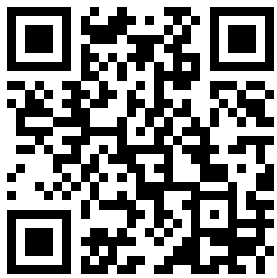

TM 11-269

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

RADIO SETS AN/TRT-1 AND AN/TRR-2

DEPARTMENT OF THE ARMY • OCTOBER 1949

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TM 11-269

This manual supersedes TM 11-269, 26 October 1944; TM 11-2612, 22 March 1944; and TB 11-269-1, April 1945.

RADIO SETS AN/TRT-1 AND AN/TRR-2

DEPARTMENT OF THE ARMY *OCTOBER 1949*

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TM 11–269 is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF THE ARMY:

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EDWARD F. WITSELL
Major General
The Adjutant General

J. LAWTON COLLINS
Chief of Staff, United States Army

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For explanation of distribution formula, see SR 310–90–1.

CONTENTS

WARNING

A potential of
625 VOLTS
is used in the operation of
this equipment.

DEATH ON CONTACT

may result if personnel fail to
observe safety precautions.

Be careful not to contact high-voltage output connections of the dynamotors when checking or trouble shooting this equipment.

When working inside the equipment after the power has been turned off, always ground every part before touching it.

Never connect a charge to the firing cord when the receiver is out of its waterproof container.

DANGEROUS VOLTAGES

exist in Radio Transmitter T–87/TRT–1

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

f. The resuscitation procedure is as follows:

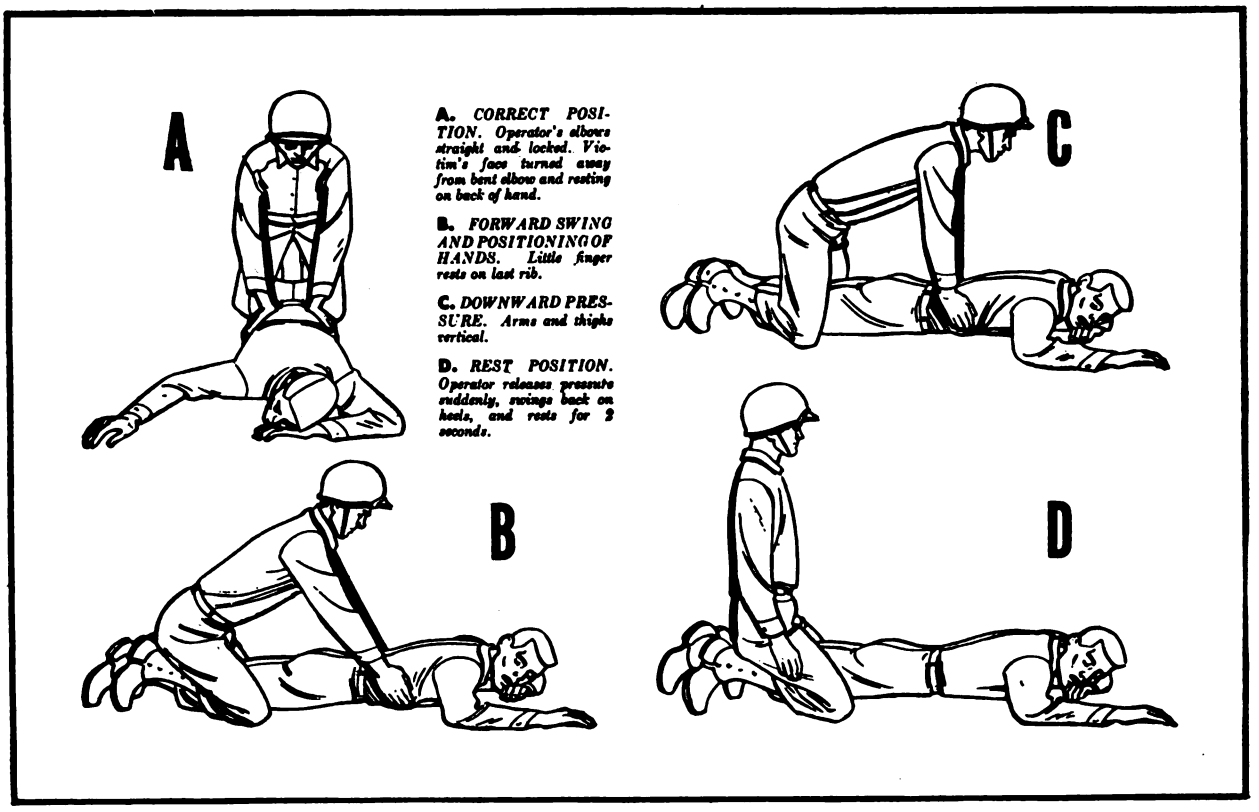
(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4

TL15338-D



A. *CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.*

B. *FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.*

C. *DOWNWARD PRESSURE. Arms and thighs vertical.*

D. *REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.*

seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

TL15338-E

Figure 1. Radio Sets AN/TRT–1 and AN/TRR–2 in operation.

This manual supersedes TM 11-269, 26 October 1944; TM 11-2612, 22 March 1944; and TB 11-269-1, April 1945.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

This technical manual contains instructions for the installation, operation, maintenance, and repair of Radio Sets AN/TRT-1 and AN/TRR-2 (fig. 1). In addition to these instructions, there are two appendixes covering a list of references and an identification table of parts.

2. Forms and Records

a. WD AGO Form 468 (Unsatisfactory Equipment Report) is used in reporting operations and maintenance of the equipment. 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. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Radio Set AN/TRT-1 (fig. 2) is a radio transmitter which is used in conjunction with Radio Set AN/TRR-2 (fig. 3), a receiver. The two equipments comprise a system for the remote detonation of land and water mines. The receiver is connected to the detonating device of a mine and is left in operation. One transmitter may be used in conjunction with a large number of receivers. A system of selective detonation is used which permits the detonation of any particular mine (or group of mines) at will. In operation, the transmitter emits an r-f (radio-frequency) signal which is modulated by a series of a-f (audio-frequency) pulses. To prevent detonation of the mine by stray signals or by enemy-radiated signals, the receiver is designed so that it causes the detonator to operate only upon reception of a signal at a predetermined radio frequency, modulated by a predetermined audio frequency and pulsed according to a predetermined code. Six radio frequencies can be set up in each transmitter at one time. The r-f signal may be modulated by any one of five audio frequencies. The audio frequency selected is in turn coded by a series of pulses. The series of pulses consists of 3 groups; each group of pulses may consist of 1 to 10 individual pulses of audio frequency. There are available 21,600 different combinations of radio frequency, audio frequency, and pulse coding. The security of the system is based upon this large number of combinations. The chance that the enemy will hit upon the combination required to detonate a particular mine or group of mines is very remote.

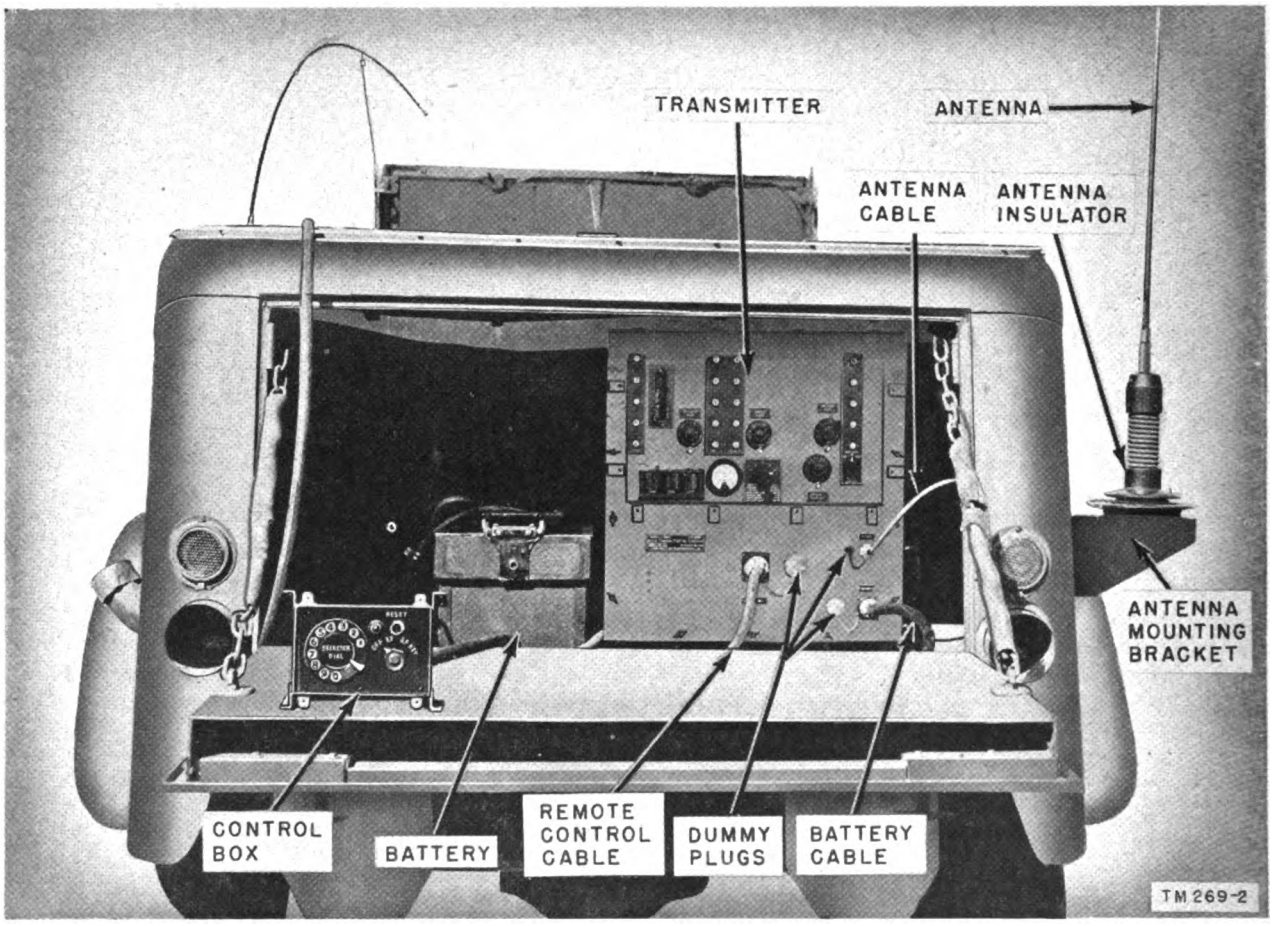


Figure 2. Radio Set AN/TRT–1, components identified.

4. Application of Equipment

a. Mines can be detonated from distances up to 8 miles when the transmitter is operated from a ground position. Operation is effective at distances up to 12 to 20 miles when the transmitter is installed in watercraft and from at least 40 miles when it is operated in aircraft at a height of 5,000 feet. Operation on the ground depends to a great extent upon radio propagation conditions between the transmitter and receiver.

b. A complete mine-detonation system consists of one transmitter (Radio Set AN/TRT–1) and any number of receivers (Radio Set AN/TRR–2). Although the receiver is designed primarily for underwater operation, the antenna float can be removed and the antenna connected directly to the receiver (fig. 14). The number of receivers to be used, the code combinations to be selected, and any other considerations will be specified in the theater of operations.

5. Technical Characteristics

a. Radio Set AN/TRT–1 (fig. 2).

Frequency range:

Twenty-five r-f channels spaced 0.5 mc (megacycles) apart in the frequency range of 28 to 40 mc are available, but only the six crystals listed in table V are furnished with the equipment for use in six channels between 29.5 and 32 mc inclusive.

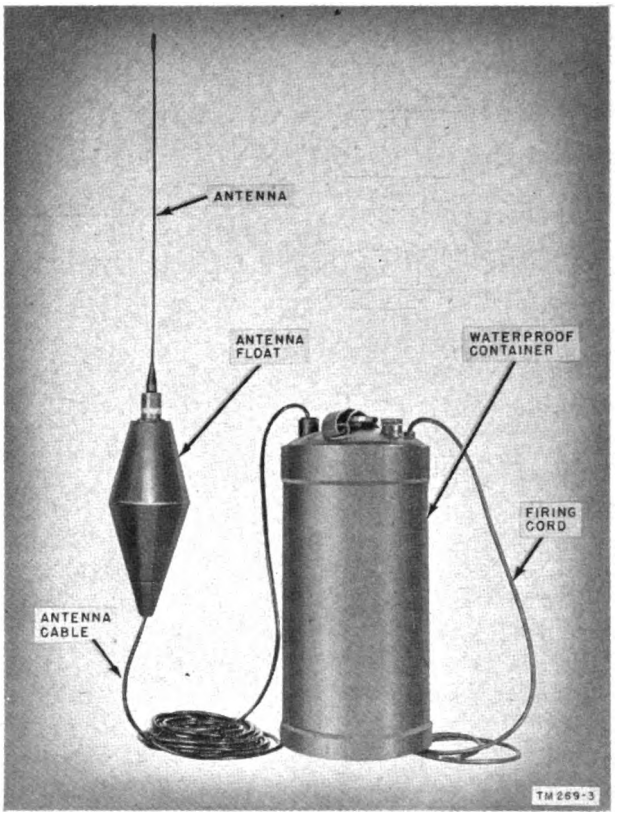


Figure 3. Radio Set AN/TRR–2, components identified.

Transmitter type	Crystal oscillator, doubler, push-pull amplifier.
Type of signal transmitted	A-m (amplitude-modulated).
Distance range:	
Land	8 miles
Water	12 to 20 miles.
Air	40 miles.
Modulating signal	Keyed audio-frequency.
Number of tubes	Seven.
Power input:	
12-volt at 38 amperes	456 watts.
24-volt at 19 amperes	456 watts.
Power output	40 to 50 watts (depending upon frequency).
Antenna	Consists of a vertical half-wave whip specially designed for operation on 29.5 to 32 mc. Includes Mast Sections MS–49 through MS–52.
Power supply	12-volt battery through Dynamotor DM–35, or 24-volt battery through Dynamotor DM–37.
Weight	119 lb.

b. RADIO SET AN/TRR–2 (fig. 3).

Frequency range:

Twenty-five r-f channels spaced 0.5 mc apart in the frequency range of 28 to 40 mc. The six channels from 29.5 through 32 mc are supplied with present receivers.

Receiver type	R-f amplifier, superregenerative detector, a-f discriminator.
Type of signals which can be received	Coded signal of a definite radio and audio frequency.
Number of tubes	Six.
Power input (stand-by condition)	570 mw (milliwatts).
Power supply	8 Batteries BA–2 (22.5 volts each); 1 Battery BA–34 (6 volts); 2 Batteries BA–35 (1.5 volts each).
Antenna	Vertical whip-type designed with maximum flexibility.
Weight	55 lb (includes receiver, antenna, float, and batteries).

6. Major Components

A list of major components, along with the common usage name, of Radio Sets AN/TRT–1 and AN/TRR–2 is given below.

Nomenclature	*Common name*
Radio Transmitter T–87/TRT–1	Transmitter
Radio Set AN/TRR–2	Receiver
Dynamotor DM–35–D	Dynamotor
Antenna Assembly AS–149/TRT–1	Transmitting antenna
Cord CG–203/TRT–1	Antenna cable
Cord CG–260/TRT–1	Dummy load cable
Cord CX–275/TRT–1	Control cable
Cord CX–276/TRT–1	Battery cable
Control Box C–152/TRT–1	Control box
Test Set TS–245/TRT–1	Audio calibrator
Test Set TS–261/TRR–2	Receiver test set
Dummy Load TS–292/TRT–1	Dummy load
Chest CY–279/TRT–1	Spare parts chest

Table I. Weights and Dimensions

Components	Weight (lb)	Dimensions (in.)			
		Height	Width	Depth	Diameter
Receiver (with batteries)	51	20.5	------	------	9
Receiver antenna and float	4	38	------	------	6
Transmitter (with waterproof covers)	99	23	24.5	14	------
Transmitting antenna	16	13.5	------	------	7
Control box (with waterproof covers)	4	5.5	7	5.5	------

7. Weights and Dimensions of Major Components

The weights and dimensions of the major components are listed in table I.

8. Packaging Data

a. Radio Set AN/TRT–1 is packed in two wooden boxes, as listed in table II. One box contains Radio Transmitter T–87/TRT–1, including tubes, crystals, dynamotors, and miscellaneous items. The second box contains spare parts Chest CY–279/TRT–1 (fig. 4) which includes test equipment for the transmitter and receiver, tools, and accessories and running spares for the transmitter. The battery is not included with the transmitter and must be procured separately. Any standard storage battery or combination of storage batteries with the required 12- or 24-volt output can be used with Radio Set AN/TRT–1.

b. Radio Set AN/TRR–2 is packed three per box, and each receiver is complete with the items shown in the table of components. Each box also contains an additional audio stage, detector stage, and r-f stage plug-in unit, and one each Tubes JAN–1L4 and JAN–1C21.

(1) The additional plug-in units make it possible to set up a different combination of radio and audio frequency for each receiver in the box. Each box is marked on the outside in large black letters with a *group number* which indirectly identifies the frequency of the plug-in units in the individual receivers and those included in the box as extras. Table III contains the group numbers of the plug-in units (stamped on top of

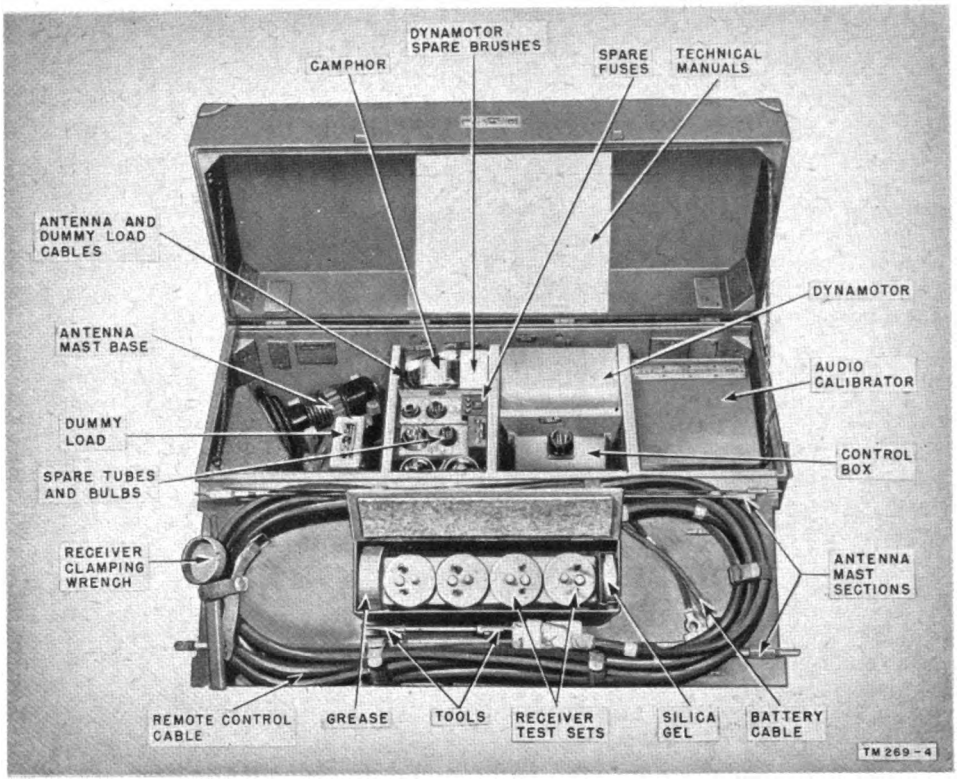


Figure 4. Spare parts Chest CY–279/TRT–1.

each unit) included in any group, and table IV the frequency of the individual units furnished.

(2) Each receiver requires eight Batteries BA–2, one Battery BA–34, and two Batteries BA–35 as sources of power. Since batteries deteriorate in time, they are not shipped with the equipment. Fresh stocks of the respective types of batteries are maintained at the same supply depots where the receivers are stored, and these batteries may be obtained on requisition.

9. Radio Set AN/TRT–1

Radio Set AN/TRT–1 (fig. 5) consists of a crystal-controlled transmitter (Radio Transmitter T–87/TRT–1) which is modulated by a pulsed a-f sine wave. The r-f section of the transmitter is capable of operating on 25 frequency channels (spaced 0.5 mc apart) in the frequency range of 28 to 40 mc. Only six crystals can be plugged into the r-f section at one time, however, and, therefore, there is a choice of only six frequency channels. The six channels available

Table II. Packaging Data

Note. Items may be packaged in a manner different from that shown, depending on supply channel.

Quantity	Package 1 (7.8 cu ft, 185 lb)
	Component
1	Radio Transmitter T–87/TRT–1, including:
1 piece	Camphor: 2 inches; synthetic.
2	Crystal: 5,333.33 kc; Crystal Holder FT–243.*
2	Crystal: 5,250 kc; type FT–243.*
2	Crystal: 5,166.66 kc; type FT–243.*
2	Crystal: 7,625 kc; type FT–243.*
2	Crystal: 7,500 kc; type FT–243.*
2	Crystal: 7,375 kc; type FT–243.*
2	Dynamotor DM–35–D: 12 volts input, 625 volts output, dc.
2	Fuse: Bussman type 3AG; 5 amperes.
2	Fuse: Bussman type 3AG; 30 amperes.
1	Lamp: ballast; 3 watts, 115 volts; Mazda type 3S6.
1 can	Silica gel: 3-inch cartridge.
3	Tube: JAN–6L6.
1	Tube: JAN–6SN7GT.
2	Tube: JAN–829B.
1	Tube: JAN–OD3/VR150.

* Crystal Unit CR–5B/U, instead of Crystal Holder FT–243, is supplied with equipments bearing serial numbers 226 and above. Frequencies remain unchanged.

Table II. Packaging Data—Continued

Quantity	Package 2 (9.3 cu ft, 215 lb) — Component
1	Spare parts Chest CY-279/TRT-1, including:
1	Antenna Assembly AS-149/TRT-1: whip type; consists of: Mast Bracket MP-50, Mast Base MP-37, and Mast Sections MS-49, MS-50, MS-51, and MS-52.
3 sets	Brushes: spare, for dynamotor.
1	Cord CG-203/TRT-1: antenna cable; 3 ft; rubber-covered; waterproof; single-conductor stranded #16 wire; with one Plug PL-259.
1	Cord CX-275/TRT-1: control box cable; 25 ft; rubber-covered; waterproof; 10-conductor #18 wire.
1	Cord CX-276/TRT-1: battery cable; 8 ft; rubber-covered; waterproof; two-conductor stranded #6 wire; complete with battery connectors and amphenol connector.
1 piece	Camphor: 2 inches; synthetic.
1	Control Box C-152/TRT-1: telephone dial and selector switch; with one pilot lamp, 6.3-volt, Mazda type 44.
1	Dummy Load TS-292/TRT-1: complete with one Cord CG-260/TRT-1 and two hermetically sealed, 73-ohm antenna resistors.
1	Dynamotor DM-35-D: 12 volts input, 625 volts output, dc.
4	Fuse: Bussman type 3AG; 5 amperes.
4	Fuse: Bussman type 3AG; 30 amperes.
1 can	Grease: General Purpose WB-2, US Army spec No. 2-108; for dynamotor.
2	Lamp: ballast; 3 watts, 115 volts; Mazda type 3S6.
3	Lamp: pilot; 6.3 volts; Mazda type 44.
1	Screw driver: 9 inches; 6-inch blade; ¼-inch tip.
1 can	Silica gel: 3-inch cartridge.
2	TM 11-269, Radio Sets AN/TRT-1 and AN/TRR-2.
1	Test Set TS-245/TRT-1: audio calibrator; complete with Cord CG-191/TRT-1 and stethoscope.
4	Test Set TS-261/TRR-2: for Radio Set AN/TRR-2.
1	Tube: type JAN-6L6.
1	Tube: type JAN-6SN7GT.
1	Tube: type JAN-829B.
1	Tube: type JAN-OD3/VR150.
1	Wrench; hexagonal; 7/16 inch.
1	Wrench: special; for receiver clamping disk and antenna.

Quantity	Package 3 (7.8 cu ft, 180 lb) — Component
3	Radio Set AN/TRR-2, each set including:
1	Antenna float: wood.
1	Antenna: rubber-covered.
1	Container: waterproof.

Table II. Packaging Data—Continued

Quantity	Package 3 (7.8 cu ft, 180 lb) — Component
1	Cord: firing; 4 ft; rubber-covered; two-conductor.
1	Cord: antenna cable; 30 ft; rubber-covered; single-conductor.
1	Audio stage plug-in unit: includes one Tube JAN-1L4.
1	Detector stage plug-in unit: includes one Tube JAN-957.
1	R-f stage plug-in unit: includes one Tube JAN-959.
1	Tube JAN-1L4.
2	Tube JAN-1C21.
2	Camphor blocks: synthetic.
1 can	Silica gel.
1	Audio stage plug-in unit: includes one Tube JAN-1L4.
1	Detector stage plug-in unit: includes one Tube JAN-957.
1	R-f stage plug-in unit: includes one Tube JAN-959.
1	Tube JAN-1L4.
1	Tube JAN-1C21.

Table III. Grouping of Plug-in Units

Group No.	Plug-in units		Additional plug-in units	
	R-f and detector stage No.	Audio stage No.	R-f and detector stage No.	Audio stage No.
1	1	1	6	5
2	2	1	5	5
3	3	1	1	5
4	4	1	2	5
5	5	1	4	5
6	6	1	3	5
7	1	2	6	4
8	2	2	5	4
9	3	2	1	4
10	4	2	2	4
11	5	2	4	4
12	6	2	3	4
13	1	3	6	1
14	2	3	5	1
15	3	3	1	1
16	4	3	2	1
17	5	3	4	1
18	6	3	3	1
19	1	4	6	2
20	2	4	5	2
21	3	4	1	2
22	4	4	2	2
23	5	4	4	2
24	6	4	3	2
25	1	5	6	3
26	2	5	5	3
27	3	5	1	3
28	4	5	2	3
29	5	5	4	3
30	6	5	3	3

Table IV. Plug-in Unit Frequencies

Code No.	R-f plug-in unit		Detector plug-in unit		A-f plug-in unit	
	Freq (mc)	Signal Corps stock No.	Freq (mc)	Signal Corps stock No.	Freq (cps)	Signal Corps stock No.
1	32.0	2S5014-2/6	32.0	2S5014-2/17	336	2S5014-2/8
2	31.5	2S5014-2/5	31.5	2S5014-2/16	433	2S5014-2/11
3	31.0	2S5014-2/2	31.0	2S5014-2/13	558	2S5014-2/7
4	30.5	2S5014-2/1	30.5	2S5014-2/14	721	2S5014-2/10
5	30.0	2S5014-2/3	30.0	2S5014-2/12	930	2S5014-2/9
6	29.5	2S5014-2/4	29.5	2S5014-2/15		

with present equipment are those between 29.5 and 32 mc. The output of the transmitter is between 40 and 50 watts, and the r-f carrier is 90 to 100 percent modulated. With the exception of the antenna and the 12-volt or 24-volt d-c (direct-current) power supply, the transmitter is self-contained.

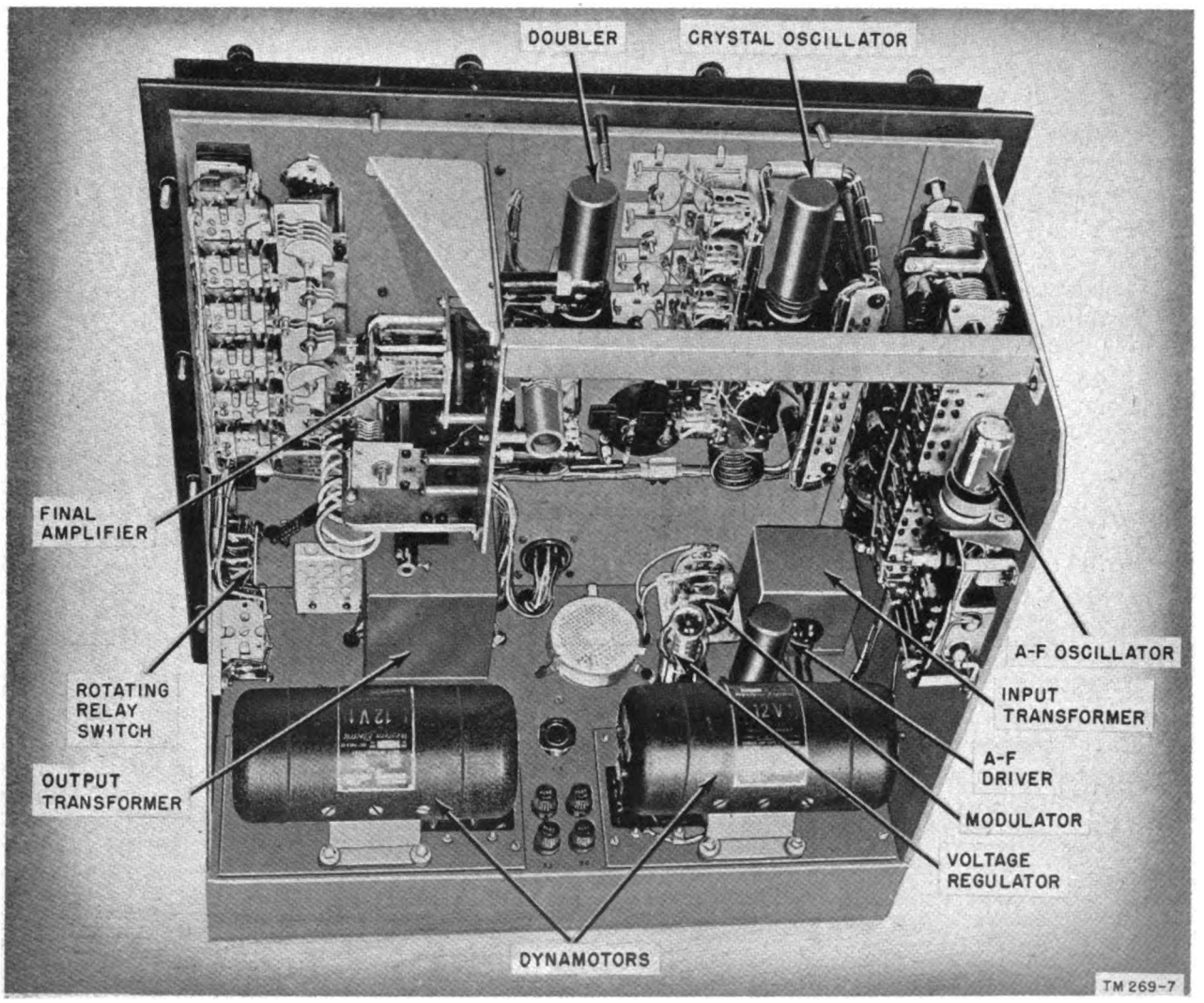


Figure 5. Transmitter, stages identified.

Table II. Packaging Data—Continued

Quantity	Package 2 (9.3 cu ft, 215 lb) Component
1	Spare parts Chest CY-279/TRT-1, including:
1	Antenna Assembly AS-149/TRT-1: whip type; consists of: Mast Bracket MP-50, Mast Base MP-37, and Mast Sections MS-49, MS-50, MS-51, and MS-52.
3 sets	Brushes: spare, for dynamotor.
1	Cord CG-203/TRT-1: antenna cable; 3 ft; rubber-covered; waterproof; single-conductor stranded #16 wire; with one Plug PL-259.
1	Cord CX-275/TRT-1: control box cable; 25 ft; rubber-covered; waterproof; 10-conductor #18 wire.
1	Cord CX-276/TRT-1: battery cable; 8 ft; rubber-covered; waterproof; two-conductor stranded #6 wire; complete with battery connectors and amphenol connector.
1 piece	Camphor: 2 inches; synthetic.
1	Control Box C-152/TRT-1: telephone dial and selector switch; with one pilot lamp, 6.3-volt, Mazda type 44.
1	Dummy Load TS-292/TRT-1: complete with one Cord CG-260/TRT-1 and two hermetically sealed, 73-ohm antenna resistors.
1	Dynamotor DM-35-D: 12 volts input, 625 volts output, dc.
4	Fuse: Bussman type 3AG; 5 amperes.
4	Fuse: Bussman type 3AG; 30 amperes.
1 can	Grease: General Purpose WB-2, US Army spec No. 2-108; for dynamotor.
2	Lamp: ballast; 3 watts, 115 volts; Mazda type 3S6.
3	Lamp: pilot; 6.3 volts; Mazda type 44.
1	Screw driver: 9 inches; 6-inch blade; ¼-inch tip.
1 can	Silica gel: 3-inch cartridge.
2	TM 11-269, Radio Sets AN/TRT-1 and AN/TRR-2.
1	Test Set TS-245/TRT-1: audio calibrator; complete with Cord CG-191/TRT-1 and stethoscope.
4	Test Set TS-261/TRR-2: for Radio Set AN/TRR-2.
1	Tube: type JAN-6L6.
1	Tube: type JAN-6SN7GT.
1	Tube: type JAN-829B.
1	Tube: type JAN-OD3/VR150.
1	Wrench; hexagonal; 7/16 inch.
1	Wrench: special; for receiver clamping disk and antenna.

Quantity	Package 3 (7.8 cu ft, 180 lb) Component
3	Radio Set AN/TRR-2, each set including:
1	Antenna float: wood.
1	Antenna: rubber-covered.
1	Container: waterproof.

Table II. Packaging Data—Continued

Quantity	Package 3 (7.8 cu ft, 180 lb) Component
1	Cord: firing; 4 ft; rubber-covered; two-conductor.
1	Cord: antenna cable; 30 ft; rubber-covered; single-conductor.
1	Audio stage plug-in unit: includes one Tube JAN-1L4.
1	Detector stage plug-in unit: includes one Tube JAN-957.
1	R-f stage plug-in unit: includes one Tube JAN-959.
1	Tube JAN-1L4.
2	Tube JAN-1C21.
2	Camphor blocks: synthetic.
1 can	Silica gel.
1	Audio stage plug-in unit: includes one Tube JAN-1L4.
1	Detector stage plug-in unit: includes one Tube JAN-957.
1	R-f stage plug-in unit: includes one Tube JAN-959.
1	Tube JAN-1L4.
1	Tube JAN-1C21.

Table III. Grouping of Plug-in Units

Group No.	Plug-in units		Additional plug-in units	
	R-f and detector stage No.	Audio stage No.	R-f and detector stage No.	Audio stage No.
1	1	1	6	5
2	2	1	5	5
3	3	1	1	5
4	4	1	2	5
5	5	1	4	5
6	6	1	3	5
7	1	2	6	4
8	2	2	5	4
9	3	2	1	4
10	4	2	2	4
11	5	2	4	4
12	6	2	3	4
13	1	3	6	1
14	2	3	5	1
15	3	3	1	1
16	4	3	2	1
17	5	3	4	1
18	6	3	3	1
19	1	4	6	2
20	2	4	5	2
21	3	4	1	2
22	4	4	2	2
23	5	4	4	2
24	6	4	3	2
25	1	5	6	3
26	2	5	5	3
27	3	5	1	3
28	4	5	2	3
29	5	5	4	3
30	6	5	3	3

Table IV. Plug-in Unit Frequencies

Code No.	R-f plug-in unit		Detector plug-in unit		A-f plug-in unit	
	Freq (mc)	Signal Corps stock No.	Freq (mc)	Signal Corps stock No.	Freq (cps)	Signal Corps stock No.
1	32.0	2S5014-2/6	32.0	2S5014-2/17	336	2S5014-2/8
2	31.5	2S5014-2/5	31.5	2S5014-2/16	433	2S5014-2/11
3	31.0	2S5014-2/2	31.0	2S5014-2/13	558	2S5014-2/7
4	30.5	2S5014-2/1	30.5	2S5014-2/14	721	2S5014-2/10
5	30.0	2S5014-2/3	30.0	2S5014-2/12	930	2S5014-2/9
6	29.5	2S5014-2/4	29.5	2S5014-2/15		

with present equipment are those between 29.5 and 32 mc. The output of the transmitter is between 40 and 50 watts, and the r-f carrier is 90 to 100 percent modulated. With the exception of the antenna and the 12-volt or 24-volt d-c (direct-current) power supply, the transmitter is self-contained.

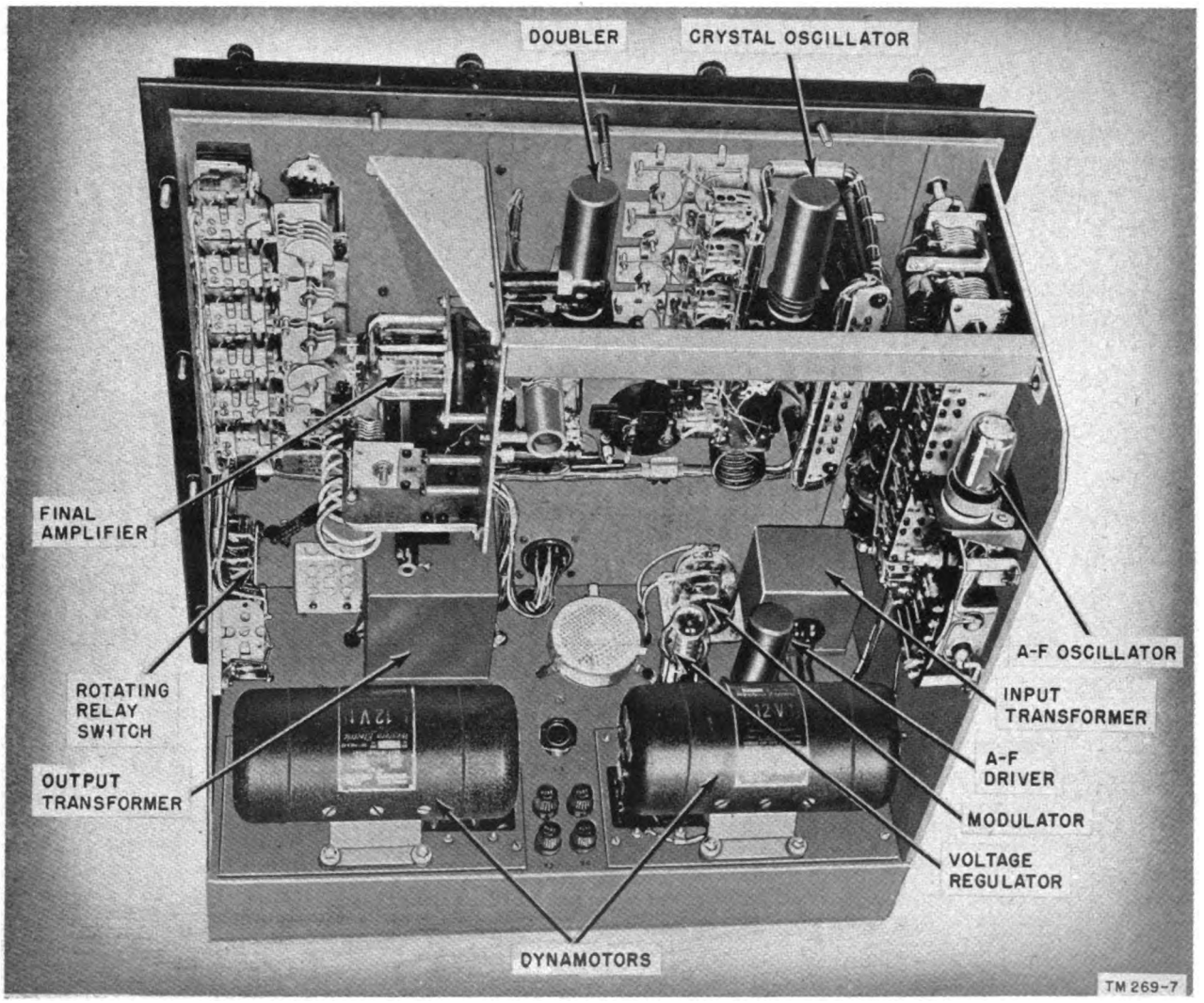


Figure 5. Transmitter, stages identified.

a. RADIO FREQUENCY SECTION. In the r-f section of the transmitter, an r-f sine wave is generated by a crystal-controlled oscillator. The frequency of this sine wave is increased either four times (by doubling the frequency in the oscillator stage and then redoubling the frequency in the doubler stage), or six times (by tripling the frequency in the oscillator stage and then doubling the tripled frequency in the doubler stage). In either case, the resulting signal is an r-f carrier wave in the desired frequency channel. Of the six plug-in crystals in the set, the one which will produce the desired output frequency is chosen by turning the SELECTOR SWITCH (fig. 17) to the RF position and dialing on the SELECTOR DIAL (fig. 17) the operating channel number indicated in column 3 of table V. The SELECTOR DIAL selects the crystal and operates a relay which selects the proper r-f tank circuit in the plate circuit of the crystal oscillator stage. The tank circuit either doubles or triples the fundamental frequency of the crystal, depending upon the crystal selected. The SELECTOR DIAL also operates a relay which connects the proper capacitors in the final amplifier which delivers the output power to the antenna.

(1) *Table V.* Table V presents operating data on the six crystals supplied with the present equipment.

(a) Column 1 gives the number marked on the respective crystals. As shown in the table, crystals 17 through 22 are supplied with the present equipment.

(b) Column 2 gives the frequency which is marked on each crystal in kilocycles (kc).

(c) Column 3 lists numbers which represent the crystal socket numbers on the front of the unit and the SELECTOR DIAL numbers which should be dialed in order to select a particular crystal.

(d) Column 4 gives the frequency channel of the crystals. The figures in this column represent the output frequency (in megacycles) of the r-f section after the crystal frequency has been increased either four or six times. Note that the frequencies of crystals 17 to 19 have been increased six times and the frequencies of crystals 20 to 22 have been increased four times.

(2) *Table VI.* Table VI presents data similar to the type given in table V except that table VI applies to all 25 frequency channels in which the transmitter is capable of operating.

(a) The heavy line which extends across the table between crystals 19 and 20 is the dividing line between those crystals (1 to 19) whose respective frequencies are tripled and then doubled, and those crystals (20 to 25) whose respective frequencies are doubled and then redoubled.

(b) Regardless of what series of six crystals may be supplied with the transmitter, the crystal with the lowest number marked on it must always be inserted in socket 1, and the remaining five crystals must be inserted in corresponding numerical order in the other five sockets.

Table V. Operating Data for Crystals 17 to 22

Crystal No.	Crystal frequency (kc)	Operating channel	Output frequency (mc)
17	5333.33	1	32.0
18	5250.00	2	31.5
19	5166.66	3	31.0
20	7625.00	4	30.5
21	7500.00	5	30.0
22	7325.00	6	29.5

Table VI. Operating Data for Crystals 1 to 25

Crystal No.	Crystal frequency (kc)	Output frequency (mc)
1	6666.66	40.0
2	6583.33	39.5
3	6500.00	39.0
4	6416.66	38.5
5	6333.33	38.0
6	6250.00	37.5
7	6166.66	37.0
8	6083.33	36.5
9	6000.00	36.0
10	5916.66	35.5
11	5833.33	35.0
12	5750.00	34.5
13	5666.66	34.0
14	5583.33	33.5

Table VI. Operating Data for Crystals 1 to 25 Continued

Crystal No.	Crystal frequency (kc)	Output frequency (mc)
15	5500.00	33.0
16	5416.66	32.5
17	5333.33	32.0
18	5250.00	31.5
19	5166.66	31.0
20	7625.00	30.5
21	7500.00	30.0
22	7375.00	29.5
23	7250.00	29.0
24	7125.00	28.5
25	7000.00	28.0

b. AUDIO-FREQUENCY SECTION. The signal which is used to modulate the r-f carrier wave is generated by a stable a-f oscillator. The oscillator is capable of operating on five audio frequencies: 336, 433, 558, 721, and 930 cps (cycles per second). The desired audio frequency is chosen by turning the selector switch to the AF position and dialing on the SELECTOR DIAL the code number indicated in column 1, table IV. The a-f section of the transmitter includes, in addition to the oscillator stage, a driver and a modulator stage.

c. OPERATION. When the r-f operating channel number is dialed, the r-f section of the transmitter is set up to produce an r-f carrier wave of the desired frequency. When the a-f code number is dialed, the a-f section is put in readiness to produce a modulating signal of the desired repetition rate. When the SELECTOR SWITCH is put into the KEY position and the three code numbers are dialed on the SELECTOR DIAL, the dial acts like a switch or a transmitting key which applies the a-f modulation to the r-f carrier wave in a number of short bursts. To detonate a mine the attached receiver of which responds to a radio frequency in channel 3, an audio frequency of code number 4, and triggering pulses of 2, 5, and 7, dial the entire code (3-4-257) as follows:

(1) Turn the SELECTOR SWITCH on the control box to the RF position and press

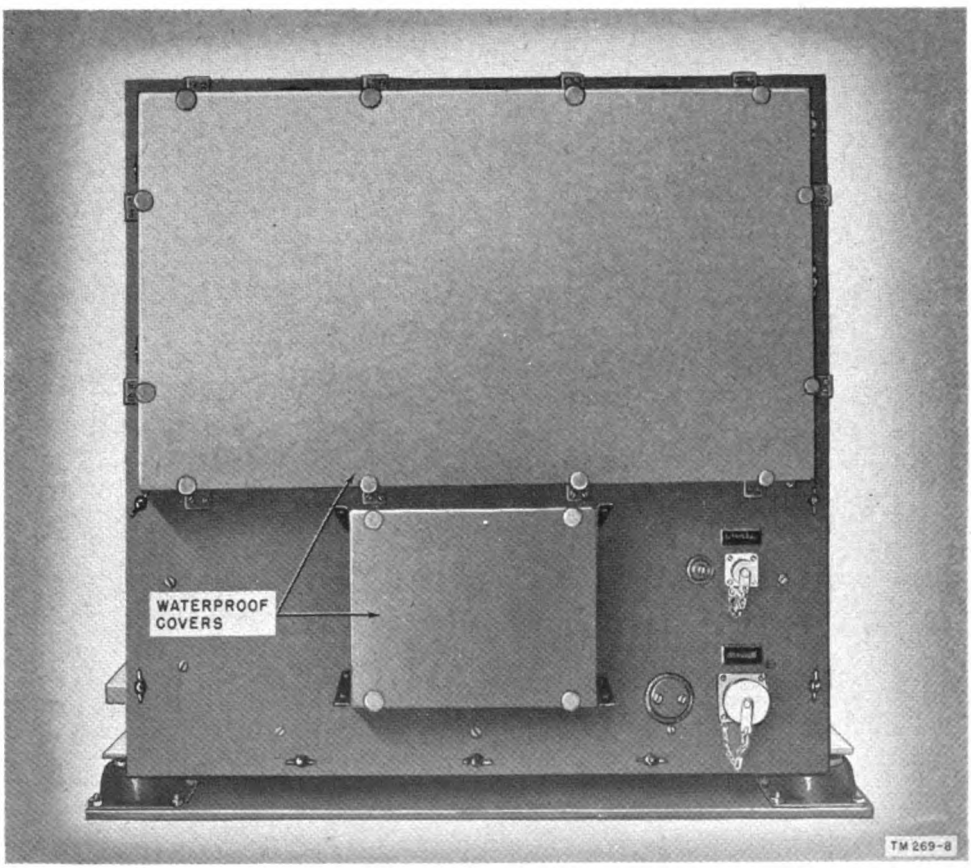


Figure 6. Transmitter, waterproof covers in place.

the RESET button (fig. 17) to clear the r-f channel. Dial 3 on the SELECTOR DIAL. This step selects the r-f channel.

(2) Turn the SELECTOR SWITCH to the AF position and dial 4 on the SELECTOR DIAL. This step selects the a-f channel.

(3) Turn the SELECTOR SWITCH to the KEY position and quickly dial 257 on the SELECTOR DIAL. This step ignites the detonator cap.

d. PHYSICAL FEATURES.

(1) The transmitter is housed in a waterproof metal cabinet which includes waterproof covers over the transmitter controls and control box (fig. 6).

(2) Operation of the set can be carried on some distance from the transmitter by removing the control box and connecting it to the transmitter by a 25-foot remote control cable (fig. 4).

(3) The antenna (Antenna Assembly AS–149/TRT–1) is a vertical half-wave whip, specially designed for the 29.5- to 32-mc frequency channels. This antenna (fig. 7), which is packed in the spare parts box, is in four sections and includes a large porcelain insulator for support and a metal plate for mounting to the carrying vehicle. The antenna is connected to the transmitter by a single-conductor cable (fig. 4).

(4) The transmitter equipment includes a large wooden splashproof spare parts box (fig. 4). The box contains, in addition to spare parts, the test sets for the receiver and transmitter, control cables, antenna, control box, and miscellaneous tools. Table II gives a complete list of the parts included in the box.

10. Radio Set AN/TRR–2

Radio Set AN/TRR–2 (fig. 3) consists of a radio receiver, a whip-type antenna, and a float used for keeping the antenna above water when the unit is used for detonation of water mines. The receiver uses very little power, and the batteries used are of a size sufficient to keep the equipment operating continuously for a period of approximately 5 days. Temperatures much below 10° F tend to decrease the battery efficiency. The set is free from radiation, and from premature operation by either natural or man-made static and is practically free from jamming by the enemy because of the large number of possible code combinations.

a. ELECTRICAL DESIGN. The receiver circuit consists of an r-f amplifier, a superregenerative detector, an a-f discriminator, a pulse detector, and a code-selector system which includes two gas tubes. The circuit will function only on receipt of a signal which is generated in definite radio- and audio-frequency channels and which consists of a coded sequence of three series of

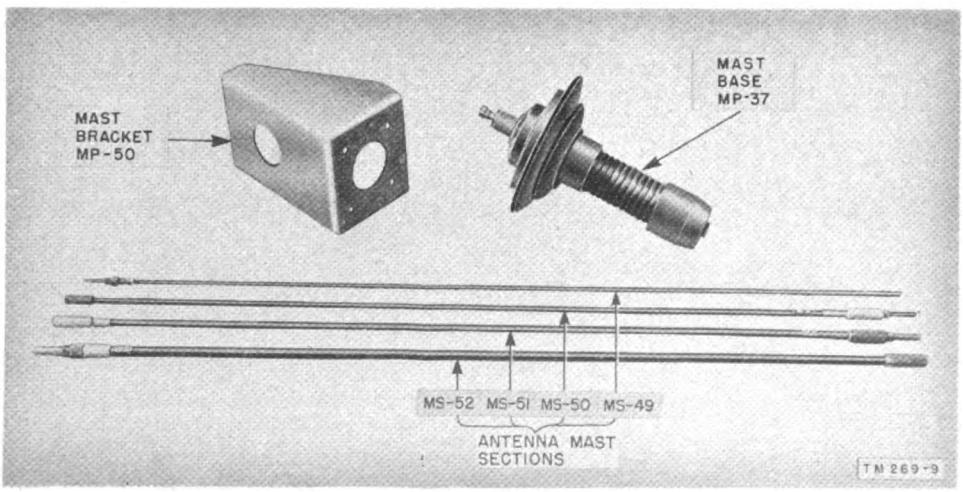


Figure 7. Antenna Assembly AS–149/TRT–1.

pulses. Briefly, the operation of the receiver is as follows:

(1) The r-f amplifier accepts certain r-f signals from the receiving antenna as determined by the tuning of the amplifier stage. The accepted signals are passed on to the superregenerative detector.

(2) After detection, the a-f discriminator accepts signals modulated with a definite audio frequency as determined by the tuning of the discriminator stage. These signals are fed to the pulse detector.

(3) After passing through the pulse detector stage, the accepted pulses operate a *stepping relay*. This relay is a 10-contact, 3-gang, selector switch, the wipers (movable contacts) of which are moved one step by each a-f pulse passed by the a-f discriminator. If the code number of the first series of pulses is correct, a capacitor in the switching section is charged. The switch contacts automatically return to the starting position after the first series of pulses. If the coding of the second series of pulses is correct, the charge on the first capacitor is transferred to a second capacitor. The switch contacts are again returned to the starting position after this series of pulses. If the code number of the third series of pulses is correct, the charge on the second capacitor causes a firing tube in the switching section to ignite a detonator cap, which may be made to explode a mine.

Note. If there is a delay of 25 seconds or more between successive series of pulses, or if any of the coding of the three series of pulses is wrong, the receiver will not ignite the detonator cap.

b. PHYSICAL FEATURES. Radio Set AN/TRR–2 (fig. 8) is built upon a metal frame which is designed to slide into a steel cylindrical container. A rubber gasket is inserted between the cover of the unit and the container, and it is possible to submerge the receiver in water to a depth of 40 feet without leakage. The receiver can be slid from the steel container by means of the carrying strap attached to the cover. The selector switch, plug-in units, and batteries are

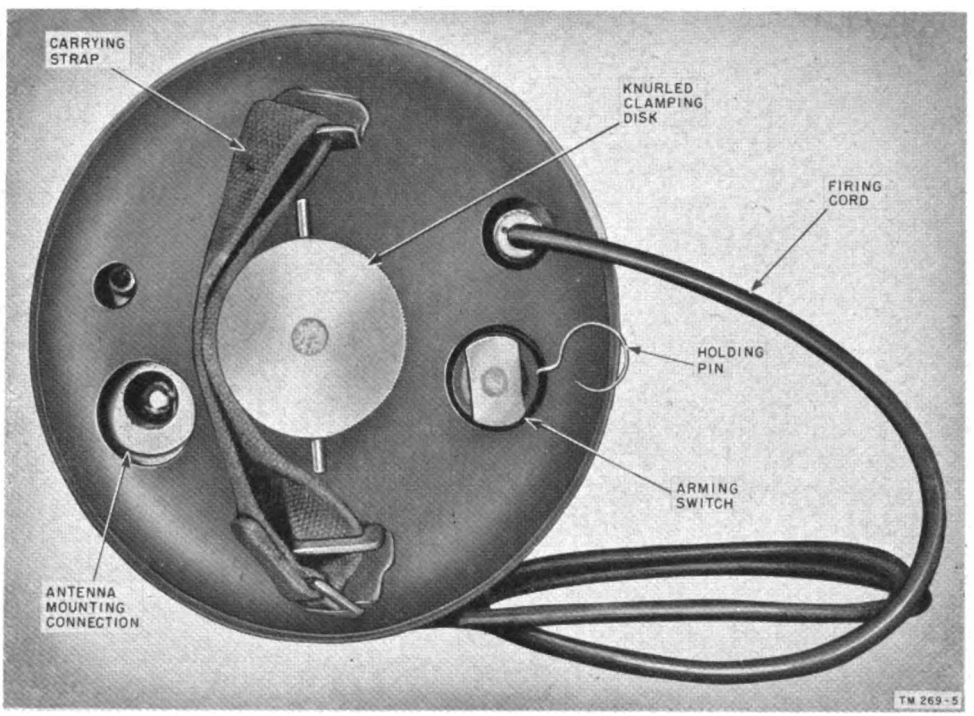


Figure 8. Receiver, top view.

then readily accessible. The receiver circuits are built on two separate chassis, shown in figure 9 as the first and second sections.

(1) The first section (fig. 9) contains the six tubes in the receiver—the r-f amplifier, superregenerative detector, a-f discriminator, pulse detector, and two thyratron type tubes. The r-f amplifier, superregenerative detector, and a-f discriminator are self-contained plug-in stages which have been factory-tuned and which are supplied with the receiver according to the information given in table III. These plug-in units make it possible to preset any receiver so that it will respond to a desired radio and audio frequency.

(2) The second section of the receiver (fig. 9) contains the electromechanical switching section, which includes the stepping relay, reset and sensitive relays, and switches and capacitors for coding and firing the system. The coded sequence of pulses to which each receiver is made to respond is determined by five small code-changing clips, located on the stepping relay. These clips are attached to the fixed contacts of the three-gang switch of the relay according to the desired code.

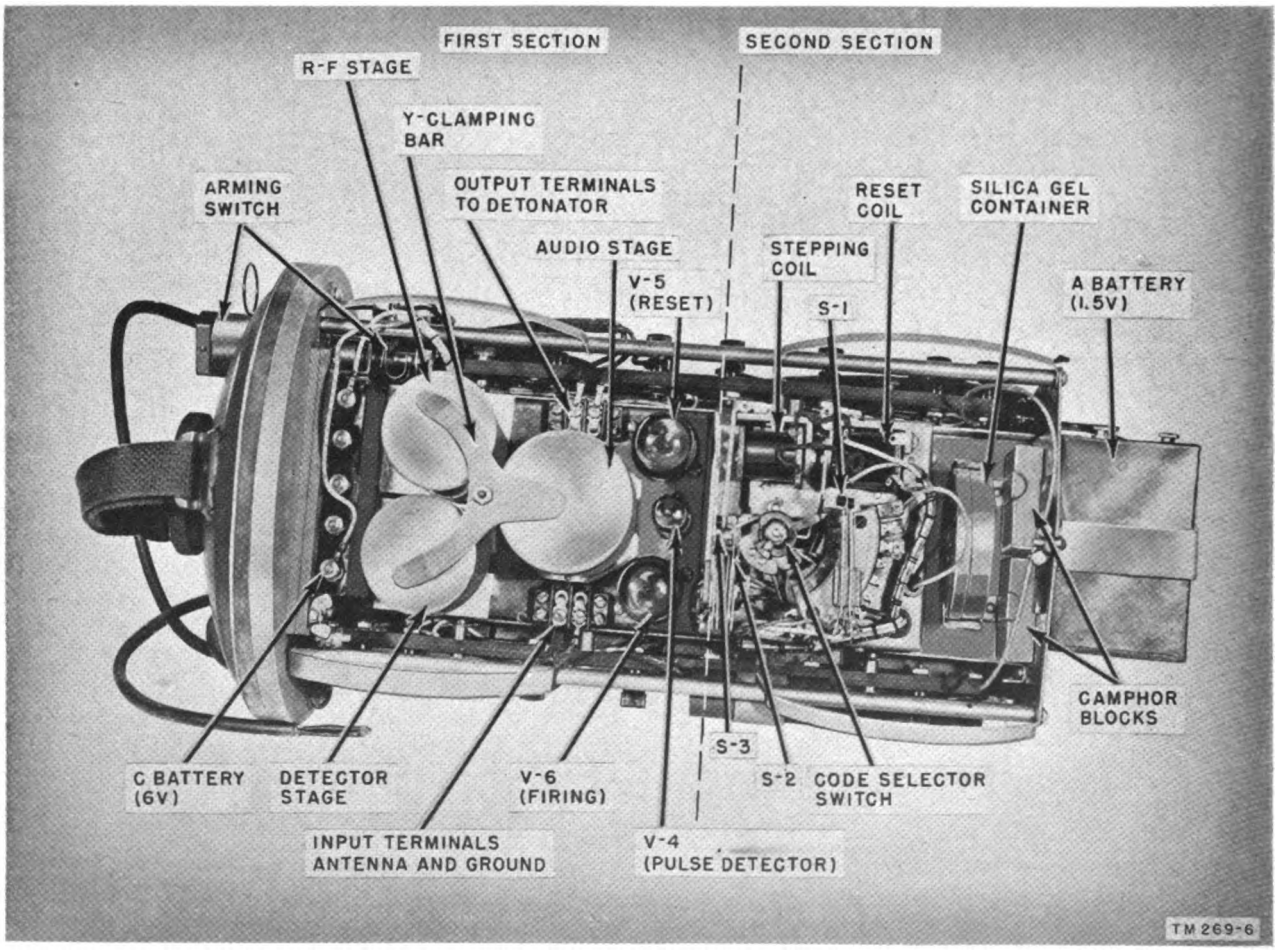


Figure 9. Receiver, top view of chassis.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIAL

11. Siting

In general the best location for radio equipment depends on the situation and local conditions, such as the following: the need to house or conceal the equipment, type of installation (vehicular, etc.) the terrain, and the need of easy access to messengers. Signals from Radio Set AN/TRT–1 have a greater range if the antenna is high and clear of hills, buildings, cliffs, densely wooded areas, and other obstructions. Depressions, valleys, and other low places are poor locations for radio transmission because the surrounding high terrain absorbs r-f energy. Weak signal strength may be expected at the receiver if either the receiver or the transmitter is operated under or close to steel bridges, underpasses, power lines, or power units. Choose, if possible, a transmitter location on a hilltop or elevation. Flat ground is desirable. See that drainage is adequate. Siting of the receiver will depend on the particular requirements.

12. Uncrating, Unpacking, and Checking

a. GENERAL. Equipment may be shipped in oversea packing cases or in domestic packing cases and, sometimes, in its own carrying cases. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements and which is convenient to the installation of the equipment. The instructions in *b* below apply to equipment shipped in export packing cases. Aside from checking to make sure that all carrying cases are present and that the equipment is undamaged, no special unpacking and uncrating procedures are necessary for equipment shipped in carrying cases.

Note. Be careful in uncrating, unpacking, and handling the equipment; it is easily damaged. If it becomes damaged, a complete overhaul might be required or the equipment might be rendered useless.

b. STEP-BY-STEP INSTRUCTIONS FOR UNCRATING AND UNPACKING EXPORT SHIPMENTS.

(1) Place the packing case as near the operating position as convenient.
(2) Cut and fold back the steel straps.
(3) Remove nails with a nail puller. Remove the top and one side of the packing case. Do not attempt to pry off the sides and top; the equipment may be damaged in the process.
(4) Remove the waterproof metal container or moistureproof barrier and any excelsior or corrugated paper covering the equipment inside the case. See *d* below for instructions on removing the waterproof metal container. Be careful when removing waterproof and protective wrappings not to remove any moistureproofing and fungiproofing coatings.
(5) Remove the equipment from its inner case.
(6) Inspect the equipment for possible damage incurred during shipment.
(7) Check the contents of the packing case against the master packing slip.

c. OPENING CARDBOARD CARTON AND WATERPROOF BARRIER. No special instructions are needed for opening the waterproof paper barrier and removing the equipment from the cardboard carton.

d. INSTRUCTIONS FOR OPENING METAL CONTAINERS. The top of the metal container is soldered to the sides. To open, break the soldered seam by prying the side of the container away from the soldered seam as follows:

(1) Wipe off excess solder with a soldering iron. Never use a torch.
(2) With a wooden block or a screw driver pry the sides from the soldered seam.
(3) When the seam is completely open, pry off the cover.

(4) Remove any desiccant and protective cardboard packing and lift out the packaging within.

e. CHECKING. Check the contents against the master packing slip.

f. UNPACKING DOMESTIC PACKING CASES. The radio equipment may be received in domestic packing cases. The instructions given in *b* above apply also to unpacking domestic shipments. Cut the metal bands. Open the cartons that protect the equipment; or, if heavy wrapping paper has been used, remove it carefully and take out the components. Check the contents of the packing case against the master packing slip.

Note. Save the original packing cases and containers for both export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment to base maintenance repair shops.

13. Installation of Radio Set AN/TRR–2

a. BATTERY INSTALLATION. Always check the dates on all batteries to make sure that the batteries are fresh. Never install a battery if the date indicates that it has had more than 6 months' shelf life.

(1) Loosen the knurled clamping disk on top of the receiver container cover (fig. 8). On equipments bearing serial numbers 44 and above, a special wrench (receiver clamping wrench, fig. 4), which may be used to loosen the disk, is included in the spare parts box. Remove the receiver from the container as follows: hold the container between the feet and, using the carrying strap, lift the receiver straight out of the waterproof housing.

Caution: Never connect a charge to the firing cord when the receiver is out of its waterproof container.

(2) Loosen the wingnuts on the two B-battery clamping bars (fig. 10) and swing the clamping bars open. Place the eight B-batteries (Batteries BA–2) in two rows with their bottoms together as shown in figure 10. Make sure that the batteries are turned so that the red battery leads line up opposite the binding posts marked B+. Swing the clamping bars closed and tighten the wingnuts. Loosen the binding post knobs and insert the red battery leads in the holes of the binding posts marked B+. Insert the black battery leads in the holes of the binding posts marked B—. Tighten the binding post knobs firmly.

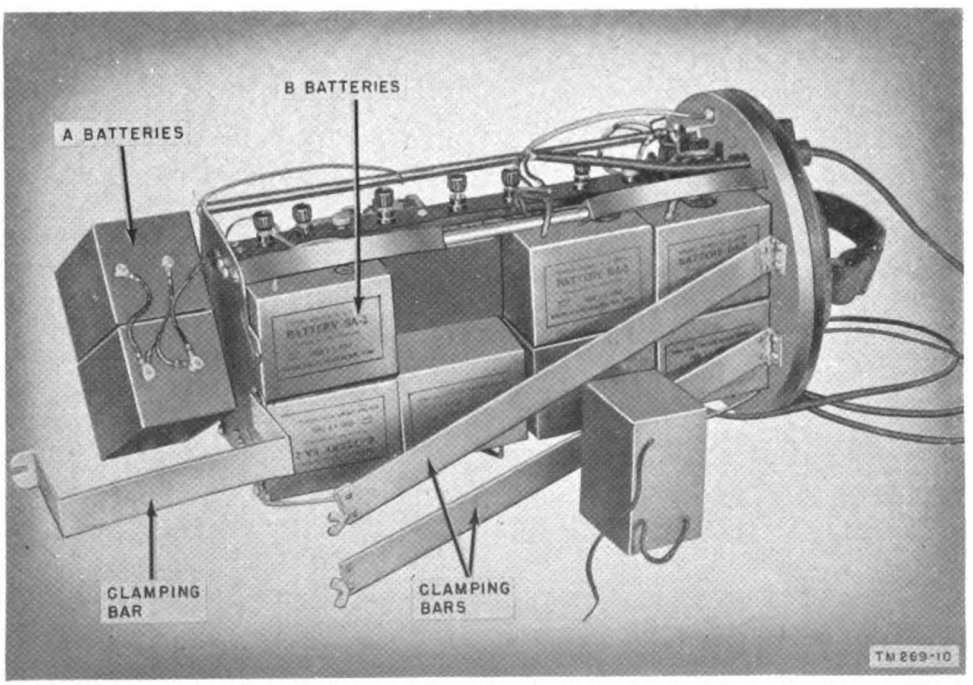


Figure 10. Receiver, showing clamping bars.

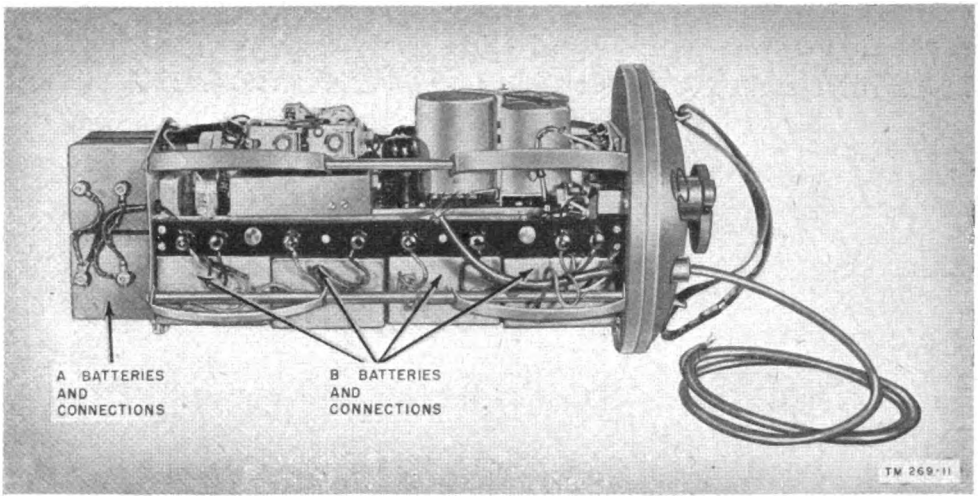


Figure 11. Receiver, showing battery connections.

(3) Loosen the wingnut on the A-battery clamping bar (fig. 10) and swing the clamping bar open. Place the two A-batteries (Batteries BA–35) side by side (fig. 11) against the base of the receiver, making sure that the battery terminals are on the same side of the unit as the receiver leads which connect to the terminals. Swing the clamping bar closed. The batteries must be connected in parallel. Connect a wire between the two terminals marked — and connect a second wire between the two terminals marked +. Then connect the receiver lead with the tracer to one of the positive terminals, and connect the other lead from the receiver to one of the negative terminals (fig. 11).

(4) Loosen the wingnut on the C-battery clamping bar (fig. 12) and swing the clamping bar open. Install the C-battery (Battery BA–34) base down, making sure that the positive terminal is on the same side as the wingnut which holds the clamping bar in place. Connect the receiver lead with the green tracer to the positive terminal, the green lead to the 3-volt terminal, the pink lead from the receiver to the negative terminal. Swing the clamping bar closed and tighten the wingnut.

b. PLUG-IN-UNIT INSTALLATION. If more than one transmitter is being operated within the range of the radio sets, the selection of code groups for the respective sets of receivers should be coordinated so that no two code groups are the same. This prevents one transmitter from operating a receiver which belongs to another transmitter. With the receiver removed from its waterproof container, install plug-in units as follows:

(1) Select a stage having the desired radio frequency from the r-f plug-in stages supplied with the receivers. The stages are numbered from 1 to 6, and the radio frequency corresponding to each of these numbers is given in table IV. Plug the selected unit into the keyed receptacle marked RF (r-f stage, fig. 12).

(2) Select a detector stage plug-in unit of the same number as the r-f plug-in unit. Plug this stage into the keyed receptacle marked DET (detector stage, fig. 12).

(3) Select a stage of the desired audio frequency from the available plug-in stages. These stages are numbered from 1 to 5, and the audio frequency corresponding to each of these numbers is given in table IV. Plug this unit into the third keyed receptacle (audio stage, fig. 12).

Note. If the receiver chassis is not marked to indicate the plug-in stage positions, use figures 9 and 12 as a guide in plugging in the stages.

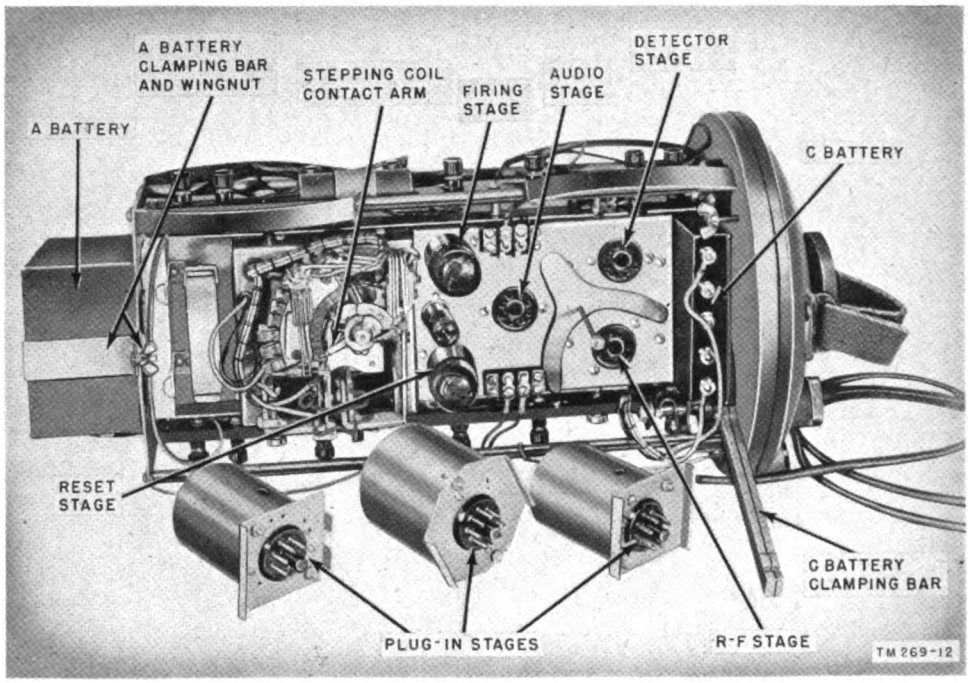


Figure 12. Receiver, top view, plug-in stages removed.

(4) After all three stages are plugged in, turn the Y-clamping bar so that one of the arms extends over each stage (fig. 9). Tighten the wingnut on the clamping bar.

c. SETTING SELECTOR SWITCH. After the r-f and a-f channels have been selected and installed, select a three-digit code number and plainly mark or tag the outside of the receiver with the *entire* code. The code consists of first, the number of the r-f channel; second, the number of the a-f channel; and finally the three-digit code number of the selector switch.

Note. Do not use any digit for more than one number of the three-digit code selected. Code numbers such as 228, 344, or 575 cannot be used.

(1) The stepping relay contacts are numbered from 1 to 10 away from the reset coil (fig. 13). The code changing clip attached to the red wire is always connected to the top bank of contacts, and the clip attached to the black wire is always connected to the bottom bank of contacts. A code number such as 863 is set up as follows:

(a) Set the clip attached to the red wire on terminal 8 of the top bank of contacts (fig. 13).

(b) Set the clip attached to the black wire on terminal 3 of the bottom bank of contacts (fig. 13).

(c) Finally, set the three clips not attached to wires on contacts 8, 6, and 3 of the middle bank of contacts (fig. 13).

(2) Make certain that the clips are properly placed. The insulated *base* of the clip should be inserted between the upper finger of the contact and the spring finger of the contact as shown in figure 13. When properly inserted, the *metallic* finger on the clip makes contact with the upper finger on the contact.

Caution: When the code clips are removed to change the code, make sure that the two contacting surfaces of the clips have not been forced apart. A poor electrical contact between the clip and the upper finger of the contact will result if the clips are not closed.

d. ANNTENA INSTALLATION.

(1) If the receiver is to be used for the detonation of water mines, the antenna float and rubber-covered cable must be used. Fasten the plug on the end of the antenna cable securely to the antenna

mounting connector (fig. 3). Use the strap end of the special wrench (fig. 19) supplied in the transmitter spare parts box for tightening the plug to the connector. Connect the whip-type antenna to the receptacle on the antenna float (fig. 3).

of the antenna, and the connection of the battery and control box to the transmitter.

a. PRELIMINARY PROCEDURE.

(1) Remove the waterproof cover from the front panel of the transmitter (fig. 6) by loosening the knurled screws which hold the cover in place.

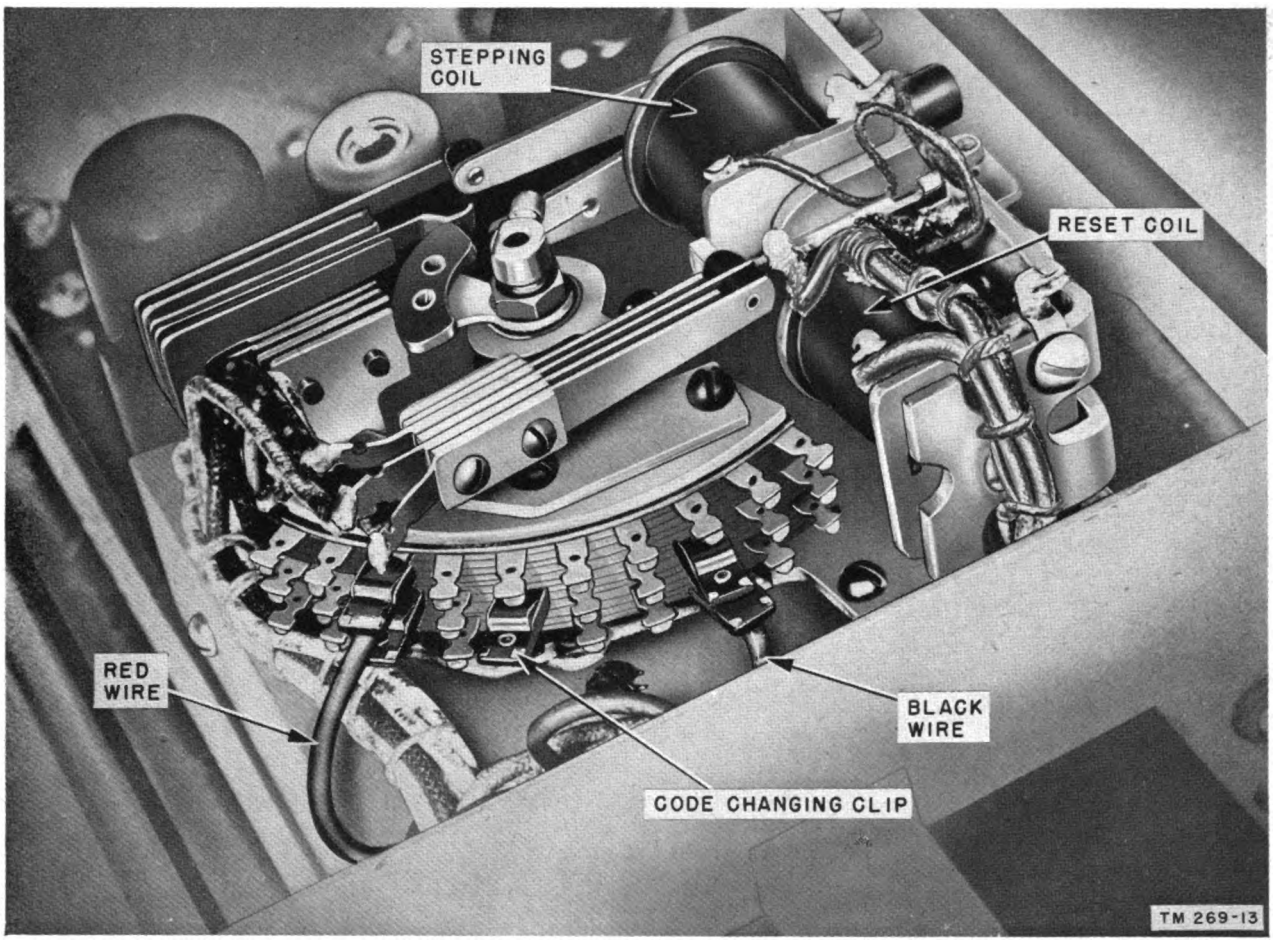


Figure 13. Receiver, code selector switch.

(2) For land mine detonation, the antenna is connected directly to the receiver (fig. 14). To prevent leakage use the special wrench (fig. 19) to tighten the antenna to the connector.

Note. This wrench is supplied with equipments bearing serial numbers 44 and above.

14. Installation of Radio Set AN/TRT-1

The transmitter is shipped completely assembled. The only installation procedures required are a check on the crystal insertions, the erection

(2) Unscrew the waterproof caps which cover the antenna, battery, and control box receptacles, and attach each cap to the dummy plug beside its receptacle (fig. 17). This prevents the retaining chains from being broken and the waterproof caps from becoming corroded or being lost.

(3) Take the control box from the spare parts box and remove the waterproof cover. The control box may be used either on the transmitter or at a point

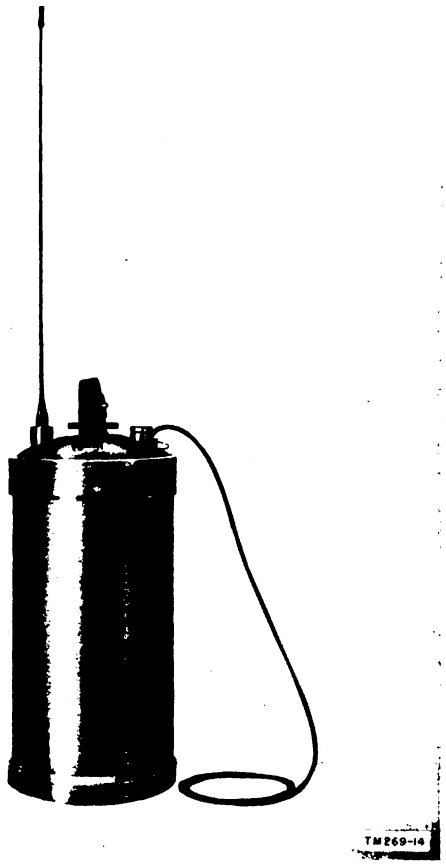


Figure 14. Receiver, with antenna attached.

up to 25 feet away from the transmitter. If remote operation is desired, remove the remote control cable from the spare parts box and connect the cable between the control box and the transmitter receptacle marked CONTROL BOX (fig. 15). If local operation is desired, connect the control box directly to the transmitter (fig. 17).

(4) Obtain the battery cable (fig. 4) from the spare parts box and connect the cable between the battery and the receptacle marked BATTERY on the front of the transmitter.

b. ANTENNA INSTALLATION. Antenna Assembly AS–149/TRT–1 (fig. 7) consists of four mast (metal) sections, a porcelain insulator, and a mounting bracket. The component parts of the antenna are contained in the spare parts box (fig. 4).

(1) Remove the four mast sections and the insulator-bracket assembly (fig. 7) from the spare parts box.

(2) Screw the four mast sections one into the other to form the whip-type antenna. Match similar colors between antenna Mast Sections MS–52 and MS–51, MS–51 and MS–50, and MS–50 and MS–49.

(3) In most installations the antenna can be mounted on a command car or truck as shown in figures 15 and 16. Fasten the insulator-bracket assembly (Mast Bracket MP–50) to the vehicle in such a manner that the antenna can be mounted in a vertical position.

(4) Remove the 3-foot antenna cable (Cord CG–203/TRT–1, fig. 4) from the spare parts box, and connect the plug end of the cable to the receptacle on the front of the transmitter. Feed the cable along the most direct path to the porcelain insulator. Alter the length of the cable to fit the individual installation, and then attach the cable to the screw-type connector on the bottom of the insulator. If it is necessary to pass the antenna cable through any metal on the vehicle, protect the cable with some low-loss insulating material such as porcelain, pyrex, or polystyrene.

Caution: To prevent leakage of r-f energy, keep the antenna cable at least 1 inch from any metal surface in the installation.

(5) Fasten the mast antenna into the receptacle on top of the porcelain insulator (Mast Base MP–37).

c. CRYSTAL INSERTION. As shown in table V, crystals numbered 17 through 22 are supplied with the equipment. Operating channels 1, 2, and 3 use crystals with a frequency of 5,333.33 kc (No. 17), 5,250 kc (No. 18), and 5,166.66 kc (No. 19), respectively. Operating channels 4, 5, and 6 use crystals with a frequency of 7,625 kc (No. 20), 7,500 kc (No. 21), and 7,325 kc (No. 22), respectively. As explained in paragraph 9*a*(1), the individual crystal must be inserted into the socket which bears a number corresponding to the operating channel number of the crystal. To determine whether the six crystals are inserted into the proper sockets, proceed as follows:

(1) Loosen the lower screw on the crystal

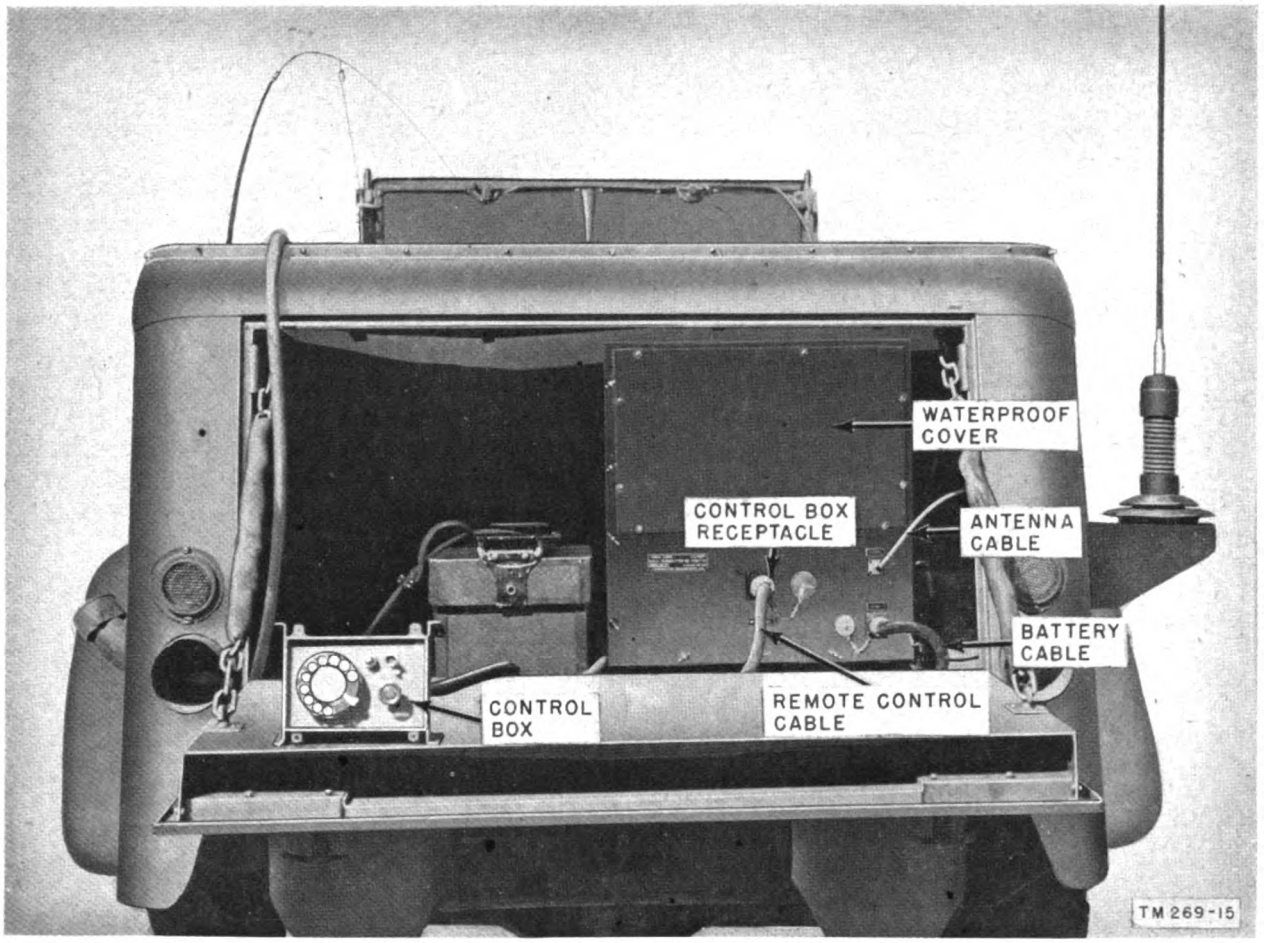


Figure 15. Transmitter, control box connected by remote cable.

clamping bar and swing the bar out of the way.

(2) Check the crystal numbers and frequencies stamped on the crystals with the operating channel numbers given in table V. The operating channel numbers correspond to the socket markings on the front of the transmitter.

(3) After the insertion of the crystals has been checked, swing the clamping bar back into place and tighten the holding screw.

Note. Six spare crystals, which duplicate the frequencies of the crystals in use, are mounted in dummy sockets on the front of the transmitter (fig. 17). They are to be used as replacements in case of damage to the crystals in use.

15. Cords

The following chart lists the cables and cords supplied with Radio Sets AN/TRT–1 and AN/TRR–2, and their uses:

Cord	Length (ft)	Connects	
		From	To
Cord CG–191/TRT–1	8	Transmitter TEST SOCKET.	Test Set TS–245/TRT–1.
Cord CG–203/TRT–1	3	Transmitter ANTENNA terminal.	Mast Base MP–37.
Cord CG–260/TRT–1	1	Transmitter ANTENNA terminal.	Dummy Load TS–292/TRT–1.
Cord CX–275/TRT–1	25	Transmitter CONTROL BOX terminal.	Control Box C–152/TRT–1.
Cord CX–276/TRT–1	8	Transmitter BATTERY terminal.	Storage battery.

16. Service upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 12 for uncrating, unpacking, and checking the equipment.

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

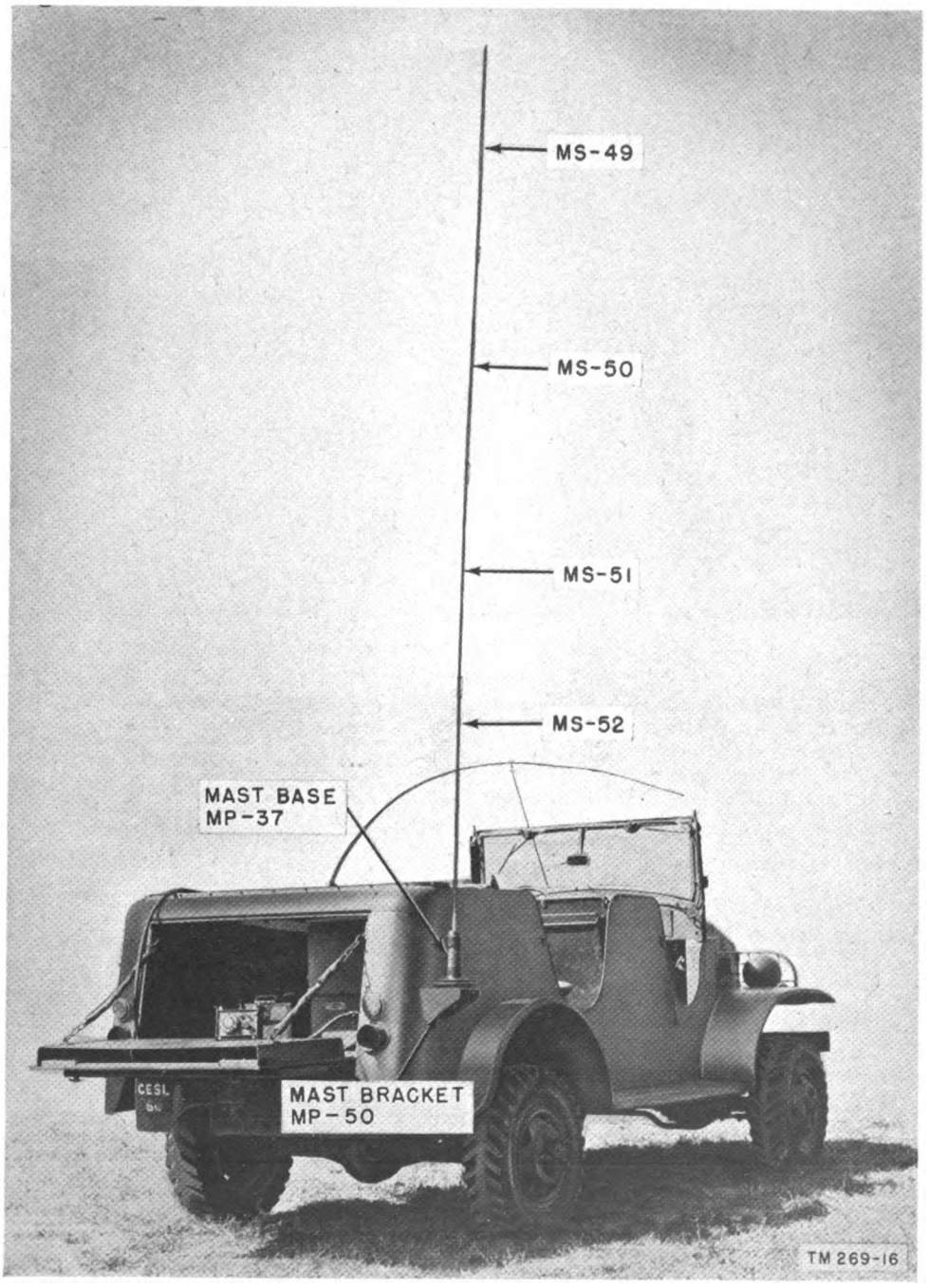


Figure 16. Antenna, mounted on vehicle.

Section II. CONTROLS AND INSTRUMENTS

17. Controls on Radio Set AN/TRT–1

All operating controls on Radio Set AN/TRT–1, with the exception of the input voltage switch, S–1, and the modulation control, R–49, are located on the front panel of the transmitter (fig. 17). S–1 is located between the dynamotors on the horizontal chassis (fig. 44), and R–49 is located on the vertical mounting strip (fig. 46). The following chart gives the description and function of each transmitter control. The controls are pointed out in figures 17 and 43.

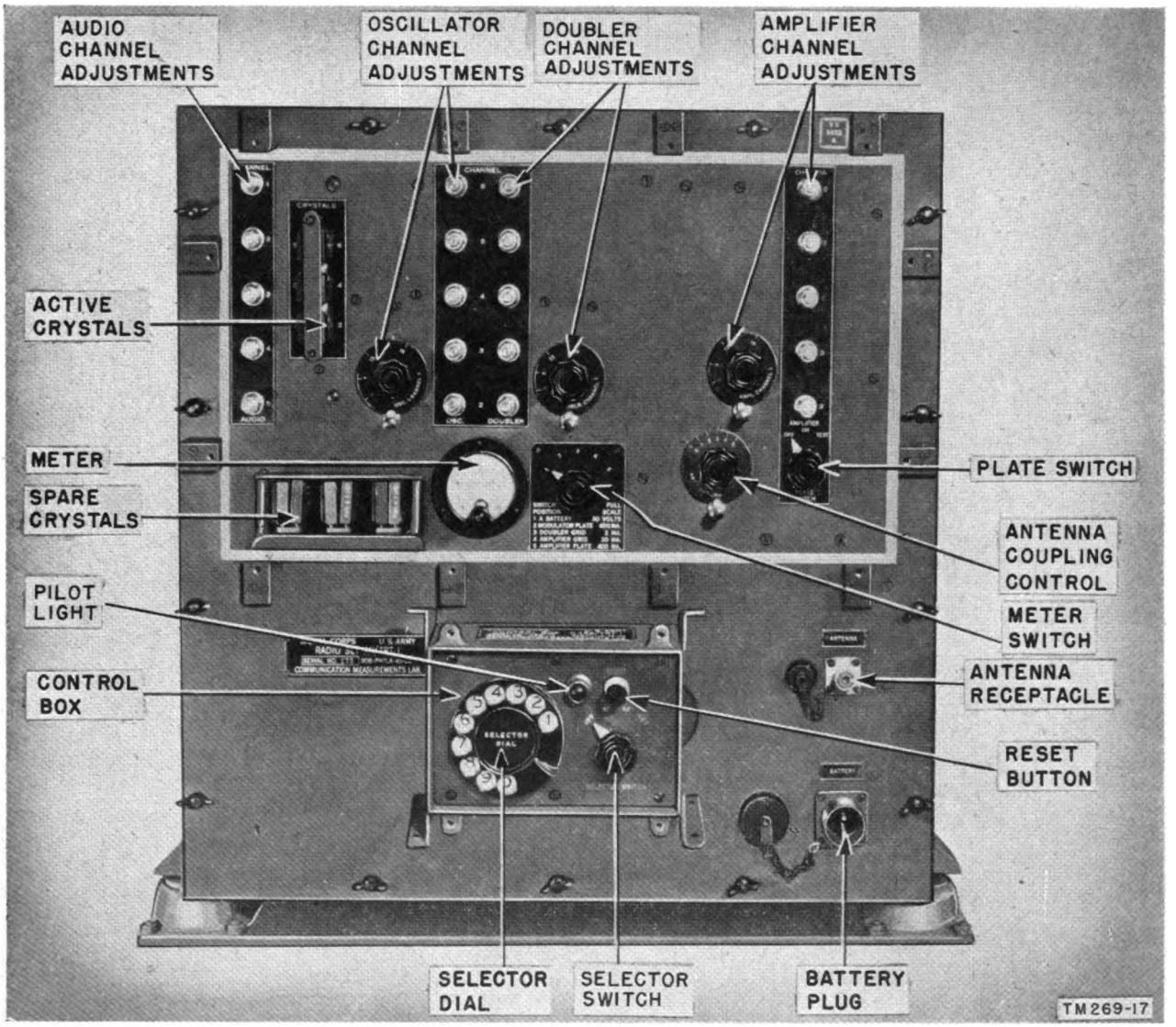


Figure 17. Transmitter, controls identified.

Note. **Panel lettering is indicated by capital letters.**

Panel designation	Ref symbol	Type	Function
Meter switch	S–3	2-pole, 5-position rotary switch.	Switches the milliammeter into various transmitter circuits.
PLATE SWITCH	S–2	2-pole, 5-position rotary switch.	Applies plate and screen voltages to the final amplifier stage in the ON and TEST positions.
Input voltage switch	S–1	8-pole, 2-position rotary switch.	Changes the power input circuit of the transmitter, depending upon whether a 12- or 24- volt source is used.
OSC. CHANNEL 1	C–44	Variable capacitor	Tunes the crystal oscillator plate tank circuit for operating channel 1.
OSC. CHANNEL 2, 3, 4, 5, 6	C–21, C–20, C–19, C–18, C–17, respectively.	Screw driver type variable capacitors.	Tune the crystal oscillator plate tank circuits for operating channels 2, 3, 4, 5, and 6, respectively.
DBLR. CHANNEL 1	C–50	Variable capacitor	Tunes the doubler plate tank circuit for operating channel 1.
DOUBLER CHANNEL 2, 3, 4, 5, 6.	C–28, C–27, C–26, C–25, C–24, respectively.	Screw driver type variable capacitors.	Tune the doubler plate tank circuit for operating channels 2, 3, 4, 5, and 6, respectively.
AMPL. CHANNEL 1	C–56	Two-gang variable capacitor	Tunes the final amplifier plate tank circuit for operating channel 1.
AMPLIFIER CHANNEL 2, 3, 4, 5, 6.	C–35, C–34, C–33, C–32, C–31, respectively.	Screw driver type variable capacitors.	Respectively tune the final amplifier plate tank circuits for operating channels 2, 3, 4, 5, and 6.
ANT. COUPLING	L–5, L–6	Variable inductor	Matches the impedance of the final amplifier stage to the impedance of the antenna cable and antenna.
Modulation control	R–49	Screw driver type potentiometer	Controls the percentage of modulation of the r-f carrier.
Milliammeter	M–1		Indicates input battery voltage and modulator plate, doubler grid, final amplifier grid, and final amplifier plate current, depending upon position of meter switch.
SELECTOR SWITCH	S–301	4-pole, 4-position rotary switch	Connects the selector dial into the respective circuits for purposes of dialing the desired code.
RESET button	S–302	Single-pole, push-button type switch.	Clears the r-f and a-f channels of any code which has been dialed into them.

Panel designation	Ref symbol	Type	Function
SELECTOR DIAL	SD–301	Telephone dial	Sets up the desired r-f and a-f channels in the transmitter and the three-digit code which operates the stepping relay in the receiver.
Red pilot light	I–301		Provides a relative check on the percentage of modulation. The modulation is correct if the intensity of the light increases as the code is dialed.
AUDIO CHANNEL 1, 2, 3, 4, 5.*	C–1 through C–5.	Screw driver type variable capacitors.	Tune the audio oscillator to correct frequency in the various channels.
Audio oscillator controls*	C–6, C–7	Screw driver type variable capacitors (fig. 46).	Act as trimming adjustments in tuning the audio oscillator to exact frequency.

* These controls are not to be adjusted as part of the *normal* operating procedure but only in connection with the tuning procedure described in paragraph 65.

18. Controls on Radio Set AN/TRR–2

The only control in the receiver, besides the three-gang selector switch discussed in paragraph 13*c*, is the arming switch (fig. 18). This switch turns the receiver on by connecting one side of the power supply to ground. The switch has three positions: *off*, *test*, and *firing*.

a. In the *off* position the switch is pressed inward against the compression of a spring, and the contacts are held open by a holding pin (fig. 18).

b. There are two positions 90° apart where the arming switch can spring out to an operating position. For each of these positions there is a hole in the shaft of the switch into which the holding pin may be inserted.

(1) The sets are packed for shipment with the switch in the *test* position. In this position the arrow (or metal tip) on the rotatable head of the switch points to the letter T at the base of the switch. Pulling the pin in this position turns on

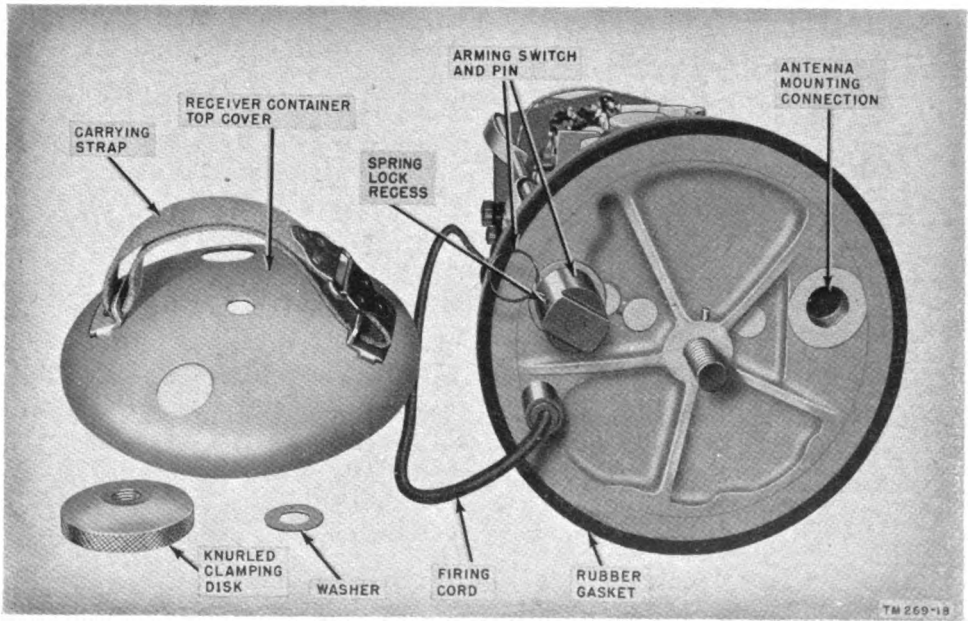


Figure 18. Receiver, top cover removed.

the receiver for testing purposes. This means that the switch can again be pushed in and the holding pin inserted.

(2) When the set is ready to be used to explode a mine, the pin is pulled and the switch is depressed and rotated 90° clockwise. With the switch still depressed the pin can again be inserted with the switch in this *firing* position. In this position the arrow on the switch points to the letter A at the base of the switch. When the holding pin is pulled, the switch closes and locks itself. This action prevents the receiver from being shut off accidentally once it has been set in place.

Caution: Never turn the switch to the firing position unless the set is definitely going to be used to explode a mine, because it is difficult to open the switch after the pin is pulled. If necessary, the switch may be unlocked by inserting a narrow object against the spring lock pin.

Section III. OPERATION UNDER USUAL CONDITIONS

19. Preliminary Starting Procedure

The transmitter is factory-tuned before shipment, and under ordinary conditions only minor adjustments are necessary prior to operation. The following procedure is required each time the transmitter site is changed.

Note. The complete tuning procedure for the transmitter is given in paragraph 67.

a. Check to see that the battery cable is securely connected to the BATTERY receptacle and that the input voltage switch, S–1 (fig. 44), is set according to the input voltage being supplied.

b. Throw the meter switch (fig. 17) to position 1 and check the input voltage. With full-scale deflection equal to 30 volts, the meter should read 0.4 for 12-volt operation and 0.8 for 24-volt operation.

c. Turn the control box SELECTOR SWITCH (fig. 17) to the RF position. This turns on the filaments of the transmitter tubes.

d. Press the RESET button (fig. 17) on the control box and then dial number 1 on the SELECTOR DIAL. This sets up r-f channel 1.

e. Turn the meter switch to position 5.

f. Loosen the dial lock and turn the ANT. COUPLING control (fig. 17) to 2 or 3.

g. Turn the PLATE SWITCH (fig. 17) to ON.

h. Turn the control box SELECTOR SWITCH to the KEY position. This starts the dynamotors, which supply the plate voltages.

i. Loosen the dial lock and adjust the AMPL. CHANNEL 1 (amplifier plate) control (fig. 17) so that a minimum reading is obtained on the meter.

j. Increase or decrease the setting of the ANT. COUPLING control as necessary until the meter reading is between 0.35 and 0.45. At this reading the final amplifier is properly loaded and the plate current is about 140 to 180 ma (milliamperes).

k. Retune the AMPL. CHANNEL 1 control until a minimum reading is again obtained. Continue to adjust the amplifier plate and antenna coupling controls alternately until the meter reading is fixed between 0.35 and 0.45. Tighten the dial locks on both controls.

l. Follow steps *c* through *k* above to tune remaining r-f channels 2, 3, 4, 5, and 6 for minimum plate current. Use the respective AMPLIFIER CHANNEL screw driver adjustments without disturbing the AMPL. CHANNEL 1 and antenna coupling controls.

Note. The amplifier plate current should never exceed 180 ma on any channel. When tuning for minimum meter reading, do not allow the maximum value of the reading to exceed 0.45, or the life of the amplifier tube will be shortened.

m. Turn the control box SELECTOR SWITCH to the AF position, and dial number 1 on the selector dial. This sets up a-f channel 1.

n. Turn the SELECTOR SWITCH to KEY, and dial any number between 5 and 10. The percentage of modulation is correct if the intensity of the red pilot light on the control box increases as the *key* number is dialed.

Note. For the method of adjusting faulty percentage of modulation, see paragraph 66.

o. Check the four remaining a-f channels by following steps *m* and *n* above.

p. Turn the SELECTOR SWITCH to OFF

and press the RESET button. This clears the r-f and a-f channels which were set up.

Caution: The RESET button must also be pressed after transmission is completed, even though the SELECTOR SWITCH is returned to the OFF position. This step is necessary to prevent current drain through the r-f relay coils and to clear the r-f channel.

q. The transmitter is now ready for operation. Replace the waterproof covers until the operation is to be started.

r. There is no preliminary starting procedure for Radio Set AN/TRR–2.

20. Operation of Radio Set AN/TRR–2

After the r-f, detector, and audio plug-in units have been properly inserted (par. 13*b*) and a three-digit code number has been set on the selector switch (par. 13*c*) check to see that the arming switch (fig. 8) is in the *firing* position (par. 18) and then withdraw the holding pin. Under normal conditions, the receiver will remain in an operating condition for approximately 5 days.

Note. All receivers should be tested according to the procedure given in paragraph 64 before being put into a firing condition.

21. Operation of Radio Set AN/TRT–1

Assume that a receiver whose complete code is 3–4–863 is to be fired.

a. Turn the SELECTOR SWITCH to the RF position and press the RESET button. Allow 1 minute for the transmitter tubes to warm up.

Note. Check to see that the PLATE SWITCH is in the ON position.

b. Dial the first number of the code combination on the SELECTOR DIAL, in this example number 3. This sets up the r-f channel in the transmitter.

c. Turn the SELECTOR SWITCH to the AF position.

d. Dial the second number of the code combination on the SELECTOR DIAL, in this example number 4. This sets up the a-f channel.

Note. If an incorrect number has been dialed in setting up either the r-f or a-f channel, the RESET button must be pushed and the entire code dialed over again.

e. Turn the SELECTOR SWITCH to the KEY position. This puts the transmitter on the air.

f. Quickly dial the last three digits of the code combination on the SELECTOR DIAL, in this example 863.

Note. If an incorrect number is dialed in dialing the last three code digits, only the last three code digits need be dialed over again.

g. Turn the SELECTOR SWITCH back to the RF position and press the RESET button. A new code combination may now be dialed by repeating the above procedure.

Note. Perform steps *e*, *f*, and *g* as rapidly as possible, because the transmitter is on the air during these operations and enemy stations may be monitoring the operating frequency. Also, if there is any hesitation (25 seconds or more) in dialing the last three digits of the code combination, the delay may prevent the receiver from functioning properly.

22. Stopping Procedures

a. RADIO SET AN/TRR–2. Normally, once the receiver switch is in the firing position, the receiver will be used to explode a mine. Depending upon the situation, however, it is possible to turn off the receiver, as follows:

(1) Insert a sharp-pointed object, such as a pin point, into the recession (fig. 18) just above the hole for the arming pin. Press in on the spring lock pin.

(2) Push in the arming switch and rotate it 90°. Insert the arming pin. This is the off position.

b. RADIO SET AN/TRT–1.

(1) Turn the PLATE SWITCH on the transmitter to the OFF position.

(2) Turn the control box SELECTOR SWITCH to the OFF position.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

23. General

The operation of Radio Set AN/TRT–1 may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs instructions are given on procedures for minimizing the effect of these unusual operating conditions.

24. Operation in Arctic Climates

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

a. Handle the equipment carefully.

b. Keep the equipment warm and dry whenever possible.

c. Before turning on the plate voltage, turn on the SELECTOR SWITCH and let the tubes heat until they feel warm to the touch. This may take from 10 to 15 minutes, depending on the temperature of the surrounding air. If the tube is not warm when the plate voltage is turned on, the surge of high voltage may ruin the tube.

d. When equipment which has been exposed to the cold is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

e. Use any improvised means to protect dry batteries, since they will fail if not protected against the cold. To prevent heat loss, place them in bags lined with kapok, spun glass fiber materials, animal skins, or woolen clothing.

25. Operation in Tropical Climates

When operated in tropical climates, radio equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When the equipment is installed below ground and frequently when it is set up in swampy areas, moisture conditions are more acute than normal in the tropics. Ventilation usually is very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the temperature of the air.

26. Operation in Desert Climates

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

b. The main problem which arises with equipment operation in desert areas is the large amount of sand or dust and dirt which enters the moving parts of the transmitter equipment, such as dynamotors and power units. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building seldom is available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Always keep the waterproof covers on when the equipment is not in use.

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

d. Take care to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (ch. 3). Pay particular attention to the condition of the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with oil and grease result in grit, which will damage the equipment.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

27. Tools and Materials

Tools and materials supplied and required with the radio sets are listed in *a* and *b* below.

a. TOOLS (fig. 19).
Screw driver, 9-inch.
Wrench, hexagonal, $\frac{7}{16}$-inch.
Wrench, special, for receiver clamping disk and antenna.

b. MATERIALS SUPPLIED.
Grease, General Purpose WB–2.
Silica gel, 3-inch cartridge.
Camphor blocks, 2-inch.

c. ADDITIONAL MATERIALS REQUIRED.
Orangestick.
Cheesecloth, bleached, lint-free.
Cloth, crocus, 9- by 11-inch sheets (spec No. 42056-Navy).
Carbon tetrachloride.
Paper, sand, flint No. 000 and No. 0000, 9- by 11-inch sheets (Fed spec No. P–P–111).
Solvent, DRY CLEANING (SD) (Fed spec No. P–S–661a).

28. Use of Special Wrench

Only one special tool, a receiver clamping wrench, is supplied with Radio Sets AN/TRT–1 and AN/TRR–2. This tool is in the spare parts chest (fig. 4). The slotted end of the special wrench is used to loosen the knurled clamping disk on the top of the receiver container. The strap end of the special wrench is used to tighten the plug on the receiver antenna cable to the antenna mounting connector (fig. 3).

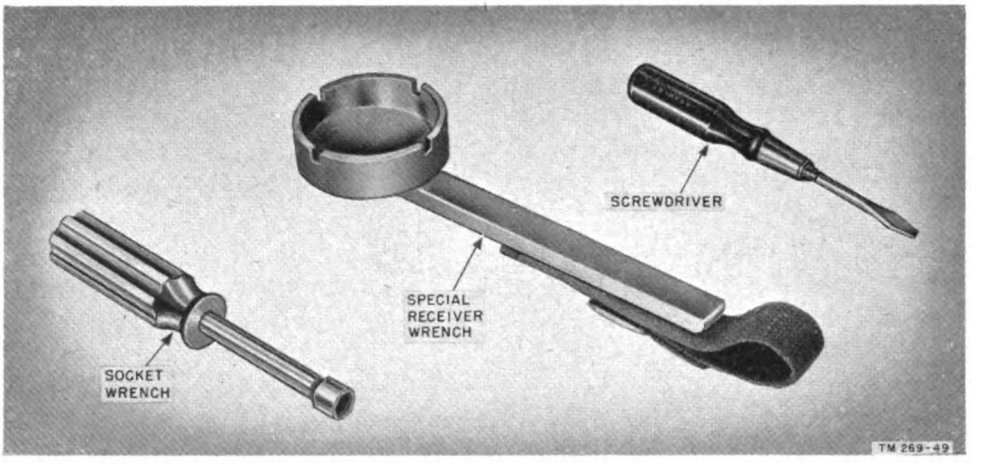


Figure 19. First echelon tools.

Section II. PREVENTIVE MAINTENANCE SERVICES

29. Definition of Preventive Maintenance

PM (preventive maintenance) is work performed on equipment (usually when the equipment is not in use) to keep it in such good working order that break-downs and needless interruptions in service will be kept to a minimum. PM differs from trouble shooting and repair since its object is to prevent certain troubles before they can occur. See TM 38–650 (Basic Maintenance Manual).

30. General Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion.

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

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

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

c. For further information on PM techniques, refer to TB SIG 178 (Preventive Maintenance Guide for Radio Communication Equipment).

31. Performing Preventive Maintenance

The PM operations which follow should be performed by organizational personnel at the intervals indicated, unless these intervals are changed by the local commander. Radio Sets AN/TRT–1 and AN/TRR–2 do not require preventive maintenance more often than once a month. The most common trouble will be corrosion resulting from exposure to salt air and water. The equipments are built into a waterproof cabinet, and a silica gel cartridge is included inside the transmitter and receiver to absorb moisture.

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. *Remove the battery cable from the transmitter before performing any preventive maintenance.*

a. Remove the waterproof covers from the control box and transmitter control panel. Loosen the 14 wingnuts holding the transmitter chassis to the waterproof cabinet, and slide the chassis from the cabinet. Place the unit in a position suitable for performing maintenance work.

b. Make a visual inspection of the items which follow; tighten and/or clean *if necessary.*

(1) Tubes and crystal sockets and pins, for loose contacts, dirt, and corrosion. Check vacuum tubes; replace them if necessary.

(2) Capacitors, for signs of break-down or deterioration.

(3) Resistors, for blistering, discoloration, and other evidence of overheating.

(4) All rotary switches, for dirt, corrosion, loose contacts, and unsatisfactory mechanical action.

(5) Plugs and connectors for dirt, corrosion, and loose contacts.

(6) Wires, cords, and cables, for cracks, cuts, and frayed insulation.

(7) Shock mounting of the dynamotors, for mechanical looseness.

(8) All visible terminals and connections for loose connections and corrosion.

(9) MFP coatings, for breaks. (Retouch with a brush, if necessary.)

(10) Finish, for scratches and bare spots. (Retouch, if necessary.)

(11) Coils L–2 and L–5, for dirt, corrosion, and damaged turns.

(12) All relay contacts, for pits and build-ups and for improper alinement.

(13) Transformers T–1 and T–2, for signs of overheating or break-down.

(14) Meter M–1, for dirt and corrosion.

c. Relay maintenance operation is an especially important PM item. Unless the relay contacts are clean, electrical contact will be poor, and pitting and corrosion may occur. If burning or pitting has distorted the contact, the original shape must be restored. The most common trouble occurs in the small relays used in low-voltage circuits. All the small relay contacts are made of palladium. To clean the contacts, run a burnishing tool between them while lightly holding the contacts together. If the set is not used for some time, the contact surfaces of the switches on the switching relays may become corroded. If wiping the contact surfaces with a clean cloth does not remove the corrosion, a small piece of No. 0000 sandpaper may be used.

d. Slide the transmitter into its cabinet and tighten the wingnuts which hold the chassis to the cabinet. Connect the battery cable to the transmitter, place the equipment in operation, and check for satisfactory performance. Replace the waterproof covers if the set is not going to be used immediately.

Section III. LUBRICATION

32. Lubrication Instructions

a. GENERAL.

(1) The armature bearings in the dynamotors are the only parts which require lubrication.

(2) Gasoline will not be used as a cleaning fluid. For electrical equipment such as the dynamotors, use carbon tetrachloride as the cleaning fluid.

b. PROCEDURE.

(1) Armature bearings will be lubricated after every 256 hours of operation or monthly, whichever interval is shorter.

(2) Remove the end covers and bearing end cap (fig. 51) in accordance with paragraph 63*b*.

(3) With a small bristled brush and cloth remove all old and hardened grease.

(4) Knead General Purpose Grease No. 2 (WB) into the space between inner and outer races. Wipe off extra grease. Do not pack grease into bearing housing.

(5) Reassemble bearing end cap and end covers.

Caution: Never add oil of any type to a moving part that is lubricated by grease. Do not get oil or grease on the commutator or brushes.

33. Lubrication under Unusual Conditions

a. ARCTIC REGIONS. Lubricants which are satisfactory at moderate temperatures stiffen and solidify at subzero temperatures; as a result moving parts bind or become inoperative. If it is necessary to prepare the dynamotors for low-temperature operation, proceed as follows:

(1) Disassemble the dynamotor and remove the armature as outlined in paragraph 63*b*. *Do not remove the bearings from the shaft.*

(2) Thoroughly clean the bearings by immersing them, mounted on the armature shaft, in a shallow pan of solvent (SD). A small bristled brush will greatly aid the cleaning operation. Use clean solvent (SD) for final rinsing of the bearings. Allow them to dry naturally before attempting to reapply lubricant. Do not use compressed air or temperatures above 212° F. to accelerate drying. Do not allow any solvent to come in contact with the commutators or the armature windings.

(3) Rotate the bearings by hand, applying a slight pressure on the outer race to simulate the load. Inspect for loose shaft fit and defects, such as binding or excessive wear, as indicated 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.

(4) The balls and races should be thoroughly coated with Grease, Special Lubricating (GL). Wipe off excess grease.

(5) Reassemble the dynamotor, reversing the procedure outlined in paragraph 63*b*.

(6) Refer to TB SIG 134 for additional dynamotor information.

b. TROPICAL REGIONS. High temperatures and moisture due to rain, condensation, etc., may cause lubricants which are normally satisfactory to flow from moving parts and other surfaces. These bearing surfaces will wear excessively, and other parts will be damaged by rust and corrosion. Inspect the dynamotor bearings frequently and lubricate them as required to insure efficient operation, using lubricants suitable for high temperatures.

c. DESERT REGIONS. Dust and sand infiltration into the equipment causes grit in the lubricants and will seriously impair and damage the moving parts of the dynamotor. Hot, dry temperatures cause the lubricants to flow from the moving parts, and conditions similar to those described in *b* above will result. Inspect the bearings frequently.

Section IV. WEATHERPROOFING

34. General

Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

35. Tropical Maintenance

A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained fully in TB SIG 13 (Moistureproofing and Fungiproofing Signal Corps Equipment) and TB SIG 72 (Tropical Maintenance of Ground Signal Equipment).

36. Winter Maintenance

Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are fully explained in TB SIG 66 (Winter Maintenance of Signal Equipment).

37. Desert Maintenance

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

38. Lubrication

The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69 (Lubrication of Ground Signal Equipment). Observe all precautions outlined in TB SIG 69, and pay strict attention to all lubrication orders when operating equipment under conditions of extreme cold or heat.

39. Rustproofing and Painting

a. When the finish on the chassis or cabinets has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use sandpaper to clean the surface down to the bare metal. Obtain a bright, smooth finish.

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

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

Section V. TROUBLE SHOOTING ON ORGANIZATIONAL MAINTENANCE LEVEL

40. Visual Inspection

a. Failure of this equipment to operate properly usually will be caused by one or more of the following faults:

(1) Improperly connected battery cable.
(2) Worn, broken, or disconnected cords or plugs.
(3) Burned-out fuses.
(4) Burned relay contacts.
(5) Wires broken because of excessive vibration.
(6) Defective tubes.
(7) Inactive (dirty or cracked) crystal.

b. When failure is encountered and the cause is not immediately apparent, check as many of the above items as is practical before starting a detailed examination of the component parts. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

c. Inspect the antenna system for obvious abnormalities.

41. Trouble Shooting by Using Equipment Performance Checklist

a. GENERAL. The equipment performance checklist (par. 42) will help the operator to lo-

cate trouble in the equipment. The list gives the item to be checked, the conditions under which the item is checked, the normal indication, and the corrective measures the operator can take. *To use this list, follow the items in numerical sequence.*

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

c. NORMAL INDICATION. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the item. If the indications are not normal, the operator should apply the recommended corrective measures.

d. CORRECTIVE MEASURES. The corrective measures listed are those the operator can make without turning in the equipment for repairs. A reference in the table to material in chapter 5 indicates that the trouble cannot be corrected during operation and that trouble shooting by an experienced repairman is necessary. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the situation requires that operation be maintained and if the set is not inoperative, the operator must maintain the set in operation as long as it is possible to do so.

42. Equipment Performance Checklist for Radio Set AN/TRT–1

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY OPERATE	1	Battery connector	Connected to BATTERY receptacle on transmitter panel.		
	2	Antenna connector	Connected to ANTENNA receptacle on transmitter panel.		
	3	Control box	Connected to CONTROL BOX receptacle on transmitter panel (either directly or by remote cable).		
	4	Input voltage switch	Set according to input voltage supplied.		
	5	Milliammeter	Read with meter switch in position 1.	Indicates 0.4 for 12-volt operation and 0.8 for 24-volt operation.	Check voltage at battery.
	6	SELECTOR SWITCH	Throw switch to RF position	All tubes light	Check fuse F–2.
	7	PLATE SWITCH	Throw switch to ON position		
	8	RESET button	Press button	R-f and a-f switching relays are released if they have been previously energized.	Check RESET button and release coils on relays.

42. Equipment Performance Checklist for Radio Set AN/TRT–1 (continued)

	Item No.	Item	Action or condition	Normal indication	Corrective measures
O P E R A T E	9	SELECTOR DIAL	Dial first numbers of code combination.	R-f switching relay operates; then the selected crystal, crystal oscillator, and final amplifier relays click.	Check SELECTOR DIAL and relays.
	10	SELECTOR SWITCH	Throw switch to AF position		
	11	SELECTOR DIAL	Dial second number of code combination.	A-f switching relay operates; then the selected a-f relay closes.	Check relays.
	12	SELECTOR SWITCH	Throw switch to KEY position		
	13	SELECTOR DIAL	Dial last three digits of code combination.	Intensity of red pilot lamp on control box increases as three-digit number is dialed.	Check percentage of modulation according to procedure given in paragraph 66.
S T O P	14	SELECTOR SWITCH	Throw switch to OFF position	Tube filaments stop glowing.	
	15	RESET button	Press button	R-f and a-f switching relays are released.	
	16	PLATE SWITCH	Throw switch to OFF position		

CHAPTER 4

THEORY

Section I. THEORY OF RADIO SET AN/TRR–2

43. Block Diagram (fig. 20)

Radio Set AN/TRR–2 includes an r-f amplifier, a superregenerative detector, an a-f discriminator, a pulse detector, and a code selector system with two gas tubes (firing and reset stages).

a. The r-f signal voltage (A, fig. 20) induced in the antenna is amplified (B) by r-f amplifier tube V-1 and applied to detector tube V-2. The r-f stage prevents any radiation of r-f energy developed by the oscillating detector tube circuit (par. 45).

b. The detector demodulates the r-f signal, and its output (C) is applied to an a-f discriminator stage. The discriminator accepts and amplifies (D) only signals at the preset (coded) audio frequency. The discriminator output is applied through a differentiating circuit to a pulse detector which converts each group of pulses (D) to a single rectangular current pulse. Thus, the pulse detector output is in the form of

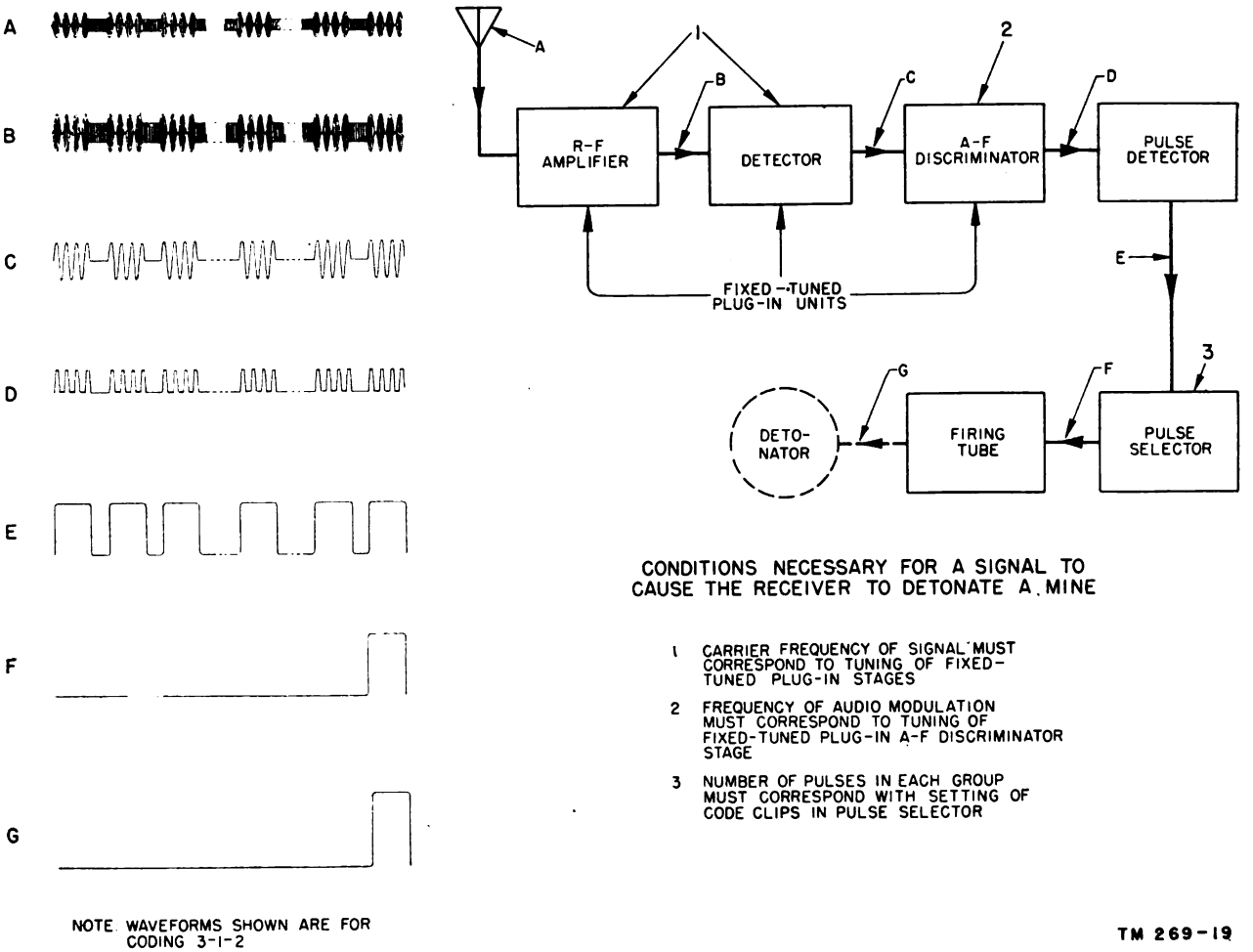


Figure 20. Receiver, block diagram.

a series of current pulses (E) through a relay (K–39, fig. 21) winding.

c. The pulse selector circuit is composed of a reset tube, firing tube, and a three-gang stepping switch (called a selector switch). These components count and add the number of pulses (up to 10), provided that the time between pulses is less than 0.4 second. When the space between pulses is greater than 0.4 second, the reset tube operates and the selector switch mechanism is automatically reset to its starting position. This action prevents operation of the firing tube by improperly coded signals. The firing tube is normally nonconducting. When the correctly coded signals are received, this tube conducts (F) and a detonator cap is fired (G).

44. R-f Amplifier (fig. 21)

a. Signals from the antenna are coupled through coil L–35 to the grid circuit, which is tuned by capacitor C–14–1. Correct grid bias is obtained from the junction of resistors R–19–3 and R–30, which form a voltage divider across the 6-volt bias battery. Capacitor C–1–1 prevents the d-c bias voltage from being shorted to ground but completes the tuned grid circuit at radio frequencies. Resistor R–31 and capacitor C–1–1 decouple the tuned circuit from the bias supply.

b. The output of the r-f stage is coupled through transformer L–36 to the detector input. Capacitor C–1–4 and r-f choke coil L–33 decouple the plate circuit of V–1 from the power supply. The screen of V–1 is bypassed by capacitor C–1–2. Correct screen voltage is obtained from the screen-dropping resistor, R–32. Capacitor C–6–1 and resistor R–25 provide additional decoupling of the plate and screen circuits from the power supply.

45. Detector Circuit (fig. 21)

a. This is a self-quenching type of superregenerative circuit which provides high sensitivity because of its high amplification. The tuned circuit consists of the secondary of L–36 and capacitor C–14–2, and it is connected between the plate and grid of detector tube V–2. Plate voltage is applied through a tap on the winding so that there is positive feedback from plate to grid. The r-f choke coil L–34 confines r-f voltages to the tuned circuit, and capacitor C–3 bypasses to ground any r-f component that may get through the choke coil. The detector output is taken from across resistor R–18 and coupled through the series combination of capacitor C–1–3 and resistor R–21–1 to the input of the a-f discriminator tube, V–3. Capacitor C–6–2 and resistor R–26 decouple the detector plate circuit from the power supply. Resistor R–19–1 and capacitor C–2 are the grid leak and capacitor

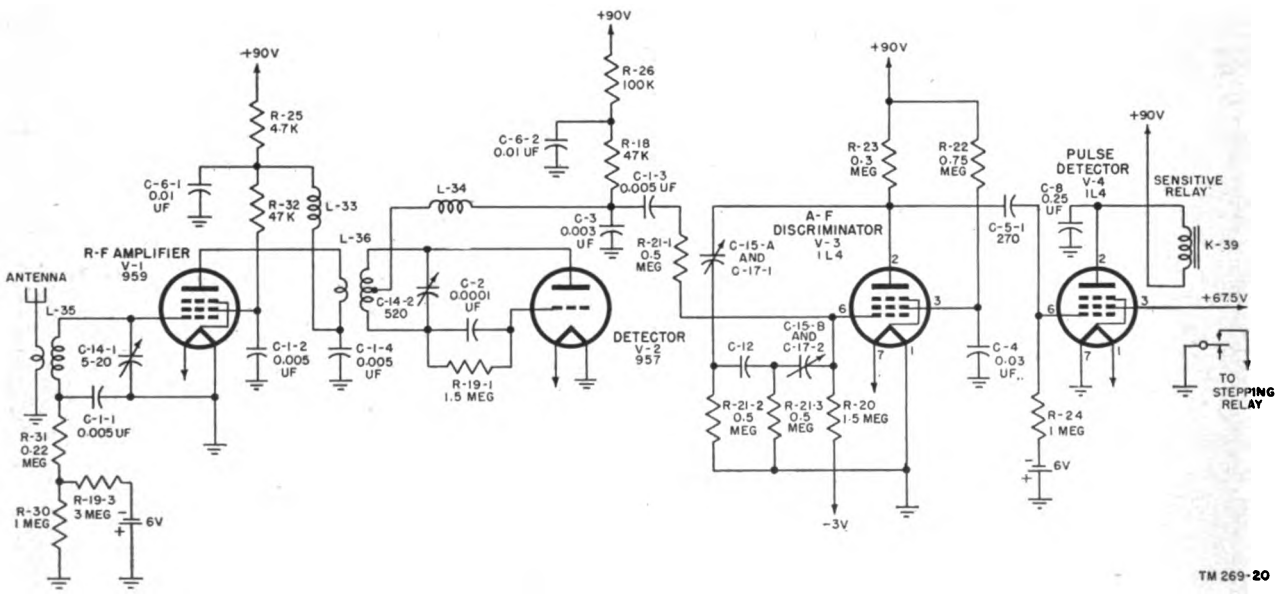


Figure 21. Receiver section, schematic diagram.

combination in the detector grid circuit. A simplified explanation of the detector circuit action is given in *b* below.

b. Plate voltage is applied through the portion of the secondary of L–36 between the tap and plate of V–2. The plate supply voltage also is applied to the grid of V–2 through the section of the coil between the tap and the grid end of the coil and through the grid leak resistor. However, this does not make the grid potential the same as the plate potential, because the grid capacitor, C–2, charges to a voltage opposite and very nearly equal to the applied voltage. Consequently, the grid voltage is approximately 0.1 volt positive. Under this condition the tube is being operated at its most sensitive point. Owing to the feedback (*a* above), any slight disturbance, such as noise voltages, will cause the detector to oscillate at the resonant frequency of the tuned circuit. However, the r-f voltage thus developed in the tuned circuit causes grid current so that the charge and, therefore, the voltage of the grid capacitor increases. After a number of r-f cycles the increasing capacitor voltage biases the tube from its original class A condition to a point so far beyond the class C condition that the r-f oscillations are quenched (stopped). When sufficient charge leaks from C–2 through the grid leak resistor, R–19–1, the bias decreases to the point at which class A operation occurs and the oscillations start again. The time constant of the grid leak and capacitor are so chosen that, in the absence of signal input, the oscillations are quenched about 35,000 times per second. For this zero-signal condition the *average* plate current will remain constant at a certain amplitude. When a c-w (continuous-wave) signal is received it will *start* each wave train (period of oscillation) earlier. The duration and amplitude of each wave train remains constant; therefore, the time interval between each wave train is shortened and the *number* of wave trains is increased. If the amplitude of the input signal increases, each wave train starts still earlier and the number of wave trains is further increased. (In terms of quenching, this is the equivalent of saying that the quench frequency increases with increasing signal input.) At first thought it might be assumed that increasing the number of wave trains would increase the average plate current. However, this self-quenching circuit uses a grid leak—capacitor detector arrangement, and increasing the number of wave trains increases the average negative grid bias. Consequently, increasing the amplitude of the input signal reduces the average plate current. Detection or demodulation occurs in the grid circuit, and the tube then acts as an amplifier of the a-f component of an a-m input signal. The circuit has inherent automatic gain control characteristics because of the automatic increase of the average grid bias with increasing signal amplitude.

46. A-f Discriminator

This stage (V–3) includes a phase-shift circuit and feedback arrangement which discriminate against all audio frequencies except that to which the plug-in stage is pre-set (table IV).

a. The detector output is coupled through C–1–3 and resistor R–21–1 to the grid of V–3. Regardless of its frequency, a signal reaching the grid causes a plate voltage change which is fed back through capacitors C–15–A and C–17–1 and then through the remainder of the phase-shifting network (R–21–2, C–12, C–15–B and C–17–2 and R–20) to the grid. A signal at the audio frequency for which the phase-shifting network produces a 180° shift is thus shifted a total of 360°; 180° through the tube and 180° more through the network. In other words at one frequency and only at one frequency the voltage fed back is in phase with and reinforces the signal at the grid. Consequently, only signals of the correct audio frequency are amplified sufficiently to actuate the following pulse detector stage.

b. Capacitor C–4 is a screen bypass capacitor. Owing to the relatively high resistances of the plate load resistor, R–23, and the screen dropping resistor, R–22, the plate and screen voltages are low. Thus, with 3 volts of bias applied to the grid the tube plate current is nearly cut off. Under this condition the signal produces a series of plate current pulses and corresponding voltage pulses across R–23. The output voltage is coupled through a differentiating circuit to the grid of the following stage.

47. Pulse Detector

The pulse detector circuit includes a differentiating circuit, relay K–39, capacitor C–8, and tube V–4. Coupling capacitor C–5–1 and grid

resistor R–24 form a differentiating circuit which converts the discriminator output voltage from a series of relatively broad pulses to a series of alternate positive and negative narrow, sharply peaked pulses. Since the grid of V–4 is biased so that plate current is very nearly cut off, only the positive pulses affect the pulse detector tube. With zero signal input, capacitor C–8 charges to a voltage equal to the supply voltage. When a narrow, sharply peaked positive pulse is applied to the grid of V–4 the tube conducts and C–8 discharges rapidly through the tube. Between these positive pulses C–8 is recharged by current through the relay winding. This charging current actuates relay K–39, which closes the circuit to the stepping coil of the stepping switch (fig. 22).

48. Electromechanical Switching Section (fig. 22)

Energizing relay K–39 closes S–5 and actuates the stepping coil. Thus the stepping switch contacts are moved up one step by each pulse produced in the transmitter. When no signals are received, the components of the switching section are in the positions shown in figure 22. When a signal of the correct radio and audio frequencies is received, relay K–39 closes with each audio pulse. If the three-digit code selected is 2–5–8, the switching section operates as follows:

a. Dialing 2 at the transmitter sends two pulses to the receiver.

(1) The first pulse energizes relay K–39 and closes switch S–5. Closing S–5 applies 45 volts to the stepping coil through the lower set of contacts of switch S–4–2. The stepping mechanism then moves the stepping switch wipers to position 1. (The switch shaft has a spring action which resists rotation, and the shaft is held in position by the catch associated with the reset coil.) The stepping coil also closes switch S–3, which shorts capacitor C–10 in the reset tube circuit.

(2) When K–39 opens S–5 at the end of the first pulse, the stepping coil is no longer energized and S–3 opens. When the selector wipers move to contact 1 on the first pulse, switch S–2 is also closed. This applies 135 volts through the reset relay to the plate of V–5 and through R–28 to C–10 and the grid of V–5. Tube V–5 is a cold-cathode gas tube which is nonconductive with less than +70 volts applied to its grid. The time constant at R–28 and C–10 is such that it takes approximately 2/5 second for 70 volts to build up across the capacitor. Once the tube begins to draw current, conduction can be cut off only by removing the plate voltage.

(3) When K–39 is closed by the second pulse, the selector wipers are moved up to contact 2. As mentioned above, switch S–3 again closes and shorts C–10, thus preventing conduction through V–5 and reset relay K–37. Although the wiper of pulse selector 1 is connected through the code clip to 135 volts, this potential cannot charge capacitor C–13 because S–4–1 is open.

(4) At the end of the second pulse, S–5 and S–3 again open. With the opening of S–3 the voltage across C–10 again builds up. Because the time required to dial the second number is appreciably greater than 2/5 second, the voltage across C–10 rises to 70 volts, and V–5 conducts. This energizes the reset relay, thus closing switches S–4–1 and S–4–2, which are mechanically arranged so that S–4–1 closes slightly ahead of S–4–2.

(5) Closing S–4–1 applies the 135 volts through S–1–1 and S–1–2 and pulse selector 3 directly to capacitor C–13 and charges it to this potential. Note that in position 2 the wiper of pulse selector 2 is insulated from ground, thus preventing C–13 from being shorted to ground. When S–4–2 closes, it energizes the reset coil to open the normally closed switches, S–1–1 and S–1–2, and releases the catch holding the selector arm shaft. Consequently, the selector wipers move back to the zero or *home* position. This action also opens S–2 to remove the 135 volts from the plate of V–5, so that V–5 becomes nonconducting. Opening S–1–2 prevents the discharge of C–13 as the

SWITCH ACTION

S-1-1 & S-1-2: CLOSED EXCEPT WHEN RELAY COIL IS ENERGIZED.

S-2: OPEN ONLY WHEN SELECTOR ARM IS IN THE 0 POSITION. CLOSED IN ALL OTHER POSITIONS.

S-3: OPEN EXCEPT WHEN STEPPING COIL IS ENERGIZED.

S-4-1: OPEN EXCEPT WHEN RESET RELAY IS ENERGIZED.

S-4-2: DOWN EXCEPT WHEN RESET RELAY IS ENERGIZED.

S-5: CLOSES WITH EACH PULSE FROM THE PULSE DETECTOR.

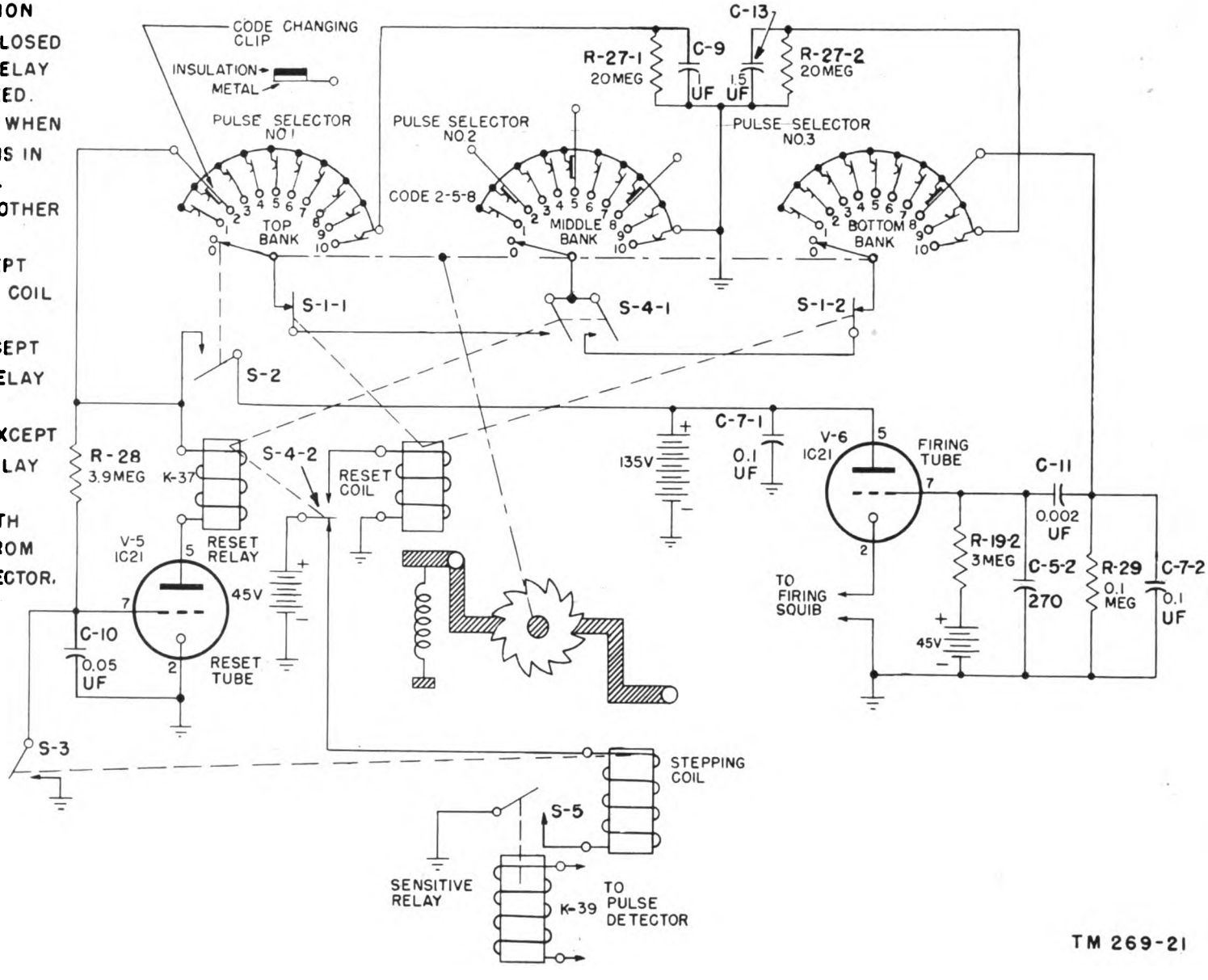


Figure 22. Receiver switching section, schematic diagram.

selector arms pass over the number 1 contacts.

Note. Assume that a higher number than 2 is dialed. Because S–4–1 is open as the arm of pulse selector 1 passes over contact 2 on the way up and S–1–1 and S–1–2 are open as the arm of pulse selector 1 passes over contact 2 on the way down, capacitor C-13 cannot charge.

(6) When V–5 conducted, capacitor C–10 discharged through the tube; therefore conditions are now the same as before the first pulse, except for the charge on capacitor C–13.

Note. If the second series of pulses does not occur before a reasonable length of time (25 seconds), the charge on C–13 will have had sufficient time to leak through 20-megohm resistor R–27–2 to make the system inoperative.

b. Dialing 5 moves the selector wipers up to the number 5 contacts. With the closing of S–4–1, one end of capacitor C–9 is connected to capacitor C–13, and the charge originally put on C–13 is distributed between C–13 and C–9. This places a potential of approximately 65 volts on C–9. The resetting action is the same as that for the first series of pulses.

Note. If the second number dialed is other than 2, 5, or 8, capacitor C-13 is discharged through pulse selector 3, S–1–2, S–4–1, and pulse selector 2 to ground when S–4–1 closes. If the dialed number is 2 or 8, capacitor C–13 merely retains its charge.

c. Dialing 8 moves the selector wipers up, in the same manner as before, to the number 8 contacts. With the closing of S–4–1, the voltage across C–9 is applied across resistor R–29 and capacitor C–7–2 in the firing tube circuit. Because capacitor C–9 is very large compared with capacitor C–7–2, nearly all of the voltage across C–9 appears instantaneously across C–7–2. During static conditions, capacitor C–11 in the firing tube circuit develops a potential of 45 volts across it from the battery in the grid circuit of V–6. The voltage of C–9, when added to this potential, is more than enough to cause V–6 to conduct. When the tube conducts, a squib in the cathode circuit is fired, and this is used to detonate a mine.

Note. If the third series of pulses is other than 2, 5, or 8, capacitors C–9 and C–13 are discharged to ground when S–4–1 closes. If the number of pulses is 2, capacitor C–13 is recharged up to 135 volts, and if the number of pulses is 5, conditions remain unaltered.

49. Power Supply

The power supply for the receiver consists of eight 22.5-volt B-Batteries BA–2, two 1.5-volt A-Batteries BA–35, and one 7½-volt C-Battery BA–34. As shown in figure 55, the batteries are connected as follows:

a. The two A-batteries (Batteries BA–35) are connected in parallel and are used to heat the filaments of all tubes in the receiver section.

b. The 7½-volt C-battery (Battery BA–34) is used to supply 6 volts grid bias voltage to the r-f amplifier and pulse detector stages. The battery also supplies 3 volts grid bias voltage to the a-f discriminator stage.

c. Six of the B-batteries (Batteries BA–2) are connected in series to supply voltages of 45, 67.5, 90, and 135 volts to certain tubes, relays, and switches. The other two B-batteries are connected in series to supply 45 volts to S–4–2 in the switching section.

Section II. THEORY OF RADIO SET AN/TRT–1

50. Block Diagram

Radio Transmitter T–87/TRT–1 consists of a crystal-controlled oscillator circuit, the r-f carrier of which is modulated by a pulsed a-f sine wave. The output of the transmitter in present equipment is on six channels between 29.5 and 32 mc. The crystal oscillator generates an r-f signal, multiplies the frequency of the signal through the use of doubler circuits, and amplifies the signal in a power amplifier so that 40 to 50 watts of output power are produced. The a-f oscillator develops the a-f modulating signal which is amplified by the driver stage and used through the modulator to amplitude-modulate the carrier. The control box is a switching or keying device which turns the modulation on and off and keys the desired a-f pulses which move the stepping relay in the receiver. The power for the transmitter is supplied by two dynamotors, one supplying power to the r-f section and the other to the a-f section.

Note. Transmitters having serial numbers 1 through 11 and 14 through 45 must be modified by the application of MWO SIG 11–269–1, if the modification work order has not already been complied with. This MWO changes the connection between resistor R–26 and switch S–1 (fig. 56).

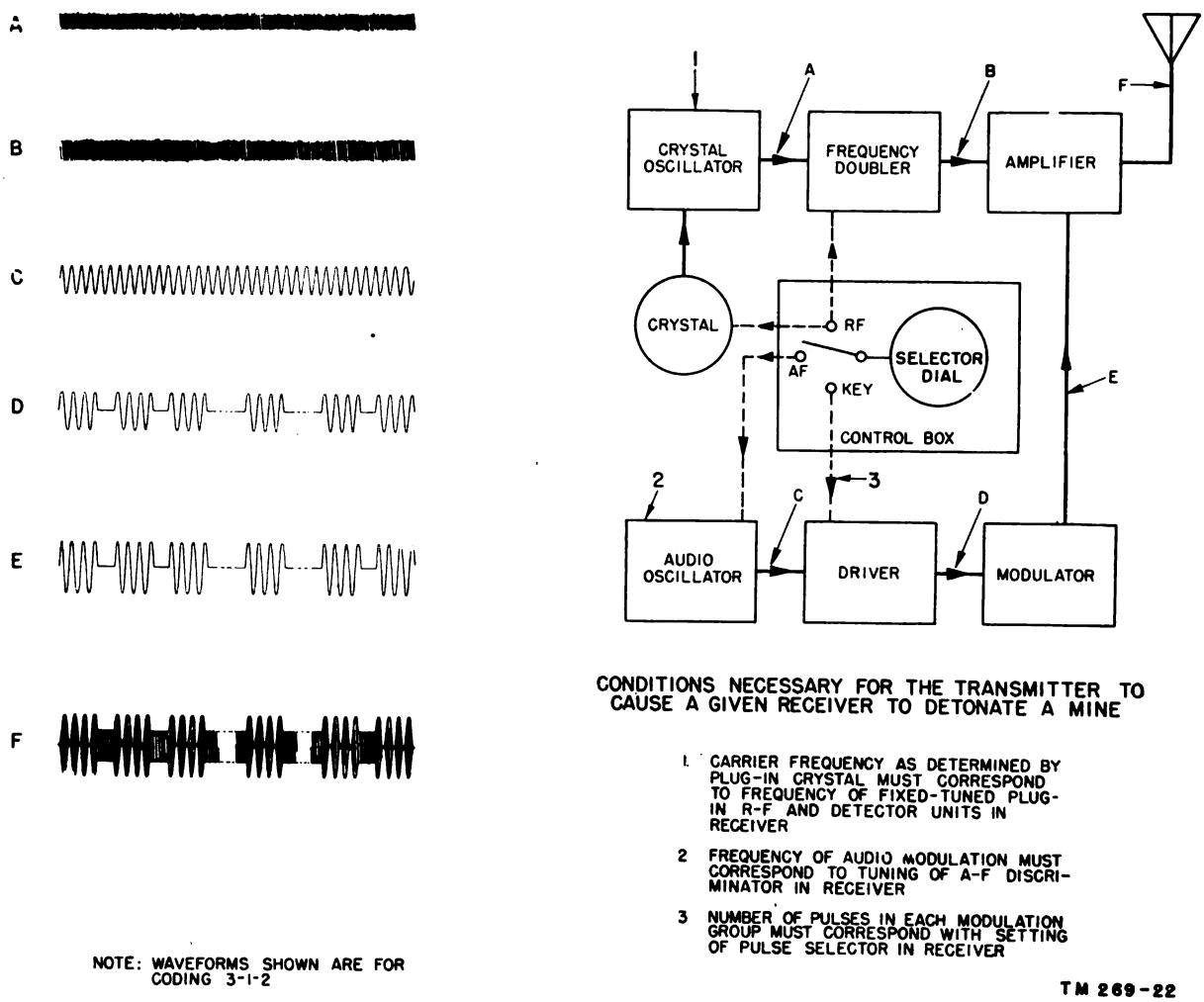


Figure 23. Transmitter, block diagram.

51. R-f Section (fig. 24)

The r-f section of the transmitter includes a crystal oscillator, doubler, and final amplifier. The transmitter circuits are located on the upper half of the chassis and are mounted on the rear side of the front panel (fig. 27).

a. CRYSTAL OSCILLATOR. The r-f generator is a tri-tet type crystal oscillator circuit using a beam power Tube JAN–6L6. The control grid, screen-grid, and cathode act as a triode crystal oscillator, the screen grid functioning as the plate of the triode. For operation in channels 1, 2, and 3 the plate tank circuit is tuned to the third harmonic of the crystal frequency; for channels 4, 5, and 6 the tank circuit is tuned to the second harmonic of the fundamental crystal frequency (table V). Besides providing high harmonic output, the tri-tet circuit offers the usual advantage of a crystal oscillator by providing frequency stability. The following discussion is based on channel 1 (fig. 24) and applies to channels 2 and 3, except for capacitor and resistor circuit values.

(1) In channel 1 the plate tank circuit, consisting of capacitors C–44 and C–23 and inductor L–2, is tuned by C–44, the oscillator plate control (OSC. CHANNEL 1 dial). In this circuit C–45, together with resistor R–35, acts as a filter to keep the r-f out of the plate supply. Feedback from the plate to the control grid of tube V–5 occurs through capacitor C–42 and the plate-to-grid capacitance (0.4 uuf (micromicrofarad)) of the tube. Capacitor C–42 is adjusted to provide sufficient

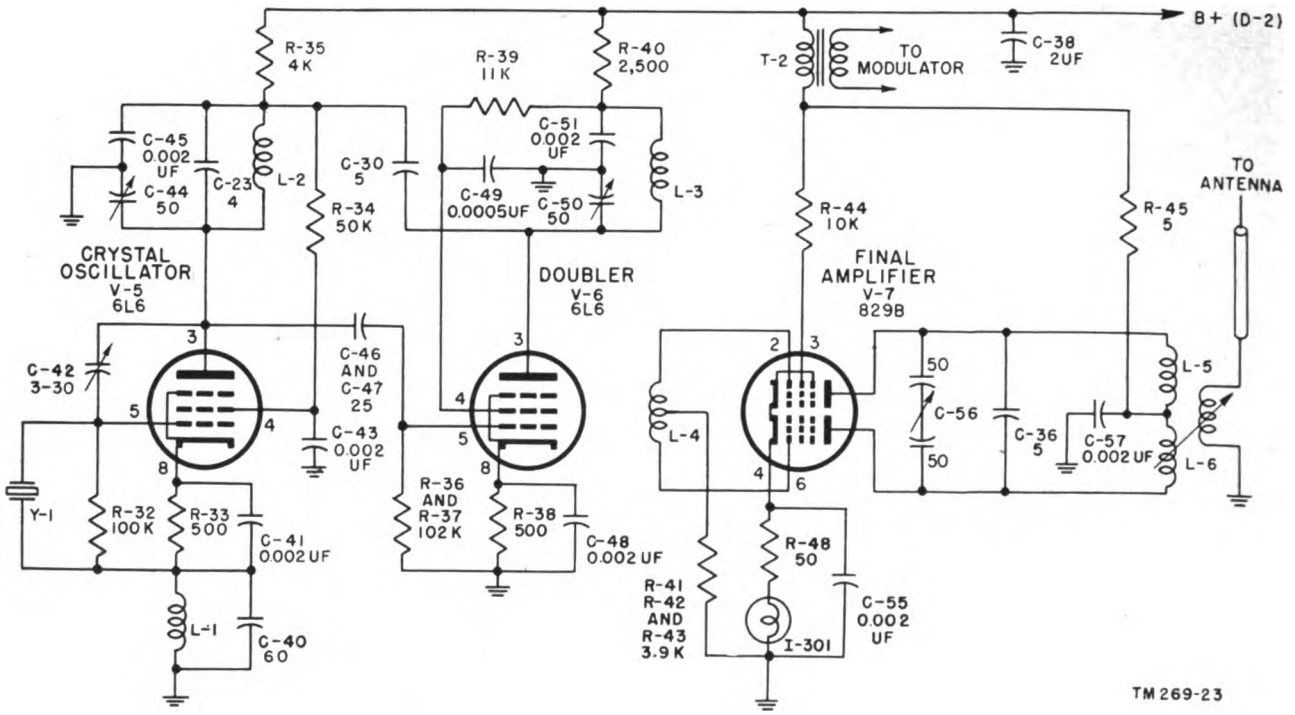


Figure 24. Transmitter, r-f section, channel 1, schematic diagram.

feedback for oscillation if the crystal activity is low.

(2) The L–C (inductance-capacitance) combination (consisting of L–1 and C–40) in the cathode circuit of tube V–5 is tuned to a frequency considerably higher than the frequency of the crystal (approximately 14,000 kc). Resistor R–33 provides cathode bias to the tube with capacitor C–41 bypassing the cathode resistor.

(3) The plate current contains the fundamental and numerous harmonic frequency components. The plate tank circuit is tuned to the third harmonic, and only the third harmonic is applied to the input of the doubler stage. The crystal oscillator output is coupled through capacitors C–46 and C–47 and grid resistors R–36 and R–37 to the grid of the doubler stage, V–6.

(4) Resistor R–34 is the screen-dropping resistor, and capacitor C–43 bypasses the screen grid of tube V–5. Grid leak resistor R–32 and the capacitance of the crystal provide proper operating bias for the grid of V–5.

b. DOUBLER. The plate tank circuit of doubler stage V–6 (fig. 24) is tuned to twice the input frequency. Since the input to V–6 is already three times the fundamental crystal frequency, the output of V–6 will be six times the crystal frequency. This applies to channels 1, 2, and 3. For channels 4, 5, and 6, the output of V–6 will be four times the crystal frequency.

(1) In the doubler stage, resistor R–38 ordinarily biases the tube to about cut-off. Additional bias for doubler operation is obtained when the signal from the oscillator drives the grid positive and the grid current charges capacitors C–46 and C–47. The time constant of the R–C (resistance-capacitance) circuit consisting of grid capacitors C–46 and C–47 and grid leak resistors R–36 and R–37 is large (2½ microseconds) compared with the time between signal peaks (approximately $\frac{1}{25}$ microsecond), so that very little of the charge on C–46 and C–47 can leak through R–36 and R–37 between positive signal peaks. Thus the grid capacitor voltage increases with excitation and the grid is biased well beyond the point of plate current cut-off. Consequently, plate current flows only at

the positive peaks of excitation voltage and the output is rich in harmonics.

(2) The plate tank circuit, consisting of inductor L–3 and capacitors C–50 (DBLR. CHANNEL 1 control) and C–51 is tuned to the second harmonic frequency. The output is coupled to L–4 and applied to the control grids of the push-pull final amplifier stage.

(3) Resistor R–39 is a screen-dropping resistor, and capacitor C–49 bypasses the screen grid. Capacitor C–51 is a plate voltage blocking capacitor. Capacitor C–48 bypasses the cathode bias resistor, R–38.

c. FINAL AMPLIFIER. This is a push-pull amplifier which is operated class C for maximum efficiency. The amplifier delivers between 40 and 50 watts to the antenna system.

(1) The r-f signal induced in L–4 is applied to the control grids of V–7. Because of the end-to-end physical positioning of coils L–3 and L–4, the center tap on L–4 is placed off center to obtain electrical balance. Cathode resistor R–48 and control box lamp I–301 bias the tube for class C operation.

Note. On equipments bearing serial numbers 1 through 44, additional grid leak and capacitor bias is supplied by a capacitor (C–54, 0.0005 uuf) connected between the cathode of V–7 and the tap on coil L–4.

(2) The plate tank circuit consisting of inductor L–5 and capacitors C–36 and C–56 (AMPL. CHANNEL 1 control) is tuned to the fundamental frequency of the input signal. The output signals are inductively coupled from the tank circuit into the antenna system by means of L–6.

(3) The plate voltage and screen voltage of V–7 are varied sinusoidally by an a-f signal through transformer T–2 in the modulator stage. Varying the plate voltage causes the output signal of the final amplifier to be amplitude-modulated. Capacitor C–38 decouples transformer T–2 from the power supply, and capacitor C–57 completes the tank circuit to ground for the r-f signal.

d. ANTENNA SYSTEM. The antenna (fig. 16), a vertical half-wave whip, radiates the modulated signal. The antenna is connected to the output tank circuit by a single wire 3 feet long or less. For maximum power output, the impedance of the antenna and feed line is matched to the impedance of the final amplifier stage by varying the mutual inductance between inductors L–5 and L–6 (the ANT. COUPLING control).

52. A-f Section (fig. 25)

The a-f section of the transmitter includes the a-f oscillator, driver, and modulator stages. The section is located on the upper and lower left-hand side of the chassis (fig. 27). The following discussion applies to audio channel 5, and to channels 1, 2, 3, and 4, with the exception of resistor and capacitor circuit numbers.

a. A-F OSCILLATOR. Because a very stable audio oscillator is required, a Wien Bridge type of oscillator circuit is used. This circuit consists of a Tube JAN–6SN7GT amplifier and inverter and a resistance-capacitance bridge which allows a voltage of only one frequency to be effective in the circuit. The operation of the oscillator is as follows:

(1) The voltage at the control grid (pin 1) of tube V–1 is amplified, and the output signal at the plate (pin 2) is applied through coupling capacitor C–13 and resistor R–19 to the grid (pin 4) of the second section of V–1. The output of the second section is coupled through capacitor C–10 to a bridge circuit and to the driver stage.

(2) The R–C network composed of R–10, C–7, C–5—C–9, R–5, C–6, and C–5—C–8 provides positive feedback (regeneration). Resistance network R–11—R–49 and lamp I–1 provides negative feedback. If the R–C network is properly proportioned, the ratio of the input voltage (across R–5) to the output voltage varies with frequency. Oscillations occur at the frequency for which this ratio is maximum; that is, at the frequency for which the feedback voltage is greatest. The amplifier circuit should have negligible phase shift, and this condi-

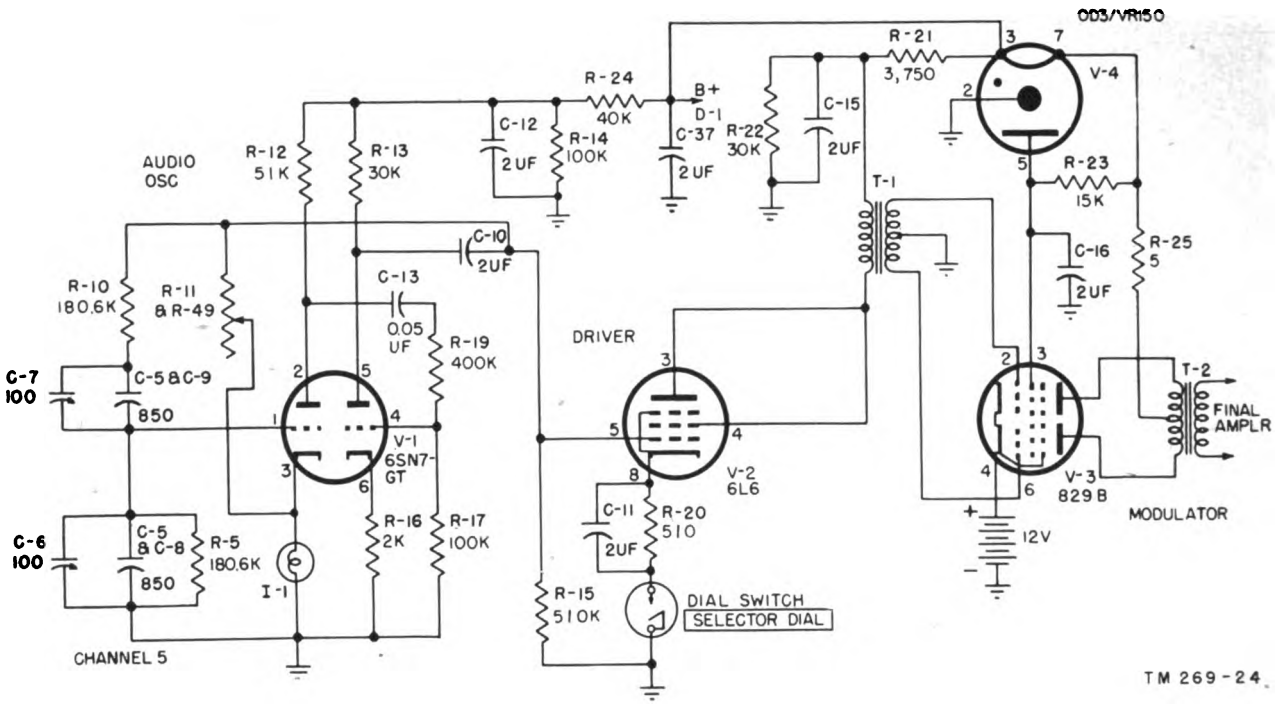


Figure 25. Transmitter, a-f section, channel 5, simplified schematic diagram.

tion is obtained by the large amount of negative feedback through R–11 and R–9 and lamp I–1.

Caution: All variable capacitors in the audio stage have been factory-tuned and should be adjusted only according to the procedure given in paragraph 65.

(3) Lamp I–1 is used as the cathode resistor for the first section of V–1 in order to stabilize the amplitude of oscillation. An increase in the amplitude of oscillation increases the current through I–1, thereby increasing the lamp resistance. Similarly, a decrease in amplitude decreases the lamp resistance. Thus, the automatic change in the amount of negative feedback holds the output voltage at a nearly constant amplitude. The negative feedback and, hence, the amplitude of oscillation are adjusted by varying R–49 (fig. 46).

(4) Resistors R–12 and R–13 are plate load resistors for the first and second sections of V–1, respectively, and resistors R–2 and R–14 make up a voltage divider which supplies the proper plate voltages to V–1. Capacitor C–12 serves to bypass the audio frequencies to ground.

b. DRIVER. The output of the a-f oscillator is applied to the grid of the driver stage, which is a class A amplifier circuit.

(1) Tube V–2 is biased by cathode resistor R–20, and the cathode circuit is normally open because of the SELECTOR DIAL. With SELECTOR SWITCH S–301 in the KEY position, dialing the SELECTOR DIAL closes the cathode circuit and causes the tube to conduct. The cathode circuit is also closed when the amplified PLATE SWITCH is in the TEST position. This position provides continuous audio modulation for test purposes only and prevents the transmission of coded pulses.

(2) Resistors R–21 and R–22 compose a voltage divider network from which screen grid and plate voltages are applied to V–2. Capacitor C–15 bypasses the a-f signal to ground. The output of the driver stage is coupled through transformer T–1 to the modulator stage.

c. MODULATOR. The modulator stage consists of a class AB_2 amplifier in which a push-pull type amplifier circuit is used. The output of the stage is sufficient to provide between 90 and 100 percent modulation of the final amplifier.

(1) Tube V–3 is biased by the 12-volt storage battery supply in the cathode circuit. The input to the grids is fed directly from the secondary of transformer T–1, the center tap of which is grounded.

(2) Tube V–4 is a cold-cathode type, constant voltage gas tube and acts as a regulator to keep the screen grid voltage on V–3 constant. Assume that the supply voltage tends to increase. The internal resistance of the gas tube decreases, and more current is drawn through R–23; as a result there is greater voltage drop across R–23. The voltage across the tube is thus maintained at a constant level. The jumper between pins 3 and 7 inside the tube serves to connect the power supply voltage to the plates of V–3 (through resistor R–25 and the primary of transformer T–2). Removing tube V–4 cuts off plate voltage for tube V–3, preventing damage to the tube. Capacitor C–16 is a screen bypass capacitor.

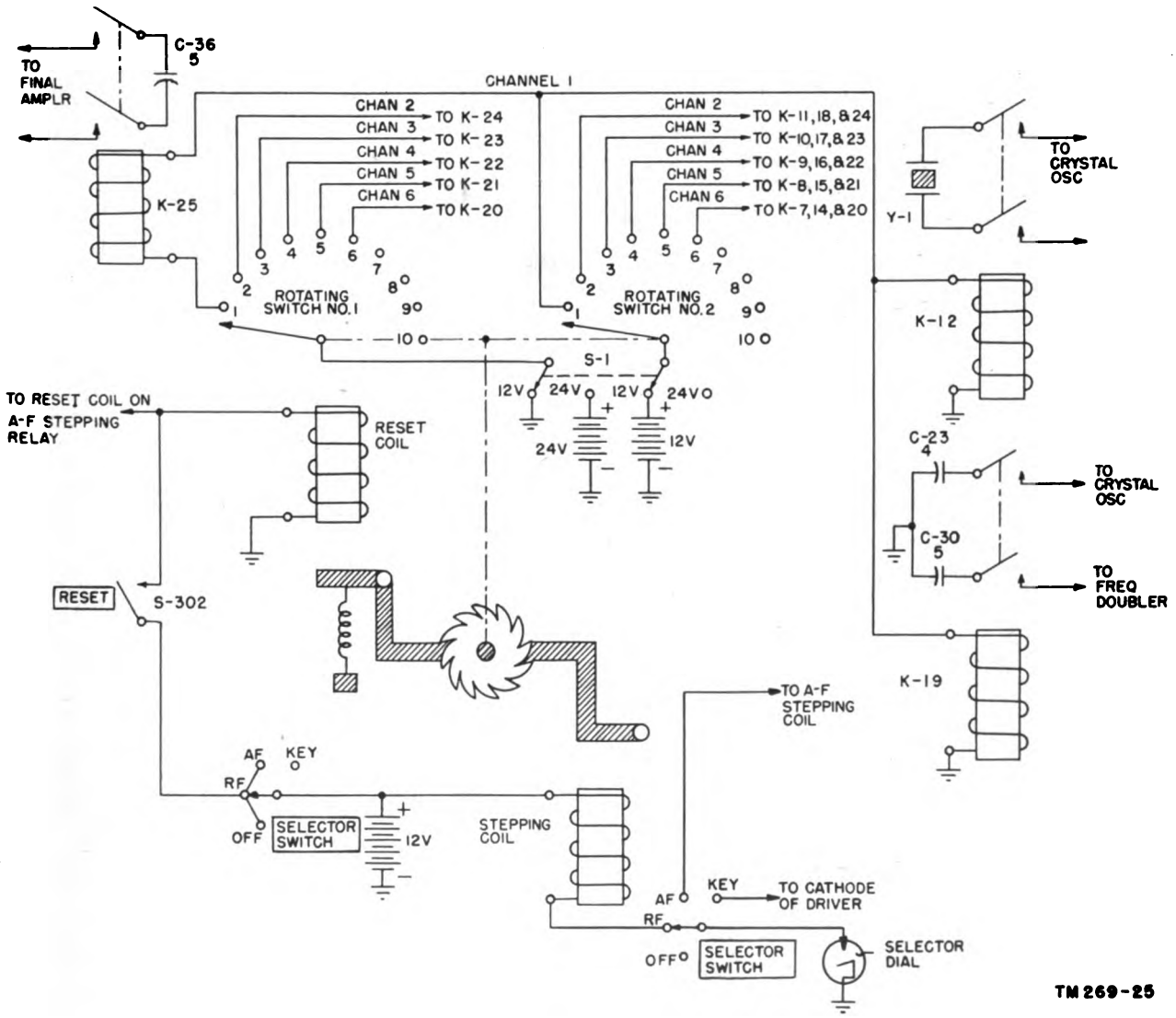


Figure 26. Transmitter, r-f switching section, simplified schematic diagram.

53. R-f and A-f Switching Sections

In order to change the radio frequency of the transmitter, it is necessary to change oscillator crystals and the value of the capacitors in the tuned tank circuits of the r-f section. The audio frequency of the transmitter is changed by varying the value of the resistors and capacitors in the a-f oscillator. For actual operating purposes the SELECTOR DIAL is used to initiate the switching action; a simplified diagram of the switching section for the r-f channels is shown in figure 26.

a. When the SELECTOR SWITCH is in the RF position, each closing of the SELECTOR DIAL switch connects the 12-volt battery across the stepping coil, moving the arms of the rotating switches up a number of contacts equal to the number dialed on the SELECTOR DIAL. The arm of rotating switch 2 connects the 12-volt battery across the relays of the channel with which the arm is in contact. These relays, of which there are three per channel, place the proper crystal and capacitors in the r-f section of the transmitter to determine the frequency of transmission. For 24-volt operation, switch S–1 (fig. 26) disconnects the arm of rotating switch 2 from the circuit and applies the 24 volts to the arm of rotating switch 1. Pressing the RESET button applies 12 volts across the reset coil, which releases the catch on the rotat-

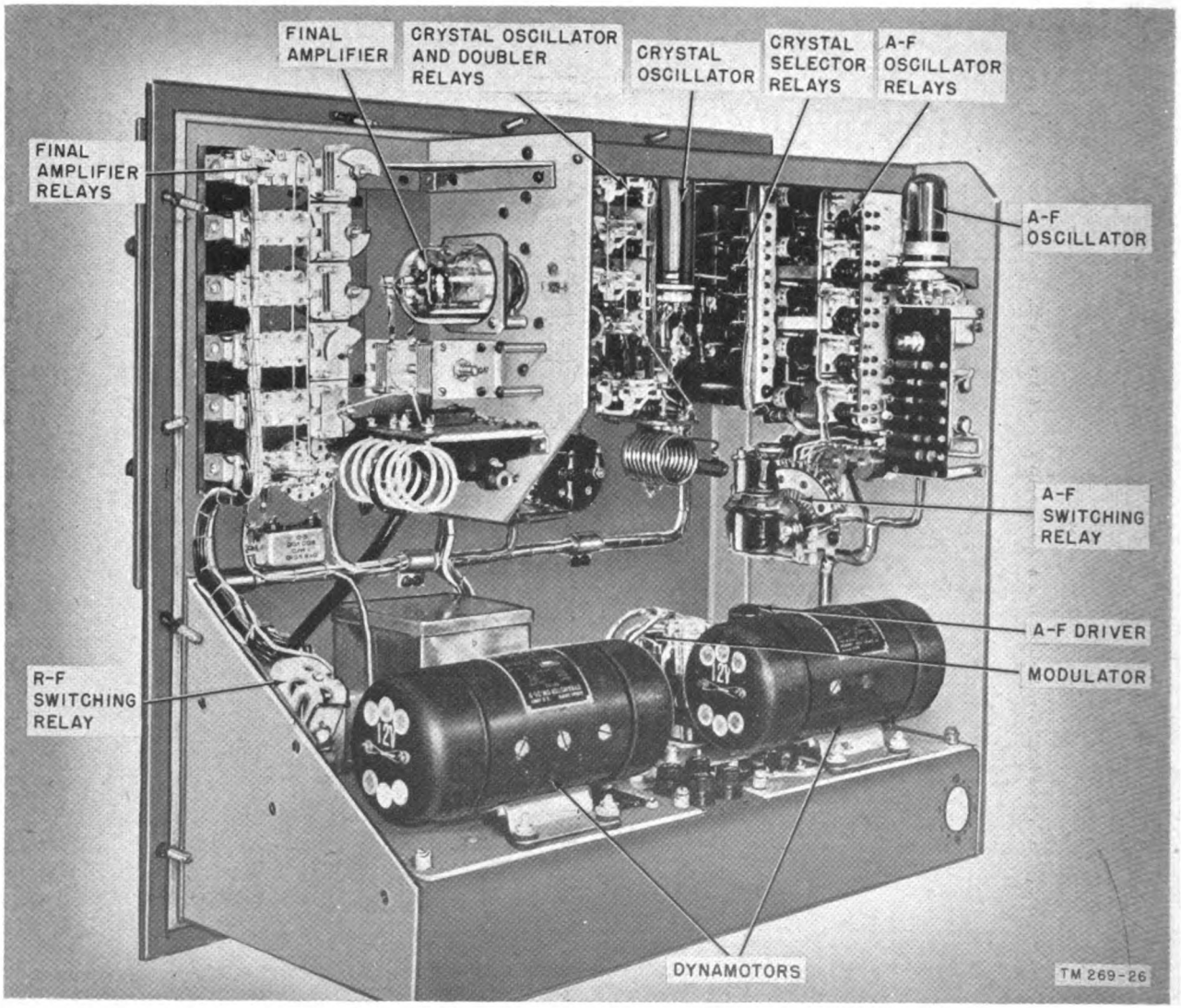


Figure 27. Transmitter, stages and relays identified.

ing switch arm shaft and allows the arms to move back to the starting position. Notice that when the SELECTOR SWITCH is in the OFF, RF, or AF position, pressing the RESET button resets the arms of both the r-f and a-f stepping relays; but when the SELECTOR SWITCH is in the KEY position, pressing the RESET button accomplishes nothing.

b. Switching the a-f channels is similar to switching the r-f channels, except that there are only five a-f channels and there is only one relay in each channel (fig. 56). This relay connects the proper resistors and capacitors to the bridge circuit of the Wien Bridge oscillator to determine its frequency of oscillation. The location of the r-f and a-f rotating relay switches is shown in figure 27.

54. Power Supply

The power supply for the transmitter consists of two dynamotors (fig. 27) which supply power to the r-f and a-f sections, respectively. The dynamotors are motor generators which convert the 12-volt d-c battery potential into 625 volts for use in the transmitter circuits. For 24-volt operation two 24/625-volt dynamotors are issued. Switch S–1 (fig. 44) changes the input voltage circuits according to the battery supply which is used. The total power consumption of the transmitter is about 450 watts.

Caution: The RESET button must be pressed after transmission, even though the SELECTOR SWITCH is in the OFF position, in order to prevent current drain through the r-f relay coils.

CHAPTER 5

FIELD AND BASE MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field and base maintenance. The amount of repair that can be performed by units having field and base maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. PREREPAIR PROCEDURES

55. Removal of Pluck-out Parts

a. TUBES. Make sure that all tubes have cooled sufficiently before removing them. Before removing any tube, *release* the particular tube clamp (if used). The two plate leads on each of Tubes JAN–829B should be unclipped before this type tube is removed. Do not rock or jiggle any tube in its socket if it can be extracted by a direct upward pull. Rock it gently if it does not release easily. Jiggling a tube in its socket during removal spreads the contacts. Label each tube as soon as it is removed so that it can be replaced later in the proper socket.

b. FUSES. Four fuses are located at the back of the transmitter chassis (fig. 44). Rotate the fuse holder cap counterclockwise. Remove the cap and the fuse.

c. CRYSTALS. The six operating crystals (and the six spare crystals) are removed by loosening the clamping bar and pulling the crystals straight out of their sockets.

56. Cleaning, Inspecting, and Testing Tubes

a. Clean the tube with a cloth moistened with solvent (SD); if necessary, clean the caps and prongs with crocus cloth.

b. Inspect the tubes for cracks in glass and base and for bent broken prongs.

c. Test the tubes for improper emission, leakage, and short circuits.

d. Replace the good tubes in their respective sockets.

57. Cleaning, Inspecting, and Testing Fuses

a. Inspect fuse ends for evidence of burning, corrosion, and looseness.

b. Clean fuse ends with emery cloth, and wipe with a clean cloth. If a file is used to remove deep pits, use crocus cloth to leave a smooth contact surface and then wipe dry with a clean cloth.

c. Test fuses for continuity.

d. Place the fuses back in the holders.

Section II. TROUBLE SHOOTING AT FIELD AND BASE MAINTENANCE LEVEL

Warning: When servicing the radio transmitter, be extremely careful; high voltage is present. Always disconnect the battery cable before making resistance checks in the transmitter. Keep one hand in your pocket when measuring socket voltages. Before touching any part after the voltage is shut off, short the part to ground.

58. Trouble-Shooting Procedures

a. SECTIONALIZATION AND LOCALIZATION. The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the *major 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 often can be located by sight, smell, and hearing. The majority of faults, however, must be localized by *checking voltage and resistance.*

b. TESTS. The tests listed below aid in isolating the source of trouble. Remember that servicing procedure should cause no further dam-

age to the radio set. First, trouble should be localized to a single stage or circuit in the transmitter. Then the trouble may be isolated within that stage or circuit by appropriate voltage, resistance, and continuity measurements.

(1) *Visual inspection.* Through this inspection alone, the repairman frequently discovers the trouble or determines the stage in which the trouble exists. This inspection is valuable in order to avoid additional damage which might occur through improper servicing methods and to forestall future failures.

(2) *Operational test.* The operational tests (pars. 64, 65, 66, and 67) are important because they frequently indicate the general location of trouble. In many instances the information gained will indicate the exact nature of the fault. In order for this information to be utilized fully, all symptoms must be interpreted in relation to one another.

(3) *Trouble-shooting charts.* The trouble symptoms listed in these charts (pars. 60 and 61) will aid in localizing trouble.

(4) *Intermittents.* In all these tests the possibility of intermittents should not be overlooked. This type of trouble may appear when the set is tapped or jarred. Look for loose connections. It is possible that the trouble is not in the set itself but in the installation, such as cord connections, etc.

c. VOLTAGE MEASUREMENTS. Voltage measurements are an almost indispensable aid to the repairman, because most troubles either result from abnormal voltages or produce abnormal voltages. Voltage measurements are always made between two points in a circuit, and the circuit need not be interrupted. Complete information on normal operating voltages is given in this section.

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

(2) Always begin by setting the voltmeter on the highest range, in order that the voltmeter will not be overloaded. Then, if necessary, set the voltmeter to a lower range.

(3) In checking cathode voltage, remember that a reading can be obtained when the cathode resistor is actually open; the resistance of the meter may act as a cathode resistor. Thus the cathode voltage may be approximately normal only as long as the voltmeter is connected between cathode and ground. An abnormally high plate voltage may indicate an open cathode resistor.

d. PRECAUTION AGAINST HIGH VOLTAGE. When it is necessary to measure voltages above a few hundred volts, observe the following rules:

(1) Connect the ground lead to the voltmeter.

(2) Place one hand in your pocket.

(3) If the voltage is less than 300 volts, connect the two test leads.

(4) If the voltage is greater than 300 volts, shut off the power, connect the two test leads (do not touch either test point), step away from the voltmeter, turn on the power, and note the reading on the voltmeter. Do not touch any part of the voltmeter, particularly when it is necessary to measure the voltage between two points neither of which is at ground potential.

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

(1) The resistance of the voltmeter on any range can always be calculated by the following simple rule: Resistance of the voltmeter equals the ohms-per-volt multiplied by the full-scale range in volts. For example: The resistance of a 1,000-ohm-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. The decreased loading due to the voltmeter will more

than compensate for the inaccuracy which results from reading only a small deflection on the scale of the voltmeter.

(3) The voltage and resistance drawings used in this manual are based on readings taken with a 20,000-ohm-per-volt meter. If a 20,000-ohm-per-volt meter is used in testing for the voltage, it is unnecessary to consider the effect of loading.

f. RESISTANCE MEASUREMENTS. When a fault develops in a circuit, its effect will very often show up as a change in the resistance values. Figures 49 and 50 include the normal resistance values as measured at the tube sockets and at the test socket of the transmitter. These values are measured between the indicated points and ground, unless otherwise stated. Before making any resistance measurements, turn off the power. An ohmmeter is essentially a low-range current meter and battery. If the ohmmeter is connected to a circuit which already has voltages in it, the needle will be knocked off scale and the meter movement may be burned out.

Caution: Always discharge high-voltage capacitors before making resistance measurements.

g. TUBE CHECKING. Tube faults are responsible for a large percentage of the failures which occur in radio sets.

(1) When putting a new tube into a circuit, it may be necessary to realine the transmitter.

(2) Do not change the tubes indiscriminately, or the spares box will become full of tubes of which the exact age and condition are uncertain.

59. Test Equipment

Three pieces of test equipment are included in the transmitter spare parts box (fig. 4) as first echelon test sets (*a* below). Certain pieces of second echelon test equipment (*b* below) are furnished with every 10 Radio Sets AN/TRT–1.

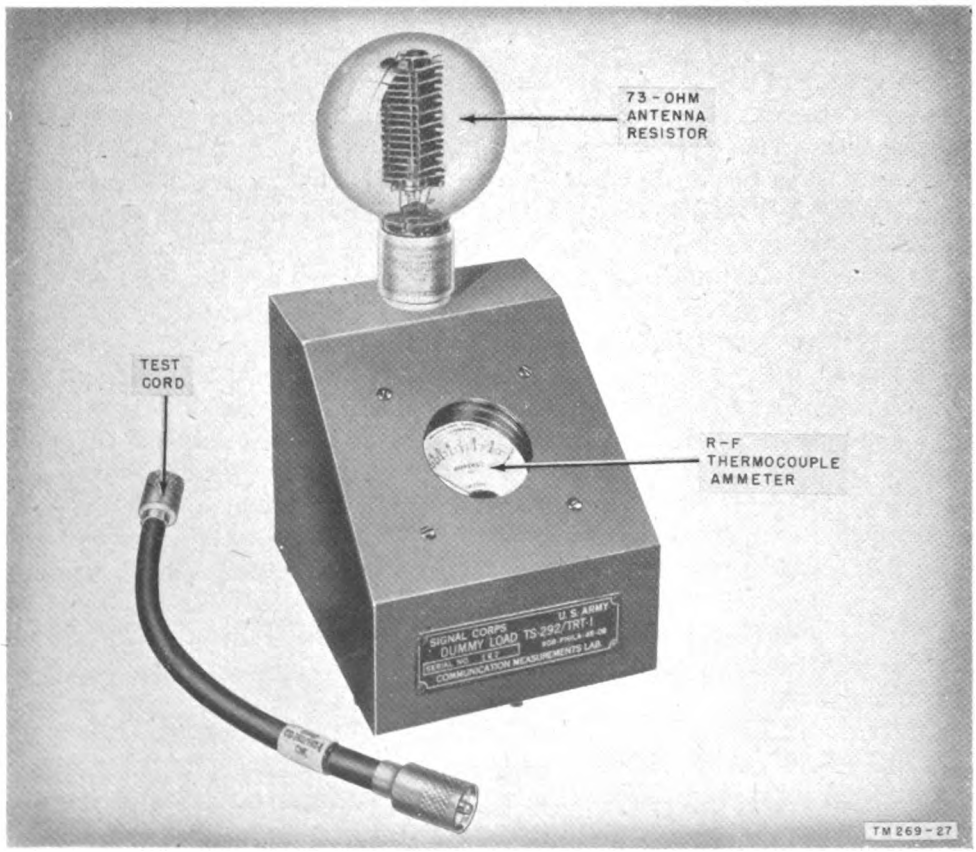


Figure 28. Dummy Load TS–292/TRT–1.

The latter equipment consists of general test instruments which are used in conjunction with the more specialized first echelon test sets.

a. FIRST ECHELON TEST EQUIPMENT.

(1) *Dummy Load TS–292/TRT–1.* To prevent blocking of the receiver during tests and to prevent normal radiation of transmitted energy when the transmitter is being tuned, Dummy Load TS–292/TRT–1 (fig. 28) is supplied with the equipment. This unit replaces the transmitting antenna during tests. The load consists of a noninductive, 73-ohm resistor which is hermetically sealed in a glass tube. An r-f thermocouple ammeter (0 to 1 ampere) and a coaxial jack are connected in series with the resistor. The transmitter is connected to the coaxial jack by means of Cord CG–260/TRT–1. The ammeter is used as an indicating device in the tuning of the final amplifier and is not required in tests which involve only the receiver.

Figure 29. Test set TS–245/TRT–1.

(2) *Test Set TS–245/TRT–1.* Test Set TS–245/TRT–1 (fig. 29) provides a means of tuning the very precise a-f channels in the transmitter. The test

set incorporates five precision tuning forks (Y–901 through Y–905, fig. 30) the natural frequencies of which are the same as the five a-f channels in the transmitter. The tuning forks are excited by coils placed near their prongs. The signal from the a-f oscillator is fed to the coils of the test set through pins 5 and 7 of the test socket. The FREQUENCY SELECTOR switch (fig. 29) on the panel of the test set selects the tuning fork to be excited. The vibrations of the tuning forks are picked up by a brass tubing pick-up device and fed through a flexible rubber hose to stethoscope type earphones. The closer the a-f frequency of the exciting coil is to the natural frequency of the tuning fork, the louder will be the frequency vibrations heard in the stethoscope. See figure 31 for the complete schematic of the test set.

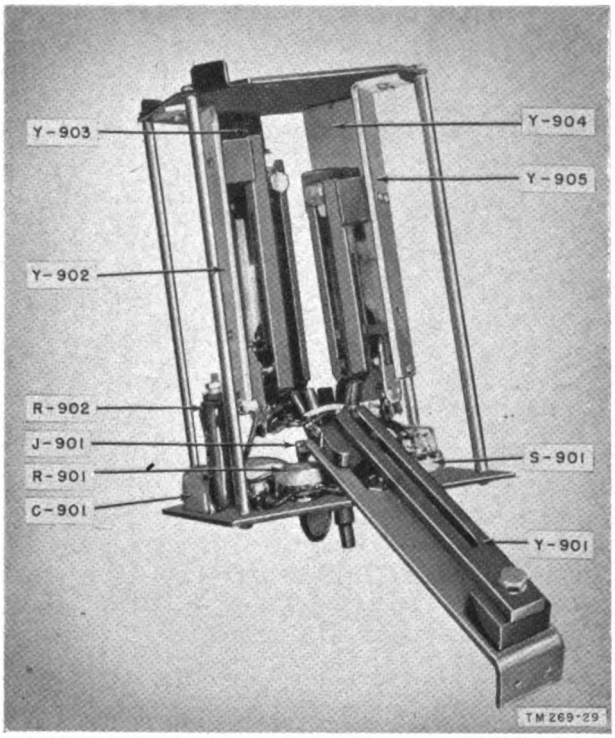


Figure 30. A-f test set, internal view.

Note. Test Set TS–245/TRT–1 is supplied only with equipments bearing serial numbers 12, 13, and 21, and above.

(3) *Test Set TS–261/TRR–2.* Test Set TS–261/TRR–2 (fig. 32) is used to check the operation of Radio Set AN/TRR–2. The unit consists of a 250-ohm resistor in series with an indicating lamp and a push-button type switch (fig. 33). The components of the test set are mounted in a waterproof aluminum box, on the outside of which are two alligator type clips. With the receiver in its case and the firing cord connected to the alligator clips, the test lamp should light (indicating proper operation) when the correct code is dialed at the transmitter. The lamp should cease to glow when the push button is depressed and should not relight after the button is released. The receiver is not functioning properly if the lamp continues to glow. Four receiver test sets are included in each spare parts box.

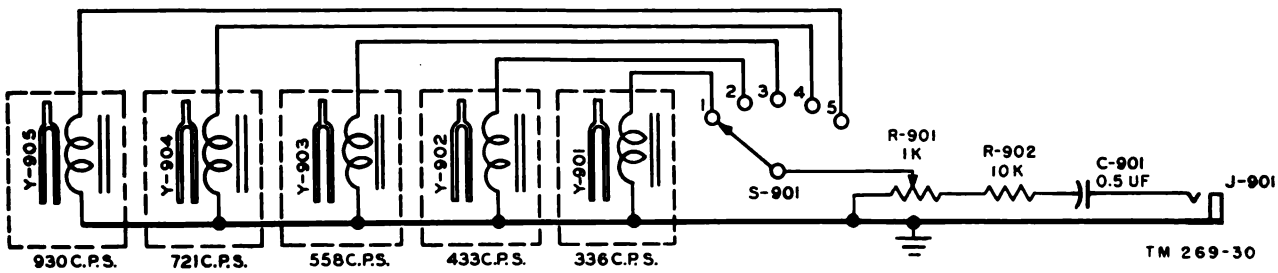


Figure 31. A-f test set, complete schematic diagram.

b. SECOND ECHELON TEST EQUIPMENT.

(1) *Oscillator I–151–B (fig. 34).* Oscillator I–151–B is an a-f oscillator with a frequency range of 20 to 20,000 cps. The instrument has a power output of 100 milliwatts (into a 1,000-ohm load) and output impedances of 10, 250, 500, and 5,000 ohms.

(2) *Oscilloscope BC–1060–A (fig. 35).* This oscilloscope is used for observing and measuring pulse and video waveform voltages. TM 11–2526, Oscilloscope BC–1060–A, gives complete information on Oscilloscope BC–106–A.

(3) *Test Set I–130 (signal generator, Ferris model 18B) (fig. 36).* This signal generator is used for test operations requiring a c-w or modulated r-f voltage. The frequency range of the instrument is covered in four bands from 20 mc to 150 mc. The generator is modulated internally with 400 cycles.

(4) *Cord CD–502.* Cord CD–502 is a 28-inch test cord which has clip leads attached to the ends. Six of the cords are supplied with the test equipment.

(5) *Test Set I–56–K.* Test Set I–56–K consists of the following pieces of test equipment:

(*a*) *Case CS–130.* Case CS–130 is a carrying case for the three pieces of test equipment in the test set.

(*b*) *Test Unit I–176 (fig. 37).* Test Unit I–176 is an analyzer or multirange meter with which it is possible to cover a wide range of voltage, current, or resistance measurements. TM 11–2626 gives detailed information on Test Unit I–176.

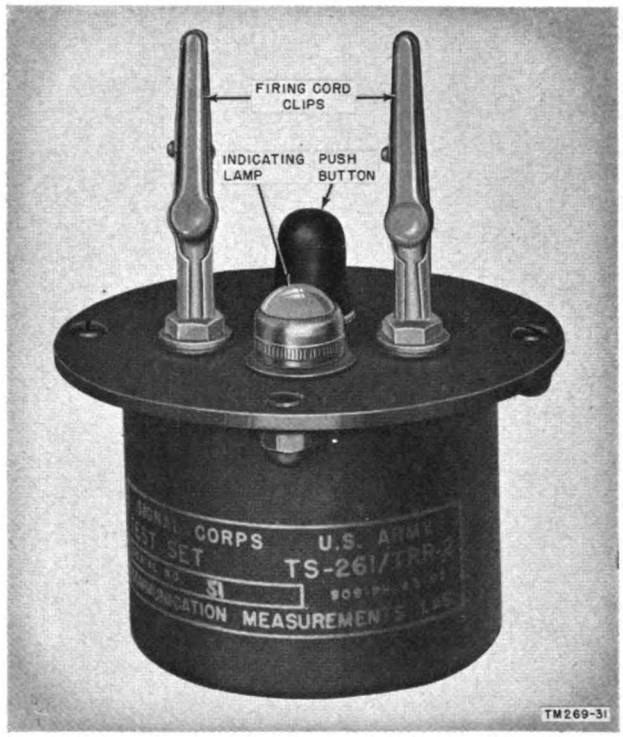


Figure 32. Test set TS–261/TRR–2.

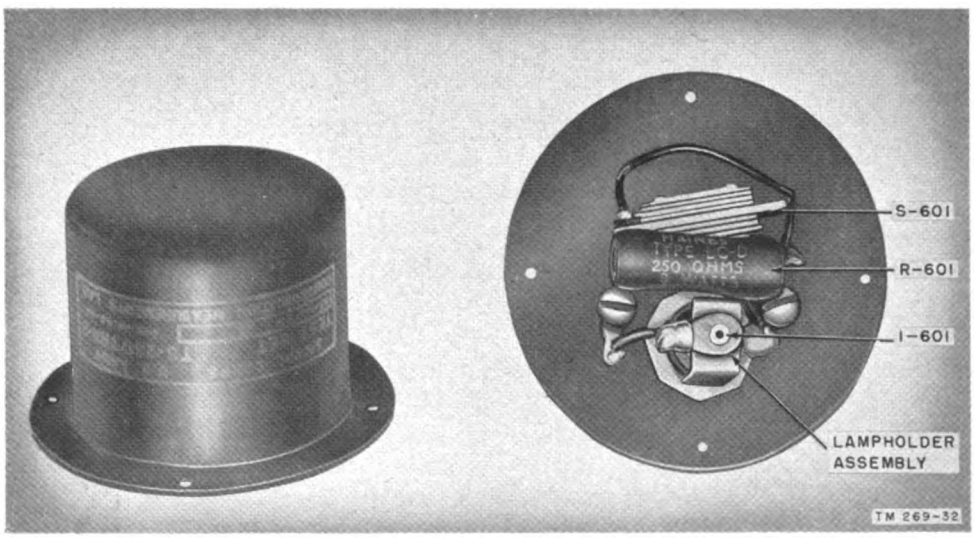


Figure 33. Receiver test set, internal view.

(c) *Tube Tester I–177 (fig. 38).* This tube tester is a dynamic mutual-conductance type instrument designed to provide either *replace* or *good* readings or mutual-conductance values in microhms for the tube under test. TM 11–2627 gives detailed information on Tube Tester I–177.

60. Trouble-Shooting Procedures for Radio Set AN/TRR–2

a. GENERAL. Very little trouble shooting is done on the receiver unit. If one receiver does not work when tested, set it aside and substitute another. However, since there may be times when the demand for receivers is greater than the immediate supply, an attempt to trouble shoot and repair the discarded receivers will not be entirely useless. A receiver should never be entirely discarded, even if it can never be repaired. Its parts may be salvaged and used to replace parts in other receivers which are defective.

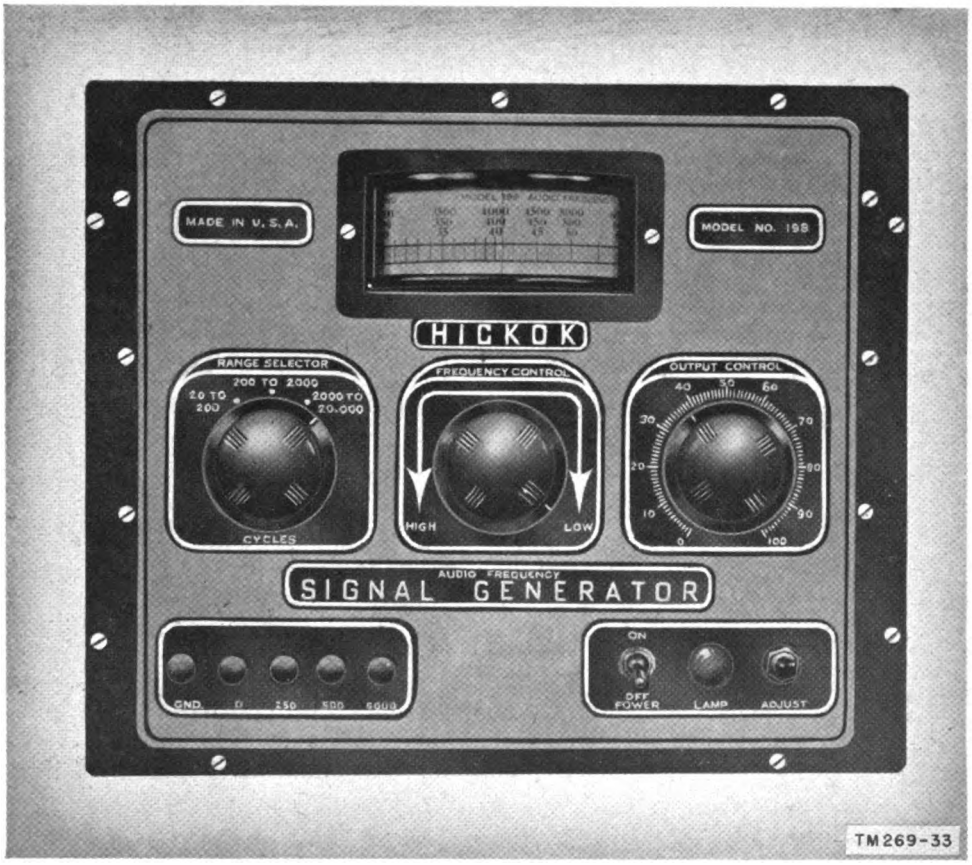


Figure 34. Oscillator I–151–B.

(d) *Voltohmmeter I–166 (fig. 39).* This meter is used for general voltage and resistance test measurements on radio equipment. TM 11–2613 gives detailed information on Voltohmmeter I–166.

(6) *Tool Equipment TE–41–B.* Tool Equipment TE–41–B is a general radio repairman's tool kit consisting of tools necessary for first and second echelon repair.

b. TROUBLE-SHOOTING CHART FOR RADIO SET AN/TRR–2. The following chart will aid in locating trouble in the receiver unit. The symptoms are based upon the testing of the receiver according to the procedure given in paragraph 64.

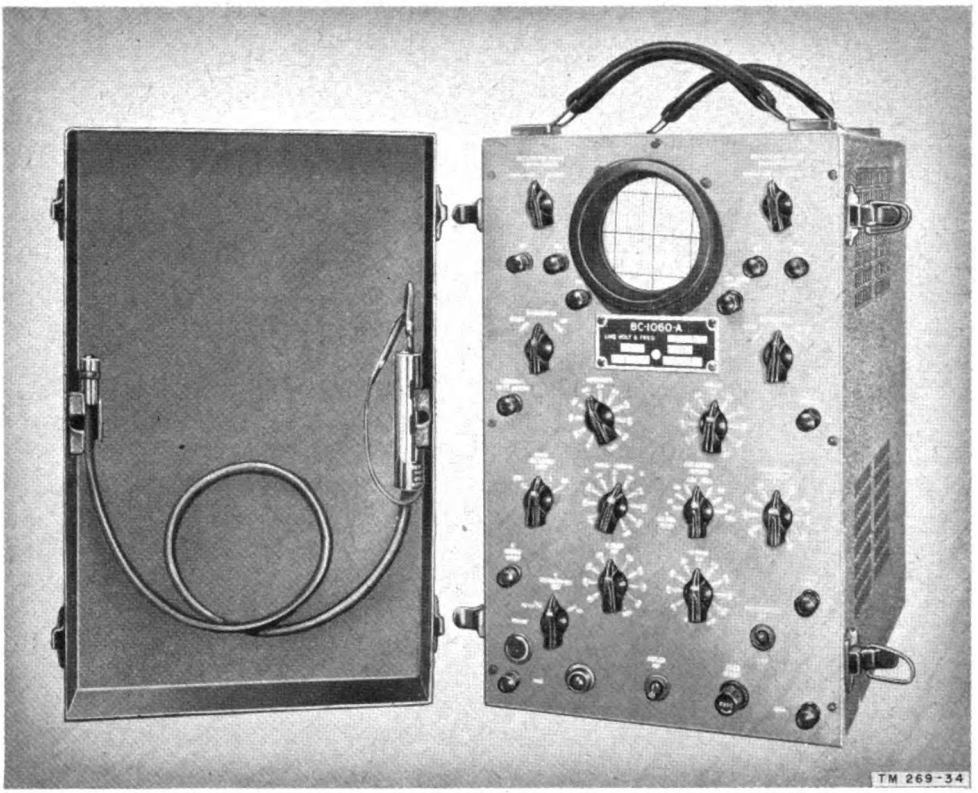


Figure 35. Oscilloscope BC–1060–A.

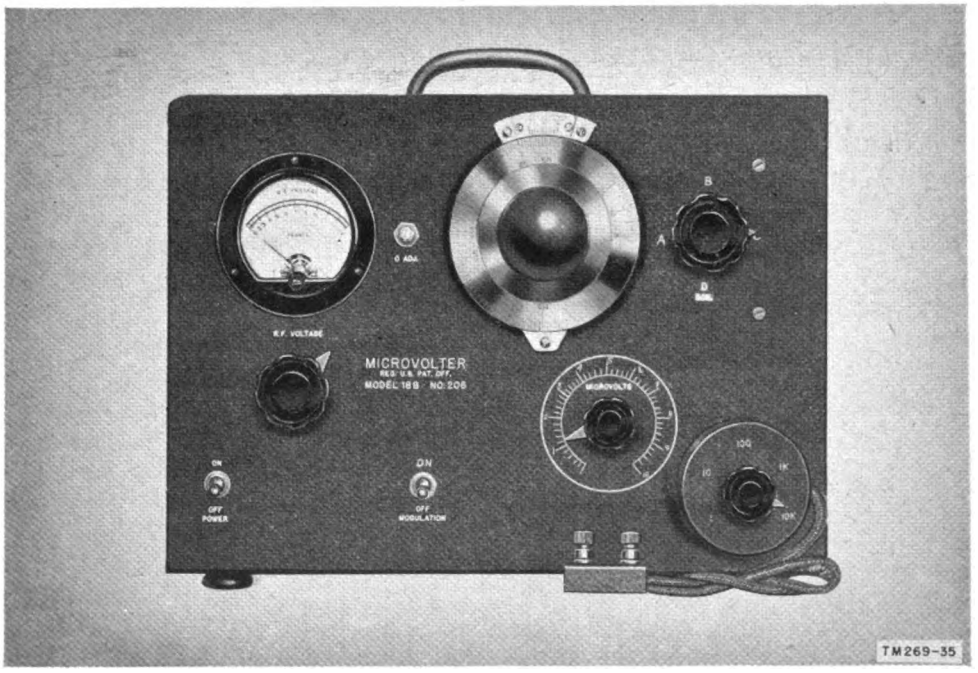


Figure 36. Test set I–136 (signal generator, Ferris model 18B).

Figure 37. Test unit I–176.

SYMPTOMS:

Switching section not working properly on test.

Receiver section not working properly on test.

Reset tube not firing.

Probable location of fault	*Procedure*
Arming switch.	Check to see whether arming switch is closing. Remove all battery leads, and check switch for continuity in closed position (should be zero ohms).
B-batteries.	Replace B-batteries with ones known to be good (tested in a receiver which is working).

SYMPTOMS:

Receiver section not working properly on test.

Sensitive relay not closing.

Probable location of fault	*Procedure*
A-batteries.	Replace A-batteries with ones known to be good (tested in a receiver which is working). Check continuity of A-battery leads.
C-battery.	Replace C-battery with one known to be good (tested in a receiver which is working). Check continuity of C-battery leads.
Plug-in stages.	Replace, one at a time, each plug-in stage with one that is known to be good. Remember to keep code number of r–f and detector stages the same. Replace all three plug-in stages with ones known to be good.
Pulse detector tube.	Replace tube V–4 with one known to be good.
Sensitive relay.	Check relay for continuity of coil.
Receiver chassis wiring.	Trace receiver chassis wiring, checking for breaks in wire or shorts to ground.

SYMPTOMS:

Receiver section not working properly on test.

Sensitive relay closes but stepping relay does not operate.

Probable location of fault	*Procedure*
B-batteries.	Replace the two 22.5-volt batteries which supply potential to stepping coil with batteries known to be good.
Switch S–4–2 or S–5.	With arming switch open, test switches for continuity. Reading should be zero ohms when switches are closed.

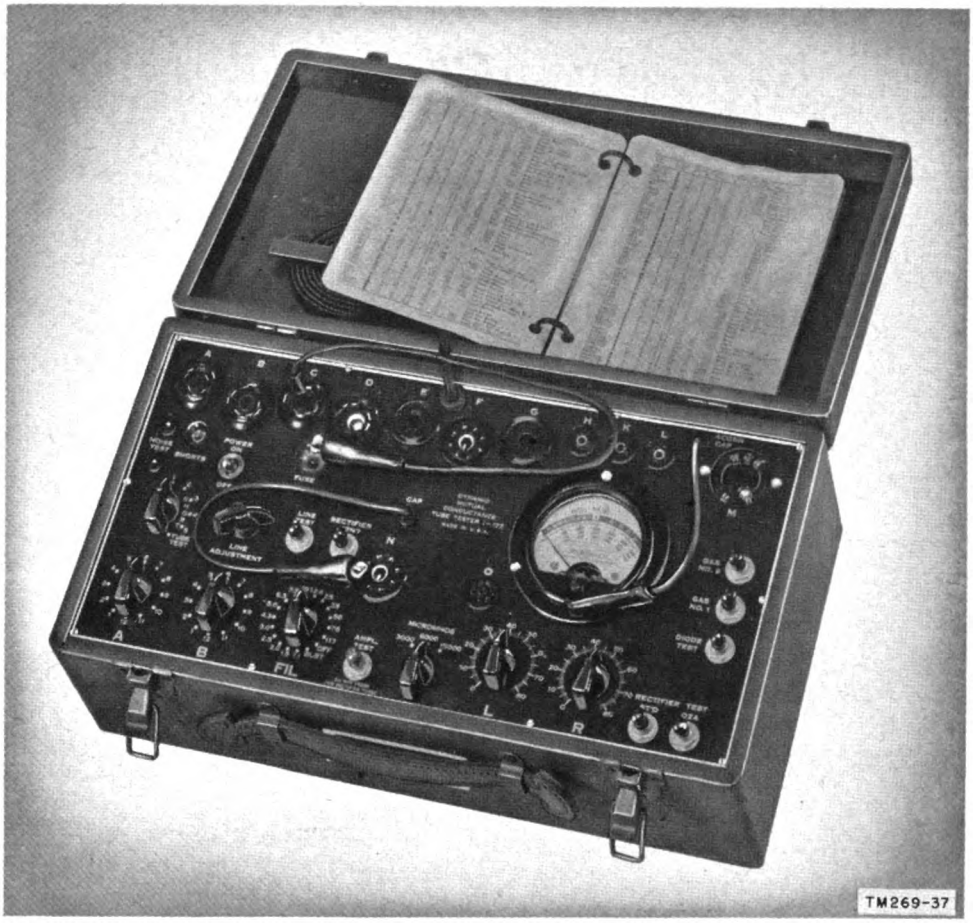


Figure 38. Tube tester I–177.

Stepping coil.	Test stepping coil for continuity.

SYMPTOMS:

Receiver section working properly on test.
Switching section not working properly on test.
Stepping relay does not reset itself.
Reset tube does not fire.

Probable location of fault	*Procedure*
Reset tube.	Replace tube V–5 with one known to be good.
Switch S–3 or S–5.	Check switch S–3 (figs. 9 and 55) for short (should be open).
Switch S–2.	Check switch S–2 (figs. 9 and 55) for continuity (should be closed except when stepping relay is in zero or home position).
Reset relay.	Check relay K–37 for continuity.
Wiring between battery and reset tube.	Trace wiring from battery to plate and grid of V–5, checking for breaks in wire or shorts to ground.

SYMPTOMS:

Receiver section working properly on test.
Switching section not working properly on test.
Stepping relay does not reset itself.
Reset tube fires.

Probable location of fault	*Procedure*
Reset relay.	Check to see that reset relay is closing switch S–4–2 (fig. 55). Clean contacts of S–4–2.
Reset coil.	Check reset coil for continuity.

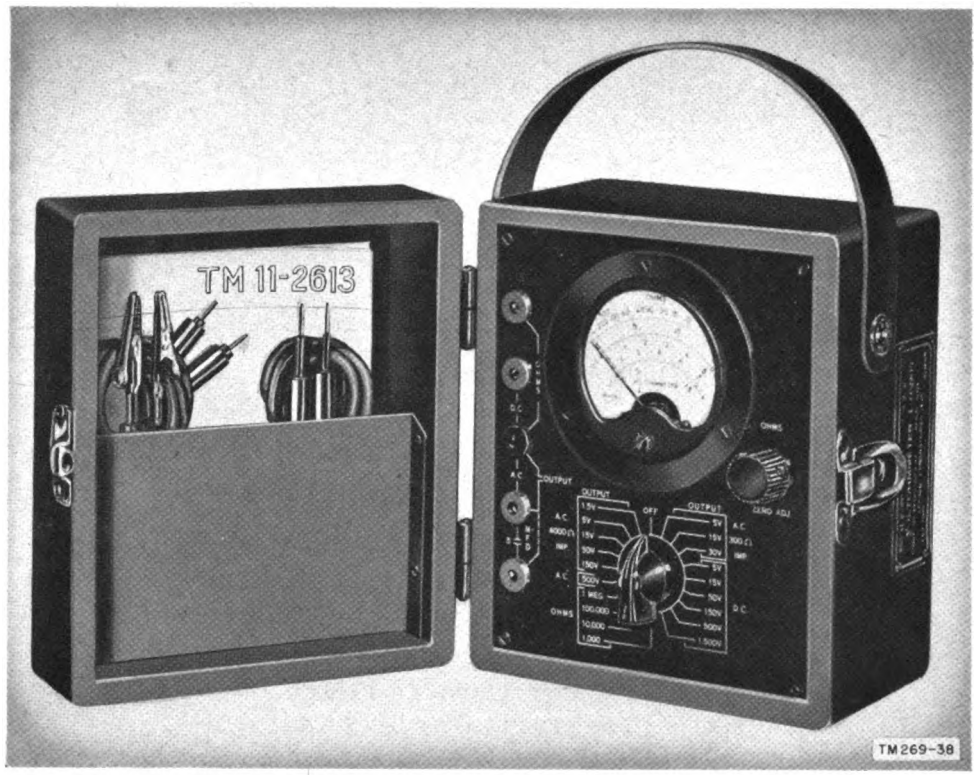


Figure 39. Voltohmmeter I–166.

SYMPTOMS:

Receiver section working properly on test.
Switching section not working properly on test.
Stepping relay resets itself properly.
Firing tube does not fire.

Probable location of fault	*Procedure*
Code error.	Check to see that correct code is being tested on selector switch. Watch arms of stepping relay to see that they stop on correct contacts.
Code changing clips.	Check to see that code changing clips are connected correctly. Check resistance between both sides of code changing clips while they are on selector switch. Resistance should be infinite.
B-batteries.	Replace B-batteries with ones known to be good (tested in a receiver which is working).
Contacts of stepping relay.	Change code on stepping relay. Clean contacts of stepping relay with the burnishing tool.
Switches S–4–1 and S–4–2 (fig. 22).	Check to see that the contacts of S–4–1 close slightly ahead of S–4–2. This also means that S–4–1 should close before S–1–1 and S–1–2 open. Check continuity of S–4–1 in closed position. Meter reading should be zero ohms.
Switches S–1–1 and S–1–2 (fig. 22).	Check continuity of S–1–1 and S–1–2 in closed position. Meter reading should be zero ohms. Check to see that switches

	S–1–1 and S–1–2 open before stepping relay resets itself.
Firing tube.	Replace V–6 with tube known to be good.
Capacitor C–9 or C–13 (fig. 22).	Check resistance across C–9 and C–13. Meter should read 20 megohms.
Circuit wiring.	Trace wiring between B-batteries and selector switch, between selector switch and firing tube circuit, and between B-batteries and firing tube circuit. Check for open wires and shorts to ground. Check firing cord for open circuit.

meter readings on the front panel, the pilot light on the control box, and certain unmistakable sounds which may be heard while the transmitter is still in its waterproof housing. Further localization of the faults can be made by taking voltage and resistance measurements at the tube sockets and test socket (see figs. 49 and 50 for correct socket voltages and resistances). In some cases where certain relays do not close, there will be no indications of trouble; the transmitter will be operating, but at a different radio frequency from the channel dialed. If there are no indications of trouble in the transmitter and if the transmitter does not fire a receiver, try repeating the code on the transmitter several times. If the transmitter is still faulty, carefully examine the final amplifier and doubler relays, K–14 through K–25 (fig. 27), for proper operation. In trouble shooting, take all the meter readings with the PLATE SWITCH in the TEST position, because in this position it is im-

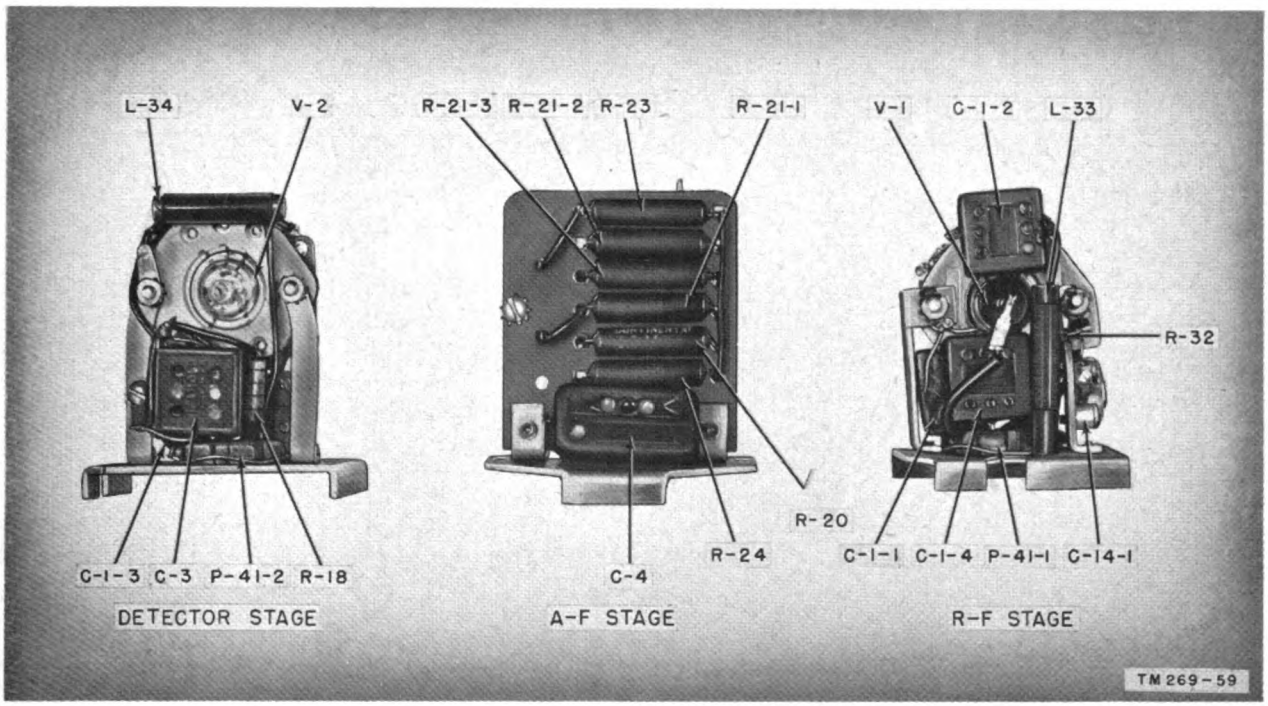


Figure 40. Plug-in units, front view.

61. Trouble-Shooting Procedures for Radio Set AN/TRT–1

a. GENERAL. The chart below is designed to aid the repairman in trouble shooting in the transmitter. The symptoms listed include the possible to transmit coded audio pulses. Normal meter readings are those readings observed during the time the transmitter is operating properly. Typical meter readings are given in table VII. These readings vary slightly with time or

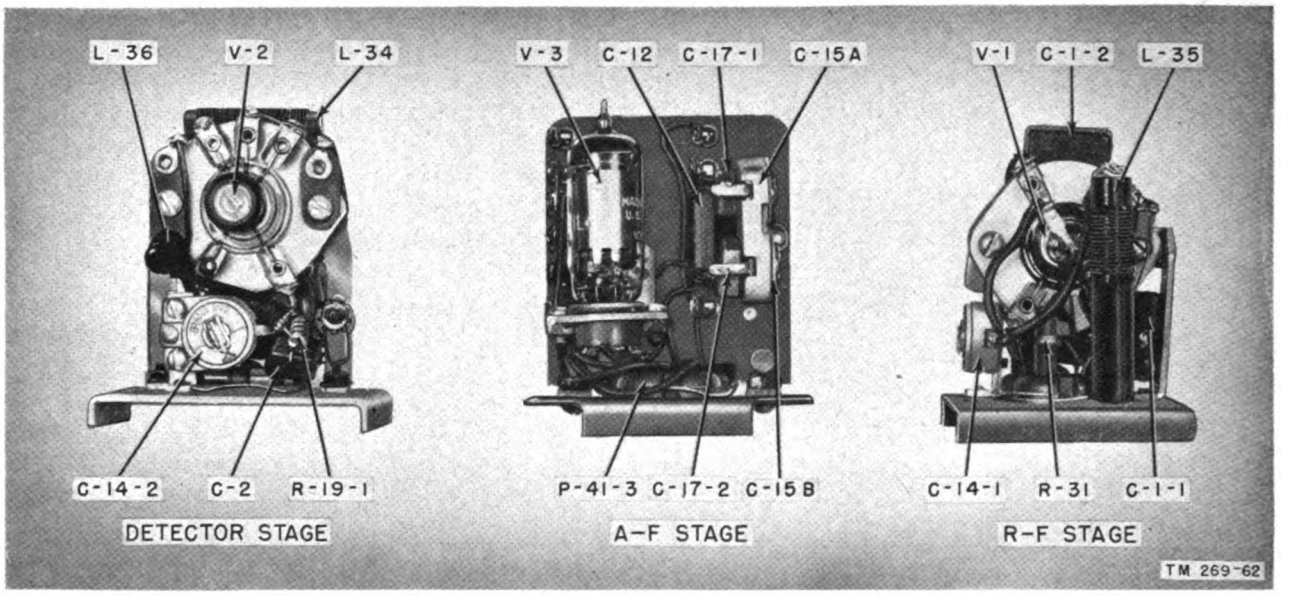


Figure 41. Plug-in units, rear view.

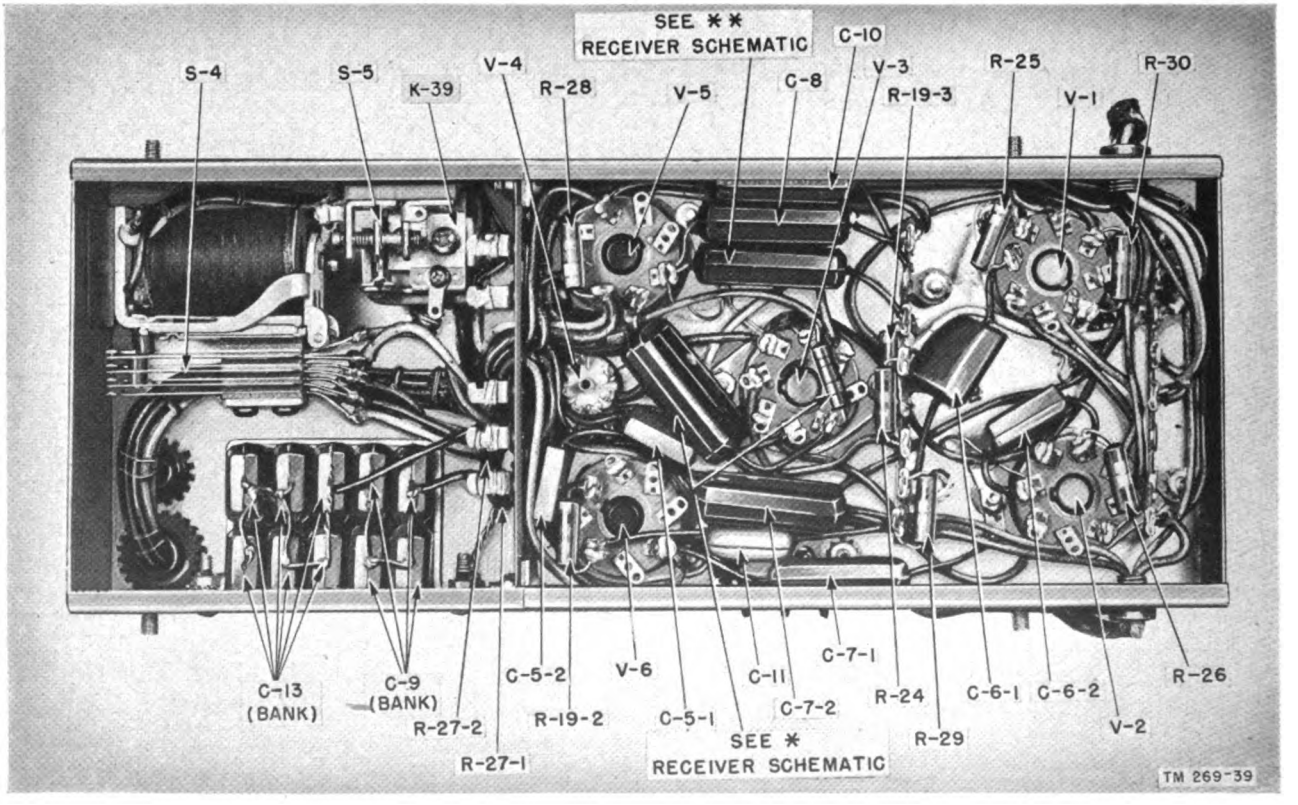


Figure 42. Receiver chassis, bottom view.

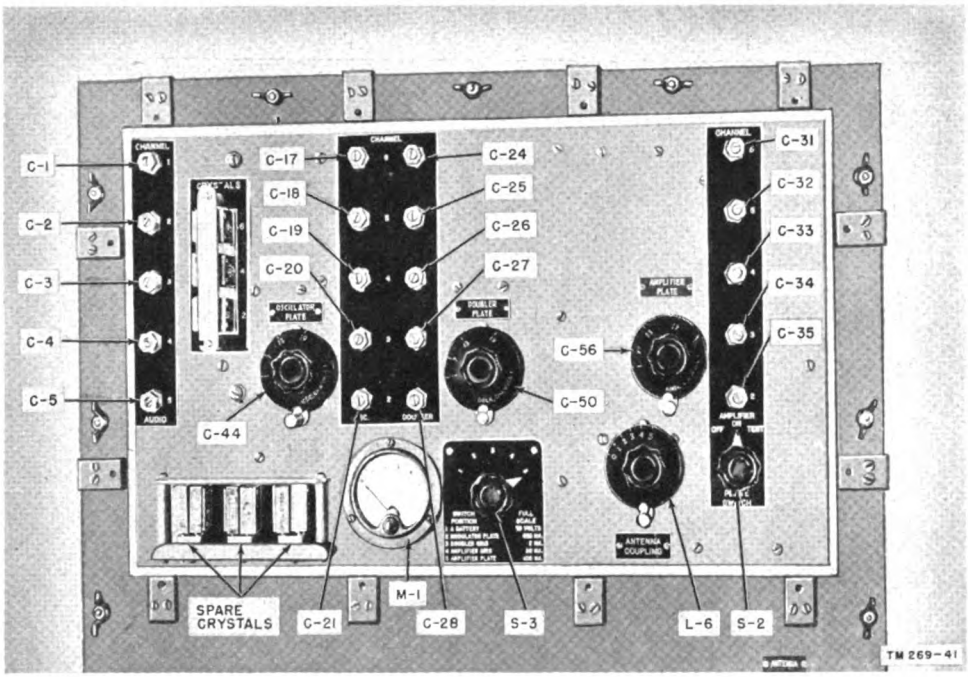


Figure 43. Transmitter, front view, parts identified.

with the combination of r-f and a-f channels set up, but marked changes in readings are an indication of trouble. Give the transmitter a complete tune-up (par. 67) before beginning trouble shooting, since variations in meter readings sometimes mean the set is in need of tuning.

b. TROUBLE-SHOOTING CHART FOR RADIO SET AN/TRT–1.

SYMPTOMS:

No meter readings in any switch positions.
No relays heard to close when SELECTOR DIAL is dialed.
Dynamotors do not run.

Probable location of fault	*Procedure*
Battery.	Check battery and connections.
Battery cable.	Check battery cable and connections for continuity and good contact.

SYMPTOMS:

Meter reads correctly with switch in position 1.
No meter readings in other switch positions.
Relays heard to close faintly on all channels when SELECTOR DIAL is dialed.
Dynamotors do not run.

Probable location of fault	*Procedure*
Dynamotor switch S–1 (fig. 44).	Check to see that switch is in the 12-volt position if a 12-volt battery is being used.
Plate relay K–27 (fig. 47).	Check to see whether contacts of relay are closing properly. Check continuity of relay windings.

SYMPTOMS:

Meter reads correctly in switch position 1.
No meter readings in other switch positions.
Relays heard to close properly when SELECTOR DIAL is dialed.
Dynamotors heard running properly.
Red light on control box does not light.

Probable location of fault	*Procedure*
Filament fuses F–1 and F–2 (fig. 47).	Check fuses and replace if burned out.
Filament relay K–26 (fig. 47).	Check to see whether contacts of relay are closing properly. Check continuity of relay windings.

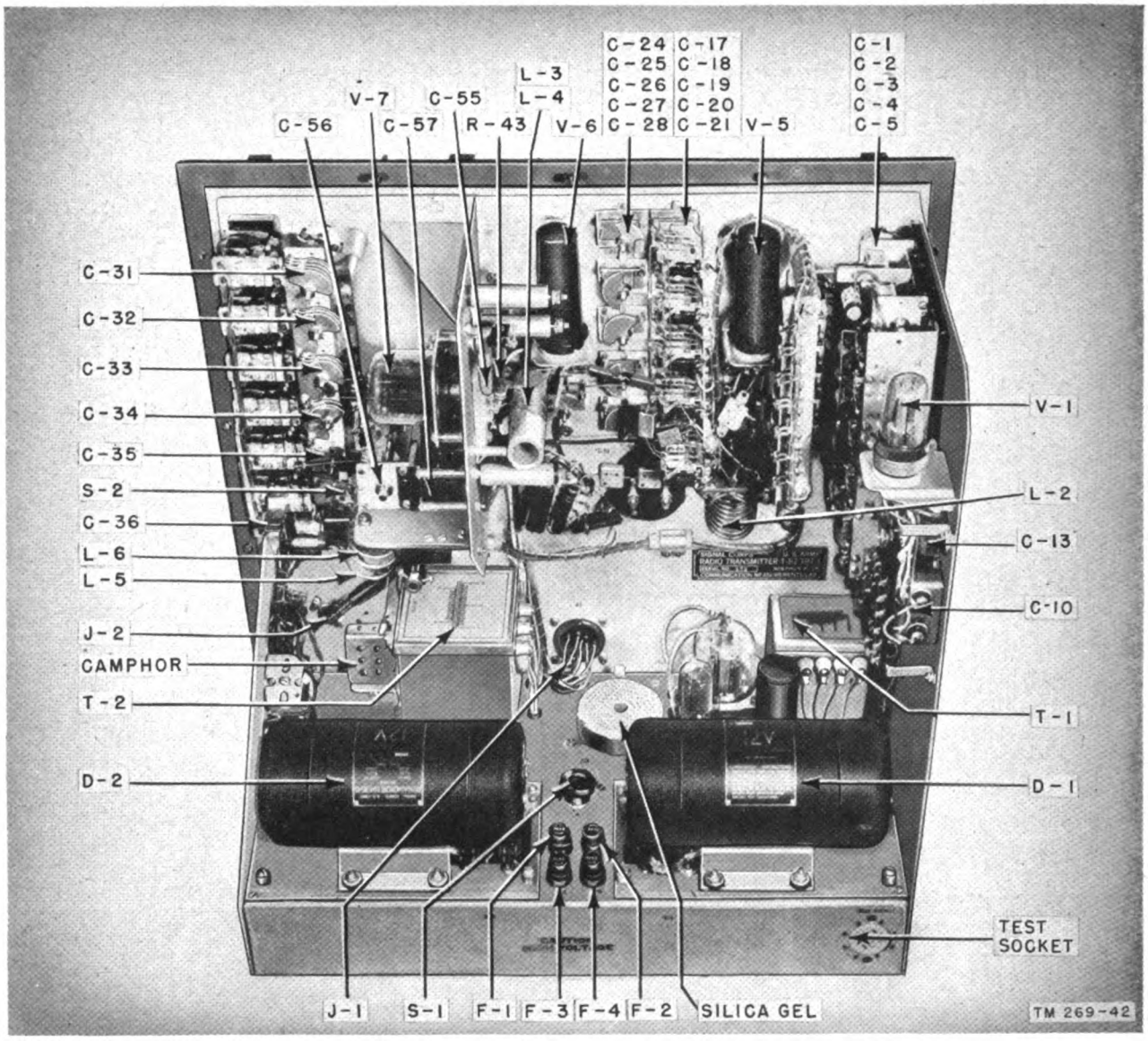


Figure 44. Transmitter, rear view, parts identified.

SYMPTOMS:

Meter readings normal in switch positions 1, 3, 4, and 5.
Meter readings 0 in switch position 2.
Red pilot light on control box lights.

Probable location of fault	*Procedure*
Fuse F–4 (fig. 47).	Check fuse and replace if burned out.
Dynamotor D–1 (fig. 44).	Check to see whether dynamotor is running when SELECTOR SWITCH is in KEY position.
	Check dynamotor output voltage.
Voltage regulator tube V–4 (fig. 45).	Check to see whether tube V–4 is glowing properly. Replace tube if necessary.
Modulator tube V–3 (fig. 45).	Replace tube V–3.
	Check socket voltages and resistances (fig. 49). Trace faults back to origin.

SYMPTOMS:

Meter reading normal in switch position 1.

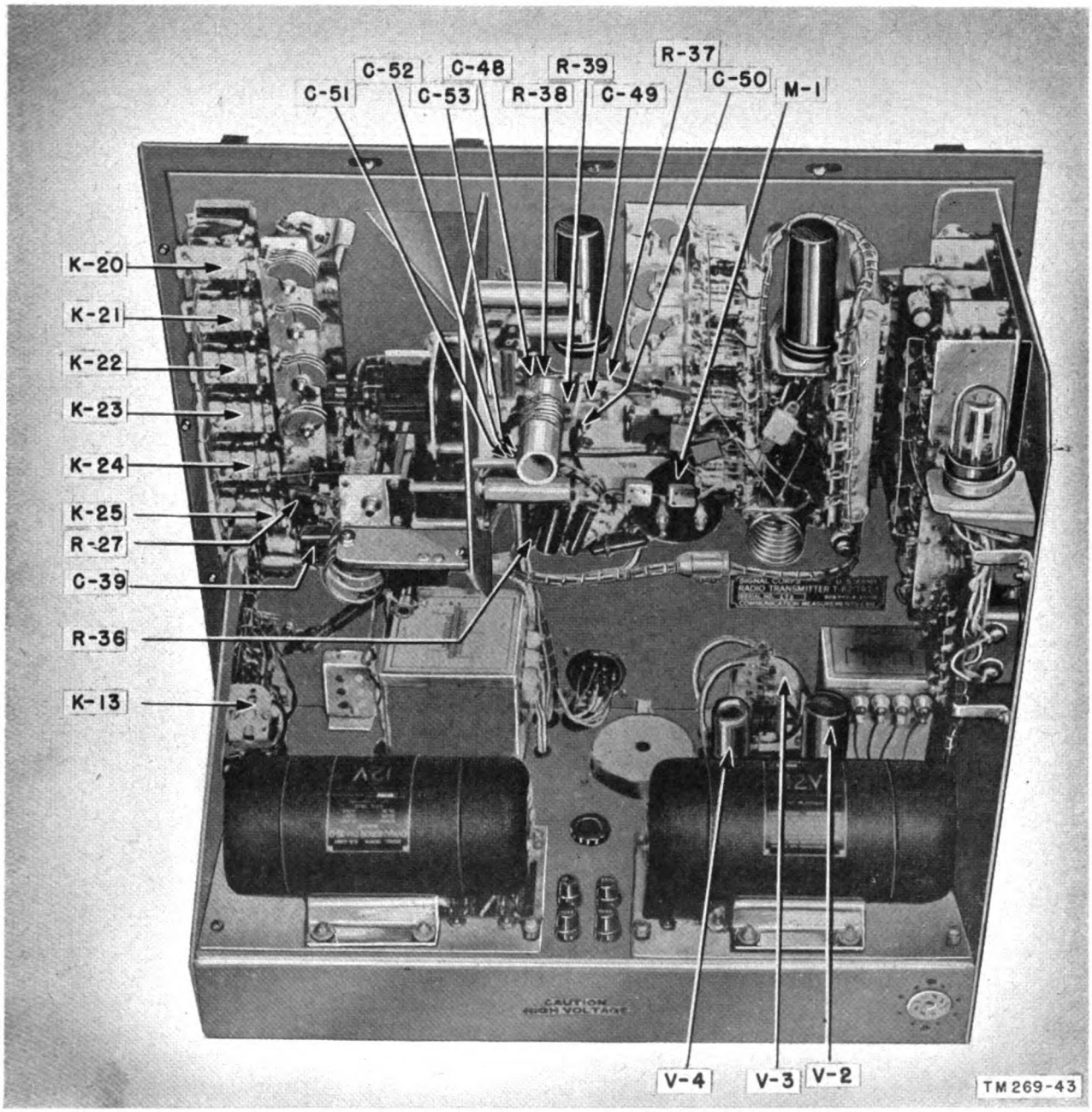


Figure 45. Transmitter, rear view, additional parts identified.

Meter reading below normal in switch position 2.

Meter readings 0 in switch positions 3 and 4.

Meter reading about one-half normal in switch position 5.

Meter reading 0 in switch position 5 when PLATE SWITCH is turned to ON position.

Red pilot light glows when PLATE SWITCH is in TEST position only.

Probable location of fault	*Procedure*
Fuse F–3 (fig. 47).	Check fuse and replace if burned out.
Dynamotor D–2 (fig. 44).	Check to see whether dynamotor is running when SELECTOR

	SWITCH is in KEY position. Check dynamotor D–2 output voltage.

SYMPTOMS:
Meter readings normal in switch positions 1, 2, and 3.
Meter readings 0 in positions 4 and 5.
Pilot light does not glow.

Probable location of fault	*Procedure*
Pilot light I–301.	Replace light in control box.
Final amplifier tube V–7 (fig. 44).	Replace tube V–7. Check socket voltages and resistances (fig. 49). Trace faults back to origin.

SYMPTOMS:
Meter readings normal in switch positions 1, 3, 4, and 5.
Meter reading about one-half normal value in switch position 2.
Red pilot light glows.
Symptoms are the same for all audio channels.

Probable location of fault	*Procedure*
Audio oscillator tube V–1 (fig. 44).	Replace tube V–1. Check socket voltages and resistances (fig. 49). Trace faults back to origin.
Driver tube V–2 (fig. 45).	Replace tube V–2. Check socket voltages and resistances (fig. 49). Trace faults back to origin.

SYMPTOMS:
Meter readings normal in switch positions 1, 3, 4, and 5.
Meter reading about one-half normal value in switch position 2.
Red pilot light glows.
Symptoms exist in only one audio channel.

Probable location of fault	*Procedure*
A-f switching relay (fig. 27).	Check to see whether switching relay is closing properly.
Wien Bridge oscillator.	Check resistances and capacitors in Wien Bridge.

SYMPTOMS:
Meter readings normal in switch positions 1, 2, and 5.
Meter readings 0 in switch positions 3 and 4.
Red pilot light glows.
Symptoms are the same for all r-f channels.

Probable location of fault	*Procedure*
R-f oscillator tube V–5 (fig. 44).	Replace tube V–5. Check socket voltages and resistances (fig. 49). Trace faults back to origin.
Doubler tube V–6 (fig. 44).	Replace tube V–6.

SYMPTOMS:
Meter readings normal in switch positions 1, 2, and 5.
Meter readings 0 in switch positions 3 and 4.
Red pilot light glows.
Symptoms exist in only one r-f channel.

Probable location of fault	*Procedure*
R-f channel relays (fig. 27).	Check to see whether all channel relays are closing properly.
Crystal.	Replace crystal of the channel at fault.

SYMPTOMS:
Meter readings normal in switch positions 1, 2, and 5.
Meter reading slightly above normal in switch position 3.
Meter reading 0 in switch position 4.
Red pilot light glows.

Probable location of fault	*Procedure*
Doubler tube V–6.	Replace tube V–6. Check socket voltages and resistances (fig. 49). Trace faults back to origin.

SYMPTOMS:
Meter readings normal in switch positions 1, 2, 3, and 4.

Meter reading in switch position 5 below 160 ma (scale reading 0.4).

Dummy antenna scale reading below 0.83 and slowly falling.

Increasing antenna coupling causes a further decrease in output reading of dummy antenna.

Probable location of fault	*Procedure*
Final amplifier tube V–7 (fig. 44).	Replace tube V–7.

Table VII. Meter Readings, Typical Values

Switch position	Doubling		Tripling		Unit
	Unmodulated	Modulated	Unmodulated	Modulated	
1	12	12	12	12	volts dc
2	65	200	65	200	ma dc
3	1.8	1.75	1.1	1.0	ma dc
4	12.5	13.0	12.0	10.0	ma dc
5	160	160	160	160	ma dc
R–f current*	.80	.94	.80	.94	amp ac

* R-f current measured with Dummy Load TS–292/TRT–1 connected to the ANTENNA receptacle on the transmitter panel.

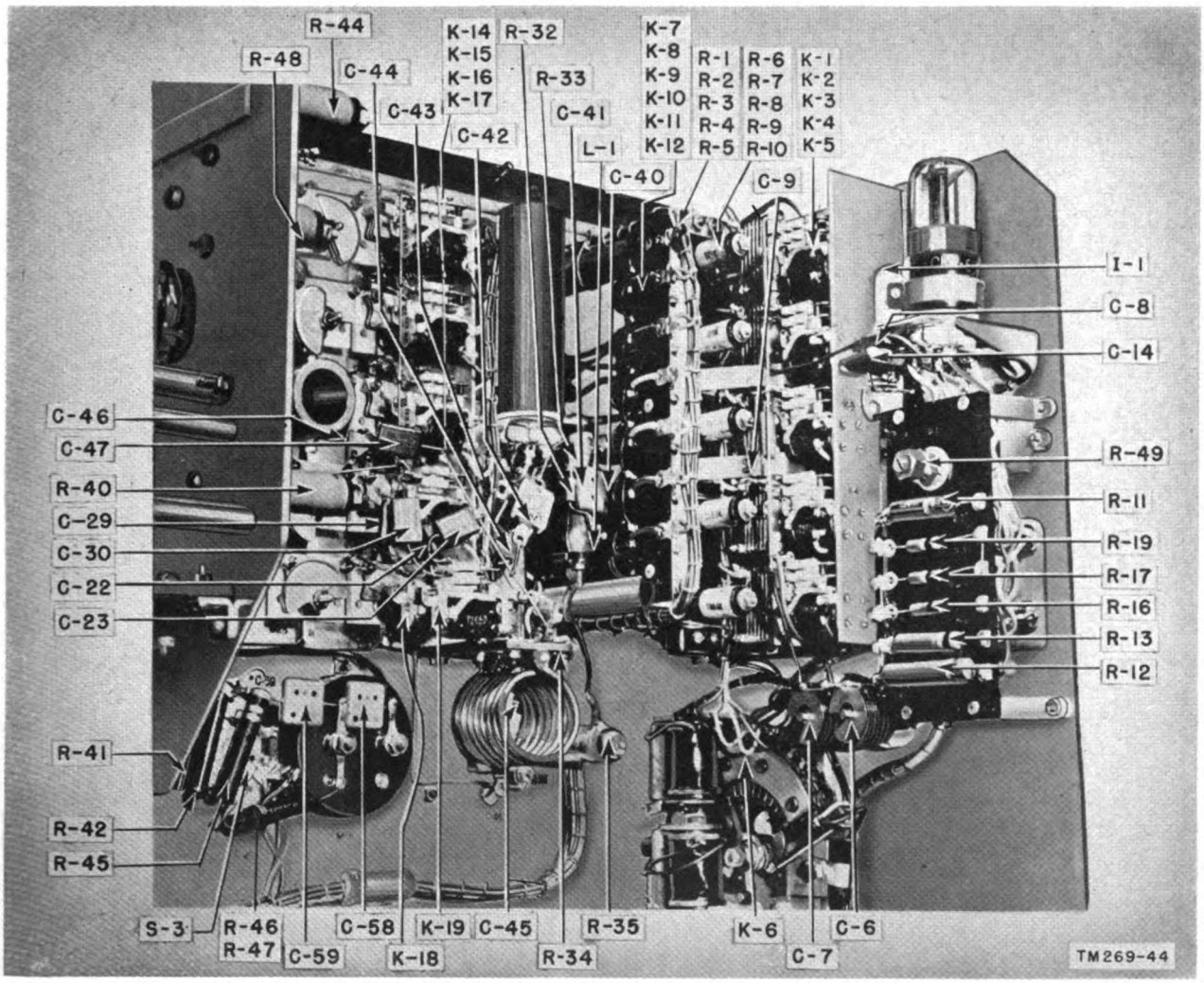


Figure 46. Transmitter, rear right-hand corner, parts identified.

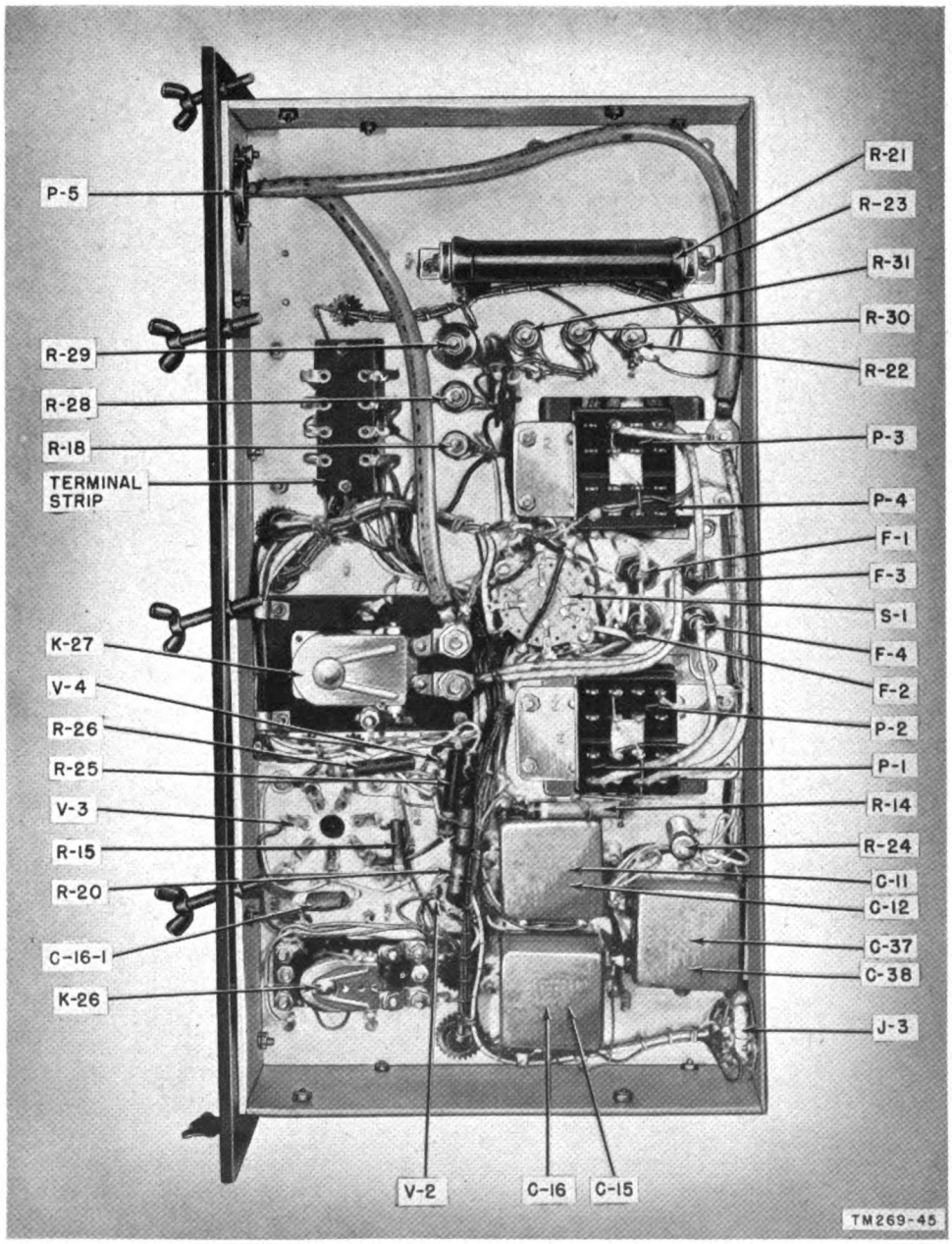


Figure 47. Transmitter, bottom view, parts identified.

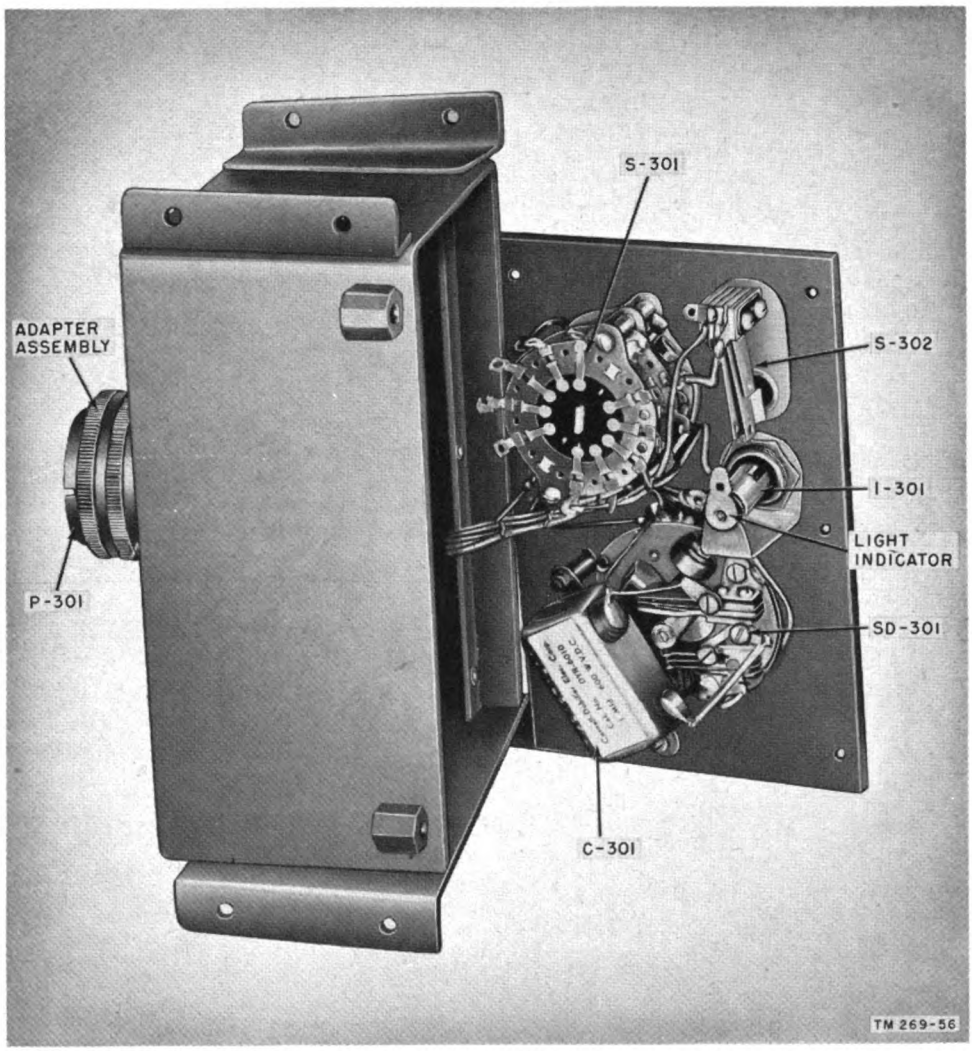
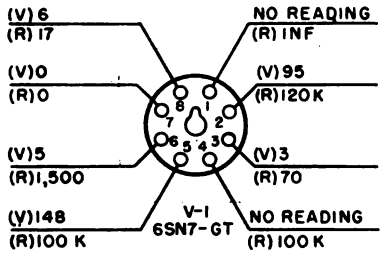


Figure 48. Control box, rear view.

TRANSMITTER, SOCKET VOLTAGES AND RESISTANCES



12-VOLT OPERATION; MODULATOR OFF

NOTES:

VOLTAGE MEASUREMENTS ARE FROM TERMINAL TO GROUND AND ARE MADE WITH A 20,000-OHM-PER-VOLT METER.

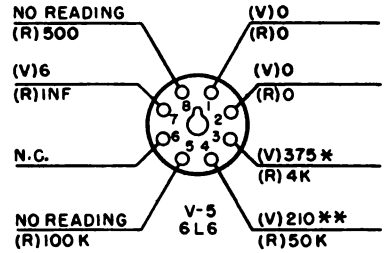
ALL VOLTAGES + D-C TO GROUND UNLESS OTHERWISE SHOWN.

RESISTANCE MEASUREMENTS ARE MADE WITH ALL TUBES REMOVED FROM SOCKETS.

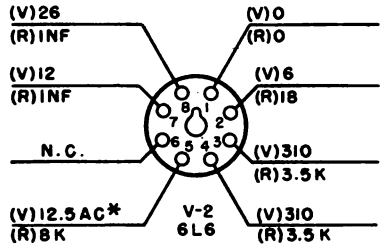
N.C. DENOTES NO CONNECTION.

MODULATOR TRANSFORMER MEASURES 120 OHMS ACROSS PRIMARY AND 50 OHMS ACROSS THE SECONDARY WINDINGS.

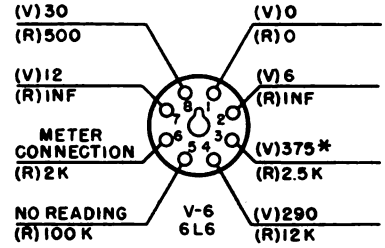
DRIVER TRANSFORMER MEASURES 120 OHMS ACROSS PRIMARY AND 30 OHMS ACROSS THE SECONDARY WINDINGS.



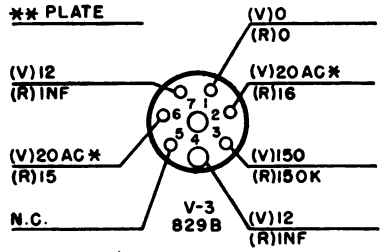
* MEASURE AT LOWER END OF PLATE COIL.
** MEASURE AT END OF SCREEN DROPPING RESISTOR.
12-VOLT OPERATION; MODULATOR OFF.



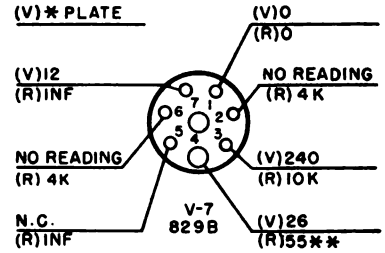
* GRID (USE VT VOLTMETER)
12-VOLT OPERATION; MODULATOR ON.



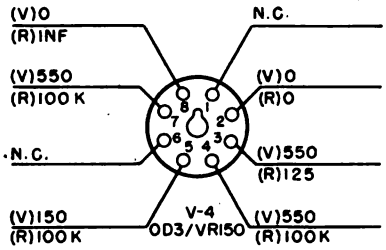
* MEASURE AT LOWER END OF PLATE COIL, END NEXT TO AMPLIFIER GRID COIL.
12-VOLT OPERATION; MODULATOR OFF.



* GRID (USE VT VOLTMETER)
** MEASUREMENTS MADE AT C.T. PRIMARY MODULATION TRANSFORMER (PIN NO. 4 TEST SOCKET)
12-VOLT OPERATION; MODULATOR ON.



* PLATES - MEASUREMENTS MADE AT CENTER TAP OF R-F PLATE COIL, 550 VOLTS DC.
12-VOLT OPERATION; MODULATOR OFF.
** CONTROL BOX CONNECTED



12-VOLT OPERATION; MODULATOR ON.

TM 269-46

Figure 49. Transmitter, tube socket voltages and resistances.

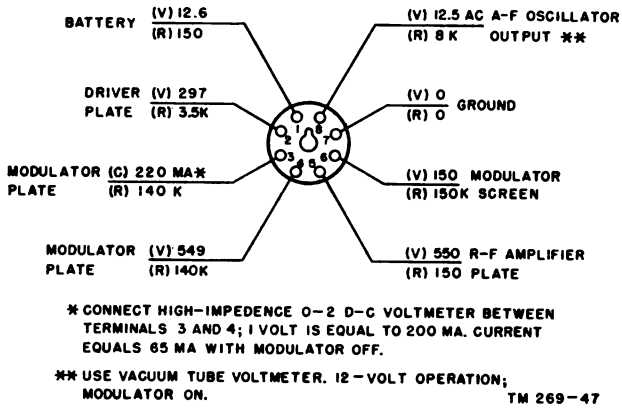


Figure 50. Transmitter, test socket voltages and resistances.

Table VIII. Audio-Frequency Measurements

Channel		Battery input (volts dc)	A-f driver grid and test socket pin 8 (volts ac)	Modulator grid (volts ac)		Modulator plate (ma dc)	Modulator plate and test socket pin 3 (volts dc)	Modulator output (volts ac)
No.	Freq			Grid 2	Grid 6			
1	336	12.1	12.4	21.5	18.7	249	550	390
2	433	12.1	12.4	21.1	18.6	244	550	390
3	558	12.1	12.3	20.2	18.6	240	550	387
4	721	12.1	12.3	18.6	18.0	235	550	381
5	930	12.1	12.0	18.4	17.3	229	550	375

Note. Test conditions as follows: external regulated power supply used; 2,500-ohm, 100-watt resistor connected across secondary of modulator transformer T-2; audio frequency on.

Section III. REPAIRS

62. Replacement of Parts

a. To remove the transmitter chassis from its waterproof case, loosen the 14 wingnuts around the outer edge of the panel. Pull the chassis straight out of the waterproof housing.

b. Most of the parts in Radio Set AN/TRT-1 are readily accessible and may be replaced if found to be faulty. In all cases, mark or tag the wires connected to the faulty part before making the replacement.

63. Repairs on Radio Set AN/TRT-1

a. RELAYS. The most common troubles in the transmitter will be found in the small relays, whose contacts carry no appreciable current. Refer to the discussion on preventive maintenance (par. 31*c*) for the method of cleaning relay contacts.

b. DYNAMOTOR DISASSEMBLY. To remove and disassemble the dynamotors, proceed as follows:

(1) Loosen the four captive screws at each corner of the base plate on which the dynamotor is mounted. Lift the dynamotor clear of the transmitter chassis (figs. 5 and 44).

(2) Cut the wire, at each end of the dynamotor, which keeps in place the two screws holding the dust covers. Remove the screws and lift off the dust covers.

(3) At each end remove the two end cap screws holding the bearing retaining

plate (end cap). Remove the end cap, being careful not to lose any shims from the end of the shaft.

Note. This completes the disassembly procedure for routine lubrication discussed in paragraph 32*b*.

(4) Remove the two screw caps and brushes at each end. Note that each brush is *marked* for correct replacement.

(5) Wipe loose dust and dirt from the unit.

(7) At the LV end, remove the two locknuts, and draw out the two through bolts from the HV end. Remove the HV end bearing bracket.

(8) Remove the LV end bearing bracket and slide the armature out. The bearing brackets are so designed that they cannot be interchanged.

c. DYNAMOTOR ASSEMBLY.

(1) Reverse the procedure for disassembly.

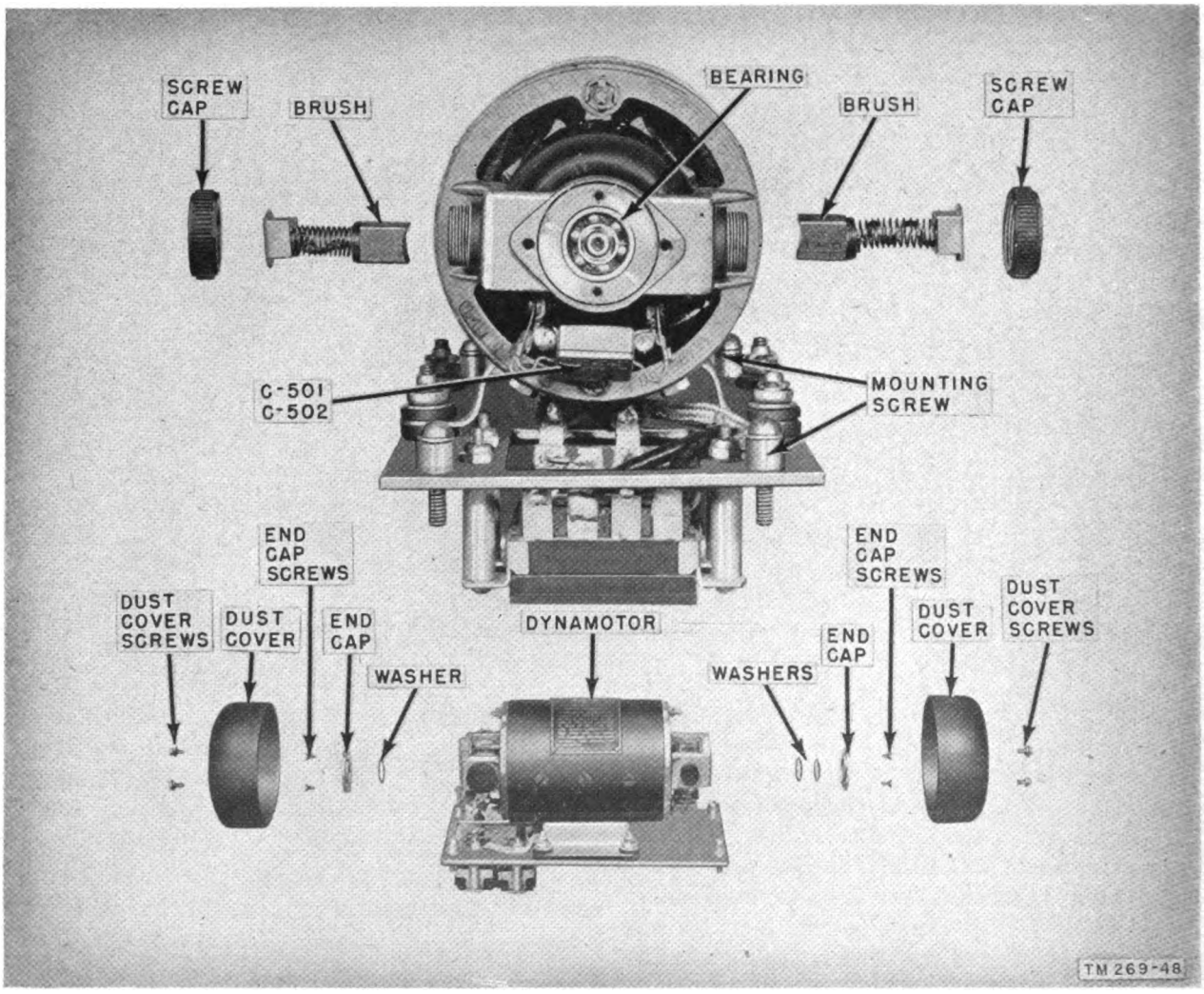


Figure 51. Dynamotor, disassembled, parts identified.

(6) At each end disconnect the leads from the stator winding to the brush holders. Remove capacitors C–501 and C–502.

(2) Do not scratch the commutator, damage the coil winding, or get dirt into the bearings. When remounting the end caps, take care in adjusting the

shims as required so that the armature shaft has a perceptible end play not exceeding 0.005 inch.

(3) When replacing the brushes, make sure the curved portion of the brush fits snugly against the commutator, or poor contact will result.

Note. Dynamotors supplied with equipments bearing serial numbers 44 through 143 have a special metal clamp installed to prevent breakage of the dynamotor frame from the base. Equipments bearing serial numbers 144 and above are equipped initially with a firm connection between frame and base and do not require the additional clamp.

d. FUSE REPLACEMENT. To replace fuses, unscrew the knurled plastic screw caps on the transmitter chassis (fig. 44) and take out the old fuse. Place a new fuse in the socket and replace the plastic screw cap.

e. TUBE REPLACEMENT. All the tubes in the transmitter chassis have some sort of clamping arrangement for holding the tubes in place. To remove the final amplifier tube or the modulator tube, loosen two screws which hold the clamping plate in place. Be sure to put the clamping plate back when replacing either of these tubes. The other tubes are held in place by binding clamps which have spring locks on them.

Section IV. ALINEMENT AND ADJUSTMENT

64. Testing Radio Set AN/TRR–2

Every receiver should be tested for proper operation before the arming switch is placed in the *firing* position. The following procedure is used in connection with Test Set TS–261/TRR–2 (fig. 32) and Dummy Load TS–292/TRT–1 (fig. 28).

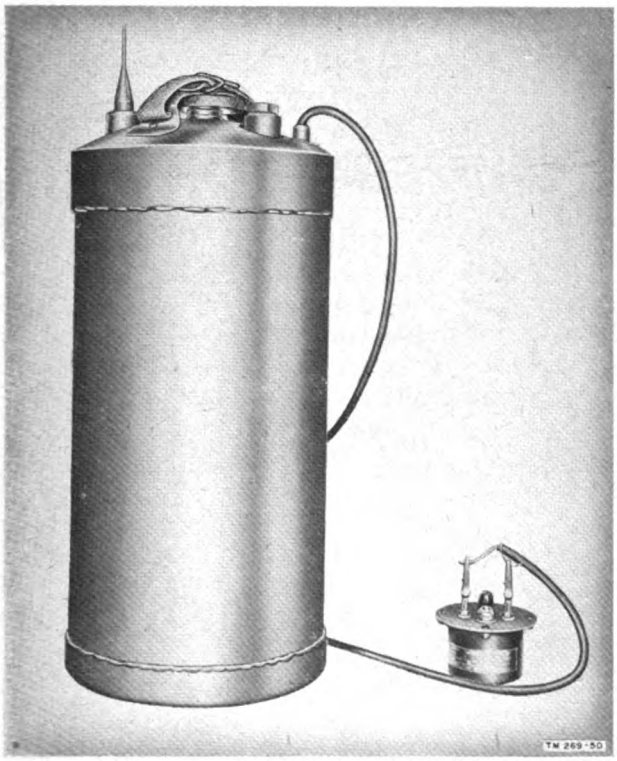


Figure 52. Receiver, connected to test set.

a. Make certain that the arming switch is in the *test* position, and then pull the arming pin. This turns on the receiver.

b. Connect Test Set TS–261/TRR–2 across the two ends of the firing cord (fig. 52).

Caution: Never short the firing cord terminals when testing the receiver. If the terminals are shorted, the firing tube will be damaged.

c. Place the receiver (or receivers) in the immediate vicinity (within 5 feet) of the transmitter and connect Dummy Load TS–292/TRT–1 to the transmitter ANTENNA receptacle with Cord CG–260/TRT–1. Plug in the dummy resistor load. If the receiver does not operate because of blocking, loosen or entirely remove the antenna from the receiver.

d. Remove the receiver from its waterproof container, and set up the r-f and a-f code channels in the receiver (par. 13*b*) ; also set the desired three-digit code on the selector switch (par. 13*c*).

e. Turn on the transmitter, and dial the complete five-number code on the SELECTOR DIAL.

Caution: If the transmitter and receiver are too close together, the receiver will overload. The transmitter should be loaded normally at all times.

f. If the contacts of the stepping relay are seen (or heard, if the receiver is in its waterproof container) to move when the code number is dialed, the receiver is working properly. The lamp on Test Set TS–261/TRR–2 will light (indicating proper operation) when the proper

code is dialed. Immediately press the test set button to extinguish the lamp. If the lamp relights after the button is released, the receiver is not functioning properly.

Note. Do not keep the transmitter on the air any longer than necessary. The enemy may be monitoring the transmitter frequency.

g. If the receiver is not working properly in any respect, mark it defective and place it aside for future investigation. There are usually enough spare receivers to replace the defective ones. After testing each receiver, place it in its waterproof container, and tighten the clamping disk. Replace the arming pin, making sure the arming switch is in the *test* position.

65. Tuning A-f Channels in Radio Set AN/TRT-1

The a-f channels in the transmitter are tuned at the factory and ordinarily do not require adjustment. After the set has been moved or parts have been replaced, however, the channels may require retuning. Test Set TS-245/TRT-1 (fig. 29), included in the spare parts box, is used as the tuning indicator.

a. Set up an r-f channel before tuning the a-f channels; otherwise the tubes in the r-f section will be damaged.

b. To tune up the a-f channels, attach Dummy Load TS-292/TRT-1 (par. 64*c*), and loosen all the shaft locknuts on the screw driver adjustments for the five audio channels (fig. 17). Connect the plug from the test set to the test socket at the rear of the transmitter chassis. Place the stethoscope over the ears, and fit the rubber tubing over the metal pipe on the panel of the tuning device (fig. 29). Place the INPUT control in the extreme counterclockwise position. Turn the meter switch on the transmitter (fig. 17) to position 2. Proceed as follows:

Caution: Connect Plug PL-55 to Test Set TS-245/TRT-1 before inserting the octal plug into the test socket on the transmitter; otherwise high voltage will be exposed at Plug PL-55. Remove the octal plug from the test socket first when the test procedure is completed.

(1) Turn the SELECTOR SWITCH on the control box (fig. 17) to the RF position and press the RESET button; this clears the channels. Dial 1 on the SELECTOR DIAL to set up an r-f channel. Turn the SELECTOR SWITCH on the control box to the AF position.

(2) Dial 1 on the SELECTOR DIAL.

(3) Turn the FREQ. SELECTOR switch (fig. 29) on the panel of the test set to position 1.

(4) Set the screw driver adjustments for audio channels 1 through 5 (fig. 17) so that the slots are all horizontal.

(5) Turn the SELECTOR SWITCH on the control box to the KEY position and the amplifier PLATE SWITCH to the TEST position. A tone which slowly increases in intensity should be heard in the stethoscope. Adjust the INPUT potentiometer on the test set for suitable intensity.

Note. If the modulator plate current exceeds 220 ma (scale reading 0.55) when the meter switch is in position 2, turn the control potentiometer R-49 (fig. 46) counterclockwise until the meter reads 200 ma (scale reading 0.5).

(6) Adjust trimming capacitors C-6 and C-7 (fig. 46) for maximum amplitude of signal in the stethoscope. Make sure that the screw driver slots of C-6 and C-7 are kept in the same relative positions. Then slowly turn AUDIO CHANNEL 1 screw driver adjustment back and forth as a check of the maximum amplitude. Leave the adjustment in the maximum amplitude position.

(7) Tighten the shaft locknut, making sure while tightening that the intensity of the sound does not decrease.

(8) Turn the SELECTOR SWITCH on the control box back to the RF position, and press the RESET button.

(9) Repeat step (1). Dial 2 on the SELECTOR DIAL. Turn the FREQ. SELECTOR switch on the test set to position 2. Repeat step (5). Then adjust the screw driver adjustment for AUDIO CHANNEL 2 on the transmitter panel until the tone heard in the stethoscope reaches a maximum intensity. Tighten the shaft locknut, making sure that the intensity of the sound does not decrease. Repeat step (8).

(10) Repeat the procedure in step (9) for audio channels 3, 4, and 5. Make sure

that number dialed on the SELECTOR DIAL and the position number of the FREQ. SELECTOR switch on the test set correspond to the channel number being tuned by the screw driver adjustment on the transmitter panel. On completion of the test, return the amplifier PLATE SWITCH to the ON position in order that coded pulses can be transmitted.

66. Adjusting Percentage of Modulation in Radio Set AN/TRT–1

The percentage of modulation of the r-f carrier is preset at the factory and runs between a maximum of 120 percent and a minimum of 90 percent. Normally there is no reason for having to adjust the modulation. When it does become necessary, however, proceed as follows:

a. Make sure the a-f channels are tuned (par. 65).

b. Attach the dummy load. Turn the amplifier PLATE SWITCH to the ON position and the meter switch to position 5.

c. Set up an r-f channel with the SELECTOR DIAL and SELECTOR SWITCH.

d. Turn the SELECTOR SWITCH to the AF position and dial 5.

e. Turn the SELECTOR SWITCH to the KEY position and note the r-f output reading on the dummy load. Immediately after taking the reading turn the SELECTOR SWITCH back to the RF position.

Caution: Never operate the transmitter on the KEY position longer than is necessary to take readings. Operation for continuous periods with the dummy load can cause serious damage to the final amplifier.

f. Set the amplifier PLATE SWITCH to TEST and the meter switch to position 2.

g. Calculate an r-f output reading 21 percent greater than the reading obtained in step *e*. An example follows:

(1) R-f output scale reading of dummy load: 0.84.

(2) Reading multiplied by 0.21: $0.84 \times 0.21 = 0.1764$.

(3) Add the result in step (2) to the dummy load reading: $0.84 + 0.176 = 1.016$ or 1.02.

(4) The new dummy load scale reading desired is thus 1.02.

h. Turn the SELECTOR SWITCH to the KEY position.

i. Quickly adjust R–49 (fig. 46) until the dummy load reads the value calculated in step *g*. Turn the SELECTOR SWITCH back to the RF position. (See caution in *e* above.)

j. Test modulation on the other four a-f channels by setting up each of the channels and then dialing a number between 5 and 10, with the SELECTOR SWITCH on KEY and the PLATE SWITCH turned back to ON for each channel. The percentage of modulation is correct if the intensity of the red pilot light on the control box increases as the code is dialed.

67. Tuning R-f Channels in Radio Set AN/TRT–1

The transmitter is factory-tuned before shipment and seldom needs adjustment; however, because of heavy jarring of mechanical circuit parts while the set is in transit or because of replacement of parts when a break-down occurs, the r-f channels in the transmitter sometimes require a complete retuning. In this case, perform the following steps:

a. Turn the SELECTOR SWITCH on the control box to the RF position. This turns on the tube filaments and sets the circuit for dialing the r-f channel desired.

b. Turn the meter switch (fig. 17) to position 3 (DOUBLER GRID) and the PLATE SWITCH to the OFF position, and press the RESET button on the control box to make certain that the r-f channels are clear.

c. Dial number 1 on the SELECTOR DIAL on the control box to set up r-f channel 1; then turn the SELECTOR SWITCH to the KEY position.

d. Loosen the dial lock on the OSC. CHANNEL 1 tuning control (fig. 17) and adjust the control for maximum current reading on the meter. Tighten the dial lock.

e. Turn the meter switch to position 4 (AMPLIFIER GRID).

f. Loosen the dial lock on the DBLR. CHANNEL 1 control (fig. 17), and adjust the control for maximum current reading on the meter. Tighten the dial lock.

g. Turn the meter switch to position 5 (AMPLIFIER PLATE).

h. Loosen the dial locks on the ANT. COUPLING and AMPL. CHANNEL 1 controls. Turn the PLATE SWITCH to the ON position and adjust the AMPL. CHANNEL 1 control until the current reading on the meter is a minimum.

i. Adjust the ANT. COUPLING control until the meter indicates between 0.35 and 0.45. Readjust the AMPL. CHANNEL 1 control until the current reading on the meter is minimum. Again increase the ANT. COUPLING control until the meter reads slightly less than half-scale; then retune the AMPL. CHANNEL 1 control for minimum current reading on the meter. Repeat this procedure until the minimum current reading is slightly less than half-scale. The final amplifier is now properly loaded, and its plate current should be between 140 and 180 ma. Tighten the dial locks on the ANT. COUPLING and AMPL. CHANNEL 1 controls.

j. Turn the PLATE SWITCH to the OFF position and the SELECTOR SWITCH to the RF position, and press the RESET button on the control box.

k. Loosen all shaft locknuts (with the hexagonal wrench included in the spare parts box) on the screw driver adjustments for the oscillator, doubler, and amplifier stages (fig. 43).

l. Turn the meter switch to position 3 (DOUBLER GRID).

m. Dial number 2 on the selector dial, and then turn the SELECTOR SWITCH to the KEY position.

n. Adjust the OSC. screw driver tuning control (CHANNEL 2) for maximum current reading on the meter. Make the adjustment slowly, because the tuning is critical. Tighten the shaft locknut, and make sure while tightening it that the meter reading is not changed.

o. Turn the meter switch to position 4 (AMPLIFIER GRID).

p. Adjust the DOUBLER screw driver tuning control (CHANNEL 2) for maximum current reading on the meter. Make the adjustment slowly, because the tuning is critical. Tighten the shaft locknut, and make sure while tightening it that the meter reading is not changed.

q. Turn the meter switch to position 5 (AMPLIFIER PLATE).

r. Turn the PLATE SWITCH to ON, and *quickly* adjust the AMPLIFIER screw driver tuning control (CHANNEL 2) for a minimum current reading on the meter. Tighten the shaft locknut, and make sure while tightening it that the meter reading is not changed.

s. Turn the PLATE SWITCH to OFF and the SELECTOR SWITCH to the RF position. Then press the RESET button on the control box.

t. Adjust the remaining channels (3, 4, 5, and 6) in the same manner as given in *l* to *s* above (see *u* below). Make certain that the number dialed corresponds to the channel adjustments which are made.

u. The DOUBLER GRID current (position 3 on the meter switch) may read *off scale* while tuning the OSC. controls for CHANNELS 4, 5, and 6. If this occurs, substitute the following procedure for *l* to *t* above (for tuning channels 4, 5, and 6 *only*) :

(1) Turn the meter switch to position 4 (AMPLIFIER GRID).

(2) Dial number 4 on the SELECTOR DIAL, and then turn the SELECTOR SWITCH to the KEY position.

(3) Adjust the OSC. screw driver tuning control (CHANNEL 4) for maximum AMPLIFIER GRID current reading on the meter. Then adjust the DOUBLER screw driver tuning control (CHANNEL 4) for maximum current reading on the meter. Repeat these two tuning adjustments until a maximum reading is obtained for each adjustment.

Note. After this step do not place the meter switch in position 3 for channel 4, 5, or 6 with the SELECTOR SWITCH in the KEY position. Tighten the shaft locknuts.

(4) Turn the meter switch to position 5 (AMPLIFIER PLATE).

(5) Turn the PLATE SWITCH to ON, and *quickly* adjust the AMPLIFIER screw driver tuning control (CHANNEL 4) for a minimum current reading on the meter. Tighten the shaft locknut, and make sure while tightening it that the meter reading is not changed.

(6) Turn the PLATE SWITCH to OFF and the SELECTOR SWITCH to the

RF position. Then press the RESET button on the control box.

(7) Adjust channels 5 and 6 in the same manner as given in (1) through (6) above. Make certain that the number dialed corresponds to the channel adjustments which are made.

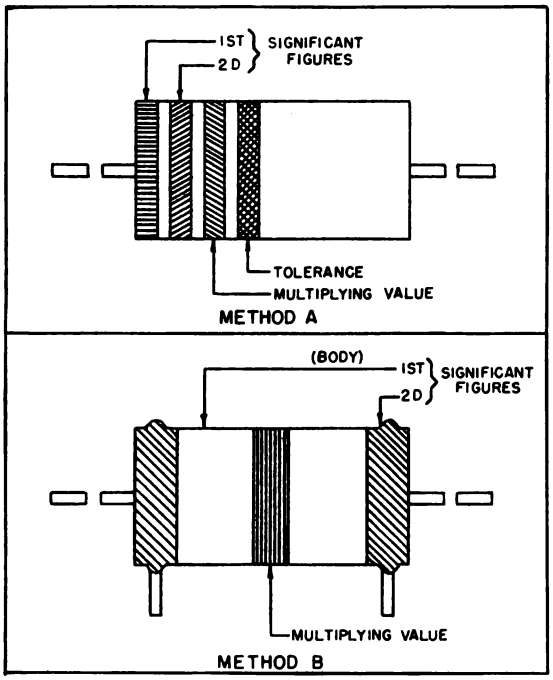
v. Turn the SELECTOR SWITCH to the RF position.

w. Press the RESET button on the control box. The transmitter r-f section is now completely tuned, and any combination of r-f and a-f channels may be dialed.

Caution: Even though the control box SELECTOR SWITCH is in the OFF position, the RESET button must be pressed after transmission is completed, in order to prevent current drain through the r-f relay coils.

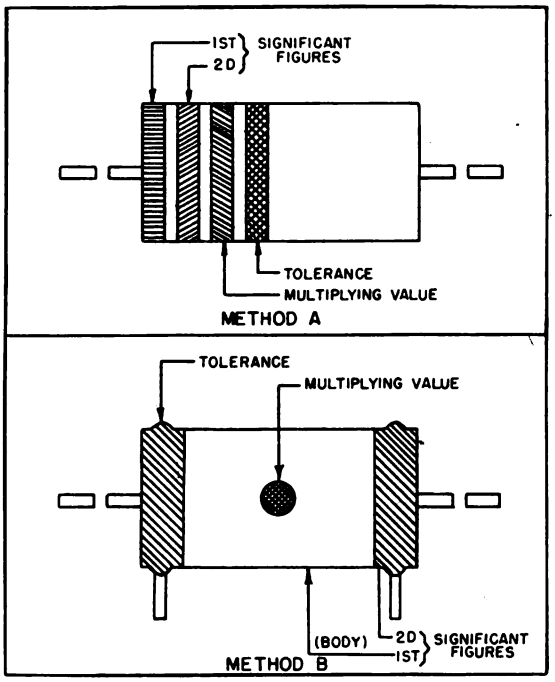
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS*



A

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS†



B

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

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR. NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND.

† RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.

RMA: RADIO MANUFACTURERS ASSOCIATION

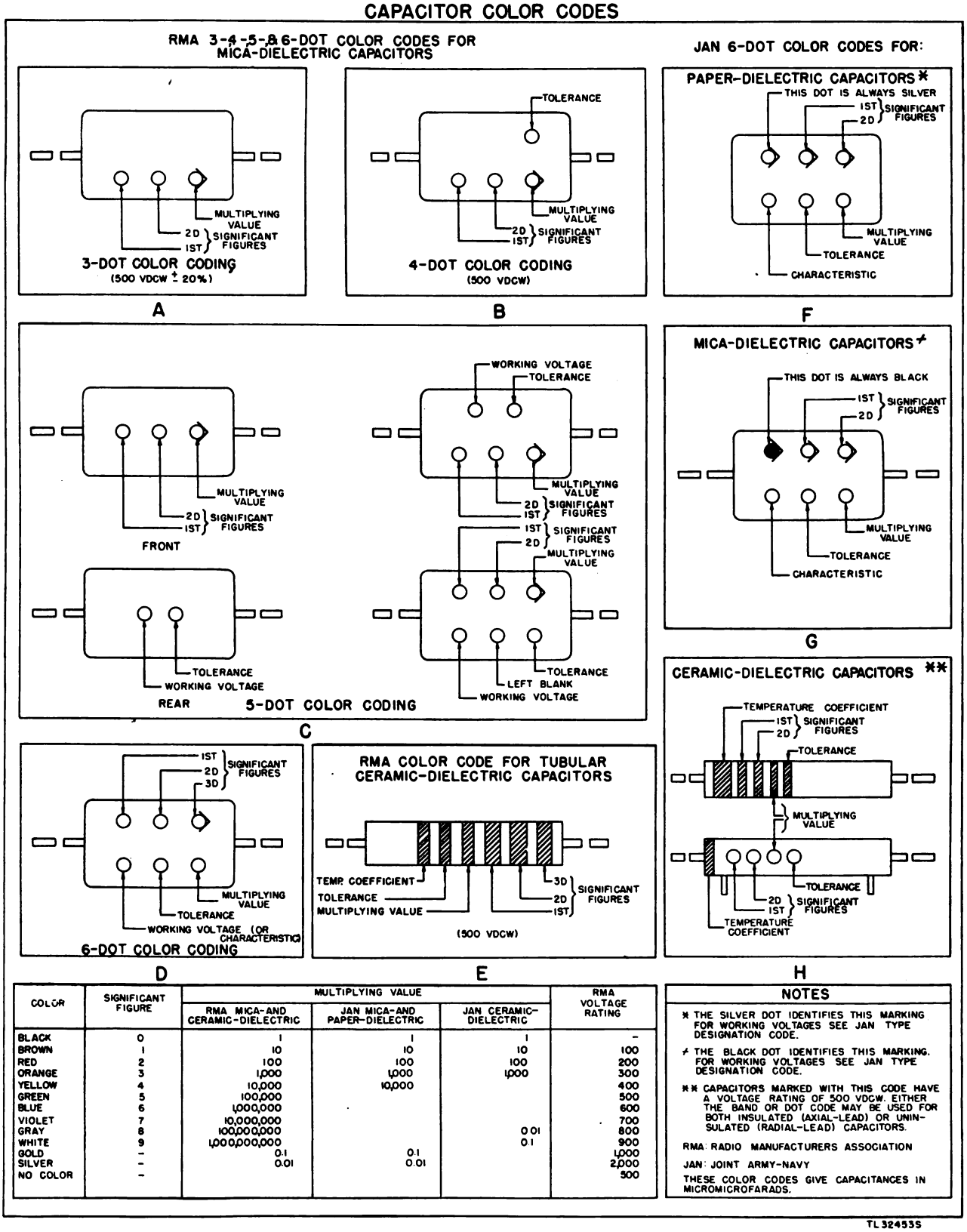
JAN: JOINT ARMY-NAVY

THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS.

TL32454S

Figure 53. Resistor color codes.

CAPACITOR COLOR CODES



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

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

≠ THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW. EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS.

RMA: RADIO MANUFACTURERS ASSOCIATION

JAN: JOINT ARMY-NAVY

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

TL 32453S

Figure 54. Capacitor color codes.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

68. Disassembly

The following instructions are recommended as a guide for preparing the radio sets for transportation and storage.

a. RADIO SET AN/TRR–2. Refer to procedures in paragraph 13.

(1) Remove the antenna from the receiver (par 13*d*). Place it in the parts box.

(2) Remove the receiver unit from the container (par. 13*a*).

(3) Remove the A, B, and C batteries from the receiver.

Note. Removal of batteries will depend upon the length of time that the set will be in storage or in transit.

(4) Remove the three plug-in coils (par. 13*b*). Replace the Y clamping bar.

b. RADIO SET AN/TRT–1. Refer to paragraph 14.

(1) Remove the four mast sections and insulator-bracket assembly of Antenna Assembly AS–149/TRT–1. Place them in the spare parts box (fig. 4).

(2) Remove the remote control box, the battery cable, and the antenna cable from the transmitter front panel. Store these parts in the spare parts box.

(3) Replace the three waterproof caps on the CONTROL BOX, BATTERY, and ANTENNA receptacles.

(4) Replace the waterproof cover on the front panel of the transmitter. Tighten the knurled screws that hold the cover in place.

69. Repacking for Shipment or Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends upon the material available and the conditions under which the equipment is to be shipped or stored. Refer to paragraph 12 and reverse the instructions.

b. Whenever practicable, place a dehydrating agent inside the chests. Protect the chests with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATERIÉL TO PREVENT ENEMY USE

70. General

The demolition procedures outlined in paragraphs 71 and 72 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished *only* upon order of the commander.

71. Methods of Destruction

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

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

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

d. Explosives. Use firearms, grenades, and TNT.

e. Other. Use anything immediately available for destruction of this equipment.

f. Disposal. Bury in slit trenches, fox holes, and other holes. Throw in streams. Scatter.

72. Destruction of Components

a. Smash meter, crystals, controls, tubes, coils, switches, capacitors, and resistors.

b. ***Cut*** cords and wiring.

c. ***Burn*** cords, technical manuals, resistors, capacitors, coils, and wiring.

d. ***Bend*** panels and chassis.

e. ***Bury or scatter*** all the above pieces after destroying.

f. ***Destroy everything.***

APPENDIX I

REFERENCES

Note. For availability of items listed, check FM 21–6.

1. Army Regulations

AR 380–5	Safeguarding Military Information.

2. Supply Publications

SIG 1	Introduction and Index.
SB 11–6	Dry Battery Supply Data.
SB 11–17	Electron Tube Supply and Reference Data.
SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi - Resistant Treatment.

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 11–307	Signal Generators I–72–G, H, J, and K.
TM 11–321	Test Set I–56–E.
TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–2526	Oscilloscope BC–1060–A.
TM 11–2613	Voltohmmeter I–166.
TM 11–2626	Test Unit I–176.
TM 11–2627	Tube Tester I–177.

4. Painting, Preserving, and Lubrication

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

5. Camouflage

FM 5–20	Camouflage, Basic Principles.

6. Decontamination

TM 3–220	Decontamination.

7. Demolition

FM 5–25	Explosives and Demolitions.

8. Packaging and Packing Instructions

a. JOINT ARMY-NAVY PACKAGING SPECIFICATIONS.

JAN–D–169	Desiccants, Activated.
JAN–P–100	General Specifications.
JAN–P–106	Boxes, Wood, Nailed.
JAN–P–116	Preservation, Methods of.
JAN–P–125	Barrier Material, Waterproof.
JAN–P–131	Barrier Material, Moisture-Vaporproof, Flexible.

b. U. S. ARMY SPECIFICATION.

100–2E	Marking Shipments by Contractors.

9. Other 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 5	Defense against Radio Jamming.
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.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TM 1–455	Electrical Fundamentals.
TM 9–2857	Storage Batteries Lead-Acid Type.
TM 11–310	Schematic Diagrams for Maintenance of Ground Radio Communication Sets.
TM 11–314	Antennas and Antenna Systems.
TM 11–415	Dry Batteries.
TM 11–430	Storage Batteries for Signal Communication Except Those Pertaining to Aircraft.
TM 11–453	Shop Work.
TM 11–455	Radio Fundamentals.
TM 11–466	Radar Electronic Fundamentals.
TM 11–483	Suppression of Radio Noises.
TM 11–4000	Trouble Shooting and Repair of Radio Equipment.
TM 38–650	Basic Maintenance Manual.

10. Forms

WD AGO Form 468 (Unsatisfactory Equipment Report).

11. Abbreviations

a-c	alternating-current
a-f	audio-frequency
a-m	amplitude-modulated
amp	ampere
cps	cycles per second
c-w	continuous-wave
d-c	direct-current
h-f	high-frequency
i-f	intermediate-frequency
kc	kilocycle
L-C	inductance-capacitance
ma	milliampere
mc	megacycle
meg	megohm
mw	milliwatt
PM	preventive maintenance
R-C	resistance-capacitance
r-f	radio-frequency
UF	microfarad
uuf	micromicrofarad

12. Glossary

Refer to the glossary in TM 11–455.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Note. The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as T/O&E, TA, T/BA, SIG 6, SIG 7&8, SIG 7–8–10, SIG 10, list of allowances of expendable material, or another authorized supply basis. Pamphlets of the Department of the Army Supply Catalog applicable to the equipment covered in this manual are listed in paragraph 1 below.

1. Supply Catalogs

The appropriate pamphlets of the Department of the Army Supply Catalog are—

SIG 7 — AN/TRT–1
SIG 8 — AN/TRT–1
SIG 8 — AS–149/TRT–1
SIG 8 — C–152/TRT–1
SIG 7 & 8 — DM–35
SIG 8 — T–87/TRT–1
SIG 8 — TS–245/TRT–1
SIG 8 — TS–261/TRR–2
SIG 8 — TS–292/TRT–1

For an index of available catalogs, see the latest issue of Department of the Army Supply Catalog SIG 1.

2. Identification Table of Parts for Radio Set AN/TRT–1

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
----------	ADAPTER ASSEMBLY, connector: watertight; aluminum, black anodized; $1^{21}/_{32}$″ lg x $1^{3}/_{8}$″ OD x $^{3}/_{4}$″ max cable diam; c/o adpt cable clamp; Amphenol #9767–22–12.	For connector on Cord CX–275/TRT–1.	2Z307–38
----------	ANTENNA ASSEMBLY AS–149/TRT–1 ----------	For radiation of modulated signal into space.	2A264–149
----------	CABLE ASSEMBLY, RF: Army-Navy Cord CG–191/TRT–1; coax; flex; characteristic impedance 73 ohms; 8 ft lg; Army-Navy RF Cable RG–39/U, single #22 ga solid copperweld cond; polyethylene dielectric; outer cond copper braid, black vinylite cover; Amphenol connector type #PM8–1 one end; SIG C Plug PL–55 on other.	Connects audio test set to receiver.	1F430–191
----------	CABLE ASSEMBLY, RF: Army-Navy Cord CG–203/TRT–1; ant; 36″ lg; single #16 cond; soft wire; 26 strands #30; Simplex Wire & Cable Tirex T–32183; Sig C Plug PL–259 one end; other end tinned.	Connects transmitter to antenna.	3E6015–203
----------	CABLE ASSEMBLY, RF: Army-Navy Cord CG–260/TRT–1; 9″ single cond Army-Navy RF Cable RG–11/U; flex; Sig C Plug PL–259 both ends.	Connects test set to transmitter.	1F430–260
----------	CABLE ASSEMBLY, RF: Army-Navy Cord CG–260/TRT–1; coax; flex; characteristic impedance 72 ohms; 9″ lg; Army-Navy RF Cable RG–11/U, 26 stranded bare copper wire; single solid polyethylene dielectric; Sig C Plug PL–259 on both ends (steel braided outer jacket).	Connects transmitter to dummy load.	1F430–260
----------	CABLE ASSEMBLY, control: Army-Navy Cord CX–275/TRT–1; RC; shielded; 25 ft; 10 cond #18; Amphenol #AN–3106–28–8P connector one end; Amphenol #97–5103–28–85 on other end.	Connects control box to transmitter.	3E6000–275

2. Identification Table of Parts for Radio Set AN/TRT-1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
----------	CABLE ASSEMBLY, power: Army-Navy Cord CX-276/TRT-1; rubber jacketed; 8 ft; 2 #6 AWG stranded cond; Amphenol #3106-20-235 connector one end; 2 batt lugs other end.	Connects battery to transmitter.	3E6000-276
----------	CONNECTOR, female contact: pol; 2 #8 round cont; straight type; 2⅛" lg x 15/16" wd o/a; Amphenol #AN-3106-20-235.	For Cord CX-276/TRT-1	2Z3063-31
----------	CONNECTOR, female contact; pol; 12 round cont; 2 #12, tin #16; straight type; 2¼" lg x 1¾" wd o/a; Amphenol #97-5103-28-85.	For Cord CX-275/TRT-1	2Z3073-6
----------	CONNECTOR, male contact; Sig C Plug PL-259; single cont.	For antenna cords	2Z7226-259
----------	CONNECTOR, male contact (plug): pol; 8 round cont; 1 3/32" lg x 13/16" diam o/a; black bakelite and metal body; Amphenol #PM8-11.	For audio test cord	2Z7234-2
----------	CONNECTOR, male contact (plug): pol; 12 round cont; 2 #12, tin #16; straight type; 2¼" lg o/a x 1 31/32" diam o/a; Amphenol #AN-3106-28-8P.	For control box cord	2ZK7122-13
----------	CONTROL BOX C-152/TRT-1	For dialing of desired a-f modulating signal.	2C666-152
----------	CRYSTAL SET: composed of 6 transmitting crystals as listed per Secret Procurement and Information Data Sheet to spec #471-2261; u/w Radio Transmitter T-87/TRT-1 (individual xtals may be requisitioned).	For crystal oscillator, V-5	3X130.1-1
D-1, D-2	DYNAMOTOR DM-35: plate supply; output 625 v DC, 225 ma; input 12 v DC at 18.7 amp.	Plate supply for transmitter	3H1635
----------	GASKET: synthetic rubber; 1 5/16" OD x 1⅛" ID x 1/16" thk; Amphenol #9779-20W.	For connector on Cord CX-276/TRT-1.	2Z4867.90
----------	GASKET: synthetic rubber; 1⅝" OD x 1 9/16" ID x 1/16" thk; Amphenol #9779-28W.	For male plug on Cord CX-275/TRT-1.	2Z5867.93
----------	PLUG, telephone: Sig C Plug PL-55; two cont	For audio test cord	2Z7155
----------	RADIO TRANSMITTER T-87/TRT-1	To produce an r-f signal modulated by a series of a-f pulses.	2C6900-87
----------	REDUCER ASSEMBLY, connector: watertight; aluminum; black anodized; 1 31/32" lg x 1⅝" OD x ¾" max cable diam; c/o adpt, cable clamp, friction washer, and rubber bushing; Amphenol #9767-28-12.	For cord CX-275/TRT-1	2Z303-10
----------	TECHNICAL MANUAL: TM 11-269	----------	(Order through AGO channels)
----------	TEST SET TS-245/TRT-1	Audio calibrator	3F4325-245

2. Identification Table of Parts for Radio Set AN/TRT–1 (continued)

Referenee symbol	Name of part and description	Function of part	Signal Corps stock No.
----------	TEST SET TS–261/TRR–2----------	To check operation of Radio Set AN/TRR–2.	3F4325–261
----------	TEST SET TS–292/TRT–1----------	Dummy antenna load--------	3F4325292

3. Identification Table of Parts for Antenna Assembly AS–149/TRT–1

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
----------	BASE, mast: Sig C Mast Base MP–37----------	To hold antenna mast--------	2A2087
----------	MAST SECTION, antenna: Sig C Mast Section MS–49; aluminum; black enamel finish; 37″ lg; supported by MS–50.	Part of antenna mast--------	2A2349
----------	MAST SECTION, antenna: Sig C Mast Section MS–50; aluminum; black enamel finish; 37″ lg; supported by MS–51.	Part of antenna mast--------	2A2350
----------	MAST SECTION, antenna: Sig C Mast Section MS–51; aluminum; black enamel finish; 37″ lg; supported by MS–52.	Part of antenna mast--------	2A2351
----------	MAST SECTION, antenna: Sig C Mast Section MS–52; aluminum; black enamel finish; 37″ lg; fits into MP–37.	Part of antenna mast--------	2A2352

4. Identification Table of Parts for Control Box C–152/TRT–1

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
C–301-------	CAPACITOR, fixed: paper; 100,000 mmf ±10%; 600 vdcw; $1\frac{13}{16}$″ x 1″ x ¾″ thk; Dubilier #DY 6010.	Bypass, input----------	3DA100–90.1
P–301-------	CONNECTOR, male contact; pol; 12 round cont; two #12, tin #16; straight type; 2″ x 2″ x $1\frac{13}{32}$″ d; Amphenol #97–5105–28–8P.	Connects to J–1----------	2Z3032–9
SO–301------	DIAL, telephone: 10 holes, 10 impulses per sec; closes a normally open ckt; cont arranged make-break; 3″ diam x 1½″ thk; Auto Elec type #AK–14.	Channel selector----------	4B794.4–13
----------	GASKET: synthetic rubber; $1\frac{5}{8}$″ OD x $1\frac{9}{16}$″ ID thk; Amphenol #9779–28W.	For connector P–1----------	2Z4867.93
----------	GASKET: synthetic rubber; 2″ x 2″ x $\frac{1}{32}$″ thk; natural finish; ctr hole 2.21″ diam; 4 #27 drill holes; Comm Meas Lab dwg #2–35–8.	Between P–1 and case-------	2C666–152/1
----------	KNOB, round: fluted; molded black bakelite; $1\frac{1}{8}$″ diam; for ¼″ diam shaft; 2 #10 setscrews; white pointer; GR type #627A.	For SELECTOR SWITCH---	2ZK5788–20

4. Identification Table of Parts for Control Box C–152/TRT–1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
I–301	LAMP, incandescent: Sig C Lamp LM–52; 6–8 v at 0.15 amp; miniature bayonet base; brown bead; T–3¼ bulb; Mazda #47.	Indicates final amplifier on	2Z5952
	LIGHT, indicator: pilot; red bull's-eye; brass, nickel pl, bracket bayonet base; 1¾″ lg x 1″ wd 1″ h; Dialco #810–BS.	Off-on indicator	2ZK5988–25
	SCREW, thumb: captive; round knurled head; brass, black nickel finish; #12–28″ thd; 1 13/16″ lg o/a; ¼ ″lg thd; Comm Meas Lab dwg #2–35–6.	Fastens waterproof cover	6L4772–19.5BK
S–301	SWITCH, rotary: 4 poles, 5 positions, and off-position; 2 sect; bakelite ins; 2¼″ x 1¾″ x 1½″ thk; Mallory #1325L; Comm Meas Lab dwg #2–35–13.	SELECTOR DIAL	3Z9827.7–3
S–302	SWITCH, push: single-pole; 1A, nonlocking; bakelite; 1 11/16″ lg x ¾″ wd x 1″ thk; Mallory #2001.	For reset coil	3Z9824–25

5. Identification Table of Parts for Dynamotor DM–35–D

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
C–501, C–502	CAPACITOR, fixed: mica; 3000 mmf ±10%; 800 vdcw; Dubilier type #1 WPS.	Spark suppression	3DA3–6
	GREASE: General Purpose #2; USA spec 2–108; 1-lb can	Dynamotor lubricant	6G670
J–501, J–502	RECEPTACLE: Jones #SS–8–AB	Dynamotor connections	3H1635A/R1
	SCREW: mtg #10–32 by 1″ lg; spcl	Mounting	3H1635A/S1
	TECHNICAL MANUAL: TM 11–600		(Order through AGO channels)

6. Identification Table of Parts for Radio Transmitter T–87/TRT–1

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
	CAP ASSEMBLY: cap and chain; fits AN connector size 105; ¾″ diam x 9/16″ d o/a; 5/8″–24 thd; Amphenol #4560–10.	Protects J–2, ANTENNA, when not in use.	2Z1607–8
	CAP ASSEMBLY: cap and chain; fits AN connector size 205; 1⅜″ diam x 9/16″ d o/a; 1¼″–18 thd; Amphenol #4560–20.	Protects P–6, BATTERY, when not in use.	2Z1607–7
	CAP ASSEMBLY: cap and chain; fits AN connector 285; 1⅞″ diam x ½″ d o/a; 1¾″–18 thd; Amphenol #4560–2B.	Protects J–1, CONTROL BOX, when not in use.	2Z1607–9
C–1 through C–5, C–56	CAPACITOR, variable: air dielectric: 2 sect, ea 2.8 to 50 mmf; 0.030″ air gap between meshed plates; 3⅛″ lg x 1⅜″ wd x 1 7/16″ h; shaft 1⅛″ lg x ¼″ diam; 13 plates per sect; Cardwell #ER–50–AD modified as per Comm Meas Lab dwg #2–34–12.	C–1 through C–5: AUDIO CHANNEL 1 through 5. C–56: AMPL. CHANNEL 1.	3D9050V–91

6. Identification Table of Parts for Radio Transmitter T–87/TRT–1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
C–6, C–7	CAPACITOR, variable: air dielectric; 5.5 to 100 mmf; air gap between meshed plates 0.013″; 1 15/32″ lg x 15/16″ wd x 1 7/16″ h; shaft 5/16″ lg x 9/32″ diam; 27 plates; scdr adj; Hammarlund #APC–100.	Forms part of resistance-capacitance bridge for V–1.	3D254
C–8, C–9	CAPACITOR, fixed: silver mica; 800 mmf ± 5%; 500 vdcw; 51/64″ x 15/32″ x 7/32″ thk max dimen; JAN type CM30C821J.	Forms part of resistance-capacitance bridge for V–1.	3K3082132
C–10, C–11, C–12, C–15, C–16, C–37, C–38	CAPACITOR, fixed: paper; 2 mf ± 10%; 600 vdcw; 2″ x 2″ x 2″ x 1⅛″ thk; JAN type CP50B1FF205KK.	C–10: Coupling capacitor, V–1. C–11: Bypass, R–20. C–12: Bypass for af, V–1. C–15: Bypass for af, V–2. C–16: Bypass for af, V–3. C–37: Bypass, filament, V–4 C–38: Bypass, T–2.	3DB2.6200–2
C–13	CAPACITOR, fixed: paper; 50,000 mmf ± 10%; 600 vdcw; 1 13/16″ x 1″ x ¾″ thk; JAN type CP50B1FF503KK.	Coupling, V–1	3DA50–20
C–14, C–16.1	CAPACITOR, fixed: mica; 1000 mmf ± 10%; 500 vdcw; 53/64″ x 53/64″ max dimen; JAN type CM30A102K.	C–14: Bypass, filament, V–1. C–16.1: Bypass, filament, V–3.	3K3010211
C–17	CAPACITOR, variable: air dielectric; 2 to 25 mmf; 0.030″ air gap between meshed plates; 1 1/16″ h x 1 3/8″ wd x 31/32″ d; shaft 1″ lg x ¼″ diam; 7 plates; Cardwell #ZR–25–AS modified as per Comm Meas Lab dwg #2–32–54.	OSC. CHANNEL 6	3D9025V–35
C–18, C–19, C–24, C–25	CAPACITOR, variable: air dielectric; 1.5 to 15 mmf; 0.030″ air gap between meshed plates; 1″ h x 1 3/8″ wd x 31/32″ d; shaft 1″ lg x ¼″ diam; 5 plates; scdr slot; Cardwell #ZN–15–AS as per Comm Meas Lab dwg #2–32–56.	C–18 and C–19: OSC. CHANNEL 5 and 4, respectively. C–24 and C–25: DOUBLER CHANNEL 6 and 5, respectively.	3D9015V–31
C–20, C–21, C–26, through C–28	CAPACITOR, variable: air dielectric; 1.2 to 10 mmf; 0.030″ air gap between meshed plates; 1″ h, 1 3/8″ wd x 7/8″ d; shaft 1″ lg x ¼″ diam; 3 plates; scdr slot; Cardwell #ZT–15–AS modified as per Comm Meas Lab dwg #2–32–55.	C–20 and C–21: OSC. CHANNEL 3 and 2, respectively. C–26 through C–28: DOUBLER CHANNEL 4 through 2, respectively.	3D9010V–30
C–23	CAPACITOR, fixed: silver mica; 4 mmf + 20% − 0%; 500 vdcw; 23/32″ x 15/32″ x 0.20″ thk; Sangamo type K.	Part of tank circuit, channel 1, V–5.	3D9004–10
C–29	CAPACITOR, fixed: silver mica; 20 mmf ± 5%; 500 vdcw; 23/32″ x 15/32″ x 0.20″ thk; JAN type CM20G200J; Sangamo type K.	Doubler circuit, V–6	3K2020032
C–30	CAPACITOR, fixed: silver mica; 5 mmf + 20% − 0%; 500 vdcw; 23/32″ x 15/32″ thk; Sangamo type K.	Part of tank circuit, channel 1, V–6.	3D9005–47
C–31	CAPACITOR, variable: air dielectric; 3 to 15 mmf; 0.070″ air gap between meshed plates; 1″ h x 1 3/8″ wd x 1½″ d; shaft 1″ lg x ¼″ diam; 9 plates; Cardwell ZT–15–AS modified as per Comm Meas Lab dwg #2–32–43–1.	AMPLIFIER CHANNEL 6	3D9015V–25
C–32, C–33	CAPACITOR, variable: air dielectric; 3.6 to 10 mmf; 0.070″ air gap between meshed plates; 1″ h x 1 3/8″ wd x 1 1/16″ d; shaft ¾″ lg x ¼″ diam; 3 plates; Cardwell #ZT–10–AS modified as per Comm Meas Lab dwg #2–32–43–2.	C–32 and C–33: AMPLIFIER CHANNEL 5 and 4, respectively.	3D9011V–3

6. Identification Table of Parts for Radio Transmitter T–87/TRT–1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
C–34	CAPACITOR, variable: air dielectric; 1.5 to 5 mmf; 0.061″ air gap between meshed plates; 1″ h x 1⅜″ wd x 31/32″ d; shaft 1″ lg x ¼″ diam; 3 plates; Cardwell #ZV–5–TS modified as per Comm Meas Lab dwg #2–32–43–3.	AMPLIFIER CHANNEL 3	3D9005V–6
C–35	CAPACITOR, variable: air dielectric; 1.5 to 5 mmf; 0.061″ air gap between meshed plates; 1″ h x 1⅜″ wd x 31/32″ d; shaft 1″ lg x ¼″ diam; 3 plates; Cardwell #ZV–5–TS modified as per Comm Meas Lab dwg #2–32–43–4.	AMPLIFIER CHANNEL 2	3D9005V–6.1
C–36	CAPACITOR, fixed: air dielectric; 5 mmf; 0.12″ air gap between plates; 1½″ lg x ½″ wd plates.	Part of tank circuit CHANNEL 1, V–7.	
C–39	CAPACITOR, fixed: paper; 100,000 mmf ± 10%; 600 vdcw; 1 13/16″ x 1″ x ¾″ thk; JAN type CP50B1FG104KK.	Coupling to screen, V–7	3DA100–90.1
C–40	CAPACITOR, fixed: silver mica; 60 mmf ± 5%; 500 vdcw; 51/64″ x 15/32″ x 7/32″ thk max dimen; JAN type CM20C620J.	Cathode tank circuit, V–5	3K2062032
C–41, C–48, C–58, C–59	CAPACITOR, fixed: mica; 2000 mmf ± 5%; 500 vdcw; 53/64″ x 53/64″; JAN type CM30A202J.	C–41: R-f bypass R–33 C–48: Bypass, R–38. C–58: Bypass, meter M–1. C–59: Bypass, screen, V–5.	3K3020212
C–42	CAPACITOR, variable: air dielectric; 3 to 30 mmf; 13/16″ x 9/16″ x ½″; Natl Co type #M–30.	Feedback coupling, grid V–5	3D9003–1
C–43, C–45, C–51, C–55	CAPACITOR, fixed: mica; 2000 mmf ± 5%; 1200 vdcw; 1¼″ x 1⅛″ x 23/64″ thk; JAN type CM45A202J.	C–43: Bypass, screen current, V–5. C–45: R-f filter, V–5. C–51: Blocking, plate V–6. C–55: Bypass, cathode V–7.	3K4520212
C–44, C–50	CAPACITOR, variable: air dielectric; 2.8 to 50 mmf; 0.030″ air gap between meshed plates; 1″ h x 1⅜″ wd x 1⅜″ d; shaft 1″ x ¼″ diam; 13 plates; Cardwell #ZR–50–AS.	C–44: OSC. CHANNEL 1 C–50: DBLR. CHANNEL 1.	3D9050V–61
C–46, C–47	CAPACITOR, fixed: silver mica; 50 mmf ± 5%; 500 vdcw; 51/64″ x 15/32″ x 7/32″ thk; JAN type CM20C510J.	Coupling to grid, V–6	3K2051032
C–49, C–52, C–53, C–54	CAPACITOR, fixed: mica; 510 mmf ± 5%; 500 vdcw; ¾″ x ¾″ x ¼″ thk.	C–49: Bypass, screen V–6 C–52 and C–53: Bypass, filaments V–7. C–54: Bypass, R–43.	3K3051112
C–57	CAPACITOR, fixed: mica; 2000 mmf ± 5%; 2500 vdcw; 1¾″ x 1⅛″ x 29/64″ thk; JAN type CM50A202J.	Bypass, plates V–7	3K5020212
----------	CLAMP, dial: brass, nickel pl; 1⅜″ lg x ¼″ diam o/a; Millen type #10050.	Lock assembly for dials	2ZK3714–6
----------	CLAMP, tube: spring steel; cad pl; 1⅛″ diam x ⅝″ h o/a x 1/32″ thk; mtd on foot; snap latch; Millen #33087–VR150.	Lock clamp for V–4	2Z2642.62
----------	CLAMP, tube: spring steel; cad pl; 1¼″ diam x ⅝″ h o/a x 1/32″ thk; mtd on foot; snap latch; Millen type #33087–6SN7GT.	Lock clamp for V–1	2Z2635.87

6. Identification Table of Parts for Radio Transmitter T–87/TRT–1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
L–1	COIL, RF: cathode; single layer wnd, single wnd; unshielded; 10 turns #24 DCC copper wire; 1½" lg x 5/8" OD x ½" ID; Comm Meas Lab dwg #P2–5.	Part of cathode tank circuit, V–5.	2C6900–87/7
L–3, L–4	COIL, RF: power amplr grid; 2 wnd, single layer wnd; unshielded; 6 turns #20 tinned copper wire; 2¾ turns #18 tinned copper wire; 3⅞" lg x 1" OD x ¾" ID; Comm Meas Lab dwg #P2–15.	L–3: Plate tank, V–6 L–4: Grid tank, V–7.	2C6900–87/8
J–1	CONNECTOR, female contact (socket): 12 cont; 2" x 2" x 1 11/32" d; Amphenol #AN–3102–28–8S.	Connects to plug P–1 on remote control cable.	2Z8682
J–2	CONNECTOR, male contact (socket): single cont for coax cable; 23/32" x 23/32" x 1 1/16" thk; straight type; Amphenol #83–IR.	ANTENNA output	2Z8799–239
P–2 through P–5	CONNECTOR, male contact: 8 flat cont, ¼" x 1/16", pol; straight type; 1 7/16" x 1⅞" x 1" thk; Jones HB #P408AB.	Dynamotor connectors.	
P–6	CONNECTOR, male contact; 2 #8 cont; straight type, 1½" x 1½" x 1 11/32" thk; Amphenol #AN–3102–20–23P.	Battery connector	2Z3022–31
	COUPLING, flexible drive; ins; 1¼" diam x ¾" lg; for ¼" diam shaft; Cardwell type A.	For control capacitors	2Z3290
N–1	DIAL, calibrated: with knob; HH brass; 2" OD x ½" ID x 1/32" thk; inscribed 1–7–13–19 OSC. CHANNEL 1, etched on black background; Comm Meas Lab dwg #P–2–60.	For OSC. CHANNEL 1 control.	2Z3714–53
N–2	DIAL, calibrated: with knob; HH brass; 2" OD x ½" ID x 1/32" thk; inscribed 1–7–13–19 DBLR. CHANNEL 1, etched on black background; Comm Meas Lab dwg #P–2–61.	For DBLR. CHANNEL 1 control.	2Z3714–52
N–3	DIAL, calibrated disk: with knob; HH brass; 2" OD x ½" ID x 1/32" thk; inscribed 1–7–13–19 AMPL. CHANNEL 1, etched on black background; Comm Meas Lab dwg #P–2–62.	For AMPL. CHANNEL 1 control.	2Z3714–50
N–4	DIAL, calibrated disk: with knob; HH brass; 2" OD x ½" ID x 1/32" thk; inscribed 0–1–2–3–4–5 ANT. COUPLING, etched on black background; Comm Meas Lab dwg #P 2–63.	For ANT. COUPLING control.	2Z3714–51
F–1, F–2	FUSE, cartridge: 5 amp, 250 v; one time; glass body; ferrule ¼" x ¼" diam; o/a 1¼" x ¼" diam; Littelfuse #3AG.	Protects tube heaters	3Z2605.2
F–3, F–4	FUSE, cartridge: 30 amp, 25 v; one time; glass body; ferrule ¼" x ¼" diam; o/a 1¼" x ¼" diam; Littelfuse #3AG.	Protects dynamotors D–1 and D–2.	3Z2630.9
	GASKET, synthetic rubber: ⅞" OD x 5/32" ID x 1/32" thk; single 5/32" hole; Comm Meas Lab dwg #2–32–49–1.	For dummy plug for J–2	2C6900–87/6
	GASKET, synthetic rubber: 1½" diam x 1/32" thk; two 5/32" holes on ¾" mtg/c; Comm Meas Lab dwg #2–32–49–2.	For dummy plug for P–6	2C6900–87/1
	GASKET, synthetic rubber: 2" OD x 1/32" thk; two 5/32" holes on 1" mtg/c; Comm Meas Lab dwg #2–32–49–3.	For dummy plug for J–1	2C6900–87/2

6. Identification Table of Parts for Radio Transmitter T–87/TRT–1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
----------	GASKET, synthetic rubber: 1″ x 1″ x 1/32″ thk; natural finish; ctr hole 21/32″ diam; 4 #32 drill holes; Comm Meas Lab dwg #2–32–7–3.	For J–2	2C6900–87/5
----------	GASKET, synthetic rubber: 1½″ x 1½″ x 1/32″ thk; natural finish; 1 5/32″ diam ctr hole; 4 #32 drill mtg holes; Comm Meas Lab dwg #2–32–27–1.	For P–6	2C6900–87/4
----------	GASKET, synthetic rubber: 2″ x 2″ x 1/32″ thk; natural finish; 1 21/32″ diam ctr hole; 4 #32 drill mtg holes; Comm Meas Lab dwg #2–32–27–2.	For J–1	2C6900–87/3
E–15	HOLDER: fuse: extractor post; for one Bussman #3AG cartridge fuse 1¼″ x ¼″; bakelite; 2¼″ lg x ¾″ diam o/a; Bussman type HOM.	To hold fuses	3Z3285–3
----------	INSULATOR, bushing: bakelite; fits 7/32″ diam hole; ½″ OD x 1/8″ ID x ⅜″ thk; Creative type #3/P–231.	For insulating mounting	3G1837–12.13
----------	INSULATOR, bushing: bakelite; fits 5/16″ diam hole; ⅝″ OD x 15/64″ ID x ⅜″ thk; Creative #3/P–233.	For insulating mounting	3G1837–12.12
----------	INSULATOR, bushing: bakelite; fits ⅝″ diam hole; ⅞″ OD x ⅜″ ID x ½″ thk; Creative #3/P–292.	For insulating mounting	3G1837–16.18
----------	KNOB, round: fluted; molded black bakelite; 1⅛″ diam; fits ¼″ shaft; 2 #10 set-screws; white pointer; GR #637A.	For PLATE SWITCH	2Z5788–18
----------	LAMP, ballast: 120 v, 3 w; bulb S clear; 1⅞″ lg o/a x ¾″ diam; candelabra screw base; GE #S–6–3w.	Stabilizes audio oscillator V–1	6Z6820–3
----------	LAMPHOLDER: candelabra base; brass; nickel pl; 1 3/16″ h x ½″ wd x ½″ d o/a; Dial Co #608.	Lampholder for I–1	2Z5884–65
M–1	METER, milliammeter: DC; 0-1 ma; round bakelite flush mtg case; 2 11/16″ diam flange; 2 13/64″ diam of body x 15/16″ d; #R25W–001 DC Ma.	Monitoring	3F891–20
----------	MOUNT, vibrator: sq; 25 lb rating; 3″ sq x 1½″ h o/a; Lord #200PH25.	For vibration-free mounting	2Z8502PH25
K–1 through K–5, K–7 through K–12, K–14 through K–19	RELAY, telephone: normally open A1A1; 1¼″ lg x ¾″ wd x 1⅜″ h; Allied Cont type TSL–AA.	Connects frequency determining resistor and tuning capacitors, at different channels, to audio oscillator V–1 and tubes V–5 through V–7.	2Z7588–75
K–6, K–13	RELAY, channel selector: reset; stepper; 10 position; 2 levels; 1½″ wd x 3⅝″ lg x 4½″ h o/a; Auto Elec #RA–71 as per Comm Meas Lab dwg #2–34–11.	Selects audio-frequency channel relays.	2Z7598–49
K–20 through K–25	RELAY, general purpose: DPDT normally open; 1 15/16″ wd x 1 15/16″ lg x ⅞″ thk; Allied Cont #BJC13D33.	Connects trimmer capacitors at different channels, in plate circuit V–7.	2Z7588–74

6. Identification Table of Parts for Radio Transmitter T–87/TRT–1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
K–26	RELAY, heater: SPST, double break, normally open; 3¾″ h x 2½″ wd x 2⅜″ d; Dunco 12 v DC type #62HXX104.	Controls operation of tube heaters.	2Z7585–96
K–27	RELAY, dynamotor: SPST, double break, normally open; 3¾″ h x 2½″ wd x 3¾″ d; Dunco 12 v DC type #61HXX105.	Controls operation of D–1 and D–2.	2Z7585–95
R–1, R–6	RESISTOR, fixed: WW; 521,000 ohms ± ½%; 1 w; 26/32″ lg x ½″ diam; Elco type B.	Forms part of R–C bridge, channel 1, V–1.	3Z6752A1
R–2, R–7	RESISTOR, fixed: WW; 400,000 ohms ± ½%; 1 w; 26/32″ lg x ½″ diam; Elco type B.	Forms part of R–C bridge, channel 2, V–1.	3Z6740–11
R–3, R–8	RESISTOR, fixed: WW; 307,500 ohms ± ½%; 1 w; 26/32″ lg x ½″ diam; Elco type B.	Forms part of R–C bridge, channel 3, V–1.	3Z6730GT
R–4, R–9	RESISTOR, fixed: WW; 235,500 ohms ± ½%; 1 w; 26/32″ lg x ½″ diam; Elco type B.	Forms part of R–C bridge, channel 4, V–1.	3Z6723E5–1
R–5, R–10	RESISTOR, fixed: WW; 180,600 ohms ± ½%; 1 w; 26/32″ lg x ½″ diam; Elco type B.	Forms part of R–C bridge, channel 5, V–1.	3Z6718–18
R–11	RESISTOR, fixed: WW; 5000 ohms ± 10%; 1 w; 1¼″ lg x ¼″ diam; IRC #BW–1.	Negative feedback voltage divider, grid V–1.	3Z6500–120
R–12, R–34	RESISTOR, fixed: carbon; 51,000 ohms ± 5%; 2 w; 1¾″ lg x 5/16″ diam; JAN type RC41BF513J.	R–12: Load, V–1 R–34: Screen, V–5.	3RC41BF513J
R–13	RESISTOR, fixed: carbon; 30,000 ohms ± 5%; 1 w; 1¼″ lg x ¼″ diam; JAN type RC31BF303J; IRC #BT–1.	Load, V–1	3RC31BF303J
R–14	RESISTOR, fixed: carbon; 100,000 ohms ± 5%; 2 w; 1¾″ lg x 5/16″ diam; JAN type RC41BF104J.	Plate voltage divider, V–1	3RC41BF104J
R–15	RESISTOR, fixed: composition; 510,000 ohms ± 5%; 2 w; 1¾″ lg x 5/16″ diam; JAN type RC41BF514J.	Grid, V–2	3RC41BF514J
R–16	RESISTOR, fixed: carbon; 2000 ohms ± 5%; ½ w; ⅝″ lg x 3/16″ diam; JAN type RC21BF202J.	Cathode, V–1	3RC21BF202J
R–17, R–32, R–37	RESISTOR, fixed: carbon; 100,000 ohms ± 5%; ½ w; ⅝″ lg x 3/16″ diam; JAN type RC21BF104J.	R–17: Grid, V–1 R–32: Grid, V–5. R–37: Grid, V–6.	3RC21BF104J
R–18	RESISTOR, fixed: WW; 20 ohms ± 5%; 15 w; 2″ lg x 7/16″ OD x 5/16″ ID; WL type O.	Filament filter	3Z4820–7
R–19	RESISTOR, fixed: metallized fil; 390,000 ohms ± 5%; JAN type RC21BE394J.	Coupling, to grid V–1	3RC21BE394J
R–20	RESISTOR, fixed: carbon; 510 ohms ± 5%; 2 w; 1¾″ lg x 5/16″ diam; JAN type RC41BF511J.	Cathode, V–8	3RC41BF511J
R–21	RESISTOR, fixed: WW; 3750 ohms ± 5%; 50 w; 4½″ lg x ¾″ OD x ½″ ID; IRC #EP.	Screen grid, V–2, voltage divider.	3Z6375–3
R–22	RESISTOR, fixed: WW; 30,000 ohms ± 5%; 20 w; 2″ lg x 7/16″ diam; Ohmite #BD.	Plate, V–2, voltage divider	3Z6630–88

6. Identification Table of Parts for Radio Transmitter T–87/TRT–1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
R–23	RESISTOR, fixed: WW; 15,000 ohms ± 5%; 50 w; 4½" lg x ¾" OD x ½" ID; IRC #EP.	Limiting	3Z6615–79
R–24	RESISTOR, fixed: WW; 40,000 ohms ± 5%; 20 w; 2" lg x 7/16" diam; Ohmite #BD.	Plate, V–1	3Z6640–76
R–25, R–45	RESISTOR, fixed: WW; 5 ohms ± 1%; 2 w; 1¾" lg x 5/16" diam; IRC #BW–2.	Decoupling	3Z5995–52
R–26	RESISTOR, fixed: WW; 150 ohms ± 1%; 2 w; 1¾" lg x 5/16" diam; IRC #BW–2.	Limiting	3Z6015–72
R–27	RESISTOR, fixed: carbon; 1000 ohms ± 10%; ½ w; 5/8" lg x 3/16" diam; JAN type RC21BF102K.	Coupling to screen, V–7	3RC21BF102K
R–29	RESISTOR, fixed: WW; 15 ohms ± 5%; 25 w; 2½" lg x 9/16" OD x 3/8" ID; IRC type DH.	Dropping	3Z6001E5–49
R–30, R–31	RESISTOR, fixed: WW; 25 ohms ± 5%; 35 w; 2" lg x 9/16" OD x 3/8" ID; WL type T.	Dropping	3Z4825.8
R–33, R–38	RESISTOR, fixed: WW; 500 ohms ± 5%; 15 w; 2" lg x 7/16" OD x 5/16" ID; WL type O.	R–33: Cathode, V–5 R–38: Cathode, V–6.	3Z5350–15
R–35	RESISTOR, fixed: WW; 4000 ohms ± 5%; 35 w; 2" lg x 9/16" OD x 3/8" ID; WL type T.	Plate, V–5	3Z5440–16
R–36	RESISTOR, fixed: carbon; 2000 ohms ± 1%; 1 w; 1½" lg x ¼" diam; Concarbon #A–1.	Grid, V–6	3Z6200–151
R–39	RESISTOR, fixed: carbon; 10,000 ohms ± 10%; 2 w; 1¾" lg x 5/16" diam; JAN type RC41BF103K.	Screen, V–6, voltage divider	3RC41BF103K
R–40	RESISTOR, fixed: WW; 2500 ohms ± 5%; 35 w; 2" lg x 9/16" OD x 3/8" ID; WL type T.	Screen, V–6, voltage divider	3Z5425–5
R–41	RESISTOR, fixed: carbon; 100 ohms ± 1%; 1 w; 1½" lg x ¼" diam; Concarbon #A–1.	Input grid circuit, V–7	3Z6010–167
R–42	RESISTOR, fixed: carbon; 200 ohms ± 1%; 1 w; Concarbon #A–1.	Input grid circuit, V–7	3Z6020–117
R–43	RESISTOR, fixed: carbon; 3900 ohms ± 5%; 2 w; 1¾" lg x 5/16" diam; JAN type RC41BF392J.	Input grid circuit, V–7	3RC41BF392J
R–44	RESISTOR, fixed: WW; 10,000 ohms ± 5%; 35 w; 2" lg x 9/16" OD x 3/8" ID; WL type T.	Screen, V–7	3Z5510–4
R–46	RESISTOR, fixed: carbon; 1975 ohms ± 1%; 1 w; 1½" lg x ¼" diam; Concarbon #A–1.	Meter resistor	3Z6197E5
R–47	RESISTOR, fixed: carbon; 28,000 ohms ± 1%; 1 w; 1½" lg x ¼" diam; Concarbon #A–1.	Limiting	3Z6628–3
R–48	RESISTOR, fixed: WW; 50 ohms ± 5%; 35 w; 2" lg x 9/16" OD x 3/8" ID; WL type T.	Cathode, V–7	3Z4850–6

6. Identification Table of Parts for Radio Transmitter T–87/TRT–1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
R–49	RESISTOR, variable: WW; 5000 ohms ± 10%; 2 w; 3 term; body 9/16" x 1¼" diam; shaft 1" lg x ¼" diam; ASA #RA20A1SD502K; IRC W.	Part of R–C bridge, V–1	2Z7280–152
	SCREW, thumb: captive; wingnut head; brass; black nickel finish; ¼"–28; 2" lg o/a x ½" lg thd; Parker-Kalon #P–6785.	To fasten set in cover	6L20504–32BN
	SCREW, thumb: captive; round knurled head; brass; black nickel finish; 12–28 thd; 2" lg o/a x ¼" lg thd; Comm Meas Lab dwg #2–32–4.	Fastens cover on panel	6L4772–32.5BK
	SOCKET, crystal: dual; 4 prong; molded mica filled bakelite; 25/32" lg x 22/32" wd x 23/32" d o/a; Cinch #9800.	For crystals	2Z8678
	SOCKET, tube: wafer; 7 prong; for Tubes JAN–829B; steatite; 2⅝" x 2⅝" x ¼" thk; Johnson #247–N.	For Tubes JAN–829B, V–3 and V–7.	2Z8663–1
	SOCKET, tube: std octal; 8 cont; steatite; 1¼" diam x 51/64" thk o/a; Amphenol #RSS–8M.	For tubes V–1, V–2, V–4, V–5, and V–6.	2Z8678.34
S–1	SWITCH, rotary: 8 poles, 2 positions, and off position; 2 sect; 2¼" x 1¾" x 1½" thk; Mallory #1322L as per Comm Meas Lab dwg #2–33–17.	Transmitter voltage switch	3Z9826–51
S–2, S–3	SWITCH, rotary: 2 poles, 5 positions; one sect; 1 15/16" x 1⅝" thk; Centralab #2505.	For final amplifier	3Z9825–74.16
	TECHNICAL MANUAL: TM 11–269		(Order through AGO channels)
T–1	TRANSFORMER, AF: interstage; pri 6000 ohms, ½ secd 275 ohms impedance; potted in brass case; 2 15/16" h x 3" wd x 2⅜" d o/a; Comm Meas Lab dwg #S–1–37.	A-f, interstage, between V–2 and V–3.	2Z9636.76
T–2	TRANSFORMER, AF: modulation; ½ pri 1425 ohms, secd 2500 ohms impedance; potted in brass case; 4⅜" h x 3⅝" wd x 3¾" d o/a; Comm Meas Lab dwg #S–1–38.	A-f, modulation, for V–3	2Z9634.86
	WRENCH, socket: 7⅛" lg o/a; shank 4" lg x 7/16" diam; round 7/16" opening, six-point; Stevens Walden #3414.	For frequency shifting	6R57413–2
V–1	TUBE, electron: JAN–6SN7GT	Wien Bridge oscillator	2J6SN7–GT
V–2, V–5, V–6.	TUBE, electron: JAN–6L6	V–2: Driver V–5: Crystal oscillator. V–6: Frequency doubler.	2J6L6
V–3, V–7	TUBE, electron: JAN–829B	V–3: Modulator V–7: Final amplifier.	2J829B
V–4	TUBE, regulator: JAN–0D3/VR150	Voltage regulator	2J0D3/VR150

7. Identification Table of Parts for Test Set TS–245/TRT–1

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
----------	TEST SET TS–245/TRT–1	Part of AN/TRT–1	3F4325–245
C–901	CAPACITOR, fixed: oil filled; paper; 500,000 mmf ± 10%; 100 vdcw; 11/16" x 1 5/16" x 1 15/16"; GE type #23F159.	Blocking	3DA500–203
----------	FITTING, tubing: Y-shaped; brass; black nickel pl; for 7/32" ID rubber tubing; 2 1/2" lg x 1 1/4" wd o/a; Pilling #P8114; Sig C dwg #SC–D–15070.	For stethoscope	6R27500/1
J–901	JACK, telephone: Sig C Jack JK–34–A; for 2 cond plug 0.25" diam; 1 5/16" o/a x 3/4" wd x 3/4" h.	Test cable receptacle	2Z5534
----------	KNOB, bar: black bakelite; for 1/4" diam shaft; single #6–32 setscrew; 1 1/4" lg x 3/4" wd x 5/8" h o/a; Mallory #336–1.	For INPUT and FREQ. SELECTOR controls.	2Z5838–3
R–901	RESISTOR, variable (potentiometer): carbon; 1000 ohms ± 20%; 2 w; shaft 3/4" lg x 1/4" OD; 1 1/16" diam x 9/16" thk; AB #J–V1022.	INPUT control	2Z7268.84
R–902	RESISTOR, fixed: WW; 10,000 ohms ± 5%; 20 w; 2" lg x 5/8" diam x 3/8" ID; Haines #NB–D–10,000.	Blocking	3Z6610–83
Y–901	RESONATOR ASSEMBLY, AF: tuning fork and exciter coil; fixed freq; tuning fork 5 1/2" lg x 5/8" wd x 9/32" thk; mtd on block 7/8" x 1" x 5/8" thk and fastened on frame 6" x 1 1/4" x 1/8"; 0–25 v; Comm Meas Lab dwg #2–350–7; Sig C dwg #SC–D–15065.	For production of natural frequency equal to an audio frequency.	3F5876.3
Y–902	RESONATOR ASSEMBLY, AF: tuning fork and exciter coil; fixed freq; tuning fork 5 1/4" lg x 5/8" wd x 9/32" thk; mtd on block 7/8" x 1" x 5/8" thk and fastened on frame 6" x 1 1/4" x 1/8"; 0–25 v; Comm Meas Lab dwg #2–350–8; Sig C dwg #SC–D–15065.	For production of natural frequency equal to an audio frequency.	3F876.1
Y–903	RESONATOR ASSEMBLY, AF: tuning fork and exciter coil; fixed freq; tuning fork 4 3/4" lg x 5/8" wd x 9/32" thk; mtd on block 7/8" x 1" x 5/8" thk and fastened on frame 6" x 1 1/4" x 1/8"; 0–25 v; Comm Meas Lab dwg #2–350–9; Sig C dwg #SC–D–15065.	For production of natural frequency equal to an audio frequency.	3F5876.4
Y–904	RESONATOR ASSEMBLY, AF: tuning fork and exciter coil; fixed freq; tuning fork 4 1/4" lg x 5/8" wd x 9/32" thk; mtd on block 7/8" x 1" x 5/8" thk and fastened on frame 6" x 1 1/4" x 1/8"; 0–25 v; Comm Meas Lab dwg #2–350–10; Sig C dwg #SC–D–15065.	For production of natural frequency equal to an audio frequency.	3F5876.2
Y–905	RESONATOR ASSEMBLY, AF: tuning fork and exciter coil; fixed freq; tuning fork 4" lg x 5/8" wd x 9/32" thk; mtd on block 7/8" x 1" x 5/8" thk and fastened on frame 6" x 1 1/4" x 1/8"; 0–25 v; Comm Meas Lab dwg #2–350–11; Sig C dwg #SC–D–15065.	For production of natural frequency equal to an audio frequency.	3F5876
----------	SCREW, captive: RHMS; black nickel finish; 9/16" lg; thd removed for 3/8" from under head; Comm Meas Lab dwg #2–350–2; Sig C dwg #SC–D–15064–6.	Secures panel to box	6L6832–9.5B

7. Identification Table of Parts for Test Set TS–245/TRT–1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
----------	STETHOSCOPE, binaural: brass, black nickel pl; for 7/32" ID rubber tubing; 7½" lg o/a; Pilling #P–8128; Sig C #SC–D–15070.	For detection of natural frequencies of tuning forks.	6R27500
S–901------	SWITCH, rotary: single circuit, 5 positions; single sect; bakelite body; 1¼" diam x 3¼" lg x ⅛" thk; Mallory type #3215J modified per Comm Meas Lab dwg #2–350–3.	FREQ. SELECTOR------	3Z9825–55.6
----------	TUBING, rubber: buna S; 11/32" OD x 7/32" ID; plain ends; durometer hardness 30; Comm Meas Lab dwg #2–350–14; Sig C dwg #SC–D–15070.	For stethoscope----------	6Z6017–19

8. Identification Table of Parts for Test Set TS–261/TRR–2

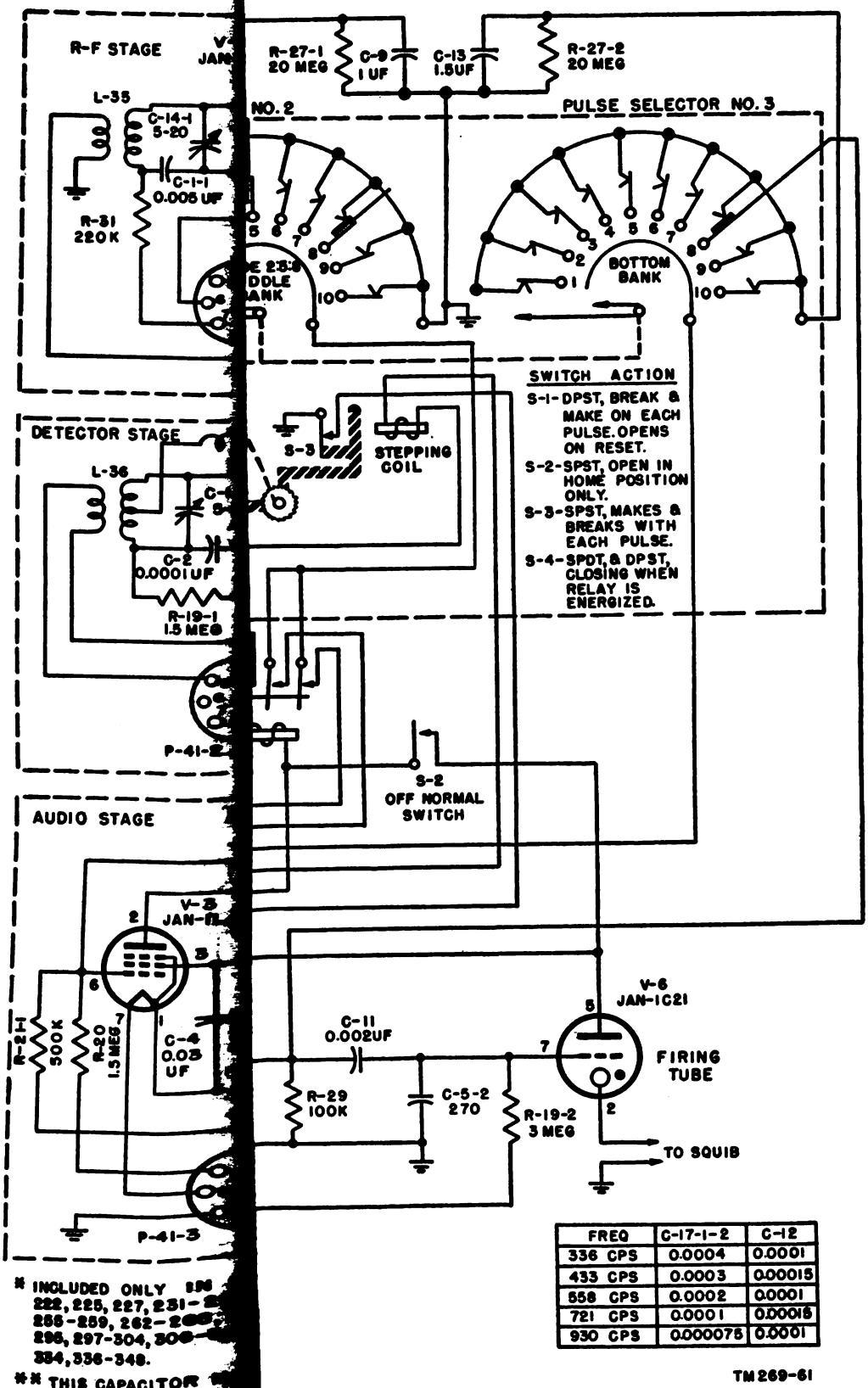
Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
----------	CLIP, alligator: copper; 2" lg x ¼" wd x ⅜" h o/a; Mueller Elec type #60C.	Connector to firing cord------	3Z1087–1
----------	COVER: switch; rubber; black; ¾" h x ½" diam x 1/16" thk.	Cover for switch----------	3Z9692–33941
L–601------	LAMP: incandescent; Sig C Lamp LM–52; 6–8 v; 0.15 amp; bulb T–3¼ clear; Mazda #47.	Test lamp----------	2Z5952
----------	LAMPHOLDER ASSEMBLY: brass; black nickel finish; 1⅞" lg x 1" diam o/a; ½" milk white faceted jewel; Dialco type #857BF.	Holds test lamp----------	2Z5991–20
R–601------	RESISTOR, fixed: WW; 250 ohms ± 5%; 8 w; JAN type RW31F251.	Limiting----------	3RW20715
S–601------	SWITCH: push button; momentary cont; DPST; normally closed; 1⅜" h x 1⅝" wd x ½" thk; AH&H #3392.	Checks receiver operation----	3Z9692–3392
----------	TECHNICAL MANUAL: TM 11–269----------	----------	(Order through AGO channels

9. Identification Table of Parts for Dummy Load TS–292/TRT–1

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
J–701------	CONNECTOR, female contact: Sig C Socket SO–239; 1 round cont; straight type; 1 1/16" lg x ⅝" diam x 1" sq flange; Amphenol #83–IR.	Input for Cord CG–260/TRT–1.	2Z8799–239
----------	GASKET: neoprene; ½" OD x ¼" ID x 1/32" thk; natural finish; Comm Meas Lab dwg #2–311–10.	For insulator----------	6L54004–7
----------	INSULATOR: bushing; conical; white steatite; male and female sect; 23/32" lg x 31/64" OD in ctr x 23/64" OD at ends; Millen type #32102.	For meter housing----------	3G112–46

9. Identification Table of Parts for Dummy Load TS–292/TRT–1 (continued)

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
M–701	METER: ammeter; RF; 0–1 amp; round bakelite flush mtg case; 2⅝″ diam flange x 2⅛″ diam body x 1½″ d; MR25W001RFAA.	R-f thermocouple ammeter, tuning indication.	3F1001–33
R–701	RESISTOR, fixed: WW; 73 ohms ± 5%; 100 w; in glass bulb 3⅛″ diam x 4 15/16″ h o/a; Ohmite type #D–100–73.	Dummy load, non-inductive	3Z6007C3.1
	SOCKET, tube: 4 prongs; steatite; 1¼″ diam x 13/16″ d o/a; Amphenol type #SS–4M.	For placement of R–701	2Z8674.22
	TECHNICAL MANUAL: TM 11–269		(Order through AGO channels)
	WINDOW: glass; clear; 1/16″ thk x 2″ diam; Comm Meas Lab #2–311–7 (meter).	For meter	2ZA1352–35



FREQ	C-17-1-2	C-12
336 CPS	0.0004	0.0001
433 CPS	0.0003	0.00015
558 CPS	0.0002	0.0001
721 CPS	0.0001	0.00015
930 CPS	0.000075	0.0001

* INCLUDED ONLY [illegible]
222, 225, 227, 231-[illegible]
255-259, 262-[illegible]
296, 297-304, 306-[illegible]
334, 336-348.

** THIS CAPACITOR [illegible]

TM 269-61

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