

105

TECHNICAL REGULATIONS }  
No. 1210-30 }

WAR DEPARTMENT,  
WASHINGTON, July 16, 1931

RADIO SET, TYPE SCR-132

Prepared under direction of the  
Chief Signal Officer

	Paragraphs
SECTION I. General uses and description.....	1-2
II. Installation for service.....	3-6
III. Operation.....	7-10
IV. Removal from service.....	11-13
V. Function of parts.....	14-18
VI. Care, maintenance, and repair.....	19-21

SECTION I

GENERAL USES AND DESCRIPTION

	Paragraph
Where used.....	1
General description.....	2

1. Where used.—Radio set, type SCR-132, is a ground telephone and telegraph set designed to provide telephone communication up to 100 miles and will normally provide telegraph communication up to four or five times that distance. The set was originally intended for use with radio set, type SCR-135, mounted in bombing planes. As the latter is now obsolescent, it is contemplated that radio set, type SCR-132, will be used in army and corps nets, and will be issued to infantry division signal companies, to operation companies of signal battalions, and to certain units of the Coast Artillery Corps and the Air Corps. At present the set is transported on a 3-ton truck pending the development of an Army radio truck. The set may also be installed permanently, in which manner it is used in some post radio stations.

2. General description.—The transmitting equipment of the radio set, type SCR-132, consists of the radio transmitter, type BC-127; 1 motor generator, type GN-32 (see par. 3 b (3)); 1 panel, type BD-44; and 1 power unit, type PE-40. The set provides continuous wave telegraph (C. W.), tone modulated telegraph (M. C. W.), and telephone operation over the frequency range of 150 to 350 kilocycles. The transmitter will deliver approximately 250 watts to the antenna over this frequency range. The power radiated, using the antenna designed for the set, is between 5 and 10 watts. With a good, high, flat-top antenna, 20 to 30 watts may be radiated. The receiving equipment of the radio set, type SCR-132, consists of the radio tuner, type BC-138, the amplifier, type BC-118-A, and the radio receiver, type BC-131. These pieces of equipment are permanently installed in a chest, type CH-2. Either C. W., M. C. W., or telephone signals can be received over a frequency range of 100 to 1,000 kilocycles. The antenna used for transmitting is a modified umbrella



201

type with an 80-foot mast. This same antenna can be used for receiving also, but better results are obtained when a small 100-foot single-wire antenna, 14 feet high, is used with the receiver.

## SECTION II

## INSTALLATION FOR SERVICE

	Paragraph
Detailed description of the set.....	3
Preparing the set for service.....	4
Installing the set.....	5
Tests and inspections for serviceability, and precautions to be observed.....	6

### 3. Detailed description of the set.—*a. Radio transmitter, type BC-127.*—

(1) The transmitter is mounted in a wooden box, the front of which opens in two sections. The upper section opens upward and is held in position by two stays. The lower section opens downward forming the operator's table. When the front of the set is opened, the transmitter panel is exposed. The components of the transmitter are fastened to an angle-iron frame. It is to this frame that the sections of the wooden box are fastened. The top section of the set box opens for the purpose of inserting and removing tubes. The rear of the box may be opened to permit connections to be made and the side sections of the set box may be taken off by removing a few screws. The transmitter weighs approximately 400 pounds. Its dimensions are as follows: Length, 36 inches; height, 39 inches; and depth, 26 inches. The transmitter is mounted on four legs and when so mounted stands 68 inches high. The legs also serve as carrying handles by coupling them together and securing them in the clasps on the front and back of the box.

(2) Seven vacuum tubes are used in the transmitter—four tubes, type VT-4-B, and three, type VT-22. These tubes are all mounted in a rack at the top of the set box. This rack is held in place by eight coil springs, to prevent the tubes from being broken due to jarring of the set box.

(3) Figure 1 shows a view of the panel of the transmitter. This view shows the way the tubes are mounted in the set and also all the equipment that appears on the panel. All of these controls are plainly marked and the function of each will be discussed later. It will be noticed that the key is attached to the lower section of the set box front and is connected to two binding posts. The microphone is also in view and can be connected as shown, or it can be connected to the two binding posts just below the jack marked MICROPHONE. The two binding posts at the right, marked ANTENNA and COUNTERPOISE, are connected to correspondingly marked binding posts on the receiver when the same antenna is used for receiving and for transmitting. Figure 2 shows a view of the transmitter from the side. This gives some idea of the location of various parts.

(4) The terminal board of the transmitter to which connections are made from the motor generator and the panel, type BD-44, is located on the lower rear part of the set. The binding posts on this terminal are equipped with wing nuts. Figure 3 shows a diagram of this terminal board and also the proper connections between the transmitter, the motor generator, and the panel, type BD-44.

*b. Motor generator, type GN-32.*—(1) The motor generator is permanently mounted on heavy skids. Its packing box fits over it in the manner of a cover



## RADIO SET, TYPE SCR-132

and is secured to the skid base by six studs. It weighs 400 pounds and consists of the following machines mounted on a single base:

2,000-volt, direct-current generator.

110-volt, direct-current generator or motor.

12-volt, direct-current generator.

110-volt or 220-volt, 60-cycle alternating current, single-phase induction motor.

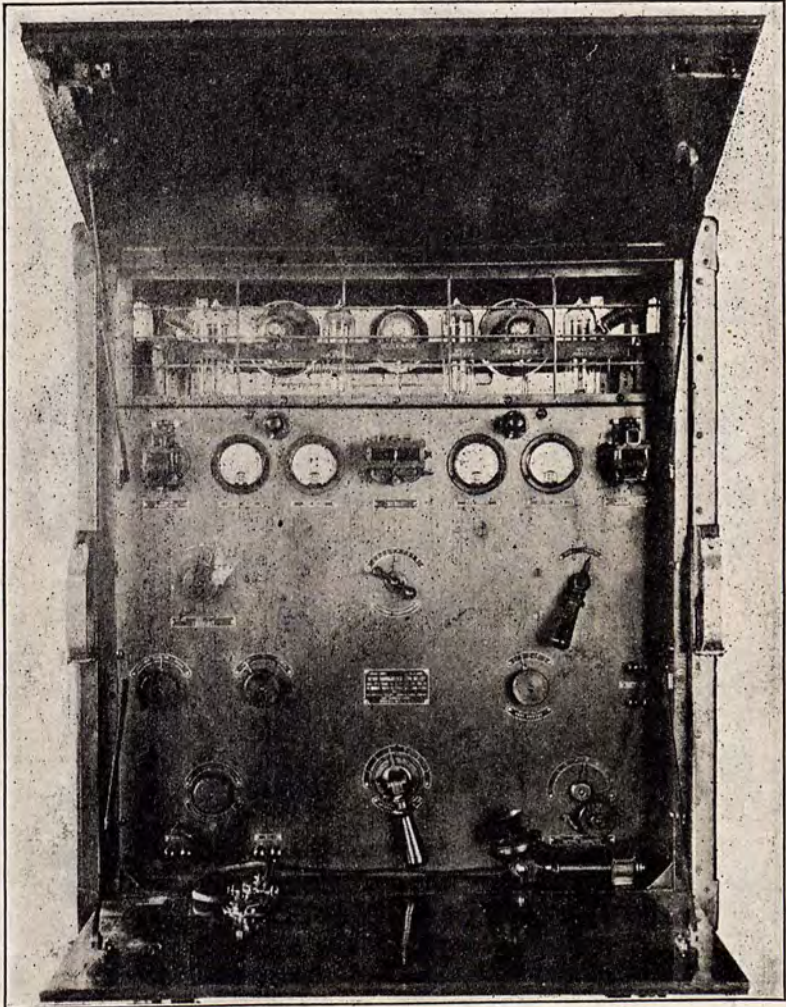


FIGURE 1.—Radio transmitter, type BC-127, front view

The low-voltage generators and the motor have a common shaft and are placed in a common housing. The high-voltage generator is directly coupled to the motor shaft. The 2,000-volt generator has two 1,000-volt commutators so that



an e. m. f. of 1,000 volts is available for the plates of the tubes, type VT-4-B. The terminal strip on the side of this generator has four binding posts as shown in Figure 3. This terminal strip is also shown in Figure 4. The first terminal

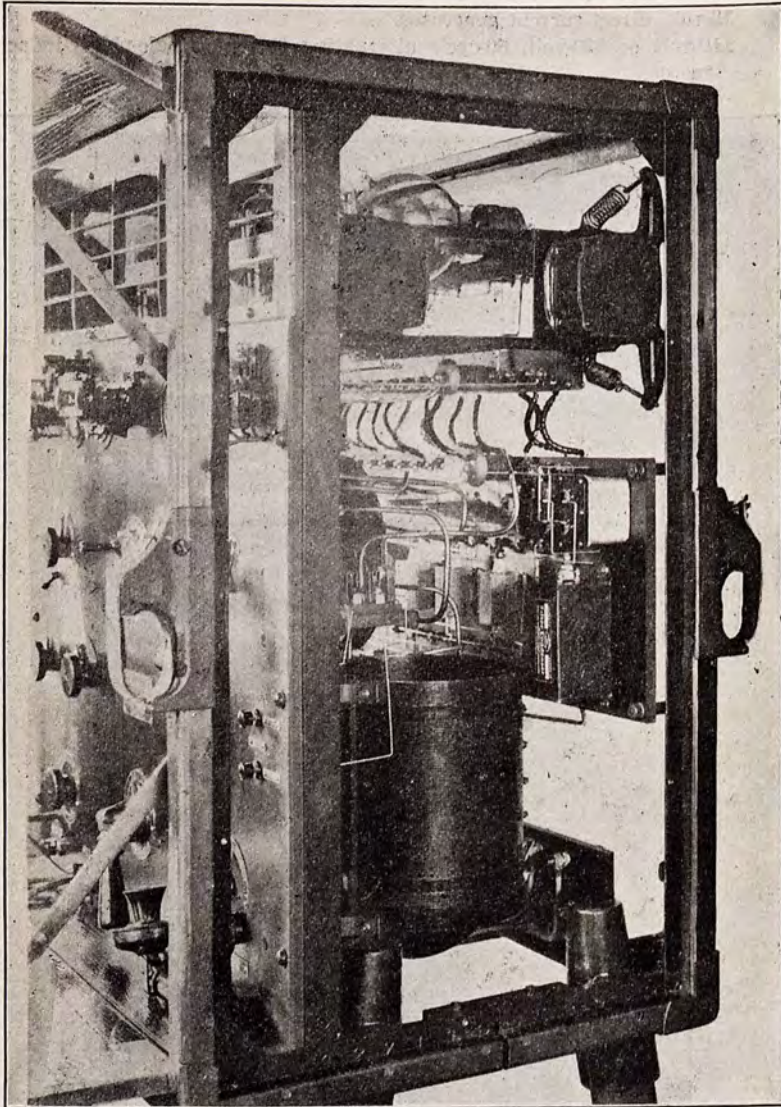
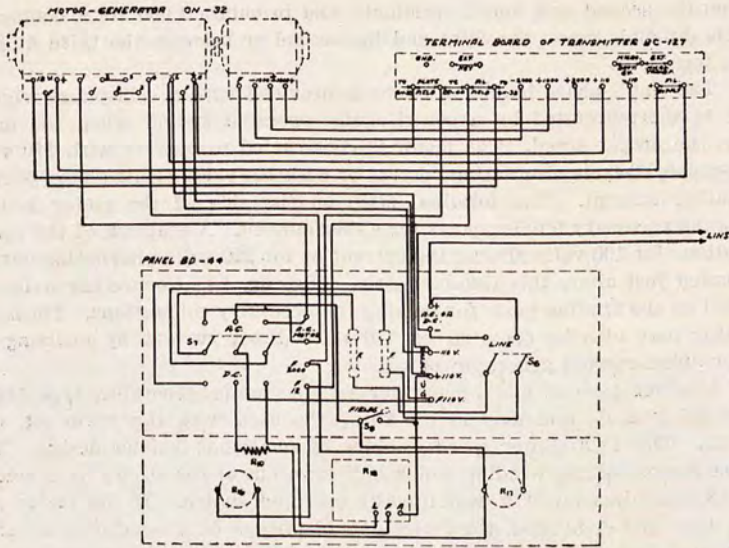


FIGURE 2.—Radio transmitter, type BC-127, side view

from the reader's left, marked F, is for the high-voltage field connection. The second, third, and fourth terminals of some sets are marked as shown in FIGURE 4. In other sets they are marked in the same order as 2,000-, 1,000+, and 2,000+. To obtain 2,000 volts from any of the sets, connection is made

RADIO SET, TYPE SCR-132



- LEGEND**
- R<sub>16</sub> P.I. FIELD RHEOSTAT
  - R<sub>17</sub> PLATE FIELD RHEOSTAT
  - R<sub>18</sub> D.C. MOTOR STARTING BOX
  - S<sub>6</sub> D.C. OR A.C. LINE SWITCH
  - S<sub>7</sub> POWER CHANGE OVER SWITCH
  - S<sub>8</sub> FIELD SWITCH
  - R<sub>19</sub> D.C. MOTOR FIELD REG. 45 W

RL-P-501

RL-D-5281-A

FIGURE 3.—Radio transmitter, type BC-127, external diagram

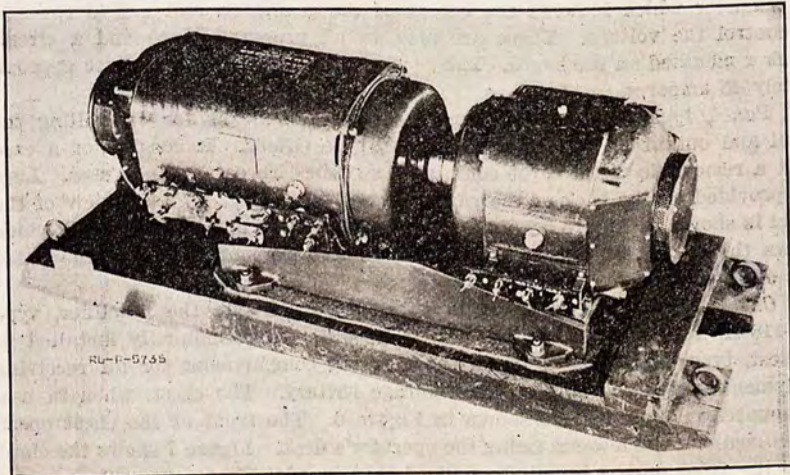


FIGURE 4.—Motor generator, type GN-32, side view



between the second and fourth terminals, and to obtain 1,000 volts, connection is made either between the third and the second or between the third and the fourth terminals.

(2) The single-phase induction motor is provided with a split-phase winding which is short-circuited by a centrifugally operated switch when the motor attains the proper speed. The motor is constructed to operate with 110 volts, single-phase, 60-cycle alternating current or with 220 volts, single-phase, 60-cycle alternating current. The terminal strip on the side of the motor housing carries the necessary binding posts for either current. A diagram of the proper connections for 100 volts alternating current or for 220 volts alternating current is mounted just above this terminal strip. (See fig. 4.) Connecting strips are provided on the binding posts for making the necessary connections. The motor generator may also be operated on 110 volts direct current by utilizing the 110-volt direct-current generator as a motor.

(3) A newer type of motor-generator set, the motor generator, type MG-8, is now being made and may in the future be used with the radio set, type SCR-132. This is a slower speed machine of somewhat heavier design. This machine has a starting winding which is thrown out of the circuit by a voltage operated relay instead of a centrifugally operated switch. If the motor generator, type MG-8, is used, the frame *should always be grounded* as a safety precaution. Due to the fact that this motor generator is not in general use, these regulations do not cover its technical features.

*c. Power unit, type PE-40.*—Where current of the proper voltage is not available for driving the motor generator at the place where the set is to be used, the power unit, type PE-40, is used to drive the motor generator. This unit consists of a 4-cylinder gasoline engine directly coupled to a 5-kilowatt generator. This generator delivers 110 volts direct current and this may be used for driving the motor generator. The engine is similar to a 4-cylinder automobile engine. It is water-cooled, has magneto ignition, and is started by cranking. The whole unit is mounted on skids. There is also a power board, type BD-42, attached to the unit. This power board contains a voltmeter and an ammeter which indicate the output of the generator, and a field rheostat to control the voltage. There are also an oil pressure gauge and a circuit breaker mounted on the board. The generator should normally deliver approximately 45 amperes.

*d. Panel, type BD-44.*—The panel provides the means for controlling the input and output of the motor generator, type GN-32. It consists of a case with a removable metal cover containing switches, rheostats, and fuses. Lugs are provided on the back of the panel for wall mounting. A front view of the panel is shown in Figure 5. Reference should also be made to Figure 3 which shows the wiring of the panel and the connections made between the panel and other equipment.

*e. Chest, type CH-2.*—The radio tuner, type BC-138, the amplifier, type BC-118-A, and the radio receiver, type BC-131, are permanently installed in a chest, type CH-2, which forms the carrying compartment for all receiving equipment except the antenna and storage battery. The chest, when in use, is mounted on four legs as shown in Figure 6. The front of the chest opens in two sections, the lower forming the operator's desk. Figure 7 shows the chest with the front open. It will be noticed that in addition to compartments for the three components already mentioned, it contains five additional compart-



ments for other equipment. The purpose of these compartments can be easily ascertained from Figure 7 or from Figure 8. The diagram in Figure 8 also shows the connections that should be made between the various components. The chest, including its normal contents, weighs about 125 pounds.

*f. Radio tuner, type BC-138.*—A front view of the tuner is shown in Figure 9, and an interior view is shown in Figure 10. The tuner contains a fixed condenser, a variable air condenser, and a variable inductance. There are only three controls on the panel as shown in Figure 9. The lower control varies the capacity of the air condenser, the upper left control varies the inductance of the coil in steps, and the upper right control places grid bias on the first tube in the amplifier. The binding posts at the left are for counter-

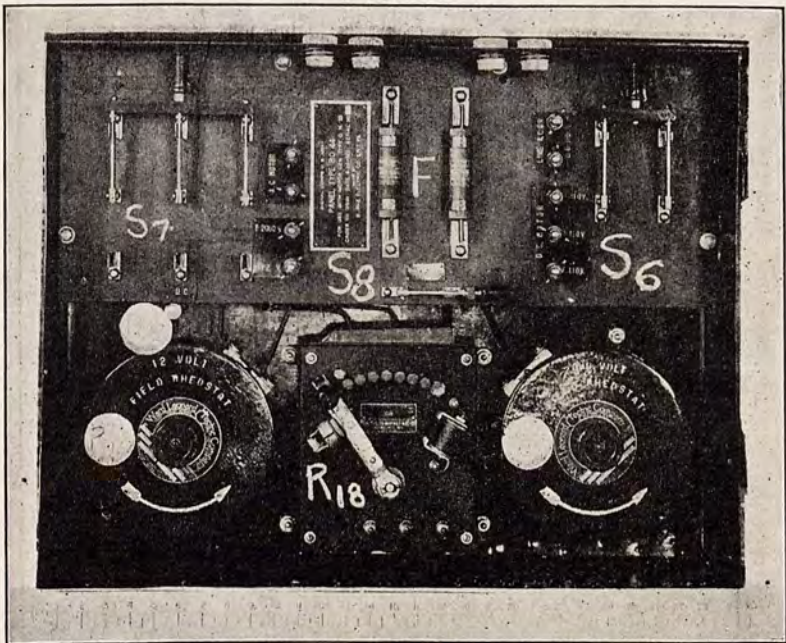


FIGURE 5.—Panel, type BD-44, front view

poise and antenna. Those at the lower right are connected to the input of the amplifier, and the biasing battery, type BA-1, is connected to the upper right-hand binding posts. All are clearly marked.

*g. Radio receiver, type BC-131.*—(1) The receiver consists essentially of two tuned circuits variably coupled and one tube used as a detector. A front view is shown in Figure 11 and an interior view in Figure 12. In addition to the latest model shown in these figures, there is also an older model which may be encountered at times. This older model is easily identified by a buzzer and an R. F. Ampl-Audion switch just to the left of the ammeter. In the receiving circuit of this set, this switch is always left in the Audion position when operating. The older model also has four binding posts along the right edge instead of five. In some of the older models the variable condenser in the primary



tuned circuit is in series with the inductance. In order to use this particular receiver with the amplifier, type BC-118-A, it is necessary to connect this variable condenser in parallel with that inductance.

(2) The radio receiver, type BC-131, is so connected to the amplifier, type BC-118-A, that one of the tuned circuits of the receiver completes the plate circuit of the last stage of radio-frequency amplification in the amplifier. The output of the receiver is then fed back through the audio-frequency stages of the amplifier. This is accomplished by making the proper interconnections

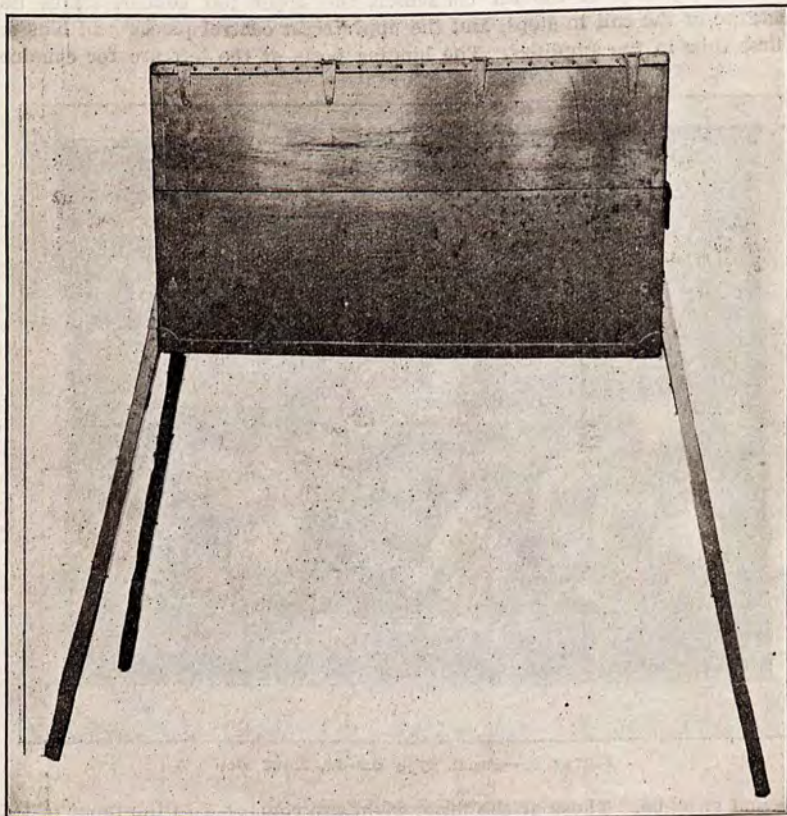


FIGURE 6.—Chest, type CH-2, front view, panel closed

between the two pieces of equipment. The binding posts on the receiver are clearly marked in Figure 8 which also shows the proper connections.

(3) Each of the tuned circuits in the radio receiver, type BC-131, consists of a large tapped inductance and a variable air condenser. The controls for these are shown in Figure 11. The coupling between the two circuits may be varied by means of the control shown in the upper left in Figure 11. The detector is of the grid rectification type using a tube, type VT-5, in an adapter, type FT-65-B. The filament current is regulated at 0.25 ampere by means of the rheostat and ammeter provided on the receiver panel. There is also a tickler coil in the plate circuit of the detector. The coupling between the tickler and



the secondary circuit may be increased by means of the control marked TICKLER from practically zero until it is sufficient to sustain oscillations for C. W. reception. Below this control is located an oscillation test button.

*h. Amplifier, type BC-118-A.*—This amplifier is used in this set to provide four stages of radio-frequency amplification and two stages of audio-frequency amplification using six tubes, type VT-5. A front view is shown in Figure 13

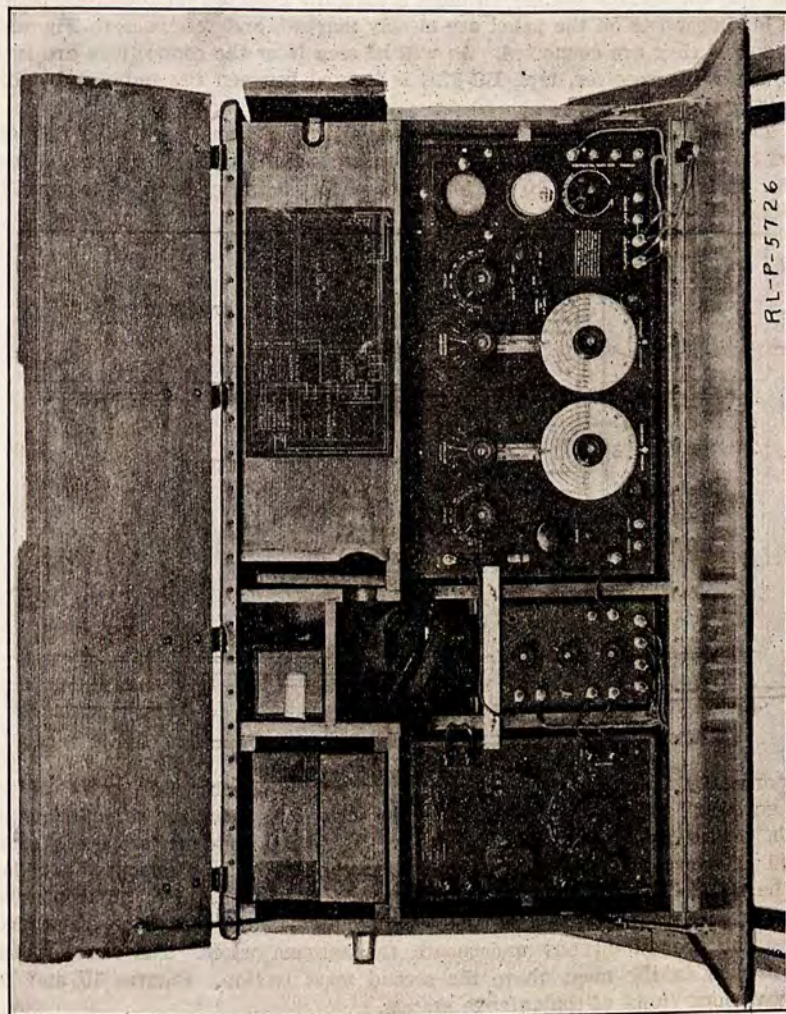


FIGURE 7.—Chest, type CH-2, front view, with all receiving equipment installed

and an interior view in Figure 14. Iron core transformers are provided for coupling between the radio-frequency stages. As any transformer of this type will cover only a limited frequency band, taps on the transformer windings are provided and are controlled by a gang switch. This control is the center knob on the panel and the approximate frequency band covered by each of the four switch settings is engraved on the panel. The RADIO AUDIO-AUDIO switch



appears on the panel just to the left of the frequency control. This switch permits the use of all the stages of amplification in the amplifier or only the audio-frequency stages, as desired. The radio-frequency stages are prevented from oscillating by an adjustable grid bias in the form of a potentiometer across the 2-volt filament circuit. This adjustment on the front panel is marked STABILIZER. All of the tubes are connected in parallel and are supplied from a 2-volt storage battery through a rheostat mounted on the front panel. The binding posts on the panel are clearly marked, and reference to Figure 8 shows how they are connected. As will be seen later the connections are such that the radio receiver, type BC-131, is located between the radio and audio stages of the amplifier.

i. *The transmitting antenna.*—The transmitting antenna used with this set is of the modified umbrella type. The mast is made of steel tubing, 80 feet high. It is composed of 10 sections each 8 feet 5 inches long. The mast is

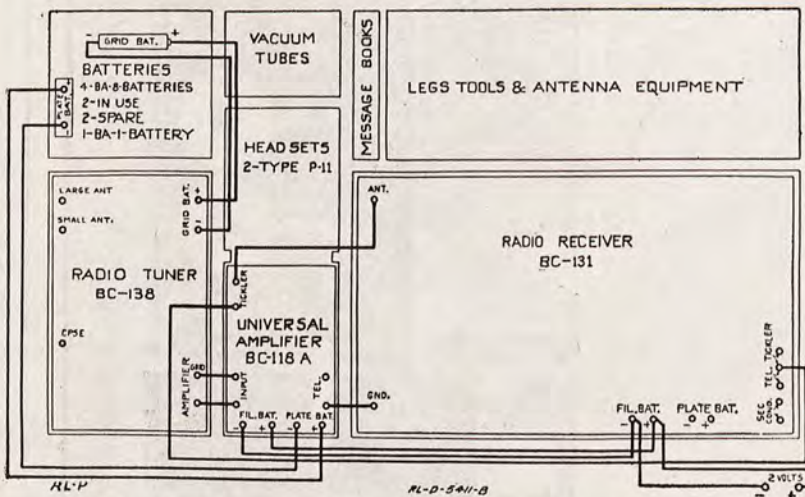


FIGURE 8.—Chest, type CH-2, cording diagram of complete receiver

supported by four sets of guys spaced 90° apart. Each set is composed of five guys. These guys are attached to the mast just above the second, fourth, sixth, eighth and tenth sections, respectively. The antenna proper is composed of two sets of six wires each, arranged in 45° fans on opposite sides of the mast. The center of each fan is midway between two adjacent sets of guys. The counterpoise is also composed of two 6-wire fans suspended above the ground directly underneath the antenna wires. The counterpoise is attached to the mast above the second mast section. Figures 15 and 16 show various views of the antenna system.

j. *The receiving antenna.*—The antenna, type AN-14, is the special small antenna used for the receiving equipment of this set. It consists of a single wire 100 feet long supported by two lance poles 14 feet high. Each lance pole is secured by two guys. The counterpoise is formed by placing a 120-foot length of wire on the ground directly under the antenna. It is possible to use the large transmitting antenna for receiving also and in such cases connec-



tion should be made to the LARGE ANT binding post on the radio tuner, type BC-138. However, the receiver is not so selective when using the large antenna.

4. Preparing the set for service.—*a. Radio transmitter, type BC-127.*—  
(1) Remove the wooden panels from the back, top, and sides of the transmit-

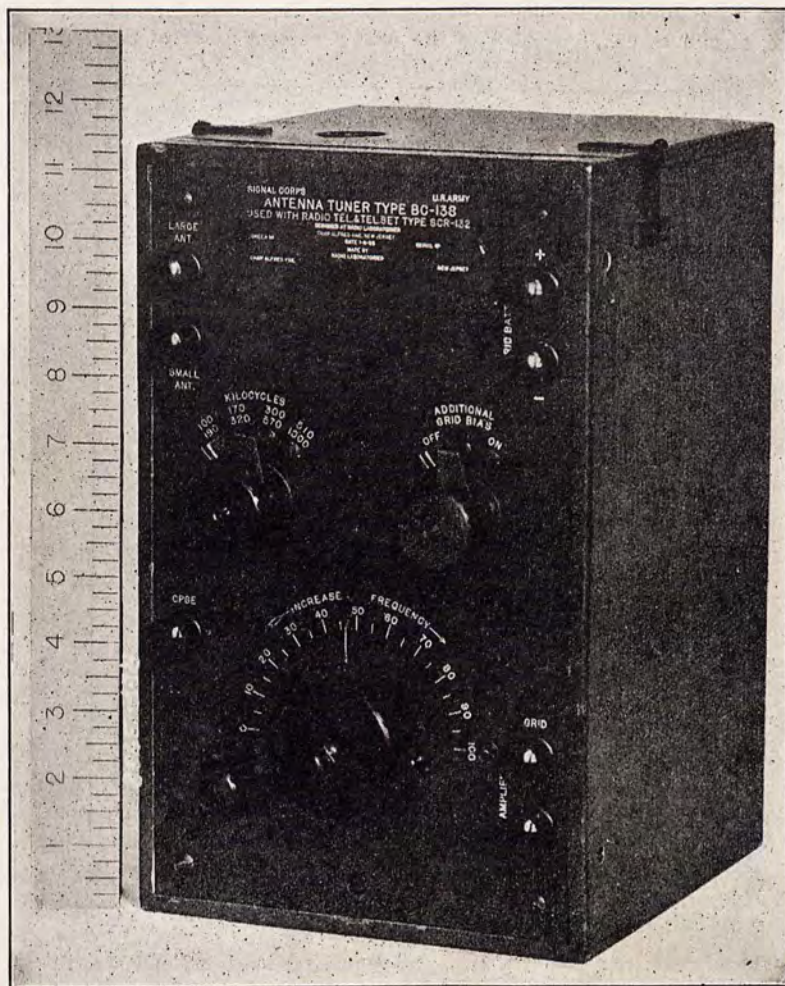


FIGURE 9.—Radio tuner, type BC-138, front view

ter. The set should be thoroughly cleaned using a brush or bellows. Examine the set for loose or broken connections, and tighten or resolder those that need it. Notice that the key cord and microphone are with the set as these are carried in the transmitter set box. Turn all switches and controls on the front panel to see that none of them bind. See that all locking devices work properly. Adjust meters to read zero. See that the two lamps which light



the panel are in place. Be sure that the two stays that hold the upper section of the front panel open are secure. See that the four legs are with the transmitter. Replace the wooden panels.

(2) The tubes for the transmitter are carried in the chest, type CH-1. This chest should be checked to see that it contains 9 tubes, type VT-22, and 12, type VT-4-B. There should also be 12 batteries, type BA-23, in this chest.

(3) In addition to the above there should also be a certain amount of cable, wire, terminals, etc., carried with the set. A careful check of this equipment

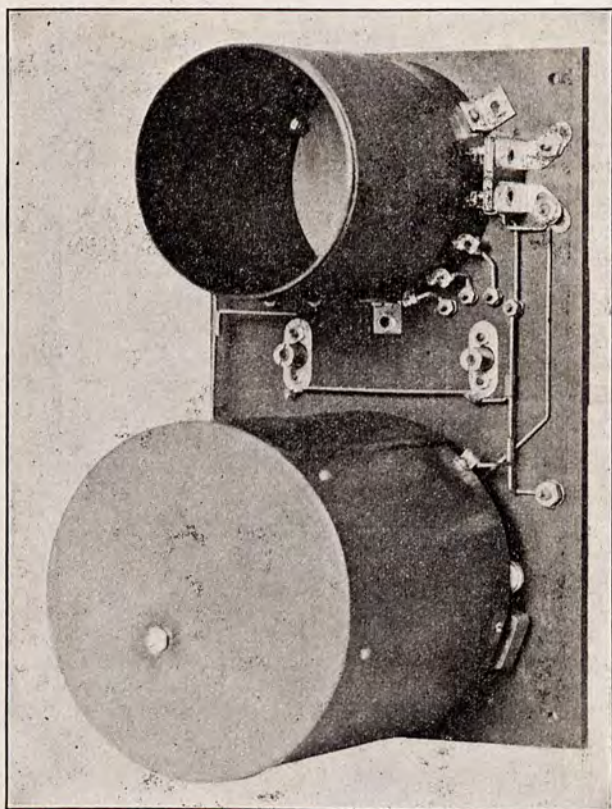


FIGURE 10.—Radio tuner, type BC-138, rear view, cover removed

should be made to see that a sufficient quantity is on hand and also that it is serviceable.

*b. Motor generator, type GN-32.*—All bearings should be oiled. The commutators should be cleaned using only the proper grade of polish. No abrasive material should be used. The brushes should be properly fitted to the commutators and be held there by the proper tension. See that the end covers of the motor generator are held tightly in place. Check the terminals for wing nuts, and see that these nuts can be easily turned to facilitate making connections. Turn the generator by hand to see that it revolves smoothly.



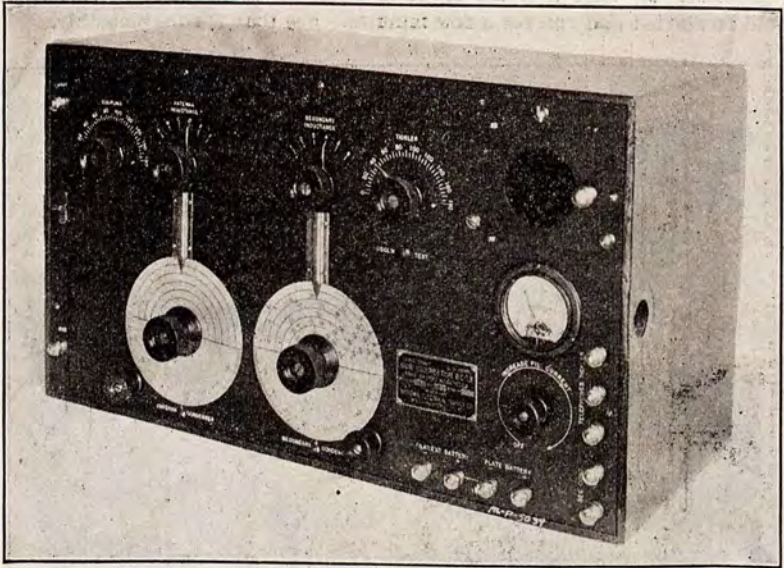


FIGURE 11.—Radio receiver, type BC-131, front view

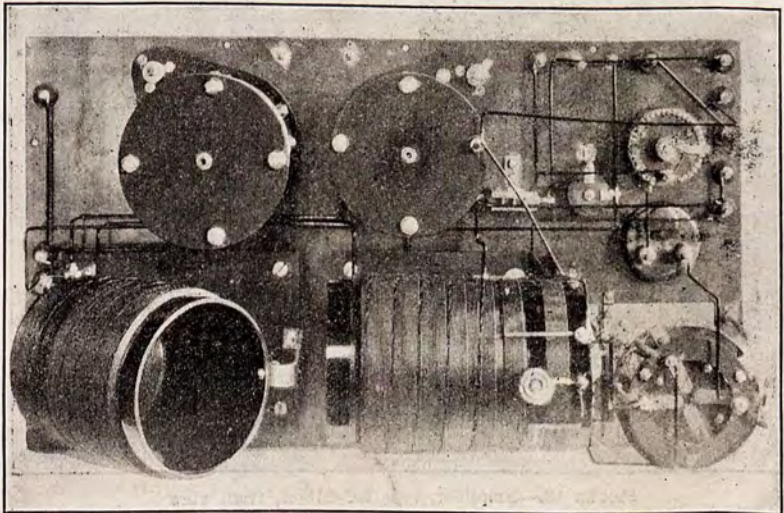


FIGURE 12.—Radio receiver, type BC-131, rear view, cover removed



c. *Power unit, type PE-40.*—Completely oil the power unit and see that the crank case is full of oil. Check the radiator for water and the gasoline tank for gasoline. Be sure that the crank is with the unit. The gasoline engine should be started and run for a few minutes. See that it runs smoothly.

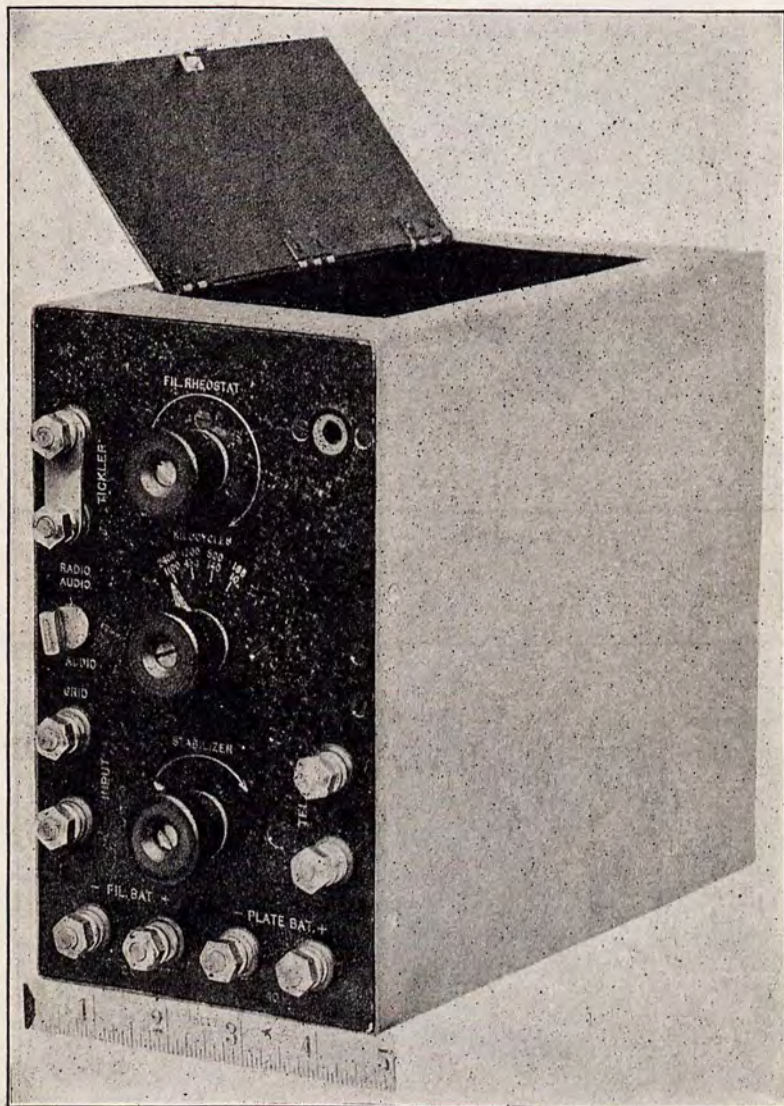


FIGURE 13.—Amplifier, type BC-118-A, front view

d. *Panel, type BD-44.*—Unless it is known that a wall, fence, or some similar object is available on which to mount the panel, a stand should be made of 2 by 4 inch timbers on which the board can be conveniently placed. The fuses



should be checked. The two rheostats and starting switch should move freely. See that all binding posts are equipped with wing nuts and that these can be turned.

*e. Chest, type CH-2.*—By reference to Figure 8 (or the same diagram which is in the chest), check the connections between the radio tuner, type BC-138, the amplifier, type BC-118-A, and the radio receiver, type BC-131. Figure 7 or the diagram in the chest shows in just which compartment each of the parts is to be carried. Check the equipment in each of the compartments against the list in the Signal Corps Supply Catalogue and make sure all the pieces are

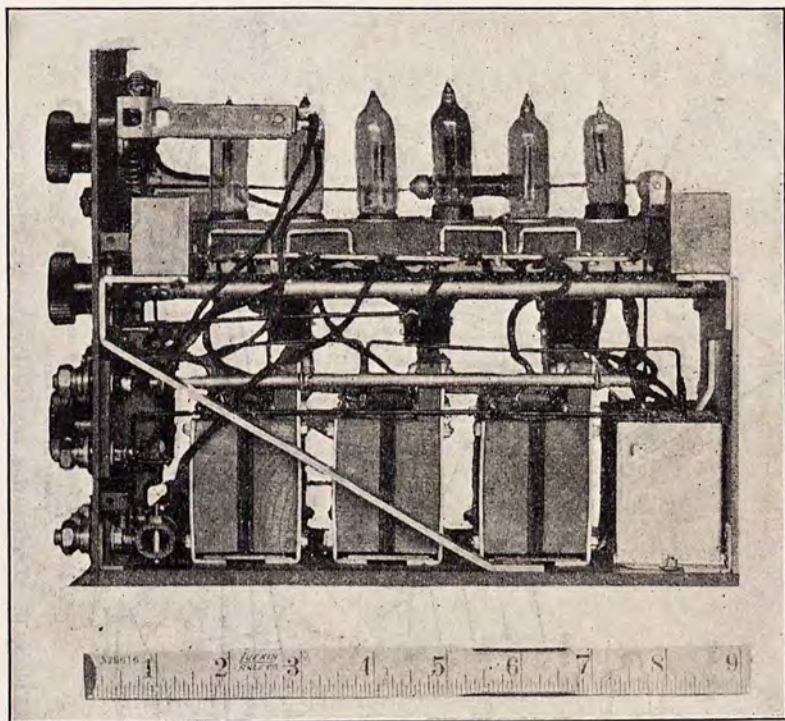


FIGURE 14.—Amplifier, type BC-118-A, side view, cover removed

there. If any part is found to be in an unserviceable condition, replace or repair it. Be sure that the two batteries, type BB-41, are fully charged.

(1) *Radio tuner, type BC-138.*—Loosen the connections to the radio tuner and remove it from the chest. Clean the tuner and inspect it for loose connections. Test all controls to see that they do not jam. Replace the radio tuner and make all connections to it.

(2) *Radio receiver, type BC-131.*—See (1) above.

(3) *Amplifier, type BC-118-A.*—See (1) above.

*f. Antenna equipment.*—All of the transmitting antenna equipment except the mast sections is carried in three chests, type CH-5. Check the equipment in the chests. Inspect the equipment at the same time and make certain that it is in a serviceable condition. The receiving antenna, except the two lance poles, may be carried in one of the chests, type CH-5, or in the chest, type CH-2.



5. Installing the set.—*a. Location.*—The transmitting antenna requires that the ground be fairly level within a radius of 50 feet from the base of the mast. The transmitter and receiver must be under cover of some kind, either in a building or in a tent. If placed in a building, the transmitter and the receiver should be conveniently located in the same room. They should both be on a level footing. The panel, type BD-44, should be mounted on a wall

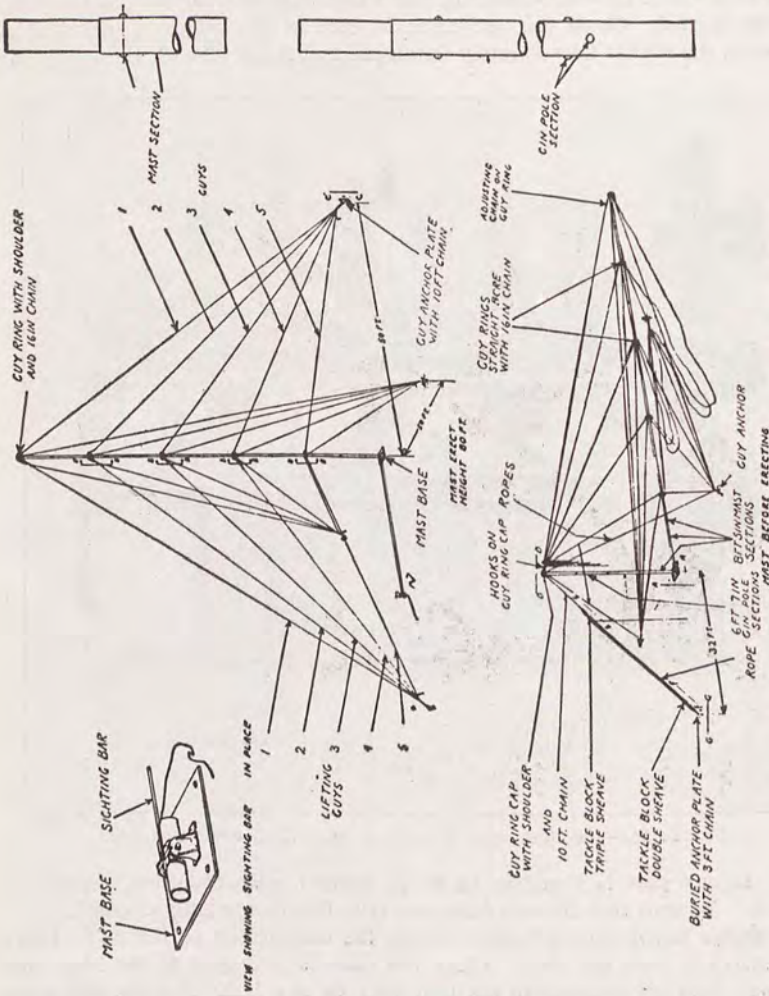


FIGURE 15.—Transmitting antenna system; the 80-foot mast

or on the stand prepared for it close to the transmitter for convenience in starting and stopping the motor generator and controlling the voltage. The motor generator should be located in a different room from the transmitter and receiver or at least 25 or 30 feet away from them to prevent the noise from interfering with the reception of signals or from being picked up by the microphone. It may be possible to locate the radio set, type SCR-132, in a building where 110 volts or 220 volts are available from a commercial or other



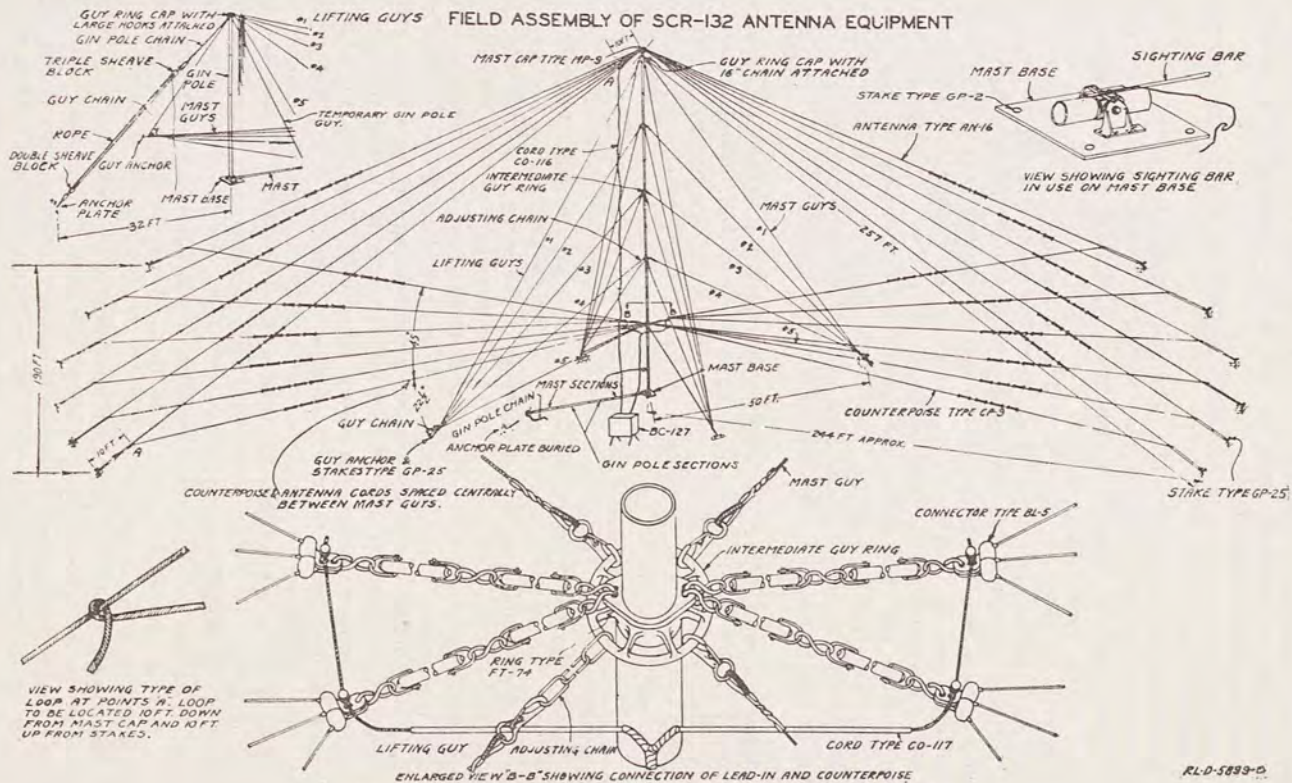


FIGURE 16.—Transmitting antenna system; the 80-foot mast



source. When such is the case, advantage should be taken of the fact. If no current is available, the power unit, type PE-40, must be used. This should be placed as far as practicable from the rest of the equipment so that it does not cause too much interference.

*b. Personnel.*—The set may be completely installed by one noncommissioned officer and four men.

*c. Radio transmitter, type BC-127.*—The radio transmitter should be set up on its legs, and the front wooden panels should be opened. The top and rear panels should then be opened to permit insertion of tubes and the making of external wiring connections. Remove 7 tubes, 3 type VT-22 and 4 type VT-4-B, from the chest, type CH-1, and place the tubes in the transmitter. Remove 4 of the batteries, type BA-23, from the chest, type CH-1. Connect these batteries in series, and then connect them to the binding posts on the terminal strip in rear of the transmitter marked MICRO. BATT. 6 V. Storage batteries may be used if dry batteries are not available. See that the key and microphone are properly connected to the set. Through the rear of the set loosen the wing nuts on the antenna and counterpoise binding posts; push these posts out through the wooden side panel as far as they will go and secure them by means of the wing nuts. The antenna lead will be connected to the binding post marked, A, and the counterpoise to the post marked, C.

*d. Motor generator, type GN-32, and panel, type BD-44.*—The motor generator should be left on its skids; it is unnecessary to bolt or stake it down. Remove the box cover from the motor generator. If alternating current at either 110 or 220 volts is to be used to drive the motor generator, connect the numbered terminals on the side of the motor generator in accordance with the diagram on the side of the machine. Mount the panel, type BD-44, on the wall or stand. (Refer to Figure 3.) If alternating current is to be used, connect the power supply to line terminals of this panel using No. 8, B. & S. wire. Leave the line switch open. Following the diagram in Figure 3, make the other connections between this panel, the motor generator, and the transmitter. Use No. 8, B. & S. wire between this panel and the alternating-current or direct-current motor terminals and also between the motor generator and transmitter 12-volt terminals. If any of these leads are over 25 feet long, it would be well to use two No. 8 wires in parallel, or a larger wire than No. 8 if available (if over 50 feet, use three No. 8 wires or the equivalent, etc.), in order to reduce the voltage drop in the line. No. 16, B. & S. wire may be used for all other connections between this panel, motor generator, and transmitter except for the plus 2,000-volt lead. This should be wire, type W-30, or other highly insulated wire. The -110 V connection from this panel to the motor generator is not required when using alternating-current power. If 110-volt direct current is to be used for the power supply, the alternating-current motor connections between this panel and the motor generator may be omitted. The A. C. to D. C. three-pole switch,  $S_7$ , on this panel should then be thrown to D. C.

*e. Power unit, type PE-40.*—If no other source of power is available at the location of the set, it is necessary to install this unit. This machine should be left on its skids, and it is not necessary to stake or fasten it down in any way. It should be placed at some distance from the transmitter and receiver where it will create a minimum amount of interference. The only connection that



need be made is from the output terminals on the power board, type BD-42, to the line terminals on the panel, type BD-44. Use two No. 8, B. & S. wires for this if the distance is 25 feet or less. If greater, use two wires of this size in parallel for each side of the circuit.

*f. Chest, type CH-2.*—The legs are taken out of the end compartment, and the chest set up on them. The two front wooden panels are then opened. A 5-foot length of wire, type W-8, should be equipped with battery clips at one end and the other end connected to the two binding posts on the radio receiver, type BC-131, marked FILAMENT BATTERY, using the red wire for positive. Connect the end with the clips to one cell of a battery, type BB-41, so as to obtain 2 volts. One battery, type BA-1 (grid), and two batteries, type BA-8, in series, should be connected to the proper terminals in the upper left-hand compartment. Six tubes, type VT-5, should be placed in the amplifier, type BC-118-A, and one tube, type VT-5, placed in the adapter, type FT-65-B, in the radio receiver, type BC-131. A head set, type P-11, should be plugged into the amplifier jack and the ground connection made.

*g. The transmitting antenna, 80-foot mast.*—(1) Before erecting the mast for the first time, a careful study should be made of Figures 15 and 16. Figure 15 shows clearly the disposition of the guys and mast during and after erection.

(2) Stake down the mast base; the hinge stubs should be in the position shown in Figure 15. Two stakes, type GP-2, will be required in hard ground, while in soft ground the plate may sink in sufficiently to prevent slipping.

(3) Using the sighting bar and the 50-foot measuring chain, locate and drive down the four guy anchors (5 inches by 20 inches) as follows: The sighting bar is laid in the notches of the mast base. One man carries out the measuring chain and carefully locates the anchor as directed by another man lying on the ground and looking along the bar, first in one direction for one anchor, then in the opposite direction for the other anchor. The sighting bar is then turned so as to place the long bar in the notches, and the two side anchors are located. Great care should be taken to get the anchors properly lined up and one pair of guys exactly at right angles to the other pair. This is necessary to prevent placing severe strains on the guys while the mast is being raised. Two stakes, type GP-25, are driven into the ground through holes in the guy anchors at an angle of about 45° to the ground level. (See fig. 17②.)

(4) Assemble 10 mast sections, each 8 feet 5 inches long, beginning at the mast base. Guy rings, straight bore with 16 inches of chain attached, are placed at the second, fourth, sixth, and eighth joints, starting from the ground end of the mast. At the second joint, the ring, type FT-74, for the counterpoise is assembled at the same time as the guy ring in the position shown in Figure 16. For the top of the mast a special guy ring cap with internal shoulder and a 16-inch chain is provided.

(5) Assemble the gin pole (4 sections) with the two 6-foot 7-inch sections in the middle. A special guy ring cap, with internal shoulder having a 10-foot chain on one side and two hooks on the other side, is provided for the top of the gin pole.

(6) Use the measuring chain to locate the gin pole anchor plate (10 inches by 20 inches, 3-foot chain attached) 32 feet from the mast base in the line of the gin pole. The 32-foot point on the measuring chain is marked with a brass



tag. The anchor plate is buried as shown in Figure 18 (2). Two stakes, type GP-25, are driven in front of the plate before refilling the hole. Only a narrow groove should be dug for the chain so as not to loosen more ground than is necessary. In frozen ground two stakes, type GP-25, will suffice. If de-

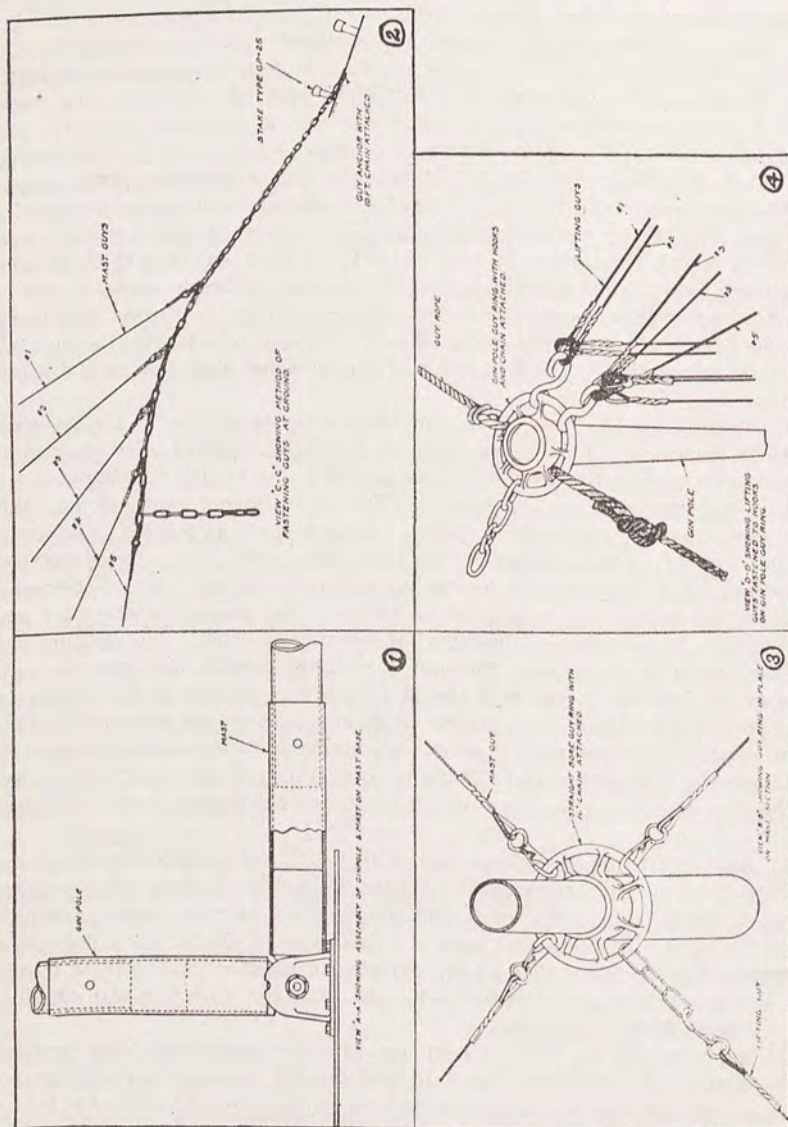


FIGURE 17.—Transmitting antenna system; the 80-foot mast

sired the gin pole anchor plate may be located and set at the same time as the four guy anchor plates.

(7) There are three identical sets of guy wires (5 wires in each set, numbered 1 (top guy), 2, 3, 4, and 5). The fourth set is for use in lifting. In

this set each guy is made up of two parts connected together through thimbles. The forward set of guy wires is now attached to the underside of the guy rings on the mast and then to the forward anchor chain. These wires are laid on the ground under or alongside of the mast so that there will be no danger of their catching on anything when the mast is raised.

(8) Before any other guy wires are attached, the antenna wires and antenna lead-in wire are attached as follows: The antenna wires are engaged to the

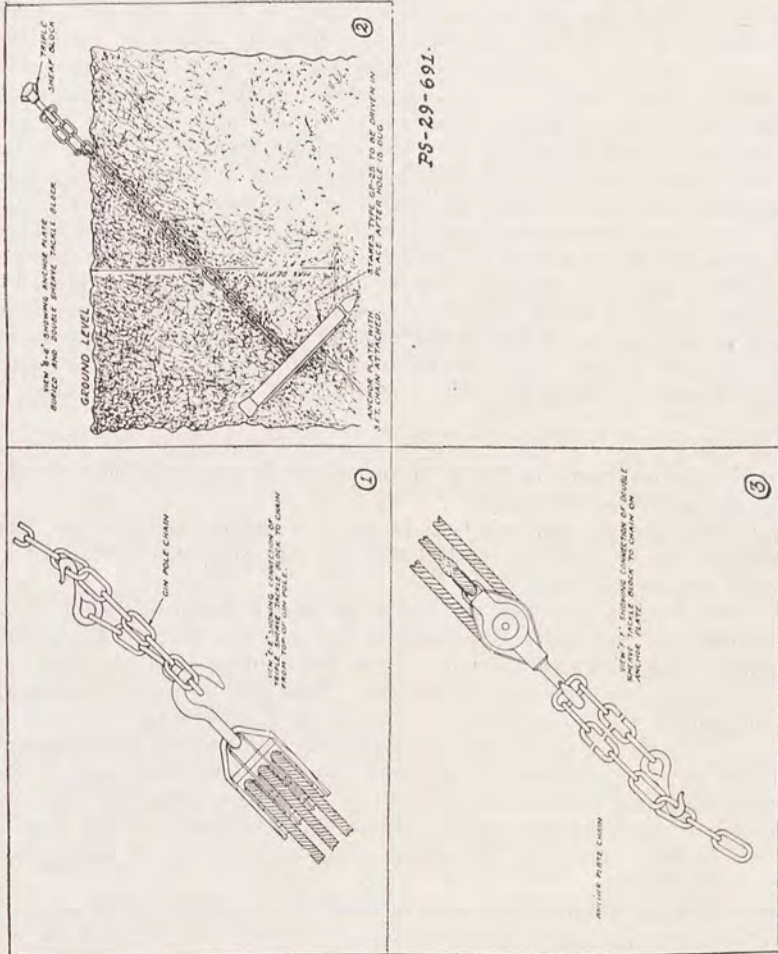


FIGURE 18.—Transmitting antenna system

mast cap as indicated in Figure 16. One groove in the mast cap accommodates three ball connectors. This groove holds the antenna lead-in wire at the bottom in addition to the two antenna wires. The lead-in wires should be tied securely to one of the outside antenna wires about 10 feet from the mast. This is to prevent grounding of this wire against the mast or guys during a wind. Each antenna wire is wound on a reel and has an identification tag marked AN-16. All the antenna wires of one set are then attached and run



out in a direction opposite to that in which the mast is to be raised. Care should be taken to run these wires as nearly as possible in the direction in which they will be when eventually attached to the antenna stakes. The other set of antenna wires is then attached and run along the mast to its base and lashed there. This arrangement of antenna wires will enable the mast to be raised easily and will prevent tangling.

(9) The side guys are then attached and when attached one man should be so stationed as to permit him to sight along the mast. One man should be at each of the side guy anchor plates. The men at the side guy anchor plates should draw up the side guy wires reasonably tight and follow the directions given by the man sighting along the mast so that the mast will be straight. The lifting guys are then attached to the gin pole (by means of the intermediate thimbles of the guys) on the two large hooks on the gin pole ring cap. The short ends of these guys are then left hanging loose. The two 75-foot lengths of rope are then attached to the gin pole ring cap. Each rope is run over to the side guy anchor and tied there. (See fig. 17④).

(10) Now assemble the block and tackle, one end being hooked to the anchor plate chain and the triple block end to the 10-foot gin pole chain. The counterpoise should now be assembled. The balls at one end of the counterpoise wires are connected to the connector, type BL-5. The connectors are then secured by the hooks at the ends of the insulator string fastened to the counterpoise ring, type FT-74. The counterpoise wire hand reels should be unwound only sufficiently to reach the bottom of the mast until after the mast is raised.

(11) The gin pole is then raised to a vertical position in the following manner. One man pulls on No. 1 lifting guy while two other men lift the top of the pole from the ground.

(12) When the gin pole has been raised to a vertical position, the mast ends of the lifting guys are hooked into the adjusting chains attached to each guy ring on the mast.

(13) By means of the block and tackle the mast is raised so that it clears the ground and the tackle is secured in this position during adjustments. Standing at the mast base, one man directs the adjustment of the right and left sets of guys until the mast is straight. These guys should not be hooked up too tightly. The lifting guys will probably need adjustment. This can be determined by looking at the mast from the side. If it is not fairly straight, note the guys which should be adjusted and then lower the mast to the ground. Make the necessary adjustment of the lifting guys and raise the mast clear of the ground as before. Repeat this operation until the mast is straight or very nearly so. It is now ready to be raised to the vertical position.

(14) The mast is raised to an angle of about  $60^\circ$  (two-thirds of the way up), using the block and tackle. From this position it can be easily pulled the rest of the way to the vertical by pulling down on the gin pole. In order that the mast will not reach its vertical position with a jerk, one man should hold the forward set of guys (which have not yet come into play) and by keeping an even tension on all five guys, gradually allow the mast to reach or even slightly pass its final upright position smoothly and without jerking.

(15) The lifting guys are unhooked from the gin pole, one at a time starting with No. 1 (top), and immediately fastened to their guy anchor chain. During

the transfer of the lifting guys to their anchor chain it is very important that the guys be kept under enough tension to prevent the mast from bowing.

(16) Standing at the base and looking up the mast, all bows and curves in the mast can easily be corrected by directing the men at the guy anchor chains to take up or let out the various guys. Care should be taken not to put so great a tension on the guys as to place an unnecessary strain on the mast.

(17) The antenna wires can now be unfastened from the mast and completely unwound from their reels. The antenna wires are carried out and the cords at the ends are secured to the stakes, type GP-25. Each set of six wires forms a 45° fan, the wires being equally spaced in the fan. Each fan should be located midway between two sets of guys.

(18) The counterpoise wires should next be placed as follows: The rope at the end of each counterpoise wire is secured to the rope of the corresponding antenna wire (fig. 16), so that the counterpoise is suspended at a height of about 1 foot from the ground at its lowest point. Suspending the counterpoise clear of the ground in this way greatly reduces the effective resistance and thereby increases the efficiency.

(19) Connect the antenna and counterpoise leads to the transmitter.

*h. The receiving antenna.*—The mast cap forming part of guy, type GY-7, is placed over the metal top of the lance pole, type PO-2. The hook on one end of the antenna, type AN-14, is fastened in the empty eye of the mast top. The lance pole is then placed erect and the guys attached to stakes so that the two guys and antenna wire make three equal angles around the mast. The antenna wire is then carried out to its full length of 100 feet and the second lance pole is erected. A 120-foot length of wire, type W-29, is used as counterpoise and laid on the ground directly under the antenna. Connect the counterpoise wire and antenna lead to the proper binding posts on the radio tuner, type BC-138.

*i. Remote control.*—(1) Telephony or telegraphy may be carried on from a remote point by proper external connections and by placing the LOCAL-REMOTE switch on the transmitter in the REMOTE position. For telephony up to a distance of 5 miles a microphone battery and a suitable transformer (General Electric Co. UP-414) are set up at the remote point. The output of the microphone transformer then connects through the extension line to the microphone transformer in the transmitter. The equipment will permit a reasonable percentage of modulation to be obtained through 5 miles of wire, type W-40. The degree of modulation increases as the length of line decreases. For telegraphy, communication may be carried on through approximately 10 miles of twisted pair. When the remote feature is in use, an attendant must be on duty at the transmitter to start the generator, make adjustments, etc. An additional wire telephone line should be installed to provide continuous communication between this attendant and the operator. In order to provide for remote control of both telegraph and telephone the following arrangement is suggested:

- (a) Install at the remote station the microphone, microphone battery, transformer (General Electric Co. UP-414) and a key.
- (b) A 3-pair cable (or a 4-pair cable if the telephone line is to be included) should be installed between the remote point and the transmitter.



- (c) Connect the pair from the microphone battery and transformer to the binding posts on the rear terminal strip of the transmitter marked EXT. MICRO. TRANSF.
- (d) Connect the pair from the key to the binding posts on the terminal strip marked EXT. KEY.
- (e) Connect a pair to a headset, type P-11, at the remote station, and to the auxiliary TEL. binding posts of the amplifier, type BC-118-A, at the radio receiving station.

(2) A radio control box, type BC-142, is required for remote operation of this set. A top view of this control box is shown in Figure 19, and a view with the panel turned upside down to show the transformer is shown in Figure 20. This box provides the circuits as shown on the cover in Figure 19 and also provides space for conveniently carrying the transmitter, type T-12 (microphone); headset, type P-11; key, type J-2; and four batteries, type BA-23; all of which are required in the operation of the remote-control station.

*j. Duplex operation.*—Duplex operation is secured by setting up the receiving antenna and equipment at a distance from the radio transmitter. Duplex operation can then be secured with another similar set operated in the same way on a slightly different frequency. The difference in frequency required will depend upon the distance between each transmitter and its receiver, as the interfering signal from the local transmitter must not be so strong as to paralyze the receiver.

3. Tests and inspections for serviceability, and precautions to be observed.—*a. Radio transmitter, type BC-127.*—Always begin the tuning-up process with a plate voltage not in excess of 1,000 volts and with a loose coupling of the antenna transformer. Tubes should not be worked above a point where the plates become a yellowish-red color. A cherry-red to bright-red color indicates a safe operating condition, except for tubes, type VT-4-B (Western Electric Co., 50-watt), which should not become hotter than a dull red. Always stop the generator before making adjustments or repairs within set, since high voltage is present even with the SEND-RECEIVE switch thrown to RECEIVE, or with the fields switch, S, on the panel, type BD-44, open, due to residual magnetism in the 2,000-volt generator field. While tuning do not keep the key closed for more than a few seconds at a time as the tubes will overheat when the circuits are untuned.

*b. Motor generator, type GN-32.*—(1) The motor generator, when in continuous use, should be oiled at all four bearings with a few drops of oil once a week. Ball bearings are used, which require very little lubrication. An excess of oil will cause the commutators to become coated, interfering with proper commutation. The lubricating oil should be of medium body. Both oiling tubes of the motor unit are on the same side as the terminal strip. Both oiling tubes of the 2,000-volt generator are on the side opposite the terminal strip.

(2) During operation of the motor generator considerable carbon dust may be formed by the action of the brushes on the four commutators. Every time the machine is oiled the commutators and brush holders should be wiped clean by means of a dry cloth. A hand bellows should also be used if available. If carbon dust accumulates on the high-voltage commutator or brush holders, it may cause a flash over and a consequent breakdown of the insulation.

(3) To oil and clean the motor generator it is necessary first to remove the plates, each one of which is fastened by six screws at the two ends of the



## RADIO SET, TYPE SCR-132

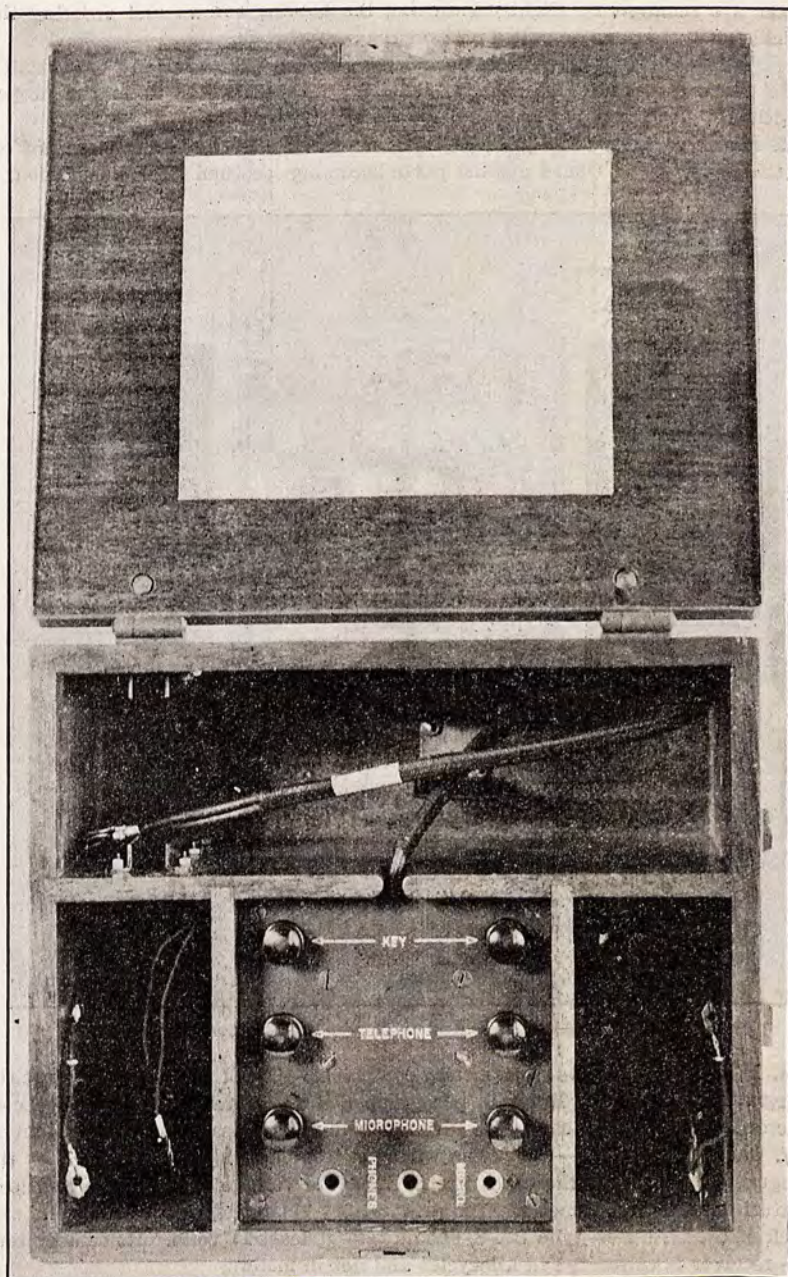


FIGURE 19.—Radio control box, type BC-142, top view



motor generator and by the curved end shields at the coupling bearings. The latter are removed by slightly loosening the holding screws and twisting the shields until they can be pulled off over the screw heads.

*c. Panel, type BD-44.*—Check the wiring between the panel and other units. Also check the fuses. Be sure that the A. C.-D. C. switch is in the proper position.

*d. Power unit, type PE-40.*—Keep this unit well oiled and keep plenty of oil in the crank case. Guard against parts becoming loosened due to vibration.

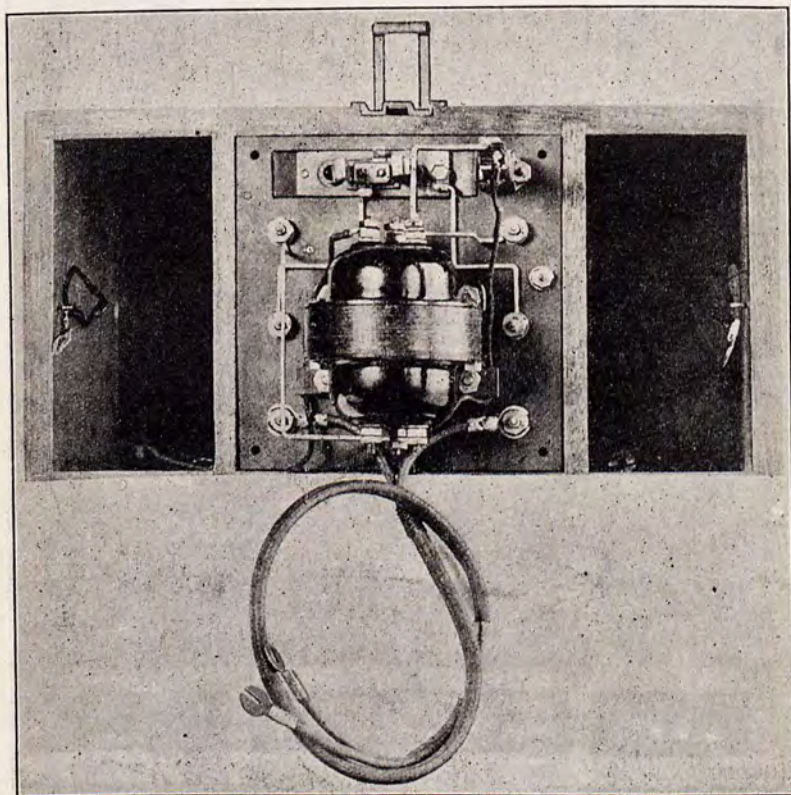


FIGURE 20.—Radio control box, type BC-142, bottom view

*e. Power leads for the transmitting equipment.*—Check the wiring against the diagram in Figure 3. Refer to paragraph 5 *d* and note that proper size conductor is used in each case. Be sure the high-voltage leads are well insulated.

*f. Chest, type CH-2.*—Check the wiring of the chest against Figure 8 or the diagram contained in the chest itself. Test the voltage of the plate and grid batteries with the voltmeter. The grid battery should test at least 2 volts and each of the batteries, type BA-8, should test at least 17 volts. Remember that the receiver is calibrated in kilocycles and not in meters.

*g. Storage batteries.*—The parts list for radio set, type SCR-132, includes two batteries, type BB-41. However, any storage battery may be used with



the receiver. The important thing to remember is that the tube filaments require only 2 volts, which necessitates splitting the battery. The filament rheostat will not protect the tubes against 4 volts.

*h. Antenna equipment.*—Make certain no part of the receiving antenna comes in contact with the transmitting antenna. If the transmitting antenna is to be used for receiving also, connect the antenna lead from the radio tuner, type BC-138, to the antenna binding post on the panel of the transmitter and *do not* merely attach it to some part of the lead-in from the transmitting antenna. If the latter is done, the coil in the tuner will be burned out when transmitting. If the 100-foot receiving antenna is erected close to the umbrella antenna, some provision must be made to short-circuit the receiver input whenever the transmitter is radiating. For telegraph only, this can be accomplished with an auxiliary key relay. A shorting switch may be used for voice modulation.

SECTION III

OPERATION

	Paragraph
To transmit.....	7
To receive.....	8
Remote control operation.....	9
Duplex operation.....	10

7. To transmit.—*a.* Line switch,  $S_6$ , and fields switch,  $S_8$ , on the panel, type BD-44, should be open when the set is not being operated. Switch,  $S_1$ , may be left thrown to A. C. or D. C. according to the kind of power used.

*b.* Turn the 12-volt field rheostat,  $R_{10}$ , and the 2,000-volt field rheostat,  $R_{11}$ , on the panel in a clockwise direction to the minimum voltage position.

*c.* Turn the filament field rheostat on the radio transmitter, type BC-127, clockwise to the minimum voltage position.

*d.* Open or remove the top panel of the transmitter to aid in cooling the tubes.

*e.* Set the SEND-RECEIVE switch on RECEIVE.

*f.* Reduce coupling of the antenna transformer to a minimum by means of the control marked ANTENNA TRANSFORMER.

*g.* Set the LOCAL-REMOTE switch on LOCAL.

*h.* See that the FILAMENT BURN OUT RELAY and PLATE CIRCUIT OVERLOAD RELAY are set to operate; that is, with their plungers down.

*i.* Set the signal switch,  $S_5$ , on the left of the transmitter panel on TELEGRAPH TONE.

*j.* Release the lock on the control marked FREQUENCY, and set the frequency of the master oscillator to the desired value. The adjustment may then be locked by the small lock near the control knob which is provided for this purpose.

*k.* Set the ANTENNA INDUCTANCE switch pointer to a position on its scale corresponding to the position of the FREQUENCY pointer on its scale.

*l.* The motor generator can now be started. Close line switch,  $S_6$ , on the panel, type BD-44. If alternating current power is being used this will start the alternating current motor. If direct-current power is being used, move the handle of the starting box,  $R_{12}$ , slowly to the right. When the machine has attained full speed, the handle will be held in the running position by the electro-magnet.

*m.* Close the fields switch,  $S_8$ , on the panel. This switch is in series with the lead common to all generator field circuits.



*n.* With the motor generator running, press the transmitting key a few times to determine whether the key relay is operating. This relay works on the 110-volt direct current supplied by the motor generator or from the 110-volt direct-current supply if the latter is used as a source of power.

*o.* Throw the SEND-RECEIVE switch on the transmitter to SEND.

*p.* Turn the 12-VOLT FIELD RHEOSTAT on the panel until the filament voltmeter on the transmitter reads 11 volts. Now turn the signal switch, *S*<sub>1</sub>, to TELEG. U. W. Adjust the filament field rheostat on the transmitter until the filament voltmeter again reads 11 volts. By this arrangement the filament voltage remains at 11 volts, with the signal switch, *S*<sub>1</sub>, on either TELEG. TONE, TELEG. U. W., or PHONE.

*q.* Turn the 2,000-volt field rheostat on the panel until the plate voltmeter on the transmitter reads 1,000 volts. This permits tuning with low power.

*r.* With the key depressed, turn the ANTENNA VARIOMETER knob through its full scale or until a deflection of the ANTENNA CURRENT meter needle is noted. This control has a fine adjustment control which must be used since the setting for maximum output is critical. If no deflection is obtained, release the key and reset the ANTENNA INDUCTANCE switch one point above or below its first setting as judgment may dictate. Press the key and retune with ANTENNA VARIOMETER.

*s.* When a deflection of the ANTENNA CURRENT meter needle is obtained, increase the plate voltage to 2,000, and increase the coupling of the ANTENNA TRANSFORMER one point at a time until the maximum output is obtained with minimum plate current. The normal output of 8 or 9 amperes should be obtained with a plate current of not more than 0.7 ampere.

*t.* It will be necessary to retune the ANTENNA VARIOMETER after each change is made in the coupling of the ANTENNA TRANSFORMER.

*u.* During the tuning process and during the operation of the set, the color of the plates of the transmitting tubes should be noted from time to time. The color of the plates should never be brighter than a straw yellow, which is the next stage above red hot.

*v.* The set is now adjusted for C. W. telegraph operation.

*w.* For M. C. W. operation, first adjust the set for C. W. telegraph operation as just described, and then turn the signal switch to TELEG. TONE. The tone may be controlled through five steps between 400 and 800 cycles by the switch on the panel marked TONE CONTROL.

*x.* For telephone operation, first adjust the set for C. W. telegraph operation as described above, and then turn the signal switch to PHONE. Talk directly into the microphone and speak clearly and slowly. A quite perceptible upward movement of the ANTENNA CURRENT meter needle should occur each time a word is spoken.

*y.* A satisfactory degree of modulation is indicated by an increase of antenna current of about 1 ampere when switching from C. W. to M. C. W. When set for telephone modulation a loud sustained note sung into the microphone should produce an increase in antenna current of about 1 ampere. When using M. C. W. or telephone, the plate current is about 10 per cent higher than when using C. W. telegraph.

*z.* To change the frequency, throw the SEND-RECEIVE switch to RECEIVE, decrease the plate voltage to about 1,000, decrease the antenna transformer coupling to minimum, set the master oscillator variometer to the new frequency, and then readjust for C. W. telegraph operation as previously described.



*aa.* To stop the set, throw the SEND-RECEIVE switch to RECEIVE, and then open the line switch,  $S_6$ , on the panel. If no changes in adjustments have been made, the set can be started subsequently by starting the motor generator and then throwing the SEND-RECEIVE switch to SEND.

*ab.* When stopping for a considerable length of time, the microphone battery should be disconnected. This battery supplies the 4-candle power, 6-8-volt lamps used to illuminate the panel, and also the microphone circuit when the signal switch is on PHONE.

8. To receive.—*a.* Turn the rheostat on the radio receiver, type BC-131, until the meter indicates 0.25 ampere. Then tap the receiver panel while turning the amplifier rheostat away from the OFF position until a ringing noise due to the tapping is heard in the headphones. Care should be taken not to light the tubes in the amplifier more brightly than necessary, as when lighted brightly, the tubes, type VT-5, often draw grid current and become poor amplifiers. Such tubes will then work poorly, especially in the audio stages. Lighting these tubes brightly also greatly reduces their life.

*b.* It is much easier to rapidly tune the receiving equipment if a calibration table is prepared and kept with the set. This may be done as follows: The tuner and amplifier switches should be set for the frequency band to be received. The secondary condenser of the radio receiver, type BC-131, should be set for the signal frequency, as the condenser dial bears an engraved calibration. Use a coupling on the receiver of 20 or less in order to provide selectivity and to prevent serious changes in calibration due to reaction between circuits. The receiver tickler coupling should be at 0 except when using C. W. telegraph signals for calibration. The primaries of the radio tuner, type BC-138, and the radio receiver, type BC-131, should be tuned slowly until the proper setting has been found for each as indicated by a rushing sound, static, or the desired signal. Such sounds indicate that all three tuned circuits are in resonance. The corresponding three condenser settings as well as the inductance switch settings should be noted as the first point in the calibration. If the signal or static sounds mushy, it is due to continuous oscillation of the amplifier, and the stabilizer should be turned until the signal clears up. If the stabilizer adjustment is insufficient to stop oscillations, the additional grid bias switch of the radio tuner, type BC-138, should be turned from OFF to ON, and the stabilizer again adjusted. The most sensitive usable amplifier adjustment is obtained at the point just before the amplifier breaks into oscillation. When the set has been roughly tuned to the designated signal frequency, the secondary condenser should be moved slightly from the calibration setting in both directions until the signal is heard; this is the most sharply tuned of the three adjustments. The antenna circuit in the tuner also tunes sharply, but the primary in the receiver tunes very broadly. When the signal is tuned in best on the secondary, the other two condensers should be readjusted slightly. Other calibration points are obtained by first setting the receiver secondary according to the engraved calibration, and then finding the corresponding settings of the tuner and the receiver primaries where signals are heard. Any change in the antenna construction will affect the tuner calibration, but the receiver primary and secondary will be unchanged.

*c.* The tuning of the set after it has been calibrated is quite easy. The various switches and condenser dials are set at the approximate frequency as obtained from the calibration table. The receiver secondary condenser is moved slowly through the designated setting, covering several degrees on both sides of



the designated setting. When the signal is picked up, the three adjustments are slightly varied until the best setting of each has been obtained. The amplifier stabilizer can then be adjusted for best signal strength. Increasing the receiver tickler coupling may increase the signal strength still more. Too close a tickler coupling will cause the circuit to oscillate, which will distort telephone signals. For the heterodyne reception of C. W. telegraph signals, the tickler coupling must be sufficiently close to cause continuous oscillations. When the receiver switch button, OSCL'N TEST, is pushed, the tickler coil is short-circuited, and if the circuit was oscillating previously, a click is heard in the head set.

9. Remote control operation.—Reference should be made to paragraph 5 *i*. The attendant on duty at the set starts the motor generator and makes the adjustments described in paragraph 7. The LOCAL-REMOTE switch on the transmitter is then thrown to REMOTE.

10. Duplex operation.—Refer to paragraph 5 *j*. Duplex operation which affords the advantage of a "break-in" system may be obtained by locating the receiving equipment at the point of remote operation.

## SECTION IV

## REMOVAL FROM SERVICE

	Paragraph
To lower the antenna equipment.....	11
Repacking for transportation.....	12
Preparation for storage.....	13

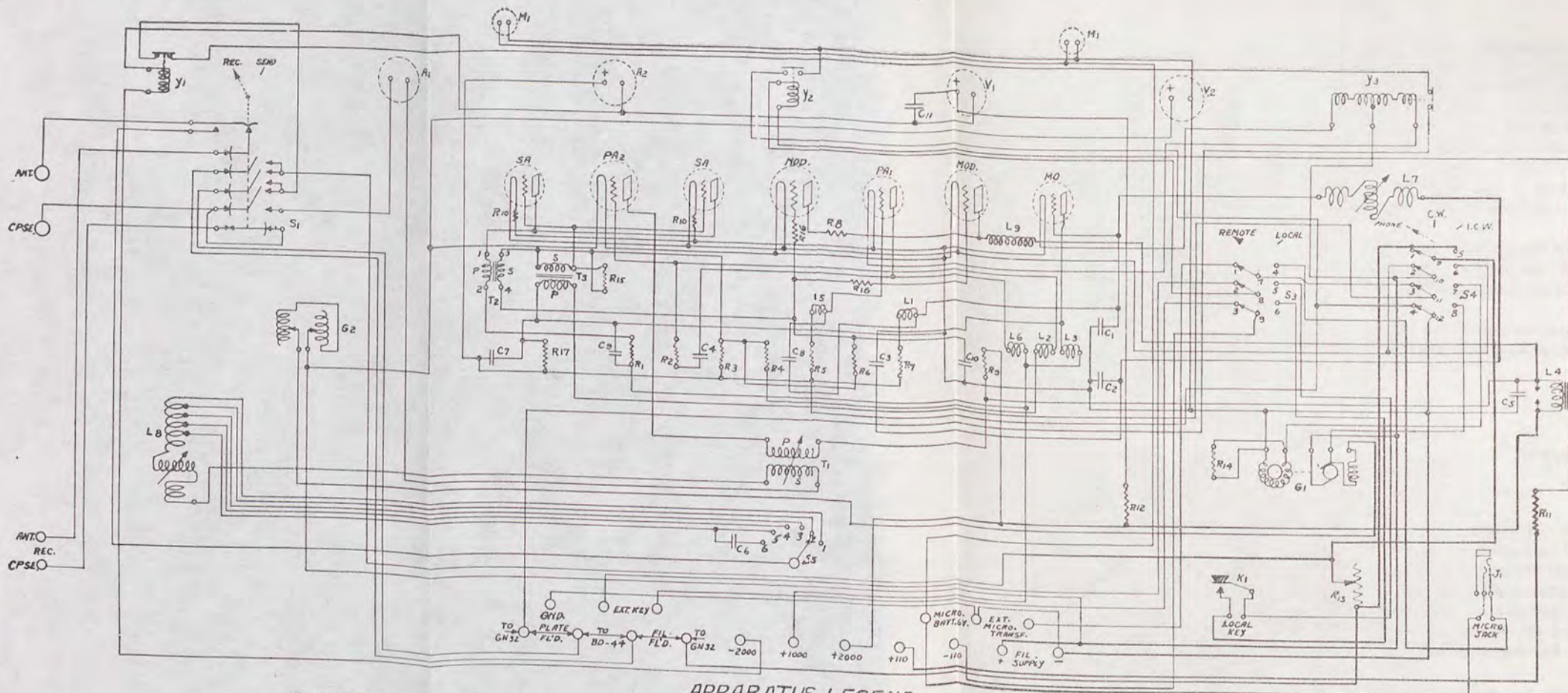
11. To lower the antenna equipment.—*a. The 80-foot transmitting antenna.*—(1) Lowering the mast is accomplished by reversing the operations by which it was raised. After the block and tackle and lifting guys have been assembled to the gin pole, the lowering of the mast is begun by one man pulling on the forward set of guys opposite the gin pole. From then on, lowering is accomplished by letting out the fall on the block and tackle. It must be kept in mind that slackness in guys and in the block and tackle must be avoided so that severe jerks will not occur.

(2) The guys are wound on hand reels starting at the guy anchor and winding toward the mast. Guys, No. 1 to No. 5, inclusive, connecting to a common anchor, are wound on the same reel. Beginning with guy, No. 1, at the guy anchor, reel in to the mast; connect the hook of No. 1 to the large hook at the mast end of guy, No. 2; proceed to reel guy, No. 2, to the guy anchor; then connect No. 3 guy and proceed in like manner to the end of No. 5 guy. The mast end of guy, No. 5, will then be the starting end when unwinding. Antenna and counterpoise wires are reeled in a similar manner starting at the stake and winding toward the mast. A separate hand reel is provided for each antenna wire and counterpoise wire. These wires are reeled up to the mast base before the mast is lowered.

*b. The receiving antenna.*—This antenna is lowered by simply taking down the two lance poles. Each counterpoise and antenna wire is wound on a reel. Each pair of guys, with mast cap attached, is put on a separate reel.

12. Repacking for transportation.—*a. Radio transmitter, type BC-127.*—Remove all connections between the transmitter and other units. Remove the tubes from the set and place them in the chest, type CH-1. Also place the microphone batteries in the chest. Close the front panel of the transmitter and replace any of the other panels that may have been removed. Remove the





### APPARATUS LEGEND

- |   |  |  |
|---|--|--|
| <p>A<sub>1</sub> AMMETER TYPE 15-70, ANT.<br/> A<sub>2</sub> AMMETER TYPE 15-12, PLATE<br/> C<sub>1</sub> CAPACITOR TYPE CA-132, MASTER OSC. GRID<br/> C<sub>2</sub> CAPACITOR TYPE CA-127, MASTER OSC. PLATE<br/> C<sub>3</sub> CAPACITOR TYPE CA-121, MASTER OSC. PLATE<br/> C<sub>4</sub> CAPACITOR TYPE CA-121, GRID COUPLING FOR PA<sub>2</sub><br/> C<sub>5</sub> CAPACITOR TYPE CA-128, BY-PASS FOR PA<sub>2</sub><br/> C<sub>6</sub> CAPACITOR TYPE CA-128, ANT. SERIES<br/> C<sub>7</sub> CAPACITOR TYPE CA-139, KEY<br/> C<sub>8</sub> CAPACITOR TYPE CA-124, GRID COUPLING FOR PA<sub>1</sub><br/> C<sub>9</sub> CAPACITOR TYPE CA-121, BY-PASS FOR PA<sub>1</sub><br/> C<sub>10</sub> CAPACITOR TYPE CA-121, GRID BY-PASS.<br/> C<sub>11</sub> CAPACITOR TYPE CA-136, VOLTMETER BY-PASS.<br/> G<sub>1</sub> MOTOR ALTERNATOR TYPE 9N-33 TONE<br/> G<sub>2</sub> RHEOSTAT TYPE RS-83, TONE CONTROL<br/> J<sub>1</sub> JACK TYPE JK-23, MICROPHONE<br/> K<sub>1</sub> TELEGRAPH KEY<br/> L<sub>1</sub> COIL TYPE C-80, GRID LEAK CHOKER FOR MO.<br/> L<sub>2</sub> COIL TYPE C-79, GRID LEAK CHOKER FOR PA<sub>2</sub><br/> L<sub>3</sub> COIL TYPE C-79, MASTER OSC. PLATE</p> | <p>L<sub>4</sub> MODULATION REACTOR<br/> L<sub>5</sub> COIL TYPE C-80, GRID LEAK CHOKER FOR PA<sub>1</sub><br/> L<sub>6</sub> COIL TYPE C-79, PLATE CHOKER FOR PA<sub>1</sub><br/> L<sub>7</sub> VARIOMETER TYPE VA-7, MASTER OSC.<br/> L<sub>8</sub> VARIOMETER TYPE VA-6, ANT. LOADING.<br/> L<sub>9</sub> COIL TYPE C-81, MOD. PLATE<br/> M<sub>1</sub> SOCKET TYPE 50-23, LAMP.<br/> MO MASTER OSCILLATOR<br/> MOD MODULATOR<br/> PA<sub>1</sub> POWER AMPLIFIER-INTERMEDIATE<br/> PA<sub>2</sub> POWER AMPLIFIER-MAIN<br/> R<sub>1</sub> RESISTOR TYPE RS-66, PLATE SA<br/> R<sub>2</sub> RESISTOR TYPE RS-56, SERIES GRID<br/> R<sub>3</sub> RESISTOR TYPE RS-63, GRID LEAK FOR PA<sub>2</sub><br/> R<sub>4</sub> RESISTOR TYPE RS-69, GRID LEAK FOR PA<sub>2</sub><br/> R<sub>5</sub> RESISTOR TYPE RS-78, GRID LEAK FOR PA<sub>1</sub><br/> R<sub>6</sub> RESISTOR TYPE RS-72, TRANSFORMER FOR T<sub>1</sub><br/> R<sub>7</sub> RESISTOR TYPE RS-72, GRID LEAK FOR MO.<br/> R<sub>8</sub> RESISTOR TYPE RS-88, MOD. PLATE<br/> R<sub>9</sub> RESISTOR TYPE RS-73, PROTECTIVE</p> | <p>R<sub>10</sub> FILAMENT RESISTOR .31 W<br/> R<sub>11</sub> RESISTOR TYPE RS-60, KEY RELAY<br/> R<sub>12</sub> VOLTMETER MULTIPLIER FOR V<sub>1</sub><br/> R<sub>13</sub> RHEOSTAT TYPE RS-84, FIL. CONTROL<br/> R<sub>14</sub> RESISTOR TYPE RS-51, TONE GEN.<br/> R<sub>15</sub> RESISTOR TRANS. FOR T<sub>3</sub> .5 MEG.<br/> R<sub>16</sub> RESISTOR TYPE RS-64 MOD. GRID.<br/> R<sub>17</sub> RESISTOR TYPE RS-86, KEY<br/> S<sub>1</sub> SWITCH TYPE SW-97, SEND REC.<br/> S<sub>2</sub> SWITCH TYPE SW-94, LOCAL REMOTE<br/> S<sub>3</sub> SWITCH TYPE SW-96, SIGNAL<br/> S<sub>4</sub> SWITCH TYPE SW-95, ANT. IND.<br/> S<sub>5</sub> SWITCH TYPE SW-98, ANT. IND.<br/> SA SPEECH AMPLIFIER<br/> T<sub>1</sub> TRANSFORMER TYPE C-82, ANT.<br/> T<sub>2</sub> TRANSFORMER TYPE C-50-A SPEECH AMPLIFIER<br/> T<sub>3</sub> TRANSFORMER TYPE C-66-A MICROPHONE<br/> V<sub>1</sub> VOLTMETER TYPE 15-114 PLATE<br/> V<sub>2</sub> VOLTMETER TYPE 15-45, FIL.<br/> Y<sub>1</sub> RELAY TYPE BK-3, OVERLOAD<br/> Y<sub>2</sub> RELAY TYPE BK-2, KEY<br/> Y<sub>3</sub> RELAY TYPE BK-1, FIL. BURNOUT.</p> |
|---|--|--|

NOTE-TRANSMITTER FRAME & BASE OF SEND-RECEIVE SWITCH ARE GROUNDED

PS-31-237  
58854°-31. (Face p. 31)

FIGURE 21.—Radio transmitter, type BC-127, circuit diagram



legs from the set and attach them to the clamps in order to permit their use as carrying handles.

*b. Motor generator, type GN-32, and power unit, type PE-40.*—Remove the leads from both units. Place the cover over the motor generator and fasten it in place.

*c. Panel, type BD-44.*—Disconnect all leads between the panel and other units. Remove the panel from its stand or from the wall to which it is fastened. Place the hinged metal cover on the panel.

*d. Chest, type CH-2.*—Disconnect the storage battery leads from the receiver. Remove the tubes from the sockets, place them in their cartons, and then pack them in the proper compartment in the chest. Place the head sets in their compartments and close the front panel. Remove the legs and place them in the chest.

*e. Antenna equipment.*—The mast sections are bound in five bundles by means of straps, type ST-18. All other equipment comprising the transmitting antenna is placed in three chests, type CH-5. The two lance poles are bound together by means of two straps. The remainder of the receiving antenna equipment may be placed in the chest, type CH-2, if there is room, or if not, in one of the chests, type CH-5.

*f. Miscellaneous equipment.*—This equipment consists mainly of cable and wire used to connect various units of the set. Each type of cable or wire should be coiled neatly and tied so that it can be conveniently handled.

**13. Preparation for storage.**—*a. Radio transmitter, type BC-127.*—The transmitter may be prepared for storage in the same manner as that prescribed for transportation in paragraph 12 *a*. If desired, the set box may be placed in a larger packing case. The four legs are stored in the space between the packing case and the set box. Any remaining space should be filled with excelsior.

*b. Motor generator, type GN-32, and power unit, type PE-40.*—See paragraph 12 *b*.

*c. Panel, type BD-44.*—This unit is stored in a rough packing box and should be bolted to the bottom of the box.

*d. Chest, type CH-2.*—Remove the batteries from the chest. The tubes should also be removed and stored in a separate place.

*e. Antenna equipment.*—See paragraph 12 *e*.

*f. Storage batteries.*—See TR 1190-5.

*g. Miscellaneous equipment.*—See paragraph 12 *f*.

## SECTION V

## FUNCTION OF PARTS

	Paragraph
Radio transmitter, type BC-127.....	14
Power equipment.....	15
Radio tuner, type BC-138.....	16
Radio receiver, type BC-131.....	17
Amplifier, type BC-118-A.....	18

**14. Radio transmitter, type BC-127.**—*a.* Refer to Figures 21, 22, and 23 in connection with the following. Figure 21 shows a complete circuit diagram of the transmitter but is rather difficult to follow. Figure 22 shows a simplified diagram for telegraph operation, while Figure 23 indicates the circuit for telephone operation. The radio-frequency circuits are of the master oscillator,

power-amplifier type. A tube, type VT-4-B, is used as the master oscillator in a circuit whose frequency is controlled by a variometer. This oscillator is of the Colpitts type, the oscillatory circuit being  $C_1$ ,  $C_2$ , and  $L_7$ . This circuit is coupled by means of  $C_1$  to the grid of a second tube, type VT-4-B, which acts as an intermediate power amplifier. This power amplifier is in turn coupled to the main power amplifier, a tube, type VT-22, by means of  $L_6$ . An intermediate power amplifier is used in order to prevent the main power amplifier from reacting on the frequency setting circuit of the master oscillator. The plate circuit of the main power amplifier is coupled to the antenna by means of the antenna transformer,  $T_1$ . The above mentioned three tubes are the only ones in the transmitter that are used for C. W. telegraph and, as will be seen by reference to Figure 22, the filaments of the others are cold. The motor generator, type GN-32, provides 2,000 volts for the plate of the tube, type VT-22, and 1,000 volts for each of the tubes, type VT-4-B. It will be noticed that these plate circuits are all completed through the key relay,  $Y_2$ ; thus, for telegraph operation the high voltage is placed on the plates of the tubes only when the key is depressed.  $R_3$ ,  $R_4$ ,  $R_5$ , and  $R_7$  are grid biasing resistors which provide the proper grid bias for the tubes. The size of these resistors is shown in the legend of Figure 21.  $C_3$  and  $C_4$  are stopping condensers, and are necessary to keep the plate voltage of one tube from the grid of another.  $C_5$  permits the placing of a different grid bias on each of the two tubes, type VT-4-B. This is necessary because one is used as an oscillator and the other as an amplifier.  $L_1$ ,  $L_2$ ,  $L_3$ , and  $L_5$  are radio-frequency chokes, so placed as to confine radio-frequency currents to the proper circuits.

b. The plate current overload relay,  $Y_1$ , is so adjusted as to open the field circuit of the 2,000-volt generator when the total plate current exceeds 1.5 amperes. One winding of the filament burn out relay,  $Y_3$ , carries the master oscillator filament current and the other carries the filament current for the power amplifier tube, type VT-4-B. The magnetic fields are normally in opposition, but if the filament of either tube should burn out, the relay will open at once, thus opening the plate generator field circuit and preventing damage to the set which would otherwise occur due to the failure of either tube.

c. Tone modulation of telegraph signals is accomplished by the use of a motor alternator, type GN-33. The motor is connected across the 11-volt filament circuit. Any one of five tones may be obtained by means of a variable field resistance,  $G_2$ , which varies the speed of the alternator. The alternator is coupled by means of the transformer,  $T_3$ , to the grids of two audio or speech amplifiers (tubes, type VT-4-B) connected in parallel. These two speech amplifiers are in turn coupled to the grids of two modulators (tubes, type VT-22) by means of the transformer,  $T_2$ . The two modulators are also operated in parallel. These two latter named tubes draw their plate supply in parallel with the main power amplifier through a large iron core reactor or choke coil,  $L_4$ . Variations in plate current to the modulator tubes thus produce audio-frequency voltages across the reactor which either aid or oppose the normal potential applied to the main power amplifier. This is known as the Heising or "constant current" system of modulation. The master oscillator and intermediate power amplifier operate with a constant plate voltage under all conditions. The resistors,  $R_6$  and  $R_{15}$ , are placed across the transformer secondaries for the purpose of making the modulation smoother and to improve the quality.



RADIO SET, TYPE SCR-132

The radio-frequency chokes,  $L_3$ , and the resistors,  $R_8$  and  $R_{10}$ , were added to the modulator grid and plate circuit to prevent high-frequency parasitic oscillations. The resistor,  $R_{10}$ , reduces the filament voltage applied to the speech amplifiers from 11 volts to approximately 10 volts, which is the proper value

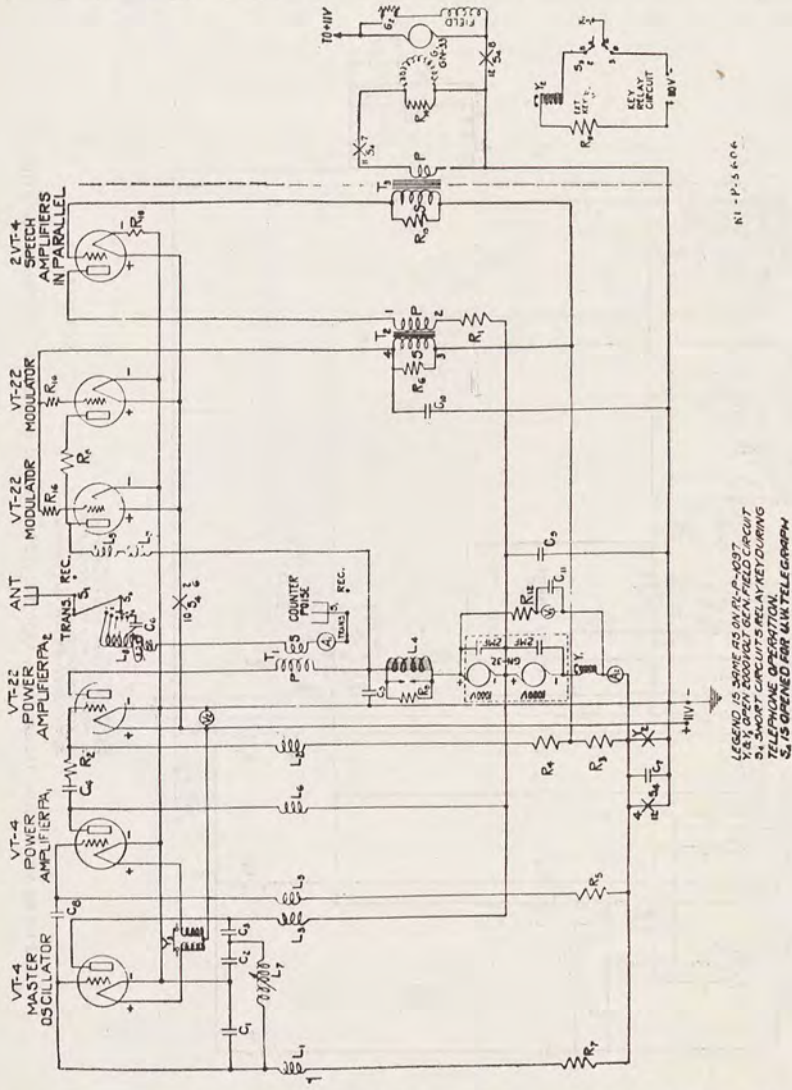


FIGURE 22.—Radio transmitter, type BC-127, schematic diagram, telegraph operation

for a tube, type VT-4-B.  $C_5$  and  $C_6$  are by-pass condensers.  $L_3$  is a tapped inductance and variometer in the antenna circuit.

d. For voice modulation the microphone and its circuit are substituted for the motor alternator, type GN-33. This arrangement is shown in Figure 23. Modulation is accomplished as described in c above.

15. Power equipment.—Figure 24 shows a schematic diagram of the power supply circuit. The equipment shown is on the transmitter, the motor generator, and the panel. The legend below the diagram shows the location of each piece of equipment. From the diagram it may be seen that either alternating current or direct current may be used as a source of power. The diagram shows

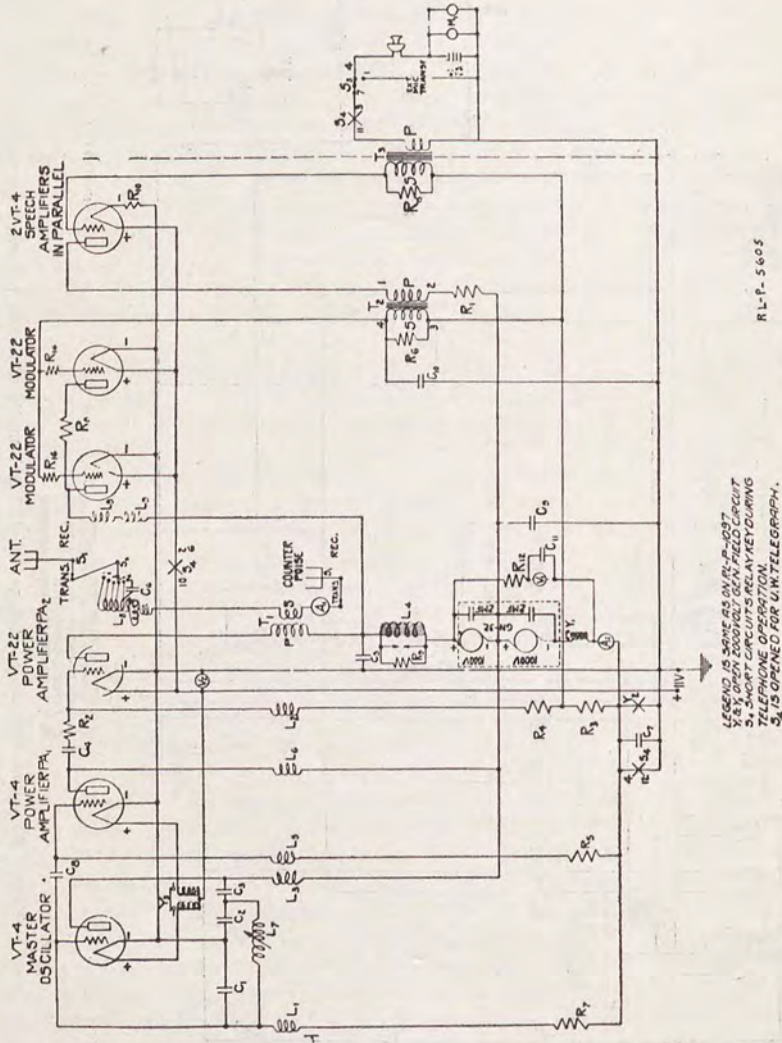
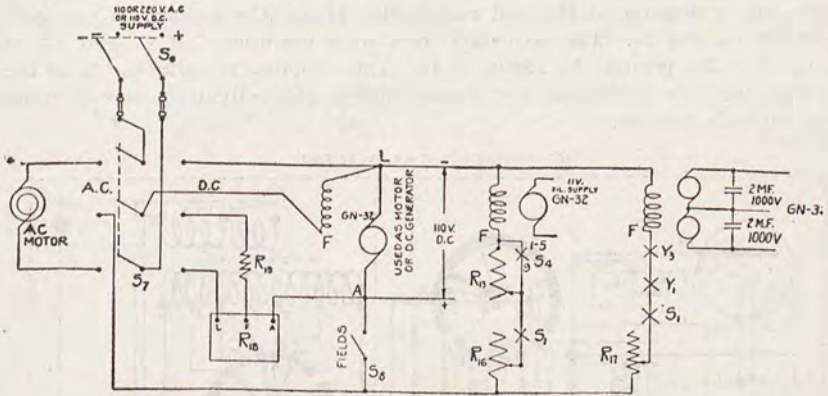


FIGURE 23.—Radio transmitter, type BC-127, schematic diagram, telephone operation

the various fields and how each is controlled. Note that both contacts of the filament burn out relay and the plate overload relay are in series with the 2,000-volt field. No part of the power unit, type PE-40, is shown in the diagram; however, as stated previously, this consists of a gasoline engine directly coupled to a direct-current generator. (See par. 3 c.)



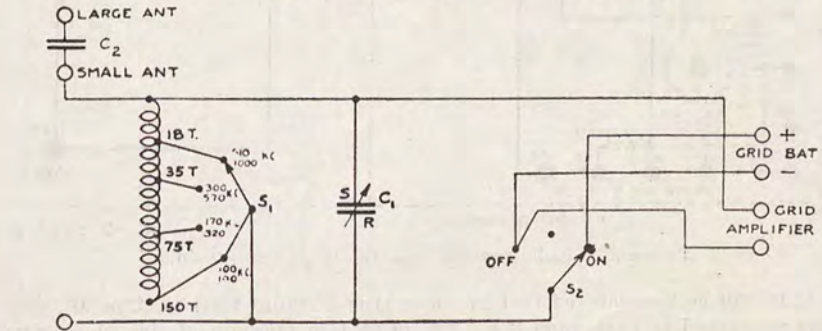
16. Radio tuner, type BC-138.—Figure 25 shows the circuit diagram of the tuner. It consists essentially of a single tuned circuit,  $L_1$ ,  $C_1$ , and closed by means of  $S_1$ . The inductance is variable in four steps, while the condenser



- $R_3$  FIL. CONTROL RHEOSTAT 400 OHMS BC-127
- $R_4$  FIL. FIELD RHEOSTAT 100 OHMS. BD-44
- $R_5$  PLATE FIELD RHEOSTAT 100 OHMS. BD-44
- $R_6$  D.C. MOTOR STARTING BOX. BD-44
- $R_7$  D.C. MOTOR FIELD RESISTANCE. 45 OHMS. BD-44
- $S_2$  SEND-RECEIVE SWITCH BC-127.
- $S_4$  SIGNAL SWITCH BC-127
- $S_6$  DC OR AC LINE SWITCH. BD-44
- $S_7$  POWER CHANGE OVER SWITCH. BD-44
- $S_8$  FIELD SWITCH. BD-44
- $Y_1$  PLATE OVERLOAD RELAY BC-127
- $Y_2$  FILAMENT BURNOUT RELAY BC-127
- $S_3$  SHORT CIRCUITS  $R_3$  FOR PHONE OR TONE TELEGRAPH

RL-P-5607

FIGURE 24.—Power supply circuit, schematic diagram



APPARATUS LEGEND

- $C_1$  - 1500 M.M.F. CONDENSER
- $C_2$  - 250 M.M.F. CONDENSER
- $L_1$  - INDUCTANCE
- $S_1$  - SWITCH TYPE SW-7-A
- $S_2$  - SWITCH TYPE SW-53-A

RL-D-5486-D

FIGURE 25.—Radio tuner, type BC-138, circuit diagram

is a continuously variable air condenser.  $C_2$  is a fixed condenser used with a large antenna to increase the selectivity of the tuner. The switch,  $S_2$ , is provided for the purpose of placing additional grid bias on the amplifier, type BC-118-A, if necessary.

17. Radio receiver, type BC-131.—*a.* The diagram for this receiver is shown in Figure 26. In this figure the equipment is arranged as it is in the set box when looking at the box from the rear. Figure 27 shows the same equipment arranged in a simplified manner. The receiver consists of two tuned circuits preceding a detector of the grid rectification type. The primary circuit consists of  $C_1$  and  $L_1$ . The secondary, consisting essentially of  $C_2$  and  $L_2$ , is coupled to the primary by means of  $L_3$ . This coupling is variable.  $L_5$  is the tickler, and the oscillation test button merely short-circuits this coil when the button is pressed.

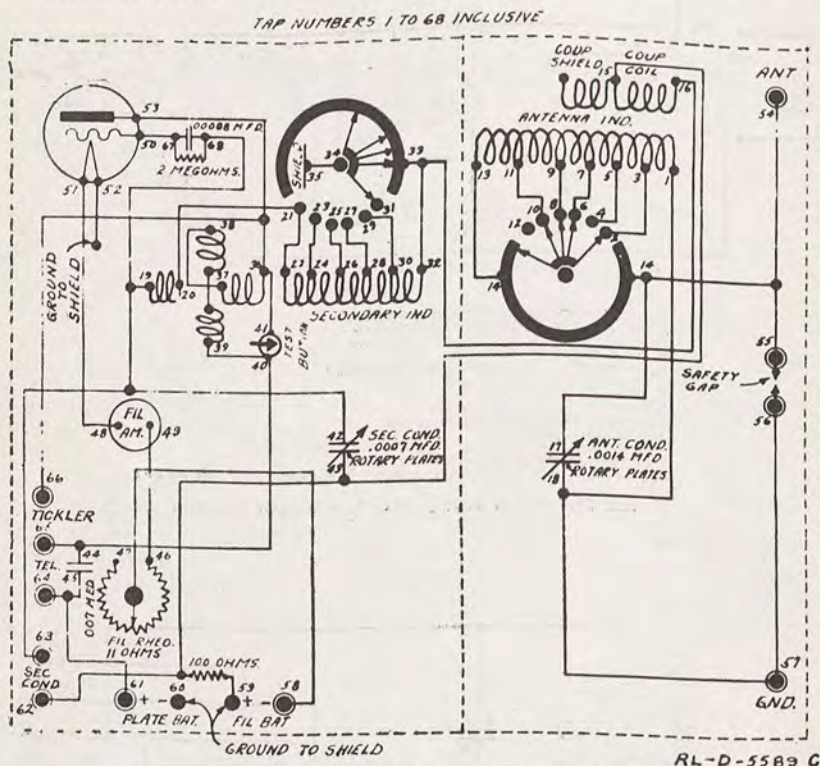


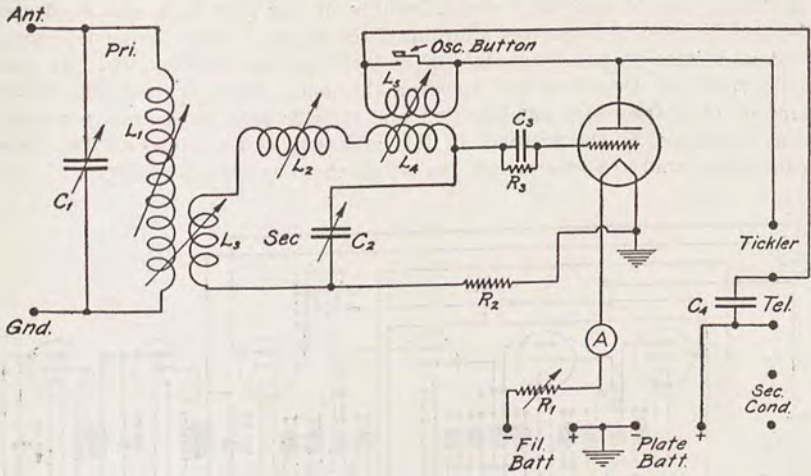
FIGURE 26.—Radio receiver, type BC-131, circuit diagram

*b.* It will be remembered that an older type of radio receiver, type BC-131, was mentioned in paragraph 3 *g.* Figure 28 is a diagram of this older type of receiver.

18. Amplifier, type BC-118-A.—*a.* The circuit diagram of this amplifier is shown in Figure 29. This amplifier contains four stages of radio-frequency amplification and two stages of audio-frequency. The purpose of the switch, B, is to provide a means for using both radio and audio amplification or audio amplification alone. However, in the radio set, type SCR-132, this switch is usually left in the RADIO-AUDIO position. Since iron core transformers are used in the radio stages and these transformers will cover only a limited frequency, taps on the windings are provided and are controlled by a gang switch, A.



RADIO SET, TYPE SCR-132



TL-889

FIGURE 27.—Radio receiver, type BC-131, schematic diagram

NOTE: TAP NUMBERS 1 TO 94 INCLUSIVE

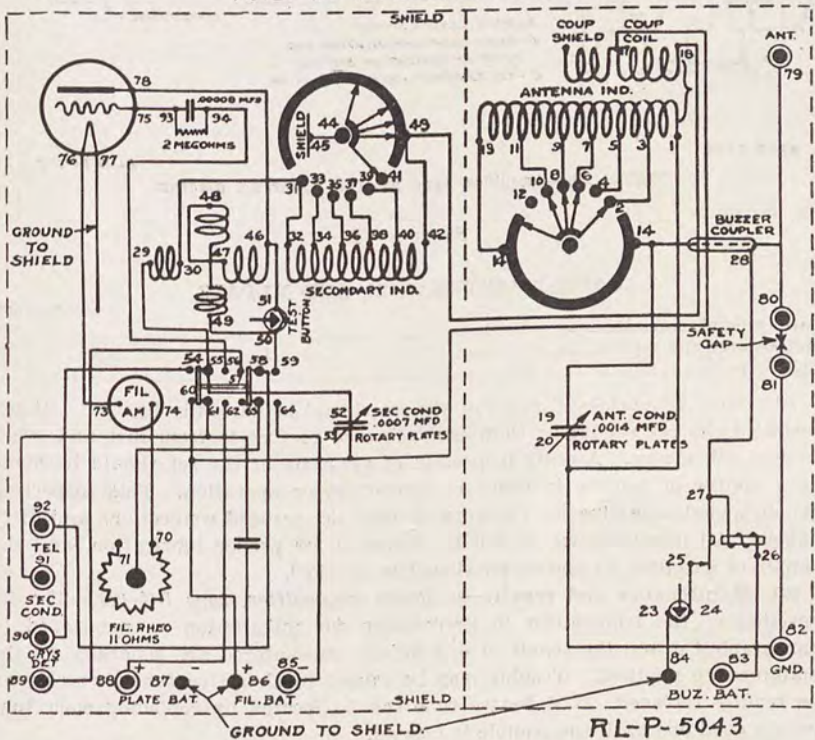
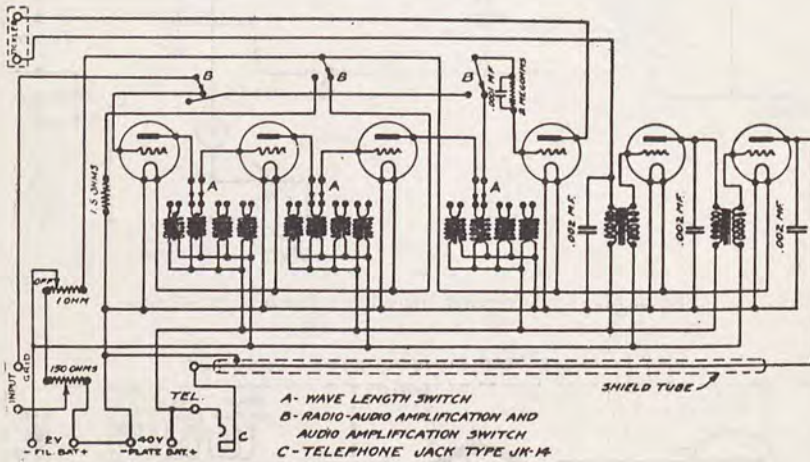


FIGURE 28.—Radio receiver, type BC-131 (old model), circuit diagram

b. This piece of equipment could, because of the grid leak and condenser installed, be used as a receiver affording three stages of radio-frequency amplification, a detector, and two stages of audio-frequency amplification. As used in the radio set, type SCR-132, however, the fourth tube serves as the fourth stage of radio-frequency amplification and its efficiency as such is not materially decreased by the presence of this grid leak and condenser. The three 0.002 microfarad condensers are radio-frequency by-pass condensers.



RL-P-3591

RL-D-5613-B

FIGURE 29.—Amplifier, type BC-118-A, circuit diagram

## SECTION VI

### CARE, MAINTENANCE, AND REPAIR

	Paragraph
Care, general.....	19
Maintenance and repair.....	20
List of parts.....	21

19. Care, general.—All parts of the set should be carefully handled. When installed the set should be thoroughly cleaned to free it from dirt and other foreign substances. A daily inspection of all parts of the set should be made as a matter of routine in order to insure proper operation. This inspection should include examination for worn, broken, or corroded connections and dirty panels. All moving parts should be inspected for proper lubrication, and the supply of gasoline, oil and water should be checked.

20. Maintenance and repair.—a. Radio transmitter, type BC-127.—The inspection of the transmitter in preparation for installation as mentioned in paragraph 4 a and the repair of any defects encountered are generally all the maintenance required. Trouble may be caused by defective tubes, which may be readily replaced. A defective tube can be located by replacing each tube with a good one until the trouble is located.



## RADIO SET, TYPE SCR-132

*b. Motor generator, type GN-32, and power unit, type PE-40.*—(1) The commutators must be kept clean of carbon and other dirt, and the brushes kept under proper tension in order to avoid sparking. See that the motor generator remains level as it may shift around slightly if not fastened down, or one side may sink into the ground further than the other, thus causing it to vibrate while running. The wing nuts on the terminals must be kept tight; otherwise a short circuit between terminals may occur or a loose connection may develop.

(2) The maintenance of the power unit is very much the same as for any gasoline engine. The crank case should be kept full of oil, and the oil should be changed at reasonable intervals. The radiator should be kept full of water, and the proper tension should be maintained on the fan belt to insure the proper cooling of the engine. The direct-current generator requires the same care as the motor generator.

*c. Panel, type BD-44.*—This requires very little care. It should be kept dry. Connections should be kept tight. Keep the cover on the panel when not in use.

*d. Chest, type CH-2.*—This requires much the same care as does the transmitter so far as keeping it free from dust and keeping all connections tight and well soldered are concerned. The B batteries should be examined frequently and their voltage checked, as these batteries frequently swell and burst when exhausted. Defective tubes should be replaced.

*e. Antenna equipment.*—Keep all antenna equipment in a serviceable condition. Parts showing signs of rust should be painted or varnished. It is very important that the resistance of the antenna counterpoise be kept low; therefore all connections of the lead-in wires to the antenna and to the counterpoise should be kept clean and tight. Replace such parts as become unserviceable.

*f. Storage batteries.*—See TR 1190-5.

21. **List of parts.**—For a list of parts comprising radio set, type SCR-132, see the current issue of the Signal Corps Supply Catalogue.

[A. G. 062.12 (4-11-31).]

BY ORDER OF THE SECRETARY OF WAR:

DOUGLAS MACARTHUR,

*General,*

*Chief of Staff.*

OFFICIAL:

C. H. BRIDGES,

*Major General,*

*The Adjutant General.*