RESTRICTED

FM 4–146

WAR DEPARTMENT

ANTIAIRCRAFT ARTILLERY FIELD MANUAL

SERVICE OF RADIO SET SCR–545

2 November 1943

Dissemination of restricted matter.—The information contained in restricted documents and the essential characteristics of restricted material may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work, but will not be communicated to the public or to the press except by authorized military public relations agencies. (See also par. 18*b*, AR 380–5, 28 Sep 1942.)

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(For explanation of symbols see FM 21–6.)

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CHAPTER 1

GENERAL DESCRIPTION OF RADIO SET SCR–545

SECTION 1

GENERAL

■ 1. PURPOSE OF EQUIPMENT.—The SCR–545–A has been developed as a further step in overcoming visibility limitations on antiaircraft fire. It is capable of locating aerial targets beyond the range of vision and providing a continuous flow of accurate present position data up to maximum ranges well beyond the capabilities of the most modern antiaircraft guns. It translates the present position data into forms immediately usable in all types of antiaircraft gun directors.

■ 2. REFERENCES.—Additional information regarding the SCR–545–A is covered in TM 11–1127. Pertinent references are listed in appendix II.

■ 3. HIGH VOLTAGE WARNING.—*MUCH OF THE EQUIPMENT IN THE SCR–545–A OPERATES AT VOLTAGES SUFFICIENTLY HIGH TO BE EXTREMELY DANGEROUS TO PERSONNEL. EXTREME CAUTION SHOULD THEREFORE BE EXERCISED IN OPERATION OF THE EQUIPMENT. IN THE EVENT OF AN ACCIDENTAL CASE OF ELECTRIC SHOCK, REFER TO APPENDIX III FOR DETAILS REGARDING ARTIFICIAL RESPIRATION.*

SECTION II

GENERAL OPERATION

■ 4. GENERAL OPERATION.—*a.* The SCR–545–A contains two complete radio systems, a SEARCH system and a TRACK system. The SEARCH system provides a board antenna pattern which is useful for two purposes. First, it is used, as its name implies, for long-range operation to give early warning of the approach of aircraft. Second, it is very useful in

picking up a target that has been lost from the narrow beam pattern of the TRACK antenna. The TRACK system with its narrow beam pattern provides present position data of sufficient accuracy to enable directors to predict target future position with the refinement necessary for hits.

b. Both the SEARCH and TRACK systems employ the *pulse-echo* method for range determination, and the *lobe-switching* method for angle tracking in both azimuth and angular height. These methods are the same as those used in the SCR–268 but refinement in antennas makes possible much greater accuracy with the SCR–545 than with the SCR–268.

SECTION III

DESCRIPTION OF AUTOMOTIVE COMPONENTS

■ 5. COMPLETE EQUIPMENT.—*a.* Figure 1 shows the truck and trailer comprising the SCR–545–A. Two 2½-ton van body trucks and one 2½-ton cargo truck are provided in the field per gun battalion for carrying spare parts and accessories.

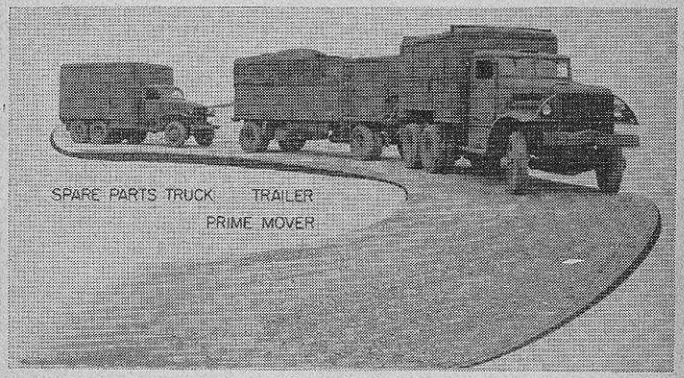


FIGURE 1.—The SCR–545–A.

b. For situations where a supply of 25-cycle commercial power is available, another van may be supplied with each SCR–545–A. This converter van carries a motor-generator set to convert the 25-cycle power to 60-cycle power.

■ 6. PRIME MOVER POWER PLANT.—*a.* The prime mover is a 6-ton van which carries a 25-kva, 60-cycle, 120-volt, single-phase alternating current generator driven by a four-cylinder, water-cooled, gasoline engine.

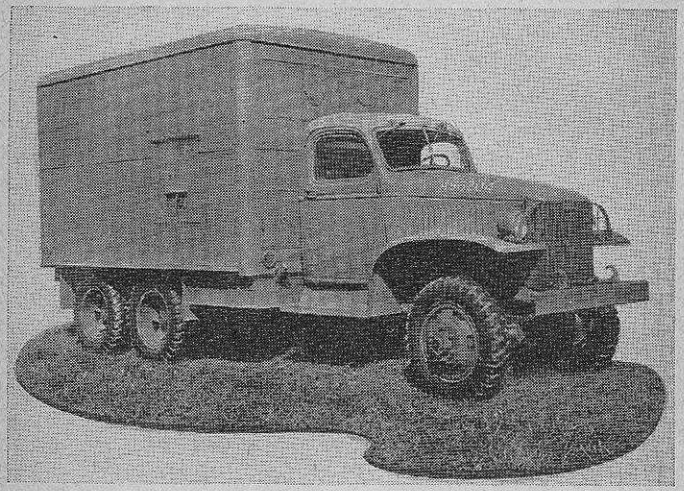


FIGURE 2.—Spare parts van truck.

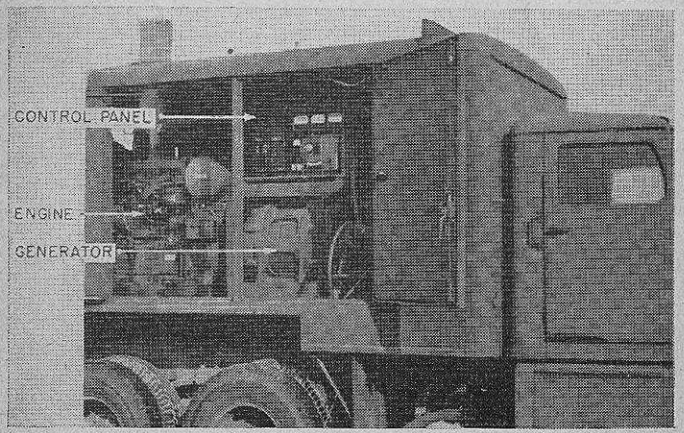


FIGURE 3.—Engine generator set.

b. Figure 3 shows the engine generator unit and its associated control panel. The control panel (fig. 37) is equipped with a line circuit breaker (for cases where commercial power is used), a generator supply breaker, manual and automatic voltage regulator, voltage, current, frequency, and elapsed running time meters and a utility circuit providing outlet receptacles and a lamp.

c. The van also carries the 250-foot power supply cable for connecting the trailer switchboard to the power plant.

d. A ground stake and cable for grounding one side of the power supply are carried in the van.

e. A number of spare vacuum tubes, tools, instruction books, a spare wheel and tire, and a fire extinguisher complete the accessories in the power van.

■ 7. TRAILER.—*a.* The trailer houses the electrical equipment of the SCR–545–A with the exception of the power supply equipment described in paragraph 6. Figure 4 is a view of the trailer ready for the road. The antenna is folded down and covered by a tarpaulin and the outriggers and jacks are disassembled and stowed for march order.

b. Complete with all equipment the trailer weighs 13½ tons. Its over-all length, including the drawbar, is 27 feet. In figuring cubic space for export the length may be reduced to 22 feet, 8½ inches, by raising the drawbar to a vertical position against the front of the trailer cab. The width of the unit is 8 feet and its over-all height (in traveling position, (fig. 4)) is 10 feet, 8 inches.

c. In operating position, the weight of the trailer is supported by four outriggers, one at each corner. Figure 5 shows details of this construction and a jack, one of which is provided at each outrigger for leveling the trailer.

d. The raised portion of the trailer body at the front of the unit is a cab which houses the operating controls of the equipment. The interior of this cab is shown in figure 9.

e. Horizontally hinged doors are provided along the sides of the trailer to give access to the various electrical components. Figure 6 shows these doors on the right side of the trailer. This figure also shows the antenna in its raised position.

■ 8. SPARE PARTS TRUCK.—*a.* The spare parts truck shown in figure 2 is a 2½-ton van especially equipped for the transport of the major equipment spares of the SCR–545–A. For this purpose it is equipped with a trolley hoist for handling the

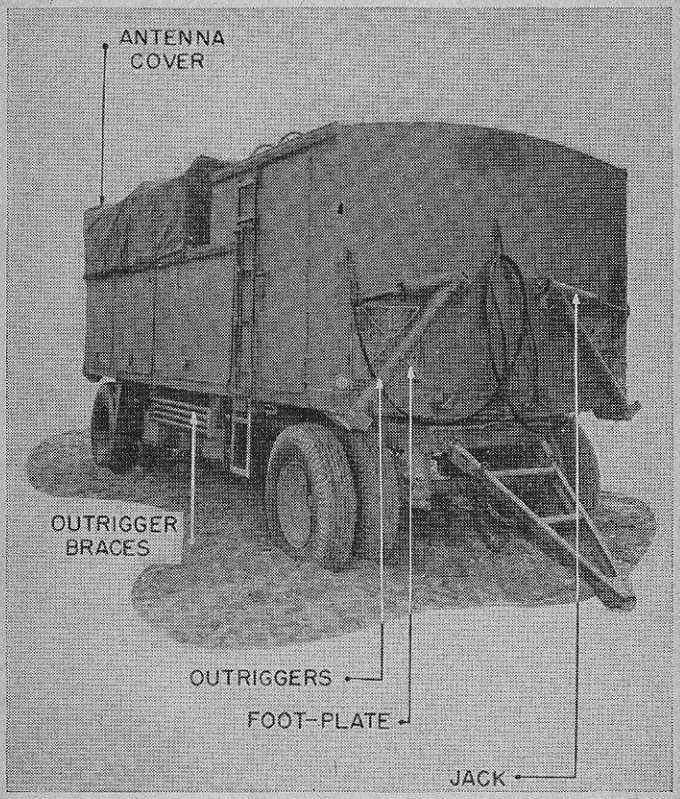


FIGURE 4.—Trailer in traveling position.

heavy equipment. Figure 7 shows the trolley hoist which has a hand operated chain ratchet lift. The lift is shown on the trolley but it is normally carried in a workbench drawer.

b. The workbench shown in figure 7 is equipped with drawers in which are carried maintenance tools, vacuum

tubes, and spare apparatus parts. Power for lighting and tools is supplied from the power truck over a two-conductor cable carried in the spare parts truck.

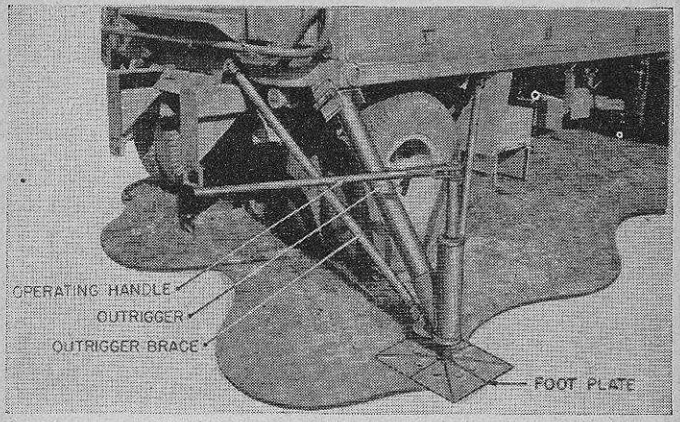


FIGURE 5.—Outrigger and jack.

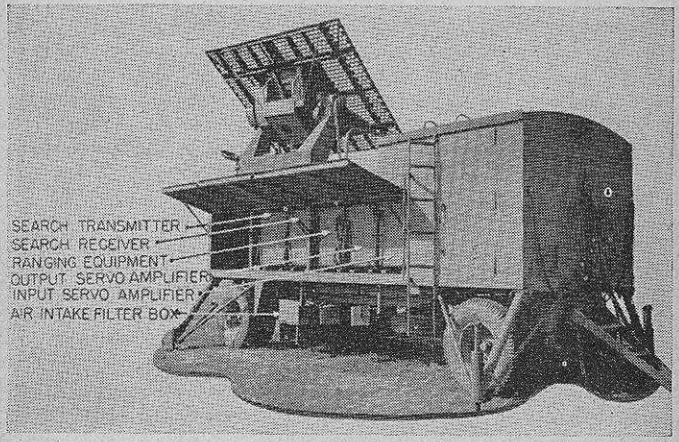


FIGURE 6.—Trailer in operating position—right side.

c. This van carries a spare RANGE UNIT, a spare OSCILLOSCOPE, and four completely assembled units in addition

to numerous spare parts and tools. These completely assembled units are a SEARCH TRANSMITTER and RECEIVER and a TRACK TRANSMITTER and RECEIVER.

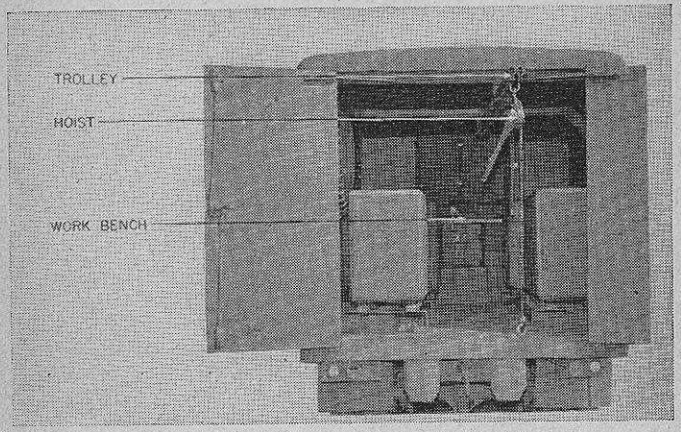


FIGURE 7.—Interior of spare parts van.

■ 9. CONVERTER VAN.—For permanent locations where only 25-cycle commercial power is available, a 2½-ton van type truck housing a frequency converter may be supplied. The

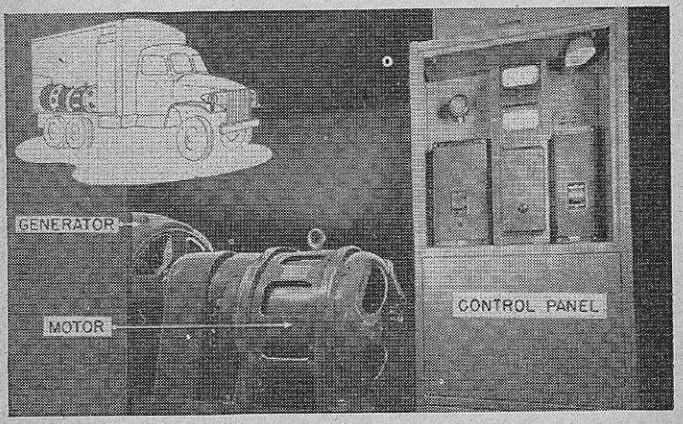


FIGURE 8.—Interior of converter van.

frequency converter consists of a 220-volt, three-phase, 25-cycle, 40-horsepower induction motor driving a 25-kva, 60-cycle, 120-volt, single-phase generator. The generator and its auxiliary equipment are identical with the equipment supplied in the regular power van. The 60-cycle output from this equipment is fed over a 75-foot cable to the power truck where it is connected at the commercial supply terminals. The power is then supplied to the trailer in the normal manner.

Section IV

DESCRIPTION OF ELECTRICAL COMPONENTS

■ 10. General.—*a.* All indicating and control equipment for the SCR–545–A is mounted in the cab of the trailer. Figure

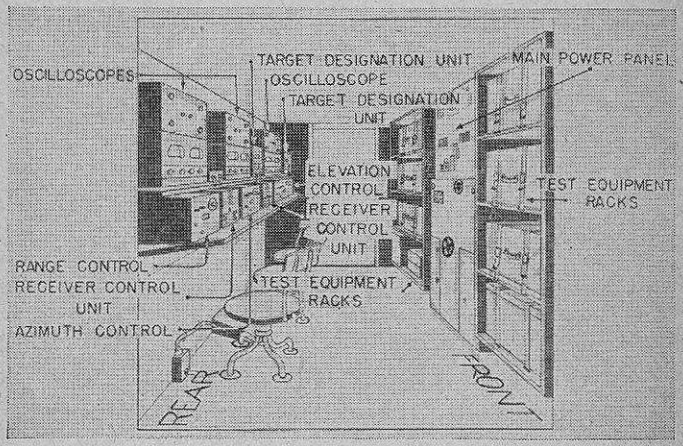


Figure 9.—Interior of trailer cab.

9 is a view of the interior of the trailer cab. It shows the main power switchboard and the test equipment racks as well as the operator's control units and oscilloscopes.

b. The remainder of the trailer is taken up with the radio components and associated control and auxiliary equipment. The arrangement of these units is shown in figures 6 and 10. Each of the components represented in the figure is housed in a steel box 31 inches high and 41 inches long. The widest

of these boxes is 35 inches, the next 27 inches, and the smallest 22 inches in width.

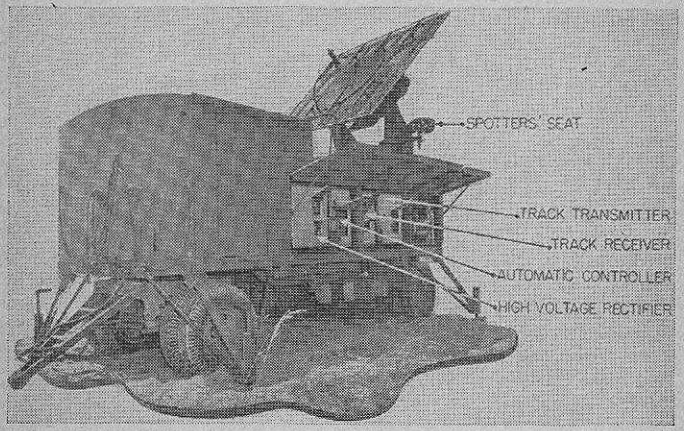


Figure 10.—Trailer in operating position—left side.

■ 11. Oscilloscopes.—Figure 11 shows one of the oscilloscope units in the cab, on which target echoes are registered and by observation of which the target can be tracked. Three of

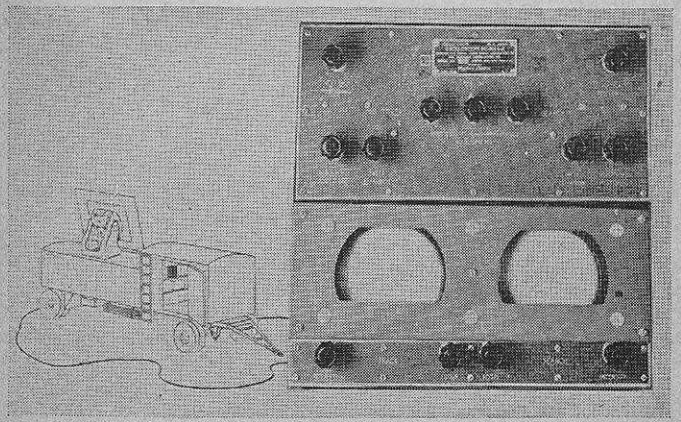


Figure 11.—Oscilloscope unit.

these units are provided, one each for the range, azimuth, and elevation operators. As may be seen in figure 11, each unit is equipped with two cathode ray tubes. The left hand tube, commonly called the TRACK scope, is connected with the TRACK system. The right-hand or SEARCH scope is connected with the SEARCH system. The tubes operate simultaneously so that each operator has before him at all times the results of both the SEARCH and TRACK system signals. Since the SEARCH system employs a much broader antenna pattern and has a longer range, targets are normally picked up by it before they are seen on the TRACK scopes. Any target being followed on the TRACK scopes, however, also appears on the SEARCH scopes.

■ 12. OPERATOR'S CONTROL UNITS.—*a.* As may be seen in figure 9, there are three operator's control units in the trailer cab. From left to right (looking toward the rear of the trailer) these units are RANGE CONTROL, AZIMUTH CONTROL, and ELEVATION (angular height) CONTROL. The three units are described below.

b. Figure 12 shows the front panel of the RANGE CONTROL UNIT. A brief description of the dials and controls is as follows:

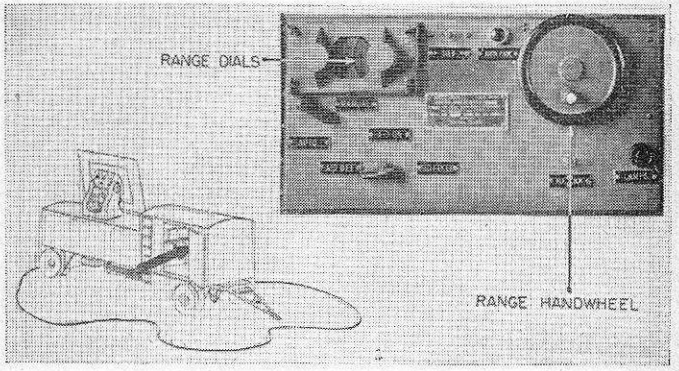


FIGURE 12.—Range control unit panel.

(1) *Range dials.*—A coarse and a fine dial to indicate slant range to the target being tracked.

(2) *Lamps.*—A rotary switch which turns on the range dial illumination and controls its intensity. This switch also turns on the power supply to the "aided tracking" motor.

(3) *Range handwheel.*—Controls position of the range notches (fig. 50) by means of the aiding mechanism described in paragraph 29.

(4) *Manual-auto.*—This two-position switch determines whether the range is set in manually by means of the RANGE HANDWHEEL or automatically by means of the AUTOMATIC CONTROLLER.

(5) *Aid off-on-fixed.*—See paragraph 29.

(6) *Slew.*—This switch moves range notches in the direction it is operated at a rate of 2,800 yards per second. It is used when it is necessary to move the range notch a considerable distance to pick up a target.

(7) *Auto fade.*—A light which goes on to signal transfer of automatic tracking to the SEARCH system.

(8) *Data flow switch.*—If the director is of the M9 type, this switch grounds out the rate circuits of the director when in the "off" position. *It must always be "off" when slewing the SCR–545–A in range.* If the director is an M4 or M7 this switch operates to position the altitude transmitter either to correspond to altitude or to slant range as desired. For M4 or M7 directors the reverse side of this nameplate which is marked ALTITUDE—SLANT RANGE, should be used.

c. Figure 13 shows the front panel of the AZIMUTH CONTROL UNIT. A brief description of the dials and controls is as follows:

(1) *Azimuth dials.*—A coarse and a fine dial to indicate the present azimuth of the antenna pedestal in mils.

(2) *Lamps.*—Same as on RANGE CONTROL unit above.

(3) *Azimuth handwheel.*—Controls direction of antenna mount in azimuth by means of the aiding mechanism described in paragraph 29.

(4) *Manual-auto.*—This two-position switch determines whether the antenna position in azimuth is controlled manually by means of the AZIMUTH HANDWHEEL or automatically by means of the AUTOMATIC CONTROLLER.

(5) *Aid off-on-fixed.*—See paragraph 29.

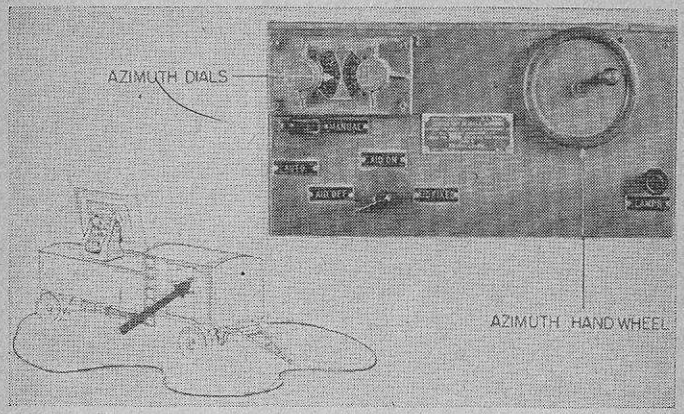


FIGURE 13.—Azimuth control unit panel.

d. Figure 14 shows the front panel of the ELEVATION (angular height) CONTROL UNIT. A brief description of the dials and controls is as follows:

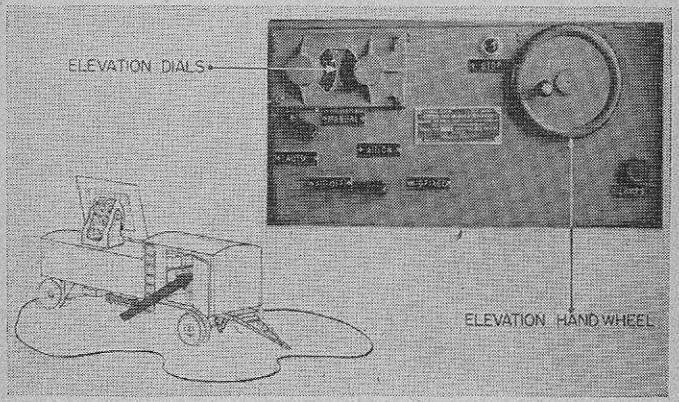


FIGURE 14.—Elevation (angular height) control unit panel.

(1) *Elevation (angular height) dials.*—A coarse and a fine dial to indicate the present angular height of the antenna in mils.

(2) *Lamps.*—Same as on RANGE CONTROL unit above.

(3) *Elevation handwheel.*—Performs similar functions in angular height to those performed by the AZIMUTH HANDWHEEL in azimuth.

(4) *Stop light.*—Flashes continually when the antenna reaches its upper or lower limit of angular height until antenna is stopped by turning off the "aid" motor or reversing the direction of the antenna motion by means of the handwheel.

■ 13. RECEIVER CONTROL UNITS.—Two receiver control units are provided in the cab of the trailer, one for the SEARCH and one for the TRACK receiver. Figure 15 shows details of the panels of these two units which are identical. The various controls accomplish the following functions:

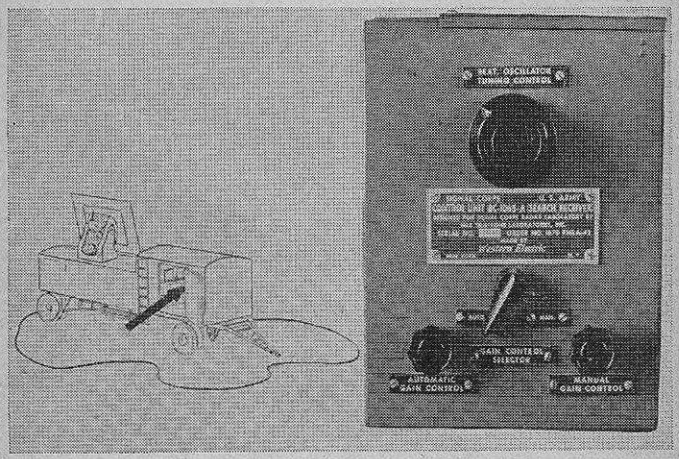


FIGURE 15.—Receiver control unit.

a. Beat osc. tuning.—A remote control on the receiver's beating oscillator.

b. Gain control selector.—To switch gain control from MANUAL to AUTOMATIC.

c. Manual gain control.—Adjusts gain where the GAIN CONTROL SELECTOR is in its MANUAL position.

d. Auto gain control.—Adjusts maximum gain of receivers when the GAIN CONTROL SELECTOR is in its automatic position.

■ 14. TARGET DESIGNATION UNITS.—*a.* Two target designation units are provided in the cab of the SCR–545–A, one for azimuth and one for elevation (angular height). (See fig. 16.) These units are mounted on the shelf in the trailer cab beside the oscilloscopes. These units contain two synchronous repeaters, the upper one of which positions itself from data received from the tracking system of the director being used, and the lower one of which positions itself from the data received from the antenna pedestal of the SCR–545–A. By watching these units the azimuth and elevation (angular height) operators can direct the radio set toward a target selected by director personnel.

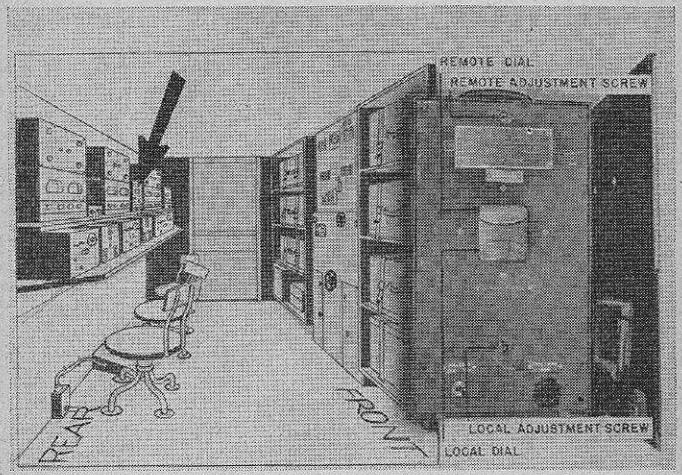


FIGURE 16.—Target designation unit.

b. Target designation data come to the SCR–545–A over cable A, and therefore is not received if cable A is not in use. See paragraph 27 for details on this cabling.

■ 15. AUTOMATIC TRACKING SWITCH.—The AUTOMATIC TRACKING SWITCH (fig. 17) on the junction box between

the RANGE and AZIMUTH OSCILLOSCOPES, has two positions, TRACK and TRACK-OR-SEARCH. In the TRACK position the AUTOMATIC CONTROLLER operates from the TRACK system only. In the TRACK-OR-SEARCH position the AUTOMATIC CONTROLLER operates from TRACK system signals until the strength of the received signal drops below a fixed level at which time the AUTOMATIC CONTROLLER is switched to SEARCH system signals. If the TRACK signal then returns to its former satisfactory level the control automatically returns to the TRACK system. While operating from SEARCH system signals, the angular height of the antenna is not automatically controlled.

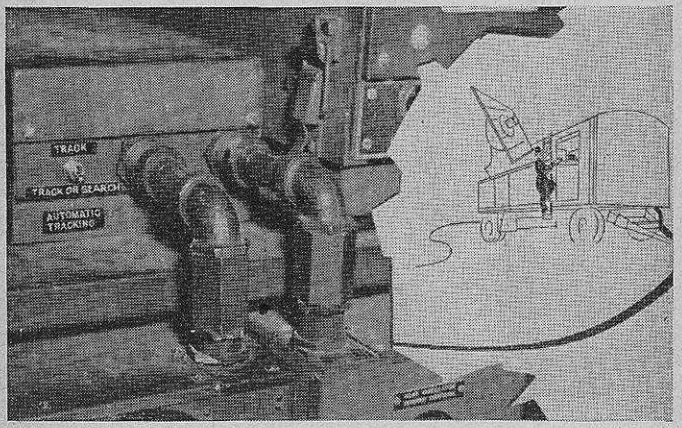


FIGURE 17.—Automatic tracking switch.

■ 16. HIGH VOLTAGE RECTIFIER.—This unit supplies the power that is transformed into radio energy in the SEARCH and TRACK TRANSMITTERS. Its d-c output, which is controlled by the HIGH VOLTAGE CONTROL HANDWHEEL shown in figure 18, and for which there is a VOLTAGE ADJUSTMENT in the trailer cab (fig. 44), is measured on the d-c ammeter and voltmeter shown in the figure. The unit cannot be placed in full operation unless the covers of the HIGH VOLTAGE RECTIFIER, the TRACK TRANSMITTER, and the SEARCH TRANSMITTER are in place because of interlocks which are held closed by these removable covers.

A time delay in the high voltage starting circuit prevents application of high voltage before the filaments of the tubes have warmed sufficiently. Operation of the time delay circuit is indicated by the signal lights at the top of the main power switchboard in the trailer cab. Paragraph 39 outlines the starting procedure and the sequence of the light signals obtained at the switchboard. The VOLTAGE ADJUSTMENT shown on the main switchboard in figure 44 is a fine adjustment to permit small changes in the d-c output of the HIGH VOLTAGE RECTIFIER.

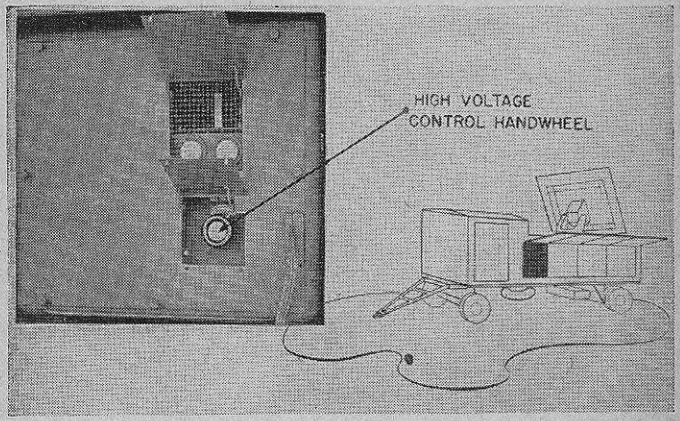


FIGURE 18.—High voltage rectifier.

■ 17. AUTOMATIC CONTROLLER.—The function of this unit (fig. 19) is to control the RANGING EQUIPMENT automatically to give a continuous indication of target range and to control the antenna position in azimuth and elevation (angular height) so that it automatically follows the target and indicates angles of azimuth and elevation (angular height).

■ 18. TRACK RECEIVER.—The TRACK RECEIVER (fig. 20), is provided to detect and amplify the signals delivered to it by the TRACK antenna. This unit is interconnected with the TRACK RECEIVER CONTROL unit in the trailer cab (par. 13) to permit remote control of beating oscillator tuning and gain.

■ 19. TRACK TRANSMITTER.—The TRACK TRANSMITTER converts d-c power from the HIGH VOLTAGE RECTIFIER into ultra high frequency radio energy for operation of the

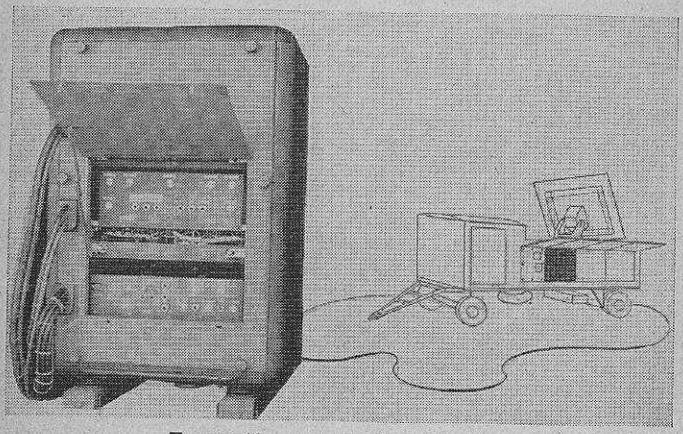


FIGURE 19.—Automatic controller.

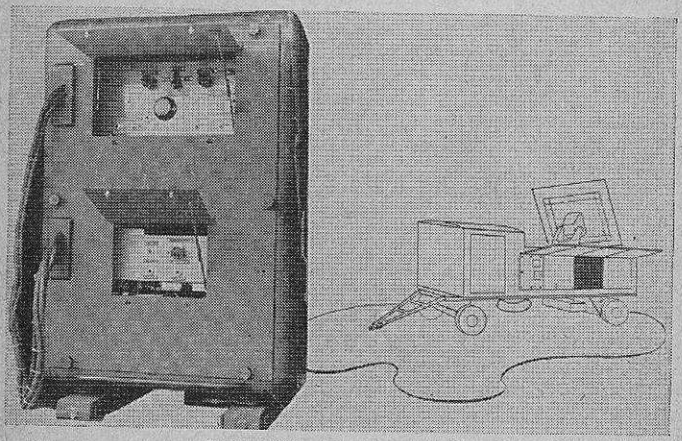


FIGURE 20.—Track receiver.

TRACK system. Visible through the small access door in the center of figure 21 is the TRACK T–R BOX which moves horizontally along a section of the TRACK transmission line.

The T–R BOX is the device which separates the transmitted and received signals, preventing the transmitted signal from overloading the receiver and the received signal from dissipating its energy in the transmitter.

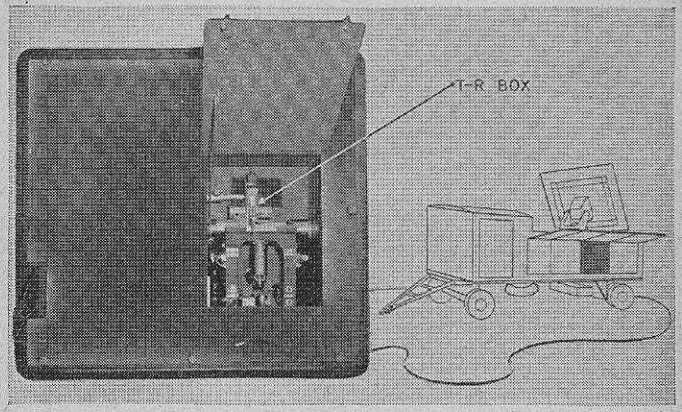


FIGURE 21.—Track transmitter.

■ 20. INPUT SERVO AMPLIFIER.—This unit (fig. 22) actually contains three separate amplifiers, one each for range, azimuth, and elevation (angular height) control. Each of these amplifiers increases the magnitude of the energy supplied by its respective control unit in the trailer cab. The outputs from these amplifiers eventually control the motors which position the RANGING EQUIPMENT and the antenna.

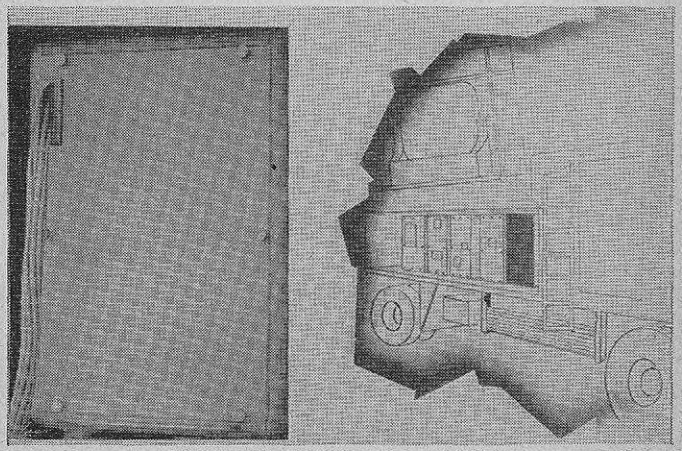


FIGURE 22.—Input servo amplifier.

■ 21. OUTPUT SERVO AMPLIFIER.—This unit (fig. 23) contains two amplifiers, one for azimuth control and one for elevation (angular height) control. These units take their input from the AZIMUTH and ELEVATION (angular height) CONTROL UNITS in the trailer cab through input amplifiers discussed in paragraph 20, or from the AUTOMATIC CONTROLLER depending on whether the system is operating by manual control or by automatic control. The output of the two amplifiers actuates the azimuth and elevation (angular height) drive motors on the antenna pedestal.

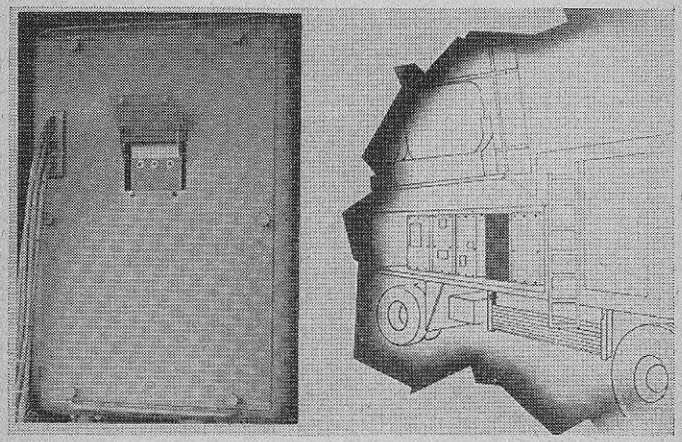


FIGURE 23.—Output servo amplifier.

■ 22. RANGING EQUIPMENT.—The RANGING EQUIPMENT consists of two units mounted in a common steel box as illustrated in figure 24. The upper unit controls the movable range notch (fig. 50) on the oscilloscope screens which is positioned by means of the RANGE HANDWHEEL in the trailer cab or by the AUTOMATIC CONTROLLER depending on whether the control is set for manual or automatic. The

lower unit is the RANGE CONVERTER which serves to convert slant range to altitude for use in certain directors.

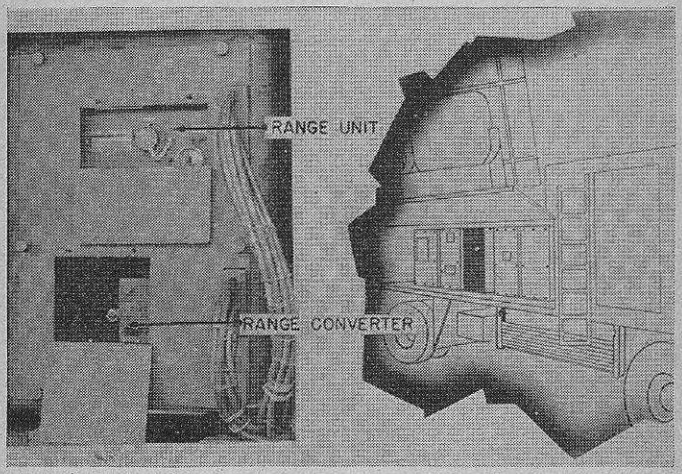


FIGURE 24.—Ranging equipment.

■ 23. SEARCH RECEIVER.—The SEARCH RECEIVER (fig. 25) detects and amplifies the signals delivered to it by the SEARCH antenna. As in the case of the TRACK RECEIVER (par. 18), remote tuning of the beating oscillator and control of receiver gain, both manual and automatic, is provided in the trailer cab.

■ 24. SEARCH TRANSMITTER.—*a*. The SEARCH TRANSMITTER (fig. 26) converts d-c power from the HIGH VOLTAGE RECTIFIER (par. 16) into very high frequency power for operation of the SEARCH system.

b. The T–R BOX for the SEARCH system, performing the same functions as the TRACK T–R BOX (par. 19) is included in this unit.

■ 25. ANTENNA.—The SEARCH and TRACK antennas are mounted on a common pedestal which may be rotated in azimuth and elevation (angular height). Figure 27 shows both antennas. The SEARCH ANTENNA consists of the 16 dipoles mounted on the perforated sheet steel reflector. The

TRACK ANTENNA consists of the SCANNER mounted in front of the parabolic reflector. The plastic rod projecting

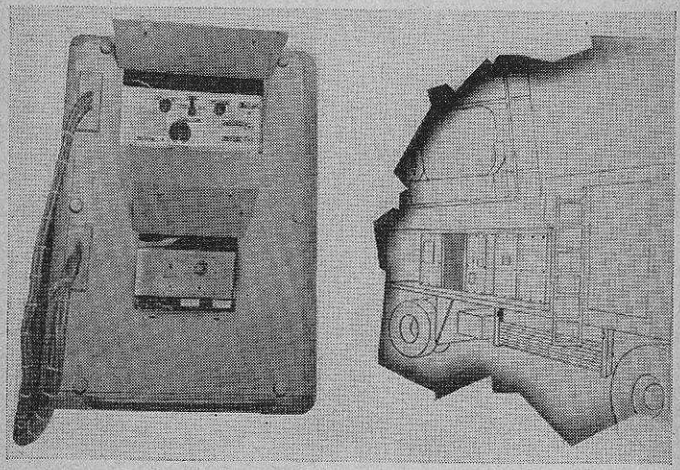


FIGURE 25.—SEARCH receiver.

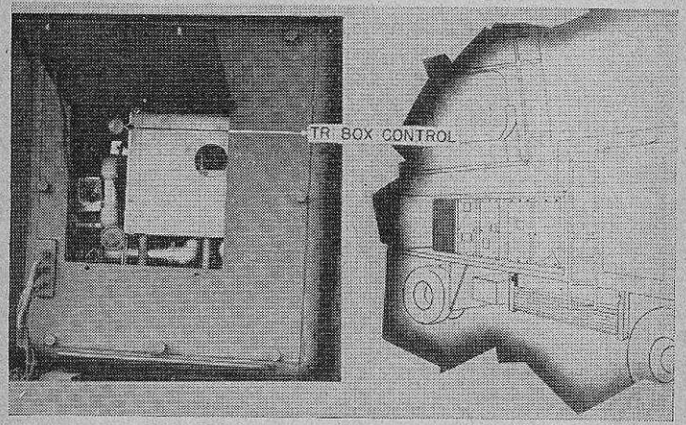


FIGURE 26.—SEARCH transmitter.

between the SCANNER and the parabola is the shaft which drives the SCANNER. The motor driven LOBE SWITCH

of the SEARCH ANTENNA system and SCANNER of the TRACK ANTENNA system provide lobe displacement making possible tracking in azimuth and elevation (angular height) by the *pip matching* method.

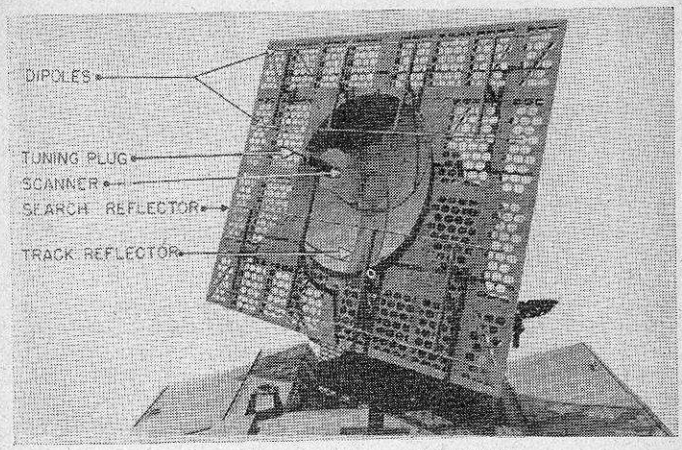


FIGURE 27.—Front view of antenna.

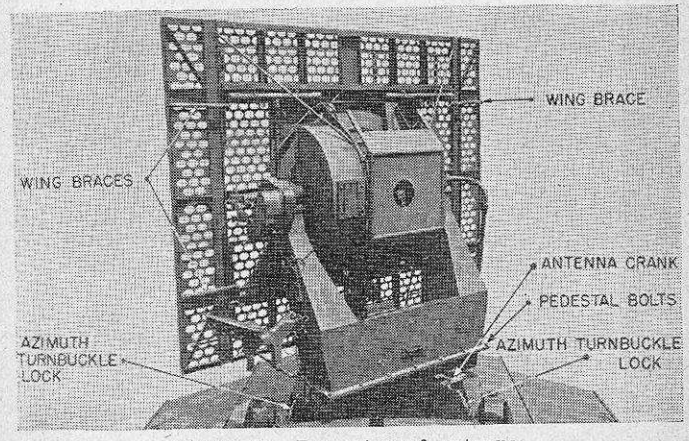


FIGURE 28.—Rear view of antenna.

■ 26. CABLE RECEPTACLES.—*a. General.*—The purpose of this paragraph is merely to point out the location of the various receptacles provided on the SCR–545–A. The data connections employed with various directors are discussed more fully in paragraph 27.

b. Power supply.—The 250-foot power cable which is carried in the power truck is provided with lug type terminations. At the trailer end, these lugs are connected to the main power panel in the cab through the POWER JUNCTION BOX (at the front of the trailer) shown in figure 29. The white wire of the cable is always connected to the lower terminal behind the door.

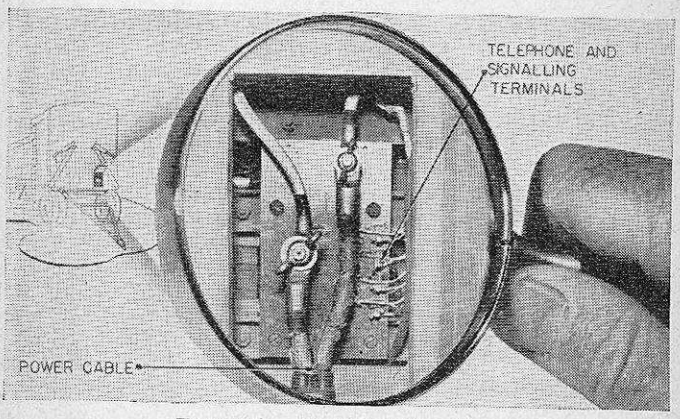


FIGURE 29.—Power junction box.

c. Telephone and signaling.—The 300-foot telephone and signal cable which is carried in a compartment of the trailer (fig. 30), is also connected at the POWER JUNCTION BOX (fig. 29) to the two lower pairs of small terminals. The white and green leads connect to the lower pair of terminals. This cable is used between the SCR–545–A and its associated director.

d. Data supply.—The data provided by the SCR–545–A terminate in all their forms at a DATA JUNCTION BOX at the rear of the trailer (fig. 31). All data cables must be provided by the director, none is carried with the SCR–545–A.

The four data receptacles accommodate standard 19-conductor plugs on a 20-conductor cable. The DATA JUNCTION BOX includes two *two-position switches.* Figure 31 shows

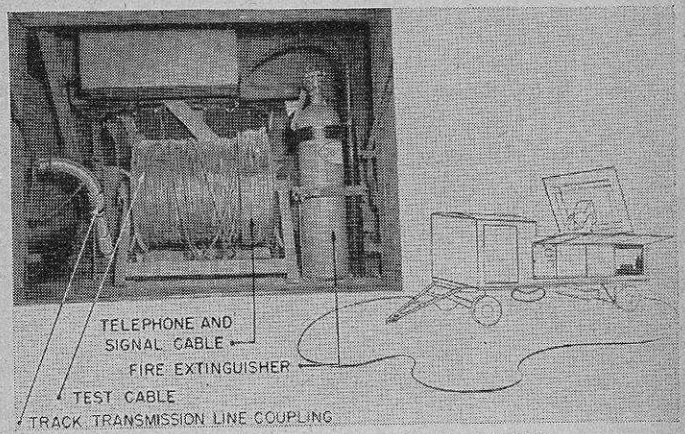


FIGURE 30.—Cable compartment on trailer.

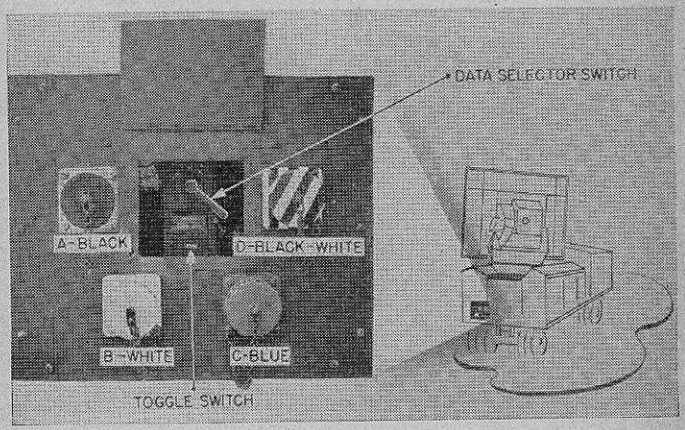


FIGURE 31.—Data junction box.

the DATA SELECTOR SWITCH which has a position marked "M9" in which the voltage data system is energized from the director M9. In its other position marked "M4, M7, T20," the

RANGE CONVERTER supplies altitude as synchronous repeater data at receptacle B. At the bottom of the box is a TOGGLE SWITCH which has two positions, *local* and *remote.* This switch controls the energy supply to the synchronous repeater fields and is used in the *remote* position for all cases where synchronous data are sent to or received from other equipment.

■ 27. EXTERNAL DATA CABLING.—It is suggested that battery commanders paint the cable plugs to correspond with the colors of the receptacles to which they connect. This practice makes the cabling job at a new location much simpler and more rapid.

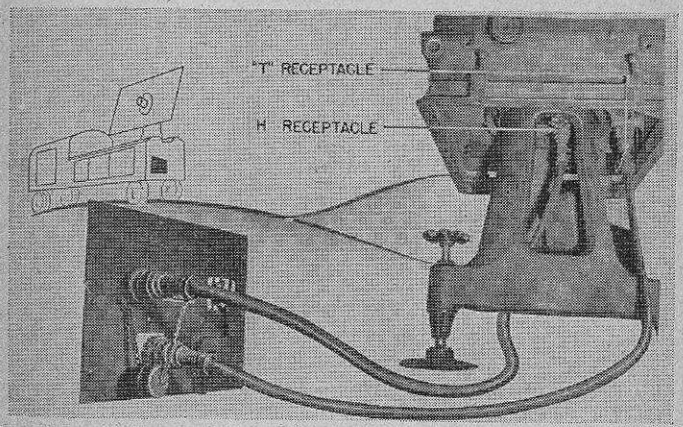


FIGURE 32.—Cabling with director M4 or M7.

a. With director M4 or M7.—When using the SCR–545–A with director M4 or M7, two data cables are used as indicated in figure 32. Both of these are 20-conductor cables with 19-terminal plugs and are furnished and carried with the director. One connects the "A" (black) receptacle on the DATA JUNCTION BOX of the SCR–545–A with the "H" receptacle on the bottom of the director. The other connects the "B" (white) receptacle on the DATA JUNCTION BOX with the "T" receptacle on the bottom of the director. With these two cables in place the director must be operated with the

toggle switch on the base of the director in the "T" position. For this connection the DATA SELECTOR SWITCH on the DATA JUNCTION BOX should be in the "M4, M7, T20" position and the TOGGLE SWITCH should be in the *remote* position. (App. V gives details of the data circuits.)

b. With director T20.—When using the SCR–545–A with director T20, the same two receptacles are used as with directors M4 or M7. The DATA SELECTOR SWITCH and the TOGGLE SWITCH on the DATA JUNCTION BOX should be in the "M4, M7, T20" and *remote* positions, respectively. The cables again are provided by the director.

c. With director M9.—(1) Figure 33 shows the recommended cabling set-up for the SCR–545–A with the director M9. The

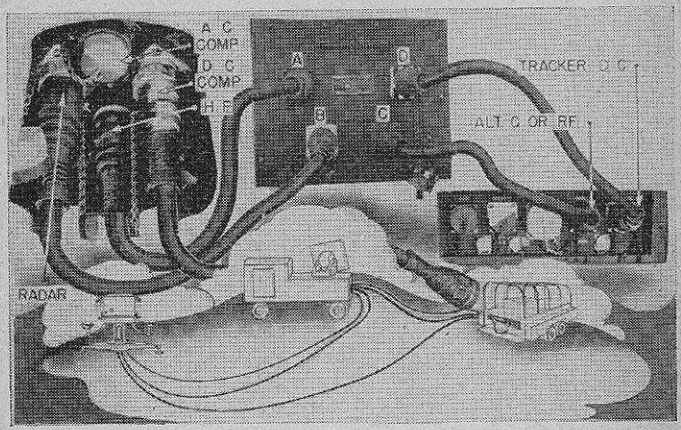


FIGURE 33.—Cabling with director M9. (This diagram does not show power cable connections.)

"A" (black) receptacle on the radar connects to the "HF" (black) receptacle on the tracker of the director. The "B" (white) receptacle on the radar connects to the "RAD" (white) receptacle on the tracker of the director. The "C" (blue) receptacle on the radar connects to the "RF" (blue) receptacle on the computer of the director. The "D" (black-white) receptacle on the radar connects to the "DC" (black-white) receptacle on the computer of the director. A fifth cable is run out between the tracker and the computer as

indicated in the figure. This cable is plugged into the "DC COMP" (black-white) receptacle at the tracker and the other end is left loose beside the "DC" (black-white) receptacle at the computer. With this cabling arrangement, the director may be used easily for either optical or radar tracking. For radar tracking, the cabling is left as shown. For optical tracking, the loose cable is plugged into the "DC" (black-white) receptacle at the computer instead of the D cable from the radar which is shown plugged in in the figure. When using either of these setups the DATA SELECTOR SWITCH (fig. 31) on the DATA JUNCTION BOX must be set at M9 and the TOGGLE SWITCH (fig. 31) at REMOTE. The toggle switch on the base of the tracker of the director may be in either the HF or RADAR position for either set-up.

(2) It is possible to receive complete data at the director without setting up and connecting the tracker. This would be accomplished by merely connecting cable "D" (black-white) from the DATA JUNCTION BOX to the DC (black-white) receptacle on the computer (fig. 35) setting the DATA SELECTOR SWITCH (fig. 31) at M9 and the TOGGLE SWITCH (fig. 31) at LOCAL. Under normal conditions, however, the complete cabling shown in figure 33 is used.

(3) The recommended method in (1) above is merely a combination of method I and method II shown in figures 34 and 35 which are described in FM 4–138, and is more flexible than either one separately.

(4) When switching from optical to radar tracking as outlined in (1) above be sure to compensate for the parallax change. For optical tracking parallax is figured "director from guns." For radar tracking parallax is figured "radar from guns."

■ 28. DATA LIMITS.—*a. Directors M4 and M7.*—(1) The following data are furnished *to the director by the SCR–545–A:*

(*a*) *Altitude.*—Transmitted by a coarse synchronous repeater system between limits of 300 and 10,000 yards. The same limits apply when the altitude transmission system is used for slant range in the case of low-angle targets (HOR FIRE).

(*b*) *Azimuth.*—Transmitted by coarse and fine synchronous repeater system without limits. The coarse transmitter

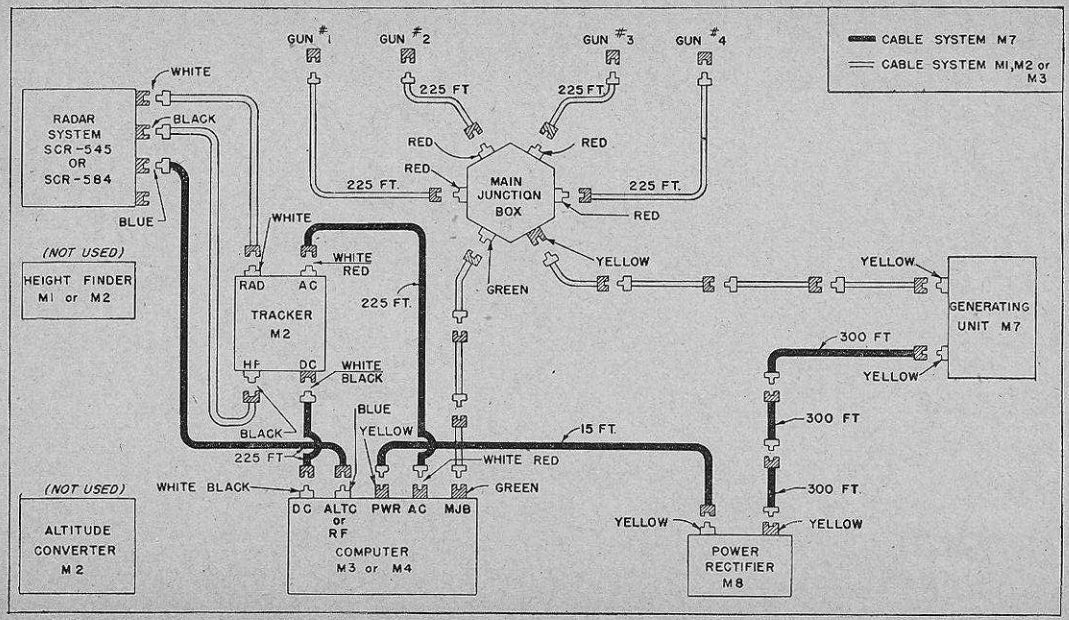


FIGURE 34.—Method I. (Cabling with director M9.)

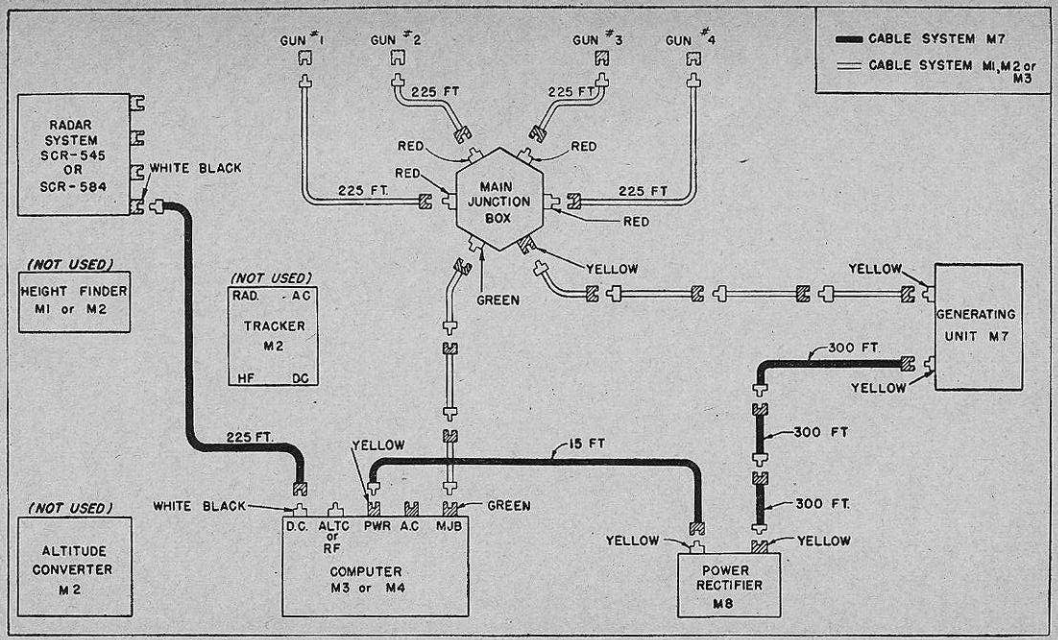


FIGURE 35.—Method II. (Cabling with director M9.)

makes one revolution per 6,400-mil traverse of the antenna pedestal. The fine transmitter makes one revolution per 400-mil traverse of the antenna pedestal. This information is used by the director in following unseen targets.

(c) *Elevation (angular height).*—Transmitted by fine and coarse synchronous repeater system between limits of —200 mills and +1,600 mils. The coarse transmitter revolves at the rate of 6,400 mils change in angular height (of antenna) per revolution. The fine transmitter makes a revolution for each 400 mils change in angular height of the antenna. This information is used by the director in following unseen targets.

(2) The following data are furnished to *the SCR–545–A by director M4 or M7:*

(a) *Azimuth.*—Transmitted by a coarse synchronous repeater system without limits. The transmitter makes one revolution per 6,400-mil change in azimuth of the director. This information is used at the SCR–545–A when the director is tracking the target visually to assure that the radio set is tracking the same target as the director. It is called azimuth target designation.

(b) *Elevation (angular height).*—Transmitted by a coarse synchronous repeater system between limits of —175 and +1,600 mils. The transmitter revolves at the rate of 6,400 mils change in angular height of the director telescopes per revolution. It is used for target designation at the SCR–545–A.

b. Director T20.—(1) The following data are furnished *to the director by the SCR–545–A:*

(a) *Slant range.*—Transmitted by coarse and fine repeater system between limits of 0 and 50,000 yards. The coarse transmitter makes one revolution for 50,000 yards change in range. The fine transmitter makes one revolution for each 2,000 yards change in range.

(b) *Azimuth.*—Same data as outlined in *a*(1)(*b*) above for directors M4 and M7.

(c) *Elevation (angular height).*—Same data as outlined in *a*(1)(*c*) above for directors M4 and M7.

(2) Target designation data are furnished *by the director to the SCR–545–A* as outlined in *a*(2) above for directors M4 and M7.

c. Director M9 or M10 (tracker used).—(1) The following data are furnished *to the director by the SCR–545–A:*

(a) *Altitude.*—Altitude is not furnished to the director in this case.

(b) *Slant range.*—Transmitted as a voltage proportional to slant range between the limits of 300 and 28,000 yards.

(c) *Azimuth.*—Same data as outlined in *a*(1)(*b*) above, for directors M4 and M7.

(d) *Elevation (angular height).*—Same data as outlined in *a*(1)(*c*) above, for directors M4 and M7.

(2) Target designation data are furnished *by the tracker to the SCR–545–A* as outlined in *a*(2) above for the directors M4 and M7.

d. Director M9 or M10 (tracker not used).—The following data are furnished *to the director by the SCR–545–A:*

(1) *Altitude* (H_o).—Transmitted as a voltage proportional to altitudes between the limits of 300 and 28,000 yards.

(2) *E–W component* (X_o).—Transmitted as a voltage proportional to X_o between the limits of 300 and 28,000 yards.

(3) *N–S component* (Y_o).—Transmitted as a voltage proportional to Y_o between the limits of 300 and 28,000 yards.

■ 29. AIDED TRACKING.—The operator's control units for range, azimuth, and elevation are all provided with aiding mechanisms. Figure 36 is a simplified schematic diagram il-

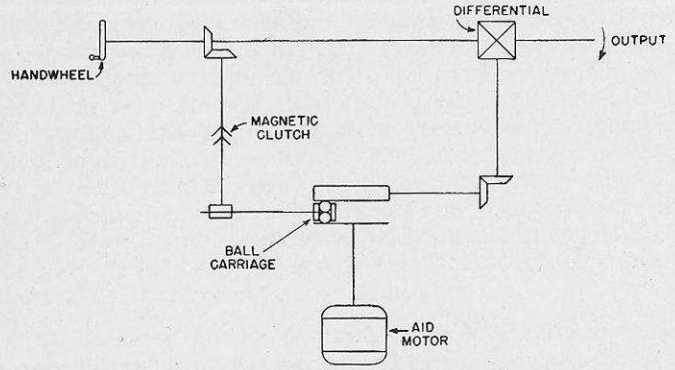


FIGURE 36.—Aiding mechanism.

lustrating the manner in which the handwheel on these units controls the output of the unit. A three-position switch, AID OFF, AID ON, AID FIXED, selects the condition in which the control is operated. The aided tracking described below is effective only when the MANUAL-AUTO switch is in the MANUAL position, and the LAMP switch on the OPERATOR'S CONTROL UNIT is "on."

a. Aid off.—In this condition, the "aid motor" is not running and the magnetic clutch is disengaged. The output therefore depends directly on the motion of the handwheel.

b. Aid on.—In this condition, the "aid motor" is running and the magnetic clutch is engaged. The handwheel and the aid motor thus both contribute to the output. The amount of aid is determined by the location of the ball carriage which is positioned by the handwheel through the magnetic clutch.

c. Aid fixed.—In this condition, the "aid motor" is running and the magnetic clutch is disengaged. The amount of aid contributed to the output is therefore fixed by the position of the ball carriage in the variable speed drive which cannot be changed by the handwheel because the clutch is disengaged. The handwheel contributes directly to the output in this condition.

CHAPTER 2

EMPLACING

SECTION I

CHOICE OF POSITION

■ 30. GENERAL.—Choice of a location for the SCR–545–A, while it must necessarily conform with tactical dispositions, must also be guided by technical considerations. Accessibility of the location is an important factor. The trailer weighs 13½ tons and firm soil is necessary for emplacement and routes into the emplacement. Within these limits a location should be selected which provides minimum interference to radio operation. The SEARCH system, since it operates in the same frequency band as the SCR–268, suffers the same general types of interference. It is therefore desirable to find a location surrounded by hills not high enough to interfere with searching operations but high enough to shield the antenna from reflecting objects at ranges at which targets may be expected. The SEARCH antenna system of the SCR–545–A has been greatly improved over the SCR–268 antenna so that reflecting objects behind the antenna can be eliminated from consideration. Thus, if the possible field of approach of aircraft is limited, the siting of the SCR–545–A may be made to cover that line of approach without consideration for rear reflecting objects. Tracking in elevation (angular height) with the SEARCH system is not usually dependable below lines of sight approximately 200 mils above obstructing reflecting objects. The TRACK system operates at a much higher frequency. The same types of objects cause objectionable echoes as in the SEARCH system but the antenna is much more directional and the interference of such objects is thus confined to much smaller angular fields. Due to the increased directivity the TRACK system tracks accurately at much lower angular heights.

■ 31. EXTERNAL POWER SOURCES.—*a.* A location accessible to commercial power is desirable in order to provide adequate time for inspection and maintenance of the power plant engine

and generator. When considering the use of commercial power it is always advisable to check with a power company engineer before choosing the exact location for the power van. Unless a converter (par. 9) is available the power supply must be 110-130-volt, single-phase, 50- or 60-cycle power. The trailer is normally set to take 60-cycle power (as supplied from the power van) but if an otherwise satisfactory commercial supply is available at 50 cycles, refer to TM 11–1127 for the necessary changes for use of such a supply.

b. As noted in paragraph 9, a converter van may be furnished for locations where the only available commercial supply operates at 25 cycles.

SECTION II

EMPLACEMENT PROCEDURE

■ 32. EMPLACING PRIME MOVER POWER VAN.—The location for the power plant must be chosen with regard for the 250-foot power cable which connects the trailer with the power supply. Consideration must be given to camouflage and fortification of the location and to the fact that the engine generator unit cannot operate satisfactorily if it is more than 10° out of level in any direction. Following is the sequence of operations for making the power unit ready for operation:

a. Unlock, open, and hook the rear and side doors.

b. Lift the muffler hatch cover clear of the opening, set the muffler in place on the exhaust manifold and place the rain shield around the muffler. Leave the hatch cover with the top upward to avoid the retention of rain water.

c. Unreel the power cable, pulling the free end to the trailer. Connect the cable at both ends.

(1) Push the end of the cable at the power plant through the entrance hole in the side or floor of the truck. Connect the cable, making sure the white wire goes to the *ground* terminal.

(2) Paragraph 26 covers details of the connection at the trailer.

d. Remove the ground stake and cable from their rack in the van, drive the stake adjacent to the right rear corner of the truck, and connect the cable to the *ground* terminal on the chassis.

e. Make sure both circuit breakers (fig. 37) are in the "off" position.

f. Remove the fire extinguisher from its rack and set it out in a location convenient for use in case of fire.

g. Check the oil, water, and gasoline supply.

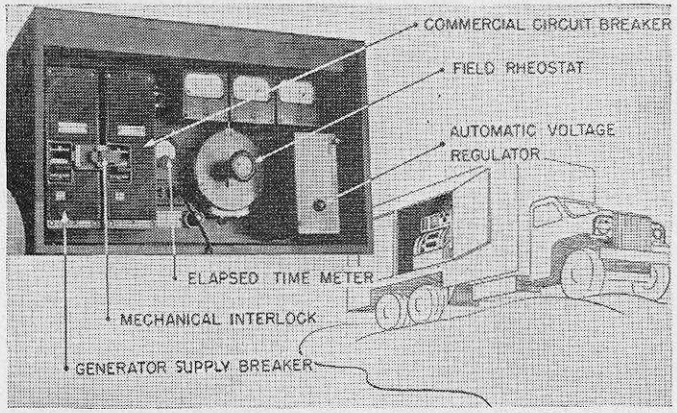


FIGURE 37.—Power control panel.

■ 33. EMPLACING CONVERTER VAN.—When a converter van is used it is emplaced with practically the same considerations that apply in the case of the power van. The power cable carried in the converter van is used to connect the converter-generator with the power van. A ground stake and cable are provided to ground the chassis of the converter van.

■ 34. EMPLACING TRAILER.—After selection of a location for the trailer in accordance with the general principles outlined in paragraph 30, it is well to make some preliminary emplacement arrangements before bringing it into the location. The jacks, one of which is shown in figure 5, have a limited lift. On a level concrete platform, they can raise the trailer chassis 7 inches. It is therefore necessary to have the trailer location almost level in order to accomplish the necessary perfect leveling with the jacks. The following steps place the trailer in readiness to operate:

a. Set the hand brake on the right side of the trailer.

b. Disconnect the brake cables, the light cable, and safety chain and uncouple the prime mover.

c. Swing out the ladder alongside the right cab door and secure it.

d. Unlock the cab and swing the doors back.

e. Release the operator's chairs in the cab and push them back against the control unit shelf. These chairs are secured for traveling by means of a locking screw under the center of each.

f. Untie and remove the antenna cover.

g. Swing down the rear cover rail shown in figure 38. (This should not be done until the rear outriggers are down.)

h. Open and fasten the antenna reflector wings in the operating position.

i. Release the antenna from traveling position by removing the four locking screws (fig. 38) from the reflector.

j. Operate the antenna crank (fig. 28) to raise the antenna to about a three-quarter erect position.

k. Set the TUNING PLUG (fig. 27) at its marked setting.

l. Remove the eight outside ends of the outside SEARCH dipoles from the box on the roof of the trailer (fig. 41).

m. Install the four longer ends of the SEARCH dipoles (step *l*), at the right side of the antenna, (facing antenna).

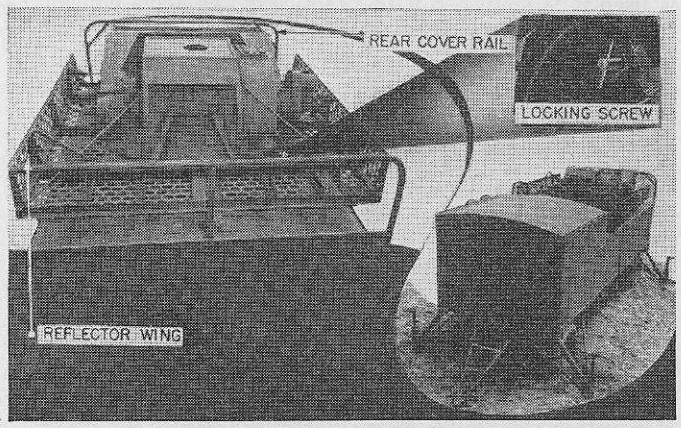


FIGURE 38.—Antenna in traveling position.

Install the four shorter dipole ends on the left side of the antenna (facing antenna). (See fig. 39.)

n. Clean off the seating surfaces on the antenna mount and resume operation of the antenna crank until the seating surfaces meet. Install the holding bolts, tighten with the wrenches provided, and replace the wrenches in their clips.

o. Unlatch holding chain and swing the antenna in elevation (angular height) by hand to about a 1,000-mil position.

p. Remove the rear hatch cover shown in figure 47.

q. Remove the transmission line section carried in the box shown in figure 41 and install it as shown in figure 40. *Make*

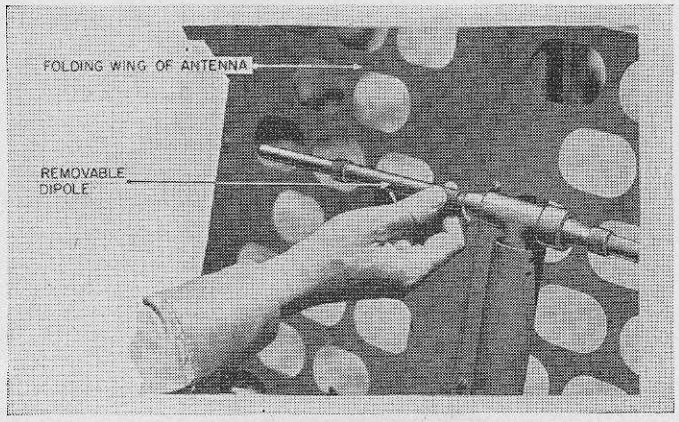


FIGURE 39.—Assembly of SEARCH dipoles.

sure that all electrical connections are clean and well made.

r. Raise all side doors of the trailer. *Make sure the detents drop into place.*

s. Remove the fire extinguisher and set it out in a convenient location.

t. Release the outriggers from traveling position by backing off on the jacks. Swing the outriggers down to operating position.

u. Remove the four jack foot plates from their carrying racks on the front and rear of the trailer (fig. 4). Place these foot plates in approximate position to receive the jack spindles.

v. Remove the eight outrigger braces from their brackets at the sides of the trailer (fig. 4). Install two braces at each outrigger.

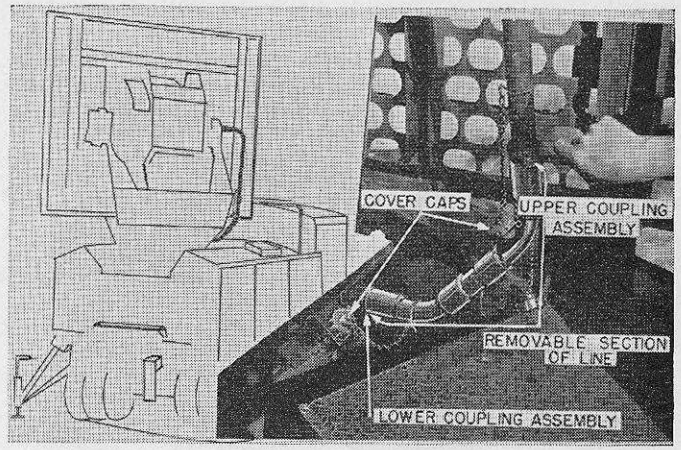


FIGURE 40.—Installation of antenna transmission line.

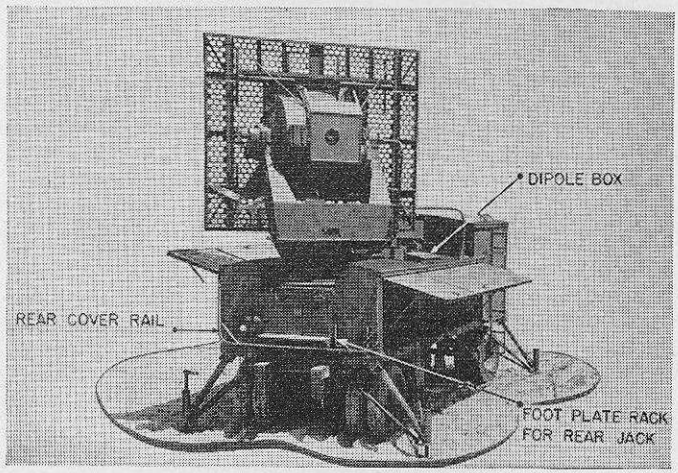


FIGURE 41.—Rear view of trailer in operating position.

w. Turn down the jacks without the handles until they bear firmly on the pads. *Do not operate the jacks without first placing the outrigger braces.*

x. Remove the fine level vials from their cases on a shelf in the trailer cab and install them in position on the pedestal as illustrated in figure 42. Make sure the seating surfaces are clean. The levels are interchangeable in the two positions. The shields on the vials must be rotated to make the bubbles visible.

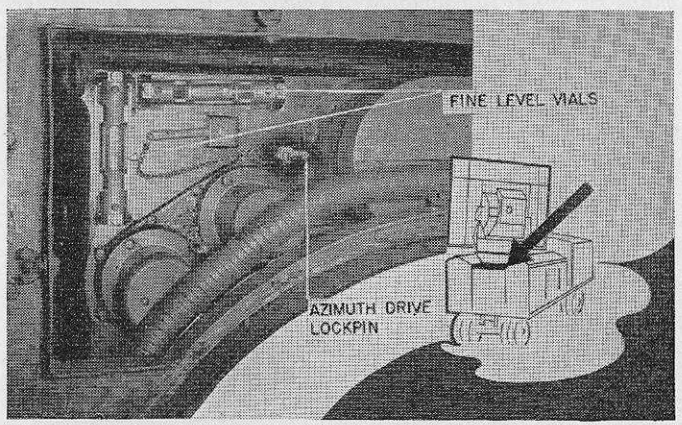


FIGURE 42.—Installation of fine level vials.

y. The four jack handles are carried in brackets under the operator's bench in the cab. Remove them from the brackets and install them on the jacks.

z. Operating the jacks simultaneously so not to place a strain on the chassis, raise the entire trailer until the wheels are clear of the ground. (A 3-inch lift should accomplish this.)

aa. With the levels under observation, operate the jacks in pairs (both rear, both right, both front, or both left) to bring the mount to a perfect level. Coarse levels are located on the front of the trailer and on the antenna pedestal where they are visible through the rear hatch (step *m*). The fine levels (installed in step *t*) are also observed through the rear hatch, and must be exactly centered.

ab. Remove the azimuth drive lock pin shown in figure 42. Reverse the pin and reseat it. (Normally this pin will not be in the "locked" position and this step may be omitted.)

ac. Unhook the turnbuckle clamps (fig. 28) on the antenna leaving the pedestal free to rotate in azimuth.

ad. Open the doors of the air intake filter box just forward of the rear wheels under the trailer body.

ae. Couple the transmission lines (figs. 30 and 43) at the output of the SEARCH and TRACK transmitters. Again, *make sure that the surfaces are clean* and *make the connections tight.* These connections are uncoupled for traveling

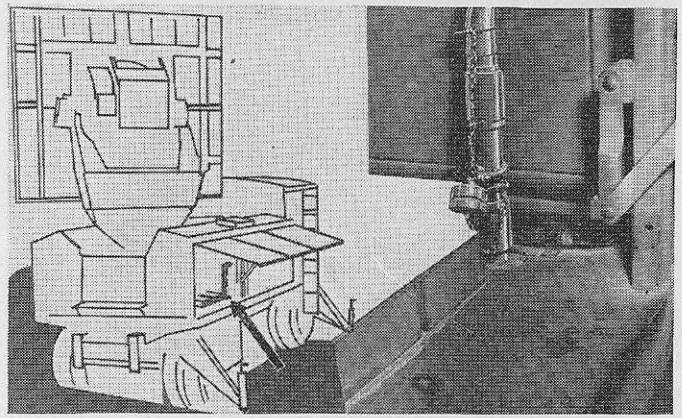


FIGURE 43.—Transmission line at search transmitter.

because the transmitters are shock mounted and thus subject to motion relative to the chassis to which the lines are solidly attached.

af. Drive the ground stake, which is carried in the cab, adjacent to the left rear corner of the trailer and connect the cable to the ground terminal on the chassis.

ag. Unreel and connect the four-conductor telephone and signal cable between the trailer and the director. This cable (fig. 30) is carried in the left rear compartment of the trailer. The connections are outlined in paragraph 26.

ah. Work with the crew from the director to connect the data cables correctly in accordance with paragraph 27.

CHAPTER 3

OPERATION

SECTION I

PERSONNEL

■ 35. PERSONNEL.—The SCR–545–A crew is composed of the following personnel:

	S. S. N.
CHIEF RADAR OPERATOR	774
RADAR REPAIRMAN	952
OPERATOR, RADAR	514
OPERATOR, RADAR	514
OPERATOR, RADAR	514
OPERATOR, RADAR	514
OPERATOR, RADAR	514
DRIVER, TRUCK, HEAVY	245
OPERATOR, POWER PLANT	846

■ 36. TRAINING.—It is extremely important to successful operation of the SCR–545–A that all members of the crew learn all the jobs at the earliest opportunity. It is especially desirable that the men understand the procedure for all adjustments necessary in obtaining optimum performance of the set. Complete adjustment and maintenance procedures are covered in TM 11–1127. The chief radar operator is responsible for the "Equipment performance log."

SECTION II

PLACING IN OPERATION

■ 37. POWER PLANT.—*a.* If the power plant is to be used as a power source, reference should be made to the separate instruction book furnished with it for detailed operating instructions. An outline of the steps follows:

(1) Check oil, gasoline supply, battery and radiator water level.

(2) Start the engine in accordance with procedures outlined in the instruction book.

(3) Make sure the engine is operating properly by observing a steady 60-cycle reading on the frequency meter (fig. 37).

(4) Close the GENERATOR SUPPLY BREAKER.

(5) Adjust the AUTOMATIC VOLTAGE REGULATOR to hold 120 volts by turning the FIELD RHEOSTAT fully counterclockwise and adjusting the REGULATOR RHEOSTAT for 120 volts on the meter. (Once this adjustment is properly made, only slight adjustments of the REGULATOR RHEOSTAT are necessary from time to time.)

b. If a commercial source of 50- or 60-cycle power is used it is brought into the power van and connected through the COMMERCIAL SUPPLY breaker. An interlock between the GENERATOR and COMMERCIAL SUPPLY circuits is provided to prevent commercial power being fed into the generator.

■ 38. CONVERTER.—If a commercial source of 25-cycle power is to be used the converter must be used to change the frequency to 60 cycles. A separate instruction book covering operation of this unit is furnished. An outline of the steps follows:

a. Close the 25-cycle LINE BREAKER.

b. Start the driving motor by moving the STARTING LEVER to the *start* position. After the motor comes up to speed, move the lever to the *run* position.

c. Close the 60-cycle LOAD BREAKER.

d. Adjust the AUTOMATIC VOLTAGE REGULATOR to hold 120 volts by the same adjustments outlined in paragraph 37*a*(5).

■ 39. RADIO AND CONTROL EQUIPMENT.—This paragraph covers the normal procedure for placing the SCR–545–A in operation. For initial operation after reaching a new position or details of the checks and adjustments necessary from time to time, see TM 11–1127.

a. Step 1.—Close the MAIN CIRCUIT BREAKER on the power panel (fig. 44) in the trailer cab.

b. Step 2.—If the weather is extremely cold or damp, close the branch circuit breakers (fig. 44) marked HEATERS No. 1, HEATERS NO. 2 and HEATERS IFF. Also close the

GAP HEATER switch just below the T–R BOX in the TRACK TRANSMITTER. Allow the equipment to heat long enough to dispel the dampness or bring the temperatures in the various units up to the point where moving parts operate freely.

c. Step 3.—Close the remaining branch circuit breakers. When the TRANS. FILAMENTS breaker is closed, the green pilot lamp at the top of the power panel should light. If the covers of all equipment are in place and the keyer motor is operating properly the amber lamp will come on in about 60

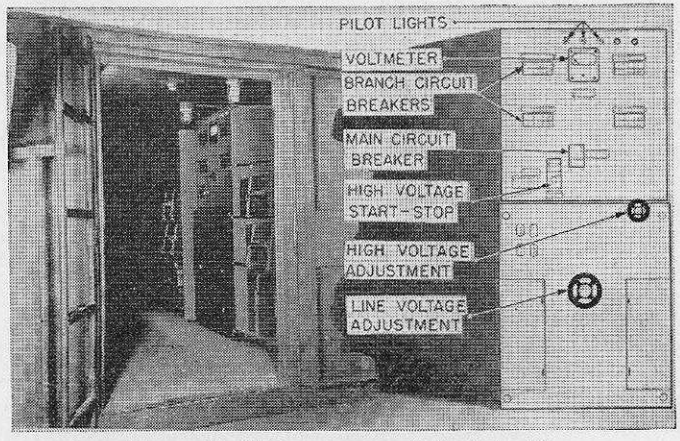


FIGURE 44.—Main power panel (trailer cab).

seconds indicating that the time delay is over and the equipment is ready for high voltage.

d. Step 4.—Press the HIGH VOLTAGE START button on the power panel (fig. 44). The red pilot lamp should light indicating that the equipment is in operation. The incoming voltage should now be adjusted to 115 volts by means of the LINE VOLTAGE ADJUSTMENT (fig. 44).

e. Step 5.—Each operator should set his control to MANUAL, turn his AID SWITCH briefly to AID ON and zero the rate of his component (RANGE, AZIMUTH, and ELEVATION) and then return to AID OFF.

f. Step 6.—Each operator should make minor readjustments of his oscilloscope controls necessary to obtain a sharp picture. Detailed operation of the scope controls is covered in TM 11-1127.

g. Step 7.—The RANGE CONTROL UNIT (fig. 12) should be checked to see that the DATA FLOW SWITCH is in the proper position (par. 12).

h. Step 8.—Traverse the antenna until a fixed echo appears on the scope screens.

i. Step 9.—With both units operating on MANUAL GAIN CONTROL, adjust the BEAT OSC. TUNING control on both the TRACK and SEARCH RECEIVER CONTROL units to obtain the maximum response on the oscilloscope screens.

j. Step 10.—With no signal in the range notch, operate the GAIN CONTROL SELECTOR switch on the SEARCH RECEIVER CONTROL unit to AUTOMATIC and turn the AUTOMATIC GAIN CONTROL fully clockwise.

k. Step 11.—Turn the AUTOMATIC GAIN CONTROL on the SEARCH RECEIVER CONTROL unit counterclockwise until the noise starts to decrease.

l. Step 12.—Switch the SEARCH GAIN CONTROL SELECTOR back to MANUAL.

m. Step 13.—Set the automatic tracking switch (fig. 17) at TRACK.

n. Step 14.—Continuing with no signal in the range notch, set the TRACK GAIN CONTROL SELECTOR at AUTOMATIC and advance the GAIN CONTROL to near its maximum.

o. Step 15.—Switch the RANGE CONTROL unit to AUTO. If any drift in position of the notch occurs, refer to TM 11-1127 for the adjustment procedure. (This test should not be made until the equipment has been in operation for 15 minutes. This applies also to steps 16 and 17.)

p. Step 16.—Switch the AZIMUTH CONTROL unit to AUTO. If the circuit is not properly balanced the antenna will commence to rotate. The proper balancing procedure is covered in TM 11-1127.

q. Step 17.—Switch the ELEVATION CONTROL unit to AUTO. If the antenna moves in angular height the circuits require balancing as outlined in TM 11-1127.

r. Step 18.—Turn the TRACK AUTOMATIC GAIN CONTROL counterclockwise until the noise starts to decrease. Leave it at this point.

s. Step 19.—Set the automatic tracking switch (fig. 17) at TRACK-OR-SEARCH.

SECTION III

CALIBRATION

■ 40. SCOPE.—This section deals with the tests and adjustments necessary to assure that the data furnished by the SCR-545-A are correct. It does not overlap into orientation, an adjustment involving direction of a line of sight.

■ 41. CALIBRATION OF RANGE DIALS.—*a.* There is a fixed amount of time delay in the range notch (fig. 50) and a different amount of delay in the receiver circuits. Because of this difference there is always a fixed amount of difference in readings between the range dials on the RANGING EQUIPMENT (fig. 24) and the range dials on the RANGE CONTROL (fig. 12) in the cab. This difference, called the "zero reference number," is determined by the manufacturer and entered in the log book furnished with the equipment. A method of checking this number is given in TM 11-1127.

b. For usual calibration, which must assume that the "zero reference number" is correct, it is convenient to have available the "range operator's dial check number" which is determined as follows:

(1) Operate the RANGE HANDWHEEL to set the RANGING EQUIPMENT range dials at the "zero reference number."

(2) Set the range dials on the RANGE CONTROL unit at zero.

(3) Position the left edge of the main pulse by means of the RANGE HANDWHEEL, (so that it just touches the left edge of the range notch (fig. 50).

(4) The new reading of the range dials on the RANGE CONTROL unit is the "range operator's dial check number."

c. Normal range calibration procedure, then, consists of the following steps:

(1) Position the main pulse so that its left edge just touches the left edge of the range notch (fig. 50).

(2) Set the range dials on the RANGE CONTROL unit to read the "range operator's dial check number." The range dials on the RANGE CONTROL unit should now indicate correct ranges to any target tracked in the center of the range notch either manually or automatically.

■ 42. CALIBRATION OF RANGE AND ANGULAR HEIGHT POTENTIOMETERS.—The range potentiometer and the angular height potentiometer are integral parts of the calculating system. They are both carefully calibrated at the factory and should require no further change in the field. If an opportunity for checking the "zero reference number," referred to in paragraph 41 and as outlined in TM 11–1127, presents itself, and a change in the "zero reference number" is indicated, then the range potentiometer must be reset by the procedures outlined in TM 11–1127. The angular height potentiometer may also be checked and reset by a method outlined in TM 11–1127.

■ 43. CALIBRATION IN ALTITUDE (HEIGHT).—When using the SCR–545–A with a director M4 or M7 the ALTITUDE POTENTIOMETER should always be calibrated by the following procedure:

a. Operate the RANGE HANDWHEEL (fig. 12) to set a reading of 15,000 yards plus the "zero reference number" (par. 41) on the range dials of the RANGING EQUIPMENT.

b. Operate the ELEVATION HANDWHEEL (fig. 14) to set a reading of 533.3 mils on the angular height dials on the right trunnion of the antenna pedestal. These dials are shown in figure 45.

c. The ALTITUDE DIAL on the RANGE CONVERTER (fig. 45) should now read 7,500 yards. If there is any variation it should be corrected by means of the HEIGHT CALIBRATE screw adjustment on the panel of the range converter (fig. 46).

d. Check the altitude calculation by several other problems such as those following: (Angular height and slant range are set by the operator's controls in the cab.)

Angular height (mils) (setting)	Slant range (yards) (setting)	Altitude (yards) (proper reading)
200	10,000	1,951
400	10,000	3,827
600	10,000	5,556
800	10,000	7,071
1,000	10,000	8,315
1,200	10,000	9,239
533	18,000	9,000
533	16,000	8,000
533	14,000	7,000
533	12,000	6,000
533	8,000	4,000
533	6,000	3,000
533	4,000	2,000
533	2,000	1,000
533	1,000	500

e. If the calculations are not correct for all altitudes, the frequency of the RANGE CONVERTER should be checked by the procedure outlined in TM 11–1127.

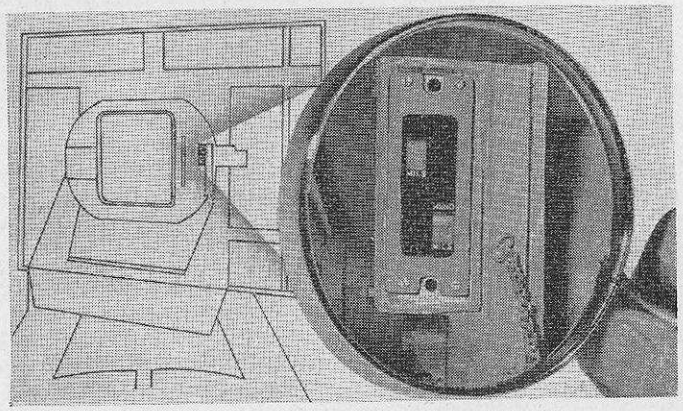


FIGURE 45.—Angular height scale on pedestal.

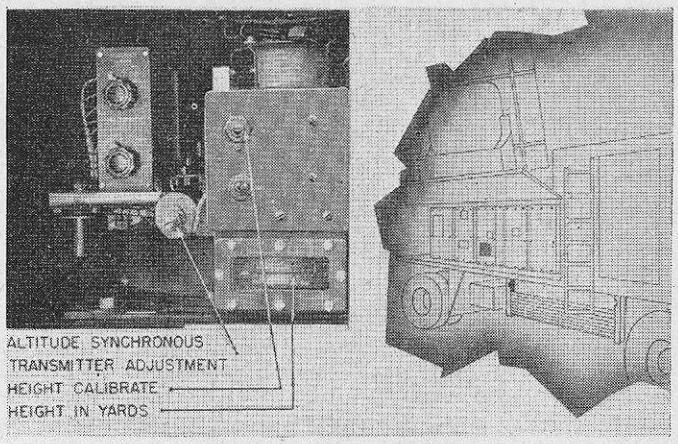


FIGURE 46.—Range converter.

SECTION IV

ORIENTATION AND SYNCHRONIZATION*

■ 44. ORIENTATION AND SYNCHRONIZATION IN AZIMUTH.—*a. Directors M4, M7, T20.*—(1) One of the crew in the seat on the antenna pedestal (fig. 6) directs the operators in the cab as they operate the AZIMUTH and ELEVATION HANDWHEELS to bring the cross hairs of the telescope to bear on the assigned orienting point. *The mount must be carefully leveled.*

(2) The TOGGLE SWITCH on the DATA JUNCTION BOX (fig. 31) at the rear of the SCR–545–A should be in the REMOTE position. The DATA SELECTOR SWITCH should be in the "M4, M7, T20" position. The toggle switch under the director should be in the "T" position.

(3) The hatch cover at the rear of the trailer roof is now removed to expose the azimuth synchronous transmitters shown in figure 47.

(4) Using the wrenches chained beside them, the coarse and fine transmitters are loosened so that they can be ro-

*NOTE.—A method of orientation and synchronization by backsighting will be found in appendix VI.

tated until the azimuth of the line connecting the SCR–545–A telescope and the orienting point is indicated exactly on the dials of the director.

(5) Loosen the coarse and fine dials of the AZIMUTH CONTROL UNIT (fig. 13) and set them to the azimuth set on the director.

(6) If the director has been oriented and is now pointed toward the orienting point, its azimuth dial pointers should now coincide with the pointers of the data receivers except for the parallax difference.

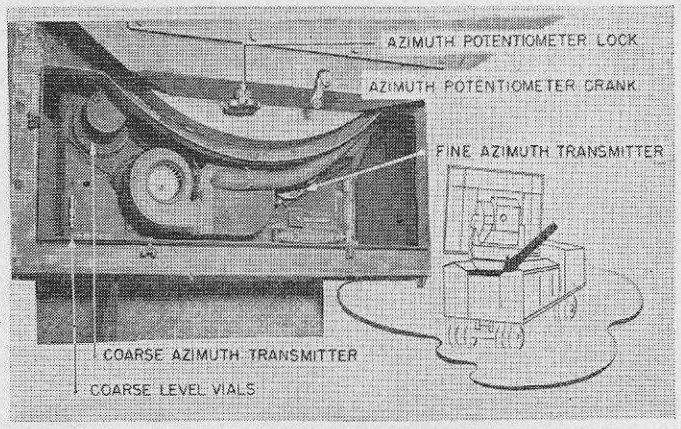


FIGURE 47.—Hatch at rear of trailer roof.

(7) Traverse the director or the SCR–545–A until their azimuth scales indicate identical readings. Set the upper and lower dials of the AZIMUTH TARGET DESIGNATION (fig. 16) unit to coincide at this same reading.

b. Director M9.—(It is assumed here that the cabling set-up recommended in paragraph 27 is being used.)

(1) One of the crew in the seat on the antenna pedestal (fig. 6) directs the operators in the cab as they operate the AZIMUTH and ELEVATION HANDWHEELS to bring the cross hairs to bear on the assigned orienting point. *The mount must be carefully leveled.*

(2) Set the DATA SELECTOR SWITCH on the DATA JUNCTION BOX (fig. 31) at the "M9" position and the

TOGGLE SWITCH at REMOTE. Set the DATA FLOW SWITCH (fig. 12) on the RANGE CONTROL UNIT at M9, OFF.

(3) Remove the hatch cover at the rear of the trailer roof to expose the azimuth synchronous transmitters (fig. 47).

(4) Loosen and rotate the housings of the coarse and fine azimuth transmitters until the azimuth of the line connecting the SCR–545–A telescope and the orienting point is indicated exactly on the dials of the tracker of the director.

(5) Loosen the coarse and fine dials of the AZIMUTH CONTROL UNIT (fig. 13) and set them to the azimuth set on the tracker of the director.

(6) If the tracker of the director has been oriented and is now pointed toward the orienting point, its azimuth dial pointers should now coincide with the pointers of the data receivers except for the parallax difference between the two instruments.

(7) With the tracker of the director and the antenna of the SCR–545–A pointed along parallel lines of sight (pointers matched at tracker), set the upper and lower dials of the AZIMUTH TARGET DESIGNATION (fig. 16) unit (in the cab of the SCR–545–A) to coincide with their scales reading the azimuth of the line of sight.

(8) Leave the antenna of the SCR–545–A at the position set in step (7). Set the DATA FLOW SWITCH (fig. 12) on the RANGE CONTROL UNIT at M9, ON. Set the computer of the director for TRACKER TEST. Operate the azimuth potentiometer ORIENTING CRANK (fig. 27) on the SCR–545–A until the firing azimuth indicated on the computer agrees with the azimuth setting of the antenna as set in step (7).

c. Director M9.—If the tracker of the director is not to be used the azimuth orientation and synchronization includes only the following steps:

(1) Same as step (1), *b* above.

(2) Set the DATA SELECTOR SWITCH on the DATA JUNCTION BOX (fig. 31) at M9 and the TOGGLE SWITCH at LOCAL. Set the DATA FLOW SWITCH on the RANGE CONTROL UNIT at M9, OFF.

(3) Same as step (5), *b* above.

(4) Leave the antenna pointed at the orienting point. Complete step (8), *b* above, making the firing azimuth at the director read the same as the orienting azimuth of the SCR–545–A.

■ 45. ORIENTATION AND SYNCHRONIZATION IN ELEVATION (ANGULAR HEIGHT).—*a. Directors M4, M7, T20.*—(1) Check the level of the mount carefully.

(2) Set the antenna at a convenient angular height by means of the ELEVATION HANDWHEEL on the ELEVATION CONTROL UNIT (fig. 14) in the cab.

(3) Set the TOGGLE SWITCH on the DATA JUNCTION BOX (fig. 31) of the SCR–545–A at REMOTE and the DATA SELECTOR SWITCH at "M4, M7, T20." The toggle switch on the base of the director must be set at the "T" position.

(4) Loosen the coarse and fine synchronous transmitter cases on the pedestal trunnion nearest the seat on the pedestal (fig. 48). Rotate the transmitters until the dials on the director indicate the same elevation as the scale (fig. 45) on the right trunnnion arm of the antenna.

(5) Check, and if necessary reset the dials on the ELEVATION (angular height) CONTROL UNIT (fig. 14) to agree with the reading of the scale (fig. 45).

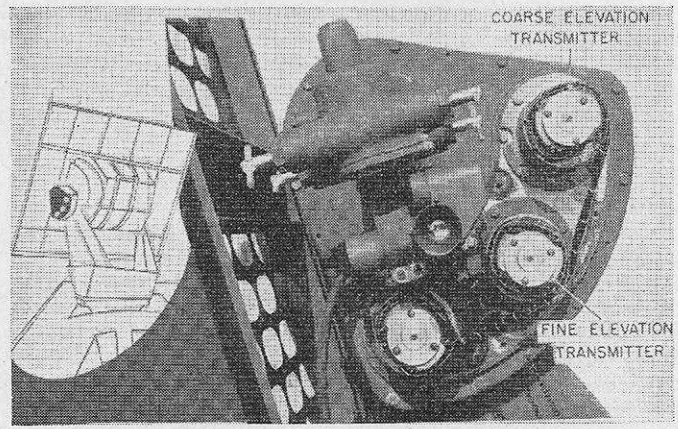


FIGURE 48.—Angular height synchronous transmitters.

(6) Adjust the ELEVATION (angular height) TARGET DESIGNATION unit in the trailer cab, (fig. 9) as follows:

(*a*) By means of the screwdriver adjustment, rotate the upper synchronous receiver housing to make the upper dial read the same as the scale setting (step (5)) on any one of its three sectors.

(*b*) By similar means set an identical reading on the lower dial.

b. Director M9.—This subparagraph covers elevation orientation and synchronization for the cabling set-up recommended in paragraph 27.

(1) Same as step (1), *a* above.

(2) Same as step (2), *a* above.

(3) Set the DATA FLOW SWITCH (fig. 12) on the RANGE CONTROL UNIT at M9, OFF. Set the TOGGLE SWITCH on the DATA JUNCTION BOX (fig. 31) at REMOTE and the DATA SELECTOR SWITCH at M9. The toggle switch on the base of the tracker may be in either the HF or RAD position.

(4) Same as step (4), *a* above; the receivers are located at the tracker.

(5) Same as step (5), *a* above.

(6) Same as step (6), *a* above.

(7) Set the DATA FLOW SWITCH (fig. 12) on the RANGE CONTROL UNIT at M9, ON. With the computer of the director set for TRACKER TEST, the reading on the QUADRANT ELEVATION dial at the computer should agree with the reading on the angular height scale (fig. 45) on the antenna trunnion. If the readings do not agree, refer to TM 11–1127 for adjustment procedure on the elevation potentiometer.

c. Director M9 without tracker.—If the director M9 is used without its tracker, the steps of *b* above referring to the tracker may be eliminated.

■ 46. SYNCHRONIZATION IN ALTITUDE FOR M4 AND M7 DIRECTORS.—*a.* Altitude calculations are checked by the procedure outlined in paragraph 43. When these checks are satisfactory, synchronization is accomplished as follows:

b. Turn the synchronization adjustment (fig. 46) to rotate the synchronous transmitter until the altitude corresponding to the setting of angular height and slant range is registered on the altitude dial of the director. This is accomplished by setting the proper altitude opposite the index on the director dial and rotating the synchronous transmitter at the SCR–545–A until the AA pointers are matched.

■ 47. SYNCHRONIZATION IN SLANT RANGE.—*a.* Range calibration as discussed in paragraph 41, is assumed to be completed. Synchronization with director M9 is automatic, but when using the M9 without the "tracker" be sure to set the TOGGLE SWITCH on the DATA JUNCTION BOX (fig. 31) of the SCR–545–A at LOCAL. The DATA SELECTOR SWITCH on the DATA JUNCTION BOX should be set to conform with the director in use.

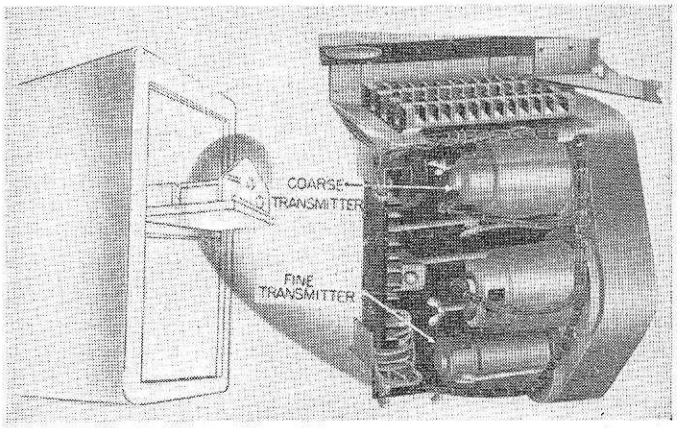


FIGURE 49.—Range unit shelf of ranging equipment.

b. If using a director which receives slant range as synchronous repeater data (T20) proceed as follows:

(1) Operate the RANGE HANDWHEEL (fig. 12) to set a reading on the range dials (fig. 24) of the RANGING EQUIPMENT, of 10,000 yards plus the "zero reference number" (par. 41).

(2) Remove the front cover from the RANGING EQUIPMENT and slide the range unit shelf (fig. 49) out to its stop.

(3) Loosen the clamping rings on the coarse synchronous transmitters (fig. 49) and rotate the housing until a reading of exactly 10,000 yards is indicated on the coarse dial of the director.

(4) Loosen the coarse dial on the RANGE CONTROL UNIT and set the dial to read 10,000 yards.

(5) Operate the fine synchronous transmitter screw driver adjustment (fig. 24) until a reading of zero is indicated on the fine dial of the director.

(6) Loosen the fine dial on the RANGE CONTROL unit and set the dial to read zero.

c. If using a director which does not receive slant range as synchronous repeater data, the coarse and fine dials on the RANGE CONTROL unit may be properly set by loosening the dials and setting them without opening the RANGING EQUIPMENT.

SECTION V

OPERATION

■ 48. OPERATION.—Following is a typical tracking course with the SCR–545–A:

a. The equipment is placed in operation and the three operators, range, azimuth, and elevation, take seats in front of their respective control units. They check the settings of the controls as follows:

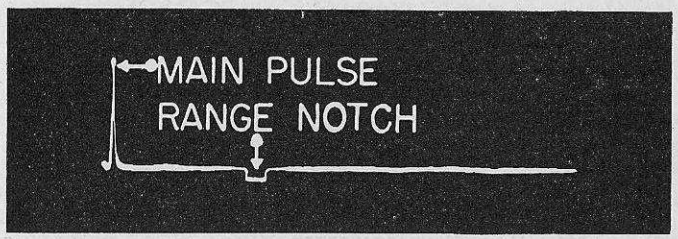
OSCILLOSCOPES:	
IMAGE SPACING SWITCH.	OFF (on RANGE OSCILLOSCOPES).
	ON (on AZIMUTH and ELEVATION OSCILLOSCOPES).
IMAGE SPACING CONTROL.	fully counterclockwise on all units.
SWEEP EXPANSION	as desired, probably fully counterclockwise which makes the maximum range visible on the scopes.

INTENSITY FOCUS HORIZONTAL POSITIONING. VERTICAL POSITIONING.	these four controls are set to produce a clear picture just below center of the scope with the main pulse close to the left edge of the screen.
RANGE CONTROL UNIT:	
AID SWITCH	OFF.
MANUAL-AUTO SWITCH	MANUAL.
LAMPS SWITCH	ON, intensity as desired.
DATA FLOW SWITCH (fig. 12).	must be at OFF if SCR–545–A is supplying a director M9 or M10.
AZIMUTH CONTROL UNIT:	
AID SWITCH	ON.
MANUAL-AUTO SWITCH	MANUAL.
LAMPS SWITCH	ON, intensity as desired.
ELEVATION CONTROL UNIT:	
AID SWITCH	ON.
MANUAL-AUTO SWITCH	MANUAL.
LAMPS SWITCH	ON, intensity as desired.
TRACK RECEIVER CONTROL:	
BEAT OSCILLATOR TUNING.	set for maximum signal intensity.
GAIN CONTROL SELECTOR.	AUTOMATIC.
AUTOMATIC GAIN CONTROL.	set just below point at which noise stops increasing.
SEARCH RECEIVER CONTROL UNIT:	
GAIN CONTROL SELECTOR.	MANUAL.
MANUAL GAIN CONTROL	near maximum.

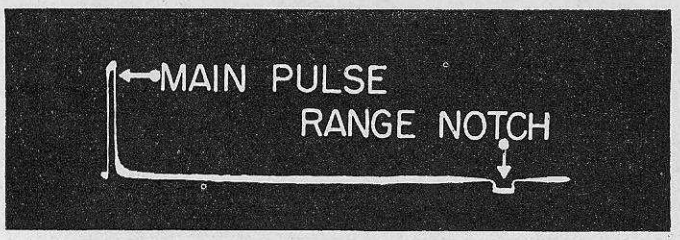
b. The elevation operator sets the antenna for an angular height of 50 mils.

c. The azimuth operator moves the AZIMUTH HANDWHEEL to a point where the antenna revolves slowly.

d. The SEARCH and TRACK oscilloscopes should present pictures basically like those shown in figure 50, but in every location the number of fixed echoes and the "grassy" effect on the scope screens vary. These pictures also vary as the



① SEARCH oscilloscope.



② TRACK oscilloscope.

FIGURE 50.—Range notch with no echoes on SEARCH and TRACK oscilloscopes. Note that main pulse is narrower and notch appears closer in ① due to fact that search covers longer range.

antenna revolves showing the effect of varying conditions in different directions.

e. When an echo appears on the scopes, the azimuth operator stops the rotation of the antenna by means of the AZIMUTH HANDWHEEL. The range operator immediately attempts to slew the notch to the echo. If the echo is farther out than the travel of the notch it does not appear on the TRACK scopes and it cannot be tracked automatically until

it reaches the notch (fig. 51). It may be tracked in azimuth however, and so the azimuth operator applies IMAGE SPACING to his scope to split the echo as shown in figure 52. He then matches echo heights as shown in figure 52 to keep the antenna on the target in azimuth. The elevation operator applies IMAGE SPACING also and attempts to match echo heights. In most cases, at long ranges, ground reflections will interfere with elevation tracking until the angular height of the target is more than 200 mils.

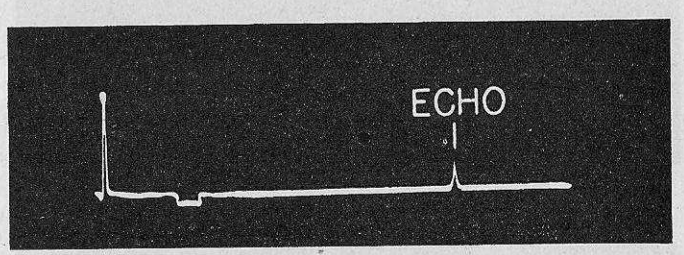
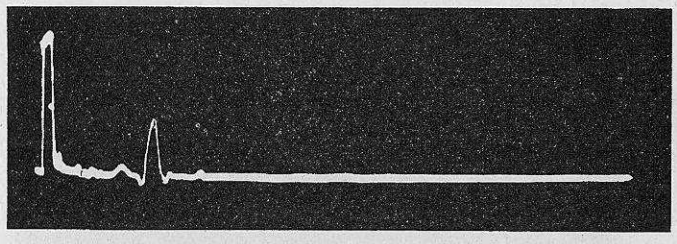


FIGURE 51.—Echo on SEARCH oscilloscopes beyond travel of notch. Target may be tracked manually until reaching notch and from that point in, either manually or automatically.

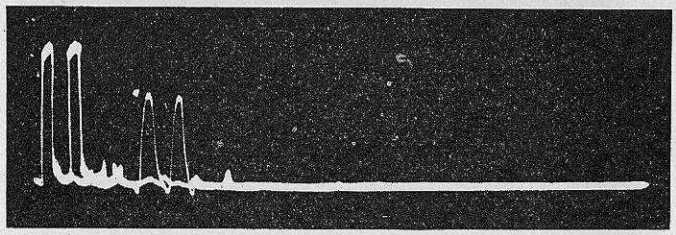
NOTE.—Advance warning of the approach of aircraft may be given in some cases by the AWS. In such cases it may be desirable to have the altitude of the target being tracked as well as its range. If the range converter (fig. 46) is being used (as in all cases except where voltage data are being fed to an M9 or M10 director) the altitude is immediately available at that point. For other cases it may be desirable to use some type of conversion chart in the cab by which slant range and angular height can be quickly converted to altitude. Two examples of simple conversion devices are shown in appendix IV.

f. As soon as the echo gets in the notch the range operator switches to AUTOMATIC. The azimuth operator may also switch to AUTOMATIC immediately since he has already been keeping the echo heights matched. The elevation operator may still find it impossible to match echo heights, but as soon as possible he does so, and switches the ELEVATION CONTROL to AUTOMATIC. At this time the range operator should operate the DATA FLOW SWITCH to the "on" position. If the echo is strong on the TRACK scopes, the AUTO FADE lamp on the RANGE CONTROL should now be dark, signifying that the SCR–545–A is tracking the target from

TRACK system signals. If the signal should fade and the AUTO FADE lamp lights it is necessary for the elevation operator to track manually until the light goes out again. Figure 52 shows a target properly positioned in the notch of the TRACK system, with the azimuth and elevation scope pictures matched in echo heights.



① Echo in notch on range oscilloscope of TRACK system.



② Echo heights properly matched on azimuth or elevation oscilloscopes of TRACK system.

FIGURE 52.—Close-in echo on TRACK system oscilloscopes.

g. With an echo such as that shown in Figure 52, the SCR–545–A should continue tracking through a normal course automatically without trouble. If the target is very high-speed, however, and so close as to cause very high rates of angular travel in the antenna system, it is necessary for the operators to watch carefully and take over manually if the target is lost on the AUTOMATIC system.

CHAPTER 4

DRILL

SECTION I

ORGANIZATION OF SECTION

■ 49. ORGANIZATION OF SECTION.—The section is organized as follows:

CRO—Chief radar operator.
No. 1—Range operator.
No. 2—Azimuth operator.
No. 3—Elevation operator.
No. 4—Power plant operator.
No. 5—Prime mover driver—relief power plant operator.
No. 6—Relief operator.
No. 7—Relief operator.
No. 8—Radar repairman.

The chief radar operator is in charge of the section and designates the duties of the relief operators during operation.

SECTION II

DRILL

■ 50. COMMANDS EMPLOYED.—*a.* The following sequence of commands is employed to place the SCR–545–A in operation at a new location:

FALL IN.
COUNT OFF.
CALL OFF (used only when considered necessary by CRO).
EMPLACE.
ORIENT AND SYNCHRONIZE.
PREPARE FOR ACTION.
ACTION.

b. At the completion of tracking the command is:

CEASE OPERATION.
CLOSE STATION.
MARCH ORDER.

c. From a condition of CLOSE STATION the command sequence to go into action is:

FALL IN.
COUNT OFF.
PREPARE FOR ACTION.
ACTION.

d. From a condition of CEASE OPERATION the command employed to go into action is:

ACTION.

■ 51. SPECIAL DRILL EXCEPTIONS.—*a.* The command ORIENT AND SYNCHRONIZE does not include coverage of range orientation. This cannot be checked accurately until after the unit has been in operation for at least 30 minutes and a complete check involves use of a fixed echo of known range. The special conditions and procedures are fully covered in TM 11–1127.

b. No sequence of duties can be outlined for the command ACTION because of the nature of the equipment. A general outline of duties performed by each man will be found in paragraph 48.

■ 52. FALL IN.—Command is given by CRO. The section takes the positions indicated in figure 53.

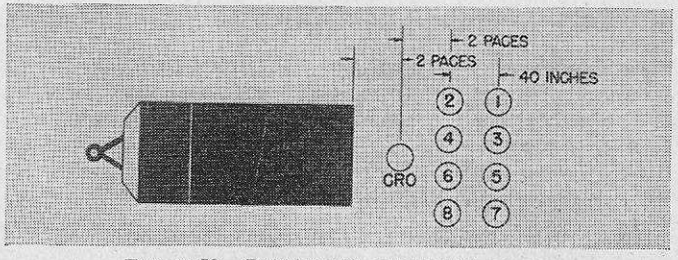


FIGURE 53.—Positions at command FALL IN.

■ 53. COUNT OFF.—Command is given by CRO. Each man in the section calls his number in turn.

■ 54. CALL OFF.—Command is given by CRO. Each man in the section calls out his duty in turn:

Range operator.
Azimuth operator.
Elevation operator.
Power plant operator.
Driver.
Relief operator.
Relief operator.
Radar repairman.

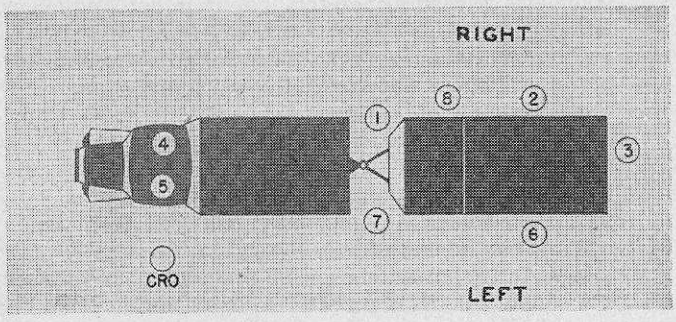


FIGURE 54.—Initial stations at command EMPLACE.

■ 55. EMPLACE.—Command is given by CRO. The men move from the positions assumed at the command FALL IN to positions shown in figure 54 and work as follows:

1 goes to pintle, uncouples brake cables, safety chains, unlocks pintle and raises drawbar assisted by 7.
2 sets hand brake, unlocks right side of air intake filter box (fig. 6), and loosens right side antenna cover ties.
3 loosens rear antenna cover ties and starts unlocking left rear outrigger.
4 takes seat on right in prime mover cab.
5 takes driver's seat in prime mover cab. Drives prime mover to parking place designated by CRO as soon as uncoupling is completed.
6 loosens left side antenna cover ties, unlocks left side of air intake filter box, and takes two braces to left rear

7 goes to pintle (left side) and starts uncoupling, assisting 1.
8 swings out and locks ladder in place beside right door, unlocks right door and starts releasing operators' chairs from traveling position.
1, 2, and 7 go to roof to remove antenna cover.
3 swings left rear outrigger down to operating position (fig. 5), then goes to tool box in trailer cab to obtain wrenches for outrigger braces.
6 removes footplate from rack on rear of trailer and places it under left rear jack spindle—starts placing outrigger braces.
8 completes releasing operators' chairs in cab and opens left door.
4, upon arriving at parking place, alights from prime mover and opens side doors of power plant.
5, upon arriving at parking place, alights from prime mover and opens rear doors of power plant.
3, 6 screw jack hand-tight onto left rear footplate and tighten locking nuts on left rear outrigger braces.
1, 2, 7 stow folded antenna cover between front cover rail and cab on trailer roof.
1 loosens left front antenna wing brace (fig. 38) to place left side of SEARCH reflector in operating position.
2 removes spotter's seat from traveling position.
3 starts unlocking right rear outrigger from traveling position.
6 goes to right side of trailer and brings back two outrigger braces to right rear jack.
7 goes to rear of trailer roof and loosens rear antenna wing brace (fig. 38) to place left side of SEARCH reflector in operating position.
1 and 7 lower left antenna wing to operating position and lock.
8 opens middle and rear compartment doors on left side of trailer and starts installing removable section of transmission line at TRACK transmitter.
4 checks oil, gasoline, water, and starting battery at power plant.
5 removes hatch cover and places muffler in position on exhaust manifold of engine.

1 loosens antenna locking screw (fig. 38) at left front of antenna.
7 loosens antenna locking screw at left rear of antenna.
2 places spotter's seat in operating position at side of antenna pedestal.
3 swings right rear outrigger down to operating position.
6 removes footplate from rack on rear of trailer and places it under the right rear jack spindle; starts placing outrigger braces.
3, 6 screw jack hand-tight onto right rear footplate and tighten lock nuts on braces.
1 loosens right front antenna wing brace (fig. 38) to place right side of SEARCH reflector in operating position.
7 loosens right rear antenna wing brace to place right side of SEARCH reflector in operating position.
1, 7 lower right antenna wing to operating position and lock.
1, 7 loosen front and rear antenna locking screws (fig. 38) on right side of antenna.
2 loosens chain holding left side of rear cover rail upright.
7 loosens chain holding right side of rear cover rail upright.
2, 7 swing rear cover rail down to operating position.
2, and 7 alternate on the antenna crank (fig. 28) to raise antenna to vertical position.
1 stands by waiting for antenna to lift sufficiently to allow access to dipole box (fig. 41).
3 starts unlocking right front outrigger from traveling position.
4, 5 drive ground stake and connect ground near right rear wheel of prime mover.
6 obtains remaining two outrigger braces from rack under right side of trailer and takes them to right front of trailer.
3 swings right front outrigger down to operating position.
6 removes footplate from rack on front of trailer and places it under the right front jack spindle; starts placing outrigger places.

3, 6 screw jack hand-tight onto right front footplate and tighten lock units on braces.
2 goes to front of antenna to assist 1.
1 opens dipole box (fig. 41) obtains four longer dipole ends and starts to install them (fig. 39) at right side of antenna (facing antenna).
2 obtains four shorter dipole ends from dipole box (fig. 41) and starts to install them at left side of antenna (facing antenna).
8 goes to SEARCH transmitter on right side of trailer and starts installing removable section of transmission line (fig. 43).
3 starts unlocking left front outrigger from traveling position.
6 goes to left side of trailer and brings back two outrigger braces to left front of trailer.
3 swings left front outrigger down to operating position.
6 removes footplate from rack on front of trailer and places it under the left front jack spindle; starts placing outrigger braces.
3, 6 screw jack hand-tight onto left front footplate and tighten lock nuts on braces.
4, 5 unreel power cable between power plant and trailer and start connecting cable.
2 pulls out tuning plug (fig. 27) on TRACK antenna to marked setting.
7 completes cranking antenna to upright position.
7 unlatches holding chain at bottom of SEARCH reflector.
1 swings antenna up to about a 1,000-mil position.
1, 2, 7 tighten pedestal bolts (fig. 28).
8, goes to roof, removes section of transmission line from dipole box and starts to install it at right side (facing front of trailer) of antenna pedestal (fig. 40). Connecting sleeves are stowed in fixed ends of transmission line.
3 takes fine level vials from case in trailer cab and installs them in position shown in figure 42, placing the third level in level seat on antenna yoke—unhooks AZIMUTH TURNBUCKLE LOCKS.

CRO gets up on step at rear of trailer to view level bubbles (fig. 47).
3, 4, 5, 6 obtain one jack handle each from rack under shelf in trailer cab and take stations, 4 at right front, 6 at right rear, 3 at left front, and 5 at left rear jacks. Working in unison, these men raise the trailer wheels clear of the ground. Then under direction of the CRO they level it, always operating the jacks in pairs, two front, two right, two rear, or two left as required. At the completion of leveling they stow the jack handles back in the carrying rack.
8 plugs in data cables laid by personnel from range section.
3, 6 drive ground stake and connect cable at left rear of trailer.

■ 56. ORIENT AND SYNCHRONIZE.—Command is given by the CRO.

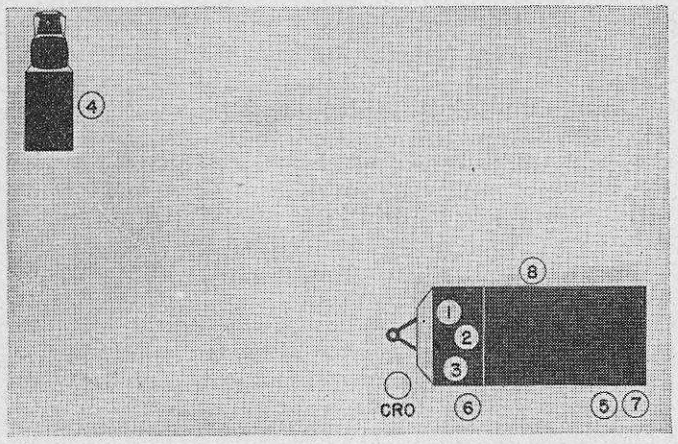


FIGURE 55.—Initial positions at command ORIENT AND SYNCHRONIZE.

5, 7 lay and connect 300-foot telephone and signal cable from SCR–545–A to director.

CRO confers with CS (chief of range section) to determine reference point. He then indicates reference point to 6, "Reference point (indicating with hand) azimuth ------ mils."

4 goes to prime mover, makes necessary checks, starts power plant, and operates the GENERATOR SUPPLY BREAKER (fig. 37) to ON.

1 operates the necessary switches on the MAIN POWER PANEL (fig. 44) to place the SCR–545–A in full operation except for closing the HIGH VOLTAGE-START relay.

CRO checks level of trailer.

1, 2, 3, and 6 level trailer as directed, if necessary.

6 obtains an EE–8A telephone set from rack under operator's control unit shelf and goes to SPOTTER'S SEAT (fig. 10) on antenna pedestal.

2 obtains an EE–8A telephone from rack and connects it to the telephone terminals on the MAIN POWER PANEL.

5 obtains an EE–8A telephone from rack and connects it outside the trailer at the POWER JUNCTION BOX (fig. 29) for use of the CRO.

6 connects telephone on side of pedestal and takes SPOTTER'S SEAT.

1, 2, 3 take their operating positions, and directed by means of telephone from 6, point the antenna of the SCR–545–A so that the reference point is centered in the cross hairs of the telescopic sight.

7 removes rear hatch cover and loosens coarse and fine azimuth transmitters (fig. 47).

CRO in telephone conversation with CS, directs 7 to turn coarse and fine azimuth transmitters as necessary to cause azimuth of reference point to be read at director M7 (at tracker of M9 and M10 directors).

7 tightens clamping rings on coarse and fine azimuth transmitters.

2 at direction of CRO ("Set azimuth dials to ——— mils."), removes azimuth dial cover on AZIMUTH CONTROL and sets dials to indicate azimuth of reference point. He also sets the lower dial on the AZIMUTH TARGET DESIGNATION UNIT to indicate the same azimuth.

7 in the case of an M9 or M10 director, waits until CS indicates ready over phone, and then operates the AZIMUTH POTENTIOMETER CRANK until CS indicates the proper azimuth reading has been reached at the computer of the director.

6, maintaining telephone communication with operators, removes cover over angular height dials on the pedestal trunnion (fig. 45). He directs the elevation operator to depress or elevate to an angular height specified by CRO ("Set angular height of ——— mils"). CS then reports reading of dials at director M7 (tracker of M9 or M10 director). If any error between the two readings exists, 6 removes cover over angular height transmitter (fig. 48) and loosens clamping ring on coarse and fine transmitters. He then rotates transmitters until CS reports correct reading at director.

3 at direction of CRO ("Set elevation dials to ——— mils"), removes elevation dial cover on ELEVATION CONTROL and sets dials to read proper angular height. He also sets the lower dial on the ELEVATION TARGET DESIGNATION UNIT to indicate the same angular height.

CRO, in the case of an M9 or M10 director, checks with CS to determine whether correct angular height is indicated at computer. If an error exists it must be corrected by procedures outlined in TM 11–1127.

CRO determines azimuth and angular height of telescopes of director (tracker of M9 or M10 director) from CS and directs 2 and 3 to set this azimuth and angular height on upper dial of AZIMUTH AND ELEVATION TARGET DESIGNATION units.

8 checks and calibrates RANGE CONVERTER as outlined in paragraph 41.

CRO notes reading of ALTITUDE DIAL (fig. 46) and directs 8 to turn ALTITUDE SYNCHRONOUS TRANSMITTER ADJUSTMENT until CS reports same reading on dial (none in case of M9 or M10 director) of director M7.

CRO directs 1 to change range, notes new reading of ALTITUDE DIAL and checks new reading with CS.

■ 57. ACTION.—Command is given by CRO. (See paragraph 50 for sequence of commands.)

1 closes necessary switches to place equipment in full operation (par. 39), then takes range operator's seat in cab.
2 takes azimuth operator's seat in cab.
3 takes elevation operator's seat in cab.
CRO designates duties of other men and directs operators as to the nature of the action. A general outline of procedures may be found in paragraph 48.

■ 58. CEASE OPERATION.—Command is given by CRO.

1 sets range dial to read approximately 20,000 yards; zeros aid rate on RANGE CONTROL UNIT; sets aid switch at AID OFF; operates HIGH-VOLTAGE-STOP button.
2 sets azimuth of antenna to standby direction (range officer will designate midazimuth of primary zone); zeros aid rate on AZIMUTH CONTROL UNIT; sets aid switch at AID OFF.
3 sets angular height of antenna at 50 mils; zeros aid rate on ELEVATION CONTROL UNIT; sets aid switch at AID OFF.
4 leaves power plant running.

CRO designates duties of other men.

■ 59. CLOSE STATION.—Command is given by CRO. (This command must be preceded by CEASE OPERATION.)

1 turns off all branch circuit breakers with exception of the H. P. BLOWER.
2 goes to trailer roof and hooks AZIMUTH TURNBUCKLE LOCKS (fig. 28).
3 closes all outside cabinet doors.
1 turns off H. P. BLOWER circuit breaker and MAIN CIRCUIT BREAKER. Turns on heater switches if directed by CRO.
2 and 3 lock air intake filter box on left and right side of trailer.

4 shuts down power plant if directed by CRO.
CRO designates duties of other men.

■ 60. PREPARE FOR ACTION.—Command is given by CRO. (This command is from condition of CLOSE STATION.)

4 makes necessary checks and starts power plant. He then closes main circuit breaker.
2 goes to roof of trailer and unhooks AZIMUTH TURNBUCKLE LOCKS (fig. 28).
CRO checks level of trailer. He reports, "Clear" to 1 when he is clear of antenna swing.
1 closes necessary switches (par. 39) to place unit in complete operation. He takes range operator's seat and tests operation of controls while awaiting elapse of time delay and warm-up period.
2 takes azimuth operator's seat and tests controls during elapse of time delay and warm-up period.
3 takes elevation operator's seat and test controls during elapse of time delay and warm-up period.
CRO designates duties of other men.

■ 61. MARCH ORDER.—Command is given by CRO. (Command follows CLOSE STATION condition.)

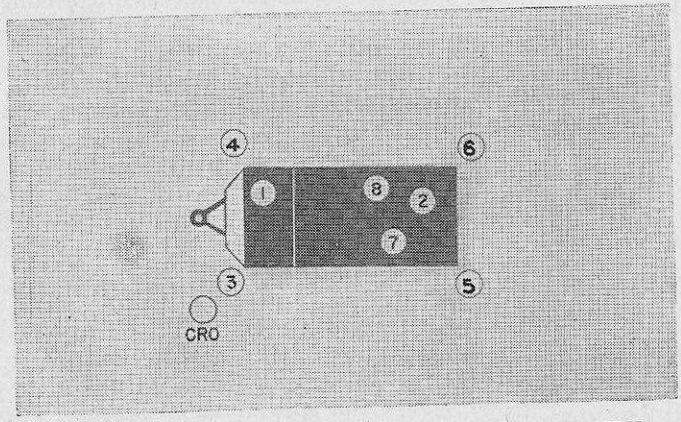


FIGURE 56.—Initial positions for the command MARCH ORDER.

1 shuts off all switches in trailer cab.
3, 4, 5, 6, obtain one jack handle each from rack under shelf in trailer cab and take stations indicated in figure 56. Working in unison, they lower trailer until all weight is off each jack.
1, 2, 7 go to trailer roof, check to see that AZIMUTH TURNBUCKLE LOCKS (fig. 28) are in place; start removing pedestal bolts (fig. 28).
4 goes to prime mover and shuts down power plant.
8 disconnects cables at rear of trailer; goes to trailer roof and starts removing section of transmission line (fig. 40). *Caution: Wait till power plant is off.*
3 removes fine level vials and stows them in case in trailer cab.
5 disconnects power cable and telephone cable at power junction box (fig. 29) at front of trailer. *Caution: Wait till power plant is off.*
3, 6 start unlocking outrigger braces at left front jack.
4 disconnects power cable at power plant.
4, 5 start reeling power cable.
6 takes two outrigger braces and places them in rack under left side of trailer.
3 swings left front outrigger up and locks it in traveling position.
6 places left front footplate in rack at front of trailer.
3, 6 start unlocking outrigger braces at right front jack.
6 takes two outrigger braces and places them in rack under right side of trailer.

3 swings right front outrigger up and locks it in traveling position.
6 places right front footplate in rack at front of trailer.
3, 6 start disconnecting and reeling 300-foot telephone and signal cable.
1 depresses antenna to allow 7 to latch holding chain in depressed position;
8 places removable section of transmission line in dipole box—connecting sleeves are stowed in the fixed ends of the transmission lines—replaces caps on ends of transmission line.
2 pushes TUNING PLUG (fig. 27) all the way in and tightens locking screw.
7 and 2 alternate cranking antenna down.
8 starts uncoupling transmission line at SEARCH transmitter (fig. 43).
4, 5 remove ground stake at power plant and stow it in rack.
2 starts removing four shorter dipole ends from left side of SEARCH antenna (facing antenna). He starts with the lowest dipole and works up.
1 starts removing four longer dipole ends from right side of SEARCH antenna (facing antenna). He works up from bottom.
2 places four short dipole ends in dipole box (fig. 41) and goes to rear of trailer to relieve 7 at antenna crank.
1 places four longer dipole ends in dipole box and stands by to secure antenna when it is down.
3, 6 remove ground stake and cable at rear of trailer.
6 stows ground stake in trailer cab.
2 completes cranking antenna down.
3, 6 start unlocking outrigger braces at right rear jack.
1 secures left front antenna locking screw (fig. 38).
7 secures left rear antenna locking screw.
2 secures right rear antenna locking screw.
1 secures right front antenna locking screw.
1 unfastens right front antenna wing brace (fig. 38).
2 unfastens right rear antenna wing brace and with 1, fastens antenna wing in traveling position.
2 and 7 swings rear cover rail up and fasten chains.
7 unfastens left rear antenna wing brace.

1 unfastens left front antenna wing brace and with 7 fastens antenna wing in traveling position.
3 swings right rear outrigger up and locks it in traveling position.
6 takes two outrigger braces to rack under right side of trailer and locks this rack after placing braces. He then replaces footplate in carrying rack at rear of trailer.
3, 6 start unlocking left rear outrigger braces.
1, 2, 7 start unfolding antenna cover.
4 replaces fire extinguisher in traveling rack at power plant.
5 starts removing muffler from power plant engine.
6 takes two outrigger braces to rack under left side of trailer and locks rack after placing braces.
3 swings left rear outrigger up and locks it in traveling position.
6 replaces footplate in carrying rack at rear of trailer.
8 goes to TRACK transmitter to uncouple transmission line (fig. 30).
3, 6 close all side doors of trailer except where 8 is working and pick up and pack all miscellaneous tools and small parts. They screw the operator's chairs in the cab to their traveling position.
5 replaces cover over muffler opening in power plant roof.
3 goes to right side of air intake filter box.
6 goes to left side of air intake filter box and, working with 3, closes and locks the box for traveling.
4, 5 close and lock power plant doors, get into prime mover and drive to trailer.
1, 2, 7 complete placing antenna cover.
1, 7 go to drawbar, 1 on right, 7 on left.
2 starts tying right side of antenna cover.
6 starts tying left side of antenna cover.
3 starts tying rear of antenna cover.
8 completes uncoupling at TRACK transmitter.
5 backs prime mover up to drawbar.
1, 7 couple drawbar, brake and light cables, and safety chains.
2 releases handbrake.
8 locks cab and swings ladder into traveling position.

APPENDIX I

DESTRUCTION AND DECONTAMINATION OF MATÉRIEL

■ 1. GENERAL PRINCIPLES.—*a*. Tactical situations may arise when, owing to limitations of time or transportation, it becomes impossible to evacuate all equipment. In such situations it is imperative that all matériel which cannot be evacuated, be destroyed to prevent—

(1) Its capture intact by the enemy, thereby disclosing information which may be unknown to the enemy.

(2) Its use by the enemy, if captured, against our own or allied troops.

b. The working principles to be followed are:

(1) Methods for destruction of matériel subject to capture or abandonment in the combat zone must be *adequate, uniform,* and *easily followed* in the field.

(2) Destruction must be as complete as the available time, equipment, and personnel permit. Since complete destruction takes some time, a priority must be set up so that the more important classified features are destroyed first. Then if the operation is interrupted before its completion, the requirements of *a*(1) above are met. Next in priority of destruction are essential parts. While these parts are not necessarily secret, they are difficult to procure, and the lack of them will prevent the equipment from being operated. *All essential parts must be destroyed on all like units to prevent the enemy from constructing one complete unit from several damaged ones by "cannibalization."* Next in priority is the complete destruction of the equipment including such features as chassis, structural members, wiring.

(3) Spare parts and accessories must be given the same priorities as the parts installed on the equipment.

c. The destruction of matériel, subject to capture or abandonment in the combat zone, *will be undertaken only upon authority delegated by division or higher commander.*

d. To accomplish the adequate, uniform destruction of matériel, it is necessary that—

(1) All units know thoroughly the plans for destruction *including the priority of destruction.*

(2) All echelons be trained in the several procedures for destruction. *Training will not involve actual destruction of matériel.*

■ 2. METHODS.—*a.* The destruction procedures outlined below are arranged in the order of effectiveness. No. 1 method should be used whenever *time permits and the necessary equipment is available.* If method No. 1 cannot be used, switch to No. 2 or 3 in order named.

b. No matter which method is used, it is imperative that the order indicated be followed. This will result in uniformity of destruction regardless of whether the destruction is carried to completion or not.

c. Certain of the methods require special equipment which may not be items of issue normally, such as explosives and incendiary grenades. The issue of these items, the equipment for which issued, and the conditions under which destruction is effected *are command decisions in each case,* according to the tactical situation.

■ 3. DESTRUCTION OF MAGNETRON.—The dimensions of the magnetron are extremely important to the enemy, so its destruction must be absolutely complete. The destruction of the magnetron is performed under the supervision of a commissioned officer. Special care must be taken that this item is thoroughly destroyed. *Magnetrons carried in the spare parts truck must also be destroyed.* Proceed as follows after removing it from transmitter:

a. Method No. 1.—Burn the magnetron with an incendiary grenade. While still hot, smash it with a sledge until it has no recognizable features and the construction and internal dimensions can no longer be discerned. Hide the remains by throwing in deep water, or bury in a hole which in turn must be concealed.

b. Method No. 2.—In case no incendiary grenades are available *or time does not permit*—

(1) Break the glass seals of the filament leads and the output terminals.

(2) Smash the tube with a sledge so that the construction and internal dimensions cannot be discerned. Smash the cathode structure separately, if possible.

(3) Hide the remains in deep water or bury in a hole which in turn must be concealed.

■ 4. DESTRUCTION OF PRINTED MATTER.—All manuals, charts, or any written matter pertaining to the equipment is destroyed by burning. Pages are torn out of books before setting on fire.

■ 5. DESTRUCTION OF TRAILER CONTENTS.—*a. Method No. 1.*—(1) Remove and destroy the magnetron as directed in paragraph 3.

(2) Smash the plexiglass cover of the scanner with a sledge.

(3) Place TNT charges as follows:

(*a*) One-pound charges are placed in each separate component of the radio and control equipment.

(*b*) A 2-pound charge is placed in the antenna pedestal through the handhole cover.

(*c*) A 1-pound charge is fastened against the center of the rear of the antenna.

(*d*) Two-pound charges are placed over the axle inside each wheel.

(4) Insert an electric cap and join all TNT charges with primacord (see FM 5–25).

(5) Remove and discharge portable fire extinguisher.

(6) Douse the interior of the cab with gasoline, oil, or distillate.

(7) Explode the charges simultaneously from cover.

(8) Destroy the tires in accordance with procedure in paragraph 7.

b. Method No. 2.—(1) Remove and destroy the magnetron as directed in paragraph 3.

(2) Remove covers from all radio and control components. If mounted in sliding drawers, pull out, cut wires, and allow drawers to fall to ground or floor. Smash thoroughly all components using a sledge, jack handle, outrigger braces, or any heavy club available.

(3) Smash the plexiglass cover of the scanner with a sledge.

(4) Smash the transmission line feeding the scanner.

(5) Smash the two-phase generator and scanner drive motor at rear of antenna with a sledge.

(6) Ignite an incendiary grenade in each of the components previously smashed, including the mechanisms in rear antenna.

(7) Remove and discharge the portable fire extinguisher just before setting off the incendiary grenades.

(8) Destroy the tires in accordance with procedure in paragraph 7.

c. Method No. 3.—

(1) Carry out steps in method No. 2 through *b*(5) above.

(2) Throw all smashed components into cab of trailer. Remove and discharge the portable fire extinguisher.

(3) Douse the interior of the cab with gasoline, oil, or distillate and ignite with a piece of burning waste or other material.

(4) Destroy the tires in accordance with procedure in paragraph 7.

NOTES.—1. If there is any doubt that method 1 cannot be completed in time, it should not be attempted. Method No. 1 will give the complete results desired *only* if carried to completion.

2. The portable fire extinguisher is included only because it is possible fire fighting equipment which the enemy might use in attempts to salvage the equipment. Otherwise it has no greater importance than any other standard accessory in the trailer.

■ 6. DESTRUCTION OF PRIME MOVER.—*a. Method No. 1.*—(1) Place TNT charges as follows:

(*a*) Two-pound charge on top of clutch housing.

(*b*) Two-pound charge on left of prime mover engine as low as possible.

(*c*) Two-pound charge on each side of generator driving engine.

(*d*) Two-pound charge inside generator frame.

(2) Insert electric caps and join charges with primacord.

(3) Puncture gas tanks.

(4) Remove and discharge portable fire extinguisher.

(5) Pour gasoline, oil, or distillate over the prime mover.

(6) Explode the charges simultaneously from cover.

(7) Destroy the tires in accordance with procedure in paragraph 7.

b. Method No. 2.—(1) With a sledge or other heavy club smash the vital elements on prime mover and generator engine (such as distributor, carburetor, radiator, engine block, crank case, transmission).

(2) Puncture the gas tanks.

(3) Smash the generator with a sledge.

NOTE.—Generator can be burned out by shorting the terminals while it is operating.

(4) Pour gasoline, oil, distillate over the vehicle (remove fire extinguisher and discharge) and set fire to the prime mover.

(5) Destroy the tires in accordance with procedure in paragraph 7.

■ 7. DESTRUCTION OF TIRES.—*a. General.*—(1) Rubber is such a critical item that attempts to destroy the tires should be made *even though it is not possible to completely destroy the remainder of the vehicle.*

(2) Tires can usually be destroyed at the same time that the remainder of the vehicle is destroyed by careful planning and training.

b. Method No. 1.—(1) Ignite an incendiary grenade under each tire.

(2) When explosives are used for the destruction of the vehicle and contents, allow the tires to become well ignited before exploding the charges.

c. Method No. 2.—Damage the tires with an ax, pick, or machine-gun fire (deflate first if possible). Pour gasoline over each tire and ignite.

d. Provided that the fire is permitted to get a good start, the tires will probably set the entire vehicle on fire.

■ 8. DESTRUCTION OF OTHER VEHICLES.—If a converter or a spare parts truck is included with the equipment, they also must be destroyed.

a. Spare parts truck.—(1) Spare parts destroyed as in paragraphs 3 and 4.

(2) Vehicle destroyed as in paragraphs 6 and 7.

b. Converter van.—(1) Motor-generator destroyed as in paragraph 6*a*(1)(*d*) or 6*b*(3).

(2) Vehicle destroyed as in paragraphs 6 and 7.

c. Although the spare parts truck is considered last, the contents of the truck should receive the same priorities given the parts when installed in the radio set.

■ 9. DECONTAMINATION.—See FM 21–40 and TM 3–series.

APPENDIX II

ELECTRICAL DANGERS AND FIRST-AID TREATMENT

■ 1. ELECTRIC SHOCKS.—*a.* Most persons who have worked with electrical apparatus have experienced an electric shock. Some of these shocks may have been severe enough to cause pain, and occasionally they may have resulted in powerful muscular spasms sufficient to throw the victim off his balance. Persons often invite electric shock by feeling for the presence of electric current at various points of circuits under inspection. THIS IS UNSAFE AND SHOULD NOT BE DONE.

b. Electric shocks are never wholly without danger. Relatively small electric currents are likely to cause death if they pass through certain vital organs of the body. Alternating currents, at the usual commercial frequencies, are somewhat more dangerous than direct currents. Thus a 60-cycle alternating current, at about $\frac{1}{10}$ ampere, in passing from head to foot, or from arm to leg, or between the two arms in such a manner as to include the lungs and heart in the circuit, will cause death in 1 or 2 seconds. Smaller currents may render a victim unable to release himself, since electric current always causes muscular contractions which at times forces victims to hang on to live circuits tighter than normally. A person caught on an electric circuit in this manner may find himself unable to get away except by going through strange contortions and using much strenuous effort. Such persons are fully aware of the almost hopeless situation in which they find themselves under such condition.

■ 2. DANGEROUS VOLTAGES.—The amount of current which a person may receive from an electric circuit depends upon the voltage of the circuit and how good a contact there is between himself and the circuit. Normally dry skin is a reasonably good insulator, offering a hand-to-hand resistance of 100,000 ohms or more. The opposite is true of wet skin, however, whether wet from applied moisture or from excessive perspiration. Persons in hot, damp locations have

often been killed from the current resulting from 120-volt, 60-cycle circuits, since their body resistance under these conditions is not more than a few thousand ohms at the most. On the other hand, it is well to know that if very dry hands are touched to such a circuit, the fact that the circuit is "alive" often can hardly be determined.

■ 3. PRECAUTIONS.—*a.* The presence of high voltage in electric equipment using vacuum tubes creates a somewhat more serious hazard than it does in many other kinds of electric apparatus. Most amplifying equipment is quite compact and "live" wiring and terminals are common. These danger spots DO NOT LOOK DANGEROUS TO THE EYE, BUT MUCH OF THE EQUIPMENT IN THE SCR–545 OPERATES AT VOLTAGES SUFFICIENTLY HIGH TO BE DANGEROUS. Consequently, persons working around equipment of this sort must have the highest respect for the danger involved. The voltages, however, are not sufficiently high to "jump" at you through any appreciable air gap.

b. Protective switches have been provided in the SCR–545, which open and ground some of the electrical circuits when high voltage wiring is exposed. These safety devices, as well as high voltage components themselves, are conceivably subject to failure, either because of intentional tampering or because of mechanical break-down. The correct way to work on this apparatus is to ALWAYS DEENERGIZE AND GROUND THE HIGH VOLTAGE CIRCUITS BEFORE BEGINNING WORK AND BE SURE THAT CONDENSERS ARE THOROUGHLY DISCHARGED. Occasionally this is not practicable because of the necessity of testing under operating conditions. When it is necessary to work on live equipment, every precaution should be taken to follow well-established safety practices and to use the greatest amount of care. BOTH SIDES OF A LIVE CIRCUIT SHOULD NEVER BE TOUCHED, AND IF FOR A GOOD REASON ONE SIDE IS TO BE TOUCHED, THE INDIVIDUAL SHOULD MAKE ABSOLUTELY SURE THAT HE IS WELL INSULATED FROM THE GROUND. Failure of these safety mechanisms or precautions, for any cause whatsoever, may result in electric shock to the personnel.

■ 4. RESCUE.—In all cases of electric shock, shut off the high voltage at once and ground the circuits. If for any reason the high voltage cannot be shut off, the victim must be freed of contact with the live conductor as promptly as possible. The rescuer himself must exert great care to prevent direct contact with either the live conductor or the victim's body by using a dry stick, dry board, dry clothing, or other nonconductor.

■ 5. SYMPTOMS.—*a.* In electric shock, the current may pass through the breathing center at the base of the brain and cause this center to stop sending out the nervous impulses which act upon the muscles responsible for breathing. In consequence, breathing stops abruptly. If the shock has not been too severe, the breathing center recovers after a time and resumes the vitally necessary duty of sending impulses to the muscles of breathing, provided that a sufficient supply of air has been furnished the body meanwhile by artificial respiration. Cases are recorded where 8 hours work was necessary before the breathing center recovered and the patient began to breathe of his own accord. Therefore, the ordinary and general tests for death should never be accepted.

b. The patient is usually blue, although occasionally he may be very white. The pulse is weak or entirely absent. Unconsciousness is complete. Burns may be present. Occasionally the body becomes rigid or stiff in a very few minutes. This is due to the action of the electricity and is not to be considered "rigor mortis." This stiffness is not a sign to stop artificial respiration, as a few of such cases are reported to have been revived.

■ 6. TREATMENT FOR ELECTRIC SHOCK.—*a.* Lay the patient face downward, one arm extended directly overhead, the other arm bent at the elbow and with the face turned outward and resting on hand or forearm so that the nose and mouth are free for breathing. (See fig. 57.)

b. Kneel straddling the patient's thighs, with your knees placed at such a distance from the hip bones as will allow you to assume the position shown in figure 57. In many cases (due to the size of the patient) it may be more convenient to straddle only one leg. Place the palms of the

hands on the small of the back with fingers resting on the ribs, the little finger just touching the lowest rib, with the thumb and fingers just out of sight. (See fig. 57.)

c. With arms held straight, swing forward slowly, so that the weight of your body is gradually brought to bear upon the patient. The shoulders should be directly over the heel of the hand at the end of the forward swing. (See fig. 58.) Do not bend your elbows.

Do not apply more than 60 pounds of pressure. This operation should take about 2 seconds.

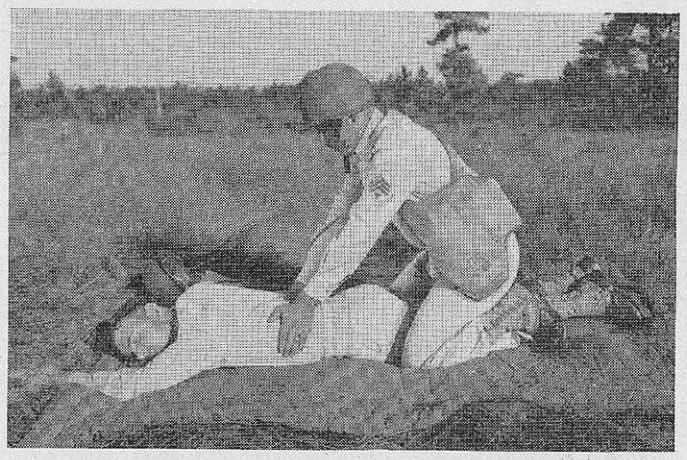


FIGURE 57.—First position of artificial respiration.

d. Now immediately swing backward so as to remove the pressure completely and suddenly. (See fig. 59).

e. After 2 seconds, swing forward again. Repeat this double movement of compression and release. A complete respiration should take 4 or 5 seconds and should be repeated twelve to fifteen times a minute.

f. Continue artificial respiration without interruption until natural breathing is restored; 4 hours or longer if necessary, or until proper medical personnel declares the patient dead.

g. As soon as artificial respiration has been started and while it is being continued, an assistant should loosen any

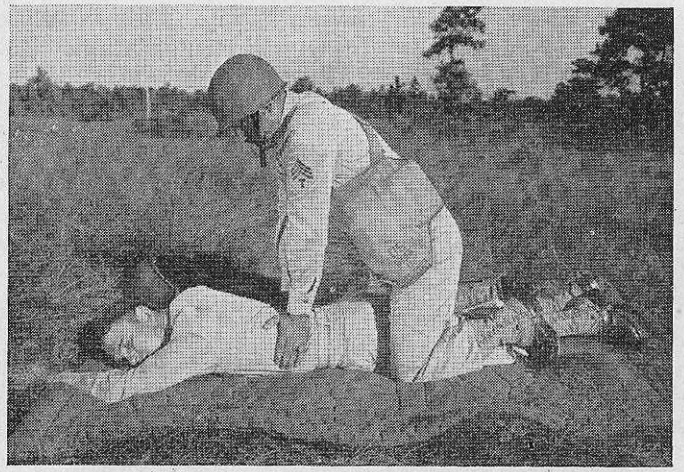


FIGURE 58.—Second position of artificial respiration.



FIGURE 59.—Third position of artificial respiration.

tight clothing about the patient's neck, chest, or waist. KEEP THE PATIENT WARM. If at all possible, the artificial respiration should be performed while the patient is wrapped in a blanket. Do not give any liquids whatever by mouth until the patient is fully conscious.

h. To avoid strain on the heart when the patient revives, he should be kept lying down and not allowed to stand or sit up. If medical personnel have not arrived by the time the patient has revived, the patient should be given some stimulant, such as one teaspoonful of aromatic spirits of ammonia in a small glass of water, or a hot drink of coffee, or tea. The patient should be kept warm.

i. Resuscitation should be carried on at the nearest possible point where the patient received his injuries. He should not be moved from this point until he is breathing normally, of his own volition, and then moved only in a lying position. Should it be necessary, due to extreme weather conditions, etc., to move the patient before he is breathing normally, resuscitation should be carried on during the time he is being moved.

j. A brief return of natural respiration is not a certain indication for stopping the resuscitation. Not infrequently the patient, after a temporary recovery of respiration, stops breathing again. The patient must be watched and if natural breathing stops, artificial respiration should be resumed at once.

k. In carrying out resuscitation, it may be necessary to change the operator. This change must be made without losing the rhythm of respiration. By this procedure no confusion results at the time of change of operator and a regular rhythm is kept up.

■ 7. EXPLANATORY NOTES ON RESUSCITATION.—*a.* If it is evident that air is not being drawn into the patient's chest, examine the mouth for a possible obstruction, and remove any foreign body such as false teeth, chewing gum, or tobacco. An assistant, if present, should watch the patient's face, and wipe out from the mouth any frothy mucus or saliva that may collect and interfere with respiration.

b. If the operator is large and the patient is small, then the operator will not swing forward until all the weight of

his body is brought to bear on the patient, but only until firm resistance is met beneath his hands. Sixty pounds pressure is sufficient for even a large adult. Damage has been done by too great pressure.

8. TREATMENT DURING RECOVERY.—*a.* The patient may show no sign of beginning recovery for some time and then may gradually begin to regain a more normal color, indicating that the blood is getting more oxygen and that the circulation is improving. Then he may show slight muscular effort, such as a slight twitching or a scratching or clutching motion of the fingers. The first attempt to breathe may be a catch of the breath or a faint sigh. The operator should watch very carefully at this point so as not to exert pressure as the patient attempts to take his first spontaneous breath.

b. Artificial respiration should be withheld when the first breathing begins. This breathing may be very slow—four to six times per minute—but should not be assisted by artificial respiration. Artificial respiration will have to be resumed at once if breathing does not continue.

c. As breathing is resumed, the patient may attempt to get up, or even become violent in his semiconscious efforts to help himself. He must be restrained and kept in the prone position.

d. A person who has been resuscitated has been through one of the most severe strains that can be experienced. His heart has been under extreme exertion, and the regulation of rhythm and the volume of heart action may not have returned to normal for some time.

e. The patient must be kept lying down. Permitting him to get up and walk may cause suddent heart failure and death. Shock treatment must be continued long after the patient begins to breathe. He must be carefully watched, as some cases, apparently breathing normally, will suddenly stop breathing and need additional artificial respiration. Never leave a resuscitated person alone until he is normal again.

APPENDIX III

GLOSSARY OF TERMS

Antenna pattern.—An imaginary figure in space representing the intensity in every direction of the signal transmitted by an antenna.

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

Cycle.—The interval or space of time during which a regularly repeating event occurs once.

Dipole.—A half wave length antenna.

Echo.—The reflected signal received by radar from the surface of an object in the field of a transmitted pulse.

Image spacing.—Separation of the azimuth or elevation oscilloscope pictures into two parts to permit tracking by pip-matching.

Notch.—A depression in the baseline on the oscilloscope screens, used in tracking targets.

Oscilloscope.—A unit employing a cathode ray tube, the fluorescent screen of which indicates the presence of high frequency impulses.

Pip-matching.—A method of radar tracking in azimuth and angular height in which an echo is split into two parts and the two parts matched in height.

Scanner.—The rotating element of the TRACK antenna which provides lobe displacement for pip-matching (matching echo heights), so that echoes can be tracked in azimuth and elevation.

Search.—In the SCR–545–A the SEARCH system is used to detect the approach of planes at medium ranges.

APPENDIX IV

RANGE CONVERSION CHARTS

■ 1. GENERAL.—In some instances it may be found convenient to construct an auxiliary range conversion device for use with the SCR–545. Two simple devices are shown in figures 60 and 61 of this appendix.

■ 2. PIVOTED ARM TYPE.—This device, shown in figure 60, is merely a slant range arm pivoted at zero slant range with an angular height scale. The arm is set at the angular height read on the ELEVATION DIALS and the altitude is read on the vertical scale opposite the slant range figure, read from the RANGE DIALS, on the pivoted arm.

■ 3. NOMOGRAPH TYPE.—*a.* This chart (fig. 61) has the distinct advantage of requiring considerably less space than the pivoted arm type. It is used by connecting a known slant range and angular height with a straightedge and reading altitude on the middle scale at the crossing point. Its accuracy, in the size shown here, may not be as great as desired, but accuracies of the order required are obtainable by construction of a larger chart. Paragraph 4 outlines the steps in construction of the chart. The limits chosen may be varied to suit particular cases.

b. The nomograph chart has a further advantage. The slant range scale and the altitude scale always read in the same units. If slant range is put in, in feet, the altitude will be read in feet. Since the scales are logarithmic they may also be used over a wider range than the chart shows. For example, if a target is detected at 60,000 yards slant range and an angular height of 200 mils its altitude can be read by joining the 6,000-yard and 200-mil points and multiplying the result (1,180 yards) by 10 giving a result of 11,800 yards.

■ 4. STEPS IN CONSTRUCTION OF CHART.—*a.* Draw a straight vertical line which will become the altitude scale.

b. Draw two lines parallel to the first and equidistant from it. These lines will become the angular height and slant range scales.

c. Select a starting point near the bottom of the left hand line.

d. Look up the log sin 20 mils (log sin 20=8.293).

e. Look up the log sin 21 mils = 8.314.

f. Take difference between *d* and *e:*

$$8.314-8.293=0.021$$

g. Plot difference (0.021) to scale 1″ = 0.1, up from starting point on angular height scale. This means that if starting point *c* represents 20 mils, then 21-mil point will be plotted $\frac{0.021}{0.1}=0.21$ inch up from starting point.

h. Plot 22 mil point:

$$\log \sin 22 \text{ mils}=8.334$$

$$\log \sin 20 \text{ mils}=\frac{8.293}{0.041}$$

$$\frac{0.041}{0.1}=0.41 \text{ inches up from starting point.}$$

i. Plot remainder of angular height scale in a similar manner, always taking differences from starting point.

j. Select a starting point near the bottom of the right hand line. For convenience only, this should be approximately opposite 20 mils on the angular height scale.

k. Look up log 2500. (The log 2500 is 3.398.)

l. Look up log 2600 = 3.415.

m. Take difference between *k* and *l:*

$$3.415-3.398=0.017$$

n. Plot difference to same scale, 1″=0.1 up from starting point *j*. This means that if starting point represents 2500, then 2600 will be plotted $\frac{0.017}{0.1}=0.17''$ up from starting point.

o. Plot remainder of slot range scale in a similar manner. *Be sure to plot a point at 2,565 yards.* Always take differences from starting point.

p. Draw a line connecting 200 mils on the angular height scale and 2,565 yards on the slant range scale.

q. The intersection of this line *p* with the center line *a* will represent 500 yards altitude.

r. Look up log 500 (log 500 = 2.699).

s. Look up log 550 = 2.740.

t. Take difference between *r* and *s*:

$$2.740 - 2.699 = 0.041$$

u. Plot difference to *different* scale 1″ = 0.2, up from 500 point *q*. This will be $\frac{0.041}{0.2}$=0.21″ up from 500 point.

v. Plot remainder of altitude scale in a similar manner.

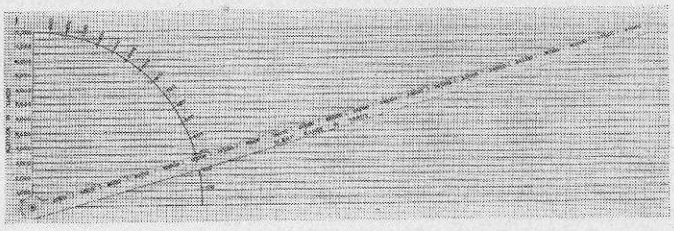


FIGURE 60.—Pivoted arm range conversion chart.

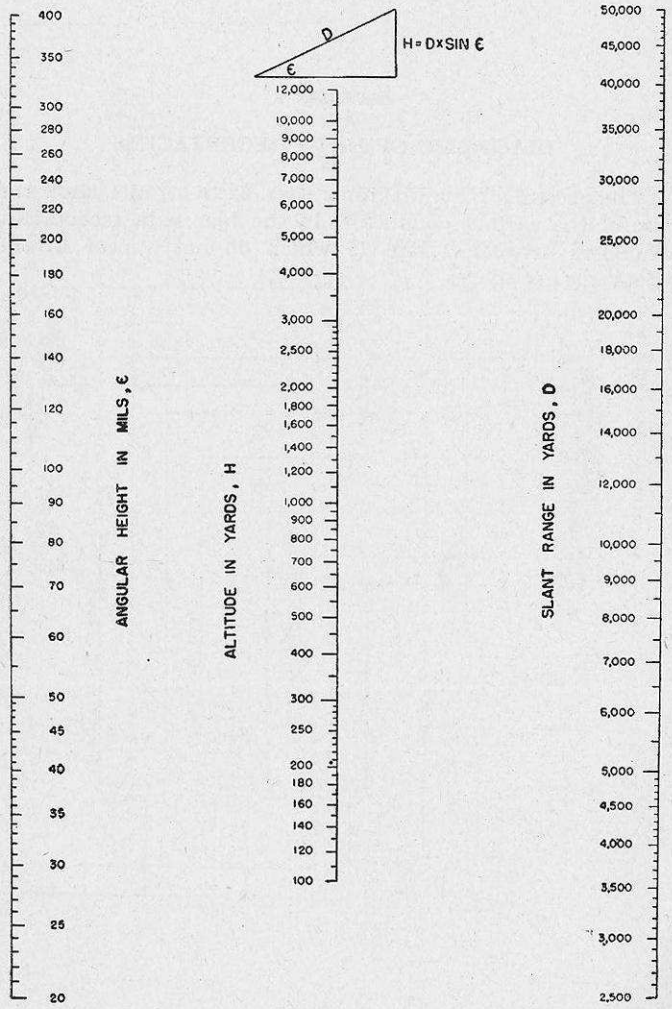


FIGURE 61.—Nomograph range conversion chart.

APPENDIX V

DIAGRAMS OF DATA RECEPTACLES

The accompanying diagrams (figs. 62 to 65, incl. show the use of the various conductors in the four data receptacles. Numbers between 1 and 19 which do not appear in the diagrams are spares.

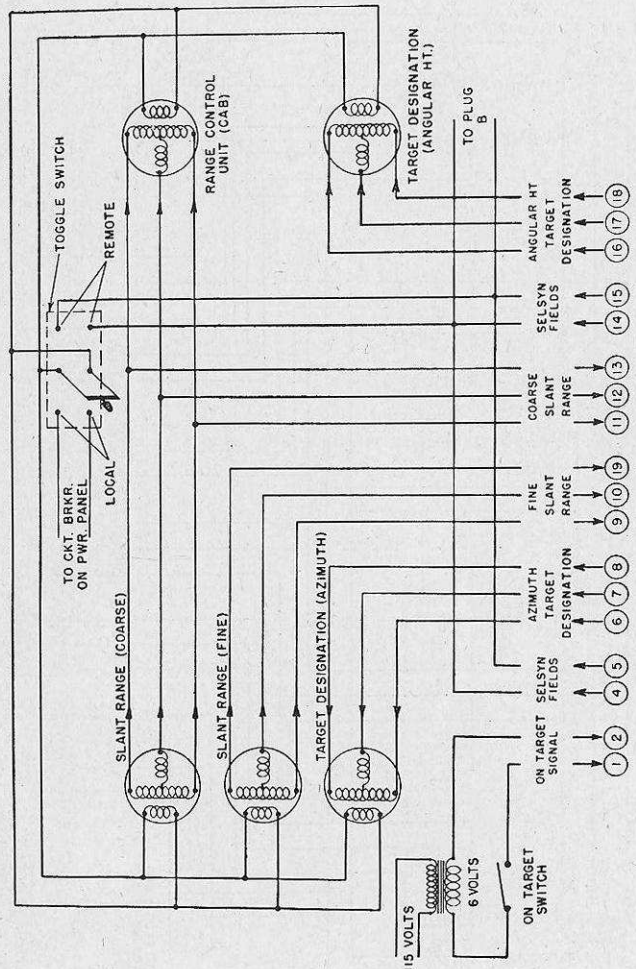


FIGURE 62.—Data receptacle A.

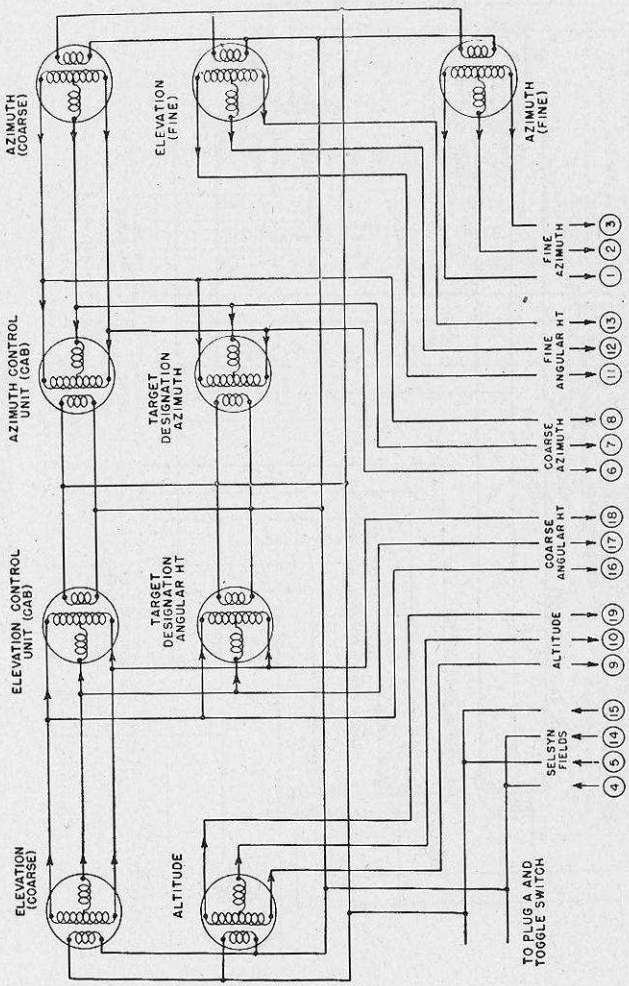


FIGURE 63.—Data receptacle B.

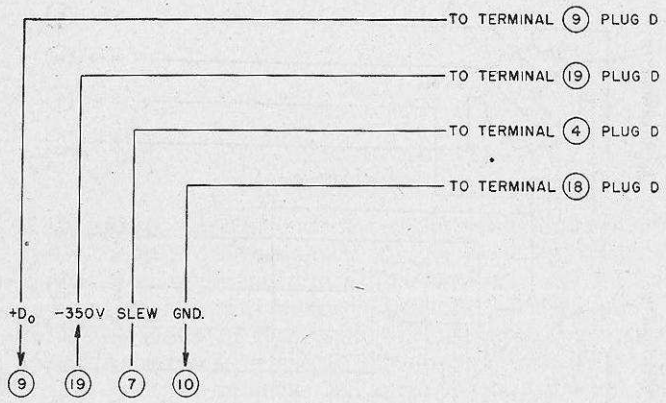


FIGURE 64.—Data receptacle C.

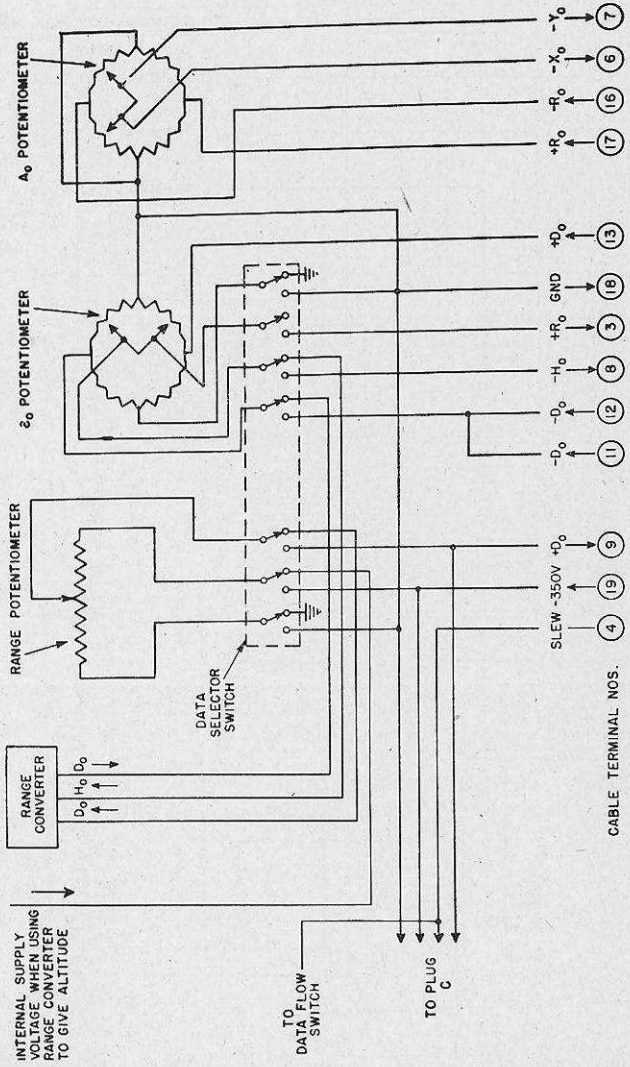


FIGURE 65.—Data receptacle D.

APPENDIX VI

ORIENTATION AND SYNCHRONIZATION BY BACK-SIGHTING

■ 1. GENERAL.—*a.* The operations of orienting and synchronizing the SCR–545 in azimuth and elevation by backsighting are most easily performed simultaneously and for purposes of clarity are discussed together. The method is quick and easily performed in the field as it requires no special instruments or special terrain conditions.

b. In order to minimize the variable parallax error that exists when transmitting slant range to a director, the distance between the director (or tracker of M9 or M10) and the radar should not exceed 30 yards. Because of the necessity for dispersion and the limit to which the antenna can be depressed to sight on the director, the distance should be at least 25 yards. This means that the radar and the director should be located between 25 and 30 yards apart.

c. Orientation and synchronization are greatly simplified if telephone connections between the radar and the director have been made.

d. This appendix covers only azimuth and elevation adjustments. Other necessary adjustments are covered in section IV, chapter 3.

■ 2. ORIENTING AND SYNCHRONIZING WITH DIRECTOR M4 OR M7.—*a.* Perform the following checks:

(1) Check the telescope on the antenna frequently and adjust it if necessary, so that its axis coincides with the electrical axis of the antenna. This can be done while tracking a plane or a meteorological balloon. If adjustments are necessary, orientation and synchronization will need correction.

(2) Check with the Chief of Range Section to see that the director has been properly oriented in azimuth and angular height.

(3) Check the level of the SCR–545–A.

(4) Connect the data cables as outlined in paragraph 27.

b. Close all switches on the main power panel, with the exception of the HIGH VOLTAGE-START. Proceed as follows:

(1) Set the MANUAL-AUTOMATIC SWITCHES on all operator control units at "Manual."

(2) By means of the AZIMUTH AND ELEVATION HANDWHEELS, direct the antenna accurately at the center of the azimuth telescope of the director, as observed through the telescope on the antenna of the SCR–545–A. When observing through the telescope, be sure to place the eye so that the cross hairs appear in the center of the field of view.

(3) At the same time, direct the azimuth telescope of the director at the center of the telescope on the antenna of the SCR–545–A. If the azimuth scope has no horizontal hair line, use the elevation scope to position the azimuth scope in elevation. Be sure the hair lines are in the center of the field of view.

(4) Remove the cover from the rear hatch (fig. 47) to expose the coarse and fine azimuth synchronous transmitters. Loosen the clamping ring on the coarse transmitter and turn it by hand until the inner and outer coarse azimuth pointers of the director differ by 3,200 mils. Tighten the clamping ring.

(5) Loosen the clamping ring on the fine azimuth transmitter and turn it by hand until the inner and outer fine azimuth pointers of the director are accurately matched. Tighten the clamping ring.

(6) Note that when the two sights are pointed at each other, one is depressed and the other elevated. If the SCR–545–A is depressed, the negative angular height as indicated by the innermost dial at the M7, must be exactly the same as the positive angular height indicated by the outermost dial. If the coarse and fine indicators are not correct, remove the cover over the angular height synchronous transmitters (fig. 48) and adjust the proper transmitter to obtain the desired reading.

(7) Remove the cover from the azimuth dials (fig. 13) and loosen the coarse and fine dials. Set these dials to read exactly the same as the inner azimuth pointers at the director.

(8) Remove the cover from the elevation dials (fig. 14) and loosen the coarse and fine dials. Set these dials to read exactly the same as the inner elevation pointers at the director.

(9) Traverse the antenna by means of the AZIMUTH and ELEVATION HANDWHEELS until the innermost and outermost pointers at the director are matched.

(10) Turn the upper and lower adjusting screws on the azimuth TARGET DESIGNATION UNIT (fig. 16) until the upper and lower dials each read the azimuth indicated by the coarse azimuth dial on the AZIMUTH CONTROL UNIT (fig. 13).

(11) Turn the upper and lower adjusting screws on the elevation TARGET DESIGNATION UNIT (fig. 16) until the upper and lower dials each read the elevation indicated by the coarse elevation dial on the ELEVATION CONTROL UNIT (fig. 14).

■ 3. ORIENTING AND SYNCHRONIZING WITH DIRECTOR M9 OR M10.—The backsighting method applies, in the case of director M9 or M10, only when the tracker is being used. The steps in orienting and synchronizing with the tracker are exactly the same as the steps for orienting and synchronizing with director M4 or M7 outlined in paragraph 2 of this appendix. Adjustment of readings between the computer and the tracker is made in the normal manner covered in FM 4–138. If the tracker is not being used the process of orienting and synchronizing is covered in section IV, chapter 3.

APPENDIX VII

LIST OF REFERENCES

Camouflage	FM 5–20
Chemical attack, defense against	FM 21–40
Communications	FM 24–series
Data transmission system	TM 9–1656
Director M4	FM 4–136; TM 9–2655
Director M7	FM 4–136; TM 9–658
Director M9 and M10	FM 4–138; TM 9–671
Field fortification	FM 5–15
Fire Control for AA guns	FM 4–121 (when published)
Formations	FM 4–120
Gunnery, antiaircraft	FM 4–110
List of—	
Film strips	FM 21–7
Publications	FM 21–6
Training films	FM 21–7
Motor transportation	FM 25–10
Organization	FM 4–104
Radio fundamentals	TM 11–455
Reference data	FM 4–118 (when published)
SCR–545–A	TM 11–1127

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