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WAR DEPARTMENT

TECHNICAL MANUAL

RADIO SET SCR-203

August 14, 1941

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TECHNICAL MANUAL
No. 11-239

WAR DEPARTMENT,
WASHINGTON, August 14, 1941.

RADIO SET SCR-203

Prepared under direction of the
Chief Signal Officer

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SECTION I

GENERAL DESCRIPTION

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1. Type.—Radio set SCR-203 is a low-power, short-range, medium-frequency, highly-portable transmitting and receiving set, intended primarily for transportation on the back of a pack animal.

2. Power.—*a. Input.*—The power required to operate the transmitter is supplied by a hand generator and dry batteries, and that required to operate the receiver is supplied by dry batteries.

b. Output.—The transmitter has a nominal rating of 7.5 watts.

3. Nature of transmission and reception.—The set transmits and receives the following:

a. Continuous-wave telegraph, hereafter abbreviated as “c. w.”

b. Tone-modulated, continuous-wave telegraph, hereafter abbreviated as “tone.”

c. Voice-modulated, continuous-wave telephone, hereafter abbreviated as “voice.”

4. Distance ranges.—The approximate ranges of this set in miles are given in *a* and *b* below. (See par. 19.) The ranges given in *b* imply movement on some means of transport other than a pack animal; for example, it may be expedient to transport the entire set on its frame in a truck. Since transmission is accomplished by turning the generator, and since this turning is not practicable while the pack animal is in motion, a halt is necessary for transmission when the set is used in mounted service.

NOTE.—Except where special permission has been granted by competent authority, the mounting of this radio set in a vehicle other than as stated above is prohibited.

	C. w.	Tone	Voice
<i>a.</i> With the set on the pack animal or on the ground	30	20	5
<i>b.</i> With the set in movement	10	6	3

5. Frequency range.—The set operates in the frequency band from 2,200 to 3,060 kilocycles.

6. Channels.—The numbers of radio channels available with the frequency separations indicated are shown below. Channels used for one type of signal are not available for other use. (See par. 19.)

	C. w.	Tone	Voice
Frequency separation in kilocycles	20	30	50
Number of channels	42	28	17

7. Weight and space.—The set weighs 162 pounds and occupies 16.7 cubic feet of space when completely assembled. The total load

on the animal, including the pack saddle. is approximately 214 pounds. See section IV for further details.

8. Transport.—The set is mounted on a steel and aluminum frame

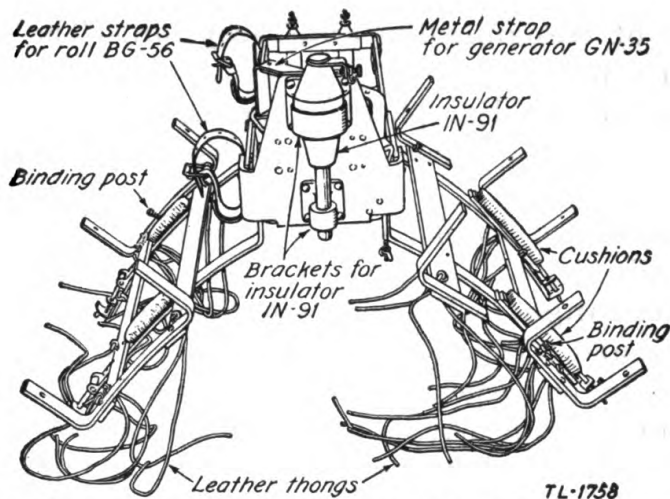


FIGURE 1.—Frame FM-18. Frame FM-18-A has the same general appearance, but employs a quick-release type of strap for the generator and for the pack saddle fastenings.

(fig. 1), which in turn is clamped to a Phillips pack saddle for transportation on one pack animal. Mounted on this frame, however, the set may be transported otherwise, and operated either on the ground or in the vehicle transporting it, as well as on an animal. (See par. 4.) Figure 2 shows how various parts of the set are located with respect to the frame and to the animal. (See par. 21.)

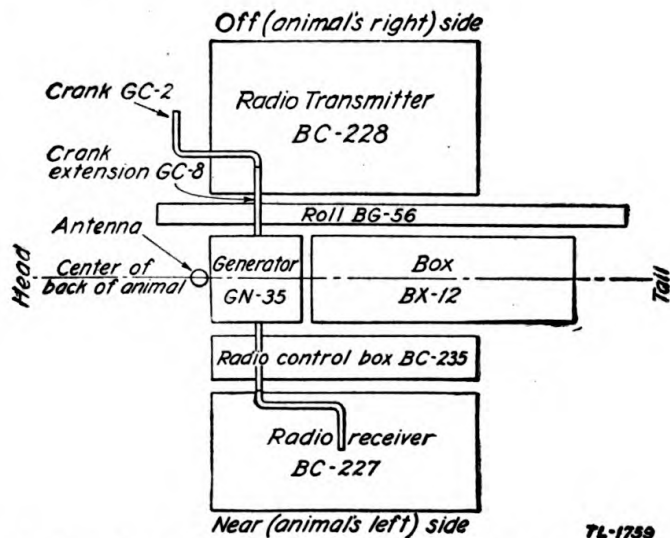


FIGURE 2.—Location of parts of radio set SCR-203 on the frame and on the animal.

9. Use.—See paragraph 20.

10. Component parts.—While the Signal Corps General Catalog is controlling in regard to component parts, they are indicated in subsequent paragraphs for information. Major component parts are covered separately in paragraphs 11 to 18, inclusive. For a more complete list see section IV.

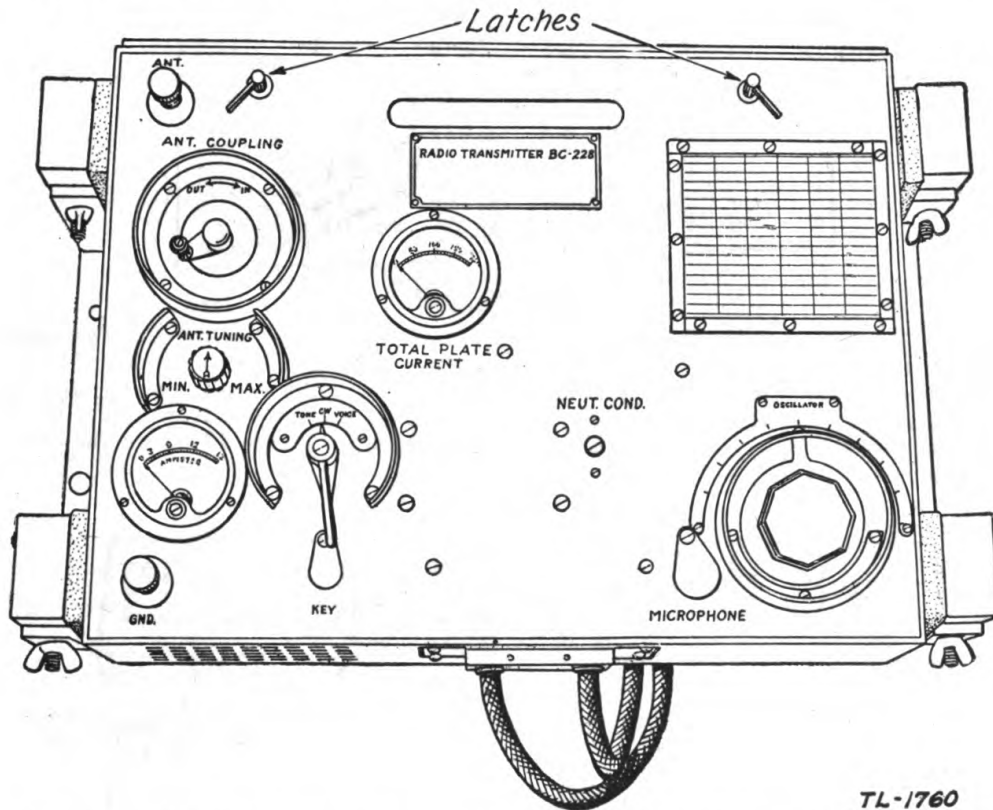
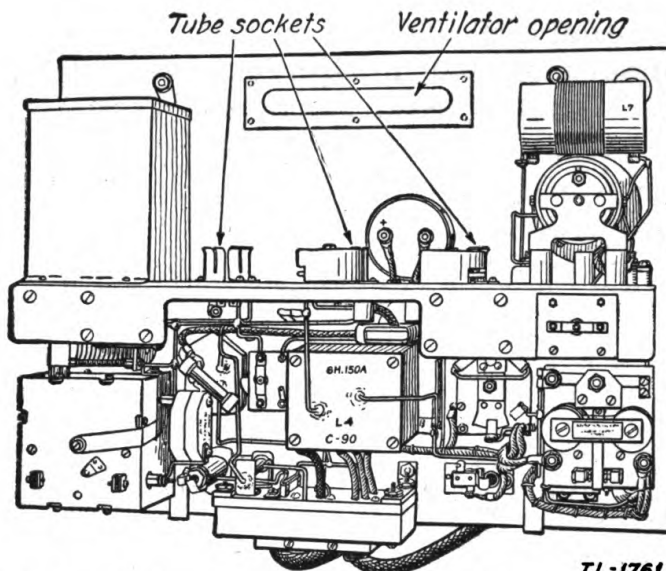


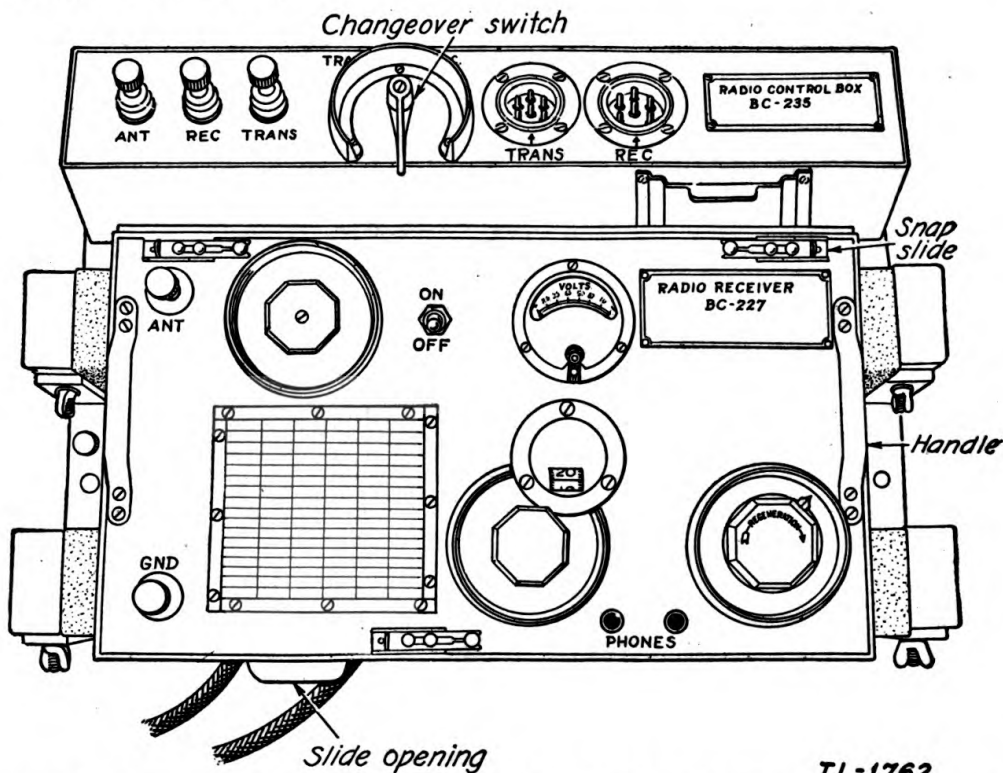
FIGURE 3.—Front panel view of radio transmitter BC-228, a part of radio set SCR-203. The BC-228-A is the same except that the ground binding post is in the upper right-hand corner of the panel.

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FIGURE 4.—Inside chassis view of radio transmitter BC-228 or BC-228-A. The square can in the upper left corner contains the oscillator inductors L2-L3; directly below it is the oscillator tuning capacitor C8. In the upper right corner the exposed coil is the antenna tuning inductor L7; directly under it is the antenna transformer L1-L2. In the extreme lower right corner is the keying relay. Figure 14 shows the circuit positions of these parts.



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FIGURE 5.—Front panel view of radio receiver BC-227 and radio control box BC-235. The BC-227-A is the same as the BC-227 except for the following: The ground binding post is closer to the antenna binding post; the filament rheostat knob to the right of the antenna post is marked INCREASE; the tuning knob in the center of the panel is marked FREQUENCY CONTROL.

11. Radio transmitter BC-228 or BC-228-A.—The transmitter (figs. 3 and 4) is contained in a metal case and is mounted on the frame by means of four sponge-rubber cushioned mountings. The circuit elements, including the tubes, are mounted on the panel and chassis assembly, which is entirely removable from the case. This assembly (fig. 4) is secured to the case by means of tongue and groove joints at the bottom and by latches at the top. Ventilation is provided by a screened opening in the bottom of the case and one near the top of the panel. To inspect or replace tubes, it is only necessary to open the two top latches and to pull the panel forward about 4 inches.

12. Radio receiver BC-227 or BC-227-A.—The receiver, shown in figures 5 and 6, is contained in a metal case and is mounted on the frame by means of four sponge-rubber cushioned mountings.

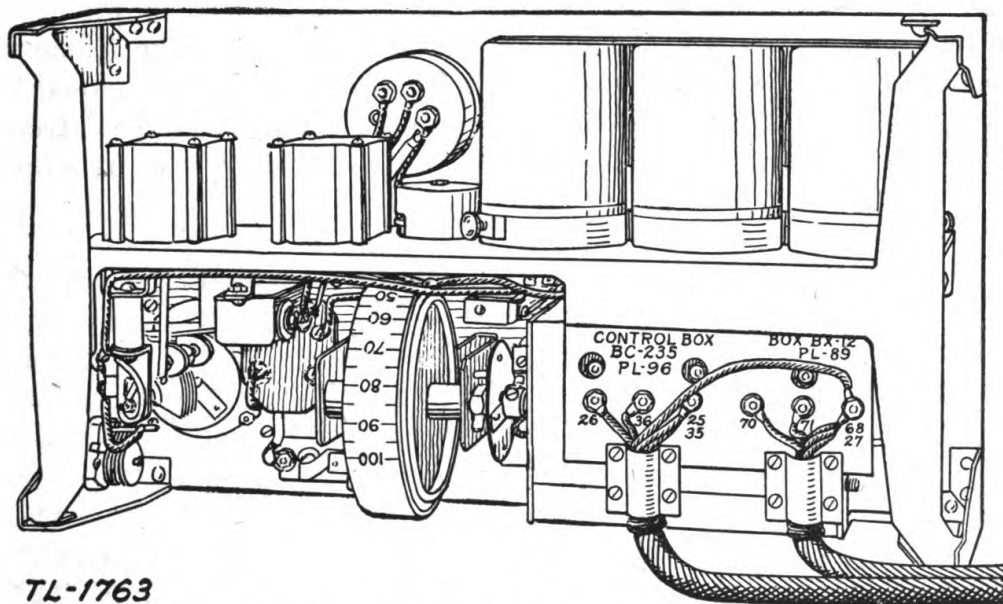


FIGURE 6.—Inside chassis view of radio receiver BC-227 or BC-227-A.

The circuit elements, including the tubes, are mounted on the panel and chassis assembly which is entirely removable from the case. This assembly is secured to the case by three snap slides on the panel.

13. Radio control box BC-235 or BC-235-A.—The control box, shown in the upper part of figure 5, is contained in a metal case and is mounted on the frame by means of two bolts and wing nuts. The circuit elements are mounted on the panel, an interior view of which is shown in figure 7. This panel assembly may be removed from the case by unscrewing the knob of the transmitting key which

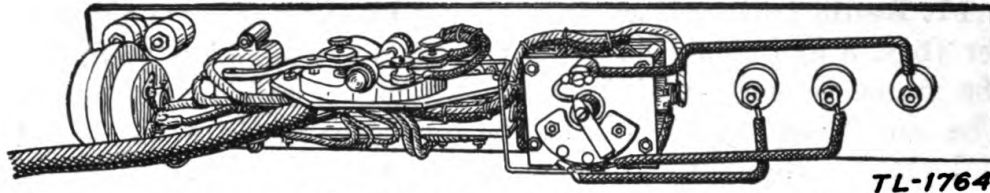


FIGURE 7.—Radio control box BC-235 or BC-235-A, interior view of panel assembly.

is located on the top of the box, removing eight screws near the edges of the panel and lifting the assembly.

14. **Generator GN-35.**—The generator, outlined in figure 2, together with the voltage regulator and ripple-filter elements, is contained in a metal case and is mounted on the frame by means of a metal strap over the generator.

The two cranks and the crank extensions are removed from the generator by pulling them out of their slots.

15. **Box BX-12 or BX-12-A.**—This is a metal box, shown closed in figure 8 and opened in figure 9, which is mounted on the frame by means of four hexagonal nuts. The hinged cover is held closed by two push-button spring catches protruding through the hinged front. The hinged front is held closed by two thumbscrews at its upper

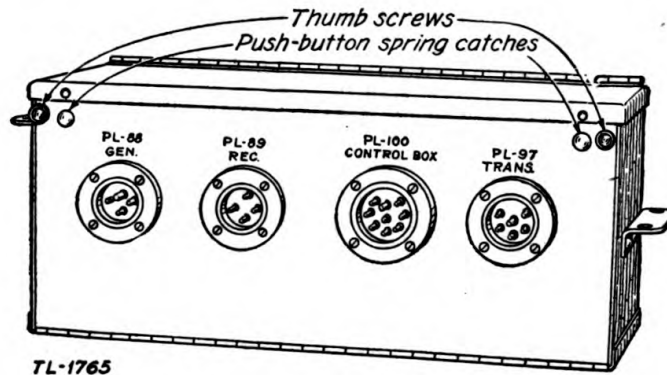


FIGURE 8.—Box BX-12 or BX-12-A, front view, closed.

corners. The box contains compartments for the batteries and spare tubes. The terminal strip (fig. 11) provides individual binding posts for the leads of all six batteries BA-2. The four batteries BA-23 and the one battery BA-27 are properly terminated by the use of interconnecting wires which are connected to the four sockets on the hinged front. The capacitor CA-177-A, also mounted on the interior of the hinged front, is a bypass capacitor across the receiver bias battery.

16. **Mast sections MS-49 to MS-56 and roll BG-56 or BG-56-A.**—*a. Mast sections.*—The eight mast sections are made of high tensile strength steel. Mast section MS-49 forms the top of the

antenna when all sections are used; the others follow in the order of their type numbers, and mast section MS-56 plugs into the insulator IN-91, which is the base of the antenna and which is secured to the frame by the brackets shown in figure 1. Mast section MS-49 terminates in a blunt point at the upper end. Mast sections MS-50 to

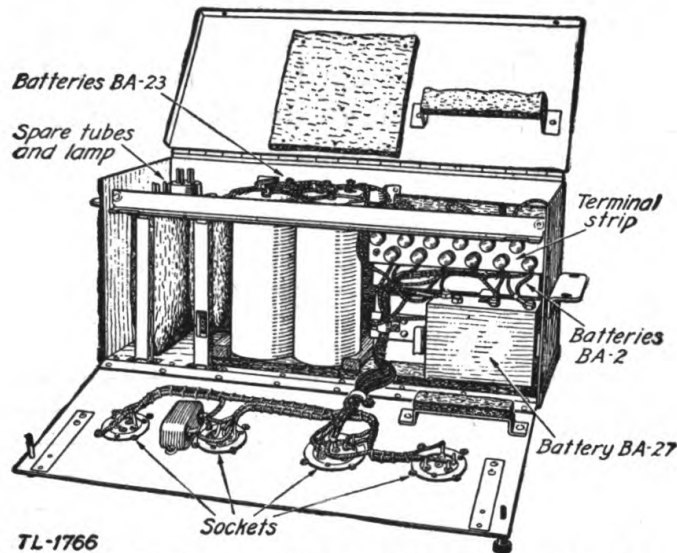


FIGURE 9.—Box BX-12 or BX-12-A, batteries and spare tubes in place.

MS-56 are fitted with a serrated shank and screw at one end and thread at the other. Ends which are joined in assembling have enamel marks of the same color. The body of each section is enameled black and bears the type number near the lower end. The over-all length of the assembled eight sections is 25 feet 2 inches.

b. Roll.—The roll is made of black canvas duck and holds the eight mast sections in separate compartments. The opening on one end and along the side is closed by a slide fastener.

17. Frame FM-18 or FM-18-A.—The frame FM-18 is shown in figure 1. Cushion pads are provided to hold the transmitter and the receiver firmly in place. Rawhide leather thongs are knotted through holes in the members of the frame to secure the cover (par. 18) to the frame. The frame FM-18-A differs from the FM-18 in that it has a quick-release type of mounting for the generator and similar straps for fastening the whole frame to the Phillips saddle.

18. Cover BG-70-A.—The cover, made of heavy waterproofed canvas duck, protects the set when it is mounted on the frame. Access to the box BX-12 or BX-12-A and the generator may be had by opening a slide fastener immediately over these parts, and access to the receiver and the control box may be had by opening two slide

fasteners on the near side. These slide fasteners are protected from moisture and dirt by flaps extending over the fasteners and being held down by snap fasteners. Two pockets, one on each side at the front of the cover, are provided for the small parts of the set. The parts which are carried in each of these pockets are indicated in section IV. Two holes, one at the front and one at the rear of the top of the offside, permit the roll BG-56 or BG-56-A containing the mast sections to extend through the cover. A hole at the front of the top, through which the mast extends, may be closed by fastening the small hood attached to the cover.

SECTION II

EMPLOYMENT

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19. Limitations.—This set has the usual limitations possessed by any radio set of its power, portability, and frequency range. Texts which discuss these limitations are generally available and are not quoted in this manual. The distance ranges (par. 4) and the channels (par. 6) must be considered approximations which are affected by many factors, the majority of which are not controlled by the user of the set. Some of those which are so controlled are listed below and require the attention of the user if the set is to be operated most effectively.

a. Distance range.—All other things being equal, maximum effective range is maintained by—

(1) Frequent inspection of the set and correction of all defects, particularly in the batteries, tubes, plugs, cords, wires, and binding post contacts.

(2) Using c.w. in preference to tone and either c.w. or tone in preference to voice.

(3) Accurate tuning.

(4) Locating the set in a dry place on level or elevated ground, avoiding all obstructions, either natural or man-made, and particularly

intervening eminences, tall metal structures, power, telephone, and telegraph lines.

b. Channels.—The maximum number of operating channels will be made available by—

(1) The action indicated in *a*(2) and (3) above, particularly that in (2).

(2) Assigning frequencies as far apart as possible to nets which must be located close to each other on the ground.

20. Using organizations and normal use.—*a. Using organizations.*—Tables of Basic Allowances prescribe the organizations using this set. Generally, it is authorized for use by the following:

(1) Signal troop of the cavalry division or cavalry corps.

(2) Headquarters of the cavalry (horse) brigade, regiment, and squadron.

(3) Headquarters of the cavalry division artillery and battalions.

b. Normal use.—While the set is capable of operating with various other sets, it is most frequently used in—

(1) The cavalry division, brigade, and regimental nets for communication between and with those headquarters, supporting field artillery headquarters, scout cars, and observation airplanes.

(2) The field artillery net of the cavalry division for communication between and with its headquarters, the cavalry equipped with this set, and observation airplanes.

21. To assemble the set.—In mounting the parts on the frame, avoid the use of tools on latches, slides, binding posts, nuts, and plugs wherever possible. Before connecting plugs to sockets, inspect the attachment of the cords to the plugs. If the cord clamp appears loose, tighten the small knurled locking ring at the base of the plug by turning it *counterclockwise*. In connecting the plugs to the sockets, place the arrow stamped on the plug opposite the arrow stamped on the socket, thrust the plug into the socket, and lock it by turning the large knurled band of the plug *clockwise* and tightening it in the socket. Figure 10 shows the external cording and wiring of the set.

a. Transmitter.—(1) Face the panel, turn the ends of the two latches toward each other, pull the top of the panel forward, and hold it open with one hand.

(2) See that the case contains nothing except the panel and chassis assembly shown in figure 4 and a circuit diagram pasted on the rear inside wall. If the set is being placed in service for the first time or after extended storage, lubricate the worm screw of the **ANT. COUPLING** control with a small amount of petroleum jelly.

(3) Insert a tube VT-50 in the center socket marked MOD VT-50, and a tube VT-25 in each of the side sockets marked PA VT-25 and MO VT-25. Close and latch the panel.

(4) Remove the four wing nuts and lock washers from the mountings. Place the transmitter on the frame in the position indicated in figure 2, being sure that its two cords CD-202 and CD-216 are placed untwisted between the back of the case and the two horizontal members of the frame. Secure the transmitter by replacing the washers and wing nuts.

(5) Using a suitable length of wire W-124 provided with the set, connect the GND binding post of the transmitter to the unmarked binding post on the offside rear member of the frame.

b. Receiver.—(1) Face the panel, release the three snap slides on it, raise the slide opening at the bottom of the case, grasp the two handles at the ends of the panel, and lift the assembly shown in figure 6 out of the case. If this assembly is removed at any time after the

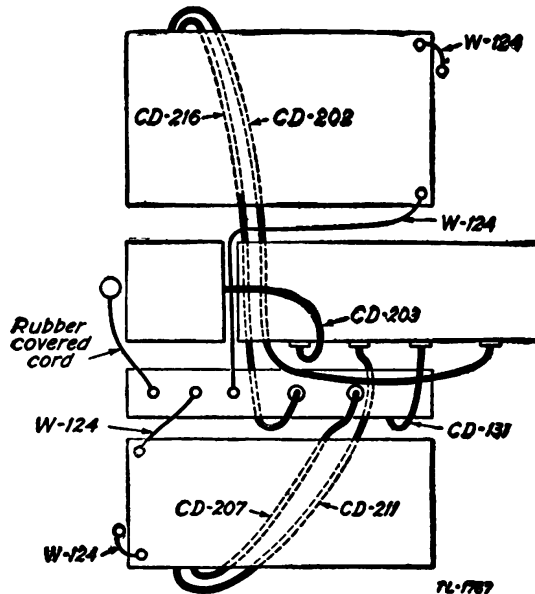


FIGURE 10.—Radio set SCR-203, top view of external cording and wiring.

cords are connected, always disconnect the plugs first to avoid shorting the receiver batteries.

(2) See that the case contains nothing except a circuit diagram pasted on the rear inside wall.

(3) Install a lamp LM-31 in its socket just below the meter. Do this by putting the forefinger of each hand around the meter, holding the bulb between them and turning it into its socket a little at a time.

(4) Insert a tube VT-24 in each of the five sockets. Replace the assembly and secure it to the case.

(5) Remove the four wing nuts and lock washers from the mountings. Place the receiver on the frame in its proper position, being sure that its two cords CD-207 and CD-211 are placed untwisted between the back of the case and the bottom horizontal member of the frame. Secure the receiver by replacing the washers and wing nuts.

(6) Using a suitable length of wire W-124, connect the GND binding post of the receiver to the unmarked binding post on the near-side lower front member of the frame.

c. Control box.—(1) Remove the two wing nuts and lock washers.

(2) Place the control box on the frame in its proper position so that the cord CD-211 of the receiver and the cord CD-216 of the transmitter are untwisted and between the control box and the upper horizontal member of the frame, and that cords CD-207, CD-216, and CD-131 are between the control box and the receiver. In bringing cord CD-216 from the off to the near side, run it under the top members of the frame. Replace the washers and wing nuts.

(3) Connect the plug PL-96 on cord CD-207 to the socket on the control box marked REC.

(4) Connect the plug PL-90 on cord CD-216 to the socket on the control box marked TRANS.

(5) Using suitable lengths of wire W-124, connect the receiver binding post marked ANT. to the control box binding post marked REC., and connect the transmitter binding post marked ANT. to the control box binding post marked TRANS., running the latter wire between the two receptacles on top of the frame provided for the generator and for the box BX-12.

d. Battery box.—Test all batteries before installing them as indicated below, and do not install any the voltage of which is less than that given in paragraph 26*a*. If, after the assembly action indicated below is completed, replacement of batteries BA-2 or BA-27 is necessary, disconnect all plugs from the box and remove the box from the frame before attempting to open the hinged front.

(1) Face the front of the box and open the hinged cover and front. *Do not lose the metal space collar on each of the two thumb-screws.*

(2) Place three batteries BA-2 in the right compartment with their red leads nearest the terminal strip and connect them as indicated in figure 11, bringing the leads *under* the terminal strip.

(3) Place three more batteries BA-2 on top of the first three with their red leads also nearest the terminal strip, and connect them as indicated in figure 11, bringing the leads *over* the terminal strip.

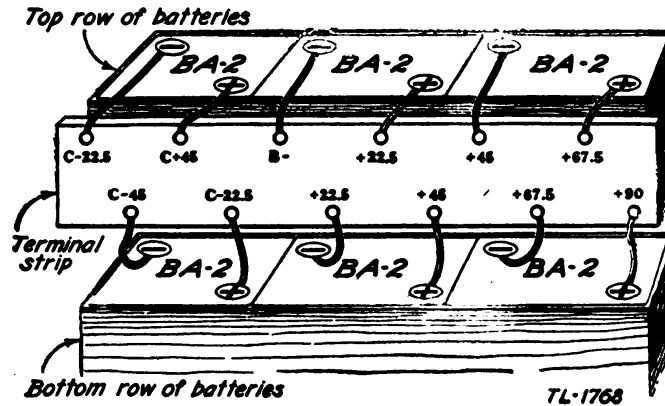


FIGURE 11.—Box BX-12, terminal strip-battery, BA-2 connections.

(4) Connect the $-4\frac{1}{2}$ and the $+$ terminals of a battery BA-27 to the two wires located below the terminal strip and marked $-4.5V$ and $+4.5V$, respectively. Press this battery into the space between the right end of the box and the spring clip.

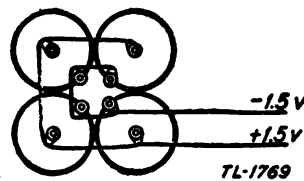


FIGURE 12.—Box BX-12, battery BA-23 connections.

(5) Place four batteries BA-23 in the middle compartment and connect them to the wires marked $+1.5V$ and $-1.5V$ as indicated in figure 12. Tighten the wing nut of the compartment to hold these batteries firmly in place.

(6) With their bases up, place three tubes VT-24 in the small felt pockets, one tube VT-50 in the large rear pocket, and one tube VT-25 in the remaining pocket of the left compartment. Wrap the spare lamp in a small piece of paper and place it in one of the pockets.

(7) Close the hinged front, tighten the thumbscrews with their collars in place, and close the hinged cover.

(8) Remove the four hexagonal nuts and washers from the top of the frame, and place the box on the frame in its proper position, being sure that the wire W-124 from the transmitter to the control box is

placed between the box and the receptacle for the generator on top of the frame. Replace the washers and nuts.

(9) Connect the plug PL-97 on cord CD-202 to the socket of box BX-12 marked PL-97 TRANS., bringing the cord under the top members of the frame.

(10) Connect the plug PL-100 on cord CD-131 to the socket of box BX-12 marked PL-100 CONTROL BOX.

(11) Connect the plug PL-89 on cord CD-211 to the socket of box BX-12 marked PL-89 REC.

e. Generator.—(1) Remove the wing nut from the metal strap at the front of the near side of the frame FM-18, or open the release catch on the FM-18-A, and place the generator on the frame with its socket side next to the battery box. Secure the generator to the frame by replacing the metal strap and wing nut, or closing the release catch.

(2) Connect the plug PL-88 on cord CD-203 to the socket of the box BX-12 marked PL-88 GEN., and the other plug on this cord to the socket of the generator.

(3) Insert the two crank extensions in the ends of the generator shaft, and the two cranks in the ends of the crank extensions. *Do not turn the generator without reading paragraph 22.*

f. Antenna.—The assembly of the mast with all eight mast sections will give the set its maximum range. However, it is sometimes advisable to use fewer mast sections when only short distances are to be covered; the reduced radiation minimizes interference with nearby stations operating in other nets. Furthermore, when the set is on a pack animal, the use of the full mast is often impracticable, especially if the animal is restless or if the wind is of appreciable intensity. If communication with a short mast is not satisfactory under these conditions, remove the set from the animal, place it on the ground, and erect the full mast, with guys, as described in (2) below.

(1) When the set is to be used in mounted service, assemble the aerial by screwing together the desired number of mast sections, beginning with the bottom mast section MS-56, and then push the end of the latter into the supporting insulator IN-91.

(2) If the set is to be used on the ground with the eight-section mast, guy the antenna. To attach the guys, slip the collar of the guy GY-11 over the lower end of mast section MS-53 with the points of the hooks toward the base of the mast, close the collar and secure it by attaching the hook of the guy GY-12 with its point toward the base of the mast.

(3) With the mast lying on the ground, place the guy lines parallel to it and the ends of the lines near the base of the mast. Raise the mast

in one continuous movement until it is vertical and slip it into the insulator IN-91.

(4) Guy the mast by staking the lines at three points equidistant from the base of the mast and spaced 120° apart. Guard against excessive bending of the mast in raising and guying it.

(5) For a ground, run a wire from one of the screws or one of the binding posts of the frame to a stake driven in the ground. Wherever possible, drive the stake into the ground near the roots of a tree, shrub, or cactus, below ground level.

(6) Connect the terminal of the insulator IN-91 to the binding post on the control box marked ANT. by means of the short rubber-covered cord provided for this purpose.

g. Cover.—In covering or uncovering the set with the cover, see that the top slide fastener is open. It should be closed when tying and untying the leather thongs. If the roll BG-56 is assembled on the frame as shown in figure 2, remove it before removing the cover, and attach it after putting on the cover. Remove the front of the cover before the rest and replace it last.

h. Roll.—Keep mast sections not in use in the roll and the roll attached to the frame as shown in figure 2.

i. Other parts.—Keep all parts not in use in their proper pockets of the cover.

j. Support.—If the assembled set is to be kept on the ground for an extended period of time, improvise a support for the loaded frame which will prevent undue spreading of its sides. If time will not permit this, at least tie the thongs on opposite sides together for the same purpose.

22. Check before operating and caution.—*a. General.*—Before operating the set, check the equipment to determine that the tubes are of the correct types and are firmly seated in their sockets, that the batteries are of sufficient voltage as indicated in paragraph 26a, that the plugs are properly connected to their sockets, and that the wire connections are correct and attached to their terminals. See that all nuts securing the parts to the frame are tight, that all parts are in place, and that the snap slides and latches are closed.

Caution: This set operates at high voltages which are dangerous to life. Therefore, *keep away from high voltage leads at all times and do not change tubes or make adjustments inside the set while the generator is being turned.*

b. Generator check.—When the generator is adjusted for 8 volts on the low voltage side, the high voltage will be approximately 350

volts. These adjustments are made by the manufacturer or at the depot before the generator is issued. However, always check a generator before taking it into the field and make any necessary adjustment of the voltage regulator. (See par. 26*b*).

23. Operation in general.—a. Interference.—(1) Interference with reception may take on various forms and is caused by either atmospheric electrical disturbances or electrical disturbances produced by the operation of electrical equipment, including all types of machinery, vacuum tubes, power, and communication lines, radio transmitters and receivers. Electrical disturbances caused by atmospheric conditions are usually registered in the headset as a series of irregular crashes, hissing, and frying sounds. This cannot be eliminated. Communication can be carried on only when the signal strength is above the noise level of the interference.

(2) Rotating machinery, like caterpillar-driven tanks, may cause considerable trouble, particularly if the communication equipment is defective in any respect. This may be indicated by a steady or irregular hum depending on conditions. This trouble should be corrected at the source if possible.

(3) Power lines may give rise to interference directly because of the electromagnetic field produced by the currents in the lines, and indirectly because of the effect of the conductors and their position with respect to the receiver antenna. The direct effect is apparent on all frequencies but is particularly noticeable on the higher ranges. As it is not known how to eliminate this form of interference, operation in the immediate vicinity of power lines must be avoided whenever possible. The indirect effect may be noticeable when traveling parallel or nearly so to a power or communication line. It is apparent in the receiver headset as a periodic increase and decrease of signal intensity. This phenomenon appears to be caused by the action of the conductors as parasitic antenna producing standing waves, whenever the distance between the conductors and the receiver antenna bears certain relations to the wave length.

(4) Discharge across defective insulators on power lines will give rise to a series of irregular crackles or hums. Clicks, either regular or irregular, may often be traced to switch gear, thermostatic devices, and sign flashers in the immediate vicinity, or to defective resistors and capacitors in the receiver or power supply itself.

(5) Heterodyning of the carrier waves of two or more stations operating on nearly the same frequency or oscillations of the re-

ceiver itself will produce whistles and squeals of varying pitch depending upon the difference in frequencies.

(6) The above-mentioned forms of interference and others may be identified after some experience. As correction of electrical conditions not in the radio set or power supply itself is usually not feasible, the only way to reduce or eliminate the noise is to operate at another location.

b. Net operation.—If net operation is desired, each set must be accurately tuned to the same frequency. This may best be accomplished with the aid of a frequency meter. *All sets within one net must be tuned under substantially the same conditions.* The position and length of antenna, the temperature, and the battery terminal voltage must all be fairly uniform if successful operation is to be expected. Avoid tuning in the immediate vicinity of buildings or metal structures. Do not tune a set in a heated garage, for example, and expect it to be on frequency when taken into the field under colder weather conditions.

c. Methods of operation.—Always operate the transmitter with the antenna circuit tuned. This is particularly important in net operation in order to maintain the correct frequency. Being broad tone transmission is well adapted to net operation but produces more interference to nearby radio sets than c.w. transmission. Voice transmission produces more interference than tone transmission. (See par. 19.)

24. Transmitting.—*a. Controls* (figs. 3 and 5).—Transmission is accomplished or controlled by the following:

- (1) The generator.
- (2) On the control box
 - (a) The changeover switch marked TRANS. OFF REC.
 - (b) The key.
- (3) On the transmitter or connected to it—
 - (a) The antenna coupling control marked ANT. COUPLING and located near the upper left corner of the panel. An arrow pointing counterclockwise is marked OUT and clockwise is marked IN.
 - (b) The antenna tuning control marked ANT. TUNING and located immediately below the antenna coupling control ((a) above). An arrow on the knob together with the mark MIN. on the left and MAX. on the right of the knob indicates the limits of tuning.
 - (c) The antenna current meter marked AMPERES R. F. with a scale from 0 to 1.5 amperes and located just below the antenna tuning control ((b) above).

RADIO SET SCR-203

(*d*) The transmitter switch marked **TONE C.W. VOICE** and located just to the right of the antenna current meter ((*c*) above).

(*e*) The key jack marked **KEY** located just below the transmitter switch ((*d*) above) and the key and cord when connected thereto.

(*f*) The plate current meter located near the center of the panel and marked **TOTAL PLATE CURRENT** with a scale from 0 to 200 milliamperes.

(*g*) The neutralizing capacitor control marked **NEUT. COND.** and located to the right of the transmitter switch ((*d*) above). This control is adjusted at the factory, and further adjustment in the field is not necessary.

(*h*) The oscillator control marked **OSCILLATOR** at the lower right corner of the panel with a pointer and scale from 0 to 10 in tenths.

(*i*) The microphone jack marked **MICROPHONE**, located just to the left of the oscillator control ((*h*) above), and the microphone and cord when connected thereto.

b. Procedure.—Regardless of whether transmission is to be c. w. tone, or voice, follow initially the procedure indicated in (1) below:

(1) *For c. w., tone, or voice.*—(*a*) Read paragraph 22.

(*b*) Turn the changeover switch of the control box to **TRANS.**

(*c*) Turn the transmitter switch to **C. W.**

(*d*) Set the **OSCILLATOR** pointer at the setting corresponding to the frequency at which it is desired to transmit, obtaining this setting from the tabulation of frequencies and settings mounted on the upper right of the panel. If the desired frequency is between any two frequencies tabulated, interpolate the value of this setting.

(*e*) Rotate the **ANT. COUPLING** control counterclockwise in the direction of **OUT** as far as possible without forcing. Forcing this control is likely to bind and break the fragile isolantite mountings. There are about 22 turns from the **IN** to the **OUT** limits. This control causes the inner inductor **L1** to slide in and out of the outer fixed inductor **L2**.

(*f*) Connect the terminals of the cord **CD-201** to the key **J-45**, and the plug of this cord to the jack marked **KEY**. While the key on the control box may be used for transmission, key **J-45** is more convenient at this time. If a longer cord is needed, use the extension cord **CD-199** also. The key is mounted on a large open clasp which fits around the operator's leg just above the knee.

(*g*) Turn the generator from 50 to 70 revolutions per minute, and during the operations indicated below in (*h*) to (*k*), inclusive, close and open the key *intermittently*, but *do not* permit the **TOTAL**

PLATE CURRENT reading to exceed 100 milliamperes. Values exceeding this will seriously overload the generator.

(*h*) Operate the **ANT. TUNING** control until a maximum reading is obtained on the antenna current meter. If no reading is obtained, rotate the **ANT. COUPLING** knob clockwise one or two turns and repeat until a reading is obtained at some point of the **ANT. TUNING** operation.

(*i*) Watch the **TOTAL PLATE CURRENT** reading, and if it is less than 100 milliamperes rotate the **ANT. COUPLING** control clockwise until about that reading is obtained, but do not exceed it.

(*j*) Operate the **ANT. TUNING** control so as to obtain a maximum antenna current as in (*h*) above. If the **TOTAL PLATE CURRENT** exceeds 100 milliamperes, rotate the **ANT. COUPLING** counterclockwise in small steps to reduce it to that value.

(*k*) Continue (*h*), (*i*), and (*j*) above until the antenna current is about .6 ampere, with a total plate current not in excess of 100 milliamperes. It will be noted that the **ANT. COUPLING** and **ANT. TUNING** react on each other. When a final adjustment is reached, variation of the latter should reduce both the antenna and total plate currents. This is an ideal condition which will not always be obtainable in practice.

(2) *For tone.*—Having completed the procedure directed in (1) above—

(*a*) Stop the turning of the generator.

(*b*) Turn the transmitter switch to **TONE**.

(*c*) Continue as directed above in (1) (*g*) to (*k*), inclusive, except keep the total plate current at or below 125 milliamperes instead of 100. If it is found impossible to keep this current at or below 125 milliamperes without a material change in the setting of the **ANT. COUPLING** control obtained in (1) above, check the voltage and connections of the transmitter biasing batteries. These are the two batteries **BA-2** nearest the middle of the box **BX-12**. Weak or improperly connected biasing batteries will seriously overload the generator and may cause serious damage to the set when tone or voice operated.

(3) *For voice.*—Having completed the procedure directed in (1) above—

(*a*) Stop the turning of the generator.

(*b*) Turn the transmitter switch to **VOICE**.

(*c*) Disconnect the key **J-45** from its jack.

(*d*) Connect the plug **PL-68** of the microphone **T-17** to the jack marked **MICROPHONE**.

(e) Continue as in (2) (c) above except speak into the microphone at a normal tone while operating the button on the microphone intermittently.

25. Receiving.—a. Controls (fig. 5).—Reception is accomplished or controlled by the following:

(1) The changeover switch on the control box marked TRANS. OFF REC.

(2) On the receiver or connected to it—

(a) The filament switch marked ON OFF and located near the upper center of the panel.

(b) The filament rheostat adjusted by means of the unmarked octagonal knob just to the left of the filament switch.

(c) The meter located just to the right of the filament switch and marked VOLTS DC with two scales from 0 to 140 volts and 0 to 3.5 volts.

(d) The tuning control located just below the meter and consisting of an unmarked octagonal knob and, visible through a circular window, a dial graduated from 0 to 100 operated by the knob and illuminated by a lamp.

(e) The regeneration control located at the lower right corner and consisting of a knob marked REGENERATION and a pointer beneath the knob operated by the knob.

(f) Two jacks at the right lower edge of the panel marked PHONES and the headset and cord when connected to either one.

b. Procedure.—(1) Press on the pin near the bottom of the meter and read the upper scale of the meter. The reading should be between 90 and 72 volts; if less than 72, replace any of the four batteries BA-2 nearest the right end of the box BX-12 whose voltage is less than 18 volts.

(2) Turn the changeover switch of the control box to REC.

(3) Turn the filament switch to ON and read the lower scale of the meter. Lamp should light, illuminating the tuning dial.

(4) If the meter reading is less than 1.1 volts indicated by the red line on this scale, turn the filament rheostat clockwise until the needle reaches that line. If a voltage of .95 volt cannot be obtained in this manner, replace any of the four batteries BA-23 in the box BX-12 whose voltage is less than 1.2 volts.

(5) Put on and adjust a headset P-18 and insert its plug PL-55 in one of the jacks. If a longer cord is needed, use the extension cord CD-199 also. A rustling sound should be heard; if not, use another headset and check the assembly of the equipment and the procedure above.

(6) By operating the tuning control, set the dial at the setting corresponding to the frequency of the expected incoming signal, obtaining this setting from the tabulation of frequencies and settings mounted on the lower left of the panel.

(7) Turn the regeneration control knob in the direction of the arrow (clockwise) until the set begins to oscillate as evidenced by a plop sound in the headset. Thereafter, operate this control and the tuning control together until the desired signal is received. For c.w. the former must be just beyond the point of oscillation, and for tone and voice, below this point. As the dial readings are decreased, the regeneration must be increased to obtain oscillation.

26. Care and adjustment.—*a. General.*—The units of this set are designed for field use and with reasonable care in handling and operating will give satisfactory service. Keep the equipment clean, and check all mechanical fittings periodically to see that screws and nuts are tight and in place. Loose and broken connections are the sources of most operating troubles. The set must be inspected, regularly or interrupted service will result. If open leads are suspected, check the circuit in question, using a battery and small voltmeter or headset. Tubes will gradually lose their efficiency and should be interchanged with tubes of known value. Tubes should be tested with the test set I-56-A. All batteries in the box BX-12 should be checked under load after several minutes of operation. Any cell the voltage of which has dropped below a satisfactory level should be replaced. In general a perceptible increase in noise level will indicate when a battery is at the end of its useful life. The following voltages may be considered as the minimum for satisfactory performance: BA-23, 1.2; BA-27, 3.6; BA-2, 18.0.

b. Generator.—(1) *Inspection.*—The generator housing should be opened at intervals and the commutator, brushes, voltage regulator, choke coil, capacitor, and bearings examined. The commutator should be smooth and entirely free from any black spots or discoloration. The brushes must seat properly and press firmly against the commutator. Carbon dust should be removed.

(2) *Commutator.*—If the commutator is black, rough, or pitted, use a piece of dry cloth free from lint and try to rub the black spots off, but *do not* use emery cloth. Only as a last resort, it should be resurfaced by running the machine and holding a fine grade of sandpaper (No. 000 or finer) against the surface until it is entirely smooth.

(3) *Brushes.*—If the brushes have worn down or are broken, chipped, or defective in any way they should be replaced. In seating

new brushes, slip a piece of sandpaper, cutting side out, between the brush and the commutator, and while turning the machine allow the brush to be pressed against the sandpaper until it is properly seated. Use a cloth saturated with gasoline or carbon tetrachloride to wipe off oil and grease. Never lubricate the commutator with oil or grease. If it is smooth, if the mica is properly under cut, and the brushes properly fitted, no sparking should occur at the contact between the brushes and commutator.

(4) *Voltage regulator*.—If the voltage regulator is suspected of giving trouble, it may be tested by disconnecting it and the open field coil lead connected to the choke-coil terminal which is connected to the positive brush of the low voltage side. If the choke coil or capacitor is suspected, it should likewise be disconnected and tested; if defective, replace it.

(5) *Voltage adjustment*.—(a) If a separate voltmeter is not available to check the voltages of the generator, only a rough check of its operation is possible. With the generator disconnected from the cord CD-203, it should turn with little or no resistance at speeds above 60 revolutions per minute. Below 40 revolutions per minute there is an appreciable resistance to turning due to the fact that the voltage regulator does not operate below that speed. If the generator turns easily at all speeds or hard at all speeds, it is an indication that the voltage regulator is out of adjustment or that the generator is out of adjustment. See also paragraph 24b(2) for a possible cause of hard turning when the generator is connected to the set.

(b) If it appears that the generator is not delivering current at the proper voltages and a separate voltmeter is available, disconnect the cord CD-203 from the generator and measure its voltages while turning it at 50 to 70 revolutions per minute. The voltages should be from 8 to 8.25 and from 325 to 365 volts, and if they are not about these values adjust the voltages as indicated below. Voltages higher than 8 and 350 volts will reduce the life of the transmitter tubes.

(c) Remove the four screws from the top of the generator housing, the two screws from the top of the projection on the right-hand side of the housing and lift off the cover plate.

(d) Remove gage TL-127 from the inside of the cover plate.

(e) Figure 13 shows a side view of the voltage regulator the top of which can be seen inside the housing. Loosen both locking screws *L*.

(f) Back off screw *B* so that the $\frac{1}{64}$ -inch end of the gage may be inserted between the core and the armature. Screw up on the screw *A* until the armature-to-core clearance is adjusted to $\frac{1}{64}$ inch.

(g) Leave *A* in place. Insert the .0006-inch end of the gage between the armature contact and *B*, and screw up *B* for an easy slip fit. Be careful not to make this fit tight enough to damage the gage. Tighten the locking screws *L*.

(h) If the voltages are too low, tighten the screw *C* by turning it clockwise; if too high, loosen this screw. This adjustment is very critical and must be carefully made.

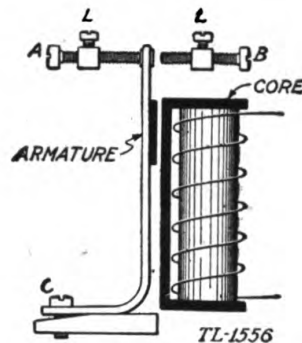


FIGURE 13.—Voltage regulator of the generator GN-35.

(i) Check the adjustment. A wobbly voltage indicates that the armature travel is too great; failure to build up voltage, evidenced by easy turning at all speeds, indicates that the armature travel is too small; hard turning at all speeds indicates that the armature is touching the core and the *A* screw.

(j) Replace and secure the gage and the cover plate.

(6) *Lubrication.*—Lubricate bearings and gears with New York and New Jersey lubricant F-925 or, if that is not available, with petroleum jelly. At regular intervals clean these parts thoroughly with carbon tetrachloride or gasoline and then lubricate them. *Caution: Do not pack bearings* because too much grease will cause excessive heat and also overflow onto the commutator. This type of bearing requires very little lubrication, the principal purpose of the grease being to protect the bearing against rust and corrosion. All bearings and the gears on one side of the generator case are accessible by removing the gear case on the right of the housing, which is secured with five machine screws. The bearings on the opposite side of the generator case are accessible by removing the two small plates, each secured with two machine screws.

27. Storage.—*a.* If the set is to remain out of service for more than a few days, proceed as follows:

(1) Remove all batteries from the box BX-12, and all tubes and the lamp from the transmitter and receiver.

(2) Blow out the inside and outside of all parts with an air hose or bellows to remove all loose dirt.

(3) Cover the ends of the mast sections with petroleum jelly.

b. If the set is to remain out of service for more than a month, in addition to the above—

(1) Wash the generator bearings with carbon tetrachloride or gasoline and pack them with petroleum jelly. When the generator is again put into service, wash the bearings again with carbon tetrachloride and cover them lightly with petroleum jelly as indicated in paragraph 26b(6).

(2) Remove all parts from the frame and wrap each individually with a heavy grade of manila paper. Pack tubes and other small parts so as to avoid damage to them in storage.

SECTION III

DETAILED FUNCTIONING OF PARTS

	Paragraph
Radio transmitter BC-228 or BC-228-A and radio control box BC-235 or BC-235-A.....	28
Radio receiver BC-227 or BC-227-A.....	29
Circuit elements.....	30

28. Radio transmitter BC-228 or BC-228-A and radio control box BC-235 or BC-235-A.—a. Circuit.—The transmitter is of the master-oscillator, power-amplifier type. It utilizes a tube VT-25 as master oscillator, a tube VT-50 as modulator, and another tube VT-25 as power amplifier. (See fig. 14.)

b. Master oscillator.—This is a tuned-plate oscillator, the principal elements of which are the tube VT-25, transformer L_3 , and capacitors C_3 and C_8 , and C_9 . L_3 has two windings, one in the plate circuit, and the other in the grid circuit. The mutual inductance between these two windings provides the grid-excitation voltage required to produce oscillation. C_3 , C_8 , and C_9 together provide the requisite capacitance to determine the frequency band. C_3 is a fixed mica capacitor, C_8 is the variable tuning capacitor (represented on the front panel by the dial marked OSCILLATOR), and C_9 is the adjusting capacitor which enables accurate calibration of the tuning capacitor C_8 . R_3 is the biasing resistor and C_5 and C_{11} are bypass capacitors. Variable capacitor C_9 is adjusted by means of a screw driver inserted through a hole in the lower part of the right side of the box containing the BC-228 or BC-228-A. This hole is normally closed by a screw plug to exclude dirt.

c. Power amplifier.—The circuit elements of the power amplifier are the tube VT-25, r.f. choke coil L_5 , resistors R_2 and R_6 , and capacitors C_2 , C_4 , and C_6 . The radio-frequency voltage of the master oscillator is impressed on the grid of the power amplifier through C_2 .

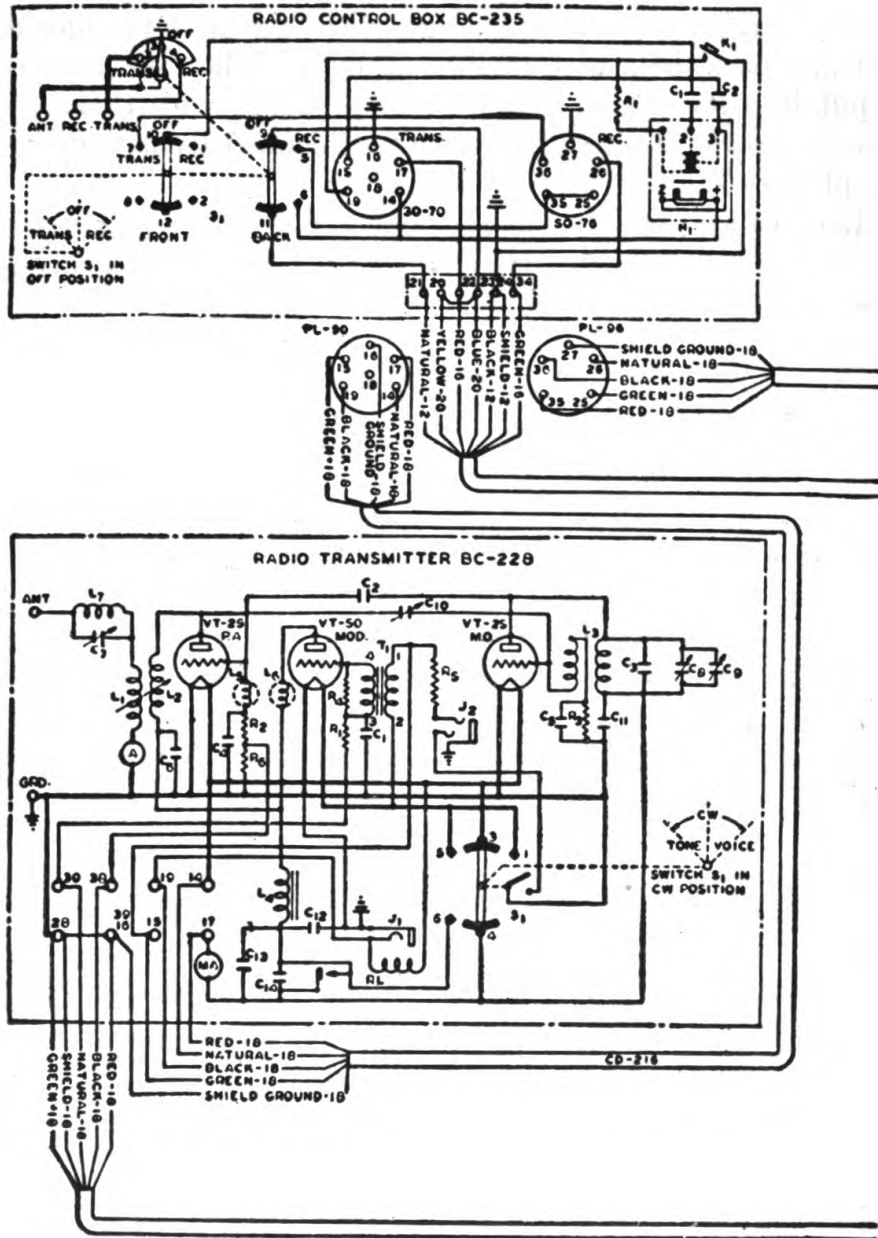


FIGURE 14.

Coils L_1 and L_2 , comprising the antenna coupling transformer, serve to transfer the radio frequency energy from the power amplifier to the antenna circuit. Coil L_7 and capacitor C_7 are the tuning elements of the antenna circuit. C_7 is the capacitor marked ANT.

TUNING on the front of the set. L_5 is the radio frequency choke coil which serves to prevent radio frequency currents from flowing through R_2 and R_6 and entering the bias supply lead, and thus maintains the radio frequency excitation voltage between the grid and

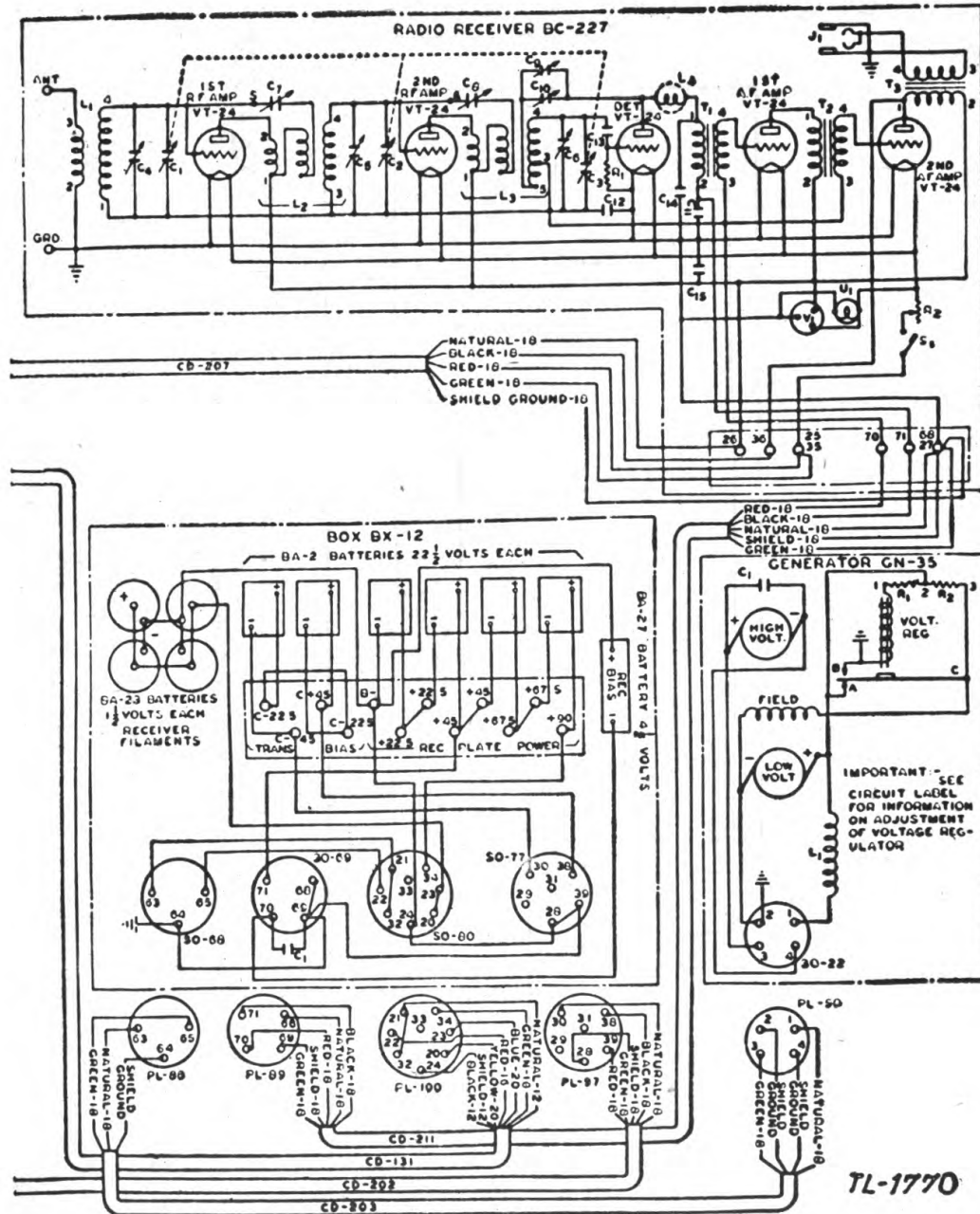
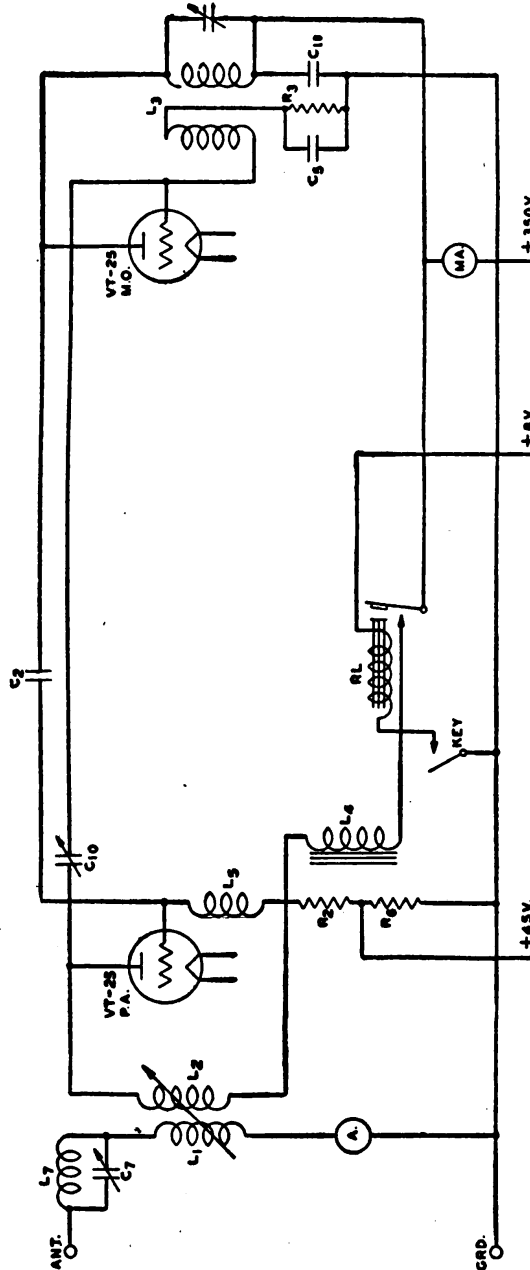


FIGURE 14—Continued.

filament. R_2 and R_6 are grid-biasing resistors; C_4 and C_6 are bypass capacitors.

d. Modulator.—The circuit elements of the modulator are the tube VT-50, transformer T_1 , coils L_4 and L_6 , resistors R_1 and R_4 , and capaci-

tors C_1 and C_{12} . The interrupter H_1 , capacitors C_1 and C_2 , and resistor R_1 , all in the control box, are a part of the input circuit of the modulator. The microphone $T-17$ is also a part of the input circuit and is connected by means of jack J_2 . The transformer T_1 serves

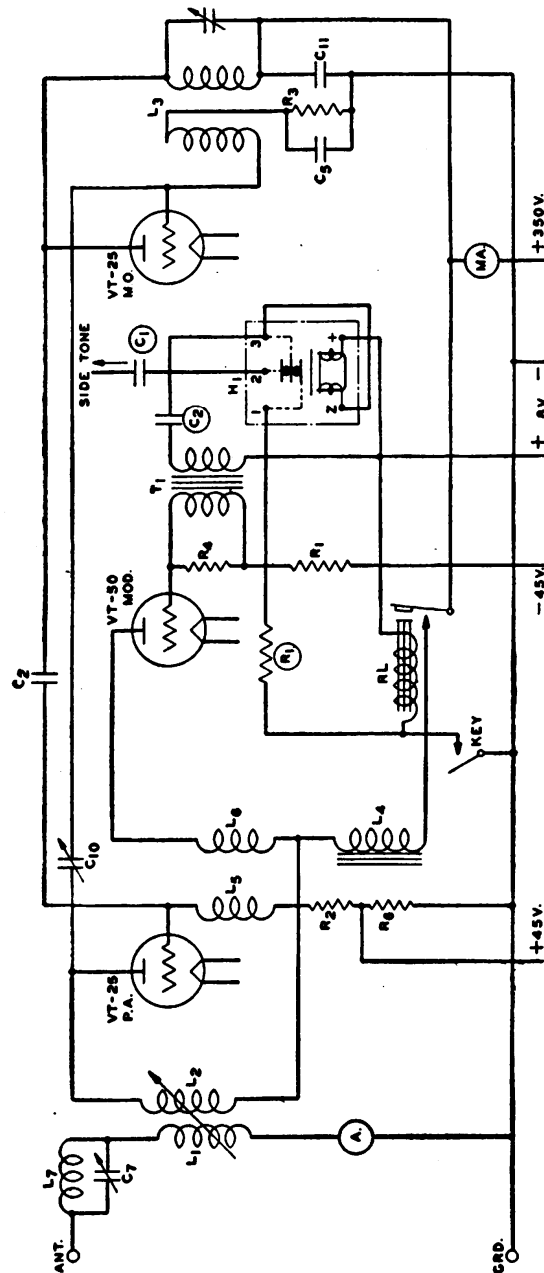


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FIGURE 15.—Radio set SCB-203, functional diagram, c. w. transmission.

to increase the audio frequency voltage of the interrupter or microphone applied to the grid of the tube. The interrupter produces an audio-frequency note of 1,350 to 1,650 cycles when connected as shown in figure 14 with the magnet coil in series with the half

of the carbon button adjacent to it. L_4 is the modulation reactor which acts to maintain the constant current required in this (Heising) system of modulation. L_6 is the choke coil which serves to reduce radio-frequency currents in the plate circuit of the tube to a minimum. R_1 acts to isolate or filter the grid-bias circuit

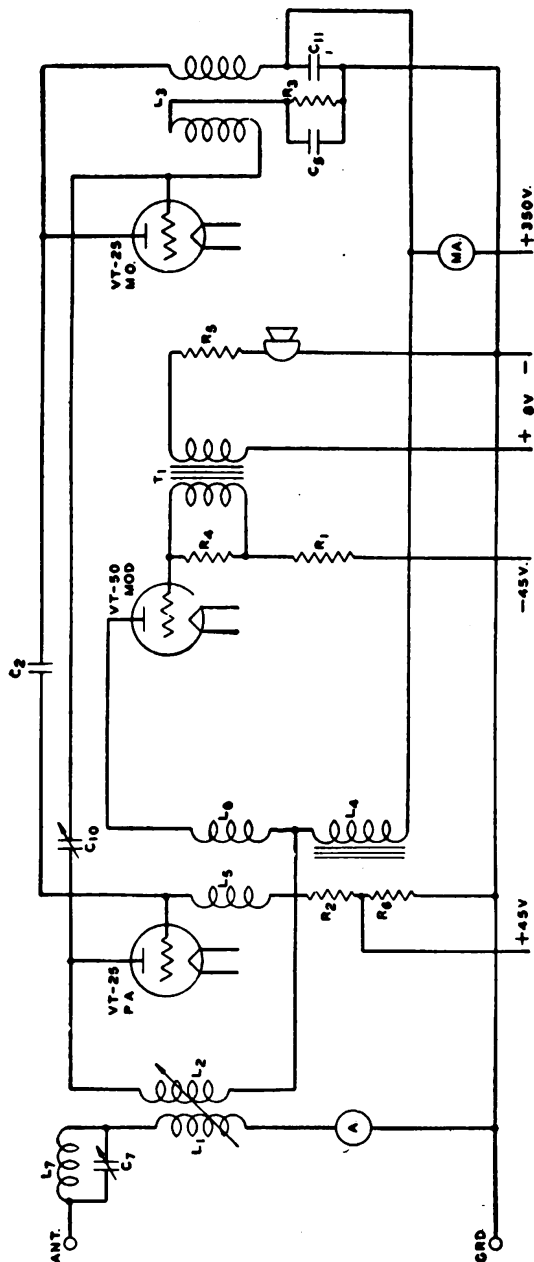


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FIGURE 16.—Radio set SCR-203, functional diagram, tone transmission.

of the modulator tube. The total grid bias is the sum of the voltage drop across the resistor R_6 and the two $22\frac{1}{2}$ -volt batteries. R_4 serves as a constant load impedance of the transformer T_1 and tends to prevent distortion. C_1 and C_{12} are bypass capacitors.

e. *C.w. transmission* (figs. 14 and 15).—The master oscillator and power amplifier operate to transmit c.w. signals when the key is depressed, closing the low-voltage circuit to the relay RL, which in turn closes the plate circuit of the amplifier. The modulator does not operate, as the filament supply of this tube is disconnected by



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FIGURE 17.—Radio set SCR-203, functional diagram, voice transmission.

the selector switch. Capacitors C_{13} and C_{14} (fig. 14) serve to reduce sparking across the contact points of the relay and key clicks in the transmission.

f. *Tone transmission* (figs. 14 and 16).—All tubes operate on tone transmission. The contact on the selector switch closes the filament

circuit of the modulator tube. The key serves to close the interrupter-transformer circuit and the circuit through the coil of relay RL, which in turn closes the plate circuit of the modulator and amplifier tubes. Resistor R_1 in the control box serves to provide the proper operating voltage for the interrupter. Capacitors C_1 and C_2 in the control box serve to impress the audio-frequency voltage of the interrupter on the headset through the receiver jack (side tone), and also across the primary of transformer T_1 .

g. Voice transmission (figs. 14 and 17).—All tubes operate on voice transmission. The selector switch connects the contact points of the relay, thus closing the plate circuit of the modulator and amplifier tubes. It also connects the microphone T-17 in series with the primary of transformer T_1 and the resistor R_5 . The microphone is connected by means of jack J_2 . The resistor R_5 serves to reduce the generator low voltage to the proper value for the microphone.

29. Radio receiver BC-227 or BC-227-A (fig. 14).—The receiver circuit comprises two stages of radio-frequency amplification, a regenerative detector, and two stages of audio-frequency amplification. Tubes VT-24 are used in all stages. Reception of all types of signals over the frequency range of 2,200 to 3,060 kilocycles is available. All stages are inductively coupled. L_1 , L_2 , and L_3 serve as interstage r.f. transformers, and C_1 , C_2 , and C_3 serve as tuning capacitors for them. T_1 and T_2 serve as the audio-frequency transformers to couple the detector, first, and second audio-frequency amplifier stages. T_3 is the output transformer. C_4 , C_5 , and C_6 are alining capacitors. These are adjusted accurately at the factory and will rarely require resetting. C_{13} is a grid-coupling capacitor. C_9 and C_{10} serve to couple the plate of the detector to the grid, thus providing regeneration. C_{10} is controlled from the front of the panel by the knob marked REGENERATION. C_9 is a midget variable capacitor which is adjusted by a screw driver through a hole in the lower left chassis bracket (as the set is viewed from the rear). This may require adjustment if a new detector tube is installed. Set the tuning dial to 100, and the regeneration pointer about an inch above the extreme left position. With C_9 at minimum capacitance (plates entirely unmeshed), start turning it up slowly until the rushing noise and "plop" indicative of regeneration is heard in the earphones; leave it in that position. As the dial is turned to the lower frequencies, regeneration is maintained by advancing the REGENERATION knob. R_1 is a grid-biasing resistor. C_7 and C_8 are neutralizing capacitors serving to compensate for the interelectrode capacitance of the r.f. amplifier tubes. C_{11} , C_{12} , C_{14} , and C_{15} are bypass capacitors.

itors. L_4 is a radio-frequency choke coil serving to prevent radio-frequency currents from passing over to the audio-frequency side of the circuit.

30. Circuit elements (fig. 14).

a. Radio control box BC-235 or BC-235-A.

C_1 Capacitor CA-177-A, .5 μ f.

C_2 Capacitor CA-177-A, .5 μ f.

H_1 Interrupter BZ-5

K_1 Key

R_1 Resistor RS-58, 200 ohms

S_1 Switch SW-103

b. Radio receiver BC-227 or BC 227-A.

C_1 Capacitor CA-182, 150 μ f.

C_2 Capacitor CA-182, 150 μ f.

C_3 Capacitor CA-182, 150 μ f.

C_4 Capacitor CA-252, 4-50 μ f.

C_5 Capacitor CA-252, 4-50 μ f.

C_6 Capacitor CA-252, 4-50 μ f.

C_7 Capacitor CA-251, 3-25 μ f.

C_8 Capacitor CA-251, 3-25 μ f.

C_9 Capacitor CA-252, 4-50 μ f.

C_{10} Capacitor CA-180, 6-100 μ f.

C_{11} Capacitor CA-177-A, .5 μ f.

C_{12} Capacitor CA-177-A, .5 μ f.

C_{13} Capacitor CA-152, 150 μ f.

C_{14} Capacitor CA-175, .002 μ f.

C_{15} Capacitor CA-177-A, .5 μ f.

L_1 Coil (first radio-frequency transformer)

L_2 Coil (second radio-frequency transformer)

L_3 Coil (detector transformer)

L_4 Coil C-91

P_1 Plug PL-89

P_2 Plug PL-96

R_1 Resistor RS-3, 2 megohms

R_2 Rheostat RS-101-A, 1 ohm

S_1 Switch SW-105

T_1 Audio-transformer C-65

T_2 Audio-transformer C-65

T_3 Output transformer C-62

V_1 Voltmeter IS-116

J_1 Jack JK-30

U_1 Lamp LM-31—2.33 volts, .27 ampere Mazda No. 10

c. Radio transmitter BC-228 or BC-228-A.

C_1 Capacitor CA-183, .01 μ f.

C_2 Capacitor CA-134, .01 μ f.

C_3 Capacitor CA-257, 250 μ f.

C_4 Capacitor CA-174, .002 μ f.

- C₂ Capacitor CA-174, .002 μ f.
- C₃ Capacitor CA-176, .005 μ f.
- C₇ Capacitor CA-263, 200 μ μ f.
- C₈ Capacitor CA-181, 400 μ μ f.
- C₉ Capacitor CA-256, 50 μ μ f.
- C₁₀ Capacitor CA-256, 50 μ μ f.
- C₁₁ Capacitor CA-183, 01 μ f.
- C₁₂ Capacitor CA-183, .01 μ f.
- C₁₃ Capacitor CA-183, .01 μ f.
- C₁₄ Capacitor CA-183, .01 μ f.
- L₁ Coil, antenna coupling
- L₂ Coil, power amplifier tank
- L₃ Coil C-92
- L₄ Coil C-90
- L₅ Coil C-103
- L₆ Coil C-103
- L₇ Coil, antenna loading
- R₁ Resistor RS-113, 5,000 ohms
- R₂ Resistor RS-99, 10,000 ohms
- R₃ Resistor RS-99, 10,000 ohms
- R₄ Resistor RS-2, 1 megohm
- R₅ Resistor RS-112, 20 ohms
- R₆ Resistor RS-138, 3,000 ohms
- RL Relay BK-6
- J₁ Jack JK-31 (key)
- J₂ Jack JK-32 (microphone)
- S₁ Switch SW-104
- T₁ Transformer C-107
- A Ammeter IS-120, radio-frequency, 1.5 amperes
- MA Milliammeter IS-119, direct-current, 200 milliamperes

d. Box BX-12 or BX-12-A.

- C₁ Capacitor CA-177-A, .5 μ f.

e. Generator GN-35.

- C₁ Capacitor CA-170, 4 μ f.
- R₁ Resistor, 23 ohms
- R₂ Resistor, 20 ohms

SECTION IV

SUPPLEMENTARY DATA AND PARTS LIST

	Paragraph
Operating currents of radio transmitter BC-228 or BC-228-A-----	31
Voltages and currents of generator GN-35-----	32
Dimensions and volume of principal parts-----	33
Quantities, weights, and loading of parts on frame FM-18 or FM-18-A-----	34
Parts list-----	35

31. Operating currents of radio transmitter BC-228 or BC-228-A.—The values given below are average values and will serve

to indicate the approximate readings that will be obtained when the transmitter is operating properly. Modulation on tone is 70 percent and on voice is 55 percent.

a. Antenna current—radio frequency.

Frequency in kilocycles	Current in amperes		
	C. w.	Tone	Voice
2200.....	. 53	. 54	. 55
2600.....	. 62	. 66	. 68
3000.....	. 64	. 68	. 69

b. Plate current.

Frequency in kilocycles	Current in milliamperes		
	C. w.	Tone	Voice
2200.....	82	96	95
2600.....	73	88	85
3000.....	67	78	81

32. Voltages and currents of generator GN-35.—The following values should normally be secured at crank speeds varying from 50 to 70 revolutions per minute. The ripple voltage on the high-voltage side should not exceed 2 percent.

- a. Low-voltage side, 8.00 to 8.25 volts, 2.5 amperes.*
- b. High-voltage side, 325 to 365 volts, 0.1 ampere.*
- c. The normal value is 340 volts.*

33. Dimensions and volume of principal parts.—These values are based on over-all dimensions.

Part	Dimensions in inches			Volume in cubic feet
	Width	Height	Depth	
Radio transmitter BC-228 or BC-228-A.....	19. 75	13. 00	6. 00	0. 90
Radio receiver BC-227 or BC-227-A.....	19. 50	9. 50	6. 00	. 65
Radio control box BC-235 or BC-235-A.....	19. 25	4. 25	5. 25	. 25
Box BX-12 or BX-12-A.....	19. 25	7. 75	7. 50	. 65
Generator GN-35.....	6. 75	6. 00	8. 25	. 80
Frame FM-18 or FM-18-A.....	34. 00	23. 50	29. 50	13. 70
Radio set SCR-203 completely assembled.....	37. 00	26. 00	37. 00	16. 70

34. Quantities, weights, and loading of parts on frame FM-18 or FM-18-A.

Quantity	Article	Weight in pounds
1	Frame FM-18 or FM-18-A.....	32.00
1	Cover BG-70-A.....	8.50
<i>Top</i>		
1	Box BX-12 or BX-12-A with batteries, spare tubes, and lamp.....	24.85
1	Generator GN-35.....	21.00
1	Cord CD-203.....	.40
1	Insulator IN-91.....	1.10
Total on top.....		47.35
<i>Near side</i>		
1	Radio receiver BC-227 or BC-227-A with tubes and lamp.....	21.80
1	Radio control box BC-235 or BC-235-A.....	6.50
1 ²	Cord CD-199.....	2.00
1 ²	Crank GC-2.....	.88
1 ¹	Guy GY-11.....	.10
1 ¹	Guy GY-12.....	.10
1 ¹	Key J-45.....	1.00
1 ¹	Reel RL-28.....	.30
1 ⁴	Stake GP-27.....	1.30
(¹)	Wire W-124, 18 feet.....	2.25
Total on near side.....		36.23
<i>Offside</i>		
1	Radio transmitter BC-228 or BC-228-A, tubes in place... Mast sections MS-49 to MS-56 and roll BG-56 or BG-56-A.....	25.82
2	Crank extension GC-8.....	6.20
2	Headset P-18.....	1.20
2	Headset P-18.....	2.00
1	Tool equipment TE-5.....	1.30
2	Microphone T-17.....	1.40
Total on offside.....		37.92
Total weight of set.....		162.00

¹ These parts are carried in the near pocket of the cover.

² These parts are carried in the off pocket of the cover.

35. Parts list.—For complete information see Signal Corps General Catalog.

Quantity	Article	Stock number
6	Batteries BA-2, no spares.....	3A2
4	Batteries BA-23, no spares.....	3A23
1	Battery BA-27, no spares.....	3A27
1	Box BX-12 or BX-12-A for batteries and spare tubes.....	2Z1112
		or
		2Z1112A
2	Cords CD-199, headset and key extension.....	3E1199
1	Cord CD-203, to generator.....	3E1203
		2Z3370
1	Cover BG-70-A.....	or
		2Z3370A
2	Cranks GC-2.....	3H1402
2	Crank extensions GC-8.....	2Z3408
		2Z4618
1	Frame FM-18 or FM-18-A.....	or
		2Z4618A
1	Generator GN-35 adjusted for SCR-163-A (includes 1 gage TL-127).....	3H2335
1	Guy GY-11.....	2A1311
1	Guy GY-12.....	2A1312
2	Headsets P-18 ¹	2B918
1	Key J-45.....	3A3445
2	Lamps LM-31, 1 in use, 1 spare.....	6Z6760
1	Mast section MS-49.....	2A2349
1	Mast section MS-50.....	2A2350
1	Mast section MS-51.....	2A2351
1	Mast section MS-52.....	2A2352
1	Mast section MS-53.....	2A2353
1	Mast section MS-54.....	2A2354
1	Mast section MS-55.....	2A2355
1	Mast section MS-56.....	2A2356
2	Microphones T-17, 1 in use, 1 spare.....	2B1617
		2C3235
1	Radio Control Box BC-235 or BC-235-A.....	or
		2C3235A
		2C4227
1	Radio Receiver BC-227 or BC-227-A.....	or
		2C4227A
		2C6228
1	Radio Transmitter BC-228 or BC-228-A.....	or
		2C6228A
1	Reel RL-28.....	2A3128
1	Roll BG-56 or BG-56-A (for mast sections).....	2Z8056

¹ When stocks of headset P-18 are exhausted, headset HS-23 and cord CD-307-A, 84 inches long, may be substituted.

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Quantity	Article	Stock number
4	Stakes GP-27, 3 in use, 1 spare.....	2A3327
1	Tool equipment TE-5.....	6R38005
8	Tubes VT-24, 5 in use, 3 spare.....	2T24
3	Tubes VT-25, 2 in use, 1 spare.....	2T25
2	Tubes VT-50, 1 in use, 1 spare.....	2T50
1	Voltammeter I-50.....	3F6050
18 feet	Wire W-124.....	1B124

[A. G. 062.11 (4-18-41).]

BY ORDER OF THE SECRETARY OF WAR :

G. C. MARSHALL,
Chief of Staff.

OFFICIAL :

E. S. ADAMS,
Major General,
The Adjutant General.

DISTRIBUTION :

IC and H 2, 6, 11 (5).
(For explanation of symbols see FM 21-6.)