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Page 41 — Paragraph 21

The correct nomenclature and stock number for the Control Box are as follows:

Item and Description:

Control Box C-98/GR (component)

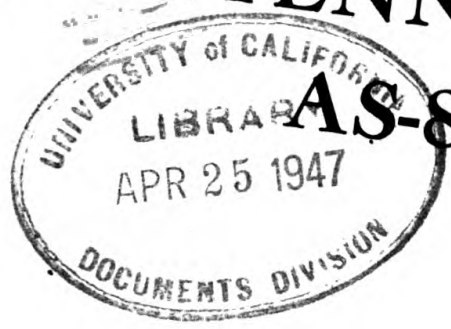
Stock number: 2C666-98

TM 11-2608

WAR DEPARTMENT TECHNICAL MANUAL

U.S. Dept. of Army
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ANTENNA SYSTEM



AS-81/GR

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WAR DEPARTMENT

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WAR DEPARTMENT,
WASHINGTON, D. C., 5 May, 1944.

TM 11-2608, War Department Technical Manual, Antenna System AS-81/GR, is published for the information and guidance of all concerned.

[A.G. 300.7 (19 Feb 1944).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION:

IC & H (5).
(For explanation of symbols see FM 21-6.)

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DESTRUCTION NOTICE

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

WHEN—When ordered by your commander.

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

2. Cut—Use axes, handaxes, machetes.

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

4. Explosives—Use firearms, grenades, TNT.

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

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT—7. Smash—Loops, tubes, vibrators, capacitors, panels, and chest.

2. Cut—Cords and wiring.

3. Burn—Cords, wiring, capacitors, chests, and manuals.

4. Bend and/or break—Loop, sensing antenna, panel, and chest.

5. Bury or scatter—All remaining parts.

DESTROY EVERYTHING

RESTRICTED

SECTION I DESCRIPTION

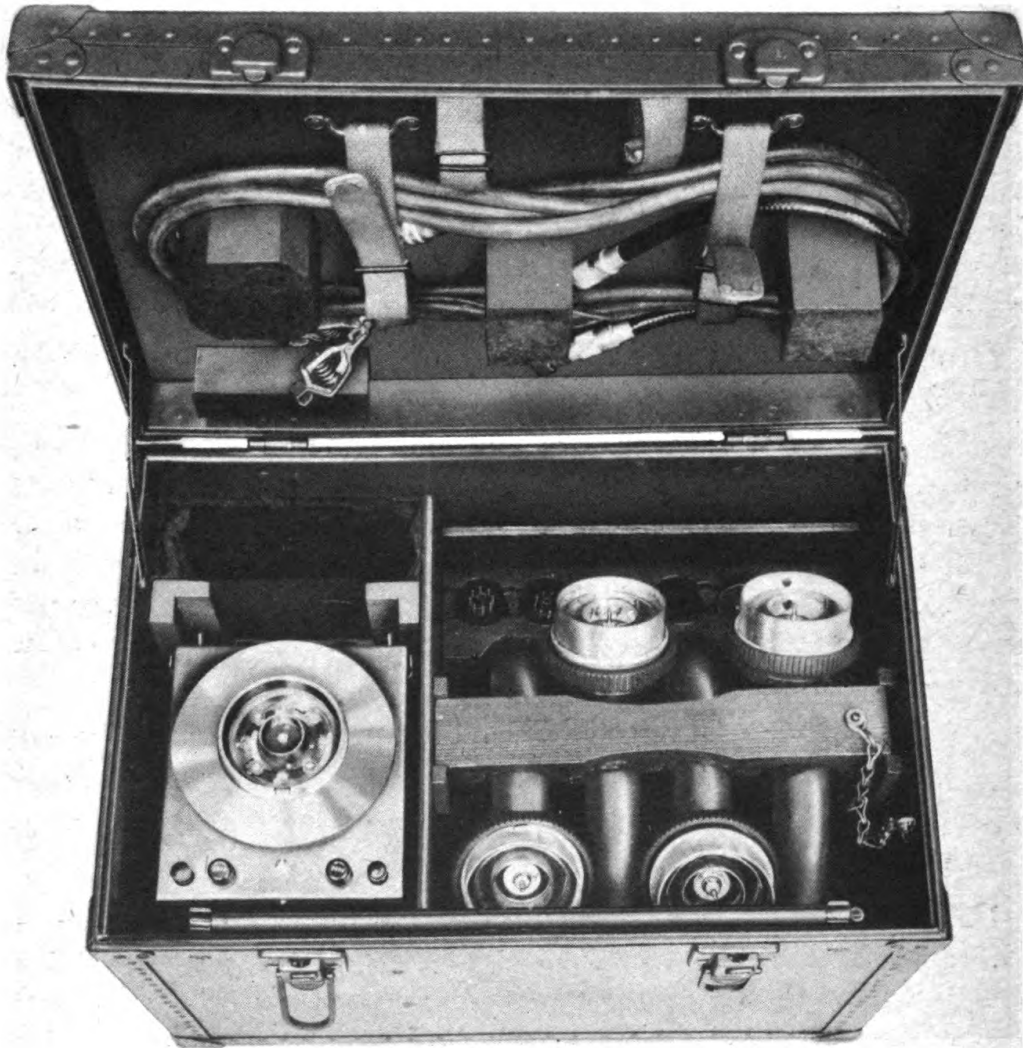
1. GENERAL.

a. Antenna System AS-81/GR is a one-tube directional antenna system designed as an addition to communication receivers. This system permits the operator to make use of unidirectional reception. Antijamming is the function of the equipment. By proper use, the pick-up of any signal can be reduced greatly or completely. Satisfactory performance of Antenna System AS-81/GR depends on the skill of the operator in adjusting it. Effective operation of the system will provide satisfactory communication and will eliminate the possibility of complete jamming by enemy or friendly stations operating on the same frequency.

b. By the use of four loops, Antenna System AS-81/GR can cover a frequency range of 1.1 to 16 megacycles. The number of loops supplied with the system depends upon the radio receiver with which Antenna System AS-81/GR is to be used. These loops are identical in physical appearance, but differ in the number of turns in each loop and in frequency range, denoted by a nameplate and color band.

c. Component parts supplied as Antenna System AS-81/GR vary depending on the radio set with which it is to be used. These sets of components vary in the number of loops and the cords supplied.

2. POWER SUPPLY. The power for operating this equipment is obtained in all cases from a 12-volt storage battery. Since the power consumption is low, Antenna System AS-81/GR can be left in the operating position during stand-by periods. A vibrator within the unit supplies about 225 volts direct current for the plate of the vacuum tube.

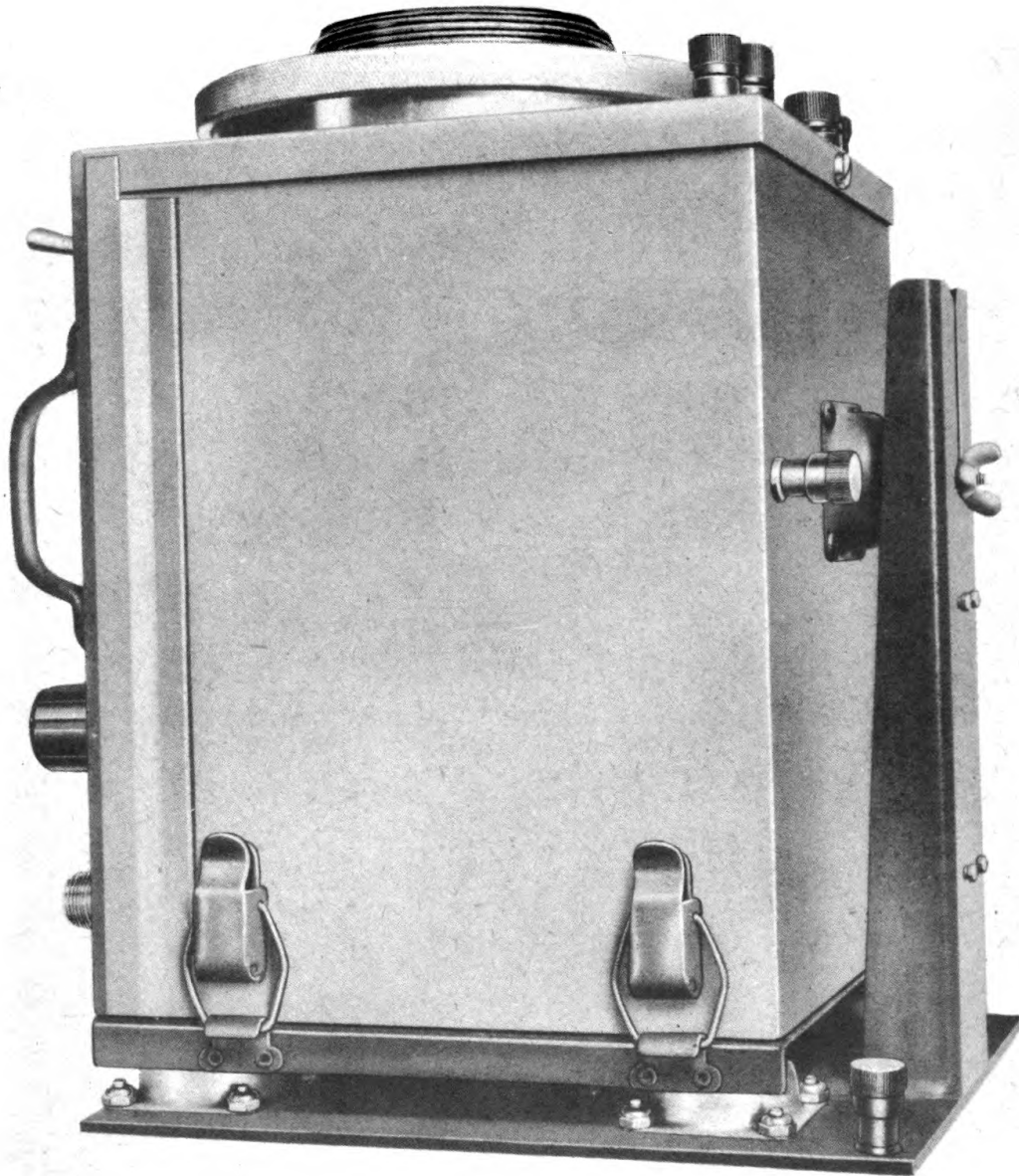


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Figure 2. Case CY-48/GR, open.

DESCRIPTION

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Pars. 1-2



TL 12322

Figure 3. Control Box C-98/GR, side view.

3. COMPONENTS OF ANTENNA SYSTEM AS-81/GR.

Quan.	Name of part	Dimensions (in.)			Weight (lb.)	Used with Radio Sets				
		Height	Width	Length		SCR-				
						193	284	399	506	543
1	Antenna AN-45-G			16 Collapsed	¾	*	*	*	*	*
1	Antenna Mounting AB-9/GR.	8½	7	8¾	4¼	*	*	*	*	*
1	Case CY-48/GR.	15½	14	20½	26¼	*	*	*	*	*
1	Cord CG-52/GR.			96	¾	*		*		
1	Cord CG-57/GR.			48	¾		*		*	*
1	Cord CX-105/GR			120	1	*	*	*	*	*
1	Loop AT-27/GR.				3¼	*		*	*	*
1	Loop AT-28/GR.				3¼	*	*	*	*	*
1	Loop AT-29/GR.				3¼		*	*		
1	Loop AT-30/GR.				3¼			*		
2	Technical Manual TM 11-2608, Antenna System AS-81/GR.					*	*	*	*	*
1	Control Box C-98/GR with the following components:	10½	7½	9½	18¾	*	*	*	*	*
3	Fuse Littelfuse 3AG: 1 in use; 2 spares in holder.									
4	Lamp GE 53: 2 in use; 2 spares.									
2	Tube JAN 12J5GT: 1 in use; 1 spare.									
3	Vibrator: 1 in use; 2 spares.				¼					
2	Spring & Contact Assembly: 1 set in use; 1 set spare.									

*Order components by stock number. Stock numbers will be found in paragraph 21.

4. DESCRIPTION OF MAIN COMPONENTS (figs. 1 and 2).

a. Antenna System AS-81/GR is housed in a metal, splashproof case. The front and top panel of the case are connected, and can be separated as a unit from the remainder of the case. The components of the electrical circuit are secured to this unit so that its removal from the case immediately exposes the electrical circuits for inspection and repair.

b. Controls on the front panel are:

- (1) PILOT ON-OFF
- (2) POWER ON-OFF
- (3) BALANCE
- (4) ANT SW
- (5) TUNING

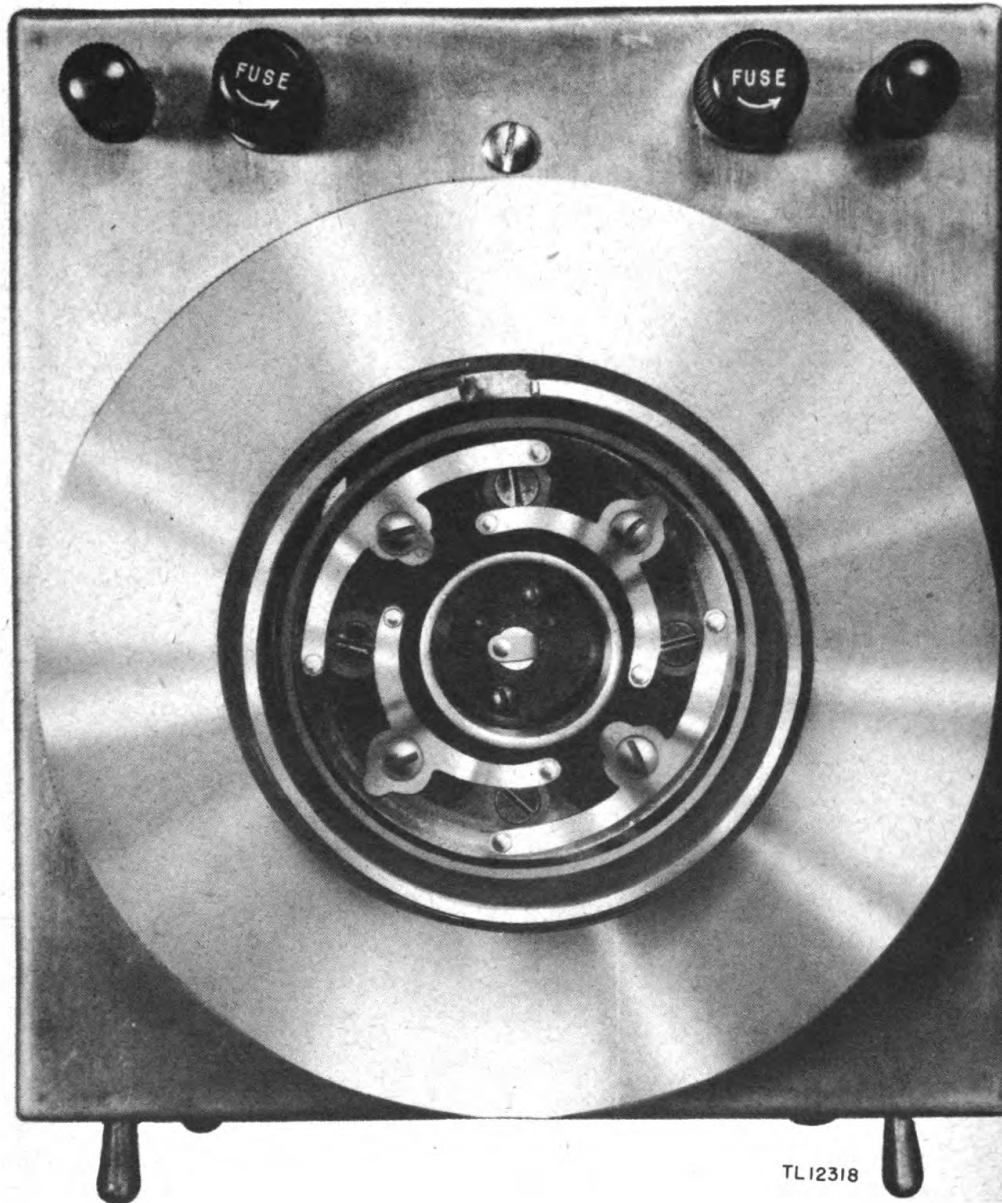
The loop is a manually-operated control which is secured to the top panel by a collar.

c. Loops AT-27/GR, AT-28/GR, AT-29/GR, and AT-30/GR are wire-wound. The wire is wound on a molded polystyrene form which is encased in a molded polystyrene shell. The joints and crevices are sealed for moistureproofing. The loop is silver plated to provide electrostatic shielding. A small gap is provided in the silver plating on each side of the loop so that there will not be a continuous electrical path in the shield. The ends of the loop winding are connected to the two inner rings in the base of the loop. These loops all have the same physical appearance and can be identified by a color band around the top as well as the nameplate on the loop housing. The color band corresponds to the colored scale on the tuning dial of the antenna system. The loops can be tuned to the frequency ranges indicated in the following table:

<i>Loop</i>	<i>Color</i>	<i>Turns</i>	<i>Frequency range</i>
AT-27/GR	White	16	1.1— 2.1 mc
AT-28/GR	Red	8	2.1— 4.2 mc
AT-29/GR	Blue	4	4.2— 8.5 mc
AT-30/GR	Yellow	2	8.0—16.0 mc

d. Vertical Antenna AN-45-G, when used, is mounted on a threaded stud which is on the insulating collar at the top center of the loop.

e. Case CY-48/GR is partitioned to house the components for any Antenna System AS-81/GR. The case is constructed of plywood, covered with fiber, and has reinforced corners and edges.



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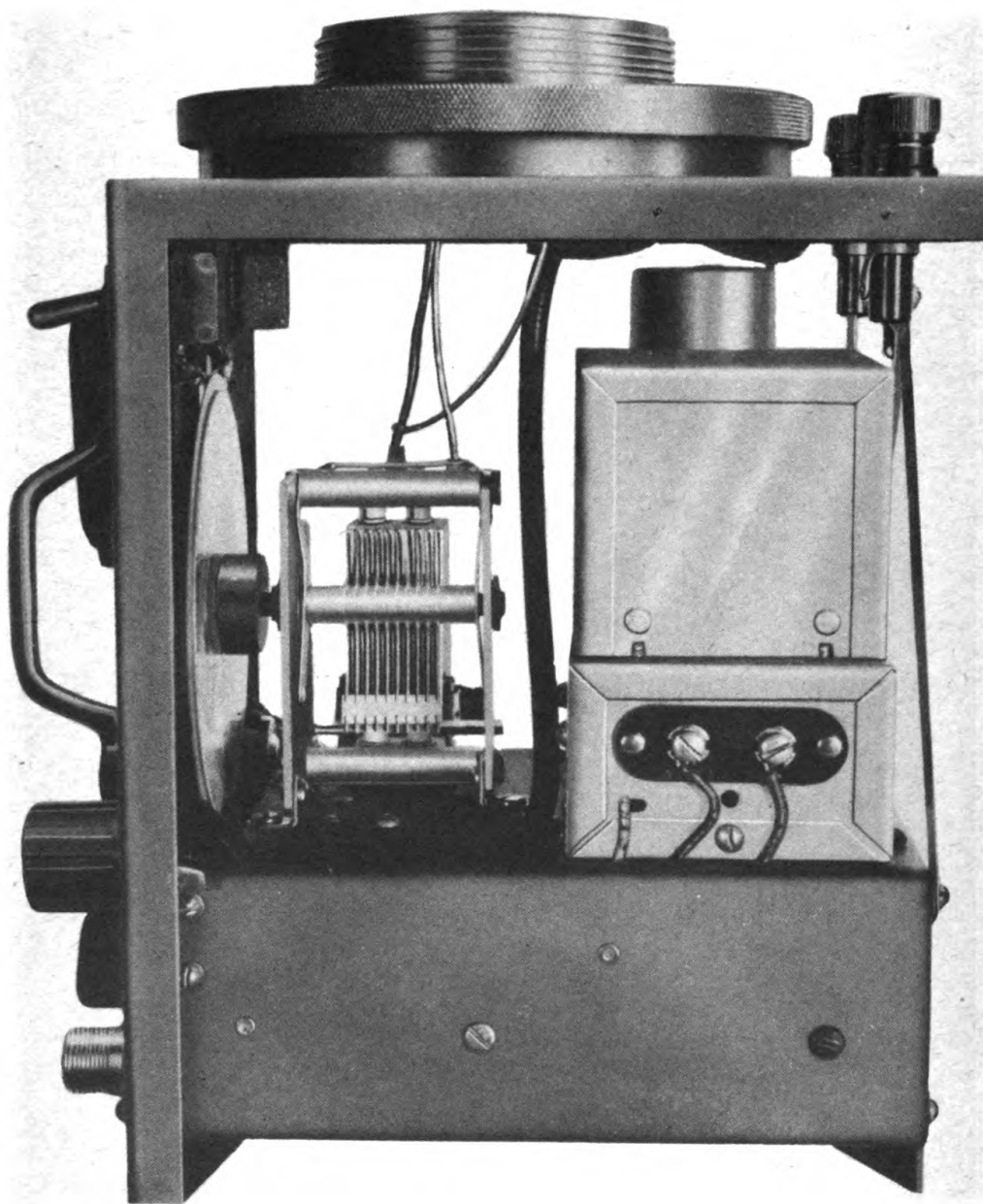
Figure 4. Control Box C-98/GR, top view

f. Power Cord CX-105/GR is a 2-wire cord, one end of which terminates in Plug AN-3106-14S-9S. The other end terminates in lugs which are designed to be inserted under the bolts of the 12-volt terminals in any convenient junction box.

g. Cord CG-52/GR, is an 8-foot coaxial cord, the outer conductor of which serves as a shield. This cord connects the output of the antenna system to the antenna terminal of the radio receiver. It is terminated at one end by a nut and ferrule assembly for connecting with the antenna terminal connector on Radio Receiver BC-312-(&), and at the other end by an SO239 connector plug for connecting with the receptacle on Control Box C-98/GR.

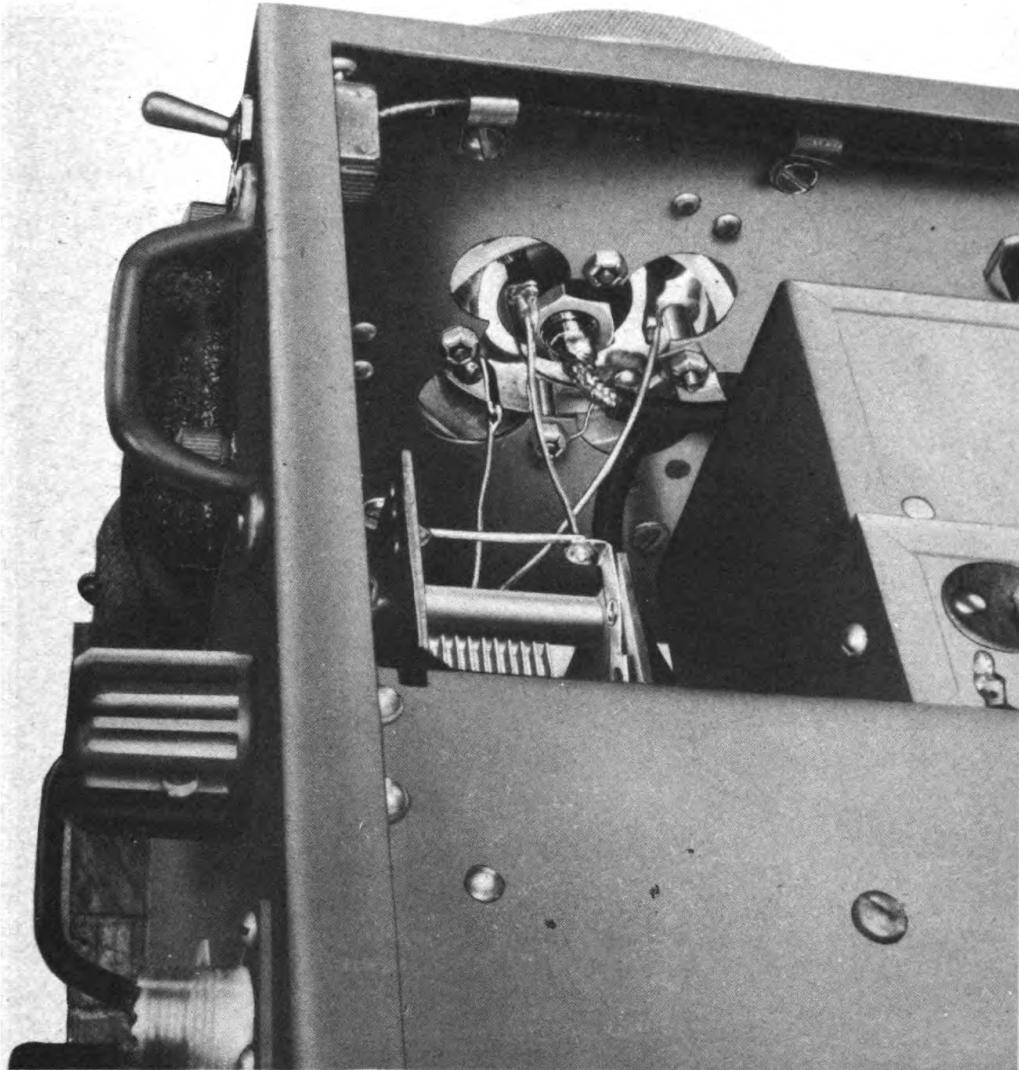
h. The Cord CG-57/GR is 4 feet long and is similar in function to Cord CG-52/GR, but is terminated with tinned leads instead of the nut and ferrule assembly.

NOTE: The symbol (&) as used throughout this manual refers to all models of the equipment.



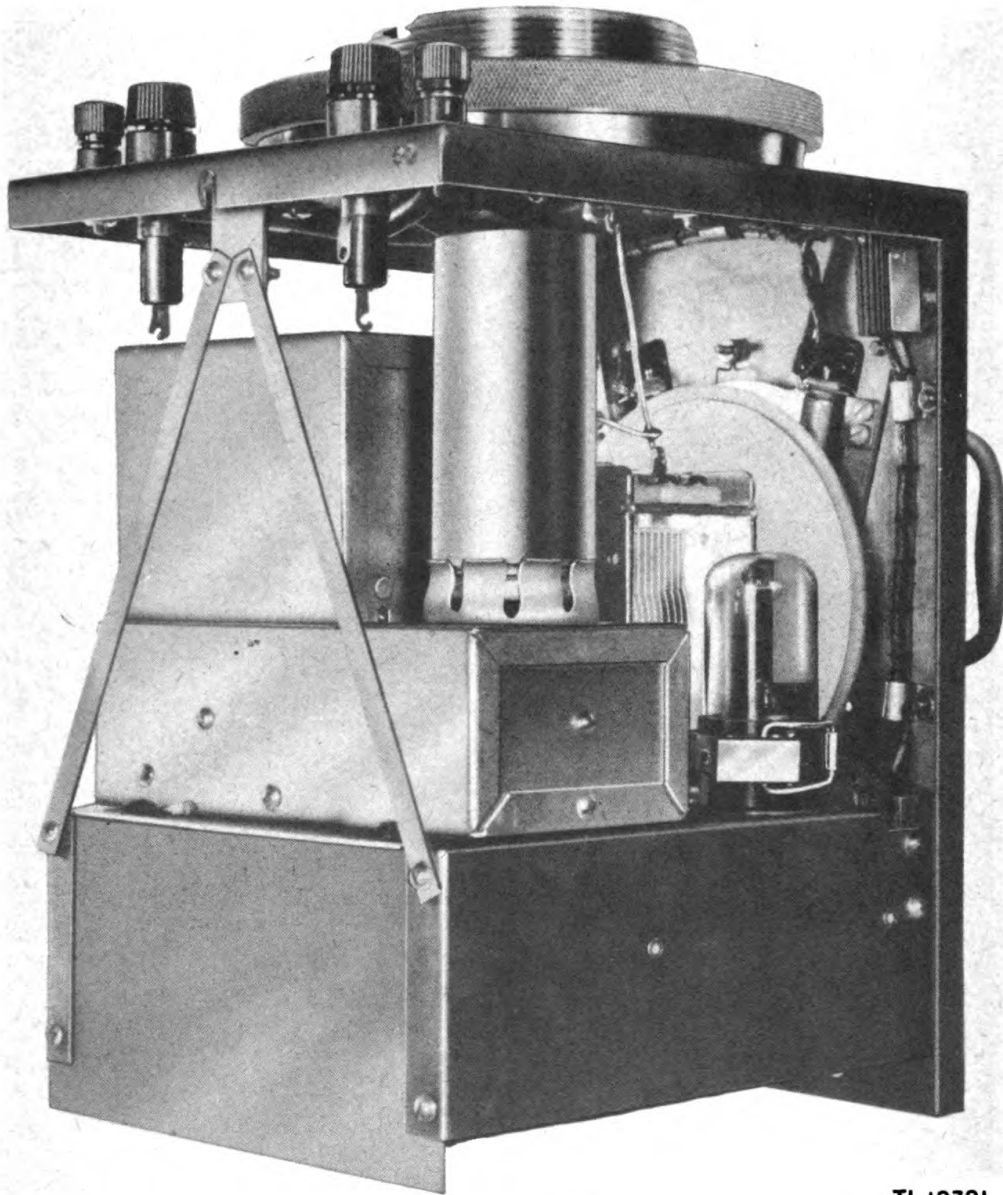
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Figure 5. Antenna System AS-81/GR, right side, case removed.



TL 12323

Figure 6. Antenna System AS-81/GR, loop connections.



TL 12321

Figure 7. Antenna System AS-81/GR, left rear view of chassis.

SECTION II

INSTALLATION AND OPERATION

5. INITIAL PROCEDURE.

a. Unpack Antenna System AS-81/GR being careful to prevent loss or damage. Inspect the unit for any damage that may have occurred during shipment. Be sure that the correct quantities of each part have been received. Components issued depend on the radio set with which the antenna system is to be used.

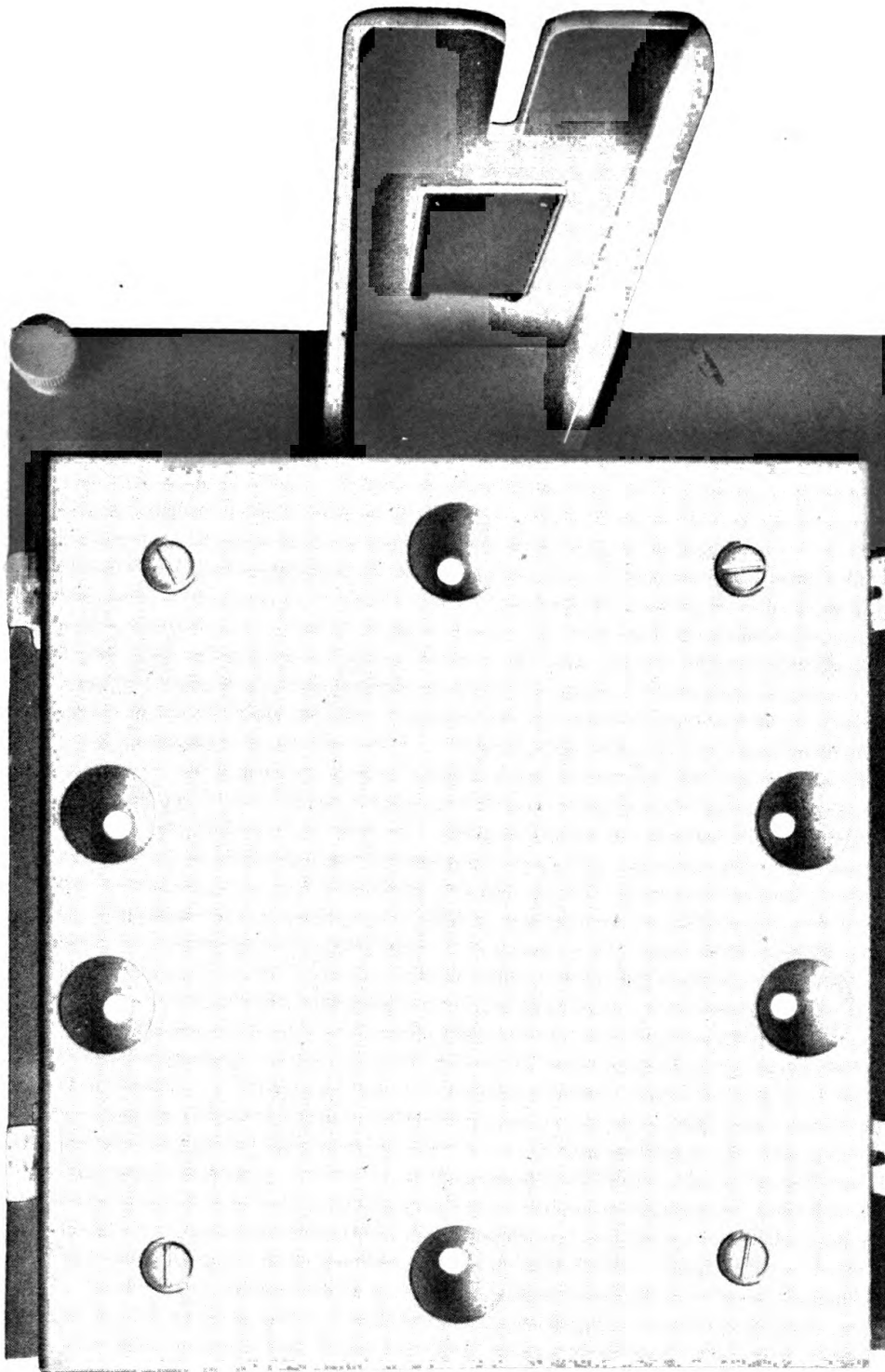
b. Instructions in this manual cover the installation of Antenna System AS-81/GR with Radio Sets SCR-284-(&), SCR-193-(&), SCR-506-(&), SCR-543-(&), and SCR-399-(&). Antenna System AS-81/GR can be used, however, with other AM radio sets. Personnel installing the Antenna System AS-81/GR must familiarize themselves with the installation procedures for all radio sets covered in this manual, in the event that they are called upon to make an installation not specifically covered in this manual.

c. Antenna System AS-81/GR can be secured to the top of the mounting case of the radio set, or to any other convenient flat surface near the radio or radio shelter. In mounting the equipment, observe the following:

CAUTION: The loop should be higher than, and mounted as far away as possible from any nearby large metallic object.

6. MOUNTING THE EQUIPMENT.

a. Before mounting the equipment on any surface, separate Antenna Mounting AB-9/GR from Control Box C-98/GR by un-snapping the trunk fasteners and releasing wingnut. Place the antenna mounting on the case of the radio receiver or another flat surface. Locate, and mark the position of the holes to be drilled with a sharp pointed instrument inserted through the openings on the antenna mounting. Drill these holes where indicated, taking care to remove any equipment under the holes. Secure the mounting with suitable bolts and replace the control box on the mounting.



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Figure 8. Antenna Mounting AB-9/GR.

b. Secure Control Box C-98/GR to Mounting AB-9/GR with the four trunk fasteners located on the sides of the mounting, and with the wingnut located at the back of the control box.

7. INSTALLATION WITH RADIO SET SCR-284-(&) (figs. 9, 10, and 11).

a. In Radio Set SCR-284-(&), a relay automatically connects the antenna to the receiver when the transmitter is not in operation. To operate Antenna System AS-81/GR, the antenna must be fed through Control Box C-98/GR before it is fed into the receiver. Therefore the connection going from the relay to the receiver must be broken and Antenna System AS-81/GR inserted electrically in the break. Figure 10 illustrates the changes to be made in the antenna relay of Radio Set SCR-284-(&) for installing the antenna system. Consult the diagram and the photograph in figures 10 and 11 and proceed as follows:

(1) Remove the chassis of Radio Set SCR-284 from its case, drill a $\frac{3}{8}$ -inch hole directly behind the relay in the case, and insert a grommet.

(2) Locate the jumper lead, marked A in figure 11, which extends across the two upper contact lugs of the relay. Disconnect the left side of this jumper lead from the left contact lug. Unsolder the jumper lead at point marked B in figure 11.

NOTE: Be sure the lead is not grounded when performing the following soldering operation.

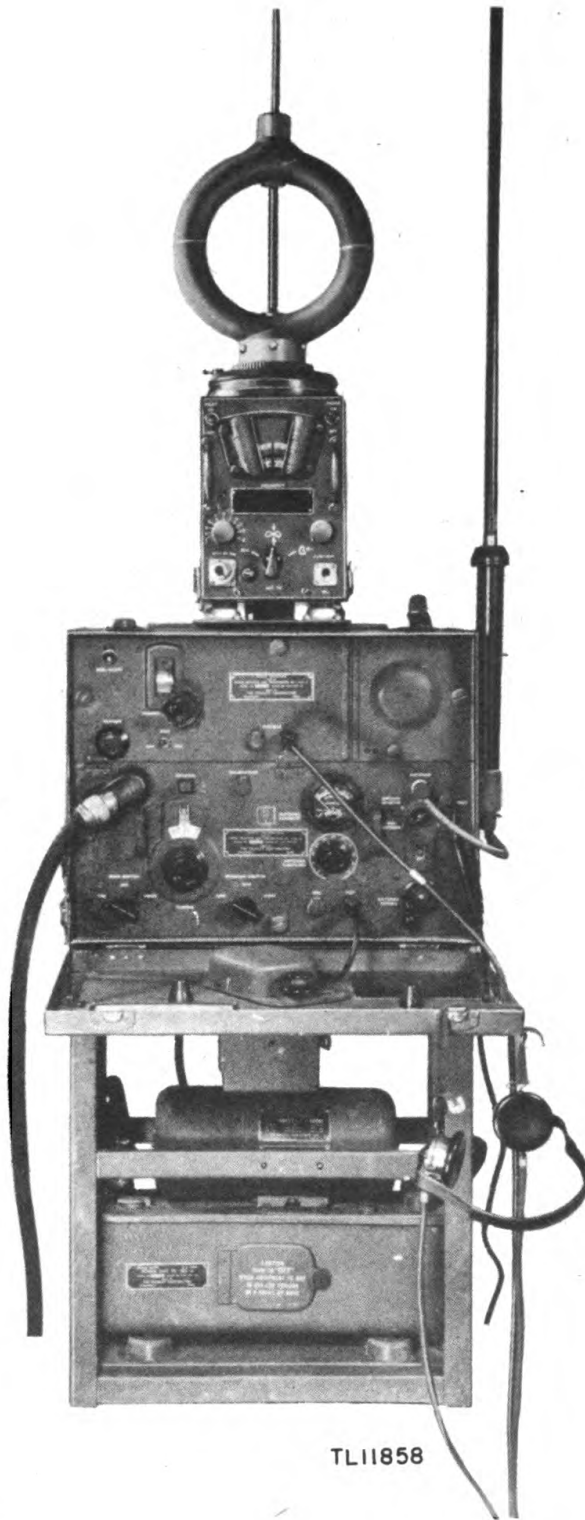
(3) Solder an insulated wire to the other side of the jumper lead at the point marked C in figure 11, and pass the wire through the $\frac{3}{8}$ -inch hole to the AS-81/GR terminal marked AUX VERT ANT. This wire should be of sufficient length to allow the chassis to be taken out of the case.

(4) Connect terminal end of Cord CG-57/GR to the REC ANT terminal on Control Box C-98/GR. Pass the other end, which is without a connector, through the $\frac{3}{8}$ -inch hole and solder the spade lugs to the tinned leads. Attach the lug of the center conductor under the screwhead marked D in figure 11, and the lug on the outer conductor or shield under the screwhead marked E in figure 11.

(5) Connect Power Cord CX-105/GR. Be sure to observe the polarity of the leads. These leads are appropriately marked for proper connection to the battery.

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ANTENNA SYSTEM AS-81/GR



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Figure 9. Antenna System AS-81/GR, mounted on Radio Set SCR-284-(&).

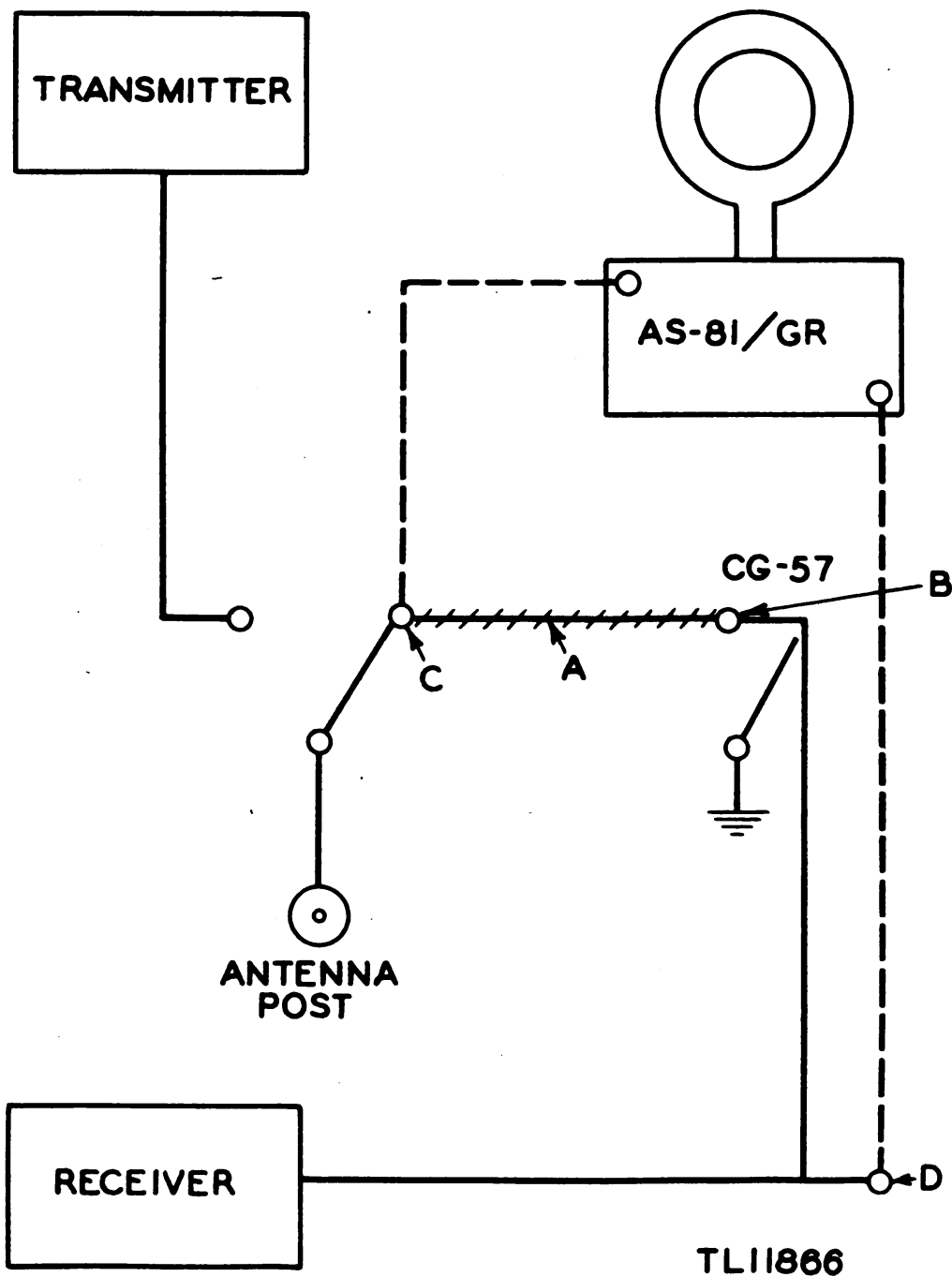


Figure 10. Antenna connections for Radio Set SCR-284-(&).

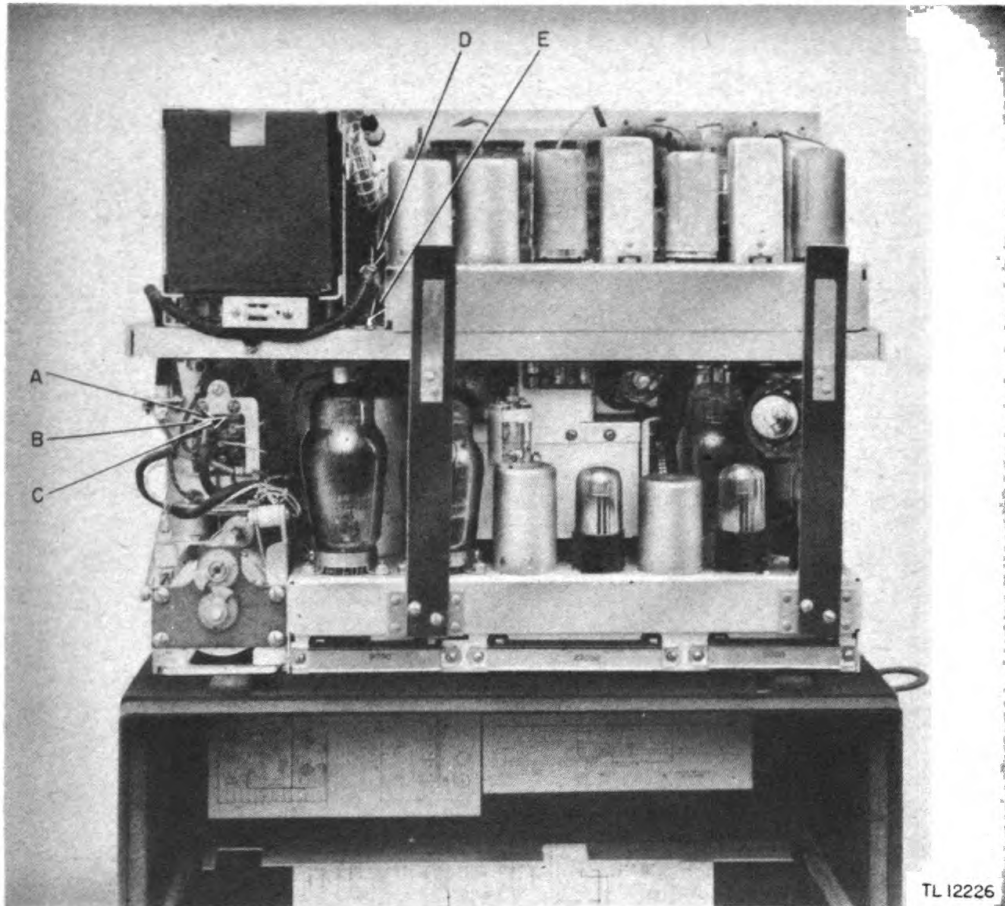


Figure 11. Chassis of Radio Set SCR-284-(&), removed from case.

b. If Antenna AN-45-G is to be used with Antenna System AS-81/GR instead of with the antenna of the radio set, proceed as directed in subparagraph *a*(1), (2), (4), and (5) above. Be sure to omit the wire connection between terminal C and the AUX VERT ANT as described in subparagraph *a*(3) above. Extend Antenna AN-45-G to its full length, and screw it on the stud at the top of the loop.

8. INSTALLATION WITH RADIO SET SCR-193-(&) (fig. 13).

a. When Radio Set SCR-193-(&) is completely set up for operation, disconnect the antenna lead from the antenna input (SIG ANT) of Radio Receiver BC-312-(&).

b. Connect the antenna lead to the binding post marked AUX VERT ANT on Control Box C-98/GR.

c. Connect one end of Cord CG-52/GR to the antenna SIG ANT input of the receiver, and the other end to the terminal marked REC ANT of the Control Box C-98/GR.

d. Connect Battery Cable CX-105/GR and be careful to observe polarity of the leads. These leads are appropriately marked for proper connection to the battery.

e. When the transmitter is not in use, or if for any reason it is desired to use Antenna AN-45-G with Antenna System AS-81/GR, follow the procedure described in subparagraphs *a*, *c*, and *d* above. Extend Antenna AN-45-G to its full length, and screw it on the stud at the top of the loop.

9. INSTALLATION WITH RADIO SET SCR-506-(&) (figs. 14 and 15).

a. Remove the top of Radio Set SCR-506-(&) to expose the keying relay. Unsolder and draw away the wire connected to the terminal marked A on figure 15.

b. Drill a small hole, large enough for an insulated wire, in the top of Radio Set SCR-506-(&) just above the relay.

c. Solder a length of insulated wire to the terminal marked A. Pass this wire through the hole drilled in the top of the set to the AUX VERT ANT terminal of Control Box C-98/GR.

d. Connect one end of Cord CG-57/GR to the REC ANT terminal of the Control Box C-98/GR. Connect the center conductor of the other end of the cord to the input binding post, marked A,

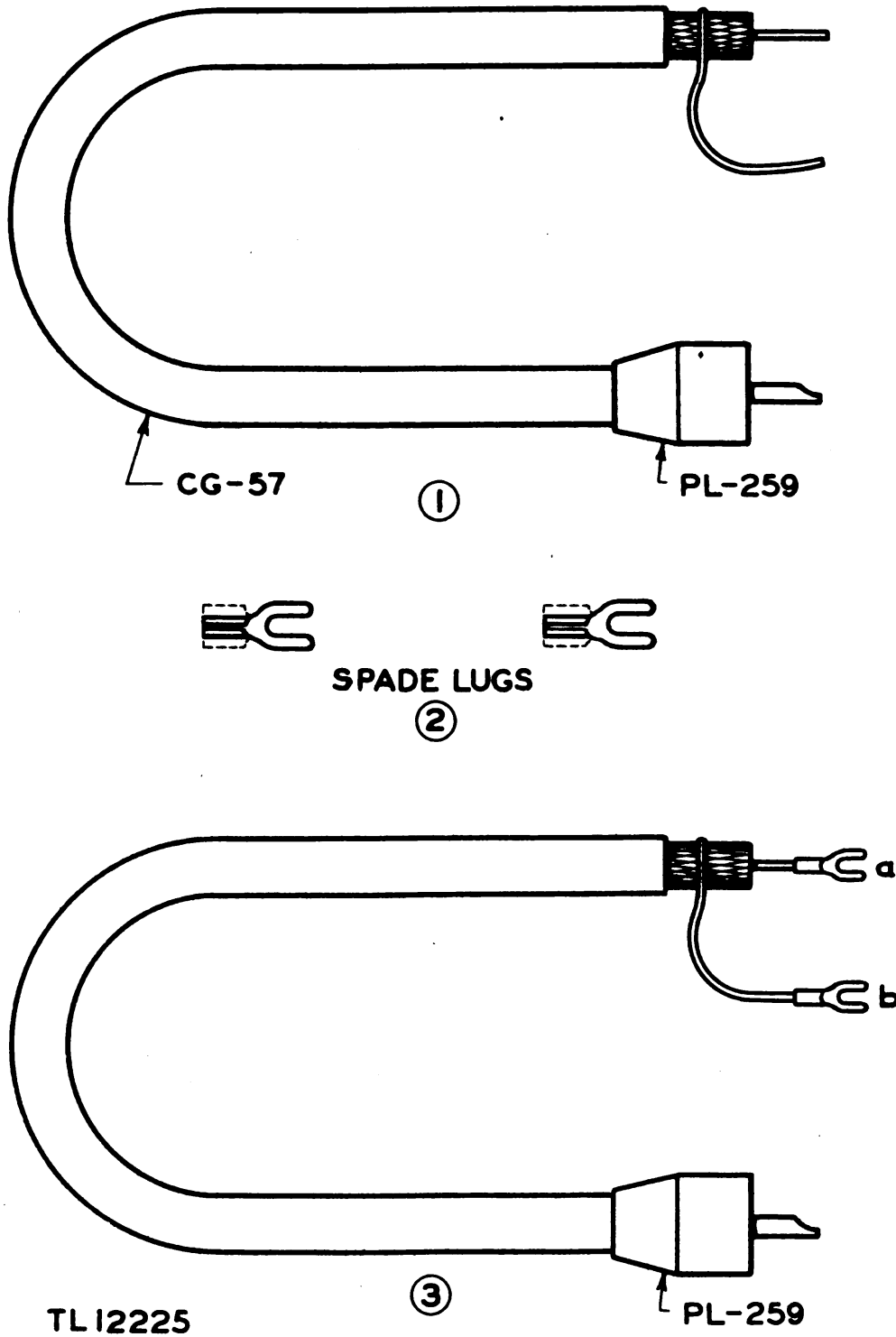


Figure 12. Cord terminals.

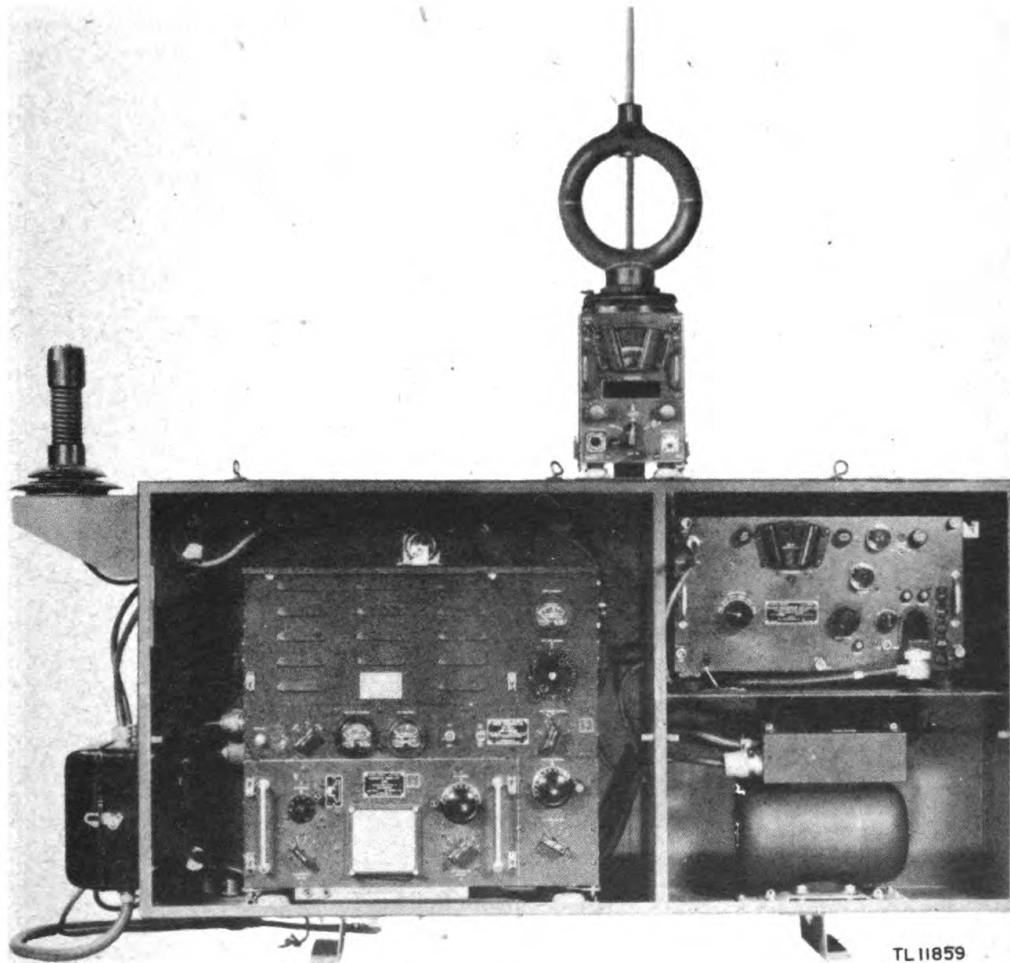
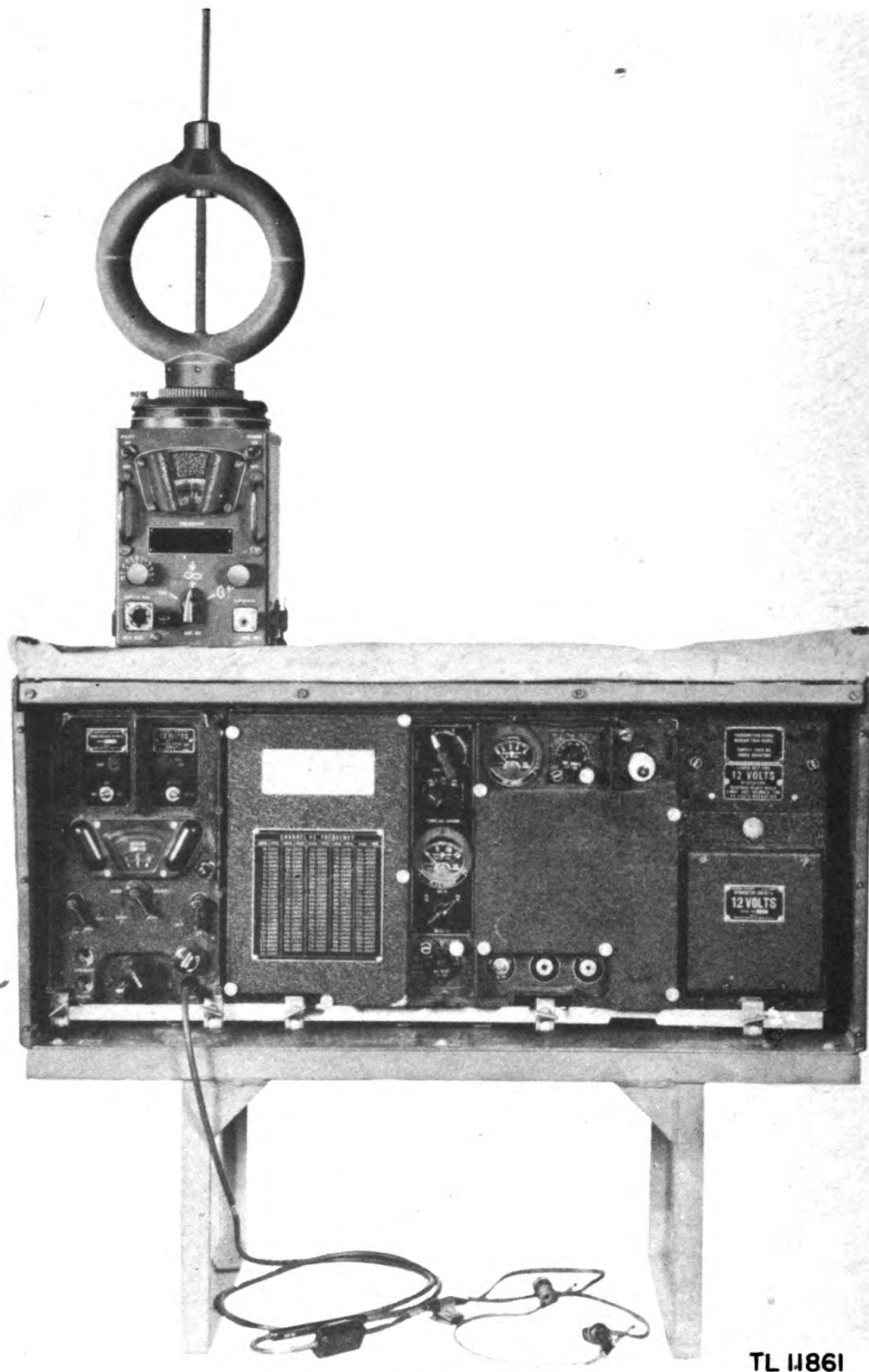


Figure 13. Antenna System AS-81/GR, mounted on Radio Set SCR-193-(&).



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Figure 14. Antenna System AS-81/GR, mounted on Radio Set SCR-506-(&).

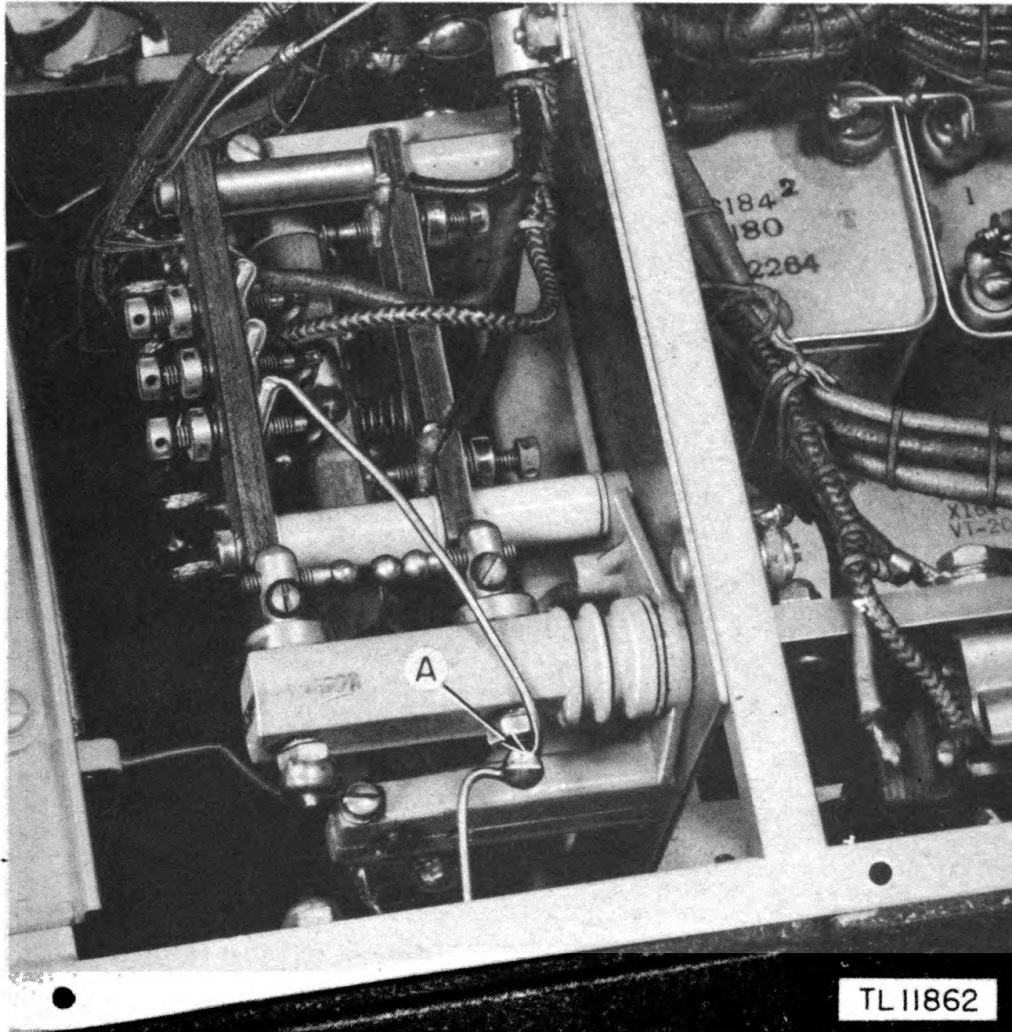


Figure 15. Radio Set SCR-506-(&), antenna relay.

of Radio Receiver BC-652, and ground the outer conductor at any convenient screwhead.

e. Connect battery Cord CX-105/GR, being careful to observe polarity of the leads. These leads are approximately marked for proper connection to the battery.

f. To use Antenna AN-45-G, omit the operation described in subparagraph *c*, above, extend Antenna AN-45-G to its full length, and screw it on the stud at the top of the loop.

10. INSTALLATION WITH RADIO SET SCR-543-($\&$) (figs. 16, 17, and 18).

a. In Radio Set SCR-543-($\&$), a relay automatically connects the antenna to the receiver when the transmitter is not in operation. When using Antenna System AS-81/GR, the antenna must be fed through Control Box C-98/GR before it is fed to the receiver. Therefore the connection going from the relay to the receiver must be broken and the Antenna System AS-81/GR inserted into the break. Figure 17 illustrates the changes to be made in the antenna relay when installing the antenna system. Consult the diagram and photograph, figures 17 and 18, and proceed as follows:

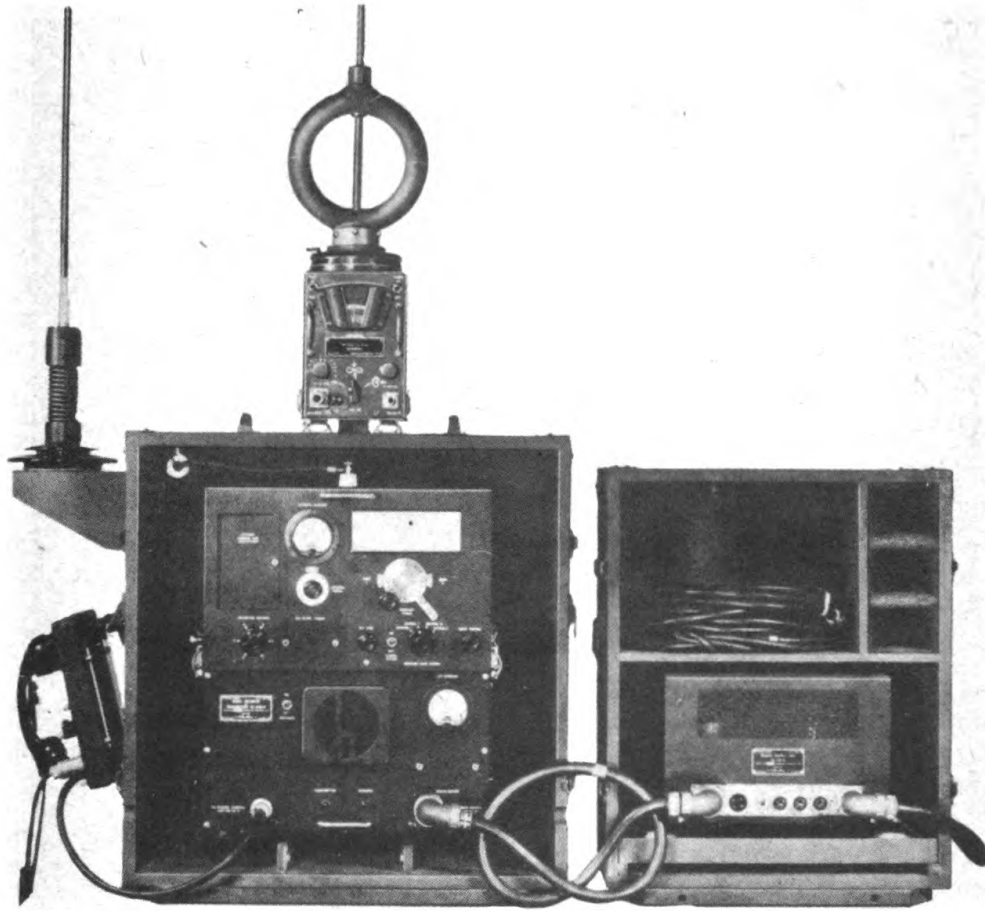
(1) Remove the receiver-antenna lead at the terminal point marked A on the diagram and photograph, figures 17, 18. Do not remove resistor R_{33} .

(2) Solder a length of wire to the terminal marked A. Pass this wire through the hole drilled in the top of the set to the AUX VERT ANT terminal of Control Box C-98/GR.

(3) Solder the center conductor of Cord CG-57/GR to the receiver lead removed from the relay. Dress and tape the splice. Ground the outer conductor or shield to the grounded end of resistor R_{33} . Connect the terminal end of the cord to the REC ANT terminal of Control Box C-98/GR.

(4) Connect battery Cord CX-105/GR, being careful to observe polarity of the leads. These leads are appropriately marked for proper connection to the battery.

b. If Antenna AN-45-G is to be used, proceed as described in subparagraph *a* above, but do not connect the wire from the AUX VERT ANT to the point marked A on the relay. Extend Antenna AN-45-A to its full length and screw it on the stud at the top of the loop.



TL 11864

Figure 16. Antenna System AS-81/GR, mounted on Radio Set SCR-543-(&).

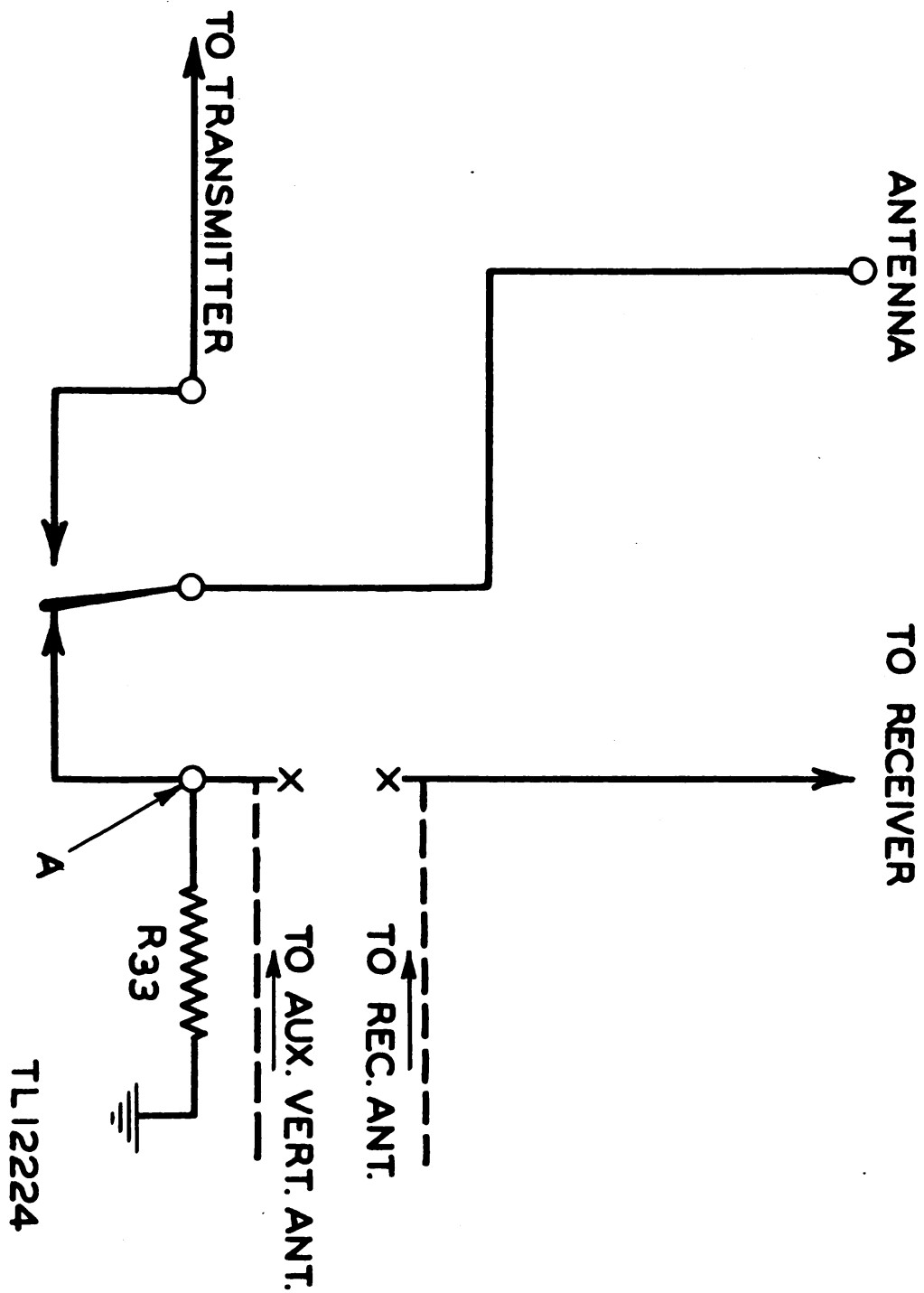


Figure 17. Antenna connections for Radio Set SCR-543-(&).

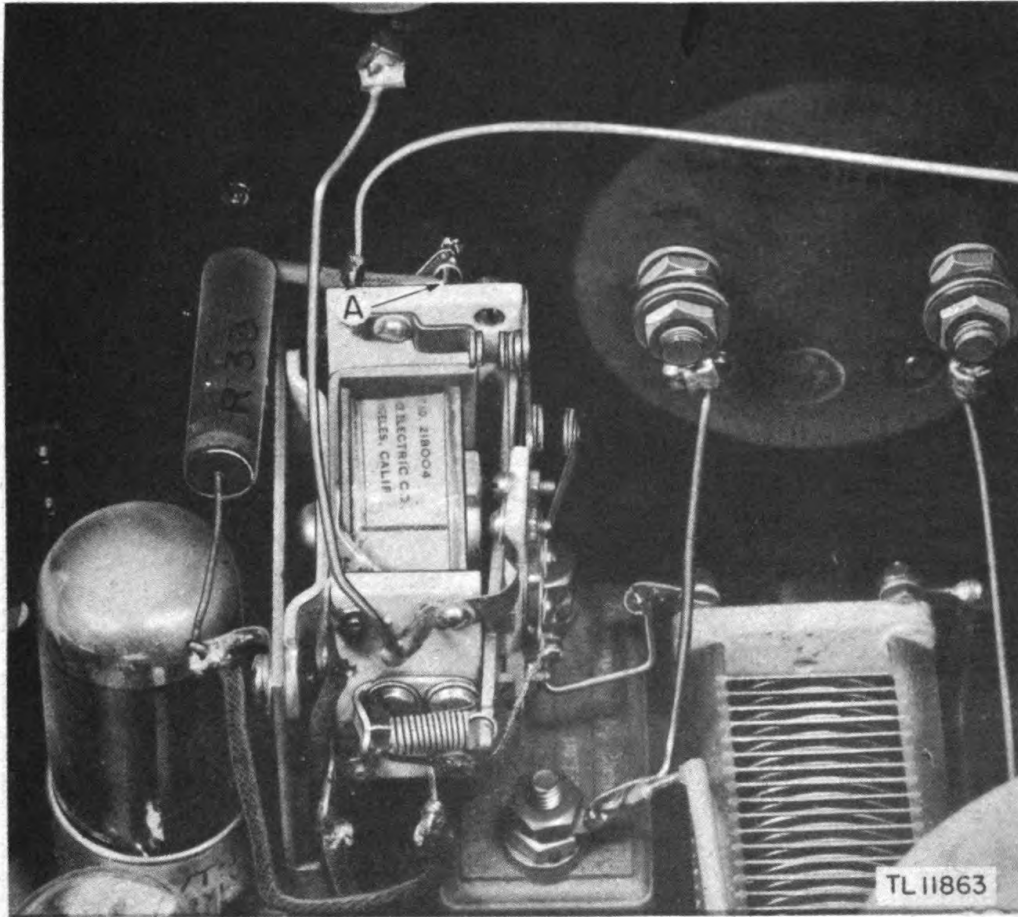


Figure 18. Radio Set SCR-543-(&), antenna relay.

11. INSTALLATION WITH RADIO SET SCR-399-(&).

a. When Radio Set SCR-399-(&) is completely set up for operation, disconnect the antenna lead from the input of Radio Receivers BC-312-(&) or BC-342-(&), and from the binding post of Mast Base MP-48 which supports the antenna of the set to be used.

b. Connect an insulated wire from the binding post on Mast Base MP-48 to the AUX VERT ANT terminal of Control Box C-98/GR.

c. Connect one end of Cord CG-52/GR to the antenna SIG ANT input of the receiver, and the other end to the terminal marked REC ANT on the Control Box C-98/GR.

d. Connect battery Cord CX-105/GR, and be careful to observe polarity of the leads. These leads are appropriately marked for proper connection to the battery.

e. If Antenna AN-45-G is to be used, proceed as described in subparagraphs *a*, *c*, and *d* above. Extend Antenna AN-45-G to its full length, and screw it on the stud at the top of the loop.

12. VEHICULAR INSTALLATION. When radio sets are installed in vehicles, it may be necessary to place Antenna System AS-81/GR in a position other than the ones described in paragraph 7, 8, 9, 10, and 11. The primary precaution to be taken is to make sure that the loop is above the level of the radio set or any other metal cabinet or shelves located on the vehicle. It may be necessary in some cases to construct a shelf or bracket to support the unit in a suitable position. Whenever possible, the location of the unit should be on the top of the radio set.

13. BASIC OPERATION. After the antenna system is installed and connected to a receiver, the following basic operating procedure applies to all installations:

a. Select the loop which covers the desired frequency range. Loops may be identified by the color band and nameplate described in paragraph 4*c*. The color band indicates the frequency range and the scale of the tuning dial to be used.

b. Turn the receiver power switch to ON. Either MVC or AVC may be used, but for weak signals MVC is preferable. The

CRYSTAL PHASING knob on sets so equipped must be in the OUT position.

c. Turn the POWER ON-OFF switch of Antenna System AS-81/GR to ON, and the ANT SW to REC.

d. Tune the receiver in the normal manner to the station desired.

14. ANTIJAMMING. If the station that the operator desires to reach is being jammed or interfered with by another transmitter, proceed as follows:

a. Turn the ANT SW switch on Control Box C-98/GR to the second position (\downarrow \otimes).

NOTE: The "figure 8" sensing pattern obtained gives a bi-directional sensing.

b. Tune the loop to the frequency of the desired signal by adjusting the TUNING control until the loudest signal is reached.

c. Turn the loop slowly until the interfering signal is either eliminated or made so weak that it can be ignored. The station to which the operator is listening now should be clear of interference.

d. Under certain conditions the desired signal will become weak at the same time as the interfering signal (fig. 19A). In this case, proceed as follows:

(1) Place the loop in the position which gives the weakest interference signal (fig. 19A).

(2) Set the BALANCE control to the mid-point on the scale.

(3) Turn the ANT SW switch to the third position ($\rightarrow \otimes$), giving an antenna pattern (fig. 19B).

NOTE: The cardioid sensing pattern obtained gives a unidirectional sensing.

(4) Turn the loop $\frac{1}{4}$ turn and note the volume (fig. 19C). Then turn the loop $\frac{1}{2}$ turn more, and note whether the interfering signal is louder or weaker than it was in the $\frac{1}{4}$ -turn (fig. 19D). Place the loop in the position where the interfering signal is weakest, as shown in figure 19E.

(5) Adjust the BALANCE control to the position where the interfering signal is weakest.

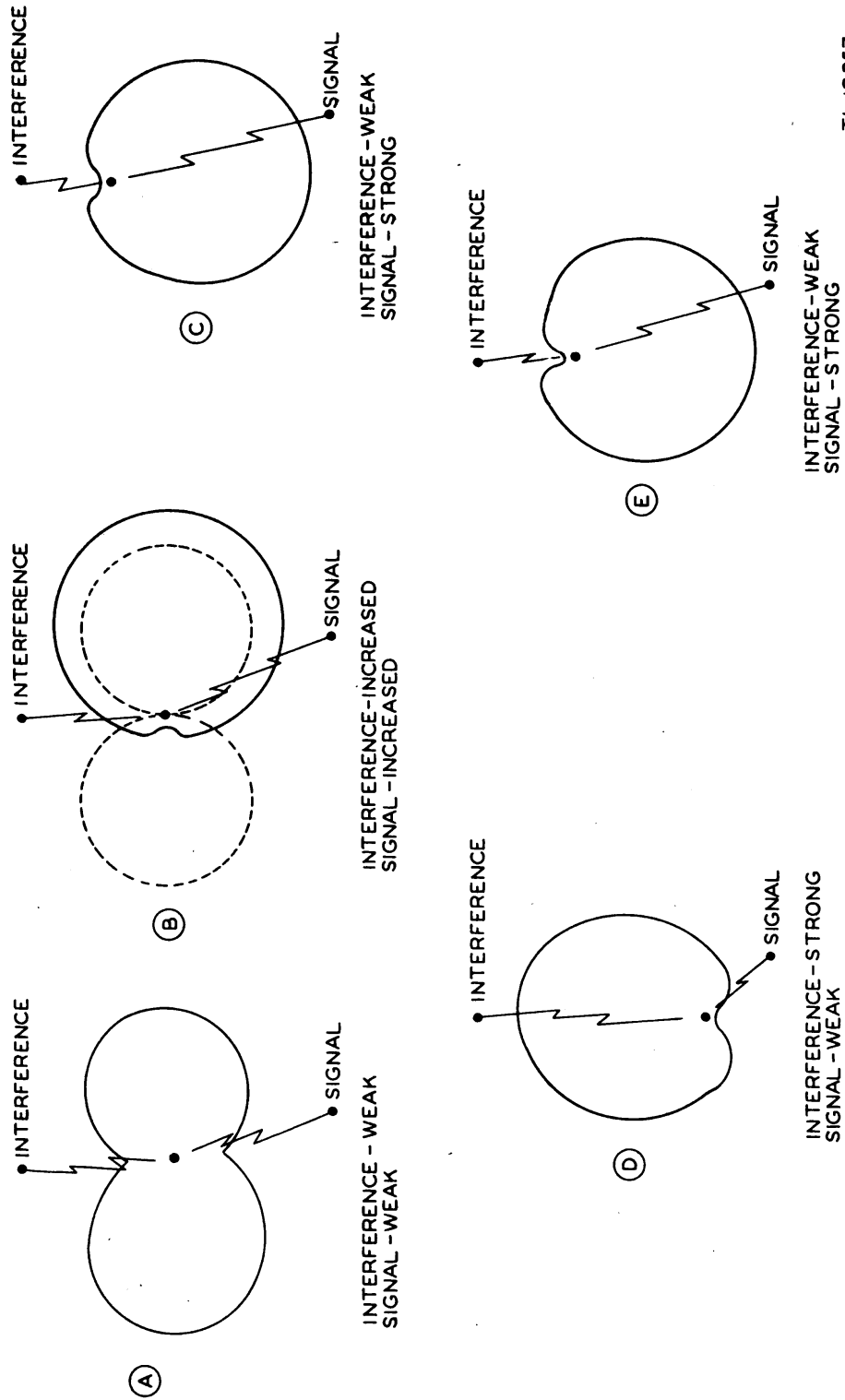
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(6) Adjust the TUNING control slightly, to the position where the interfering signal is weakest.

(7) Adjust the loop further to the position where the interfering signal is weakest, as shown in figure 19E.

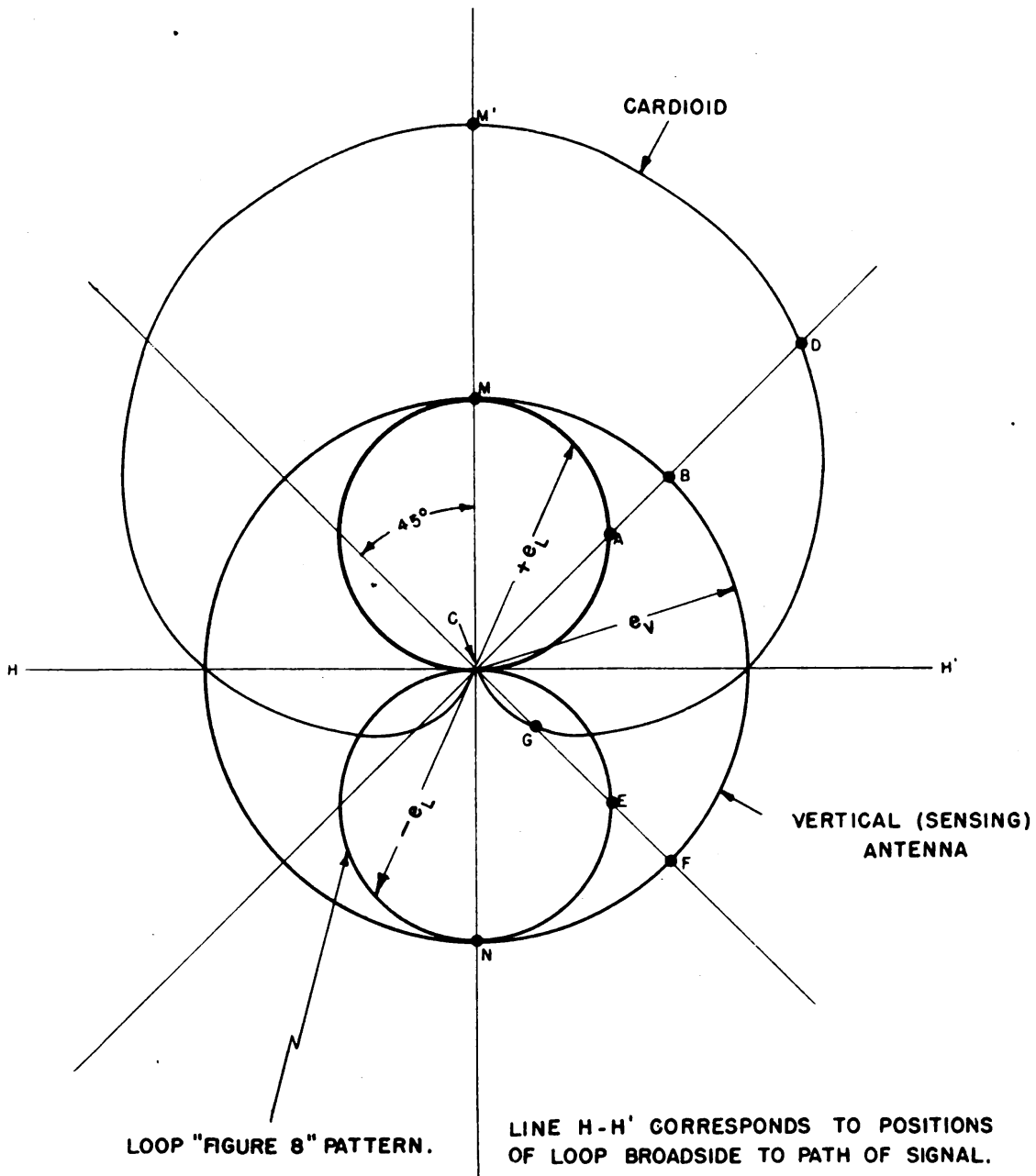
(8) Repeat steps (5), (6), and (7) above. Usually, the best anti-jamming position is the place where the movement of these controls in either direction make the interfering signal louder.

NOTE: When the correct adjustments have been made, take care not to disturb the position of the equipment or the setting of any control. If normal reception is desired turn the ANT SW on Control Box C-98/GR to REC position.



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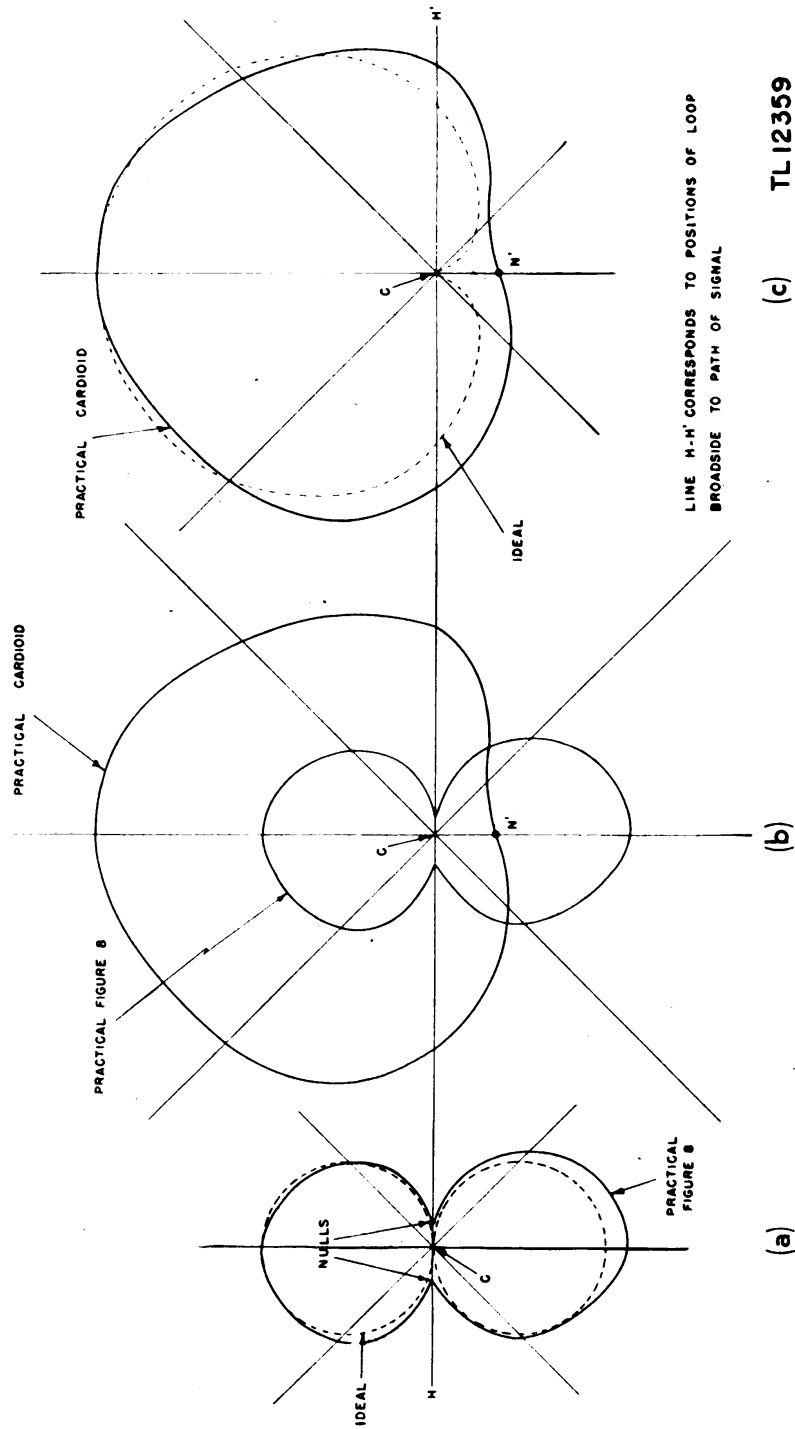
Figure 19. Practical "figure 8" and cardioid patterns.



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Figure 20. Derivation of ideal cardioid from an ideal antenna.

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TL 12359

Figure 21. Cardioid characteristics.

SECTION III

FUNCTIONING OF PARTS

15. GENERAL (fig. 23).

a. The loop is a bi-directional antenna and is silver-plated to provide electrostatic shielding. The loop antenna is coupled to the grid of tube V_1 by the coupling capacitor C_2 . The loops are tuned to any desired frequency within their range by the variable capacitor C_1 connected across the terminal connectors of the loop. A neon lamp LM-1, which is across this tuned circuit, has a very high resistance to low voltages and is used to protect the circuit from any excessive voltage that might be applied to the antenna. When the threshold voltage is exceeded, the lamp becomes a conductor by ionization, bypassing the excess voltage to ground. Capacitors C_4 and C_5 constitute a combination radio-frequency and audio-frequency filter circuit. Capacitor C_{10} is a hash filter and is connected between the two plate-filter resistors R_3 and R_4 . Resistor R_1 is a grid leak, resistor R_2 provides the cathode bias, and resistor R_5 is a bleeder.

NOTE: Either Antenna AN-45-G or the receiver antenna can be used for sensing. Hereafter in the text of this manual these antennas will be referred to as sensing antennas.

b. The antenna system has three operating positions controlled by the ANT SW switch, SW_1 .

(1) When the switch SW_1 is in the first position (REC) the Antenna System AS-81/GR is inoperative and the sensing antenna is connected directly through the Antenna System AS-81/GR to the receiver. This permits the receiver to function in its normal manner.

(2) When the switch SW_1 is in the second position (\downarrow) the sensing antenna is disconnected. The Antenna System AS-81/GR is in operation and the signal impressed in the loop is coupled to the grid of tube V_1 (which acts as a cathode follower). This is essentially an impedance-matching circuit and the output is coupled to the receiver through the cathode-coupling capacitor C_3 and switch SW_1 .

(3) When the switch SW_1 is in the third position ($\rightarrow \emptyset$) the sensing antenna and the loop are used. The two circuits are connected by potentiometer R_6 , the BALANCE control. The purpose of this resistance between the sensing antenna and the loop circuit is to attenuate the sensing voltage without shifting its phase. This potentiometer also helps to match the unequal impedance of the sensing and the loop circuits. The signal is fed from the variable contact of the potentiometer to the receiver.

c. The power supply is made up of a filter section, transformer T_1 , and a vibrator. The RFC chokes RFC_1 and RFC_2 , with capacitor C_7 , are an inductance-capacitance filter. Capacitors C_8 and C_9 are buffers connected across the primary and secondary of transformer T_1 . The vibrator is a synchronous type with a 12-volt input and a 225-volt output. The vibrator is marked for polarity so that it may be reversed in its socket. If the positive terminal of the battery is grounded, plug in the vibrator so the plus sign is nearest the transformer T_1 . If the negative terminal of the battery is grounded, plug in the vibrator so the negative sign is nearest the transformer T_1 .

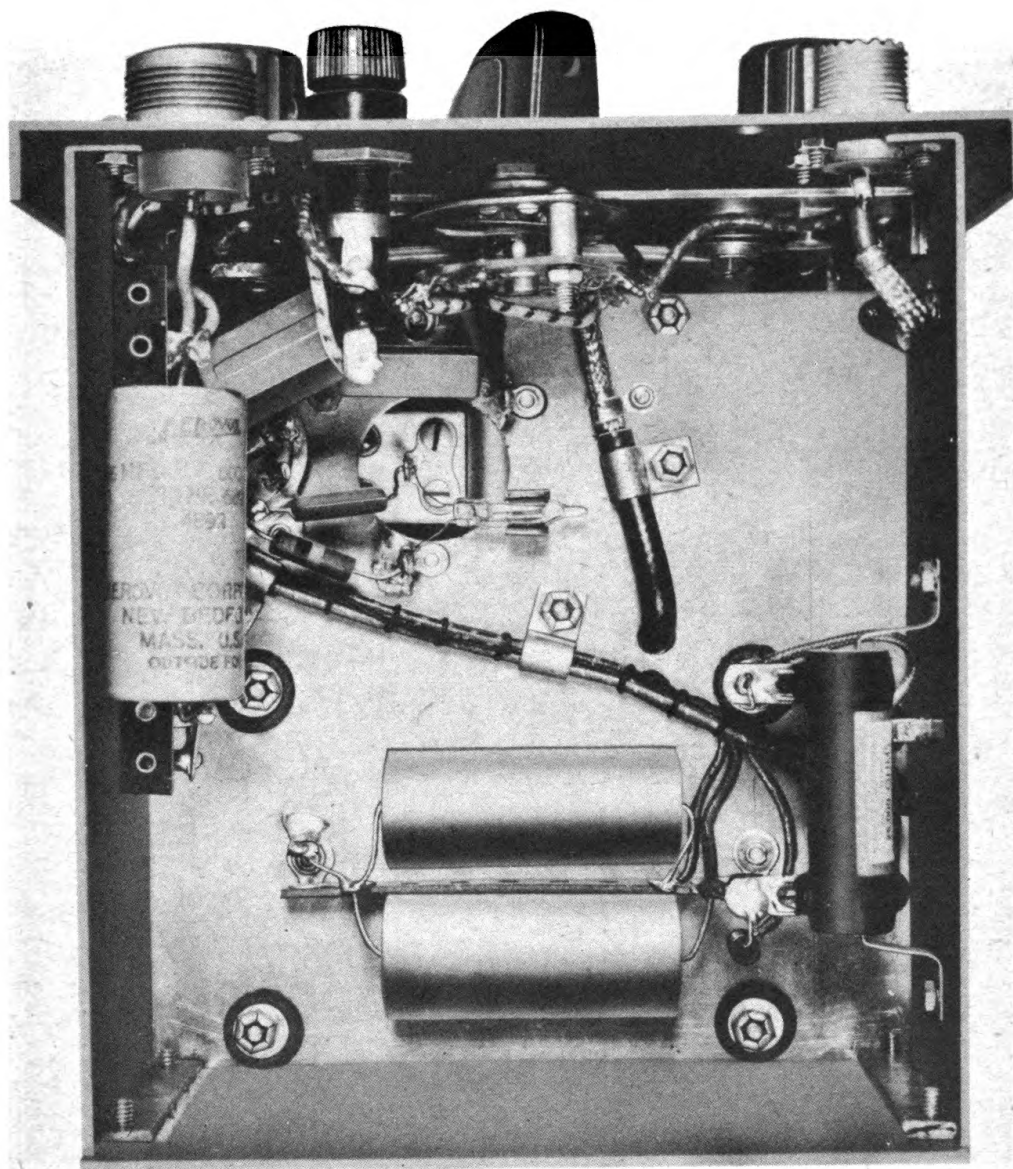
16. DIRECTIONAL CHARACTERISTICS OF THE ANTENNA.

a. The directional characteristic of a loop antenna is shown in figure 20. This pattern is commonly known as a "figure 8". Under ideal conditions this pattern can be obtained by measuring the voltage at the terminal of a loop, at successive angular positions of the loop as it is rotated through 360° in a horizontal plane. The voltages measured are plotted as radial distances from the center of the graph at C, as indicated in figure 20. An examination of the ideal "figure 8" pattern shows that at two positions of the loop the voltage is zero. In these two positions the loop is broadside to the arriving signal. The maximum voltage points on the "figure 8" at M and N (fig. 20) correspond to the two positions where the loop is in line with the path of the signal, that is, $\pm 90^\circ$ from the broadside position. The two positions of zero voltages are referred to as nulls. However, the ideal condition is not obtained in normal use so the nulls in the "figure 8" do not go to zero. Nevertheless they do reach a minimum as shown in figure 19A.

b. The directional characteristic of the loop antenna may be changed by the addition of a vertical antenna, commonly known as a nondirectional antenna. When used in this manner, the vertical

antenna is referred to as a sensing antenna. The voltages produced by the loop and the vertical antenna are added together algebraically, to form a new directional characteristic. This new pattern, being heart-shaped, is called a cardioid and is shown in figure 20. This heart-shape is formed when the "figure 8" and the nondirectional or circle pattern are added together since the voltage of the lower lobe of the "figure 8" is opposite in time phase to the voltage in the circle pattern, and the time phase of the voltage in the upper lobe of the "figure 8" is in agreement with the pattern. Thus $CA + CB = CD$ and $CF - CE = CG$ (fig. 20).

c. Though the cardioid shown in figure 20 indicates a unidirectional pattern, the practical pattern of the cardioid is better illustrated in figure 21. Always remember that the cardioid does not have as sharp a null as the "figure 8" and should be used only when necessary. Use cardioid when the transmitting station and the jamming station are about 180° apart.



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Figure 22. Antenna System AS-81/GR, bottom view.

ANTENNA SYSTEM AS-81/GR

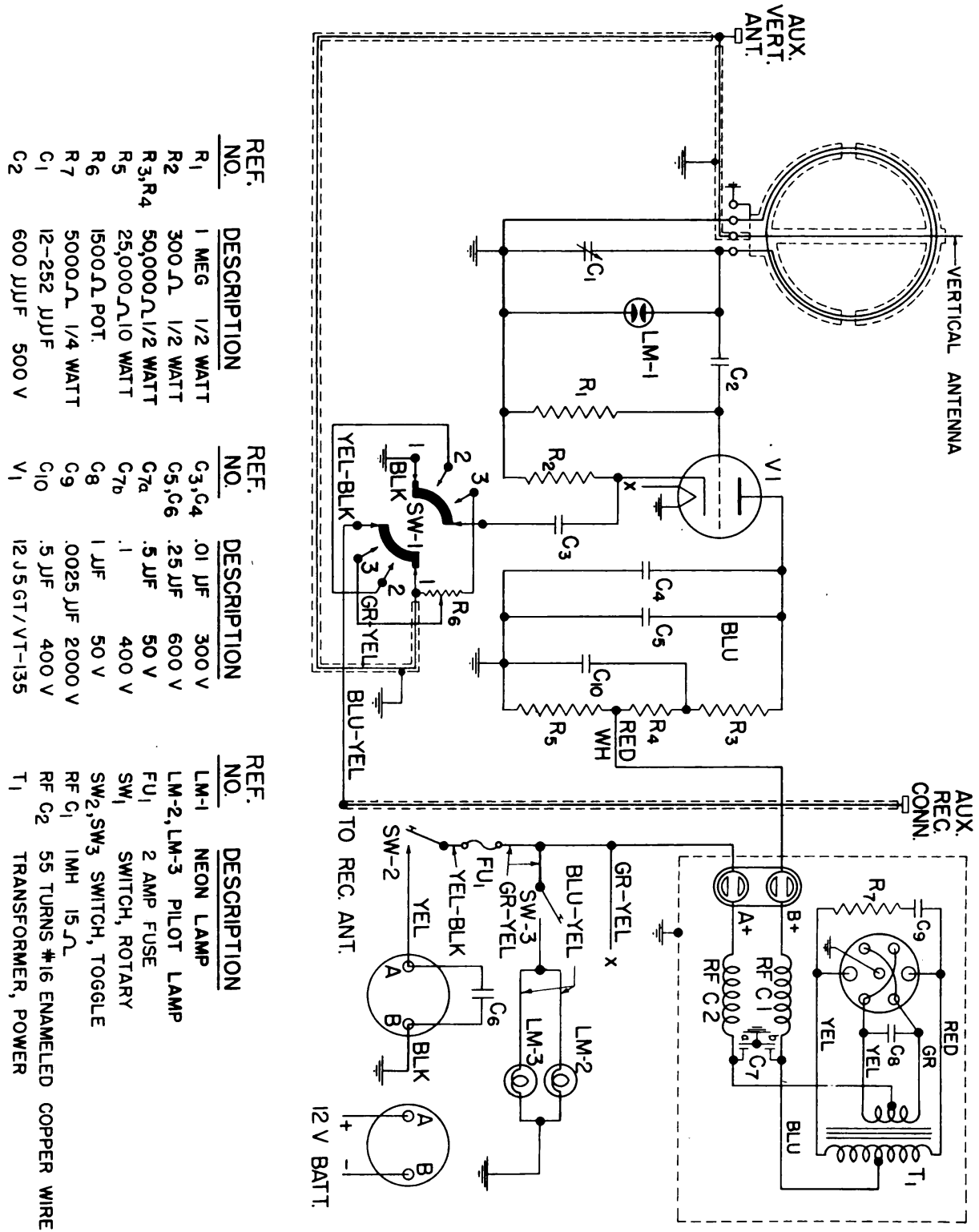


Figure 23. Antenna System AS-81/GR, schematic diagram.

SECTION IV MAINTENANCE

NOTE: Unsatisfactory performance of this equipment will be reported immediately on WD AGO Form No. 468. If form is not available see TM 38-250.

17. GENERAL INSTRUCTIONS. Operating personnel will confine the maintenance and repair of this equipment to the outline in paragraph 18. If trouble develops which does not respond to the treatment outlined in the trouble chart below, the equipment requires the service of Signal Corps maintenance personnel thoroughly experienced in its repair. Any attempts by inexperienced personnel to service the equipment can result in serious damage.

18. TROUBLE CHART.

<i>Trouble</i>	<i>Probable causes</i>	<i>Remedy</i>
Antenna system dead	POWER switch OFF	Throw POWER switch ON.
	Cord CX-105/GR defective.	Repair or replace.
	Tube loose in socket.	Seat tube firmly.
	Tube defective.	Replace tube.
	Vibrator defective.	Replace vibrator.
	Cord CG-52/GR or Cord CG-57/GR defective.	Repair or replace.
	Fuse defective.	Replace.
No cardioid sensing	Loop defective.	Replace.
	Antenna AN-45-G not fully extended.	Extend antenna full length.
	Receiver antenna not connected to AUX VERT ANT.	Connect receiver antenna to AUX VERT ANT.
Signal weak.	Poor loop contact.	Clean spring contacts and loop rings.
	Faulty tube.	Replace tube.
	Faulty vibrator.	Replace vibrator.

19. TUBE SOCKET VOLTAGES.

a. Characteristics. All voltages taken with a 1,000-ohm per volt voltmeter; all reading $\pm 10\%$; battery voltage 12.5 at time of readings.

b. Tube V1, JAN 12J5 GT.

<i>Pin No.</i>	<i>Ground</i>	<i>Voltage</i>
1	*	0.0
2	*	0.0
3	*	37.5
4	*	—
5	*	0.0
6	*	137.5
7	*	12.0
8	*	0.6

20. TUBE SOCKET RESISTANCE MEASUREMENTS TO GROUND.

CAUTION: Before making point-to-point resistance measurements the battery must be removed from the antenna system or incorrect readings will result and the ohmmeter will be damaged.

<i>Pin No.</i>	<i>Ground</i>	<i>Resistance</i>
1	*	0 ohms
2	*	0 ohms
3	*	125,000 ohms
4	*
5	*	1 megohm
6	*	75,000 ohms
7	*	5 ohms
8	*	300 ohms

SECTION V SUPPLEMENTARY DATA

21. MAINTENANCE PARTS LIST FOR ANTENNA SYSTEM AS-81/GR.

NOTE: Order maintenance parts by stock number, name and description. Only parts listed below can be requisitioned.

<i>Ref symbol</i>	<i>Signal Corps stock No.</i>	<i>Name of part and description</i>	<i>Running spares</i>	<i>Orgn stock</i>	<i>3d ech</i>	<i>4th ech</i>	<i>5th ech</i>	<i>Depot stock</i>	<i>Quan per unit</i>
C ₁	3DB250V	CAPACITOR: variable, Hammerlund 12601-G1.				*	*	*	1
C ₂	3K3062112	CAPACITOR: fixed, 600- μ f \pm 10%; 500 v dc (working); C-D type 5 W.			*	*	*	*	1
C ₃	3K4010321	CAPACITOR: fixed; mica; 0.01- μ f \pm 10%; 300 v dc (working); C-D type PL-3LWS.			*	*	*	*	2
C ₄		CAPACITOR: same as C3							
C ₅	3DA250-39	CAPACITOR: fixed; 250,000- μ f \pm 20% —10%; 600 v dc (working); Aerovox 689.			*	*	*	*	2
C ₆		CAPACITOR: same as C5							
C _{7a}	3DA100-152	CAPACITOR: fixed; paper; dual-section; 0.1- μ f \pm 10%; 400 v 0.5- μ f 50 v dc (working); Mallory #A205099-2.			*	*	*	*	1
C ₈	3DB1.290-1	CAPACITOR: fixed; paper; 1- μ f \pm 10%; 50 v dc (working); (metal case); Mallory A42290-2.			*	*	*	*	1
C ₉	3DA42.500-14	CAPACITOR: fixed; paper; 0.0025 μ f \pm 10%; 1600 v dc working			*	*	*	*	1

21. MAINTENANCE PARTS LIST FOR ANTENNA SYSTEM AS-81/GR. (Continued)

Ref symbol	Signal Corps stock No.	Name of part and description	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock	Quan per unit
C10	3DA500-162	CAPACITOR: fixed; 500,000- μf $\pm 20\%$; 400 v dc (working); Aerovox 484.			*	*	*	*	1
FU1	3Z1927	FUSE: 2-amp; 125-v; FU-27 Littelfuse 3AG.	2		*	*	*	*	1
LM-1	2Z5893	LAMP: neon			*	*	*	*	1
LM-2	2Z5933.1	LAMP: pilot; GE-53.			*	*	*	*	2
LM-3		LAMP: same as LM-2.	2		*	*	*	*	2
R1	3Z6801-1	RESISTOR: fixed; 1-meg.			*	*	*	*	1
R2	3Z6030-8	RESISTOR: fixed; 300-ohm.			*	*	*	*	1
R3	3Z6650-10	RESISTOR: fixed; 50,000-ohm; IRC, BT- $\frac{1}{2}$.			*	*	*	*	2
R4		RESISTOR: same as R3.			*	*	*	*	1
R5	3Z6625-108	RESISTOR: fixed; wire-wound; 25,000-ohm; 10-w; ITE Circuit Breaker Co. 216-FZ.			*	*	*	*	1
R6	2Z7268.38	POTENTIOMETER: single-section; 1,500-ohm $\pm 20\%$; shaft, $\frac{3}{4}$ ".			*	*	*	*	1
R7	3Z6500-75	RESISTOR: fixed; 5,000-ohm $\pm 20\%$; IRC, BT- $\frac{1}{4}$.			*	*	*	*	1
RFC1	3C337-7	COIL: r-f choke; Mallory A42334-2; (1.0-mh, dc resistance 15-ohm).			*	*	*	*	1
SW1	3Z9900-7	SWITCH: rotary; 2-pole 3 positions; Oak Mfg Hammarlund 12665).			*	*	*	*	1
SW2	3Z9858-8.28	SWITCH: toggle; (spst Arrow-Hart and Hegeman CHH-24000).			*	*	*	*	2
SW3		SWITCH: same as SW2.			*	*	*	*	2
T1	2Z9625-18	TRANSFORMER: Mallory B44678-15.			*	*	*	*	1

<i>Ref symbol</i>	<i>Signal Corps stock No.</i>	<i>Name of part and description</i>	<i>Running spares</i>	<i>Orgn stock</i>	<i>3d ech</i>	<i>4th ech</i>	<i>5th ech</i>	<i>Depot stock</i>	<i>Quan per unit</i>
	2A245G	ANTENNA AN-45-G:			*	*	*	*	1
	2A2571-9	ANTENNA MOUNTING AB-9/GR:			*	*	*	*	1
	3ZK764-6	BINDING POST: Eby Ensign 38			*	*	*	*	2
	2Z1891-48	CASE CY-48/GR			*	*	*	*	1
	1F425-11	CABLE RG-11/U: Federal Telephone and Radio			*	*	*	*	16 ft
	2Z7112.30	CONNECTOR AN-3102-14S-9P: 2-prong			*	*	*	*	1
	2Z8799-239	CONNECTOR SO-239:			*	*	*	*	1
	2Z8879-19	CONTACT SPRING: U-shaped; North American Philips A-12216-1	2		*	*	*	*	2
	2Z8879-20	CONTACT SPRING: North American Philips A12210-1	2		*	*	*	*	2
	2Z8879-21	CONTACT SPRING: North American Philips A12209-1	2		*	*	*	*	2
	2C6666-98	CONTROL BOX CY-98/GR: (Component)			*	*	*	*	1
	3E6015-52	+CORD CG-52			*	*	*	*	1
	3E6015-57	+CORD CG-57			*	*	*	*	1
	3E6000-105	CORD CX-105/GR:			*	*	*	*	1
	2Z3724.33	DIAL: tuning; Hammarlund 12658			*	*	*	*	1
	2Z5822-2.1	KNOB: bar; olive drab bakelite; (1-½" long ¼" shaft) Hammarlund #12646			*	*	*	*	1
	2Z5836.10	KNOB: round; olive drab wood index line (1" dia x 15/16" h; ¼" shaft) Hammarlund #12647-1			*	*	*	*	1
	2Z5836.11	KNOB: round, olive drab wood; (1" dia x 15/16" h; ¼" shaft) Hammarlund #12647-2			*	*	*	*	1

† State desired length when requisitioning.

21. MAINTENANCE PARTS LIST FOR ANTENNA SYSTEM AS-81/GR. (Continued)

<i>Ref symbol</i>	<i>Signal Corps stock No.</i>	<i>Name of part and description</i>	<i>Running spares</i>	<i>Orgn stock</i>	<i>3d ech</i>	<i>4th ech</i>	<i>5th ech</i>	<i>Depot stock</i>	<i>Quan per unit</i>
	2A1990-27	LOOP AT-27/GR			*	*			1
	2A1990-28	LOOP AT-28/GR			*	*			1
	2A1990-29	LOOP AT-29/GR			*	*			1
	2A-1990-30	LOOP AT-30/GR			*	*	*	*	1
	2Z6198-1	LOOP RECEPTACLE ASSEMBLY: Hammarlund #12619			*	*	*	*	1
	2Z7560/2	PANE: dial; glass			*	*	*	*	1
	3ZK3275.4	POST: fuse extractor; Bussman type HKM			*	*	*	*	3
	6L20908-4-1.8K	SCREW: knurled head; North American Philips G5.200.00			*	*	*	*	4
	2Z5883-85	SOCKET: lamp; miniature bayonet;			*	*	*	*	2
	2Z8678.112	American Radio Hardware 1787 and 1788			*	*	*	*	1
	2Z5042-4	SOCKET: tube; standard octal; Cinch 9860			*	*	*	*	1
	2J12J5GT	TUBE HOLDER: Birtcher Corp. type 926B			*	*	*	*	1
	3H6785-3	TUBE: JAN 12J5GT; VT-135	1		*	*	*	*	1
	3H4496-110/N1	VIBRAPACK: with vibrator G534C; Mal- lory 12A225D			*	*	*	*	1
	6L50153-1BN	VIBRATOR: Mallory G534C			*	*	*	*	1
		WASHER: shoulder; brass; .204 I D; 7/16" O D; shoulder 9/32"			*	*	*	*	2

ADDENDA SHEET FOR TECHNICAL MANUAL, ANTENNA SYSTEM AS-81/GR

The following information corrects portions of TM 11-2608. Personnel using the equipment and having custody of the technical manual will attach this addenda sheet securely in the back of the TM, and will enter suitable notations beside each changed portion in the TM to indicate the presence of this information.

Page 43. Par. 22 Add the following paragraph:

22. HASH ELIMINATION. Early models of the equipment have insufficient electrical shielding of the vibrapack including the vibrator. In order to eliminate the vibrator "hash" caused by this condition, it was necessary to modify Antenna System AS-81/GR. Serial Nos. 301 through 400 and 451 through 2000, Order 1371-MPD-44 Antenna System AS-81/GR the following modifications have been made:

- a. The bottom edge of the transformer case has been soldered to the top of the power supply filter case.
- b. The spring fingers of the vibrator spring clip are soldered to the top of the power supply filter case.
- c. Additional r-f filtering was obtained by adding a .05-uf capacitor between the A- terminal of the power supply and ground lug on the vibrapack.
- d. The "hot" lead of capacitor C 10 is removed from the terminal between resistors R3 and R4, and connected to lug between resistors R4 and R5. This parallels capacitor C 10 to resistor R5 and aids in the elimination of hash.
- e. The grid leak, R₁, has been changed from 1 megohm to 100,000 ohms.