RESTRICTED

FM 4–145

WAR DEPARTMENT

COAST ARTILLERY FIELD MANUAL

ANTIAIRCRAFT ARTILLERY

RADIO SET SCR–268

OPERATION OF MATÉRIEL

AND

EMPLOYMENT OF PERSONNEL

April 5, 1942

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ANTIAIRCRAFT ARTILLERY RADIO SET SCR–268 OPERATION OF MATÉRIEL AND EMPLOYMENT OF PERSONNEL

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1942

WAR DEPARTMENT,
WASHINGTON, April 5, 1942.

FM 4–145, Coast Artillery Field Manual, Antiaircraft Artillery, Radio Set SCR–268, Operation of Matériel and Employment of Personnel, is published for the information and guidance of all concerned.

[A. G. 062.11 (9–5–41).]

BY ORDER OF THE SECRETARY OF WAR:

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DISTRIBUTION:

B 4 (5); IR 4, 11 (5); IBn 4 (5); IC 4 (15), 11 (5).
(For explanation of symbols see FM 21–6.)

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RADIO SET SCR–268

OPERATION OF MATÉRIEL AND EMPLOYMENT OF PERSONNEL

CHAPTER 1

GENERAL

		Paragraphs
SECTION I.	General	1–3
II.	Instrument	4–8
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IV.	Simplified explanation	10–18

SECTION I

GENERAL

■ 1. SCOPE.—*a.* This manual furnishes a general description of the radio set SCR–268 and provides information relative to the details of operation and employment by the using personnel. A knowledge of the fundamentals of antiaircraft gunnery as covered in FM 4–110 will be helpful in understanding the problem of locating and tracking aerial targets.

b. The matter contained herein is intended only as a guide in the assignment of individuals and duties. Minor changes in procedure may be made to suit local conditions.

■ 2. REFERENCES.—This manual should be studied in connection with the various references listed in appendix II. Detailed instructions for operation and maintenance of the equipment will be found in instruction manuals issued with the set.

■ 3. WARNING.—*Voltages sufficient to cause death on contact are used in radio set SCR–268. Extremely dangerous potentials exist throughout units. All possible precautions must be taken to insure the safety of personnel when the power is turned on.*

SECTION II

INSTRUMENT

■ 4. GENERAL.—The problem of detecting and locating aircraft under all sorts of atmospheric conditions has been studied for a long time. As a consequence, various devices for the detection and tracking of aircraft have been developed. One of the more recent and effective of these developments is the radio set SCR–268.

■ 5. CAPABILITIES.—The functioning of this unit remains unimpaired even though aircraft may be hidden by smoke, haze, clouds, or darkness. It is designed to locate aerial targets at long range. It supplies a continuous flow of data which accurately locate aircraft with reference to the detecting unit. These data, covering azimuth, angular height, and altitude, become instantly available in a usable form.

■ 6. ANTENNA SYSTEMS.—The ability of radio set SCR–268 to locate aircraft depends upon the functioning of three separate antenna systems, each with directional characteristics. By a simple mechanical system the arrays may be pointed as one unit in any desired direction. A powerful beam of high-frequency energy from one of these antennas is radiated in that direction. Targets of a conducting material in the field of the beam will reflect or reradiate a portion of the energy back to the unit. Reception of the reflected signal or echo by the remaining two direction-finding antenna arrays will permit further adjustment of the beam, and a close determination of the azimuth and angular height of the target.

■ 7. SLANT RANGE AND ALTITUDE DETERMINATION.—The time taken by a radio pulse to travel from the unit to an airplane and back is determined by electrical means, providing in this manner a measure of the distance traveled by the pulse.

This time interval is converted by mechanical means into the slant range of the aerial target. A mechanical device combines the slant range with the angular height to compute the altitude of the target.

■ 8. SUMMARY.—To sum up, radio set SCR–268 finds and tracks aerial targets by means of a radio echo. It determines the azimuth, angular height, and altitude of the target from the detecting unit and simultaneously transmits these data as required to a searchlight or a gun director.

SECTION III

DEFINITIONS

■ 9. DEFINITIONS.—*Altitude.*—The vertical distance to a point in space from a horizontal reference plane, usually the horizontal plane containing the directing point of a gun battery.

Angular height.—The vertical angle between the line of position (site) and the horizontal.

Array.—An assembly of antenna units for the purpose of attaining directivity.

Azimuth.—The horizontal angle, measured in a clockwise direction, from a selected reference line (usually the grid north line) passing through the position of the observer to the horizontal projection of the line of sight from the observer to the objective.

Azimuth operator.—The person who matches pulse echoes on the azimuth oscilloscope by turning the azimuth handwheel.

Bias.—The d-c voltage applied to the grid circuit of an electron tube.

Carrier frequency.—The radio frequency upon which a radio transmitter operates.

Data receiver.—*See* Synchronous repeater.

Data transmitter.—*See* Synchronous repeater.

D. E. C.—*See* Distant electric control.

Dipole.—A half-wave antenna.

Director.—A predicting instrument used to determine the firing data pertaining to the future position of the target.

Distant electric control (D. E. C.).—A system for the control of the pointing of searchlights from a distance. The system consists of a controller at the control station and the necessary motors or receivers at the searchlight.

Echo.—The reflected signal received by the SCR–268 from the surface of a conducting material in the field of a transmitted pulse.

Elevation operator.—The person who matches pulse echoes on the elevation oscilloscope by turning the elevation handwheel.

Filament.—An element within an electron tube in the form of a metal wire, heated by current passing through it.

Fixed echo.—The echo received from the surface of a fixed object such as a water tank or a steel bridge.

Focus control.—The control on the front of the oscilloscope which concentrates the electron beam of the cathode-ray tube in order to give a sharp image on the screen of the oscilloscope.

Grid.—An element within an electron tube designed to control the flow of electrons.

Grid voltage.—The voltage applied to the grid of an electron tube.

Horizontal range (*AA*).—The length of the base of the vertical right triangle in space, the vertical side of which is altitude and the hypotenuse of which is the line of position.

Intensity control.—The control on the front of the oscilloscope which determines the brightness of the visual image.

Interlocks.—Plunger switches placed in the doors of the transmitter filament transformer and rectifier, and in the cover plate of the modulator. These units must be completely inclosed before the switches will make contact and permit the high voltage to be thrown on.

Keyer.—Same as keying unit.

Keying unit.—A unit used in the radio set SCR–268 to control the output of the modulator.

Leveling.—The process of adjusting an instrument so that all vertical or horizontal angles will be measured in true vertical or horizontal planes.

Line of position.—The line of position or line of site of a point is the straight line connecting the point of origin with that point. The point of origin is usually a gun or a position-finding instrument.

Line of site.—*See* Line of position.

Mil.—A unit of angular measure. One sixty-four-hundredth part of a circle. For practical purposes the arc which subtends a mil at the center of a circle is equal in length to one-thousandth of the radius.

Milliampere.—One one-thousandth of an ampere.

Modulator.—A unit used to control or shape the output of the transmitter.

Orientation.—The adjustment of an instrument so that when directed at a given point, it will indicate accurate basic position data of that point.

Oscillator.—An electron tube circuit generating a given frequency.

Oscilloscope.—A unit employing a cathode-ray tube, the fluorescent screen of which indicates the presence of high frequency impulses. These indications are used for the purpose of tracking targets.

Phasing section.—A set of connecting lines between the halves of an antenna array.

Plate.—An electrode within an electron tube to which the electrons flow.

Plate voltage.—The voltage applied to the plate of an electron tube.

Range operator.—The person who adjusts the position of the pulse echo on the range oscilloscope by turning the range handwheel.

Repeater.—*See* Synchronous repeater.

Rotatable column.—That rotatable member of the mount which supports the operators' seats, oscilloscopes, the transmitter, the antennas, and several other units.

Sensitivity control.—The control on the front of the oscilloscope which determines the amplification of the receiver.

Sight tube.—A hood placed over the oscilloscope screen for daylight viewing of the image.

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Slant range.—The hypotenuse of the vertical right triangle in space, the vertical side of which is altitude and the base of which is horizontal range.

Slip ring.—A device for making electrical connections between stationary and rotating contacts.

Stub.—A tuning or matching unit composed of a U-shaped length of conductor, which is connected across a two-wire transmission line to adjust its efficiency.

Sweep.—The action of a saw-tooth voltage on application to the horizontal deflecting plates of an oscilloscope so as to produce a base line or time axis.

Sweep control.—The control on the front of the oscilloscope which determines the length of horizontal line seen on the screen of the cathode-ray tube.

Synchronization.—A process in which the values indicated by all data receiver pointers of a data transmission system are made to agree with the values set on the corresponding data transmitters.

Synchronous repeater.—A device for the transmission or reception of mechanical movement by electrical means.

Tracking.—The process of moving the antenna arrays of the radio set so that the split echoes on the oscilloscope screen are matched.

Transmitter.—A unit which produces radio-frequency signal energy under the control of the modulator.

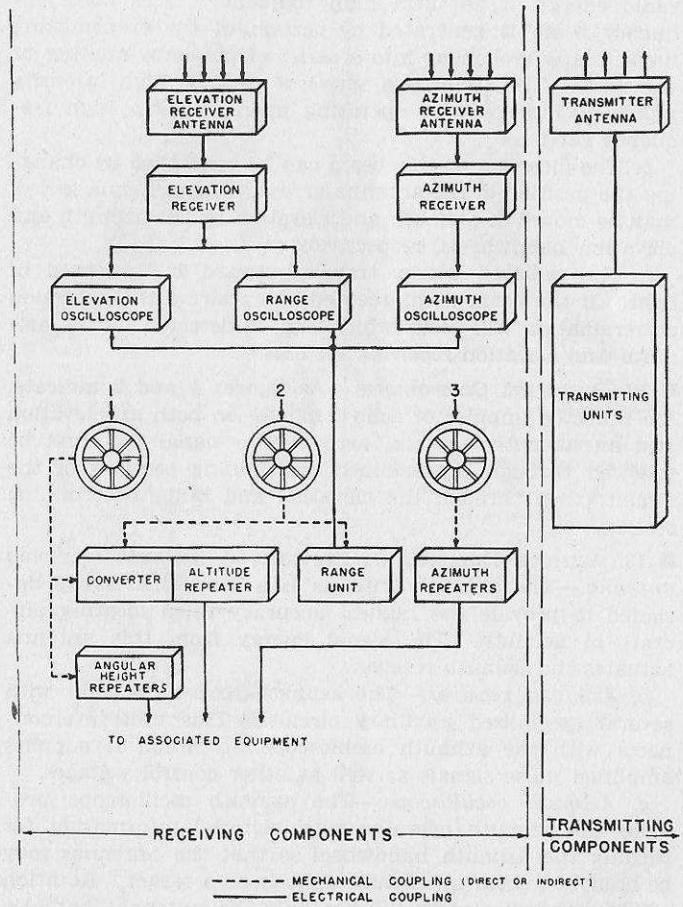
Zero reader (AA).—A device for indicating when a searchlight is properly pointed in accordance with the data transmitted to it.

SECTION IV

SIMPLIFIED EXPLANATION

■ 10. BASIC ELEMENTS.—The basic elements of radio set SCR–268 are shown in figure 1. These elements have been grouped for purposes of description into a transmitting components group and a receiving components group. In the interest of clearness, interconnections between the transmitting and receiving components have been omitted.

■ 11. TRANSMITTING COMPONENTS.—*a.* The transmitting components are designed to generate and radiate a beam of



1. Elevation handwheel. Movement directed by elevation oscilloscope.
2. Range handwheel. Movement directed by range oscilloscope.
3. Azimuth handwheel. Movement directed by azimuth oscilloscope.

FIGURE 1.—Simplified diagram showing basic components.

radio energy at an ultra high frequency. This high frequency beam is generated by certain of the transmitting units and is broken up into a series of pulses by another of the units. The result is a series of periodic high intensity pulses of radio energy operating upon an ultra high frequency carrier.

b. The direction of this beam can be controlled by changing the position of the antenna arrays. The antenna arrays may be moved in azimuth and elevation by the azimuth and elevation handwheels, respectively.

c. The radiated energy travels outward at the speed of light. If the beam is intercepted by an aircraft, a reflection or reradiation will occur which can be detected by the azimuth and elevation receiving systems.

■ 12. RECEIVING COMPONENTS.—As figures 1 and 2 indicate, the reflected impulse or echo impinges on both an elevation and an azimuth antenna array. The signal will first be followed through the azimuth determining sections of the circuit; then through the elevation and range determining section.

■ 13. AZIMUTH DETERMINING SECTION.—*a. Azimuth receiving antenna.*—The azimuth antenna is a directional array designed to provide the highest accuracy when locating aircraft in azimuth. The signal energy from this antenna actuates the azimuth receiver.

b. Azimuth receiver.—The azimuth receiver is built with several specialized auxiliary circuits. This unit interconnects with the azimuth oscilloscope, to which it supplies amplified pulse signals as well as other control voltages.

c. Azimuth oscilloscope.—The azimuth oscilloscope provides the azimuth operator with pictorial information for turning the azimuth handwheel so that the antennas may be brought to bear in azimuth directly on a target. Rotation of the handwheel actuates not only the antennas but also a coarse and a fine synchronous repeater.

d. Azimuth repeaters.—The synchronous repeaters are mechanically connected to the azimuth rotating mechanism and each position of the repeaters corresponds to one position of the antenna arrays. The azimuth repeaters transmit this information electrically by cable to data receivers

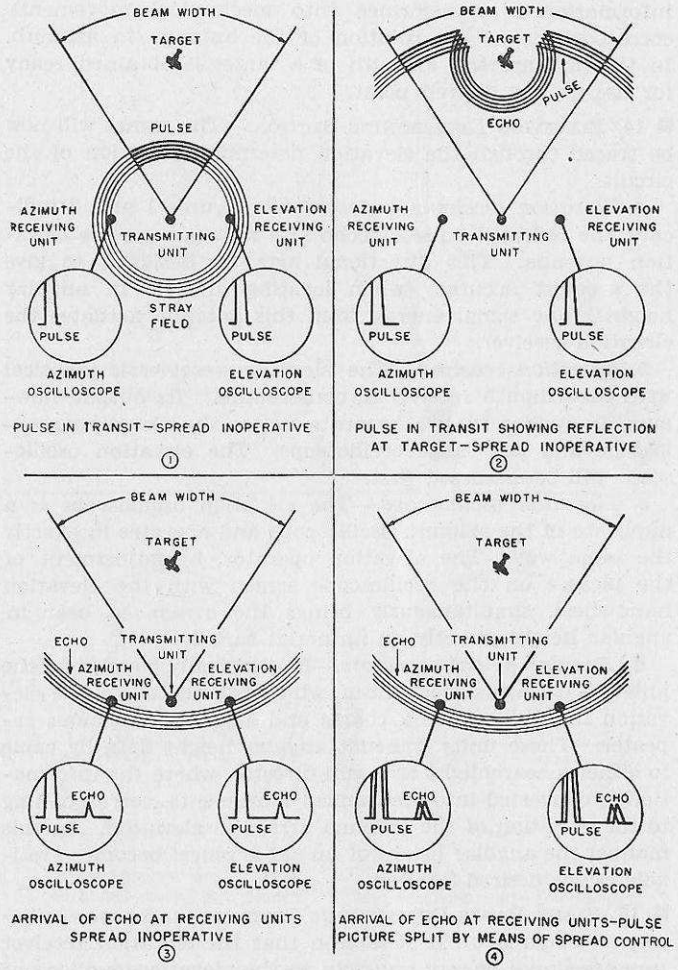


FIGURE 2.—Diagrammatic sketch showing action of main pulse and echoes.

in either a searchlight or a gun director. Here the electrical information is transformed into mechanical movements corresponding to the rotation of the antenna in azimuth. In this manner the azimuth of a target is obtained ready for use at any desired point.

■ 14. ELEVATION DETERMINING SECTION.—The signal will now be traced through the elevation determining section of the circuit.

a. Elevation receiving antenna.—As figures 1 and 2 indicate, the reflected pulse or echo also impinges on the elevation antenna. This directional array is designed to give the greatest accuracy when locating aircraft in angular height. The signal energy from this antenna actuates the elevation receiver.

b. Elevation receiver.—The elevation receiver is identical with the azimuth receiver in construction. Its output, however, is applied to two separate units: the elevation oscilloscope and the range oscilloscope. The elevation oscilloscope will be discussed first.

c. Elevation oscilloscope.—The elevation oscilloscope is a duplicate of the azimuth oscilloscope and operates in exactly the same way. The elevation operator, by adjustment of the picture on the oscilloscope screen with the elevation handwheel, simultaneously brings the arrays to bear in angular height directly on an aerial target.

d. Angular height repeaters.—Mechanically coupled to the antenna elevating mechanism, which is actuated by the elevation handwheel, are a coarse and a fine synchronous repeater. These units transmit angular height data by cable to either a searchlight or a gun director, where the information is converted into mechanical movements, corresponding to the variation of the antenna arrays in elevation. In this manner the angular height of an aerial object becomes available at any desired location.

■ 15. SLANT RANGE DETERMINING SECTION.—*a. Range oscilloscope.*—From figure 1 it is seen that the elevation receiver supplies signal energy not only to the elevation oscilloscope but also to the range oscilloscope. The range oscilloscope is identical in construction with the azimuth and elevation oscilloscopes. Two of its controls are, however, rendered

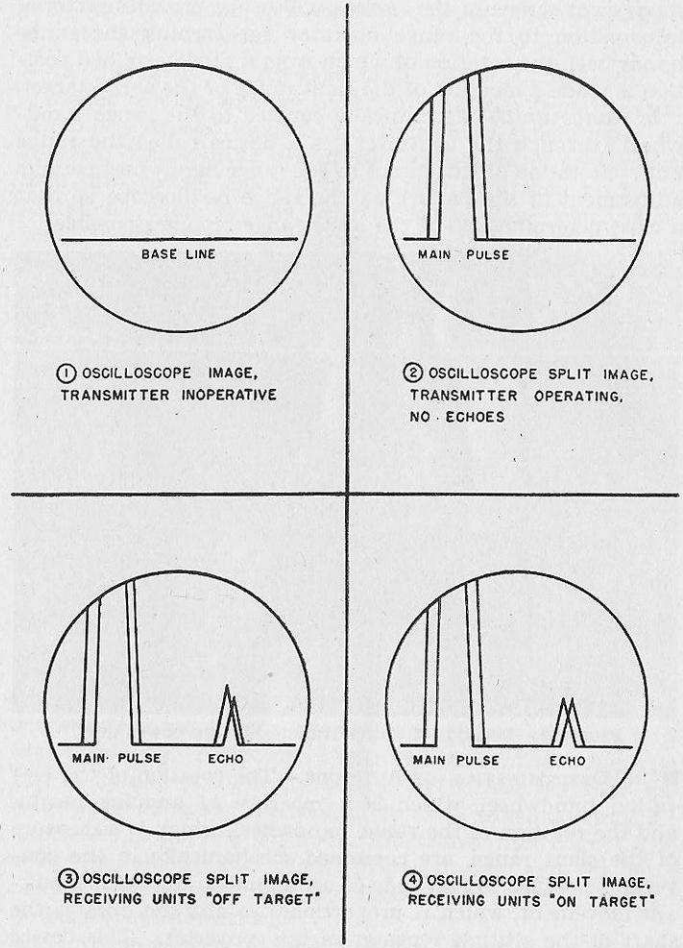


FIGURE 3.—Appearance of main pulse and echoes on oscilloscope screen.

inoperative by the design of its cable connections. The fluorescent screen of the range oscilloscope provides pictorial information to the range operator for turning the range handwheel, the rotation of which from a predetermined position is made a measure of the slant range of the aerial target.

b. Range unit.—Mechanically coupled to the range handwheel (through the converter) is a device called the range unit. Rotation of this device by the range handwheel permits adjustment of the picture on the range oscilloscope so that a close determination of the slant range becomes possible.

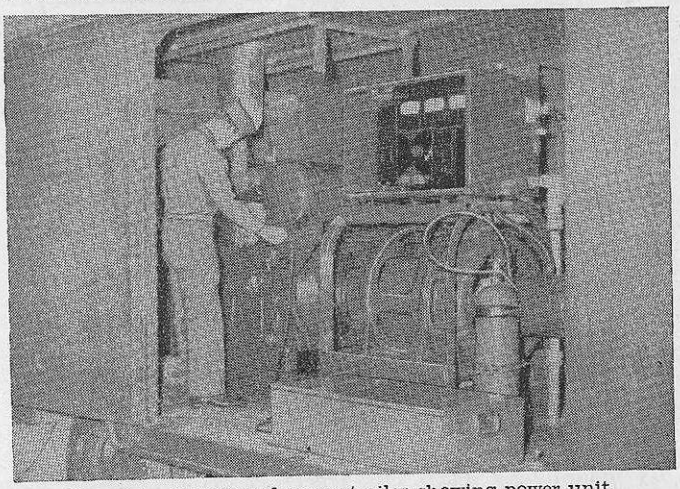


FIGURE 4.—Interior of power trailer showing power unit.

■ 16. DETERMINATION OF ALTITUDE.—The rotation of the elevation handwheel, which is a measure of angular height, and the rotation of the range handwheel, which is a measure of the slant range, are combined mechanically in the converter to secure the altitude of an aerial target. The resultant movement, which is proportional to altitude, rotates the shaft of the altitude repeater in the converter. This device transmits altitude data electrically by cable to the gun director.

■ 17. POWER SUPPLY.—The power supply necessary to operate the various components is housed in the power trailer

where an engine-driven alternator delivers power at 60 cycles and 120 volts, single phase. This arrangement frees the radio set from dependence on external sources of power and makes the unit self-contained.

■ 18. SYNCHRONOUS REPEATERS.—*a. General.*—In order to transmit azimuth, angular height, and altitude from the radio set to any desired location, use is made of synchronous repeaters. These units permit the conversion of mechanical data into voltage relationships, which may then be transmitted by cable to any desired point. Here synchronous repeaters reconvert the voltages into mechanical data. In this manner mechanical movements are effectively transmitted over large distances. In a data transmission system of this type, the sending and receiving units are commonly known as data transmitters and data receivers, respectively.

b. Operation.—Figures 5 and 6 illustrate data transmission systems employing two different designs of synchronous repeaters. The principle of operation, however, is the same.

(1) In figure 5 the rotors of both the data transmitter and data receiver connect to the same a-c source. Voltages of unequal magnitudes are then induced in the three windings of each stator, these voltages varying with the positions of the rotors. When the positions of the rotors of both units correspond, equal and opposite voltages are induced in the corresponding windings of the two stators, and consequently no current flows.

(2) Movement of the transmitter rotor from its position of equilibrium destroys the balance of voltages in the stator windings and produces a current flow. These currents produce torques in both rotors. With the transmitter rotor held fast in its new position, the torque on the receiver rotor will cause it to move to a position of balance, which corresponds accurately to the new position of the transmitter rotor. The action is smooth and almost instantaneous, and the data receiver follows accurately the slightest movement imparted to the transmitter rotor.

(3) If the rotor of the data receiver rotates in a direction opposite to that of the transmitter, two of the three leads from the stator must be reversed. The two units will then be correctly interconnected.

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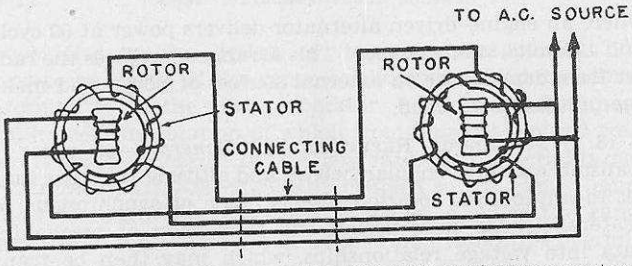


FIGURE 5.—Synchronous repeaters with field excitation on rotor.

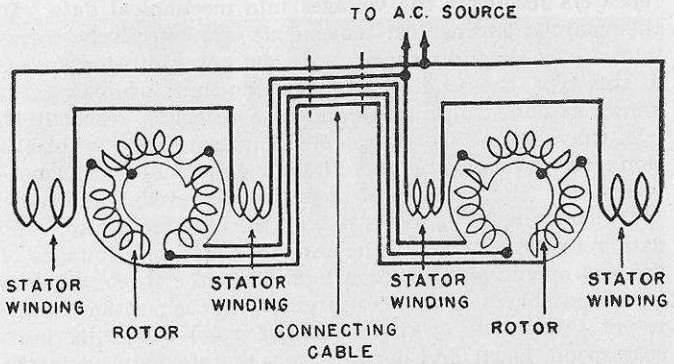


FIGURE 6.—Synchronous repeaters with field excitation on stator.

c. In figure 6, even though the stator and rotor windings of units have been interchanged, the operation of the data transmission system is essentially the same as that illustrated in figure 5 and no difference is noted in its use.

d. Five synchronous repeaters are used in the radio set. They transmit the following elements of data: coarse azimuth, fine azimuth, coarse angular height, fine angular height, and altitude. If the radio set is used in connection with a searchlight instead of a gun director, the data from only the coarse azimuth and coarse angular height repeaters are used.

e. All repeater units of the radio set are provided with stator adjustments. These permit the rotation of the stators so that alinement with interconnected data receivers may be made.

CHAPTER 2

INSTALLATION

		Paragraphs
SECTION I.	Location of units	19–21
II.	Assembly	22–38
III.	Adjustments	39–47

SECTION I

LOCATION OF UNITS

■ 19. GENERAL.—The various components of radio set SCR–268 are transported in two trailers. Trailer K–28–A is the mount upon which the radio position finding equipment is assembled and operated. This unit will be referred to as the *mount*. Trailer K–34–B contains the power plant and certain auxiliary apparatus. When the radio set is disassembled and packed for transportation, many of the instruments are carried in this trailer. This unit will be referred to as the *power trailer*.

■ 20. SITE.—In order to obtain ease of maneuverability and optimum performance of the unit, the location of the radio set is important. Whenever possible the unit should be placed on hill tops or elevated sections of the countryside so as to obtain maximum visibility in all directions. It should be as far removed as possible from formations or objects that rise above the horizontal plane, and from metal buildings, transmission lines, or other obstructing objects which tend to interfere with the directional characteristics of the antennas. In some instances echoes from fixed objects will interfere so badly with tracking operations as to make a new location imperative. Not only must the location be satisfactory electrically, but it must as much as possible remain inconspicuous from the air. In addition, enough space should be available about the radio set to permit easy assembly and manipulation.

■ 21. TRAILERS.—After the mount has been properly located, the prime mover is disconnected and the handwheel at the

front of the trailer is turned to lock the brakes in place. The power trailer, which carries a number of removable components as well as the power unit, should be kept near until the radio set is completely assembled. The power trailer should then be moved as far from the mount as the connecting cables will conveniently allow, preferably placing it in the direction from which targets are least likely to approach. If possible, it should be placed under nearby trees, concealed from hostile observation, and protected against hostile bomb fragments and automatic weapons fire.

SECTION II

ASSEMBLY

■ 22. GENERAL.—Whenever the radio set SCR–268 is to be moved from one location to another, all components must be disassembled and fastened in their assigned places. The unit therefore arrives at its destination in a packed condition and must be reassembled. The following paragraphs present a method of assembly. A great many of the operations described can be performed simultaneously, and experience will in time indicate a faster and more efficient system of procedure.

■ 23. UNPACKING.—When unpacking the components the position and placing of each component should be carefully noted, particularly the method of fastening. This study will be an invaluable aid later in packing the units of the radio set for transportation. To prevent loss, all bolts should be placed back in their respective holes and nuts should be replaced.

■ 24. COVERS AND FRAMES.—Remove the two covers from the frames at either side of the mount. (See fig. 27.) Next disassemble the wooden framing about the antennas and remove the rectangular iron frames forming the ends of the housing supports. Take care that all bolts are placed back in the holes from which they are taken and the nuts are replaced. This will prevent loss or misplacement.

■ 25. REMOVAL OF COMPONENTS FROM MOUNT TRAILER PLATFORM.—*a.* Unfasten the two antenna beams indicated in

figure 28. Remove the beams from the trailer and place them on improvised V-supports as indicated in figure 7. Remove the outriggers, stand-by supports, outrigger jacks, terminal box, keyer, modulator, antenna supports, and modulator frame and platform.

b. Place the keyer and the modulator alongside of the mount. Remove the low voltage slip ring from the back of the terminal box, and plug it into the bottom of the rotatable column as indicated in figure 12. Tighten the two clamp screws.

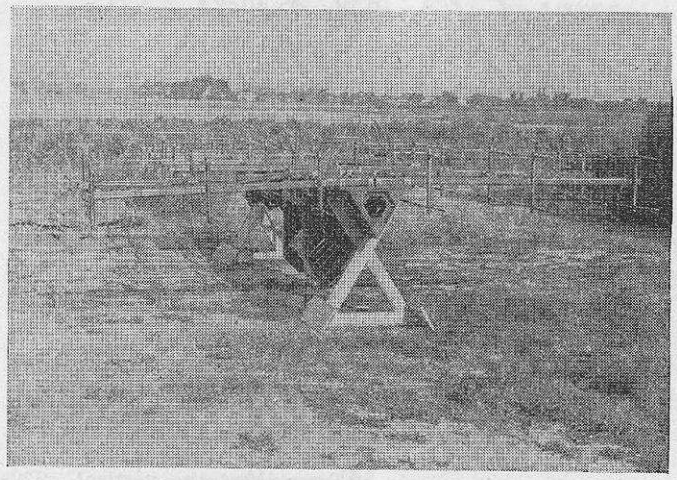


FIGURE 7.—Antenna beam mounted on improvised V-supports.

■ 26. HOIST.—To place the transmitter on top of the rotatable column requires the use of the hoist on the roof of the power trailer. Figure 8 illustrates the mounting and use of the hoist. As will be noticed, the hoist is composed essentially of two parallel beams with a pulley-carrying cross beam at the top. These parallel beams are hinged at the bottom to two short wooden members bolted to the trailer platform. A chain from each of the four corners of the trailer platform fastens to the top of the hoist. Intentional slack present in these chains permits the hoist to be rotated

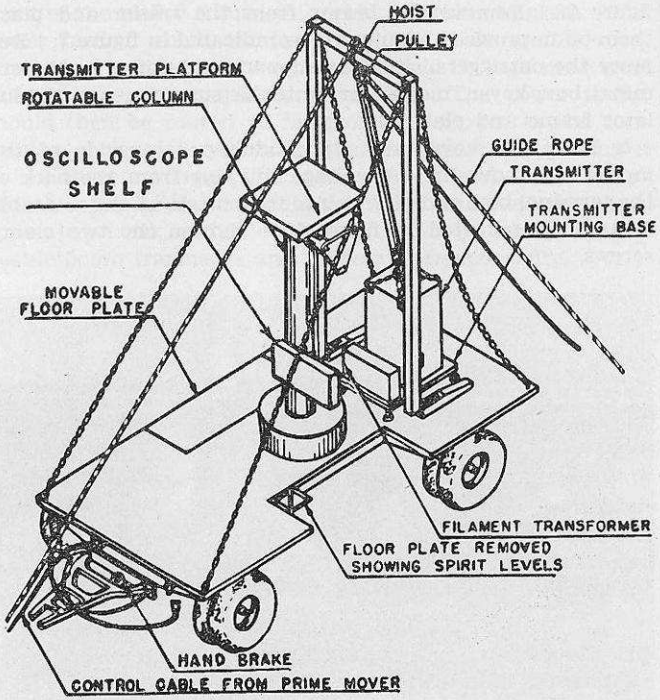


FIGURE 8.—Mount trailer, method of raising or lowering transmitter.

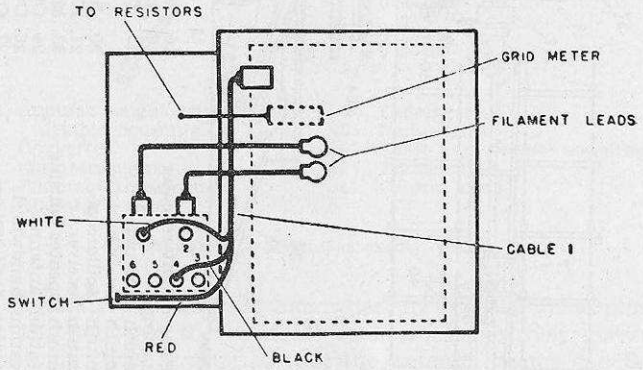
through a small arc on either side of the vertical. This movement is accomplished by applying tension to one or the other of the two guide ropes illustrated in the sketch.

■ 27. TRANSMITTER AND FILAMENT TRANSFORMER.—*a.* Fasten chains to the lugs at the top of the transmitter and then attach the pulley hook to these chains. With the rotatable column in the position shown in figure 8, raise the transmitter to the top of the hoist by means of the pulley, swing the hoist toward the rotatable column by pulling on the rope, and then lower the transmitter to its place on the transmitter platform. Bolt this unit in position.

b. Follow a similar procedure in raising the filament transformer, and then fasten it in place at the top of the rotatable column. Next interconnect the transmitter and filament transformer as indicated in figure 9. In addition, connect the cases of the two units together with the ground braid inside the filament transformer housing.

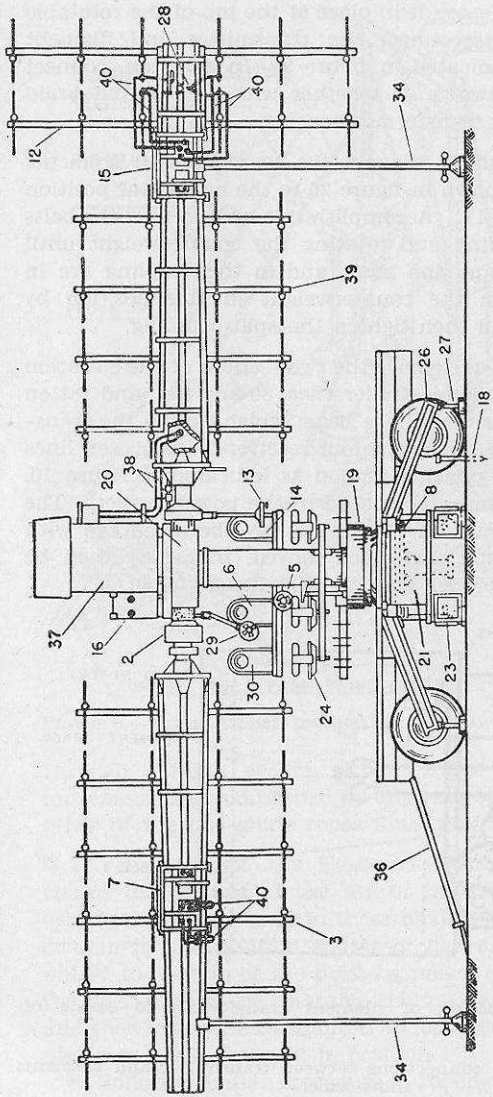
■ 28. COUNTERWEIGHT.—Change the counterweight from the vertical position shown in figure 26 to the horizontal position indicated in figure 11. Accomplish this by loosening the bolts on the split coupling and rotating the counterweight until the holes in the antenna shaft and in the coupling are in alinement. Fasten the counterweight in this position by means of bolts and then tighten the split coupling.

■ 29. ANTENNAS.—*a.* Remove the two sections of the elevation antenna from the power trailer (figs. 30 and 32), and fasten them to the end section of the beam which carries the transmitting antenna. Attach the four receiver transmission lines and the elevation phasing section as indicated in figure 10. All transmission lines are packed in the power trailer. The positions of the stubs on these lines have been marked with paint. If the stubs have been moved, they may then be replaced in their proper position with little trouble.



NOTE.—Connect casing of filament transformer to casing of transmitter.

FIGURE 9.—Detail of connections between transmitter and filament transformer.



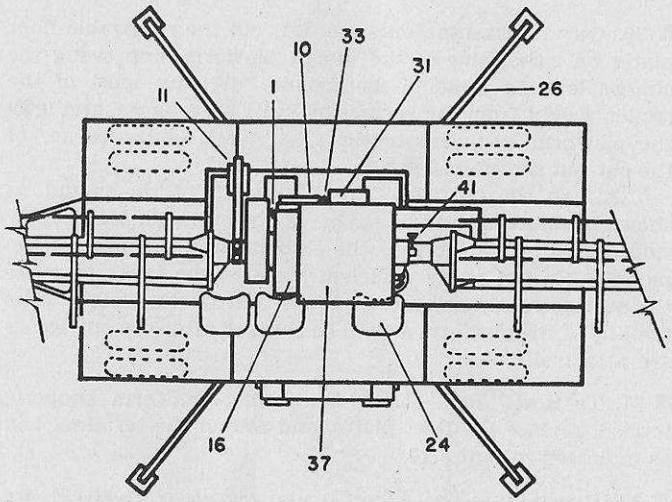
2. Angular height repeater housing.
3. Azimuth antenna.
5. Azimuth handwheel.
6. Azimuth oscilloscope.
7. Azimuth receiver.
8. Azimuth repeater housing.
12. Elevation antenna.
13. Elevation handwheel.
14. Elevation oscilloscope.
15. Elevation receiver.
16. Filament transformer.
18. Ground stake.
19. High voltage slip ring assembly.
20. Junction box.
21. Keying unit.
23. Modulator.
24. Operator's seat.
26. Outrigger.
27. Outrigger jack.
28. Phasing section.
29. Range handwheel.
30. Range oscilloscope.
34. Stand-by support.
36. Towing tongue.
37. Transmitter.
38. Transmitter transmission lines.
39. Transmitting antenna.
40. Transmission lines.

NOTE.—Cables not shown.

FIGURE 10.—Mount assembly, elevation.

b. Remove the receiver brackets from their positions in the power trailer (figs. 30 and 31).

c. Attach the receiver brackets to the antenna beams at the indicated points. The brackets can be distinguished from each other by noting that the hole for cable connections must be toward the mount.



1. Angular height shaft and flexible coupling.
10. Converter.
11. Counterweight.
16. Filament transformer.
24. Operator's seat.
26. Outrigger.
31. Range unit.
33. Shaft and flexible coupling.
37. Transmitter.
41. Tuning knob.

FIGURE 11.—Mount assembly, plan.

d. Rotate the elevation handwheel so that the guide pins on the flange of the rotatable column assume their lowest position. This is done so that the antenna beams can be mounted with the antenna arrays parallel to the earth.

e. Raise the azimuth antenna to its flange and fasten it in place. The stand-by antenna supports, illustrated in figure 10, may be used to raise the outer end of the beam if a plat-

form is not available. Note that the azimuth antenna is placed on the same side of the rotatable column as the range handwheel.

f. Next raise the beam carrying the elevation and transmitting antennas, and bolt it in place. After the antennas are in place, connect the transmitter transmission lines as indicated in figures 10 and 12.

■ 30. OUTRIGGERS AND JACKS.—*a.* Lift out the removable floor plates on either side of the mount platform, and swing the chassis leveling jacks to the ground. Remove most of the trailer weight from the springs by using these jacks, and level the platform by means of the spirit levels in the corner of the cut-out shown in figure 8.

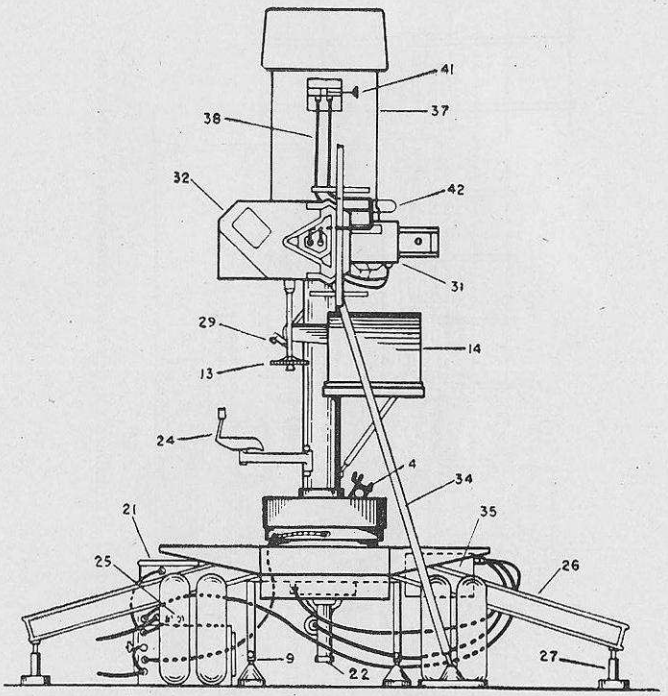
b. Attach the outriggers to the chassis of the mount as shown in figure 10, and by means of the outrigger jacks apply sufficient force to increase the stability and firmness of the mount. Do not apply sufficient force to the jacks to make the outriggers support any of the weight of the trailer. The leveling of the platform should be checked after the outriggers are attached.

■ 31. TERMINAL BOX.—With the trailer platform properly leveled, replace the floor plates, and attach the terminal box as indicated in figure 12.

■ 32. RECEIVERS.—The azimuth and elevation receivers are transported in a rack in the power trailer. Remove two units and place one in each receiver bracket on the antenna beams. Fasten each one in place by means of a canvas strap. The packing case of the modulator may be used as a platform in placing the receivers. Insert and tighten the screw connections of the transmission lines.

■ 33. OSCILLOSCOPE SHELF.—Raise the shelf shown lowered in figure 26 and fasten it in position by means of the struts underneath.

■ 34. OPERATORS' SEATS.—Shift these seats outward from the antenna column and pin their support to the projecting member hinged to the rotatable column.



4. Azimuth foot brake.
9. Chassis leveling jack.
13. Elevation handwheel.
14. Elevation oscilloscope.
21. Keying unit.
22. Low voltage slip ring assembly.
24. Operator's seat.
25. Outlet, 120-volt, for appliances.
26. Outrigger.
27. Outrigger jack.
29. Range handwheel.
31. Range unit.
32. Receiver bracket.
34. Stand-by support.
35. Terminal box.
37. Transmitter.
38. Transmitter transmission lines.
41. Tuning knob.
42. Tuning stub.

FIGURE 12.—Mount assembly, side.

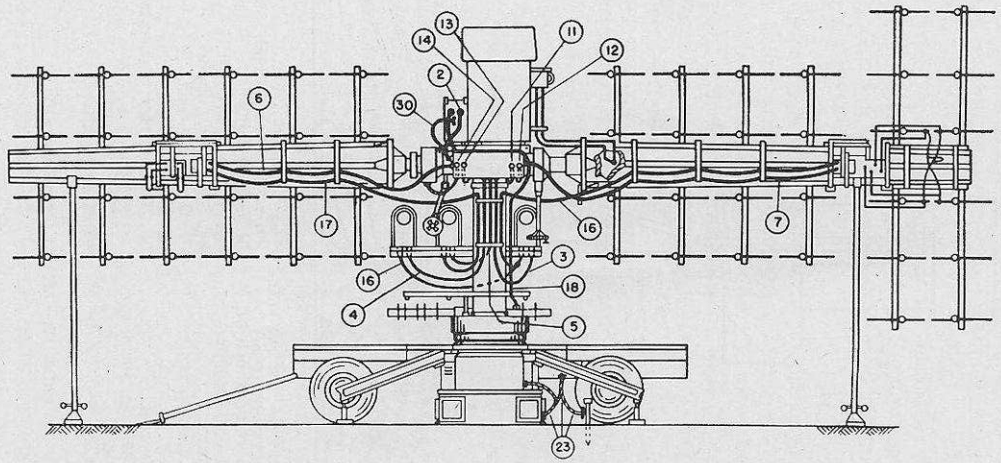
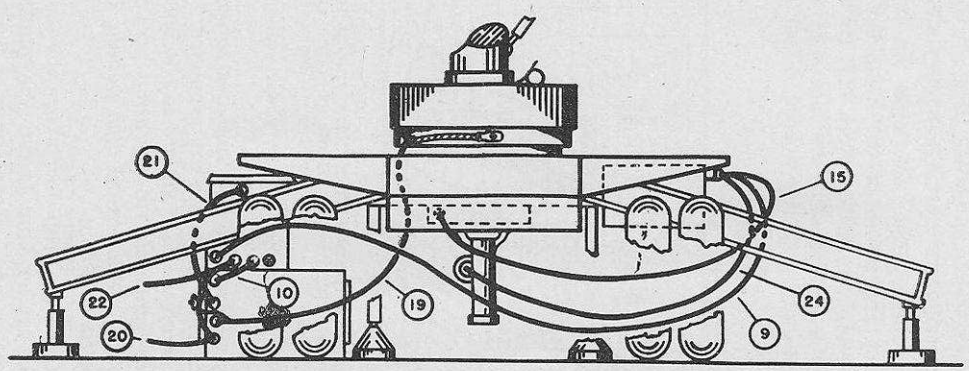


FIGURE 13.—Cable connections on mount. (Numbers on drawing correspond to cable tags.)

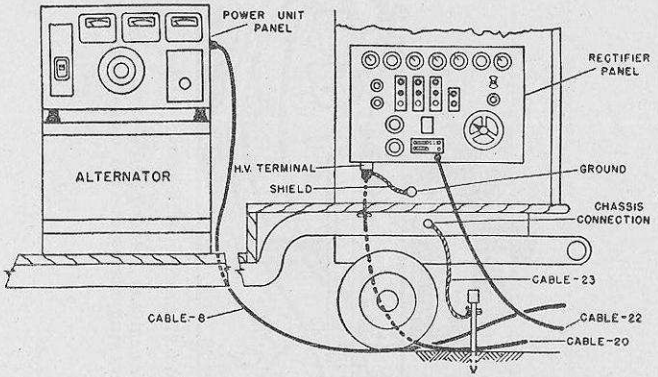


NOTE.—Cables 20 and 22 terminate in power trailer.

FIGURE 14.—Cable connections below platform on mount. (Numbers on drawing correspond to cable tags.)

■ 35. OSCILLOSCOPES.—Remove three of the oscilloscopes from the rack in the power trailer and place them on the oscilloscope shelf. These oscilloscopes are not fastened down.

■ 36. CABLE CONNECTIONS.—Place the keyer on top of the modulator. Connect the cables of the radio set as indicated in figures 13, 14, 15, and 16. Note that each cable is numbered, permitting identification by means of the cable diagrams easily and quickly. Drive a ground stake into the ground at each of the trailers.



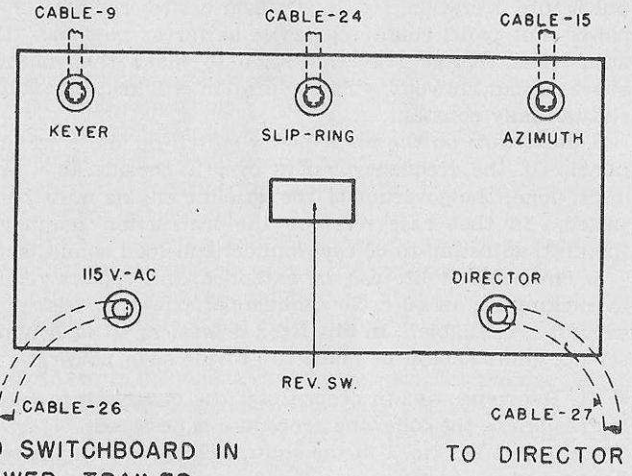
NOTE.—Cable 8 connects to cable 26 which connects to terminal box. Cable 20 connects to modulator. Cable 22 connects to keying unit.

FIGURE 15.—Cable connections at power trailer.

WARNING: Before operation of any components, make certain that the cases of all units are grounded. All cable shields must also be grounded. Failure to comply with this warning may prove dangerous to operating personnel. Do not depend upon the insulation of high voltage cables for protection. Stay clear of them.

■ 37. MUFFLER.—Open the trap door above the gasoline engine in the power trailer, and fasten the muffler to the exhaust port of the engine. Place the roof flange for the muffler in position. The muffler should be removed and the trap door closed when the engine is not in use.

■ 38. POWER UNIT GASOLINE SUPPLY.—With an outside source of gasoline available, use the gasoline hose and fitting in one of the spare-parts boxes, and attach them to the valve at the front of the gas tank. The gasoline flow from the tank itself may be stopped by a shut-off valve directly underneath. After the gasoline line is primed, the fuel pump of the engine is capable of drawing gasoline from a reservoir twelve feet lower than itself.



NOTE.—Cable 26 connects to cable 8 which connects to power unit panel in power trailer.

FIGURE 16.—Table connections at terminal box.

SECTION III

ADJUSTMENTS

■ 39. INSPECTION OF COMPONENTS AND CONNECTIONS.—Before any power is turned on, make certain that—

a. The cases of all components are grounded.

b. Ground stakes are firmly driven into the ground.

c. Antennas are free from misalinement, broken tubing, missing insulators, loose joints, and other bad connections.

d. Transmission lines are correctly connected.

e. All cables are properly connected and fastened.

f. All components are firmly held in place.

g. Sufficient gasoline is available for operation of the unit.

■ 40. POWER UNIT.—*a.* After preparation of the power unit for service as directed by the manufacturer's instruction book, put it into operation. Turn the field exciter rheostat on the power unit panel counterclockwise as far as possible. Then adjust the voltage regulator knob to make the voltmeter above it read 118 volts. This operation will keep the voltage substantially constant.

b. Next turn on the main power switch on the power unit panel. If the frequency varies over a considerable range under load, the governor of the gasoline engine must be adjusted. In that case refer to the instruction manual on the unit, adjusting to 60 cycles under full-load conditions.

c. Power plant life can be extended and repairs reduced by making use of 60-cycle commercial power or post power when it is available. In any fixed defense or semipermanent set-up, effort should be made to provide such power.

■ 41. RECTIFIER.—*a.* In order to set the rectifier into operating readiness, the following procedure is observed:

(1) Insert key No. 1 in the control panel door of the rectifier and open.

(2) With key No. 1 unlock lockswitch "C", and remove key No. 2 from lock "D"; then with key No. 2 unlock lockswitch "E".

(3) Press line "On" button and filament "On" button.

(4) Adjust the filament voltage to the red mark on the filament voltmeter by means of the filament control handwheel.

(5) At the expiration of approximately 1 minute, the remote control cable will permit the rectifier to be thrown on or off at the keyer.

b. When first setting the rectifier into operation the plate control handwheel should be set at zero. The plate voltage may later be increased to the correct value if all other components are operating normally. Reference should be made to the manufacturer's instruction book for further details on the rectifier.

■ 42. JUNCTION BOX.—With the power unit in operation, turn on the main power switch at the keyer. Then throw on all switches of the junction box except that of the heaters. Adjust the voltage regulator control so that the pointer of the transmitter filament meter is on the red line.

■ 43. OSCILLOSCOPES.—To adjust each oscilloscope proceed as follows:

a. Note the existence of sweep which manifests itself as a base line on the oscilloscope. This indicates operation of the keyer and range unit.

b. Adjust the intensity control so as to secure a sufficiently bright trace on the oscilloscope screen.

c. Adjust the focus control so that the trace on the screen is as clear cut as possible.

d. Adjust the sweep control so as to secure a base line stretching almost entirely across the oscilloscope screen.

e. Adjust the vertical and horizontal positioning controls so that the base line is somewhat below center on the oscilloscope screen.

f. Note, with the sensitivity control at a maximum, that a high noise level appears above the base line.

g. Vary the spread control and note that the base line expands and contracts laterally.

■ 44. KEYER.—*a.* Thirty (30) seconds after closing the keyer main switch, the keyer high voltage may be applied.

b. With the bias control at maximum, and the keying supply voltage control at minimum, press the start button marked "Keyer high voltage." Adjust the keying supply voltage to read 3,000 volts on the meter directly above the control.

c. Push the start button marked "Rectifier" at the keyer. By means of the plate control handwheel at the rectifier panel, bring the voltage slowly up to 5,000 volts. Reduce the bias at keyer slightly if necessary to bring the transmitter grid current up to approximately 20 milliamperes and tune the transmitter rack for minimum grid current. If all components are functioning properly, bring the rectifier voltage

445751°—42——5

up to 11,000 volts. Then adjust the bias at the keyer to bring the transmitter plate current gradually up to 400 milliamperes.

■ 45. RANGE UNIT.—Check the range unit for proper operation through one complete traverse by means of the range handwheel.

■ 46. TRANSMITTER.—*a.* The tuning knob at the side of the transmitter is adjusted for the minimum grid current. The correct position of the stub on the transmission line has been marked with paint and should require no adjustment. The keyer bias should be reduced to produce a transmitter plate current as close to 400 milliamperes as possible. The transmitter should then be operating with these values:

Transmitter filaments	—5.1 volts (readjust voltage regulator knob at junction box if necessary).
Plate current	—400 milliamperes, approximately.
Grid current	—80 milliamperes.

The transmitter should not ordinarily be operated with the grid current under 80 milliamperes.

b. The frequency and stability of the signal produced by the transmitter should be checked with the frequency meter. The frequency should not depart from the given frequency by more than one-fourth megacycle.

■ 47. RECEIVERS.—Point the antenna arrays at any object with a range sufficient to provide a suitable fixed echo. Adjust the tuning of both the elevation and azimuth receivers until the greatest height of echo is obtained on the screens of their respective oscilloscopes.

CHAPTER 3

ORIENTATION AND SYNCHRONIZATION

	Paragraphs
SECTION I. General	48–50
II. Orientation	51–54
III. Synchronization with gun director	55–63
IV. Synchronization with searchlight	64–68

SECTION I

GENERAL

■ 48. ORIENTATION.—Orientation includes the adjustment of the radio set SCR–268 for azimuth, angular height, and slant range.

■ 49. SYNCHRONIZATION.—Synchronization is the process of making certain that the elements of data are being transmitted correctly between the radio set SCR–268 and its associated equipment.

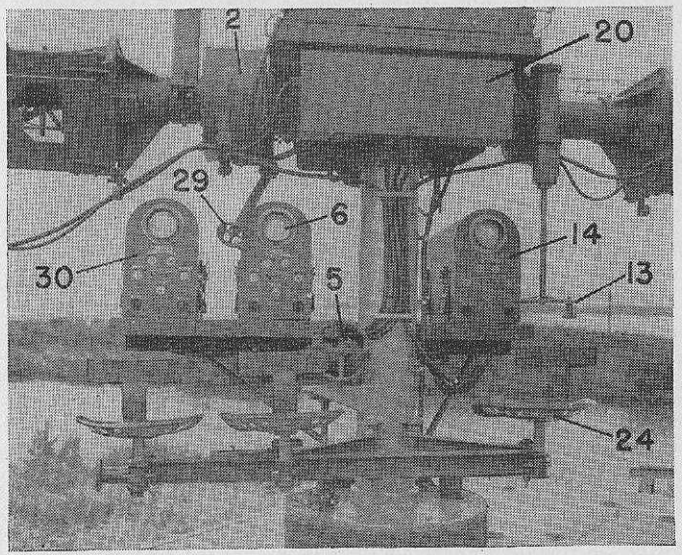
■ 50. ORIENTATION REQUIREMENTS.—Subject to the tactical requirements, the operating position of the radio set should be selected so that a fixed echo from a visible object, such as a water tank, a steel tower, or even a hill, can be obtained. The range to this object should be as great as the visibility requirements permit. A range of less than 2,500 yards should be avoided. An object beyond the visibility range may be used as an orienting point provided it yields a suitable echo, its azimuth and range are known, and also a local means of orienting the director is available.

SECTION II

ORIENTATION

■ 51. ORIENTATION IN RANGE WITH FIXED ECHO.—In order that the correct altitude can be transmitted to the gun director, it is necessary to orient the radio set SCR–268 in range. In order to accomplish this, the antenna system is directed toward the fixed orienting point. The horizontal positioning controls of all oscilloscopes are set at about midpoint, spread removed, sweep controls set for approximately a 4-inch base line, and focus and intensity adjusted properly. The range handwheel (fig. 17) is turned until the fixed echo is approximately at the center of the screens. The coupling

between the converter and the range unit (fig. 18) is loosened, and the range handwheel is turned until the slant range dial indicates the range to the fixed orienting point. Since the range unit is disconnected during this operation, no change in the position of the echo takes place. After the converter is set at the proper reading, the range unit is reconnected and the fixed echo of each oscilloscope is moved, by means of its horizontal positioning potentiometer, until the line on the oscilloscope screen coincides with the peak of the echo. The radio set is now oriented in range. *Movement of any control other than sensitivity or spread will cause a loss of orientation.* When orientation is done in the manner described above, the range operator in tracking should keep the peak of the echo on the cross hair.



2. Angular height repeater housing.
5. Azimuth handwheel.
6. Azimuth oscilloscope.
13. Elevation handwheel.
14. Elevation oscilloscope.
20. Junction box.
24. Operator's seat.
29. Range handwheel.
30. Range oscilloscope.

FIGURE 17.—Rear of mount.

■ 52. ORIENTATION IN RANGE WITHOUT FIXED ECHO.—If no suitable source of a fixed echo at known slant range is available as an orienting point, it will be necessary to orient in range without a fixed echo. By means of the plate control handwheel at the rectifier panel, adjust the output voltage to 1,000 volts. Adjust the bias at the keyer to produce a pulse about 2 inches high on the oscilloscope screen with "sensitivity" control at a minimum. The peak of this pulse is set at zero range in the manner described for a fixed echo at a known range.

■ 53. ORIENTATION IN AZIMUTH.—Due to the fact that the radio set SCR–268 is not equipped with an azimuth scale at present, it is impossible to orient the instrument in azimuth except by reading the azimuth dials on the director. The process of alining the radio set with the director is discussed in paragraphs 55 to 68, inclusive.

■ 54. ORIENTATION IN ANGULAR HEIGHT.—*a.* Orientation in angular height is accomplished by alining the radio set with the director (pars. 55 to 68, incl.).

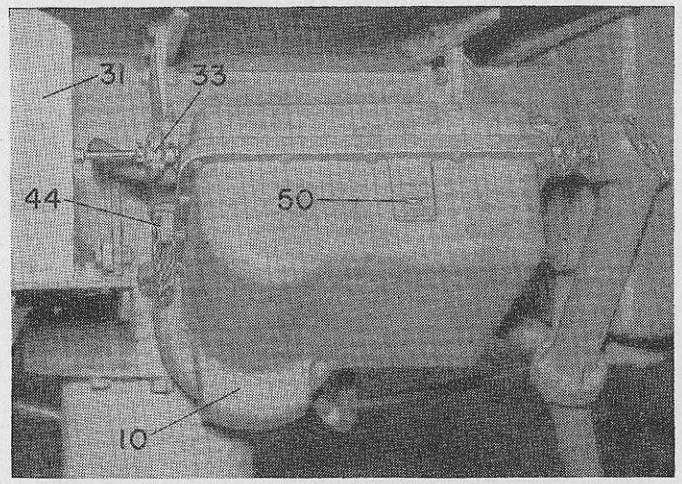
b. If the methods referred to in paragraphs 60, 61, and 62 cannot be applied, a rough check on orientation in angular height can be made by placing the antenna arrays at zero elevation and adjusting the angular height counter to zero.

SECTION III

SYNCHRONIZATION WITH GUN DIRECTOR

■ 55. ALINEMENT.—Before the data from radio set SCR–268 can be properly assimilated by the gun director, it is necessary to aline the director with the radio set. This process is called synchronization, and is described in the following paragraphs. The procedure outlined applies primarily to the director M4 (modified) and later models of the gun director.

■ 56. SYNCHRONIZATION IN ALTITUDE.—*a.* The synchronous repeater circuits of the radio set and the director are energized and the rotation of the altitude data receiver dial is verified. If the direction is reversed, that is, increasing altitude at the radio set rotates the altitude data receiver dial counter-



10. Converter.
31. Range unit.
33. Shaft and flexible coupling.
44. Altitude repeater adjustment.
50. Slant range dial.

FIGURE 18.—Rear view of converter.

clockwise, the altitude reversing switch at the terminal box should be thrown.

b. Range orientation having been completed, the converter is set at any combination of angular height and slant range that will give an altitude of 2,000 yards.

c. The altitude setting handwheel at the director is turned until the 2,000-yard mark is opposite the index on the altitude dial.

d. The altitude data transmitter adjusting screw on the radio set (fig. 18) is rotated until the "AA" pointers on the altitude dial at the director are matched. Stops limit the rotation of the altitude data transmitter housing to about 40°. If the radio set and gun director have been properly zeroed electrically, this rotation should be ample to match the "AA" pointers.

e. Early production models of the radio set SCR–268 were not zeroed electrically in altitude. The altitude data transmitter on such models may be zeroed electrically by a qualified ordnance mechanic. A field adjustment may be made by

shifting the dial of the altitude receiver in the director to make the transmitted and received data agree.

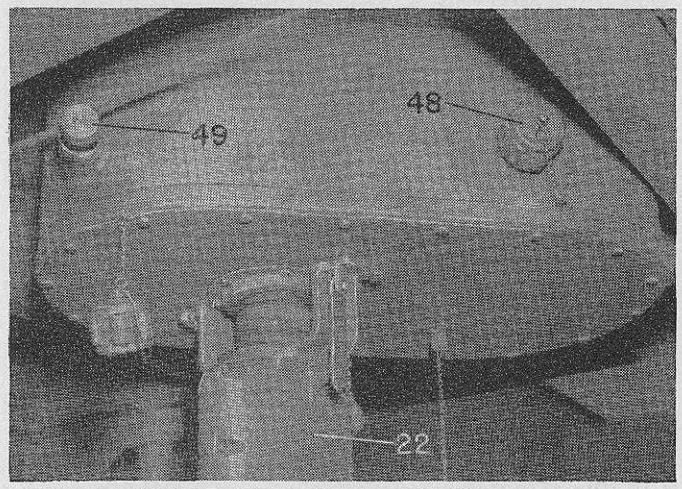
■ 57. SYNCHRONIZATION IN AZIMUTH WITH FIXED ECHO.—*a.* A check is first made for the proper direction of rotation of the azimuth data receiver dials. If the direction is reversed, that is, increasing azimuth at the radio set transmits decreasing azimuth to the director on either the coarse or the fine dials, the corresponding reversing switch, at the terminal box should be thrown.

b. The mount is carefully leveled.

c. If a visible source of a fixed echo is available, the antenna system is directed at this orienting point. The split echoes are now carefully balanced.

d. The director is now pointed at the same orienting point that the radio set is using and the azimuth dial is set at either a true or an arbitrary reading.

e. The pointers on the fine and coarse azimuth dials at the director are matched by turning the azimuth data transmitter adjusting screws at the radio set. (See fig. 19.)



22. Low voltage slip ring assembly.
48. Coarse azimuth repeater adjustment.
49. Fine azimuth repeater adjustment.

FIGURE 19.—Azimuth repeater housing.

■ 58. SYNCHRONIZATION IN AZIMUTH WITHOUT FIXED ECHO.—If a visible source of a fixed echo is not available, the following alternate method of synchronization may be used:

a. A check for proper direction of rotation of the azimuth data receiver dials is made in a manner similar to that described in the preceding paragraph, and correction is similarly made if necessary.

b. The mount is carefully leveled.

c. The antenna system is traversed until it points in the general direction of the director.

d. The azimuth telescope of the director is pointed at the center of the vertical column of the mount.

e. The test modulator (BC–423) is placed on a line 11 feet 4 inches to the right of the line of sight from the director

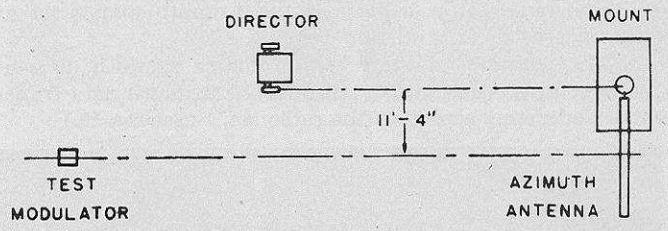


FIGURE 20.—Position of test modulator for synchronization in azimuth.

to the mount. It should be placed as far from the mount as the cables and the terrain will permit. (Fig. 20.)

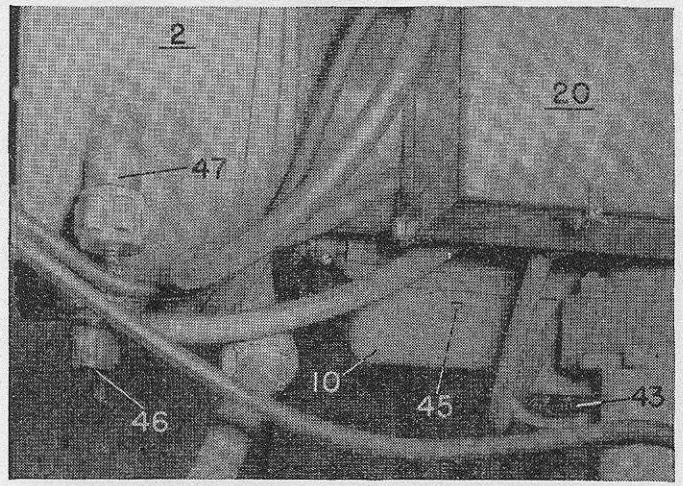
f. With the test modulator and the radio set in operation, the split echoes produced on the azimuth oscilloscope screen by the test modulator are balanced by turning the azimuth handwheel.

g. Azimuth fine pointers on the director are matched by turning the adjusting screw of the corresponding data transmitter at the radio set. Azimuth coarse pointers on the director are made to read 3,200 mils apart in a similar manner.

■ 59. PARALLAX CORRECTIONS.—Inclusion of a parallax correction depends upon the distance and the direction of the orienting point and upon the separation of the director and

the radio set. In general, the line of sight of the director and the electrical axis of the radio set should converge at midrange in the most likely target direction.

■ 60. SYNCHRONIZATION IN ANGULAR HEIGHT.—*a.* A check for proper direction of rotation of the present angular height data receiver dials is made in a manner similar to that described for the azimuth data receivers and correction



2. Angular height repeater housing.
10. Converter.
20. Junction box.
43. Altitude dial.
45. Angular height dial.
46. Coarse angular height repeater adjustment.
47. Fire angular height repeater adjustment.

FIGURE 21.—Components near center column of mount.

is similarly made if necessary.

b. With the mount leveled, the antenna is placed at zero angular height (frame vertical).

c. The telescopes of the director are set at zero angular height.

d. The pointers on the fine and coarse present angular height dials at the director are matched by turning the angular height data transmitter adjusting screws at the radio set. (See fig. 21.)

e. As the electrical and mechanical axes may diverge by a considerable amount, a check of angular height synchronization is essential. (See pars. 61*b* and 62.)

■ 61. CHECK OF SYNCHRONIZATION.—If a friendly airplane is available, it is desirable that a check of synchronization of the radio set with the director be made.

a. The check of synchronization in azimuth is preferably made with the airplane flying a course radially toward or away from the director site in order to produce nearly constant azimuth readings. The operators of the radio set and of the director put their instruments "on target" and continue to track. The chief of section of the radio set observes the azimuth dials of the director and notes the average error of the data transmitted from the radio set. This procedure is repeated, if possible, for several radial courses in the sector from which targets are most likely to approach, and the average of all errors is used as the magnitude of the required correction in azimuth. To introduce this correction the mount is first traversed so as to transmit any convenient azimuth and clamped in position with the foot brake. The adjusting screw of the fine azimuth transmitter of the radio set is turned so as to change the transmitted reading by the desired amount. Unless this correction is very large, it should not be necessary to adjust the coarse azimuth transmitter.

b. For the check of synchronization in angular height, it is desirable that the airplane fly a course that will give angular height readings of 500 to 800 mils, and it is preferable that the course be an arc with the director site as a center in order to produce nearly constant angular height readings. If necessary, the check of angular height may be made simultaneously with that of azimuth. The average error is similarly determined for several courses at different angular heights. The corresponding correction is made as directed in paragraph 63.

■ 62. CHECK OF ANGULAR HEIGHT SYNCHRONIZATION BY MEANS OF TEST MODULATOR.—If a friendly airplane is not available for a check of synchronization, the test modulator may be used to adjust the alinement in angular height.

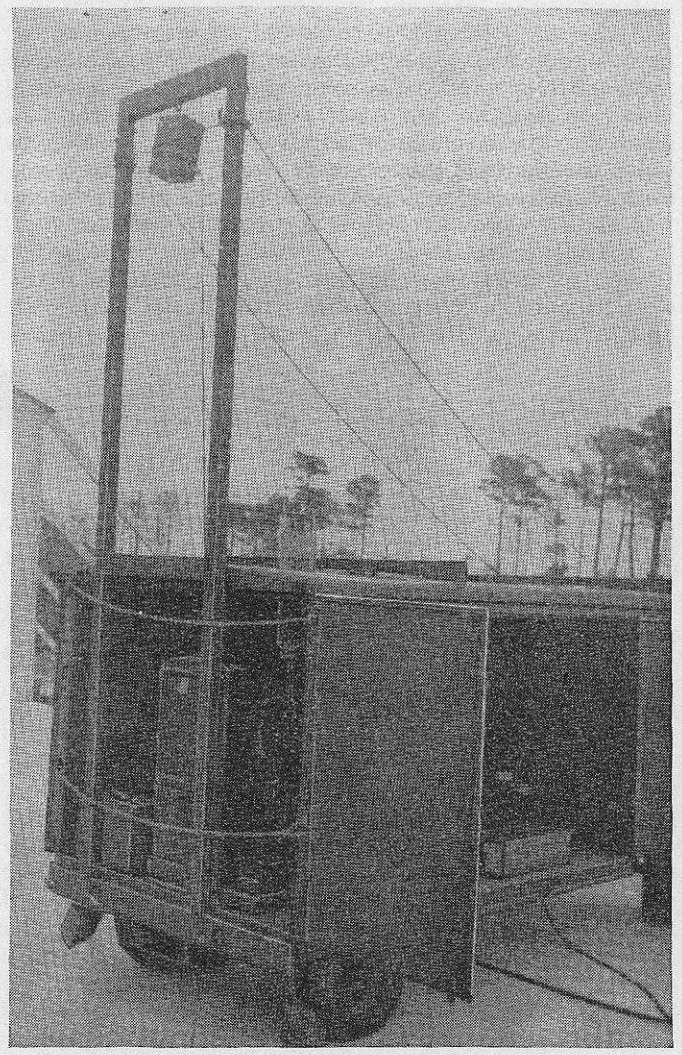


FIGURE 22.—Test modulator in position for check of synchronization in angular height.

a. The test modulator is suspended from the top of the hoist, and the hoist lashed to the rear of the power trailer as indicated in figure 22. The power trailer is placed approximately 30 feet from the elevation antenna as indicated in figure 23. The mount must be traversed to that position in which the line from the test modulator to the center of the elevation antenna is perpendicular to the plane of the antenna.

b. The director is leveled and the elevation telescope is set to zero angular height.

c. A steel tape is suspended from the axis of rotation of the elevation antenna on the radio set. The director is traversed until it points at the steel tape and the vertical distance

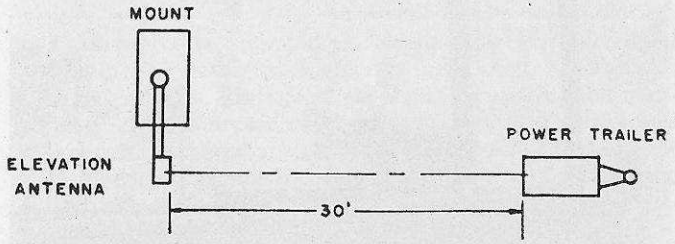


FIGURE 23.—Location of power trailer for check of synchronization in angular height.

between the line of sight of the telescope and the axis of rotation of the elevation antenna is read.

d. In a similar manner, the vertical distance between the line of sight of the telescope and dipole of the test modulator is measured.

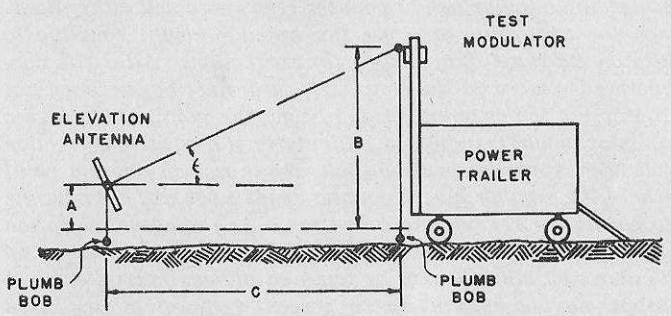
e. The horizontal distance between the axis of rotation of the elevation antenna and the vertical plane containing the test modulator dipole is measured, using plumb bobs as indicated in figure 24.

f. By means of the preceding measurements, the actual angular height of the test modulator with respect to the axis of rotation of the elevation antenna can be calculated using the formula:

$$\epsilon = \tan^{-1}\frac{B-A}{C} \qquad \text{(See fig. 24.)}$$

g. With the test modulator and the radio set in operation, the split echoes on the elevation oscilloscope are balanced by turning the elevation handwheel of the radio set. When balancing the split echoes and making the various measurements, it is necessary that the antenna system be firmly clamped in azimuth by means of the azimuth brake.

h. The director is set at an angular height equal to the computed angle ϵ, and the fine and coarse angular height pointers on the director are matched by adjusting the corresponding data transmitters at the radio set.



A. Vertical distance between axis of rotation of elevation antenna and line of sight of director telescopes.
B. Vertical distance between dipole of test modulator and line of sight of director telescopes.
C. Horizontal distance between axis of rotation of elevation antenna and vertical plane containing test modulator dipole.
ϵ. Angular height of elevation antenna.

FIGURE 24.—Calculation of angular height of elevation antenna.

■ 63. PLACING FIXED ANGULAR HEIGHT CORRECTION IN CONVERTER.—*a.* If as a result of a check of angular height orientation on a friendly airplane, an angular height correction is indicated, this correction must be included in the converter system. Assume that the indicated *correction* is plus 50 mils. Then the angular height dial (fig. 21) at the converter must be made to indicate 50 mils when the antenna system is at zero angular height. This is accomplished, with the antenna system rotated to zero angular height, by loosening the locking screw on the worm adjustment located beside the

angular height coupling to the converter, turning the adjusting screw until the angular height counter indicates the proper value, and then tightening the locking screw. Normally, the correction will be positive. If the correction is negative, say minus 50 mils, the antenna system must be set at 50 mils actual angular height, and the counter made to read zero in the manner described above.

b. The converter has limit stops at angular height readings of zero and 1,600 mils. If a negative correction has been applied, *depressing the antenna system below the point at which the angular height counter reads zero will either damage the apparatus or cause the angular height coupling to slip on its shaft and remove the correction. After the correction is placed in the converter, care must be exercised not to depress the antenna system below the point where a zero angular height is indicated. Similarly, if a positive correction has been applied, elevating the antenna system above a point where the angular height counter reads 1,600 will damage the apparatus or remove the correction. As the actual elevation of the mount is limited to about 85°, positive corrections up to about 90 mils will not be removed at maximum elevation. Stops may be improvised to prevent removal of any fixed corrections.*

Section IV

SYNCHRONIZATION WITH SEARCHLIGHT

■ 64. Cable Connections.—Since only two elements of data, namely coarse angular height and coarse azimuth, are utilized by the searchlight in locating a target, it is necessary that the cables of the data transmission system be modified. The short adapter cable (No. 28) of the radio set is joined to the director cable (No. 27) and inserted in the sound locator cable receptable at the searchlight.

■ 65. Synchronization in Azimuth With Fixed Echo.—*a.* If a visible source of a fixed echo is available, the antenna system is directed at this orienting point. The split echoes are then carefully balanced.

b. The searchlight azimuth clutch is disengaged (turned to "hand control" or "out" position), and the searchlight is pointed at the source of the fixed echo. The azimuth clutch

is reengaged (turned to D. E. C. or "in" position), power is applied, and a vernier adjustment on the orienting point is obtained by means of the distant electric control.

c. (1) When the radio set and the searchlight have been alined as described above, the azimuth zero readers at the searchlight and the control station may or may not read zero. They should be made to read zero by turning the azimuth data receiver adjusting screw at the searchlight.

(2) It is possible to obtain two zero readings on the azimuth zero reader which are 180° apart. The correct zero is obtained when the needle of the azimuth zero reader at the control station moves to the right when the azimuth handwheel is rotated clockwise, and to the left for counterclockwise rotation.

d. The azimuth handwheels of the control station are held to prevent turning, and the control station is slipped until it is directed at the source of the fixed echo. If the echo source is not visible from the control station, the searchlight may be directed at any visible object by means of the D. E. C., and the control station slipped until it is directed at the same object.

e. The same considerations governing parallax corrections for the director apply also to the searchlight. (See par. 59.)

■ 66. Synchronization in Azimuth Without Fixed Echo.—If a visible source of a fixed echo is not available, the following method of synchronization in azimuth is necessary:

a. (1) The antenna system is directed away from the searchlight.

(2) The searchlight sight is directed at a point on the mount the same distance to the left of the center column as the searchlight sight is left of the center of the searchlight.

(3) A point is marked on the prolongation of this line of sight and the same offset "d" (fig. 25) is measured in order to establish a new point on the line of centers of the searchlight and the mount.

(4) The test modulator is placed on a line 11 feet, 4 inches left of the line of centers as viewed from the mount. It should be placed as far away as the cables and the terrain will permit (fig. 25).

b. With the test modulator and the radio set in operation, the antenna system is directed at the test modulator by turning the azimuth handwheel of the radio set until the split echoes produced on the azimuth oscilloscope screen by the test modulator are balanced.

c. The radio set and the searchlight now being pointed in the same direction, synchronization is accomplished by making the azimuth readers on the searchlight and control station read zero. The control station is oriented as described in paragraph 65*d*.

■ 67. SYNCHRONIZATION IN ANGULAR HEIGHT.—*a.* The searchlight elevation clutch is turned to the hand position, and the searchlight is set to zero elevation by hand. The elevation

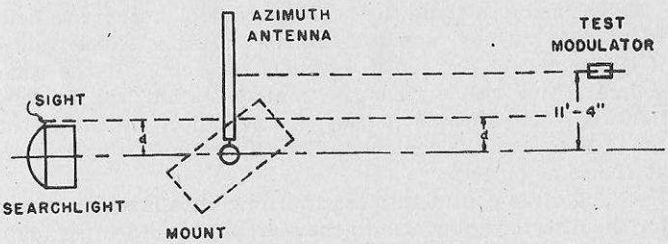


FIGURE 25.—Position of test modulator with respect to searchlight and radio set.

clutch is turned to D. E. C. and the searchlight is set accurately to zero elevation by means of the control station.

b. The antenna system of the radio set is placed at zero elevation.

c. (1) The elevation zero reader is adjusted to a zero reading by adjusting the elevation data receiver located on the left trunnion arm of the searchlight.

(2) Two zero readings can be obtained. The correct zero reading is indicated when the needle of the elevation zero reader at the control station moves to the right with clockwise rotation of the elevation handwheel, and to the left with counterclockwise rotation.

■ 68. CHECK OF SYNCHRONIZATION.—If a friendly airplane is available, it is desirable that a check of synchronization of

the radio set with the searchlight be made. Such a check must be made at night.

a. For the check of synchronization in azimuth, it is preferable that the airplane fly a course directly toward or away from the light in order to produce nearly constant azimuth. The operators of the radio set and of the control station track the target continuously, while the chief of section of the radio set observes the azimuth zero reader on the searchlight and notes the average deflection of the needle. During this operation, it is desirable that the observer at the control station carry the target as nearly as possible in the center of the beam laterally. This procedure is repeated, if possible, for several courses in the sector from which targets are most likely to approach, and the average of all needle deflections is determined. Tracking is then stopped and, with the radio set held stationary, the searchlight is traversed to produce the same zero reader deflection in magnitude and direction as the average noted during the tracking. Both mount and searchlight are held stationary while the azimuth receiver of the searchlight is adjusted to make the zero readers indicate zero deflection.

b. For the check of synchronization in angular height, it is desirable that the plane fly a course at average pick-up range and at such altitudes as to give angular heights of 500 to 800 mils. It is preferable that the course be an arc about the searchlight as a center in order to maintain nearly constant angular height. For the greatest accuracy, the observer at the control station should carry the target as nearly as possible in the center of the beam vertically. The average deflection of the elevation zero reader on the searchlight or control station is noted for several courses at different angular heights in the sector from which targets are most likely to approach. The method of applying the correction to the elevation receiver at the searchlight is similar to that for the azimuth receiver.

c. If a friendly airplane is not available, the test modulator may be used to adjust alinement in angular height. The method is the same as given in paragraph 62 for the director, using the searchlight sight in the same way as the director telescope.

CHAPTER 4

OPERATION

	Paragraphs
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II. Detection of targets	72–74
III. Tracking	75–79
IV. Closing of station	80

SECTION I

PERSONNEL

■ 69. REQUIREMENTS.—*a.* To operate radio set SCR–268 properly, the following personnel are required:

Personnel	*Station*
Range operator	Mount
Azimuth operator	Mount
Elevation operator	Mount
Keyer-modulator attendant	Mount
Power plant operator	Power trailer

b. For emplacing the mount and putting it in traveling position, three additional men are required. In addition to the above, the section contains a chief of section and a radio noncommissioned staff officer for maintenance and service of equipment. The duties of the operators at the oscilloscopes (azimuth, elevation, range) are not difficult, but this type of work is tiring. For alert and effective operation, these men should not track for more than an hour at a time nor more than 6 hours a day. With a trained assistant operator for each of these three posts, 24-hour operation can be maintained over short periods of time.

■ 70. MANNING TABLE.—The normal manning table of the radio set SCR–268 is as follows:

Maintenance sergeant (NCSO, radio).
Chief of section (NCO).
Range operator (NCO).
Azimuth operator.
Elevation operator.
Keyer-modulator attendant.
Power plant operator.
Chauffeur and assistant operator.
Antiaircraft lookout and assistant operator.

■ 71. TWENTY-FOUR HOUR OPERATION.—The manning table in paragraph 70 specifies the minimum personnel requirements for field operations. If, however, a 24-hour schedule is to be maintained over an extensive period, the section must be increased to allow the necessary reliefs of trained operators.

SECTION II

DETECTION OF TARGETS

■ 72. SEARCHING.—With the unit in operation, properly oriented, and synchronized with the associated equipment, the azimuth operator should adjust the sensitivity control to a high level and slowly traverse the antennas back and forth across the sector to be searched. At the same time, the elevation operator should similarly adjust sensitivity and elevate and depress slowly between 100 and 400 mils. When more than one echo appears on the screen of the oscilloscope, the range operator should designate the one to be tracked.

■ 73. AZIMUTH AND ELEVATION.—With the target designated, the azimuth and elevation operators match the echoes on the screens of their respective oscilloscopes, thereby pointing the antenna arrays directly at the target, and thus transmit azimuth and angular height data to the searchlight or director.

■ 74. ALTITUDE.—The range operator meanwhile moves the peak of his echo to the vertical hairline, thus measuring the slant range which is mechanically combined with angular height to compute altitude. Altitude, in turn, is transmitted electrically to the gun director.

SECTION III

TRACKING

■ 75. SMOOTH TRACKING.—The tracking operations are carried out continuously. When tracking a target it is absolutely essential, in order to provide correct information for the director, to track smoothly. There should be no sudden bursts of speed "to catch up." Instead, the various handwheels should be turned at a smooth enough rate to keep the split echoes always equal. Smooth tracking of this type

will enable the director to predict the future position of aerial targets with greater accuracy.

■ 76. MOVING OBJECTS.—There will ordinarily be several different echoes indicated on the oscilloscope screen, some fixed objects and some aircraft. In most cases the operator will be able to distinguish between fixed and moving echoes. Fixed echoes will be found to maintain a more or less constant height. Moving objects, such as airplanes, will produce echoes which vary in height continually.

■ 77. FALSE TRACKING.—During normal operation, one of the split echoes on the elevation oscilloscope screen grows larger and the other smaller when the elevation handwheel is turned one way, while the opposite is true on rotating this handwheel the other way. If this correspondence of handwheel rotation with echo variation should reverse—that is, the wrong echo should grow larger—then the arrays are not on target, and false information is being sent to the searchlight or gun director. When a condition of this sort occurs, the antenna arrays should be rotated in elevation until the correct tracking point is found. This false tracking point usually manifests itself in angular height determinations only, but it may sometimes occur in azimuth tracking. Both the elevation and azimuth trackers must be always alert to these possibilities.

■ 78. TARGET BEYOND RANGE OF INSTRUMENT.—*a.* In tracking, one other difficulty may occur. If the target is beyond the maximum of the range scale, the echo will return after *two* pulses have been emitted by the transmitter. The equipment of the radio set cannot assimilate this information properly. Therefore, false information will be sent to the gun director regarding altitude.

b. However, the operators of the radio set can usually determine this condition. If it is found that the angular height of the target is close to zero, that the slant range reading of the converter is small, and that the echo received is of small magnitude, then the actual slant range of the target is probably beyond the maximum of the scale.

■ 79. TARGET CLOSE TO INSTRUMENT.—With a very close approach of a target, the echo grows very strong and disappears into the main pulse. Under these conditions the sensitivity

should be decreased, and the spread increased to a point where equalization of the echoes can be carried out as soon as their emergence from the main pulse becomes evident.

SECTION IV

CLOSING OF STATION

■ 80. TEMPORARY CLOSING.—If it is desired to close station and no change of location is contemplated before the next operation of the set, the following procedure is carried out:

a. Throw off the rectifier high voltage at the keyer.

b. Shut off the keyer high voltage at the keyer.

c. Shut off the main power switch at the keyer.

d. Turn off the filaments and line power to the various components at the junction box.

e. Turn off the filaments and line voltage at the rectifier panel, and then remove key No. 2 from lockswitch "E". Insert key No. 2 in lock "D" and turn. Remove key No. 1 from lockswitch "C" and lock the control panel door.

f. Throw off the main switch at the power panel.

g. Shut off the gas by means of the hand valve underneath the gas tank.

h. After the engine has come to a halt, move the carburetor shaft lever to the stop position.

i. Place canvas covers over the various units of the radio set.

j. Rotate the antenna arrays so that their plane is parallel to the earth. Tighten the azimuth brake on the footrest. (See fig. 26.)

k. Place the stand-by antenna supports in place as shown in figures 10 and 12. These supports should each be inclined at the same angle so that their thrusts oppose each other. This will prevent rotation of the mount if the foot brake fails to hold. Note that although figures 10 and 12 show the antennas in the vertical plane, the stand-by supports are used *only* when the antennas have been placed in the horizontal plane (maximum elevation).

l. If the stand-by period is to be for a short time, the power unit and heaters for the various components should be left in operation.

CHAPTER 5

PREPARATION FOR MOVEMENT

	Paragraphs
SECTION I. Disassembly and packing	81–88
II. Coupling trailers to prime movers	89–90

SECTION I

DISASSEMBLY AND PACKING

■ 81. GENERAL.—In general, the order of disassembling radio set SCR–268 is the reverse of the order of assembling it.

■ 82. REMOVAL OF COMPONENTS FROM MOUNT.—*a.* Disconnect cables and insert plugs in their corresponding dummy receptacles. Remove completely disconnected cables and place them on reels. Remove the ground stakes.

b. Remove the oscilloscopes from their shelf and carry them to the power trailer. Lower the oscilloscope shelf to the traveling position.

c. Shift the operators' seats forward and lock them in the traveling position.

d. Remove the receivers and carry them to the power trailer.

e. Remove the terminal box and the low voltage slip ring assembly. Put the cover on the slip ring receptacle. Place the slip ring in its compartment in the terminal box.

■ 83. OUTRIGGERS AND JACKS.—*a.* Lift out the removable floor plates on either side of the platform and remove the outriggers and outrigger jacks.

b. Lift the leveling jacks to the traveling position.

■ 84. ANTENNAS.—*a.* Remove the transmitter transmission line and carry it to the power trailer.

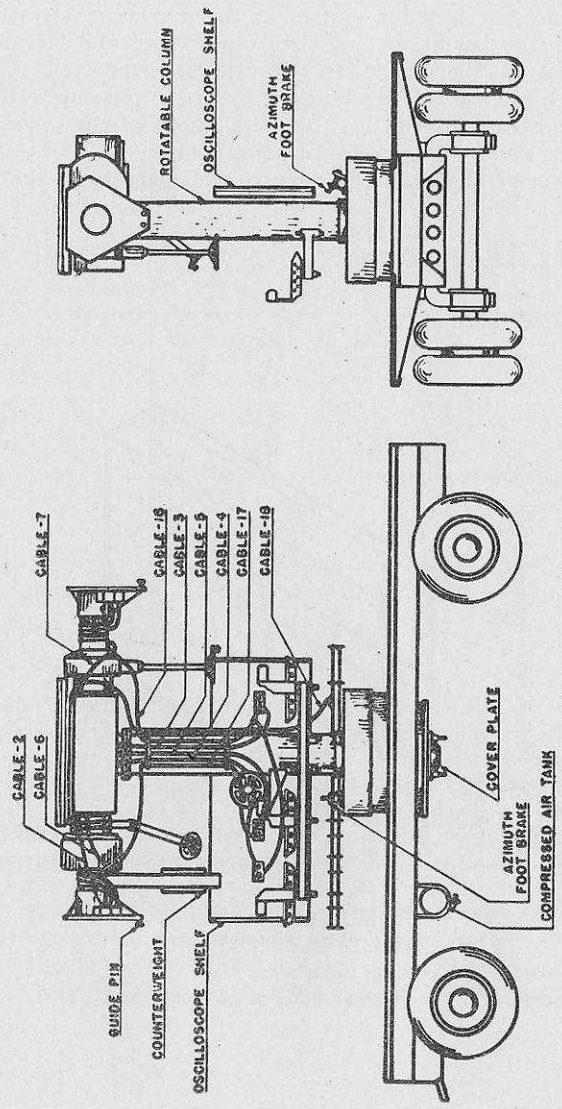
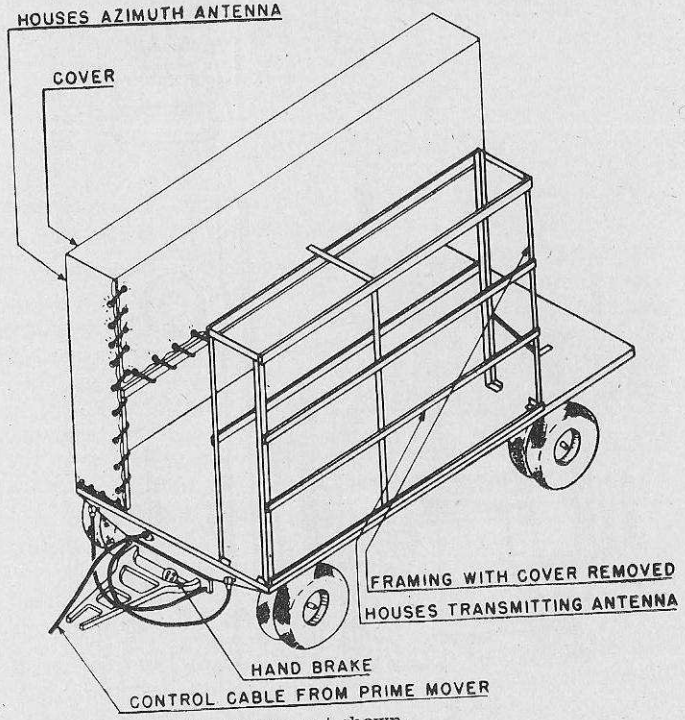


FIGURE 26.—Rotatable column in packed mount trailer.

b. Place the antenna system at the maximum elevation. Remove the beam carrying the transmitting and elevation antennas and place it on the improvised V-supports.

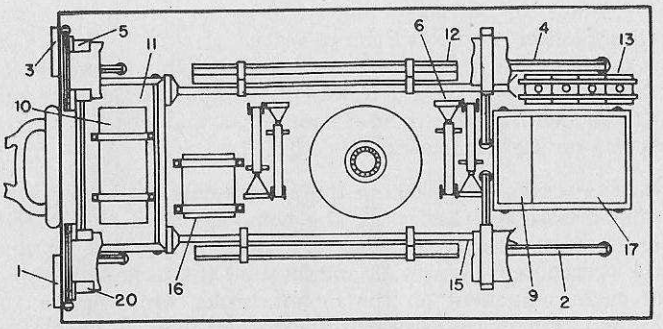
c. Remove the receiver brackets, elevation phasing section, elevation transmission lines, the two halves of the elevation antenna, and carry them to the power trailer.

d. Remove the azimuth antenna and place it on the V-supports.



NOTE.—Rotatable column not shown.

FIGURE 27.—Covers and frames of packed mount trailer.



1. Antenna support, left front.
2. Antenna support, left rear.
3. Antenna support, right front.
4. Antenna support, right rear.
5. Azimuth antenna beam.
6. Chassis leveling jacks.
9. Filament transformer.
10. Keyer.
11. Modulator.
12. Outrigger.
13. Outrigger jacks.
15. Stand-by antenna support.
16. Terminal box.
17. Transmitter.
20. Transmitting antenna beam.

FIGURE 28.—Plan view of packed mount trailer.

e. Remove the azimuth receiver bracket and azimuth transmission lines and carry them to the power trailer.

■ 85. COUNTERWEIGHT.—Place the counterweight in the traveling position as shown in figure 26.

■ 86. TRANSMITTER AND FILAMENT TRANSFORMER.—Lower the filament transformer to the traveling position by means of the hoist. Bolt it in place. Lower the transmitter to the traveling position and bolt it in place. Remove the hoist and place it in traveling position on the top of the power trailer.

■ 87. PLACING COMPONENTS ON MOUNT TRAILER.—*a.* Place the terminal box in position and bolt it in place.

b. Erect the modulator and keyer frame and fasten these units in traveling position.

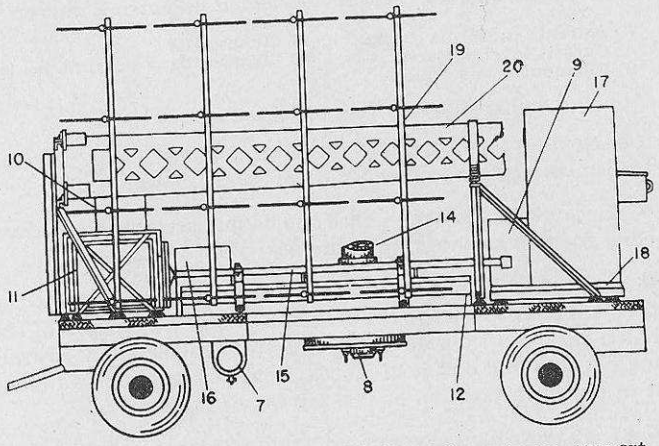
c. Secure the outrigger jacks in the traveling position.

d. Erect the antenna carrying frames.

e. Place the outriggers and stand-by supports in the traveling position, and bolt them in place.

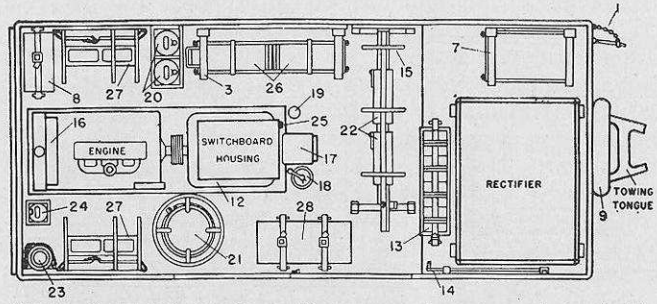
f. Secure the antenna beams in the carrying frames, erect the rectangular iron end frames of the housing supports and the wooden frames around the antennas, and lace the canvas covers on the framework. (See fig. 27.)

■ 88. PACKING.—In packing the components for transportation, disassemble and pack the components in the reverse order from assembly. The preceding paragraphs outline the procedure. Figures 28 and 29 show the packing position of each component on the mount trailer while figures 30, 31, and 32 show the position of each component in the power trailer. Note in figure 26 the position of the rotatable column when packing.



7. Compressed air tank.
8. Cover plate.
9. Filament transformer.
10. Keyer.
11. Modulator.
12. Outrigger.
14. Rotatable column, broken view.
15. Stand-by antenna support.
16. Terminal box.
17. Transmitter.
18. Transmitter carrying platform.
19. Transmitting antenna.
20. Transmitting antenna beam.

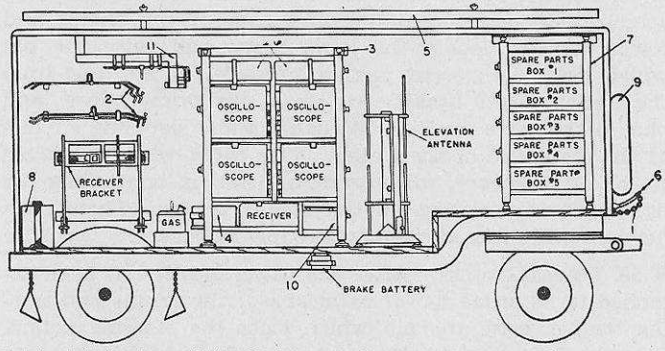
FIGURE 29.—Left side of packed mount trailer.



NOTE.—Canvas covers for oscilloscopes and receivers, hoist tackle, and roof flange for muffler are stored in any convenient place in power trailer.

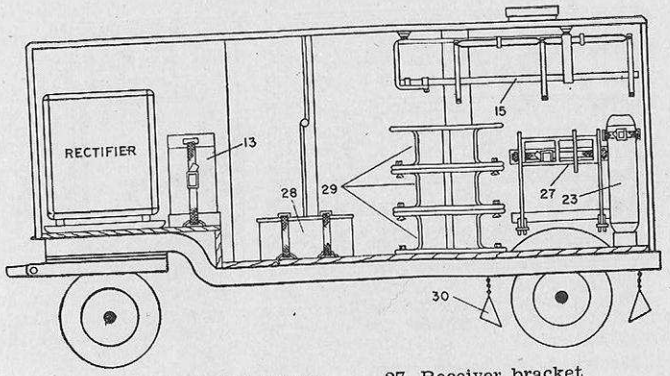
1. Electric brake safety chain.
3. Equipment rack.
7. Spare parts box rack.
8. Spare slip ring box.
9. Spare tire.
12. Alternator.
13. Cathode-ray tubes, spare.
14. Door locking lever.
15. Elevation antenna (one-half).
16. Engine battery.
17. Exciter.
18. Fire extinguisher.
19. Floor duct.
20. Gasoline cans.
21. Ground stakes and short cables (in center of reels).
22. Hoist bases.
23. Muffler.
24. Oil can.
25. Outlet, 120 volts (supplies mount).
26. Receivers.
27. Receiver bracket.
28. Spare parts box No. 6.

FIGURE 30.—Plan view of power trailer, roof removed.



1. Electric brake safety chain.
2. Elevation receiver feed lines.
3. Equipment rack.
4. Frequency meter.
5. Hoist.
6. Light and brake power cable from prime mover.
7. Spare parts box rack.
8. Spare slip ring box.
9. Spare tire.
10. Test modulator.
11. Transmitter transmission lines.

FIGURE 31.—Components packed near left wall of power trailer.



13. Cathode-ray tubes, spare.
15. Elevation antenna (one-half).
23. Muffler.
26. Receiver.
27. Receiver bracket.
28. Spare parts box No. 6.
29. Cable reels.
30. Wheel chock.

FIGURE 32.—Components packed near right wall of power trailer.

SECTION II

COUPLING TRAILERS TO PRIME MOVERS

■ 89. MOUNT TRAILER.—After the mount trailer has been attached to its prime mover by means of the chains and towing tongue, loosen the hand brake and raise the pin which locks the steering action. Attach the air hose from the trailer to the braking system of the prime mover, and plug in the cable carrying the lighting and signaling circuits at the front end of the trailer. This cable, when connected to the prime mover, will provide a means of controlling the lighting and signaling on the mount trailer. These connections will make the unit ready for movement.

■ 90. POWER TRAILER.—After the power trailer has been attached to its prime mover by means of the chains and towing tongue, raise the pin which locks the steering action. Plug the four-circuit cable located on the prime mover into the socket at the front of the trailer. This cable carries the signaling as well as the electric brake circuits into the trailer. If a prime mover equipped for use with electric brakes is not available, the kit of electric brake control equipment which is stored in the power trailer may be temporarily installed in any prime mover. If, for any reason, the mechanical coupling between the trailer and the prime mover should break, the cable will be snapped out of its socket and, by means of the chain attached to it, actuate the electric brake control to stop the trailer. A battery strapped underneath the trailer, as indicated in figure 31, supplies the energy for this emergency operation. Under normal conditions the brakes are controlled from the prime mover. Reference should be made to the Warner Electric Brake Service Manual for further details. This book, as well as the electric brake control equipment for installation in a prime mover not otherwise equipped for use of electric brakes, will be found in one of the spare parts boxes in the power trailer. These connections will make this unit ready for movement.

CHAPTER 6

SERVICE OF INSTRUMENT

		Paragraphs
SECTION I.	Duties of personnel	91– 93
II.	Drill of section, general	94–104
III.	Drill table	105
IV.	Notes on service of instrument	106–112

SECTION I

DUTIES OF PERSONNEL

■ 91. MAINTENANCE SERGEANT.—The maintenance sergeant is responsible for the condition of the matériel under his charge. He personally directs the work of care and preservation and personally supervises all repairs to the equipment. He assists the chief of section in the supervision of operation and installation.

■ 92. CHIEF OF SECTION.—The chief of section is in command of the unit, and is responsible for the instruction and efficiency of the personnel of the unit.

a. He normally selects the exact location for the mount and the power trailer.

b. He supervises operation and drill, including going into and out of position. He gives all commands.

c. He directs orientation and the synchronization of the radio set with the associated equipment.

d. He selects the parking place of the trucks, and after all equipment is unloaded, he orders the chauffeurs to park them at the designated place.

■ 93. RANGE OPERATOR.—The range operator is responsible for coordinating the tracking operations of the azimuth and elevation operators. He selects the target to be tracked by alining its echo with the vertical cross hair.

SECTION II

DRILL OF SECTION, GENERAL

■ 94. SCOPE.—This section and the drill table (sec. III) outline a drill for the personnel operating radio set SCR–268. This drill furnishes a satisfactory method of procedure, but changes may be made as may be necessary to meet local conditions.

■ 95. DETAILS POSTS.—The equipment being emplaced and properly oriented, the chief of section commands: DETAILS, POSTS. He then takes post where he can supervise the work of the section. The various members of the section take places where they can examine the equipment.

■ 96. EXAMINE EQUIPMENT.—The chief of section commands: EXAMINE EQUIPMENT, as soon as all personnel have taken their proper positions. The members of the section check the level of the mount and examine all the various cable connections.

■ 97. REPORT ON EQUIPMENT.—The chief of section commands: REPORT ON EQUIPMENT, when it is apparent that all the men have completed their duties of examining equipment. The members of the section, in turn, report their particular part of the equipment in order. If any defects which cannot be remedied without delay are discovered, the fact is reported.

■ 98. TEST OPERATION.—After all the reports have been received and no defects have been reported or, having been reported, have been remedied, the chief of section commands: TEST OPERATION.

a. At this command, the power unit is started. The voltage is adjusted to 118 volts. The frequency of the power unit is checked at 60 cycles. If necessary, the governor is adjusted. The main circuit breaker is closed. The line voltage and filament voltage are then applied to the rectifier. The plate control is set at its minimum position.

b. All the switches at the junction box, except the heater switch, are turned on. The transmitter filament voltage is adjusted to the red line. The keyer main switch is turned on.

c. After 30 seconds delay, the bias is set at maximum, the keying supply is set at minimum, and the keyer-voltage is started. The keying supply voltage is set at 3,000 volts.

d. After the "time delay over" signal is received, the rectifier high voltage is turned on.

e. After the "plate on" signal is observed, the high voltage is set at 5 kv.

f. After the high voltage is 5 kv, the transmitter is tuned.

g. The high voltage is set at 11 kv.

h. After the high voltage is set at 11 kv, the keyer bias is reduced until the plate current is 400 milliamperes. The 11

kv output is maintained as the transmitter current is brought up. The modulator grid current is then checked at less than 25 milliamperes and in the proper direction. All the oscilloscopes are now checked for the presence of sweep and the main pulse. The operation of the range unit is also checked.

i. The transmitter frequency is checked.

j. The radio set is oriented and the receivers are tuned on the fixed orienting point.

■ 99. REPORT ON OPERATION.—When it appears that the equipment is operating properly, the chief of section commands: REPORT ON OPERATION, and takes post where he can best supervise the operation of the equipment. Each member of the section reports his particular piece of equipment in order. If any defects in the functioning of the equipment which cannot be remedied without delay are discovered, the fact is reported.

■ 100. SEARCH ——— SECTOR.—The chief of section commands: SEARCH ——— SECTOR, and gives any specific directions applicable to the situation.

a. At this command, the sensitivity of both receivers is set at a maximum and spread removed. The elevation is varied slowly from 100 to 400 mils while the assigned sector is traversed until an echo is received.

b. The target to be tracked is then selected by alining its echo with the vertical cross hair of the range oscilloscope.

c. Upon selection of a target, spread is applied and echoes are balanced.

d. The operators then report "On target".

e. All meters are observed and checked for proper operation.

■ 101. CEASE TRACKING.—At the command CEASE TRACKING, given by the chief of section, tracking of the target is stopped. Details remain at their posts pending further command.

■ 102. OUT OF ACTION.—When it has been determined to cease operation of the equipment, the chief of section commands: OUT OF ACTION.

a. At this command, the rectifier high voltage and the keyer high voltage are removed. The keyer main power

switch is thrown off, but the adjustments of bias and keying supply voltages are not altered.

b. All switches at the junction box are thrown off. The heater switch is then thrown on.

c. The high voltage control at the rectifier is left in the operating position. The filament and line voltages are then removed from the rectifier.

■ 103. POWER OFF.—If the equipment is to remain shut down for some time, and when all operations relative to taking the equipment out of action have been completed, the chief of section commands: POWER OFF, and the power plant is shut down.

■ 104. IN ACTION.—Quite often the equipment will be temporarily shut down in response to the command OUT OF ACTION, after the check on operation has been completed. In order to resume operation, the chief of section commands: IN ACTION.

a. At this command, the power unit is started. The power unit voltage is adjusted to 118 volts. The frequency of the power unit is checked at 60 cycles. The main circuit breaker is closed. Line voltage and filament voltage are then applied to the rectifier. The plate control is left as it was at the previous commands of OUT OF ACTION.

b. All switches at the junction box except the heater switch are turned on. The heater switch, if on, is turned off. The transmitter filament voltage is adjusted to the red line. The keyer main switch is turned on.

c. After 30 seconds delay, the keyer high voltage is started, leaving the bias and keying supply set as they were at the previous command of OUT OF ACTION.

d. After the "time delay over" signal is received, the rectifier high voltage is turned on.

e. After the "plate on" signal is observed, the high voltage is checked at 11 kv.

f. The transmitter grid current is checked at approximately 80 milliamperes and the plate current at its previous normal setting. The modulator grid current is checked at less than 25 milliamperes and in the proper direction. All oscilloscopes are checked for the presence of sweep and the main pulse. The operation of the range unit is checked.

SECTION III
DRILL TABLE

■ 105. DRILL OF SCR–268 SECTION.

Command	Range operator	No. 1	No. 2	No. 3	No. 4
DETAILS POSTS	Takes post near transmitter.	Takes post near oscilloscopes.	Takes post near terminal box.	Takes post at keyer.	Takes post at power plant.
EXAMINE EQUIPMENT.	Checks cable connections of filament transformer and transmitter.	Checks cable connections of oscilloscopes, receivers, range unit, and converter.	Checks cable connections at terminal box. Checks level of mount assisted by No. 3.	Checks cable connections at keyer and modulator. Assists No. 2 in checking level of mount.	Checks cable connections at power plant and rectifier. Checks oil, water, and gasoline.
REPORT ON EQUIPMENT.	Reports "Transmitter in order."	Reports "Scopes, receivers, range unit, and converter in order."	Reports "Terminal box and level in order."	Reports "Keyer and modulator in order."	Reports "Power plant and rectifier in order."
TEST OPERATION	(*b*) Directs No. 2 in adjusting transmitter filament voltage to the red line.		(*b*) Turns on all switches at junction box except heater switch. Adjusts transmitter filament voltage under direction of range operator.	(*b*) Turns on keyer main switch.	(*a*) Starts power unit; closes main circuit breaker. Adjusts power unit voltage to 118 volts. Checks frequency of power unit at 60 cycles. If necessary, adjusts governor, assisted by relief personnel. Applies line voltage and filament voltage to rectifier. Sets plate control at its minimum position.
				(*c*) After 30 seconds delay, sets bias at maximum, sets keying supply at minimum, and starts keyer high voltage. Sets keying supply voltage at 3000 volts.	(*c*) Signals No. 3 when the time delay is over.
				(*d*) After the "time delay over" signal is received, turns on the rectifier high voltage.	(*e*) After "plate on" signal is observed, sets high voltage at 5 kv. Signals No. 3 when high voltage is 5 kv.
	(*f*) After receiving signal that high voltage is 5 kv, tunes transmitter, assisted by No. 3.			(*f*) Assists range operator in tuning transmitter. Signals No. 4 when transmitter is tuned.	(*g*) Upon signal from No. 3, sets high voltage at 11 kv and signals range operator when this adjustment has been made.
	(*h*) After signal that high voltage is 11 kv, directs No. 3 in reducing the keyer bias until the plate current is 400 milliamperes.	(*h*) Checks all oscilloscopes for presence of sweep and main pulse. Checks operation of range unit.		(*h*) Reduces keyer bias under direction of range operator. Checks modulator grid current at less than 25 milliamperes and in the proper direction.	(*h*) Maintains 11 kv output as transmitter current is brought up.

105. DRILL OF SCR–268 SECTION—Continued.

Command	Range operator	No. 1	No. 2	No. 3	No. 4
TEST OPERATION—continued.	(*i*) Checks transmitter frequency.	(*j*) Traverses mount to bear on fixed orienting point. (*k*) Directs No. 3 in tuning azimuth receiver.	(*j*) Depresses mount to minimum elevation. (*l*) Directs No. 3 in tuning elevation receiver.	(*k*) Tunes azimuth receiver under direction of No. 1. (*l*) Tunes elevation receiver under direction of No. 2.	
	(*m*) Orients and synchronizes.	(*m*) Orients and synchronizes.	(*m*) Orients and synchronizes.	(*m*) Orients and synchronizes.	
REPORT ON OPERATION.	Reports "Transmitter in order." Takes his place in range operator's seat.	Reports "Scopes and range unit in order." Takes his place in azimuth operator's seat.	Reports "Junction box in order." Takes his place in elevation operator's seat.	Reports "Keyer and modulator in order." Takes his place near the keyer.	Reports "Power plant and rectifier in order." Takes his place at the power trailer.
SEARCH ——— SECTOR.	(*b*) Selects target to be tracked by alining its echo with the vertical cross hair.	(*a*) With sensitivity set at maximum and spread removed, traverses the assigned sector until an echo is received.	(*a*) With sensitivity set at maximum and spread removed, varies the elevation slowly from 100 to 400 mils.	Observes all meters on keyer, modulator, and transmitter. Checks for proper operation.	Observes all meters on the power panel and rectifier of the power trailer. Checks for proper operation.
		(*c*) Applies spread. Balances split echo.	(*c*) Applies spread. Balances split echo.		
	(*e*) Reports "Mount on target."	(*d*) Reports "Azimuth on target."	(*d*) Reports "Elevation on target."		
CEASE TRACKING.	Ceases tracking. Remains at post.	Ceases tracking. Remains at post.	Ceases tracking. Remains at post.	Remains at post.	Remains at post.

OUT OF ACTION.			(*b*) Throws all switches at the junction box to the "off" position. Turns heater switch on.	(*a*) Removes rectifier high voltage and keyer high voltage. Throws keyer main power switch off, but does not alter adjustments of bias and keying supply voltages.	(*c*) Leaves high voltage control in operating position. Removes filament and line voltages from the rectifier.
POWER OFF.					Shuts down the power plant.
IN ACTION. NOTE.—This command only given after temporary shut down in response to command of OUT OF ACTION.	(*b*) Directs No. 2 in adjusting transmitter filament voltage to the red line.		(*b*) Turns on all switches at junction box except heater switch. If heater switch is on, turns it off. Adjusts transmitter filament voltage under direction of range operator.	(*b*) Turns on the keyer main switch.	(*a*) Starts the power unit; closes main circuit breaker. Adjusts power unit voltage to 118 volts. Checks frequency of power unit at 60 cycles. Applies line voltage and filament voltage to rectifier.
				(*c*) After 30 seconds delay, starts the keyer high voltage, leaving bias and keying supply set as at the previous command of OUT OF ACTION.	(*c*) Signals No. 3 when the time delay is over.
				(*d*) After "time delay over" signal is received, turns on rectifier high voltage.	(*e*) After "plate on" signal is observed, checks high voltage at 11 kv.

■ 105. DRILL OF SCR–268 SECTION—Continued.

Command	Range operator	No. 1	No. 2	No. 3	No. 4
IN ACTION—con.	(*f*) Checks transmitter grid current at approximately 80 ma and plate current at its previous normal setting.	(*f*) Checks all oscilloscopes for the presence of sweep and main pulse. Checks operation of range unit.		(*f*) Checks the modulator grid current at less than 25 ma and in the proper direction.	

NOTES

1. All operations at a given command are performed in alphabetical sequence. Operations bearing the same letter are performed simultaneously. That is, all operations labeled (*a*) are performed simultaneously and are completed before any operation labeled (*b*) is started.
2. At the command DETAILS POSTS, Nos. 5, 6, and 7 take posts as directed.
3. At the command EXAMINE EQUIPMENT: No. 5 examines cables between power plant and mount, inspecting junctions of cables 8 and 26; No. 6 examines cable between mount and director (or searchlight).
4. At the command REPORT ON EQUIPMENT: No. 5 reports "Power cable in order"; No. 6 reports "Director (or searchlight) cable in order."
5. No. 7 performs such duties as are directed by the chief of section.

SECTION IV

NOTES ON SERVICE OF INSTRUMENT

■ 106. GENERAL.—*a.* The drill prescribed herein for the radio set SCR–268 *cannot* be conducted with the snap and precision of a formal drill. There are so many delicate mechanisms and electrical devices involved that careless attempts to greatly speed up the operations of emplacing the mount and of placing it in traveling position will result only in a great number of matériel failures. The time required for these operations can, however, be greatly reduced by careful training.

b. In the drill, stress should be laid on the saving of time during the operation of locating the target, that is, between the time the first echoes are received and the time the set is smoothly tracking the target and transmitting data to its associated equipment.

c. The drill is conducted at ease and with as few orders as possible.

d. The drill as described in the previous section gives only an outline of the duties of each man at the various commands. A knowledge of what to do must be supplemented by continued practice until the unit can operate, if necessary, without commands. The procedure of locating, isolating, and tracking the target must become second nature if the section is to be capable of coping with multiplane attacks, pursuit-plane interference, and other stratagems of an attacking air force.

■ 107. DISASSEMBLING EQUIPMENT.—It is necessary to exercise special care when the equipment is to be disassembled and placed in traveling position. This work may frequently be done when the crews are tired, hungry, and anxious to get back to bivouacs. Noncommissioned officers must exercise the supervision necessary to prevent damage to the matériel, both during the preparation of the matériel for the road and the securing of the matériel in the vehicles. It should be remembered that the care with which the equipment is placed in the trailers will determine to a large extent the ease with which it can be assembled and placed in operation.

■ 108. COMMANDS AND SIGNALS.—Commands are given in the prescribed form, signals (buzzer, flashlight, or whistle) being substituted for commands wherever practicable.

■ 109. SAFETY PRECAUTIONS.—*a.* It must be remembered that dangerous voltages exist in many parts of the equipment. It is absolutely essential that all safety rules and regulations be rigorously adhered to. It is particularly important that cables carrying high voltages be handled with the greatest care even when they are disconnected. During operation all personnel should avoid touching or stepping on any cables.

b. In loading and unloading the various parts care must be exercised that no one will be hurt if a block and tackle or a cable falls.

■ 110. HANDLING EQUIPMENT.—*a.* Since much handling of equipment may take place under the cover of darkness, special care must be exercised at such times to avoid injury to personnel and damage to matériel.

b. Since most of the instruments used on the radio set are extremely delicate in nature, it cannot be overemphasized that the maximum care should be exercised under all conditions. Careless handling of an instrument may well cause the equipment to be inoperative for a considerable length of time.

c. As soon as matériel is unloaded from the trailers or trucks, it should be moved off the road. Matériel disassembled for loading should not be left in the road unless under guard. Cables should be thrown to the side or off the road so as to avoid damage by vehicles. Tractors or tanks passing over a cable will completely destroy it. If a truck must be driven over a cable, the cable must be protected by planks laid on each side of it or by covering it over in a shallow trench.

d. Chauffeurs must exercise special care when moving without lights to avoid damage to equipment or injury to personnel. When backing the truck, the chauffeur should be assisted by another member of the crew who directs the movement from an advantageous position. Backing of the trailers is facilitated by use of the pin which locks the steering action.

■ 111. ACTION ON MARCH.—Members of the section should be given instructions relative to the action to be taken if attacked while on the march. A single section is *not* a profitable target for low-flying light bombardment aviation, but it is important that each member of the section know the correct action to be taken should an occasion make it necessary.

■ 112. FALL OUT.—At drills and practice and in the field when higher authority authorizes discontinuance of operation, the chief of section may command: FALL OUT. At this command all members of the section may leave their posts except any communication personnel that may be on continuous duty.

APPENDIX I

LUBRICATION

■ 1. ANTENNA MOUNT.—The following parts of the antenna mount require lubrication (see fig. 33):

a. Elevation handwheel drive.—Remove the overflow plug at the rear of the housing. Pour motor oil SAE No. 40 into the oil cup until the oil level reaches the overflow hole. Note the drain plug at the bottom of the housing.

b. Range handwheel drive.—Remove the cover from the bevel gear housing and pack with fiber grease as required. Replace the locking wire in cover screws.

c. Azimuth handwheel drive.—Remove both the cover from the oil cup near the handwheel, and the overflow plug which is placed a trifle lower down on the housing. Fill the case to the level of the overflow with motor oil SAE No. 40.

d. Azimuth shaft drive.—Remove the pipe plug at the base of the vertical azimuth shaft drive and pack with fiber grease as required.

e. Angular height repeaters.—Remove the angular height repeater cover and place graphite grease on the gears as required.

f. Azimuth repeaters.—Remove the azimuth repeater cover and lubricate the gears with graphite grease as required.

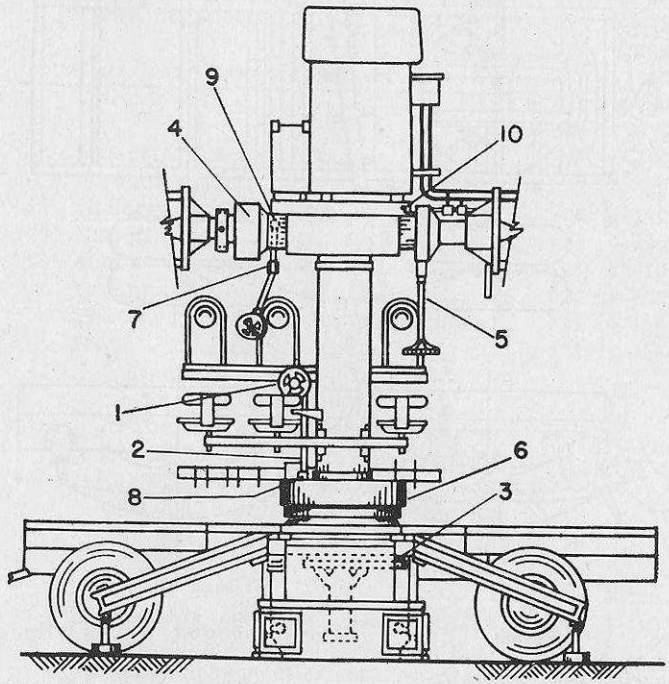
g. Azimuth drive gears.—Remove the handhole cover from the high voltage slip-ring housing, and place a small amount of fiber grease on the gears, operating the azimuth handwheel to reach all parts of the gears.

h. Main bearings.—All main bearings which support the rotatable column should be packed with fiber grease on disassembly or repair only. Otherwise they require no attention.

■ 2. TRAILER.—Figure 34 indicates the points requiring lubrication on the mount trailer. The power trailer should be greased in the same manner as any car or truck.

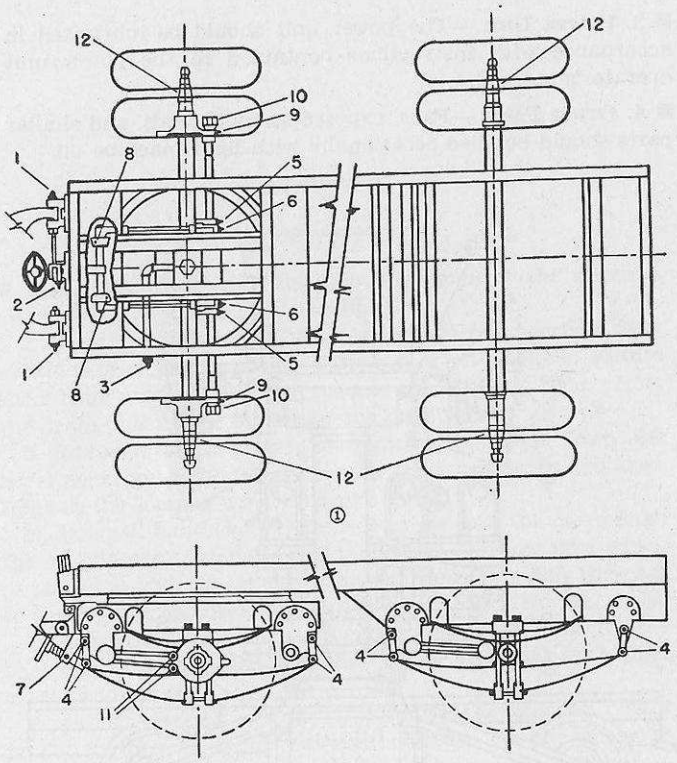
■ 3. POWER UNIT.—The power unit should be lubricated in accordance with instructions contained in the power unit operator's manual.

■ 4. OTHER PARTS.—Fans, exposed screw threads, and similar parts should be oiled occasionally with light machine oil.



1. Azimuth handwheel and drive.
2. Azimuth drive shaft.
3. Azimuth repeater housing. Remove cover to grease gears.
4. Angular height repeater housing. Remove cover to grease gears.
5. Elevation drive shaft.
6. High voltage slip ring housing. Remove handhole cover to grease azimuth gears.
7. Range drive shaft.
8. Grease plug.
9. Grease hole cover.
10. Oil plug.

FIGURE 33.—Lubrication chart for antenna mount.



No.	Location	Type of lubricant	How often
1.	Draw bar bolts	Standard chassis lubricant	Every 2,000 miles
2.	Gear lock bracket		
3.	King post		
4.	Spring shackles		
5.	Cam shaft bracket bearing		
6.	Slack adjuster		
7.	Hand parking brake screw		
8.	Brake cross shaft bearing		
9.	Cam shaft bearing		
10.	Brake cam	Brake cam grease	
11.	Anchor pin bushing	Penetrating oil	
12.	Axle wheel bearings	Wheel bearing grease	Every 8,000 miles

FIGURE 34.—Lubrication chart for mount trailer.

APPENDIX II

LIST OF REFERENCES

■ 1. GENERAL.

Camouflage and protective measures	FM	4–105
	FM	5–20
Chemical attack, defense against	FM	21–40
Communications	FM	24–5
	FM	4–105
Data transmission system	TM	9–1656
Director M4	FM	4–110
	TM	9–2655
Fire control equipment	FM	4–110
Formations	FM	4–120
Gunnery, antiaircraft	FM	4–110
Inspections	FM	4–120
Motor transportation	FM	25–10
Organization	FM	4–105
Position finding, antiaircraft artillery	FM	4–110
Radio	TM	11–455
"Radio Handbook" (Radio Ltd., Santa Barbara, California).		
"The Radio Amateur's Handbook" (American Radio Relay League, West Hartford, Conn.).		
"Radio Telegraphy and Telephony" (Signal Corps School Pamphlet No. 3).		
Reference data	FM	4–155
Searchlights, operation of	FM	4–115
Tactical employment of searchlights	FM	4–105
Tactical employment of antiaircraft guns	FM	4–105

■ 2. PARTICULAR MATÉRIEL.

Power unit	Operator's Manual and Parts List, Engine—Generator Unit, U. S., Type PE–84–A.
Rectifier	Instructions for Rectifier RA–38.
Trailers	Handbook—Parts List—Lubrication Charts for U. S. Army Four-wheel Trailer, Model R–H–4.

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