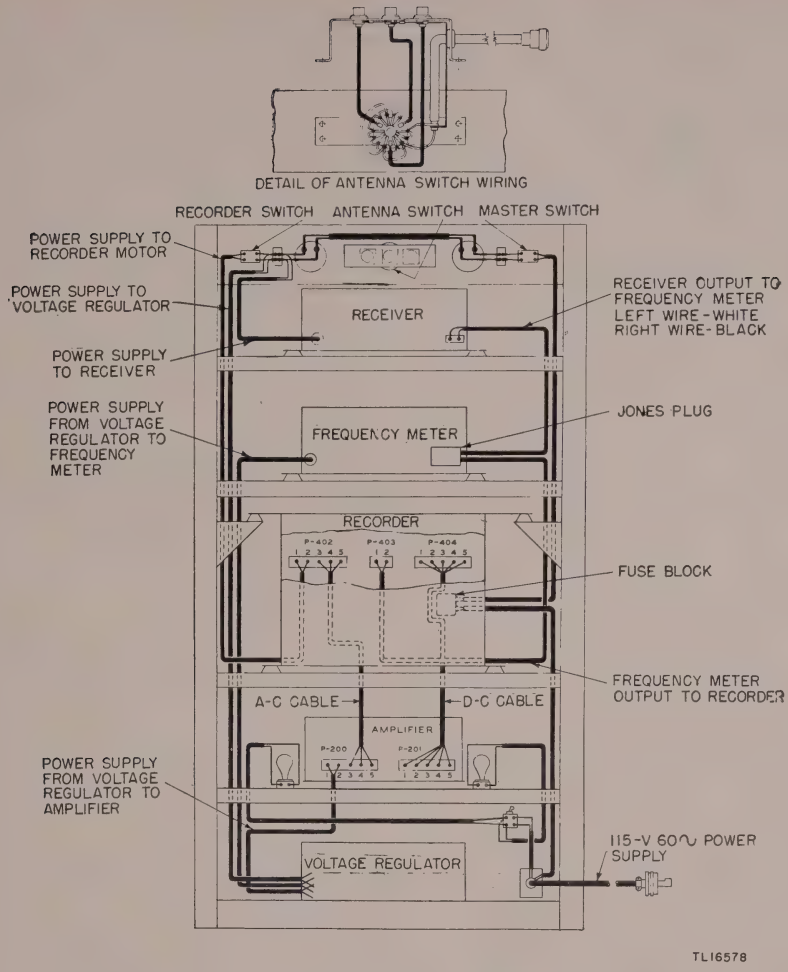


Figure 14. Radiosonde Receptor AN/FMQ–1A, interunit cording diagram.

comes necessary to install a new ribbon, lift the spools off and slide the ribbon from under the tapper bar and off the guide rolls. Then fasten the free end of a new ribbon to an empty spool by catching it on the sharp point on the hub of the spool. Next, place the spools on the spindles with the ribbon spool shaft levers in the slots between the spool hubs and the ribbon. Make certain that the lever is inside the inner turn of the ribbon.

d. Installation of Ground Rod. Drive Ground Rod GP–29 into ground at a location outside of and not more than 40 feet away from the building which houses the radiosonde receptor. Connect the bottom rear shield of the receptor to the ground rod with #10 wire. Run the wire so that the connection will not present a walking hazard.

Caution: Before connecting the radiosonde receptor to the power line, check all external and internal wiring as shown in figures 12 and 14. Carefully check the polarity of the connections to the recorder meter. See section III of this manual before applying power to the equipment.

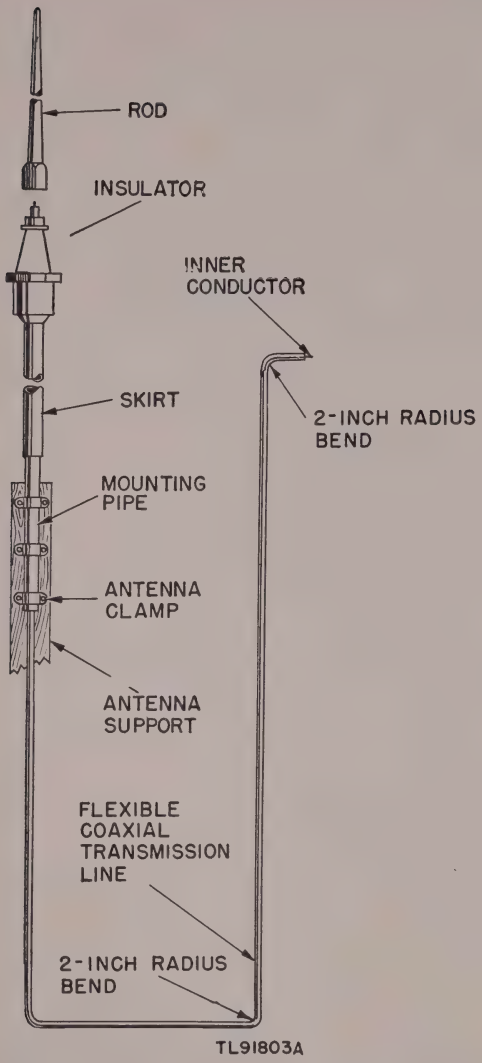


Figure 15. Antenna Assembly AS–11/FMQ–1.

15. Installation of Antennas

a. After the ground-level site has been selected, a wooden post approximately 4 inches square should be driven into the ground to a depth of 3 or 4 feet at each antenna location. These posts will serve as supports for the antennas. Each post should project vertically upward to the required height above ground which permits the desired antenna height to be obtained (par. 11*a*).

b. The antennas can be fastened to the wooden posts by means of the clamps and lag screws provided for this purpose (fig. 15 and par. 9*d*).

c. If the antennas are to be mounted over the roof of a building, make certain that they are securely fastened in order to minimize the possibility of damage during a strong wind.

16. Installation of Radio Frequency Cable RG–11/U

Each antenna is connected to the radiosonde receiver by means of a coaxial cable (Radio Frequency Cable RG–11/U). On Radiosonde Receptor AN/FMQ–1, the antenna binding posts on the back of the receiver chassis are used to terminate the coaxial cable (fig. 5). On Radiosonde Receptor AN/FMQ–1A, the cable is terminated at the sockets located near the top of the rack assembly (fig. 6).

a. Laying Coaxial Cables. The outdoor portion of the coaxial cables can either be buried in a trench about 6 inches deep or raised to a position several feet above the ground, depending on which method will be most practicable for a specific location. In either case, however, the cables should be protected from damage. If the cables run under a roadway, the cables should be buried deep and should be protected by steel conduit. It is important that the cables be protected by steel conduit at all points subject to strain.

Caution: To avoid the danger of short-circuiting the coaxial cable, never allow the cable to be bent in a radius of less than 2 inches.

b. Splices. The solid coaxial cable may be spliced by use of the special copper sleeve provided.

(1) Strip off approximately 2½ inches of the outer insulation from each end of the cable to be spliced.

(2) Trim off approximately ¾ inch of the braided copper shield from each end. Then cut away the exposed inner insulation, thus exposing the inner conductor for tinning.

(3) Tin the inner conductor and its shielding.

(4) Slip the large sleeve over the outside of one end of the transmission line.

(5) Solder the small sleeve to the ends of the inner conductor.

(6) Place the large sleeve over the joint and solder in place.

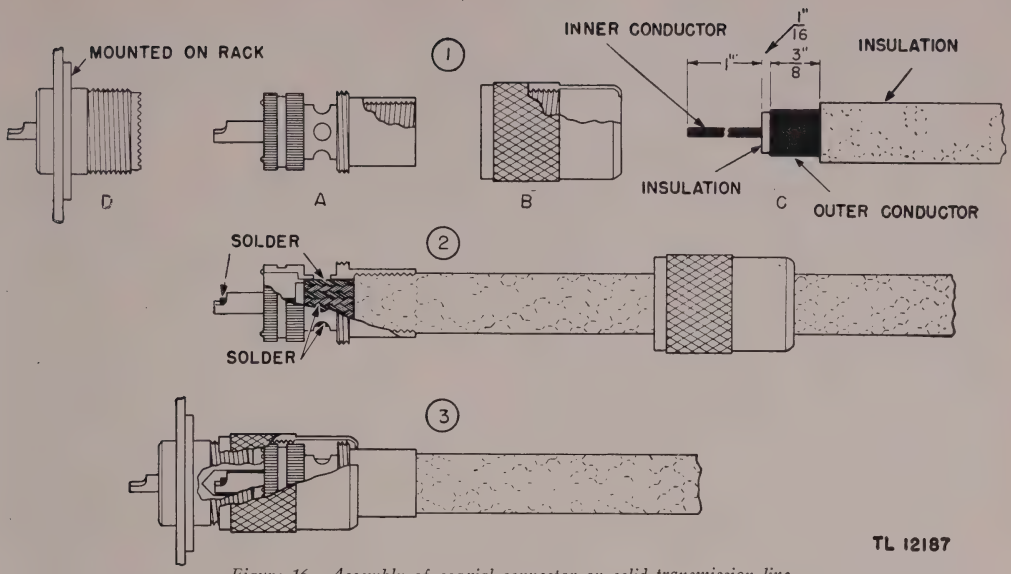


Figure 16. Assembly of coaxial connector on solid transmission line.

Caution: Avoid using too much flux when soldering because flux may cause a high-resistance short from the inner conductor to the outer conductor.

c. Installing Coaxial Connector (fig. 16). (1) Cut the outer insulation back $1\frac{7}{16}$ inches, the outer conductor $1\frac{1}{8}$ inches, and the inner insulation back 1 inch.

(2) Place the ferrule over the line and push it back several inches out of the way.

(3) Place the plug on the line, screwing it onto the outer covering until the copper shielding protrudes through the holes in the side of the plug.

(4) Solder the copper shielding at each of the four openings.

(5) Solder the inner connector to the projection on the plug and clip off the excess inner conductor.

(6) Slide the ferrule down over the threads all the way.

Note. Before covering the transmission line or screwing the antenna in place permanently, test the line for electrical resistance.

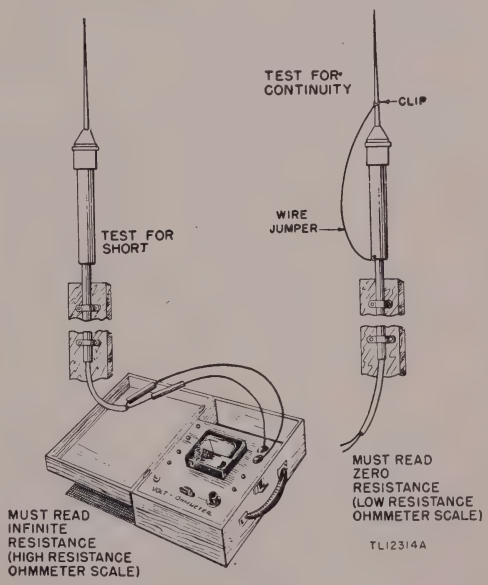


Figure 17. Electrical resistance tests.

17. Electrical Resistance Test

a. Testing for Short Circuit. Disconnect the coaxial cable from the antenna switchbox. An ohmmeter with a high-resistance range connected across the receptor end of the cable should indicate infinite resistance. If infinite resistance is not indicated, there is a short circuit which may be caused by loose

solder, excess flux, or other foreign matter in the cable. If such a condition exists, disconnect the cable at some convenient point between the antenna and receiver and test each section independently until the short is found and removed.

b. Testing for Open Circuit. Disconnect the coaxial cable from the antenna switchbox. Short the rod of the antenna to the skirt with a wire jumper and connect an ohmmeter with a low-resistance range across the receptor end of the coaxial cable. The meter should indicate either a short circuit or a reading of a few ohms, the exact indication depending on the length of cable. If such an indication is not obtained, the cable must be checked, section by section, until the open circuit is found.

18. Emergency Antenna

Whenever it becomes necessary to use an emergency antenna, one can easily be made by taking a piece of twisted-pair wire and untwisting it to a length of 41 inches. The 41-inch lengths of wire constitute an antenna which can be mounted in any convenient way as long as one wire extends vertically downward and the other wire extends vertically upward. The remaining part of the twisted-pair wire can then be used as a transmission line.

19. Power Source

The power source should be selected so that the power input to the radiosonde receptor will meet the following conditions:

Voltage	105 v to 125 v ac
Frequency	60 cps ± 2 cps
Phase	single
Output power	500 watts (minimum)

If there is a choice between two or more power supplies, the following factors, which are listed in order of their importance, should be considered: frequency stability, noise suppression features, voltage stability.

Note. Changing load may change the voltage and frequency output of the power source.

20. Repacking for Transport or Storage

a. Export. When repacking the equipment for export, the instructions contained in paragraph 12 are used in a reverse procedure. The packaging data given under paragraph 13*a* are recommended.

b. Domestic. In general, packaging for domestic shipment or for short movement of using troops should follow the same specifications as packaging for export, but may omit the use of moisture-vapor-proof barriers and desiccants. The outer carton and/or nailed wood shipping container together with the excelsior cushion provided for export shipments may be omitted at the discretion of the proper authority charged with the responsibility for a short movement or domestic shipment. Computations given under paragraph 13*b* are based on the use of innermost containers only.

PART TWO

OPERATING INSTRUCTIONS

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

Section III. OPERATION OF EQUIPMENT

21. Controls and Their Uses

a. Rack Assembly MT–47(*)/FMQ–1 (figs. 1 and 2). (1) *Antenna Selector Switch.* This switch is located in the center of the front panel, extreme top, of Radiosonde Receptor AN/FMQ–1(*). It is used to select the antenna to be used with the radiosonde receptor for receiving the signals from a 72.2-mc radiosonde.

(2) *MASTER ON-OFF Switch.* This switch, located on the front panel at the upper left corner of Radiosonde Receptor AN/FMQ–1(*), controls the power to all units of the receptor.

(3) *RECORDER ON-OFF Switch.* This switch, located on the front panel at the upper right corner of Radiosonde Receptor AN/FMQ–1(*), controls the power for the recorder motors. The MASTER ON-OFF switch must be in the ON position before power can be applied to the recorder with the RECORDER ON-OFF switch.

(4) *Meters.* On Radiosonde Receptor AN/FMQ–1A, a power supply voltmeter and frequency meter are located near the antenna selector switch (fig. 2). For Radiosonde Receptor AN/FMQ–1, Test Set I–209–( ) is supplied for making power supply voltage and frequency measurements (app. I).

b. Radiosonde Receiver R–17(*)FMQ–1.

Note. When Radio Set SCR–658 is used in conjunction with the radiosonde receptor, only the power ON-OFF switch and S'P'K'R' VOLUME control on the radiosonde receiver are needed.

(1) *Tuning Dial.* The receiver tuning dial is located in the center of the receiver (top) front panel. It is used to tune the receiver through its range of 56 to 85 mc.

(2) *R. F. TRIMMER.* The R. F. TRIMMER is a capacitor connected across the r-f section of the main tuning capacitor. The control knob for the R. F. TRIMMER is located at the left of the main tuning capacitor dial. Adjustment of this control peaks the tuned r-f circuit at resonance.

(3) *REGENERATION Control.* This control, located to the left of the main tuning dial and below the R. F. TRIMMER, regulates the voltage at the plate of the superregenerative detector tube. This action controls the regeneration of the detector, for obtaining optimum sensitivity.

(4) *AUDIO GAIN.* This control regulates the output from the detector to amplifier circuits supplying the loudspeaker, frequency meter, and the S meter. The control is located to the right of the main tuning dial and below the speaker. This control may be considered as the master audio gain control.

(5) *S'P'KR' VOLUME.* This control is located to the right of the AUDIO GAIN control and regulates the audio signal to audio amplifier tube V706. This control affects the volume of the speaker without affecting the signal to the frequency meter and S meter circuit.

(6) *ON-OFF Switch.* On Radiosonde Receiver R–17A/FMQ–1 only, a power ON-OFF switch is located on the panel of the receiver (fig. 2). This switch controls the power input to the receiver when the MASTER ON-OFF switch is ON.

(7) *PHONES Jack.* On the A model, a PHONES jack is provided.

c. Frequency Meter TS–29(*)/FMQ–1. The electronic frequency meter is located directly below Radiosonde Receiver R–17(*)/FMQ–1 on the radiosonde receptor. The following controls are located on the front panel of the frequency meter:

(1) *INPUT Switch.* This switch is located on the upper left of the frequency meter front panel. There are three positions for the switch. Position X connects the output from the receiver (or from Radio Set SCR–658) to the input of the frequency meter. The switch is used in the X position during

reception and calibration. Position SC is a short-circuit position. In this position the receiver (or Radio Set SCR–658) output is disconnected and the frequency meter input is grounded. This control position in conjunction with the DEIONIZE switch is used to check the 0 setting of the visual and recording meters during alinement. This position is also used to hold the recorder to zero prior to the ascension of the radiosonde. The third position of the input switch (60 ∞) is used to check the frequency meter, to adjust the radiosonde receptor before starting the preliminary performance test of the radiosonde, and to check the power supply frequency. For further information on alinement and calibration, see section X.

(2) *COARSE and FINE Controls.* The COARSE control, located below and to the left of the visual meter, and the FINE control, located below and to the right of the meter, regulate the current to the recorder and visual meters. These controls are used to compensate for a-f shifts or drifts in the radiosonde, and also when needed during the performance test, base line test, and flight.

(3) *DEIONIZE Switch.* This switch, located on the front panel, is used to deionize the thyratrons in the frequency meter when position SC is used. Model TS–29/FMQ–1 uses a push-button type switch and model TS–29A/FMQ–1 uses a spring return toggle switch.

(4) *EQUALIZER.* This control is reached through a small opening just below the visual meter. The control, which is turned only when the radiosonde receptor is recalibrated, is operated by a screwdriver. The EQUALIZER control is used to adjust the settings of the visual and recorder meters so that they give similar indication.

(5) *POWER ON-OFF Switch.* On Frequency Meter TS–29A/FMQ–1 only, a POWER ON-OFF switch is located on the front panel of the frequency meter. This switch controls the power input to the frequency meter when the MASTER ON-OFF switch is ON.

22. Preliminary Starting Procedure

Perform the preliminary starting procedure given below before using the starting procedure described in paragraph 23.

a. Rotate the antenna selector switch to connect in one of the antennas.

b. Throw the MASTER ON-OFF power switch to OFF.

c. Throw the RECORDER ON-OFF switch to OFF.

d. Rotate the S'P'K'R' VOLUME, AUDIO GAIN, REGENERATION, and R. F. TRIMMER controls to 0.

e. Throw the ON-OFF power switch (on Radiosonde Receptor AN/FMQ–1A only) on the receiver to OFF.

f. Rotate the main tuning dial of the receiver to the approximate setting at which a signal is expected (approximately 320 divisions for 72.2-mc operation). For 403-mc operation, this dial is not used. Instead, Radio Set SCR–658 is tuned to the signal frequency. See TM 11–1158A for instructions on operation of Radio Set SCR–658.

g. Turn the INPUT switch on the frequency meter to position SC. Then observe meter reading. If needle does not rest at zero, reset the meter by following the instructions given in paragraph 36*d*(3).

h. Throw the POWER switch (on Radiosonde Receptor AN/FMQ–1A only) on the frequency meter to OFF.

i. Set COARSE and FINE controls to the approximate center of their control range.

j. Open the folding desk shelf of the radiosonde recorder and inspect the recorder to make certain that the—

(1) Rocker frame is in its normal position with the pull-out arm in and the pull-out arm catch locking the arm (fig. 18).

(2) Recorder is in its normal operating position.

(3) Friction fingers are pressing the paper against the spiral drum.

23. Starting Procedure

See paragraph 22 before using this starting procedure.

a. STEP 1. Throw the MASTER ON-OFF switch to ON. Then wait approximately 15 minutes for the radiosonde receptor to warm up. More time may be required in very cold climates. Turn on dehumidifier lamps if preheating or drying is desired (par. 9*a*(2)).

b. STEP 2. Read the power supply voltmeter and frequency meter on the radiosonde receptor (or on Test Set I–209). If the frequency is not stable and between 58 and 62 cycles per second or if the voltage is not between 105 and 125 volts, the performance of the equipment will be affected.

c. STEP 3. See note 1 below. Advance the AUDIO

GAIN, S'P'K'R' VOLUME, and REGENERATION controls on the receiver until a rushing sound is heard in the speaker and a reading is obtained on the S meter. Avoid regeneration squeal by not advancing the REGENERATION control too far. If no sound is heard, see section IX.

Note 1. This step is not necessary when the radiosonde receptor is used in conjunction with Radio Set SCR–658 for 403-mc operation. See TM 11–1158A for complete instructions on turning on and checking Radio Set SCR–658.

Note 2. If Radiosonde Receptor AN/FMQ–1A is being used, the ON-OFF power switch on the panel of the receiver must be thrown to ON.

d. STEP 4. Rotate the INPUT switch on the frequency meter to 60 ∞. The meter on the panel of the frequency meter should read approximately 30 divisions when the COARSE and FINE controls are set to their mechanical center. Then rotate the INPUT switch to position SC and deionize momentarily by pressing the DEIONIZE switch. The meter should read zero. If these readings are not obtained, see section IX.

Note. If Radiosonde Receptor AN/FMQ–1A is being used, the POWER ON-OFF switch on the frequency meter must be thrown to ON.

e. STEP 5. Throw the RECORDER ON-OFF switch to ON. Then rotate the INPUT switch of the frequency meter to the SC position and deionize momentarily by pressing the DEIONIZE switch. The recorder should print at approximately the zero and 100 lines of the chart. Then throw the RECORDER ON-OFF switch to OFF. If, however, the recorder is not functioning properly, see section IX.

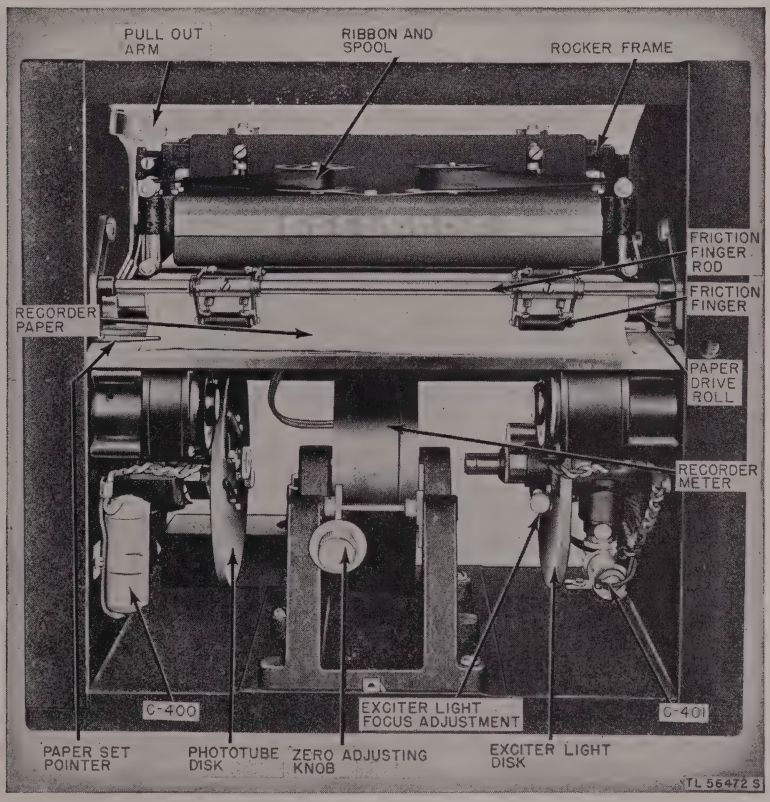


Figure 18. Radiosonde recorder, front view.

24. Test Run

a. Inspect and prepare the radiosonde, following the procedure as given in TM 11–2430.

b. After putting the radiosonde transmitter on the air, tune the dial of the radiosonde receiver (for 72.2-mc operation) or tune Radio Set SCR–658 (for 403-mc operation) to the frequency of the radiosonde transmitter. If a modulated signal is received, the radiosonde transmitter and receiver systems are operating.

c. Shut off the radiosonde transmitter. Prepare it for flight as outlined in TM 11–2430. Prepare and inflate the radiosonde balloon in accordance with instructions given in TM 11–2405.

d. Complete tests as follows:

(1) Connect the test switch to the radiosonde.* Then turn on the radiosonde according to instructions given in TM 11–2430.

(2) Turn the RECORDER ON-OFF switch ON and turn the INPUT switch to the X position.

(3) For 72.2-mc operation, adjust the receiver tuning dial and the R. F. TRIMMER control for maximum signal as read on the S meter. If regeneration squeal is heard, back off on the REGENERATION control. For 403-mc operation, do not advance the regeneration control of the radiosonde receiver. Instead, adjust Radio Set SCR–658 for best signal reception as explained in TM 11–1158A.

(4) The recorder will print graphic marks indicating the temperature, humidity, and high and low references. See TM 11–2430.

e. Release the balloon in accordance with instructions given in TM 11–2405.

25. Detailed Operating Instructions

a. General. The operation of the radiosonde is entirely automatic after the instrument has been released. The instructions given below pertain to the operation of Radiosonde Receptor AN/FMQ–1(*) and to the method of obtaining the record of the flight of the radiosonde in order to obtain an accurate record from the radiosonde in flight. The radiosonde receptor requires continuous and careful attention. It is often possible for an experienced observer to evaluate the record during the ascent but this evaluation should not be allowed to interfere with the adjustments of the receiver system and frequency meter controls.

b. Tuning Radiosonde Receiver during 72.2-mc Operation. The output of the electronic frequency meter depends upon the waveform of the signal fed into it from the receiver. Increasing the audio gain beyond a certain level amplifies the interference so that the waveform is distorted, with a resulting scattered or unsteady record. For this reason, a better record can be obtained by adjusting the audio gain for stability of the visual meter needle or of the recorder trace than by adjusting it for the maximum output from the loudspeaker. The signal strength meter also should be used as a guide for proper tuning. As soon as the radiosonde transmitter is put on the air, the receiver should be tuned for the steadiest indication of audio frequency. As the radiosonde is released and moves away from the earth, the radio and audio frequencies usually shift slightly, especially during the first few minutes of flight. Drifting of the radio frequency will result in a weak signal until the receiver is returned. If the receiver has been tuned to a side band, the signal may disappear entirely. Therefore, when a signal becomes weak, the main tuning dial of the receiver should be readjusted before the audio gain is increased. As explained in paragraph 69, one of the antennas may give a better signal than the other. Retune receiver after switching antennas.

(1) The REGENERATION control should be turned to the lowest value which will provide a steady record. It usually requires little or no adjustment after it has once been set.

(2) The R. F. TRIMMER should be set to the point of maximum signal strength. It requires little adjustment except when the antennas are interchanged.

(3) In the latter part of the flight it is often possible to obtain a better record by reducing the audio gain of the receiver for all audio frequencies, or by reducing it for temperature signals and then increasing it for the reference and humidity signals. The radio frequency of some radiosondes will shift with each contact, thus requiring continuous retuning of the receiver at each contact to avoid loss of record.

c. Tuning Radio Set SCR–658 during 403-mc Operation. See section V, TM 11–1158A.

d. Adjusting Frequency Meter. As each low-reference signal is being received, bring it to 95.0 value on the recorder paper by means of the frequency meter adjustments (COARSE and FINE) if a drift or shift has occurred since the last low-reference contact. However, such an adjustment

*TB 11–2403–3, Field Construction of Radiosonde Test Switch to supersede Test Equipment TS–30/FMQ–1.

should not be made until a readable low-reference value has been recorded. Then the adjustment should be made quickly so that a readable value will be recorded after the adjustment has been completed, and before the low-reference signal has been terminated. If the ascensional rate is so high that the recorded low-reference contacts are too short to provide a readable record both before and after the adjustment, no adjustment should be attempted. Similarly, no adjustment should be made when the low-reference record is so scattered that there is doubt of the actual value of the low-reference frequency.

(1) The low-reference adjustment should be made at the first steady low-reference signal received. After the radiosonde is released, the required correction should be considered a drift for all signals except the first low-reference contact, unless the record indicates an abrupt change or shift.

(2) Because of the capacitive effect of the surface of the earth or of an object on the earth, a rapid a-f drift may occur immediately after the radiosonde is released. Therefore, if the first low-reference is not at 95.0 and the temperature or humidity trace indicates no definite shift or drift, the recommended procedure is to assume that a rapid drift, equivalent to the amount of the correction required to bring low-reference back to 95.0, took place at release. Since this drift takes place very rapidly, treat it as a shift on the record. The above procedure is based on the assumption that the frequency meter is adjusted to 95.0 on the low-reference frequency during the base line check, or just prior to release of the radiosonde, and that the adjustment is not changed until the first low-reference contact is made during the sounding.

(3) The observer must use care in determining whether a-f changes shown by the low-reference occurred as shifts or drifts, and at what points they occurred. If the change occurs as a shift during the sounding it can be determinded usually by an abrupt change in the trace for one or more circuits. A distortion or variation in the audio signal as heard from the loudspeaker of the receiver frequently will give the observer additional information as the nature of the displacement and the point on the record at which it took place. A displacement also may be caused by defective ground equipment. Such displacements are usually greater and more erratic than those caused by a normal radiosonde, and no corresponding changes will be heard in the loudspeaker. If a displacement is caused by the recorder, the relationship of the visual meter and recorder will vary. Therefore, it is important that the observer give the equipment continuous attention.

e. Descent Record. If the descent record is needed for the confirmation or correction of indicated ascent temperature values, the receiver system in use should be tuned carefully and the low-reference contacts adjusted to 95.0 as on the ascent portion of the record. The high-reference contact is often required to determine the actual contact number of the highest altitude attained during the flight. Set the INPUT selector switch at the SC position and deionize the tubes momentarily as soon as this high-reference contact has been recorded. With the INPUT switch in this position, check the recorder zero to see whether any drift of the recorder paper occurred during the flight. The zero record should be continued until the paper has moved out of the recorder far enough to permit a portion of the zero record to be cut off with the rest of the record. Allow the paper to feed out of the recorder because it will be out of alinement if it is pulled out manually.

f. Drift of Recorder Paper. The recorder zero should be checked whenever it is believed that the paper has drifted since the start of the observation. Such a drift frequently can be detected as a uniform drift occurring between consecutive low-reference contacts. If it appears that the paper is drifting, turn the INPUT switch to position SC and depress the DEIONIZE switch momentarily to obtain a zero reading. Hold the INPUT switch at position SC long enough for the recorder microammeter needle to reach the zero setting. This check should be made at a point in the record where no significant data will be lost, preferably during a long temperature trace. During flight, a zero check should be made at intervals to see if the zero setting of the recorder is in error. These zero checks should be frequent enough to determine the magnitude of the drift error for the various levels as long as the drift continues. When the recorder paper drift exceeds 0.3 ordinate, a proportional correction should be applied to the temperature ordinates. (The correction is proportional since low-reference adjustment compensates for the drift of the paper at 95.0.) For example, a zero check is made 60 minutes after the base line zero check; the paper has drifted 2.0 ordinates to the left so that the zero value is now recorded at 2.0 instead of 0.0 as indicated by the calibration. Check to determine

whether the drift is indicated at the low-reference contacts. If a uniform drift is indicated after release, it can be assumed the drift began after the first zero check. Therefore, the drift would be 0.5 ordinate 15 minutes after the first zero check, and 1.5 ordinates at the end of 45 minutes. Assume the temperature frequency to be 30.0 ordinates after recorder and frequency drift corrections have been applied at a level occurring 45 minutes after the original zero check. The correction would then be 65/95 of 1.5, or 1.0. (Note that correction of low-reference contacts to be 95.0 makes the drift correction zero at this point; 1.5 at the correct zero setting point and 65/95 of 1.5, or 1.0, at 30.0.) Since the paper has drifted to the left, the value is too high. Therefore the correction would be negative or 1.0, making the corrected temperature ordinate 29.0. Because of inaccuracies caused by drifting of the recorder paper and difficulties of correcting therefor, care should be taken to have the recorder paper alined properly prior to the beginning of the observation.

26. Stopping Procedure

After the record has been completed and the recorder operated with the INPUT switch in the SC position and momentarily deionizing to obtain the zero check, stop Radiosonde Receptor AN/FMQ-1(*) by turning the RECORDER ON-OFF switch and the MASTER ON-OFF switch to the OFF positions. Cut off the paper chart above the last low-reference marks, leaving enough of the zero check to indicate correct calibration.

PART THREE

MAINTENANCE INSTRUCTIONS

Section IV. PREVENTIVE MAINTENANCE TECHNIQUES

27. Meaning

PM (preventive maintenance) is a systematic series of operations performed at regular intervals on equipment, when turned off, to eliminate major break-downs and unwanted interruptions in service, and to keep equipment operating at top efficiency. To understand what is meant by PM, it is necessary to distinguish PM from trouble shooting and repair. The prime function of PM is to *prevent breakdowns* and, therefore, the need for repair. The prime function of trouble shooting and repair is to locate and correct *existing* defects. The importance of PM cannot be overemphasized. The usefulness of an entire meteorological system depends upon each piece of equipment in the system being ready to operate at peak efficiency when needed. Consequently, operators and repairmen of meteorological equipment must maintain their equipment properly.

Note. The operations in sections IV and V are organizational maintenance.

28. Description of Techniques

a. GENERAL. (1) Most of the electrical parts used in Radiosonde Receptor AN/FMQ–1(*) require routine PM. Some parts require more maintenance than others. Some require maintenance of a different kind. Because hit-or-miss techniques cannot be applied, definite and specific instructions are needed. This section of the manual contains these specific instructions to guide personnel assigned to perform the six basic maintenance operations: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the lettering system for the six operations will be as follows:

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

(2) The first two operations show when the other four are needed. Selection of operations is based on a knowledge of field needs. For example, dust encountered on dirt roads during cross-country travel filters into equipment no matter how much care is taken to prevent it. Rapid changes in weather (such as heavy rain followed by blistering heat), excessive dampness, snow, and ice tend to cause corrosion of exposed surfaces and parts. Without frequent inspections and the necessary tightening, cleaning, and lubricating, equipment becomes undependable and may break down when it is needed most.

b. FEEL. The Feel operation is used most often to check rotating machinery, such as drive motors, and to determine whether electrical connections and bushings are overheated. Feeling will show the need for lubrication or the existence of other defects requiring correction. The maintenance man must become familiar with the normal operating temperatures of motors, transformers, and other parts, to recognize signs of overheating.

Note. It is important to perform the Feel operation as soon as possible after shut-down and always before any other maintenance is done.

c. INSPECT. Inspection is the most important operation in PM. A careless observer will overlook evidences of minor trouble. Although these defects may not at the moment interfere with performance of the equipment, valuable time and effort can be saved if they are corrected *before* they lead to major breakdowns. To be able to recognize the signs of a defective component, make every effort to become thoroughly familiar with indications of *normal* functioning. Inspection consists of carefully observing all parts of the equipment, noticing their color, placement, state of cleanliness, moisture accumulations, etc. Inspect for the following conditions:

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

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

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

(4) Tightness, by testing any connection or mounting which appears to be loose.

d. TIGHTEN, CLEAN, AND ADJUST. These operations are self-explanatory. Specific procedures to be followed in performing them are given wherever necessary throughout part three. Whenever a loose connection is tightened, it should be moistureproofed and fungiproofed again by applying the varnish with a small brush. See section VII for details of moistureproofing and fungiproofing.

Caution: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

e. LUBRICATE. Lubrication refers to the application of grease or oil to the bearings of motors or rotating shafts. It may also mean the application of a light oil to door hinges or other sliding surfaces on the equipment. When lubrication is required, refer to section VI.

29. Vacuum Tubes

Note. Do not work on tubes immediately after shutdown. Severe burns may result from contact with envelopes of hot tubes.

a. INSPECT (I). (1) Inspect glass and metal tube envelopes and tube caps for accumulation of dirt and for corrosion. Tubes with loose grid caps or loose envelopes should be replaced if possible.

(2) Examine the spring clips that make contact with the grid and plate caps for corrosion and for looseness. Check the condition of wires soldered to the spring clips. The wires should be free from frayed insulation or broken strands.

(3) Inspect firmness of tubes in their sockets. Make inspection by pressing tubes down in sockets and testing them in that position, *not* by partially withdrawing the tubes and jiggling them from side to side. Movement of a tube tends to weaken the pins in the base and unnecessarily to spread the contacts in the socket. Inspect tube sockets at the time tubes are removed.

(4) Be careful when removing a tube from its socket. Never jar a warm tube.

b. TIGHTEN (T). Tighten all loose connections to tube sockets or to tubes. If connections are dirty or corroded, clean them before tightening.

c. CLEAN (C). (1) Clean the tubes if necessary.

(2) Remove dust and dirt from glass or metal envelopes with a clean, lint-free, dry cloth. If proper care is used, grid caps may be cleaned with a piece of #0000 sandpaper by wrapping the paper around the cap and *gently* rubbing the surface. Excessive pressure is not needed. It is not necessary to grip the cap tightly. Wipe the cap with a clean dry cloth.

(3) When tube sockets are cleaned and the contacts are accessible, fine sandpaper may be used to remove corrosion, oxidation, and dirt.

(4) Wipe off moisture with a clean dry cloth.

d. ADJUST (A). Adjust loose tube connector clips. Do not flatten tube connector clips during adjustment. Flattened clips do not make adequate contact with surface of tube cap. The clip is made of thin metal and can be adjusted by gently compressing it with the fingers.

30. Capacitors

a. INSPECT (I). (1) Inspect terminals of large fixed capacitors for corrosion and loose connections Carefully inspect mountings to discover loose mounting screws, studs, or brackets. Examine leads for poor insulation, cracks, and evidences of dry rot. Cut away frayed strands on insulation. If wire is exposed, wrap it with friction tape. See that terminals of capacitors are not cracked or broken.

(2) Thoroughly inspect the case of each large fixed capacitor for leaks, bulges, and discoloration.

(3) Inspect plates of variable capacitors for dirt, dust, or lint. Examine the movable set of plates for signs of damage or misalignment that would cause the movable plates to touch the fixed plates during tuning. Rotate the movable plates, using the panel tuning control, and thus check for proper operation of the capacitor.

b. TIGHTEN (T). Tighten loose terminals, mountings, and connections on capacitors, when necessary. Do not break the bushing or damage the gasket.

c. CLEAN (C). (1) Clean the cases of fixed capacitors, the insulated bushings, and all connections that are dirty or corroded. Capacitor cases and bushings can usually be cleaned with a dry cloth. However, if deposit of dirt is hard to remove, moisten cloth with Solvent, Dry Cleaning (SD).

(2) Clean plates of variable capacitors with a small brush or pipe cleaner, removing all dust and lint.

31. Resistors

a. General. Various types of resistors are used in Radiosonde Receptor AN/FMQ–1(*). Connections to resistors are either of pig-tail or solder-lug type.

b. Inspect (I). Inspect coating of vitreous-enameled resistors for signs of cracks and chipping, especially at the ends. Examine bodies of all types of resistors for blistering, discoloration, and other indications of overheating. Inspect leads and all other connections for corrosion, dirt, dust, looseness, and broken strands in connecting wires. Check security of all mountings. Do not attempt to move resistors with pig-tail connections, because there is danger of breaking the connections at the point where they enter the body of the resistor. Such defects cannot be repaired.

c. Tighten (T). Tighten resistor connections and mountings whenever they are loose. If a resistor remains loose, vibration may break the connection or damage the body.

d. Clean (C). (1) Clean all carbon resistors with a small brush.

(2) The vitreous-enameled resistors must be kept clean to avoid leakage between the terminals. Wipe them with a dry cloth. However, if the dirt deposit is unusually hard to remove, use solvent (SD).

(3) Resistors with discolored bodies cannot be cleaned. Discoloration indicates that there has been overloading and overheating at some time prior to the inspection. The discoloration is probably due to circuit trouble which requires analysis and correction. Trouble-shooting procedures are described in part five.

32. Switches

a. Inspect (I). Inspect mechanical action of each switch and, while so doing, look for signs of dirt or corrosion on all exposed elements. In some cases it will be necessary to examine the elements of the switch visually. In others, the action of the switch is checked by flipping the control knob or toggle, or pressing switch button and noting freedom of movement and amount of spring tension.

b. Clean (C). Clean exterior surfaces of switches with a stiff brush, moistened with solvent (SD).

33. Rheostats and Potentiometer

a. Inspect (I). (1) Inspect the mechanical condition of rheostats. The arm should be keyed tightly to the shaft, and the shaft should turn easily in the bushing which supports it.

(2) Inspect the assembly and mounting screws, setscrews, and nuts.

(3) Examine the insulating body of the rheostat for dust, dirt, cracks, and chipped places.

(4) Examine all metallic parts for dust, dirt, and corrosion.

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

c. Clean (C). (1) Clean exposed contact surfaces of rheostat and connections whenever they are dirty or corroded.

(2) Remove grease and dirt from rheostat parts with carbon tetrachloride.

(3) If contact surfaces are corroded, clean them with crocus cloth.

(4) Clean contact surface of the arm by inserting a strip of crocus cloth between the arm and the rheostat winding and drawing cloth back and forth.

(5) Clean body of rheostat or potentiometer with a brush or cloth.

34. Terminal Strips

a. Inspect (I). (1) Inspect terminal blocks for cracks, breakage, dirt, loose connections, and loose mounting screws.

(2) Carefully examine connections for mechanical defects, dirt, and corrosion.

b. Tighten (T). Tighten loose screws, lugs, and mounting bolts. When tightening screws, be sure to select a screwdriver of correct size. Do not exert too much pressure. Tighten loose connections.

c. Clean (C). Clean terminal blocks, when they require it, with a brush or cloth moistened with carbon tetrachloride. Thoroughly wipe block with a cloth and then brush it to remove any lint.

35. Multiple Connectors

Multiple connectors and plugs are used to connect the frequency meter to the receiver and to the recorder.

a. Inspect (I). Inspect multiple connectors for loose connections, dirt, and corrosion. Look for bent or loose fitting pins. Examine for broken strands of wire at the connections to the pins. Solder loose

strands to the pins. Tape exposed wires with friction tape to avoid shorts.

b. CLEAN (C). Clean male and female ends of connectors with a brush moistened with carbon tetrachloride. Remove corrosion with #0000 sandpaper. Wipe with a clean cloth.

36. Meters

Meters are extremely delicate instruments and must be handled carefully. They require very little maintenance. They are precision instruments and ordinarily cannot be repaired in the field.

a. INSPECT (I). Inspect leads and connections of meters. Look for loose, dirty, and corroded connections. Look for cracked or broken cover glasses. Inspect the meter in the recorder unit, especially for dust on the cover glass. Dust in this glass will impair the operation of the recorder because a light beam shines through this glass.

b. TIGHTEN (T). Tighten all loose connections. Any loose meter wires should be inspected for dirt or corrosion before they are tightened. The tightening of meter connections requires special care because careless handling can easily crack a meter case.

c. CLEAN (C). Meter cases can usually be cleaned with a dry cloth. If cleaning is difficult, dampen the cloth with carbon tetrachloride. Clean dirty connections with a small brush dipped in solvent (SD), or with a small piece of cloth dipped in solvent.

d. ADJUST (A). (1) A power supply frequency meter is located at the top of Rack Assembly MT–47(*)/FMQ–1. This meter requires no adjustment.

(2) The recorder meter is adjusted only when necessary according to the instructions given in section X.

(3) Other meters in the equipment should normally indicate zero when the equipment is turned off. Before deciding that a meter needs readjusting, tap the meter case lightly with the tip of one finger. This will help the meter to overcome the slight friction which sometimes exists at bearings and prevents an otherwise normal unit from coming to rest at zero. If adjustment is needed, insert the tip of a suitable screwdriver into the slotted screw head located below the meter glass and *slowly* turn the adjusting screw until the pointer is at zero. Lightly tap the meter case again and view meter face and pointer full on and not from either side. Avoid turning the screw too far, because the needle may be bent or the hairspring damaged.

37. Pilot Lamps

Pilot lamps are used to indicate when power has been applied to a circuit. They are easily removed and replaced.

a. INSPECT (I). Inspect pilot-lamp assemblies for loose lamps, loose mounting screws, and loose, dirty, or corroded connections.

b. TIGHTEN (T). (1) Tighten loose mounting screws and resolder any loose connections. If connections are dirty or corroded, clean them before soldering.

(2) Screw loose lamps tightly into their sockets.

38. Control Knobs

Capacitors, switches, and resistors in the set are rotated by control knobs on the front panels. Keep these control knobs tight at all times. Use a small screwdriver to tighten the setscrews on the knobs whenever they are found loose.

39. Power Transformers, Filter Chokes, and Audio Transformers

Since power transformers, filter chokes, and audio transformers are of similar construction, preventive maintenance for them is similar.

a. FEEL (F). As soon as possible after shutdown, feel the filter chokes for abnormal heating, which may indicate an overload or imminent failure due to moisture absorption or other causes. Likewise feel audio transformers for abnormal heating. The power transformers normally operate at a warm temperature. Feel for abnormal heating, but take care to avoid burns.

b. INSPECT (I). Inspect the power transformers, filter chokes, and audio transformers for signs of blistering, bulging, or leakage of tar or insulating compounds. Inspect for external signs of electrolytic action or corrosion.

c. TIGHTEN (T). Tighten all mounting bolts or screws, but not to the point that threads are destroyed. The securing of such heavy parts as transformers and chokes to the chassis is very important in preventive maintenance. Should a heavy filter choke or transformer break loose from its mounting in vehicular use or in transit, it may smash tubes, variable capacitors, coils, and resistors, and at the same time sever a large number of connections.

d. CLEAN (C). Clean power transformers, filter chokes, and audio transformers with a dry cloth. Be sure that no dirt, lint, threads, or foreign material

is present between terminals. Dirt, lint, and thread absorb moisture which may provide a leakage path for high voltages between these terminals. Be sure that none is present.

40. Drive Motors

a. FEEL (F). To determine if the motor bearings are overheating, feel them as soon as possible after the equipment has been shut down. The operator or maintenance man must become familiar with correct operating temperature of the motor bearings to determine easily, by feeling, the bearing condition.

b. INSPECT (I). Examine the motor mountings for loose screws and nuts. Look for loose connections at the motor input. Examine for general cleanliness.

c. TIGHTEN (T). Tighten loose mounting bolts or nuts. Tighten (after cleaning) the connections to the motor input.

d. CLEAN (C). If dry compressed air is available, blow out any dirt or dust with compressed air.

e. LUBRICATE (L). Lubricate the motor in accordance with the lubrication instructions given in section VI.

41. Gears and Rotary Shafts

a. INSPECT (I). Inspect all gears and rotating shafts for cleanliness and corrosion. Examine the bearing surfaces of the shafts for need of lubricant.

b. CLEAN (C). Clean all gears with a small stiff brush. Remove all dirt and dust from rotating shafts with a clean dry cloth. Rust and corrosion should not be permitted to accumulate. Remove all corrosion and rust with #0000 sandpaper.

42. Cords and Cables

The cables are the life lines of the equipment. Condition of the cabling must be closely observed. Operating equipment in all kinds of weather, and moving it on all kinds of roads, subjects cabling to a great deal of punishment.

a. INSPECT (I). Inspect the cables for cracked or deteriorated insulation, frayed or cut insulation at the connecting and supporting points, and improper placement which places the cables or connections under strain. Also watch for kinks and improper supports.

b. TIGHTEN (T). Tighten loose cable clamps, coupling rings, and cable connections.

c. CLEAN (C). Clean dirty or corroded cable connections. Clean corroded connectors with #0000 sandpaper. Clean the entire surface of the connector. Make no attempt to remove individual prongs from cable plugs.

43. Antennas

a. INSPECT (I). Inspect the antennas and their connections for general cleanliness. Look for rust and corrosion. Examine the antenna mounting for loose mounting bolts. Examine the antenna insulators for cracks and other signs of deterioration. Cracked insulators must be replaced at the earliest opportunity. See that the antenna lead-in wire has no sharp right-angle bends.

b. TIGHTEN (T). Tighten loose mounting bolts and loose antenna lead-in clamps.

c. CLEAN (C). Remove all dust, dirt, and other foreign matter from the antenna, antenna lead-in wire, connector, and mounting. Use #0000 sandpaper to remove dust and corrosion from the antenna mounting. Touch up bare metal spots with paint. Clean antenna insulators with a clean cloth dampened with solvent (SD). Wipe dry and polish with a clean dry cloth.

44. Cabinet, Chassis, and Mountings

a. INSPECT (I). Inspect for dirt, rust, or corrosion. Look for loose screws, nuts, and bolts. Make certain that adjustments on coils are not mistaken for screws. If such adjustments are tampered with, the operation of the equipment will be impaired.

b. TIGHTEN (T). Tighten all loose mounting screws, nuts, and bolts on the cabinet, chassis, and mountings.

c. CLEAN (C). Remove all dust and dirt on cabinets, chassis, and mountings. Use #0000 sandpaper to remove rust or corrosion. Use paint to touch up bare metal spots.

Section V. ITEMIZED PREVENTIVE MAINTENANCE

45. Introduction

For ease and efficiency of performance, PM on Radiosonde Receptor AN/FMQ–1(*) will be broken down into operations that can be performed at different time intervals. In this section the PM work to be performed on the equipment at the specific time intervals is broken down into units of

work called items. The general techniques involved and the application of the FITCAL operations in performing PM on individual parts are discussed in section IV. These general instructions are not repeated in this section. When performing PM, refer to section IV if more information is required for the following items. Perform all work with the power removed from the equipment. After PM has been performed on a given day, put the equipment into operation and check it for satisfactory performance.

46. Tools and Materials

The following PM tools and materials will be needed:

Common hand tools.
Clean cloth.
#0000 sandpaper.
Crocus cloth.
Fine file.
Solvent (SD).
Carbon tetrachloride.
Stiff brush.

47. Item 1, Exterior of Radiosonde Receptor AN/FMQ–1(*)

Operations:

ITC	Cabinet.
ITC	Knobs and controls.
ITC	Cords and cables.
ITCA	Meters (exterior panel side only).

Remarks. Perform only those item 1 operations which can be accomplished without opening the cabinet.

48. Item 2, Radiosonde Receiver R–17(*)/FMQ–1 (fig. 68)

Operations:

ITCA	Vacuum tubes.
ITC	Capacitors.
ITC	Resistors.
ITCA	Switches.
ITC	Potentiometers and rheostats.
ITCA	Meters.
ITC	Pilot lamps.

Remarks. Blow dust out of the speaker.

49. Item 3, Frequency Meter TS–29(*)/FMQ–1 (fig. 72)

Operations:

ITC	Vacuum tubes.
ITC	Capacitors.
ITC	Resistors.
ITC	Switches.
ITC	Potentiometers and rheostats.
ITCA	Meters.
ITC	Pilot lamps.
IC	Multiple connectors.

Remarks. Check fuse connections for cleanliness.

50. Item 4, Radiosonde Recorder RD–3(*)/FMQ–1 (fig. 18)

Operations:

ITC	Switches.
ITCA	Meters.
ITC	Terminal strips.
ITCA	Exciter lamp (pilot lamps).
IC	Multiple connectors.
FITCL	Drive motors.
ICL	Gear and rotary shafts.
ITC	Knobs and controls.
ITC	Chassis and mounting.
ITCL	Tapper mechanism (fig. 31).

Remarks. Inspect the tapper mechanism for cleanliness and for need of lubrication. Clean as required, using a soft brush dampened with solvent (SD). Lubricate as instructed in section VI.

51. Item 5, Amplifier AM–7(*)/FMQ–1 (fig. 76)

Operations:

ITC	Vacuum tubes.
ITC	Capacitors.
ITC	Resistors.
ITC	Potentiometers and rheostats.
ITC	Terminal strips.
ITC	Chassis and mountings.

Remarks. Do not move the setting of variable resistor R203, R204, or R205.

52. Item 6, Voltage Regulator CN–2(*)/FMQ–1 (fig. 58)

Operations:

ITC	Capacitors.
ITC	Chassis and mountings.
ITC	Terminal strips.

Remarks. Clean dust and dirt from the transformers. Tighten the transformer mounting bolts.

53. Item 7, Antenna Assembly AS–11(*)/FMQ–1

Operations:

IC Antenna mast section.
IC Antenna insulator.
ITC Antenna mounting.

54. Item 8, Transmission Lines

Operations:

I Transmission lines.
IC Connections.

Remarks. Avoid sharp right-angle turns and kinks in the coaxial lead-in wire. Turns in coaxial lines must not be sharper than a 2-inch radius.

55. Preventive Maintenance Check List

a. General. The following check list is a summary of the PM operations to be performed on Radiosonde Receptor AN/FMQ–1(*). The suggested time intervals shown on the check list may be varied at any time by the local commander. However, for best performance of the equipment, it is recommended that the operations be performed at least as frequently as suggested in the list. The *Maintenance performed by* column indicates what operations are performed by the operator and what operations are performed by maintenance personnel. The lubrication operation of PM, although listed as a monthly operation, may not be required more frequently than semiannually or anually. However, it is recommended that the lubrication operation be performed whenever inspection shows the necessity.

b. Check List.

Item No.	Operations	Item	When performed				Maintenance performed by—
			After operation	Daily	Weekly	Monthly	
1	ITCA	Exterior of Radiosonde Receptor AN/FMQ–1(*)	X	X	.....	.....	O
2	ITCA	Radiosonde Receiver R–17(*)/FMQ–1	.....	.....	.....	X	O
3	ITCA	Frequency Meter TS–29(*)/FMQ–1	.....	.....	.....	X	O
4	FITCAL	Radiosonde Recorder RD–3(*)/FMQ–1	.....	.....	.....	X	OM
5	ITC	Amplifier AM–7(*)/FMQ–1	.....	.....	.....	X	O
6	ITC	Voltage Regulator CN–2(*)/FMQ–1	.....	.....	.....	X	O
7	ITC	Antenna Assembly AS–11(*)/FMQ–1	.....	.....	X	.....	O
8	IC	Transmission lines	.....	.....	X	.....	O

Note: X indicates when operations are to be performed, O indicates operator, and M indicates maintenance personnel.

Section VI. LUBRICATION

56. Department of the Army Lubrication Orders

Department of the Army lubrication orders (formerly War Department lubrication orders, or WDLO's) are illustrated, numbered, and dated cards or decalcomania labels which prescribe approved organizational lubrication instructions for mechanical equipment which requires lubrication by using organizations. Current lubrication orders which are available are listed in the latest issue of FM 21–6. Lubrication orders should be requisitioned in conformance with instructions and lists in FM 21–6. Department of the Army lubrication orders are mandatory and supersede all conflicting lubrication instructions of an earlier date. Applicable lubrication orders which are available will be obtained, carried with the equipment at all times, and fully complied with. Difficulties experienced in obtaining and complying with such orders will be reported through technical channels.

57. Approved Lubricants

Symbols	Standard nomenclature
PL–SPECIAL (formerly PS).	Oil, Lubricating, Preservative, Special.
GL	Grease, Lubricating, Special.
OE	Oil, Engine.

58. Lubrication of Radiosonde Receptor AN/FMQ–1(*)

Perform the lubrication instruction given in Department of the Army lubrication orders. Organizational

maintenance personnel will also perform the following operations:

a. Radiosonde Recorder RD–3(*)/FMQ–1. (1) *Light Disk Support Shaft Bearings.* Every six months, or more often if conditions warrant, disassemble and remove the ball bearings as outlined below. Inspect for loose shaft fit and defects, such as binding or excessive wear as evidenced by extreme wobble between inner and outer races. Defects may be caused by dirt or other material, cracked or defective races, a chipped or flattened ball, or hardened grease. Thoroughly clean the bearings by immersing the bearings in a shallow pan of solvent (SD). A small bristle brush will greatly aid the cleaning operation. Rotate the bearing by hand, applying a slight pressure on the outer race to simulate the load. If bearing seems to catch or bind, visually inspect for cause. Clean again and recheck before marking bearing defective. Always use clean solvent for final rinsing of the bearing. Allow bearings to dry naturally before attempting to reapply lubricant. Neither compressed air nor a temperature above 212° F. should be used to accelerate drying. Bearings found good should be lubricated with grease (GL). The balls and races should be thoroughly coated, but do not pack the bearing or bearing housing. Fill the bearing approximately two-thirds full. Wipe off excess grease.

(*a*) To disassemble—

1. Remove the three screws holding the disk drive gear of the optical system. Remove gear.
2. Remove the light disk assembly by unscrewing the thumbnut and pulling the assembly from the shaft.
3. Remove the two Allen head setscrews from the optical disk drive gear hub.
4. Remove the gear hub and key from the shaft.
5. Remove the bearing retainer and outer bearing.
6. Remove the shaft and inner bearing from the inner side of the recorder frame.

(*b*) To reassemble, reverse the procedure for disassembly.

Caution: Do not lubricate the slip rings of the phototube and exciter light disk. Clean with carbon tetrachloride. Remove corrosion with #0000 sandpaper. After smoothing, remove all traces of cleaning abrasive and white film formed by carbon tetrachloride. A clean, dry lint-free cloth or canvas will act as a burnishing agent.

(2) *Phototube Disk Support Shaft Bearings.* The phototube disk assembly is disassembled and lubricated in the same manner as the light disk assembly.

b. Radiosonde Receiver RD–17(*)/FMQ–1. (1) Every 6 months, or more often if conditions warrant, clean each tuning and r-f trimmer control shaft bearing (fig. 21) and then apply 1 or 2 drops of oil (PL-SPECIAL).

(2) Every 6 months, or more often if conditions warrant, lubricate the tuning capacitor drive gears. To do this, remove the four screws and tuning capacitor drive gearbox cover (fig. 21). Then clean gears with a clean lint-free cloth dampened with solvent (SD). Allow to dry and coat gear teeth sparingly with grease (GL). Rotate dial to spread grease. Replace cover.

c. Frequency Meter TS–29(*)/FMQ–1. Lubrication is not essential and therefor no instructions are required.

Section VII. WEATHERPROOFING

59. Winterization

a. General. Special precautions are necessary to prevent poor performance or total operational failure of equipment in subzero temperatures. Most signal equipment can be used in winter if difficulties common in low temperatures are anticipated and precautions taken to prevent them. For operation purposes, place equipment in heated rooms whenever possible. Wrap it in blankets when on the march to protect it from winds and freezing temperatures. Refer to TB SIG 66, Winter Maintenance of Signal Equipment, for complete information. The following problems may be encountered:

(1) Steel shrinks and becomes brittle in subzero temperatures.

(2) Glass is especially susceptible to sudden temperature changes. The difference between a low air temperature and the warmth of a man's breath may be sufficient to shatter a lens.

(3) Certain types of synthetic rubber are unreliable and become brittle.

(4) Lubricants become stiff, causing drag and also causing moving parts to stick. Refer to section VI for detailed lubrication instructions.

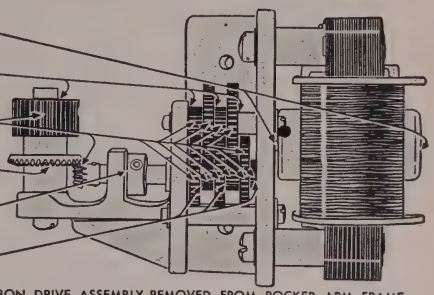
b. Radiosonde Receptor AN/FMQ–1(*). Radiosonde Receptor AN/FMQ–1(*) is normally installed as fixed equipment in shelters warmed to temperature high enough so that the operators may work with bare hands when preparing charts. If the

RADIOSONDE RECORDER
RD-3/FMQ-1 & RD-3A/FMQ-1
RADIOSONDE RECEPTOR AN/FMQ-1

Intervals given are maximums for normal 8-hour day operation. For abnormal conditions or activities, intervals should be shortened to compensate. Clean parts with SOLVENT, dry cleaning. Dry before lubricating.

Lubricate points indicated by dotted arrow-headed leaders on both sides of the equipment.
CAUTION: Stop mechanism to lubricate. After lubricating, operate mechanism to distribute lubricant. Stop mechanism and wipe off excess lubricant.

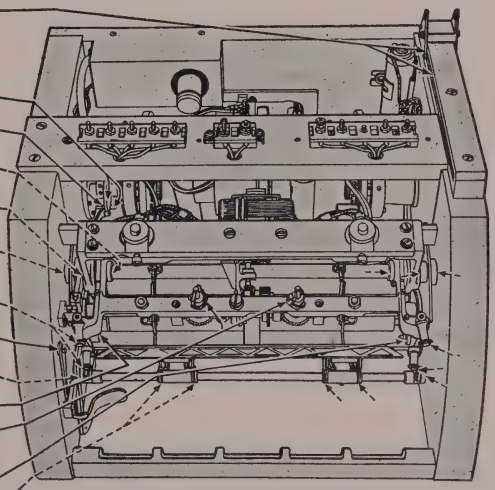
NOTE
1. After lubrication, operate mechanism to distribute lubricant. Stop mechanism and wipe off excess lubricant to prevent spreading onto ribbon and paper roll.



Lubricant—Interval

- DRIVE MOTOR BEARINGS — PL S — 3 or 4 drops, each oil hole.
- GEAR SHAFTS — PL M — 1 or 2 drops, each.
- GEARS AND PINIONS — GL M — Clean and coat teeth sparingly.
- GEAR SHAFT — PL M — 1 or 2 drops.
- DRIVE SHAFT BEARING — PL M — 1 or 2 drops.
- GEAR SHAFTS — PL M — 1 or 2 drops, each.

RIBBON DRIVE ASSEMBLY-REMOVED FROM ROCKER ARM FRAME



Lubricant—Interval

- CHASSIS RETURN ASSEMBLY — GL M — Clean and apply light film of lubricant to contact surfaces of slide rollers and guide. Lubricate roller shafts with 1 drop, each of OE.
- CAM AND CAM ROLLER — GL M — Clean and coat contact surfaces sparingly.
- CAM ROLLER SHAFT — OE M — 1 or 2 drops.
- TAPPER BAR ASSEMBLY SUPPORT BEARINGS — OE M — 1 or 2 drops.
- ROCKER FRAME SUPPORT BEARING — OE M — 2 or 3 drops.
- BACK SECTOR GEAR SHAFT — OE M — 3 or 4 drops. Apply lubricant between sector gear hub and recorder frame.
- RIBBON TAPE GUIDE PINS — PL M — 1 drop, each.
- PULL OUT ARM CATCH PIVOT — PL M — 1 or 2 drops.
- FRICTION FINGER SUPPORT ARM PIVOT — PL M — 1 drop.
- CHART ROLL SOCKET BEARINGS — OE M — 1 drop.
- RIBBON SPOOL SHAFT ASSEMBLIES — PL M — Lubricate lever shaft pivot sparingly and apply 1 drop of lubricant to lever shaft plunger bore.
- CHART ROLL SPRING LOADED BEARING — OE M — 1 or 2 drops.
- FRICTION FINGER PIVOT — OE M — 1 drop, each end of pivot.

TOP VIEW—TILTED OUT OF RACK

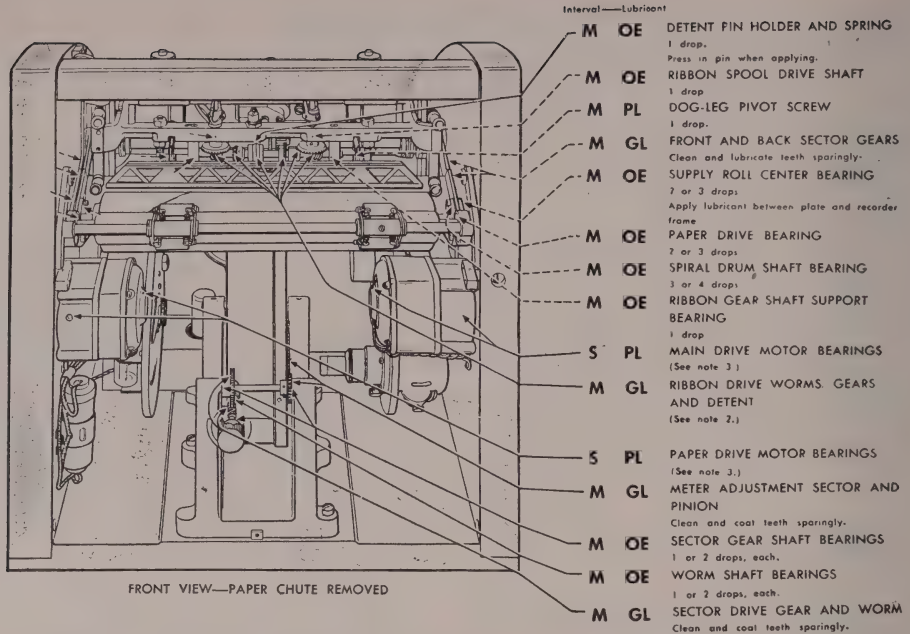
2. RIBBON DRIVE WORMS, GEARS AND DETENT
Clean worm and gear teeth and contact surface of detent. Lubricate worm and gear teeth sparingly and apply light film of lubricant to surface of detent.

3. MAIN AND PAPER DRIVE MOTOR BEARINGS
Add lubricant through oil hole until it appears at vent hole on under side of bearing. Lubricate main drive motor drive end bearing from rear of recorder after removing light disk assembly.

4. LUBRICATED BY MAINTENANCE PERSONNEL
Light Disk and Photo Tube Disk Assembly.
Support Shaft Bearings.
Meter Mount Pivot Bearings.

TL 35077S

Figure 19. Lubrication reference data.



FRONT VIEW—PAPER CHUTE REMOVED

NOTE

S. These features of the Paper Drive Mechanism (Left side) and Spiral Drum Cylinder Drive Mechanism (Right side) are of similar construction and require the same lubrication and service attention.

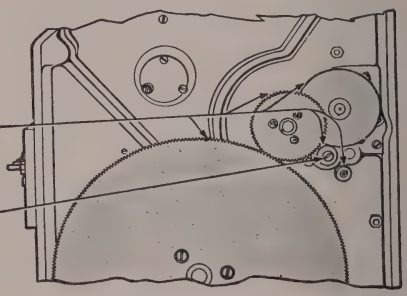
Lubricant—Interval

DRIVE GEARS AND PINION **GL M**

Clean teeth and polished metal surfaces of gears and pinion. Apply lubricant sparingly to teeth, then remove excess. Wipe polished metal surfaces with clean cloth lightly dampened with PL.

IDLER GEAR SHAFT **PL M**

Located behind main gear on right side. 1 or 2 drops.



DRIVE MECHANISM—RIGHT AND LEFT SIDES
(Left Side Illustrated)

KEY

LUBRICANTS	EXPECTED AIR TEMPERATURE		
	above + 32° F.	+ 32° F. to 0° F.	below 0° F.
OE—OIL, engine	OE—10	PL—special	PL—special
GL—GREASE, lubricating, special. All air temperatures.			INTERVALS
PL—OIL, lubricating, preservative, special.			M—monthly
			S—semiannually

OILCAN POINTS

Apply OE sparingly, at monthly intervals, to the following parts: Rack Hinges, Locks and Fasteners, Pivots and Slides, Optical Adjustment and Light Bulb Clampscrew Threads, and Friction Arm Tension Locks.

TL 35078S

Figure 20. Lubrication reference data.

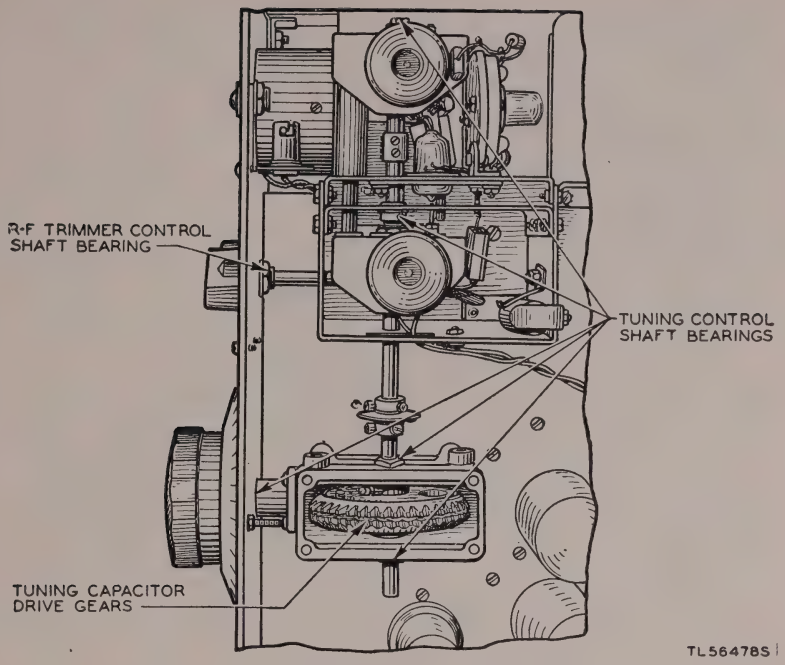


Figure 21. Lubrication points in Radiosonde Receiver RD–17(*)/FMQ–1.

equipment is operated at low temperatures, or if it is operated after transportation or storage at low temperatures, do the following:

(1) Keep all can covers on the rear of the equipment in place.

(2) Operate the drying lamps continuously.

(3) Readjust the rocker frame stop screw and the tapper bar assembly by means of the vertical locknuts until the trace made by the recorder has maximum legibility.

(4) Lubricate the three motors in the recorder, as explained in Department of the Army lubrication orders.

60. Dustproofing

Signal Corps equipment operated in desert localities is affected by the extremely high temperatures and the amount of dirt, dust, sand, and other foreign matter in the air. Be careful to prevent such elements from filtering into lubricated parts. Cover the equipment when it is not in use. Thorough cleanliness is imperative. Instead of merely adding new lubricants at regular intervals, whenever practicable clean and lubricate all moving parts. If possible, inspect and clean the equipment daily. Refer to TB SIG 75, Desert Maintenance of Ground Signal Equipment. Some of the problems encountered are the following:

a. Lubricants become thin and drain from moving metal and fiber parts rapidly. Refer to section VI for detailed lubrication instructions.

b. Foreign matter, such as dirt, dust, and sand, acts as an abrasive, causing excessive wear and impeding the flow of air.

61. Tropicalization

a. General. Because fungus growth, insects, corrosion, salt spray, and excessive moisture affect most materials harmfully, a special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. Refer to TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, for a detailed description of the varnish-spray method of moistureproofing and fungiproofing and the supplies and equipment required in this treatment.

(When information in this manual and that in TB SIG 13 differ, the information contained herein shall be taken as correct.) The following problems may be encountered:

(1) Resistors, capacitors, coils, chokes, transformer windings, etc., fail because of the effects of fungus growth and excessive moisture.

(2) Electrolytic action, often visible in the form of corrosion, takes place in resistors, coils, chokes, transformer windings, etc., causing eventual breakdowns.

(3) Hook-up wire insulation and cable insulation break down. Fungus growth accelerates deterioration.

(4) Moisture forms electrical paths on terminal boards and insulating strips, causing flash-overs and crosstalk.

Caution: Varnish spray may have poisonous effects if inhaled. To avoid inhaling spray, use a respirator if available; otherwise fasten cheesecloth or other cloth material over nose and mouth. Never spray varnish or lacquer near an open flame. Do not smoke in a room where varnish or lacquer is being sprayed. The spray may be highly explosive.

b. Components. (1) Paragraphs 62 through 66 give step-by-step instructions for treating the various components of Radiosonde Receptor AN/FMQ–1(*). The moistureproofing and fungiproofing treatment for Radiosonde Receptors AN/FMQ–1 and AN/FMQ–1A is similar except for the disassembly of transformers and chokes, which applies to the AN/FMQ–1 only.

(2) Upon completion of the treatment, examine the equipment to make sure that the lubrication has not been affected. If necessary, relubricate in accordance with the instructions outlined in section VI.

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

62. Instructions for Radiosonde Receiver R–17(*)/FMQ–1

a. Preparation. Make all repairs and adjustments necessary for the proper operation of the equipment.

b. Disassembly. (1) Remove the receiver from the rack and place in position shown in figure 22.

(2) Remove the rubber cushion plate located at the bottom of the chassis.

(3) Disconnect and remove the S meter from the front panel.

(4) Remove the cover from the r-f choke coil L700.

(5) Remove the screw that fastens the r-f choke coil to the chassis.

(6) Unsolder and remove the r-f choke coil.

(7) Clean all dirt, dust, rust, fungus, oil, grease, etc., from the equipment to be processed.

c. Masking (fig. 22). (1) Mask the S meter control R717 located at the rear of the chassis (exposed wire type).

(2) Mask the chassis opening near the r-f unit to prevent the varnish from damaging the tuning capacitors and the acorn tube sockets.

(3) Remove the r-f bias batteries located in the r-f unit and mask battery connections.

(4) Leave all tubes in sockets to prevent varnish from coating the socket contacts.

d. Drying. Place the receiver in a drying oven, and bake approximately 2 to 3 hours at 160° F. *Do not bake the S meter.*

Caution: Do not exceed 160° F. If wax should begin to melt in any of the components, decrease the temperature and increase the drying time approximately 1 hour for each decrease of 10° F. in temperature.

e. Varnishing. Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-Resistant, spec No. 71–2202 (Sig C stock No. 6G1005.3), or equal) to the components, allowing a 15- to 20-minute drying period after each coat. Use a brush to apply varnish to the components which cannot be reached by a spray gun so that all components may be adequately protected by the fungus-resistant varnish.

Note. Immerse the r-f choke coil in varnish. Saturate the speaker transformer thoroughly with varnish by brush coating.

f. Reassembly. (1) After the varnish is thoroughly dry, remove all masking tape from the components.

(2) Clean all contacts with varnish remover, and burnish the contacts.

(3) Reassemble the unit by following the instructions for disassembly in the reverse order.

(4) Check the receiver for over-all performance.

g. Marking. Mark the unit with MFP and the

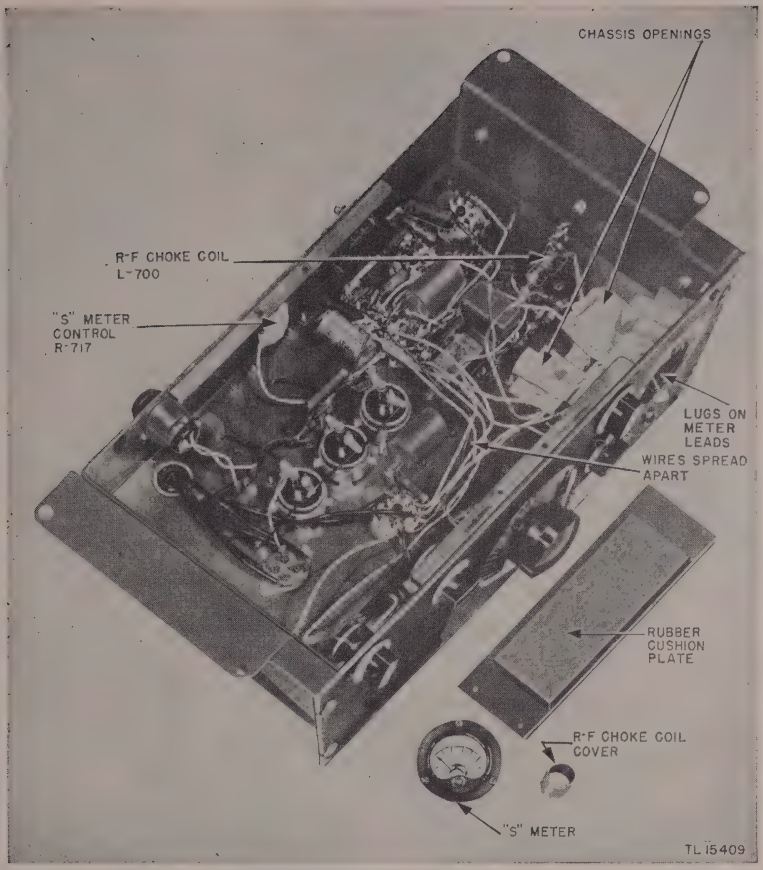


Figure 22. Radiosonde Receiver R–17/FMQ–1, disassembled and masked for treatment.

date of treatment near the most conspicuous nameplate on the equipment.

Example: MFP—21 October 1947.

63. Instructions for Frequency Meter TS–29(*)/FMQ–1

a. Preparation. Make all repairs and adjustments necessary for the proper operation of the equipment.

b. Disassembly. (1) Remove Frequency Meter TS–29(*)/FMQ–1 from the rack.

(2) Remove the rubber cushion plate under the chassis.

(3) Disconnect and remove the visual meter from the panel.

(4) If Thordarson type T70R61 transformer is used in the frequency meter, disassemble the transformer as shown in figure 23.

(5) Clean all dirt, dust, rust, fungus, oil, grease, etc., from the equipment to be processed.

c. Masking. (1) Mask the input selector switch. If the COARSE, FINE, and EQUALIZER controls are of the exposed wire types, mask them.

(2) Leave all tubes in sockets.

d. Drying. Place the frequency meter in a drying oven, and bake it approximately 2 to 3 hours at 160° F. *Do not bake the visual meter.*

Caution: Do not exceed 160° F. If wax should begin to melt in any of the components, decrease the temperature and increase the drying time approxi-

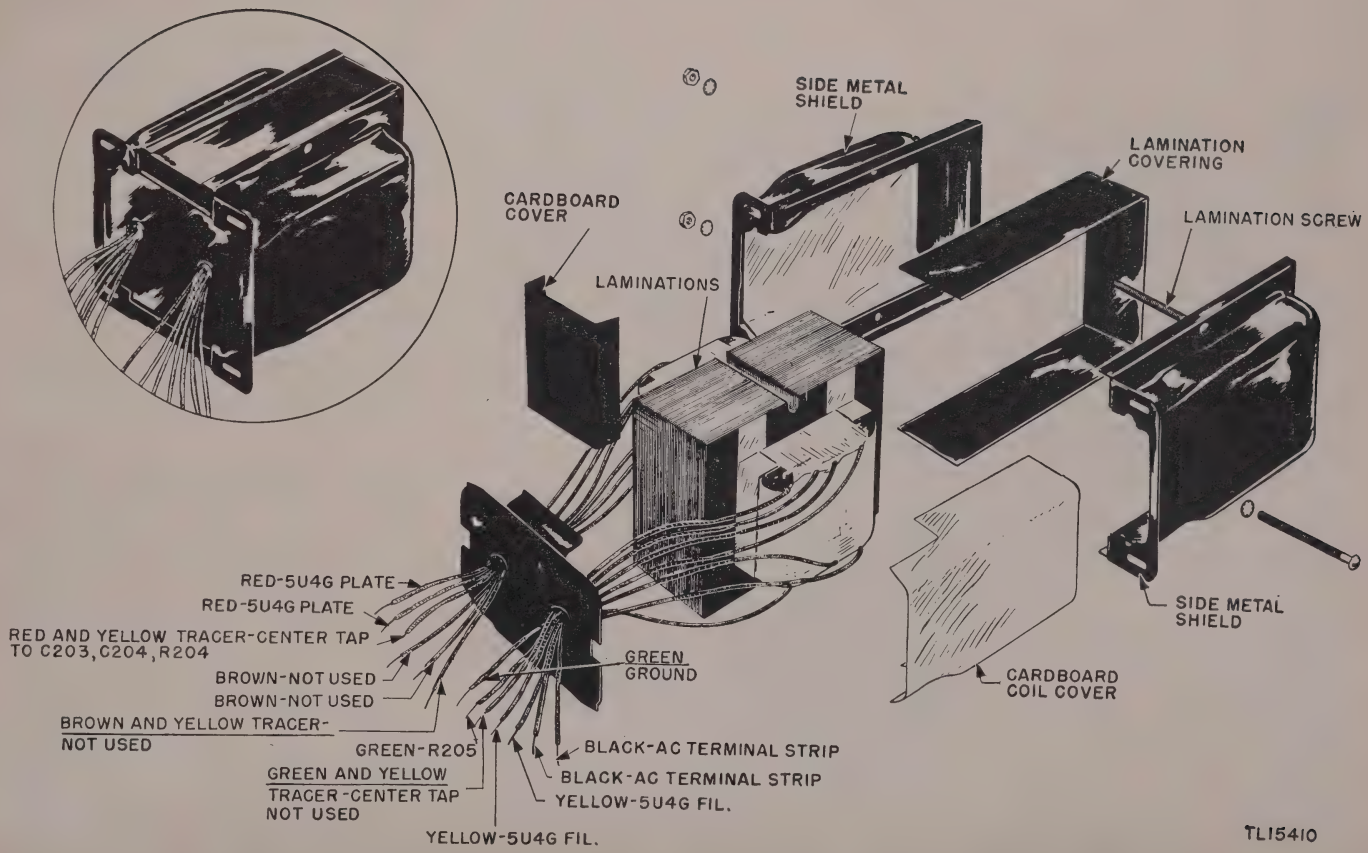


Figure 23. Thordarson type T70R61 transformer, disassembled.

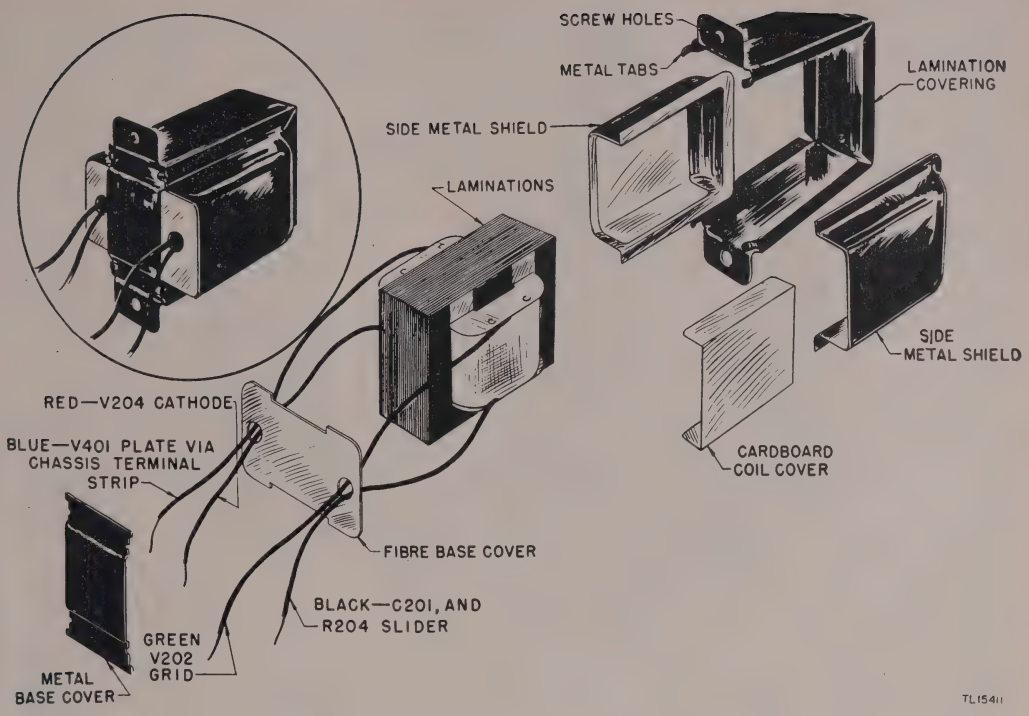


Figure 24. Transformer T200 (same structure as choke L201), disassembled.

mately 1 hour for each decrease of 10° F. in temperature.

e. Varnishing. Apply three coats of moisture-proofing and fungiproofing varnish (Lacquer, Fungus-Resistant, spec No. 71–2202 (Sig C stock No. 6G1005.3), or equal) to the components, allowing a 15- to 20-minute drying period after each coat. Use a brush to apply varnish to the components which cannot be reached by a spray gun so that all components are adequately protected by varnish. If Thordarson type T70R61 transformer is used, immerse laminations and coil of transformer in the varnish.

f. Reassembly. (1) After the varnish is thoroughly dry, remove all masking tape.

(2) Clean all contacts with varnish remover, and burnish the contacts.

(3) Reassemble the unit by following the instructions for disassembly in reverse order.

(4) Check the frequency meter for over-all performance.

g. Marking. Mark the unit with MFP and the date of treatment near the most conspicuous nameplate on the equipment.

Example: MFP—21 October 1947.

64. Instructions for Amplifier AM–7(*)/FMQ–1

a. Preparation. Make all repairs and adjustments necessary for the proper operation of the equipment.

b. Disassembly. (1) Disconnect and remove the amplifier from the rack.

(2) Remove the cover from the amplifier.

(3) Remove the a-c and d-c terminal strips from the rear of the chassis.

(4) Unsolder all transformer and filter choke leads in order to facilitate removal of these parts from the chassis. Remove transformers T200, T201, and T202 and choke L201 from the chassis.

(5) Disassemble transformer T200 as shown in figure 24.

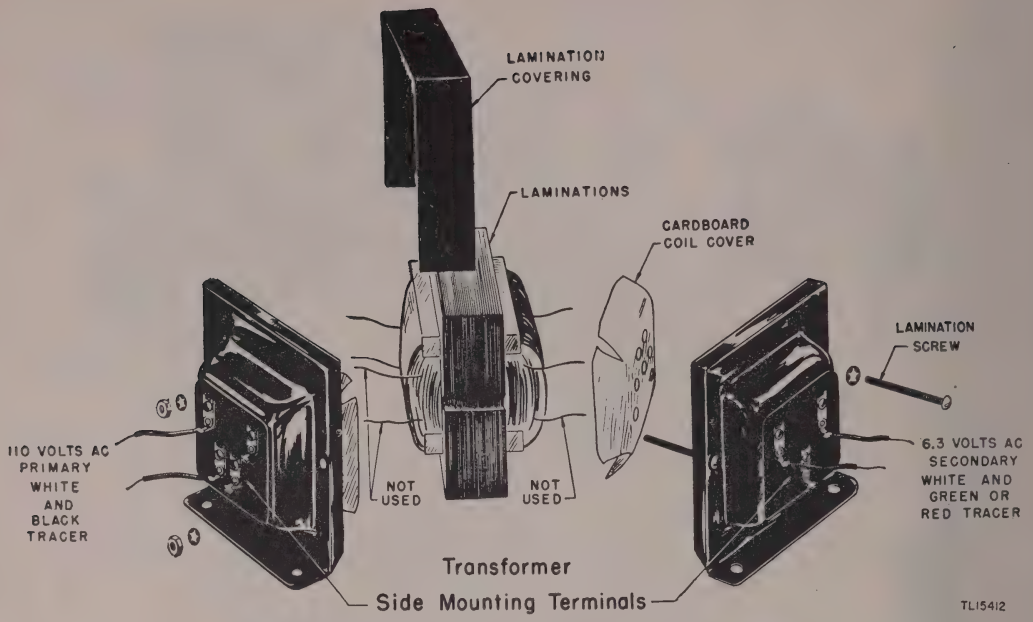


Figure 25. Transformer T202, disassembled.

(6) Disassemble transformer T201 as shown in figure 23.

(7) Disassemble transformer T202 as shown in figure 25.

(8) Disassemble filter choke L201 as shown in figure 24.

(9) Clean all dirt, dust, rust, fungus, oil, grease, etc., from the equipment to be processed.

c. DRYING. Place the amplifier, choke L201, and transformers T200, T201, and T202 in a drying oven, and bake them approximately 2 or 3 hours at 160° F.

Caution: Do not exceed 160° F. If wax should begin to melt in any of the components, decrease the temperature and increase the drying time approximately 1 hour for each decrease of 10° F. in temperature.

d. VARNISHING. Apply three coats of moisture-proofing and fungiproofing varnish (Lacquer, Fungus-Resistant, spec No. 71–2202 (Sig C stock No. 6G1005.3), or equal), to the amplifier, allowing a 15- to 20-minute drying period after each coat. Use a brush to apply varnish to the components which cannot be reached by a spray gun so that all components are adequately protected by varnish. Immerse the laminations and coils of the transformers and choke in the varnish.

e. REASSEMBLY. (1) Clean all contacts with varnish remover, and burnish the contacts.

(2) Reassemble the units by following the instructions for disassembly in reverse order.

(3) Check the amplifier for over-all performance.

f. MARKING. Mark the unit with MFP and the date of treatment near the most conspicuous nameplate on the equipment.

Example: MFP—21 October 1947.

65. Instructions for Radiosonde Recorder RD–3(*)/FMQ–1

a. PREPARATION. Make all repairs and adjustments necessary for the proper operation of the equipment.

b. DISASSEMBLY. To disassemble the recorder remove the following:

(1) The radiosonde recorder from the rack (figs. 26 and 27).

(2) Ribbon spools and Chart Roll ML–182.

(3) Rocker frame assembly.

(4) Ribbon drive metal hood.

(5) Terminal strips.

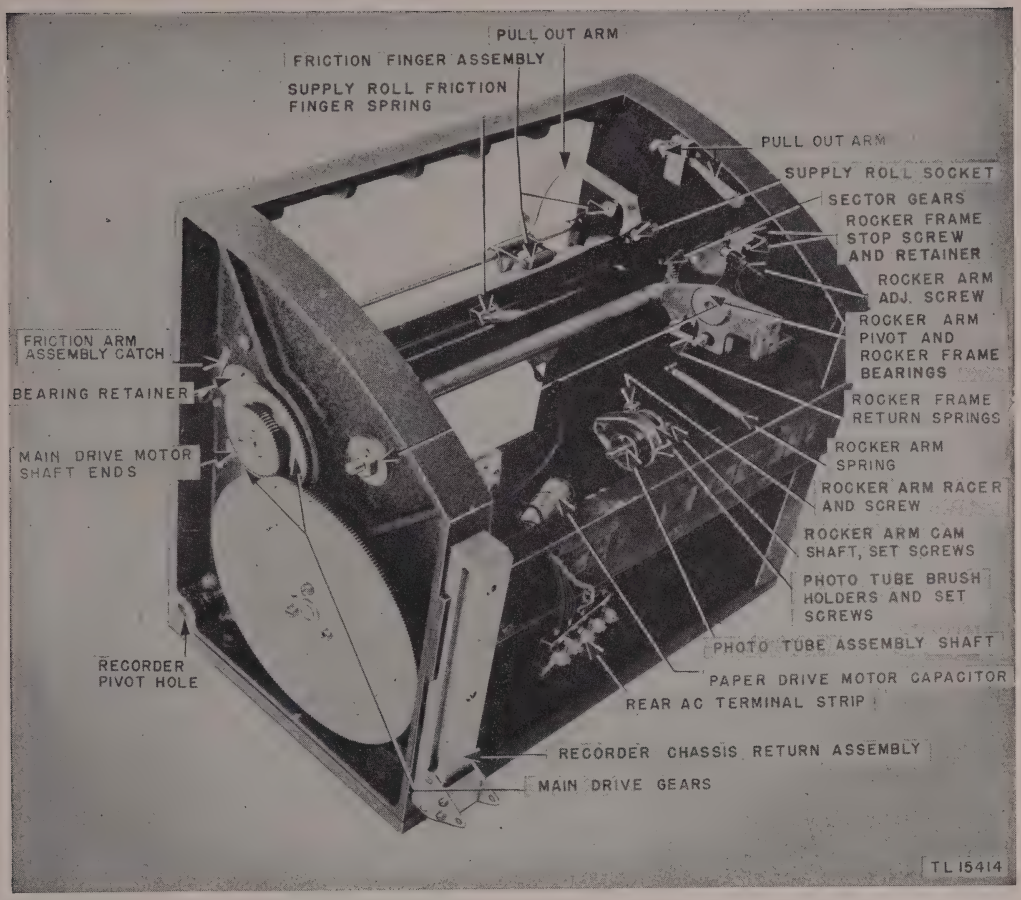


Figure 26. Radiosonde Recorder RD–3/FMQ–1, right rear three-quarter view, prepared for tropicalization.

(6) Armature cores and tapper coils.
(7) Ribbon drive motor and fiber gear assembly.
(8) Tapper bar assembly.
(9) Front panel.
(10) Recorder meter assembly.

Caution: Designate position by scribing the position corners on the base, and identify polarity.

(11) Phototube disk and brushes.
(12) Exciter light disk and brushes.
(13) Preamplifier tube and cover.
(14) Preamplifier base mounting screws.
(15) Motor-capacitor mounting screws. *Do not unsolder capacitor wires.*
(16) Rear terminal-strap mounting screws.
(17) Five d-c wires.
(18) Fiber wire clamps.
(19) Two recorder meter leads.
(20) Blue and black wires leading to the phototube brush holders.
(21) Three-conductor rubber-covered cable.
(22) Twisted phototube leads.
(23) Blue 6.3-volt a-c filament heater wire (fig. 28).
(24) Wire jumpers connected to terminals B, C, D, and to the plate.
(25) Grid connections of the JAN–6C5 tube socket.
(26) The jumper connecting lug G to lug C.

Note. Clean all wires and motor capacitors. Unsolder connections to remove components (17), (19), (20), (21), (22), and (23) above.

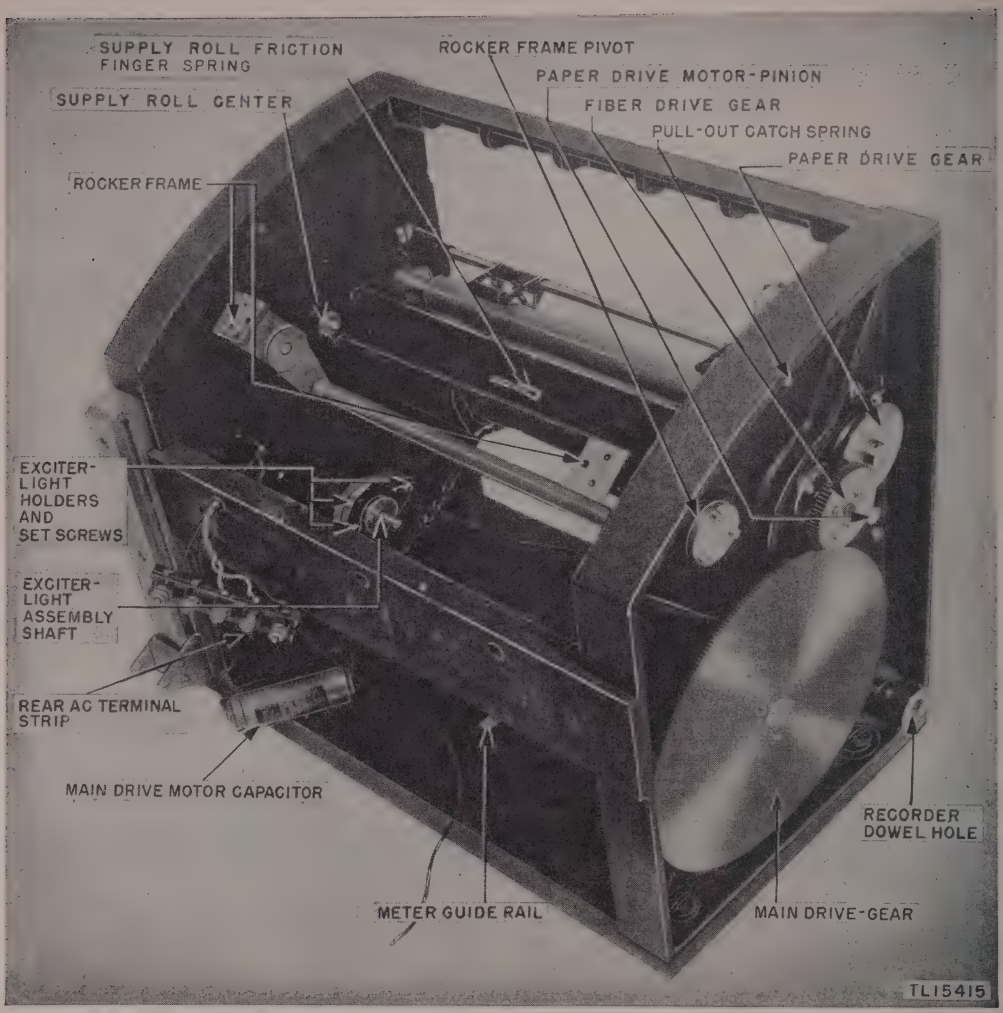


Figure 27. Radiosonde Recorder RD–3/FMQ–1, left rear three-quarter view, prepared for tropicalization.

c. Rewiring. To rewire the preamplifier, see figure 28 and follow instructions given below.

(1) Cut three 15-inch lengths of the replacement hook-up wire WL–20–A, spec No. 71–4943 (furnished with tropicalization kit). *Observe the color coding recommended.* Connect the recorder rear d-c terminal strip to the preamplifier. Use white with black tracer for ground, white with red tracer for 240-volt preamplifier, and white for 90-volt phototube anode supply.

(2) Connect the white wire to terminal lug G.

(3) Connect the white wire with red tracer to the plate terminal of the preamplifier tube.

(4) Connect the white wire with black tracer to ground terminal lug F or K.

(5) Lace the three wires with lacing twine and tie to the preamplifier grounded metal loop.

(6) Solder the opposite ends to corresponding terminals on the rear terminal strip.

(7) Remove the cathode phototube lead from lug

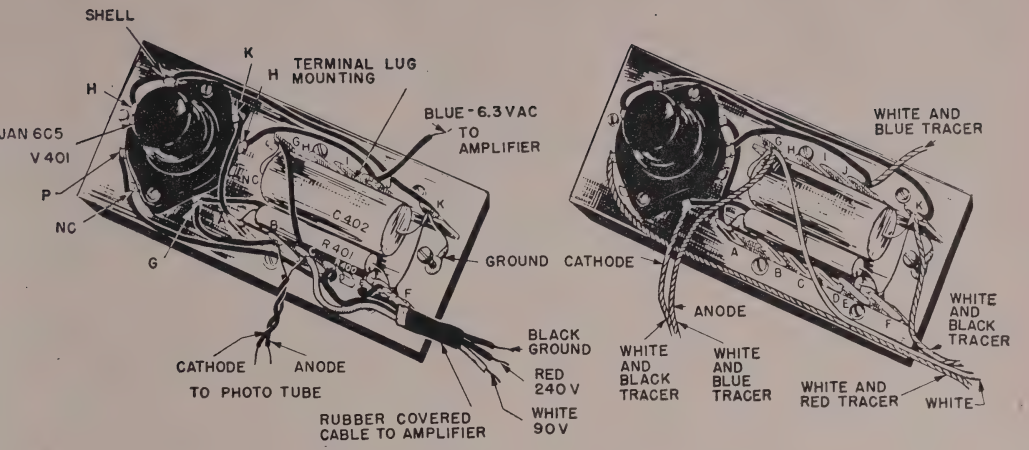


Figure 28. Preamplifier, Radiosonde Recorder RD–3/FMQ–1, shown before and after rewiring.

B and replace with white wire with black tracer connected directly to grid terminal of the preamplifier tube socket.

(8) Replace the anode lead on lug C with white wire with blue tracer, connecting the new wire directly to terminal lug G.

(9) Resolder the cathode and anode leads to the phototube brush holders.

(10) Replace the rubber-covered cord leads between the recorder meter and the twin terminal strip. Note polarity. Use the white wire with red tracer as positive and the white wire with black tracer as negative.

(11) Replace the rubber-covered cord between the rear terminal strip and the rocker arm frame with WL–20–A white wire.

(12) Unsolder the rubber-covered cord which supplies the ribbon drive motor and replace it with WL–20–A white wire; use terminal lugs at the rocker arm frame end.

(13) Connect WL–20–A white wire between the terminal lugs at the rocker arm frame and the two existing black wires on the rear a-c terminal strip.

(14) Replace all terminal strip connecting screws and nuts; tighten to prevent the lacquer from acting as an insulator when the cables are reconnected.

(15) Clean all dirt, dust, rust, fungus, oil, grease, etc., from the equipment to be processed.

d. Drying. Place all components of the recorder except the recorder meter in a drying oven, and bake for approximately 2 to 3 hours at 160° F.

Caution: Do not exceed 160° F. If wax should begin to melt in any of the components, decrease the temperature and increase the drying time approximately 1 hour for each decrease of 10° F. in temperature.

e. Varnishing. With a brush, apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-Resistant, spec No. 71–2202 (Sig C stock No. 6G1005.3), or equal) to all electrical circuit components except the tapper coils and the ribbon drive motor coil. Coat the tapper coils and the ribbon drive motor coil by immersing in the varnish. *Remove the fiber gear assembly from the ribbon drive motor before immersion of the coil. Do not immerse beyond the coil windings of the motor.* Brush varnish on the terminal strips, wiring, motor capacitors, exposed power cable connection points, and recorder meter terminal mount.

f. Reassembly. (1) Clean and burnish the contacts.

(2) Reassemble the units by following the instructions for disassembly in reverse order.

(3) Check the recorder for over-all performance.

g. MARKING. Mark the unit with MFP and the date of treatment near the most conspicuous nameplate on the equipment.

Example: MFP—21 October 1947.

66. Instructions for Voltage Regulator CN–2(*)/FMQ–1

a. PREPARATION. Make all repairs and adjustments necessary for the proper operation of the equipment.

b. DISASSEMBLY. (1) Remove the voltage regulator from the rack.

(2) Remove the metal cover by loosening the screws to expose transformers T300 and T301, capacitors C300 and C301, and circuit wiring.

(3) Clean all dirt, dust, rust, fungus, oil, grease, etc., from the equipment to be processed.

c. DRYING. Place the voltage regulator in a drying oven and bake it for approximately 2 or 3 hours at 160° F.

Caution: Do not exceed 160° F. If wax should begin to melt in any of the components, decrease the temperature and increase the drying time approximately 1 hour for each decrease of 10° F. in temperature.

d. VARNISHING. Apply three coats of moisture-proofing and fungiproofing varnish (Lacquer, Fungus-Resistant, spec No. 71–2202 (Sig C stock No. 6G1105.3), or equal), to the voltage regulator, allowing a 15- to 20-minute drying period after each coat.

e. REASSEMBLY. After the varnish is thoroughly dry, reassemble by following the instructions for disassembly in reverse order. Check the equipment for over-all performance.

f. MARKING. Mark the unit with MFP and the date of treatment near the most conspicuous nameplate on the equipment.

Example: MFP—21 October 1947.

PART FOUR

AUXILIARY EQUIPMENT

(Not Used)

PART FIVE

REPAIR INSTRUCTIONS

Section VIII. THEORY OF EQUIPMENT

Note. Unless otherwise noted, this section explains the functioning of the equipment using the circuit symbols of Radiosonde Receptor AN/FMQ–1. The over-all functioning of Radiosonde Receptors AN/FMQ–1 and AN/FMQ–1A is the same.

67. General

The radiosonde receptor is used to receive, indicate, and record signals transmitted by 72.2-mc balloon-borne radiosondes. (As previously explained, when the radiosonde receptor is used in conjunction with Radio Set SCR–658, it may also be used to indicate and record signals transmitted by 403-mc radiosondes. TM 11–1158A explains the functioning of Radio Set SCR–658.)

a. Radiosonde Signals. The radiosonde transmits an interrupted continuous wave of r-f energy (72.2 mc for Radiosonde AN/AMT–1). The interruptions occur at some rate between 8 and 200 cps (cycles per second), the exact frequency varying in response to the varying pressure, temperature, and relative humidity conditions encountered by the radiosonde during its ascent. Thus, the transmission by the radiosonde consists of a series of bursts or pulses of r-f energy, with the repetition rate of the pulses being dependent on the weather conditions at the location of the radiosonde. For example, figures 29A and 29B represent the transmitted energy from Radiosonde AN/AMT–1 at pulse frequencies of 8 and 16 cps, respectively. Note that when the frequency increases, the time *duration* of each pulse becomes shorter while the time *between* pulses remains constant.

b. Presentation of Theory. (1) In figure 30, the radiosonde receptor is represented by blocks which symbolize the basic components of the equipment. The interconnecting lines with arrows show the relationship of each component to the entire system. Radio Set SCR–658 is shown as a single block and, when this set is used, it replaces the antennas and receiver of the radiosonde receptor except for the audio output tube and speaker of the radiosonde receiver. Paragraph 68 explains the over-all functioning of the equipment on the basis of figure 30.

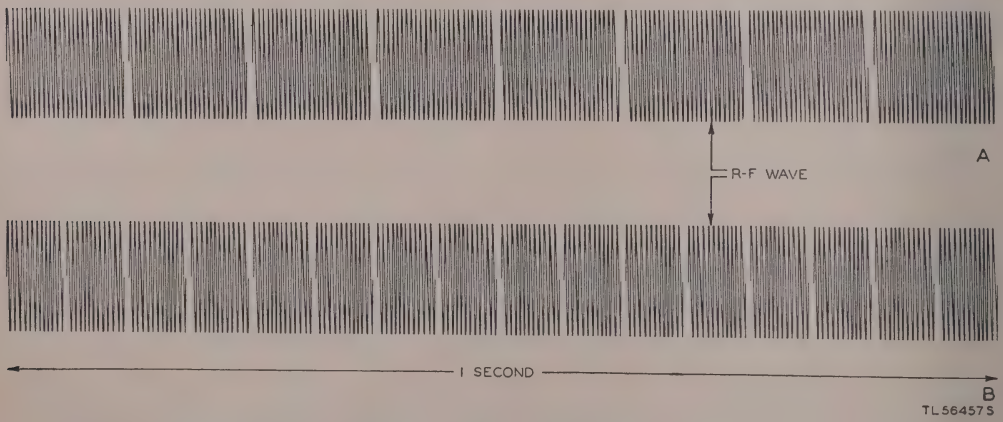


Figure 29. Representation of transmission of Radiosonde AN/AMT–1 at pulse frequencies of 8 and 16 cps.

(2) In figure 31, the blocks are broken down to show the principal circuits of each component. Radio Set SCR–658 has been omitted from the diagram because functioning of this set is explained in TM 11–1158A. For purposes of explanation, the pictorial portion of figure 31 shows the recorder mechanism in simplified form. Paragraphs 69 through 93 present the theory of the equipment on the basis of figure 31, but also contain numerous other illustrations which clarify the explanation.

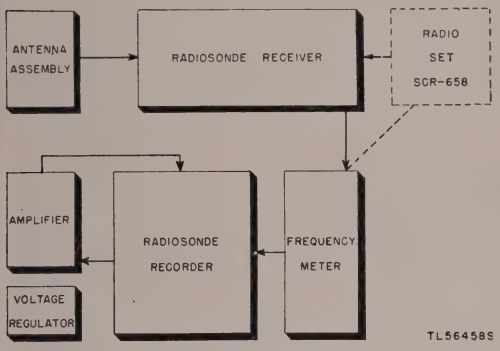


Figure 30. Radiosonde Receptor AN/FMQ–1, simple block diagram.

68. Over-all Functioning of Equipment (fig. 30)

a. Antenna System. The antenna picks up the r-f signals transmitted by the radiosonde. These signals are carried to the receiver by means of coaxial cable (transmission line). Two antennas and two transmission lines are installed but only the antenna which provides the better signal is used in actual operation for one particular set of flight conditions.

b. Receiver. The receiver amplifies and converts the 72.2-mc r-f signals received from the antenna into a-f signals of correct amplitude and waveform (essentially a saw-tooth voltage) for operation of the frequency meter. In addition, the receiver has a speaker output for aural monitoring purposes, an intensity meter (S meter) for indicating the strength of the modulated r-f signal, and a built-in power supply.

c. Radio Set SCR–658. When signals from a 403-mc radiosonde (Radiosonde AN/AMT–2) are to be recorded, the antenna system of the radiosonde receptor is not used, being replaced by the antenna system of Radio Set SCR–658. During 403-mc operation, the frequency meter receives an a-f signal from Radio Set SCR–658. This signal has approximately the same amplitude and waveform as the a-f signal which is supplied to the frequency meter by the radiosonde receiver during 72.2-mc operation. A shielded cable (Cord CD–1312 of Radio Set SCR–658) carries the a-f signal from Radio Set SCR–658 to the frequency meter and to the speaker channel of the radiosonde receiver.

d. Frequency Meter. The frequency meter produces a direct current having a value proportional to the frequency of the a-f input signals. This current passes through two microammeters, the deflections of which indicate the audio frequency. The scales of the microammeters are graduated in bi-cycles per second (1 bi-cycle equals 2 cycles). One microammeter, called the *visual meter,* is located on the front panel of the frequency meter, and the other microammeter, called the *recorder meter,* is located on the recorder chassis. The frequency meter has its own built-in power supply and voltage regulator.

e. Recorder. (1) The recorder makes a continuous, printed record of the frequencies measured by the frequency meter. The recorder is an electromechanical device, the principal components of which are the recorder meter, a photoelectric scanning assembly, and a printing mechanism. All moving parts within the recorder, with the exception of the recording paper and its feed system, are held in precise synchronism by a system of gears which are rotated by a common drive motor.

(2) In operation, current pulses are produced because of interference by the pointer of the recorder meter with a beam of light in the photoelectric scanning assembly. The current pulses, after amplification (*f* below), energize solenoids which in turn actuate a printing mechanism.

(3) The printing mechanism prints a continuous record of the position of the pointer of the recorder meter with respect to time and, in so doing, makes a continuous record of the frequencies measured by the frequency meter. Hence, because these frequencies represent the intelligence transmitted by the radiosonde, a record of the weather conditions at the location of the radiosonde is obtained.

f. Amplifier. The amplifier sends a uniform, heavy pulse of current through the tapper bar magnets of the recorder in response to each current pulse received from the photoelectric scanning assembly in the recorder. The amplifier has its own built-in power supply.

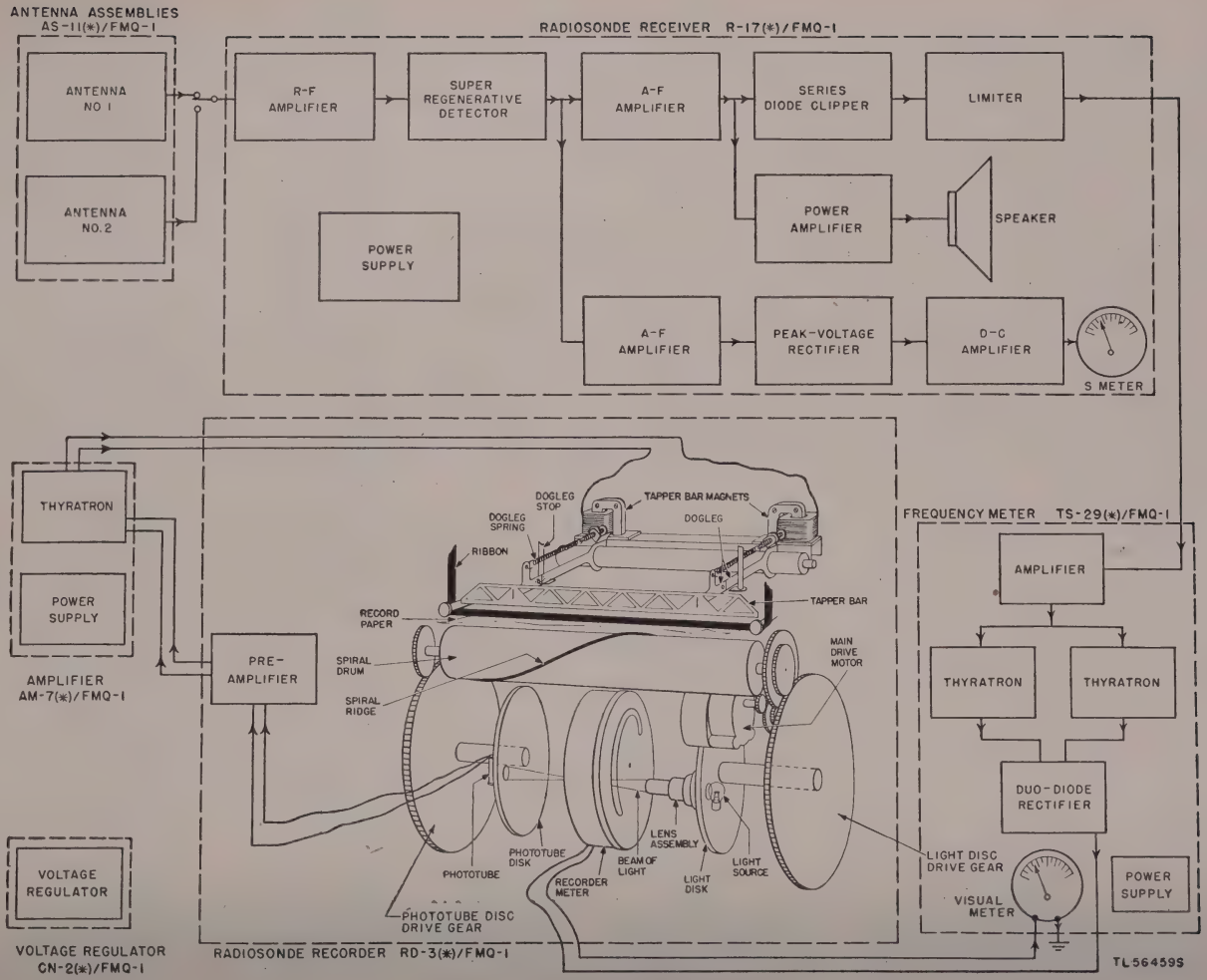


Figure 31. Complete block-pictorial diagram.

g. Voltage Regulator. The voltage regulator maintains the a-c power input to the power supplies of the frequency meter and amplifier at a constant voltage (±0.5%) even though wide variations of line voltage occur. The regulator has two transformers and two capacitors in a suitable circuit to perform this function.

69. Antennas and Transmission Lines

Part of the electromagnetic energy radiated by the radiosonde antenna, after travelling through space, sweeps across the receiving antenna at the velocity of light, inducing in the receiving antenna a voltage which is proportional to the strength of the travelling electromagnetic wave. At frequencies of 72.2 mc and 403 mc, this energy is propagated in a direct line, commonly called *line of sight transmission* and suffers little effect by absorption in the atmosphere of the earth or in the ground. This direct wave, however, is subject to reflection, and objects in the path of the wave can deflect it and change its direction of travel. Thus, if a tree, building, or other object obstructs the line of sight path between the antenna of the radiosonde and the antenna of the radiosonde receptor, the induced voltage may be attenuated or lost completely. For this reason, two antennas are installed for each receptor, thus insuring, at any azimuth angle, an unobstructed line of sight path between the radiosonde antenna and one or the other of the receptor antennas (fig. 8). Only one antenna is used at a time, however, the operator selecting that antenna which provides the better signal strength. Each antenna has its own transmission line which carries the received energy from the antenna to the receiver.

a. Transmission Lines. Coaxial cable is used for the transmission lines. As explained in paragraph 4, this cable is composed of a seven-strand copper wire inside of and coaxial with a tubular, copper-stranded outside conductor. On this line, the electromagnetic field is confined to the space between the inner and outer conductors. Hence, there is no loss of power from the line by radiation or induction. The outside surface of the outer line also serves as a shield to exclude unwanted waves originating from other sources.

(1) The characteristic impedance of the line is determined by the ratio of the outside diameter of the inner conductor to the inside diameter of the outer conductor. The characteristic impedance in the case of the particular cable in use, is 75±3 ohms.

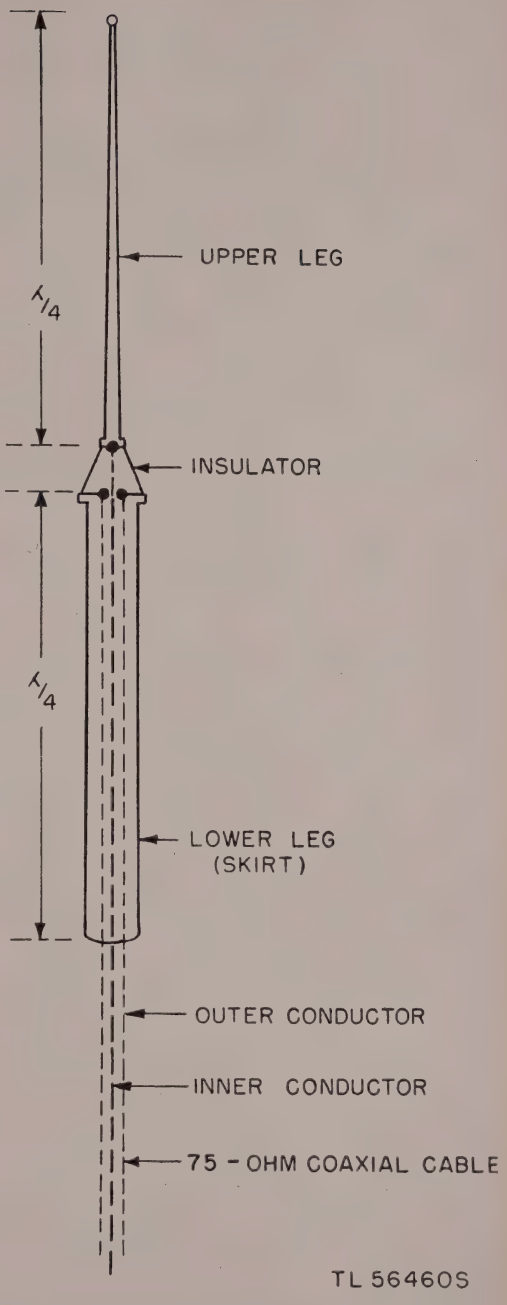


Figure 32. Coaxial vertical antenna, simplified diagram, showing method of connecting coaxial transmission line.

This value of characteristic impedance is desirable because it permits an impedance match to be effected between the coaxial line and the antenna without the use of a matching section. Thus the coaxial line, being so terminated, is nonresonant and presents a constant impedance of approximately 75 ohms at the receiver end of the line, regardless of the length of line used.

(2) The line is flexible, and its installation is therefore comparatively simple.

b. Antenna. The antenna is a half-wave, center-fed, coaxial vertical antenna having a characteristic impedance of approximately 75 ohms, being fed by the 75 ohm coaxial cable.

(1) The field pattern of the antenna, in the horizontal plane, is circular, the antenna receiving signals equally well at all azimuth angles. In the vertical plane, the field pattern varies with the height of the antenna above ground and with the composition of the soil and underlying terrain. However, because the two receptor antennas are installed at different heights, sufficient signal strength is usually obtained from one or the other of the antennas at any angle of elevation.

(2) As explained in paragraph 4, the antenna is composed of two quarter-wave sections, mounted in line and separated by an insulator. The upper quarter-wave leg is a metal rod and the lower leg is a metal tube, called a *skirt,* as shown in the simplified sketch of figure 32. The coaxial transmission line is brought up through the inside of the skirt and connects to the center of the half-wave antenna; the inner conductor of the line connects to the upper leg of the antenna, and the outer conductor of the line connects to the skirt. This method of feeding the antenna prevents the transmission line from acting as a parasitic element which would cause the antenna to acquire unwanted directional characteristics, thus distorting the normal field pattern. Because the electromagnetic field is confined to the inside of the coaxial line and because the fields about the antenna do not penetrate the outside surface of the skirt (skin effect), no field exists on the inside of the skirt. Therefore, the coaxial line can be brought up inside the skirt without affecting the normal characteristics of the antenna.

70. Receiver

The receiver (fig. 31) amplifies the r-f energy received by the antenna system and converts it into an a-f signal suitable for operation of the frequency meter. The receiver consists of a power supply, an r-f amplifier, a superregenerative detector, and three output channels.

a. The r-f amplifier increases the level of r-f signal going to the detector. It also acts as a buffer stage to prevent oscillations produced in the superregenerative detector from being radiating by the antenna.

b. The superregenerative detector, which is characterized by simplicity, poor selectivity, and extreme sensitivity at the carrier frequency of 72.2 mc, demodulates the r-f signal and passes the a-f component to the output channels. The a-f component has a frequency between 8 and 200 cps which corresponds to the modulation frequency of the radiosonde transmitter.

c. The output channel to the frequency meter consists of an a-f amplifier, a series diode clipper, and a limiter stage. This channel performs the functions of amplifying, limiting, and waveshaping the a-f signals from the detector before the signals are sent to the frequency meter.

71. R-f Section of Receiver

The r-f section of the receiver is comprised of the r-f amplifier and the superregenerative detector (fig. 33).

a. R-f Amplifier. The r-f amplifier uses an acorn pentode amplifier tube, Tube JAN–954, in a conventional h-f (high-frequency) circuit.

(1) The signals received by the antenna and carried to the receiver by means of the coaxial transmission line are coupled to the amplifier tube by means of transformer L703. The primary of the transformer has a low impedance to match the 75-ohm impedance presented at the receiver end of the coaxial line. The secondary of the transformer is tuned to resonance by variable capacitors C700 and C711. Capacitor C700 is ganged with capacitor C701 in the detector circuit, and the combination is tuned by means of the MAIN tuning dial. Capacitor C711, the R.F. TRIMMER control, is used to compensate for any misalignment in the circuits tuned by capacitors C700 and C701.

(2) Grid bias voltage for class A amplification is obtained from a 3-volt battery. Capacitor C702 bypasses r-f energy around the battery to ground.

(3) Screen voltage is obtained through series resistor R700, with capacitor C704 placing the screen at r-f ground potential.

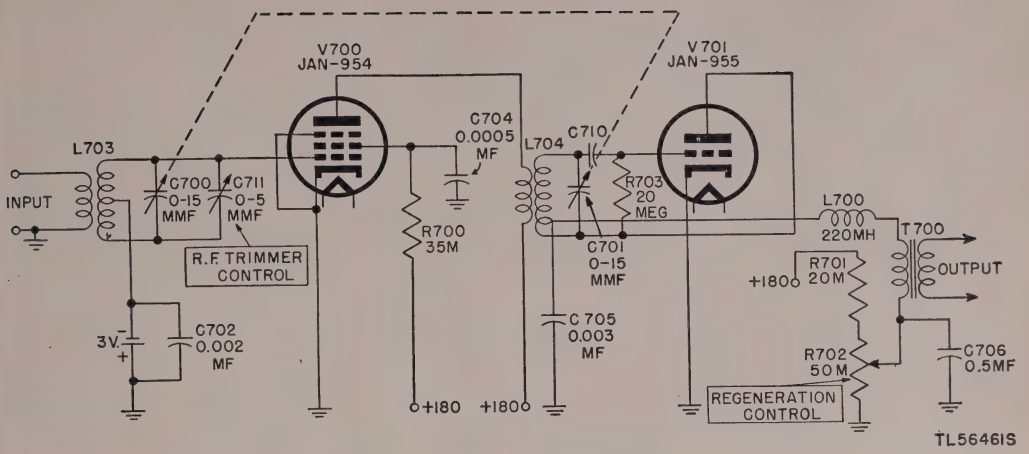


Figure 33. R-f section of radiosonde receiver, simplified schematic diagram.

(4) The amplified r-f voltage appears across the impedance of the primary winding of the transformer L704.

b. Superregenerative Detector. The detector stage uses an acorn triode vacuum tube, Tube JAN-955, in a self-quenching superregenerative detector circuit (fig. 33).

(1) The r-f voltage appearing across the primary of transformer L704 is inductively coupled to the secondary and appears between the grid of the tube and ground; the tap on the secondary winding is held at r-f ground potential by capacitor C705. The secondary is tuned to resonance at the r-f operating frequency by capacitor C701.

(2) The initial voltage appearing at the grid of the tube is amplified by the tube with the amplified voltage, called a *feedback* voltage, appearing across the lower part of the secondary winding. Potentiometer R702 (REGENERATION control) is used to adjust the value of d-c plate voltage applied to the plate of the tube. As the d-c plate voltage is increased, the amplification factor of the tube and the amount of feedback voltage is also increased.

(3) The field produced by the feedback voltage is in phase with the field produced by the original grid voltage; these two fields add to produce, at the grid of the tube, a large resultant voltage which is again amplified by the tube. As this cycle of operation repeats, the r-f voltage at the grid and plate of the tube is built up to higher and higher amplitudes until a condition of equilibrium is reached when the feedback voltage will no longer increase the amplitude of the r-f voltage to any greater extent. The circuit is then an oscillator at the r-f input frequency.

(4) The circuit does not continue to oscillate for long, however. When the r-f voltage at the grid of the tube reaches a high amplitude, as explained above, the positive portions of this voltage causes the grid of the tube to become positive with respect to the cathode, and grid current flows. The cathode-to-grid resistance of the tube falls to a low value during this time, and capacitor C710 quickly charges through this low resistance path, developing a negative bias voltage on the grid. During the negative portions of r-f grid voltage, grid current does not flow and the capacitor discharges through resistor R703. However, because of the long R-C (resistance-capacitance) time constant of capacitor C710 and resistor R703, the capacitor is unable to discharge to any appreciable extent during the negative alternation. As a result, each successive cycle of r-f grid voltage adds a greater charge to the capacitor until a point is reached where the bias voltage across capacitor C710 is so high that the amount of feedback provided by the plate circuit is not sufficient to sustain oscillations. The circuit does not break into oscillation again until sufficient voltage across the capacitor leaks off through the resistor to permit the r-f grid voltage to again gain control of the tube. This combined action results in periods of oscillations and periods of rest, and the tube becomes an intermittent oscillator.

The rate of interruptions of oscillations (quenching frequency) is variable, being determined by the amplitude of the r-f voltage input across the primary of transformer L704 and the R-C time constant of resistor R703 and capacitor C710. (The quench frequency is somewhere within the low r-f range for any operating condition.) Because the resistor and capacitor values are fixed, the quenching frequency is actually dependent on the strength of received signals, with the quenching frequency becoming higher as the amplitude of r-f input signal increases.

(5) The most important effect of the quenching frequency on the operation of the circuit is that it controls the rate of current flow through the primary of output transformer T700.

(*a*) Assume a given setting of the REGENERATION control and an r-f input signal of constant amplitude; the quenching frequency remains constant because the amplitude of the r-f signal input to the detector tube neither increases nor decreases. For such an input signal, there is a flow of plate current during each period of oscillation and no flow of plate current during the resting time between oscillations, the oscillations recurring at the r-f quenching frequency. The current drain from the plate supply through the primary of the output transformer cannot, however, follow these r-f current bursts because of the high r-f impedances of the primary winding of transformer T700 and r-f choke coil L700, and the low shunt impedance of capacitor C705. Instead, the current passing through the primary winding of the output transformer, if metered, would show the average value (averaged over both the oscillating time and the resting time) of plate current drawn by the tube. The primary transformer current would, in this case, be constant, and no current would be induced in the secondary winding. Thus, the output of the detector would be zero.

(*b*) Now assume that the receiver is picking up a high-amplitude signal from the radiosonde. In this case, the r-f input signal to the detector stage consists of strong pulses of r-f energy with a short no-signal period between successive pulses (fig. 29). During each strong pulse of r-f energy, the quenching frequency is comparatively high. At the same time, the plate current is high because the ratio of the resting time to the oscillating time of the detector is low. Thus, the current flow in the primary of the output transformer is high. During the off-the-air time of the radiosonde between successive pulses of energy, the r-f input to the detector suddenly falls to zero and, as a result, the quenching frequency suddenly falls to its minimum. At this time, the ratio of resting time to oscillating time for the detector increases to its maximum, causing the plate current to drop to a minimum. The flow of current through the primary of the output transformer suddenly falls to its minimum, inducing a sudden change in current flow through the secondary winding. And, because the voltage across the secondary depends on the rate of current change, the secondary or output voltage for the detector is high. As another pulse of r-f energy suddenly reaches the detector in response to the transmissions of the radiosonde, the above events reverse, causing another large voltage, of opposite polarity, to appear across the secondary of the output transformer. Thus, the output of the detector consists of a voltage which reverses polarity in response to the modulation of the radiosonde transmitter.

(6) As the REGENERATION control is advanced, higher d-c operating voltage is applied to the plate of the tube, and this higher voltage in turn raises the amplification factor for the tube, causing larger changes in plate current in response to changes in grid voltage. Conversely, as the control is turned from maximum toward its lower settings, the amplification factor for the tube is reduced and, when the plate voltage is reduced to a certain low value, the point is reached where the feedback voltage is not sufficient to build up oscillations and the detector output falls off.

(7) In the absence of an input r-f signal to the receiver, there is a noise output from the superregenerative detector. This noise is caused by random variations of voltage in the input circuit of the tube which are amplified in the detector in the same way as signal voltage. The amplified noise appears at the output of the detector and can be heard in the speaker in the absence of a signal. As soon as a signal of greater amplitude than the noise is received, however, the noise immediately disappears in the detector output because the signal voltage controls the operation of the tube to a far greater extent than the transient noise peaks. This noise is in control of the tube for such short periods of time in comparison to the periodic signal voltage that its presence is not indicated in the detector output.

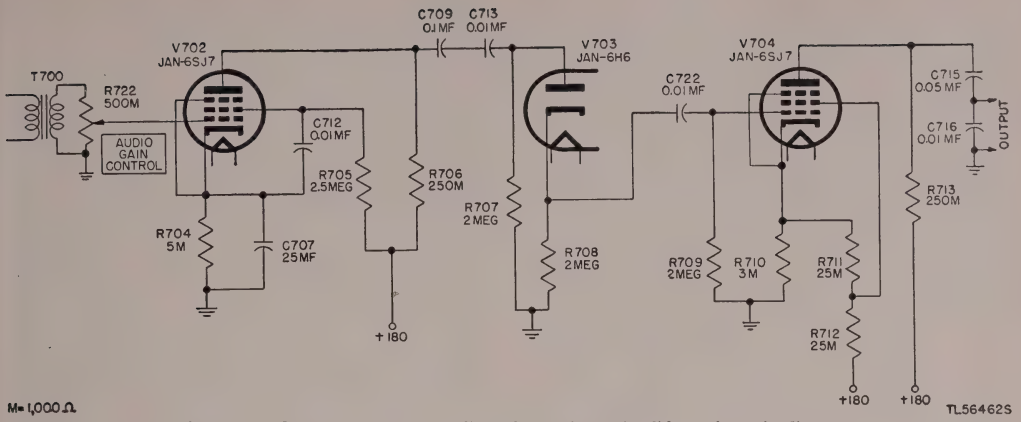


Figure 34. Output channel of radiosonde receiver, simplified schematic diagram.

72. Output Channel of Receiver

The output channel produces the signals necessary for operation of the frequency meter. Three tubes are used: tube V702, a pentode amplifier; tube V703, a series diode clipper; and tube V704, a limiter-amplifier (fig. 34). The channel accepts signals from the superregenerative detector and performs the three functions of amplification, waveshaping, and amplitude-limiting before sending the output signal to the frequency meter.

a. The a-f signal appearing at the input to a-f amplifier tube V702 is not a faithful reproduction of the signal transmitted by the radiosonde because of distortion produced in the superregenerative detector. As shown in figure 29, the signal transmitted by the radiosonde is an interrupted continuous wave of r-f energy, the a-f component of which is a rectangular wave inherently rich in harmonics. The superregenerative detector, however, is not a linear device, and, as a result, distortion of the signal is produced and the rectangular waveform of the received signal is not retained in its entirety. Instead, the detector output is an a-f signal, the exact waveform of which varies with the setting of the REGENERATION control, the AUDIO GAIN control, and the main tuning dial and the strength of received signals. The actual signal appearing at the grid of the a-f amplifier is a distorted wave which does, however, retain the modulation frequency of the transmitted signals.

b. Tube V702, a Tube JAN–6SJ7 pentode, is used as a class A amplifier to increase the level of the a-f signals received from the detector. The AUDIO GAIN control, a 500,000-ohm potentiometer, is connected in shunt with the secondary of transformer T700 in the grid circuit of tube V702. The flow of current through cathode resistor R704 develops the bias voltage. Capacitor C707, the cathode a-f bypass capacitor, places the cathode of the tube near ground potential for audio frequency and thus prevents degeneration at the higher a-f frequencies in use. Without the capacitor, degeneration would develop because of changes in current flow through the resistor in response to the impressed a-f signal voltage on the grid of the tube. Such current changes would swing the bias voltage in opposition to the signal voltage at the grid and decrease the amplification of the tube. Screen voltage for the tube is supplied through series resistor R705. Capacitor C712 bypasses a-f energy effectively at the higher a-f frequencies and partially at the lower a-f frequencies, where distortion due to feedback is almost impossible because of the extremely high reactance of the grid-to-plate tube capacitance at these frequencies. Resistor R706 is the plate load resistance. As the voltage on the grid of the tube swings through its positive and negative alternations, plate current flow in the tube swings in unison. The flow of plate current through the load resistance causes a corresponding swing in voltage across the resistor with the a-f component of this voltage being coupled through capacitor C709 to an R-C differentiating network comprised of capacitor C713 and resistor R707. The R-C time constant of the network is short in comparison to

the time required for one complete cycle of the a-f voltage impressed across the network at any of the a-f frequencies in use. Because of this short time constant, the voltage appearing across the resistance does not have the same waveform as the voltage applied to the network. Instead, the resistor voltage consists of positive and negative alternations with the positive peaks somewhat rounded.

c. Tube V703, a Tube JAN–6H6 twin diode, is used as a series diode clipper. This tube, in series with its cathode resistor, R708, is connected in shunt with the resistor of the r-f differentiating network and thus, the positive and negative alternations of the differentiated output appear between the plate of the diode and ground. However, because of diode action (unidirectional electron flow through the tube), the negative alternations of applied plate voltage are eliminated in the output of the clipper. Thus, the diode output consists only of the positive alternations of diode plate voltage which appear across cathode resistor R708. These positive alternations are then applied to another R-C differentiating network comprised of capacitor C722 and resistor R709.

d. The purpose of this second differentiating network, in combination with limiter-amplifier tube V704, is to develop (at the plate of the tube), a saw-tooth voltage, as shown in figure 35B.

(1) Tube V704, a Tube JAN–6SJ7 sharp cut-off pentode, is used as the limiter tube. *With no signal input,* there is no flow of electrons through the tube because a high value of positive voltage (approximately 12 volts) is applied to the cathode of the tube. This voltage is approximately twice the voltage necessary for plate current cut-off and is obtained from a tap on the voltage divider comprised of resistors R710, R711, and R712, the series combination of which is connected between B+ and ground. Another tap on the resistor voltage divider furnishes screen voltage for the tube. Resistor R713 is the plate load resistance.

(2) The differentiated voltage appearing at the control grid of the pentode is essentially a positive pulse waveform with a steep leading edge and an exponentially falling lagging edge. Some distortion may appear along the more negative portions of the voltage waveshape, such as that shown in figure 35A. The amount of distortion is largely dependent on the settings of the receiver tuning controls. In any case, however, the more negative portions of the grid voltage are completely eliminated by the use of cut-off limiting, and the distortion does not appear at the plate of the tube, as is explained below.

(3) As the steep leading edge of the pulse voltage drives the grid more positive, the difference in potential between cathode and grid becomes smaller and the tube becomes conductive causing a sudden flow of plate current. Series capacitors C715 and C716, which had previously been charged through resistor R713 to the value of the B+ supply (180 volts) when the tube was cut off, then discharge very rapidly through the low resistance of the tube in its conducting state. This, in turn, causes an abrupt fall of potential at the plate of the tube, as shown in figure 35B.

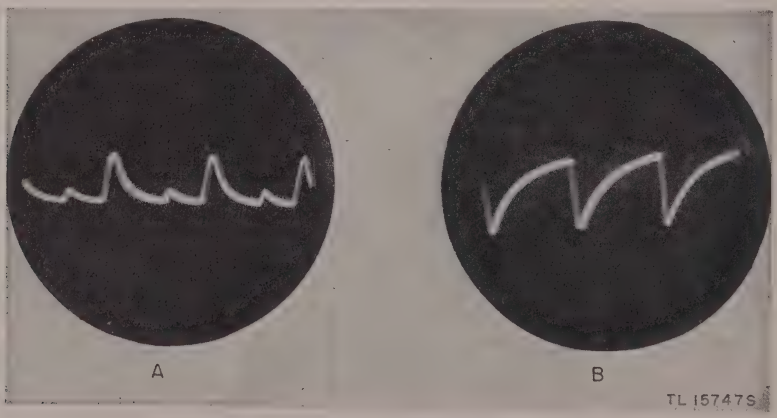


Figure 35. Radiosonde receiver waveforms.

(4) The pulse input may or may not go sufficiently positive to drive the grid positive with respect to the cathode. Assume that it does not do so. As the grid voltage swings from its most positive value, the plate voltage swings in unison as long as the grid voltage holds the tube within its conducting region. As the grid voltage becomes more and more negative in response to the sloping or lagging part of the input voltage, however, a critical value of grid voltage is reached when the tube is driven to cut-off and the grid voltage loses control of the tube. At cut-off, current flow through the tube is abruptly halted and the plate voltage would, at this point, swing abruptly to its most positive value of 180 volts if it were not for the presence of capacitors C715 and C716. These capacitors cannot, however, instantly charge to the full value of the supply voltage but must obtain their charge through resistor R713. Therefore, the capacitors continue to charge exponentially until either their fully charged state is reached or until the tube again conducts, causing them to discharge. The charge of the capacitors corresponds to the sloping part of the saw-tooth voltage shown in figure 35B.

(5) On successive cycles of grid voltage, the above action is repeated, thus producing at the plate of the tube and across the receiver output terminals (voltage across capacitor C716) a succession of saw-tooth voltages which are fed to the input circuit of the frequency meter.

(6) *At comparatively high signal inputs to the receiver* and with the REGENERATION and AUDIO GAIN controls of the receiver advanced, the amplitude of the pulse voltage at the grid of the saw-tooth generator is also high. Thus, the positive peaks of this voltage drive the grid of tube V704 more positive than the cathode. As a result, grid current flows between the cathode and grid elements. While the grid draws current, its voltage cannot rise appreciably and plate current remains practically constant. The voltage at the plate thus levels off and limits the amplitude of the negative peaks of the saw-tooth voltage. Because of this grid limiting, the amplitude of the plate voltage is held approximately constant for comparatively strong and comparatively weak signals. In fact, the output voltage is approximately the same for signals of S meter strength 1 to S meter strength 40. (Par. 73 describes the operation of the intensity (S) meter.)

e. The receiver output, therefore, is either a saw-tooth voltage or a limited saw-tooth voltage, the amplitude of which remains almost constant regardless of the modulation frequency of the radiosonde transmitter, the tuning of the receiver, or the amplitude of received signals (within wide limits). The only variable quantity in this output is the frequency of the saw-tooth wave. This frequency varies from 8 to 200 cps; the exact frequency is the same as the modulation frequency of the radiosonde transmitter. Actually, one complete saw-tooth wave occurs each time the transmitter completes a cycle of operation (one pulse of r-f energy plus one off-the-air period between successive pulses). And it is this signal voltage which is sent to, and measured by, the frequency meter.

73. Intensity (S) Meter Channel of Receiver

The intensity or S meter indicates the relative amplitude of the a-f signal detected by the super-regenerative detector and fed to the output channel of the receiver. The intensity meter channel consists of an a-f amplifier, a peak voltage rectifier, and a d-c amplifier or vacuum tube voltmeter, with the meter connected to read the level of plate current flow in the d-c amplifier (fig. 36).

a. A-F AMPLIFIER. The a-f amplifier stage uses one section of a twin-triode amplifier tube, V705, Tube JAN–6F8G, in a class A amplifier stage.

(1) The input signals are fed to the control grid and are the same signals which are sent to the output channels of the receiver, as shown in the diagram of figure 80.

(2) The flow of plate current through cathode resistor R724 provides the bias voltage. The cathode of the tube is held near ground potential at the higher audio frequencies by capacitor C714 to prevent degeneration with its accompanying loss of gain at these frequencies.

(3) Resistor R723 is the plate load resistor. The changes of plate current through the tube in response to a-f changes of signal voltage on the grid produce an a-f voltage across the load resistor. This a-f component of plate voltage is impressed on the R-C differentiating network comprised of capacitor C723 and resistor R725. The differentiated voltage across the resistor of the network is an a-c voltage having an amplitude proportional to the average value of a-f signal voltage input to the output channel.

b. DIODE. This differentiated voltage is also applied to the series combination comprised of the

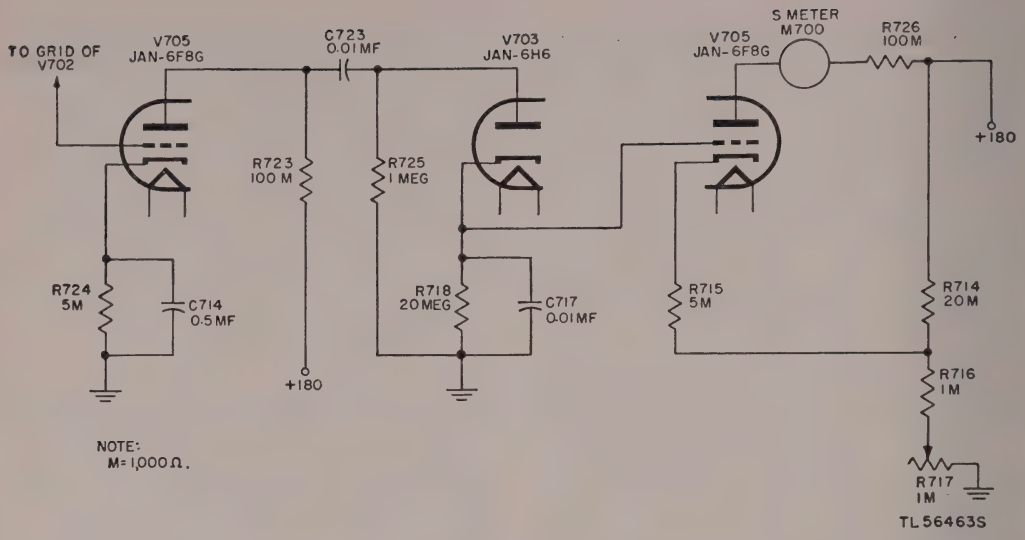


Figure 36. S meter channel in radiosonde receiver, simplified schematic diagram.

second section twin diode tube, V703 (Tube JAN–6H6), and resistor R718. During a positive alternation of diode plate voltage, the tube conducts and the plate-to-cathode resistance of the tube falls to a low value. At this time, capacitor C717 quickly charges to the peak value of plate voltage. During the negative going alternation of plate voltage, the tube does not conduct because the plate is more negative than the cathode. Capacitor C717 then discharges through cathode resistor R718 but, because of the long R-C time constant of the combination in comparison to the period of one cycle of applied a-f voltage at the plate of the tube, the capacitor is unable to discharge to any appreciable extent during the negative alternation of a-f plate voltage. At the positive peaks of succeeding cycles of a-f plate voltage, the tube again conducts and the capacitor regains that small part of its charge which was lost during the negative alternations. Thus the diode plate current consists of a series of bursts or pulses while the voltage across the capacitor is practically a d-c voltage with an amplitude equal to the peak value of applied a-f plate voltage. It is this positive, d-c cathode voltage which is fed to the d-c amplifier.

c. D-c Amplifier. The d-c amplifier uses the second section of twin-triode tube V705 (Tube JAN–6F8G).

(1) Fixed bias in the cathode circuit is obtained from a tap on the voltage divider composed of resistor R714, resistor R716, and potentiometer R717, the series combination of which is connected from the B+ supply to ground. In the absence of a positive voltage on the grid of the tube (no input to output channel of receiver), this fixed bias is sufficient to hold the tube at cut-off. Potentiometer R717 is used to adjust the value necessary for the tube to operate at exactly cut-off. Hence, no electrons flow through the tube and the S meter reads exactly zero.

(2) When the grid of the tube becomes more positive in response to diode output voltage, the tube conducts and current flows through the meter, load resistor R726, resistors R715 and R716, and potentiometer R717. The meter then indicates the level of plate current flow. As the grid becomes more and more positive in response to a higher and higher diode output voltage, the flow of plate current becomes proportionally larger and the meter, in turn, has a correspondingly higher reading. Thus, the meter indicates the relative amplitude of input signals fed to the output channel.

(3) Current flow through the cathode resistance increases the bias on the tube while the flow of plate current through the load resistor (100,000 ohms) produces a voltage drop across the resistor

and causes a lower voltage at the plate of the tube. As a result the circuit is degenerative. In this usage degeneration is an advantage because it improves the linearity of the grid voltage-plate current characteristics of the tube. That is, changes in plate current more nearly follow changes in grid voltage. For this reason, it has been possible to use a linear scale on the meter.

74. Speaker Channel of Receiver

Note. This channel is used to monitor a-f signals received by Radio Set SCR–658 during 403-mc operation.

The speaker allows aural monitoring of signals present in the output channel of the receiver. The speaker channel consists of one stage of class A, a-f power amplification (fig. 80).

a. The input to the control grid of power amplifier tube V706, a Tube JAN–6F6 power amplifier pentode, is taken from the output of the a-f amplifier stage in the output channel to the frequency meter. Resistor R719 is an isolating resistor and prevents any abnormal departure from the class A operating characteristics of the power amplifier stage from affecting the waveform of the a-f signal in the output channel. Potentiometer R720 is used as a combination grid leak resistance and speaker volume control. The use of this control permits the operator to regulate the volume of aural output from the speaker without affecting the level of the a-f signal in the output or intensity meter channels.

b. Bias voltage is provided by the voltage developed across cathode resistor R721 as a result of the flow of plate and screen currents through this resistor. Capacitor C718 is the cathode a-f bypass capacitor.

c. D-c operating screen and plate voltage for the tube is obtained from the B+ supply; the plate voltage is supplied through the primary of the output transformer.

d. Changes in plate current in response to a-f signals on the grid of the tube cause corresponding changes in current through the primary winding of the output transformer. Current changes in the primary produce proportionate changes of current in the transformer secondary winding, the impedance of which matches the impedance of the speaker voice coil.

75. Power Supply of Receiver

The receiver power supply (fig. 80) furnishes low a-c voltage for the heaters of all tubes and operating d-c potentials for all circuits.

a. The 115-125-volt, 60-cycle, a-c input is connected across the primary winding of power transformer T701.

b. This transformer has three secondary windings: One winding furnishes 6.3 volts for the filaments or heaters of the tubes and for the pilot light. Another secondary winding furnishes 5 volts for the filament of the rectifier tube. The 420-volt, center-tapped secondary winding furnishes 210 volts for the plates of the rectifier tube; the center-tap on the winding is grounded.

c. The rectifier tube is a type Tube JAN–80, full-wave, high-vacuum rectifier tube, connected in a conventional full-wave rectifier circuit.

d. The pulsating d-c output voltage appearing between the filament of the rectifier tube and ground is filtered by capacitors C721, C720, C719, and choke coils L701 and L702. This capacitor-input, two-section filter provides adequate smoothing of the rectified voltage and, because the current drain on the rectifier is almost constant, the regulation of the d-c output is adequate.

76. Frequency Meter (Figs. 82, 83, and 84)

The input voltage to the frequency meter is either the saw-tooth voltage from the receiver or a saw-tooth voltage from Radio Set SCR–658 (fig. 35B). For test purposes, the input voltage is usually obtained from Frequency Standard TS–65( )/FMQ–1 and consists of either a square wave or a modified square wave of voltage, depending on the frequency of operation (fig. 37). Regardless of which input is used, however, the frequency meter develops a direct current having a value proportional to the frequency of the input signal. The measurement of this current indicates the frequency of the input signal. The frequency meter consists of amplifier tube V600, thyratron tubes V605 and V606, rectifier tube V607 plus their associated circuits, and two voltage-regulated power supplies.

77. Amplifier in Frequency Meter

The amplifier uses a triode vacuum tube V600, a type Tube JAN–6C5 (or Tube JAN–6J5).

a. The single-pole, 3-position rotary switch S600 (fig. 82) has the following functions:

(1) In its X position, the switch connects the receiver (on Radio Set SCR–658) output voltage to the input circuit of amplifier tube V600.

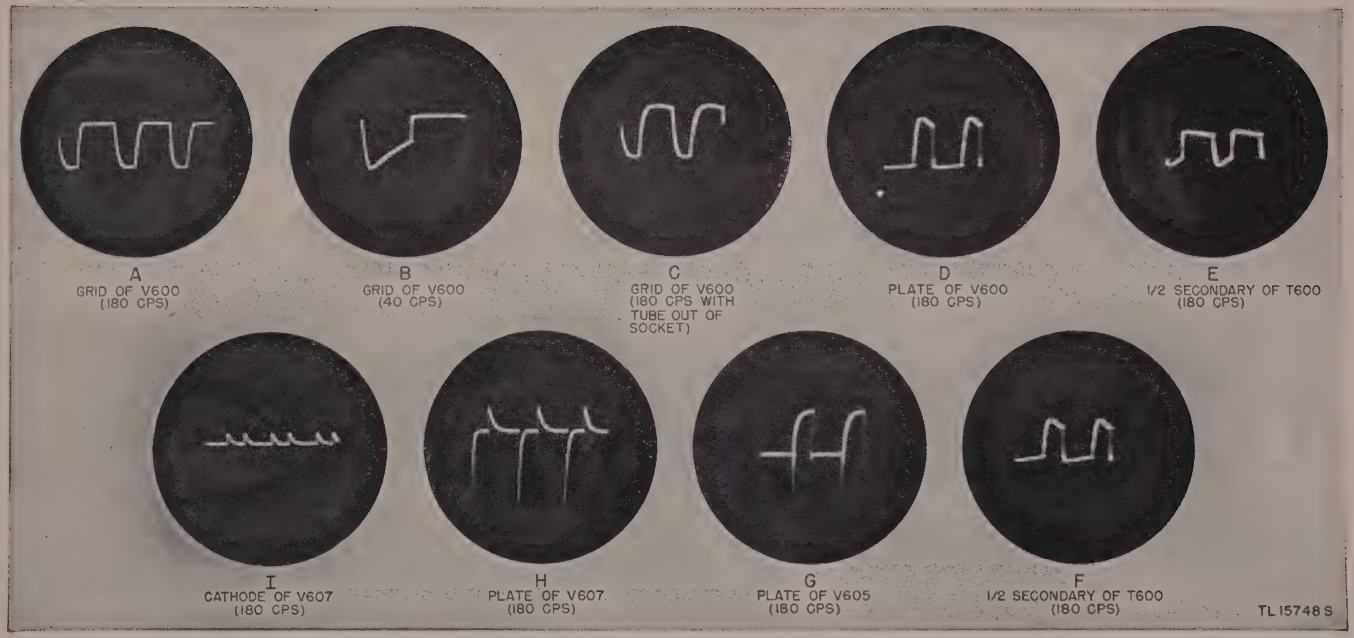


Figure 37. Frequency meter waveforms.

(2) In its SC position, the input circuit to the amplifier tube is grounded. In this position of the switch, after depressing momentarily the deionize switch, the meters can be calibrated to zero frequency.

(3) In its 60 cps position, the switch connects a source of 3-5 volt, 60-cycle ac to the input circuit of the amplifier tube. This voltage permits the frequency meter to be calibrated at a frequency of 60 cycles and also provides a simple means of checking the calibration and over-all operation when desired.

b. The frequency meter operates equally well with a saw-tooth, limited saw-tooth, sine wave, square-wave, or modified square-wave input voltage at a sensitivity approximating 2 V RMS. *For purposes of explanation, the output voltage of Frequency Standard TS–65( )/FMQ–1 is used as the input to the frequency meter and the waveforms shown at various test points and under various operating conditions are those obtained with an input signal from the frequency standard.* For literature describing frequency standard, see paragraph 3, appendix II.

c. Resistor R601 is an isolating resistor and prevents any interaction between the amplifier stage and the input signal source.

d. Capacitor C602 and resistor R600 form an R-C coupling network. The values of the capacitor and resistor in this network have been chosen so that the waveform at the grid of the tube (with the tube removed from its socket) is essentially the same as the input voltage. A linear R-C network at the very low audio frequencies used would require extremely large values for the capacitor and resistor and, (because the size of the grid resistor is limited by the tube characteristics) the use of a linear network is not practical.

e. Bias voltage is obtained from the voltage drop across cathode resistor R602. C600 is the cathode a-f bypass capacitor.

f. Figure 37 shows waveforms at the input of the frequency meter and at the grid of the tube for operation at 40- and 180-cycle input frequencies. Note that the positive peaks of the input wave are flattened as a result of grid limiting. At the higher grid voltages, the grid becomes more positive than the cathode, and grid current flows, at which time the grid voltage cannot rise to any appreciable extent. Note that on the negative alternation of the 40-cycle grid voltage, the lagging edge is rounded. This distortion is caused by the small R-C values used for capacitor C600 and resistor R602 but does not detract from the usefulness of the voltage.

g. The amplified voltage appears across the primary of transformer T600 and has essentially the same waveshape as the grid voltage except for amplitude and inversion. Limiting resistor R611 is in series with the primary of the transformer.

78. Thyratron Tubes

Tubes V605 and V606 are type Tube JAN–884 gas-filled thyratron type triodes. These tubes differ in their operating characteristics from ordinary vacuum triodes. In the vacuum triode, plate current flow can be started, the amplitude of plate current can be controlled, and plate current flow can be stopped, all by the application of proper values of grid voltage. In the thyratron tube, however, the addition of gas and a special grid structure make the operating characteristics quite different. For a given plate voltage, negative grid bias voltage can be applied to prevent the tube from conducting. Then, as the grid is made more positive, a critical value of grid voltage is reached when the gas in the tube breaks down, causing ionization of the gas, and plate current flows. At this time, the grid voltage loses complete control of the tube and the value of plate current depends entirely on the value of plate voltage. The point where the grid voltage causes the gas to become ionized is called the firing point. Once plate current starts to flow, it continues to do so regardless of grid potential as long as plate voltage is applied. If, however, the plate voltage is reduced below a minimum value, which in the case of the Tubes JAN–884 in use is approximately 16 volts, plate current flow will stop. Once the plate current is stopped, sufficient voltage on the grid can prevent the tube from again firing even though a higher plate voltage is reapplied. Thus, the only function of grid voltage is to control the firing point for the tube.

79. Thyratron Stage in Frequency Meter

The output voltage of a-f amplifier tube V600 is applied to the thyratron stage through transformer T600. This voltage may vary somewhat in amplitude as a result of fluctuations in the output of the receiver or frequency standard. The purpose of the thyratron stage is to convert the input voltage to a pulsating voltage of constant amplitude and waveshape, the frequency of which is the same as the input frequency.

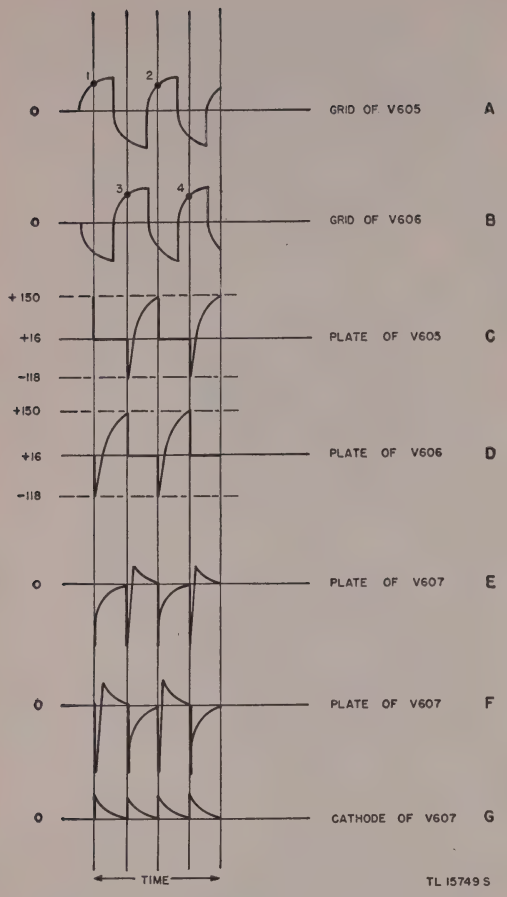


Figure 38. Theoretical waveforms in frequency meter.

a. Transformer T600 has a single primary winding and a center-tapped secondary winding. The center-tap is connected to ground through resistors R616 and R618 on some models (fig. 82). These resistors, in combination with resistor R615, form a voltage dividing network across the 75-volt, d-c bias supply. In this way, a negative bias of 45 volts is supplied to the grids of thyratron tubes V605 and V606 through the secondary winding and through resistors R610 and R609. On the first model of Frequency Meter TS-29/FMQ-1, resistors R615 and R616 comprise the complete voltage divider (fig. 83).

b. The a-f voltage appearing across the primary of the transformer is induced into the secondary winding and appears across the entire secondary winding with approximately the same amplitude and waveform as the primary voltage (fig. 37). As measured from the center-tap on the secondary to each end of the secondary winding, however, the amplitude of the total secondary voltage is halved. In addition, the instantaneous voltage across one side of the secondary has the opposite polarity to the voltage across the other side of the secondary, as shown by the inverted waveshapes in figure 37. Thus, during the first half-cycle of a-f voltage applied to the primary of the transformer, the grid of one thyratron tube becomes more positive as the grid of the other tube becomes more negative. During the second half-cycle of primary voltage, on the other hand, the polarities of the grid voltages reverse.

c. In the absence of signal input to the frequency meter and with the DEIONIZE switch open, the thyratron tubes do not operate because there is no plate voltage for the tubes. Then, if the DEIONIZE switch is closed (normal position of switch), plate voltage is applied but the tubes still will not conduct because of the negative d-c bias voltage applied to the grids of the tubes. This bias voltage is sufficient to hold the tubes below cut-off. At this time, there is no voltage drop across resistors R607 and R608 because there is no flow of current through the resistors, and, as a result, the plates of the thyratron tubes are at a potential of +150 volts. Also, there is no charge on capacitor C610 because no difference of potential exists across the capacitor. under this set of conditions, the following events happen as an a-f signal voltage is applied to the grids of the tubes:

(1) During the first half-cycle of a-f input voltage, the grid of tube V606 remains negative as shown in figure 38B, and this tube does not fire.

(2) At this time, the grid of tube V605 is driven more positive, as shown in figure 38A. This reduces the difference of potential between the cathode and grid of the tube until this difference is approximately —15 volts. At the —15 volt level, the tube fires and plate current flows through resistor R607.

(3) The flow of current through the tube and resistor produces voltage drops around the circuit shown by the solid line with arrow in figure 39A. The plate of the tube instantly drops to +16 volts when current starts to flow in this circuit. Figure 38C shows the plate voltage at +150 volts

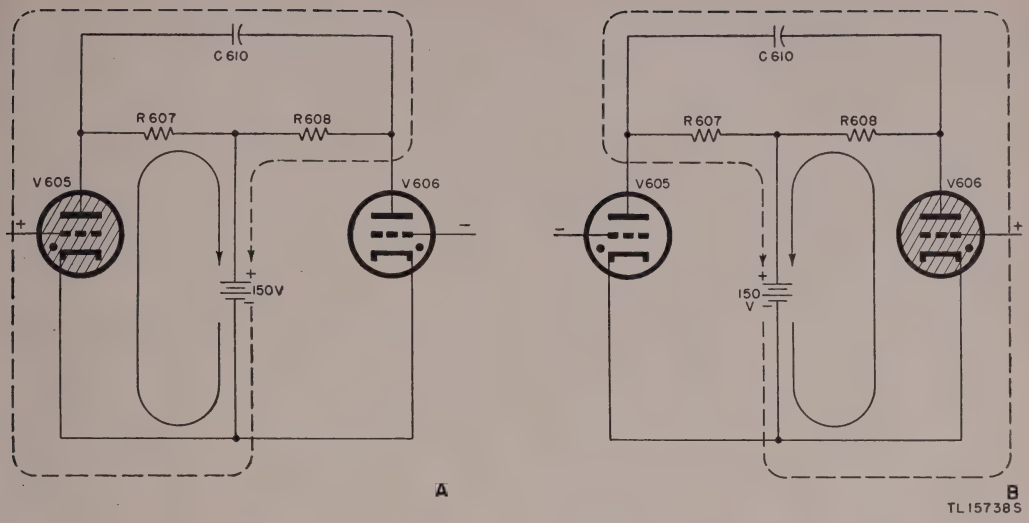


Figure 39. Functional diagrams of thyratron operation.

before the tube fires and falling to +16 volts instantaneously when the tube conducts. Sixteen volts is the normal voltage drop across the type Tube JAN–884 during conduction.

(4) Once plate current flow is started, the grid voltage loses control of plate current, which continues to flow as long as plate voltage is applied. This is shown in figure 38C by the constant level of plate voltage after the tube fires.

(5) While the plate voltage is at the +16-volt level, capacitor C610 attains a charge because of the difference of potential between its plates. The capacitor charges exponentially through resistor R608, the charging circuit being shown by the dashed line with arrow in figure 39A. After charging, the plate of the capacitor connected to the plate of tube V605 is at a potential of +16 volts while the other plate is at a potential of +150 volts; the voltage across the capacitor is 134 volts.

(6) During the second half-cycle of a-f grid voltage, the voltage at the grid of tube V605 is negative while the grid of tube V606 is driven more positive. When the grid voltage of tube V606 reaches the critical point (approximately −15 volts), this tube fires and its plate voltage immediately drops to +16 volts (fig. 38D) as current flows through resistor R608. (See solid line with arrow in figure 39B.)

(7) Simultaneously with the fall of voltage at the plate of tube V606 from +150 volts to +16 volts, the voltage across capacitor C610 (134 volts as explained in (5) above) shifts in level with the side of the capacitor connected to the plate of tube V606, falling to +16 volts; and the other side of the capacitor falls to −118 volts. The −118 volts at the plate of tube V605 causes this tube to stop conducting. Figure 38C and 38D shows the relationship of the plate voltages at this time.

(8) After tube V606 fires, capacitor C610 charges to an opposite polarity through resistor R607 in the circuit shown by the dashed line with arrow in figure 39B. The plate voltage of tube V605 follows the capacitor voltage as can be observed by the exponential rise of plate voltage from −118 to +150 volts in figure 38C. After the capacitor has attained its charge, the voltage at the plate of tube V605 again reaches +150 volts, but this tube does not fire until the next cycle of operation because the tube is held below cut-off by the negative grid bias voltage.

(9) Thus, as the a-f voltage across the primary of the transformer goes through its positive and negative alternations, the thyratron tubes alternately fire and produce at the plate of each tube a pulsating voltage of constant amplitude and waveform, as shown in figure 38C and 38D.

80. Rectifier Stage in Frequency Meter

The rectifier stage in the frequency meter consists of an R-C differentiating network, a rectifier tube V607, and a meter circuit in the cathode leg of the rectifier tube.

a. The voltage appearing between the plate of tube V605 and ground is applied across the differentiating network comprised of capacitor C608 and resistor R606 in series with resistor R616. The output of the differentiator, appearing across the resistance of the network, is a voltage of which the amplitude is proportional to the *rate of change* of input voltage. The output voltage is, therefore, a series of sharp positive and negative pulses with one positive pulse occurring during each cycle of input voltage (figs. 37 and 38). As a result, the number of positive pulses occurring per second is the same as the frequency of the a-f input to the frequency meter.

b. The output voltage of thyratron tube V606 is impressed across a second differentiating network (capacitor C609 and resistors R605 and R616). The differentiated voltage across the resistance is identical to that appearing across the resistance of the first R-C differentiator except that all pulses of voltage are displaced by 180°. This is shown in figure 38.

c. The voltage pulses appearing across resistor R606 in series with resistor R616 are applied between one plate of the rectifier tube and ground while the voltage pulses appearing across resistor R605 in series with resistor R616 are applied between the other plate of the rectifier tube and ground. Because of normal rectifier action, clipping of the negative pulses occurs and only the positive pulses of voltage at the plates of the rectifier tube produce current flow through the tube and through the cathode resistances. Therefore, the cathode current consists of a series of pulses; the frequency of these pulses is double the frequency of the voltage at either plate. The frequency doubling is a result of the 180° out-of-phase relationship of the plate voltages. That is, the first section of the rectifier tube conducts for a brief period as a positive pulse voltage appears at the plate of this section of the tube. Simultaneously, a negative pulse voltage is applied to the other plate, preventing the second section from conducting. A half-cycle later, the second section of the tube conducts because, at that time, a positive pulse voltage is applied to the plate of that section while a negative pulse prevents the first section of the tube from conducting. Thus, two pulses of cathode current are developed during each cycle of input voltage to the frequency meter. Figure 38 shows the relationship between the various voltages in this circuit.

d. With no signal input to the frequency meter, no current flows through the cathode circuit of tube V607 because the plates of the tube are held slightly negative with respect to the cathode by the application of a —4-volt potential to the plates of the tubes. This negative voltage is obtained from the bias voltage supply. On some models, the voltage is taken off from the voltage divider of resistors R615, R616, and R618, as shown in figure 84. On other models, R618 is not used in the voltage divider (fig. 83). When a signal is applied, the positive voltage pulses override this 4-volt bias and cause the rectifier tube sections to conduct alternately, as explained previously.

e. The recorder and visual meters are connected in series with each other, and the combination is placed in the cathode circuit. Thus the meters indicate the amount of cathode current. The current pulses flowing through the meter coils do not cause the meter pointers to deflect each time that a pulse occurs because the meter pointers cannot follow the fluctuations of current fast enough to do so. Instead, the meters indicate the *average* current flowing in the cathode circuit, the average cathode current being directly proportional to the number of current pulses per second which occur in the cathode circuit. Capacitor C607 provides insurance against meter fluctuation at the lower a-f frequencies. This capacitor, in combination with resistor R612 and the d-c resistance of the meter coils, comprises an R-C network, with the capacitor charging during each pulse period and discharging during the period between pulses. This action produces a filtering or smoothing effect.

f. Because no current flows in the cathode circuit with no signal input to the frequency meter (INPUT switch at S. C. position), the meters both read 0. With an input signal of known frequency, such as a 60-cycle signal (INPUT switch at 60 position), the cathode current can be adjusted until the meters read 30 bi-cycles (60 cycles) by means of variable resistor R604 and potentiometers R614 and R613.

(1) Variable resistor R604 is adjusted when the frequency meter is originally calibrated and does not normally require any further adjustment. This

is a rough adjustment of cathode current and is located on the chassis.

(2) Potentiometer R614 (COARSE control) is used to obtain an approximate calibration. After this approximate calibration is obtained, potentiometer R613 (FINE control) is used for precise calibration.

(3) Potentiometer R612 (EQUALIZER control) can be adjusted from the front panel by means of a screwdriver. This control balances the current flow of the two meters so that identical meter readings can be obtained.

81. Power Supply in Frequency Meter

The power supply in the frequency meter provides the heater voltages for the tubes and the d-c operating voltages for all circuits. The a-c input for this supply is obtained from the voltage regulator (par. 92) which insures that the 115-volt a-c input voltage is constant. Two power transformers and two rectifiers are used in this power supply (fig. 82). Some equipments only use one transformer (fig. 83).

a. Transformer T601 (fig. 82) has three secondary windings: One winding furnishes 6.3 volts a-c for the heaters of tubes V600 and V607. A second winding furnishes 5 volts a-c for the filament of rectifier tube V601. The third winding furnishes 385 volts a-c for the plates of tube V601. Rectifier tube V601, a type Tube JAN–80 full-wave, high-vacuum rectifier tube, functions as a conventional full-wave rectifier.

(1) Choke coils L600 and L601 with capacitors C605 and C606 make up a two-section, choke-input filter which provides an output voltage with good filtering and good regulation.

(2) Resistor R603 and tube V603, a type Tube JAN–OD3/VR–150 gas voltage-regulator tube, are connected across the output of the rectifier. The combination holds the output voltage at +150 volts for any normal load current.

b. Transformer T602 also has three secondary windings: One winding supplies 6.3 ac for the heaters of tubes V605 and V606. The second winding furnishes 385 volts ac for the plates of rectifier tube V602 (JAN–80 type). The third winding furnishes 5 volts ac for the rectifier tube filament. A full-wave conventional rectifier circuit is used. A single-section, capacitor-input filter, comprised of choke coil L602 and capacitors C603 and C604, provide sufficient filtering and regulation of the output voltage. Additional regulation is furnished by the series combination of resistor R617 and another gas voltage-regulator tube V604, a type Tube JAN–OA3/VR75. Resistors R615, R616, and R618 comprise a voltage dividing network across the output of the rectifier.

82. Theory of Radiosonde Recorder (fig. 31)

The position of the print on the recorder chart is determined by the output current of the frequency meter. This current is proportional to the modulation frequency of the radiosonde transmitter. The current is sent through the visual and recorder meters which, in responding to the current, indicate the audio frequencies. The radiosonde recorder prints a record of the positions of the pointer on the recorder meter. This is accomplished by a photoelectric scanning assembly which controls a printing mechanism. A light beam in the photoelectric scanning assembly sweeps across the pointer of the meter once during each cycle of operation (every 2 seconds) and produces a small electrical pulse, the time phase of which is dependent on the position of the pointer. The pulse is then amplified by the preamplifier located in the radiosonde recorder, and the amplified pulse is used to develop a large surge of current in the output of Amplifier AM–7(*)/FMQ–1. This large current surge is passed through the coils of the tapper bar magnets, causing the printing mechanism to tap a dot on the recorder paper. The placement of this dot on the horizontal (X axis), of the paper indicates the audio frequency measured by the frequency meter. In continuous operation, a pulse recurs every 2 seconds and causes the printing mechanism to tap a dot every 2 seconds. Even when the a-f input is constant, the dots are not superimposed on each other because the recorder paper feeds at a constant speed of 0.4 inch per minute. The coordinates of the paper thus represent time and audio frequencies. The following paragraphs explain in more detail how this entire operation is accomplished.

Note. A rotating helix cylinder located beneath the chart paper and tapper bar is synchronized to rotate with the scanning assembly. When the scanning assembly passes the 0 position of the recorder meter, the helix simultaneously passes the 0 position of the chart.

83. Recorder Meter

a. As shown in the block diagram of figure 31, the recorder meter is connected in series with the visual meter and the output current is divided between them

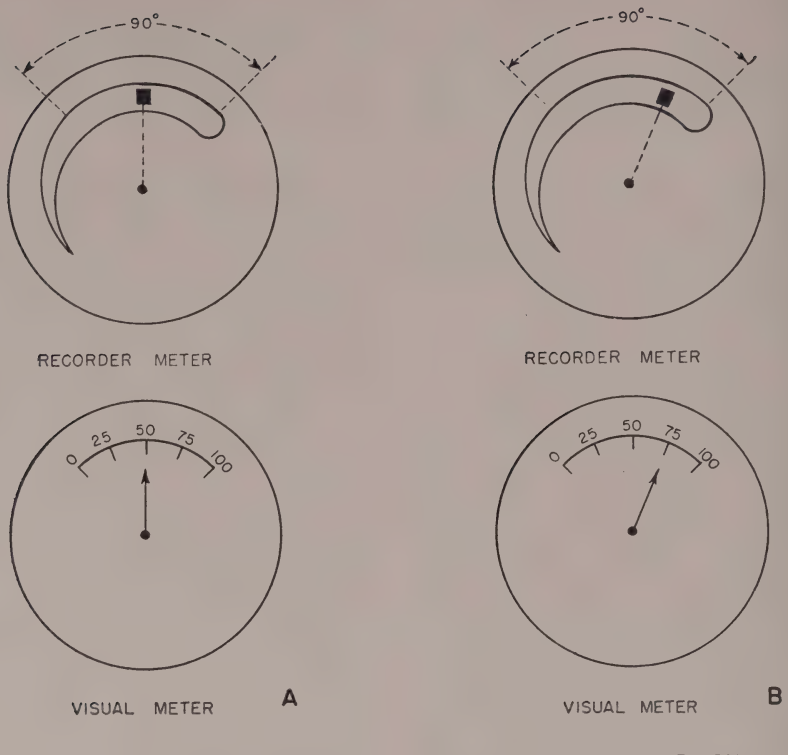


Figure 40. Relationship of pointers of visual and recorder meters with a-f inputs to the frequency of 100 and 150 cycles per second.

by means of an equalizing control in the frequency meter. When this control is correctly adjusted, the pointer of the recorder meter moves through a 90° arc and the pointer of the visual meter moves from 0 to 100 bi-cycles as the a-f input to the frequency meter is varied from 0 to 200 cps. For example, if the a-f input to the frequency meter were 100 cps, the pointer of the visual meter would rest at 50 bi-cycles on the meter scale while the pointer of the recorder meter would rest midway between its 0° and 90° positions, as shown in figure 40A. Or, if the a-f input were 150 cps, the visual meter would indicate 75 bi-cycles and the pointer of the recorder meter would rest in the position shown in figure 40B.

b. Electrically, the recorder meter is a standard 500-microampere d-c meter. Mechanically, however, it differs from the standard type of meter. The meter assembly is mounted in a circular cast iron case (fig. 41). This case has a concentric glass window on each side so that a beam of light can be projected through the case.

84. Scanning Assembly

a. A main drive motor (fig. 31) in combination with a gear assembly drives the light disk drive gear and the phototube disk drive gear continuously at a speed of one revolution every 2 seconds, the two drive gears rotating in precise synchronism in the same direction and at the same speed.

b. Connected to the shaft of one drive gear is the exciter light disk. On this disk a lens assembly and a small lamp which serves as a light source are mounted. The lens assembly focuses the light into

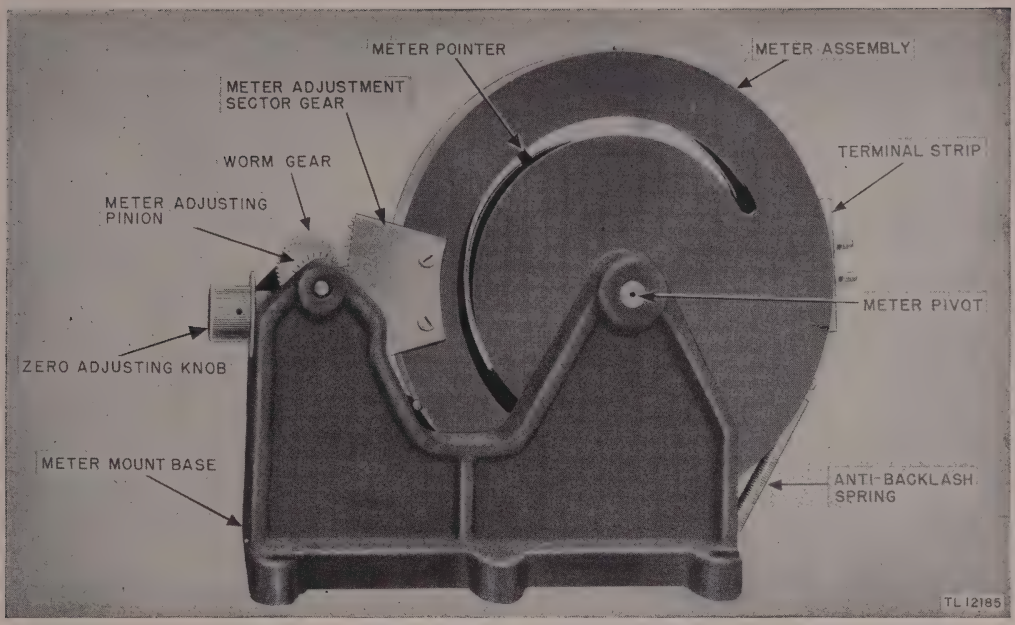


Figure 41. Recorder meter assembly.

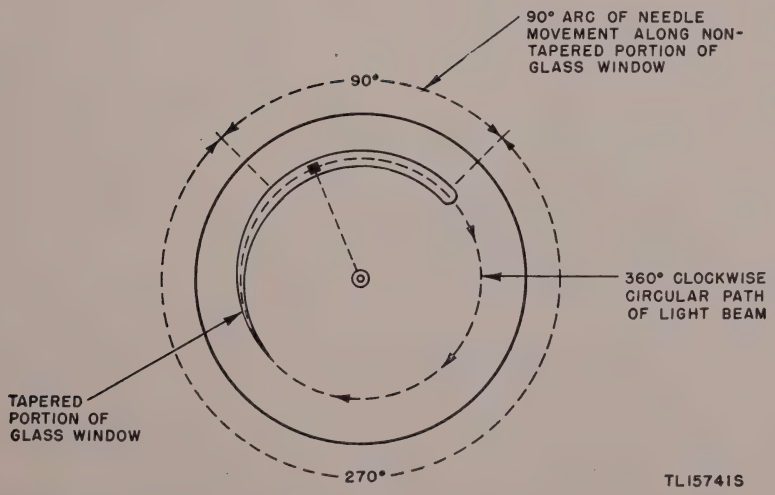


Figure 42. Functional diagram of recorder meter.

a narrow beam and projects this beam onto one side of the stationary recorder meter case. As the exciter light disk rotates at its speed of one revolution every 2 seconds, the beam of light traces a circular path on one side of the meter case. This path of light is shown by the circle with dashed lines in figure 42. Note that as the light beam passes through each 360° revolution, it sweeps in succession the—

(1) Tapered portion of the glass window.

(2) Nontapered portion of the glass window.

(3) Metal side of the meter case.

c. During operation, the rectangular shaped pointer of the meter rests at some position along the nontapered portion of the glass window, the exact position of the pointer depending on the a-f input frequency to the frequency meter. Thus, the beam of light passes by the pointer of the meter once during each revolution of the exciter light disk or once every 2 seconds. In passing the meter pointer, the beam of light is suddenly interrupted and, during this instant, no light passes through the glass windows of the meter case to the photocell.

d. The other drive gear, called the phototube disk drive gear, is used to rotate the phototube disk (fig. 31). The phototube is attached to this disk in such a position that it is always directly opposite the light source. During operation, the two drive gears, rotating in synchronism, also turn the exciter light disk and phototube disk in synchronism. The circle of revolution for the phototube has the same radius as the path of the light beam. For this reason, light strikes the phototube whenever the beam of light passes through the glass windows. Note that, during each 360° revolution, the beam of light acts on the phototube as follows:

(1) As the light beam passes through the tapered portion of the glass window, a gradually increasing amount of light strikes the phototube.

(2) As the light passes through the nontapered portion of the glass window, a constant amount of light strikes the phototube except when the beam passes the pointer of the meter. (No light reaches the phototube when the beam strikes the pointer of the meter.)

(3) During the time that the beam is striking the side of the metal case, no light reaches the phototube.

85. Phototube

Tube V400 (JAN–921) is a cartridge type, gas phototube.

a. This tube consists of a cathode and an anode but does not operate in the same way as a conventional diode tube. The phototube is also constructed differently. The basic points of difference between the two tubes are—

(1) In a conventional diode, the cathode resembles a long, thin rod located at the center of the tube, and the anode is usually a hollow tube placed outside of, and coaxial to, the cathode.

(2) In the phototube, on the other hand, the anode resembles a long, thin rod and is placed at the center of the tube. The cathode consists of a relatively large, semicircular cylinder so placed that the anode lies at the axis of the cylinder.

(3) The cathode of the diode requires heat to make it emit free electrons. The cathode of the phototube is coated with a photosensitive material which causes it to emit free electrons when a light strikes its surface. The anode of either tube, however, performs the same function, namely, the attraction of free electrons emitted by the cathode when the anode has a potential more positive than the cathode.

(4) The phototube is filled with an inert gas to increase its sensitivity.

b. The number of electrons emitted by the cathode depends on the color and the quantity of the light which strikes the photosensitive surface of the cathode.

(1) Variation of electron emission because of changes in the color of the light can be disregarded because, in the radiosonde receptor, the color of the light is constant, being determined by the characteristics of the lamp used in the exciter light.

(2) With an anode potential of 90 volts, the characteristics of the tube are such that the number of electrons leaving the cathode and reaching the anode vary in almost direct proportion to the amount of light which strikes the cathode of the tube. During operation of the photoelectric scanning assembly, the quantity of light which strikes the cathode is not constant, as explained in paragraph 84*d*. Therefore, the number of electrons which leave the cathode varies in response to the amount of light which passes through the tapered glass window of the recorder meter.

86. Phototube Circuit

The phototube circuit develops a voltage which varies in accordance with the amount of light which

falls on the phototube. In other words, the phototube circuit converts light changes to voltage changes.

a. The phototube circuit consists of tube V400, capacitor C402, resistor R400, as shown in figure 86.

Note. Figure 86 is a composite, schematic diagram of the phototube, preamplifier, and amplifier circuits. Physically, the phototube, preamplifier, and tapper coils are located in the radiosonde recorder and, for this reason, are shown inside the dash-dot lines of the diagram. All other parts shown in this figure are located on the chassis of Amplifier AM–7(*)/FMQ–1.

b. The phototube is connected in series with resistor R400, the series combination of which is placed across a regulated, d-c potential of 90 volts.

c. When a light strikes the cathode of the phototube, a minute current of about 1 or 2 microamperes flows through the resistor and tube; the exact current is dependent on the amount of light striking the cathode. Because resistor R400 has a high resistance value, this small current develops a sizable voltage drop across the resistor. For example, if the current flow is 1 microampere, the voltage drop across the 3-megohm resistor is 3 volts.

d. When no light strikes the cathode of the phototube, there is no electron flow through the resistor and tube. As a result, the tube acts as an infinitely high resistance and no voltage appears across resistor R400.

e. Therefore, it can be seen that the voltage appearing across the resistor varies in proportion to the amount of light which falls on the cathode of the phototube. This voltage is applied to the control grid of preamplifier tube V401.

87. Preamplifier

Tube V401 is a Tube JAN–6C5, triode vacuum tube. Cathode bias is obtained by the voltage drop appearing across resistor R401 as a result of the flow of plate current through the resistor.

a. The plate of the tube is connected to a regulated, d-c potential of 240 volts through the primary winding of transformer T200. The current which flows through this winding varies in response to the grid voltage. As a result, this current varies in proportion to the amount of light which strikes the phototube. The amplitude of voltage developed across the winding, however, is dependent upon the *rate of change* of the current. This fact is important in the operation of the equipment, as is explained in paragraph 88.

b. Voltage changes across the primary winding cause corresponding voltage changes across the secondary winding; the secondary voltage is applied to the control grid of thyratron tube V202.

88. Amplifier Tube V202

Tube V202 is a Tube JAN–2051 type thyratron (gas tetrode) tube. (See par. 78 for general theory of thyratron tubes.)

a. With no voltage induced in the secondary of transformer T200, the d-c potentials applied to the tube hold the tube beyond cut-off and no current flows through the tube nor through tapper coils L400 and L401 of the plate circuit. The cathode of the tube is at ground or the zero reference potential. Twenty-five volts of negative grid bias voltage is applied to the grid of the tube; this bias voltage is obtained from the slider on variable resistor R204. This resistor is connected across a regulated, d-c potential of 75 volts. Because there is no current flow in the plate circuit, there is no voltage drop across resistor R202 of the tapper coils (L400 and L401) after capacitor C202 attains its charge. The plate of the tube, therefore, is at a potential of +315 volts during this time.

b. The characteristics of Tube JAN–2051 are such that, with plate potential of +315 volts, the firing point of the tube occurs when the grid voltage is approximately —4 volts. Once the tube has fired, the grid voltage loses control and current continues to flow until the plate voltage is reduced to below +8 volts.

c. The voltage developed in the phototube circuit as a result of the scanning of the light beam is as follows:

(1) As the light beam moves steadily along the tapered portion of the glass window of the recorder meter, a gradually increasing amount of light strikes the cathode of the phototube. As a result, a gradually increasing positive voltage is developed at the grid of preamplifier tube V401. This grid voltage produces a *gradually increasing flow of current* through the primary winding of transformer T200. Because the voltage across the primary winding is proportional to the *rate of current change,* the primary voltage is relatively low. Likewise, the voltage induced in the secondary winding of the transformer and at the grid of tube V202 is relatively low. This low voltage makes the grid of the tube more positive but not enough to cause the thyratron tube to fire and conduct current. Thus, during this travel of the light beam, the thyratron tube does not fire.

(2) Neither does tube V202 fire as the beam of light sweeps through the nontapered portion of the glass window up to the point where the beam strikes the rectangular pointer of the meter. While the light beam strikes the phototube with a constant illumination, there is no change of voltage in the phototube circuit. Consequently, there is no change of current flow or voltage in the amplifying circuit.

(3) When the beam of light strikes the pointer of the meter, however, the light is suddenly cut off from the phototube and the voltage at the grid of the preamplifier tube suddenly falls to zero. As a result, there is a sudden decrease of plate current through the primary of transformer T200, and this sudden change in current produces a large voltage across the primary and secondary windings and at the grid of the thyratron tube. However, the polarity of this voltage is such that the grid is driven more negative and this circuit remains inoperative. Thus, the beam of light, upon reaching the pointer of the meter, produces no current in the tapper coils.

(4) As the beam of light leaves the pointer of the meter, light is suddenly returned to the phototube and the voltage at the grid of the preamplifier tube suddenly rises from zero to a relatively high positive value. As a result, there is a sudden increase of current through the primary winding of transformer T200 with a large voltage instantaneously appearing across the primary and secondary windings and at the grid of the thyratron tube. This voltage has a sufficient positive amplitude to overcome the fixed bias voltage on the grid, and the firing point for the tube (approximately —4 volts) is reached. At this time, the gas in the tube ionizes and begins to conduct current. This current, flowing through the plate circuit of tube V202, energizes tapper coils L400 and L401 and causes the recorder to tap a print. At the same instant that the gas ionizes, capacitor C202 which was previously charged to the same potential as the plate of tube V202 (315 volts) rapidly discharges through the low-resistance path presented by the tapper coils in series with the tube. (During conduction, the cathode-to-the-plate resistance of the tube falls to an extremely low value and, conversely, the resistance of the tube is extremely high during a period of nonconductance). The discharge of the capacitor lowers the plate potential of the tube to a value below that which is necessary to keep the gas ionized (below +8 volts), and the tube stops conducting. The tube then remains inoperative until another large positive voltage appears at its grid to again overcome the fixed negative bias voltage. The recurrence of such a positive voltage appears once during each 360° revolution of the scanning assembly—at the instant the beam of light leaves the pointer of the meter. Therefore, the tapper coils are energized for only one brief period during each cycle of normal operation.

89. Amplifier AM–7(*)/FMQ–1, Power Supply (fig. 86)

Power transformer T201 and exciter lamp transformer T202 operate on 115 volts ac supplied through Voltage Regulator CN–2(*)/FMQ–1. The secondary of transformer T201 produces: 6.8 volts ac, reduced to 6.3 volts ac by resistor R205, for the filaments of tubes V401 and V402; 5 volts ac for the filament of tube V203; and 1,200 volts ac, center-tapped, to furnish 600 volts ac on each plate of tube V203. The rectified voltage output of tube V203, a Tube JAN–5U4G full-wave rectifier type, is filtered by the network composed of capacitors C203 and C204 and filter choke L201. Four voltage-regulator tubes, V204, V205, V206, and V207 across the output of the filter network, function both as voltage regulators and voltage dividers. The output of the power supply is tapped or divided as follows:

a. Plate of tube V204 tapped for +315 volts.
b. Plate of tube V205 tapped for +240 volts.
c. Plate of tube V206 tapped for +90 volts.
d. Plate of V207 grounded.
e. Cathode of V207 tapped for —75 volts. Resistor R204 across tube V207 is tapped to provide —25 volts bias for tube V202.

Note. Transformer T201 contains an additional 7.5-volt a-c secondary winding which is not shown in figure 86. On Amplifier AM–7/FMQ–1, this winding is not used but can be connected to power the exciter light in an emergency. On Amplifier AM–7A/FMQ–1, this winding is used to power the exciter light instead of transformer T202 which is not supplied with the A model.

90. Printing Mechanism (figs. 44 through 52)

a. Each time that current flows in the tapper coils, the magnet of each coil is energized, causing the armature bar to be drawn upward. The upward movement of the armature bar forces the tapper bar rapidly downward, and a print is produced as the tapper bar strikes a typewriter ribbon against the recorder paper. This print is made at the point where the tapper bar intersects the raised spiral ridge, or helix, on the rotating spiral drum assembly (fig. 45).

b. (See fig. 50.) The armature bar is pivoted on ball bearings, and its motion is passed on to the

tapper bar by the dog legs. When the magnets pull the armature bar up rapidly, the dog legs and tapper bar move downward, striking the dog-leg-stops. The stops prevent further motion of the armature bar and the rear portion of the dog legs. But the tapper bar and front part of the dog legs continue downward because of their momentum and rotate about the dog leg pivots until the bar taps and makes a print. This latter motion stretches the dog-leg-springs which (after a tap) draw the tapper bar away from the paper. Thus, the tapper bar is provided with a snap action which improves the quality of the print.

c. The helix is a spiral ridge which extends about $\frac{1}{32}$ inch above the surface of the drum so that when the tapper bar strikes downward, an impression will be made only at the point where the ridge and tapper bar collide. At that point the ribbon will be pressed against the paper, making a dot. To insure that the helix is always in the correct position to produce a dot on the recorder paper (which indicates the position of the pointer of the meter), the rotation of the spiral drum assembly is synochronized with the rotation of the phototube scanning assembly. To accomplish this synchronization, a common drive motor and set of gears are used. The helix, however, rotates four times as fast as the phototube scanning assembly (par. 91).

d. The main drive motor is a synchronous motor. A capacitor is placed in the circuit to make the motor start in the right direction.

e. The print is made on graduated chart paper which is drawn past the tapper bar by the paper drive roll and the friction finger at a uniform rate of 0.4 inch per minute. The paper feed is propelled by another synchronous motor which also uses a starting capacitor. There are 100 graduations across the paper at 0.1-inch intervals, each graduation representing 1 bi-cycle. The paper is also graduated lengthwise at 0.1-inch intervals, each vertical line representing 0.25 minute. There are 21 yards of paper on one roll.

f. The ribbon drive and its reverse mechanism is powered by a small induction motor. This motor is geared down to a slow speed for driving the main shaft drive gear (fig. 47).

g. The whole printing mechanism is mounted on the rocker frame. By cam action, the rocker frame is rocked back and forth once during each revolution of the phototube scanning assembly. The purpose of this movement is to raise the ribbon and tapper bar away from the paper between taps so that the print can be seen.

h. The pull-out arm moves the rocker frame, with its printing mechanism, away from the helix so that recorder paper can be installed and adjustments can be made when the recorder is tilted forward.

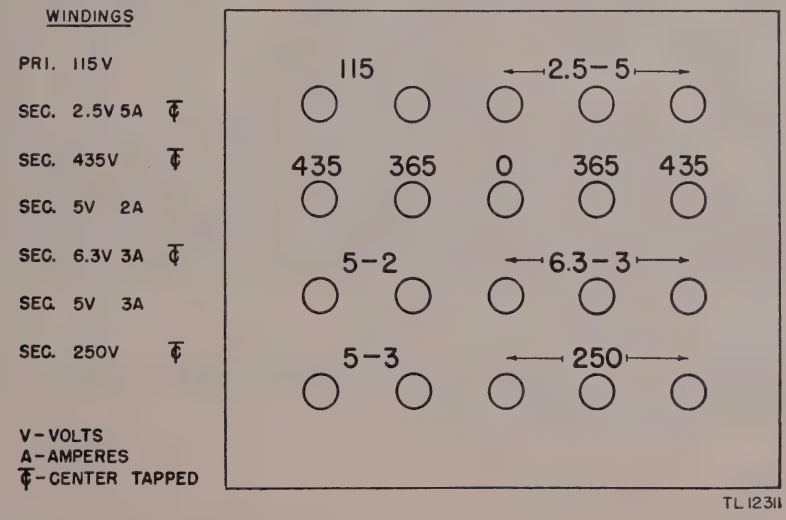


Figure 43. Terminal markings for replacement Transformer PA–422 (modified).

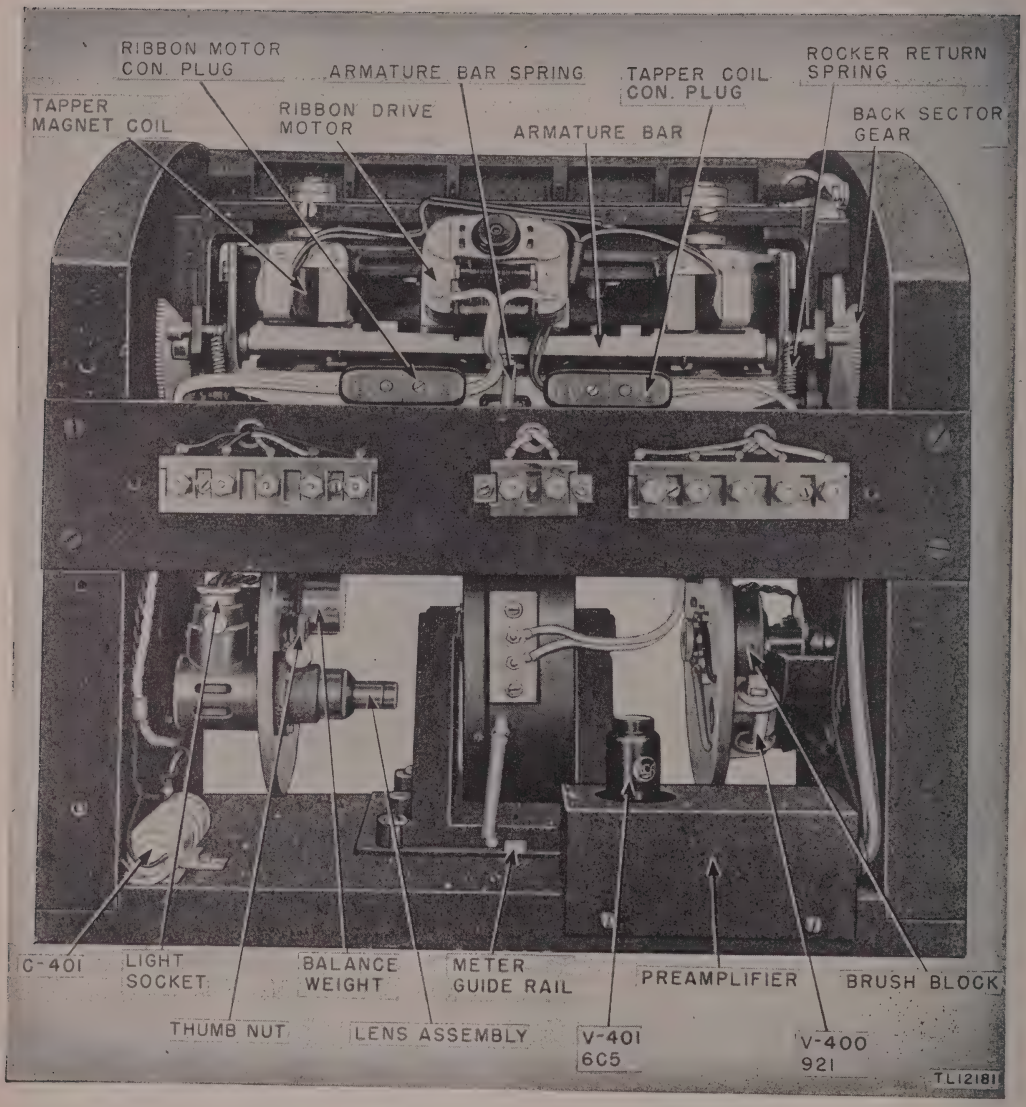


Figure 44. Radiosonde Recorder RD-3/FMQ-1, rear view.

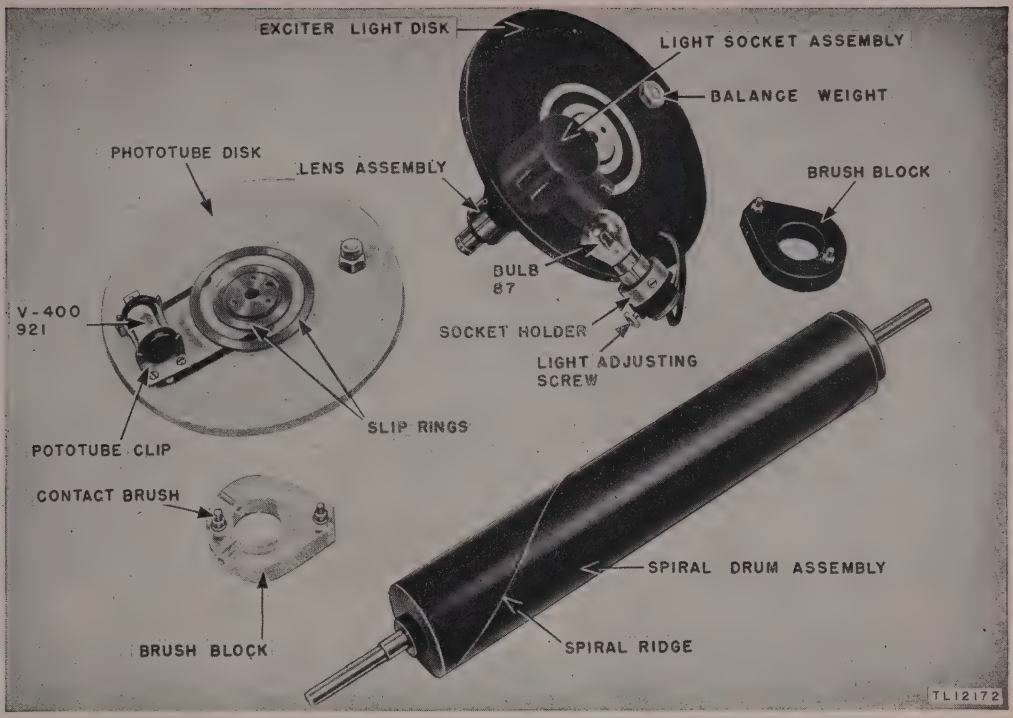


Figure 45. Scanning assembly.

91. Over-all Functioning of Radiosonde Recorder

Figures 53 and 54 are composite drawings which simplify the relationship of various parts and voltages in the radiosonde recorder.

a. For figure 53, it is assumed that the a-f signal input to the frequency meter is 150 cps.

(1) Under this condition, the pointer of the visual meter on the frequency meter will register 75 bi-cycles (fig. 53B).

(2) Likewise, one edge of the pointer of the recorder meter will rest at an angle of 67.5°, when 0° represents 0 bi-cycle and 90° represents 100 bi-cycles (fig. 53C).

(3) The beam of light, in making its clockwise excursions, traces the path shown by the dotted lines in figure 53C. As the beam of light passes the 0° position of the meter pointer, maximum light reaches the phototube (beam of light in nontapered portion of glass window), and maximum voltage is generated in the phototube circuit (fig. 53D). This voltage then remains constant at this high level as the beam passes through the window until it strikes the pointer of the meter. As it sweeps by the pointer, light is suddenly shut off and then just as suddenly returned to the phototube. As a result, the phototube circuit voltage suddenly falls to zero and then suddenly returns to its maximum value (fig. 53D). As explained previously, the tapper bar magnets are energized only when the light leaves the pointer of the recorder meter. Therefore, at this time, the tapper bar strikes down and makes a dot on the recorder paper.

(4) The position of the rotating helix when the tapper bar operates is shown in figure 53E. Note that the point on the helix which coincides with the tapper bar will make the print at 75 divisions on the recorder paper (fig. 53F). Thus, if the a-f input to the frequency meter is held constant at 150 cps, the

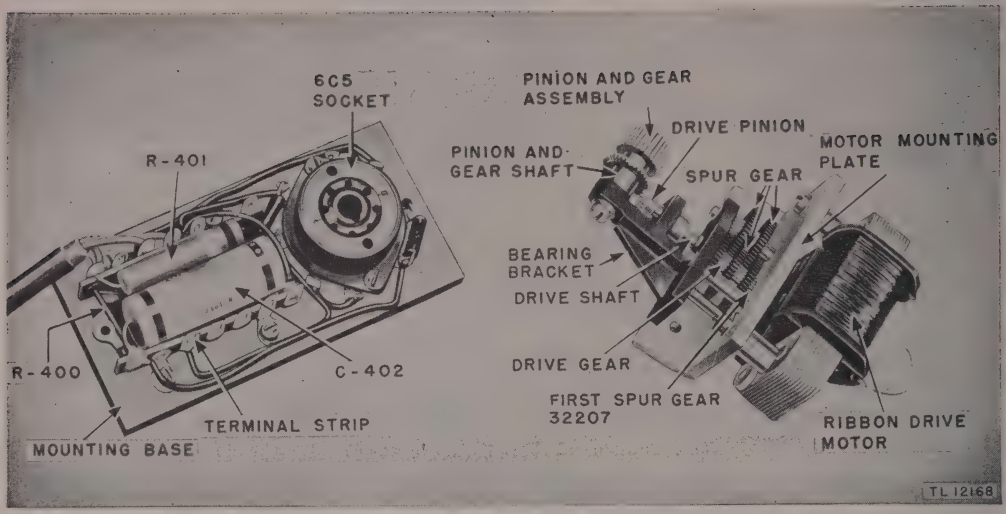


Figure 46. Preamplifier and ribbon drive assembly.

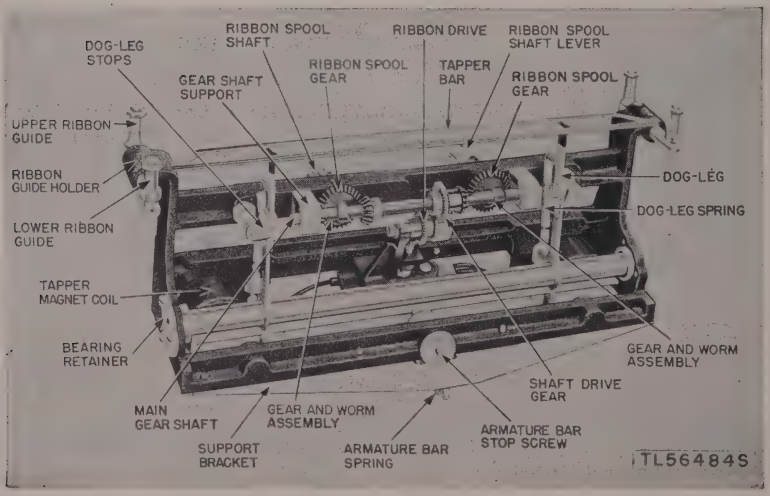


Figure 47. Rocker frame assembly.

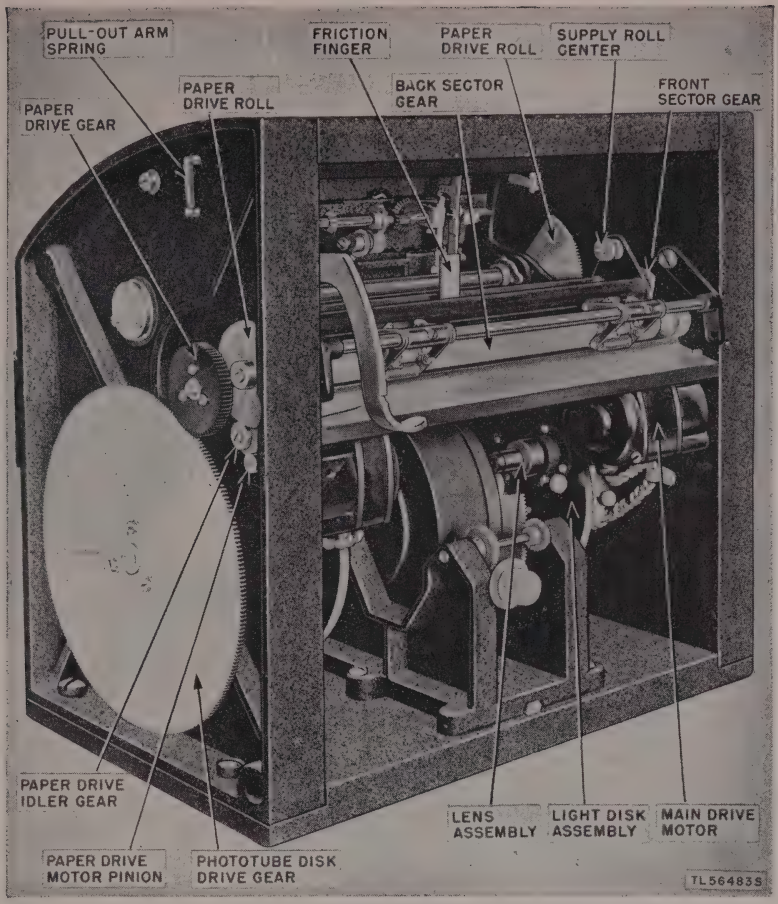


Figure 48. Radiosonde Recorder RD-3/FMQ-1, left front view.

recorder will print every 2 seconds and produce a print on the recorder paper at 75 divisions to correspond to the 75-bi-cycle (67.5°) position of the meter pointer. The paper feed constantly moves the paper past the tapper bar at a rate of 0.4 inch per minute so that an average of 30 prints, placed one under the other, will appear every 0.4 inch. Because there is one division every 0.1 inch, the 30 marks will occupy a depth of 4 divisions, as shown in figure 53F.

(5) The beam of light, in sweeping from the 0° to 90° positions, requires an elapsed time of 0.5 second (360° equals 2 seconds). The rotation of the helix is synchronized with the rotation of the phototube scanning assembly so that the helix makes one complete revolution during this 0.5 second period. In making this revolution, the helix is synchronized with the scanning assembly so that it is always in the correct position to record the position of the pointer on the meter.

(6) As the beam of light passes out of the glass window and continues its clockwise rotation, it passes, in succession, the 90° to 180°, the 180° to 270°, and the 270° to 360° (0°) arcs, as shown in figure 53C. During each of these arcs, the helix makes another complete revolution but, because the

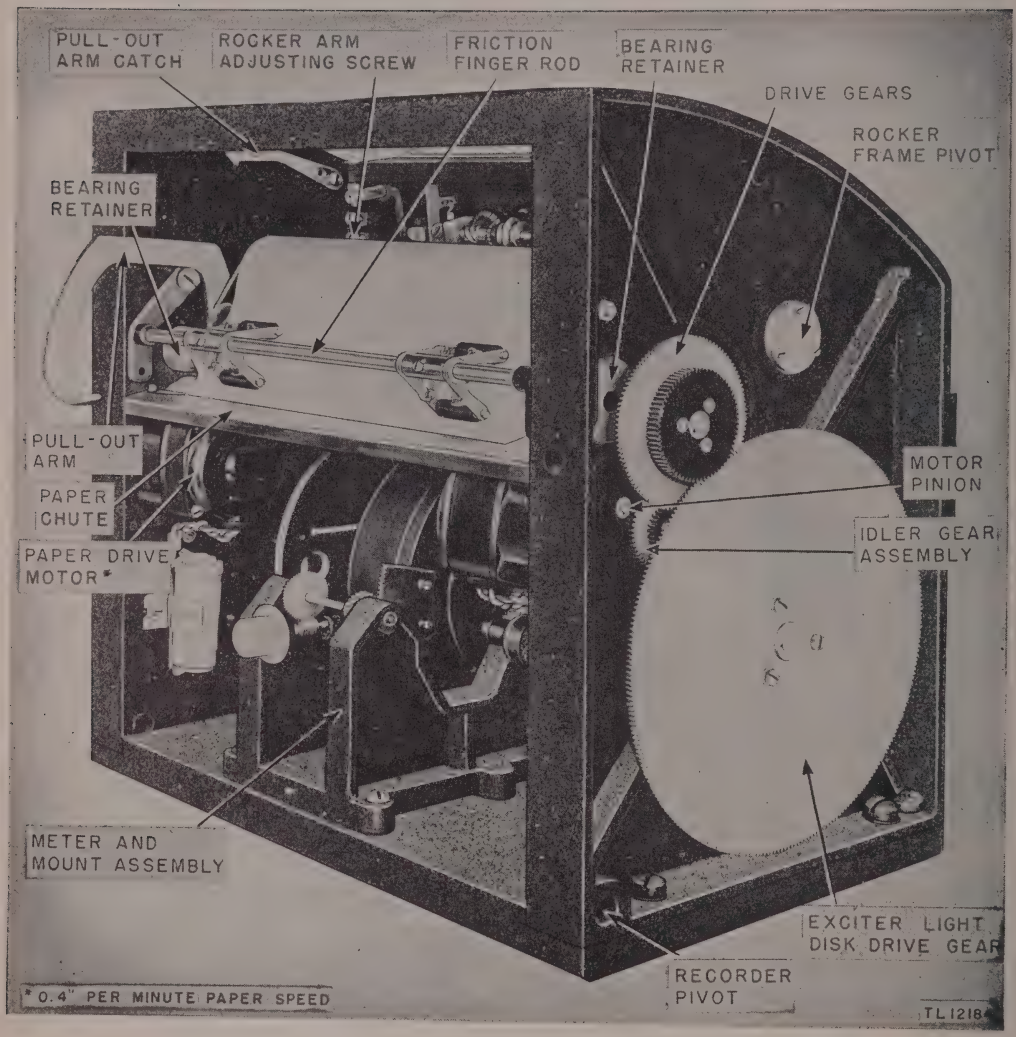


Figure 49. Radiosonde Recorder RD-3/FMQ-1, right front view.

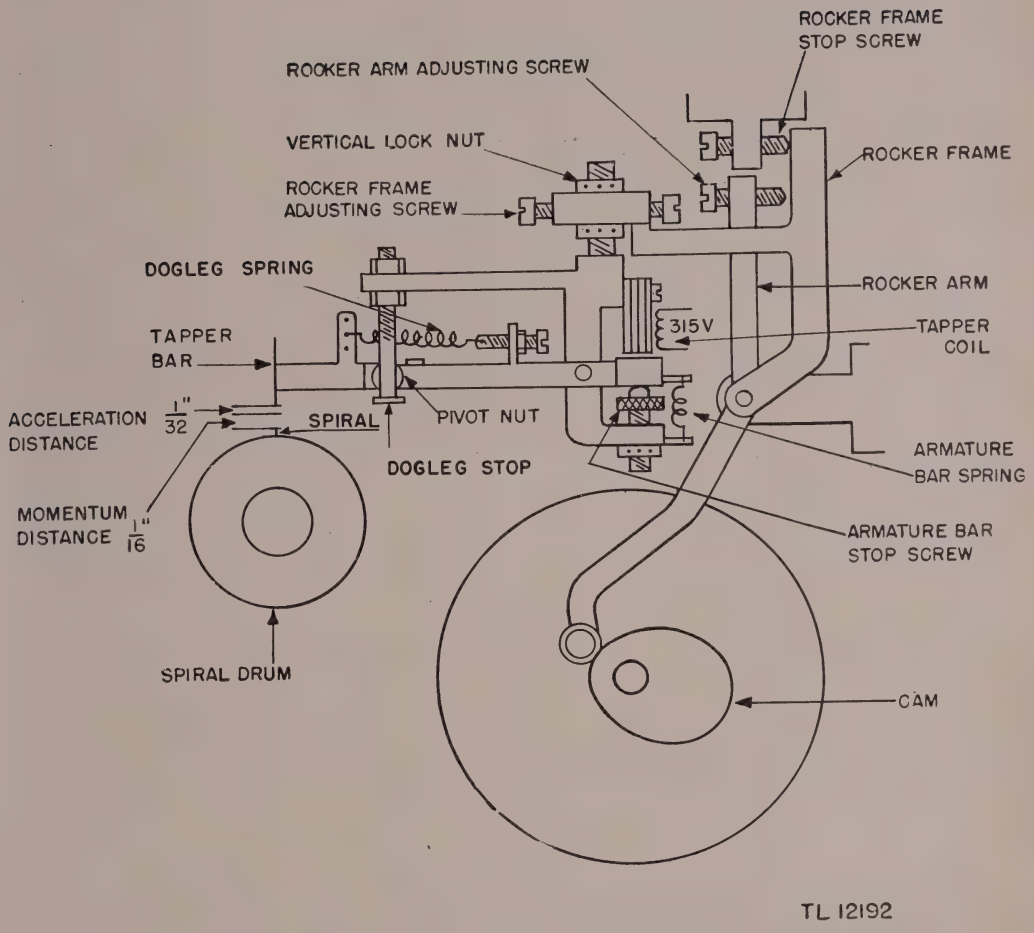


Figure 50 Radiosonde Recorder RD-3/FMQ-1, sketch of adjustment locations.

tapper bar is not normally actuated during this time, no print is made on the paper. Thus, the helix makes four revolutions for each revolution of the phototube scanning assembly. Only during the 0° to 90° arc is the tapper bar actuated and a print made.

b. For figure 54, another composite diagram is shown. In this figure, an input frequency of 100 cps has been assumed (fig. 54A). Note that the pointer of the meter (fig. 54C) rests at the 45° angle in the path of the light beam, causing the phototube voltage (fig. 54D) to appear earlier in the cycle. Also note that the tapper bar is actuated at a correspondingly earlier time to produce a print at 50 divisions on the paper (fig. 54F), the helix having been rotated to the position shown in figure 54E at this instant.

92. Voltage Regulator

The voltage regulator (fig. 85) furnishes a practically constant a-c output voltage for the frequency meter and amplifier even though the power a-c voltage input to the voltage regulator varies over wide limits.

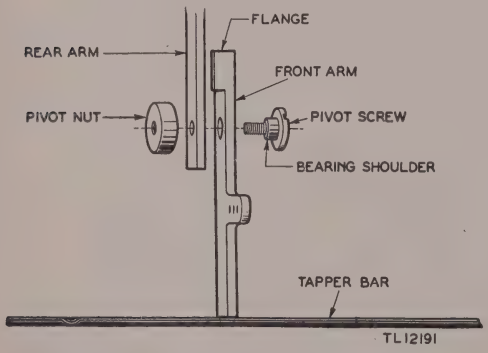


Figure 51. Detailed sketch of dog leg joints.

a. The primaries of transformers T300 and T301 are connected in series across the a-c input voltage. When the a-c input voltage is within the range of voltages over which the equipment is designed to operate, transformer T301 operates as an ordinary transformer and transformer T300 has its core slightly saturated.

b. The secondaries are connected in series opposition with the secondary of transformer T300 tapped to permit initial adjustment of the output voltage. Most of the output voltage is contributed by the secondary of transformer T300.

c. When the a-c voltage input increases in amplitude, the secondary of transformer T300 contributes less to the output voltage although the two secondary voltages add (in opposition) to produce practically the original output voltage. If, on the other hand, the a-c voltage input decreases, the secondary of transformer T300 contributes more to the output voltage, with the two secondary voltages adding to maintain the original output voltage.

d. Capacitor C300 partially resonates the primary winding of transformer T300, improving the regulation and waveshape of the output voltage. Capacitor C301 is a line filter capacitor.

e. Figure 56 shows the regulation provided for various input frequencies. Note that the regulation depends to a great extent on the maintenance of a stable input power line frequency.

93. Functional Differences in Models

The functioning of Radiosonde Receptor AN/FMQ–1 and AN/FMQ–1A is the same, except as noted in previous paragraphs. Electrical differences between the models are minor. (See complete schematic diagrams at the back of the manual.)

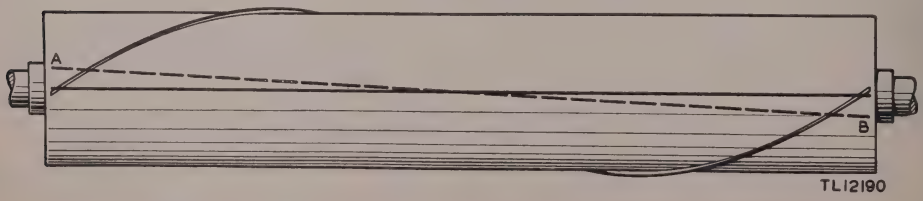


Figure 52. Relationship between principal axis of spiral drum and tapper bar.

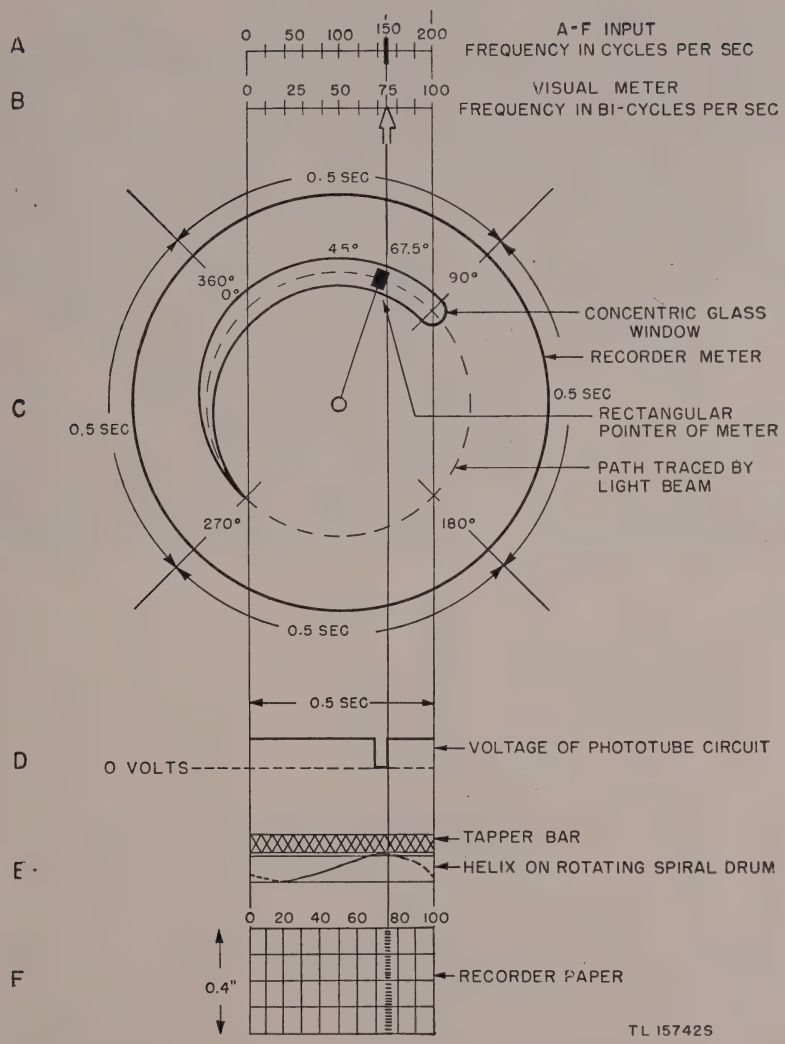


Figure 53. Functional diagram of radiosonde recorder operation.

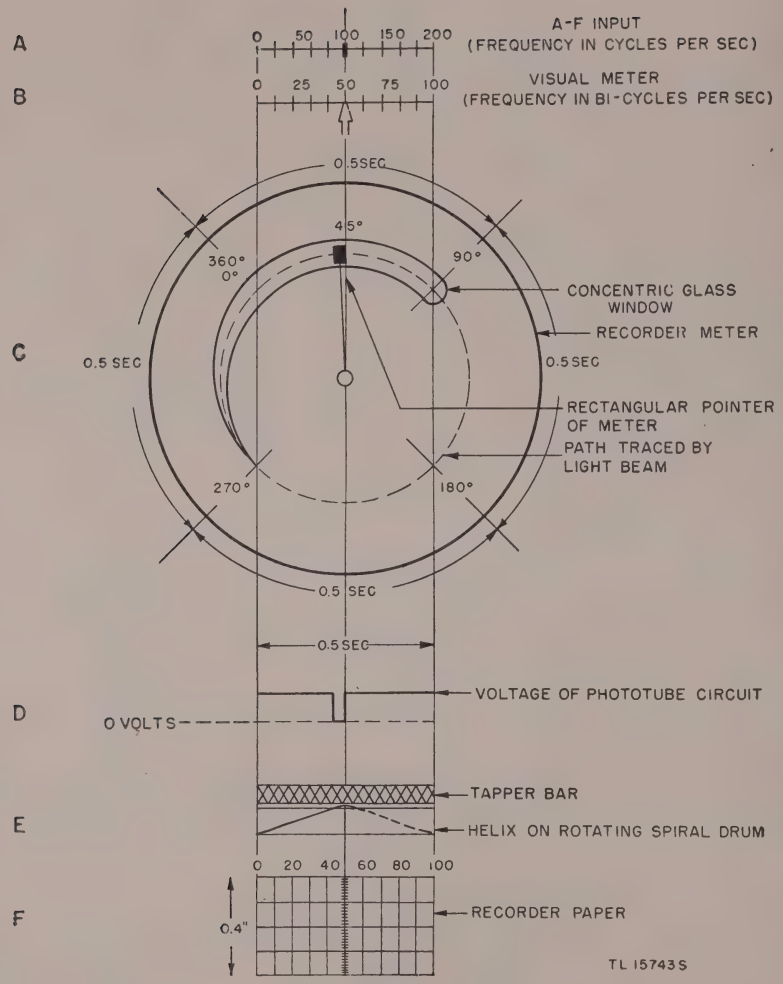


Figure 54. Functional diagram of radiosonde recorder operation.

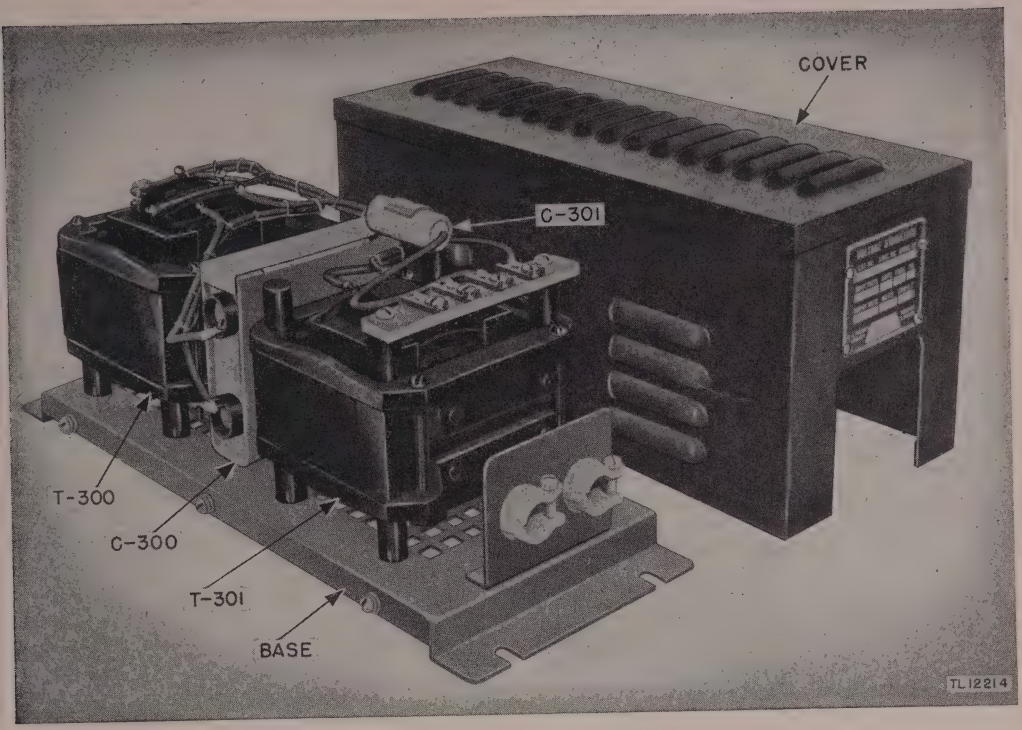


Figure 55. Voltage Regulator CN-2/FMQ-1, cover removed.

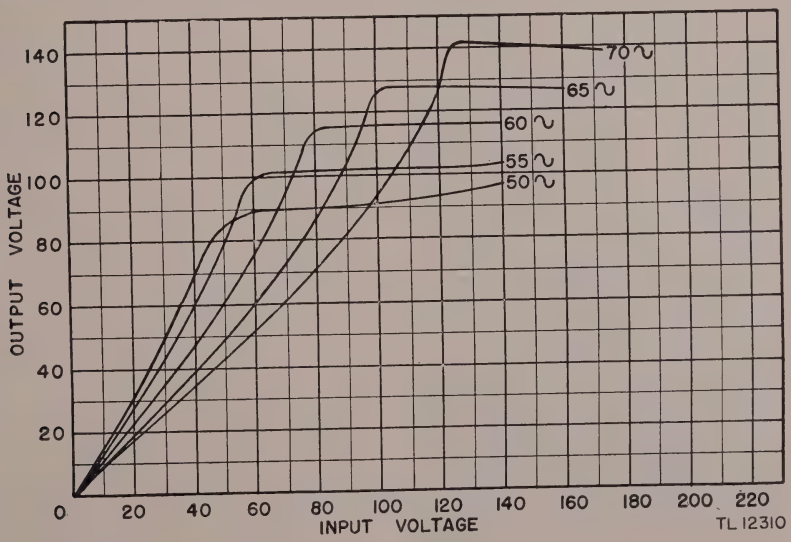


Figure 56. Voltage Regulator CN-2/FMQ-1, frequency-voltage regulation curves.

Section IX. REPAIR

94. General Trouble-shooting Information

No matter how well equipment is designed and manufactured, faults may occur in service. If such faults do occur, the repairman must locate and correct them as rapidly as possible. This section contains general information to aid personnel assigned to trouble shooting the equipment.

a. Trouble-shooting Data. The material supplied in this manual will help in the rapid location of faults. Consult the following trouble-shooting data:

(1) Block diagram of Radiosonde Receptor AN/FMQ–1(*) (fig. 31).

(2) Complete schematic diagrams (figs. 80 through 86).

(3) Simplified and partial schematic diagrams (sec. VIII).

(4) Voltage and resistance data for all socket connections (par. 100).

(5) Illustrations of components. Front, top, and bottom views which aid in locating and identifying parts.

(6) Pin connections. Pin connections on sockets, plugs, and receptacles are numbered or lettered on the various diagrams.

(*a*) Seen from the bottom, pin connections are numbered in a *clockwise* direction around the sockets. On octal sockets, the first pin clockwise from the keyway is the No. 1 pin.

(*b*) Plugs and receptacles are numbered on the side to which the associated connector is attached. To avoid confusion, some individual pins are identified by letters appearing directly on the connector.

b. Trouble-shooting Steps. The first step in servicing a defective radio set is to *sectionalize* the fault. Sectionalization means tracing the fault to the component or *circuit* responsible for the abnormal operation of the set. The second step is to *localize* the fault. Localization means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults such as burned-out resistors, r-f arcing, and shorted transformers can often be located by sight, smell, and hearing. The majority of faults, however, must be located by checking voltage and resistance.

(1) *Sectionalization.* Careful observation of the performance of the radio set during the starting procedure often sectionalizes the fault to the transmitter or the receiver, and careful observation of the meters on the equipment often determines the stage or circuit at fault. Further procedures on sectionalizing the fault are discussed in paragraph 96.

(2) *Localization.* Paragraphs 97 to 100 describe the method of localizing faults within the individual components.

c. Voltage Measurements. Voltage measurements are an almost indispensable aid, for most troubles either *result* from abnormal voltages or *produce* abnormal voltages. Voltage measurements are taken easily, because they are always made between two points in a circuit; the circuit need not be interrupted.

(1) Unless otherwise specified, voltages listed on the voltage charts are measured between the indicated points and ground.

(2) Always begin by setting the voltmeter on the *highest* range so that the voltmeter will not be overloaded. Then, if it is necessary to obtain increased accuracy and sensitivity, set the voltmeter to a lower range.

(3) When checking cathode voltage, remember that a reading can be obtained when the cathode resistor is actually open as 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 ground. Before cathode voltage is measured, first make a resistance check with the power off to determine whether the cathode resistor is normal.

d. Voltmeter Loading. Voltmeter resistance should be at least 10 times as large as the resistance of the circuit across which the voltage is measured. If the voltmeter resistance is nearly equal to the circuit resistance, the voltmeter will indicate a voltage *lower* than the actual voltage present when the voltmeter is removed from the circuit.

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

(2) To minimize voltmeter loading in high resistance circuits, use the highest voltmeter range. Although only a small deflection will be obtained (possibly only 5 divisions on a 100-division scale), the electrical accuracy of the voltage measurement

will be increased. The decreased loading of the voltmeter will more than compensate for the visual inaccuracy which results from reading only a small deflection on the voltmeter scale.

(3) Close observation of the meter when switching voltage ranges will show if the voltmeter is loading the circuit under test.

(*a*) *Extremely heavy loading* is indicated when the deflection of the pointer on the meter (not the voltage reading) is nearly the same for different ranges.

(*b*) *Appreciable loading* is indicated when the voltage readings (not the deflection) for different ranges do not agree.

(*c*) *Negligible loading* is indicated when the voltage readings (not the deflection) for different ranges do agree.

(4) The ohms-per-volt sensitivity of the voltmeter used to obtain the readings recorded on the voltage and resistance charts in this manual is printed on each chart. Use a meter having the same ohms-per-volt sensitivity. Otherwise it may be necessary to consider the effect of loading.

95. Test Equipment

Equipment issued for use in installing, repairing and calibrating Radiosonde Receptor AN/FMQ–1(*) includes the following:

a. Tool Equipment TK–17/FMQ–1.

b. Test Unit I–176.

c. Headset HS–33–( ), complete with Cord CD–307.

d. Frequency Standard TS–65( )/FMQ–1.

e. Expendable Hardware Items MK–27/FMQ–1.

96. Sectionalization

a. Starting Procedure. Trouble can very often be sectionalized through observations made as the equipment is turned on. Normal conditions for each step of the starting procedure are given in paragraph 23. Indication of a departure from these normal conditions is an aid in the sectionalization of trouble.

b. Antenna and Radiosonde Receiver. When the receiver is turned on according to the instructions given in paragraph 23, noise will be heard in the speaker and, if a signal is being picked up, the signal will also be heard.

(1) If neither noise nor the signal is heard, the trouble is in the receiver.

(2) If noise is heard but the signal is not heard, the trouble is in the antenna system, in the connections between the antenna and receiver, or in the r-f stage of the receiver.

Note. Make sure that the signal source is not at fault, and also check to see whether the receiver is being tuned properly to the frequency of the signal.

c. Receiver. Trouble can usually be sectionalized in the receiver with the aid of the following sectionalization chart. (See pars. 71 through 75 and fig. 31.)

Speaker channel	S meter channel	Output channel	Cause
Inoperative.	Inoperative	Inoperative.	R-f amplifier, detector, or power supply stage.
Inoperative.	OK	OK	Power amplifier (audio).
OK	Inoperative	OK	S meter channel (tubes V703 and V705).
OK	OK	Inoperative.	Series diode clipper or limiter stage.
Inoperative.	Inoperative	OK	Power amplifier and S meter channel (tubes V703 and V705).
Inoperative.	OK	Inoperative.	A-f amplifier (tube V702) or the audio power amplifier, series diode clipper, or limiter stage.
OK	Inoperative.	Inoperative.	Both diodes of tube V703, or tube V704 or V705.

d. Frequency Meter. The frequency meter normally indicates the modulation frequency of the transmitted signals.

(1) If no indication is obtained, the trouble is either in the output channel of the receiver (or Radio Set SCR–658 if in use) or in the frequency meter. To determine which component is at fault, rotate the INPUT switch to the 60 ∞ position. If the frequency meter then shows normal indication, the trouble is in the receiver (or Radio Set SCR–658 if in use) or in the connections from the receiver (or Radio Set SCR–658 if in use) to the frequency meter. If, on the other hand, still no indication is obtained, the trouble is in the frequency meter.

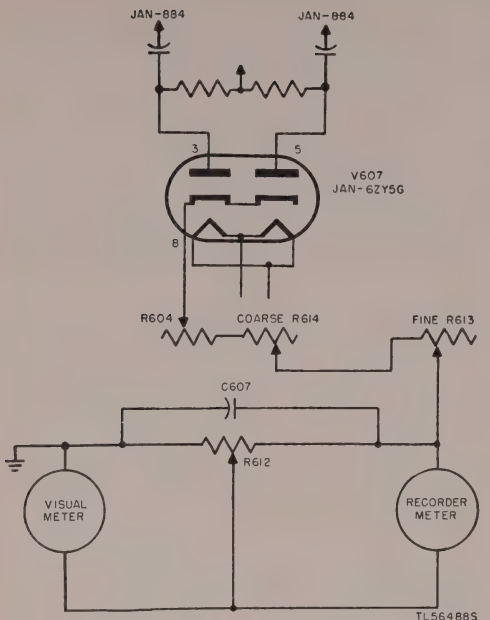


Figure 57. Visual and recorder meter circuit, simplified diagram.

Note. When checking the frequency meter, make sure that the EQUALIZER control is set at approximately its center-range position.

(2) If the indication of the frequency meter is relatively steady but the reading is incorrect, trouble may exist in the circuits given in (1) above or an alinement may be required. Section X explains alinement procedures.

(3) If the indication of the frequency meter is not steady although a signal of good strength is heard in the speaker, the trouble will be found in the circuits given in (1) above.

e. Recorder Not Printing. If the recorder is not printing although the frequency meter is properly indicating the modulation frequency of the transmitted signal, the trouble may be sectionalized as follows:

(1) Leave the MASTER ON-OFF switch ON.

(2) Turn the RECORDER ON-OFF switch OFF.

(3) Remove the front cover plate from the meter and scanning assembly section. Then rotate the phototube disk by hand until the phototube is at the front of the recorder.

(4) With the RECORDER switch off, place the thumb on the contact at one end of the phototube socket and the index finger on the contact at the other end of this socket. Then remove the thumb and finger.

(*a*) If the tapper bar operates as the contacts are touched, all components from the phototube socket through the preamplifier and amplifier to the tapper coils are functioning. Therefore, the trouble is caused by the light assembly or alinement. If so, see (5) below.

(*b*) If, on the other hand, the tapper bar does not function, and the tapper bar armature has sufficient clearance from the tapper coils, check or replace all tubes in the preamplifier and amplifier. The VR tubes normally operate with a distinctive glow; Thyratron Tube JAN–2050 or JAN–2051 should be checked by replacement. If the tubes are not at fault, remove, check, and clean the phototube disk, commutator rings, and brushes for dirt or excessive wear. If normal operation of the recorder is still not obtained, the preamplifier or amplifier circuits are at fault ((6) below).

Note. Section X explains the alinement and basic adjustment of the recorder and also gives procedures for correcting a faulty print.

(5) If in the test of (4) above the tapper bar operates, check the phototube by using a focused light or flashlight. Flash the light on and off *with the beam aimed at the phototube.*

(*a*) If the tapper bar operates as a result of this test, the trouble is in the exciter lamp assembly. If so, check to see whether the optical system is properly focused. Clean the recorder meter glass if the glass is dirty.

(*b*) If, on the other hand, the tapper bar does not operate when the flashlight test is made, replace the phototube.

Note. When replacing the phototube, observe correct polarity.

(6) To determine whether the trouble is in the preamplifier or in the amplifier ((4)(*b*) above), make the following check:

(*a*) Set the voltage range of the test analyzer to the 250-volt position. Connect the negative test lead of the analyzer to the chassis and connect the positive lead to terminal No. 3 on the d-c terminal strip. A reading of 240 volts, the plate potential of the preamplifier tube, should be obtained.

(*b*) If large fluctuations or instability of plate voltage is indicated by the meter and it is known that good voltage regulator tubes are in use, the trouble

may be overcome by replacing audio transformer T200. A faulty transformer is the cause of intermittent or erratic operation of the recorder or printing mechanism.

(*c*) If only a slight movement of the meter occurs during the measurement of this plate voltage with the RECORDER switch ON and if the movement occurs at the scanning rate (once every 2 seconds), the pulse produced by the phototube circuit is being amplified by the preamplifier. Therefore, the trouble is sectionalized to the amplifier or tapper coils.

f. Erratic Operation. Erratic operation of the tapper bar may be localized by using the method of analysis given in *e*(6) above. That is, the cause of the erratic operation of the tapper bar may be localized by observing the movement of the analyzer meter needle. Frequently this defect is caused by an incorrect bias voltage for Tube JAN–2050 or JAN–2051. This voltage is obtained from a tap on resistor R204.

97. Localization

After the sectionalization procedure has isolated the trouble to a single component or circuit, the trouble must be further localized to the defective part or condition. For electrical or electronic circuits, this localization is accomplished by the use of the senses (sight, smell, or hearing), by the testing of tubes, or by means of voltage and resistance measurements.

a. Use of Senses. Trouble can often be located quickly by noting the appearance of parts or any unusual odors. Try to detect by sight or smell such defects as burned resistors, shorted wiring, leaking transformers, or a tube which lights abnormally or not at all. Any of these defects will be definite clues to the trouble. Sometimes hearing can be used to detect trouble; a motor or other moving part may sound different when it is operating improperly.

b. Testing of Tubes. One of the most frequent causes of trouble is a defective tube. After trouble has been sectionalized to a component, test the tubes before performing any other trouble-shooting procedures. When replacing voltage regulator tubes, make certain that each tube is replaced in the correct socket.

Caution: If the tube base keys are missing and no replacement tubes are available, determine where the key was and aline with the key or socket before inserting the tube.

c. Voltage and Resistance Tests. Figures 60 through 65 show normal voltage and resistances at tube socket contacts of the equipment. These measurements are obtainable when the conditions given under the notes of each chart are satisfied. If, during voltage and resistance tests, an abnormal measurement is obtained, the associated circuit must be completely tested to isolate the part or connection causing the abnormal reading. For example, if no voltage reading is obtained at pin 6 of tube V702 in the radiosonde receiver but normal voltage is obtained at pin 8 of the same tube, the defective part is either resistor R705 (open) or capacitor C712 (shorted) or both.

98. Trouble in Voltage Regulator

Voltage Regulator CN–2(*)/FMQ–1 (fig. 58) seldom fails in service. If, however, it is necessary or desirable to check its operation, use the following procedure:

a. To increase the output voltage of the voltage regulator, move lead A to a higher numbered tap and move lead B to a lower numbered tap on transformer T300 (fig. 59).

b. If the voltage regulator fails to produce a satisfactory output, check the input voltage; it should be between 105 and 125 volts and at a frequency of 60 cps ± 2 cps. If the input voltage and frequency are normal, disconnect the unit from the power source and check the transformer windings for open or short circuits (fig. 59).

99. Paper Feed Difficulty

If, during operation of the recorder, the paper does not feed out straight, or if the paper gathers in a bunch beneath the paper drive roll, the cause is probably either misalinement or a change in spring tension of the friction finger rod assembly. When correction of misalinement does not rectify the trouble, a temporary repair can be made by inserting small props between the paper chute and on top of each of the two motors; one motor is mounted on each side of the recorder. A new friction rod assembly should be installed for the permanent repair.

Caution: Do not allow the rear edge of the paper chute to touch or rub against the paper drive roll.

Note. A calibration check is required following any maintenance or readjustments of the recording system. See section X for adjustment and calibration procedures.

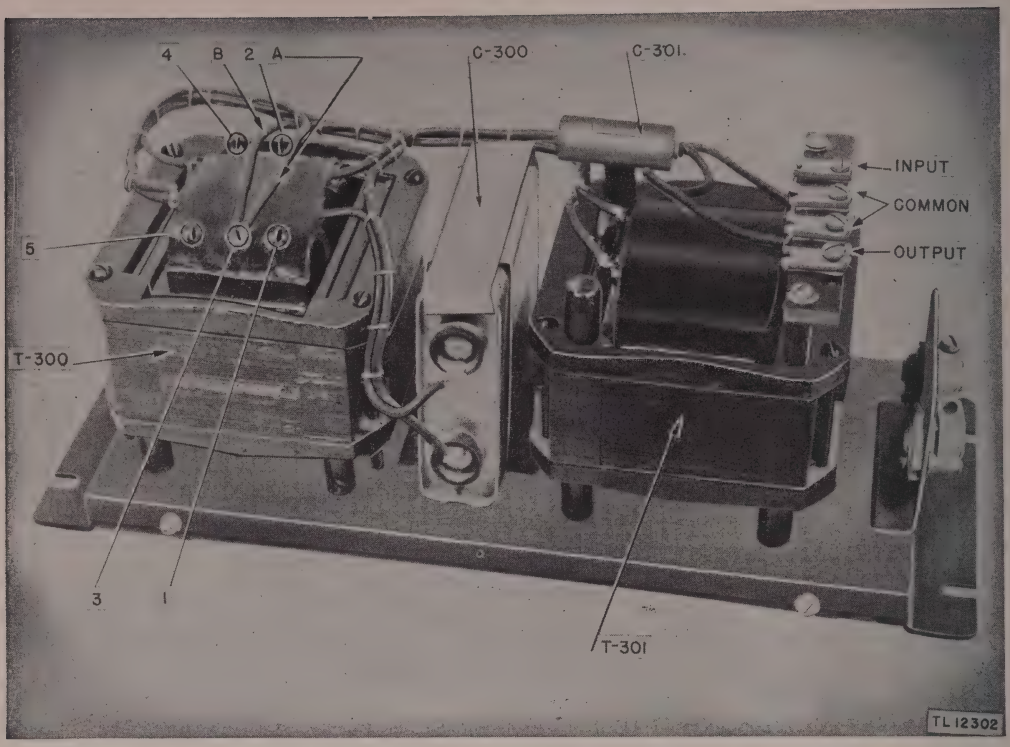
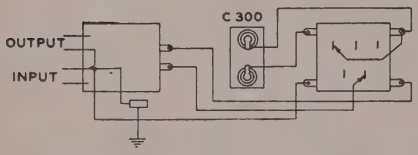


Figure 58. Voltage Regulator CN–2(*)/FMQ–1.



OHMMETER CONNECTED TO EITHER TERMINAL OF LARGE CAPACITOR C 300 AND ANY OTHER TERMINAL EXCEPT ADJACENT CAPACITOR TERMINAL WILL SHOW COMPLETE CIRCUIT.

DISCHARGE CAPACITOR BY SHORTING BEFORE TOUCHING

VOLTAGE REGULATOR
CONTINUITY CHECK TL12215A

Figure 59. Voltage Regulator CN–2(*)/FMQ–1, continuity check.

100. Voltage and Resistance Charts

Figures 60 through 65 show normal voltage and resistance measurements obtainable at the tube socket contacts in the radiosonde receiver, frequency meter, and amplifier when the conditions listed under the notes on each chart are satisfied.

101. Unsatisfactory Equipment Report

a. WD AGO Form 468 (Unsatisfactory Equipment Report) for Equipment Used by the Army. WD AGO Form 468 will be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C., when trouble occurs more often than is normal, as determined by qualified repair personnel.

b. AF Form 54 (Unsatisfactory Report) for Equipment Used by Department of the Air Force. AF Form 54 will be filled out and forwarded to Commanding General, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, in accordance with AF Regulation 15–54.

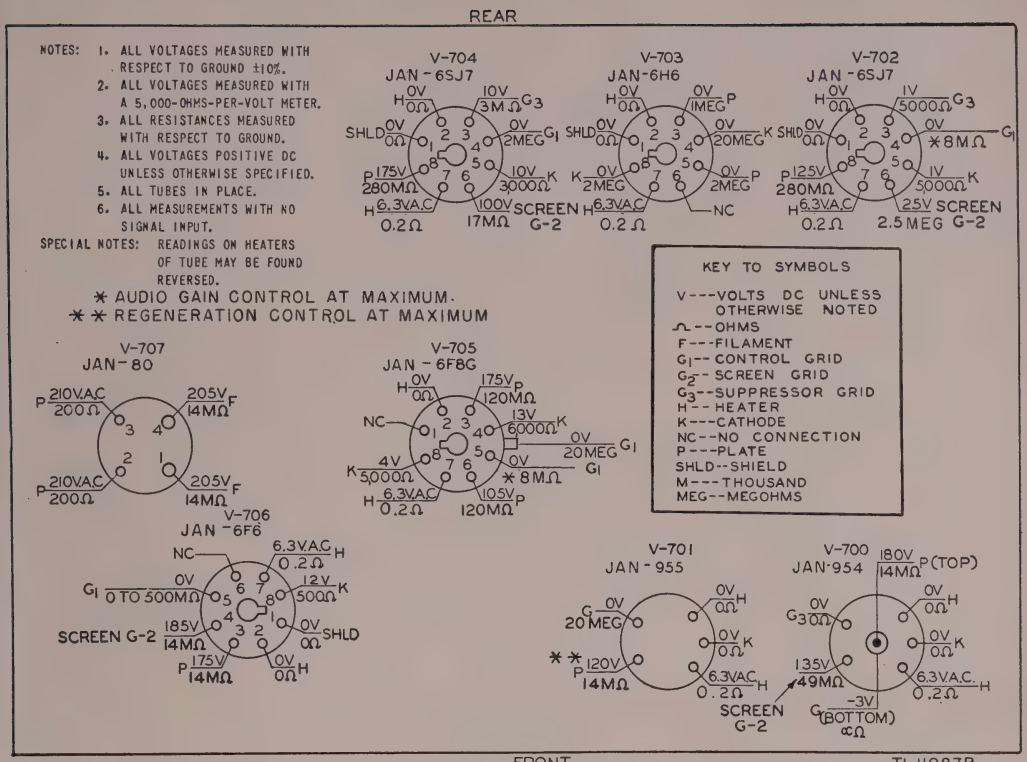


Figure 60. Radiosonde Receiver R–17/FMQ–1, normal tube socket voltage and resistance values.

Section X. ALINEMENT AND ADJUSTMENT

102. Alinement

a. General. By alinement, the visual meter on the panel of the frequency meter and the recorder print are made to indicate the input frequency as accurately as possible so that a minimum applied correction will be necessary in computation of a flight. It is especially important to have zero-correction for the low reference frequency since this is the reference line from which the meteorological values are measured.

b. Requisites and Preparation for Alinement. Alinement is accomplished when the following requisites and preparations have been fulfilled:

(1) With a 190-cycle input, the visual meter must read 95.0 and the recorder must print 95.0.

(2) With a 40-cycle input, the visual meter falls where it may and the recorder must print 20.0.

(3) With a 100-cycle input, the visual meter must read 50.0 ±0.3 and the recorder must print 50.0 ±0.3.

(4) With the INPUT switch on SC (short circuit) and the DEIONIZE switch momentarily depressed, the visual meter must read 0.0 and the recorder print falls where it may.

Note. Before the frequency meter and the recorder are alined, all parts of the ground station and the power supply should be functioning satisfactorily.

(5) The output leads of a suitable frequency generator, such as Frequency Standard TS–65A/FMQ–1, should be attached to the output terminals of the receiver.

(6) The AUDIO GAIN control on the receiver MUST be turned to 0 to prevent interference.

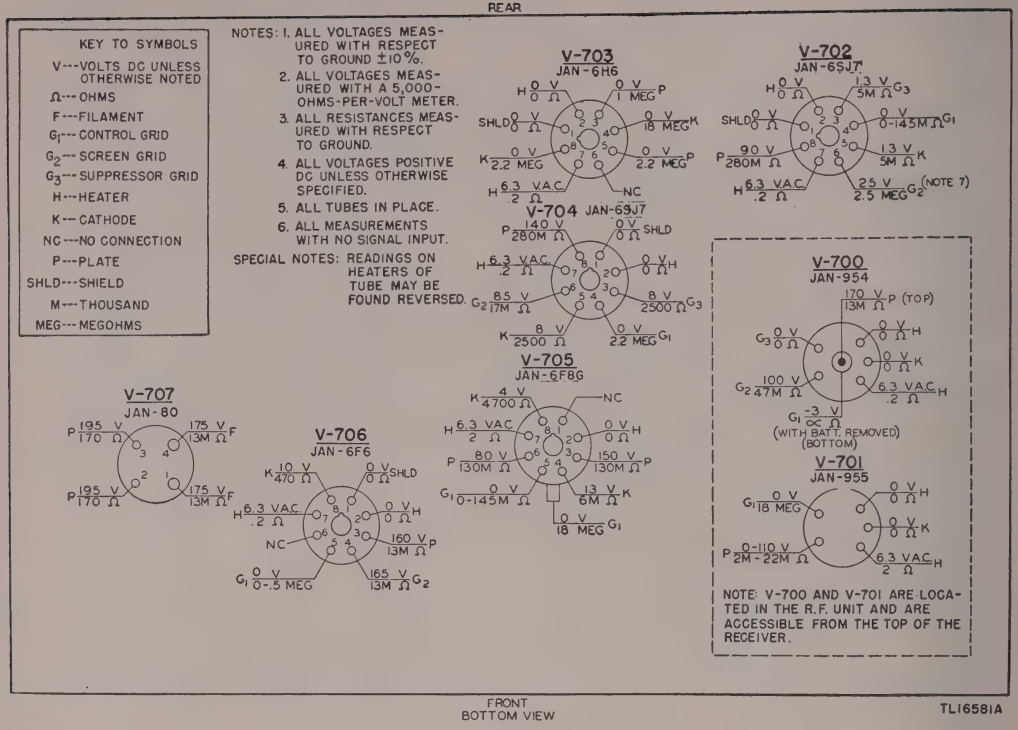


Figure 61. Radiosonde Receiver R–17A/FMQ–1, normal tube socket voltage and resistance values.

(7) A shielded cable should also be used to minimize interference.

(8) Connect the shield to the ground terminal of both the frequency generator and the receiver.

(9) Connect the inner wire to the ungrounded terminals.

(10) After making this connection, test to see that it was made with proper polarity by selecting the lowest frequency, 10 cycles. If it is connected wrong, there will be no deflection of the visual meter.

(11) The output control should be turned up all the way.

Note. Multifrequency Generator SC–16 and Frequency Standard TS–65/FMQ–1 have output controls.

103. Alinement Procedure

The following procedure should be used in alinement:

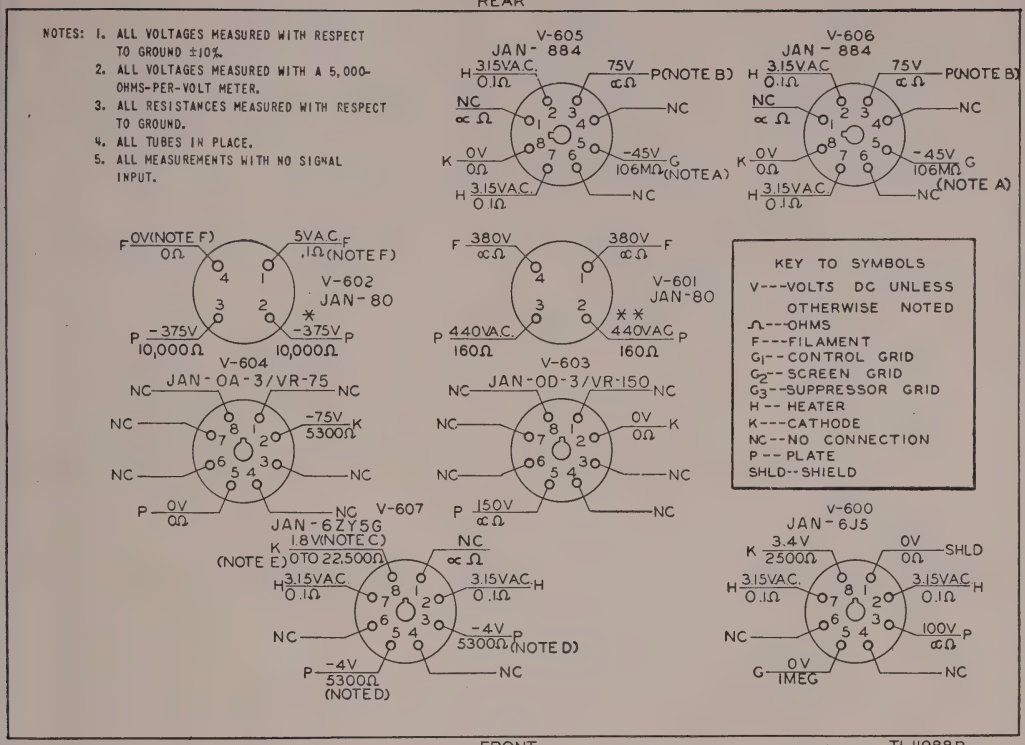
a. Let the recorder print for 15 minutes so that the paper will be feeding straight and the ground station will be warm. Also, let the frequency standard warm up for 15 minutes.

b. Adjust the recorder meter assembly (fig. 18), if necessary, so that the curved window is concentric with the path of the exciter light beam.

c. With the INPUT switch at SC and the DEIONIZE switch momentarily depressed, adjust the visual meter to mechanical 0 and use the zero adjusting knob to make the recorder print zero.

d. With a 190-cycle input, adjust the EQUALIZER and COARSE and FINE calibration controls until both the recorder print and the visual meter register 95.0 bi-cycles.

e. With a 40-cycle input, check the "20" print. If the recorder does not indicate exactly 20.0, correct 6/5 of the error by use of the zero adjusting knob. For example, if the recorder prints 20.5, turn the zero adjusting knob until the recorder prints 19.9.



SPECIAL NOTES: A. -45 VOLTS, VTVM, TUBE DEIONIZED. -1 VOLT, 5,000-OHMS PER-VOLT METER, TUBE DEIONIZED.
B. +75 VOLTS, 884'S FIRING. +150 VOLTS, 884 DEIONIZED. +15 VOLTS, 884 IONIZED.
C. +1.8 VOLTS, 884'S FIRING. 0 VOLTS, 884'S NOT FIRING.
D. -4 VOLTS, VTVM. -2.5 VOLTS, 5,000-OHMS PER-VOLT METER.
E. DEPENDS ON SETTING OF R604, R613, R614.
F. FILAMENTS READINGS MAY BE FOUND REVERSED.

* -375 V IN 2D CIRCUIT REVISION ONLY.
-200 V IN ORIGINAL, FIRST REVISION, AND MODIFIED REVISIONS.
** MAY BE 365 V AC, 385 VAC, OR 440 V AC.

Figure 62. Frequency Meter TS-29/FMQ-1, normal tube socket voltage and resistance values.

f. Repeat steps *d* and *e* until the recorder and visual meter indicate 95.0 with a 190-cycle input and the recorder prints 20.0 with a 40-cycle input.

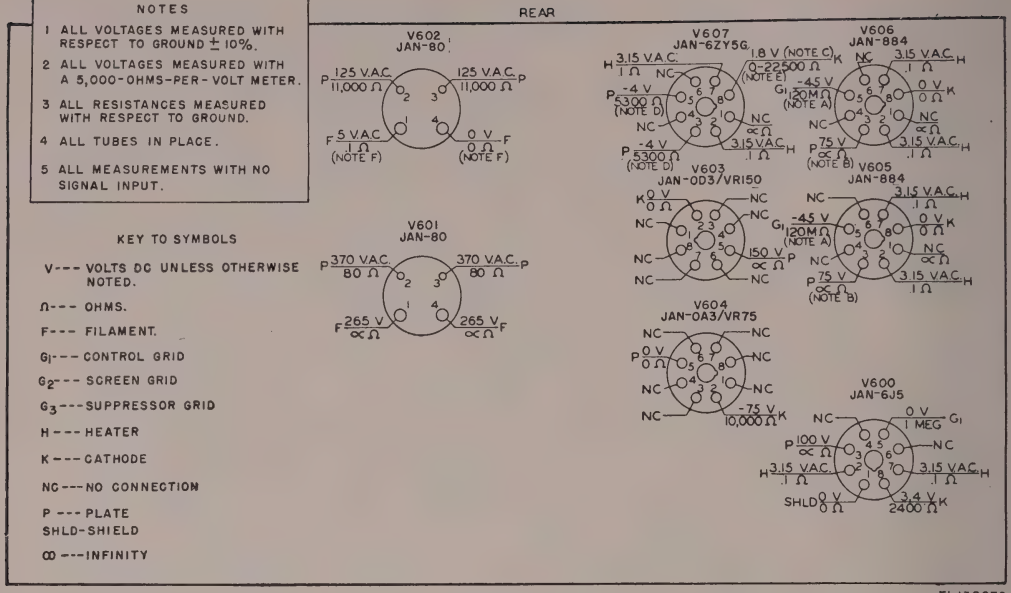
g. With a 100-cycle input, check the "50" print. If it is not correct within ±0.3 bi-cycle, move the recorder meter assembly backward or forward sufficiently to correct 5 times the error. For example, if the recorder prints 50.4, slide the meter forward until the recorder prints 48.4. Then start the alinement procedure, beginning with step *c*.

Note. Loosen recorder meter assembly mounting screws for adjusting meter; then retighten.

h. When the foregoing procedure of alinement is complete, the COARSE and FINE calibrators should be resting in about the center of their range of adjustment. If they are not, center them and adjust resistor R604, which is in series with the coarse and fine resistors, R614 and R613, until the visual meter and recorder give the correct indications of 190 cycles.

104. Calibration

a. Calibration is the process whereby two correction graphs are made, one for the recorder and one for the visual meter. The graphs show the correc-



SPECIAL NOTES: A. −45 VOLTS, VTVM, TUBE DEIONIZED. 1 VOLT, 5,000-OHMS-PER-VOLT METER. TUBE DEIONIZED.

B. +75 VOLTS, 884'S FIRING. 150 VOLTS, 884 DEIONIZED +15 VOLTS, 884 IONIZED.

C. +1.8 VOLTS, 884'S FIRING. 0 VOLTS, 884'S NOT FIRING.

D. −4 VOLTS, VTVM, −2.5 VOLTS, 5,000-OHMS-PER-VOLT METER

E. DEPENDS ON SETTING OF R604, R613, R614

F. FILAMENT READINGS MAY BE FOUND REVERSED.

Figure 63. Frequency Meter TS-29A/FMQ-1, normal tube socket voltage and resistance values.

Sample Calibration Table

Input freq	Recorder and visual meter should read—	Recorder reads—		Recorder average correction	Visual meter reads—		Visual meter average correction
		Down	Up		Down	Up	
190	95.0	95.0	95.0	0.0	95.0	95.0	0.0
180	90.0	90.0	90.0	0.0	90.1	90.0	0.0
160	80.0	80.0	80.0	0.0	80.1	80.1	−0.1
140	70.0	70.2	70.1	−0.2	70.0	70.0	0.0
120	60.0	60.3	60.2	−0.2	60.0	60.0	0.0
100	50.0	50.1	50.1	−0.1	50.1	50.0	0.0
80	40.0	40.0	40.0	0.0	40.1	40.1	−0.1
60	30.0	30.0	29.9	0.0	30.1	30.1	−0.1
40	20.0	20.0	20.0	0.0	20.0	20.0	0.0
20	10.0	9.9	9.9	+0.1	10.0	9.9	0.0
10	5.0	4.9	4.9	+0.1	5.0	5.0	0.0
SC	0.0	0.1		+0.1	0.0		0.0

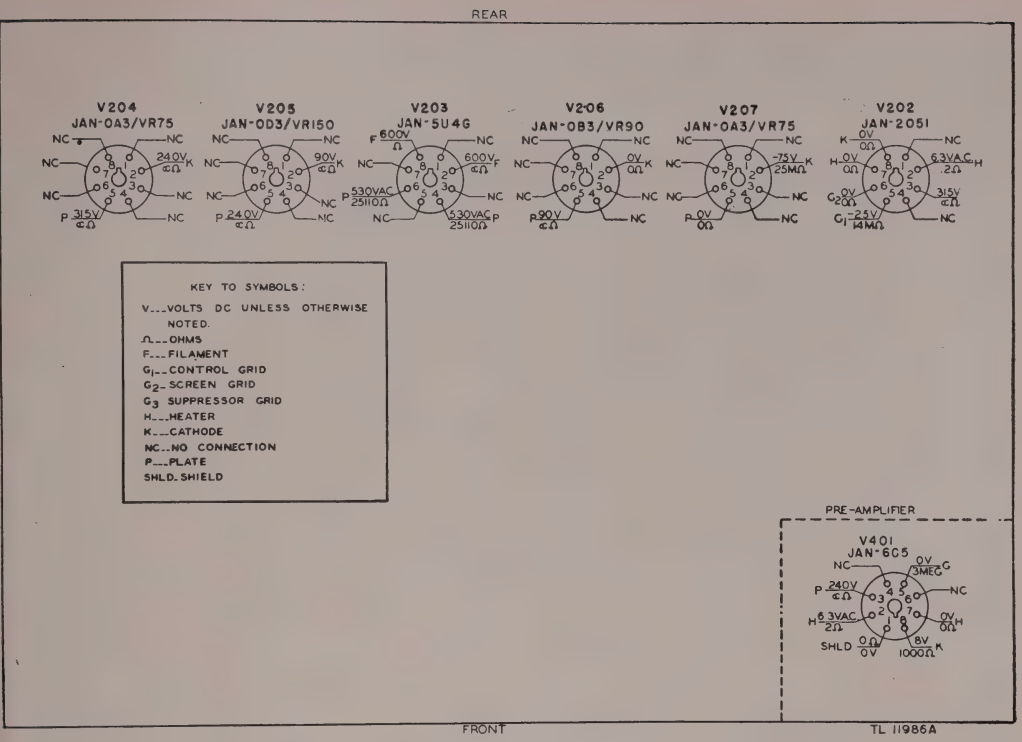


Figure 64. Amplifier AM-7/FMQ-1, normal tube socket voltage and resistance values.

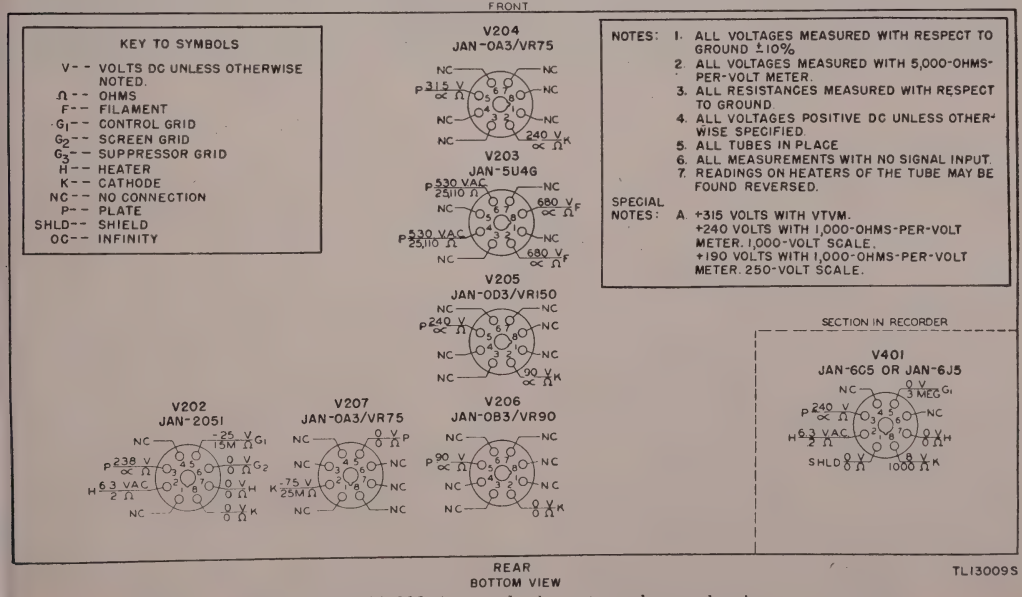


Figure 65. Amplifier AM-7A/FMQ-1, normal tube socket voltage and resistance measurements.

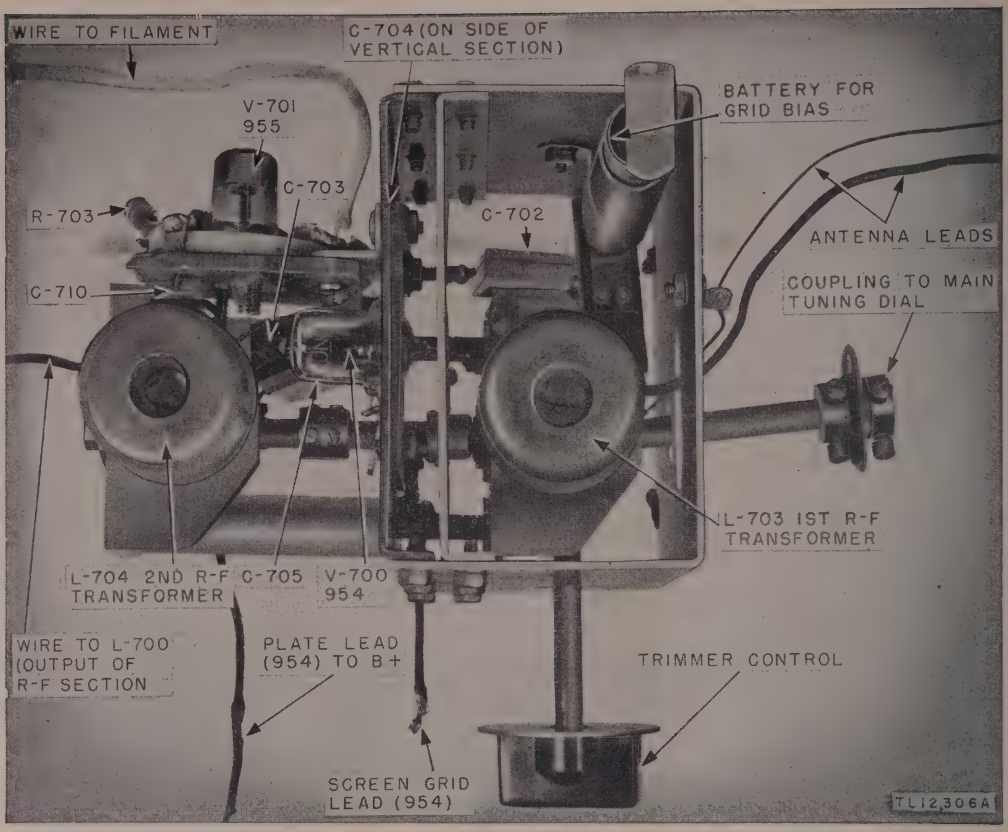


Figure 66. Radiosonde Receiver R–17/FMQ–1, top view of r-f section.

tions which are necessary if accurate computation of frequencies from the printed records or from observed indications on the visual meter is to be made. Calibration is the accumulation of the data and the plotting of the two correction graphs or calibration curves. Data are noted for each frequency produced by the frequency standard, going down the scale, then going up the scale, to eliminate meter pointer friction error. The correction figures are calculated and used for plotting the graphs. The use of a table similar to the Sample Calibration Table shown will aid in the tabulation of data.

b. Alinement of the frequency meter and recorder is preliminary to calibration. The ground station and power supply must be in excellent condition. It should be noted that after alinement, the recorder zero print may not be on the zero line of the recorder paper. This new position for the zero print is known as calibration zero. Calibrations shall be repeated as often as possible and the interval between calibrations shall not exceed one month.

105. Calibration Procedure

a. Before making the calibration run, let the recorder print for 15 minutes so that the paper will be running straight and the ground station components will have reached operating temperature. Also let the frequency generator warm up for 15 minutes. This may be omitted if the ground station was not turned off following the alinement procedure.

b. Check the print of the line frequency against the print of the 60-cycle output of the signal generator.

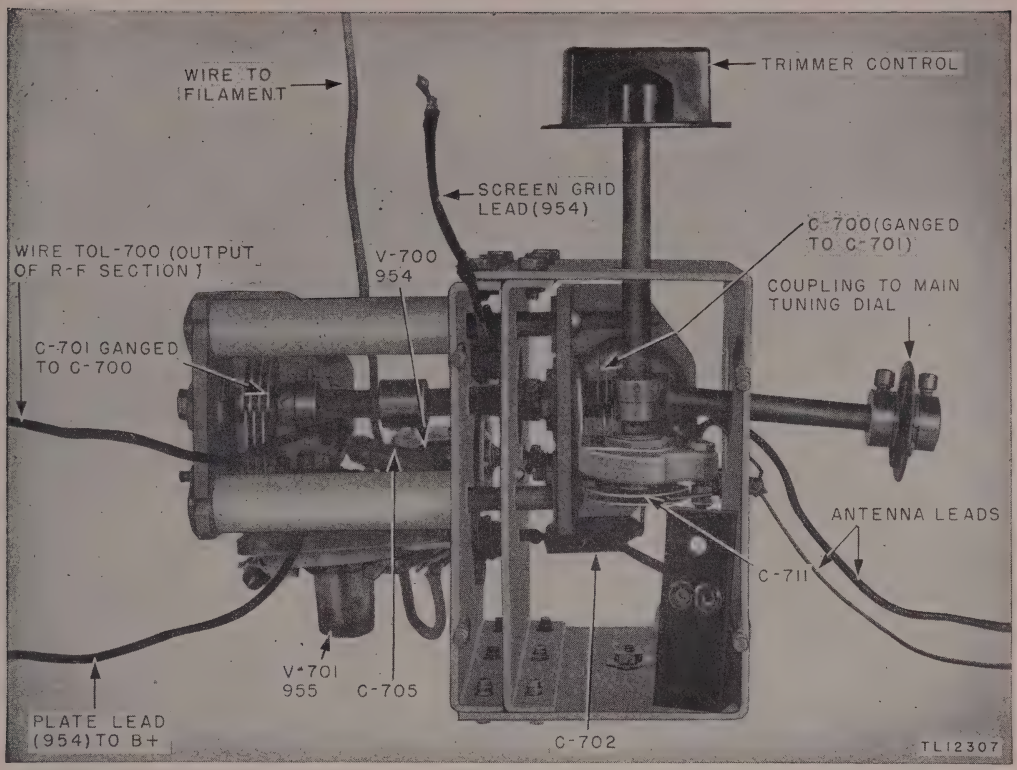


Figure 67. Radiosonde Receiver R-17/FMQ-1, bottom view of r-f section.

(1) Print 60 cycles from the signal generator for ¼ inch.

(2) Print SC (DEIONIZE) for ¼ inch.

(3) Turn INPUT switch of frequency meter to 60 cycles and let the recorder print 1 inch. It is permissible for this print to be slightly irregular, but it must not vary more than one cycle (½ bi-cycle). Furthermore, it must agree with the 60-cycle print from the frequency generator within ±2 cycles.

c. Starting with 190 cycles, switch in the frequencies in the order indicated on the sample calibration table. Go down the scale to zero, then up the scale to 190 cycles. Let the recorder print about ¼ inch on each frequency. For each frequency read the visual meter and the record print to the nearest $\frac{1}{10}$ of a bi-cycle, and enter the readings in the appropriate columns.

d. At the end of the calibration run, check the recorder for the location of the calibration zero print, and check the line frequency.

(1) Print the 60-cycle signal from the frequency generator for ¼ inch. This print must not have changed during the calibration run.

(2) Print SC (DEIONIZE) for ¼ inch.

(3) Print the line frequency for 1 inch (input switch on 60 cycles). This print must agree with the previous line frequency check.

(4) Print SC (DEIONIZE) for 2 feet. The recorder will be printing on calibration zero. Adjust the zero indicator pointer (located on the paper chute) to calibration zero.

e. Compute the average corrections to the nearest $\frac{1}{10}$ of a bi-cycle, making certain to use the proper sign (+ or —). For example, if the recorder prints 70.3 down and 70.2 up when it should have printed

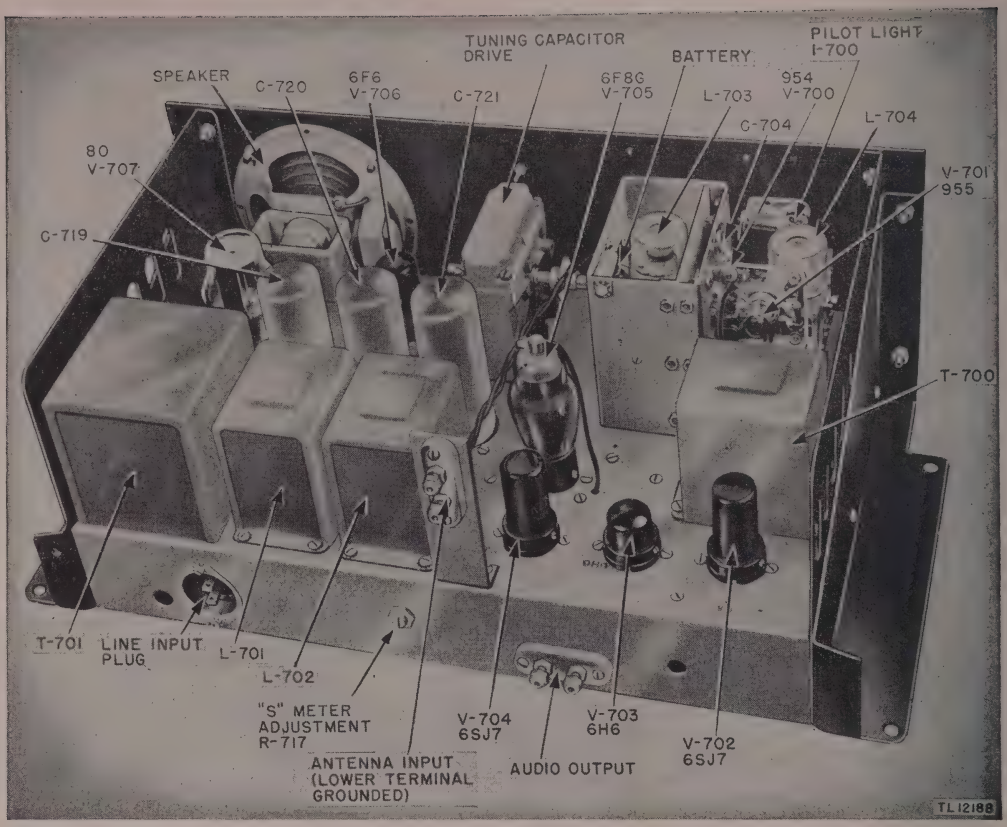


Figure 68. Radiosonde Receiver R-17/FMQ-1, rear view.

70.0 both times, the average correction is —0.25, which reduced to the nearest tenth is —0.2. If between 10 and 95 any average correction is greater than 0.3, investigate the possibility of reducing the error by moving the recorder meter assembly and realining.

f. In all cases the figures in the DOWN column should be the same or larger than in the UP column. If any pair of figures differ by more than 0.2 of a bi-cycle, there is excessive drag in the meter movement, and the meter should be replaced.

g. Attach a sample of the calibration zero to the ground station so that the operator may set the zero adjustment of the recorder before every flight.

h. Use the average correction figures to plot the two calibration curves. Plot them on the record paper just above the calibration run, between the 0 and 100 prints of the 1 foot SC run. Leave enough space above the calibration to include the information in step *j* below. Select two heavy, solid horizontal lines for base lines, and label one *Recorder Calibration Curve* and the other *Visual Meter Calibration Curve.* Plot the correction figures, using the base lines as 0.0 correction with plus corrections above and minus corrections below. Plot the points $\frac{1}{10}$ inch from the base line for each tenth of a bi-cycle in the correction figure. Connect the points with straight lines.

i. Make a copy of the calibration table on the record paper above the calibration curves.

j. Enter the following data above the calibration table:

(1) Name of station, call letters.

(2) Serial numbers of ground station and frequency generator.

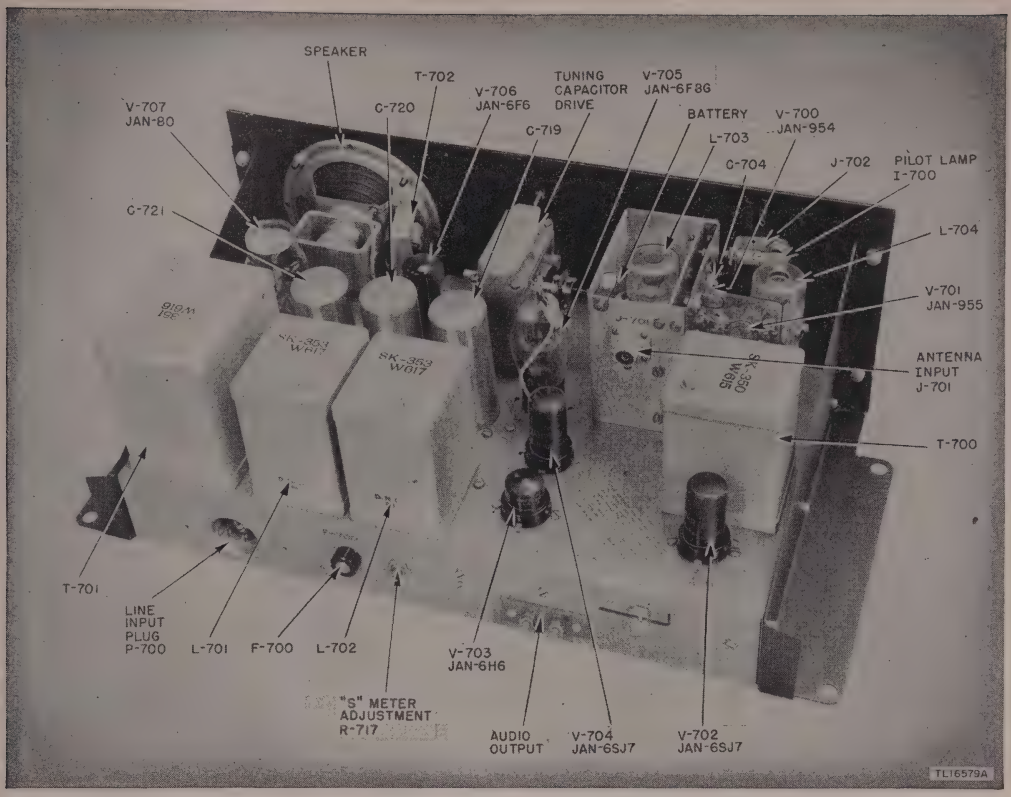


Figure 69. Radiosonde Receiver R-17A/FMQ-1, rear view.

(3) Date.

(4) Remarks, including repair or adjustment which was necessary.

(5) Signature of the maintenance man.

(6) Signature of the weather officer.

106. Basic Adjustment of Recorder

a. Adjust the position of the exciter lamp to get the maximum intensity of light on the target of the phototube. This is accomplished by means of the thumb adjusting screw, accessible from either the front or the rear of the recorder (figs. 18 and 44) on the base of the light disk assembly (fig. 45).

b. Adjust the lens assembly of the optical system so that the beam of light is in sharp narrow focus on the pointer of the recorder meter and is parallel to the edge of the pointer. A thumbscrew for this adjustment is accessible from either the front or the rear of the recorder (figs. 18 and 44).

c. To prevent interference with other adjustments (fig. 50)—

(1) Lower the dog leg stops so the end of the bolt is flush with the top of the nut.

(2) Raise the lower ribbon guides as far as possible.

(3) Raise the magnet cores as far away from the armature bar as possible.

(4) Raise the tapper bar by lowering the armature bar stop screw.

(5) Turn the rocker arm screw counterclockwise until it is flush with the rocker arm.

d. Remove all perceptible friction from the dog leg joints (fig. 51). Adjustment of the dog leg joints is rather difficult and should be done with the utmost care. For this adjustment, the dog leg springs

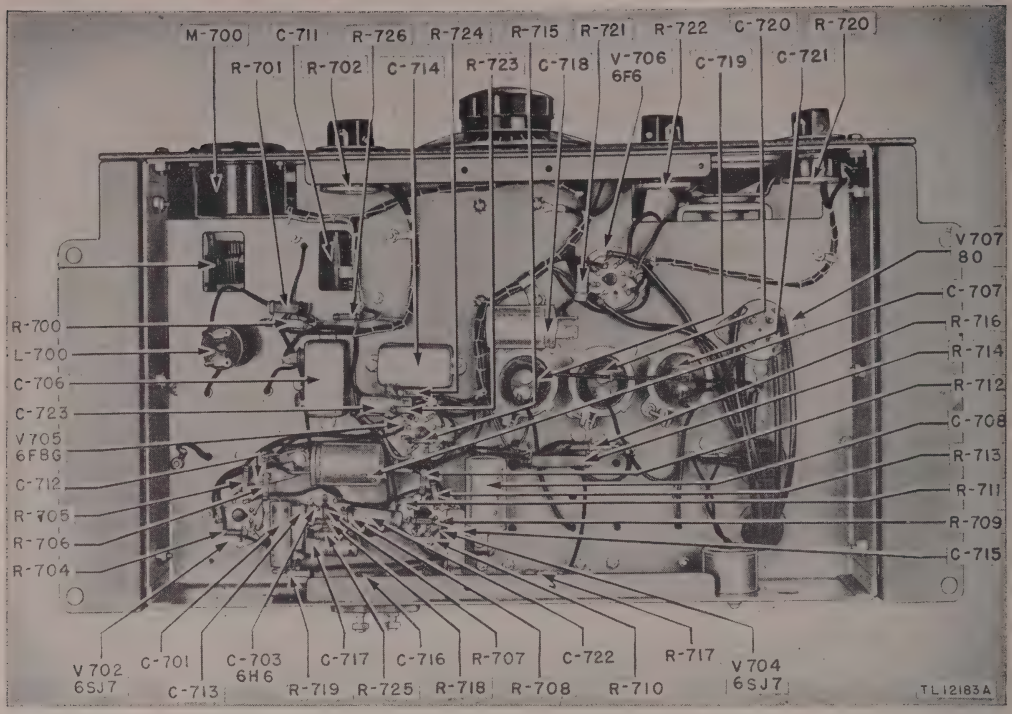


Figure 70. Radiosonde Receiver R–17/FMQ–1, bottom view.

must be removed and the rocker frame must be opened away from the spiral drum by use of the pull-out arm.

(1) To test for friction, place one finger under the middle of the bar and raise the tapper bar until the flange touches the rear arm. Move the bar up and down very slowly for a distance of about ¼ inch. If there is any friction, the pressure of the tapper bar against the finger will be slightly greater when raising the bar than when lowering it. Even the slightest friction detected in this manner must be removed.

(2) Four conditions that may cause friction and their remedies are—

Cause	*Remedy*
Burred, dirty, or gummy surfaces in the joint.	Polish off burrs with a piece of crocus cloth, and clean and oil the surfaces of the joint.
Contact surfaces of the front and rear arms not parallel.	This indicates that one of the arms or the tapper bar has become bent or twisted. Arms may be straightened with long-nose pliers. The tapper bar has a preformed curve, and care must be used so as not to straighten the bar beyond this point.
Bearing shoulder not wide enough to permit rear arm to move without binding.	Widen shoulder by placing threads of the pivot screw gently in a drill chuck, drill press, or lathe and cutting away a small portion of the screw head. Take care not to cut away enough of screw to weaken its head, but enough to prevent the dog leg joints from binding when the screw is tightened.

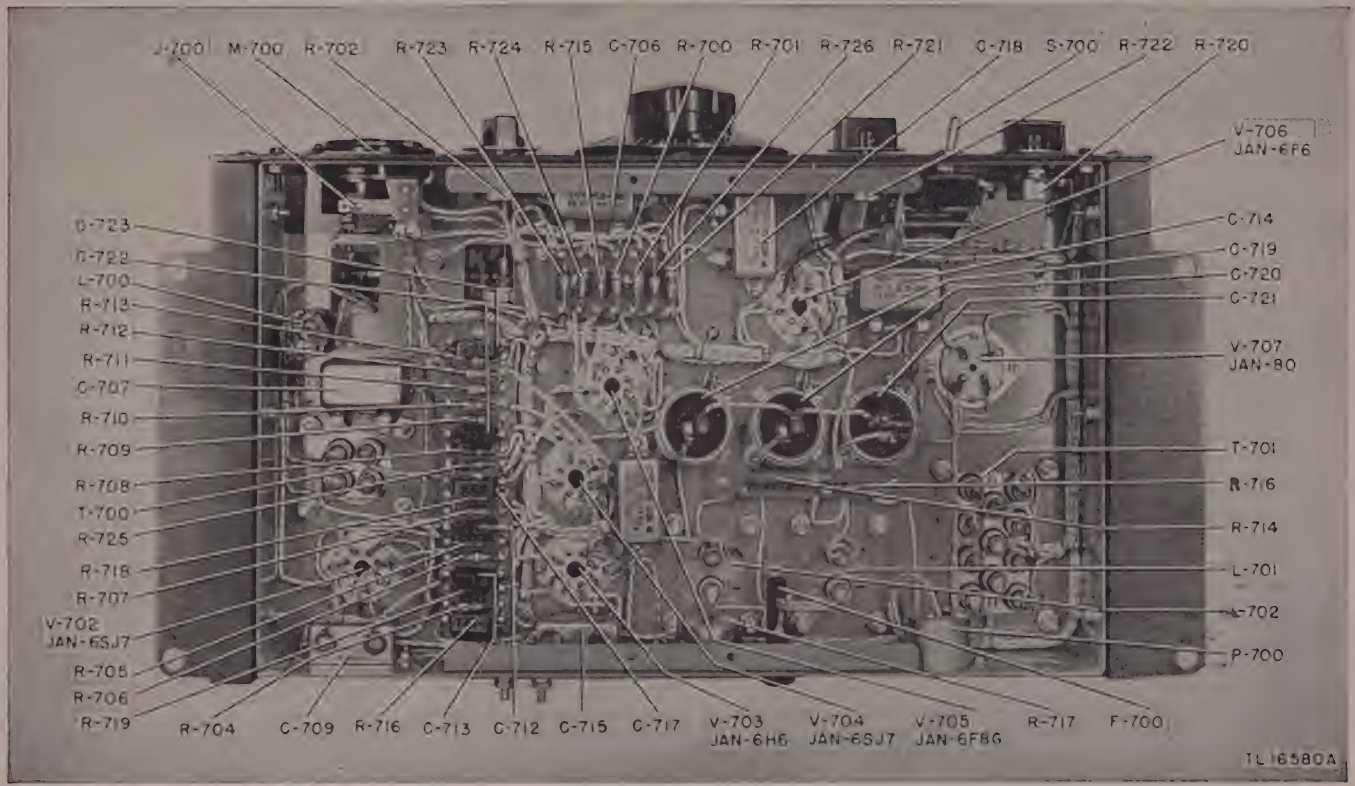


Figure 71. Radiosonde Receiver R-17A/FMQ-1, bottom view.

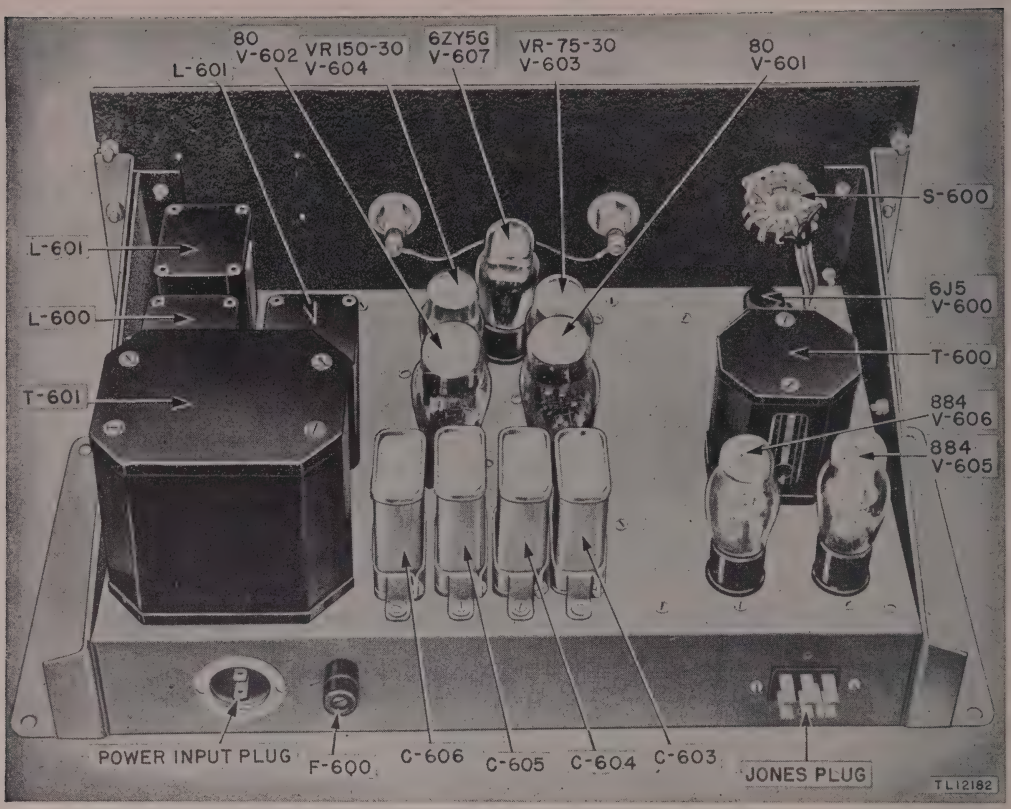


Figure 72. Frequency Meter TS-29/FMQ-1, rear view.

Cause	*Remedy*
Two rear arms too close or too far apart in comparison to two front arms.	Bend the two rear arms very slightly. These arms are made of light metal and may be bent with the fingers.

(3) Four conditions which might cause excess looseness in the dog leg joints and their remedies are—

Cause	*Remedy*
Hole in the front arm too large for the pivot bolt, causing front-to-rear looseness of front arm.	Change either front arm or pivot bolt, or both.
Bearing shoulder too wide, due to excessive wear of pivot bolt or front arm, causing side movement of front arm.	Remove a small portion of shoulder on pivot bolt with a file. Be careful not to make the shoulder too short.
Front arm flanges not touching rear arms of both dog legs. When lifting tapper bar, flanges on each side must touch at exactly the same time.	Usually, if one side touches before the other, the contact surface of the flange can be filed slightly to correct the trouble. If the difference is too much to be removed by filing the flange surface, it may be necessary to bend the part which is out of shape.
Dog leg pivot bolt too loose.	It should be tight enough to hold the bearing shoulder firmly against the rear arm and tight enough not to jar loose with vibration.

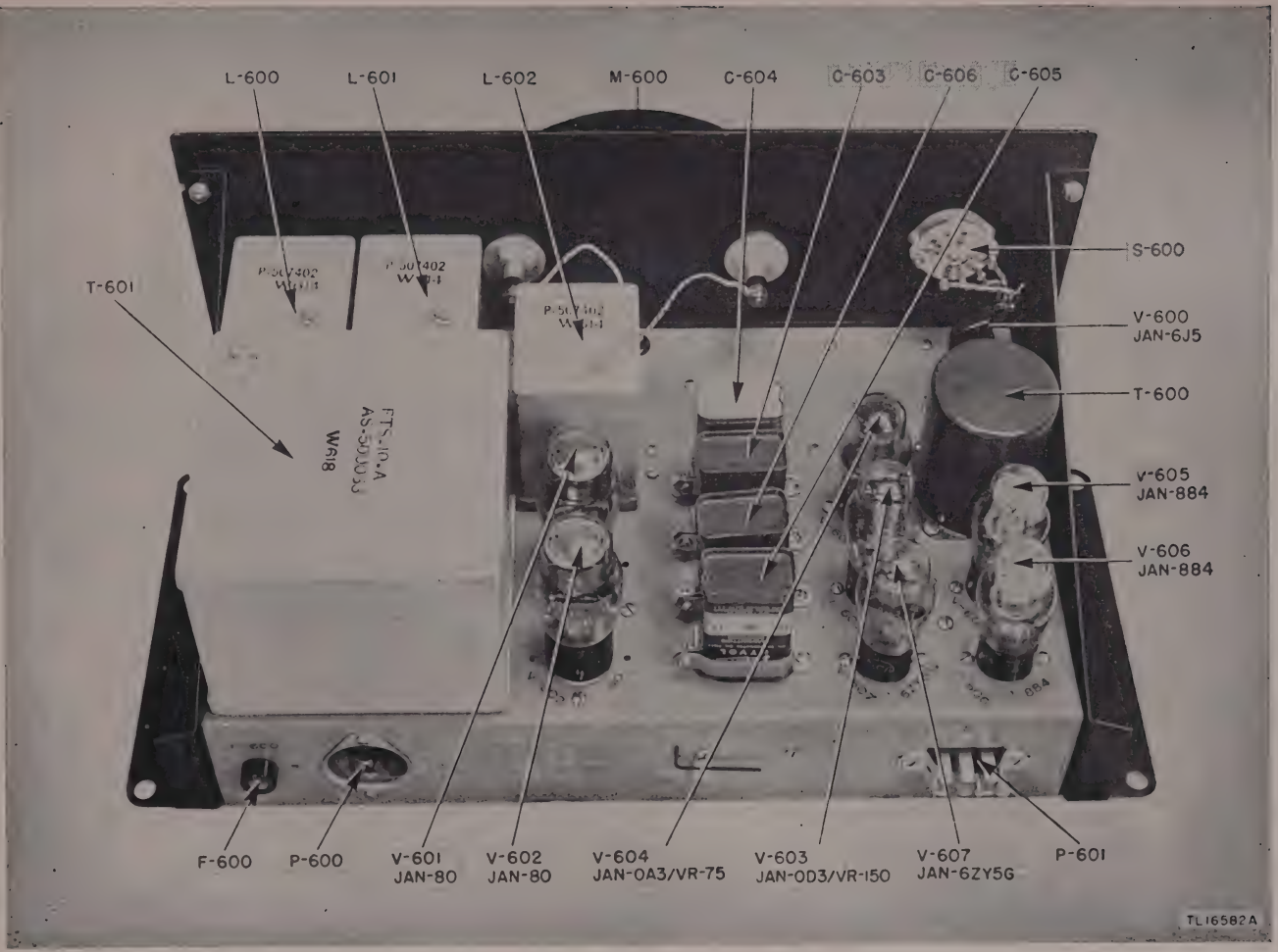


Figure 73. Frequency Meter TS-29A/FMQ-1, rear view.

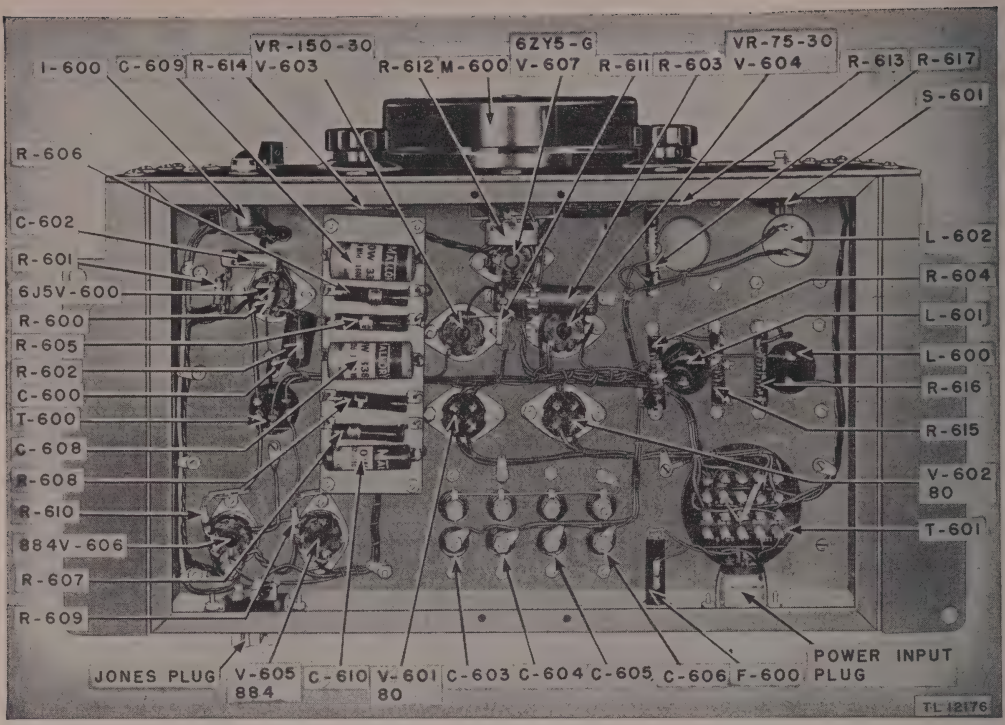


Figure 74. Frequency Meter TS-29/FMQ-1, bottom view.

e. Adjust the dog leg springs so that their combined equal tension will support a weight of 1 to 2 ounces suspended from the center of the tapper bar. The spanner wrench (1.7 ounces) found in the spare parts box is convenient for this purpose. Suspend the spanner wrench from the center of the tapper bar with a small piece of wire or string. Loosen the locknuts on each of the dog leg spring adjustment screws. Turn each of the adjusting screws the same amount so that each of the dog leg springs has equal tension. The combined tension of the dog leg springs should be just enough to keep the tapper bar in a raised position. Tighten the locknuts and remove the spanner wrench from the tapper bar.

f. Center the rocker frame adjusting screws and vertical locknuts (fig. 50).

Note. Loosen the vertical locknuts before turning the rocker frame adjustment screws.

g. Turn the rocker frame stop screw counterclockwise until it is just flush with the retainer boss. Then turn it clockwise five turns. The rocker frame must make solid contact with this screw (fig. 50).

h. Adjust the recorder to the 0–100 printing position by means of the rocker frame adjusting screws and obtain a clearance of about 0.002 inch (one thickness of recorder paper) between the tapper bar and spiral drum by use of the armature bar stop screw.

Note. 0–100 printing is not absolutely required if 95, 50, and 20 cannot be alined properly (par. 103) when recorder is printing 0–100 exactly.

i. The core of the tapper bar coil should be placed four thicknesses of recorder paper from the armature bar. To make this adjustment, first loosen the four screws which hold the cores in place. Insert four thicknesses of recorder paper (about 0.008 inch) between the magnets and the armature bar. Move the tapper bar cores so that they fit snugly against the paper and tighten the screws.

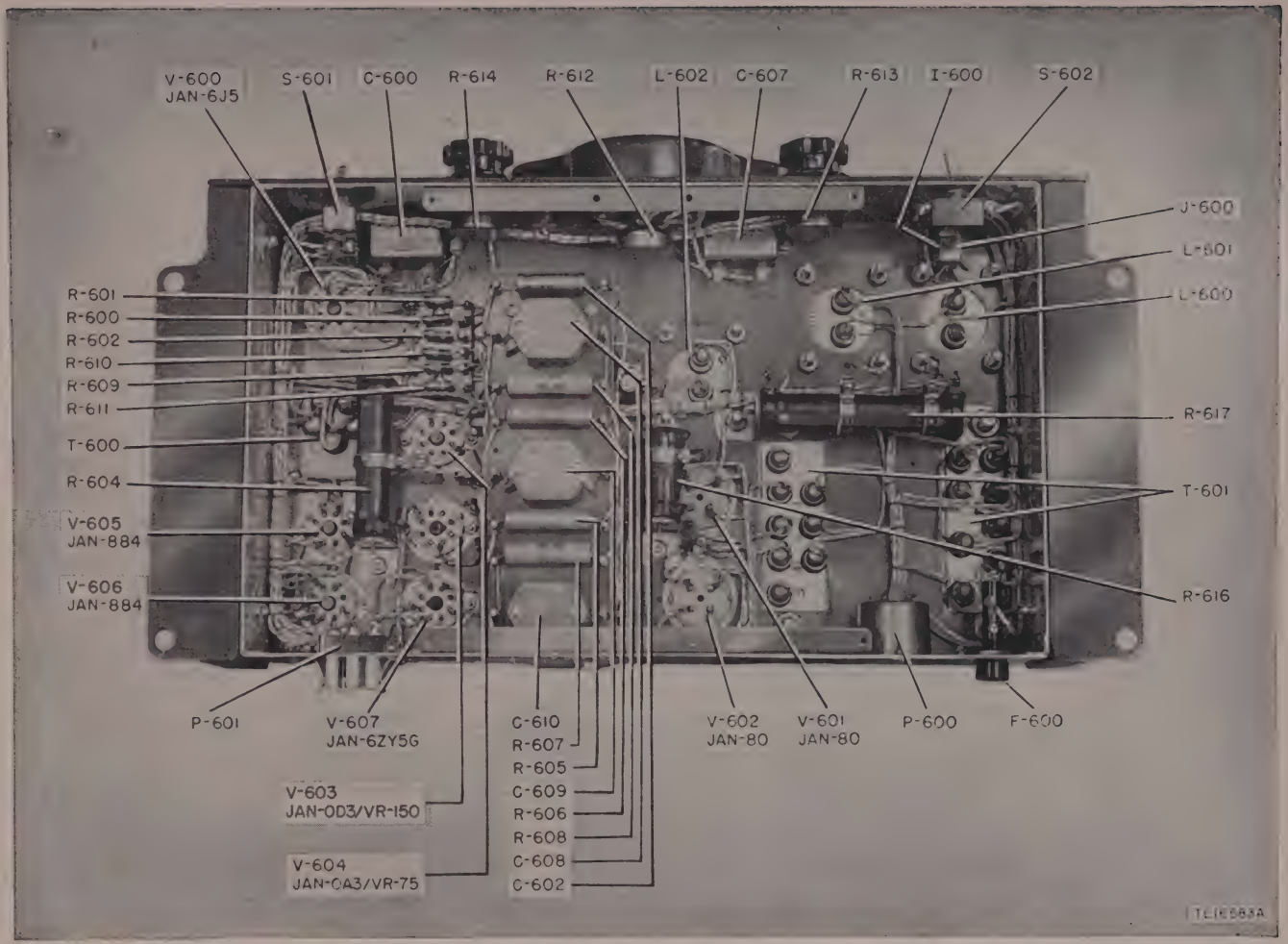


Figure 75. Frequency Meter TS-29A/FMQ-1, bottom view.

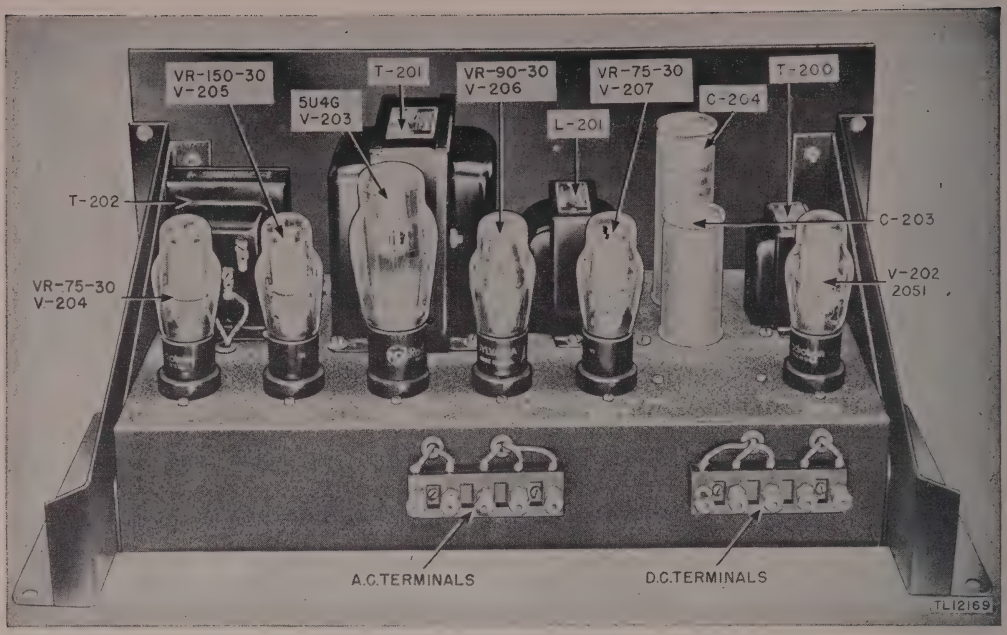


Figure 76. Amplifier AM-7/FMQ-1, rear view.

j. Adjust the tapper bar by use of the vertical locknuts so that the tapper bar is exactly level with respect to the spiral drum.

k. Raise the dog leg stops so that they lightly touch the dog legs (fig. 50).

l. Obtain a clearance of $\frac{1}{16}$ inch between the tapper bar and the spiral drum by adjusting the rocker frame stop screw (fig. 50).

m. Turn the rocker arm adjusting screw in the direction necessary to obtain a clearance of approximately $\frac{1}{64}$ inch between it and the rocker frame (fig. 50). The rocker arm adjusting screw must not touch the rocker frame while the recorder is in any printing position.

n. By use of the armature bar stop screw, obtain a clearance of $\frac{3}{32}$ inch between the tapper bar and the spiral drum (fig. 50).

o. Adjust the lower ribbon guides so that they hold the ribbon approximately $\frac{1}{32}$ inch below the tapper bar.

107. Correcting Faulty Print

Faulty print will be apparent in all or part of the following ways: wrong intensity of print; dissimilar printing of the "5" and "95"; irregular, drifting, erratic, or extra print; "0" falls out of place; or improper spacing of the "0" print from the "100" print. The faults should be corrected in the same order stated above unless it is obvious that a preliminary correction of some fault must be made before the sequence can be followed. Assuming the basic adjustments have been made, the procedure given below should be followed for the correction of faulty print of the recorder.

a. Wrong Intensity of Print. It is normal for the recorder to print the "5" and "95" light, the "0" and "100" medium (see note in par. 106*h*), and the "50" slightly heavy. To correct the intensity of the print, use only the armature bar stop screw, which adjusts the distance through which the force of the tapper bar coils act upon the armature bar. To increase the intensity of the print, lower the armature bar away from the tapper bar coils. This increases the acceleration distance of the tapper bar. Decrease the acceleration distance to decrease the intensity of the print.

Caution: Adjusting the rocker frame stop screw to overcome this difficulty requires a calibration check of the recorder.

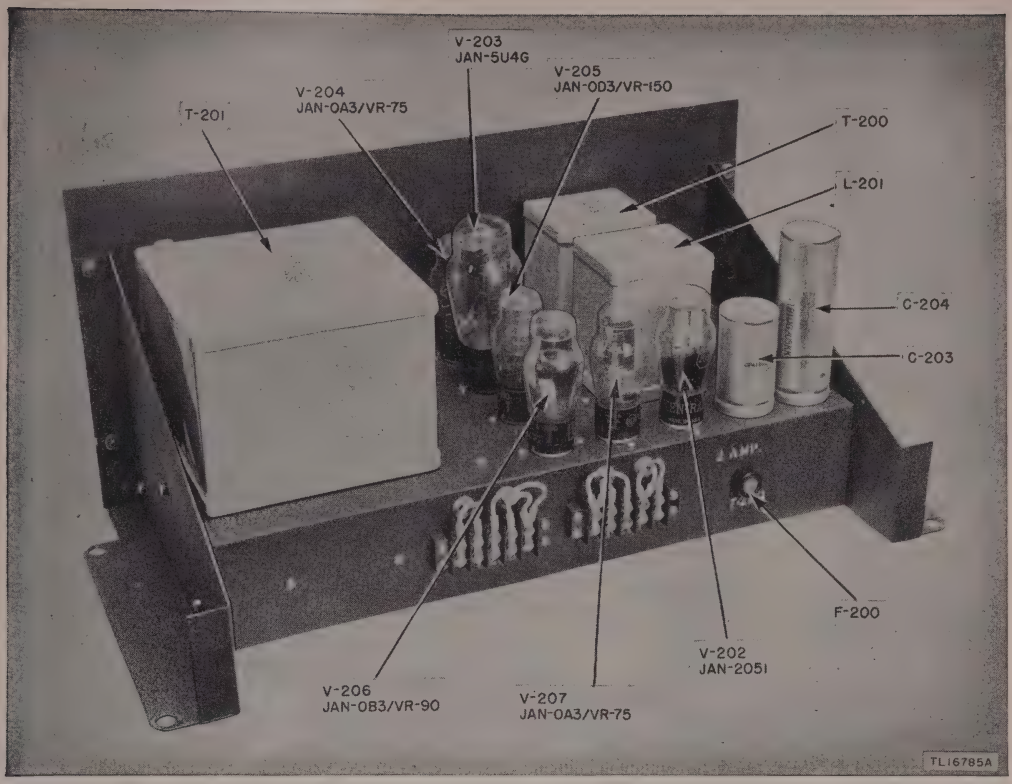


Figure 77. Amplifier AM–7A/FMQ–1, rear view.

b. Dissimilar Printing of "5" and "95". The "5" and "95" prints are dissimilar if one is darker than the other or if there is a shadow or phantom print on one side. This condition may be corrected as follows:

(1) Remove all friction or excess looseness from the dog leg joints.

(2) Be sure the vertical locknuts hold the tapper bar level with respect to the spiral drum.

(3) Adjust the dog leg stops so that both dog legs strike the stops at the same time.

(4) Be sure that the tapper bar coil cores are equidistant from the armature bar.

(5) Be sure that the dog leg springs have equal tension.

c. Drifting, Erratic, or Extra Print. Faulty electrical parts such as dirty or worn slip rings and brushes, loose parts on the scanning assembly, varying current from the frequency meter, or faulty action of the recorder amplifier will cause the recorder to print unevenly. Remove the brushes and disks, and clean the contact surfaces with crocus cloth. Tighten all loose parts and check the mechanical adjustment by referring to steps *a, b, d, k, m, n,* and *o* in the preliminary basic adjustments given in paragraph 106.

d. "0" Print Out of Place. This condition may be corrected by use of the recorder meter zero adjusting knob. The recorder is printing "0" correctly if the left-hand edge of the black print coincides with the calibration zero indicator located on the paper chute.

Note. Calibration ZERO should not exceed ±0.3 bi-cycles.

e. Improper Spacing of the "0" Print from the "100" Print. The spiral ridge is mounted on the spiral drum so that the proper spacing of the "0" print from the "100" print is obtained when

the tapper bar is parallel with the horizontal axis of the spiral drum (fig. 52). Adjustment is made by use of the rocker frame adjusting screws (after loosening the vertical locknuts), two on the left side and two on the right side of the rocker frame.

If the tapper bar is in position AB, as shown by the dotted line, the "0" and "100" prints will be too close together; but with the tapper bar in the position indicated by the solid line, the spacing between "0" and "100" will be correct (par. 106*h*).

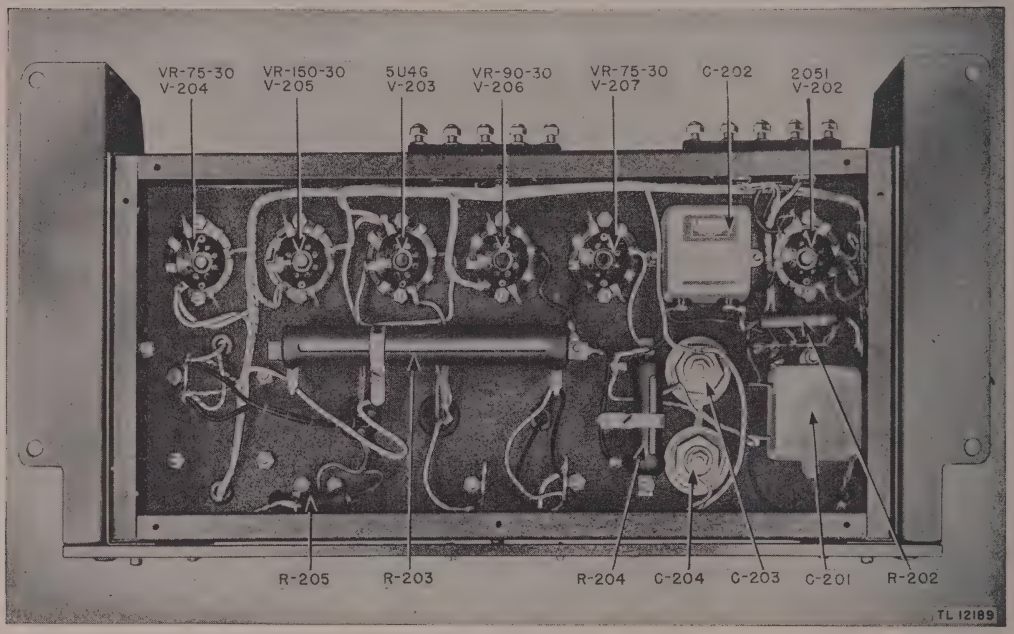


Figure 78. Amplifier, AM–7/FMQ–1, bottom view.

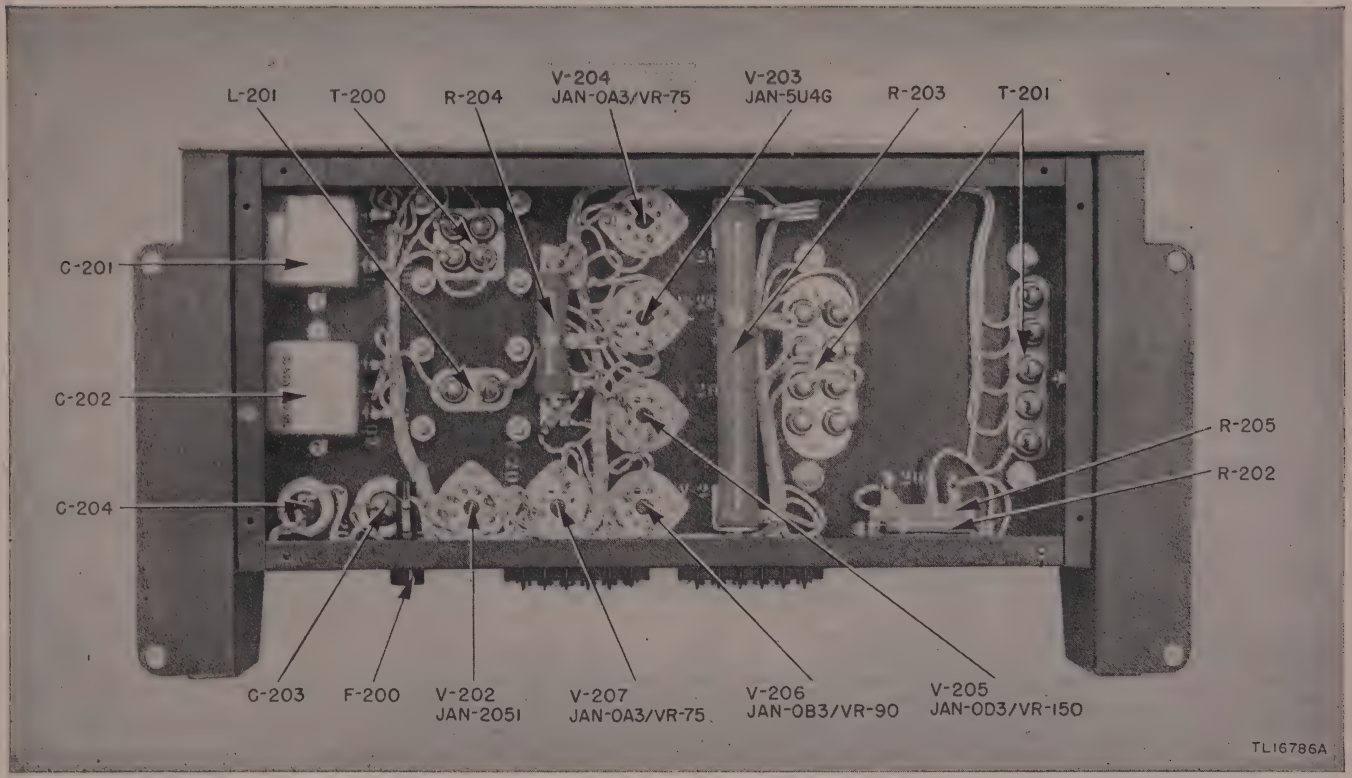


Figure 79. Amplifier AM-7A/FMQ-1, bottom view.

APPENDIX I

INSTALLATION AND USE OF TEST SET I-209-( ) IN RADIOSONDE RECEPTOR AN/FMQ-1

1. Description

Test Set I-209-( ) consists of a vibrating reed line frequency meter and an a-c voltmeter mounted in a wooden case and provided with a connecting cord for attaching the meters to the power supply line of Radiosonde Receptor AN/FMQ-1. (In Radiosonde Receptor AN/FMQ-1A these meters are included in Rack Assembly MT-47A/FMQ-1.)

2. Installation

To install the test set proceed as follows:

a. Check the test set to see that it is in proper operating condition (see TM 11-2501).

b. Place the test set in position in the left rear corner of the writing shelf of the receptor.

c. Locate the 1½-inch diameter ventilation hole in the lower rear section of the left side shield in the rack assembly. This hole is opposite the left heater lamp socket in the bottom rear section of the receptor.

d. With diagonal cutting pliers, cut away the wire mesh screen from the ventilation hole.

e. With a half-round file, smooth the cut edges of the screen.

f. Remove the left heater lamp from its socket. Insert the adapter plug furnished with Test Set I-209-( ) into this socket and place the heater lamp in the adapter plug.

g. Insert the test set line cord plug into the receptacle on the adapter plug.

3. Operation

a. Turn the master switch of the receptor OFF.

b. Start the power unit used with the receptor.

c. Check the operation of the heater lamp switches to make sure that they turn the lamps and the test set on and off. Leave the switches turned on.

d. Check to see that the test set is indicating both frequency and voltage.

e. In normal operation of the radiosonde receptor, follow this procedure:

(1) Warm up the gasoline engine power unit used with the receptor, in accordance with the instructions furnished with the power unit.

(2) After the normal warm-up period, with the master switch on the receptor off and the heater lamp switches on, connect the receptor to the power unit.

(3) Check to see that the frequency meter switch on the test set is on. Adjust the governor of the power unit as required, until the frequency meter indication is a steady 59 cycles. The voltage should be constant between 110 and 125 volts.

(4) Operate the power unit with the lamp load for 5 minutes.

(5) Check the frequency and voltage. If both frequency and voltage have remained constant for 5 minutes, turn the master switch on the receptor on. If the frequency and voltage have not remained steady during this period, readjust the power unit.

(6) After frequency and voltage have remained constant 5 minutes, and with the master switch of the receptor on, readjust the power unit until the frequency meter indicates 60 cycles.

(7) Note the voltage indicated on the test set.

(8) Operate the power unit and receptor for 5 minutes. Check to see that the voltage and frequency remain constant.

APPENDIX II

REFERENCES

Note. For availability of items listed, check FM 21–6 and Department of the Army Supply Catalog SIG 1 & 2. Also see latest issue of FM 21–6 for applicable technical bulletins, supply bulletins, modification work orders, and changes.

1. Army Regulations

AR 380–5, Safeguarding Military Information.

2. Supply Publications

SIG 1 & 2, Introduction and Index.
SIG 7 & 8, Organizational and Higher Echelon Spare Parts.
SB 11–76, Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.
SB 11–17, Electron Tube Supply and Reference Data.

3. Technical Manuals on Auxiliary Equipment and Test Equipment

TM 11–300, Frequency Meter Sets SCR–211–( ).
TM 11–303, Test Sets I–56–C, –D, –H, and –J.
TM 11–321, Test Set I–56–E.
TM 11–472, Repair and Calibration of Electrical Measuring Instruments.
TM 11–2501, Test Set I–209–A.
TM 11–2602, Frequency Standard TS–65/FMQ–1.
TM 11–2602A, Frequency Standard TS–65A/FMQ–1.
TM 11–2627, Tube Tester I–177.

4. Preserving and Lubrication

TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69, Lubrication of Ground Signal Equipment.

5. Camouflage

FM 5–20, Camouflage, Basic Principles.

6. Packaging and Packing Instructions

a. Joint Army-Navy Packaging Specifications.
JAN–D–169, Desiccants, Activated.
JAN–P–75, Tubes, Radio, Electron.
JAN–P–100, General Specifications.
JAN–P–101, Adhesive, Water-resistant, for Sealing Fiberboard.
JAN–P–106, Boxes, Wood, Nailed.
JAN–P–115, Compound, Sealing, Dipcoating.
JAN–P–116, Preservation, Methods of.
JAN–P–117, Bags, Interior Packaging.
JAN–P–121, Barrier Material, Greaseproof.
JAN–P–125, Barrier Material, Waterproof.
JAN–P–127, Tape, Adhesive, Pressure Sensitive, Water-resistant.
JAN–P–128, Tape, Water-resistant, Gummed.
JAN–P–131, Barrier Material, Moisture-Vaporproof, Flexible.
JPI–7, Packaging and Packing of Hardware, Builders and Pole Line.
b. U. S. Army Specifications.
100–2, Marking Shipments by Contractors (and Signal Corps Supplement thereto).
c. Signal Corps Instructions.
720–7, Standard Pack.
726–15, Interior Marking.

7. Decontamination

TM 3–220, Decontamination.

8. Demolition

FM 5–25, Explosives and Demolitions.

9. Other Publications

FM 21–6, List and Index of War Department Publications.
FM 24–18, Radio Communication.
FM 72–20, Jungle Warfare.
TB SIG 4, Methods for Improving the Effectiveness of Jungle Radio Communication.

TB SIG 25, Preventive Maintenance of Power Cords.
TB SIG 66, Winter Maintenance of Signal Equipment.
TB SIG 72, Tropical Maintenance of Ground Signal Equipment.
TB SIG 75, Desert Maintenance of Ground Signal Equipment.
TM 11–453, Shop Work.
TM 11–455, Radio Fundamentals.
TM 11–466, Radar Electronic Fundamentals.
TM 11–483, Suppression of Radio Noises.
TM 11–496, Training Text and Applicatory Exercises for Amplitude-modulated Radio Sets.
TM 11–499, Radio Propagation Handbooks.
TB 11–499–( )*, Basic Radio Propagation Predictions.
TM 11–1158A, Radio Set SCR–658.
TM 11–2405, Meteorological Balloons.
TM 11–2424, Instructions for Modulated Audio Frequency Radiosonde Observations (WBAN RAOB manual).
TM 11–2430, Radiosondes AN/AMT–1 and AN/AMT–2.
TM 11–4000, Trouble Shooting and Repair of Radio Equipment.

10. Forms

WD AGO Form 468, Unsatisfactory Equipment Report.
AF Form 54, Unsatisfactory Report.

11. Abbreviations

See list of abbreviations in TM 11–455, Radio Fundamentals.

12. Glossary

See glossary in TM 11–455, Radio Fundamentals.

*A new TB in this series is issued monthly which gives propagation predictions 3 months in advance.

APPENDIX III

IDENTIFICATION TABLES OF REPLACEABLE PARTS

Note. The fact that an item appears in this technical manual is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as T/O & E, TE, TA, T/BA, SIG 6, SIG 7 & 8, SIG 7–8–10, SIG 10, list of allowances of expendable material or other authorized supply basis. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1 & 2.

Table I. Identification Table of Replaceable Parts for Radiosonde Receptors AN/FMQ–1 and AN/FMQ–1A

Ref. symbol	Models	Name of part and description	Function of part	Signal Corps stock No.
		RADIOSONDE RECEPTORS AN/FMQ–1 and AN/FMQ–1A: reception and recording of met. data transmitted by audio-modulated radiosonde; recording type; AM reception; 56 to 85 mc; 110 v, 60 cyc, 450 w; rack mtd; approx 72″ h x 28″ wd x 26″ d.	.....	7A1326
		TECHNICAL MANUAL TM 11–2403.....	Instruction manual (technical).	(Order through AGO channels)
		AMPLIFIER AM–7/FMQ–1: AF; approx 28″ wd x 26″ d x 24″ h.	Builds up pulse received from recorder scanning system to energize recorder tapper coils.	7A46–7
		ANTENNA ASSEMBLY AS–11/FMQ–1: dipole; receiving; one piece antenna approx 72″ lg; includes 200 ft Army-Navy Radio Frequency Cable RG–11/U; fixed.	Picks up r-f energy transmitted by radiosonde.	7A1326/A1
		CABLE ASSEMBLY, power two #18 AWG stranded copper cond; rubber-jacketed; round, 7/16″ diam; 10 ft lg including term.; w/Hubbell No. 9102; 2 cont male connector one end; Hubbell No. 7224, 2 cont female connector other end; Friez dwg No. 507593–1.	For a-c supply...	3E7293
		CONNECTOR, female contact: 2 parallel cont; straight; 2¼″ lg x 1¾″ diam; Hubbell No. 7224.	For a-c cord.....	6Z3150
		CONNECTOR, male contact; 2 parallel twist-lock polarized cont; straight; 1⅞″ lg x 1⅜″ diam; Hubbell No. 9102.	For a-c cord.....	6Z1735.2
		FREQUENCY METER TS–29/FMQ–1: u/w radiosonde equipment; 0–200 cps in one band; 28″ wd x 26″ d x 12″ h.	Indicates modulation frequency of radiosonde transmission.	7A889–29
		GROUND ROD MX–148/G: galv steel; 72″ lg x ¾″ diam; Sig C spec No. 71–3121.	Establishes ground connection for equipment.	3Z3330–148

Table I. Identification Table of Replaceable Parts for Radiosonde Receptors AN/FMQ-1 and AN/FMQ-1A—Continued

Ref. symbol	Models	Name of part and description	Function of part	Signal Corps stock No.
		RACK ASSEMBLY MT-47/FMQ-1: houses radiosonde receptor components; steel; approx 72" h x 28" wd x 26" d; includes folding table.	.....	7A8337-47
		RADIOSONDE RECEIVER R-17/FMQ-1: receives data transmitted by radiosonde; AM reception; 56 to 85 mc; 110 v, 60 cyc; rack mtd; approx 28" wd x 26" d x 12" h.	.....	7A8340-17
		RADIOSONDE RECORDER RD-3/FMQ-1: chart; printed dot type; approx 21" wd x 17" h x 18" d over-all; 110 v, 60 cyc.	Records frequencies indicated by frequency meter TS-29 (*)/FMQ-1.	7A1326-3
		VOLTAGE REGULATOR CN-2/FMQ-1: input 95-130 v, 2.3 amp, 60 cyc, output 115 v ±0.5%, 1.3 amp, 60 cyc; approx 5¾" h x 5¾" d x 15" wd over-all.	Regulates a-c power supplied to portion of equipment.	7A1680
		WIRE, electrical: Sig C Cable WC-679; insulated; single #10 AWG cond; copper; 0.275" OD; seven #18 AWG strands; black; rubber-insulated; impregnated black braid.	Grounding lead..	1B1679

Table II. Identification Table of Replaceable Parts for Amplifiers AM-7/FMQ-1 and AM-7A/FMQ-1

Ref. symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	AM-7/FMQ-1	AM-7A/FMQ-1			
			AMPLIFIERS AM-7/FMQ-1 and AM-7A/FMQ-1: approx 28" wd x 26" d x 24" h.	Builds up pulse received from recorder scanning system to energize recorder tapper coils.	7A46-7
P200, P201		*	BOARD, terminal: 5 brass nickel pl screw term.; molded bakelite; 2 15/16" lg x 1⅛" wd x ½" h over-all; Jones HB No. 5-141.	.....	2Z9405.1
	*		BOARD, terminal: 5 solder lugs w/term.; black phenolic; 3¾" lg x 1½" wd x ⅞" thk over-all; Friez dwg No. 504365.	.....	7A371-6
C201	*	*	CAPACITOR, fixed: paper; 1 mf ±10%; 600 vdcw; max over-all dimen 2" lg x 1¾" wd x 1" h; JAN type CP53B1EF105K.	A-f bypass, grid circuit of tube V202.	3DB1-139
C202	*	*	CAPACITOR, fixed: paper; 1 mf ±10%; 1,000 vdcw; max over-all dimen 2" lg x 2" wd x 1⅛" h; JAN type CP53B1EG105K.	Plate voltage source for tube V202. (See paragraph 89.)	3DB1-140

Table II. Identification Table of Replaceable Parts for Amplifiers AM-7/FMQ-1 and AM-7A/FMQ-1—Continued

Ref. symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	AM-7/FMQ-1	AM-7A/FMQ-1			
C203	*	*	CAPACITOR, fixed: paper; 1 mf ±10%; 1,000 vdcw; body dimen 3⅜" lg x 1½" diam; JAN type CP41B1EG105K.	Filter, power supply.....	3DB1–56
C204	*	*	CAPACITOR, fixed: paper; 2 mf ±10%; 1,000 vdcw; body dimen 4½" lg x 1½" diam; JAN type CP41B1DG205K.	Filter, power supply.....	3DB2–74
F200	*	*	FUSE FU–27: cartridge; 2 amp, 250 v; glass body; ferrule term.; 1¼" lg x ¼" diam over-all.	Overload protection	3Z1927
	*		HOLDER, fuse: block type; for single No. 3AG fuse; bakelite base w/Shakeproof tinned term.; 1⅝" x ½" x 3/16; Littelfuse No. 351001.	Holds Fuse FU–27.....	3Z3276
		*	HOLDER, fuse: extractor post; for single No. 3AG fuse; bakelite body; 10 amp max; 2⅛" lg x ⅝" OD over-all; Littelfuse No. 41001.	Same as above	3Z3275
L201		*	REACTOR: filter choke; single winding; 15 hy; 85 ma, 375 ohms dc resistance; HS metal case; 2⅞" wd x 4⅞" h x 2½" d over-all; Dinion Coil No. W–614.	Filter, power supply.....	7A702–6
L201	*		REACTOR: filter choke; single winding; 32 hy at 0 amp, 15 hy at 85 ma; 375 ohms d-c resistance; inclosed metal case; 3⅜" lg x 2½" wd x 3" d; Thordarson No. T16CO7.	Same as above	7A702
R205	*	*	RESISTOR, adjustable: wire-wound; 1 ohm ±5%; 10 w; 1¾" lg x 5/16" diam; IRC No. ABA.	Adjustment of voltage for tube heaters.	3Z5991–88
R203	*	*	RESISTOR, adjustable: wire-wound; 15,000 ohms; 75 w; 6½" lg x ¾" diam; IRC No. ESA.	Series regulation	3Z6615–86
R204	*	*	RESISTOR, adjustable: wire-wound; 25,000 ohms ±10%; 25 w; 2½" lg x 9/16" diam; IRC No. DHA.	Voltage divider	3Z6625–76
R202	*	*	RESISTOR, fixed: composition; 150,000 ohms ±10%; 2 w; max body dimen 1.78" lg x 0.405" diam; JAN type RC41BF154K.	Charging resistor for capacitor C202.	3RC41BF154K
	*	*	SOCKET, tube: std octal; isolantite; 1⅞" lg x 1½" wd x ¾" thk; Natl Co No. CIR–8.	.....	2Z8678.53
T200	*		TRANSFORMER, AF: plate coupling type; pri 10,000 ohms; secd 90,000 ohms impedance; inclosed metal case; 2⅞" lg x 2⅛" wd x 2⅜" h; Thordarson No. T57A36.	Interstage, tubes V401 and V202.	2ZK9717-57A36
T200		*	TRANSFORMER, AF: plate coupling type; pri 10,000 ohms; secd 90,000 ohms impedance; inclosed metal case, oil-filled; 4⅞" h x 2⅞" x 2½" over-all; Dinion Coil No. W–613.	Same as above	7A1860–3
T202	*		TRANSFORMER, power: fil; pri 105/115 v, 60 cyc; secd 6.3 v, 5 amp, CI; 3 11/16" h x 2⅞" wd x 2 13/16" d; Thordarson No. T–73F60.	Furnishes 8 volts ac to exciter lamp.	2Z9611.16

Table II. Identification Table of Replaceable Parts for Amplifiers AM-7/FMQ-1 and AM-7A/FMQ-1—Continued

Ref. symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	AM-7/FMQ-1	AM-7A/FMQ-1			
T201	*		TRANSFORMER, power: plate and fil; pri 105/115 v, 60 cyc; secd No. 1, 1,120 v, 150 ma, CT; secd No. 2, 5 v, 3 amp; secd No. 3, 6.3 v, 3 amp, CT; secd No. 4, 7.5 v, 2.5 amp, CT; 3¾" x 4" x 4⅞"; Thordarson No. T-19R30.	Power	2ZK9717-19R30
T201		*	TRANSFORMER, power plate and fil; pri tapped 105/115/125 v, 60 cyc; secd No. 1, 1,120 v, 150 ma, CT; secd No. 2, 6.3 v, 5 amp; secd No. 3, 6.3 v, 3 amp; secd No. 4, 5 v, 3 amp; HS metal case; 5¾" wd x 5¾" d x 5$^{11}/_{16}$" h over-all; Dinion Coil No. W-611.	Same as above	7A1860.2-0
V204 V207	*	*	TUBE, electron: JAN-OA3/VR-75	Gas voltage regulator	2JOA3/VR75
V206	*	*	TUBE, electron: JAN-OB3/VR-90	Same as above	2JOB3/VR90
V205	*	*	TUBE, electron: JAN-OD3/VR-150	Same as above	2JOD3/VR150
V203	*	*	TUBE, electron: JAN-5U4G	Rectifier	2J5U4G
V202	*	*	TUBE, electron: JAN-2050	Thyratron amplifier	2J2050

Table III. Identification Table and Replaceable Parts for Antenna Assemblies AS-11/FMQ-1 and AS-11A/FMQ-1

Ref. symbol	Models	Name of part and description	Function of part	Signal Corps stock No.
		ANTENNA ASSEMBLIES AS-11/FMQ-1 and AS-11A/FMQ-1: dipole; receiving; one piece antenna approx 72" lg, includes 200 ft Army-Navy Radio Frequency Cable RG-11/U; fixed.	Picks up energy transmitter by radiosonde.	7A1326/A1
		ANTENNA: whip; hardened steel, zinc chromate; one piece; 41⅝" lg x 5/16" diam one end, 0.110" diam w/$^{5}/_{32}$" diam ball other end; Comm Prod No. M32-10794.		7A93.1
		CABLE, RF: Army-Navy Radio Frequency Cable RG-11/U; coaxial; flexible; impedance 75 ohms; inner cond, seven #26 AWG strands plain copper; outer cond single braid; polyethylene "A" dielectric; vinylite jacket, 0.405" OD.	R-f transmission line from antenna to radiosonde receiver.	1F425-11
		CONNECTOR, male contact: Sig C Plug PL-259; single round cont; straight; 1½" lg x $^{23}/_{32}$" diam over-all; Sig C dwg No. SC-D-5888.		2Z7226-259
		COUPLING, rigid: straight; one end ⅝"-24 thd w/slots, other end ½"-20 thd, $^{23}/_{16}$" lg x ¾" access flats over-all; Comm Prod No. M32-10766.	Female end fastens to insulator stud, male compresses w/whip antenna.	7A845

Table III. Identification Table and Replaceable Parts for Antenna Assemblies AS-11/FMQ-1 and AS-11A/FMQ-1 —Continued

Ref. symbol	Models	Name of part and description	Function of part	Signal Corps stock No.
		GASKET: asbestos; 2⅜" ID x 2⅞" OD x 1/32" thk; Comm Prod No. G53-10796.	Pad for antenna insulator.	7A940-1
		GASKET: rubber; 2¼" ID x 2⅞" OD x 1/16" thk; Comm Prod No. G53-10797.	Seal for antenna insulator.	7A940.1
		GASKET: asbestos; 0.505" ID x ⅞" OD x 1/32" thk; Comm Prod No. G53-10798.	Seals inner stud against bowl insulator.	7A940
		INSULATOR, bowl: conical shape; brown bakelite; 2" lg x 2⅞" diam over-all; top diam ⅞", fl ⅜" thk x 2⅞" diam, axial hole 0.503" at top flaring to 1¼" diam at bottom; top and sides glazed; Comm Prod No. D-33-10760.	.....	7A1088
		INSULATOR, disk: round; skirted, white ceramic, wax-impregnated; 1 5/64" ID x 1 15/16" OD x ¾" thk secured by rings; Comm Prod dwg No. D-33-10761.	.....	7A1088.5-1
		NUT, cap: hex.; brass, nickel pl; ⅝"-24; 29/32" thk; ¾" across flats; Comm Prod No. M32-10768.	Compresses prongs on connector against whip.	7A1148
		WASHER, flat: bakelite w/canvas base; round, ⅞" OD x 0.510" ID x 1/16" thk; Comm Prod No. W-14-10799.	.....	7A1088.5

Table IV. Identification Table of Replaceable Parts for Frequency Meters TS-29/FMQ-1 and TS-29A/FMQ-1

Ref. symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	TS-29/FMQ-1	TS-29A/FMQ-1			
			FREQUENCY METERS TS-29/FMQ-1 and TS-29A/FMQ-1: u/w radiosonde equip; 0-200 cps in one band; 28" wd x 26" d x 12" h.	Indicates modulation frequency of radiosonde transmission.	7A889-29
C610	*	*	CAPACITOR, fixed: mica; 20,000 mmf ±2%; 1,200 vdcw; body dimen 1 25/32" max lg x 1 11/32" max wd x 49/64" thk; JAN type CM60B203G.	Plate, for tubes V605 and V606. See paragraph 79.	3K6020323
C602	*	*	CAPACITOR, fixed: paper; 20,000 mmf ±10%; 400 vdcw; max dimen 1 5/16" lg x ½" diam; JAN type CP25A1EE203K.	Coupling, to grid of tube V600.	3DA20-157
C608, C609	*	*	CAPACITOR, fixed: mica 39,000 mmf ±2%; 600 vdcw; body dimen 1 25/32" max lg x 1 11/32" max wd x 49/64" thk; JAN type CM60B393G.	Coupling to grid of tube V607.	3K6039323
C603 through C606	*	*	CAPACITOR, fixed: paper; 2 mf ±10%; 600 vdcw; body dimen 1 3/16" lg x 3¼" h x 1 1/16" wd; JAN type CP70E1EF205K (CP07FA4).	Filters, power supply.....	3DB2-73
C600	*		CAPACITOR, fixed: electrolytic; 25 mf; 25 vdcw; ⅝" diam x 1 1/16" lg; Dubilier No. BR-252A.	Cathode bypass, for tube V600.	3DB25-23

Table IV. Identification Table of Replaceable Parts for Frequency Meters TS-29/FMQ-1 and TS-29A/FMQ-1—Continued

Ref. symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	TS-29/FMQ-1	TS-29A/FMQ-1			
C600		*	CAPACITOR, fixed: electrolytic; 25 mf; 100 vdcw; max dimen 1 13/16" lg x 1" wd x 15/16" h; JAN type CE63F250H.	Cathode bypass, for tube V600.	3DB25-67
C607	*		CAPACITOR, fixed: electrolytic; 50 mf; 25 vdcw; 1 7/16" lg x 5/8" diam; HS; Dubilier No. BR-502.	L-f filter, meter circuit..	3DKB50-18
C607		*	CAPACITOR, fixed: electrolytic; 50 mf; 25 vdcw; max dimen 1 13/16" lg x 1" wd x 15/16" h; JAN type CE63F500F.	L-f filter, meter circuit..	3DB50-54
	*		CONNECTOR, male contact: 2 rectangular parallel blade cont; straight; body dimen 1 3/8" diam x 1 1/4" d; Hubbell No. 6808.	A-c socket	6Z7589
P600		*	CONNECTOR, male contact: 2 rectangular parallel cont; straight; body dimen 1 1/4" diam x 1 1/4" lg; Hubbell No. 4897.	A-c plug	6Z7816
P601	*	*	CONNECTOR, male contact: 6 phosphor-bronze polarized cont; straight; 1 7/16" lg x 1" wd x 13/16" d less cont; Jones HB No. P-406-AB.	Power connector	2Z7228.29
F600	*	*	FUSE FU-27: cartridge; 2 amp, 250 v; glass body; ferrule term.; 1 1/4" lg x 1/4" diam over-all.	Overload protection	3Z1927
E600	*	*	HOLDER, fuse: extractor post; for single No. 3AG fuse; bakelite; 250 v, 10 amp max; 2 1/8" lg x 5/8" OD; Littelfuse No. 341001.	Holds Fuse FU-27.....	3Z3275
E603	*	*	KNOB, bar: black bakelite; for 1/4" diam shaft; 2 No. 6-32 setscrews; metal pointer 1/4" lg attached; 1 3/16" lg x 3/4" wd x 5/8" thk; Natl Co. No. SA1690.	INPUT control	2Z5821-65
E601, E602	*	*	KNOB, round: black bakelite; for 1/4" diam shaft; 2 No. 10-32 setscrews; white indicator line; 2 1/16" diam x 7/8" thk; ICA No. 1171.	COARSE and FINE controls.	2Z5844-3
I600	*	*	LAMP LM-27: incandescent; 6-8 v, 0.25 amp; Mazda No. 44; bulb T-3 1/4" clear; 1 1/8" lg over-all; miniature bayonet base; Sig C dwg No. SC-D-2573, item 3.	.....	2Z5927
J600	*	*	LIGHT, indicator: w/faceted green jewel; for T-3 1/4" miniature bayonet base lamp; steel socket and mtg frame; 1 7/16" lg x 15/16" diam over-all; Drake Mfg No. 50 (on-off indicator).	Pilot light	2Z5991-1
M600	*	*	METER, ammeter: dc; 0 to 500 ua; fan-shaped, surface mtg, switchboard type case; pressed steel w/dull black finish; 6 3/16" h x 7 7/8" wd x 3 3/16" d over-all; Weston No. 271.	Visual meter (0-100 divisions).	3FK875-7
L600, L601, L602	*		REACTOR: filter choke; single winding; 15-32 hy; 85 ma, 375 ohms d-c resistance; 3 3/8" lg x 2 1/2" d x 3" h over-all; Thordarson No. T-16C07 (used on Order No. 11092-SCGDL-43 only).	Filter, power supply.....	7A702

Table IV. Identification Table of Replaceable Parts for Frequency Meters TS-29/FMQ-1 and TS-29A/FMQ-1—Continued

Ref. symbol	Models TS-29/FMQ-1	Models TS-29A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
L600, L601, L602		*	REACTOR: filter choke; single winding; 15–32 hy; 85 ma, 375 ohms d-c resistance; 2⅞" lg x 2½" d x 4⅞" over-all; HS; Dinion Coil No. W-614.	Filter, power supply.....	3C574A
L600, L601, L602	*		REACTOR: filter choke; single winding; 20 hy; 50 ma, 200 ohms d-c resistance; 2 7/16" lg x 2" wd x 2⅛" h over-all; Kenyon No. T-157 (used on Order Nos. 608-WF-43, 4290-WF-43, 6869-SCGDL-43 only).	Filter, power supply....	3C369-3
R616	*	*	RESISTOR, adjustable: wire-wound; 250 ohms ±10%; 25 w; 2" lg x ¾" diam; IRC No. EMA.	Part of voltage divider, power supply.	3Z6025-107
R603	*	*	RESISTOR, adjustable: wire-wound; 4,000 ohms ±10%; 20 w; 2" lg x 9/16" diam; IRC No. DGA (for TS-29A/FMQ-1 and also for TS-29/FMQ-1 on Order No. 11092-SCGDL-43).	Series regulation	3Z6400-104
R603, R615	*		RESISTOR, adjustable: wire-wound; 5,000 ohms ±10%; 25 w; 2" lg x 9/16" diam; Ohmite No. 0382 (for TS-29/FMQ-1 on Order Nos. 608-WF-43, 6869-SCGDL-43, and 4290-WF-43).	R603—Same as above. R615—Part of voltage divider, power supply.	3Z6500-104
R617	*	*	RESISTOR, adjustable: wire-wound; 7,500 ohms ±10%; 50 w; 4½" lg x ¾" diam; IRC No. EPA.	Series regulation	3Z6575-4.1
R604		*	RESISTOR, adjustable: wire-wound; 10,000 ohms ±10%; 50 w; 4" lg x 9/16" diam; Ohmite No. 0581.	Calibration control	3Z6610-92
R619		*	RESISTOR, fixed: wire-wound; 450 ohms ±5%; 5 w; 1⅛" lg x 13/32" diam; Sprague No. 5K.	Part of voltage divider, power supply.	3Z6045-26
R615	*	*	RESISTOR, fixed: wire-wound; 900 ohms ±10%; 10 w; 1¾" lg x 5/16" diam; IRC No. AB (for TS-29A/FMQ-1 and also for TS-29/FMQ-1 on Order No. 11092-SCGDL-43).	Same as above	3Z6090-29
R618	*		RESISTOR, fixed: wire-wound; 1,200 ohms ±10%; 10 w; 1¾" lg x 5/16" diam; Ohmite "Brown Devil" (used on order No. 11092-SCGDL-43 only).	Same as above	3ZK5412
R618		*	RESISTOR, fixed: wire-wound; 1,200 ohms ±5%; 24 w; 3" lg x 19/32" diam; JAN type RW33D122.	Same as above	3RW24911
R602	*	*	RESISTOR, fixed: composition; 2,400 ohms ±5%; ½" w; max body dimen 0.655" lg x 0.249" diam; JAN type RC21BF242J.	Cathode resistor for tube V600.	3RC21BF242J
R605 through R608	*	*	RESISTOR, fixed: wire-wound; 5,000 ohms ±5%; 10 w; max dimen 2 1/16" lg x ⅜" diam; JAN type RW56J502.	R605, R606—Plate load, tube V607. R607, R608—Plate loads, tubes V605 and V606.	3RW28520
R611	*	*	RESISTOR, fixed: composition; 24,000 ohms ±5%; ½" w; max body dimen 0.655" lg x 0.249" diam; JAN type RC21BF243J.	Series plate, tube V600.	3RC21BF243J

Table IV. Identification Table of Replaceable Parts for Frequency Meters TS-29/FMQ-1 and TS-29A/FMQ-1—Continued

Ref. symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	TS-29/FMQ-1	TS-29A/FMQ-1			
R609, R610	*	*	RESISTOR, fixed: composition; 100,000 ohms ±10%; ½" w; max body dimen 0.655" lg x 0.249" diam; JAN type RC21BF104K.	Grid limiters, tubes V605 and V606.	3RC21BF104K
R601	*	*	RESISTOR, fixed: composition; 270,000 ohms ±10%; ½" w; max body dimen 0.655" lg x 0.249" diam; JAN type RC21BF274K.	Isolation, grid circuit of tube V600.	3RC21BF274K
R600	*	*	RESISTOR, fixed: composition; 1 meg ±10%; ½" w; max body dimen 0.655" lg x 0.249" diam; JAN type RC21BF105K.	Grid, tube V600.....	3RC21BF105K
R613	*	*	RESISTOR, variable (potentiometer): wire-wound; 2,500 ohms ±10%; 2 w; 3 term.; body dimen 1.28" diam x 0.62", shaft ¼" diam x 1" lg; JAN type RA20A1RE252AK.	FINE control	3RA6314
R614	*	*	RESISTOR, variable (potentiometer): wire-wound; 5,000 ohms ±10%; 2 w; 3 term.; body 1.28" diam x 0.62" d, shaft ¼" diam x 1" lg; JAN type RA20A1RE502AK.	COARSE control	3RA6916
R612	*	*	RESISTOR, variable (potentiometer): wire-wound; 5,000 ohms ±10%; 2 w; 3 term.; body 1.28" diam x 0.62" d, shaft ¼" diam x ½" lg; screwdriver slot; JAN type RA20A1SA502AK.	EQUALIZER control...	3RA6912
R604	*		RESISTOR, variable (potentiometer): wire-wound; 10,000 ohms; 2 w; 1¼" diam x 9/16" thk; shaft ¼" diam x ⅝"; IRC No. W-10,000.	Meter calibration control.	2ZK7296-10M.8
X601, X602	*	*	SOCKET, tube: std 4 cont; isolantite; 1⅞" lg x 1½" wd x ⅜" thk; Natl Co No. CIR-4.	.....	2Z8757.3
X600, X603 through X607	*	*	SOCKET, tube: std octal; isolantite; 1⅞" lg x 1½" wd x ¾" thk; Natl Co. No. CIR-8.	.....	2Z8678.53
S600	*	*	SWITCH, rotary: 2 pole, 3 position; single sec.; isolantite body; 1 25/32" lg x 1⅞" x 1½" over-all; Oak No. 22743-HIC.	INPUT switch	3Z9825-62.256
S601	*	*	SWITCH, toggle: DPST; 30 v, 30 amp; bakelite body; 49/64" wd x 1 21/64" h x 1 1/16" lg; momentary off, normally closed; JAN type ST-52L.	DEIONIZE switch	3Z9849.113
S602		*	SWITCH, toggle: DPST; 125 v, 6 amp; bakelite body; max body dimen 1 25/32" h x 23/32" wd x 31/32" d; JAN type ST-26K.	Power ON-OFF switch..	3Z9863-26K
T600	*		TRANSFORMER, AF: plate coupling type; pri 10,000 ohms, secd 40,000 ohms impedance, CT; fully inclosed 2⅝" x 3" lg x 3 7/16" h; UTC No. 55486.	Coupling, between plate circuit of tube V600 and grid circuits of tubes V605 and V606.	7A1860-2

Table IV. Identification Table of Replaceable Parts for Frequency Meters TS-29/FMQ-1 and TS-29A/FMQ-1—Continued

Ref. symbol	Models: TS-29/FMQ-1	Models: TS-29A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
T600		*	TRANSFORMER, AF: plate coupling type; pri 10,000 ohms, secd 40,000 ohms impedance, CT; drawn steel, upright fully shielded case; 2½" diam x 3¼" h; HS; UTC No. 86884.	Same as above.....	7A1860-4
T601	*		TRANSFORMER, power: plate and fil; pri 115 v, 50/60 cyc; secd No. 1, 435/365/0/365/435 v, 100 ma; secd No. 2,250 v, CT, 100 ma; secd No. 3, 5 v 3 amp; secd No. 4, 6.3 v, CT, 3 amp; secd No. 5, 5 v, 3 amp; fully inclosed steel case; 6¼" lg x 6½" h x 3¾" wd; Friez dwg No. 500038.	Power	2Z9613.443
T601		*	TRANSFORMER, power: plate and fil; pri 115 v, 50/60 cyc; secd No. 1, 435/365/CT/365/435 v, 125 ma; secd No. 2, 250 v, 25 ma, CT; secd No. 3, 6.3 v, 3 amp, CT; secd No. 4, 5 v, 3 amp; secd No. 5, 5 v, 3 amp; HS; 5¾" x 5¾" x 4½" d; Dinion Coil No. W618.	Power	7A1860.2-4
V604	*	*	TUBE, election: JAN-OA3/VR-75.....	Gas regulator	2JOA3/VR75
V603	*	*	TUBE, electron: JAN-OD3/VR-150	Same as above.....	2JOD3/VR150
V600	*	*	TUBE, electron: JAN-6J5	Amplifier	2J6J5
V607	*	*	TUBE, electron: JAN-6ZY5G	Rectifier	2J6ZY5G
V601, V602	*	*	TUBE, electron: JAN-80	Same as above.....	2J80
V605, V606	*	*	TUBE, electron: JAN-884	Thyratrons	2J884
		*	WASHER, cup: brass, nickel pl; ¼" ID x 9/16" OD x ⅛" thk; Grammes Wire Prod No. 2222.	.....	6L50244N1
	*	*	WRENCH: setscrew; L-shaped; legs 1¾" lg and ½" lg; 1/16" across flats; Allen No. 6.	For control knobs.....	6R57400-6

Table V. Identification Table of Replaceable Parts for Rack Assemblies MT-47/FMQ-1 and MT-47A/FMQ-1

Ref. symbol	Models: MT-47/FMQ-1	Models: MT-47A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
			RACK ASSEMBLIES MT-47/FMQ-1 and MT-47A/FMQ-1: houses radiosonde receptor components; steel; empty; approx 72" h x 28" wd x 26" d; includes folding table.	.....	7A8337-47
		*	BOARD, terminal: 2 double brass, nickel pl screw term.; molded bakelite; 1⅛" wd x ½" h x 1¾"; Jones HB No. 2-141.	Connection strips for meters.	2Z9402.44

Table V. Identification Table of Replaceable Parts for Rack Assemblies MT–47/FMQ–1 and MT–47A/FMQ–1—Continued

Ref. symbol	Models MT–47/FMQ–1	Models MT–47A/FMQ–1	Name of part and description	Function of part	Signal Corps stock No.
P501, P502, P503	*	*	CONNECTOR, female contact: Sig C Socket SO–239; single round cont; straight; 1″ sq x 1 1/16″ lg over-all; Sig C dwg No. SC–D–5850.	Antenna input	2Z8799–239
	*	*	CONNECTOR, female contact: 2 parallel polarized cont; straight; 1 3/8″ diam x 61/64″; Hubbell No. 7257.	A-c connector for frequency meter and radiosonde receiver.	6Z3150–4
		*	CONNECTOR, female contact: 2 parallel cont; straight; 1 1/2″ lg x 15/16″ diam over-all; Hubbell No. 7084.	A-c connector for frequency Meter TS–29A/FMQ–1.	6Z3150–5
	*	*	CONNECTOR, female contact: 6 parallel cont; straight; 2 9/16″ h x 1 1/2″ wd x 1 1/16″ thk over-all; Jones HB No. S–406–CCT.	For control cable for frequency meter.	2ZK8639.10A
		*	CONNECTOR, male contact: Sig C Plug PL–259; single round cont; straight; 1 1/2″ lg x 23/32″ diam over-all; Sig C dwg No. SC–D–5888.	R-f input to receiver....	2Z7226–259
	*	*	CONNECTOR, male contact: 2 rectangular polarized cont; straight; 1 19/32″ diam x 1 9/32″ h; Hubbell "Twist Lock" No. 9105.	A-c input to rack assembly.	6Z7813
	*	*	KNOB: round; phenolic; for 1/4″ diam shaft; 2 No. 8–32 setscrews; w/white pointer; 1 1/8″ diam x 5/8″ h; GR No. 637–A.	Antenna selector switch..	2ZK5822–32
	*	*	LAMP, incandescent: 120 v, 100 w; bulb A–23, inside frosted; medium screw base; Mazda No. 100–A23.	Dehumidifier lamps	6Z6820–4
	*	*	LAMPHOLDER: medium screw base; porcelain body; base dimen 2 15/16″ x 2 23/32″; Hubbell No. 9402.	Sockets for dehumidifier lamps.	6Z7803–1
M501		*	METER, frequency indicator: ac 58/62 cyc, 115 v; round, molded flush mtg case; 2 11/16″ diam flange x 2 5/32″ diam body x 1 29/32″ d; J–B–T Inst No. 21–FX.	Indicates frequency of a-c power input.	3F2745–8
M500		*	METER, voltmeter: ac; 0–150 v; round, bakelite flush mtg case; 2.695″ diam flange x 2.21″ diam body x 1.75″ d max body dimen; JAN type MR25W150ACVV.	Indicates voltage of a-c power input.	3F8150–50
I500	*		SWITCH, rotary: 2 pole, 2 position; steatite insulation; 1 1/8″ wd x 1 1/4″ h x 2″ d approx dimen; Airadio No. 40C–2554.	Antenna selector	3Z9825–84.1
S503		*	SWITCH, rotary: 3 pole, 4 position; ceramic body; 2 3/16″ diam x 2 1/2″ lg over-all; Oak type DHC.	Same as above	3Z9826–78
	*	*	SWITCH, toggle: DPST; 25 amp, 125 v; bakelite body; 1 21/64″ h x 49/64″ wd x 1 1/16″ d; JAN type ST–52K.	For MASTER, RECORDER, dehumidier lamps.	3Z9863–52K

Table VI. Identification Table of Replaceable Parts for Radiosonde Receivers R–17/FMQ–1 and R–17A/FMQ–1

Ref. symbol	Models R–17/FMQ–1	Models R–17A/FMQ–1	Name of part and description	Function of part	Signal Corps stock No.
			RADIOSONDE RECEIVERS R–17/FMQ–1 and R–17A/FMQ–1: receives data transmitted by radiosonde; AM reception; 56 to 85 mc; 110 v, 60 cyc; rack mtd; approx 28″ wd x 26″ d x 12″ h.	Receives signals picked up by antenna.	7A8340–17
	*	*	BATTERY BA–58: dry; 1½″ cylindrical; 1 31/32″ lg x 37/64″ diam; single flat cont on top.	Bias, for tube V700.....	3A58
C710	*	*	CAPACITOR, fixed: mica; 47 mmf ±10%; 500 vdcw; max body dimen 51/64″ lg x 15/32″ wd x 7/32″ thk; JAN type CM20C470K.	Grid, for tube V701.....	3K2047031
C702, C703, C705	*	*	CAPACITOR, fixed: mica; 2,700 mmf ±10%; 500 vdcw; max body dimen 53/64″ x 53/64″ x 9/32″ thk; JAN type CM30C272K.	C702—Grid return bypass, for tube V700. C703—Plate return bypass, for tube V700. C705–Grid return bypass, for tube V701.	3K3027231
C712, C713, C716, C717, C722, C723	*	*	CAPACITOR, fixed: mica; 10,000 mmf ±10%; 300 vdcw; max body dimen 53/64″ x 53/64″ x 11/32″ thk; JAN type CM35B103K.	C712—Screen bypass, for tube V702. C713—Coupling, to tube V703. C716—Output, of tube V704. C717 — Cathode bypass, for tube V703. C722—Coupling, to grid of tube V704. C723—Coupling, to tube V703.	3K3510321
C715		*	CAPACITOR, fixed: paper; 50,000 mmf ±10%; 600 vdcw; 1 13/16″ lg x 1″ wd x ¾″ h; JAN type CP53B1FF503K.	Output, of tube V704....	3DA50–275
C715	*		CAPACITOR, fixed: paper; 50,000 mmf ±20%; 600 vdcw; 1½″ lg x ⅝″ diam; JAN type CP25A1EF503M.	Same as above	3DA50–220
C709	*		CAPACITOR, fixed: paper; 100,000 mmf ±10%; 400 vdcw; 1 3/16″ lg x 11/16″ diam; JAN type CP25-A1EE104K.	Coupling, to tubes V703 and V706.	3DA100–563
C709		*	CAPACITOR, fixed: paper; 100,000 mmf ±10%; 600 vdcw; 1 13/16″ lg x 1″ wd x ¾″ h; JAN type CP53B1FF104K.	Coupling, to tubes V703 and V706.	3DA100–650
C706, C714	*	*	CAPACITOR, fixed: paper; 500,000 mmf ±10%; 200 vdcw; 1 13/16″ lg x 1″ wd x ¾″ h; JAN type CP53B1FC504K.	C706—A-f bypass, detector circuit. C714 — Cathode bypass, for tube V705.	3DA500–518
C719, C720, C721	*	*	CAPACITOR, fixed: paper; 4 mf ±10%; 600 vdcw; 4½″ lg x 1½″ diam; JAN type CP41B1DF405K.	Filters, power supply....	3DB4–224

Table VI. Identification Table of Replaceable Parts for Radiosonde Receivers R-17/FMQ-1 and R-17A/FMQ-1 —Continued

Ref. symbol	Models R-17/FMQ-1	Models R-17A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
C707, C708, C718	*	*	CAPACITOR, fixed: electrolytic; 25 mf; 100 vdcw; max dimen 1 13/16" lg x 1" wd x 15/16" h; JAN type CE63F250H.	C707 — Cathode bypass, for tube V702. C708 — Cathode bypass, for tube V704. C718 — Cathode bypass, for tube V706.	3DB25-67
E701	*	*	CLIP: electron tube; brass; 1 1/16" lg x 1/4" wd x 1/4" h; Natl Co. No. 8.	.....	2Z2708
E702	*	*	CLIP: for 954 acorn tube; bronze; 13/32" lg x 1/8" wd x 3/32" h; RCA No. R-562.	.....	2Z2726.54
L700	*	*	COIL, RF: choke; 2 pie universal wound; unshielded; 220 mh, 1,000 ohms d-c resistance; 1 3/4" lg x 1" diam; Natl Co. No. SA2779.	R-f choke, detector circuit.	3C326-82
J701		*	CONNECTOR, female contact: Sig C Socket SO-239; single round cont; straight; 1 1/16" lg x 1" sq over-all; Sig C dwg No. SC-D-5850.	Antenna-ground connector.	2Z8799-239
P700	*	*	CONNECTOR, male contact: 2 flat parallel cont; straight; body dimen 1 3/8" diam x 1 1/4" d; Hubbell No. 6808.	A-c socket	6Z7589
O-706	*	*	COUPLING, rigid: canvas; bakelite insulated; 1 1/16" diam over-all, fits 1/4" shaft; Natl Co. No. TX10.	For drive unit.....	2Z3269-11
O-702	*	*	DIAL: bakelite knob w/nickel-silver pl disk; engraved "AUDIO GAIN" w/numbers 0—10; mtd w/2 No. 6 setscrews; 1 5/8" diam x 1 1/16" d over-all dimen; Natl Co. No. SA2770.	AUDIO GAIN	7A1050-2
O-700	*	*	DIAL: bakelite knob w/nickel-silver pl disk; engraved "REGENERATION" w/numbers 0—10; mtd w/2 No. 6 setscrews; 1 5/8" diam x 1 1/16" d over-all dimen; Natl Co. No. SA2772.	REGENERATION	7A1050-1
O-703	*	*	DIAL: bakelite knob w/nickel-silver pl disk; engraved "R.F. TRIMMER" w/numbers 0—10 mtd w/2 No. 6 setscrews; 1 5/8" diam x 1 1/16" d over-all dimen; Natl Co. No. SA2769.	R.F. TRIMMER	7A1050-3
O-701	*	*	DIAL: bakelite knob w/nickel-silver pl disk; engraved "S'P'K'R VOLUME" w/numbers 0—10; mtd w/2 No. 6 setscrews; 1 5/8" x 1 1/16" d over-all dimen; Natl Co. No. SA2771.	S'P'K'R VOLUME.....	7A1050
O-704	*	*	DIAL: micrometer; bakelite knob w/zinc diecast dial; direct reading, 1 part in 500; mtd w/2 No. 8 headless setscrews; 4 1/2" diam x 3 3/8" thk; Natl Co. No. SA-645.	MAIN tuning	2Z3764.26
O-705	*	*	DRIVE, dial: cast zinc housing; drives at "right angles" to dial; 3" lg x 1 7/16" wd x 1 3/16" h over-all; Natl Co No. PWO.	.....	2Z4870-16

Table VI. Identification Table of Replaceable Parts for Radiosonde Receivers R–17/FMQ–1 and R–17A/FMQ–1 —Continued

Ref. symbol	Models R–17/FMQ–1	Models R–17A/FMQ–1	Name of part and description	Function of part	Signal Corps stock No.
F700	*	*	FUSE FU–27: cartridge; 2 amp, 250 v; glass body; ferrule term.; 1¼″ lg x ¼″ diam over-all.	Overload protection	3Z1927
E700	*	*	HOLDER, fuse: extractor post; bakelite; 10 amp max; 2⅛″ lg x ⅝″ OD; Littelfuse No. 341001.	For single No. 3AG fuse.	3Z3275
	*		INSULATOR, plate: antenna binding posts; 2 screw term.; polystyrene; 2⅛″ lg x ¾″ wd x 0.249″ thk; Natl Co No. FWB.	.....	3G1838–34.4
J700		*	JACK, telephone: for 2 cond 0.25″ diam plug; 1⅝″ lg x 1 11/16″ wd x ¾″ thk; over-all; J3–1A cont arrangement; Mallory No. 704A.	PHONES jack	2Z5598–8
I700	*	*	LAMP LM–27: incandescent; 6–8 v, 0.25 amp; Mazda No. 44, bulb T–3¼ clear; 1⅛″ lg over-all; miniature bayonet base; Sig C dwg No. SC–D–2573, item 3.	Pilot light	2Z5927
J702	*	*	LIGHT, indicator: w/lens; miniature bayonet base; brass socket w/steel frame; 1½″ lg x 1″ wd; Mallory No. B–3100.	ON-OFF indicator	2Z5883–37
M700	*		METER, ammeter: dc; 0–1 ma; round brass flush mtg case; 2¼″ diam flange x 2 1/16″ diam body x 1⅜″ d; calibrated for steel panel; Marion Elec Insts No. 52RM.	S meter	3F891–28
M700		*	METER, ammeter: dc; 0–1 ma; round bakelite flush mtg case; 2 11/16″ diam flange x 2 13/16″ diam body x 2¼″ d; calibrated for nonmagnetic panel; JAN type MR25W001DCMA.	S meter	3F891–20
L701, L702		*	REACTOR: filter choke; single winding; 10 hy; 60 ma; 300 ohms; 2⅞″ x 2½″ x 3 13/16″; HS metal case; Dinion No. W–617.	Filters, power supply....	7A702–5
L701, L702	*		REACTOR: filter choke; single winding; 17 hy; 80 ma; Natl Co No. 80.	Same as above	3C326–80
R721	*	*	RESISTOR, fixed: composition; 470 ohms ±10%; 1 w; max body dimen 0.750″ lg x 0.280″ diam; JAN type RC30BF471K.	Cathode, for tube V706..	3RC30BF471K
R716	*	*	RESISTOR, fixed: composition; 1,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF102K.	Part of voltage divider, meter circuit.	3RC21BF102K
R710	*	*	RESISTOR, fixed: composition; 2,700 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF272K.	Cathode, for tube V704..	3RC21BF272K
R704, R715, R724	*	*	RESISTOR, fixed: composition; 4,700 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF472K.	R704—Cathode, for tube V702. R715—Part of voltage divider, meter circuit. R724—Cathode, for tube V705.	3RC21BF472K

Table VI. Identification Table of Replaceable Parts for Radiosonde Receivers R–17/FMQ–1 and R–17A/FMQ–1 —Continued

Ref. symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	R–17/FMQ–1	R–17A/FMQ–1			
R701	*	*	RESISTOR, fixed: composition; 22,000 ohms ±10%; 1 w; max body dimen 0.750″ lg x 0.280″ diam; JAN type RC30BF223K.	Part of voltage divider, detector circuit.	3RC30BF223K
R714	*	*	RESISTOR, fixed: composition; 22,000 ohms ±10%; 2 w; max body dimen 1.78″ lg x 0.405″ diam; JAN type RC41BF223K.	Part of voltage divider, meter circuit.	3RC41BF223K
R711, R712	*	*	RESISTOR, fixed: composition; 24,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF243J.	Part of voltage divider, for tube V704.	3RC21BF243J
R700	*	*	RESISTOR, fixed: composition; 33,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF333K.	Screen, for tube V700...	3RC21BF333K
R723, R726	*	*	RESISTOR, fixed: composition; 100,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF104K.	R723—Plate load, for tube V705. R726—Part of voltage divider, meter circuit.	3RC21BF104K
R706, R713	*	*	RESISTOR, fixed: composition; 220,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF224K.	R706—Plate load, for tube V702. R713—Plate load, for tube V704.	3RC21BF224K
R719, R725	*	*	RESISTOR, fixed: composition; 1 meg ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF105K.	R719 — Isolation, grid circuit of tube V706. R725—Plate load, for tube V703.	3RC21BF105K
R705, R707, R708, R709	*	*	RESISTOR, fixed: composition; 2.2 meg ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF225K.	R705—Screen, for tube V702. R707—Plate load, for tube V703. R708—Cathode, for tube V703. R709—Grid, for tube V704.	3RC21BF225K
R718, R703	*	*	RESISTOR, fixed; composition; 18 meg ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF186K.	R718—Cathode, for tube V703. R703 — Grid, for tube V701.	3RC21BF186K
R717	*	*	RESISTOR, variable (potentiometer): wire-wound; 1,000 ohms ±10%; 2 w; 3 term.; body 1.28″ diam x 0.62″ d, shaft ¼″ diam x ½″ lg; linear taper; JAN type RA20A1SA102AK (S meter adjustment).	Part of voltage divider, meter circuit.	3RA5710
R702	*	*	RESISTOR, variable (potentiometer): composition; 50,000 ohms ±20%; ½ w; 3 term.; body 1⅛″ diam x ½″ d; shaft ¼″ diam x 0.406″ lg; A taper; CTS No. 35.	REGENERATION control.	3Z7450–28

Table VI. Identification Table of Replaceable Parts for Radiosonde Receivers R-17/FMQ-1 and R-17A/FMQ-1 —Continued

Ref. symbol	Models R-17/FMQ-1	Models R-17A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
R720, R722	*	*	RESISTOR, variable (potentiometer): composition; 500,000 ohms ±20%; ½ w; 3 term; body 1⅛" diam x ½" d; shaft ¼" diam x 0.531" lg; B taper; CTS No. 35.	R720—AUDIO control. R722—VOLUME control.	3Z7498–50.30
X707	*		SOCKET, tube: 4 cont; one piece saddle mtg; bakelite body; 2$^{7}/_{32}$" lg x 1⅜" diam; Cinch No. X–18.	.....	2Z8674.40
X707		*	SOCKET, tube: std 4 cont; one piece saddle mtg; isolantite body; 1⅞" lg x 1½" wd x ⅜" thk; Natl Co No. CIR–4.	.....	2Z8757.3
X702 through X706	*	*	SOCKET, tube: std octal; one piece saddle mtg; isolantite; 1⅞" lg x 1½" wd x ¾" thk; Natl Co No. CIR–8.	.....	2Z8678.53
LS700	*	*	SPEAKER, magnetic: 5" diam cone; PM; 2½ w; voice coil impedance 4 ohms; 5$^{1}/_{32}$" diam x 2$^{19}/_{32}$" d over-all; Jensrad No. PM5–FS.		6C35–6
S700		*	SWITCH, toggle: DPST; 3 amp, 250 v; bakelite body; body dimen 1$^{25}/_{32}$" h x $^{23}/_{32}$" wd x $^{23}/_{32}$" d; JAN type ST26K.	Power ON-OFF	3Z9863–26K
T702	*	*	TRANSFORMER, AF: plate coupling type; pri 7,000 ohms impedance; secd 4 ohms impedance; open steel frame; over-all 1⅜" h x 1$^{11}/_{16}$" wd x 1½" d; Jensrad No. Z2255.	Speaker	2Z9632.73
T700	*		TRANSFORMER, AF: plate coupling type; pri 30,000 ohms impedance, secd 500,000 ohms impedance; fully cased; 3⅜" x 2$^{5}/_{16}$" x 3$^{13}/_{64}$" h; Natl Co No. S–100.	Interstage, tube V701 to tubes V702 and V705.	2Z9631.87
T700		*	TRANSFORMER, AF: plate coupling type; pri 50,000 ohms impedance, secd 500,000 ohms impedance HS steel case; 2⅞" lg x 2½" wd x 3$^{3}/_{16}$" h; Dinion Coil No. W–615.	Same as above	7A1860
T701	*		TRANSFORMER, power: plate and fil; pri 115 v, 50/60 cyc; secd No. 1, 400 v, 50 ma, CT; secd No. 2, 5 v, 2 amp; secd No. 3, 6 v, 3 amp; inclosed metal case; 3½" lg x 3$^{5}/_{16}$" wd x 3⅞" h; Natl Co No. 5886–F.	Power	2Z9613.136
T701		*	TRANSFORMER, power: plate and fil; pri 115 v, 50/60 cyc; secd No. 1, 400 v, 60 ma, CT; secd No. 2, 5 v, 2 amp; secd No. 3, 6.3 v, 2.5 amp, CT; HS metal case; approx 5¾" lg x 5½" wd x 4½" h; Dinion Coil No. W–616.	Power	7A1860.2–3
V706	*	*	TUBE, electron: JAN–6F6	Power amplifier	2J6F6
V705	*	*	TUBE, electron: JAN–6F8G	A-f and d-c amplifiers...	2J6F8G

Table VI. Identification Table of Replaceable Parts for Radiosonde Receivers R–17/FMQ–1 and R–17A/FMQ–1 —Continued

Ref. symbol	Models R–17/FMQ–1	Models R–17A/FMQ–1	Name of part and description	Function of part	Signal Corps stock No.
V703	*	*	TUBE, electron: JAN–6H6	Series diode clipper and peak voltage rectifier.	2J6H6
V702, V704	*	*	TUBE, electron: JAN–6SJ7	V702—A-f amplifier. V704—Limiter.	2J6SJ7
V707	*	*	TUBE, electron: JAN–80	Rectifier	2J80
V700	*	*	TUBE, electron: JAN–954	R-f amplifier	2J954
V701	*	*	TUBE, electron: JAN–955	Super-regenerative detector.	2J955
	*	*	TUNING UNIT, RF: w/Sig C Socket SO–239; aluminum chassis w/copper inner shield; 54 to 88 mc; 5¼″ lg x 4⅛″ h x 3⅜″ d; Natl Co No. SA–2985 (replaces Natl Co No. SA–2766 and No. SA–1129).		7A1932
	*	*	WASHER, cup: brass, nickel pl; ¼″ ID x 9/16″ OD x ⅛″ thk; Grammes Wire Prod No. 2222.	For No. 10 countersunk head screw.	6L50244N1
H704	*	*	WRENCH: setscrew; L-shaped, legs 1¾″ lg and ½″ lg; 1/16″ across flats; Allen No. 6.	For knobs	6R57400–6

Table VII. Identification Table of Replaceable Parts for Radiosonde Recorders RD–3/FMQ–1 and RD–3A/FMQ–1

Ref. symbol	Models RD–3/FMQ–1	Models RD–3A/FMQ–1	Name of part and description	Function of part	Signal Corps stock No.
			RADIOSONDE RECORDERS RD–3/FMQ–1 and RD–3A/FMQ–1: chart; printed dot type; 17″ h x 21″ wd x 18″ d; 110 v, 60 cyc.	Makes printed record of frequencies indicated by Frequency Meter TS–29(*)/FMQ–1.	7A1326–3
	*	*	BAR, tapper: includes 1 left front dog and 1 right front dog; brass; nickel pl; 10½″ lg x 1¼″ wd x 2 1/16″ over-all; Friez No. 507228.		7A1326–3/A5
	*	*	BEARING, ball: single row angular; plain; bore 5 mm, OD 16 mm x 5 mm wd; Norma-Hoff No. E–5.	For rocker frame	3H310–2
	*	*	BEARING, ball: single row angular; bore 8 mm, OD 24 mm x 7 mm wd over-all; SKF No. E–8.	For rocker frame, paper drive shaft, brush blocks.	3H2335/5

Table VII. Identification Table of Replaceable Parts for Radiosonde Recorders RD-3/FMQ-1 and RD-3A/FMQ-1—Continued

Ref. symbol	Models RD-3/FMQ-1	Models RD 3A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
	*	*	BEARING, ball: single row angular; bore 12 mm, OD 32 mm x 7 mm wd over-all; Norma Hoff No. E-12.	For photocell and optical system drive shaft.	3H1601/2
	*		BOARD, terminal: 2 brass, nickel pl screw term.; bakelite; 1½" lg x 1" wd x ⅞" thk over-all; Friez No. ST-369.	.....	7A371
		*	BOARD, terminal: 2 brass, nickel pl screw term.; molded bakelite; 1⅝" lg x 1⅛" wd x ½" thk over-all; Jones HB No. 2-141.	.....	2Z9402.44
P400, P401		*	BOARD, terminal: 4 brass, nickel pl screw term.; molded bakelite; 2⅝" lg x 1⅛" wd x ½" h over-all; Jones HB No. 4-141.	.....	2Z9404.1
		*	BOARD, terminal: 5 brass, nickel pl screw term.; bakelite; 2 15/16" lg x 1⅛" wd x ½" thk; Jones HB No. 5-141.	.....	2Z9405.1
	*		BOARD, terminal: 5 screw term.; bakelite; 3¾" lg x 1¼" wd x ⅞" thk over-all; Friez dwg No. 32812.	.....	7A371-5
	*	*	BRUSH, electrical contact: slip rings; copper graphite; ½" lg x 5/32" diam over-all; Chas E Chapin No. 680.	.....	7A1326-3/B4
	*	*	CAM: rocker arm; phosphor bronze and brass; 1 7/16" lg x 1 11/32" wd x 27/64" thk over-all w/2 No. 6-32 hex. socket setscrews, ⅛" lg. Friez No. 32406.	.....	7A1326-3/C3
	*	*	CAPACITOR, fixed: paper; 250,000 mmf ±10%; 400 vdcw; body dimen 2 5/16" lg x ¾" diam w/1 13/16" lg bracket; JAN type CP28A1EE254K.	For preamplifier	3DA250-279
C400	*	*	CAPACITOR, fixed: paper; oil-filled; 1 mf +15%-0%; 220 vacw; 3¼" lg x 1 1/32" diam; Holtzer No. 100295.	Starting, for paper drive motor.	3DB1.295-1
C401	*	*	CAPACITOR, fixed: paper; 1.2 mf ±10%; 220 vacw; 3¼" lg x 1 1/16" diam; Holtzer No. PC-103509.	Starting, for main drive motor.	3DB1A2-1
	*	*	CLIP: electron tube; phosphor bronze; U-shaped, 1 1/32" h x 1" wd w/one 7/16" flange on one leg of "U"; Friez No. 507234-2.	.....	7A525
	*	*	CLIP: electron tube; phosphor bronze, nickel pl; U-shaped, 1 1/32" h x 1" wd w/one 7/16" flange on one leg of "U"; Friez No. 507234-1.	.....	7AK1326-3/C1
	*	*	COIL, solenoid: single winding; 110 v, 60 cyc; 690 ohms d-c resistance; 1 5/16" lg x 1 5/16" x 1 5/16" over-all; Friez No. 32411.	For energizing tapper bar mechanism.	7A702.3
	*		CONNECTOR SET, male and female contact: 2 round cont; straight; 2⅜" lg x 13/16" wd x 1 5/32" over-all; Friez No. ST-229.	For ribbon motor and tapper coils.	2Z3020-14

Table VII. Identification Table of Replaceable Parts for Radiosonde Recorders RD-3/FMQ-1 and RD-3A/FMQ-1—Continued

Ref. symbol	Models RD-3/FMQ-1	Models RD-3A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
M400	*	*	CONTROL, light beam: 0–500 ma meter movement; cylindrical case w/rectangular mtg base; approx 7″ OD x 2¼″ d over-all; Friez No. P–35664.	Interrupts light beam between light source and photocell in accordance w/electrical pulses.	7A1326–3/M2
	*	*	DISK, mounting: mts optical system; plastic and copper; complete less lens assembly; 6 7/16″ OD x 2 9/16″ over-all; Friez part No. OAP–32415 less part No. 507406.	.....	7A1326–3/2
	*	*	DISK, mounting: mts photoelectric cell; plastic and copper; complete less photoelectric cell; 6 7/16″ OD x 1½″ thk over-all; Friez part No. OAP–32414 less part No. A–507231.	.....	7A1326–3/16
	*	*	DRUM, spiral: brass; consists of rod shaft, spiral drum, drum ends; 15 9/16″ lg x 1⅞″ OD over-all; Friez No. P32445.	.....	7AK1326–3/D1
	*	*	FUSE FU–27: cartridge; 2 amp, 250 v; glass body; ferrule term.; 1¼″ lg x ¼″ diam over-all.	Overload protection	3Z1927
F400, F401	*	*	FUSE, cartridge: 6 amp, 250 v; ferrule term.; over-all dimen 2″ lg x 9/16″ diam; Navy spec No. 17–F2 (a-c line).	Overload protection	3Z2606.16
	*	*	GEAR: bevel; phosphor bronze; straight teeth; 12 teeth; 0.291″ OD x ¼″ bore x 17/64″ thk; Friez No. 506958.	Engages long face pinion of motor drive for tape reverse.	7A1326–3/3
	*	*	GEAR: spur; phosphor bronze, nickel pl; straight teeth; 18 teeth; ⅜″ OD over-all x 0.126″ bore x 23/64″ thk; Friez No. 32209.	Motor pinion of tape reverse assembly.	7A1326–3/6
	*	*	GEAR: spur; lacquered bakelite gear, nickel pl brass hub; straight teeth; 24 teeth; 13/16″ OD x 0.187″ bore x 25/64″ thk; Friez No. 32454.	For 1,050 rpm motor drive shaft.	7A1326–3/G15
	*	*	GEAR: spur; brass, nickel pl; straight teeth; 24 teeth; 0.812″ OD x 0.187″ bore x ⅜″ thk; Friez No. 35663.	Meter adjustment	7A1326–3/5
	*	*	GEAR: spur; brass, nickel pl; straight teeth; 31 teeth; 0.515″ OD x 0.187″ bore x 13/32″ thk; Friez No. 32821.	For paper drive motor. 0.4″ paper drive.	7A1326–3/P1
	*	*	GEAR: spur; phosphor bronze, nickel pl; straight teeth; 50 teeth; 13/16″ OD x 0.187″ bore x 11/32″ thk; Friez No. 32198.	Meshes w/spur gears of tape reverse assembly.	7AK1326–3/G1
	*	*	GEAR: spur; lacquered fiber gear, nickel pl brass hub; straight teeth; 67 teeth; 2⅜″ OD x 5/16″ bore x 13/16″ thk; Friez No. 32400.	Drive for spiral drum assembly.	7A1326–3/G12

Table VII. Identification Table of Replaceable Parts for Radiosonde Recorders RD–3/FMQ–1 and RD–3A/FMQ–1—Continued

Ref. symbol	Models RD–3/FMQ–1	Models RD–3A/FMQ–1	Name of part and description	Function of part	Signal Corps stock No.
	*	*	GEAR: spur; brass, nickel pl; straight teeth; 153 teeth; $2^{27}/_{64}$" OD x $^{5}/_{16}$" bore x $^{11}/_{32}$" thk over-all; Friez No. 32816.	Drive for paper roll.....	7A1326–3/G10
	*	*	GEAR: spur; brass, nickel pl; straight teeth; 268 teeth; 8.437" OD x $^{3}/_{4}$" bore x 0.128" thk; Friez No. 32279.	Drive for optical and photo tube disks.	7A1326–3/G13
	*	*	GEAR: worm; stainless steel; helical teeth; single LH thd; 0.374" OD x 0.187" bore x $^{5}/_{8}$" lg; Friez No. 506916.	For rotating meter. See WORM, gear.	7A1326–3/15
	*	*	GEAR: worm; phosphor bronze, nickel pl; straight teeth; 50 teeth; $1^{1}/_{16}$" OD x 0.187" bore x $^{13}/_{32}$" thk; Friez No. 506915.	For rotating meter.....	7A1326–3/4
	*	*	GEAR ASSEMBLY: bevel and spur; phosphor bronze, nickel pl; $^{13}/_{16}$" diam over-all x 0.187" bore x $^{29}/_{64}$" thk; bevel gear 36 teeth, spur gear 30 teeth; Friez No. 32195.	For tape reverse.....	7AK1326–3/G4
	*	*	GEAR ASSEMBLY: spur; bronze, nickel pl and bakelite, lacquered; $1^{9}/_{16}$" OD x $^{1}/_{4}$" bore x $^{11}/_{32}$" thk; large gear 48 teeth, small gear 24 teeth; Friez No. A–32489.	For slow speed drum drive.	7A947.1
	*	*	GEAR ASSEMBLY: spur; phosphor bronze nickel pl and bakelite, lacquered; $^{13}/_{16}$" OD over-all x 0.187" bore x $^{5}/_{16}$" thk; large gear 50 teeth, small gear 18 teeth; Friez No. 32207.	Meshes w/motor pinion at tape reverse assembly.	7AK1326–3/G2
	*	*	GEAR ASSEMBLY: spur; phosphor bronze nickel pl and bakelite, lacquered; $^{13}/_{16}$" OD x 0.187" bore x $^{17}/_{64}$" thk; large gear 50 teeth, small gear 18 teeth; Friez No. 32204.	Meshes w/drive gear for tape reverse.	7AK1326–3/G3
	*	*	GEAR ASSEMBLY: spur; brass, nickel pl; 0.952" OD x $^{1}/_{4}$" bore x $^{13}/_{32}$" thk; large gear 59 teeth, small gear 39 teeth; Friez No. 32820.	Meshes w/pinion of paper drive motor.	7A1326–3/G9
	*	*	GEAR ASSEMBLY: spur; brass hub and gear, and lacquered fiber gear; $3^{11}/_{32}$" OD x $^{5}/_{16}$" bore x $^{13}/_{16}$" thk; large gear 105 teeth, small gear 67 teeth; Friez No. 32435.	For spiral drum drive....	7A1326–3/G14
	*	*	HOLDER, contact brush: black plastic, lacquered; pear-shaped; $2^{1}/_{2}$" lg x 2" wd x $^{1}/_{2}$" thk over-all; Friez No. 507210.	.....	7A1326–3/H4
	*		HOLDER, fuse: block type; bakelite base w/Shakeproof tinned term; $1^{5}/_{8}$" x $^{1}/_{2}$" x $^{3}/_{16}$"; Littelfuse No. 351001.	For single No. 3AG fuse.	3Z3276

Table VII. Identification Table of Replaceable Parts for Radiosonde Recorders RD-3/FMQ-1 and RD-3A/FMQ-1—Continued

Ref. symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	RD-3/FMQ-1	RD-3A/FMQ-1			
		*	HOLDER, fuse: extractor post; bakelite body; 10 amp max; 2⅛" lg x ¾" diam over-all; Littelfuse No. 341001.	For single No. 3AG fuse.	3Z3275
	*	*	HOLDER, tape guide: lower; brass, nickel pl; 1⅝" lg x 0.311" diam over-all; Friez No. 31765.	.....	7A1326-3/19
	*	*	HOLDER, tape guide: upper; brass, nickel pl; 1³⁄₁₆" lg x 0.311" diam over-all; Friez No. 31766.	.....	7A1326-3/8
	*	*	HUB: brass, nickel pl; 0.4375" ID x 2" OD x 1¹⁄₁₆" thk over-all; Friez No. 31794.	Fastens to large drive gear.	7A1326-3/9
	*	*	INSERT, brush holder: brass, nickel pl; ²⁵⁄₃₂" lg x ¼" diam, w/hole 0.157" diam x ⅝" d; Friez No. 32429.	.....	7A1326-3/1
	*	*	KNOB: round; brass, nickel pl; for ¼" diam shaft; single No. 5-40 x ³⁄₁₆" hex. socket, cup point set-screw; 1¼" diam x ⅝" lg over-all; knurled; Friez No. 36240.	Meter zero adjustment...	7A1050-4
	*	*	LAMP, incandescent: 6-8 v, 15 cp; round clear bulb; 2" lg x 1" diam; bayonet base; Mazda No. 87 (for optical disk assembly).	Light source for photo-cell.	6Z6806.6
	*	*	LAMP, incandescent: 115 v, 7 w; bulb C-7 frosted; 2½" lg over-all; candelabra screw base; C7A fil; GE No. 7C7/W.	To illuminate recorder..	6Z6825.1
	*	*	LAMPHOLDER: candelabra bayonet base; bakelite; 125 v, 75 w; approx dimen 4¾" h x 2½" wd over-all; w/snap-on lamp shade; Marks Prod No. W-0682.	.....	7A1055A
	*	*	MODIFICATION KIT MX-636/FMQ-1: for Radiosonde Recorder RD-3/FMQ-1, p/o Radiosonde Receptor AN/FMQ-1; Sig C dwg No. SC-D-14918-A through SC-D-14922-A and No. SC-B-15669-A.	Replaces ribbon reversing assembly.	7A1123-636
B400	*	*	MOTOR, AC: capacitor-start sync type; 1 rpm; closed frame; keyed shaft to fit Woodruff No. 201 key; 2¹¹⁄₁₆" lg x 2⁹⁄₁₆" wd x 2⁹⁄₁₆" h, shaft ½" lg x ³⁄₁₆" diam; 115 v ac, 60 cyc, single ph; Friez No. P-507066.	For paper drive.....	7A1129-1
B401	*	*	MOTOR, AC: capacitor-start sync type; 1,050 rpm; closed frame; keyed shaft to fit Woodruff No. 201 key; 3¹⁵⁄₁₆" lg x 2⁹⁄₁₆" wd x 2⁹⁄₁₆" h; shaft ½" lg x ³⁄₁₆" diam; 115 v ac, 60 cyc, single ph; Friez No. 507061.	For main drive.....	7A1129-4

Table VII. Identification Table of Replaceable Parts for Radiosonde Recorders RD-3/FMQ-1 and RD-3A/FMQ-1—Continued

Ref. symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	RD-3/FMQ-1	RD-3A/FMQ-1			
B402	*	*	MOTOR, AC: induction type; 0.004 hp; open frame; w/setscrew fastened pinion; 2 19/32″ lg x 2 11/32″ h x 1¾″ d over-all, shaft 0.1247″ diam x ⅝″ lg; 115 v ac, 60 cyc, single ph, ½ amp; 14 w; Friez No. 506956 and No. 32209.	For ribbon reverse assembly.	7A1129
	*	*	NUT, hexagon: brass, nickel pl; No. 5–40; 1/16″ thk; 3/16″ wd across flats; Friez No. 32933.	For locking adjusting screw on spiral drum.	6L3105–40–3.1A
	*	*	NUT, hexagon: brass, nickel pl; 5/16″–18; 3/16″ thk; 7/16″ wd across flats; Friez No. 32810.	For eccentric screw.....	6L3505–18–7.1
	*	*	NUT, hexagon: brass, nickel pl; 5/16″–48; 15/16″ thk; ¾″ wd across flats; w/6 radially drilled holes; Friez No. 40909.	Secures rocker frame pivot.	7A1148–1
	*	*	NUT, round: stainless steel; No. 5–40; 7/64″ thk; ⅜″ diam; Friez No. 31724.	Pivot screw locknut for tapper bar.	6L3655–40
	*	*	NUT, round: brass, nickel pl; 5/16″–48; ⅞″ diam x 3/16″ thk; w/6 radially drilled holes; Friez No. 31747.	For rocker frame.....	7AK1326–3/N1
	*	*	NUT, thumb: brass, nickel pl; 5/16″–18; 5/16″ thk; ⅞″ OD; knurled top; Friez No. 32425.	For fastening photo tube and light disk to shaft.	6L3885–18–14.1
	*	*	OPTICAL SYSTEM: for optical disk; consists of optical elements in metal case; approx dimen 2 15/32″ lg x 1″ diam over-all; Friez No. 507406, ST–591.	Focuses photocell light source.	7AK1326–3/OS1
	*	*	PIN, roller: stainless steel; 1 15/64″ lg x ¼″ diam; w/head 3/64″ thk x ¼″ diam; Friez No. 31769.	Secures tape guides to rocker frame.	7A1326–3/10
	*	*	POINTER, indicator: paper set; brass; nickel pl; 1½″ lg x 1⅛″ wd x 5/64″ thk over-all; w/pointer 1⅛″ lg; Friez No. 36098.	.....	7A1326–3/P4
R401	*	*	RESISTOR, fixed: composition; 1,000 ohms ±10%; 2 w; max body dimen 1.78″ lg x 0.405″ diam; JAN type RC41BF102K.	Cathode, for tube V401. For preamplifier.	3RC41BF102K
R400	*	*	RESISTOR, fixed: composition; 3 meg ±5%; 2 w; max body dimen 1.78″ lg 0.405″ diam; JAN type RC41BF305J.	Grid, for tube V401. For preamplifier.	3RC41BF305J
	*	*	RIBBON, printing: black; ½″ wd; 36 ft lg; metal spool; Fed spec DDD–R–311, type A, class No. 1.	.....	6M1175
	*	*	ROLLER, guide: ribbon, lower; brass; nickel pl; 49/64″ lg x ⅜″ diam over-all; Friez No. 31767.	.....	7A1326–3/G49
	*	*	ROLLER, guide: ribbon, upper; brass; nickel pl; 25/32″ lg x 7/16″ diam over-all; Friez No. 31768.	.....	7A1326–3/G50

Table VII. Identification Table of Replaceable Parts for Radiosonde Recorders RD–3/FMQ–1 and RD–3A/FMQ–1—Continued

Ref. symbol	Models RD–3/FMQ–1	Models RD–3A/FMQ–1	Name of part and description	Function of part	Signal Corps stock No.
	*	*	ROLLER ASSEMBLY, guide: brass and rubber; consists of hub assembly, springs and rubber rollers; 1⅝″ lg x 1½″ h x 1½″ d over-all; Friez No. 32790.	Maintains pressure on paper on chart roll.	7AK1326–3/R1
	*	*	SCREW, set: slotted, headless; stainless steel; No. 5–40; ⅝″ lg w/cone point; Friez No. 32739.	For adjusting spiral drum assembly.	6L18505–10.35
	*	*	SCREW, machine: F Fil H; brass, nickel pl; No. 2–56; 5/16″ lg w/3/16″ lg thd; head 3/32″ thk x 3/16″ diam w/⅛″ lg x 0.125″ diam shoulder; Friez No. 32267.	For friction roller assembly.	6L15002–5.10
	*	*	SCREW, machine: F Fil H; brass, nickel pl; No. 3–48; 7/32″ lg w/⅛″ lg thd; Friez No. 500255–4.	Secures cap spring holder on supply roll assembly.	6L6348–3–1.7
	*	*	SCREW, machine: F Fil H; brass, nickel pl; No. 4–40; ¼″ lg w/13/64″ lg thd; head 3/32″ thk x ¼″ diam; Friez No. 32211.	Secures long face pinion assembly to pinion shaft.	6L20804–5–1.54
	*	*	SCREW, machine: F Fil H; stainless steel; No. 5–40; 3/16″ lg w/9/64″ lg thd; head 3/32″ thk x 5/16″ diam; Friez No. 32222.	For idler gear and pull-out arm catch.	6L20905–4–1.10
	*	*	SCREW, machine: F Fil H; brass, nickel pl; No. 5–40; 5/16″ lg w/0.227″ lg thd; head 5/16″ diam x 1/16″ thk; two shoulders, 0.155″ diam x 0.069″ lg, 7/32″ diam x 1/164″ lg; Friez No. 31723.	Pivot screw for tapper bar.	6L15005–6.54
	*	*	SCREW, machine: F Fil H; brass, nickel pl; No. 10–32; ¾″ lg; two flats on thd end, 3/32″ across x 3/16″ lg w/0.063″ hole through flats; Friez No. 31725.	For dog leg spring.....	6L20810–7–1.4
	*	*	SCREW, machine: F Fil H; brass, nickel pl; No. 10–60; 11/16″ lg w/19/32″ lg thd; head 3/16″ thk x 5/16″ diam; Friez No. 31745.	Rocker frame stop screw.	6L7060–11.54
	*	*	SCREW, machine: F Fil H; brass, nickel pl; No. 12–32; ½″ lg; head 3/16″ thk x 5/16″ diam; Friez No. 32230.	Center adjusting	6L7232–8.54
	*	*	SCREW, machine: hex. head; brass, nickel pl; No. 10–32; 7/32″ lg w/5/32″ lg thd; head 3/32″ thk, ⅜″ across flats; Friez No. 32896.	For idler gear stud.....	6L20810–5.81N
	*	*	SCREW, machine: RH; brass, nickel pl; No. 3–48; ¼″ lg; Friez No. 500205–8.	Secures tape reverse assembly.	6L6348–5.5
	*	*	SCREW, set: hex. socket; steel; nickel pl; No. 6–32; ⅛″ lg w/cup point; Friez No. 500718–4.	For meter mount assembly, recorder assembly, tape guide holders.	6L18506–2.40
	*	*	SCREW, set: hex. socket; steel, nickel pl; No. 6–32; 3/16″ lg w/cup point; Friez No. 500718–6.	For tape guide holders...	6L18506–3.40

Table VII. Identification Table of Replaceable Parts for Radiosonde Recorders RD-3/FMQ-1 and RD-3A/FMQ-1—Continued

Ref. symbol	Models RD-3/FMQ-1	Models RD-3A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
	*	*	SCREW, set: hex. socket; hardened steel, nickel pl; No. 8-32; 1/8" lg w/cup point; Friez No. 500719-4.	For contact brush holder.	6L18508-2.40
	*	*	SCREW, thumb: knurled head; brass, nickel pl; No. 6-32; 11/32" lg threaded full lg; oval point; head 7/64" thk x 13/32" diam; Friez No. 502304.	Clamp for optical socket assembly.	6L17006-7-1.5
	*	*	SCREW, thumb: knurled head; brass, nickel pl; No. 10-32; 23/32" lg w/1/4" lg thd; flat point; head 3/16" thk x 15/32" diam; shoulder 1/4" diam x 3/8" lg; Friez No. 32449.	Light adjusting screw for optical system.	6L7032-11-1.24
	*	*	SHADE, lamp: reflector; bakelite; approx dimen 2 3/8" lg x 1 1/2" OD over-all; Friez No. 500127, item 111.	Protects lamp GE No. 7C7/W.	6Z8100
	*	*	SOCKET, tube: std octal; isolantite; 1 7/8" lg x 1 1/2" wd x 3/4" thk; Natl Co No. CIR-8.	For preamplifier	2Z8678.53
	*	*	SPRING: helical compression; 0.013" diam steel music wire, nickel pl; 7/16" lg x 9/64" OD; 7 turns; ends flat and sq; Friez No. 32900.	For contact brush holder.	7A1326-3/S7
	*	*	SPRING: helical compression; 0.031" diam music wire; 9/16" lg x 9/32" OD; 7 turns; plain flatted ends; Friez No. 31740.	For supply roll.....	7A1326-3/14
	*	*	SPRING: helical extension; 0.020" diam music wire; 3/4" lg x 3/16" OD; close-wound; 0.147" diam parallel eye term; Friez No. 32740.	For friction finger.....	7A1326-3/18
	*	*	SPRING: helical extension; 0.041" diam music wire; 1 1/16" lg x 1/4" OD; close-wound; 1.4" diam parallel eye term.; Friez No. 32462.	For rocker return.....	7A1326-3/S6
	*	*	SPRING: helical extension; 0.020" diam phosphor-bronze wire; 1 3/8" lg x 9/32" OD; close-wound; 1/8" diam parallel eye term.; Friez No. 32229.	Return for tapper bar....	7A1326-3/S10
	*	*	SPRING: helical extension; 0.020" diam music wire; 1 3/8" lg x 3/16" OD; close-wound; 1/4" diam parallel eye term.; Friez No. 31722.	For dog legs.....	7A1326-3/S8
	*	*	SPRING: helical extension; 0.020" diam nickel pl music wire; 1 11/64" lg x 11/64" OD; close-wound; 1/8" diam parallel eye term.; Friez No. 35676.	For pull-out arm catch...	7A1326-3/S9
	*	*	SPRING: helical extension; 0.021" diam beryllium copper; 1 9/16" lg x 9/64" OD; approx 65 turns; 1/8" diam parallel hook term.; Sig C dwg No. SC-D-14919-A, item 8.	For ribbon reversing.....	7A1326-3/21
	*	*	SPRING: helical extension; 0.032" diam phosphor-bronze music wire; 2" lg x 9/32" OD; close-wound; 7/32" diam parallel eye term.; Friez No. 34173.	Antibacklash on meter mount assembly.	7A1326-3/S11

Table VII. Identification Table of Replaceable Parts for Radiosonde Recorders RD-3/FMQ-1 and RD-3A/FMQ-1— Continued

Ref. symbol	Models RD-3/FMQ-1	Models RD-3A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
	*	*	SPRING: helical extension; 0.025″ diam music wire, nickel pl; $2\frac{13}{16}$″ lg x ¼″ OD; close-wound; ¼″ diam parallel eye term.; Friez No. 32779.	For rocker arm return...	7A1326–3/13
	*	*	STUD: stainless steel; $\frac{19}{32}$″ lg x ½″ wd x ⅜″ h over-all, shoulder 0.218″ lg x ½″ x ⅜″ h; No. 5–40 x 0.283″ d female thd one end; No. 10–32 x ¼″ d female the other end; Friez No. 32234.	For paper drive idler gear.	7A1687–3
	*	*	STUD: stainless steel; $\frac{43}{64}$″ lg x ½″ wd x ⅜″ h over-all, shoulder 0.235″ lg x ½″ wd x ⅜″ h; No. 5–40 x 0.346″ d female thd one end; No. 10–32 x ¼″ d female thd other end; Friez No. 32484.	For spiral drum idler gear.	7A1687–3.1
	*	*	STUD: brass nickel pl; $\frac{11}{16}$″ lg x ½″ diam over-all, shoulder $\frac{1}{16}$″ thk x ½″ diam; $\frac{5}{16}$″–18 x $\frac{11}{32}$″ lg male thd one end; No. 5–40 x ¼″ d eccentric female thd other end; Friez No. 32497.	.....	7A1687–2
	*	*	STUD: brass; $1\frac{15}{16}$″ lg w/$\frac{5}{16}$″–48 thd $1\frac{11}{32}$″ lg; Friez No. 31746.	For locknut on rocker frame.	6L31224–1
	*	*	SUBASSEMBLY: recorder meter and mount; meter 0–500 ua; 10″ lg x 8″ h x 5″ wd; Friez No. 35670.	.....	7A1326–3/A4
	*	*	SUBASSEMBLY: rocker frame assembly complete w/tapper bar and tapper coils; approx 12″ lg x $5\frac{3}{8}$″ h x $5\frac{1}{2}$″ wd; Friez No. 32173.	.....	7A1326–3/R5
V401	*	*	TUBE, electron: JAN–6J5.....	Preamplifier	2J6J5
V400		*	TUBE, electron: JAN–921.....	Photocell	2J921
	*	*	WINDOW, glass: $5\frac{21}{32}$″ diam x ⅛″ thk; Friez No. P–32264.	For microammeter on meter mount assembly.	2ZA1352–115
	*	*	WORM, gear: stainless steel; single LH thd; 0.374″ OD x 0.187″ bore x ⅝″ lg; Friez No. 506916.	For rotating meter helical teeth.	7A1326–3/15
	*		WRENCH: multiple spline; 0.069″ diam; L-shaped, one leg $1\frac{27}{32}$″ lg, other leg $\frac{21}{32}$″ lg; steel; Friez No. 500729–2.	For Bristol No. 5 setscrew.	6R57400–5
	*		WRENCH: multiple spline; 0.076″ diam L-shaped, one leg $1\frac{27}{32}$″ lg, other leg $\frac{21}{32}$″ lg; steel; Friez No. 500729–3.	For Bristol No. 6 setscrew.	6R55230
	*		WRENCH: multiple spline; 0.094″ diam; L-shaped, one leg $1\frac{31}{32}$″ lg, other leg $\frac{45}{64}$″ lg; steel; Friez No. 500729–4.	For Bristol No. 8 setscrew.	6R55231.1
	*		WRENCH: screwdriver type, multiple spline; 0.069″ diam; 7″ lg x ⅜″ hex.; brass handle, steel bit; hex. handle; Friez No. 37249.	For Bristol No. 5 setscrew.	6R55230–5

Table VII. Identification Table of Replaceable Parts for Radiosonde Recorders RD-3/FMQ-1 and RD-3A/FMQ-1—Continued

Ref. symbol	Models RD-3/FMQ-1	Models RD-3A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
	*		WRENCH: screwdriver type, multiple spline; 0.076″ diam; 7″ lg x 3/8″ hex.; brass handle, steel bit; hex. handle; Friez No. 37246.	For Bristol No. 6 setscrew.	6R55230-2
	*	*	WRENCH: setscrew; 1/16″ across flats; L-shaped, one leg 1 3/4″ lg, other leg 1/2″ lg; steel; Friez No. 500730-2.	For Allen No. 5 and No. 6 hex. head socket setscrew.	6R57400-6
	*	*	WRENCH: setscrew; 5/64″ across flats; L-shaped, one leg 1 7/8″ lg, other leg 5/8″ lg; steel; Friez No. 500730-3.	For Allen No. 8 hex. head socket setscrew.	6R57400
	*	*	WRENCH: spanner; for 3/4″ diam serrated nut; 3 7/16″ lg x 5/8″ wd x 1/4″ thk; steel; flat straight handle; Friez No. 36365.	Special for Friez No. 31747 nut.	6R57505

Table VIII. Identification Table of Replaceable Parts for Voltage Regulators CN-2/FMQ-1 and CN-2A/FMQ-1

Ref. symbol	Models CN-2/FMQ-1	Models CN-2A/FMQ-1	Name of part and description	Function of part	Signal Corps stock No.
	*	*	VOLTAGE REGULATORS CN-2/FMQ-1 and CN-2A/FMQ-1: input 95-130 v, 2.3 amp, 60 cyc; output 115 v ±0.5%, 1.3 amp, 60 cyc; approx 5 3/4″ h x 5 3/4″ d x 5″ over-all.	.....	7A1680
C301	*	*	CAPACITOR, fixed: paper; 100,000 mmf +20% −10%; 350 vacw; metal can; 1 25/32″ lg x 1 1/16″ diam; mineral oil impregnated; term. on one end attached to case; other end has 6″ lg wire lead w/term. Raytheon SR-35-55-P1.	Line filter. For No. 10 screw.	3DA100-319
C300	*	*	CAPACITOR, fixed: paper; 5 mf +10% −25%; 440 vacw; HS metal can; 3 3/4″ lg x 1 1/4″ wd x 4 3/8″ h; synthetic oil impregnated; GE No. 9CE1A324.	Voltage regulating	3DB5-27

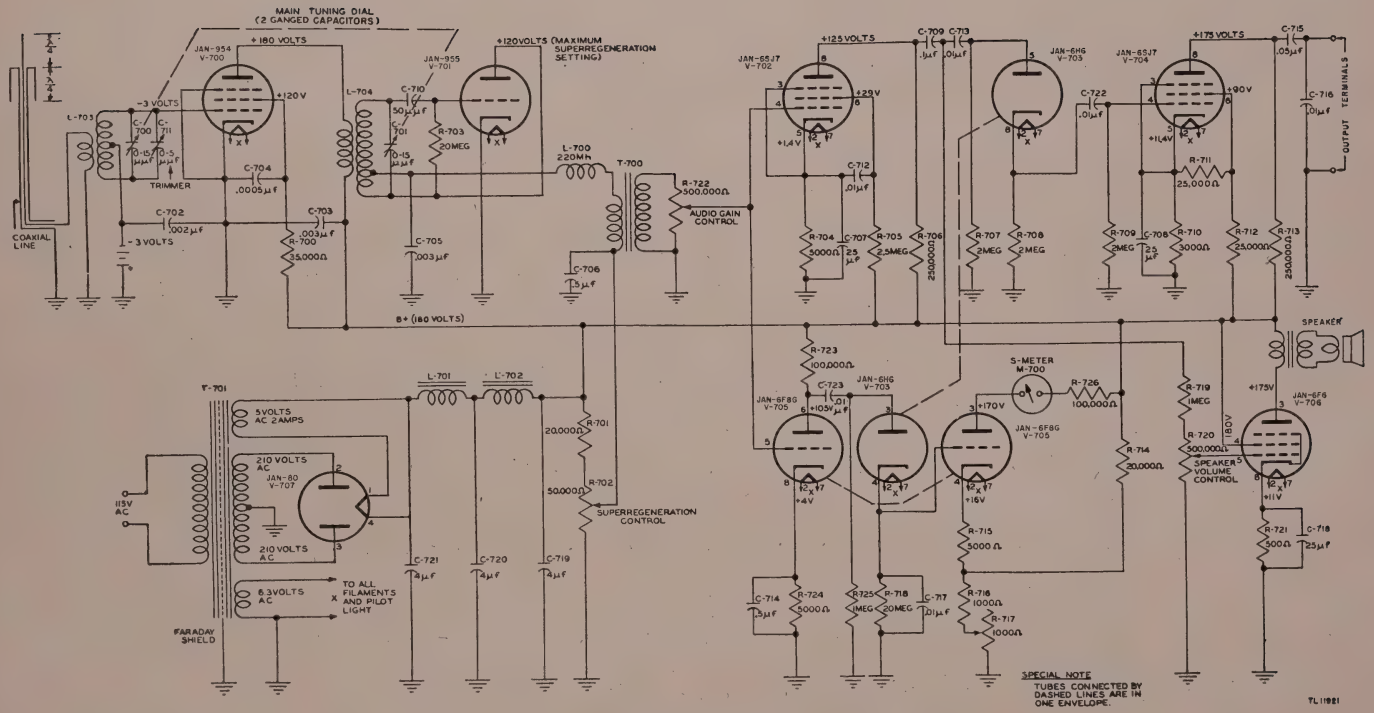


Figure 80. Radiosonde Receiver R–17/FMQ–1, schematic diagram.

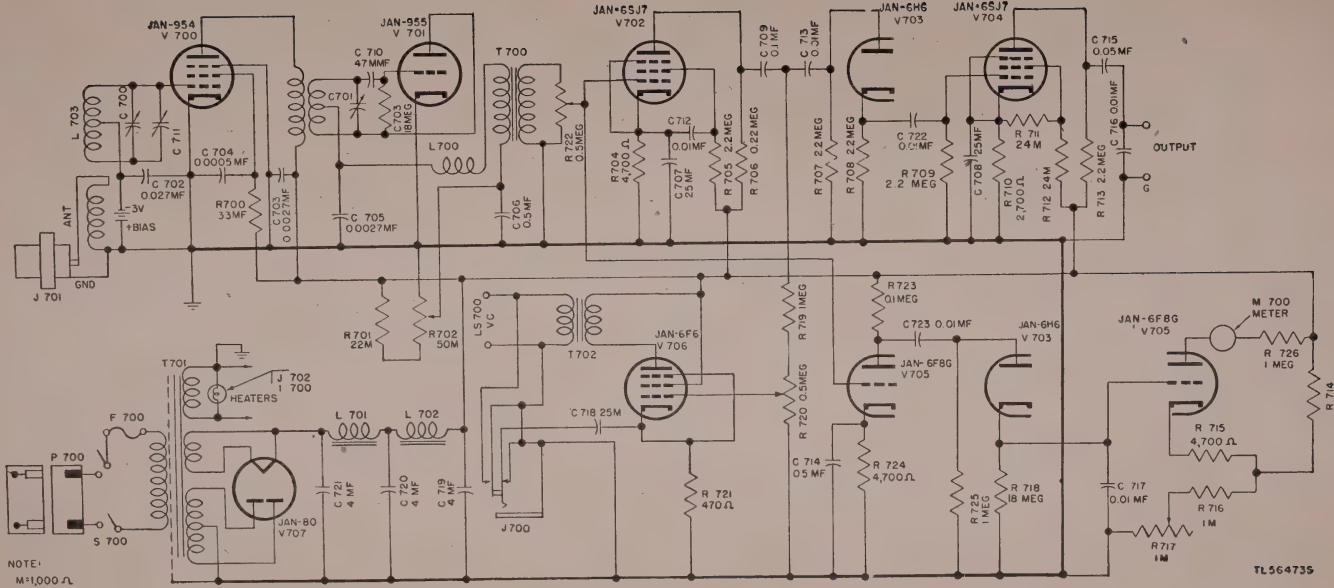


Figure 81. Radiosonde Receiver R–17A/FMQ–1, schematic diagram.

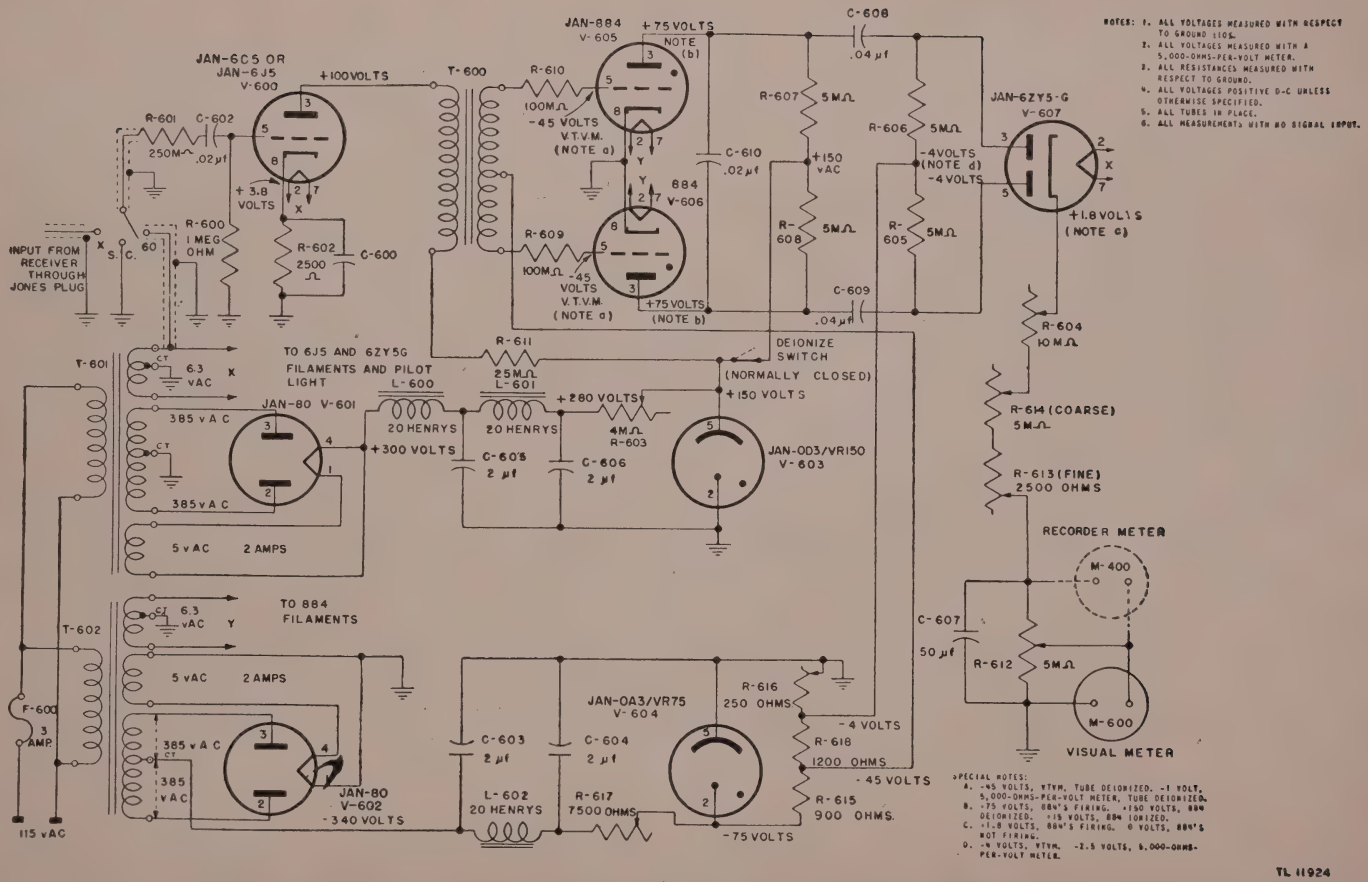


Figure 82. Frequency Meter TS-29/FMQ-1 with two power transformers, schematic diagram showing circuit revisions.

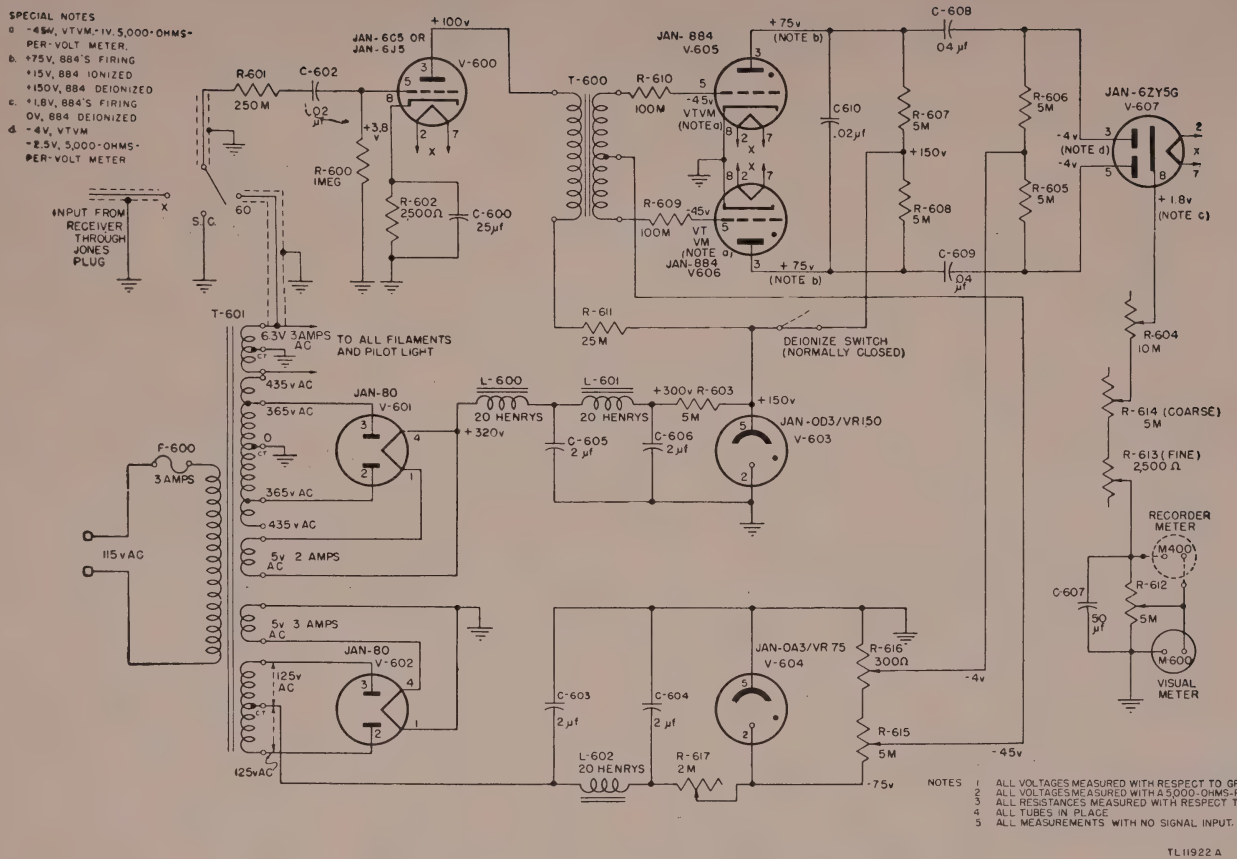


Figure 83. Frequency Meter TS-29/FMQ-1 with one power transformer.

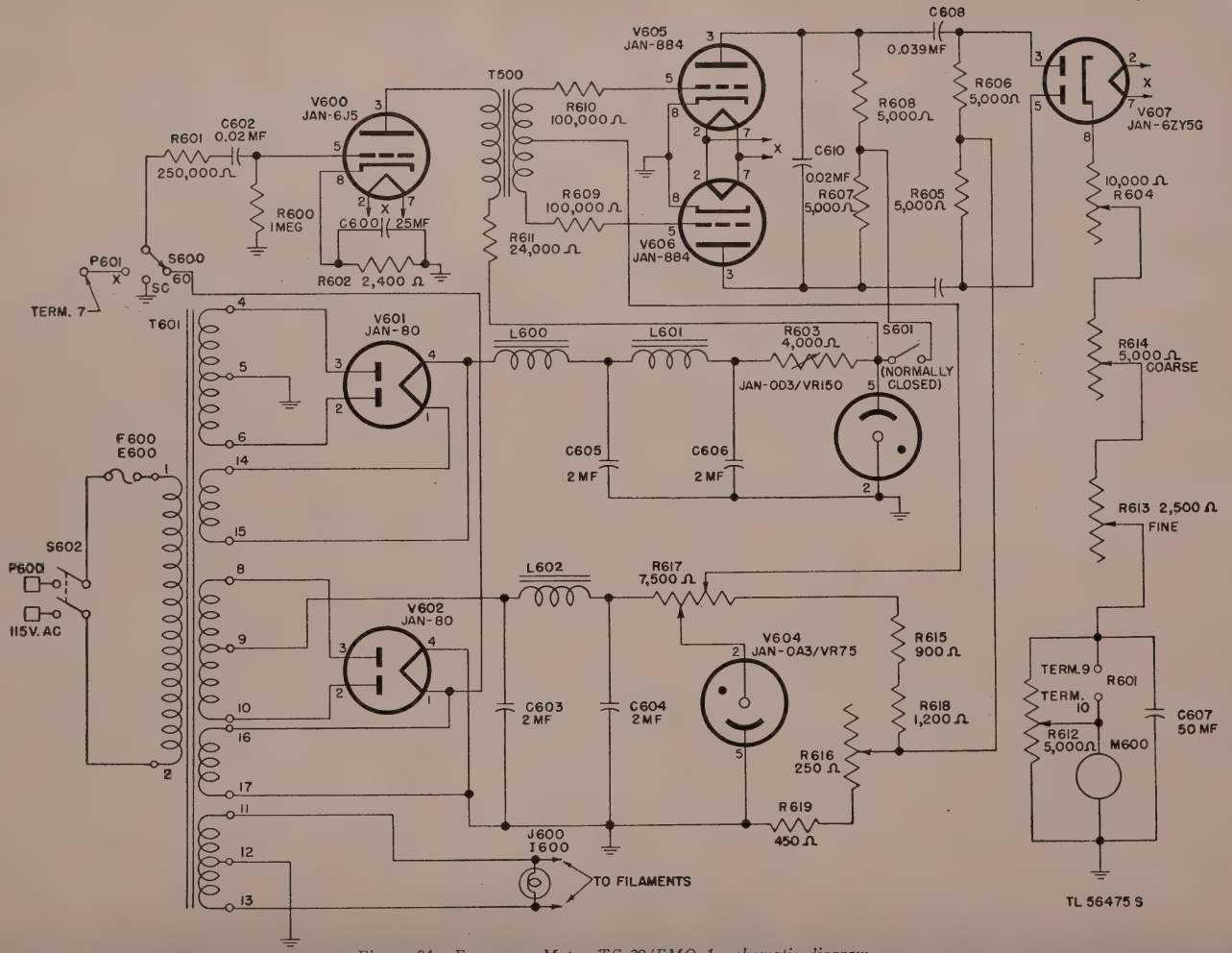


Figure 84. Frequency Meter TS-29/FMQ-1, schematic diagram.

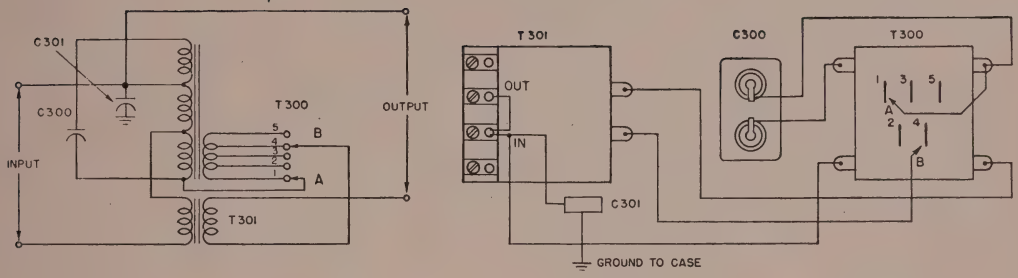
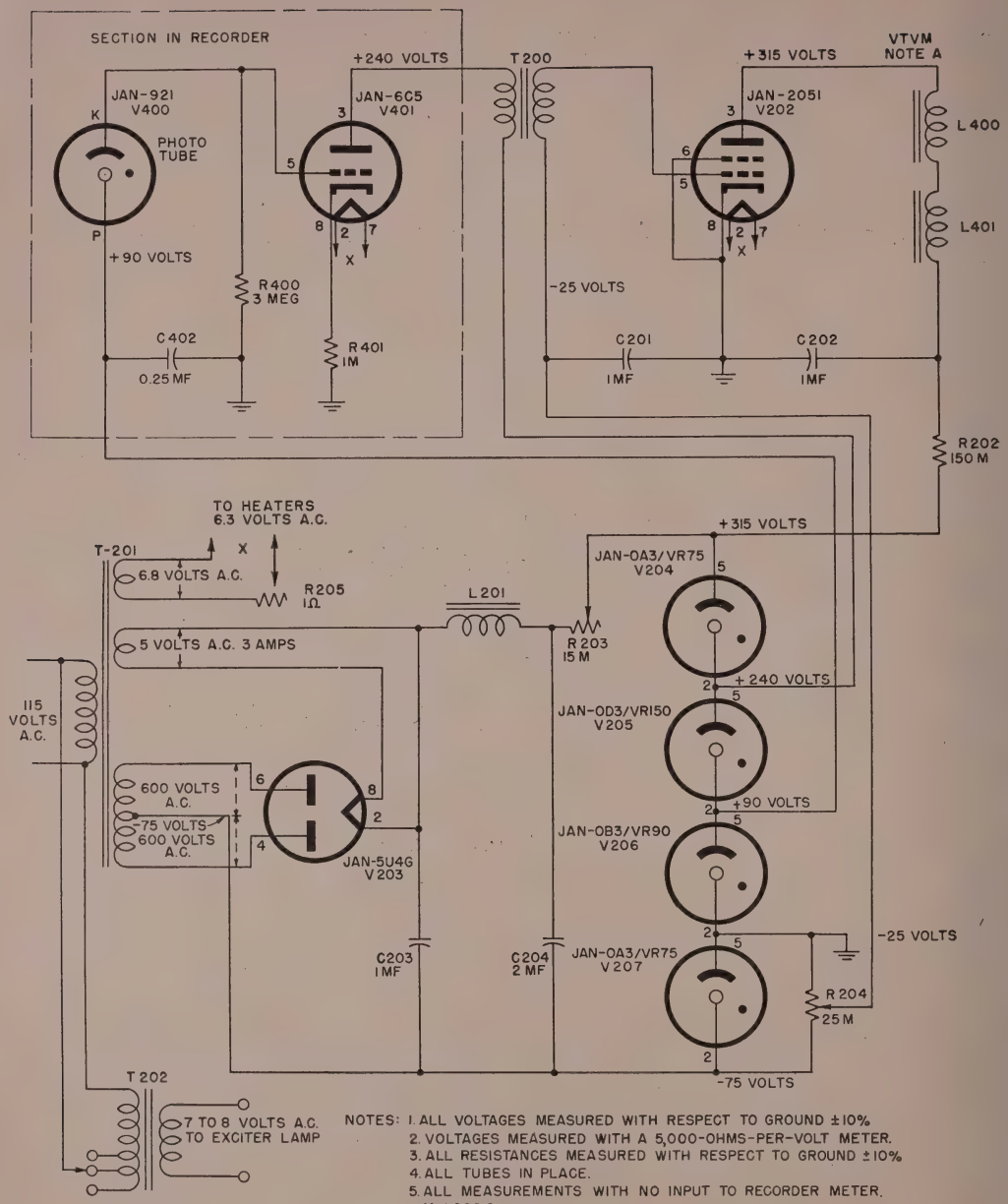


Figure 85. Voltage Regulator CN–2/FMQ–1, schematic and wiring diagram.



NOTES:
1. ALL VOLTAGES MEASURED WITH RESPECT TO GROUND ±10%
2. VOLTAGES MEASURED WITH A 5,000-OHMS-PER-VOLT METER.
3. ALL RESISTANCES MEASURED WITH RESPECT TO GROUND ±10%
4. ALL TUBES IN PLACE.
5. ALL MEASUREMENTS WITH NO INPUT TO RECORDER METER. M=1,000Ω

SPECIAL NOTES: A. +315 VOLTS WITH VTVM.
+240 VOLTS WITH 1,000-OHMS-PER-VOLT METER, 1,000-VOLT SCALE.
+190 VOLTS WITH 1,000-OHMS-PER-VOLT METER, 250-VOLT SCALE.

TL56474S

Figure 86. Amplifier AM-7/FMQ-1, schematic diagram.

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