RESTRICTED

FM 4-143

WAR DEPARTMENT

ANTIAIRCRAFT ARTILLERY FIELD MANUAL

SERVICE OF HEIGHT FINDER SCR-547

30 June 1943

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SERVICE OF HEIGHT FINDER SCR–547

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FM 4–143, Antiaircraft Artillery Field Manual, Service of Height Finder SCR–547, is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF WAR:

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

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CHAPTER 1

GENERAL

		Paragraphs
SECTION I.	General	1
II.	Instrument	2–5
III.	Description	6–12
IV.	Simplified explanation	13–19

SECTION I

GENERAL

■ 1. SCOPE.—*a.* This manual furnishes a general description of radio sets SCR–547–A, 547–B, and 547–C, and provides information relative to the details of their operation and employment by the using personnel. A knowledge of the fundamentals of antiaircraft gunnery as covered in FM 4–110 is helpful in understanding the problem of locating and tracking aerial targets. FM 4–118 (now published as FM 4–155) should be consulted for definitions of terms unfamiliar to the reader. Appendix III contains a limited number of definitions.

NOTE.—The term "SCR–547" used throughout this manual includes SCR–547–A, SCR–547–B, and SCR–547–C.

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

c. MUCH OF THE EQUIPMENT IN THE SCR–547 OPERATES AT DANGEROUSLY HIGH VOLTAGES. IN THE EVENT OF SEVERE ELECTRIC SHOCK PROPER REMEDIAL TREATMENT MUST BEGIN IMMEDIATELY. APPENDIX II COVERS THIS TREATMENT IN DETAIL.

SECTION II

INSTRUMENT

■ 2. PROBLEM.—Measuring accurately and quickly the slant range or altitude of a fast-moving target has always been one of the difficult problems in antiaircraft firing. The

SCR–547 has the following advantages over other methods in common use:

a. It provides continuous altitude data.

b. It provides continuous slant range data.

c. It requires less skilled operators.

■ 3. GENERAL OPERATION.—Radio set SCR–547 is directed toward the target by means of visual azimuth and elevation tracking. Selsyn indicators for azimuth and elevation indicate the position of the director to insure that the same target is followed by both instruments. The SCR–547 emits a radio pulse which is limited to a spread of approximately 5° by a parabolic reflector at the transmitter antenna. This pulse strikes the target and is reflected back to the receiver. The time it takes this radio pulse to travel to the target and return determines the slant range. (See fig. 14.) This slant range may be converted to altitude. Either slant range or altitude is sent to the director, depending on the type of director being used.

■ 4. LIMITS.—*a.* Altitude or slant range for M4 and M7 directors is transmitted by a single synchronous repeater up to a maximum value of 10,000 yards. A switch is provided on the front panel of the range unit (fig. 11) which has two positions, "Height" and "Range." When tracking targets at low angular heights, it is desirable to transmit slant range instead of altitude. In such cases the switch is placed in the "Range" position.

b. Certain directors require slant range as synchronous repeater data. For each of those directors there is provided a coarse and a fine synchronous repeater for slant range data to a maximum of 25,000 yards.

c. Slant range data for M9 and M10 directors are provided as voltage data. The maximum limit of this data is 28,000 yards.

NOTE.—*Each of the above data transmission systems requires a certain set of connections at the SCR–547 pedestal terminal block (behind the transmitter drawer) and at the terminal block in junction box JB–57–A. These changes are shown in TM 11–1109 and in the circuit labels for the SCR–547.*

■ 5. MODELS AND THEIR DIFFERENCES.—*a.* The SCR–547–A is equipped with manual tracking in azimuth and elevation and with aided tracking in slant range.

b. The SCR–547–B is equipped with manual tracking in azimuth and with aided tracking in elevation and slant range.

c. The SCR–547–C is equipped with aided tracking for each of the three trackers. In addition, there is a mechanism which changes the spherical coordinates (A_o, E_o, D_o) of the target's present position into d-c voltages for use in the *computer* of the electrical director. This eliminates the need of the *tracker* unit in the electrical director.

SECTION III

DESCRIPTION

■ 6. AUTOMOTIVE EQUIPMENT.—*a.* The automotive equipment of the unit consists of a semitrailer drawn by a 1½-ton tractor truck as shown in figure 1. The trailer is equipped with an electric brake system for use on the road and a hand brake system for use when the unit is parked. The trailer unit weighs 6 tons fully loaded.

b. Each battalion with one or more SCR–547 units is issued a 2½-ton van truck carrying spare parts and test instruments. Figures 2 and 3 show the arrangement of equipment in this unit. In general, it carries one of each of the major components of the radio assembly, that is, a low voltage rectifier, indicator unit, range unit, transmitter unit, high voltage rectifier, and range converter. These assemblies are used as replacements. The van also carries instruments and spare parts necessary for locating and repairing trouble.

c. Some SCR–547 units are issued a power plant in a 2½-ton van truck. See figures 3 and 4 for the arrangement of equipment carried in this truck.

■ 7. TRAILER UNIT.—*a.* The trailer is supported entirely by two outriggers and a rear jack in the operating position. Figure 7 shows the rear jack and the special axle clamps used to prevent the rear springs from expanding as the jack is operated. The outriggers are shown in figures 5 and 20.

b. The trailer supports a pedestal which carries the radio units in a cabinet as shown in figure 8. This pedestal is arranged to rotate on roller bearings in the operating posi-

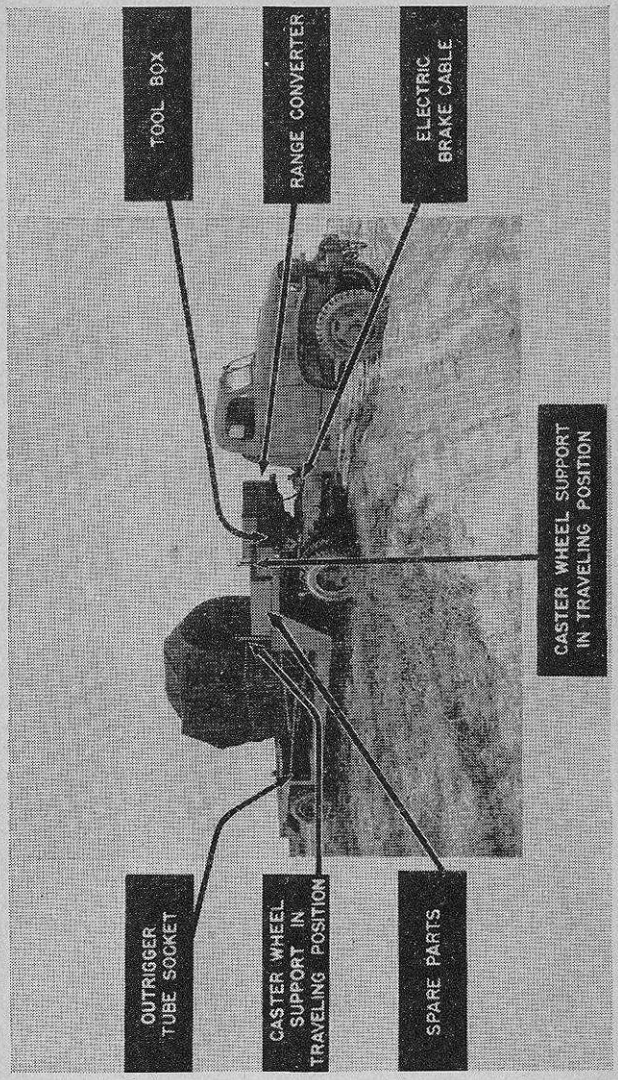
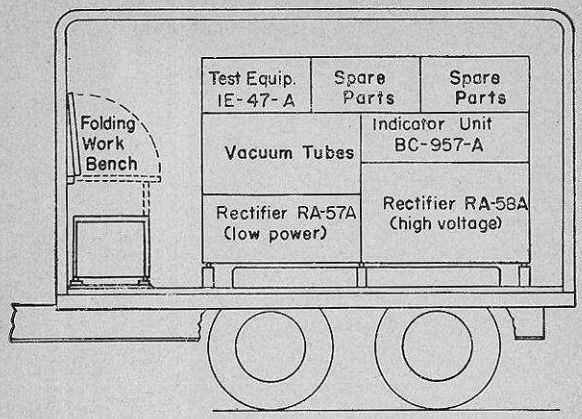
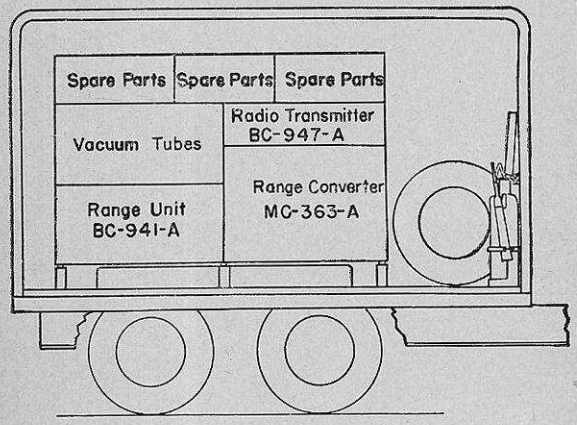


FIGURE 1.—The SCR–547.

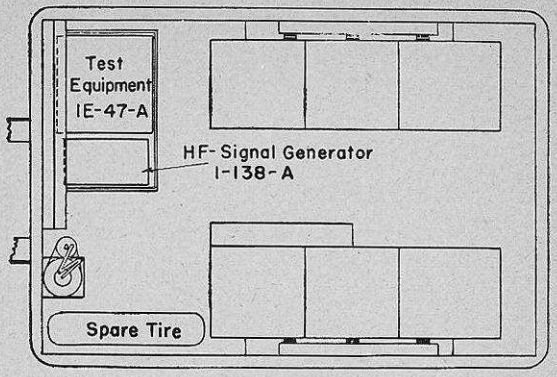


① Right side.

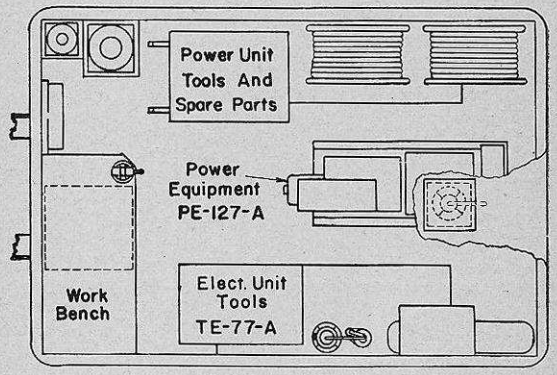


② Left side.

FIGURE 2.—Elevation views of spare parts van arrangement.

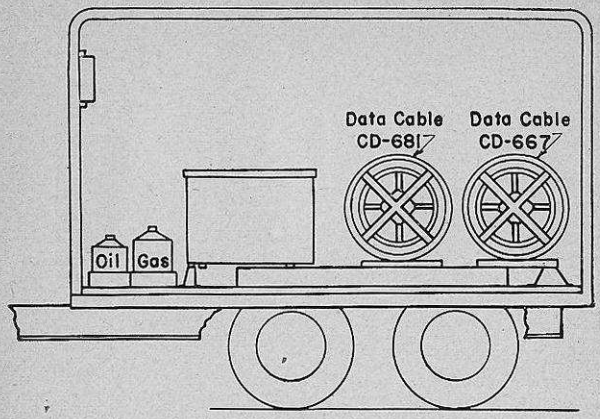


① Spare-parts truck.

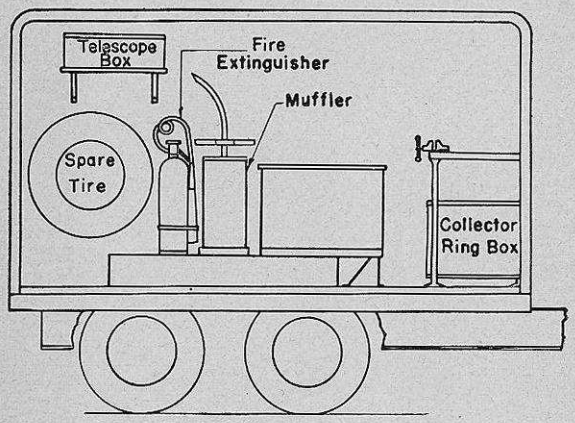


② Power truck.

FIGURE 3.—Plan views of spare parts van and power van.



① Right side.



② Left side.

FIGURE 4.—Elevation views of power van arrangement.

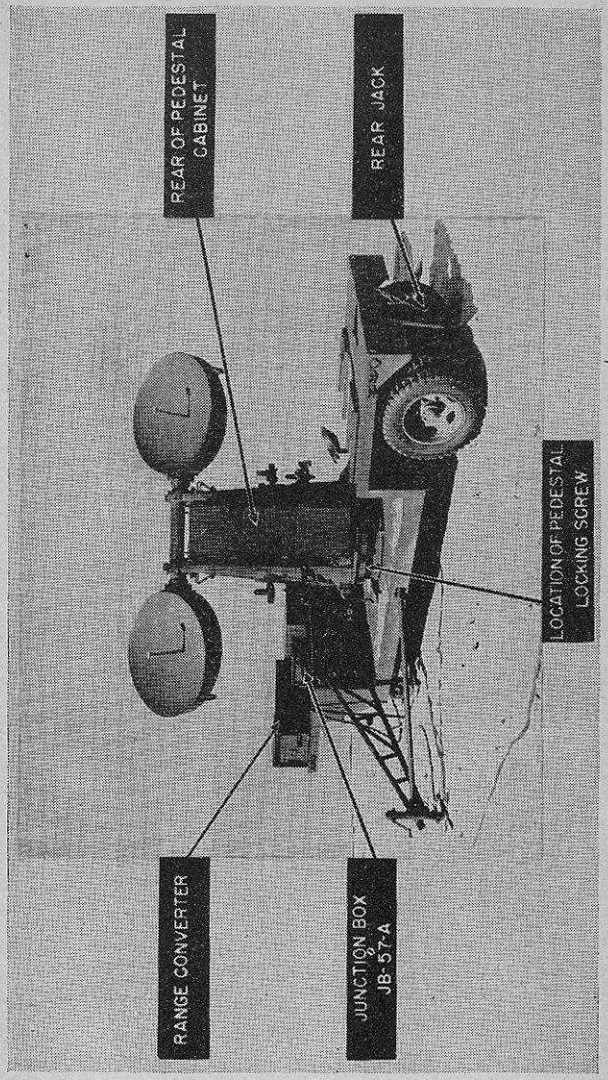


FIGURE 5.—The trailer.

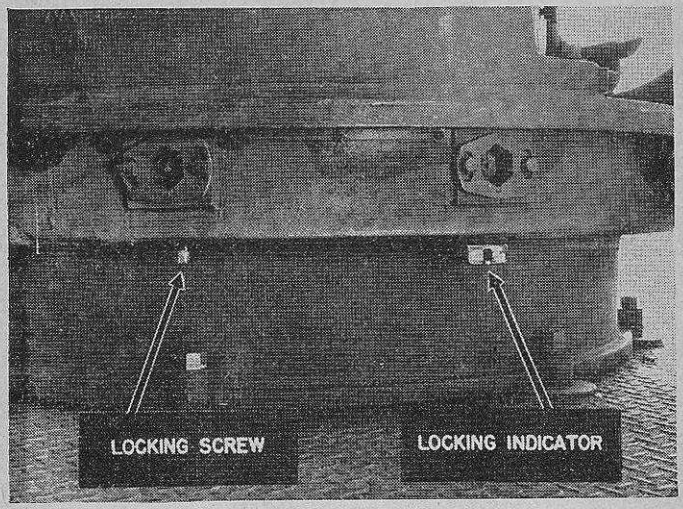


FIGURE 6.—Pedestal locking screw.

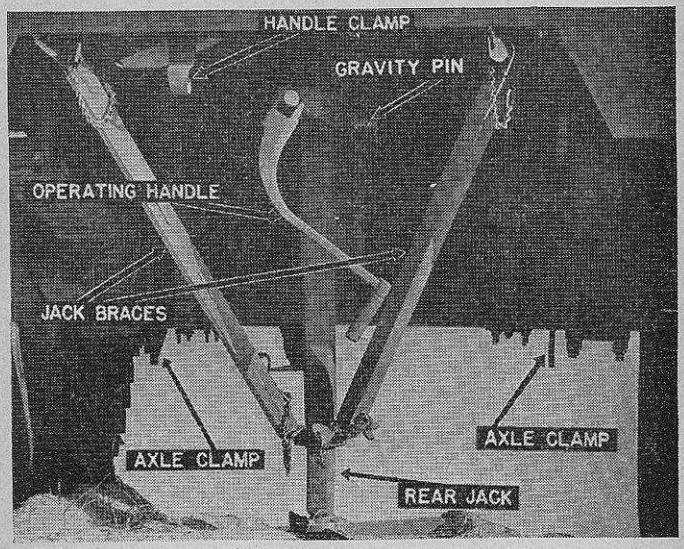


FIGURE 7.—Rear jack in operating position.

tion, but is jacked up from the roller bearings for traveling by means of the locking screw shown in figure 6. This locking screw and an indicator showing the pedestal position are at the bottom of the pedestal on the left side of the trailer.

8. RADIO UNIT.—*a.* The radio unit is a cabinet mounted in the pedestal, consisting of five drawers which contain integral parts of the equipment. Figure 8 shows the cabinet in its

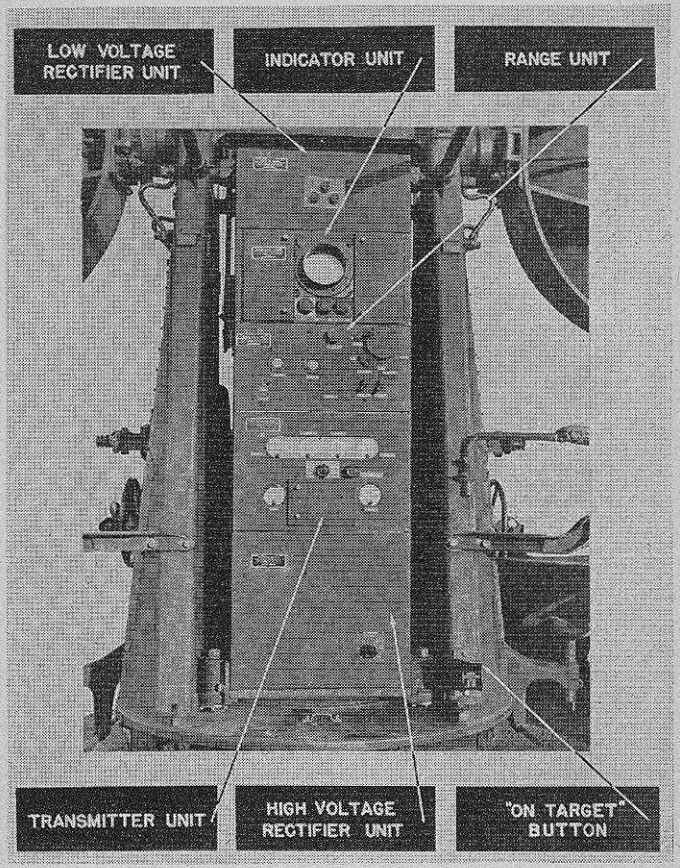


FIGURE 8.—Pedestal cabinet.

mounting. The drawer-type construction shown in figure 9 is so arranged that any drawer, except the indicator unit, may be approximately half opened without disconnecting any leads. In the case of the indicator unit, the receiving antenna must be disconnected at the point near the left front of the drawer where it passes through the pedestal cabinet before that drawer is opened. Even though no leads need be dis-

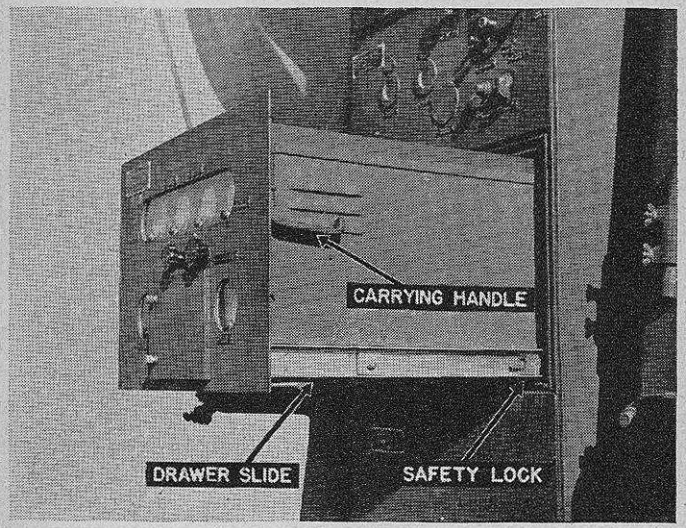


FIGURE 9.—Drawer-type construction.

connected and it is still possible to energize filaments, it is impossible to apply high voltage when a drawer is in the open position because of interlocks. Each drawer is provided with four carrying handles, one of which is shown in figure 9. The units are heavy and a man is required at each of the four handles when a drawer is removed.

b. The low-voltage rectifier unit drawer, the front panel of which is shown in figure 10, includes three rectifiers. Rectifier No. 1 supplies all negative voltages throughout the SCR–547. Rectifiers Nos. 2 and 3 supply 300 volts d-c for plate operation in the range unit and the indicator unit.

c. The indicator unit drawer, the front panel of which is shown in figure 25, contains the receiver, including the circuits for the oscilloscope. ***Caution:*** ALWAYS DISCONNECT RECEIVING ANTENNA BEFORE OPENING DRAWER.

d. Figure 11 shows the front panel of the range unit drawer. This unit includes the motors and gearing for the aided tracking range controls. Its mechanical operation is described in detail in paragraph 42.

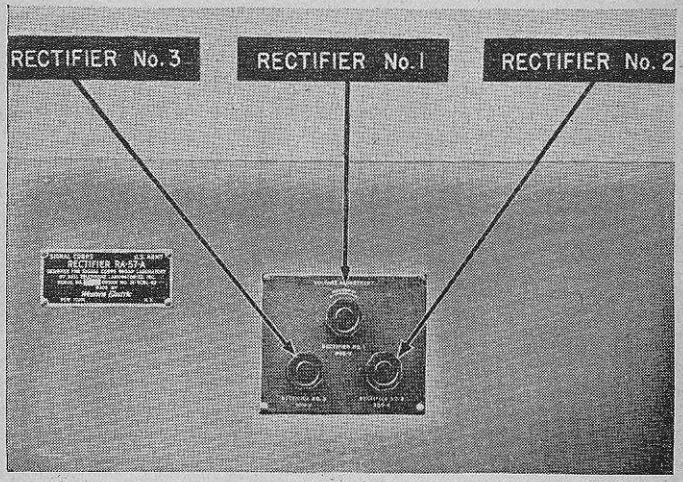


FIGURE 10.—Low-voltage rectifier.

e. The transmitter unit drawer (fig. 24) includes on its front panel all of the instruments and switches normally used in putting the SCR-547 into operation.

f. The high-voltage rectifier unit drawer has only a voltage control on its front panel. The rectifier tubes may be observed through the viewing window provided. The front panel of the drawer is shown in figure 12.

such a

9. RANGE CONVERTER.—The information obtained from the indicator unit and the range unit is in the form of slant range to the target. For most directors, the slant range must be converted to altitude. This is accomplished in the

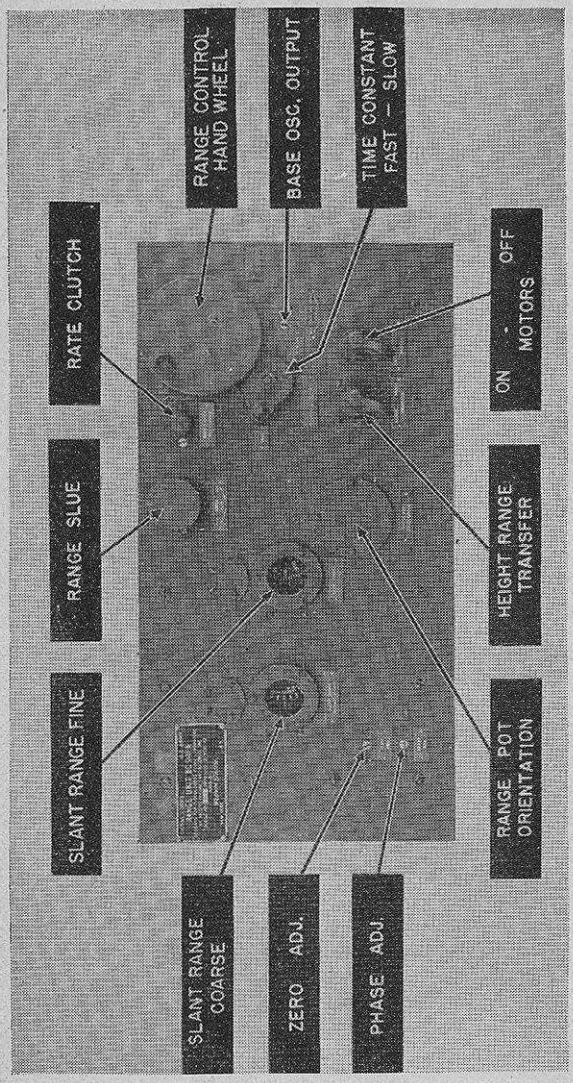


FIGURE 11.—Range unit.

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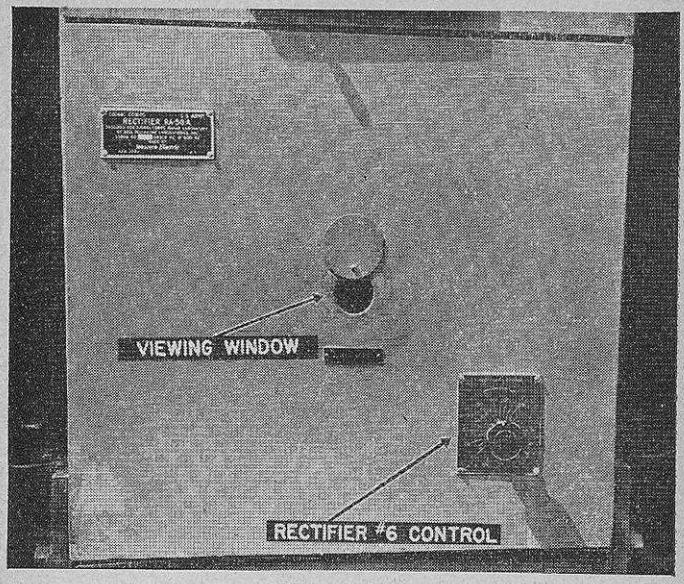


FIGURE 12.—High-voltage rectifier.

range converter shown in figure 5. This unit is also built as a drawer, and figure 27 shows the details of its front panel.

(10) POWER PLANT ENGINE.—*a.* The engine is a Continental, 6-cylinder, 4-cycle, vertical type, operating on commercial grades of gasoline at 1,200 rpm. It is mounted on a fabricated steel sub-base, together with its alternator, exciter, and control panel. The engine is directly connected to the alternator by means of a steel disk coupling.

b. The engine is normally started by an electric push-button type switch mounted on the control panel, and an automotive type starting motor. The electric starting system is operated by a 6-volt battery provided with a charging generator. A removable crank is also provided for manually starting the engine. The ignition system is magneto-operated. A hand throttle and an air choke control lever are provided on the control panel.

c. The engine is cooled by means of a radiator and a pusher

type fan with a centrifugal water pump, capable of keeping the cooling water below 190° F. for ambient temperatures up to 120° F. A high water temperature cut-off switch is provided to cut off the ignition and shut down the engine when the radiator water temperature reaches 194° to 196° F. A thermostatically operated temperature indicator gage is provided to indicate the temperature of the outlet water of the engine. A positive pressure oiling system is provided, together with a pressure gage to indicate its operation.

d. The exhaust silencer, when in use, is mounted above the engine, with a tail pipe projecting through the roof of the truck. When not in use, the silencer is removed from the exhaust line and placed in a special holder adjacent to the spare tire mount in the power truck to prevent mechanical damage while traveling.

e. The speed of the engine is controlled by a centrifugal type governor which operates by throttling the mixture to the cylinders. From no load to full load, the speed will remain within the limits of 1,200 to 1,260 rpm.

(11) ALTERNATOR.—*a.* The alternator is the single-bearing type, with a direct-connected exciter supported from the alternator bearing housing opposite the coupling. The alternator is a 7.5-kilowatt, 120-volt, single-phase, two-wire, 60-cycle machine, with a full load current rating of 78 amperes. The maximum momentary load which may be sustained by the alternator without injury is 150 percent of the continuous rating, with the field rheostat set for rated load operation. The set is not equipped for parallel operation with another set.

b. The exciter field rheostat is equipped with a manual control which permits adjustment of the alternator output voltage. An automatic voltage regulator of the Westinghouse Silverstat type normally controls the voltage by means of a variable resistance in series with the exciter field rheostat. With this voltage regulator operating, the voltage of the alternator will remain within the limits of ±5 percent under all anticipated operating conditions of temperature, and between no load and a 7.5-kw load.

c. Shielding is provided on the alternator, exciter, battery charging generator, the leads from each, and the ignition

system of the engine, so as substantially to eliminate radio frequency interference.

d. A rigid control panel is furnished with each engine-generator set and is mounted above the alternator within a weather-protecting cabinet.

12. Power Supply.—*a.* The SCR–547 requires a 60-cycle, single-phase, alternating electric power supply. The voltage may be changed to its correct operating value of 115 volts by means of the control handwheel on the junction box (fig. 18), if the voltage supplied is between 90 and 130 volts.

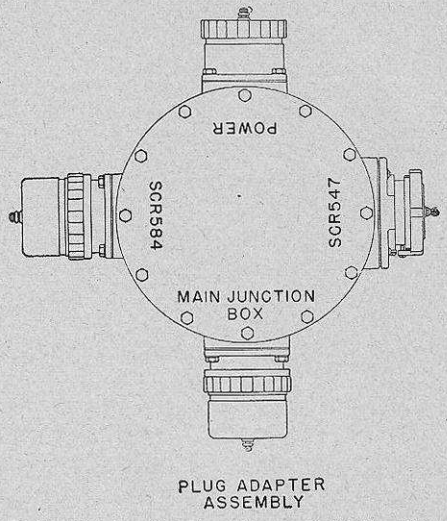


Figure 13.—Special junction box for use with the M7 generator.

b. Power supply is normally provided by the M7 power plant. This three-phase supply passes through a special junction box on its way to the guns, at which point taps are provided on one phase terminating in a receptacle which takes the plug on the power cable supplied with the SCR–547. The special junction box is supplied as part of the SCR–547 equipment. (See fig. 13.)

c. In static positions it may be feasible to connect an outside source of power suitable for the operation of radio set

SCR–547. In making such an outside connection, it is particularly important to ascertain the characteristics of the power supply to avoid danger of injury to personnel, or damage to apparatus from a high voltage. The voltage of the outside supply should be within the limits of 90 and 130 volts, capable of control by the voltage control handwheel on the junction box (fig. 18). The frequency of the supply should remain within limits of 58 to 62 cycles. A standard 5 kva transformer will carry the load satisfactorily.

Section IV

SIMPLIFIED EXPLANATION

13. General.—The general principles involved in the operation of the SCR–547 are illustrated in figure 14. The left side shows successive stages in the movement of a radio pulse directed toward a target by a parabolic reflector. The right side shows the formation of a base line, commonly called a sweep, on the oscilloscope screen. Study of the successive sketches indicates that the sweep lengthens in direct proportion to the distance the original pulse has traveled. When such a high frequency radio pulse strikes certain types of objects, the object, in effect, reflects a portion of the pulse, which, unlike the original pulse, has no reflector to concentrate it and therefore spreads equally in all directions. The reflected pulse may be likened to an expanding bubble with its center at the object. In exactly the same length of time that it took for the original pulse to strike the object, a small portion of the reflected pulse (commonly called the echo) strikes the receiving antenna, from which it passes through amplifiers and is made to appear on the oscilloscope screen as a vertical deflection. The time represented from the start of the sweep to the echo is the time that a radio wave takes to travel from the transmitter to the object and back. After deflecting in response to the echo, the sweep resumes its original travel along a horizontal line which it continues until the original pulse has gone so far away that, even if it struck an object, the portion of the returned echo reaching the receiver would not

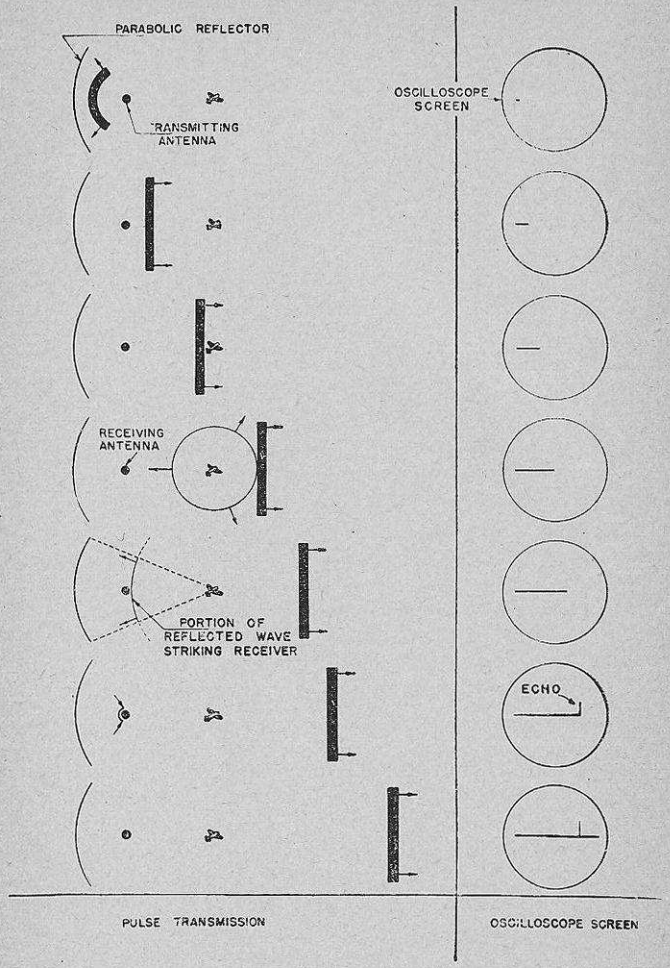


FIGURE 14.—Principles of operation, SCR–547.

be sufficient to cause a visible echo on the screen. Then the sweep suddenly returns to the left, a new original pulse is sent out from the transmitter, and the entire cycle of

events represented by the series of sketches is repeated. Radio waves travel in air at a rate of approximately 186,000 miles per second and the length of time between repetition of the cycles need not be very long for the original pulse to get so far away that an echo will not be visible. The fact that this repetition occurs many times a second makes the oscilloscope picture essentially continuous. Hence, the operator sees a sweep with an echo that changes in position as the range to the target changes.

■ 14. SWEEP CIRCUITS.—The sweep developed, as outlined in paragraph 13 and figure 14, is called the "FULL SWEEP", and shows the full range of the instrument. Since the sweep is only approximately 4 inches long (as usually adjusted for operation), a small error in measurement of the length between its origin and an echo would result in a large error in indicated range to the target. To minimize such an error the SCR–547 provides a PRECISION SWEEP, which acts merely as a magnifier of a portion of the FULL SWEEP. The portion chosen for manification may be selected and the choice is always in the vicinity of the target selected on FULL SWEEP.

■ 15. RANGE DETERMINATION.—*a.* Range is determined by positioning a step on the sweep. (See fig. 15.) This step, sometimes called an electrical hairline, is positioned on the

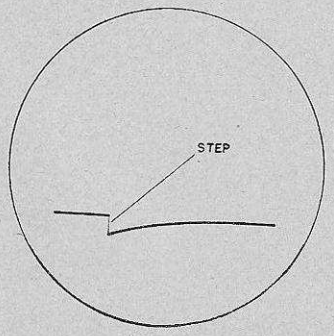


FIGURE 15.—Appearance of a step on FULL SWEEP. (Range dials read approximately one-fourth maximum range.)

baseline by rotating the range handwheel shown in figure 11. The range to the target is determined by moving the step along the sweep until the relative positions of the echo and the step are as shown in figure 16. The range dials (fig. 11) are geared directly to the range-control handwheel.

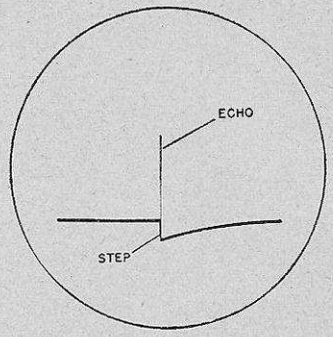


FIGURE 16.—Echo properly positioned in step on FULL SWEEP. (Range dials read approximately one-half maximum range.)

b. The selector switch (fig. 25) on the indicator unit is then thrown to PRECISION SWEEP in order to use the

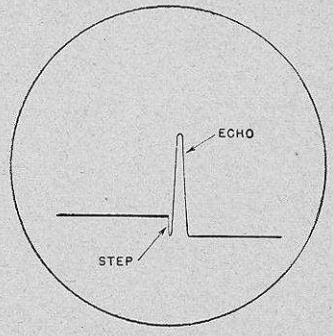


FIGURE 17.—Echo properly positioned in step on PRECISION SWEEP.

magnification provided. The resulting picture on the oscilloscope screen will probably show the echo not quite in position, necessitating a further adjustment of the range con-

trol handwheel (fig. 11) to bring the echo to the step, as shown in figure 17.

NOTE.—The echo as shown in figure 17 has some width, while that shown in figure 16 is only a line. The widening of this echo is due to the magnification provided by PRECISION SWEEP. Notice that on FULL SWEEP the movement of the range control handwheel causes the step to move, whereas on PRECISION SWEEP a similar handwheel movement causes the echo to move.

■ 16. BLANKING.—In most oscilloscopes the picture observed represents effects occurring during any part of a cycle. A baseline travels from the starting point and is visible during all of this time. If a picture of this character were presented on the screen of the oscilloscope in the SCR–547, it would be impossible to determine whether a vertical deflection of this baseline was caused by a target in the range of the left-to-right travel, or one in the range of the right-to-left travel. To eliminate this difficulty the indicator unit provides PRECISION BLANK and FULL SWEEP BLANK controls which when properly adjusted cause the picture on the screen to represent only ranges increasing from a minimum on the left to a maximum on the right, as viewed by the operator facing the oscilloscope. The position of the step can then represent only one possible slant range.

■ 17. AIDED TRACKING.—The range control handwheel (fig. 11) positions the echo by means of an aided tracking mechanism. A small portion of the change in range is accomplished directly by means of the range control handwheel, but the greater portion of the change is secured from the variable speed motor drive. The output speed of this motor drive is controlled by the range control handwheel. The aided tracking mechanism is used so that, once the target echo is properly positioned in the step, it may be kept properly positioned by varying the output of the variable speed drive with the range control handwheel, to change the range at exactly the correct rate to maintain the step and the echo in contact. An additional motor drive, controlled by the RANGE SLUE control (fig. 11), is provided to move the step rapidly from one target to another.

■ 18. RANGE CONVERTER.—The information obtained from the SCR–547 is transmitted to a director. Slant range is pro-

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vided for those directors which require it directly, and altitude is provided for the remaining directors. To provide altitude a slant range converter is necessary. The slant range and angular height are sent to the range converter, which automatically and continuously solves for altitude. These data are transmitted to the director by means of a synchronous repeater.

■ 19. DATA TRANSMISSION.—*a.* In order to transmit azimuth and angular height from the director to the SCR–547 and to transmit altitude or slant range to the director, use is made of synchronous repeaters commonly known as selsyn motors. These units permit the conversion of angular position into

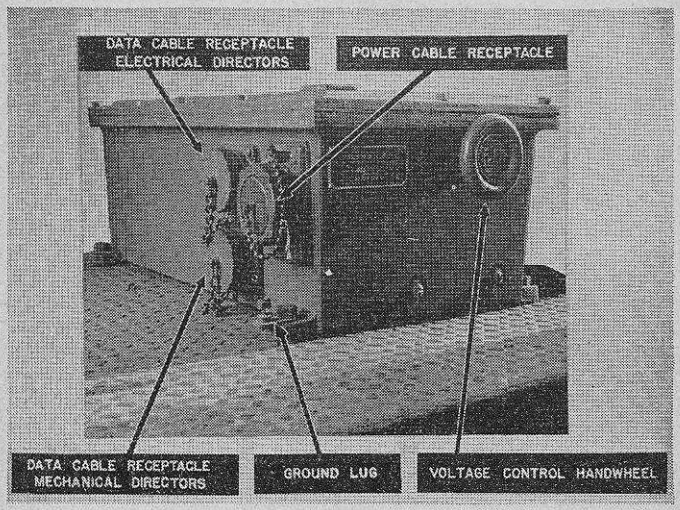


FIGURE 18.—Junction box JB–57–A.

electrical relationships, which may be transmitted by cable to the director and there reconverted into angular position. For a complete explanation of such a transmission system, see TM 9–1653 or TM 9–1656.

b. Data obtained from the SCR–547 may be either in the form of motion to be transmitted by synchronous repeaters

or of voltage to be transmitted directly (see par. 4). In either case the information terminates in junction box JB–57–A (fig. 18) where sockets are provided for data cables. For directors using the data from synchronous repeaters, only one data transmission cable is needed. It is plugged into the socket designated in figure 18 for mechanical directors. For directors using voltage directly it may be necessary to use data cables from both the tracker and computer sockets. Certain interchanges of leads on the terminal strips inside the junction box JB–57–A and on the terminal block in the rear of the pedestal are necessary for different directors. (To determine the correct connections for any desired director, see TM 11–1109. This manual is part of every equipment and is carried in the trailer tool box.) *The directors will be damaged if these connections are not for the director being used.*

CHAPTER 2

INSTALLATION

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SECTION I

CHOICE OF POSITION

■ 20. LOCATION OF UNITS.—*a.* Both the radio and optical apparatus of the SCR–547 require an unobstructed view. For this reason the site selected for the location of the equipment should provide, if possible, a clear field of visibility in all directions. Hilltops, elevated ground, cliff tops, beaches, and unobstructed level areas are well suited for the purpose.

b. In the case of semipermanent installations, consideration should be given to the availability of existing power facilities to serve as a power source during standby conditions or while repairs to the mobile power equipment are being made.

c. The exact position selected for the location of the trailer must provide a cleared area for extending the outriggers. The position is further limited by the 225-foot data cable to the director and the 150-foot power cable. Consideration must be given to the leveling of the mount since the jacks will provide only about 6 inches of leveling. If the slope of the ground is appreciable, considerable excavation will be necessary in emplacing the mount.

d. More than one radio set SCR–547 adjusted to transmit at the same frequency should not be used within a limited area. In cases where it is necessary to operate more than one set at a given location, they should be selected to operate at different frequencies to avoid interference.

SECTION II

EMPLACING

■ 21. PREPARATION OF TRAILER.—The following procedure is a guide in the preparation of the trailer for operation:

a. While the tractor is still coupled to the trailer, remove the gravity pins from the caster wheel supports, and lower the caster wheels to the ground. On soft ground planks should be placed under the caster wheels to prevent their sinking. Replace the pins in the holes provided in the supports so that when the tractor is removed, the weight of the forward part of the trailer will be carried on the caster wheels. Set the hand parking brake on the right side of the trailer (fig. 19) to prevent movement of the trailer during disconnection or after the tractor has been disconnected. Disconnect the brake cable (fig. 1) and the chain connecting the tractor with the break-away safety device located on the under side of the forward deck of the trailer.

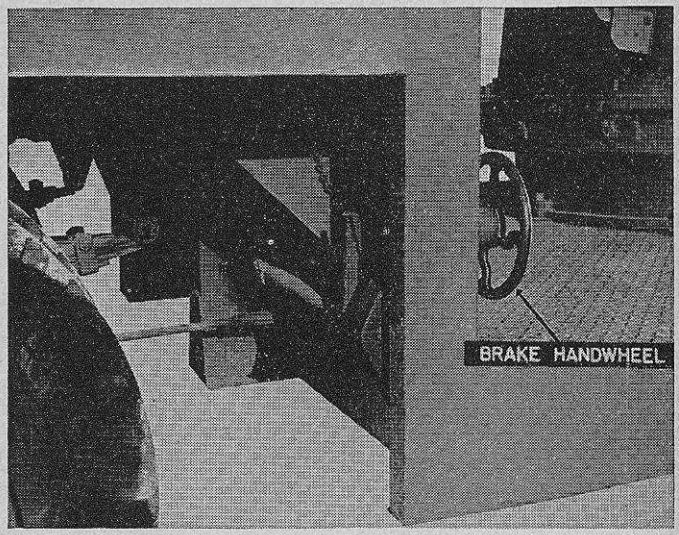


FIGURE 19.—Hand parking brake on trailer.

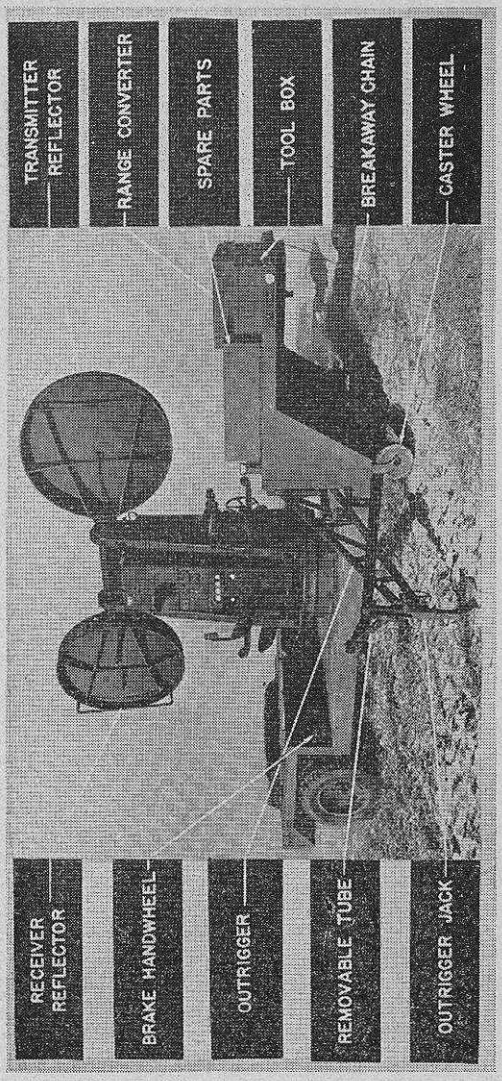


FIGURE 20.—Trailer in operating position.

b. Disconnect the tractor from the trailer by raising the small flap at the front end of the coupler and releasing the latch to allow the tractor to be driven away.

c. Remove the pin from the brace tube on each outrigger so that these tubes may slide freely in their supports on the outriggers. Slide the tubes clear of the openings supporting them in the rear drop of the trailer. (See fig. 1.)

d. Operate the cranks of the outrigger jacks to make the footplates of the jacks clear the trailer deck, being careful not to jam the plates at their ball and socket joints. Do not force the jacks as the limit pins may be sheared.

e. Swing the outriggers to allow the removable brace tubes to clear the rear drop of the trailer and remove the tubes completely from their supports on the outriggers. Swing the outriggers into position at right angles to the trailer length and place the brace tubes in position between the bracket on each jack and the bracket on the under side of the trailer lower deck. Pin the tubes in place at these points. The jacks are then ready to be used for raising the caster wheels from the ground.

f. In the case of the rear jack, first lower the axle clamps shown in figure 7 to hold the springs. Release the handle of the rear jack from the handle clamp. Lower the rear jack by releasing the gravity pin at the top, inserting it again at the lower bracket approximately 11 inches below its raised position. The two braces for this jack, normally carried in the trailer tool box, are then pinned in their proper position between the brackets on the jack and those on the under side of the rear deck. The jack handle may then be placed in its proper position for turning.

g. Connect the power supply cable between the junction box JB–57–A (fig. 18) and the special junction box which must be installed in the supply cable between the M7 power plant and the guns. Turn on the power.

h. Remove the canvas covers from the pedestal.

■ 22. PREPARATION OF PEDESTAL.—*a.* Install the transmitting and receiving dipole antennas in the antenna reflectors after removing the protective caps from the transmission lines.

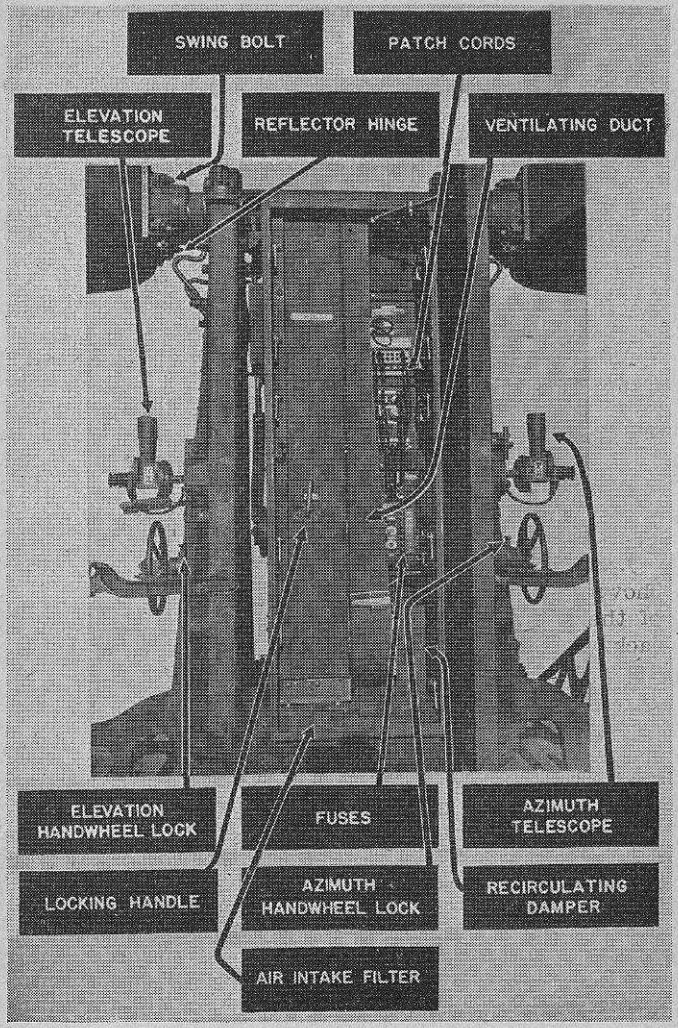


FIGURE 21.—Rear view of pedestal cabinet.

b. Remove the canvas covers from the hinged flanges and wipe any dust and grit from the reflector flanges.

c. Release the reflector clamps (fig. 22) and swing the reflectors into place and clamp them with the swing bolts on the flanges shown in figure 21.

d. Lower the pedestal to the roller bearing with the ratchet wrench which is kept in the trailer tool box. The locking screw is on the left side of the trailer. To the right of it is an indicator marked "Locked—Unlocked." Details of this are shown in figure 6. To unlock the pedestal, operate the ratchet wrench in a direction away from the indicator until the indicator pointer reaches the unlocked position. *Do not force the locking screw.* Return the ratchet wrench to the trailer tool box.

e. Unlock the elevation and azimuth controls by pulling upward the handwheel locks (fig. 21) located behind the control handwheels until the pins emerge from their slots. Twist the knobs one-fourth turn to hold them in place. Rotate each handwheel slowly to check its freedom of operation.

f. Turn the knurled sleeve guards of the two levels on the azimuth side to make the glass tubes visible. (See fig. 22.)

g. Accurately level the trailer by means of the three jacks. Adjust the outrigger jacks first and then the rear jack. Repeat until the level bubbles are centered and remain within one and one-half scale divisions of center during a 360° traverse of the pedestal. When located on soft ground, make frequent checks of the leveling to be sure that the jack foot plates have not settled. For very unstable ground, planks must be used to provide a larger footing for the jacks.

h. Remove the telescopes from their transportation cases and see that all parts are clean. The lenses may be cleaned with a camel's-hair brush, cleaning tissue or soft cloth. If greasy, clean with alcohol on absorbent cotton, cleaning tissue, or soft cloth. Place the cross slots on the flanges over the pins of the pedestal telescope mounting flanges to make the three screws coincide with the three holes. Centralize the telescopes and tighten the screws.

i. Remove the data cable from its reel and insert the male plug end into the height finder receptacle on the bottom of the M4 or M7 director. BEFORE INSERTING THE OTHER

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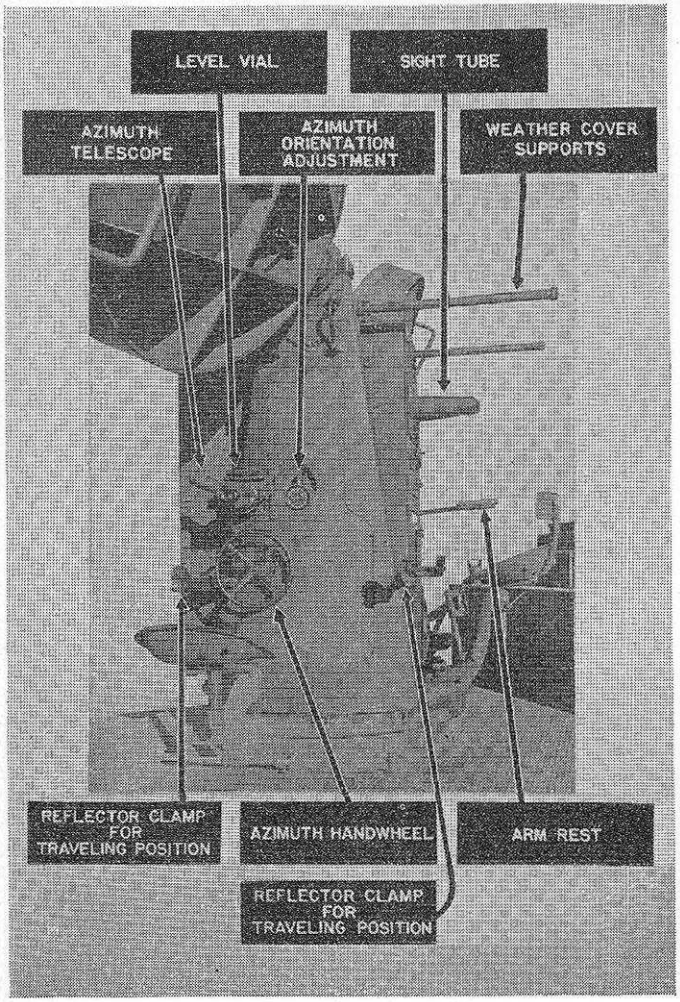


FIGURE 22.—Azimuth side of pedestal.

END INTO THE PROPER RECEPTACLE ON JUNCTION BOX JB-57-A MAKE SURE THAT THE CONNECTIONS AT THE PEDESTAL TERMINAL BLOCK AND AT THE

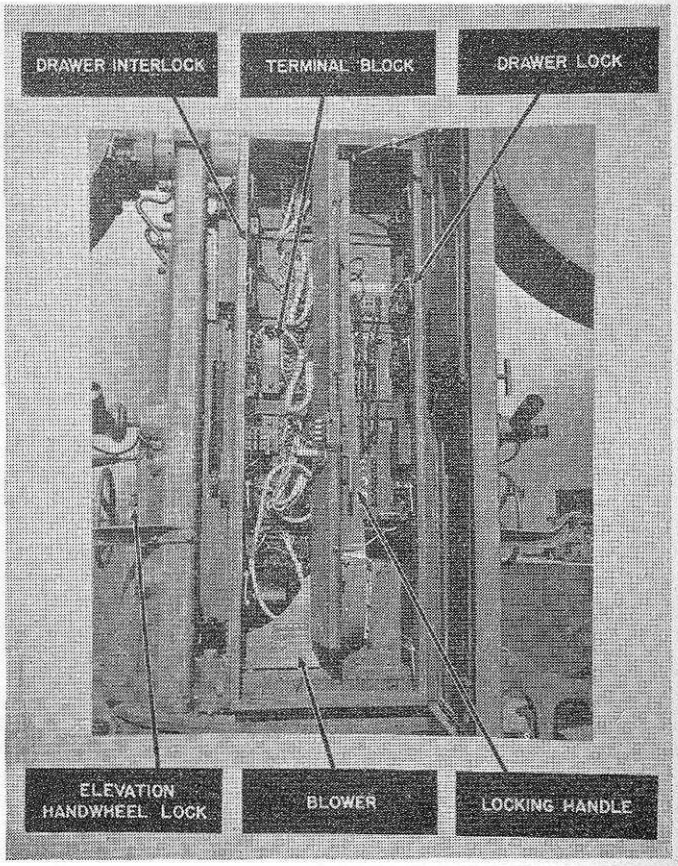


FIGURE 23.—Rear view of pedestal cabinet.

TERMINAL BLOCK IN JUNCTION BOX JB-57-A ARE FOR THE M4 OR M7 DIRECTOR. EACH TYPE OF DIRECTOR REQUIRES A CERTAIN SET OF CONNECTIONS. THESE

CONNECTIONS ARE SHOWN IN TM 11–1109 AND IN THE CIRCUIT LABELS FOR THE SCR–547. DAMAGE WILL RESULT TO THE DIRECTOR IF IMPROPERLY CONNECTED. Having determined that connections are correct for the director being used, complete cable connections. See FM 4–138 (when published) when using the SCR–547 with the M9 or M10 directors.

j. Make sure that the patch cords on the rear of the cabinet are in place. Figure 21 shows these six cords which complete the following connections:

J18 indicator unit to J20 indicator unit
J1 indicator unit to J1 range unit
J2 indicator unit to J2 transmitter unit
J7 indicator unit to J4 range unit
J3 range unit to J3 transmitter unit
J7 range unit to J5 transmitter unit

k. Drive two ground rods at the front of the trailer and connect both to the lug at the side of the junction box shown in figure 18.

CHAPTER 3

OPERATION

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VI. Tracking	39–40

SECTION I

PERSONNEL

■ 23. PERSONNEL.—*a.* Actual operation of the Radio Set SCR–547 requires only three men but, in addition to the basic requirements, consideration must be given to maintaining efficiency in the crew by proper supervision, proper maintenance of equipment, and adequate relief personnel to maintain long alert periods. For these reasons, the personnel requirements for the equipment are expanded to the following complete manning table:

Chief radar operator (NCO)
Range operator
No. 1 Azimuth tracker
No. 2 Elevation tracker
No. 3 Communications operator
No. 4 Tractor driver—relief operator
No. 5 Relief operator
No. 6 Relief operator

b. The maintenance sergeant is responsible for the proper technical operation of the unit. He makes frequent checks on all radio equipment to insure its proper operation and keeps all spare equipment in readiness for use. His duties include other battery radio equipment and his assignment, therefore, is not in the SCR–547 section.

c. The chief radar operator is in command of the unit and is responsible for the efficient training of the crew. He directs the operators in searching for targets and coordinates the radio unit operation with that of the battery range section. His responsibility also includes all maintenance ex-

cluding the radio elements handled by the maintenance sergeant.

SECTION II

ADJUSTMENTS

■ 24. GENERAL.—This section covers a series of adjustments which are made periodically to insure the greatest operation efficiency of the unit. Some of these adjustments are also made each time the instrument is placed in operation but they are duplicated here because they are part of the natural sequence of tests that is applied to the unit. With experience the chief radar operator and the range operator can make all of these checks relieving the maintenance sergeant to accomplish the more exacting work of repair to faulty units.

■ 25. TRANSMITTER ADJUSTMENTS.—The following series of adjustments is the sequence necessary for placing the transmitting components in operation (putting the set "on the air"). See figure 24 except where other references are made.

a. The power supply is adjusted.

b. The filament switch (FILS) on the transmitter is thrown on.

c. The control handwheel on junction box JB–57–A (fig. 18) is adjusted until the line voltage meter on the transmitter front panel is at 115 volts.

d. A check is made through the viewing window on the front of the high voltage rectifier unit (fig. 10) to see that the rectifier filaments are operating. A check is made at the rear of the radio cabinet to make sure the blower is operating.

e. With the plate voltage switch (PLATES) on the transmitter front panel off, a portable voltmeter is attached between terminal 2 on terminal strip No. 1 and terminal 17 on terminal strip No. 2 at the rear of the transmitter drawer. These terminals are the primary leads of the transformer which supplies the magnetron filament. For additional details on these terminal strips see TM 11–1109. The voltage at this point is adjusted to read 104 by means of the "magnetron normal" control on the front panel of the transmitter unit when rectifier No. 6 control (fig. 12) is at its extreme counter-

clockwise position. Mark the position of the magnetron normal control.

f. Rectifier No. 6 control (fig. 12) is now turned to its extreme clockwise position. When in this position the portable voltmeter (step *e*) is adjusted to read 67 volts by means of the "magnetron auto" control on the front panel of the transmitter unit. Mark position of the magnetron auto control.

g. Rectifier No. 6 control is returned to its extreme counterclockwise position, the portable voltmeter is disconnected from the terminal strips, and the inner rear door of the radio cabinet is closed and locked.

h. Plate voltage is now applied to the vacuum tubes in the pedestal units by throwing on the PLATES switch at the front panel of the transmitter unit.

i. The following voltages, which are read on the voltmeter controlled by the transfer switch on the front panel of the transmitter unit, are now adjusted to the values indicated:

(1) Rectifier No. 1 main circuit to 850 volts.
(2) Rectifier No. 2 to 300 volts.
(3) Rectifier No. 3 to 300 volts.

j. The magnetron field current knob control shown in figure 24 is next adjusted to a value of 150 milliamperes.

k. Again using the transfer switch, the following voltages are checked. These voltages are not separately controlled but if the unit is operating properly and the adjustments up to this point have been correctly made the readings do not vary appreciably from—

(1) Rectifier No. 1 auxiliary circuit at 125 volts.
(2) Rectifier No. 5 at 1,200 volts.
(3) Rectifier No. 4 at 250 volts.

l. The base oscillator output (fig. 11) screw control is now adjusted until the pulse circuit current meter (fig. 24) reads 0.6 amperes.

m. Rectifier No. 6 control is turned slowly clockwise and the field current control knob (step *j*) is further adjusted to keep the magnetron current at a value not exceeding 30 milliamperes as the high voltage is brought up to its operating value of 15,000 volts.

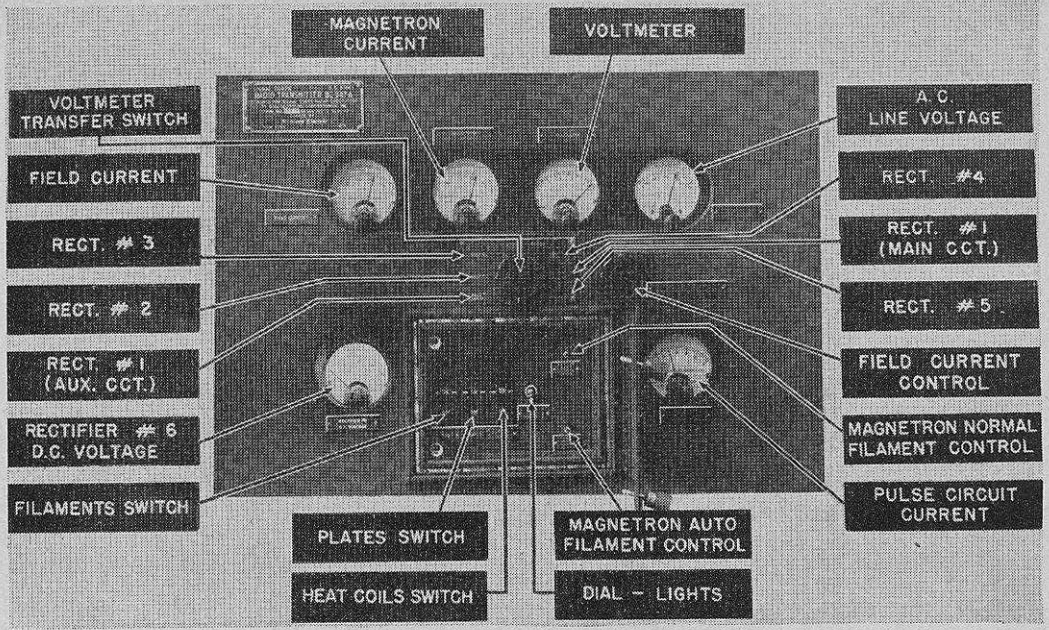


FIGURE 24.—Transmitter unit.

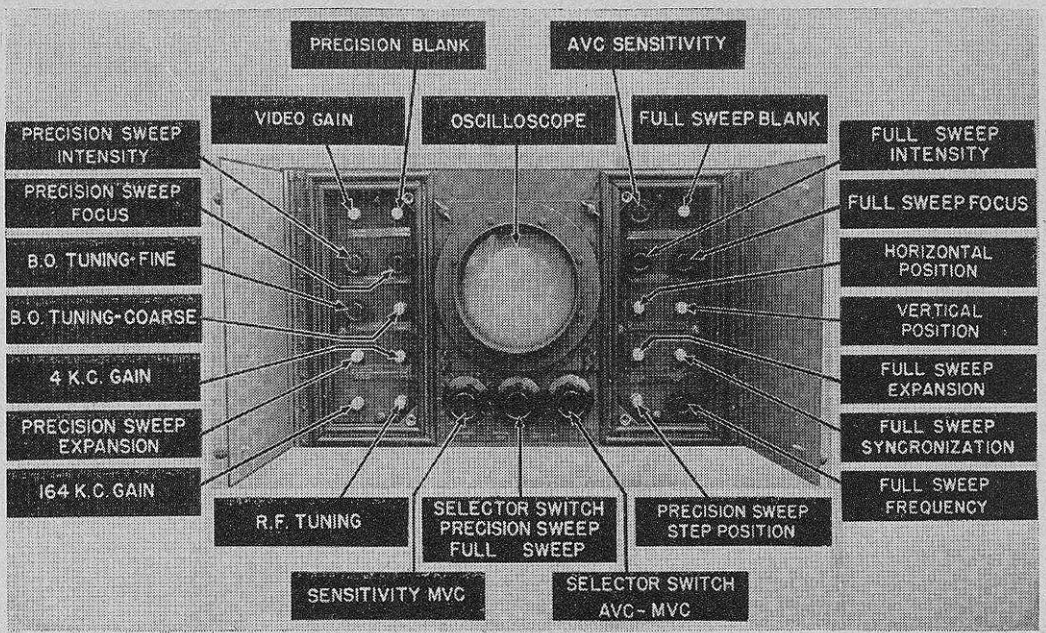


FIGURE 25.—Indicator unit.

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■ 26. INDICATOR ADJUSTMENTS.—After the transmitter has been placed in operation the next step is to make the following adjustments, the controls for which are located on the indicator unit (fig. 25), to bring the indicating components to their maximum efficiency:

a. Throw the sweep selector switch on the indicator unit to FULL SWEEP position.

b. Adjust the full sweep intensity control to secure a bright trace on the oscilloscope screen.

c. Adjust the full sweep expansion control to obtain a sweep approximately 4 inches long.

d. Adjust the full sweep focus to obtain a clear picture on the screen.

e. Adjust the horizontal position and vertical position controls to center the oscilloscope picture.

f. Adjust the full sweep frequency control and then the full sweep synchronization control to the center of the range over which a steady, clearly defined sweep appears.

g. Adjust the full sweep blank control so that the picture seen does not include the main pulse of the transmitter which would otherwise show up during the return trace of the sweep.

h. Throw the sweep selector switch to PRECISION SWEEP position.

i. Adjust the CRO (cathode ray oscilloscope) precision sweep intensity control to secure a bright trace on the oscilloscope screen. Adjust the precision sweep focus control to make the picture clear.

j. Adjust the precision sweep expansion control to obtain a sweep of approximately 4 inches long.

k. Adjust the precision (sweep) blank control to just below the point at which a bright spot at each end of the sweep appears and refocus to make the picture clear.

l. Turn the 4Kc gain control, the 164Kc gain control, and the precision sweep step position control, to their extreme counterclockwise position.

m. Increase the 4Kc gain control to a setting at which the sweep makes a sudden drop and is steady and clearly defined in its lower position.

n. Adjust the precision sweep step position control to bring a slanting portion of the sweep into view on the oscilloscope screen.

o. Adjust the 4Kc gain control to make the slanted portion of the sweep as flat as possible.

p. Set the range dials to read "zero" by means of the range control handwheel. (See fig. 11.)

q. Disconnect the receiving antenna at the jack where it enters the left side of the indicator unit drawer.

r. By means of the phase adjustment (fig. 11), center the left edge of the main pulse on the slanted portion of the sweep.

s. With the AVC–MVC switch set for MVC adjust the sensitivity MVC to a point where the main pulse is just reaching saturation.

t. Increase the 164Kc gain to a setting at which a steady vertical step appears as in figure 15.

u. Center the step on the screen by means of the precision sweep step position control.

v. Using the zero adjustment screw (fig. 11) position the step so that it just touches the left edge of the main pulse.

w. Now run the step out to maximum range with the range slue control. (See fig. 11.) If a step remains visible over the full range the adjustment is correct. If at some point the step is lost the range should be set at this point and the phase adjustment (step *r*) changed to bring a step into view. After readjustment, the step is moved over the full range again. This process is repeated until a setting of the phase adjustment is obtained which maintains a step over the full range of both PRECISION and FULL sweep.

x. Finally, orientation in slant range is rechecked. If adjustment is required, the step is checked again over the full range of the instrument.

■ 27. TRANSMISSION LINE AND RECEIVER.—*a.* With the adjustments completed to this point the next step is to obtain maximum transfer of energy from the transmitter unit into space and from space into the oscilloscope screen on the indicator unit.

b. Certain cases arise, especially after replacement of the magnetron, in which no echoes show up on the oscilloscope

screen because the receiving components are not tuned close enough to the transmitter frequency. Two methods of procedure in such a case may be followed:

(1) The frequency of the receiving and transmitting components can be matched by use of the frequency meter I–140–A. The instruction book accompanying this meter outlines precautions which must be observed in its use. After obtaining the transmitter frequency, the meter is disconnected from its test dipole and reconnected to the indicator unit at the jack on the side of the drawer where the receiving antenna is plugged in. By changing the frequency of the beating oscillator with the **BO COARSE** and **BO FINE** tuning knobs (fig. 25) and reading the frequency indicated by the meter after each adjustment, the beating oscillator is set to a frequency below that of the transmitter in an amount equal to the intermediate frequency. Upon completion of this adjustment the frequency meter is unplugged and the receiving antenna replaced in the jack on the indicator unit.

(2) An experienced range operator can usually short-cut the use of the frequency meter by setting the range dials at zero and manipulating the **BO COARSE** and **FINE** controls until the main pulse can be seen on **PRECISION SWEEP**.

(3) In either of the above cases the adjustments must be refined, after obtaining a picture of the main pulse on **PRECISION SWEEP**, by—

(*a*) Setting for maximum sensitivity with MVC (manual volume control) (fig. 25).

(*b*) Setting the range control handwheel to bring either the main pulse or an echo into view.

(*c*) Adjusting **RF TUNING** and **BO COARSE** controls to lift as much as possible of the sweep into the right edge of the pulse.

(*d*) Adjusting the **BO FINE** control to give as much additional lift as possible to the right edge of the pulse.

c. After the receiver has been tuned to the proper frequency as outlined in *b* above, the transmission lines are tuned. Adjustments are provided in both the transmitter (fig. 26) and receiver transmission lines. Normally these adjustments follow tuning of the receiver and the same pulse

chosen in step (2) of *b* above is used. Figure 26 shows the transmitter transmission line adjustments. The slide adjustment shown in this figure can be set at a point where maximum lift is accomplished on the right edge of the pulse chosen for tuning. The slide must be tightened in this po-

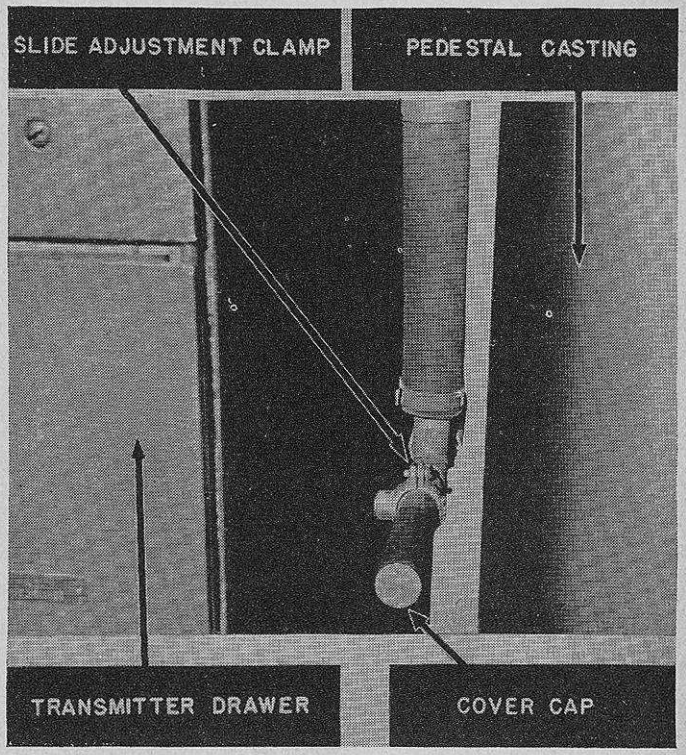


FIGURE 26.—Transmitter feed line adjustment.

sition and refinement of the adjustment made by means of the tuning plug under the cover cap shown in figure 26. This tuning plug adjustment is very broad but a maximum setting can be determined. At certain positions of the slide adjustment, considerable arcing will take place inside the

line. When the line is adjusted to its maximum efficiency, the arcing should be completely eliminated. In most sets, however, there will still be a barely audible whistle of the recurrence frequency of the set. The receiver transmission line adjustment is a tuning plug similar to the one under the cover cap in figure 26 but located immediately at the back of the receiver antenna reflector. This is also a very broad adjustment but again a maximum setting can be determined.

■ 28. RANGE CONVERTER.—Certain adjustments may be necessary at the range converter (fig. 27) to assure correct conversion of slant range into altitude data. These adjustments are made in the following sequence:

a. Place the converter in operation by means of the PLATES and FILS switches.

b. Plug in a portable voltmeter at the plate voltage jack J2 and, using the plate voltage adjustment (fig. 27), adjust to obtain a reading of 5 volts. (For this adjustment use the 10 volt d-c scale of the Weston 772 analyzer and make the connection with cord C-4. The red plug of the cord is connected to the positive terminal of the analyzer and the black plug to the negative terminal.)

c. Set the slant range to 9,000 yards at the range unit and elevate the antenna reflectors to 1,000 mils by means of the elevation handwheel. Allow the "Height in yards" dial to come to rest.

d. Throw the frequency check switch (fig. 27) to the "Test" position.

e. Adjust the coarse and fine frequency controls (fig. 27) until the "Height in yards" dial remains motionless while the antenna reflectors are depressed rapidly.

f. Throw the frequency check switch (step 4) back to its "Normal" position.

g. The unit is now ready for orientation and synchronization in altitude. These adjustments are covered in paragraphs 32 and 35.

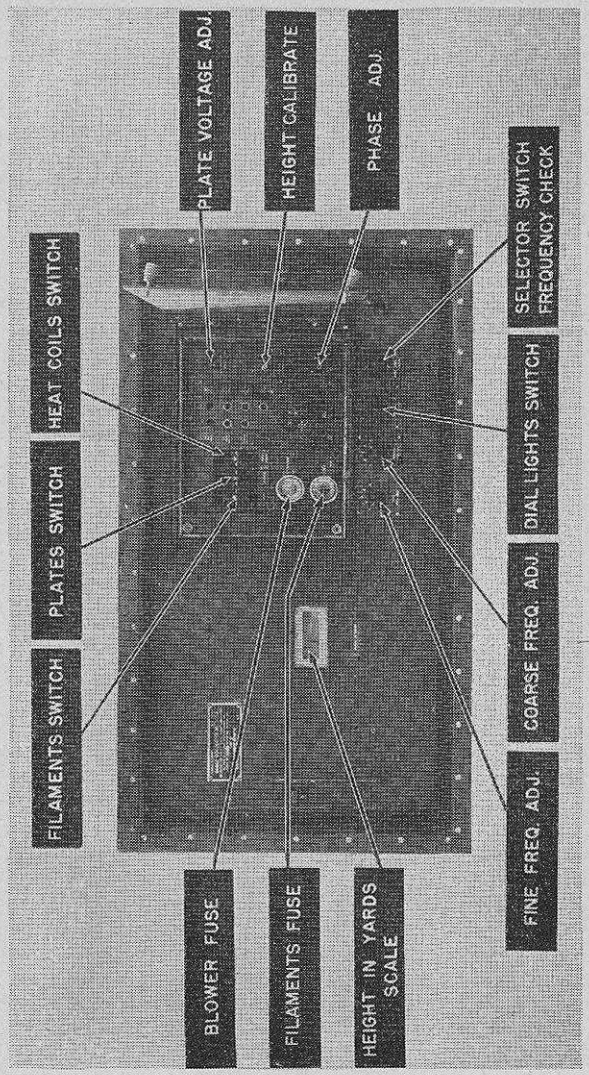


FIGURE 27.—Ranger converter.

SECTION III

ORIENTATION

■ 29. ORIENTATION IN AZIMUTH.—*a.* For this adjustment it is assumed that the azimuth of a reference point has already been established, presumably by the director. The established azimuth may be either the true value or an assumed value.

b. Sight on the assigned reference point through the azimuth telescope of the SCR–547. Loosen the knurled cover cap (fig. 22) over the orientation adjustment of the azimuth indicator. Push in and turn the adjustment to move the outer pointer of the indicator to the proper azimuth reading.

■ 30. ORIENTATION IN ANGULAR HEIGHT.—Orientation in angular height is accomplished when the mount is properly leveled. The leveling process is covered in detail in paragraph 22*g*.

■ 31. ORIENTATION IN SLANT RANGE.—*a.* Orientation in its strictest sense implies an operation involving direction of a line of sight. This paragraph deals with an element of data without regard to its direction but for which the operation performed is very similar to orientation.

b. Orientation in slant range is accomplished by starting the SCR–547 and positioning the *main pulse* in the step just as an echo would be positioned. For this adjustment the set must be operating on PRECISION SWEEP. When the main pulse has been positioned the range dials should read zero range. If there is any variation it must be adjusted by means of the zero adjustment on the front of the range unit.

■ 32. ORIENTATION (OR CALIBRATION) IN ALTITUDE.—*a.* As in paragraph 31, the adjustment covered in this paragraph is not orientation in its strictest sense. Again, however, the operation is closely similar and may be called orientation.

b. Set a slant range of 18,000 yards by means of the range control handwheel. Set the angular height to 533 mils with the elevation tracker's handwheel. Adjust the altitude to

read 9,000 yards by means of the HEIGHT CALIBRATE adjustment on the range converter. As a check, reduce the slant range and check to see that the altitude constantly reads one-half the slant range.

SECTION IV

SYNCHRONIZATION

■ 33. SYNCHRONIZING AZIMUTH.—Synchronization, by definition, is the process by which data receivers are made to agree with their respective transmitters. Between the SCR–547 and the director it is not essential that received and transmitted azimuth agree exactly. The only purpose of synchronization is to assure that both instruments pick up the same target in their telescopes; therefore, a few mils variation between the instruments will not be troublesome. For this reason, then, there is no adjustment provided for the electrical pointer at the SCR–547 to make it agree exactly with the transmitter on the director. The synchronous repeater system is set up at the factory to position itself properly and will perform properly in the field without adjustment unless trouble develops.

■ 34. SYNCHRONIZING ANGULAR HEIGHT.—Synchronization in angular height is also factory adjusted and will require no adjustment unless trouble develops.

■ 35. SYNCHRONIZING ALTITUDE.—This adjustment is made to bring the reading of the altitude on the director to agreement with the reading on the range converter. This is accomplished by pulling out the range converter drawer halfway and removing its cover, exposing the housing of the altitude selsyn. Six screws which hold the selsyn housing are loosened to allow the slotted shaft to turn until the altitude received at the director agrees with the dial on the range converter. The operation is then completed by tightening the screws, replacing the cover, and closing the drawer.

■ 36. SYNCHRONIZING SLANT RANGE.—Directors which take slant range data directly from the SCR–547 may be of two

types, those requiring the data as a voltage and those requiring it as a motion obtained from a synchronous repeater. The problem of synchronizing slant range in either case resolves itself into making the received data at the director agree with the range dial reading at the SCR–547. In the case of the data transmitted as a voltage, the synchronization adjustment is made at the factory and should not require further attention in the field. For synchronous repeater data, the orientation adjustment is on the rear panel of the range unit drawer. This adjustment is turned until the received data at the director agrees with the reading of the slant range dials on the front of the range unit.

SECTION V

DETECTION OF TARGETS

■ 37. SEARCHING.—In general, optical searching is the only practical searching method for the SCR–547. During such search, however, it is desirable to have the radio set in operation on FULL SWEEP with MVC at maximum and have the range operator at his post in order to call the attention of the trackers to distant targets which might show up as radio echoes and yet escape the notice of the optical trackers. If a target is located in this manner the chief of section notifies the battery range section, giving azimuth, elevation, and slant range.

■ 38. ASSIGNMENT.—The battery commander is responsible for the assignment of targets. The radio unit is directed at the same target by means of the azimuth and elevation synchronous receivers. Once the assigned target is observed in the telescopes, tracking is by optical means.

SECTION VI

TRACKING

■ 39. GENERAL.—As is indicated throughout this manual, the radio unit SCR–547 is pointed at the target by means of

optical observing instruments positioned by the azimuth and elevation trackers. It is essential that the elevation tracker realize his is a very important job because the movement of his telescope directly positions the angular height potentiometer which is used in the range converter in the solution of the right triangle to determine altitude. The range operator also occupies an important position. By keeping the echo and the step properly positioned, he determines slant range which is used as the hypotenuse of the right triangle solved in the range converter. With existing fire control systems, the function of the azimuth tracker assumes secondary importance because no firing data depend on exact positioning of the mount in azimuth. However, the SCR–547 may soon be employed in situations where the azimuth of the target will be taken from it and the training of the azimuth tracker should, therefore, be no less diligent than that of any other position.

■ 40. AIDED RANGE TRACKING.—*a*. The problem in range tracking (with the unit set for PRECISION SWEEP) is to position the echo so that its left edge just touches the step. The basic design of the unit is such that on PRECISION SWEEP the step remains stationary. In some production models, however, some movement of the step has been noted. This movement of the step is accompanied by an equal movement of the echo and there is no effect on the range measurement. All models of the SCR–547 are equipped with a mechanism to assist the range operator in positioning the echo with a target that may be changing rapidly in range. By leaving the MOTORS switch (fig. 11) in the OFF position, the RANGE CONTROL handwheel can be used without motor aid in following a target. This, however, is a very laborious process because one turn of the handwheel accomplishes only a 10-yard change in range and if a plane traveling 300 mph were approaching the unit directly, its range would be decreasing at a rate of approximately 150 yards per second, making it necessary for the operator to turn the handwheel at a rate of 15 turns per second to keep the echo in contact

with the step. With the MOTORS switch in the ON position the RANGE CONTROL handwheel controls the variable speed motor drive described in paragraph 17. For a target which is changing its range at a constant rate, it has a setting at which it maintains the echo in any desired position relative to the step. (The following are the effects noted on PRECISION SWEEP. On FULL SWEEP the echo remains fixed and the step moves in opposite directions to those being described.) If, from that position, the handwheel is rotated clockwise one turn and remains in that position the echo moves at a constant rate across the screen to the right. If it is desired to have it move at a faster constant rate, the handwheel must be turned more in a clockwise direction. Similar movement to the left is accomplished by counterclockwise rotation. The limit of the aiding mechanism is finally reached when the echo is moving across the screen at its maximum rate, which is changing slant range at a rate of 299 yards per second. This limit, however, does not prevent further rotation of the handwheel which thereafter acts only to add 10 yards for each turn.

b. The TIME CONSTANT lever may be set in either the SLOW or FAST position. In the SLOW position *one turn* of the range control handwheel adds *25 yards per second* to the rate at which the slant range changes. In the FAST position *one turn* of the handwheel adds *50 yards per second* to the rate. In the first case it would take twelve turns of the handwheel to cause the slant range to reach its maximum rate of change of 299 yards per second. In the second case six turns of the handwheel would bring the slant range up to its maximum rate of change. In addition to changing the rate of change by 25 or 50 yards per second depending on the TIME CONSTANT, each rotation of the RANGE CONTROL handwheel adds 10 yards to the range. This fact is used in conjunction with the RATE CLUTCH. If the echo is not quite in coincidence with the step but is set for the proper rate, the RATE CLUTCH may be depressed and the step and echo brought into coincidence by rotating the handwheel without effecting the rate.

c. Actual tracking is done as follows:

(1) With the unit on FULL SWEEP the step is brought to the echo by use of the RANGE SLUE control. This moves the step at a rate of 3,300 yards per second.

(2) When the step is close to the echo, an approximate rate is established by use of the RANGE CONTROL with the MOTORS switch in the ON position.

(3) The unit is then switched to PRECISION SWEEP and the left edge of the echo is brought to the foot of the step and kept there by use of the RANGE CONTROL.

CHAPTER 4

PREPARATION FOR MOVEMENT

■ 41. SCOPE.—The purpose of this chapter is to present an over-all picture of the operations necessary in preparing the SCR–547 for movement from its operating position. Preparation for movement normally will not be performed by precision drill, but the section will work as a team to accomplish the following procedure under direction of the chief radar operator.

■ 42. PROCEDURE.—The following outline serves as a guide in preparing for movement:

a. Collect all small parts such as wrenches, spare parts, circuit diagrams, and instruction books and store them in their assigned places. If the movement is to be made during darkness, this should be done while it is still light.

b. Remove power and data cables from their operating positions and roll and store them properly in place. Cover caps are provided which must be placed on receptacles as soon as cables are removed.

c. Remove the tracking telescopes by loosening the three knurled thumbscrews. Replace the telescopes in their carrying case.

d. Close and lock all cabinet doors.

e. Traverse the pedestal in azimuth until the vertical plane containing the reflector trunnions is parallel to the trailer chassis as shown in figure 20. Lock the pedestal in azimuth by means of the plunger shown in figure 21.

f. Elevate the reflectors to 1,600 mils and lock them with the plunger lock.

g. Loosen the swing bolts shown in figure 21 and lower the reflectors to traveling position against the clamps shown in figure 22. Attach and tighten the holding clamps.

h. Remove the dipoles and replace them in their carrying case.

i. Install the canvas covers provided for each half of the hinged joint left exposed by step *g*.

j. Raise the pedestal to its locked position by means of the locking screw shown in figure 6.

k. Install the canvas cover over the entire pedestal unit assembly.

l. Lower the trailer from its jacks onto its rear traveling wheels and front caster wheels.

m. Remove the outrigger brace tubes by removal of appropriate pins.

n. Swing the outriggers toward their traveling position. Slide the outrigger brace tubes into the slots provided just before the outrigger jacks reach the trailer platform.

o. After placing the outrigger brace tubes, complete the swing of the outriggers to their traveling positions. Secure the outriggers by sliding the braces into the traveling slot provided and operating the jack handle to bring the foot plate firmly onto the trailer platform. Exercise care in swinging the outriggers over the edge of the platform to avoid damaging the ball-and-socket joint.

p. Remove the rear jack braces and place them in the trailer tool box.

q. Swing the axle hooks up to their traveling position. Raise and pin the rear jack in its traveling position.

r. Back the tractor unit under the universal coupling and lock it in place.

s. Attach the break-away chain and the electric brake cable.

t. Turn on the electric brakes of the truck.

u. Release the trailer parking brake.

v. Raise the caster wheels and pin them in traveling position.

CHAPTER 5

DRILL TABLES

		Paragraphs
SECTION I.	General	43–44
II.	Drill tables	45–57

SECTION I

GENERAL

■ 43. GENERAL.—The accompanying drill tables have been tested and found satisfactory but it is anticipated that minor changes may be necessary to satisfy special local conditions. For the commands EMPLACE and MARCH ORDER the entire crew of eight men have duties, whereas for the usual operating commands only four men have jobs. The drill is set up in this fashion to allow relief personnel to get necessary rest in the field.

■ 44. COMMAND SEQUENCE.—Commands are given in the following sequence:

a. When the unit has just reached a new location, the complete sequence of commands up to the point of getting on target is:

(1) FALL IN.
(2) COUNT OFF.
(3) EMPLACE.
(4) EXAMINE EQUIPMENT followed by REPORT (on equipment.)
(5) TEST OPERATION followed by REPORT (on test).
(6) TARGET assigned either by instructions to match elevation and azimuth pointers or by designating sector.
(7) Report: ON TARGET.

b. When a target has passed out of range and another target is momentarily expected, all equipment is continued in operation and all operators remain in their seats. The command given is CHANGE TARGET or CEASE TRACKING. When a new target is announced, the chief radar operator commands TARGET just as in step *a*.

c. (1) When a target has passed out of range and there is time for a break for the operators, the chief radar operator commands:

(*a*) CEASE TRACKING.
(*b*) REST.

(2) To go back into action, the chief radar operator commands:

(*a*) STAND BY.
(*b*) TARGET.

d. (1) When no targets are expected for some time and the equipment is to be left unmanned, the chief radar operator commands:

(*a*) CEASE TRACKING.
(*b*) CLOSE STATION.

(2) To go back into action, the sequence of commands is:

(*a*) EXAMINE EQUIPMENT.
(*b*) REPORT (on equipment.)
(*c*) TEST OPERATION.
(*d*) REPORT (on test.)
(*e*) TARGET, designating target as in step (1).

e. When location of the unit is to be changed, the entire personnel is assembled and the commands are:

(1) FALL IN.
(2) COUNT OFF.
(3) MARCH ORDER.

SECTI

DRILL

45. COMMAND: EMPLACE.

	a	*b*	*c*	*d*
Range operator.	Sets hand brake on trailer.	Assists Nos. 1 and 6 in removing covers.	Assisted by No. 5, releases the right outrigger from its traveling position. Swings the outrigger and pins the brace in place.	Cranks right outrigger jack to raise caster wheel clear of ground.
No. 1	Starts removing canvas covers assisted by No. 6.	Completes *a*, then loosens clamps holding rear reflector in traveling position.	Obtains rear jack braces from trailer tool box and assists No. 6 in positioning them.	Starts removing cover cap from rear dipole socket.
No. 2	Lowers both caster wheels and pins them in place, assisted by No. 4. Then goes for wrenches. Gives one to No. 1.	Loosens clamps holding front reflector in traveling position.	Assisted by No. 4, releases and positions the left outrigger.	Cranks left outrigger jack to raise caster wheel clear of ground.
No. 3	Starts preparing power supply by installing special junction box in line from M7 power plant to guns.	Continues *a*.	Unreels power cable between mount and special junction box. Connects cable at both ends.	Continues *c*.
No. 4	Assists No. 2.	At the direction of chief radar operator, drives tractor away from mount a short distance. (The tractor is parked after the mount is set up.)	Assists No. 2.	Starts removing cover cap from front dipole socket.
No. 5	Disconnects electric brake cable and safety chain at front of trailer.	Unlocks coupler latch to allow tractor to uncouple.	Assists range operator.	Obtains dipoles from carrying box to deliver one to No. 1 and one to No. 4.

ON II

TABLES

e	*f*	*g*	*h*	*i*
Continues *d*.	Unlocks pedestal from its traveling position with the ratchet wrench	Places rear telescope (handed up by No. 5), attaches cross hair illumination cable, and unlocks rear tracker's handwheel.	Uncovers level vials and directs leveling.	Sets azimuth dial to correspond with orientation azimuth data received by telephone or runner from director.
Installs rear dipole which is handed up by No. 5.	Raises rear reflector to operating position (horizontal).	Assists No. 6 in securing rear reflector in operating position.	Takes post in azimuth tracker's seat to traverse mount at direction of the range operator.	Traverses mount to orienting point.
Continues *d*.	In position at trunnion hinge of front reflector, starts to secure reflector.	Assists No. 4 in securing front reflector in operating position.	Takes post in elevation tracker's seat to depress reflectors to pick up orienting point.	Depresses mount to orienting point.
Continues *c*.	Drives and connects two ground stakes at the trailer.	Continues *f*.	Unreels and connects data cable at junction box and director.	Takes post as telephone operator (assuming that battery communication section has installed phone) or acts as runner.
Installs front dipole which is handed up by No. 5.	Raises front reflector to operating position (horizontal).	Completes *f*, then checks to see that the dipoles both lie along the same straight line.	Takes post at left outrigger jack to assist in leveling.	Drives tractor away from location as directed by chief radar operator.
Having finished with dipoles, goes to obtain telescopes from carrying box.	Continues *e*.	Places front telescope, attaches cross hair illumination cable, and unlocks front tracker's handwheel.	Takes post at right outrigger jack to assist in leveling.	Starts work on local security measures (slit trenches, camouflage, etc.) at direction of chief radar operator.

DRILL TABL

	a	b	c	d
No. 6....	Assists No. 1.	Continues *a*.	Lowers rear jack and axle clamps. Positions braces, assisted by No. 1.	Cranks rear jack to raise rear wheels clear of ground.

ES—Continued

e	f	g	h	i
Continues *d*.	In position at trunnion hinge of rear reflector, starts to secure reflector.	Completes *f*.	Takes post at rear jack to assist in leveling.	Assists No. 5.

46. COMMAND: FALL IN.

Chief radar operator	Takes his position six paces from and facing the center rear of height finder.
Range operator	Takes position on right of No. 2 at close interval.
No. 1	Takes position 40 inches directly in rear of the range operator.
No. 2	Takes position two paces from, one half pace to right of, and facing the chief radar operator.
No. 3	Takes position 40 inches directly in rear of No. 2.
No. 4	Takes position to the left of No. 2 at close interval.
No. 5	Takes position 40 inches directly in rear of No. 4.
No. 6	Takes position to left of No. 4 at close interval.

47. COMMAND: DETAILS, POST.

Chief radar operator	Takes post at range converter.
Range operator	Takes post at oscilloscope.
No. 1 (azimuth tracker)	Takes post in azimuth tracker's seat.
No. 2 (elevation tracker)	Takes post in elevation tracker's seat.
No. 3 (communication operator)	Mans telephone.
No. 4 (tractor driver)	Takes post at the tractor.
No. 5 (relief operator)	Takes post as lookout.
No. 6 (relief operator)	Takes post as lookout.

48. COMMAND: EXAMINE EQUIPMENT.

	a	*b*
Chief radar operator	(1) Commands: EXAMINE EQUIPMENT. (2) Checks range converter to see that all switches are open. (3) Checks power cable connections and makes sure that power supply is ready. (4) Checks data cable connections.	Operates leveling jacks at direction No. 1.
Range operator	(1) Checks readiness of cabinet as follows: (*a*) All switches open. (*b*) Dipoles properly installed. (*c*) Rectifier No. 6 control at minimum. (*d*) HEIGHT-RANGE switch at HEIGHT. (*e*) Patch cords in place. (2) Takes tracking seat during leveling check.	
No. 1	(1) Unlocks pedestal if necessary. (2) Checks motion of azimuth dial as mount is traversed. (3) Checks orientation. (4) Checks level while standing on footrest with No. 2 and range operator in seats.	Directs leveling while standing on footrest.
No. 2	(1) Checks motion of elevation dial as reflectors are depressed. (2) Remains in seat during leveling check.	

49. COMMAND: REPORT.

Chief radar operator.	Commands: REPORT.
Range operator	Reports: CABINET READY.
No. 1	Reports: AZIMUTH IN ORDER.
No. 2	Reports: ELEVATION IN ORDER.

50. COMMAND: TEST OPERATION.

	a	*b*	*c*	*d*
Chief radar operator.	(1) Commands: TEST OPERATION. (2) Closes HEATERS and FILS switches on range converter. (3) Checks to see that range converter blower operates. (4) Closes PLATES switch on range converter.	Adjust HEIGHT CALIBRATE at range converter (par. 34) to read 8,660 yards.	Checks reading of HEIGHT IN YARDS scale on range converter at 7,070 yards. (If this figure is not checked within 10 yards, the height calibration must be reset and the check problem tried again. If problem is solved correctly, proceed to (*d*). If resetting height calibration does not correct trouble, see par. 30 for further adjustments.)	Checks reading of HEIGHT IN YARDS scale on range converter at 5,000 yards.
Range operator.	(1) Closes HEATERS and FILS switches on transmitter. (These switches should be left on for at least 20 minutes at the beginning of a day's operation before high voltage from rectifier No. 6 is applied, in order to minimize danger of flashovers.) (2) Adjusts line voltage to 115 volts. (3) Determines that— (*a*) Blower in cabinet operates. (*b*) High voltage filaments are on (through viewing window). (*c*) Magnetron AUTO and NORMAL adjustments are at marked settings (par. 27).	(1) Determines that HEIGHT RANGE switch is in HEIGHT position. (2) Sets range dial at 10,000 yards. (3) Closes PLATES switch on transmitter. (4) Adjusts voltages as follows: (*a*) Rectifier No. 1 (main CCT) to 850 volts. (*b*) Rectifier No. 2 to 300 volts. (*c*) Rectifier No. 3 to 300 volts.	(1) Adjusts FIELD CURRENT control to give 150 milliamperes and BASE OSCILLATOR OUTPUT to give 0.6 amperes. (2) Checks to see that following voltages are approximately correct: (*a*) Rectifier No. 1 (auxiliary CCT) at 125 volts. (*b*) Rectifier No. 4 at from 200 to 300 volts. (*c*) Rectifier No. 5 at from 1,100 to 1,200 volts.	If unit is thoroughly dried out, starts to apply high voltage by turning rectifier No. 6 control clockwise. As soon as magnetron current starts to increase, the operator changes the FIELD CURRENT CONTROL along with rectifier No. 6 control to reach a reading of 30 milliamperes magnetron current at a voltage of 15,000 volts.

e	*f*	*g*	*h*	*i*
Checks transmission of altitude data to director. Synchronizes selsyn data if necessary (see par. 37).	Continues *e*.	Continues *e*.	Checks altitude synchronization at director with several problems.	Continues *h*.
(1) Sets selector switch at indicator unit for FULL SWEEP. (2) Adjusts full sweep intensity to secure a bright trace on the screen. (3) Adjusts full sweep expansion until trace is about 4 inches long. (4) Adjusts full sweep focus to obtain a clear picture. (5) Positions trace on screen with horizontal and vertical position control. (6) Adjusts the full sweep frequency and then the full sweep synchronization to the center	(1) Sets the selector switch for PRECISION SWEEP. (2) Adjusts precision sweep intensity to secure a bright trace on the screen. (3) Adjusts precision sweep expansion to secure a trace about 4 inches long. (4) Adjusts precision sweep blanking to eliminate a bright spot from each end of the sweep.	(1) Sets range dials to a value larger than 2,000 yards. (2) Turns 4 Kc gain, 164 Kc gain, and step position controls to extreme counterclockwise. (3) Increases 4 Kc gain until sweep makes a distinct drop and becomes clearly defined in lower position. (4) Turns step position control to bring slanted portion of sweep into view. (5) Adjusts 4 Kc gain to make slanted portion as flat as possible. (6) Disconnects receiving antenna at jack on side of indicator unit. (7) Sets range dials to zero.	(1) Turns phase adjustment screw to center left edge of main pulse on slanted portion of sweep. (See par. 28 if no main pulse can be obtained.) (2) With selector set for MVC, adjusts sensitivity until main pulse is about at saturation. (3) Increases 164 Kc gain until one steady vertical step appears near the left edge of the main pulse. (4) Centers step on screen with step position control. (5) Positions left edge of main pulse in step with zero adjustment.	(1) Checks step over full range. If step disappears at any point, it must be brought back into view with the phase adjustment. (See par. 28.) (2) Checks BO tuning. (See par. 29.) (3) Checks transmission line tuning. (See par. 29.)

	a	*b*	*c*	*d*
No. 1	Traverses mount to bring front of radio cabinet toward front of trailer.	No further duties.	No further duties.	No further duties.
No. 2	Takes position in elevation tracker's seat.	Sets elevation at 1,067 mils.	Sets elevation at 890 mils.	Sets elevation at 533 mils.

e	*f*	*g*	*h*	*i*
of the range over which a steady, clearly defined sweep appears. (7) Adjusts full sweep blanking to eliminate the main pulse from the picture.				
No further duties.	No further duties.	No further duties.	No further duties.	No further duties.
Assists chief radar operator.	Continues *e*.	Continues *e*.	Sets various angles of elevation at direction of chief of section.	Continues *h*.

51. COMMAND: REPORT ON TEST.

Chief radar operator	*a.* Commands: REPORT. *b.* Receives reports from other operators and reports to the director: HEIGHT FINDER IN ORDER.
Range operator	RADIO EQUIPMENT IN ORDER.
No. 1	AZIMUTH IN ORDER.
No. 2	ELEVATION IN ORDER.

52. COMMAND: TARGET.

	a	*b*
Chief radar operator.	Commands: TARGET, designating whether to search a certain sector or to match azimuth and elevation pointers.	Watches altitude dial and when altitude is steady, tells range operator that altitude is OK.
Range operator	(1) With unit operating on FULL SWEEP, watches for appearance of echo pulse. (2) Immediately slues step to echo and establishes correct rate of range following. (3) Switches to PRECISION SWEEP and tracks target.	After receiving report from chief radar operator that altitude is OK, he signals the director with a foot switch that data are OK.
No. 1	Traverses mount to pick up target.	
No. 2	Elevates or depresses to pick up target.	

53. COMMAND: CEASE TRACKING.

Chief radar operator.	Commands: CEASE TRACKING.
Range operator No. 1 No. 2	At this command the unit is left in full operation and all men remain at their tracking positions.

54. COMMAND: REST.

Chief radar operator	*a.* Commands: REST. *b.* Turns off PLATES switch at range converter.
Range operator	*a.* Reduces rectifier No. 6 control to minimum. *b.* Turns off PLATES switch on transmitter unit. *c.* Leaves post but remains near unit.
No. 1	*a.* Locks azimuth handwheel. *b.* Leaves post but remains near unit.
No. 2	*a.* Locks elevation handwheel. *b.* Leaves post but remains near unit.

55. COMMAND: STAND BY.

Chief radar operator	*a.* Commands: STAND BY. *b.* Places range converter in full operation.
Range operator	Places radio cabinet in full operation and takes post in tracker's seat.
No. 1	Checks level and remains at post.
No. 2	Takes post in elevation tracker's seat.

56. COMMAND: CLOSE STATION.

Chief radar operator	Commands: CLOSE STATION.
Range operator No. 1 No. 2	At this command the unit is closed to the satisfaction of the chief of section. During training this will probably include removing telescopes, lowering reflectors, removing dipoles, and covering equipment with its regular covers.

57. COMMAND: MARCH ORDER.

	a	*b*	*c*
Range operator	Removes rear telescope from flange and hands it to No. 5.	Locks pedestal in traveling position. Replaces ratchet wrench in trailer tool box.	Continues *b*.
No. 1	Traverses mount to make line of trunnion axis parallel trailer length. Locks handwheel.	Assists No. 6 at rear reflector. Lowers reflector to traveling position.	Tightens rear reflector holding clamps in traveling position.
No. 2	Elevates reflectors and locks handwheel at 1,600 mils.	Assists No. 4 at front reflector. Lowers reflector to traveling position.	Tightens front reflector holding clamps in traveling position.
No. 3	Disconnects power cable. Removes ground stakes.	Disconnects data cable. Starts placing cables on reels.	Continues *b*.
No. 4	Takes position to loosen swing bolts at front reflector.	Loosens swing bolts at front reflector.	Removes front dipole, hands it to No. 5, and replaces socket cover cap.
No. 5	Removes front telescope from flange and takes it and rear telescope from range operator to carrying box.	Places telescopes in carrying box. Returns to mount to get dipoles.	Replaces dipoles in carrying box.
No. 6	Takes position to loosen swing bolts at rear reflector.	Loosens swing bolts at front reflector.	Removes rear dipole, hands it to No. 5, and replaces socket cover cap.

	d	*e*	*f*	*g*
Range operator	Cranks right outrigger jack to lower caster wheel to ground.	Assists No. 5 in disassembling right outrigger and brace tube and placing them in carrying position.	Works with Nos. 1, 2, and 6 in replacing canvas covers.	No further duties.
No. 1	Stands by to assist No. 6.	Assists No. 6 in disassembling rear jack, replacing axle clamps and jack braces. (Rear jack must be raised completely to assure proper road clearance.)	Assists range operator.	Assisted by No. 2, raises caster wheels and pins them in traveling position.
No. 2	Cranks left outrigger jack to lower caster wheel to ground.	Assists No. 4 in disassembling left outrigger and brace tube and placing them in carrying position.	Assists range operator.	Assists No. 1.
No. 3	Continues *b*.	Continues *b*.	Continues *b*.	No further duties.
No. 4	Stands by to assist No. 2.	Works with No. 2.	Backs tractor in place, coupling with trailer.	No further duties.
No. 5	Stands by to assist range operator.	Works with range operator.	Attaches safety chain and electric brake cable.	No further duties.
No. 6	Cranks rear jack to lower rear wheels to ground.	Works with No. 1.	Assists range operator.	No further duties.

APPENDIX I

DESTRUCTION OF EQUIPMENT

■ 1. Tactical situations may arise which will necessitate the destruction of matériel. During a retreat, limitations of time or transportation may make it impossible to evacuate all equipment. If the enemy is successful in surrounding the SCR–547, *and capture is imminent,* equipment must be destroyed or made useless to the enemy. *The destruction of matériel is a command decision to be implemented only on authority delegated by the division or higher commander.* If time does not permit the thorough destruction of all parts, at least the most important features of the matériel should be thoroughly destroyed, and parts essential to operation of the units should be ruined or removed. The same essential parts must be destroyed on all like units to prevent the construction of one complete unit out of several damaged ones by the enemy.

NOTE.—ALL DIAGRAMS AND SCHEMATICS OF THE SCR–547 SHOULD BE DESTROYED BY BURNING BEFORE THE UNIT ENTERS THE ACTIVE COMBAT ZONE, OR LEFT IN THE REAR IN THE HANDS OF THE THEATER COMMANDER.

■ 2. The following methods will insure the effective demolition of the SCR–547 in the field:

a. Open the transmitter drawer and remove the MAGNETRON. ITS DIMENSIONS ARE EXTREMELY IMPORTANT TO THE ENEMY, SO ITS DESTRUCTION SHOULD BE ABSOLUTELY COMPLETE. This is accomplished by smashing the tube with a sledge and breaking it into small parts.

b. Remove the dipoles from the reflectors and smash them so that their dimensions and characteristics are destroyed.

c. Place ½-pound TNT charges as follows: one each in high voltage rectifier unit, transmitter unit, range unit, indicator unit, low voltage rectifier unit, range converter unit, and junction box. Join the charges with primacord (detonating cord) and detonate simultaneously. See FM 5–25 for detailed instructions. Observe a 200-yard safety zone.

d. If no TNT, then thoroughly smash tubes and other parts with a sledge hammer, douse with gasoline, and ignite.

e. Smash the telescopic sights.

f. Ignite an M14 incendiary grenade, if available, under each tire. If not available, damage the tires with a pick, an ax, or machine-gun fire, and/or douse with gasoline and ignite.

g. Destroy all spare parts in a similar manner.

h. In case of vehicles, remove and empty the fire extinguisher. Place a 2-pound TNT charge on top of the clutch housing (the hood must be open if this is to be done properly). Place another 2-pound charge on the left side of the engine as low as possible. Insert tetryl nonelectric caps with at least 5 feet of safety fuze in each charge. Place an incendiary grenade under each tire. Smash open the gasoline tank. Ignite the incendiary grenades and the fuze to the TNT charge. Observe a 200-yard safety zone. Be sure the incendiary fires are going well before setting off the charges.

i. In case of a power plant, remove, empty, and smash the fire extinguisher. Place ½ pound TNT in generator and two ½-pound blocks of TNT on each side of cylinder block near bottom. Smash open the fuel tank. Douse with gasoline and set off charges. Observe a 200-yard safety zone.

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 helpless situation in which they find themselves under such conditions.

■ 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" can oftentimes 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–547 operates at voltages sufficiently high to be dangerous.* Consequently, persons working around equipment of this sort should have the highest respect for the danger involved. The voltages, however, are not sufficiently high to "jump" through any appreciable air gap.

b. Protective switches have been provided in the SCR–547, 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.—*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. 28.)

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 28. 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. 28.)

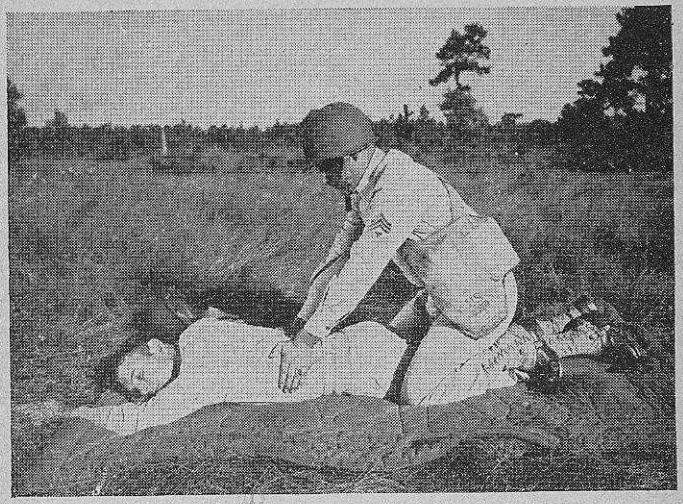


FIGURE 28.—First position of artificial respiration.

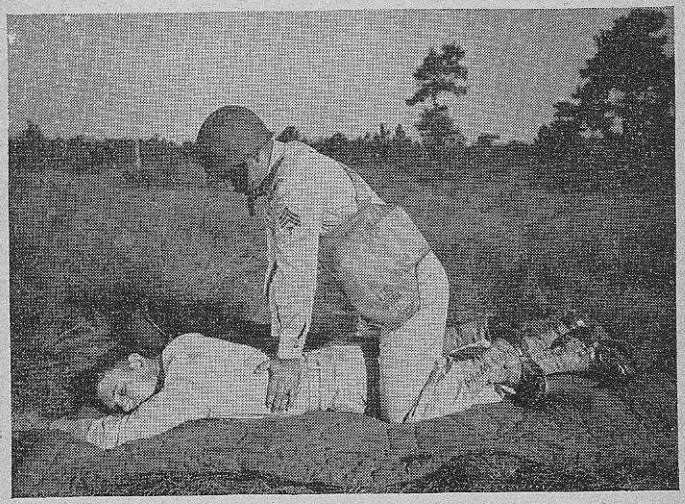


FIGURE 29.—Second position of artificial respiration.

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. 29.) Do not bend your elbows. Do not apply more than 60 pounds of pressure. This operation should take about 2 seconds.

d. Now immediately swing backward so as to remove the pressure completely and suddenly. (See fig. 30.)

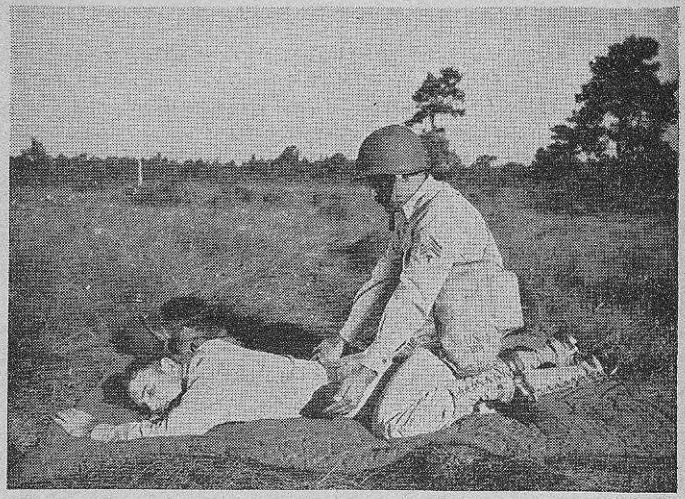


FIGURE 30.—Third position of artificial respiration.

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 12 to 15 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 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 drink of hot 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 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 sudden 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

AVC.—Automatic volume control (AVC) is used to stabilize the echo on the oscilloscope at any desired value.

Bias.—The d-c voltage applied between the control grid and the cathode of an electronic tube.

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.

Fixed echo.—The echo received from the surface of a fixed object such as a watertank or prominent terrain features such as a hill.

Full sweep.—A base line covering slant ranges from 1,000 yards to maximum range.

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

Grid voltage.—The voltage applied between the grid and the cathode of an electronic tube. Normally the grid is negative.

Milliampere.—One thousandth of an ampere.

MVC.—When manual volume control (MVC) is used, the echo will show considerable fluctuations, but its average may be adjusted to any desired value.

Oscillator.—An electronic tube circuit which generates an alternating current usually of some given frequency.

Oscilloscope.—A unit employing a cathode-ray tube, the fluorescent screen of which indicates the presence of high frequency impulses. In the SCR–547, these indications are used for the purpose of determining slant range to the target.

Patch cord.—A cord used to connect two jack terminals.

Pedestal.—That portion of the SCR–547 which rotates in azimuth.

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

Plate voltage.—The voltage applied between the plate and the cathode in an electronic tube. Normally the plate is positive.

Precision sweep.—A base line of the same physical length as "full sweep" but which is actually an electrical magnification of a portion of the "full sweep."

Range operator.—The person who adjusts the relative positions of the echo and the step on the oscilloscope by turning the range handwheel.

Rectifier.—An electrical device for changing alternating current to direct current.

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

Slipring.—A device for making electrical connections between stationary and rotating parts.

Step.—An electrical hairline in the form of an offset in the horizontal base line in the oscilloscope image.

Sweep.—The action of a voltage applied to the horizontal deflecting plates of an oscilloscope so as to produce a base line or time axis.

APPENDIX IV

LIST OF REFERENCES

Camouflage and protective measures	FM 5–20
Chemical attack, defense against	FM 21–40
Communications	FM 24–5
Data transmission system	TM 9–1653
Director M4	FM 4–136 (when published) TM 9–2655
Director M7	FM 4–136 (when published) TM 9–2658
Director M9 and M10	FM 4–138 (when published) TM 9–671
Formations	FM 4–120
Gunnery, antiaircraft	FM 4–110
Motor transportation	FM 25–10
Organization	FM 4–104 (when published)
Radio	TM 11–455
Reference data	FM 4–118 (now published as FM 4–155)
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