RESTRICTED

TM 11-272

WAR DEPARTMENT

TECHNICAL MANUAL

RADIO SETS SCR-210-A, -B, -C, -D, -E, -F, -G, -H, AND -J; AND RADIO SETS SCR-245-A, -B, -C, -D, -E, -F, -G, -H, -J, -K, -L, -M, -N, AND -P

February 23, 1942

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RADIO SETS SCR-210-A, -B, -C, -D, -E, -F, -G, -H, AND -J; AND SCR-245-A, -B, -C, -D, -E, -F, -G, -H, -J, -K, -L, -M, -N, AND -P

Prepared under direction of the
Chief Signal Officer

*This manual supersedes TR 1210-73, December 1, 1939.

SECTION I

GENERAL DESCRIPTION

1. **Purpose.**—Radio sets SCR-210-A, SCR-210-B, SCR-210-C, SCR-210-D, SCR-210-E, SCR-210-F, SCR-210-G, SCR-210-H, and SCR-210-J; and radio sets SCR-245-A, SCR-245-B, SCR-245-C, SCR-245-D, SCR-245-E, SCR-245-F, SCR-245-G, SCR-245-H, SCR-245-J, SCR-245-K, SCR-245-L, SCR-245-M, SCR-245-N, and SCR-245-P, are intended primarily for installation in vehicles for the purpose of providing intervehicular communication whether the vehicles are stationary or moving. This manual explains the use of the above sets in the following vehicles:

Radio set	Vehicle
SCR-210-	
A	Light tank M2A3.
B	Medium tank M2.
C	Light tank M2A4.
D	Scout car M3A1.
E	Light tank M1A1.
F	Medium tank M2A1.
G	Light tank M3.

Radio set	Vehicle
SCR-210—Continued.	
H	Medium tank M3.
J	75-mm gun motor carriage.
SCR-245-	
A	Combat car M1A1.
B	Light tank M2A3.
C	Scout car M3.
D	Scout car T13.
E	Medium tank M2.
F	Light tank M2A4.
G	Scout car M3A1.
H	Scout car M1.
J	Truck, ½-ton 4 by 4 command (radio).
K	Light tank M1A1.
L	Medium tank M2A1.
M	Medium tank M3.
N	Light tank M3.
P	Scout car M2, ½-ton.

a. Radio sets of the SCR-210 series are used when only radio reception is required. The major component is a radio receiver of the BC-312 series.

b. Radio sets of the SCR-245 series are used when two-way radio communication is required. The major components are a radio receiver of the BC-312 series, a radio transmitter of the BC-223 series, and a suitable dynamotor for the latter.

c. These radio sets have been assigned different type numbers because of minor differences in the component parts necessary to effect suitable installation in the particular vehicles concerned. The designations SCR-210-I, SCR-245-I, and SCR-245-O are not used because of the possibility of confusing the suffix letters I and O with the numbers 1 and 0 (zero).

d. The information and instructions in this manual apply equally to all the sets listed in *a* and *b* above unless a particular set is specifically referred to by type number.

2. Power.—*a. Input.*—The primary source of power for these sets is the 12-volt storage battery in the vehicle. This battery is not a radio set component. The current normally drawn from the battery by the receivers and transmitters under various modes of operation is given in paragraph 43*a*.

b. Output.—The transmitters have a nominal output rating of 10 watts.

3. Modes of transmission and reception.—*a.* Radio sets of the SCR-245 series transmit and receive the following:

(1) Continuous-wave telegraph signals, abbreviated as "cw."

(2) Tone-modulated, continuous-wave telegraph signals, abbreviated as "tone."

(3) Voice-modulated, continuous-wave telephone signals, abbreviated as "voice."

b. All modes of transmission given in *a* above may be master-oscillator or crystal controlled.

c. Radio sets of the SCR-210 series are designed to receive the modes of transmission listed in *a* above.

4. Distance ranges.—The distance over which communication may be established with these radio sets varies considerably according to frequency and mode of operation, and as a result of terrestrial, atmospheric, and electrical conditions. Approximate reliable communication ranges in miles are as follows:

	Cw	Tone	Voice
Stationary	45	35	20
Moving	25	20	15

5. Frequency ranges.—*a.* Receivers of these sets have a frequency range of 1,500 to 18,000 kilocycles (kc).

b. The transmitters have a frequency range of 2,000 to 5,250 kilocycles. This is obtained by the use of three separate tuning units of the plug-in type, only one of which can be used at a time. The ranges of the three units are as follows:

Transmitter tuning unit	Frequency range in kilocycles
TU-17, TU-17-A, or TU-17-B	2, 000 to 3, 000
TU-18, TU-18-A, or TU-18-B	3, 000 to 4, 500
TU-25-A	3, 500 to 5, 250

6. Channels.—The numbers of radio channels available under average conditions, together with frequency separations, are as follows:

Control	Master oscillator			Crystal		
Mode of operation	Cw	Tone	Voice	Cw	Tone	Voice
Frequency separation in kilocycles	20	40	40	10	20	20
Number of channels	162	81	81	325	162	162

NOTE.—The frequency separations indicated above are approximate and are affected by terrestrial, atmospheric, and electrical conditions, as well as by the distances between stations. They are generally reliable for distances between stations of 3 miles or more. At shorter distances, greater frequency separation of channels is required.

7. Use.—*a. Using organizations.*—These radio sets are employed by organizations to which the vehicles named in paragraph 1 are issued.

b. Liaison.—(1) Radio sets of the SCR–245 series may be used in two-way communication with the same set or other types of radio sets listed in the left-hand column of figure 1, provided all sets are within the maximum distance range of all others in the net. Figure 1 shows the frequency band of radio transmitters BC–223 and BC–223–A, components of these radio sets, and bands of the other types of radio sets which overlap it. Authorized frequencies which lie within the overlapping bands may be selected for such communication.

(2) Radio sets of the SCR–245 series may be used in one-way communication with those radio sets indicated in figure 1 as having no transmitters, provided the latter sets are within the maximum distance range of the former. Authorized frequencies which lie within the overlapping bands for receiver and transmitter as shown in the figure may be selected for such communication.

(3) Radio sets of the SCR–210 series may be used in receiving the transmissions of other types of radio sets within the frequency range of 1,500 to 18,000 kilocycles, provided they are located within the maximum distance ranges of the other sets.

8. Transport.—*a.* Each vehicle named in paragraph 1, with the exception of the truck, ½-ton 4 by 4 command, is prepared by the Ordnance Department with all the necessary mounting holes and

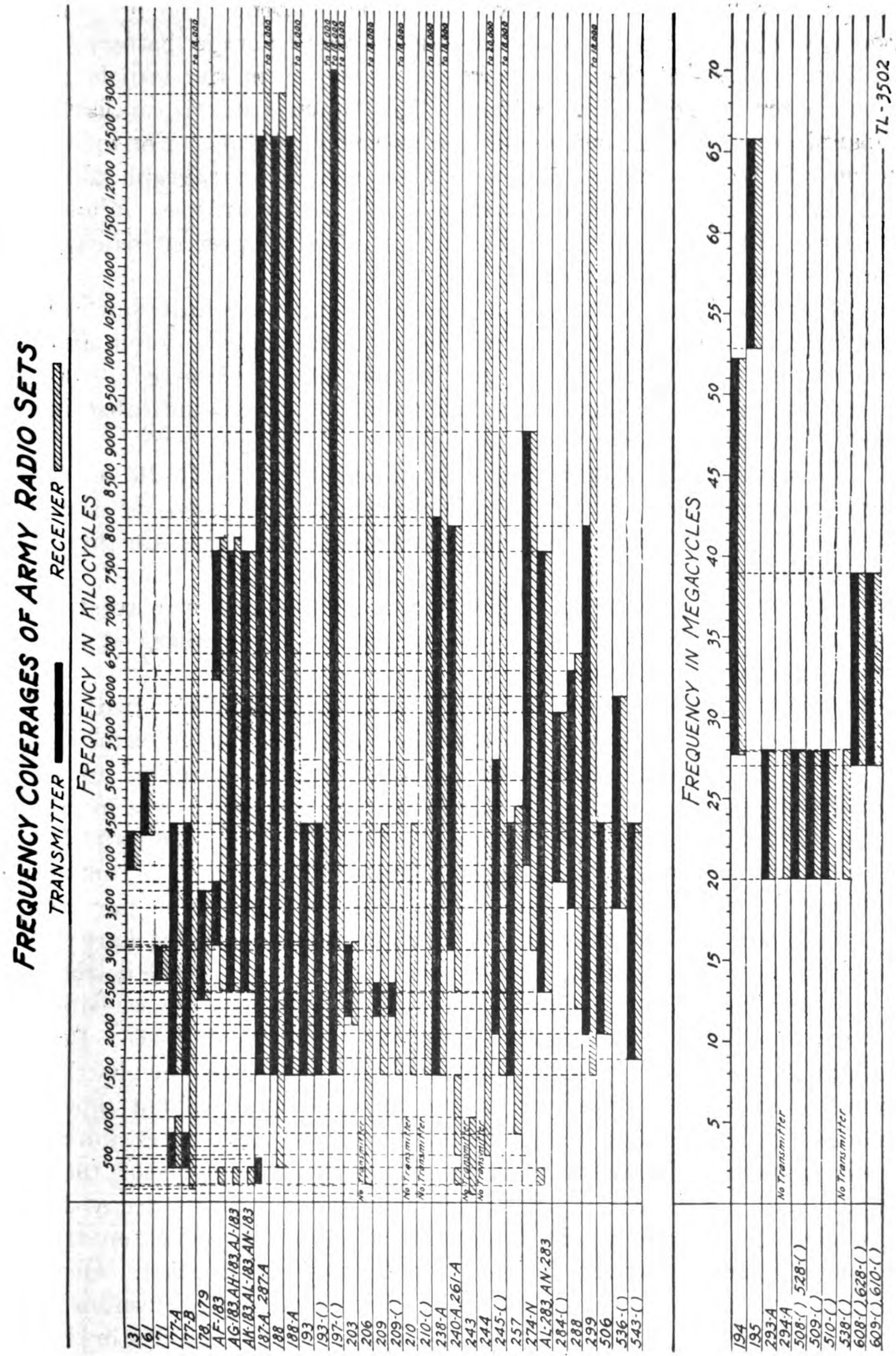

FIGURE 1.—Overlapping frequency band chart for use with radio sets of the SCR-245 series.

many of the fittings required for radio installation. The ignition system is shielded, a 12-volt, 180-ampere-hour storage battery is installed, and a 750-watt generator is employed in the vehicle to maintain the charge of the battery. The ½-ton truck is similarly prepared and equipped, but by the Quartermaster Corps. For information relative to the installation of these sets, see paragraph 23.

b. All set components are designed for vehicular use. Where necessary, suitable shock mountings are provided to prevent damage from excessive shock or vibration.

9. Supply.—These sets are not stocked as complete units but are made up from component parts which are requisitioned, stored, and issued separately. While the Signal Corps General Catalog is controlling in regard to these component parts, they are indicated in section V for information.

10. Weight and dimensions.—Radio sets of the SCR-245 series weigh approximately 185 pounds. Weights and dimensions of components of the sets of the SCR-210 and SCR-245 series are given in detail in section V.

11. Major components.—The major components are treated individually in paragraphs 12 to 21, inclusive. For a detailed list of components, see section V.

12. Radio transmitter BC-223 and transmitter tuning units TU-17, TU-18, and TU-25-A.—The transmitter elements (figs. 2, 3, and 4) are housed in a metal cabinet composed of a metal front panel, top, sides, back, and bottom supported by a metal frame. The transmitter includes a calibration chart, pilot lamp LM-33, and shock mounting FT-173. Any one of the transmitter tuning units may be plugged into a compartment in the right front part of the transmitter so that the tuning unit front panel becomes a part of the transmitter front panel. Extensions at the corners of the bottom plate of the transmitter cabinet have snap slide catches for securing the cabinet to four rubber shock elements of mounting FT-173. Releasing the two rear snap slide catches of this mounting permits the cabinet to be tilted forward on hinges provided on the front shock elements. Releasing two snap slide catches on the top of the cabinet permits removal of the top shield and provides access to the tube compartment. Removal of the lower back plate permits access to other circuit elements of the transmitter. A metal pocket on the right-side panel is provided for carrying the calibration chart. Output terminals and a compartment for the input and control terminals are located on the left side. Ventilation is provided by louvres in the sides, back, and tube compartment shield. Rubber shock mounting

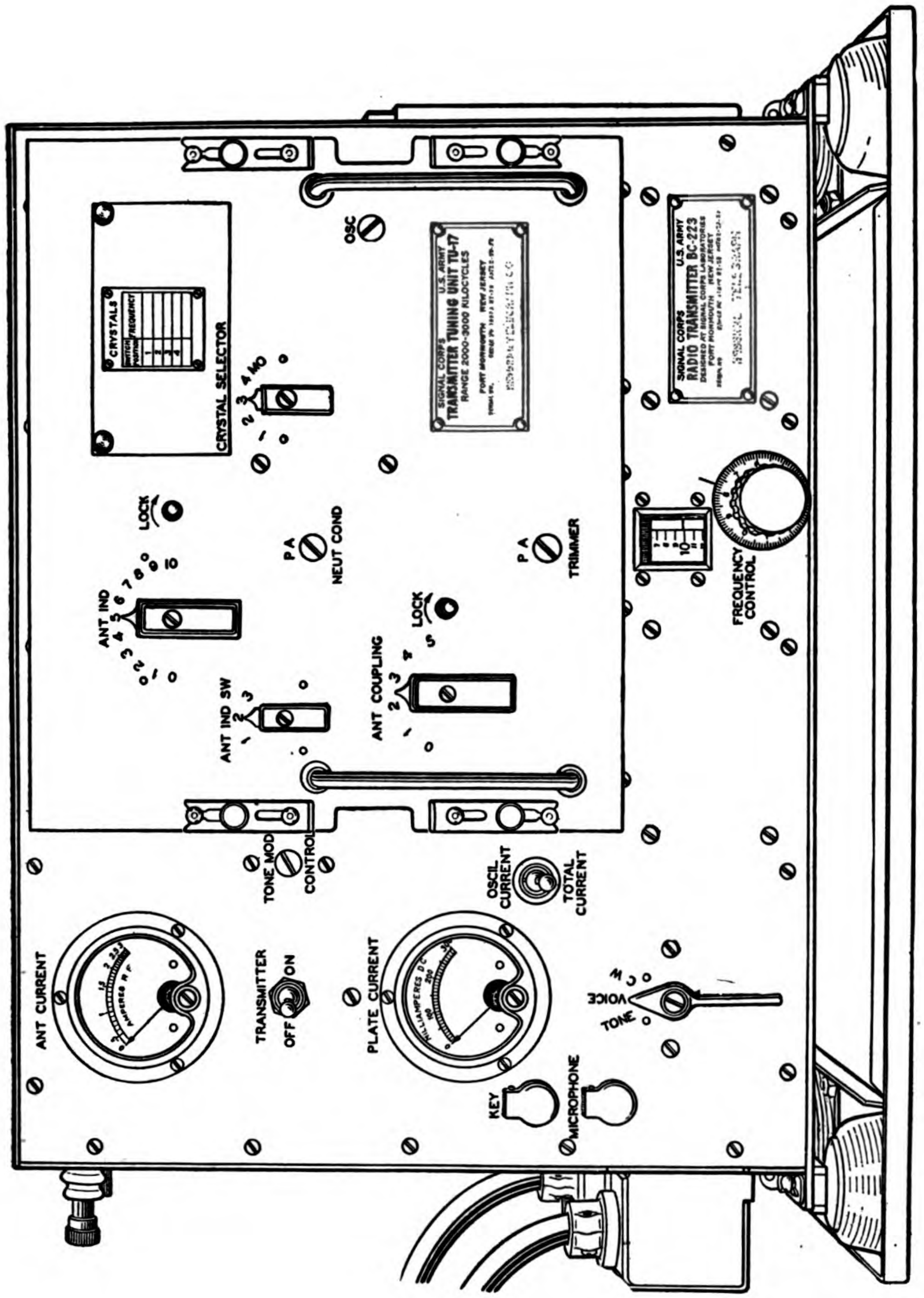

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FIGURE 2.—Radio transmitter BC-223 with transmitter tuning unit TU-17 in place, front view.

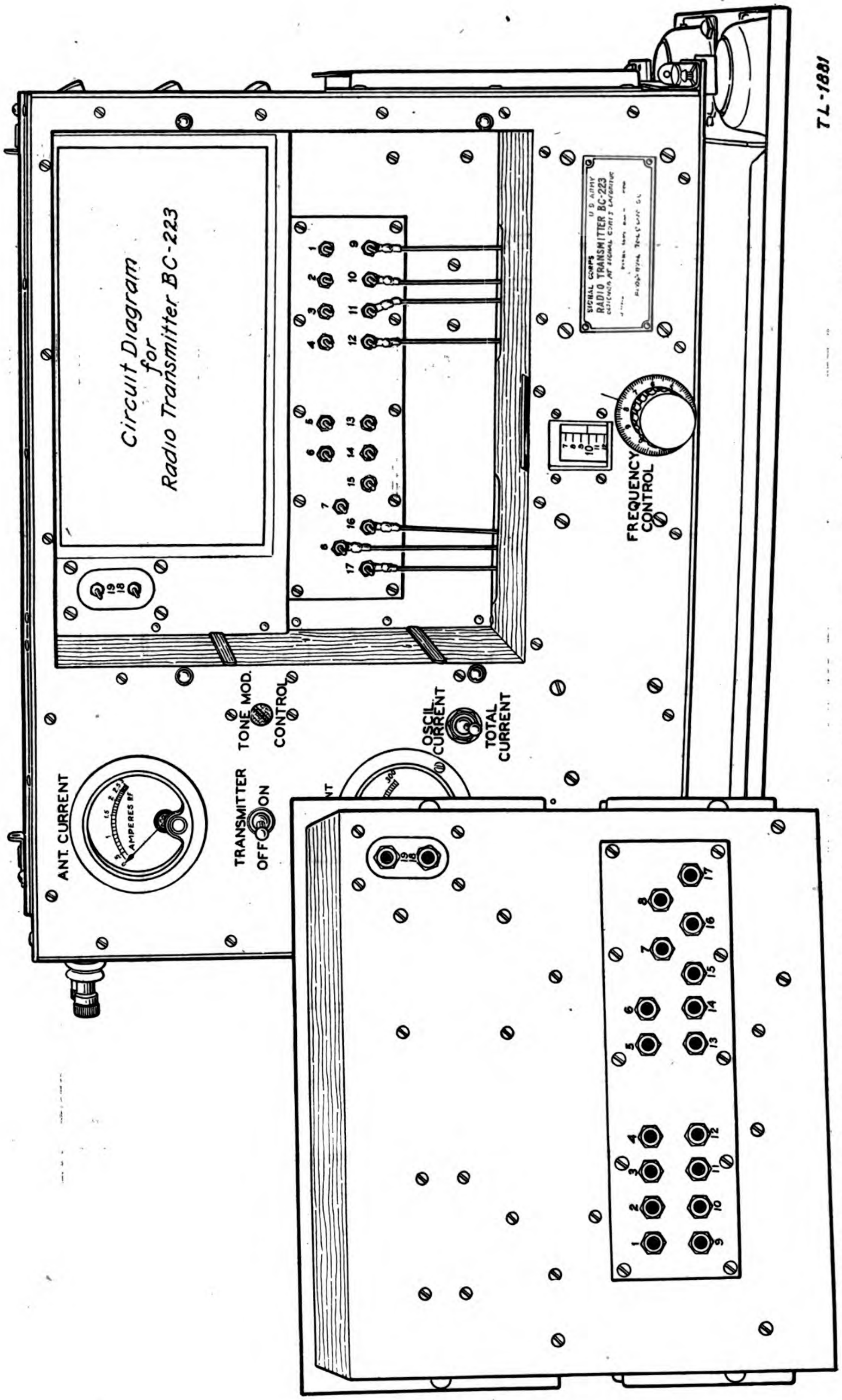

FIGURE 3.—Radio transmitter BC-223, transmitter tuning unit removed. (Radio transmitter BC-223-A is similar.)

FT–172 is fastened to the vehicle and to the top of the cabinet to provide additional support for the transmitter.

13. Radio transmitter BC–223–A and transmitter tuning units TU–17–A or TU–17–B, TU–18–A or TU–18–B, and TU–25–A.—In general design and appearance, the BC–223–A is virtually identical with the BC–223. The knobs on the lock screws of the BC–223–A have merely been made larger and the output terminal compartment has been replaced by two sockets for dynamotor and control plugs.

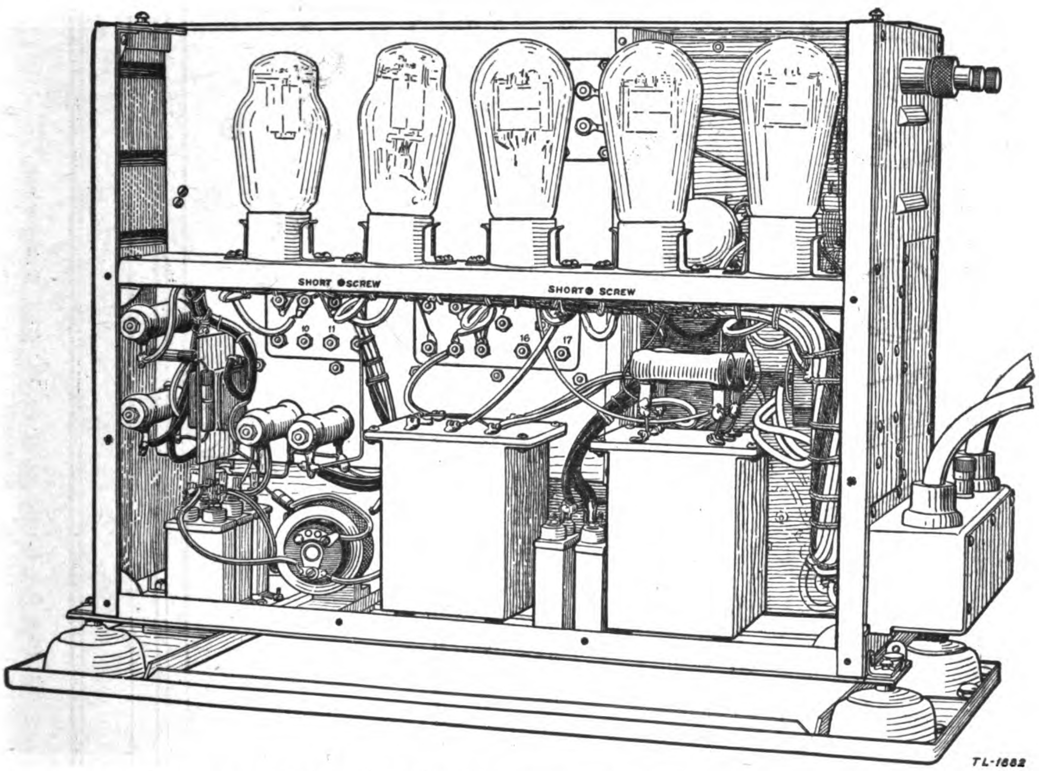

FIGURE 4.—Radio transmitter BC–223, tube compartment shield and backplate removed, rear view.

14. Radio receiver BC–312.—The radio receiver (figs. 5 and 6) is contained in a metal cabinet. The various parts are mounted on a metal front panel and chassis assembly which is entirely removable from the cabinet. This assembly is secured to the cabinet by five panel lock knobs on the front panel. The cabinet has four snap slide catches at the bottom which secure it to four rubber shock elements of mounting FT–162. Rubber shock mounting FT–178, when used, is fastened to the vehicle and left side of the cabinet to provide additional support to the receiver. Fuses FU–21–A, lamps LM–27, and mounting FT–162 are included as parts of the radio receiver.

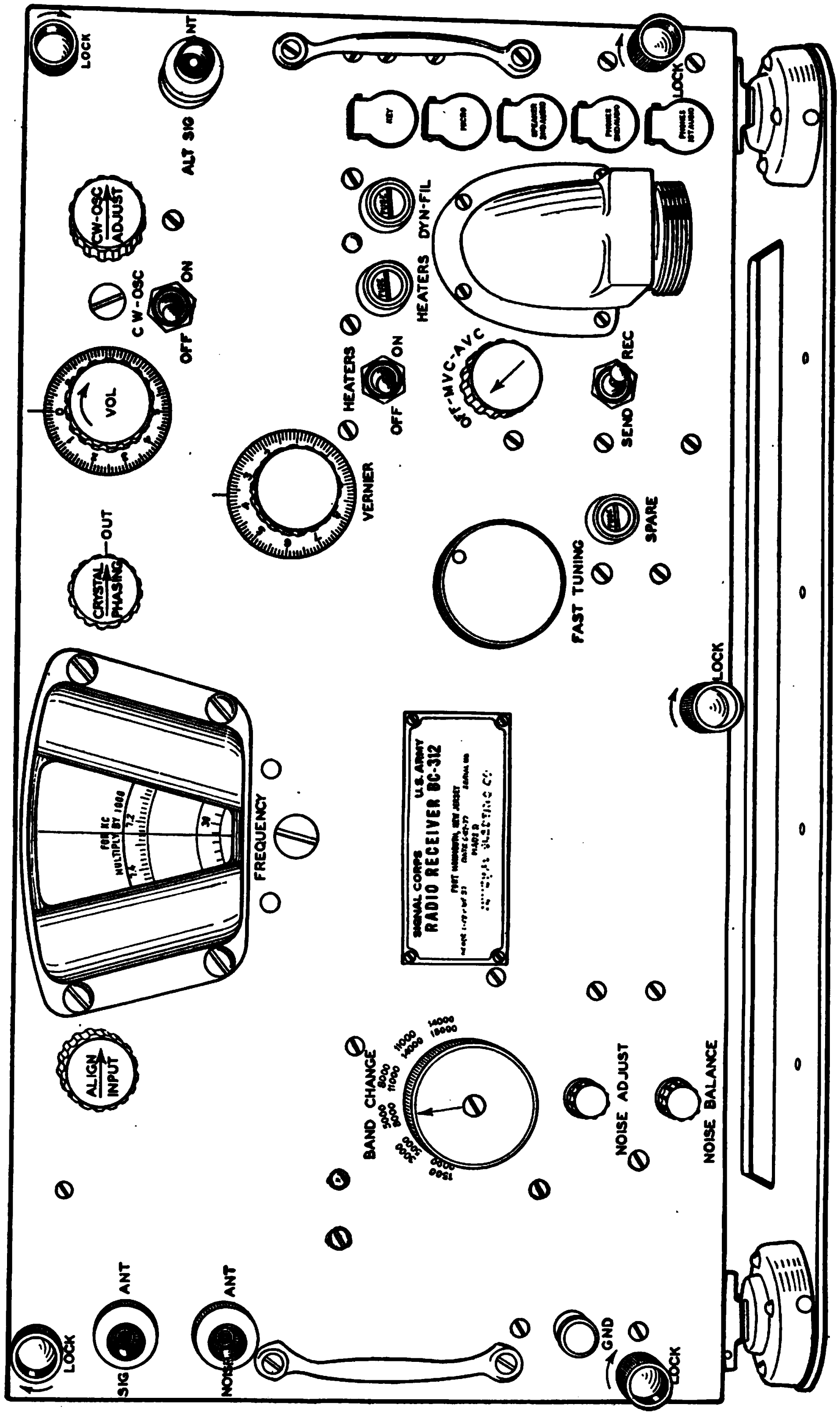

FIGURE 5.—Radio receiver BC-312, front view.

15. Radio receiver BC-312-C.—This receiver is very similar to radio receiver BC-312. The differences in construction and electrical circuits are described in detail in paragraph 32. The general appearance is the same as that of the BC-312, as shown in figure 5, except that the following marked items are not found on the front panel: NOISE ANT, NOISE ADJUST, NOISE BALANCE, HEATERS OFF ON switch, and HEATERS fuse.

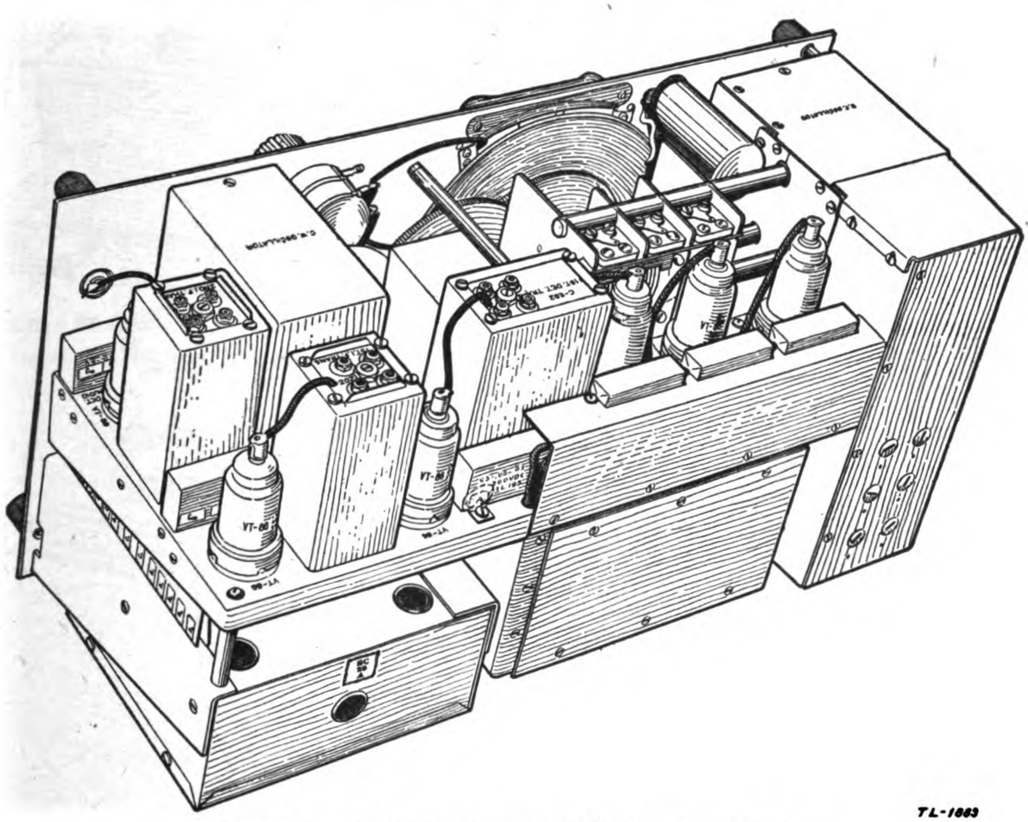

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FIGURE 6.—Radio receiver BC-312, chassis, rear view.

16. Control box BC-321.—This control box (fig. 7) consists of a metal box rigidly secured to the vehicle by means of a metal bracket. Removal of the two volume control knobs and four screws on the front plate provides access to the interior elements of the box.

17. Dynamotor unit PE-55.—This unit (figs. 8 and 9) consists of dynamotor DM-19-A rigidly mounted on a metal box base. Extensions of the bottom panel of the box base have four snap slide catches for securing the unit to four rubber shock elements of mounting FT-185. A socket and a hole in the left-side panel of the box base provide for terminal connections to the unit. Releasing two snap slide catches on the front panel permits removal of the cover and access to circuit elements within the box base. Fuses FU-30

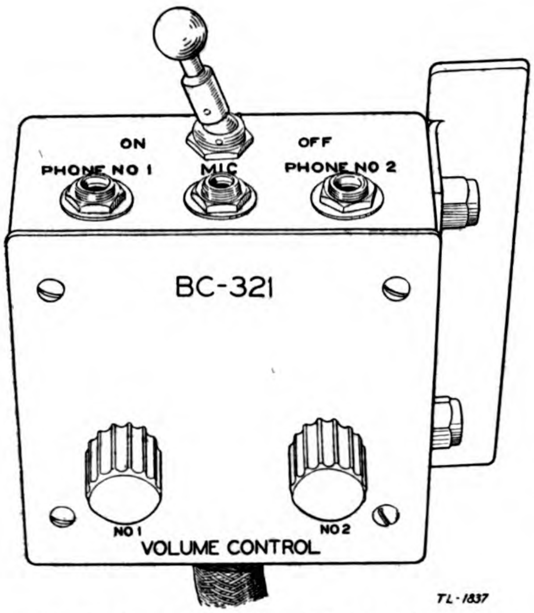


FIGURE 7.—Control box BC-321, front and top view.

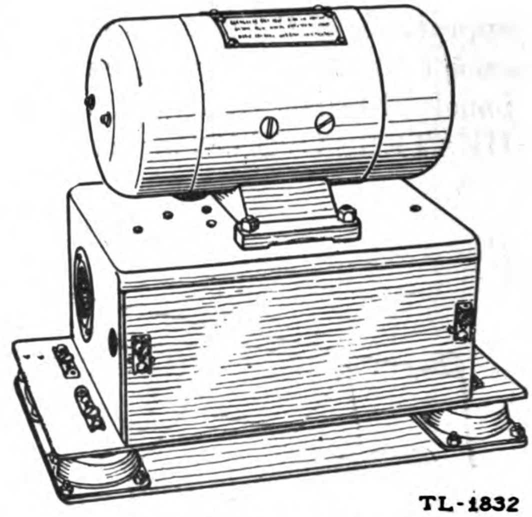


FIGURE 8.—Dynamotor unit PE-55, front view.

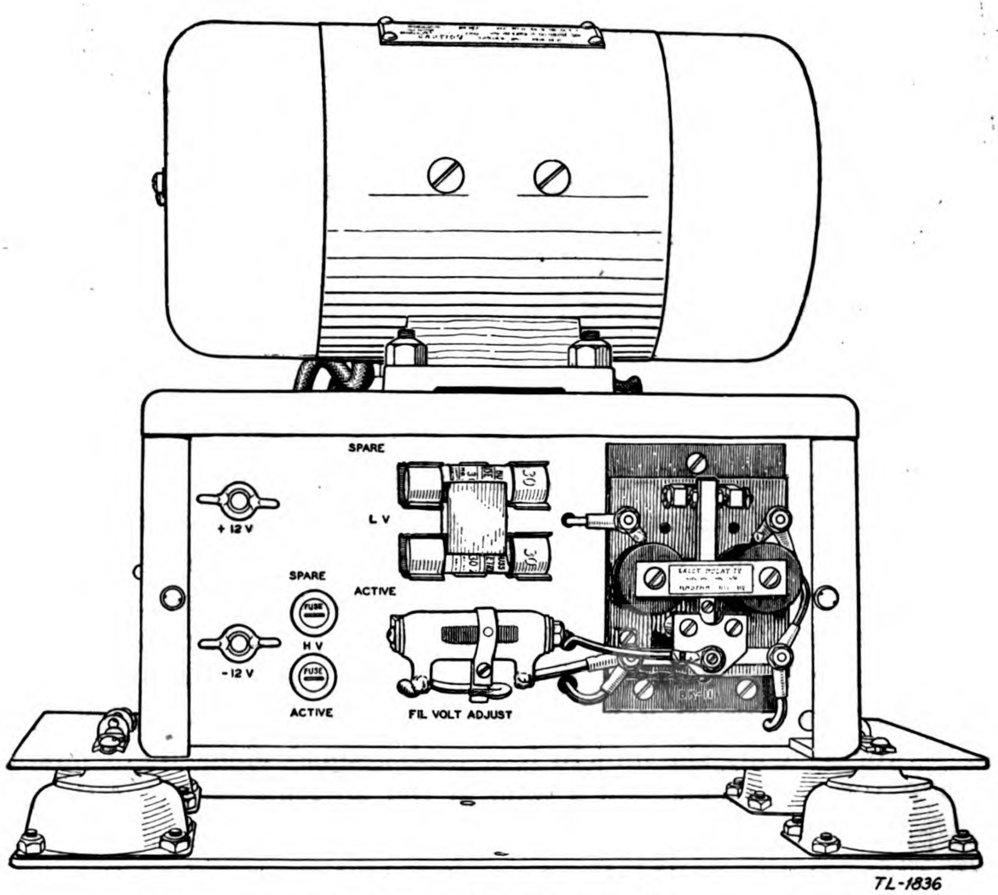


FIGURE 9.—Dynamotor unit PE-55, box base with front panel removed.

and FU–26 and mounting FT–185 are included as parts of this dynamotor unit.

18. Mast sections MS–49 to MS–53 and mast base MP–37.—The five mast sections (fig. 10) are made of high-tensile-strength flexible steel. Mast section MS–49 forms the top of the antenna when all sections are used and the others follow in sequence of their type numbers. Mast section MS–53 screws into mast base MP–37, which is rigidly secured to the vehicle. A large helical spring in the mast base provides additional flexibility to the antenna. The upper end of the mast section MS–49 terminates in a blunt point. The lower

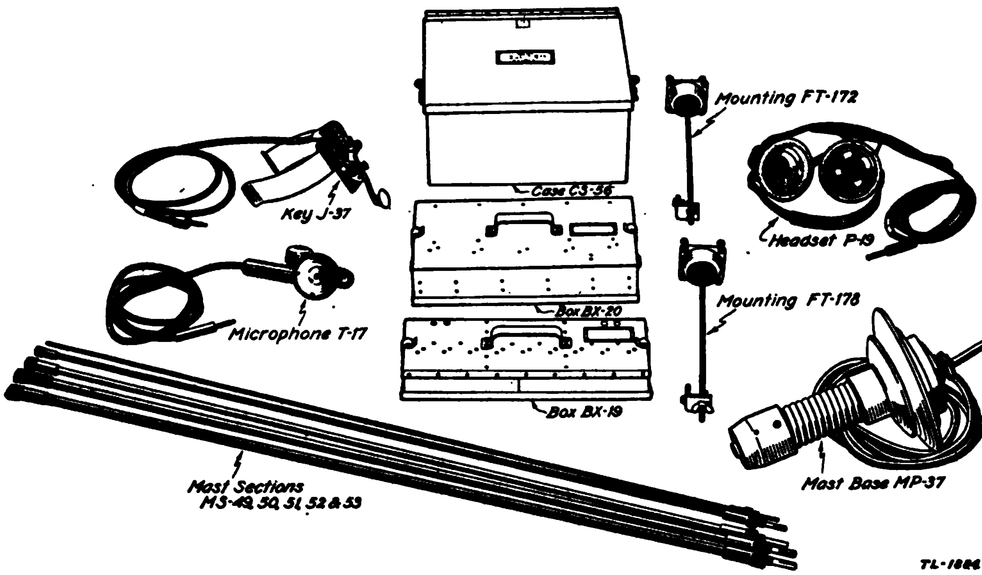


FIGURE 10.—Miscellaneous components of radio sets of the SCR–245 series.

end of each mast section is fitted with a serrated shank and screw for engaging the threaded upper end of the next mast section. 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 at the lower end. The over-all length of the assembled antenna is 15½ feet.

19. Case CS–56 and boxes BX–19, BX–20, and BX–21.—Case CS–56 is a metal container with a hinged top which is secured in the closed position by two snap slide catches. This case is rigidly fastened in the vehicle and houses one spare transmitter tuning unit. Four lugs inside the case are engaged by the snap slide catches on the panel of the transmitter tuning unit to secure the latter inside the case. Boxes BX–19 and BX–20 carry spare tubes, fuses, and pilot lamps for the receiver and spare tubes for the transmitter, respectively. Box BX–21 carries the microphone, key, and headsets when not in use. These boxes are rigidly fastened inside the vehicle. The metal covers of boxes BX–19 and BX–20 are secured to metal bases by spring clips. The cover of box BX–21 is secured by a hinged hasp.

20. Covers BG–67, BG–75, BG–76, BG–77, and BG–86, and roll BG–56 or BG–56–A.—Cover BG–67 is made of black canvas duck and is placed over the mast base MP–37 when the antenna is not in use. It is secured to the mast base by a leather strap fastened at the bottom of the cover. Cover BG–75 protects the BC–312 type receiver; BG–76, transmitter BC–223; BG–76, transmitter BC–223–A; and BG–77, the dynamotor PE–55. Slide fasteners on the fronts of covers BG–75, BG–76, and BG–86 can be opened to provide access to the front panels of the receiver and the transmitter; the flaps released by opening the slide fasteners are held back by snap fasteners on the tops of the covers. Openings on the sides of the latter three covers permit the entry of connecting cords to the components within. Roll BG–56 or BG–56–A is made of black canvas duck and holds two sets of five mast sections each in separate compartments. The opening on one end and along the side is closed by a suitable fastener.

21. Vehicular accessories.—*a*. A junction box is installed in certain vehicles by the Ordnance Department to facilitate the making of connections for the radio set. In it are mounted terminal block TM–183 and jack JK–34–A (or JK–34) (furnished by the Signal Corps). In installations made after September 1, 1939, junction box TM–188, which is a combination of the above items, is standard equipment.

b. A car terminal box is installed in each vehicle named in paragraph 1 by the Ordnance Department, or the Quartermaster Corps in the case of the command truck. In it are mounted a terminal block for storage battery connections and brackets for the installation of terminal block TM–183, when used. The terminal box is connected to the junction box (when used) by conduit.

SECTION II

EMPLOYMENT

22. Limitations.—These sets have the usual limitations possessed by any radio set of the same power, mobility, and frequency range. 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 the factors which are controllable are listed below and require the attention of the user if the sets are to operate most effectively.

a. Distance range.—(1) All other things being equal, maximum effective distance range is maintained by—

(*a*) Frequent inspection of the set and correction of all defects. For inspection procedure, see paragraph 34.

(*b*) Using cw in preference to tone, and either cw or tone in preference to voice.

(*c*) Accurate adjustment of all tuning controls.

(*d*) Avoiding all obstructions either natural or man-made, particularly intervening eminences such as tall metal structures, and power, telephone, and telegraph lines. The type and contour of the ground affect the range, and a change of location to a more favorable place will increase it.

(*e*) The use of a higher and longer antenna than that normally used with the vehicle. A wire antenna longer than the standard mast antenna, properly installed between the mast base and a tree or other elevated object, will serve this purpose. The best length of wire should be determined by preliminary experiment; from 30 to 50 feet will probably be found sufficient.

(2) In some situations where only very short ranges are required, the range may be decreased and interference reduced by the removal of one or two mast sections, provided the reduced antenna can be properly tuned to the prescribed frequency.

(3) The transmitter has more output with master oscillator operation than with crystal control. When maximum range is desired,

and frequency stability is not the prime requisite, the first method is preferable.

b. Channels.—All other things being equal, the most effective use of the available number of channels is obtained by—

(1) The action indicated in *a*(1)(*a*), (*b*), and (*c*) above, particularly that in (*b*).

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

(3) The use of crystal control in the transmitter.

23. Installation.—*a. Care.*—Particular care must be observed when unpacking or handling the equipment because, when not protected by cabinets or shock mountings, it may be easily damaged. Inspect equipment for damage when removing it from the shipping box. If necessary, clean with brush or blower before installation.

b. Instructions.—Detailed information relative to the installation of these sets is found in installation instructions for the particular type of vehicle concerned. These instructions are issued with the equipment, and because of their volume and possible changes, are not repeated in this manual. Figures 11 to 39, inclusive, show the schematic and cording diagrams of the various radio sets of the SCR-210 and SCR-245 series. Figures 40 to 43, inclusive, show a typical installation in a command truck, this set being designated the SCR-245-J.

c. Minor installation.—Minor installations are made as indicated in (1) and (2) below. All controls, knobs, switches, jacks, etc., identified by markings will hereafter be designated by such markings; for example, a three-position switch on the front panel of the transmitter which has the marking CW TONE VOICE above the three possible positions of the switch pointer will hereafter be designated the CW TONE VOICE switch.

(1) *Radio transmitter BC-223 and radio transmitter BC-223-A.*—(*a*) If necessary, place a pilot lamp LM-33 in the socket on the bracket assembly located above the main capacitor dial on the front panel This is accomplished by first removing the transmitter tuning unit. Then the bracket assembly is released by unscrewing a screw in the front panel about 1½ inches above the index marking for the vernier knob marked FREQUENCY CONTROL.

(*b*) Remove the tube compartment shield and insert corresponding vacuum tubes in sockets marked with the respective vacuum tube Signal Corps type numbers.

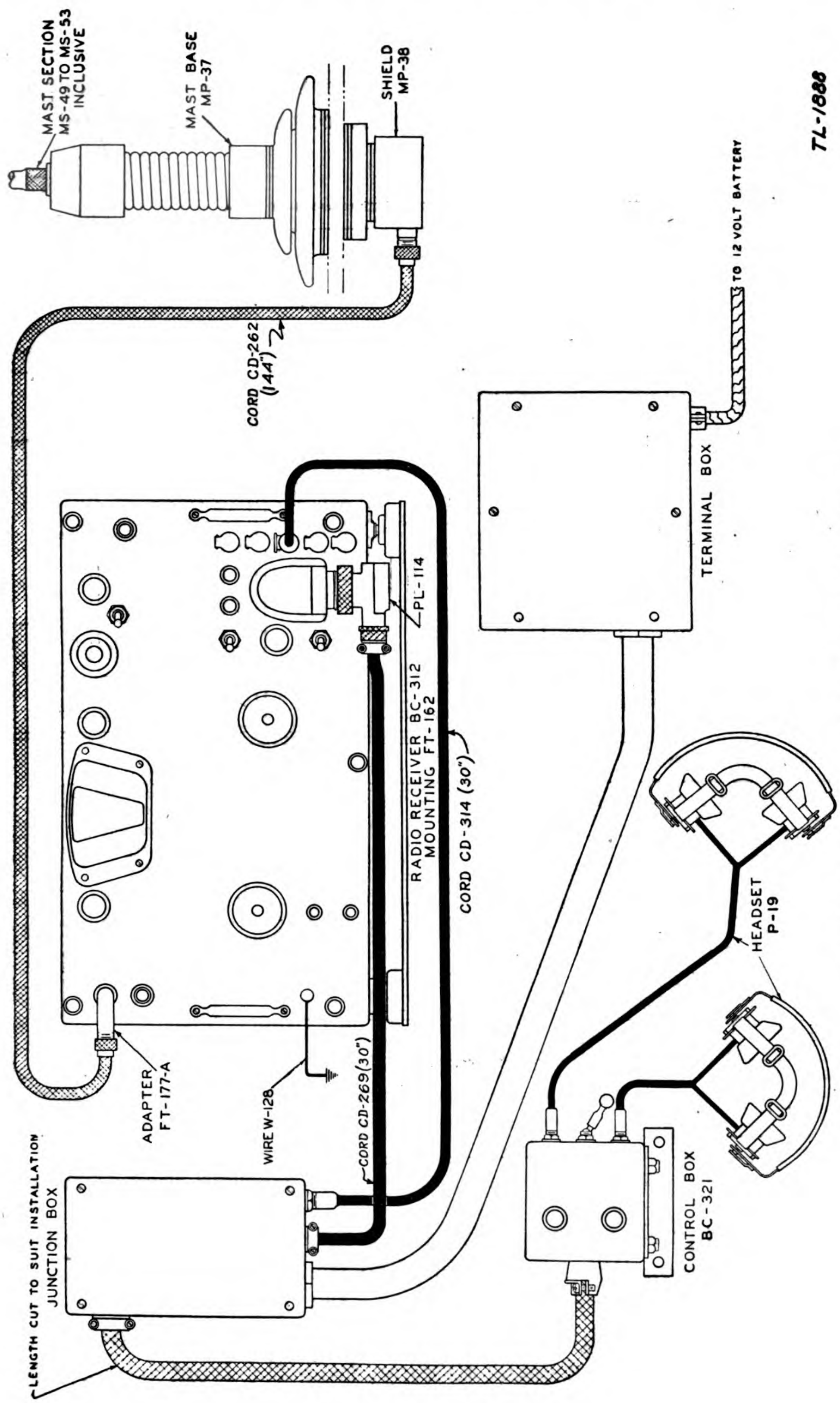


FIGURE 11.—Radio set SCR-210-A, cording diagram.

(*c*) Insert crystal holders FT-171, FT-171-A, or FT-171-B in the crystal compartment of the transmitter tuning unit being used, making sure that the marking TOP on the front end of the crystal holder is uppermost. The compartment cover is removed by un-

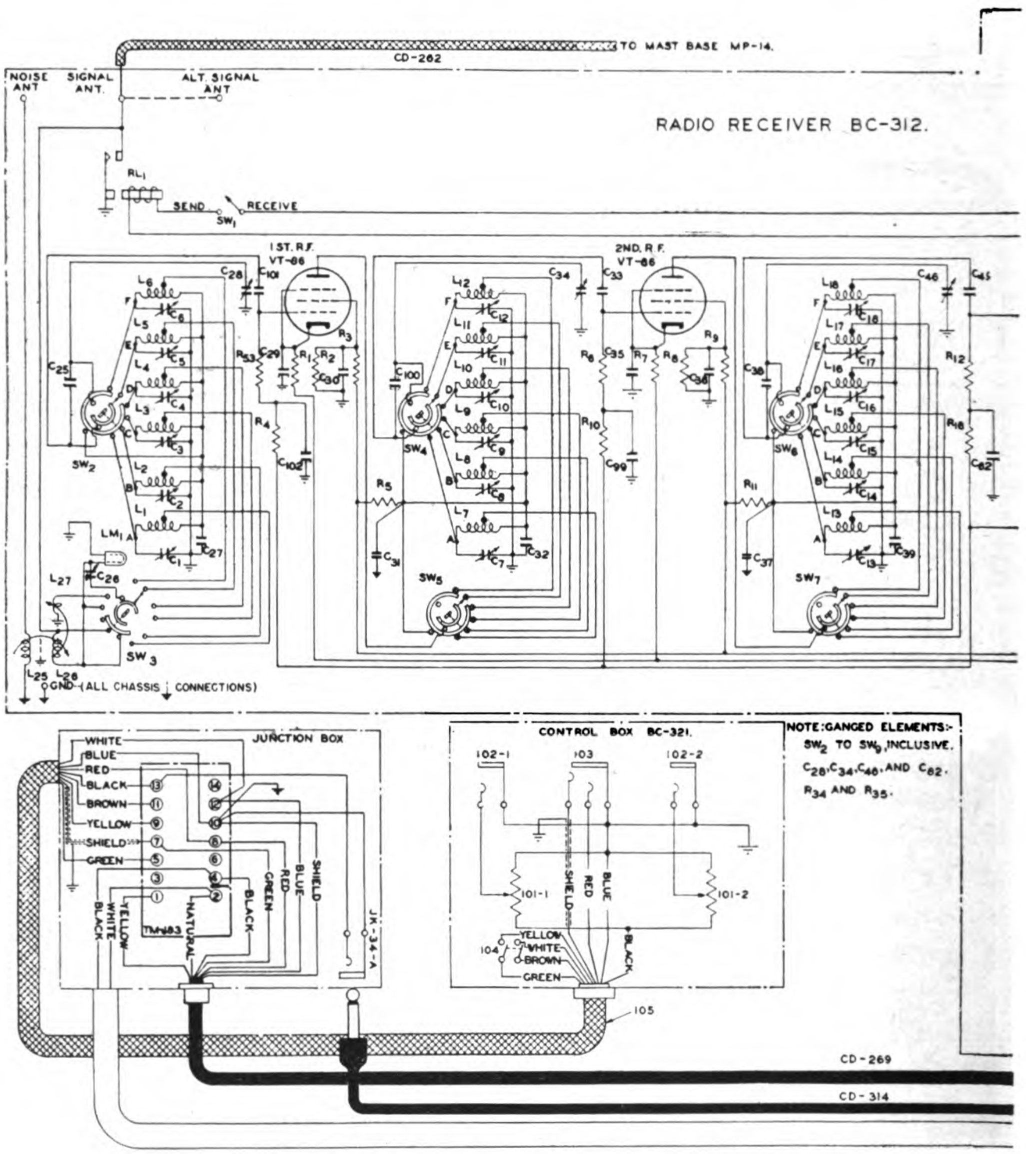


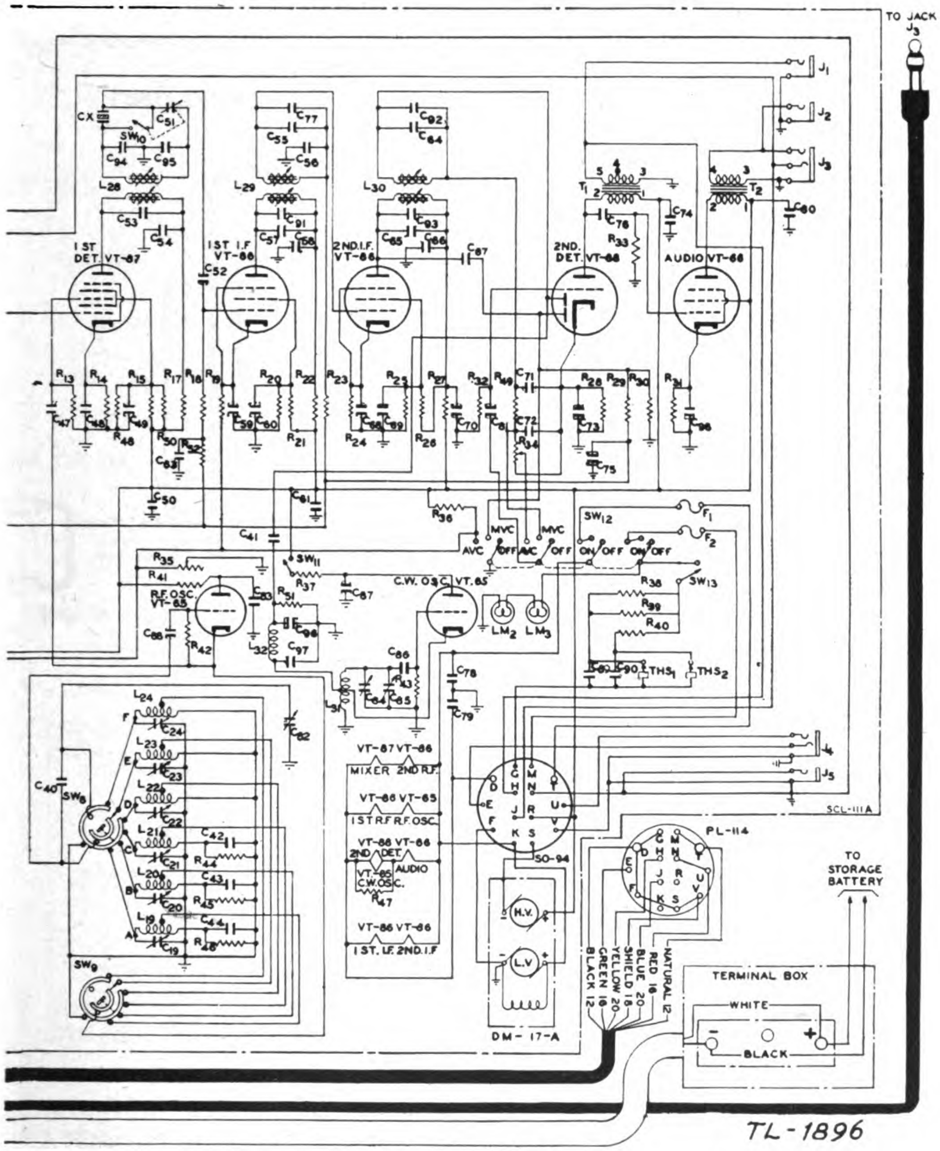
FIGURE 12.—Radio set SCR-210-A, schematic diagram, including

screwing two thumbscrews. Mark the frequencies of the crystals in the proper place on the chart attached to the compartment cover.

(2) *Radio receivers of BC-312 series.*—(*a*) Insert two pilot lamps LM-27 in sockets which are accessible upon removal of four thumbscrews and the reflector secured thereby, from the front panel. The reflector is the fitting covering the main tuning dial directly above

the marking FREQUENCY. Replace the reflector after insertion of the pilot lamps.

(*b*) The receiver is ordinarily furnished with tested vacuum tubes installed. Do not remove or interchange these tubes unless they are



complete schematic diagram of radio receiver BC–312.

defective. If necessary, disconnect the power cord and insert tubes in sockets marked with the respective vacuum tube Signal Corps type numbers. These sockets are accessible upon removal of the front panel and chassis assembly from the cabinet, with the exception of those in the CW OSCILLATOR and RF OSCILLATOR compartments. The CW OSCILLATOR tube socket is accessible upon removing the top front screw and a screw in the center of the right side, loosening a screw at the bottom rear, and then lifting off the compartment cover. The RF OSCILLATOR tube socket is accessi-

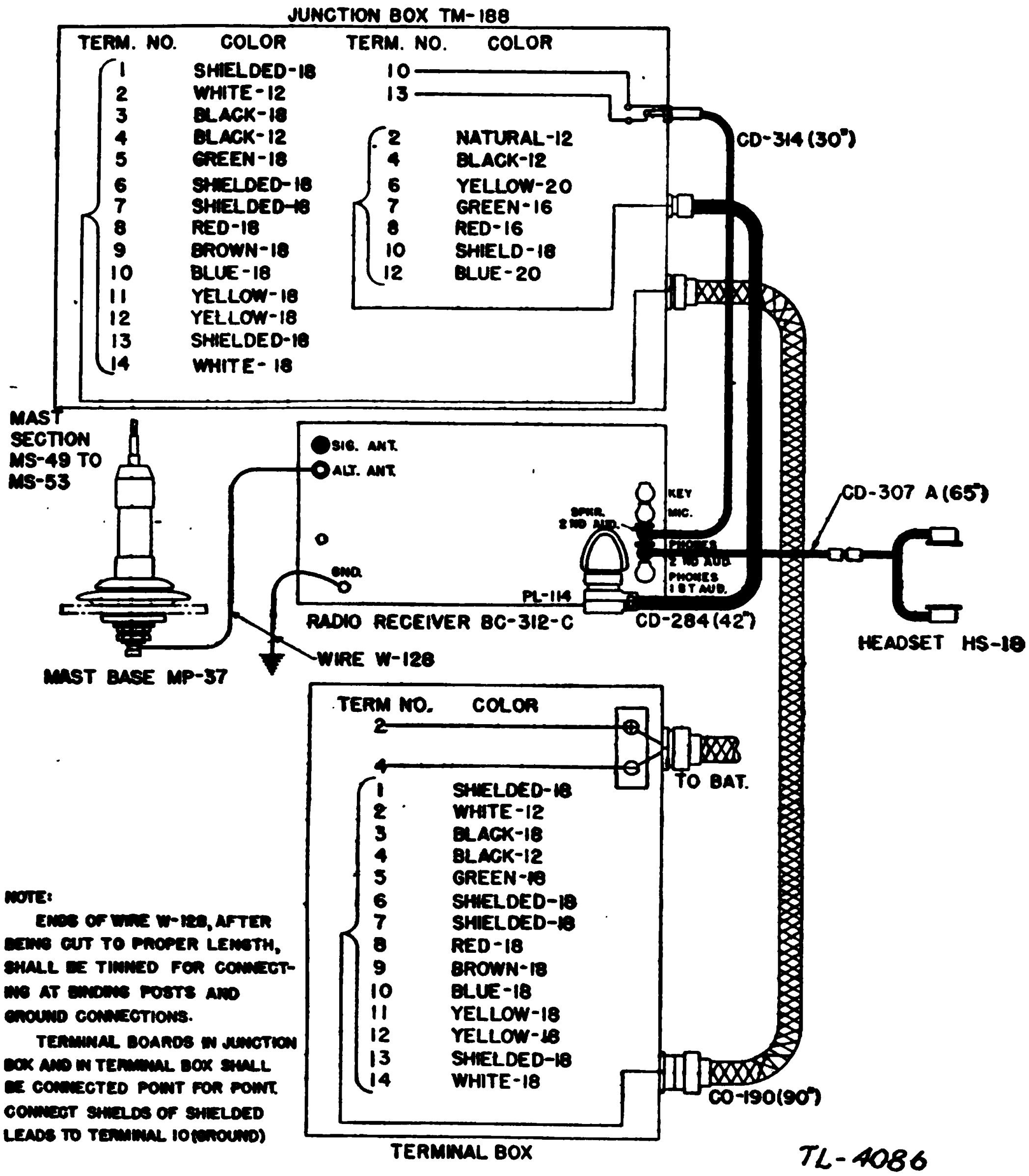


FIGURE 13.—Radio set SCR–210–B, cording diagram.

ble upon loosening two screws at the top right side and lifting the hinged cover of the compartment.

24. Check and adjustments prior to operation.—***Caution:*** Both the small dynamotor in the receiver and the large dynamotor used with the transmitter generate voltages which are dangerous to human life. Make sure that all their control switches are OFF and that their armatures are completely at rest before changing fuses or touching any inside part of the equipment with the bare fingers. If it is necessary to take voltage readings with the high-voltage supply on, make sure that your hands are dry and use well-insulated test prods.

a. Check.—Make a detailed inspection of the installation and equipment as prescribed in paragraph 34 and correct where necessary.

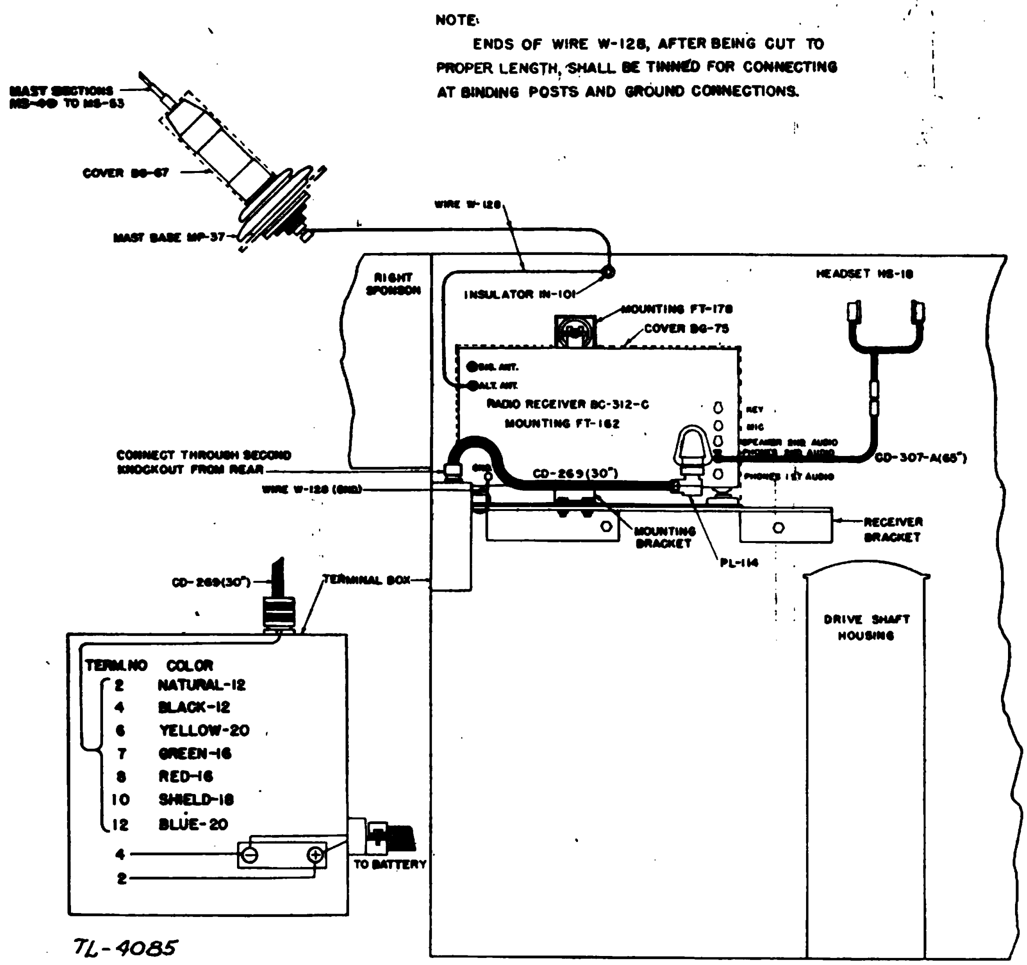


FIGURE 14.—Radio set SCR–210–C, cording diagram.

b. Adjustments prior to operation of transmitter BC–223.—After making the check in *a* above, adjust the filament voltage for the transmitter as follows:

(1) On the transmitter panel, turn the TRANSMITTER OFF ON switch to the OFF position.

(2) Remove the front panel on the box base of dynamotor unit PE–55 (fig. 8). Remove H V ACTIVE fuse within by unscrewing corresponding FUSE cap.

(3) Remove the cover of terminal compartment on left side of the transmitter by unscrewing five screws on the left side of the compartment.

(4) Connect a voltmeter (taken from test set I–56–A, or any other voltmeter capable of indicating 8 volts direct current) to terminals 22 (8 volts) and 24 (ground) on the terminal strip within the termi-

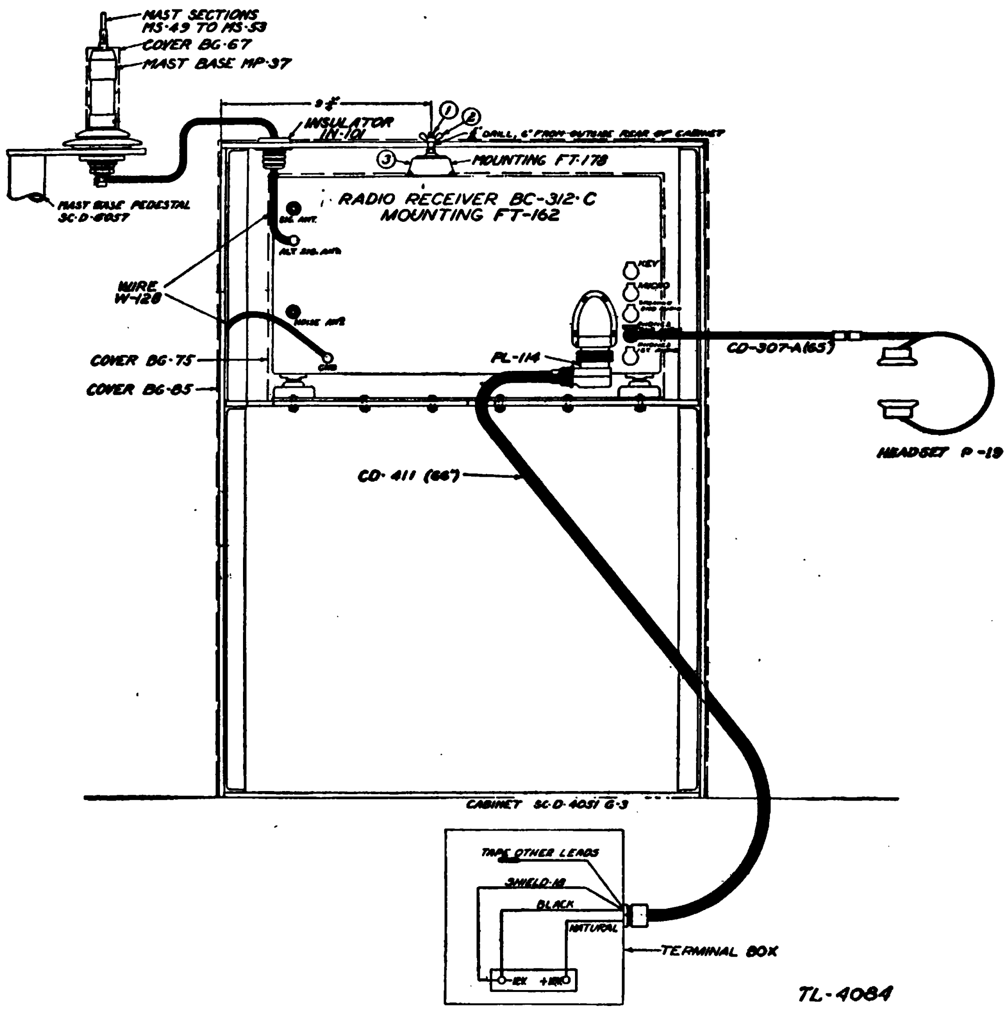


FIGURE 15.—Radio set SCR–210–D, cording diagram.

nal compartment (fig. 55). The positive lead of the voltmeter is connected to terminal 22.

(5) Turn the TONE VOICE CW switch to the TONE position.

(6) Turn the TRANSMITTER OFF ON switch to the ON position. The tubes will light and the dynamotor will start.

(7) Loosen the screw holding the band on the resistor marked FIL VOLT ADJUST, in the box base of the dynamotor unit, and move the band either way, a turn of wire at a time, until the volt-

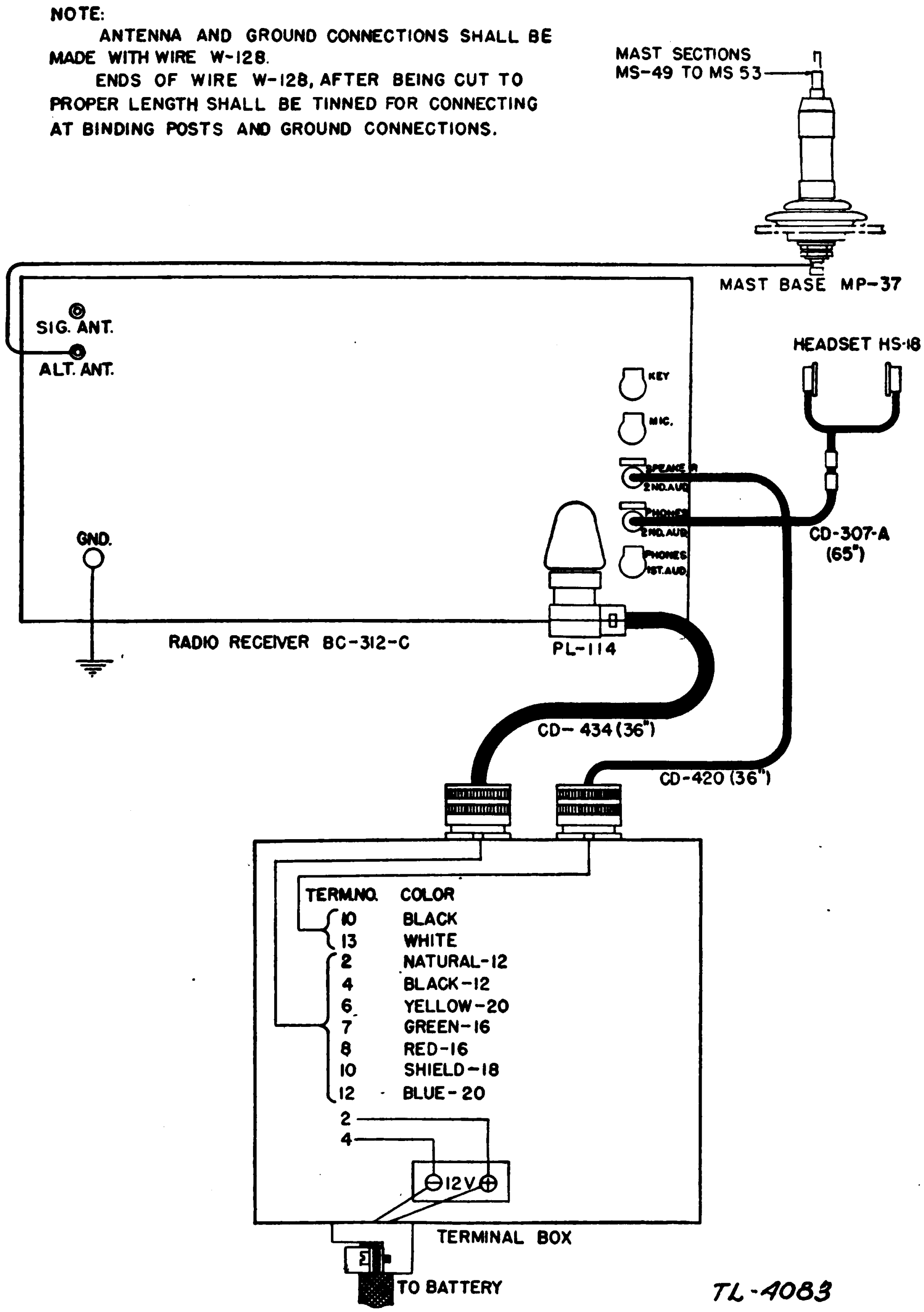


FIGURE 16.—Radio set SCR-210-E, cording diagram.

meter reads exactly 8 volts. Tighten the screw and make another reading to be certain that the band has not shifted.

(8) Turn the TRANSMITTER ON OFF switch to OFF.

(9) Replace the H V ACTIVE FUSE, the front panel on the box base of the dynamotor unit, and the cover of the terminal compartment on the transmitter.

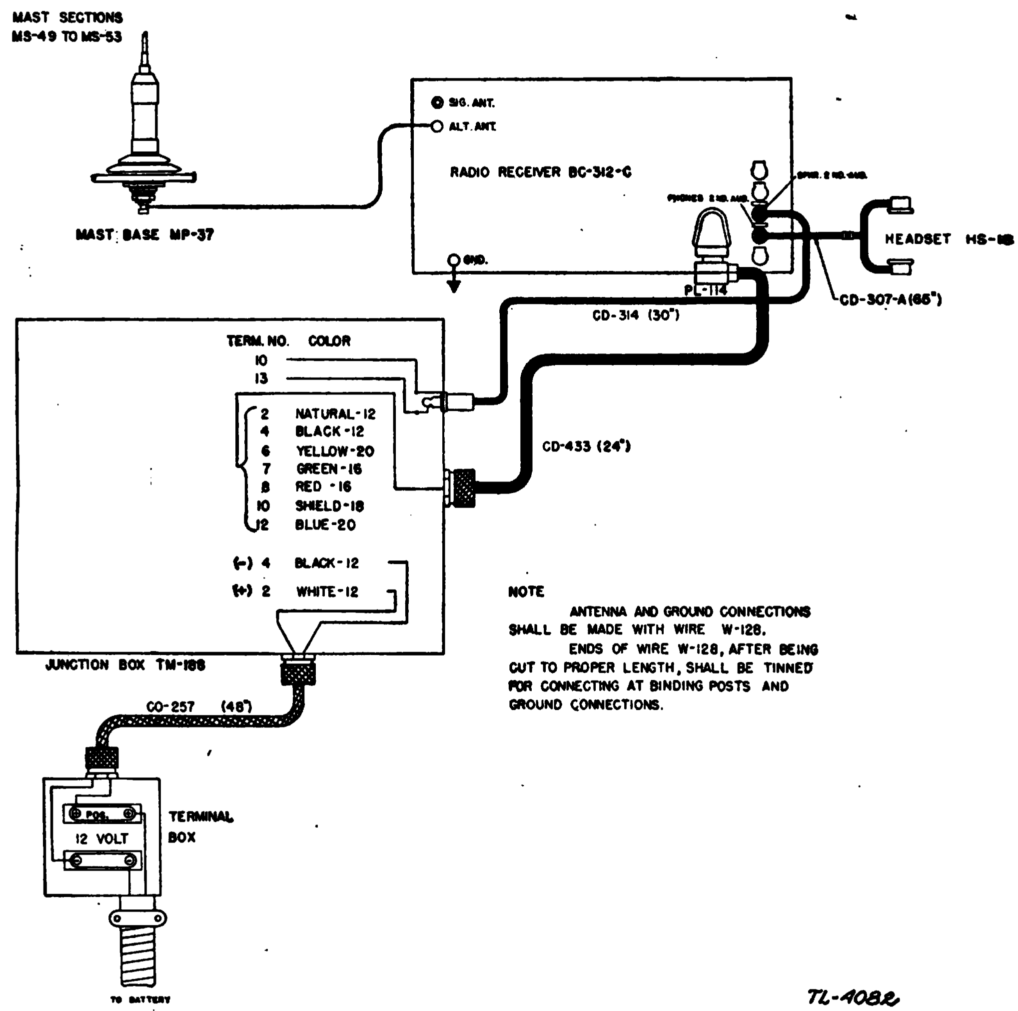


FIGURE 17.—Radio set SCR-210-F, cording diagram.

c. Adjustment prior to operation of radio transmitter BC-223-A.—The filament voltage of radio transmitter BC-223-A is adjusted in the same manner described in *b* above, except that the voltmeter is connected between the chassis (negative) and the end of resistor 19 closest to the rear of the transmitter. Resistor 19 is located on the back of the front panel, below and to the right of relay 33 when the transmitter is viewed from the front.

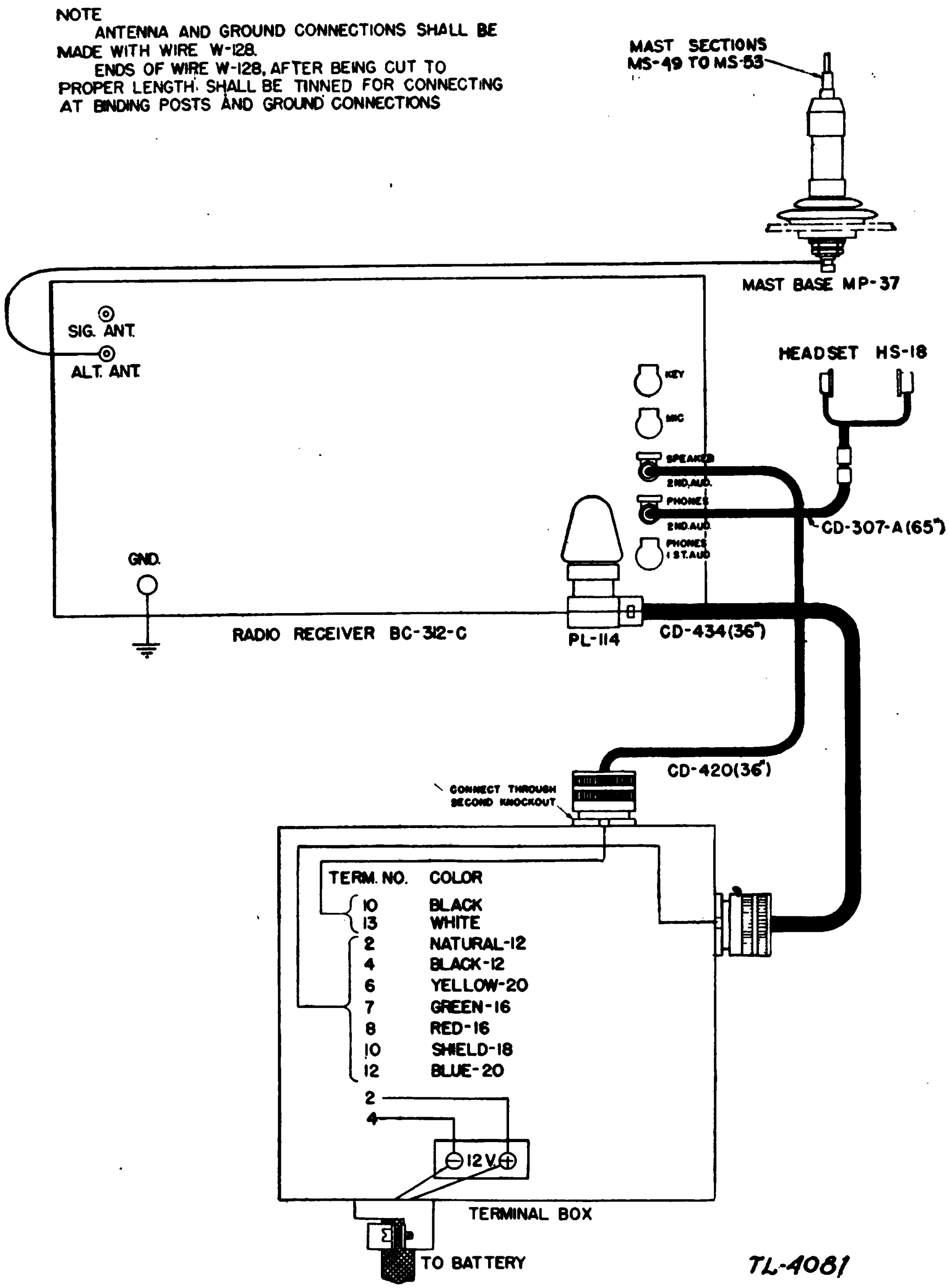


Figure 18.—Radio set SCR-210-G, cording diagram.

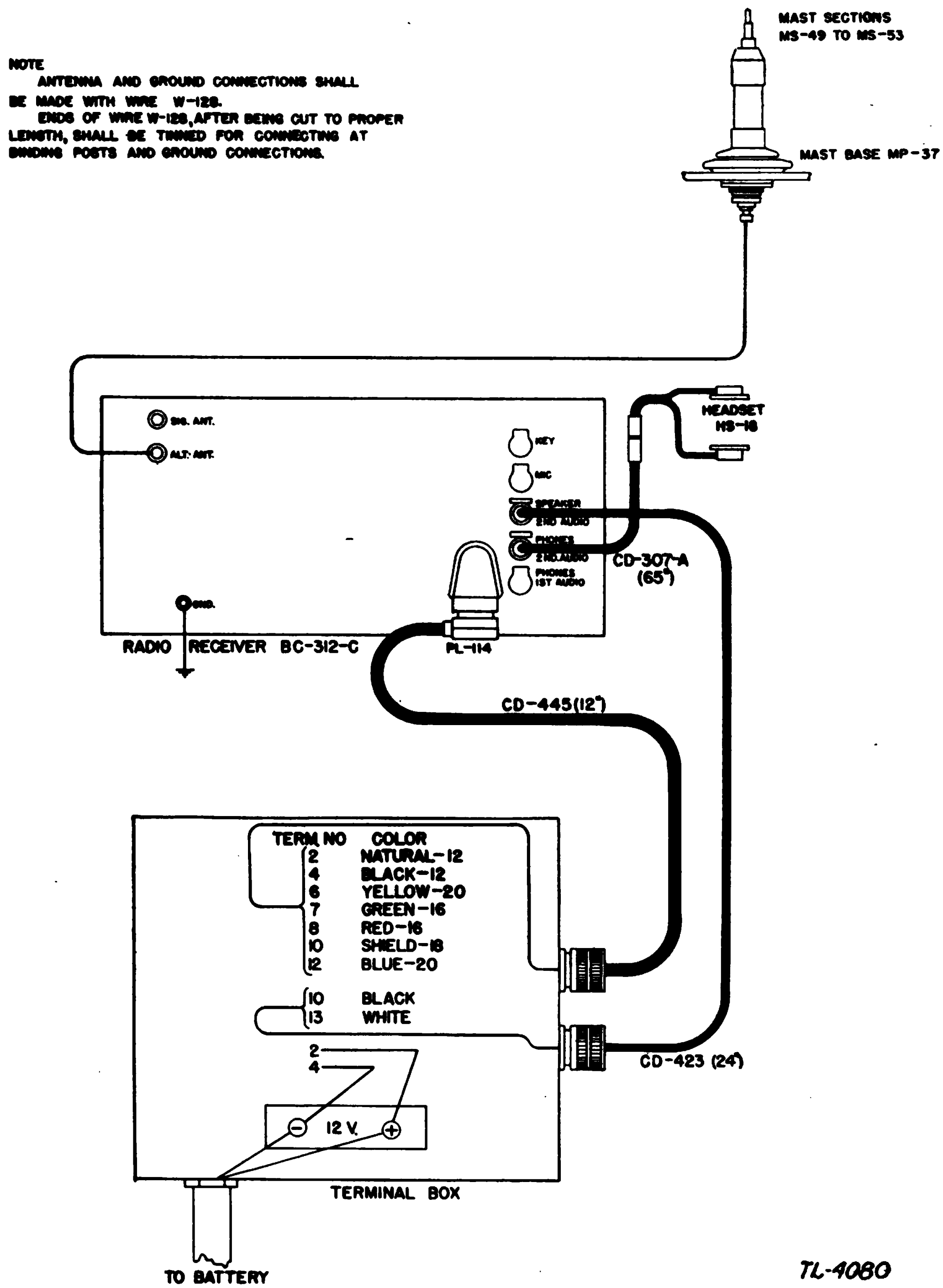


FIGURE 19.—Radio set SCR-210-H, cording diagram.

d. Special adjustments.—When necessary, special adjustments are made as prescribed in paragraph 36.

25. Operation in general.—*a. Interference.*—(1) Interference with reception may result from atmospheric electrical disturbances called static or by the operation of electrical equipment in the vicinity of the radio set. These effects may be minimized by cw operation and the use of the crystal filter in the receiver. (See par. 27*b*(4).)

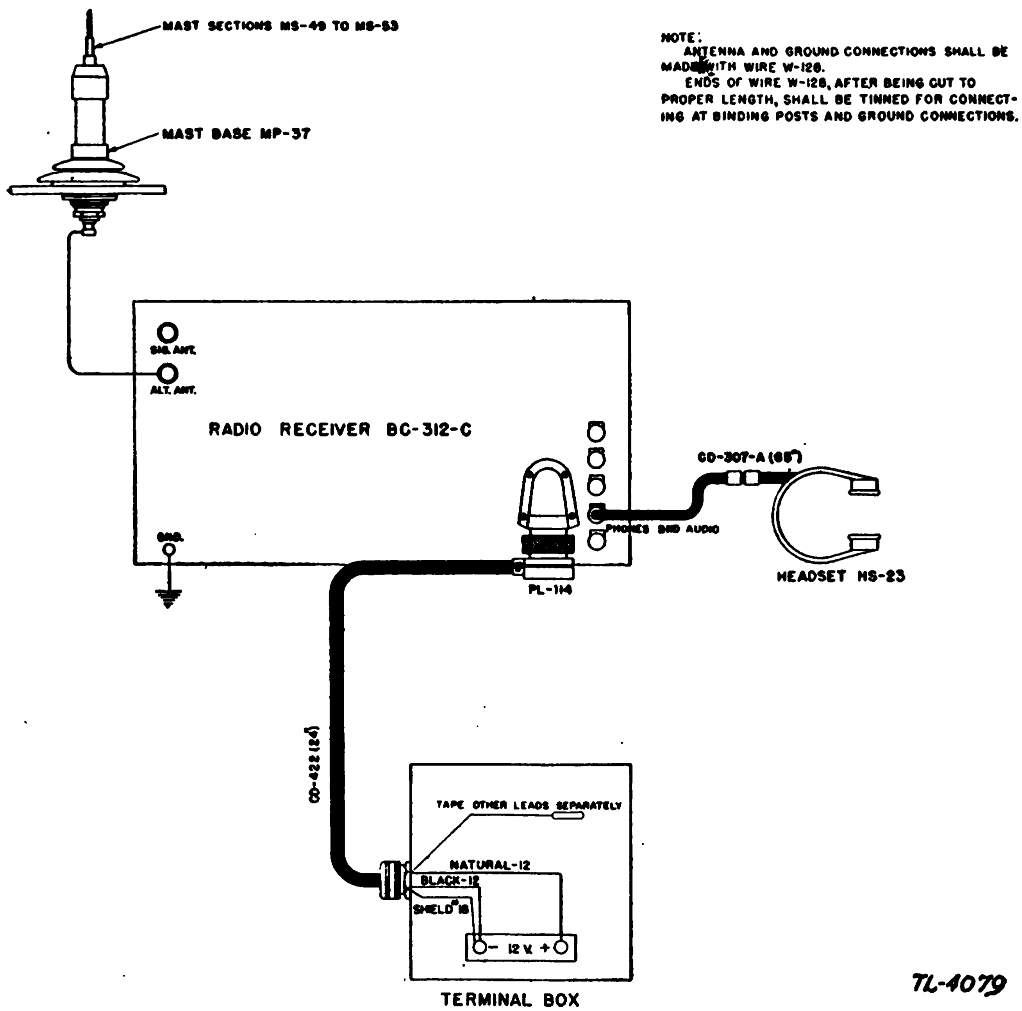


FIGURE 20.—Radio set SCR–210–J, cording diagram.

(2) Power lines may contribute a source of interference, particularly at the higher frequencies. This type of interference cannot be overcome without sacrificing signal strength. Avoid operation in the vicinity of power lines.

(3) A form of interference may be generated by track-laying vehicles called track static. This source of interference must be cured at the source, by bonding of loose joints.

(4) A form of interference due to improper joining of metal parts of the vehicle may be prevented by care in grounding the radio equipment and carefully bonding (connecting) all metal parts of the vehicle together.

(5) In moving vehicles, vibration may cause thermostats in the radio receiver BC-312 to produce noise, in which case the oscillator compartment heaters should be turned off.

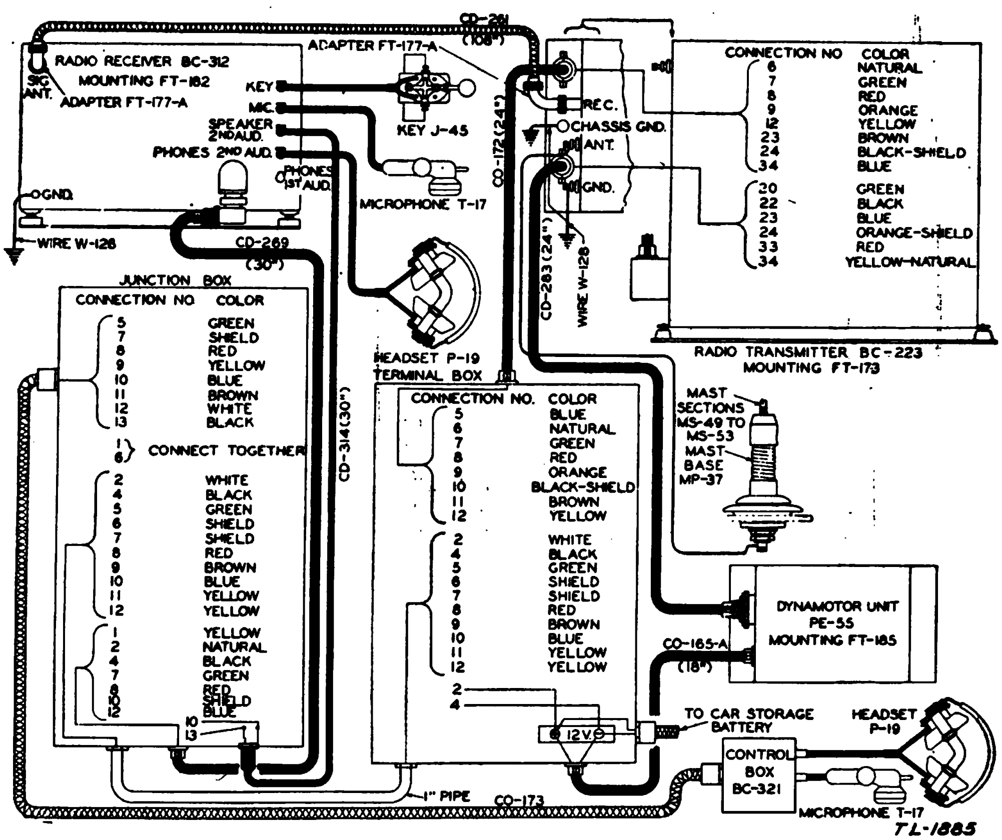


FIGURE 21.—Radio sets SCR-245-A and SCR-245-B, cording diagram.

(6) The above forms of interference and any others, after some experience, may be identified by characteristic noises.

b. Net operation.—(1) If net operation is prescribed, each set in the net must be accurately tuned to the same frequency. If master oscillator operation is used in the transmitter, frequency adjustment is best accomplished with the aid of a frequency meter of the SCR-211 series. *Tune all sets within the same net under substantially the same conditions.* The position and length of the antenna, the temperature, and the battery terminal voltages must be fairly uniform. Avoid tuning in the immediate vicinity of buildings and metal structures. If operation in transit is to be effected, tune sets with

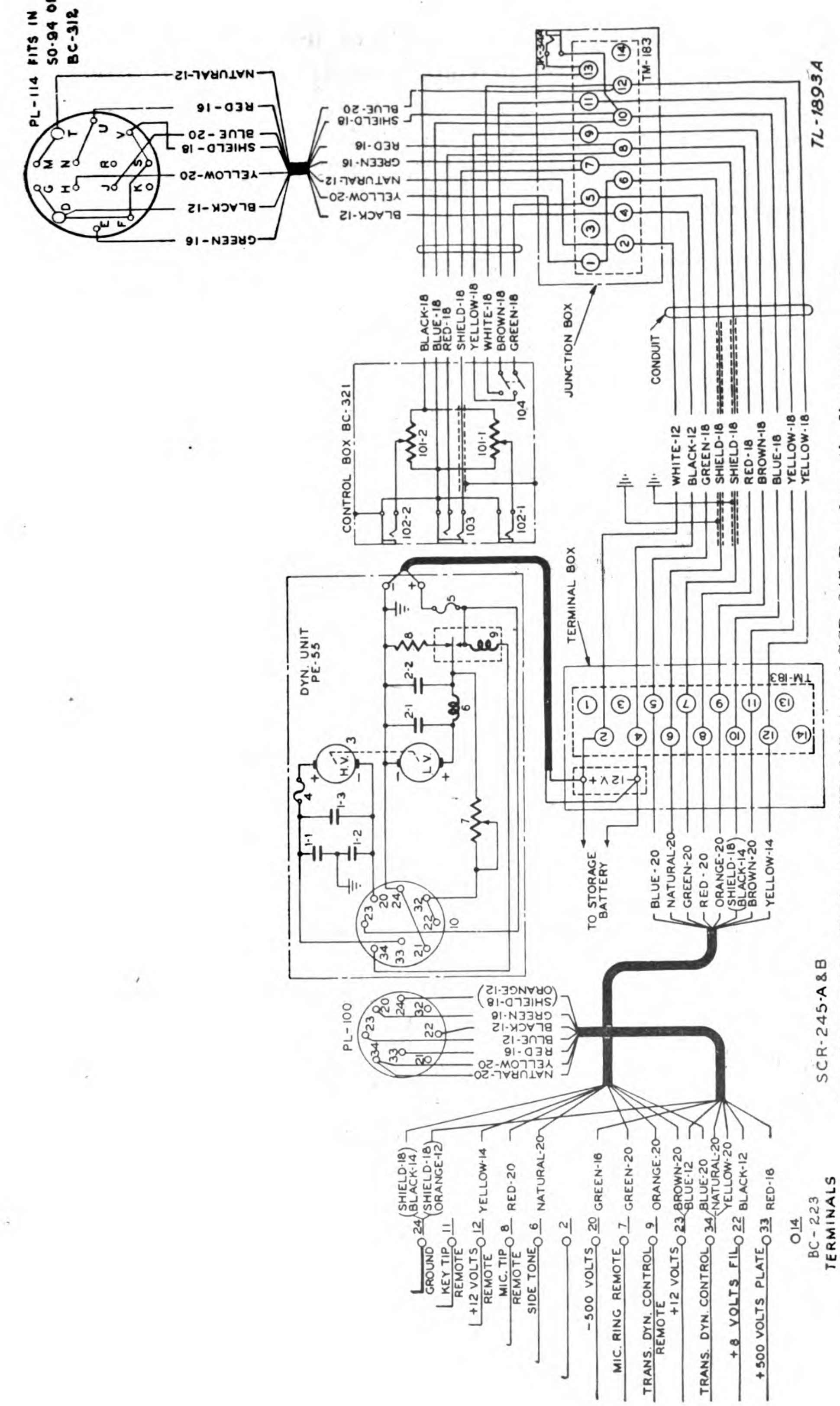


FIGURE 22.—Radio sets SCR–245–A and SCR–245–B, schematic diagram.

engines of the vehicles running. Lock all transmitter controls after the net tuning operation. Where nets of more than three stations are set up, use crystal control in the transmitter if crystals of identical frequency are available for all transmitters. Since no quartz crystals are issued as part of radio sets of the SCR-245 series, sets of crystals necessary for net operation in holders FT-171-B must be requisitioned separately.

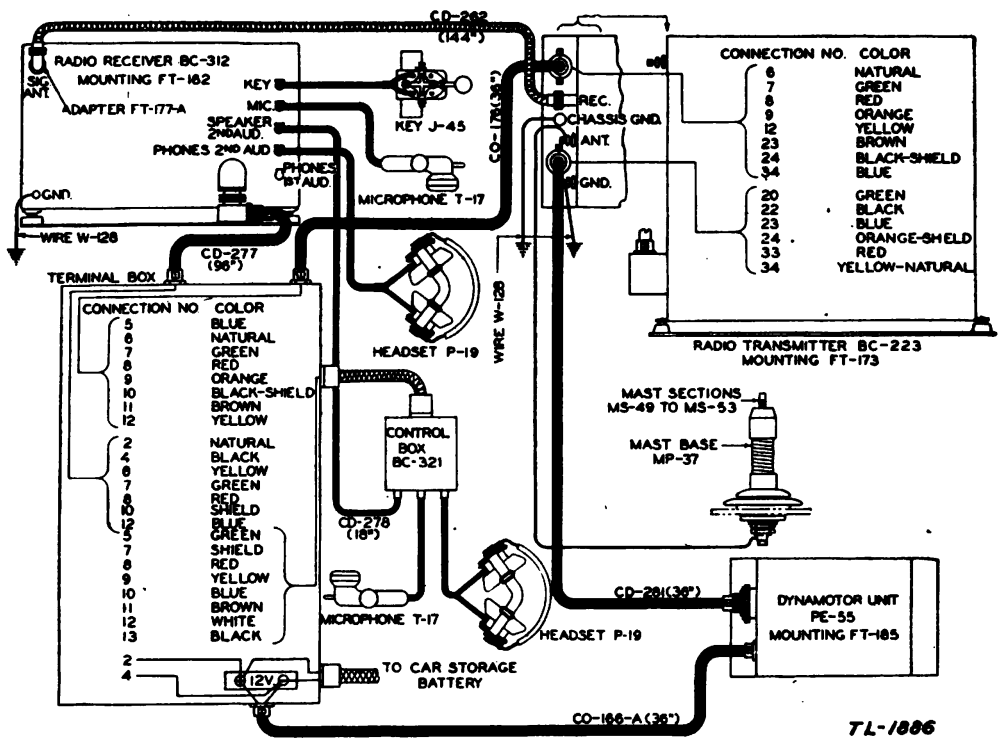


FIGURE 23.—Radio set SCR-245-C, cording diagram.

(2) If a frequency meter of the SCR-211 series is not available, or if it becomes necessary for scattered stations of a net to change frequency in the field, the net control station will issue the necessary instructions by means of the proper procedure signals ZFE, meaning, "I am shifting to transmit on ______ kilocycles," and ZFR, meaning, "Adjust your transmitter frequency to zero beat with mine." The secondary stations will tune in the net control station on the new frequency, and then adjust their own transmitters until their signals zero beat accurately in their receivers. During the tuning operation, side tone signals (generated in the transmitters) will be fed to the receivers and these will be heard regardless of the frequency adjustment of the transmitters. However, the whistling sound that is characteristic of the heterodyne action can readily be distinguished from the unchanging side tone signals. (See par. 30.)

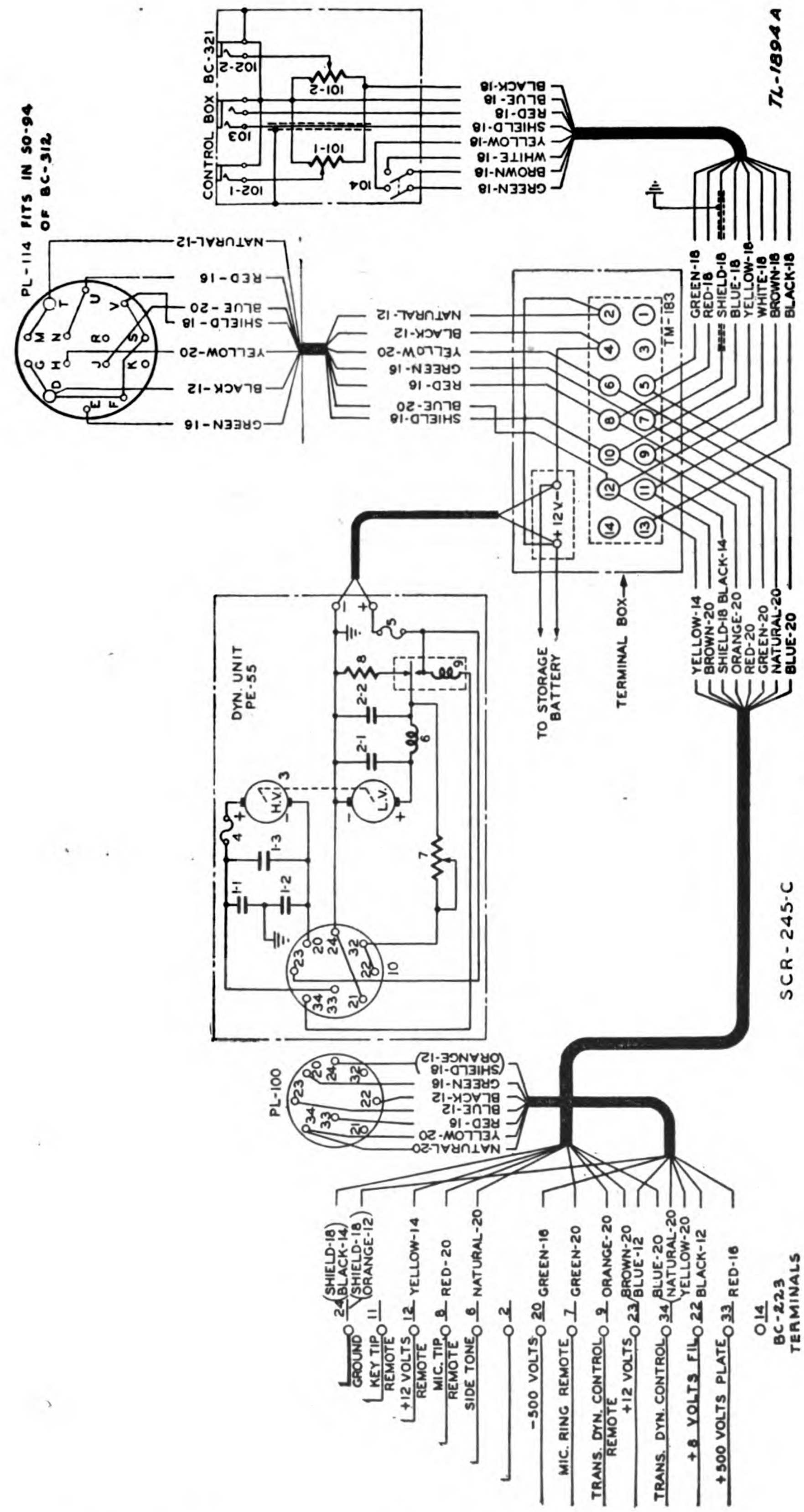


FIGURE 24.—Radio set SCR-245-C, schematic diagram.

c. Methods of operation.—(1) Being broad, tone transmission is well adapted to net operation but produces more interference to nearby radio sets than does cw transmission. Voice transmission produces more interference than does tone transmission.

(2) For satisfactory net operation when the radio receiver BC-312 is used, turn on the RF OSCILLATOR compartment heaters for 15 to 30 minutes prior to operation and maintain during operation. The heaters are controlled by the HEATERS OFF ON switch on the receiver front panel.

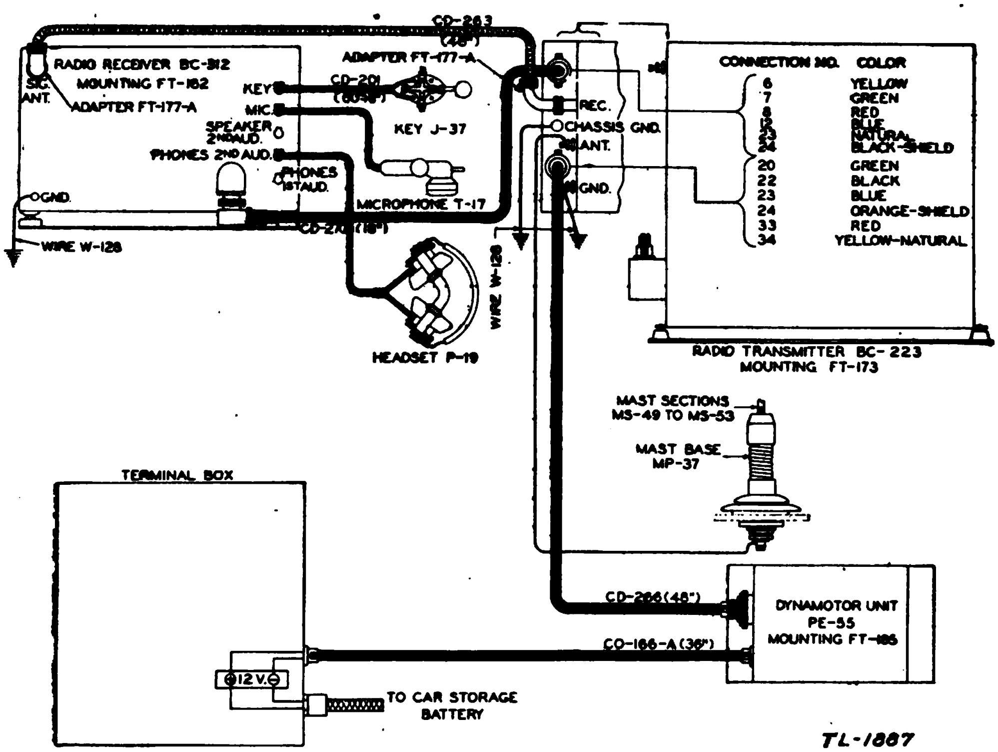


FIGURE 25.—Radio set SCR-245-D, cording diagram.

(3) So that the receiver will not be too selective during stand-by periods, turn the CRYSTAL PHASING knob, which controls the use of the crystal filter, to the OUT position.

d. Precautions.—(1) *Controls.*—Observe care in handling controls. Most of them are equipped with stops to limit their movement. Forcing a control beyond its normal stop will seriously damage the equipment. This caution applies particularly in the receiver to controls marked VERNIER, CRYSTAL PHASING, and VOL. In the transmitter, do not force the ANT IND and the ANT COUPLING controls after they have been locked in position.

(2) *Serial numbers.*—Radio transmitters of the BC-223 series and all tuning units issued initially with them bear identical serial and

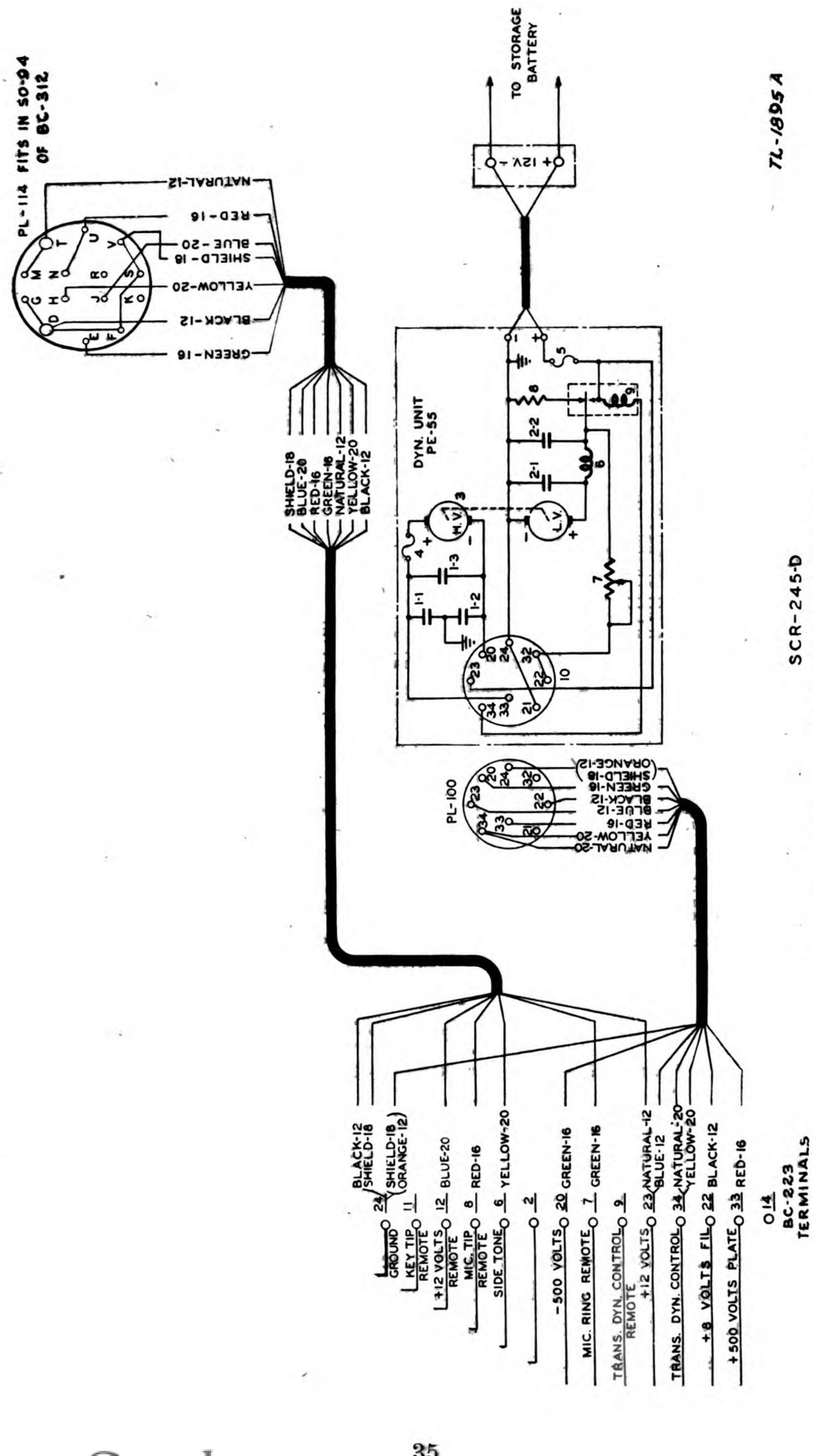


FIGURE 26.—Radio set SCR-245-D, schematic diagram.

order numbers for purposes of identification. *Do not interchange tuning units of other transmitters*, as the value of the calibration charts will thereby be destroyed. On tuning units TU–25–A which are issued separately to organizations already having radio sets of the SCR–245 series, the spaces on the name plate for the serial number and the Signal Corps order number are left blank. After each unit has been calibrated in a particular transmitter, these spaces must

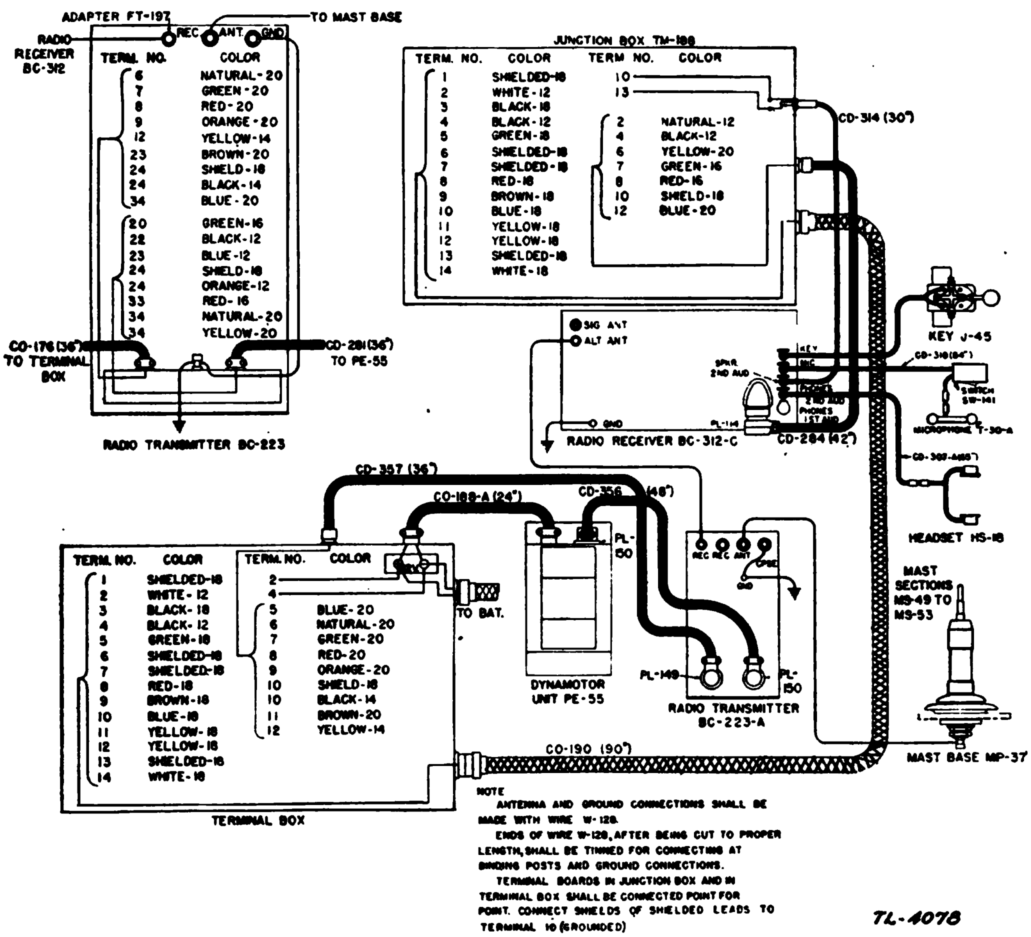


FIGURE 27.—Radio set SCR–245–E, cording diagram.

be filled in with the respective serial and order numbers of that transmitter. If regular punches for this purpose are not available, the numbers can be scratched in by means of a scriber or a center punch.

(3) *Vacuum tubes.*—A marked decrease in the life of the transmitter vacuum tubes results from over or under voltage applied to the filaments. Check the filament voltage frequently and adjust, if necessary, as prescribed in paragraph 24.

(4) *Relay contacts.*—When voice transmission is used, the microphone button controls the starting and stopping of transmitter dynamotor unit PE-55, the lighting of the tubes, and the operation of the antenna relay. After pressing the button, do not release it until the

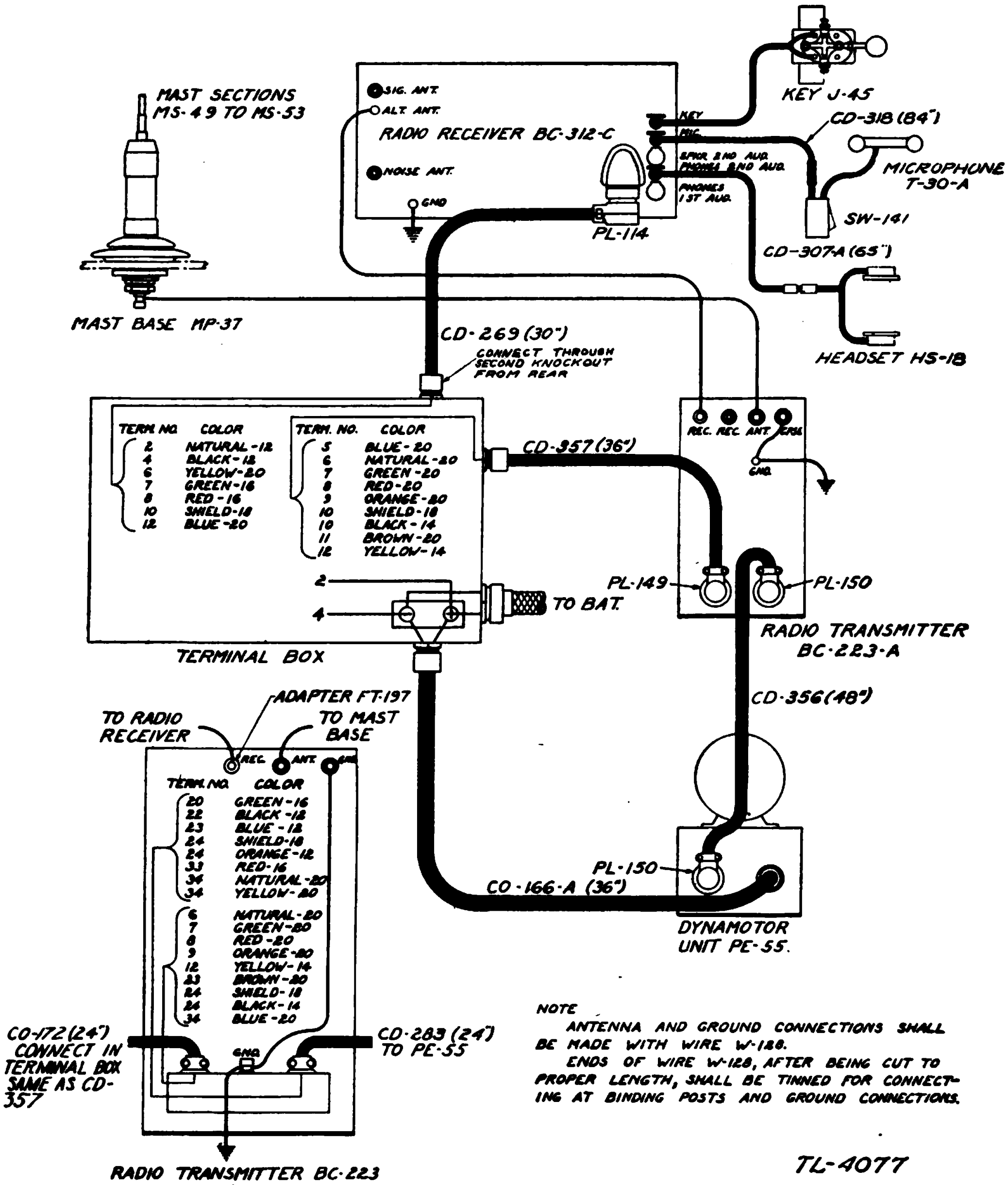


FIGURE 28.—Radio set SCR-245-F, cording diagram.

dynamotor has attained normal operating speed. If it is released before then, the starting relay must break the heavy starting current, and rapid pitting of the relay contacts results.

(5) *Band change.*—In changing the frequency band of the receiver, it is possible to stop the BAND CHANGE switch between two bands.

Turn this switch until it definitely engages the desired band, as indicated by the appearance of the correct scale in the FREQUENCY window.

(6) *Receiver power cord.*—Avoid undue pulling or stressing of this cord. Disconnect the cord from the receiver before the receiver panel

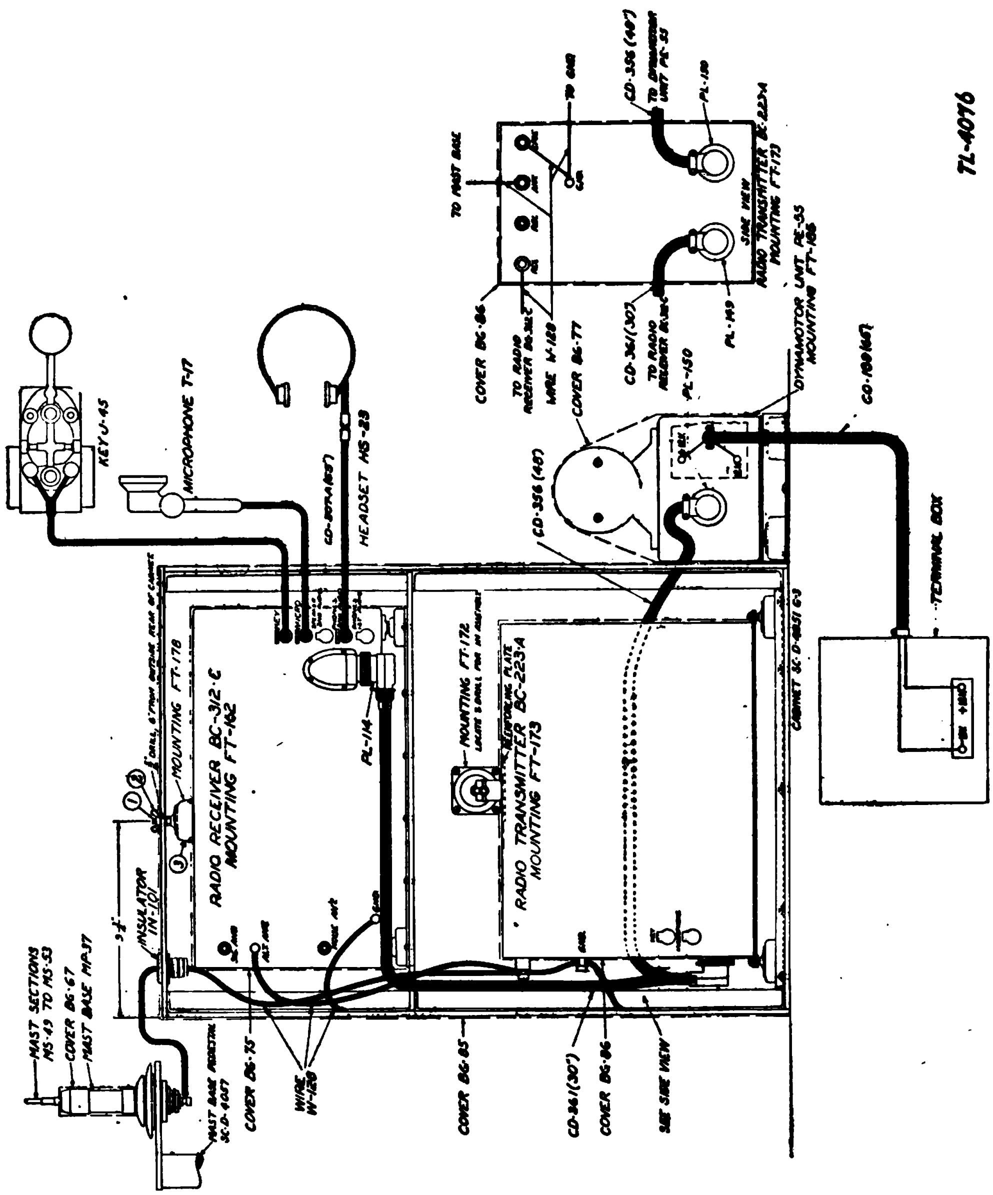


FIGURE 29.—Radio set SCR-245-G, cording diagram.

and chassis assembly is removed from the cabinet. At no time apply power to the receiver while the panel and chassis assembly is being handled.

(7) *SEND REC switch.*—When not being used during actual transmission periods, place the SEND REC switch in the REC position.

If left in the SEND position, there is a small current drain on the battery.

(8) *Main power fuse.*—In order to prevent any accidental current drain during periods when the radio set is not in use, remove the main power fuse holder in the box base of the dynamotor unit, place it in the bottom of the box, and replace the box cover.

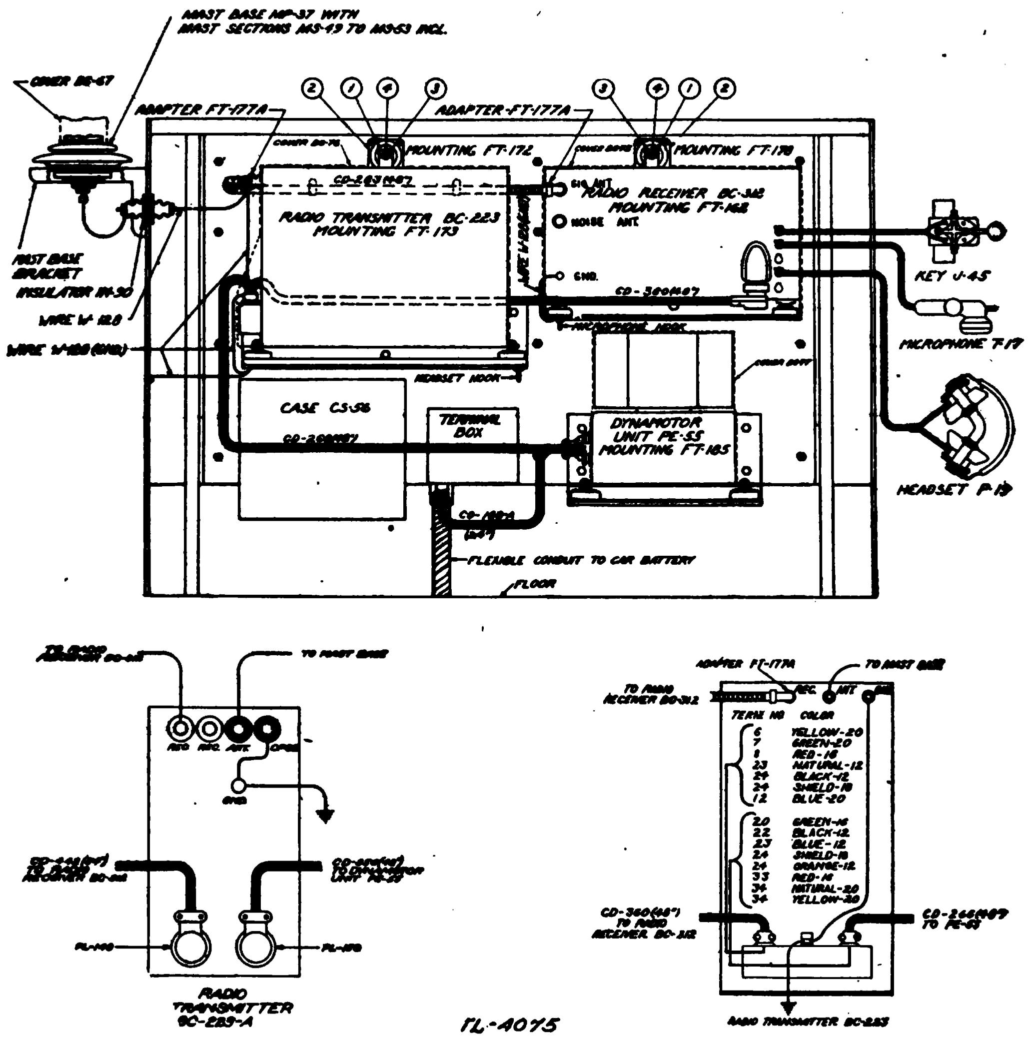


FIGURE 30.—Radio set SCR-245-H, cording diagram.

26. Transmitting.

—*a. Controls* (figs. 2, 5, and 7).—Transmission is accomplished or controlled by the proper use of the following:

NOTE.—There are key and microphone jacks on the front panel of radio transmitters of the BC-223 series and also on the front panel of radio receivers of the BC-312 series. The microphone alone can also be plugged into a jack on the control box, if one is used. The respective jacks are connected in parallel through the cording of the sets so that the key can be used at either the transmitter or the receiver, or the microphone at the transmitter, receiver, or control box. This arrangement allows great operating flexibility.

(1) Dynamotor unit PE-55.
(2) At control box BC-321:
(*a*) ON OFF switch.

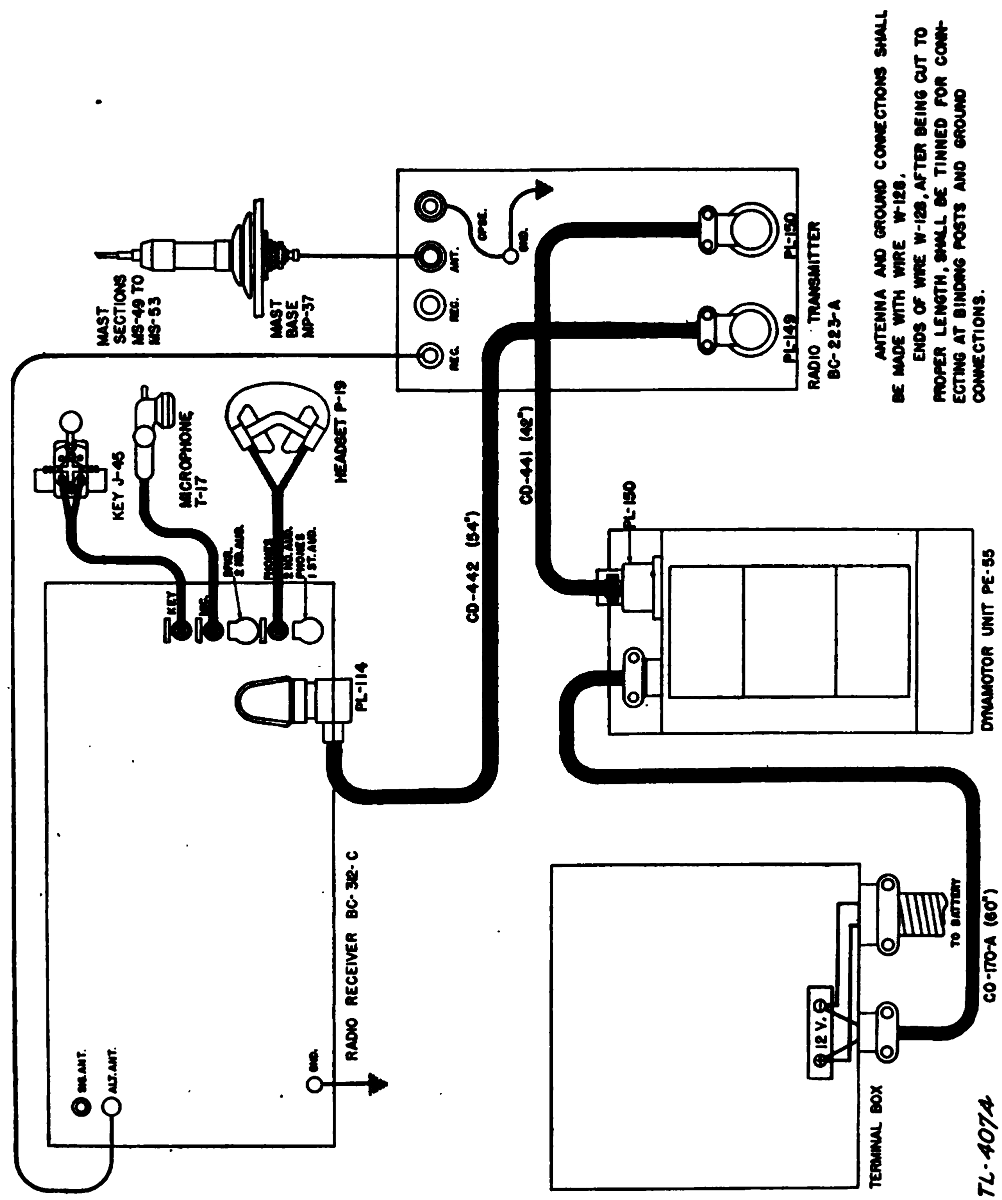


FIGURE 31.—Radio set SCR-245-J, cording diagram.

(*b*) MIC jack and microphone T-17 connected thereto for voice transmission.

(3) On radio receivers of the BC-312 series, KEY and MICRO jacks and a key and microphone for cw and tone, or voice, respectively, connected thereto.

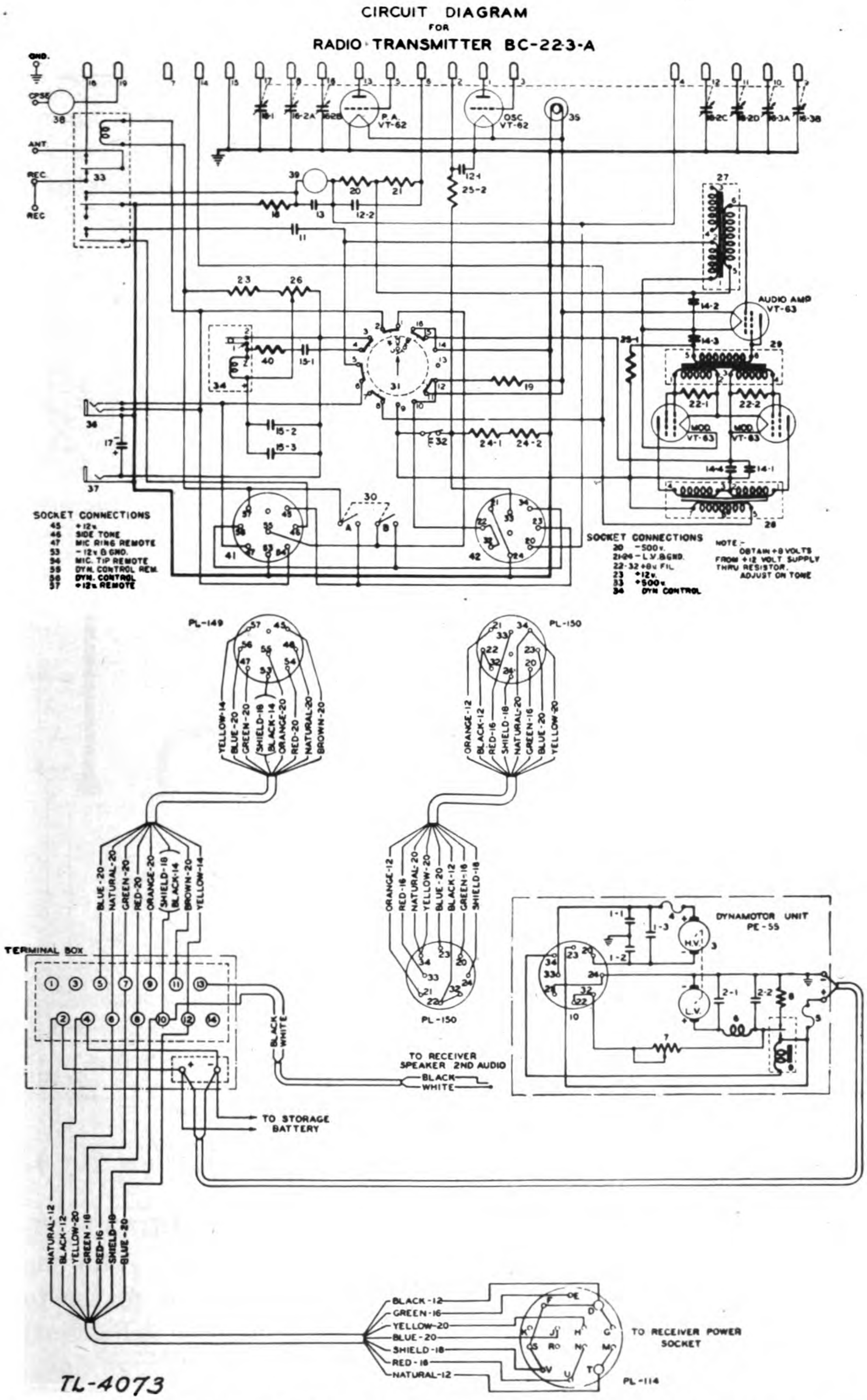


FIGURE 32.—Radio sets SCR-245-J and SCR-245-P, transmitter schematic diagram.

(4) On radio transmitter BC–223 or connected to it:

(*a*) An antenna (described in par. 18) connected to the ANT terminal on the upper left-side panel.

(*b*) A thermocouple type, 0- to 3-ampere, radio-frequency ammeter marked ANT CURRENT located in the upper left-hand corner of the front panel. This meter indicates the current output of the transmitter.

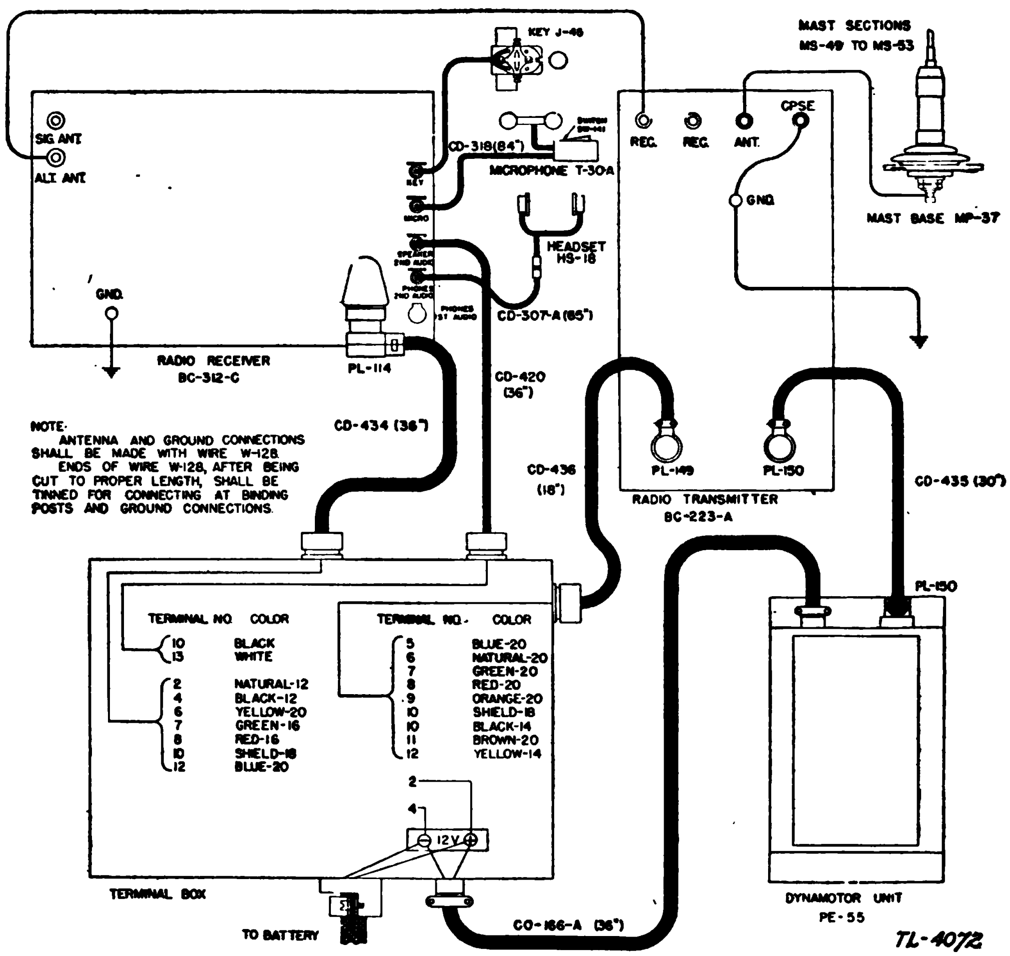


FIGURE 33.—Radio set SCR–245–K, cording diagram.

(*c*) A TRANSMITTER OFF ON toggle switch below the ANT CURRENT meter.

(*d*) A 0- to 300-milliampere, d-c ammeter marked PLATE CURRENT, below the TRANSMITTER OFF ON switch. This meter indicates the plate current of the oscillator tube alone or the total plate current of the transmitter tubes as controlled by switch described in (*e*) below.

(*e*) An OSCIL CURRENT-TOTAL CURRENT toggle switch located at the lower right of the PLATE CURRENT meter.

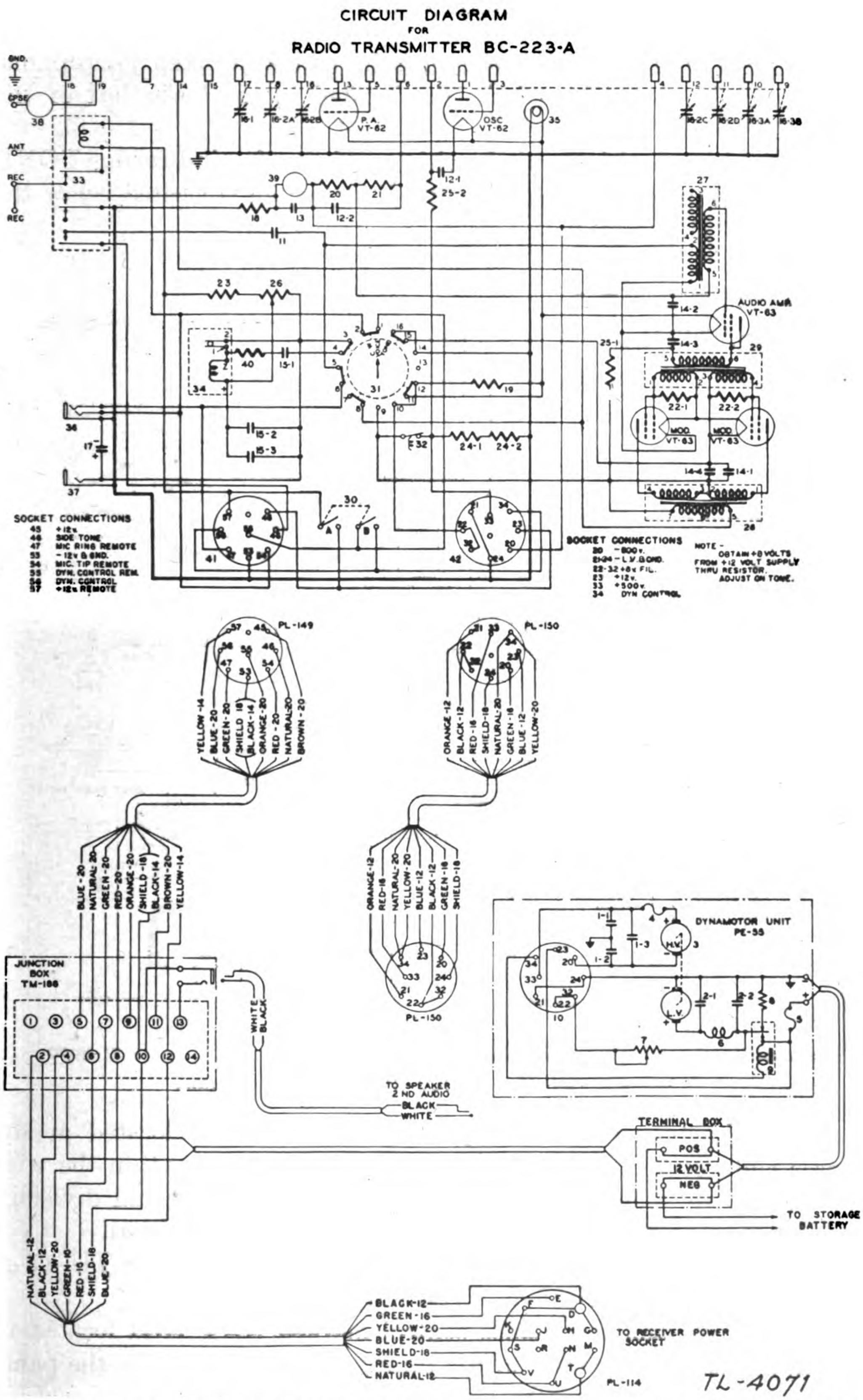


FIGURE 34.—Radio sets SCR–245–K, SCR–245–M, and SCR–245–N, transmitter schematic diagram.

(*f*) KEY and MICROPHONE jacks and a key and microphone connected thereto. These jacks are located to the lower left of the PLATE CURRENT meter.

(*g*) A three-position switch with a pointer for indicating TONE VOICE CW positions, respectively. This switch is located below the PLATE CURRENT meter.

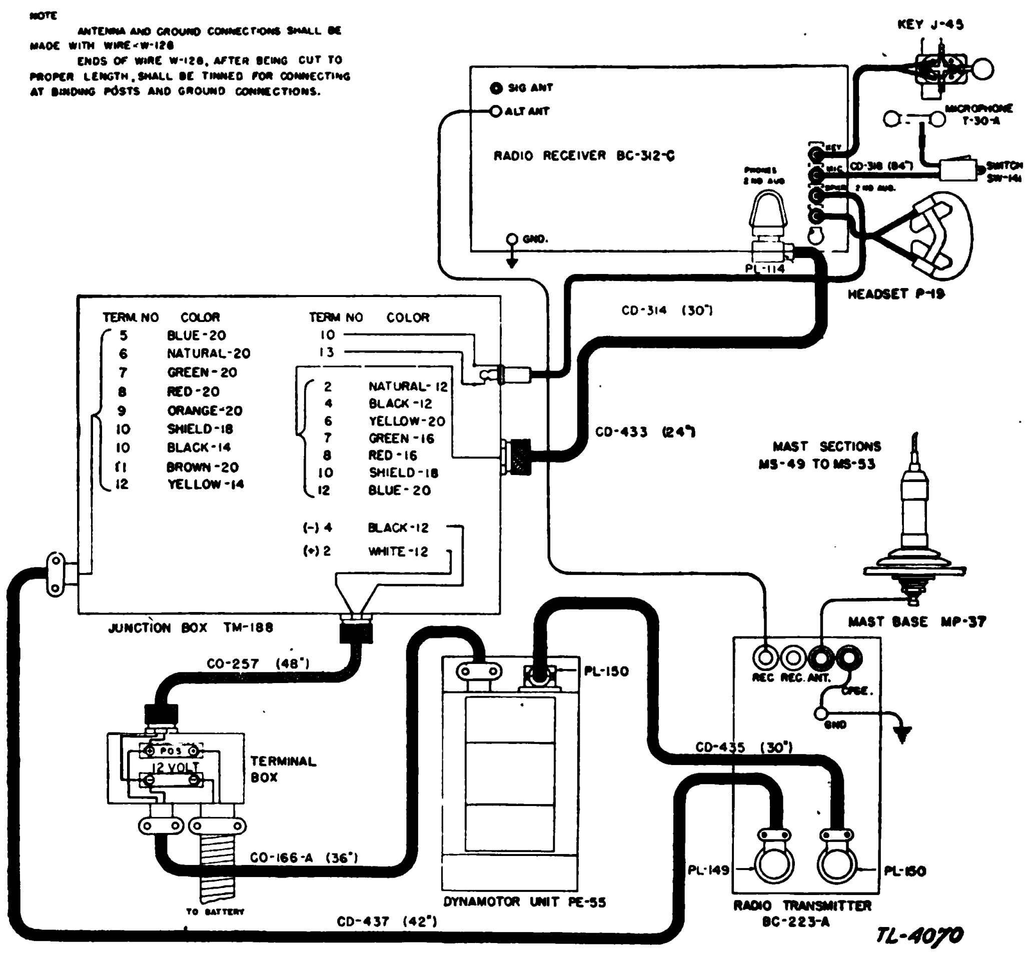


FIGURE 35.—Radio set SCR-245-L, cording diagram.

(*h*) A knob marked FREQUENCY CONTROL located at the lower right center of the panel which rotates a dial within the window above the knob. The knob is marked with 100 equal divisions on its periphery for interpolating the divisions on the dial.

(5) On transmitter tuning units TU-17 and TU-18, or TU-17-A and TU-17-B and TU-18-B, TU-18-A, or TU-25-A:

(*a*) An antenna inductance control marked ANT IND located in the upper left-hand corner of the tuning unit. Numbers on the panel are used for indicating the position of the pointer of this control. A LOCK is provided for locking this control in place.

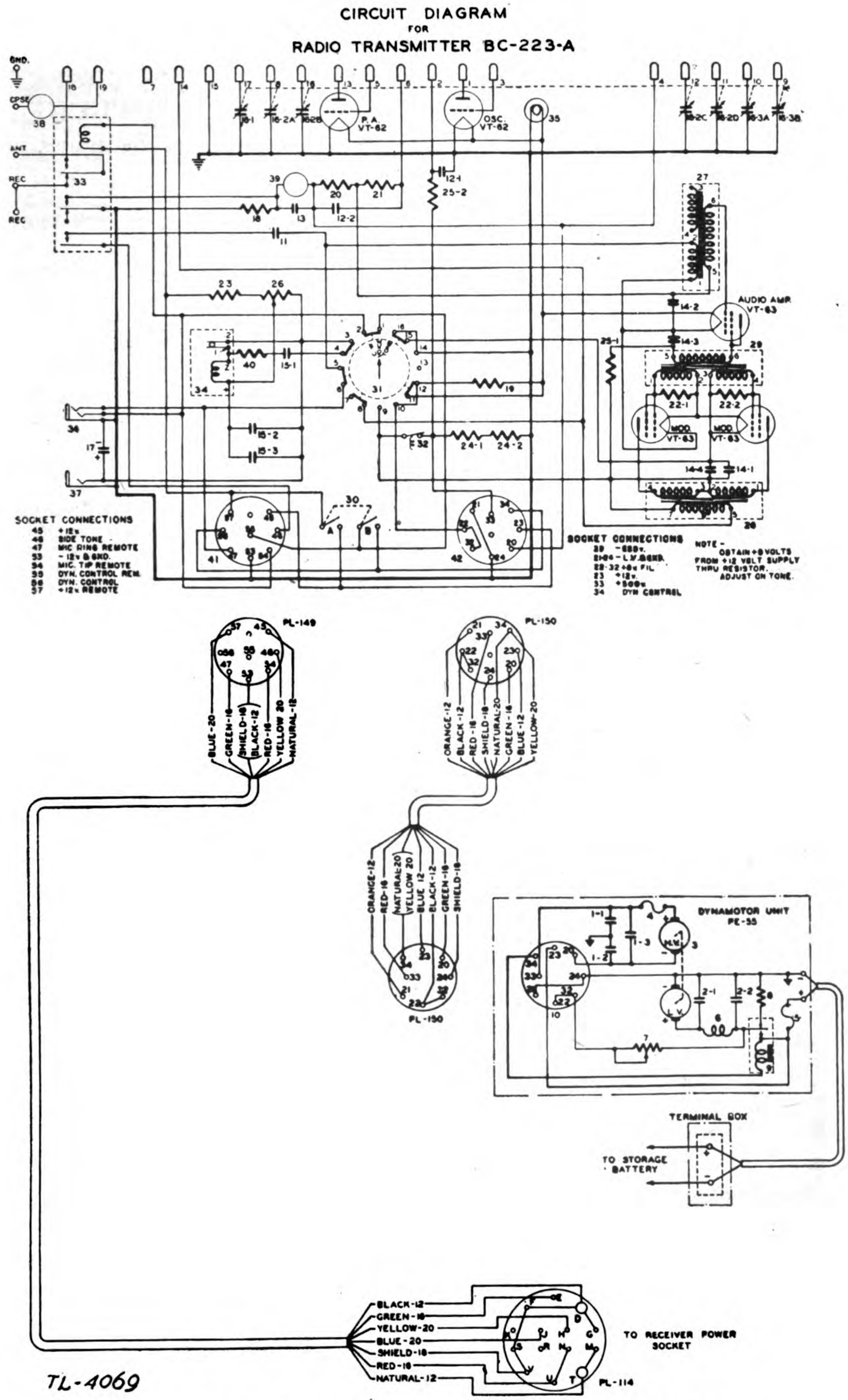


FIGURE 36.—Radio set SCR–245–L, transmitter schematic diagram.

(*b*) An antenna inductance switch marked ANT IND SW located to the lower left of the ANT IND control.

(*c*) An antenna coupling control marked ANT COUPLING located below the ANT IND SW switch. Numbers on the panel are

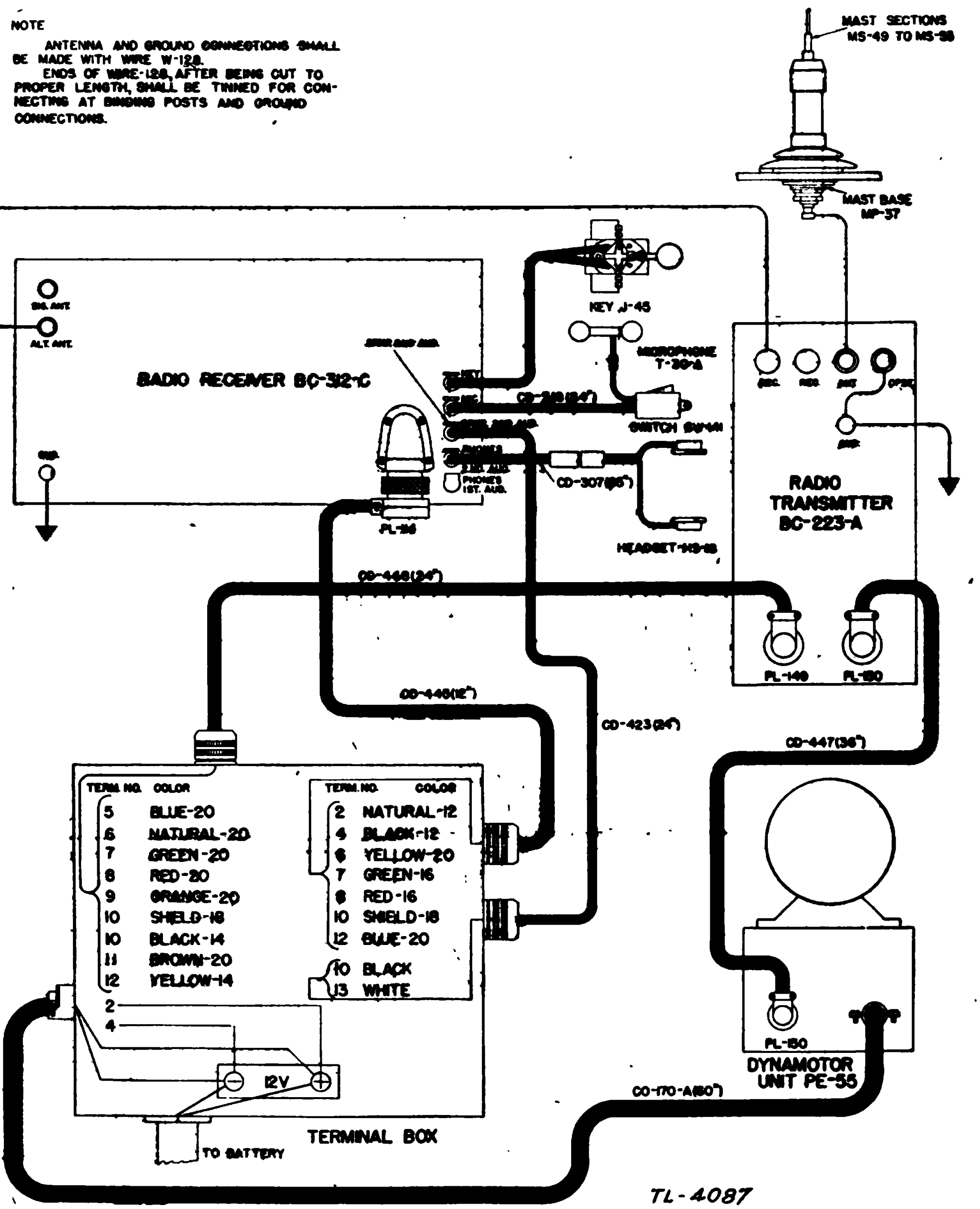


FIGURE 37.—Radio set SCR–245–M, cording diagram.

used for indicating the position of the pointer of this control. A LOCK is provided for locking this control in place.

(*d*) Crystals which are inserted in any of four numbered positions in a compartment in the upper right-hand corner of the tuning unit.

(*e*) A five-position switch marked CRYSTAL SELECTOR located below the crystal compartment cover. Markings 1 2 3 4 MO above the switch pointer positions indicate the crystal selected, or master oscillator operation in the case of MO.

(*f*) Four controls on the transmitter and tuning unit panels which are accessible by use of a screw driver upon removal of screw

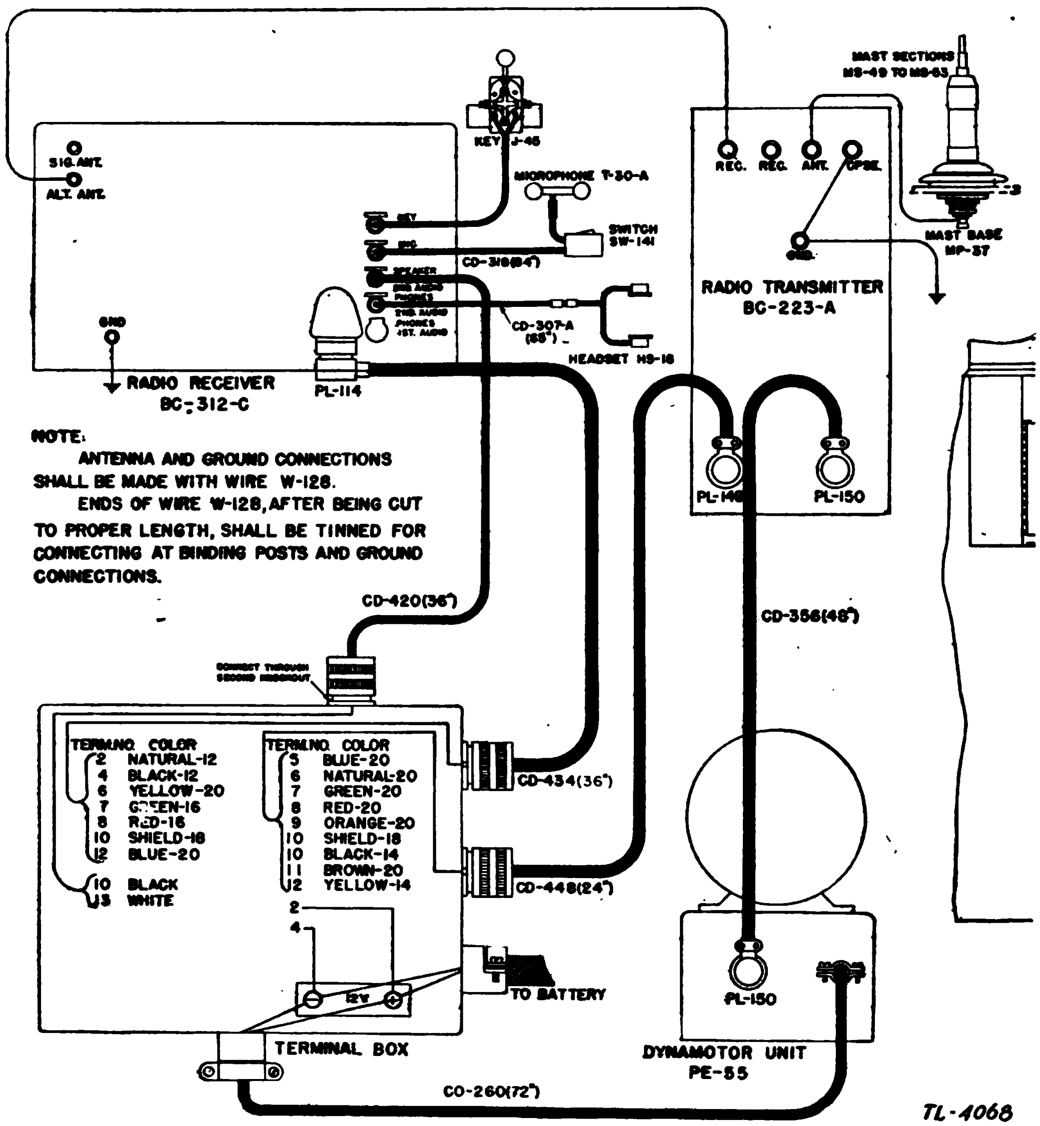


FIGURE 38.—Radio set SCR-245-N, cording diagram.

caps. They are marked OSC TRIMMER, PA NEUT COND, PA TRIMMER, and TONE MOD CONTROL, respectively. These controls are not normally adjusted during operation of the transmitter but may be adjusted if necessary as prescribed in paragraph 36.

b. Procedure.—The transmitter can be operated for cw, tone, or voice transmission with crystal or master oscillator control. *In all cases adjust the transmitter initially for cw transmission.* The pro-

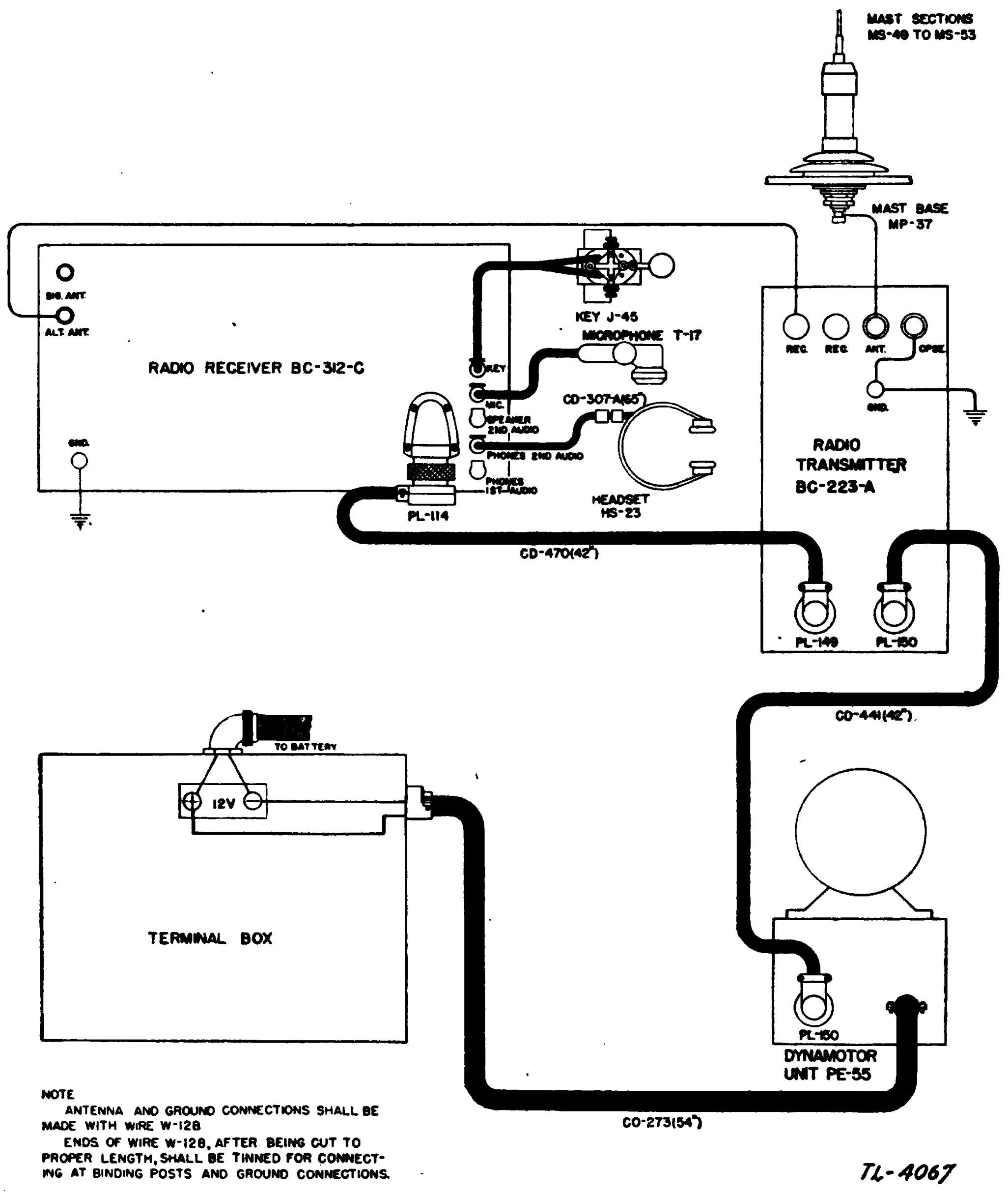


FIGURE 39.—Radio set SCR-245-P, cording diagram.

cedure employing the master oscillator is prescribed in (1) below. The procedure employing crystal control is prescribed in (2) below.

(1) *For cw master oscillator operation.*—(*a*) Read paragraphs 24 and 25.

(*b*) Turn TRANSMITTER OFF ON switch to OFF position.

(*c*) Plug into the transmitter the transmitter tuning unit which covers the assigned frequency.

(*d*) Determine the dial setting for the assigned frequency from the calibration chart located in the right-side metal pocket. If the prescribed frequency is between any two tabulated frequencies, interpolate the correct dial setting. It is important that all operating personnel become thoroughly familiar with the manner of adjusting the FREQUENCY CONTROL. The drum dial behind the illuminated window starts at 0 (zero) and goes to 30. This gives the "hundreds" figure. The small disk dial is marked with 10 divisions starting with 0 and ending back at 0. Each of these divisions is subdivided into 10 smaller divisions. The disk dial indicates "tenths" and "units." For example, suppose a desired frequency is indicated on the calibration chart by the dial setting 179. Start with the drum and the disk both at 0. Turn the disk knob slowly until the drum reads 1 and the disk reads 0; this dial setting represents 100. (One "hun-

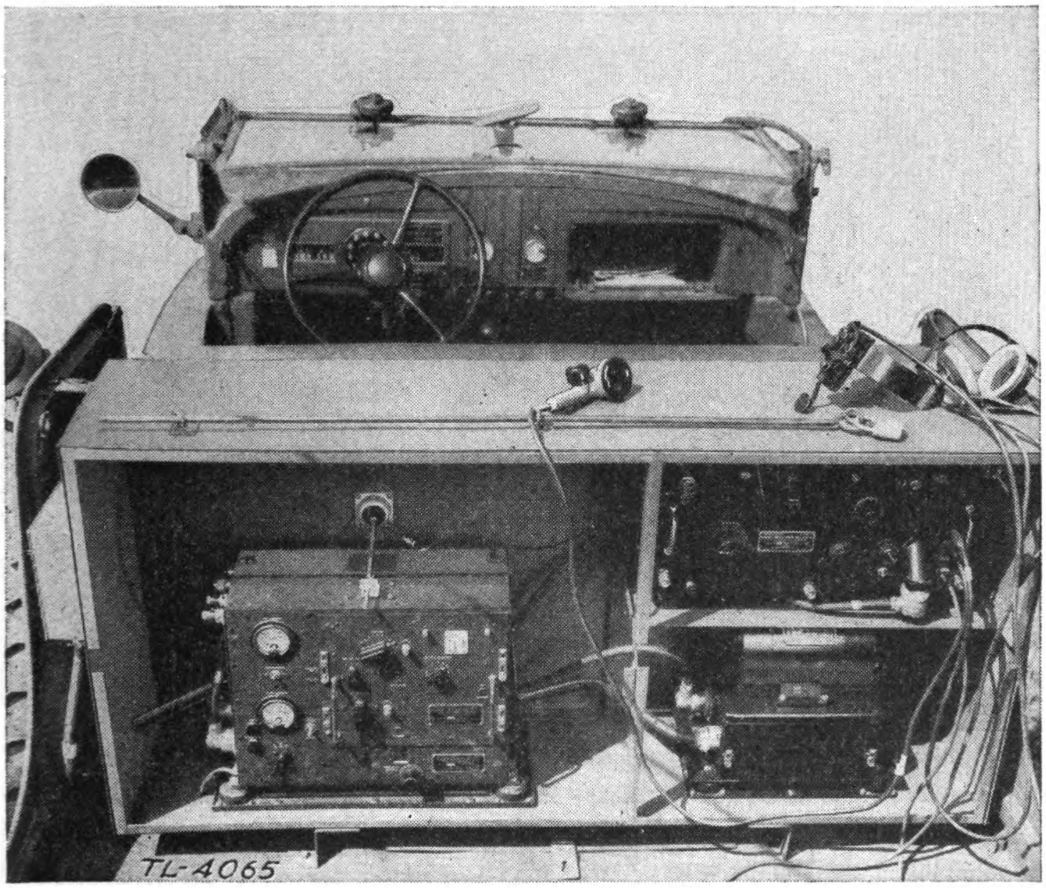


FIGURE 40.—View from operator's seat of radio set SCR-245-J, installed in a command truck.

dreds" and zero "tenths" and "units.") Continue turning the knob to 7 on the disk; this represents 170. Turn the knob still farther to the ninth subdivision beyond the full number 7 on the disk; the setting is then 179.

(*e*) Loosen the locking screw and place the ANT COUPLING pointer at 2.

(*f*) Place the ANT IND SW on position 1.

(*g*) Loosen the locking screw and place the ANT IND pointer at 0.

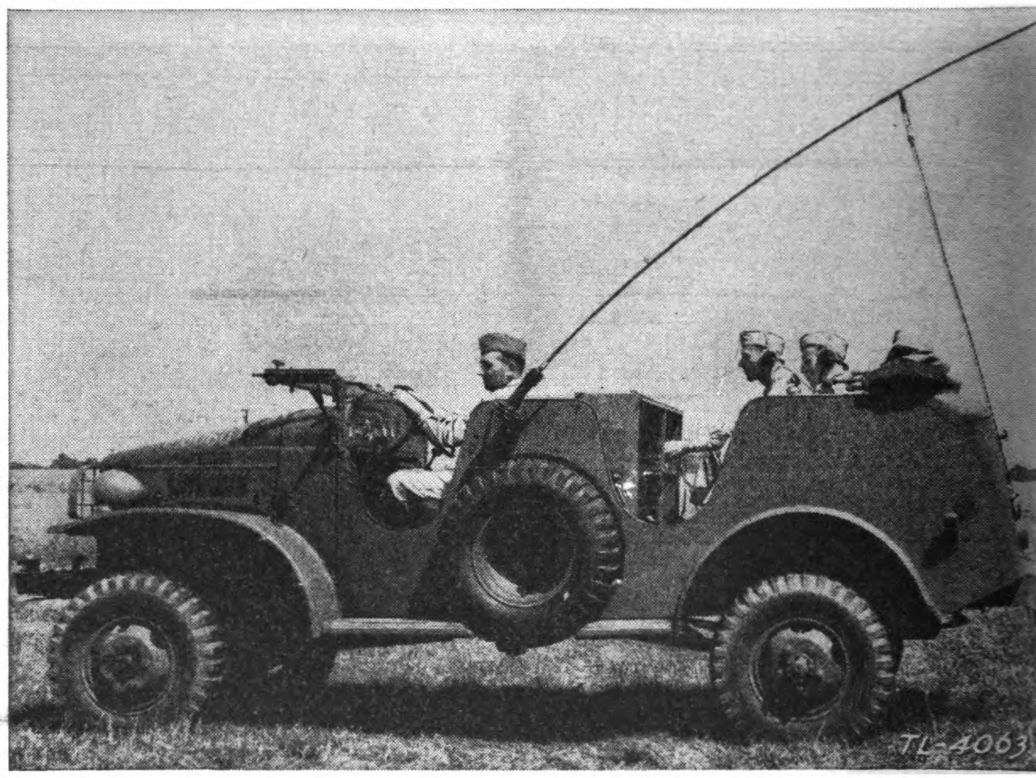


FIGURE 41.—Side view of command truck containing radio set SCR-245-J.

(Antenna is held at an angle of about 45° by piece of cord tied to reflector on back of truck. A short insulator is used between antenna and cord.)

(*h*) Place the TONE VOICE CW switch on the CW position.

(*i*) Place the CRYSTAL SELECTOR switch on the MO position.

(*j*) Insert the plug for the key in the KEY jack. If the key plug is inserted in the KEY jack of the receiver, move the SEND REC switch on the receiver panel to the SEND position.

(*k*) Move the TRANSMITTER OFF ON switch to the ON position. The dynamotor will start and the filaments of the oscillator and power amplifier tubes only will light.

(*l*) Press the key and observe the value of total plate current which should be about 60 milliamperes without antenna loading. If the total plate current is more than 70 milliamperes without antenna loading, mistracking between the oscillator and power amplifier stages is indicated and should be corrected as in paragraph 36*d*.

(*m*) Tune the antenna to resonance by moving the ANT IND control until a maximum indication is obtained in the ANT CURRENT meter. If the antenna does not tune to resonance, move the ANT IND SW switch to the second or third position (depending on which tuning unit is used), and retune with the ANT IND control.

FIGURE 42.—Operator using knee key in command truck equipped with radio set SCR-245-J.

(*n*) Increase the ANT COUPLING control and readjust the ANT IND control until a total plate current of 120 milliamperes is obtained when the antenna current is a maximum (approximately 1 ampere). When using a five-section whip antenna the ANT COUPLING control should normally be between 2 and 3.

(*o*) Lock the ANT IND and ANT COUPLING controls in place by turning the LOCK thumbscrews clockwise.

(2) *For cw crystal-controlled operation.*—(*a*) Read paragraphs 24 and 25.

(*b*) Turn the TRANSMITTER OFF ON switch to the OFF position.

(*c*) Plug into the transmitter the transmitter tuning unit which covers the assigned frequency.

(*d*) Place the CRYSTAL SELECTOR switch on the position selecting the crystal of the assigned frequency.

(*e*) Determine the approximate dial setting for the assigned frequency from the calibration chart located in the right-side metal pocket. If the desired frequency is between any two tabulated frequencies, interpolate the correct dial setting.

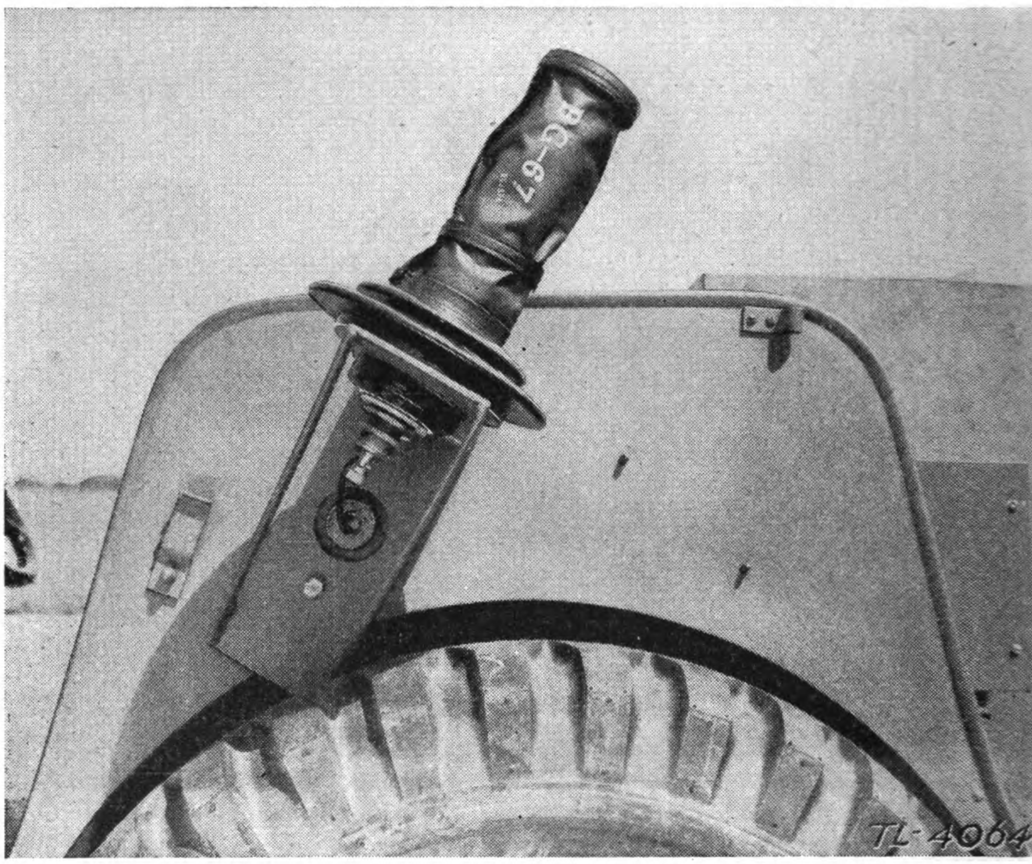


FIGURE 43.—Close-up of mast base with cover BG–67 in position over insulator.

(*f*) Turn the FREQUENCY CONTROL knob and dial to the setting determined in (*e*) above.

(*g*) Loosen the locking screw and place the ANT COUPLING pointer at 2.

(*h*) Place the ANT IND SW on position 1.

(*i*) Loosen the locking screw and place the ANT IND pointer at 0.

(*j*) Place the TONE VOICE CW switch on the CW position.

(*k*) Insert the plug for the key in the KEY jack. If the key plug is inserted in the KEY jack of the receiver, move the SEND REC switch on the receiver panel to the SEND position.

(*l*) Move the TRANSMITTER OFF ON switch to the ON position. The dynamotor will start and the filaments of the oscillator and power amplifier tubes only will light.

(*m*) Move the OSCIL CURRENT-TOTAL CURRENT switch to the OSCIL CURRENT position and hold it there by means of a short stick of wood propped under its handle.

(*n*) Press the key.

(*o*) Watch the PLATE CURRENT meter closely during this operation. Turn the FREQUENCY CONTROL knob on both sides of its initial setting until a sharp dip in the oscillator plate current is indicated on the PLATE CURRENT meter. At the point of minimum reading (bottom of dip) the oscillator is tuned to the crystal frequency. In tuning into this dip it will be observed that the dip is more abrupt on one side than on the other. Tune slightly toward the side of the *less* abrupt dip. If the crystal stops oscillating (indicated by a sudden increase in total plate current), tune farther toward the side of the less abrupt dip.

(*p*) Press the key several times and note if the plate-current indication returns to the same value each time. If it does not, retune as indicated in (*o*) above, but farther toward the side of the less abrupt dip. Press the key for the next operation.

(*q*) Tune the antenna to resonance and adjust the antenna coupling as described for master oscillator operation.

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

(*a*) Move TRANSMITTER ON OFF switch to the OFF position.

(*b*) Place the TONE VOICE CW switch on the TONE position.

(*c*) Move the TRANSMITTER ON OFF switch to the ON position. The dynamotor will start and all the tubes will light.

(*d*) Press the key. At resonance, the plate current with key depressed as indicated in the PLATE CURRENT meter should not exceed 260 milliamperes.

(4) *For voice operation.*—Having completed the procedure directed in (1) or (2) above—

(*a*) Move the TRANSMITTER OFF ON switch to the OFF position.

(*b*) Place the TONE VOICE CW switch on the VOICE position.

(*c*) Insert the plug for the microphone in the MICROPHONE jack on the panel of the transmitter. If the microphone plug is inserted in the MICRO jack of the receiver of a complete radio set SCR–245 installation, move the SEND REC switch on the receiver panel to the SEND position. If the microphone plug is inserted in the MIC jack of the control box, move the ON OFF switch of the control box to the ON position. Nothing will happen when this switch is moved to ON.

(*d*) Move the TRANSMITTER OFF ON switch to the ON position. Nothing will happen.

(*e*) Press the microphone button. The dynamotor will now start and all transmitter tubes will light. Keep a firm grip on the microphone button at all times during voice transmission, and especially during the first several seconds when the tubes are warming up and the dynamotor is gathering speed. Intermittent snapping of the button will cause the starting relay in the dynamotor base to chatter, and the contacts will pit rapidly.

(*f*) Check the antenna tuning, without speaking into the microphone.

(*g*) With a sustained normal voice spoken into the microphone, the ANT CURRENT meter and the PLATE CURRENT meter should show increases, the result of modulation. The maximum total plate current with the sustained normal voice should not exceed 260 milliamperes.

(*h*) The transmitter can thereafter be controlled "push to talk" by pressing the microphone button to transmit and releasing it to receive. Do not begin talking immediately after pressing the microphone button, but wait until the dynamotor comes up to full speed. If the dynamotor cannot be heard directly, because of noise in the vehicle, count three slowly to yourself after pressing the button, and then talk. Hold the microphone about half an inch from the lips and speak slowly and evenly in a normal tone. Operators wearing tight-fitting headsets have a tendency to shout into the microphone; this must be avoided because it produces overmodulation and distortion.

27. Receiving.—*a. Controls.*—Reception is accomplished or controlled by the following:

(1) On the receiver or connected to it—

(*a*) A six-position switch located on the left center of the front panel marked BAND CHANGE. Each position is marked with the limiting frequencies in kilocycles of the band through which the receiver can be tuned. (See par. 30.) The BAND CHANGE switch also operates a masking plate in front of the main tuning dial.

(*b*) A flat disk main tuning dial located in the upper left of the front panel behind a windowed reflector and marked FREQUENCY. The dial has seven concentric scales, the outer six of which are calibrated directly in frequency. The first or inner scale is calibrated in equal divisions from 0 to 45 for ready position reference. The masking plate referred to in (*a*) above covers the frequency scales not in active use so that only the 0 to 45 scale and that pertaining to the frequency band selected by the BAND CHANGE switch are in sight.

(*c*) Two controls on the right center of the front panel marked FAST TUNING and VERNIER, respectively. The FAST TUNING control rotates the main tuning dial at a reduction ratio of 25 to 1. The VERNIER control rotates the main tuning dial at a reduction ratio of 90 to 1. A calibration of 100 equal divisions around the periphery of the VERNIER control permits interpolation of the inner 0 to 45 scale of the main tuning dial. The VERNIER control makes one complete revolution to move the main tuning dial one graduation on the 0 to 45 scale.

(*d*) An antenna tuning control to the left of the main tuning dial marked ALIGN INPUT.

(*e*) A crystal filter control to the right of the main tuning dial marked CRYSTAL PHASING. An arrow on the control when the latter is rotated to the OUT marking on the panel indicates that the crystal filter is out of the circuit. Other positions of the arrow indicate that the crystal filter is in the circuit.

(*f*) A volume control to the right of the CRYSTAL PHASING control. It is marked VOL and has 100 equal divisions marked on its periphery for ready position reference. An arrow marking on the control indicates the direction of rotation for increasing volume.

(*g*) A two-way toggle switch marked CW OSC OFF ON located to the right of the VOL control.

(*h*) A CW OSC ADJUST control located in the upper right-hand corner of the front panel.

(*i*) A three-position switch in the lower right section of the panel marked OFF MVC AVC. When the arrow of the switch knob points to OFF, the receiver is entirely dead. When it is moved to MVC, the tubes and the dial lamps light, the small dynamotor inside the chassis starts, and the receiver functions with manual volume control only. When the knob is advanced to the AVC position, the set remains in operation, but automatic volume control is also provided to supplement the manual volume control exercised by means of the knob marked VOL.

(*j*) A two-way toggle switch in the lower right of the front panel marked SEND REC.

(*k*) Two small knob controls located below the BAND CHANGE switch, marked NOISE ADJUST and NOISE BALANCE, respectively.

(*l*) A two-way toggle switch located in the right center of the front panel, marked HEATERS OFF ON (on radio receiver BC-312 only).

(*m*) Three fuse holders marked FUSE on their screw caps and HEATERS, DYN-FIL, and SPARE, respectively, on the panel immediately below. Being identical, the fuses contained within all three holders are interchangeable.

(*n*) Four terminals marked SIG ANT, NOISE ANT, and GND, respectively, on the left-hand side of the panel and ALT SIG ANT in the upper right-hand corner of the front panel of radio receiver BC-312 only. In radio receiver BC-312-C the ALT SIG ANT terminal is not provided.

(*o*) Five jacks marked KEY, MICRO, SPEAKER 2ND AUDIO, PHONES 2ND AUDIO, and PHONE 1ST AUDIO, respectively, located on the lower right edge of the front panel. These jacks are provided for the insertion of plugs for a key, microphone, loudspeaker, and headphones, respectively.

(*p*) A 14-contact socket located on the front panel. Power for the receiver is supplied through a cord plug which is inserted into this socket. The leads from this power socket to the interior of the receiver are accessible upon unscrewing four screws of a protective metal cover above the socket and removing the cover.

(*q*) A shielded wire for connecting the SIG ANT or ALT SIG ANT terminals to the antenna or to the REC terminal of the transmitter when the latter is used with the receiver.

(*r*) A noise suppressor antenna, if used, is connected to the NOISE ANT terminal.

(*s*) A ground wire for grounding the receiver chassis to the chassis of the vehicle is connected to the GND terminal.

(2) On the control box, if used—

(*a*) Two jacks located on the bottom marked PHONE NO. 1 and PHONE NO. 2 in which may be inserted plugs for two headsets for remote reception.

(*b*) Two controls located on the front plate marked VOLUME CONTROL NO. 1 and NO. 2, respectively, for controlling the volume in headphones referred to in (*a*) above.

b. *Procedure*.—The receiver can be operated for cw, tone, or voice reception. Volume level can be controlled automatically or manually. Selectivity can be controlled by the use of the crystal.

(1) *For cw reception.*—(*a*) Read paragraphs 24 and 25.

(*b*) For conditions requiring above-average frequency stability, when the radio receiver BC-312 is used, move the HEATERS OFF ON switch to the ON position from 15 to 30 minutes prior to operation.

(*c*) Insert plugs for headsets P-19 in PHONES 2ND AUDIO jack or PHONES 1ST AUDIO jack of the receiver; in PHONE NO. 1 and/or PHONE NO. 2 jack of the control box, if used. Insert plug for loud speaker, if used, in SPEAKER 2ND AUDIO jack. Loudspeakers are not issued with radio sets of the SCR-210 and SCR-245 series. However, loudspeakers LS-3, which may be requisitioned separately, are useful for group training purposes.

(*d*) Rotate BAND CHANGE switch to the position which covers the assigned frequency.

(*e*) Move the CW OSC OFF ON switch to the ON position.

(*f*) Move the CRYSTAL PHASING control to the OUT position.

(*g*) Move the SEND REC switch to the SEND position if the receiver is used in conjunction with the transmitter.

(*h*) Rotate the FREQUENCY or main tuning dial by means of the FAST TUNING control until the assigned frequency is indicated on the dial.

(*i*) Move the OFF MVC AVC control switch to the MVC position. Receiver output volume is manually controlled when the switch is in this position.

(*j*) After a brief period of time in which the receiver "warms up," rotate the ALIGN INPUT control until maximum set noise is heard.

(*k*) It may be necessary to tune on either side of the assigned frequency by means of the VERNIER control, until the desired signal is located.

(*l*) The pitch of the signal may now be further adjusted to a desired note by the CW OSC ADJUST control. The use of the CW OSC ADJUST control permits a 4,000-cycle variation in the resultant beat note of the cw signal, but does not change the frequency adjustment or sensitivity of the receiver.

(*m*) The VOL control may be rotated at any stage of the tuning to adjust the output volume to a desired level. An increase in the VOL setting increases the sensitivity of the receiver. In tuning the receiver initially, it is preferable to maintain the volume fairly high. Volume is further adjusted by VOLUME CONTROL NO. 1 or NO. 2 on the control box if the latter is used. The latter volume controls adjust the audio level only, and have nothing to do with the sensitivity of the receiver itself. When remote control is employed, it is usually desirable to set the VOL knob on the receiver to maximum. The receiver is then functioning at maximum sensitivity. If the full output is too great, the remote operator can reduce the signals in his headset to a comfortable level by means of VOLUME CONTROL NO. 1 or NO. 2 on the control box.

(*n*) An increase in selectivity of radio receivers of the BC-312 series, if desired, may now be accomplished as prescribed in (4) below.

(2) *For tone or voice reception.*—Use the same procedure as prescribed for cw reception ((1) above) except place the CW OSC OFF ON switch in the OFF position as soon as the signal is tuned in.

(3) *For automatic volume control.*—Move the OFF MVC AVC switch to the AVC position. While this reduces the sensitivity of the receiver, it tends to maintain the output at a constant level as determined by the VOL control setting. Automatic volume control is preferable where the signal fluctuates or otherwise tends to vary in output level. Generally, it is inadvisable to employ automatic volume control when receiving cw or tone signals, although under some circumstances it is helpful. A quick flip of the OFF MVC AVC switch, during actual reception, will indicate the better type of control to use.

(4) *For increased selectivity or rejection of interfering signals.*—(*a*) In radio receivers of the BC-312 series the rotation of the CRYSTAL PHASING control from the OUT position in a counterclockwise direction increases the selectivity of the receiver, by allowing the crystal circuit to operate. While this reduces the sensitivity of the receiver, selectivity is greatly improved. Careful adjustment of this control will permit of rejecting or minimizing an interfering signal on an adjacent channel without serious attenuation of the desired signal. Maximum selectivity is in general indicated by minimum background noise and usually is established when the arrow on the CRYSTAL PHASING control is in nearly the vertical position.

(*b*) To secure maximum response from the receiver when crystal operation is being used it is necessary to make certain that the signals being received fall exactly on the resonance frequency of the crystal. This is done by slowly adjusting the VERNIER control. When the point of maximum response is found, it may be necessary to readjust the CW OSC ADJUST control until a pleasing tone is produced.

(*c*) The crystal filter is intended primarily for the reception of cw and tone signals when bad interference from stations on neighboring frequencies is experienced. It is somewhat less effective, but still helpful, when voice signals are being received under similar circumstances. The crystal filter distorts voice signals by chopping off the upper side bands, but careful adjustment of the CRYSTAL PHASING and VERNIER controls preserves enough of the transmission to make it intelligible. The best use of the filter is determined by trial.

(5) *To reduce engine ignition interference on 1,500–3,000 and 3,000–5,000 kilocycle frequency bands.*—(*a*) Follow the procedure prescribed in (1) above, tuning on any frequency in the two frequency bands.

(*b*) Connect the signal antenna to the SIG ANT terminal. (Disconnect the noise antenna temporarily. The latter is a piece of shielded wire; one end is connected to the NOISE ANT terminal on the receiver, and the other is left open and hung in the engine compartment of the vehicle, without touching any "live" part of the ignition wiring.) Adjust the NOISE ADJUST control to receive maximum noise output.

(*c*) Disconnect the signal antenna. Connect the noise antenna to the NOISE ANT terminal. Adjust the NOISE BALANCE to receive maximum noise output. The noise output should be equal to that secured in (*b*) above. If the noise outputs are not equal, relocate the pick-up end of the noise antenna until they are, and readjust the NOISE BALANCE control for maximum noise output.

(*d*) Connect both antennas. Adjust both NOISE ADJUST and NOISE BALANCE controls until the minimum noise output is secured.

(*e*) If noise reduction is unsatisfactory, it may be necessary to move the pick-up end of the noise antenna a number of times, repeating the above procedure each time until the best results are obtained. In some vehicles the noise antenna raises rather than lowers the noise level, and it may therefore be removed entirely.

28. Care and adjustments.—*a. Inspections.*—To insure uninterrupted service, inspect the various components of each installation before and after each day's operation. Make a thorough inspection of each installation after every 50 hours of operation. For inspection instructions, see paragraph 34.

b. When not in use.—At all times when the receiver, transmitter, and dynamotor unit are not in actual operation, place covers BG-75, BG-76, or BG-86, and BG-77 over these components, respectively. Close all slide fasteners. Securely fasten boxes and cases containing the transmitter tuning units not in use, spare tubes, and other accessories. Remove headsets, keys, and microphones when not in use and put in a safe place. The antenna may or may not be disassembled, depending on its prospective use. If it is disassembled, insert mast sections in compartments of roll BG-56 and place the latter in a safe place. Screw a bolt provided for the purpose in the top of the mast base and strap cover BG-67 over the whole. To avoid injury due to shock or vibration of the vehicle when in motion, secure or pad all items of these sets which are not otherwise protected.

c. Lubrication.—Components of these sets will be lubricated according to instructions outlined in paragraph 35.

d. Special adjustments.—See paragraph 36.

e. In inclement weather.—Where there is a likelihood of exposure of the set components, cover the components as in *b* above. These sets can be operated with covers on. Slide fasteners on the covers of the receiver and transmitter are opened and the front flaps held up and back by snap fasteners during operation.

29. Storage.—*a.* If the sets are to remain out of service but within the vehicles for more than a few days, proceed as directed in paragraph 28*b*. Disassemble the antenna and cover the ends of the mast sections with vaseline before placing in roll BG-56.

b. If set components are to be removed from the vehicle and stored elsewhere, handle them carefully, cover or wrap securely against dust, place in a dry, protected location, and safeguard against accidental injury. Inspect frequently for dust, rust, or injury, and clean and repair if necessary.

SECTION III

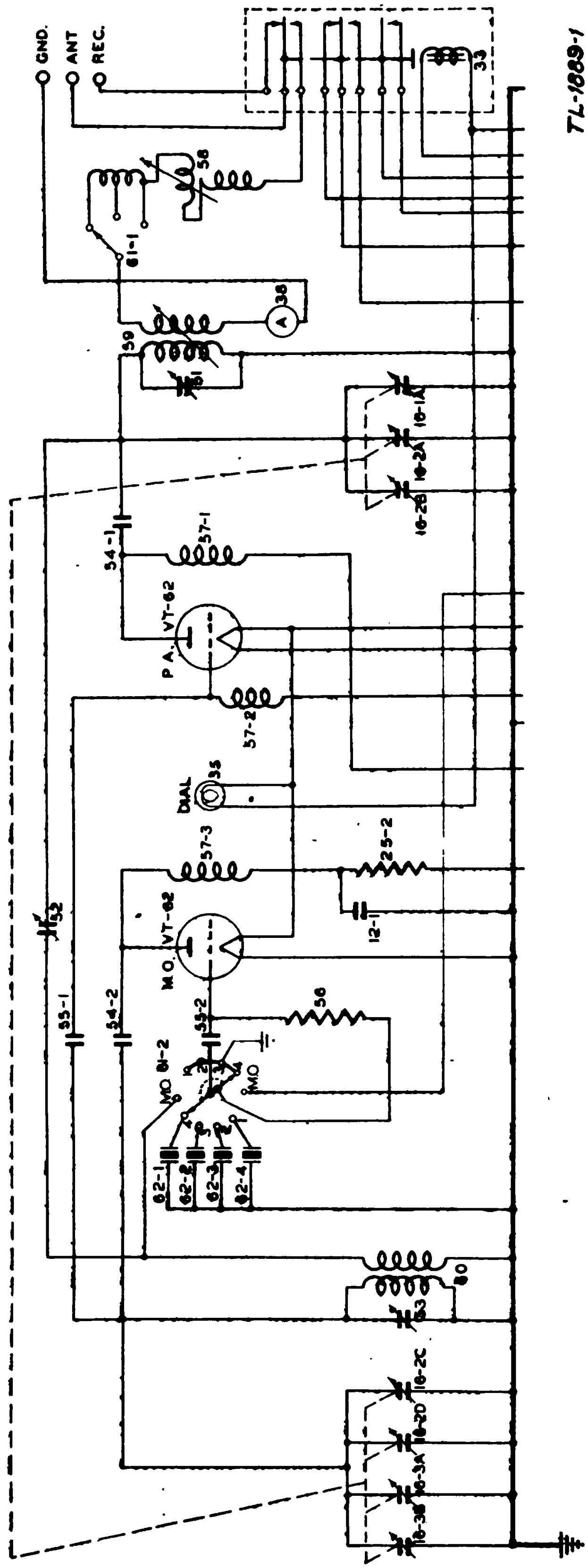
DETAILED FUNCTIONING OF PARTS

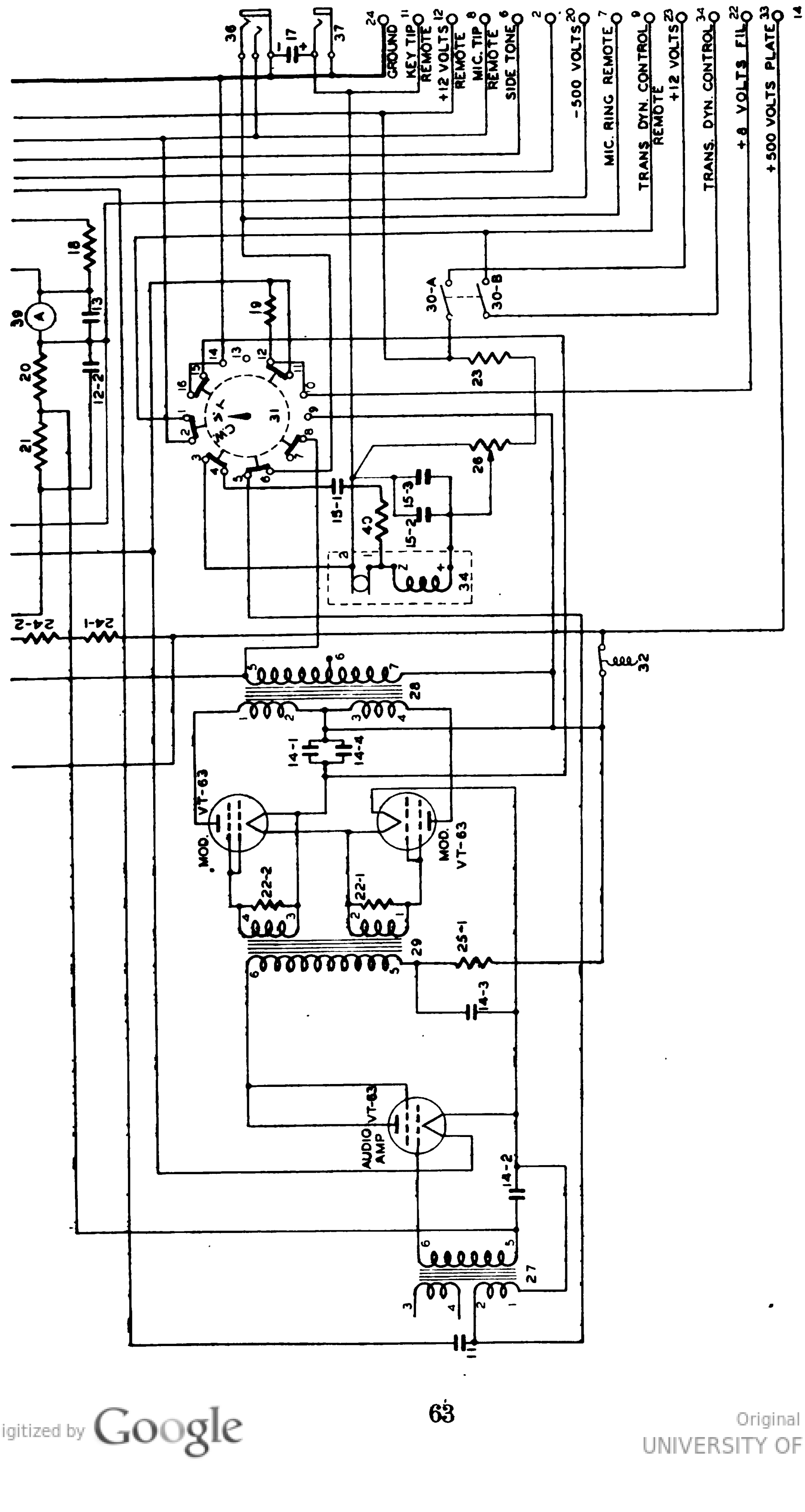
30. Radio transmitter BC-223 and transmitter tuning units TU-17, TU-18, and TU-25-A, or radio transmitter BC-223-A and transmitter tuning units TU-17-A or TU-17-B, TU-18-A or TU-18-B, and TU-25-A.—The transmitter together with any transmitter tuning unit contains the circuit elements for cw, tone, or voice transmission. During the explanation of the detailed functioning of the transmitter, it will be assumed that transmitter tuning unit

TU-17, TU-17-A, or TU-17-B is plugged in and is an integral part of the transmitter. All coils work in the same manner.

a. General circuit.—The radio frequency circuit of the transmitter is of the master oscillator, power amplifier type with optional crystal control on four chanels. The audio frequency circuit consists of a push-pull modulator which in turn is driven by an audio amplifier. The transmitter uses a tube VT-62 for the oscillator, a tube VT-62 for the power amplifier, two tubes VT-63 for the modulator, and a tube VT-63 for the audio amplifier driver (see fig. 44). For cw transmission only the master oscillator and power amplifier tubes operate. For tone and voice transmission, all five tubes operate. The power amplifier operates class C, the modulator tubes in push-pull operate class B, and the audio amplifier driver tube operates class A. Sufficient audio frequency power is obtained from the modulator tubes to plate modulate the power amplifier with 100 percent modulation of the transmitter carrier (tone or voice transmission). The use of ganged capacitors in the master oscillator and power amplifier circuits, so that both are constantly tuned to resonance at all frequency positions, prevents damage to equipment from misalinement of the two circuits. Side tone for monitoring purposes is supplied to the receiver during cw, tone, and voice transmission. For voice transmission, a "push to talk" control circuit is employed, permitting control of the transmitter from the microphone position.

b. Oscillator (fig. 44).—The master oscillator (MO) uses a triode tube VT-62 in a modified Hartley circuit which is shunt-fed with only the plate coil tuned. Variable capacitors 16-2C, 16-2D, 16-3A, and 16-3B, which are four sections of a seven-section ganged capacitor in parallel with the plate tuning coil 60, fix the frequency band and determine the frequency of oscillation for any particular setting. These capacitors are geared to the control knob marked FREQUENCY CONTROL. Transmitter tuning units TU-17, TU-17-A, and TU-17-B use sections 16-3A, 16-3B, 16-2C, and 16-2D, while transmitter tuning units TU-18, TU-18-A, TU-18-B, and TU-25-A use only sections 16-3A and 16-3B. The following discussion assumes transmitter tuning unit TU-17, TU-17-A, or TU-17-B to be in use in the transmitter. The explanation is analgous for use of transmitter tuning unit TU-18, TU-18-A, TU-18-B, or TU-25-A. Grid excitation on master oscillator operation (switch 61-2 turned to MO) is obtained by feedback coupling from the plate winding into the grid winding of coil 60. Grid excitation on crystal control (switch 61-2 turned to crystal points 1, 2, 3, or 4) is obtained directly from


GND.
ANT
REC.
TL-1889-1
P.A. VT-62
M.O. VT-62
DIAL



TL-1889-2

FIGURE 44.—Radio transmitter BC-223 with transmitter tuning unit TU-17 in place, schematic diagram.

the piezo-electric effect of any one of four crystals 62–1, 62–2, 62–3, or 62–4. On crystal control, the crystal determines the frequency of oscillation. Crystal oscillation is started and maintained by tuning the plate circuit to the approximate frequency of the crystal. Variable capacitor 53 is provided with a screw driver control marked OSC TRIMMER, accessible through the front panel of the tuning unit. Fixed resistor 56 is the grid resistor and grid bias is maintained by the voltage developed across this resistor when rectified grid current flows through it. When switch 61–2 is turned to MO, grid resistor 56 is connected to −500 volts (terminal 20) and as explained in *f* below, whenever the key is up a negative grid bias is introduced. This cuts off the master oscillator tube so that it operates only when the key is pressed. When switch 61–2 is turned to points 1, 2, 3, or 4, grid resistor 56 is connected directly to ground. When so connected, the crystal oscillator tube operates continuously with the key up, although its plate voltage is reduced and oscillation is weak. This insures fast, clean keying on crystal control and eliminates crystal starting-time lag. Fixed capacitor 55–2 serves to prevent the direct grid current from flowing to ground by any other path than the grid resistor 56. Plate voltage is applied to the tube through resistor 25–2 and choke 57–3. Fixed resistor 25–2 is used to drop the 500-volt supply to the proper oscillator plate voltage (approximately 340 volts). Radio frequency choke 57–3 maintains the plate at high radio frequency potential. This choke 57–3, together with bypass capacitor 12–1, prevents radio frequency current from entering the high-voltage supply. Fixed capacitor 54–2, a necessary adjunct of the shunt-feed arrangement, prevents direct plate potential from reaching ground through plate coil 60. The oscillator output voltage developed across plate coil 60 is fed to the grid of the power amplifier tube through capacitor 55–1, which also prevents loss of power amplifier grid bias by blocking the rectified grid current of the power amplifier tube from flowing to ground through oscillator plate coil 60.

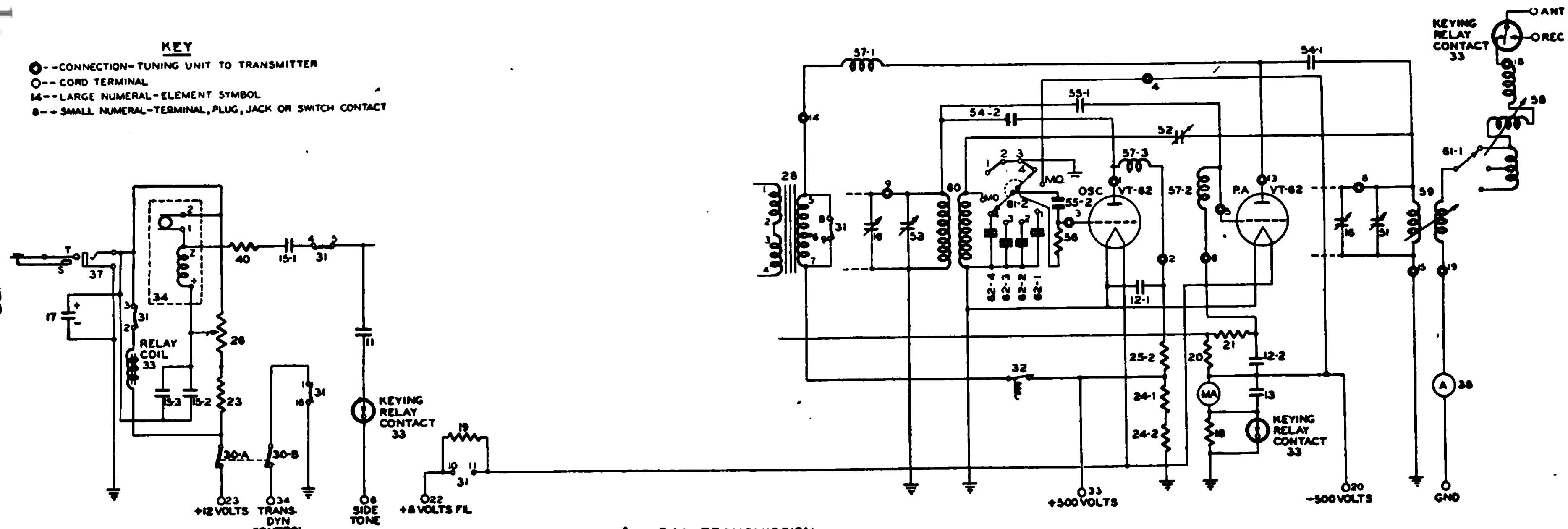
c. Power amplifier.—This is a conventional class C shunt-fed triode circuit. The plate tank circuit is tuned to resonance by variable capacitors ganged with the master oscillator variable capacitors, so that the power amplifier resonant frequency always tracks with the master oscillator frequency. Variable capacitors 16–1A, 16–2A, and 16–2B, are three sections of the seven-section ganged capacitor by which this operation is effected for both transmitter tuning units. Grid excitation is obtained from the oscillator by the radio frequency voltage developed across oscillator plate coil 60. When the key is pressed normal negative grid bias is maintained by the rectified grid current flowing through resistors 21 and 20 to ground. Radio frequency choke 57-2 serves to prevent any loss of radio frequency power through this biasing circuit and with capacitor 12-2 forms a filter to exclude radio frequency potential from the grid of the audio amplifier tube. Fixed capacitor 54-1 is a necessary element of the shunt-feed circuit and prevents the power amplifier plate voltage from being short-circuited to ground through the plate tank circuit while passing radio frequency current from the power amplifier plate to the plate tank circuit. Variable capacitor 51 is a trimmer capacitor which is used for the plate tank coil 59 for accurate tracking of the master oscillator power amplifier circuits. It is provided with a screw driver control marked PA TRIMMER, accessible through the front panel of the tuning unit (see par. 33). Plate voltage is supplied to the tube through radio frequency choke 57-1, which serves to maintain the plate at a high radio frequency potential and to prevent radio frequency current from entering modulation transformer 28. Variable capacitor 52 is the neutralizing capacitor used to balance the grid-to-plate capacitance of the power amplifier tube. It is provided with a screw driver control marked PA NEUT COND, accessible through the front panel of the tuning unit (see par. 33). The radio frequency power output of the power amplifier is transferred to the antenna variometer 58 and antenna circuit through the secondary of coil 59, the primary of which is the power amplifier tank inductor. This coupling is variable, the control being marked ANT COUPLING. Antenna variometer 58, controlled by the ANT IND knob, smoothly varies the inductance in the antenna circuit. Switch 61-1 changes the inductance in three steps in transmitter tuning unit TU-17, TU-17-A, and TU-17-B, and in two steps in transmitter tuning unit TU-18, TU-18-A, TU-18-B, and TU-25-A. The output of the transmitter appears between the binding posts marked ANT and GND. The antenna ammeter 38 is in the ground side of the antenna circuit.

d. Audio amplifier.—This amplifier uses tube VT-63 with screen and plate tied together to form a triode which is biased to operate as a class A amplifier. Transformer coupling is used for both input and output. Signal voltage is applied to the grid from the secondary of input transformer 27. (The winding 3-4 of this transformer is not used.) Grid bias is obtained from the voltage drop existing across resistor 20 by rectified grid current flowing from the power amplifier grid. Plate voltage of approximately 320 volts is supplied to the tube through the primary of transformer 29 in series with resistor 25-1. Capacitor 14-3 acts to bypass audio frequency currents back to the filament, while capacitor 14–2 serves to complete the audio frequency circuit of winding 5–6 of input transformer 27 and also to isolate the grid from the filament for biasing purposes. The audio output of the amplifier appears across the primary winding 5–6 of transformer 29, the secondary of which constitutes the push-pull drive to the grids of the modulator tubes.

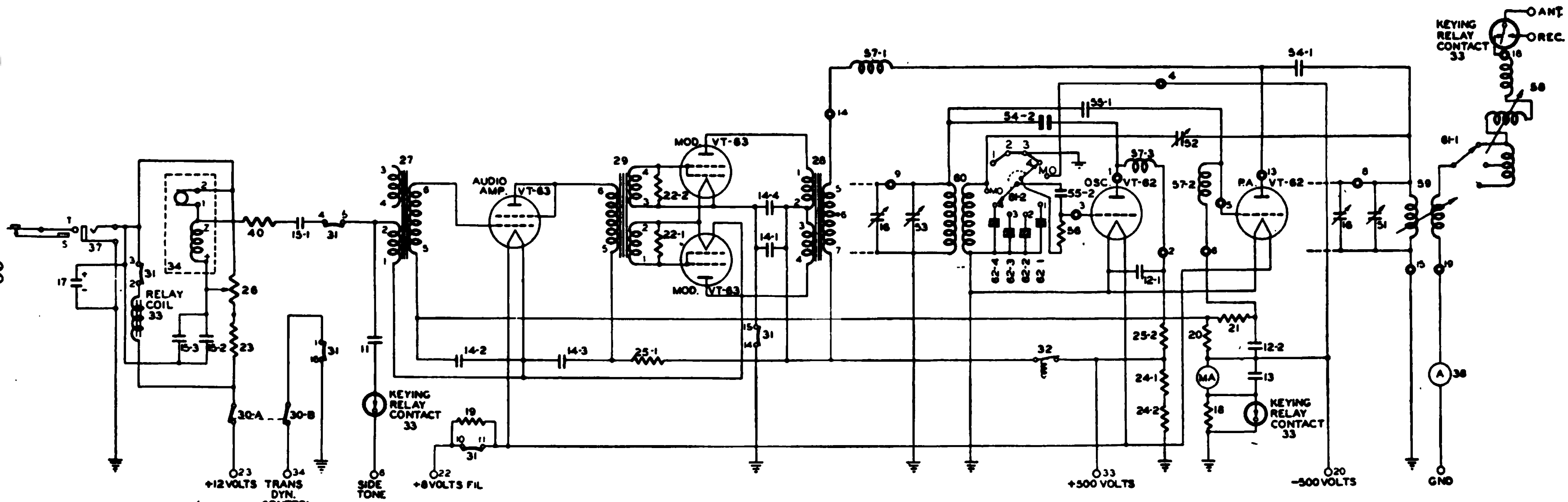
e. Modulator.—The modulator circuit utilizes two tubes VT–63 with screens and grids tied together to form triodes and operated as a push-pull class B amplifier. The grid of each tube is fed from opposite ends of the balanced secondary windings of input transformer 29. The plate of each tube is fed from opposite ends of a balanced primary winding of modulation transformer 28 which in turn is supplied at the center tap of the winding. Fixed capacitors 14–1 and 14–4, connected in parallel, bypass the audio frequency current back to the filaments. Grid returns are connected directly to the negative side of the filaments so that the only grid bias obtained is that through the filament of the tube. Across each grid winding 1–2 and 3–4 of transformer 29, resistors 22–1 and 22–2 are used to maintain a constant input impedance. The audio frequency voltage developed by the modulator tubes appears across the secondary of modulation transformer 28 and varies the plate voltage of the power amplifier at an audio rate, thus effecting modulation.

f. Keying.—Keying of the transmitter on master oscillator operation is accomplished by "cut-off" biasing of both the oscillator and power amplifier tubes. Keying on crystal operation is accomplished by cut-off biasing of the power amplifier tube only. In master oscillator operation, when switch 61–2 is turned to MO and the key is up, a negative voltage exists between both grids and filaments sufficient to prevent the flow of plate current. The grounded sides of the filaments of both tubes are connected to a tap of a voltage divider across the ends of which the full available high voltage (500 volts) is impressed. This voltage divider consists of resistors 24–1 and 24–2 (each 100,000 ohms) in series with resistor 18 (25,000 ohms), the ground tap being between the 20,000-ohm and the 25,000-ohm sections. The grid of the master oscillator tube is connected through grid resistor 56 and switch 61–2 to the negative end of this voltage divider (25,000-ohm end), as is the grid of the power amplifier tube through grid resistors 20 and 21. The grounded sides of the filaments of both tubes are at a potential higher by the voltage drop in resistor 18 (keying bias) than the potential of the grids, and no plate current flows. Keying relay 33 has a pair of contacts connected across resistor 18 so that when the key is pressed (that is, the relay energized), these contacts short-circuit the resistor. The keying bias is thus removed from the grids of the tubes and plate current flows in each tube with normal biases developed from the flow of rectified grid currents through their respective grid resistors. For crystal operation, the action is the same as described above for master oscillator operation with the following exceptions: since grid resistor 56 is connected directly to ground through switch 61-2 when on a crystal point, the oscillator operates continuously regardless of the position of the key. Grid excitation is supplied to the power amplifier tube and the resulting rectification of grid current flowing through grid resistors 20 and 21 provides grid bias. To this bias already present is added the keying bias existing across resistor 18, the sum of these biases being sufficient to prevent the flow of plate current in the power amplifier tube. When the key is pressed, normal rectified grid current bias is secured, plate current flows, and the tube operates as an amplifier. When tone operation is employed, the audio amplifier driver tube is simultaneously keyed. Grid bias for this driver tube is obtained from the voltage drop across power amplifier grid resistor 20. When the key is up, blocking bias is applied to the grids of the power amplifier and audio amplifier driver tubes. Electrolytic capacitor 17 is connected between the key tip and ground to reduce key thumps in nearby receivers.

g. Cw operation (figs. 45 and 46).—For cw operation the TONE VOICE CW switch (31) is turned to the CW position. Contacts 2-3, 4-5, 6-7, 8-9, 12-13, and 16-1 of switch 31 are made. Contacts 6-7 and 12-13 are not used. Proper filament voltage is supplied to the master oscillator and power amplifier tubes through resistor 19. Plate voltage is supplied to the master oscillator plate from +500 volts (terminal 33) through resistor 25-2. Plate voltage is supplied to the power amplifier plate from +500 volts (terminal 33) through the OSCIL CURRENT-TOTAL CURRENT switch (32) and across contacts 8-9 which also act to short-circuit the secondary of modulation transformer 28. The key tip is connected through contacts 2-3 to one side of the coil of relay 33, the other side being connected directly to +12 volts. When the key contact is made, the ground return circuit of the relay coil is completed, energizing the coil, thus pulling in the relay armature. This closes relay contacts, short-circuits resistor 18, and keys the transmitter (*f* above). When the key contact is made the ground return circuit of interrupter 34 is also completed, causing it to operate. On cw operation, the output of interrupter 34 is used only to provide side tone to the receiver. Connections are provided, however, so that its audio frequency output is impressed



A - C W TRANSMISSION



B - TONE TRANSMISSION

FIGURE 45.—Radio transmitter BC–223 or radio transmitter BC–223–A, cw tone, voice transmission, functional diagram.

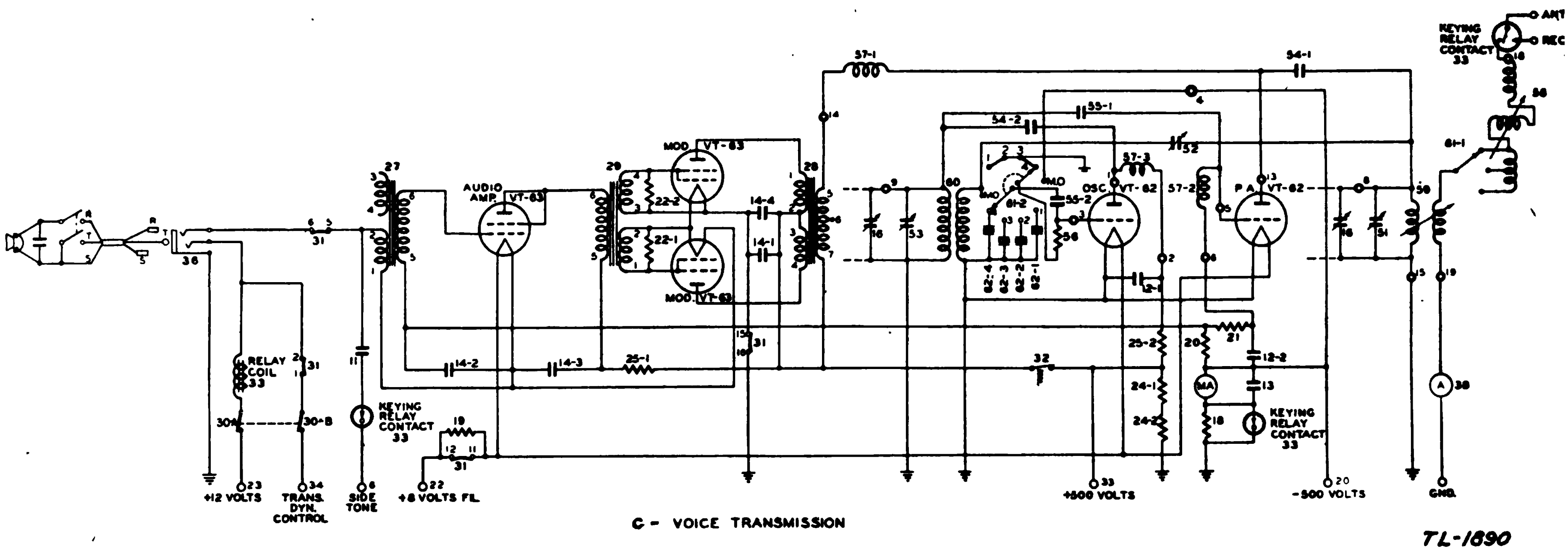
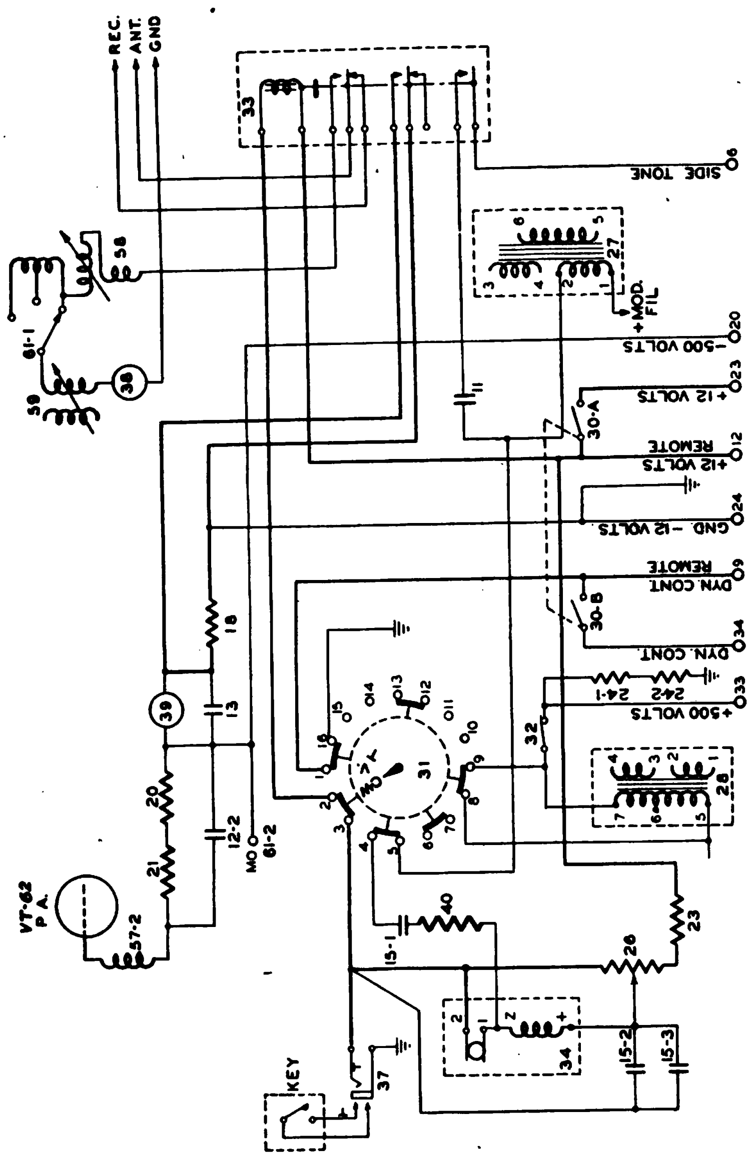


FIGURE 45.- -Radio transmitter BC–223 or radio transmitter BC-223–A, cw tone, voice transmission, functional diagram—Continued.

across primary winding 1-2 of input transformer 27, when switch 31 is set to CW as well as to TONE. The operation and the circuits of interrupter 34 are described in *h* below. Side tone to the receiver is obtained by tapping the audio frequency voltage available across primary winding 1-2 of input transformer 27 at terminal 2,

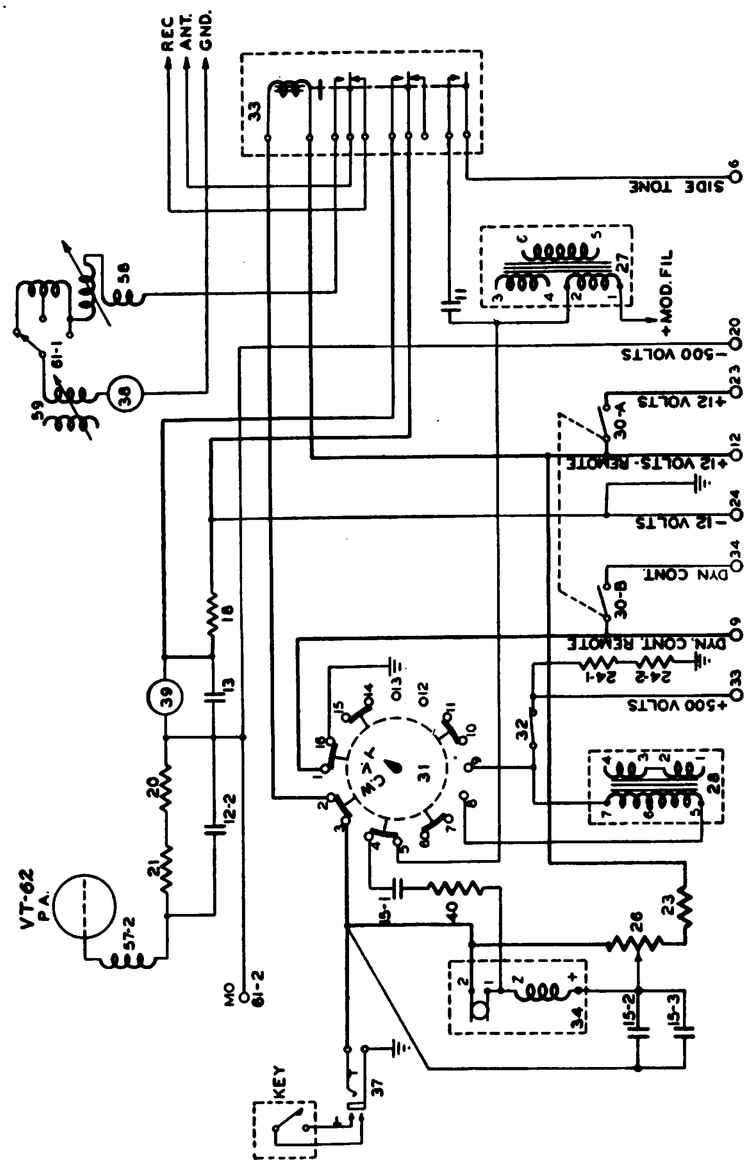


A-C W CONTROL CIRCUIT

FIGURE 46.—Radio transmitter BC-223 or radio transmitter BC-223-A, control circuits, cw, tone, voice, functional diagram.

thence through capacitor 11 and across the side tone contacts of relay 33 (which are closed in the energized position) to side tone terminal 6, at which point external connection to the receiver is made. Fixed capacitor 11 is a blocking capacitor used to eliminate direct current in the external side tone circuit. Contacts 16-1 of switch

31 provide the ground return circuit for the dynamotor starting relay which allows the dynamotor to remain running while the OFF ON switch contacts 30–B are closed. Dynamotor unit PE–55 runs continuously while the TRANSMITTER OFF ON switch is in the ON position and the TONE VOICE CW switch is on CW.



B - TONE CONTROL CIRCUIT

h. Tone operation (figs. 45 and 46).—For tone operation, the TONE VOICE CW switch 31 is turned to the TONE position. Contacts 2–3, 4–5, 6–7, 10–11, 14–15, and 16–1 are made. Contacts 6–7 are not used. Proper filament voltage is supplied to all transmitter tubes through contacts 10–11 and 14–15. Plate voltage is supplied (as for cw operation) to the master oscillator plate through resistor 25-2 from +500 volts (terminal 33). Plate voltage is supplied to the power amplifier plate through the OSCIL CURRENT-TOTAL CURRENT switch (32) and in series with secondary winding 5-7 of modulation transformer 28. Plate voltage is also supplied to the

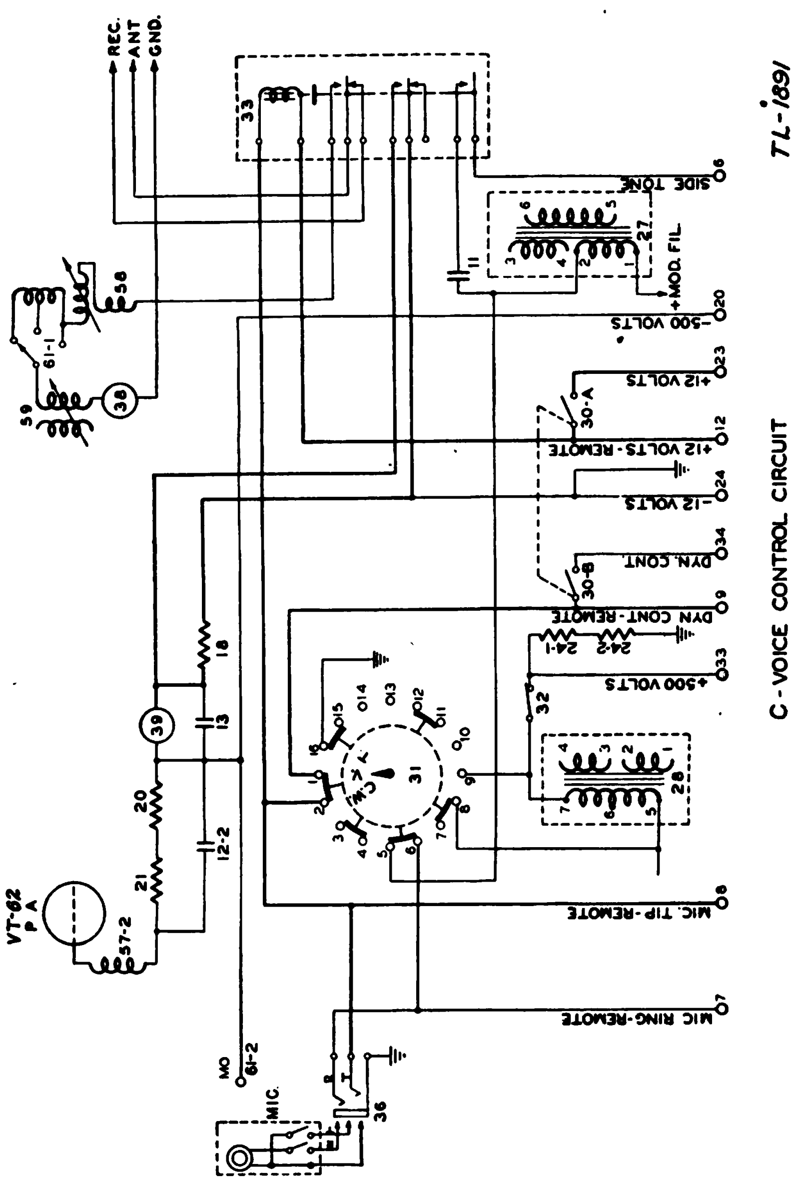


FIGURE 46.—Radio transmitter BC-223 or radio transmitter BC-223-A, control circuits, cw, tone, voice, functional diagram—Continued.

audio amplifier and modulator tubes from +500 volts (terminal 33) through the OSCIL CURRENT-TOTAL CURRENT switch (32). The key tip is connected through contacts 2-3 of switch 31 to the relay coil in the same manner as described under cw operation and the key performs its function of operating relay 33 in the same manner. Interrupter 34 operates to furnish audio frequency voltage for modulation when the key contact is made. Direct current across the actuating winding and the carbon button is obtained from potentiometer 26, which, together with resistor 23, forms a low-voltage bleeder circuit. The negative end of this bleeder is connected to the key tip so that current is drawn only (and the interrupter operates only) when the ground return circuit is completed by pressing the key. The direct voltage available for interrupter 34 is variable from zero to approximately 5 volts. Potentiometer 26 is provided with a screwdriver control marked TONE MOD CONTROL, accessible from the front panel of the transmitter. It is adjusted for 100 percent tone modulation of rated carrier output (see par. 36). The audio frequency voltage (approximately 1,000 cycles) developed across the carbon button 1–2 is impressed through resistor 40 in series with capacitor 15–1 and across contacts 4–5 of switch 31 to the primary winding 1–2 of input transformer 27. The return to ground is made through the battery by the lead extending from terminal 1 of input transformer 27 to the filament of the audio amplifier tube. Fixed capacitors 15–2 and 15–3 in parallel across interrupter 34 reduce the inductive transients produced by operation of the keying relay. They also reduce transient voltages across the interrupter. Fixed capacitor 15–1 is used to keep direct current out of the input circuit of interrupter 34. The interrupter voltage impressed across the primary of input transformer 27 is stepped up through the transformer and amplified by the audio amplifier driver tube, and then it excites the modulator tubes. These in turn vary the plate voltage of the power amplifier tube with a 1,000-cycle frequency and thus effect tone modulation.

i. Voice operation (figs. 45, 46, and 47).—For voice operation the TONE VOICE CW switch (31) is turned to VOICE. Contacts 1–2, 3–4, 5–6, 7–8, 11–12, and 15–16 are made. Contacts 7–8 are not used. Filament voltage is applied to the tube filaments when the dynamotor operates, through contacts 11–12 and 15–16 (see *j* below and *C*, fig. 46). Plate voltage is supplied to all tubes in the same manner as described for tone operation (see *h* above). The tip of microphone jack 36 is connected at all times to one side of the coil of relay 33 and to the dynamotor starting relay control lead (terminal 9) through contacts 1–2 of switch 31. Pressing the microphone button starts the dynamotor unit and closes relay 33 simultaneously. The latter relay when closed connects the antenna to the transmitter, keys the transmitter by short-circuiting resistor 18, and connects side tone to the external circuit. The ring of microphone jack 36 is connected across contacts

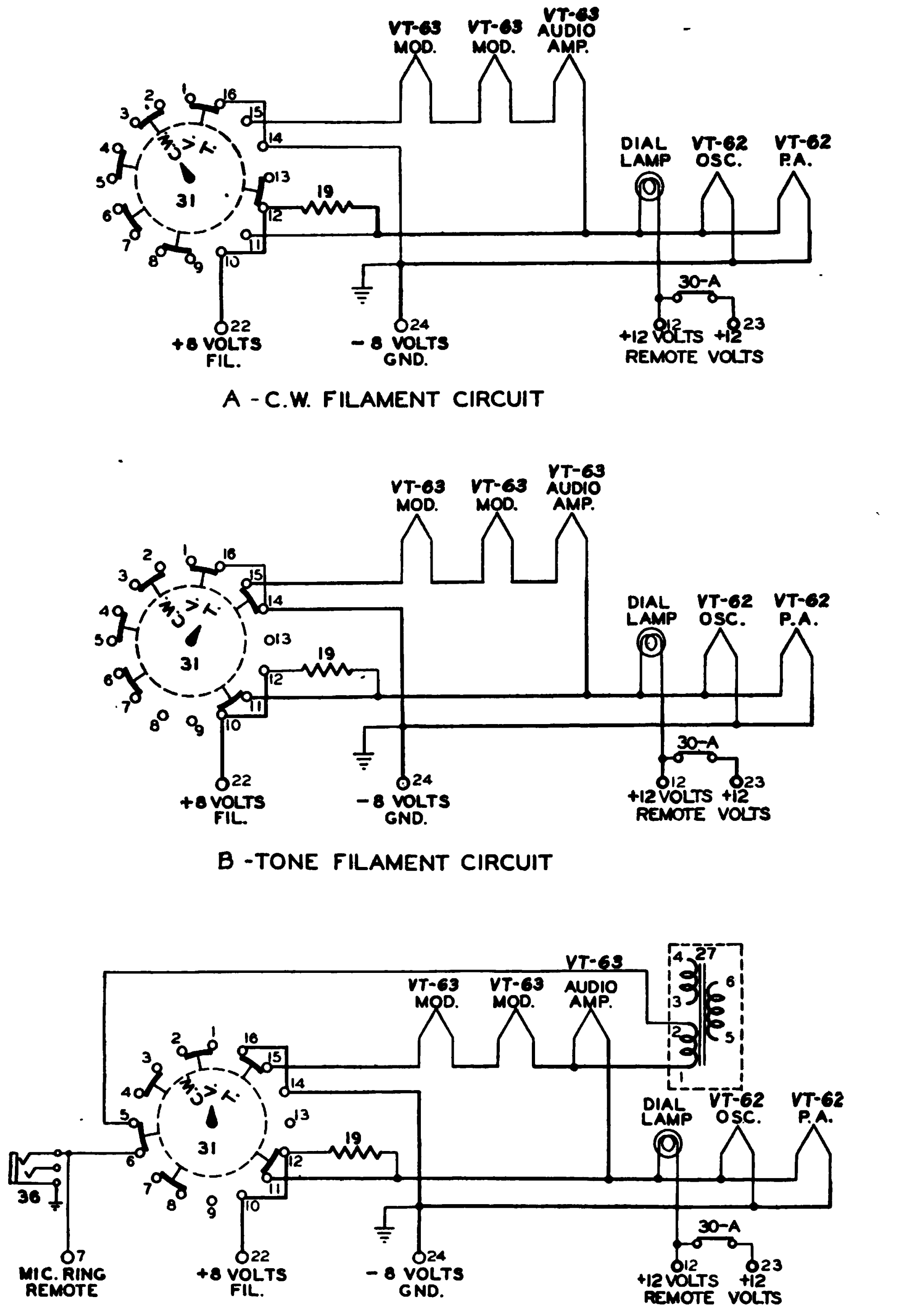


Figure 47.—Radio transmitter BC-223 or radio transmitter BC-223-A, filament circuit, cw, tone, voice.

5–6 of switch 31 to the primary winding 1–2 of input transformer 27. Direct current at approximately 5.5 volts, for the microphone button, is obtained by tapping the audio amplifier filament supply, this voltage being introduced in series with primary winding 1–2 of input transformer 27. Voice voltages set up in the microphone are thus impressed across the primary of input transformer 27, stepped up through the transformer, amplified by the audio amplifier driver tube, and then excite the modulator tubes. The modulator tubes in turn vary the plate voltage of the power amplifier tube in accordance with the voice voltages and thus effect voice modulation.

j. Filament circuit (figs. 47 and 48).—The filament supply for the transmitter tubes is obtained from terminal 22 (+8 VOLTS FIL). The external circuit supplying this voltage is shown in figures 20, 22, and 24. An adjustable resistor 7 (2 ohms) in dynamotor unit PE–55 is in series with the lead connecting terminal 22 of the transmitter to the dynamotor and provides a drop in battery voltage of approximately 4 volts when filament current is flowing. The master oscillator and power amplifier filaments are connected in parallel while the audio amplifier and both modulator tube filaments are connected in series. Fixed resistor 19 (0.75 ohm) is inserted in the positive side of the filaments and connected to the TONE VOICE CW switch (31) in such manner (through contacts 10, 11, and 12) that it is short-circuited and thus taken out of the circuit when this switch is turned to the TONE or VOICE positions. The battery return connections of the filaments of the master oscillator and power amplifier tubes are made directly to ground terminal 24 so that filament voltage is applied to these tubes irrespective of the position of the TONE VOICE CW switch (31). The battery return connections of the filaments of the audio amplifier driver and modulator tubes are connected to point 15 of switch 31. When switch 31 is turned to the CW position, no connection is made to point 15, and thus these tube filaments do not light. When switch 31 is turned to the TONE or VOICE positions, contacts 14–15 or 15–16, respectively, are made, completing the battery return connection of these tubes and causing their filaments to light. Adjustment of the filament voltage is made at variable resistor 7 in dynamotor unit PE–55 as prescribed in paragraph 24. When switch 31 is placed in the CW position, the voltage at the master oscillator and power amplifier tube filaments will remain at 8 volts. This is accomplished by the insertion of resistor 19 in the filament circuit as described above. Resistor 19 introduces an additional voltage drop in the circuit to compensate for the reduction in voltage drop across resistor 7 in dynamotor unit PE–55 when the current through it is reduced by the opening of the circuit of the audio amplifier driver and modulator tube filaments. Thus the filament voltage is automatically held to 8 volts for all modes of operation.

k. Keying relay (fig. 46).—Relay 33 combines in one unit the functions of a keying relay and antenna switching relay. When the telegraph key or microphone switch is pressed, the relay coil is energized, making contacts which key the transmitter by short-circuiting resistor 18 (*f* above), and connect the antenna to the transmitter. When actuated, the relay also provides contacts for side tone connection to the receiver (to terminal 6). When the relay is unoperated (that is, key up or microphone switch open), the antenna is connected to the receiver.

l. Dial lamp LM-33 (fig. 44).—Lamp LM-33 (35) provides illumination for the dial of the main tuning capacitor and operates at different voltages, depending upon the position of the control switches. On cw and tone operation, a potential of 4 volts is applied to the lamp, producing adequate but reduced brilliancy. On voice operation, with the OFF ON switch in the ON position but with the microphone switch open, a potential of 12 volts is applied and a higher brilliancy is obtained. When the microphone switch is closed, the potential is reduced to 4 volts. The operating voltage of the lamp is obtained from the drop across resistor 7 of dynamotor unit PE-55.

m. Switches.—(1) Two sections, switch 30-A and switch 30-B (fig. 44), comprise one switch marked TRANSMITTER OFF ON. It is a double-pole single-throw switch. This switch controls the +12-volt supply for local power control and for microphone, relay, and interrupter operation. When the TONE VOICE CW switch is set to either the TONE or CW position, moving the TRANSMITTER OFF ON switch to the ON position immediately actuates relay 9 in the base of dynamotor unit PE-55. When the TONE VOICE CW switch is set to the VOICE position (with the TRANSMITTER OFF ON switch in the ON position), the microphone switch must be pressed before relay 9 is actuated. When actuated, relay 9 starts the dynamotor unit which supplies plate voltage to the transmitter, and it closes the filament circuit to the transmitter tubes.

(2) The OSCIL CURRENT-TOTAL CURRENT switch (32) controls the PLATE CURRENT meter. It is a two-position switch with spring return to the TOTAL CURRENT position. In the OSCIL CURRENT position, it disconnects the high-voltage plate supply to all transmitter tubes except the master oscillator tube, and when the telegraph key or microphone switch is pressed, the oscillator plate current only is indicated on the meter. When the switch is

released it returns to the TOTAL CURRENT position, and with the telegraph key or microphone switch pressed, the total plate current of all tūbes is indicated on the meter.

31. **Dynamotor unit PE-55.**—*a.* Dynamotor unit PE-55 (fig. 48) provides the high-voltage plate supply for radio transmitter BC-223 or BC-223-A. It consists of dynamotor DM-19-( ) mounted on a box base which houses the starting relay, fuses, filter elements, filaments, rheostat, and braking resistor. The unit is capable of supplying continuously 200 milliamperes of direct current at 525 volts or of intermittently supplying 400 milliamperes at 500 volts. The nominal input voltage is 12 volts. The full load rated speed of the dynamotor is 4,000 rpm; the no-load rated speed is 4,400 rpm.

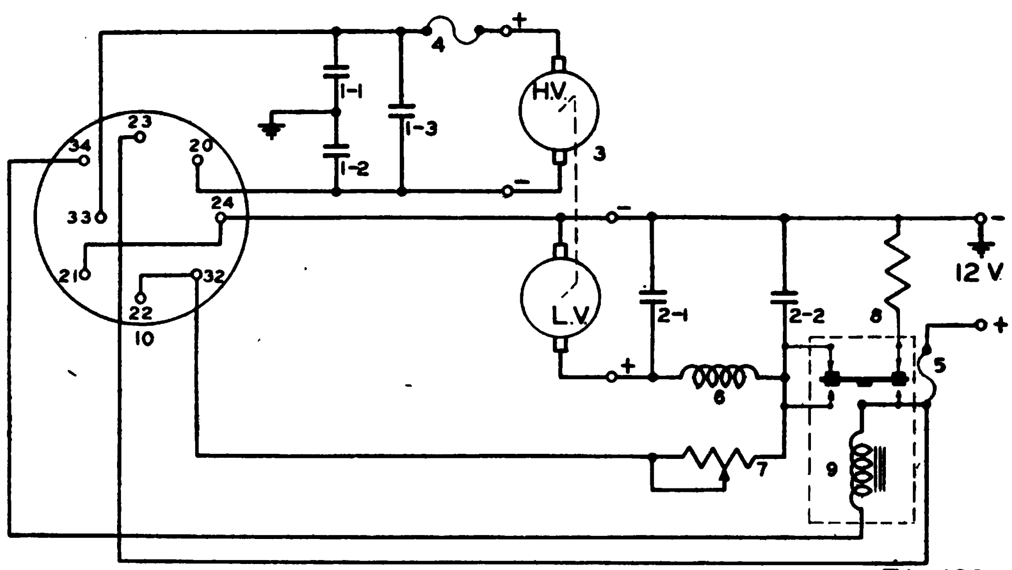


FIGURE 48.—Dynamotor unit PE-55, circuit diagram.

b. Dynamotor DM-19-( ) has a double armature winding consisting of a low-voltage (12-volt motor) winding and a high-voltage (500-volt generator) winding. Each winding terminates at a commutator on either end of the armature. The windings are carefully insulated from each other. The field is common to both motor and generator windings and is excited from the 12-volt storage battery supply.

c. Within the box base is mounted a molded phenolic panel parallel to the removable front panel. On this phenolic panel are mounted the starting relay, the filament voltage adjusting resistor, the low-voltage fuses (one active and one spare), the high-voltage fuses (one active and one spare), and the input binding posts. Behind the panel are mounted the capacitors and choke coil comprising the low-voltage filter, the capacitors comprising the high-voltage filter, and the braking resistor.

d. Battery voltage is supplied to the +12- and −12-volt binding posts. Fuse 5 (FU-30, 30 amperes, 250 volts) is the protective fuse in the low-voltage circuit. The low-voltage winding of dynamotor DM-19-A is so connected to starting relay 9 that power is applied to it when the relay is energized. Choke 6 and capacitors 2-1 and 2-2 are filter circuit elements in the input circuit. Capacitors 1-1, 1-2, and 1-3 are filter capacitors in the high-voltage circuit. These filter circuits are employed to reduce the high-voltage ripple to a minimum. The positive high-voltage output is connected through fuse 4 (FU-26, 1 ampere) to point 33 of socket 10. The negative high-voltage output is connected directly to point 20 of socket 10. Braking resistor 8 (0.75 ohm) is connected to back contacts of relay 9 so that when the relay opens, it is placed directly across the low-voltage winding of dynamotor DM-19-( ). When power is removed from the dynamotor by the opening of relay 9, induced currents in the armature flow through resistor 8 and this load prevents free coasting rotation. One side of the coil of relay 9 is connected directly to 12. The other side is brought to point 34 of socket 10. When this point is grounded through the external control circuits, the relay coil is energized, operating the relay 9. Filament voltage adjusting resistor 7 (2 ohms) is connected to relay 9 so that when the relay is operated, +12 volts are applied through it to points 22 and 32 of socket 10. Thus filament voltage is applied to the transmitter as soon as relay 9 closes. Dynamotor unit PE-55 is connected to radio transmitter BC-223 or BC-233-A by means of a cord attached at one end to the transmitter and plugged at the other end into socket 10 (SO-80) in the box base of the unit.

32. Radio receiver BC-312-( ).—Radio receiver BC-312 is of the multiple band, integral coil, superheterodyne type. It employs metal tubes throughout. Provision is made for the reception of cw, tone, or voice signals over the frequency range of 1,500 to 18,000 kilocycles in six steps as follows:

Band	*Frequency coverage excluding overlap (kilocycles)*
A	1,500 to 3,000
B	3,000 to 5,000
C	5,000 to 8,000
D	8,000 to 11,000
E	11,000 to 14,000
F	14,000 to 18,000

a. General circuit.—Figure 49 is a functional circuit diagram of radio receiver BC-312 showing the connections set up by the band change switch to receive a signal in one particular frequency band. In this functional diagram the band change switch itself and all coils and capacitors not essential to the operation on that band are omitted for the sake of simplicity. Radio receiver BC-312 employs two stages of pentode radio frequency amplification, a pentagrid mixer and separate triode radio frequency oscillator, two stages of pentode intermediate frequency amplification, a duplex diodetriode which performs the functions of a diode detector and one stage of audio frequency amplification, and a separate stage of pentode audio frequency amplification. A separate triode oscillator is provided to produce a beat note for cw reception. The antenna circuit of the receiver provides a means of transferring the desired signal to the first radio frequency stage and also provides a means of transferring local noise to the first stage on bands A and B phased in such a manner that the total noise is materially reduced below that normally picked up on the antenna. The two radio frequency stages provide selectivity and also act to reduce possible interference from signals occurring at either the intermediate frequency or at the so-called repeat point, or image frequency. The mixer tube circuit with its associated oscillator adds to the selectivity of the receiver and also changes the frequency of the signal from the frequency received to that at which the intermediate frequency amplifier is tuned. The intermediate frequency stages provide the major part of the receiver's selectivity and gain. The second detector stage demodulates the amplified signal to audibility. The audio frequency stages provide additional amplification. The cw oscillator, operating at a frequency slightly different from that to which the intermediate frequency stages are tuned, provides for an audible beat frequency, adjustable in pitch, when receiving cw signals.

b. Differences in models.—All radio receivers of the BC-312 series employ the same essential signal operating circuits. The BC-312 and the BC-312-A, which are identical, contain a heater system for the oscillator compartment and a noise-balancing system in the antenna stage. There is no receiver bearing the designation BC-312-B. The radio receiver BC-312-C does not have the heater system, but does have the noise-balancing system. In the radio receivers BC-312-D, BC-312-E, BC-312-F, and BC-312-G, both the heater and the noise systems have been eliminated. The rest of the circuits, the general mechanical arrangement and construction, and the front panel controls (with the exception of the absent heater and noise con-

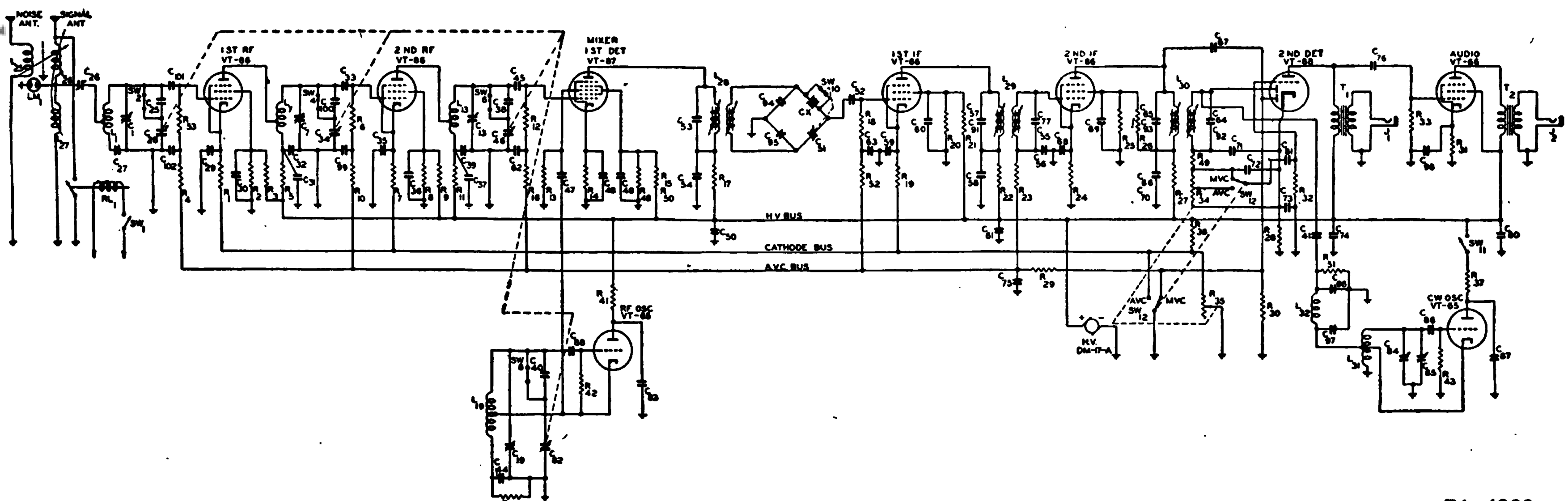


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FIGURE 49.—Functional diagram of radio receiver BC–312, manual volume control operation.

trols) are identical in all models. Information that applies only to the BC-312 or BC-312-C is clearly indicated as such in the following paragraphs; otherwise, the data given apply to all models.

c. Antenna circuit (figs. 49 and 50).—The antenna circuit is coupled to the tank coil L1 of the first radio frequency stage through capacitor C26. L25, L26, and L27 are inductors added to the circuit to permit canceling out locally generated noise normally received on the signal antenna. In addition, coil L27 serves as a radio frequency choke between the antenna and ground. The functioning of this noise suppression circuit is described in detail in *l* below. Capacitor C26. controlled by the knob on the front panel marked ALIGN INPUT, in conjunction with the changes in connections of L25, L26, and L27 produced by the band change switch, permits tuning the antenna circuit to resonance to an incoming signal. LM is a neon lamp which normally has a very high resistance. When a certain threshold voltage is exceeded, the lamp becomes a conductor by ionization and prevents further rise in voltage, bypassing the current to ground. It is used in this circuit to protect the receiver from any excessive voltages which might be applied to the antenna by nearby transmitters or by lightning discharges.

d. Radio frequency.—The circuits of the first radio frequency, second radio frequency, and mixer stages are very nearly identical. They are so designed to permit tuning with a single control four-section gang capacitor, indicated by the dotted lines connecting capacitors C28, C34, C46, and C82. The screen grid voltages for the first radio frequency, second radio frequency, and mixer tubes are provided by voltage dividers connected between plus plate voltage and ground. R2 and R3, R8 and R9, and R48, R15, and R50 form these voltage dividers. The screen grids are bypassed to ground across these voltage dividers by capacitors C30, C36, and C49, respectively. Cathode bias for the first radio frequency and second radio frequency tubes is partly fixed and partly variable. The fixed portion of this bias is secured by the voltage drop across R1 and R7, respectively, and from the junction of these resistors to the variable bias at the voltage divider formed by R36 and adustable resistor R35. These latter are connected between plus plate voltage and ground so that a change in the value of R35 will cause a change in this cathode bias. R35 is short-circuited to ground for automatic volume control (AVC) operation and in this mode of operation the cathode biases of these tubes are secured entirely by the voltage drop across R1 and R7. The cathode bias of the mixer tube is secured by the drop across R14. The injector grid bias is secured through resistor R13.

C29, C35, and C48 bypass radio frequency currents to ground around the cathode biasing resistors. C33 and C45 keep the plate voltages from the preceding tubes from reaching the grids of the second radio fre-

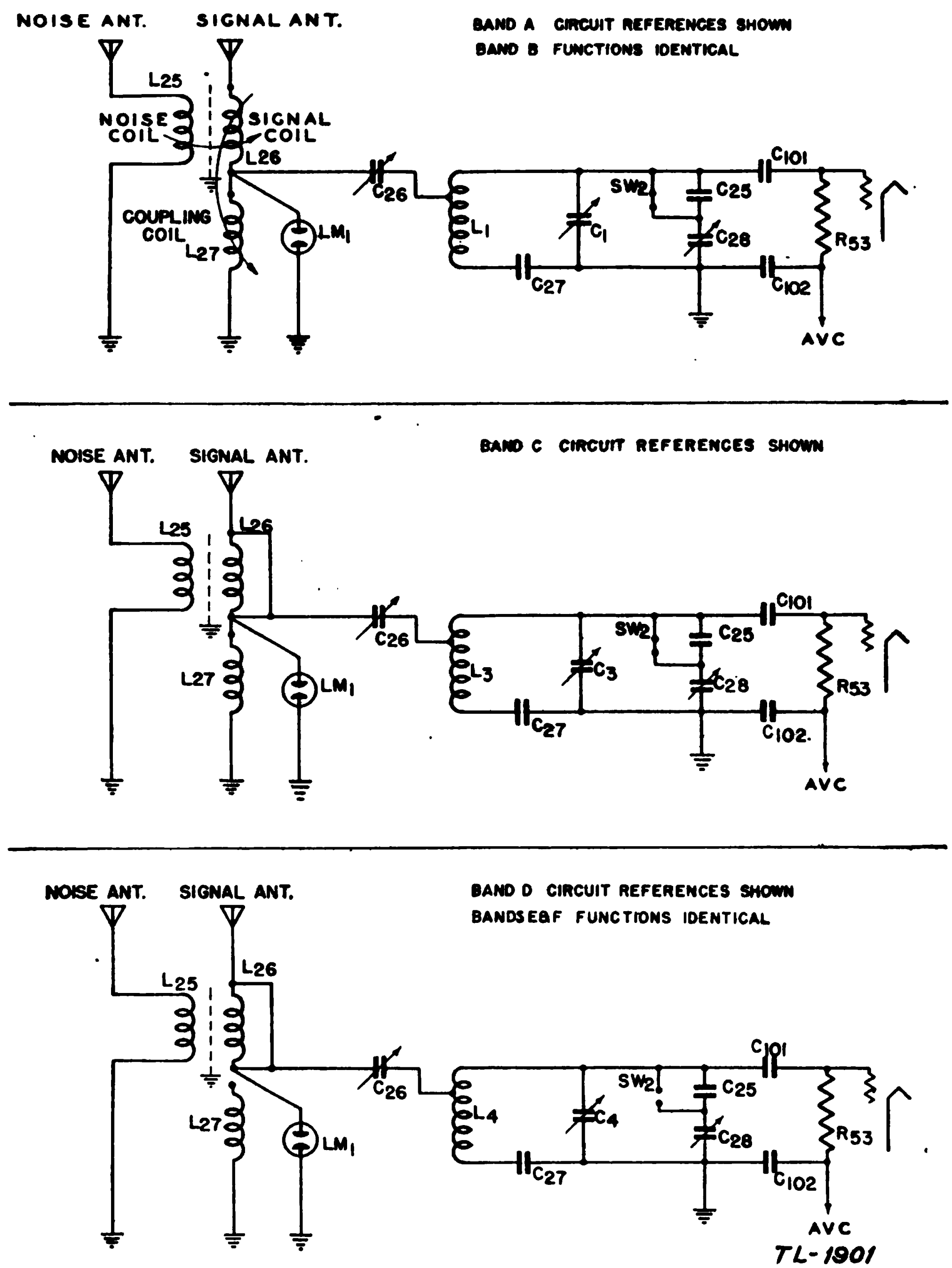


FIGURE 50.—Radio receiver BC-312, antenna circuits, functional diagram.

quency and mixer tubes, respectively. C101 in the first radio frequency stage is used to make the grid circuit of this stage identical with those of the two succeeding stages to permit the gang tuning referred to above. L1, L7, and L13 are the tank inductors of the grid circuits of the first radio frequency, second radio frequency, and mixer stages, respectively. The plate circuits of the first radio frequency and second radio-frequency tubes are conductively coupled to the tank inductors of the next succeeding stages. These tank inductors are tuned by a gang capacitor consisting of C28, C34, and C46. In series with the sections of this gang capacitor are three capacitors, C25, C100, and C38, across which is placed a gang control switch SW2, SW4, and SW6 (operating with the band change mechanism). This gang control switch permits these series capacitors to be used in the three higher frequency bands to obtain a greater frequency spread on the dial, and short-circuits these capacitors in the three lower frequency bands. Trimmer capacitors C1, C7, and C13 are provided to permit individual preadjustment (alinement) of the three circuits involved to resonance at a given input frequency with one setting of the gang tuning capacitor. C32 and C39 serve as radio frequency bypass capacitors and to prevent short-circuiting the plate supplies of the first and second radio frequency tubes to ground. C27 in the first radio frequency stage is placed in the circuit to make the latter identical to those of the second radio frequency and mixer stages for purposes of gang tuning. C102, C99, and C62 act as bypass capacitors for AVC operation. R4 and R53, R6 and R10, and R12 and R16 provide a high impedance d-c grid return for the tubes involved, and with capacitors C31, C37, C50, and C54, serve to reduce a applied. The grid return of these three stages is made through resistor R29 to ground for MVC operation and through R29 and R30 for AVC operation. The purpose of R30 is explained in detail in *k* below. R5, R11, and R17 are in series with the plate leads of the tubes involved, and with capacitors C31, C37, C50, and C54 serve to reduce to a negligible value the amount of radio frequency voltage reflected back into the power supply circuit from these tubes.

e. Radio frequency oscillator.—The radio frequency oscillator employs a modified Hartley circuit with the plate end of the tank circuit operating at ground potential for radio frequencies. The tank circuit of this oscillator consists of inductor L19, which is tuned by C82. C82 is ganged with the main tuning capacitors C28, C34, and C46. C40, in series with C82, is used in the three higher frequency bands to obtain greater frequency spread but is short-circuited by switch SW8 in the three lower frequency bands. Switch SW8 is ganged with switches SW2, SW4, and SW6. C19 is a trimmer capacitor which adjusts the tracking of the oscillator stage with the other tunable stages of the receiver. C44, while not essential to the functioning of the oscillator circuit, is included in the tank circuit to make it suitable for tracking in all bands with those of the radio frequency and mixer stages. C88 serve as a grid-blocking capacitor and R42 as a grid-bias resistor. R41 and R46 together serve to reduce the plate voltage supplied by the dynamotor to the proper value for this tube. The resistor in the R46 position is different for the different frequency bands of the receiver to insure that the plate voltage on the oscillator tube will be correct in each band. The radio frequency plate circuit of the oscillator is completed through C83 and ground to the tank circuit. The radio frequency voltage occurring between the cathode of the oscillator tube and ground is impressed on the injector grid of the mixer tube (first detector) through C47. The action of the mixer and oscillator on the received signal produces an output signal at 470 kilocycles having the same modulation as the signal received in the antenna. The intermediate frequency amplifier is tuned to 470 kilocycles.

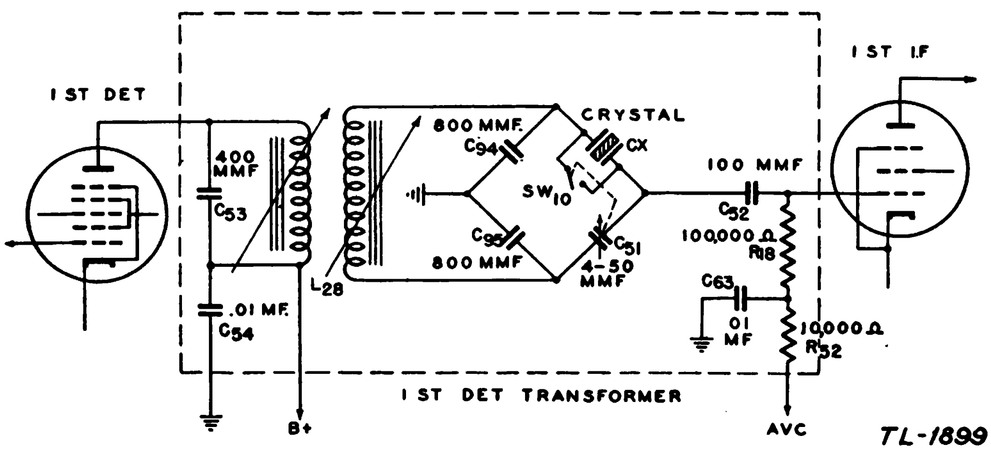


FIGURE 51.—Radio receiver BC-312, crystal filter operation, functional diagram.

f. Crystal filter (figs. 49 and 51).—The output of the first detector stage is inductively coupled to the grid circuit of the first intermediate frequency stage through transformer L28. C53, in parallel with the primary of this transformer, forms a resonant circuit which is tuned to 470 kilocycles by varying the position of an iron core within the transformer coil. The secondary of this transformer and both coils of transformers L29 and L30 are tuned in a similar manner. In the grid side of transformer L28, there is a bridge circuit consisting of capacitors C94, C95, and C51 and crystal CX. With the switch SW10 closed, the secondary of L28 and capacitors C94 and C95 form a resonant circuit tuned to the intermediate frequency so that one-half of the available voltage across the secondary of L28 is impressed on the grid of the first intermediate frequency tube through blocking capacitor C52. When switch SW10 is open (by turning the CRYSTAL PHASING control from the OUT position), the signal is impressed on the grid of the first intermediate frequency tube through crystal CX and through capacitor C52. Crystal CX is cut to the intermediate frequency of 470 kilocycles. It behaves as a sharply tuned resonant circuit and offers a high impedance to all frequencies except its resonant frequency. The capacitance of the crystal holder would normally serve as a bypass to this resonant circuit, reducing its impedance. For this reason, the bridge circuit consisting of capacitors C94, C95, and C51 and crystal CX is employed. The proper adjustment of capacitor C51 permits balancing out the effect of the capacitance of the crystal holder and raises the impedance of the circuit to frequencies other than the resonant frequency. Other adjustment of capacitor C51 permits bypass around the crystal and reduces circuit impedance to undesired signals. This control is referred to as the CRYSTAL PHASING control since the crystal, neglecting the effects of the holder, behaves as a resonant circuit with the current and voltage very nearly in phase.

g. Intermediate frequency amplifier.—Resistor R18 provides a high impedance d-c grid return for the first intermediary frequency tube and in series with R52 provides for the introduction of automatic volume control voltage. C63 is a radio frequency bypass to ground shunting radio frequency out of the automatic volume control circuit. The coupling between first and second intermediate frequency stages and between the second intermediate frequency stage and the second detector is inductive through transformers L29 and L30. Both sides of both of these transformers form circuits which are resonant to the intermediate frequency, the necessary capacitance being provided by C57 and C91, C77 and C55, C65 and C93, and C64 and C92. The necessary tuning to secure resonance is achieved through the use of movable iron cores in the same manner as in transformer L28. The cathode bias for the first intermediate frequency tube is obtained through resistor R19 and the same voltage divider system as for the first and second radio frequency tubes. The cathode bias for the second intermediate frequency tube is obtained through resistor R24. The grid return of the second intermediate frequency tube is through resistor R23, which provides means for introducing automatic volume control voltage, and with capacitor C56 prevents radio frequency current from feeding into the automatic volume control circuit. The screen grid voltages of these two tubes are obtained from the voltage dividers consisting of R20 and R21, and R25 and R26. These screen grids are bypassed to ground by capacitors C60 and C69, respectively. C59 and C68 serve to bypass the cathodes to ground.

h. Second detector (figs. 49 and 52).—A duplex diode-triode is employed as a second detector, one diode circuit actually serving for purposes of demodulation, the other diode circuit providing for automatic volume control action. The triode portion of the tube serves as the first audio frequency amplifier. These two latter functions will be described in detail in subparagraphs below. The cathode and the detector diode plate act as a half wave rectifier so that any current flowing through resistors R49 and R34 is pulsating. Any portion

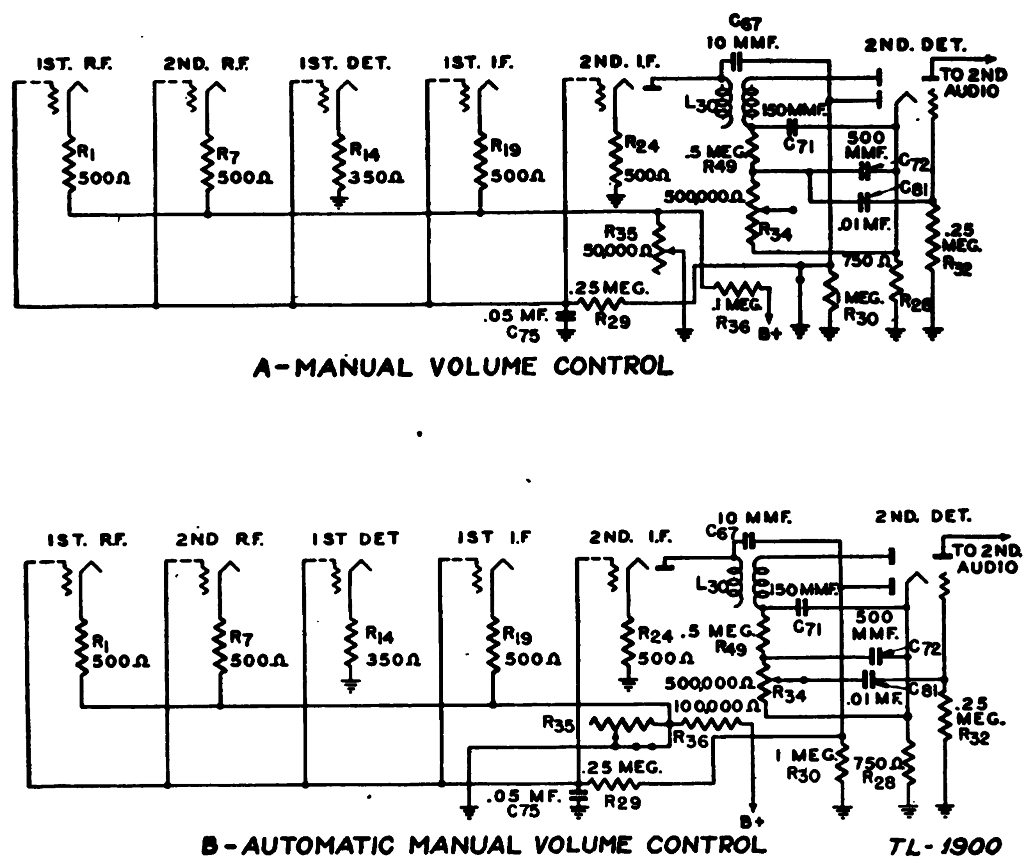


FIGURE 52.—Radio receiver BC-312, MVC and AVC circuits.

of the drop across these resistors may be amplified as audio frequency. C71 and C72 are placed in the circuit as radio frequency bypasses across these resistors. R28 provides the proper cathode bias for this tube and is bypassed to ground by C73.

i. Audio frequency amplifier (fig. 49).—The triode portion of the detector serves as the amplifying tube for the first stage of audio frequency. This tube receives its grid excitation through capacitor C81. This excitation consists of the drop across the entire resistor R34 for manual volume control operation and the drop across the lower portion of resistor R34 for automatic volume control operation.

R32 serves as a high impedance d-c grid return for the tube. The output circuit of the first audio frequency tube is coupled to the control grid of the second audio frequency tube through capacitor C76. The primary of transformer T1 acts as an impedance coupling element and also as the primary of the transformer for coupling to a secondary circuit containing jack J1 into which phones may be plugged. C74 in this circuit prevents audio frequency feedback into the power supply and completes the audio frequency plate circuit for this tube. R33 serves as a high impedance d-c grid return for the second audio frequency tube. The cathode bias of the second audio frequency tube is provided by R31, which is bypassed to ground by capacitor C98. The output of the second audio frequency tube is coupled through transformer T2 to jack J2, into which phones or a loudspeaker may be plugged. C80 in this plate circuit prevents audio frequency feedback into the power supply and completes the audio frequency plate circuit. In the simplified diagram (fig. 49) only one output jack is shown. However, in the actual receiver, two output jacks are employed. One is marked PHONES 2ND AUDIO and the other SPEAKER 2ND AUDIO, and they have openings of different sizes to take two different plugs. The tip and sleeve connections of the two jacks are in parallel, so the same signal appears across both. However, there is also a ring connection on the SPEAKER 2ND AUDIO jack which goes +12 volts. This connection is provided so that field excitation is available for older models of the loudspeaker LS-3. Newer models are of the permanent magnet type. A three-contact plug must be used with either model loudspeaker, but with the permanent magnet type only the tip and sleeve are connected. When the receiver BC-312 is used with a transmitter, side tone for monitoring purposes, generated in the transmitter, is introduced into the audio system at terminal 5 of audio transformer T1, figure 12.

j. Cw oscillator (fig. 49).—A modified Hartley circuit is employed, operating with the plate end of the tank circuit at ground potential for radio frequency. The tank circuit of this oscillator consists of coil L31 tuned by capacitors C84 and C85 in parallel. C86 is a grid-blocking capacitor and R43 is a grid-biasing resistor. The plate supply of this oscillator is obtained through switch SW11 (CW OSC ON OFF switch) which permits turning this oscillator on or off at will. R37 in series with the d-c plate circuit serves to drop the plate voltage from that supplied by the dynamotor to the correct value for this tube. The radio frequency plate circuit is completed through capacitor C87 and ground to the tank circuit.

A portion of the drop across tank coil L31 is impressed on the plate end of the second detector tank circuit through a low-pass filter consisting of C96, C97, R51, and L32 and through coupling capacitor C41. The purpose of this filter is to prevent the introduction of harmonics of the cw oscillator frequency into the detector circuit of the receiver.

k. Volume control.— (1) *Manual volume control action* (figs. 49 and 52).—When operating on manual volume control (MVC), the cathodes of the first and second radio frequency tubes and the first intermediate frequency tube are returned to the voltage divider consisting of R35 and R36. This voltage divider is located between plus plate voltage and ground, so that changing the value of the resistor R35 by operating the VOL control on the front panel changes this cathode bias and thus varies the gain of these tubes. R30 is short-circuited, preventing the automatic volume control action described in (2) below. In this mode of operation, that portion of the audio frequency signal which appears across all of resistor R34 is available at the input of the first audio frequency tube.

(2) *Automatic volume control action.*—For automatic volume control (AVC) operation, resistor R35 is short-circuited to ground. The audio frequency voltage available at the grid of the first audio frequency tube is now the voltage across that portion R34 between ground and the sliding contact of resistor R34. Changing the position of this contact by operation of the VOL control on the front panel changes the amount of audio frequency voltage impressed on the first audio frequency tube without interfering with automatic volume control operation. The second diode plate of the second detector tube is coupled to the plate tank circuit of the second intermediate frequency stage through capacitor C67 to generate the automatic volume control supply voltage. A rectifier circuit exists between this plate resistor R30 to ground, thence through resistor R28 to the cathode. The cathode is maintained at a positive potential with respect to the automatic volume control plate by direct plate current in the triode section of the tube flowing through R28. Rectification will take place in this automatic volume control circuit when the peak value of the alternating voltage impressed is greater than the d-c drop across resistor R28 and this rectified voltage will appear across resistor 30. The magnitude of the voltage across R30 is therefore dependent upon the strength of the signal received in excess of the drop across resistor R28. Thus no automatic volume control action is obtained on signals whose a-c peak value is less than the drop across the resistor R28. This type of action is referred to as "delayed" automatic volume control.

In automatic volume control operation, the control grids of the first radio frequency, second radio frequency, mixer, first intermediate frequency, and second intermediate frequency are returned to ground through resistor R30. A change in the voltage across resistor R30 therefore affects the bias and gain of these tubes. The circuit is designed to bias these tubes more negatively on a strong signal, thus reducing their gain and tending to maintain a constant input to the detector.

l. Noise suppression circuit (figs. 49 and 50).—A circuit is provided for the purpose of reducing interference on bands A and B caused by poorly shielded engine ignition systems. Three coils L25, L26, and L27 function when properly adjusted to reduce this type of interference. L25 is coupled to L26, an electrostatic shield being provided to insure that this coupling is entirely magnetic. This coupling is also adjustable. The coupling between L26 and L27 is primarily electrostatic, the necessary magnetic shield being provided to insure that this type of coupling is secured. The coupling between L26 and L27 is also adjustable. A knob on the front panel marked NOISE BALANCE controls the coupling between L26 and L25 and serves to adjust the amount of noise introduced into the receiver circuits from the noise antenna. The coupling between L27 and L26 is controlled by the NOISE ADJUST control and determines the phase relationship of the resultant noise voltage introduced into the receiver. The coupling between L25 and L26 is adjusted to produce minimum noise (not necessarily zero). L27 is then varied to reduce the noise to zero, thereby insuring that the phase of the noise fed by the separate antennas results in cancelation.

m. Tube heater circuits.—Metal tubes of the heater type are employed in radio receiver BC-312. These tubes require a heater voltage of approximately 6 volts per tube. To permit operation on a 12-volt power supply system, these tubes are connected in a series-parallel combination, with two tubes which require the same heater current connected in series, and then these pairs arranged in parallel. Tube heaters are bypassed by C78 and C79.

n. Oscillator compartment heater circuit (fig. 53).—In order to maintain the radio frequency oscillator of the BC-312 and BC-312-A at a constant frequency for a given setting of its tuning capacitor, the entire circuit is installed in a heat-insulated compartment. The use of electric heaters and thermostats maintains this compartment at a constant temperature of 110° F. R38, R39, and R40 are the heater elements for this chamber, the first two being connected in parallel and controlled by the temperature control THS1. R40 is cut out and into the circuit by temperature control THS2. In series with this combination is the switch SW13 (HEATERS OFF ON switch) which permits the heater circuits to be manually controlled. C89 and C90 are connected across the contacts of temperature controls THS1 and THS2, respectively, to reduce interference caused by the opening and closing of the contacts. The two temperature controls are adjusted to open at 109° and 111° F., respectively. These values have been selected so that the temperature of 110° F. is maintained with the minimum number of temperature control contact breaks.

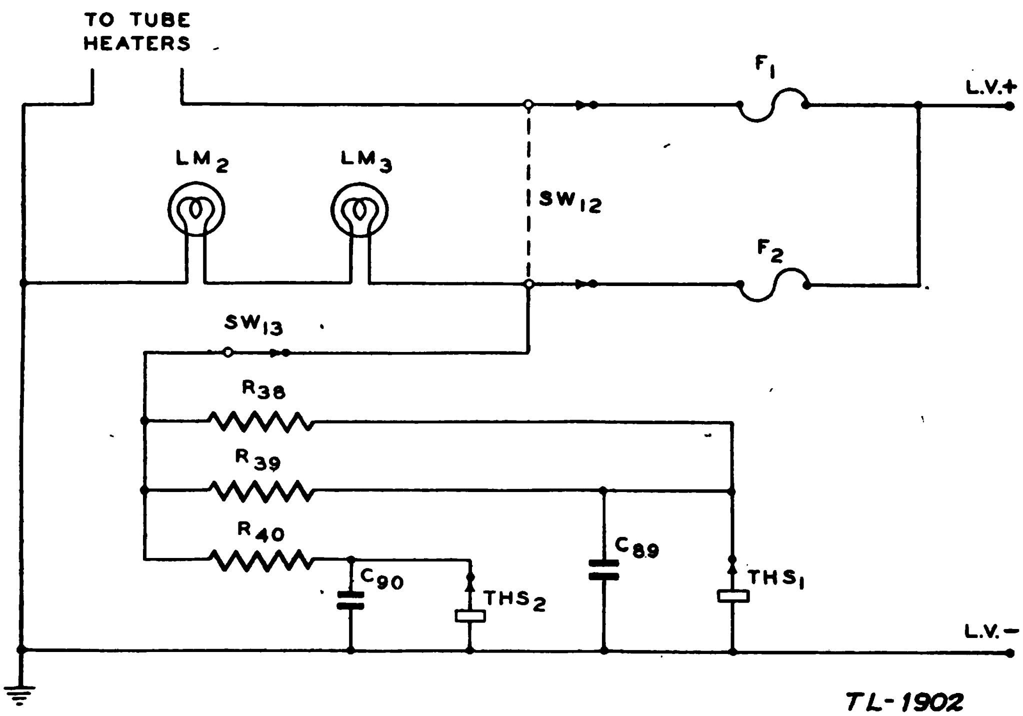


FIGURE 53.—Radio receiver BC-312, low-voltage circuits, functional diagram.

Of the total heater capacity (49 watts with 14 volts input), 33 watts are used between 109° and 111° and 40 watts at 109° and below. When the temperature rises above 109°, only 33 watts are applied to the compartment. At and above 111° no heat is supplied. On the reverse cycle, as the temperature falls below 111°, 33 watts are applied, slowing down the rate of temperature fall until 109° is reached, at which time 49 watts are applied. A fuse marked HEATERS, accessible on the front panel, protects the heater circuit.

o. Dial lamp circuit (fig. 53).—Two dial lamps LM-27 (circuit symbols LM2 and LM3) are connected in series across the heater circuit in such a manner as to receive current through the heater fuse and be turned off and on by the OFF MVC AVC switch.

p. Dynamotor DM-17-A (figs. 49 and 54).—Dynamotor DM-17-A, operating on an input voltage of from 12 to 14 volts, produces the necessary plate voltage for the receiver. This dynamotor is secured to the underside of the chassis of the receiver. Under full load conditions, the dynamotor requires 2.7 amperes at 14 volts direct current with an output of approximately 82 milliamperes at 230 volts direct

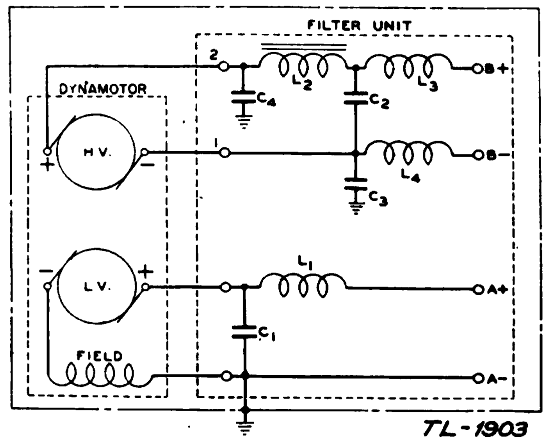


FIGURE 54.—Dynamotor DM-17-A, schematic diagram.

current. L1 and C1 constitute a filter circuit to prevent radiation of radio frequency interference into the low-voltage supply circuit. L2, L3, and L4, together with capacitors C2, C3, and C4, constitute a combination audio frequency and radio frequency filter circuit which reduces commutator ripple to a value which will not be objectionable and also prevents radio frequency interference from being transmitted by the dynamotor to the receiver circuits.

SECTION IV

SERVICING AND REPAIR

Paragraph

33. Servicing.—***Caution:*** Care must be observed in servicing this radio equipment. Using personnel will make only such repairs as are indicated in paragraph 46. Servicing should be attempted only by competent personnel supplied with adequate equipment. An inexperienced operator, in attempting to locate and repair a minor trouble which a competent man could service in a few moments, may damage the equipment to such an extent as to require shipment to a depot for repair.

34. Inspections.—*a. Daily inspection.*—The various components of radio sets of the SCR-210 and SCR-245 series will be given a thorough inspection before and after each day's operation to insure that the set is ready for use at any time. This inspection includes examination of all cordage for proper fastening and for damage. All accessible components are examined for dirt and are cleaned if necessary. At the end of a long period of storage, this inspection also includes a check to see that the dynamotor armatures revolve freely.

b. 50-hour inspection.—A thorough inspection of the complete installation will be made after every 50 hours of operation. This materially aids in securing uninterrupted performance in the field. The procedure for this inspection is as follows:

(1) Check to see that the storage battery is at the proper specific gravity and that the charging generator and regulator are adjusted so as to keep the battery fully charged.

(2) Clean accumulated dust and dirt from all units, using air hose or bellows where necessary.

(3) Make sure that all wiring is in place, that all mounting brackets and supports are rigidly fastened, and that all nuts and machine screws are supplied with lock washers and are tight.

(4) Determine that the cords are not damaged and that all ground connections are secure.

(5) Inspect plugs for proper fit and sockets for compressed pin springs. Pin springs which have taken a permanent set can usually be restored by a very light hammer blow at the end of the pin.

(6) Make certain that all cartridge fuses are held tightly in their clips. A loosely held fuse should be removed and the clips bent by hand until they grip the fuse tightly. Clean clips and fuse ends. Clean all contact surfaces.

(7) Inspect the high-voltage fuses by removal from mounting. Carefully clean all contact surfaces and replace the fuses.

(8) Inspect the antenna system for broken or frayed leads or loose mast sections. Wipe the insulator clean. To prevent loosening and

loss of mast sections, joints should be covered with rubber tape. Make sure that antenna leads have not been bent close to metalwork, where high antenna voltages might cause spark-overs.

(9) Inspect key and microphone for defective cords and damaged plugs.

(10) To inspect the receiving dynamotor it is necessary to remove the receiver chassis from its cabinet. *Carefully* place the receiver upside down on a servicing bench with the dynamotor corner of the chassis next to the service man. Remove the two knurled thumbscrews and the two buttonhead screws from the dynamotor housing cover. Make a record of the color coding of the connecting wires. Remove the wires attached to the filter unit which go to the terminal strip located on the panel by loosening the screws holding the wire lugs.

(*a*) The brushes in dynamotor DM-17-A (used in the BC-312) can be removed without the use of tools. Their removal is accomplished by stretching the helical springs and slowly but carefully disengaging the curved sections of the two brush holders from the posts in which they are engaged. *Be careful not to break the soldered pigtail connections.* If it is desired to withdraw the brushes completely from the dynamotor, it will be necessary to unsolder the pigtail connections on the brush holders.

(*b*) To inspect the brushes in dynamotor DM-21-B used in radio receiver BC-312-C after completing the general operations as above, the entire dynamotor must be removed. First, the wires going from the filter to the dynamotor are removed, and a careful written record made of the color code. Next, remove the two long fillister head screws leading through the stand-off studs to the dynamotor housing. One fillister head screw is located near the first intermediate frequency tube socket and the other near the second intermediate frequency socket. Two removable stand-off studs can now be worked out of position. Remove the two long screws from the hinge-like brackets and the dynamotor housing can be worked free of the brackets. Then the four bottom head screws from each end of the dynamotor housing that fasten the U-brackets are removed, and the dynamotor worked free from the rubber mounting grommets. To remove the brush, remove the cotter pin, unscrew the castellated plug, and work the spring fitting of the brush out of the brush holder. Be careful not to break the soldered pigtail connections.

(*c*) *Always place all screws, washers, lock washers, and small parts removed in the disassembly of apparatus in a suitable container so that these small items will not become lost before assembly takes place.*

(*d*) The dynamotor may now be inspected for—

1. Free rotation.

2. No end play.

3. Mechanical adjustments.

4. Brush wear.

5. Brush bearing (70 percent or better in contact with commutator).

6. Freedom of brushes to move in holder.

7. Grooved commutator.

8. Broken leads.

9. Indication of softening of soldering of commutator.

10. Freedom of all circuits from ground.

11. Possible electrical interconnection between high- and low-voltage armatures; there should be definite resistance between high- and low-voltage commutator bars.

See paragraph 46*c* for instructions as to repairs of dynamotors.

(11) Upon completion of an inspection, all plugs and sockets should be completely reengaged and screwed down tightly. All tubes should be inserted all the way into their corresponding sockets and grid-cap connections, if any, firmly made. The chassis should be effectively locked in the receiver case by means of the locking catches on the front panels.

c. *Receiver vacuum tubes*.—The vacuum tubes used in radio receivers of the BC–312 series normally have an effective life of from 2 to 3 years. However, to insure best performance of the receiver, they should be checked frequently with an accurate tube checker. All tubes should be checked annually and particularly just prior to extended field maneuvers. Those which do not come up to standard should be replaced, the receiver carefully checked for performance, and circuits realined, if necessary.

35. Lubrication.—Lubrication should be accomplished in accordance with the chart below. *Do not use excessive amounts of oil or grease and do not allow electrical connections to become greasy.* Excess lubricant in dynamotors will tend to work out of bearing housings and onto commutators, where it will cause trouble. It also may cause the bearing to overheat. Make sure that lubricants and oilholes are clean and free from sand, grit, or dirt. These abrasives are the chief causes of bearing wear and the necessity for bearing replacement.

LUBRICATION CHART

Apparatus	Points of lubrication	Lubricant to be employed	Quantity of lubricant	Service periods	Special instructions
Dynamotor DM-17-A.	Oil cups	SAE 10 mineral oil	One drop each bearing.	500 hours	These bearings are of the sealed, ball-bearing type, packed with grease at the time of manufacture. Any oil above the stated amount will do more harm than good.
	Ball bearings	Grease F-925 as made by New York and New Jersey Lubricant Company.	As required by special instructions.	Whenever armature is removed and replaced.	For removal of armature, the dynamotor case must first be separated from the chassis. Turn receiver chassis upside down and remove four screws holding cover in place. After lifting cover, disconnect all leads to receiver. Next, completely remove dynamotor DM-17-A. (Six screws in front panel and two in subpanel hold mounting brackets.) It is then necessary to separate physically the dynamotor proper from its case. This is accomplished by removal of the soldered ground lead, the leads marked 1 and 2, and the unmarked lead, and lifting unit from cradle. This operation involves forcing the two U-brackets holding the four rubber mounting grommets. The end brackets are next removed and the armature withdrawn from position. The quantity of grease should be sufficient thoroughly to cover the ball-bearing assembly surfaces. Excess grease should be removed.
Dynamotor DM-21-B.	Ball bearings	Grease having an ASTM penetration of 200-220, preworked, such as No. S-58 manufactured by the New York and New Jersey Lubricant Company.	As required by special instructions.	Whenever armature is removed and replaced.	See paragraph 34b(10) for removal of dynamotor from receiver chassis. The end brackets are next removed and the armature withdrawn from position. The quantity of grease should be sufficient thoroughly to cover the ball-bearing assembly surfaces. Excess grease should be removed.

Dynamotor unit PE-55.	End bearing oilers	SAE 40 mineral oil	2 or 3 drops	300 hours	Remove the bearing end cover cap and insert sufficient grease to coat the ball-bearing containers.
	Ball bearings	High temperature ball-bearing grease 295 grade, Air Corps Special No. 36-50. Also No. 1572 New York and New Jersey Lubricant Company, or Calol grease made by New Departure Manufacturing Company.	As required by special instructions.	1,000 hours or at 6-month intervals.	At least every 2 years, remove the armature from the dynamotor, thoroughly clean the bearings and bearing housings with carbon tetrachloride, and repack each ball bearing with approved ball-bearing grease. The quantity of grease should be sufficient thoroughly to cover the ball-bearing assembly surfaces. Excess grease should be removed.
Radio receiver BC-312 or BC-312-C.	Gears and bearings of band change mechanism and capacitor drive.	Petrolatum	Sufficient to permit quiet, smooth drive of mechanism involved.	When required	The various gears and bearings of the radio set chassis are lubricated at the time of manufacture with a sufficient amount of lubricant to last the life of the equipment and, unless operated in an abnormal manner, should never require lubrication. In the event that such lubrication becomes necessary, petrolatum should be used very sparingly.
Radio transmitte BC-223; transmitter tuning unit TU-17, TU-18, and TU-25-A.	Switch shafts	SAE 20 mineral oil	Very thin film	Whenever apparatus is removed from service and thoroughly cleaned.	
Radio transmitter BC-223-A; transmitter tuning units TU-17-A, TU-18-A, and TU-25-A; control box BC-321.	Switch contacts; switching relay.	White vaseline	Very thin film	Whenever apparatus is to be removed from service and thoroughly cleaned.	

36. Special adjustments to radio transmitter BC–223 or BC–223–A.—*a. Auxiliary equipment.*—The following auxiliary apparatus should be used to adjust properly radio transmitter BC–223 or BC–223–A.

(1) One frequency meter set of SCR–211 series.

(2) One radio frequency milliammeter (100 or 200 milliamperes full scale).

(3) One A–58 dummy antenna.

(4) Weston output meter model 571.

b. Neutralization.—Radio transmitter BC–223 or BC–223–A is adjusted for neutralization by the manufacturer and normally will never require adjustment in the field. When necessary, neutralization may be checked and adjusted as follows:

(1) Set the FREQUENCY CONTROL to 3,000 kilocycles for transmitter tuning unit TU–17 or TU–17–A, to 4,500 kilocycles for transmitter tuning unit TU–18 or TU–18–A, and to 5,250 kilocycles for transmitter tuning unit TU–25–A.

(2) Place TONE VOICE CW switch in CW position.

(3) Turn CRYSTAL SELECTOR to MO.

(4) Turn the OFF ON switch to ON, press the key, and tune the antenna circuit for maximum radio frequency output as described in paragraph 24*b*, using the regular vehicular antenna or the dummy antenna.

(5) Turn the OFF ON switch to OFF and insert the radio frequency milliammeter in series with the antenna.

(6) ***Caution:*** Prior to turning the transmitter ON, the plate current switch *must* be moved up to the OSCIL CURRENT position and held there during the entire time that the 100-milliampere (or 200-milliampere) radio frequency ammeter is in the antenna circuit, the transmitter is ON, and the key closed. If the plate current switch is released and allowed to resume its position of TOTAL PLATE CURRENT while the key is closed, the external radio frequency ammeter will be burned out. It is advisable to tie the OSCIL CURRENT-PLATE CURRENT switch in the OSCIL CURRENT position to prevent accidental burn-out of this meter.

(7) With the key up, again turn the OFF ON switch to ON.

(8) Hold the OSCIL CURRENT-PLATE CURRENT switch in the OSCIL CURRENT position and press the key. If the external radio frequency ammeter indicates less than 20 milliamperes antenna current, the power amplifier is neutralized satisfactorily. If it reads more than 20 milliamperes, the panel screw cap PA NEUT COND

should be removed and, with an insulated shank screw driver, this control adjusted to give a minimum current in the external radio frequency ammeter. Retune the antenna variometer through reso-

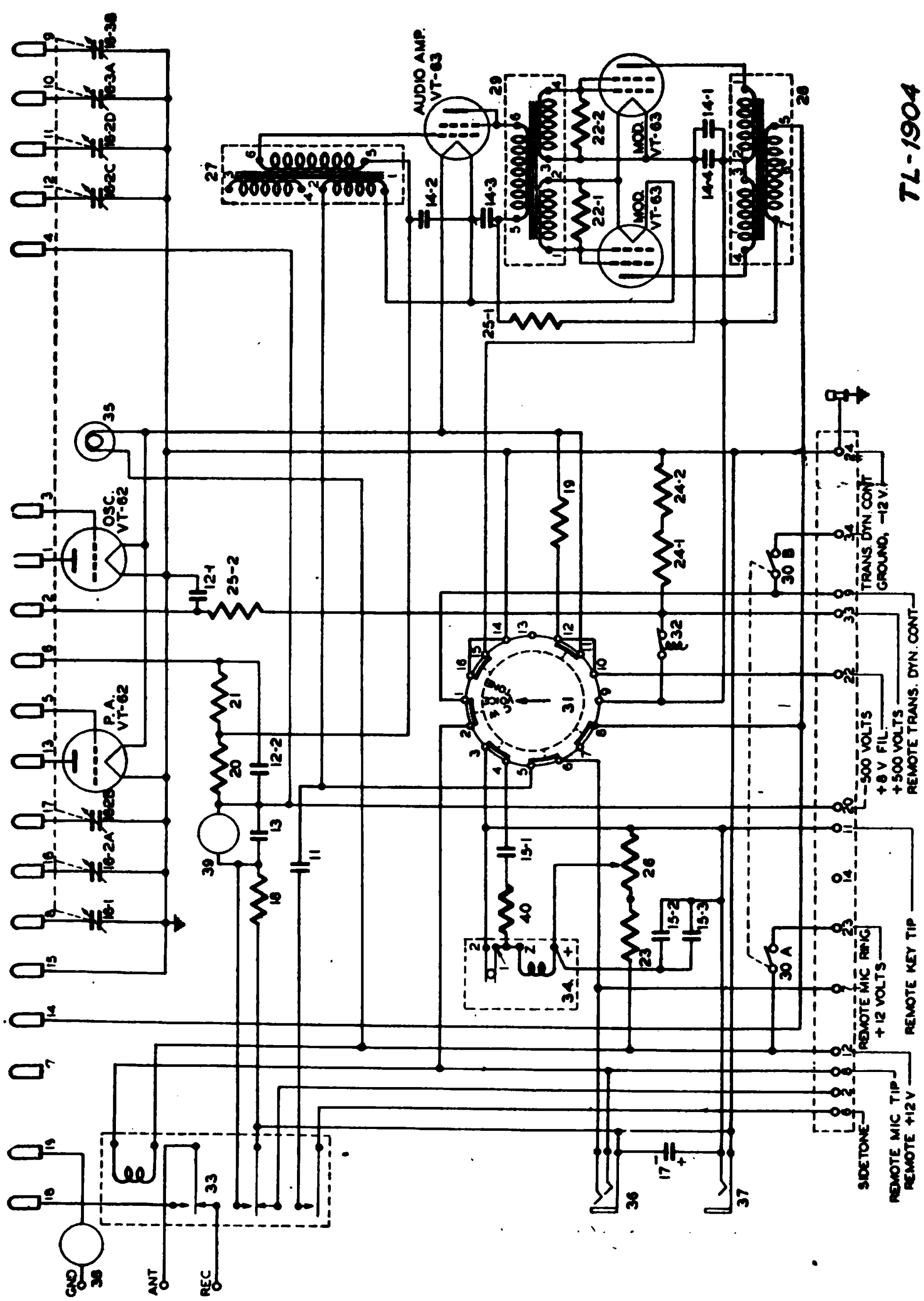


FIGURE 55.—Radio transmitter BC-223, circuit diagram.

nance to make sure that this meter is indicating correctly. After making neutralization adjustments, the calibration and tracking should be checked.

(9) If a 100- to 200-milliampere radio frequency ammeter is not available, the transmitter antenna ammeter may be used, provided a fixed capacitor of 100 micromicrofarads is placed across the ANT and GND binding posts and the antenna circuit adjusted to give 3 amperes current; the procedure is then the same as outlined above except that PA NEUT COND is varied to give minimum current in the transmitter antenna ammeter.

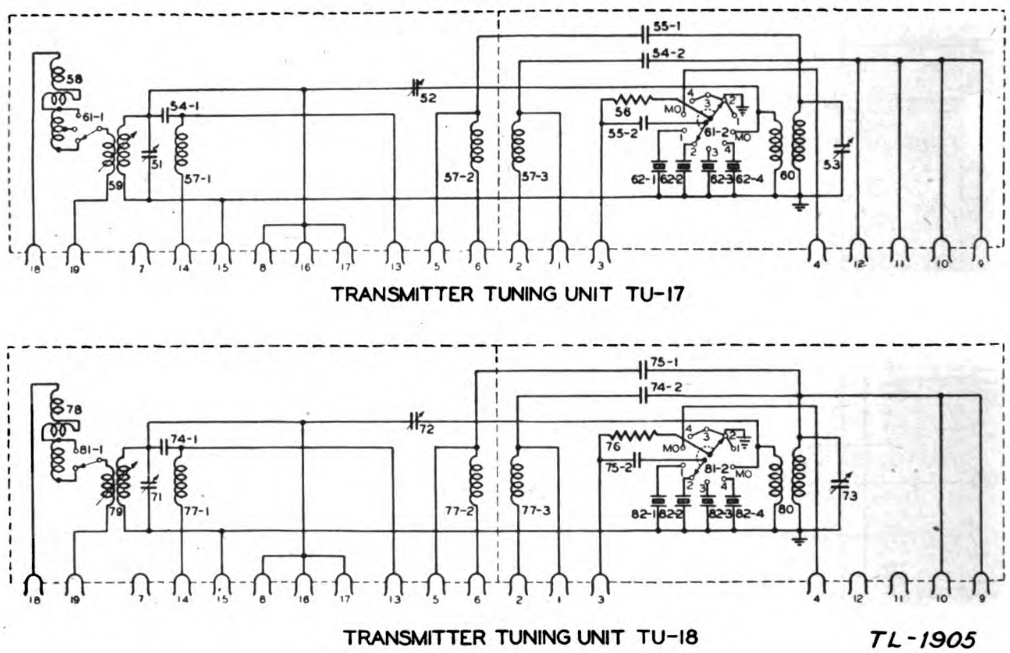


FIGURE 56.—Transmitter tuning units TU-17 and TU-18, circuit diagrams.

c. Calibration reset.—The calibration of the transmitter should be checked periodically, employing a frequency meter set of the SCR-211 series for the purpose. If the check indicates that the transmitter varies more than 3 kilocycles from the operating frequency indicated on the FREQUENCY CONTROL dial, the oscillator frequency should be adjusted as follows:

(1) Warm up the transmitter for 15 minutes, with the antenna tuned for rated output, prior to adjusting.

(2) Check neutralization and readjust if necessary (see par. 36*b*). Use a dummy antenna preferably.

(3) Set the transmitter to the lowest calibrated frequency of the tuning unit being adjusted, using the dial setting shown on the calibration chart and place the TONE VOICE CW switch in CW position. This step should preferably be accomplished with the transmitter installed in the vehicle using the normal antenna.

(4) Measure the actual frequency, using a frequency meter SCR-211-( ).

(5) Repeat steps in (3) and (4) above for at least five other frequency settings up to and including the maximum calibrated frequency of the tuning unit.

(6) Observe whether all measured frequencies are higher or lower than the corresponding calibration chart frequencies. If all measured frequencies are higher, the OSC TRIMMER capacitance should be increased; if the measured frequencies are lower, the OSC TRIMMER capacitance should be decreased. The red-painted side of the end of the capacitor shaft shows the position of the rotor plates. When this is at the right side, the capacitor is set for minimum capacitance. When it is at the left side, the capacitor is set for maximum capacitance. This should be done as follows:

(*a*) Set the transmitter FREQUENCY CONTROL to the dial setting shown on the chart for maximum calibrated frequency, and adjust the transmitter for normal output (see par. 26*b*(1)).

(*b*) Adjust the frequency meter SCR-211-( ) to the frequency of the dial setting in (*a*) above.

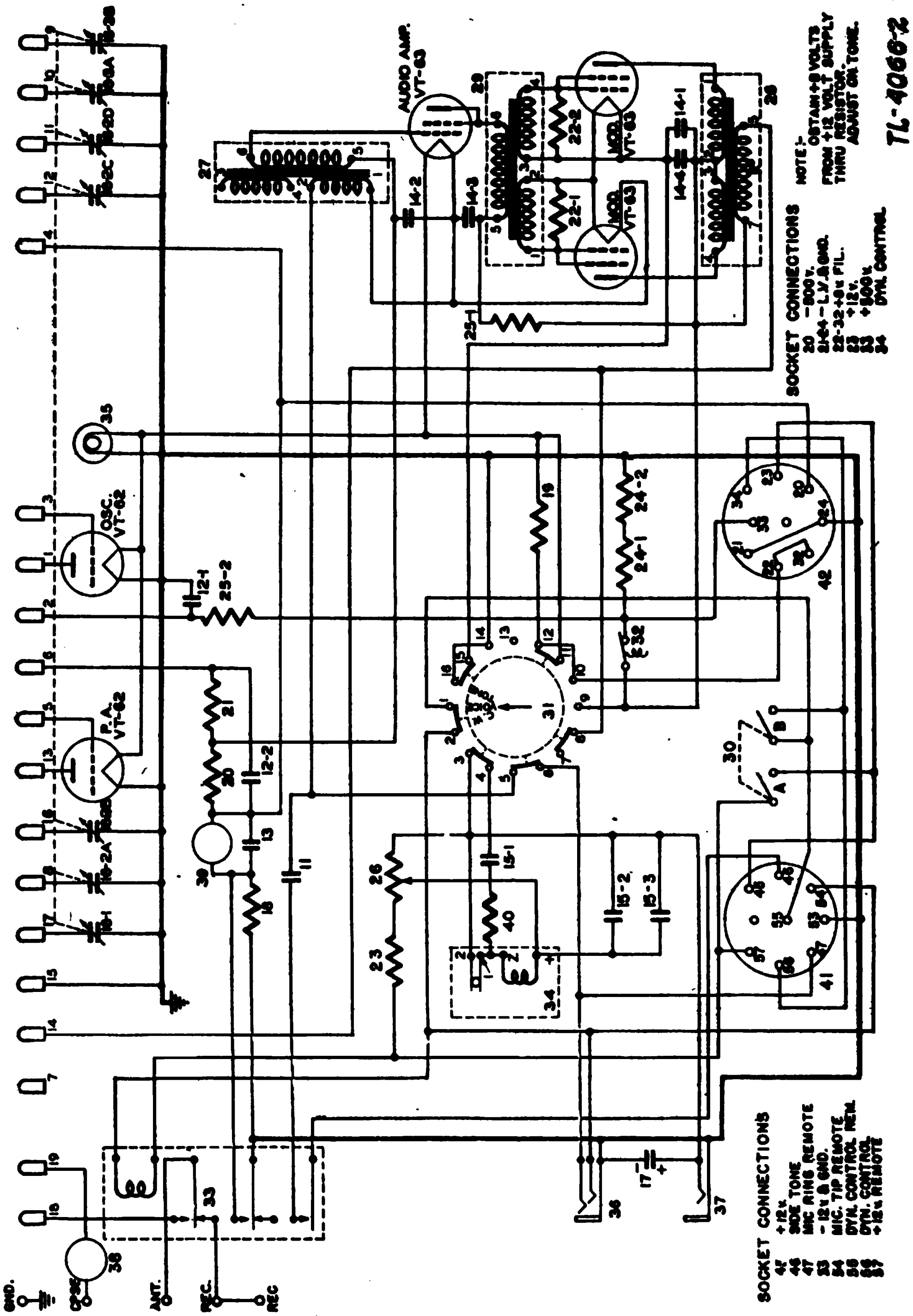
(*c*) Using an insulated adjusting tool, turn the OSC TRIMMER capacitance until zero beat is obtained in the frequency meter.

(7) Repeat measurement of frequencies as in steps in (3), (4), and (5) above to determine whether actual frequencies are within 1 kilocycle of the calibration chart for TU-17 and TU-18, and 1½ kilocycles for TU-25. If frequencies are not within these limits, repeat steps in (6) and (7).

NOTE.—While tolerance is set at 3 kilocycles in operation, readjustment must be made within narrower limits.

d. Tracking.—Since the oscillator and the power amplifier are tuned by the FREQUENCY CONTROL knob, it is essential for satisfactory operation that for any setting of the FREQUENCY CONTROL the power amplifier remain in tune with the oscillator. This is termed power amplifier tracking. The tracking of the power amplifier is checked by placing the transmitter in operation on cw with the antenna disconnected. Close the key and observe the PLATE CURRENT meter as the FREQUENCY CONTROL knob is rotated through the calibrated range. The power amplifier is tracking satisfactorily if the plate current does not vary more than 10 milliamperes. If the plate current variation is greater than 10 milliamperes, the FREQUENCY CONTROL should be set to 3,000, 4,500 or 5,250 kilocycles for transmitter tuning units TU-17 or

TU-17-A, TU-18 or TU-18-A, and TU-25-A, respectively, and the PA TRIMMER adjusted to give a minimum plate current. Recheck



the tracking as above. The plate current during these tests will normally be between 60 and 70 milliamperes.

e. Tone.—To check the setting of the tone modulation potentiometer, connect a Weston output meter 571 (supplied with test set I-56-A) or equal a-c voltmeter (1 or 2 volts full scale, 1,000 ohms per volt) between terminals 6 and 24. With the TONE VOICE CW

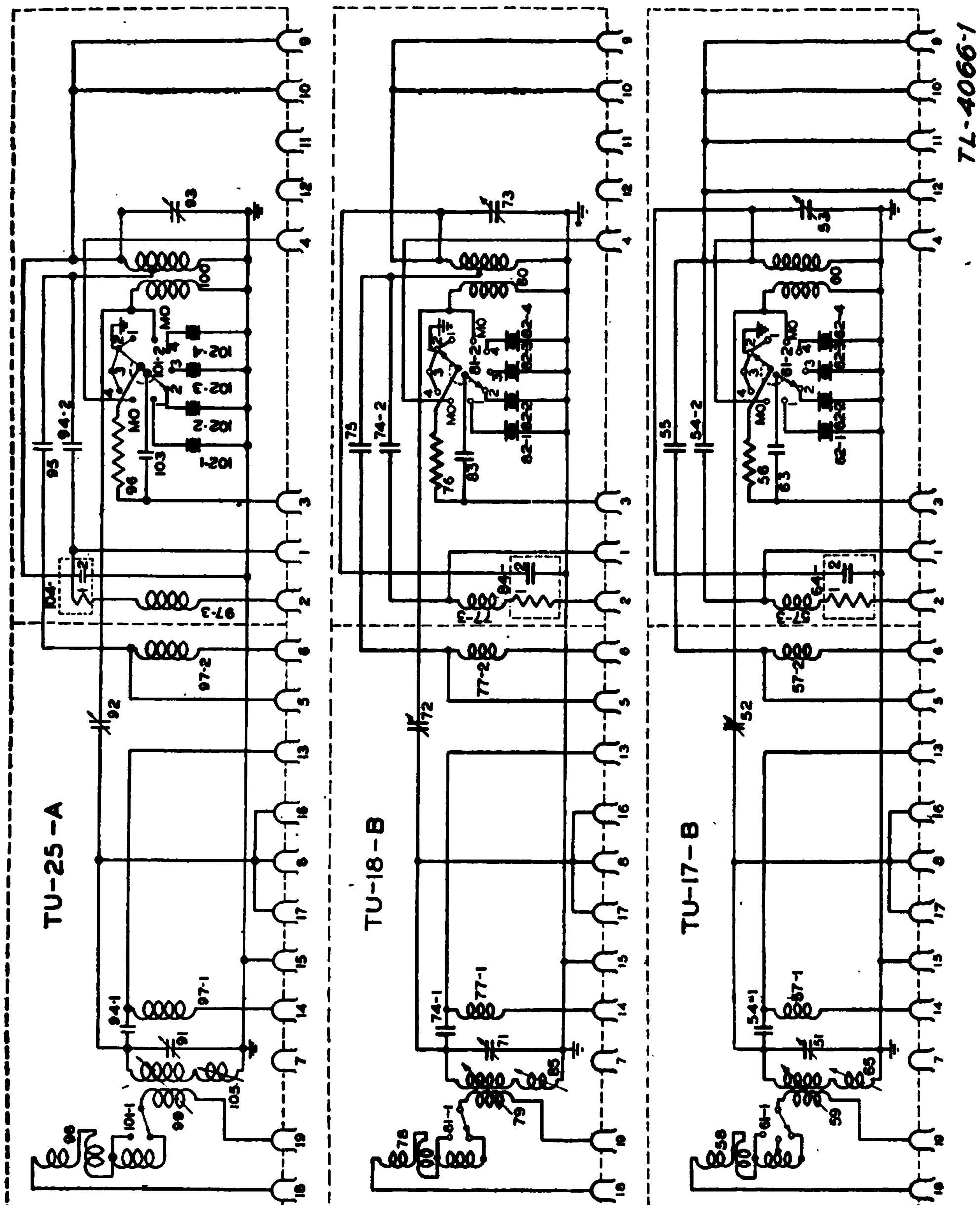


FIGURE 57.—Radio transmitter BC-223-A, including tuning units TU-17-A, TU-18-A, and TU-25-A.

switch set to CW and the TRANSMITTER OFF ON switch moved to the ON position, press the key; the voltmeter should read approximately 0.6 volt. With the TONE VOICE CW switch set to TONE, the TRANSMITTER OFF ON switch moved to the ON position and the key pressed, the voltmeter should read approximately 0.55

volt. If these values are not obtained, the panel screw cap marked TONE MOD CONTROL should be removed and a screw driver used to adjust this control to give the above values. Rotating in a clockwise direction increases the tone output.

37. Receiver alinement, general considerations.—*a. Preliminary requirements.*—The alinement of a superheterodyne radio receiver is a detailed task that requires a thorough knowledge of all principles pertaining to the particular radio receiver to be alined and the availability of the proper auxiliary instruments, suitable tools, and other maintenance bench facilities. Alinement should not be undertaken until it is certain that it is required and that all other repairs have been accomplished. The alinement of radio receivers of the BC-312 series by organizations *other than* repair organizations authorized to make extensive repairs, under provisions of the status letter X of appendix C of the Signal Corps General Catalog, will *not* be attempted.

b. Equipment for alinement operations.—The alinement of these receivers will require the following apparatus:

(1) Signal generator (I-72-B or equal).

(2) Plug for output meter.

(3) Headset or loudspeaker.

(4) Dummy antennas (50-micromicrofarad, radio frequency alinement; 300-ohm resistor, intermediate frequency alinement).

(5) Frequency meter of the SCR-211 series.

(6) Test set (I-56-A or equal).

(7) Miscellaneous tools (screw drivers, socket wrenches, and neutralizing tools).

(8) A plug PL-114 (or equal) wired for the introduction of battery power to the receiver.

(9) Suitable test bench with auxiliary 12-volt storage battery (BB-46 or equal).

c. General test conditions.—A standard signal-to-noise ratio of 4:1 should be employed. Standard output power should be taken as 10 milliwatts. Standard load should be 4,000 ohms. Type of signal source should be modulated radio frequency for all but MVC CW operation. Modulation frequency should be 400 cycles. Modulation percentage should be a minimum of 30 percent. Power supply voltage should be 12 volts direct current, minimum.

38. Test equipment.—*a. Accuracy.*—In the radio frequency and intermediate frequency alinement of military radio receivers a high degree of accuracy is desired without employment of excessive time. Thus considerable time can be saved by employing a frequency calibrated signal generator wherein the accuracy of calibration is of the order of 0.02 percent. If this procedure is to be followed, alinement of the receiver using the calibrated signal generator should prove all that would be necessary to keep the equipment in first-class operating condition. While the SCR-211-A frequency meter may be used directly to calibrate such radio receivers, considerable sacrifice of time and the probability of errors will result. Therefore, it is desirable to calibrate a signal generator which may then be used to aline the receiver, should a standard signal generator of the above-mentioned precision be unavailable.

b. Calibration of signal generator.—Allow the signal generator to warm up for an hour before using it. Turn on the SCR-211 frequency meter set about 15 minutes before the hour is up. Consult the calibration charts with the meter and calibrate the instrument to the crystal check point nearest 470 kilocycles; then switch to the **OPERATE** position and set the dial accurately to 470 kilocycles as given in the charts. Couple the "high" side of the output of the signal generator to the antenna post of the frequency meter through a 50-$\mu\mu$f capacitor and bridge the ground side over directly to the chassis of the frequency meter. Set the dial of the signal generator to approximately 470 kilocycles, as indicated by its own calibration charts. Without touching the dial of the frequency meter, carefully adjust the dial of the signal generator until zero beat is obtained in the headset of the frequency meter. Adjust the output of the signal generator to the minimum signal necessary to produce a comfortable heterodyne note. Disconnect the generator from the frequency meter and leave the dial alone all during the subsequent alinement operations.

c. Indication equipment.—Indication equipment, such as the output meter, need not be accurately calibrated, as it is used for indicating relative values to determine when the maximum setting has been obtained.

39. Preparation of receivers for alinement and calibration.—*a. Preliminary steps.*—The receiver should be removed from the cabinet and the dynamotor DM-21-B swung out of place. First remove the two fillister head screws, fastening the spacers in place. Turn the receiver upside down and remove the bolt from the dynamotor mounting hinge nearest the center of the set. The dynamotor unit can be turned to one side on the outside hinge. It may be necessary to carry this still further and separate the dynamotor unit completely from the chassis by the removal of the bolt in the remaining hinge. This latter action is dependent upon whether the alinement tools available are suitable for adjustment of the under chassis screw of the second intermediate frequency transformer. ***Caution:*** If the dynamotor is to be removed from all chassis mountings during the progress of alinement, care should be taken that the full weight of the dynamotor unit does not stress the attached leads. A tube checker should be employed to determine the serviceability of all tubes before alinement. Any needed repair or servicing of the receiver should precede alinement.

b. Precautions to be taken.—Radio receivers of the BC-312 series should be turned on and allowed to operate for at least 1 hour prior to attempting alinement. This is to permit stabilization of the radio frequency circuits in order that alinement can proceed without rechecking. It is also considered advisable to allow the signal generator employed to be operated for a period of approximately 1 hour prior to use as a frequency checking device. While not generally realized, the frequency of all forms of test equipment may drift appreciable amounts during the initial warm-up time and therefore the precaution of allowing stabilization permits a more rapid alinement because each adjustment is final. In connecting the receiver for alinement and calibration, extreme care should be taken that the sensitive meter located in some signal generators is not damaged by connection to the power supply employed by the receiver. Certain designs of signal generators are particularly susceptible to burn-out of attenuator and meter if care is not taken in properly connecting the instrument to the receiver. Thus a check should be made to ascertain that no direct current is introduced into the line connecting the signal generator and receiver. No fuses are provided in the output circuits of signal generators. Furthermore, it is recommended that the receiver be placed as close as possible to the signal generator and connected thereto through short leads. Excessively long leads from signal generator to radio receiver serve no useful purpose and are likely to produce erratic results in the actual alinement.

40. Receiver markings.—*a. Radio frequency band letter marking.*—Radio receivers of the BC-312 series have six band positions. The trimmer capacitor adjustment screws are marked with letters A through F, inclusive, corresponding to the band positions.

b. Radio frequency trimmer capacitor markings.—The trimmer capacitor adjustment screws, in addition to the band letter markings, show the relative value of capacitance included in the circuit. A red dot is located on one side of the screw-driver slot in the end of the screw. The capacitor is of the air-trimmer type composed of a stator and a rotor. The rotor may be turned through 360°, two points being found during each revolution where the same value of capacitance is

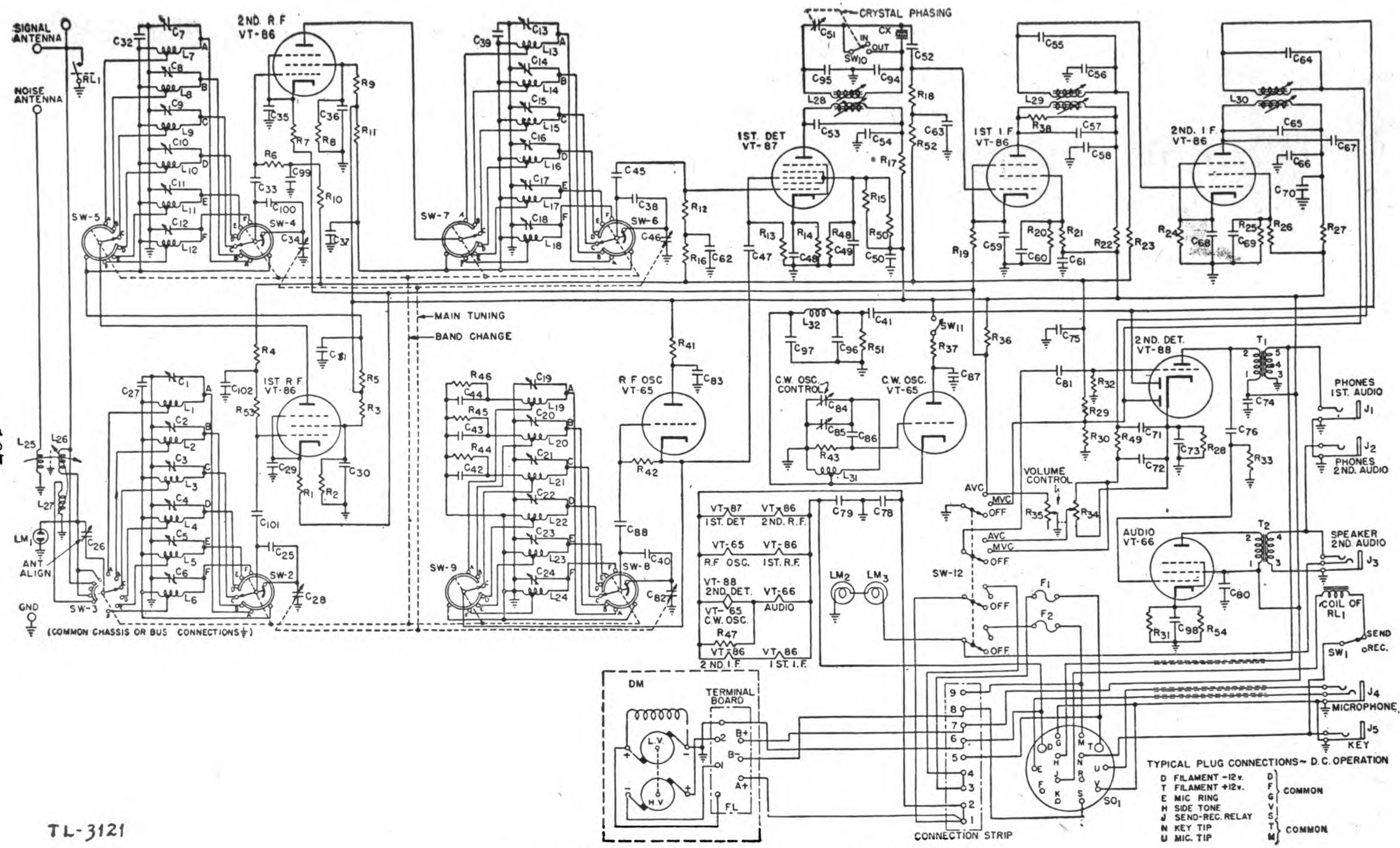


FIGURE 58.—Radio receiver BC–312–C, circuit diagram.

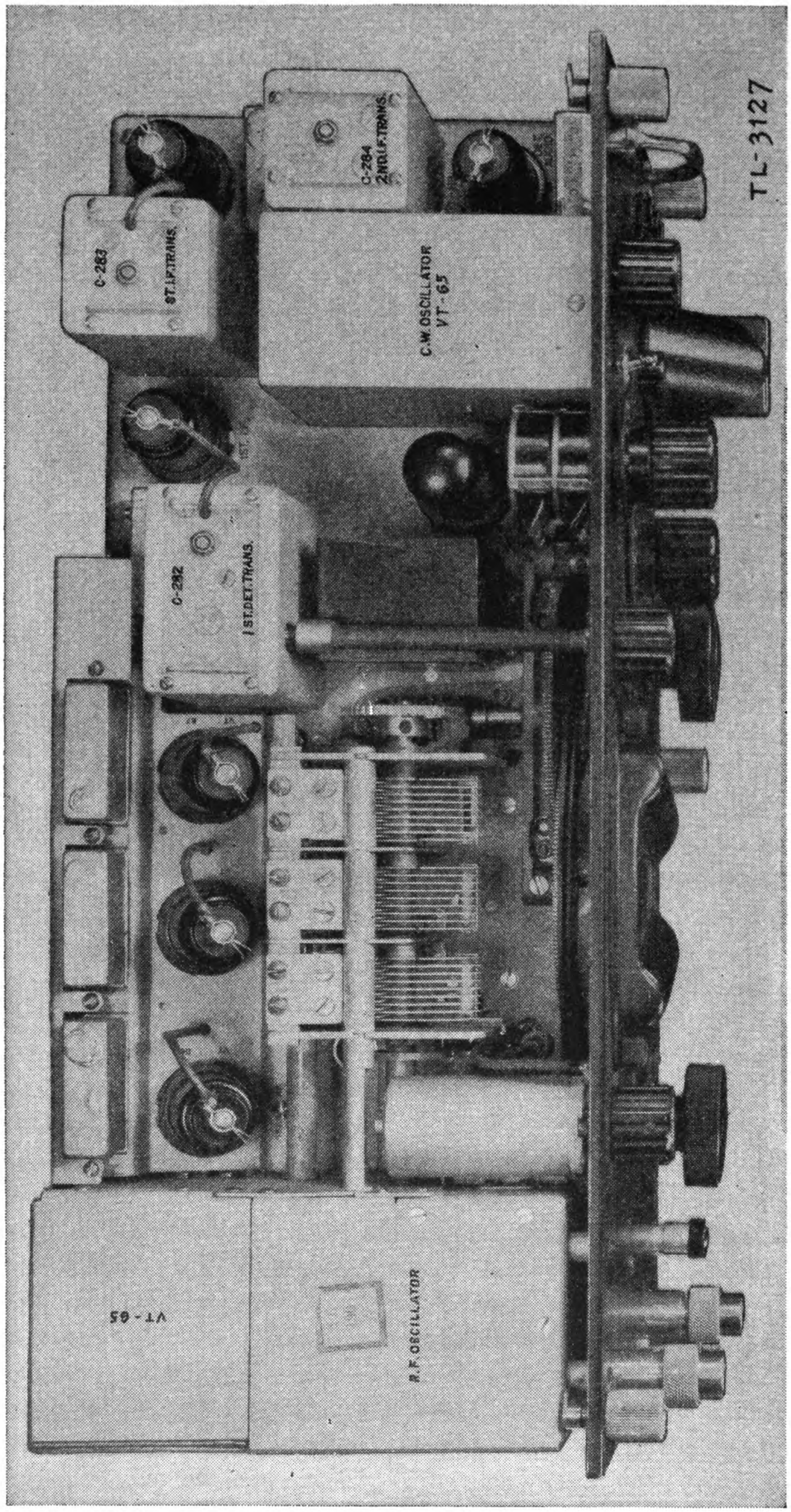


FIGURE 59.—Radio receiver of BC-312 series, chassis view from above.

obtained. With the receiver in a normal upright position, the stator plates are located on the lower side of the adjusting screws. The capacitance is at a minimum when the red dot is above the center line, and the capacitance is at a maximum when the red dot is below the center line.

c. Intermediate frequency markings.—Each intermediate frequency transformer is marked on the top of the container with its functional purpose as follows: 1ST DET TRANS and C-282, 1ST IF TRANS and C-283, and 2D IF TRANS and C-284. On the top of each transformer and under the chassis will be found a total of six adjustment screws. C-282 also contains the crystal phasing circuits. For both receivers these adjustment screws operate upon the iron cores of the transformer as a means of adjustment. Each adjusting screw is locked in place by a locknut of the elastic nut type. ***Caution:*** All of the radio frequency and intermediate frequency adjusting screws are held in place by either elastic nuts or split-screw type locknuts and any attempt to adjust the screws without first releasing the locknut may result in damage to the adjusting screw.

41. Alinement frequencies.—*a. Intermediate frequency.*—The intermediate frequency of radio receivers of the BC-312 series is 470 kilocycles.

b. Radio frequency alinement frequencies.—The radio frequency alinement frequencies are as follows:

Band	*Alinement frequency (kilocycles)*
A	2,900
B	4,900
C	7,850
D	11,000
E	13,750
F	17,700

c. Oscillator frequency.—On bands A, B, and C the radio frequency oscillator operates at a frequency 470 kilocycles higher than the frequency of the signal being received and on bands D, E, and F it operates 470 kilocycles lower than the frequency of the signal being received.

42. Receiver alinement procedure.—*a. Order.*—With the receiver connected for operation outside its case, the volume control should be adjusted to maximum volume employing manual volume control operation, the crystal filter phasing control turned to the OUT position, and the headset (or loudspeaker) and the output meter plugged in. After becoming stabilized by operation for at least an hour, alinement should be accomplished in the following order:

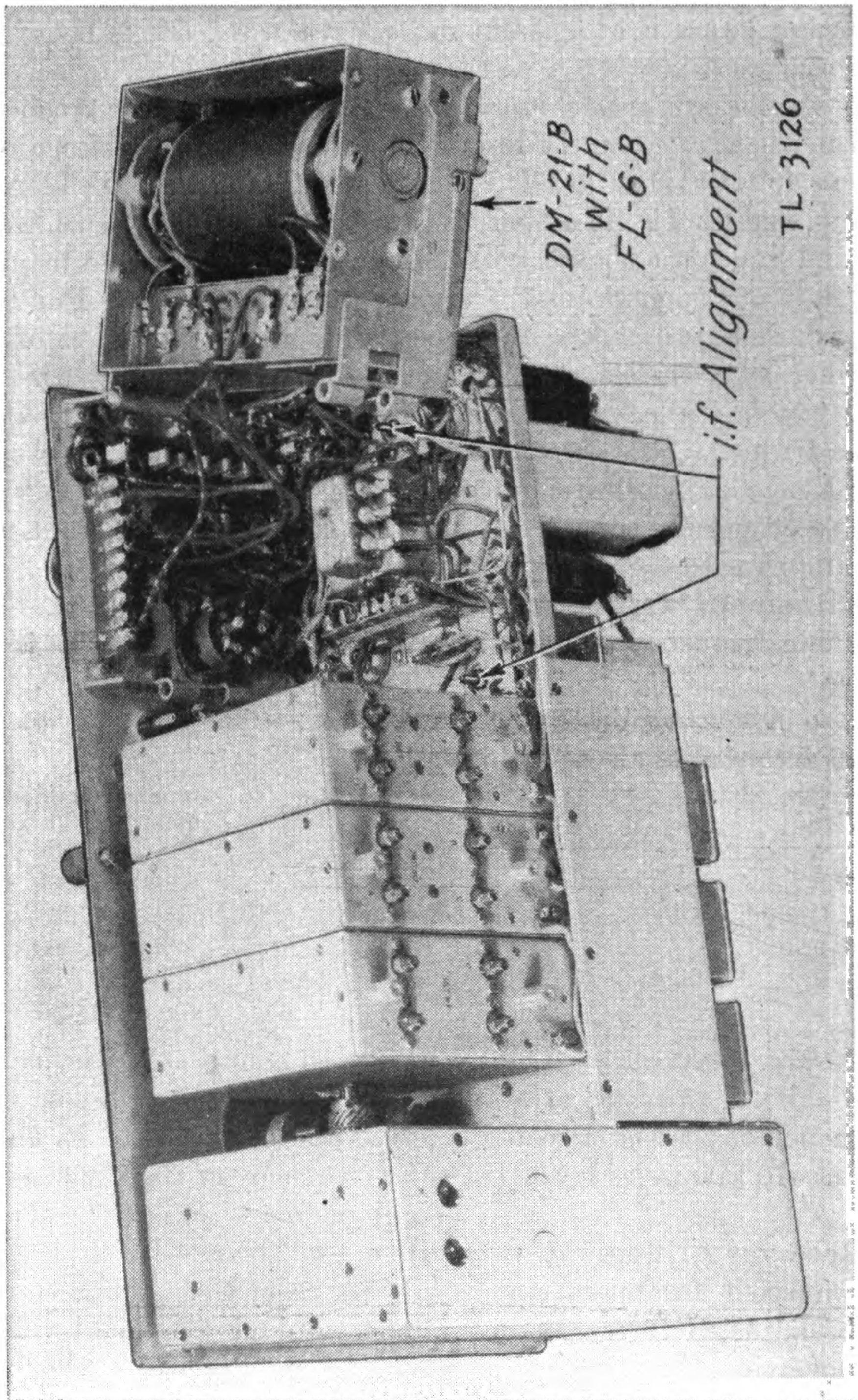


FIGURE 60.—Radio receiver of BC–312 series. (Chassis is upside down, and dynamotor unit is swung out to reveal intermediate frequency adjusting screws.)

(1) 2D IF transformer.
(2) 1ST IF transformer.
(3) 1ST DET transformer.
(4) Continuous wave oscillator.
(5) Radio frequency oscillator.
(6) Grid circuits of first detector, and second radio frequency stages.
(7) Grid circuit of first radio frequency stage and antenna alinement capacitor.
(8) Crystal filter.

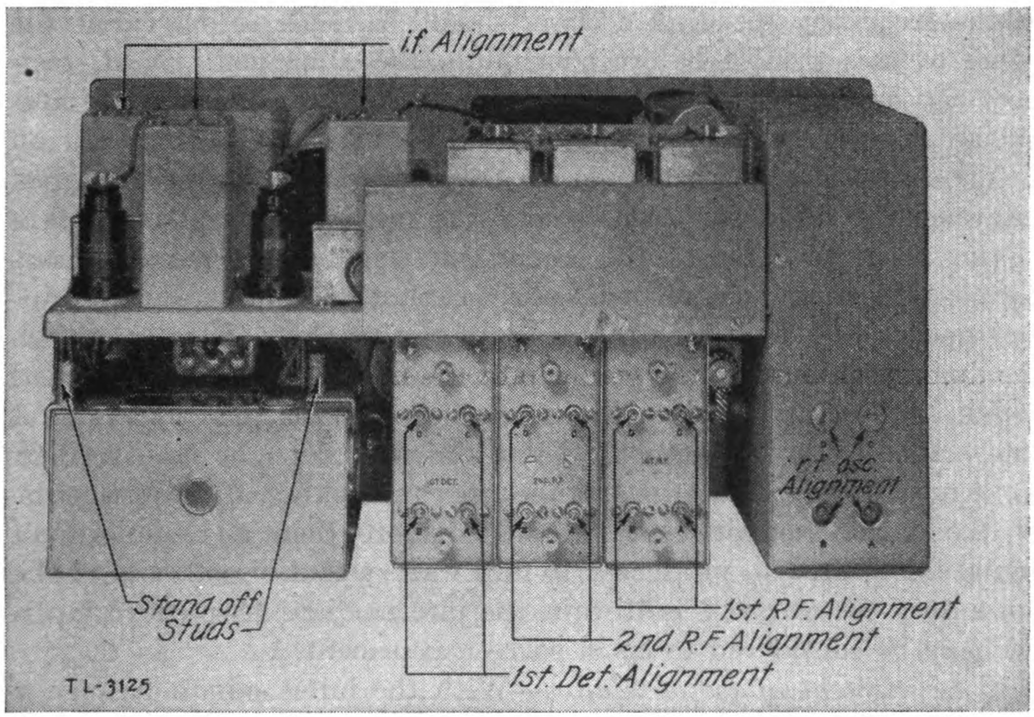


FIGURE 61.—Back view of receiver of BC-312 series, showing location of adjusting screws.

b. Intermediate frequency alinement.—(1) If the intermediate frequency stages are not too far out of alinement, the signal generator may be introduced at the first detector grid circuit. This is done by connecting the ground wire of the signal generator to the chassis and the output wire of the signal generator to the 300-ohm series resistor (dummy antenna) and the resistor in turn to the grid of the first detector tube, normal cap in place. Use a modulated wave as heretofore specified. Aline the intermediate frequency circuits in sequence beginning with the second intermediate frequency transformer, then with the first intermediate frequency transformer, and finally the first detector output transformer. Always use the least signal generator voltage for which a good resonance indication may be obtained.

(2) In the event that major repairs have been made on the intermediate frequency stages, the intermediate frequency circuits may be too far out of alinement to respond to this procedure, in which case begin alinement with the signal generator and 300-ohm dummy antenna connected to the grid of the second intermediate frequency tube (normal cap removed), the ground wire remaining connected to the chassis. Adjust the second intermediate frequency transformer for maximum response. If for any reason this circuit will not peak at the frequency specified, a check should be made to determine the cause of this trouble before continuing the alinement. Next, connect the dummy antenna to the grid of the first intermediate frequency tube (normal cap removed), and replace the normal cap on the grid of the second intermediate frequency tube. Adjust the first intermediate frequency transformer for maximum response. Here again, as in the case of the second intermediate frequency transformer, if a maximum response effect cannot be obtained, circuit investigation will determine the cause of the trouble. Finally, attach the dummy antenna to the grid cap of the first detector tube (normal cap in place), and replace the normal cap on the grid of the first intermediate frequency tube. Aline the first detector transformer. Take note of any erratic operation after rechecking all adjustments. If the output remains steady and no more than a 150-microvolt signal is required to produce a 10-milliwatt output signal, and if the noise does not exceed 1 milliwatt, the intermediate frequency amplifier may be considered to be in correct alinement.

c. *Adjustment of cw oscillator.*—With the intermediate frequency circuits alined as explained above, the continuous wave oscillator should be turned on. The modulation of the signal generator should be turned off only after ascertaining that the frequency of the signal generator corresponds to exact resonance frequency of the intermediate frequency circuits. Place the CW ADJUST control in the horizontal position. Vary the trimmer of the cw oscillator, which is accessible through a hole in the front panel after the slotted cap is removed, until a heterodyne note of about 1,000 cycles is obtained between the signal generator and the beat oscillator. To avoid the possibility of a heterodyne being produced by the beating of other frequencies or harmonics, the receiver dial should be turned. If the beat note remains constant in pitch, the correct adjustment has been obtained.

d. Alinement of radio frequency oscillator.—With the cw oscillator turned off and with modulation on at the signal generator, a signal should be applied to the grid of the first detector tube through the 50-micromicrofarad dummy antenna, the normal grid cap remaining in place. The frequency of this signal will depend upon the band change switch setting, and is determined for each band by reference to *b*(2) above. With the signal generator accurately adjusted to the correct frequency for the band change switch position being alined, the trimmer capacitor of the radio frequency oscillator should be adjusted until maximum response is secured in the output circuit. ***Caution:*** The adjusted position of the radio frequency oscillator is *exceedingly* critical. In the final adjustment, rock the main tuning control back and forth for maximum output. If the center point obtained on the dial agrees with the frequency of alinement, the trimmer is correctly adjusted. If, however, the maximum output is obtained at a somewhat different frequency on the dial, repeat the adjustment of the radio frequency oscillator trimmer until exact frequency agreement is obtained.

e. Alinement of radio frequency stages.—Remove the six buttonhead screws and the shield plate which covers the radio frequency amplifier trimmer capacitors. Use the 50-micromicrofarad capacitor as a dummy antenna between the signal generator and the ALTERNATE SIGNAL antenna post on the receiver. With all grid caps in place, adjust each of the radio frequency amplifier trimmer capacitors marked 2D RF and 1ST DETECTOR for maximum response. ***Caution:*** When working on the trimmer capacitors for a particular band do not touch the trimmer capacitors for other bands.

f. Alinement of first radio frequency amplifier and antenna alinement capacitor.—Adjust the trimmer capacitor marked 1ST RF only after the control marked ALINE INPUT has been set in the midposition. This will insure that the ALINE INPUT control has sufficient range to cover all antenna conditions under which the receiver might be called upon to work.

g. Check of crystal filter.—When the radio frequency and intermediate frequency circuits are properly alined, turn the CRYSTAL PHASING control from the OUT position and adjust for minimum background noise. Turn the cw oscillator OFF. Set the signal generator for an unmodulated radio frequency signal. Turn the main dial sharply back and forth across the band point for which the signal generator is set. Under these conditions a musical "chirp" should be heard in the headphones or speaker. If the chirp is present, this indicates that the quartz crystal is being excited by the varying intermediate frequency signal produced by the above tuning operation. The effect will be more pronounced for one direction of tuning of the main dial than the opposite.

h. Check of final alinement.—With the receiver alined as described in preceding paragraphs, the frequency control dial should be varied throughout the band and the alinement checked for three frequencies in each band to make sure that optimum results are being secured. If the variable high frequency oscillator is correctly following the tuning of the radio frequency stages and producing a difference frequency equal to that of the intermediate frequency amplifier satisfactory performance should be secured. In actual practice of course, perfect tracking is never obtained, but it is considered absolutely essential that the receiver be checked throughout each range and the circuit so compensated that the best available results are obtained throughout all bands. In general, radio receivers of the BC-312-C series should be capable of producing a 10-milliwatt output signal with a 4:1 signal-to-noise ratio with not more than 5 microvolts input at any frequency

i. Preparation for return to service.—After each radio receiver has been serviced following the procedure outlined herein it will be necessary to lock all adjusting controls that are equipped with locking devices, and to replace the dynamotor. The chassis should be turned upside down and cleaned with an air blast to definitely remove any metallic particles. All grid caps should be properly attached and the tubes firmly seated. The receiver can then be replaced in its cabinet, and the cabinet replaced on the shock mounting from which it was removed for servicing.

j. Special procedure of alinement of crystal filter.—(1) Under the alinement conditions set forth above, the receiver sensitivity without the use of the crystal is at a maximum. When the crystal is switched into the circuit and the PHASING CONTROL is adjusted for balance of the bridge, considerable loss in sensitivity results from the detuning effect of these operations upon the secondary of the first detector transformer.

(2) In the event that the crystal circuit is being used frequently, the alinement suggested below will result in improved sensitivity when crystal operation is required.

(*a*) Aline the receiver as above.

(*b*) Set the crystal PHASING CONTROL for minimum background noise.

(*c*) Vary the signal generator frequency above and below 470 kilocycles by means of the fine frequency control so as to bring the signal generator frequency to exact coincidence with the natural crystal frequency.

(*d*) Readjust the top core trimmer screw located at the top of the first detector output transformer for maximum output.

(*e*) Repeat the operations in (*c*) and (*d*) above.

(3) While this operation will result in somewhat reduced sensitivity when the crystal is not used, sufficient sensitivity will remain to secure adequate reception of all but the weakest signals.

43. Normal current and voltage readings.—The following normal current and voltage readings are furnished for the information and guidance of servicing personnel. (The values are approximate and will vary slightly with different sets and different measuring equipment.)

a. Current readings.—(1) The following tables give the current consumptions of the receiver and transmitter measured at the vehicular storage battery. The voltages listed are measured at the battery. Where the voltage supplied is 14.2 volts, the vehicular storage battery generator is operating (vehicular motor running).

(*a*) *Radio receivers of BC-312 series.*

Voltage	Current (amperes)	
	Heaters off	Heaters on (BC-312 only)
12	4. 2	7. 4
14.2	4. 6	8. 1

(*b*) *Radio transmitter BC-223 or BC-223-A.*

Voltage	Current (amperes)			
	Total		Filaments	
	Cw	Tone and voice	Cw	Tone and voice
12	12	17. 8	2. 2	4. 6
14.2	14. 2	20. 1	2. 5	5. 2

(2) The following table gives current readings of radio transmitter BC-223 or BC-223-A taken from the PLATE CURRENT meter for cw and voice operation (no modulation). The high-

voltage supply to the transmitter is read at terminals 33–20 of the transmitter power-connection panel of the BC–223 and is varied to give a range of readings.

High-voltage supply (volts)	Current (milliamperes)				
	Cw (key depressed)			Voice	
	Oscillator	Power amplifier	Total plate	Oscillator	Total plate
400	35	60	95	35	128
450	40	70	110	40	145
500	48	72	120	48	165
550	50	85	135	50	185

b. Voltage readings.—The following tables give voltage measured at points indicated in the tables for the transmitter and receiver:

(1) *Radio transmitter BC–223 or BC–223–A.*—These readings are made on voice operation (no modulation). Terminal connections of transmitter tuning units are accessible from within the transmitter upon removal of the backplate. The high-voltage supply is read at terminals 33–20 of the transmitter power connection panel and is varied to give a range of readings.

High-voltage supply (volts)	Voltages (volts)				
	Oscillator	Power amplifier	A–F amplifier	First modulator	Second modulator
	2 (+) and 15 (−) of tuning unit terminal strip	14 (+) and 15 (−) of tuning unit terminal strip	6 (+) of transformer 29 (C–224) and GND	4 (+) of transformer 28 (C–223) and GND	1 (+) of transformer 28 (C–223) and GND
400	275	385	255	400	400
450	305	435	285	450	450
500	340	480	320	500	500
550	375	530	340	550	550

Voltage across interrupter BZ–7 is 3 volts direct current.

(2) *Radio receivers of BC–312 series.*—These readings are made at the tube prongs with test set I–56–A, with an input voltage of 14 volts, the OFF MVC AVC switch in the MVC position, and the VOL control turned to maximum. For the cw oscillator readings the CW OSC OFF ON switch is in the ON position. For all other readings this switch is in the OFF position.

Tube		Voltages (volts)			
		Filament	Cathode to ground	Screen grid to ground	Plate to ground
1st r. f. amplifier (VT-86)		6. 5	3. 5	92	207
2d r. f. amplifier (VT-86)		6. 5	3. 3	82	217
1st detector (VT-87)		6. 5	2. 5	77	217
1st i. f. amplifier (VT-86)		6. 5	3. 6	94	215
2d i. f. amplifier (VT-86)		6. 5	3. 7	97	217
Cw oscillator (VT-65)		6. 5			100
Diode; 1st audio (VT-88)		6. 5	6. 7		215
2d audio amplifier (VT-66)		6. 5	18. 5	222	212
R. f. oscillator (VT-65)	Band A	6. 5	20		106
	Band B		15		102
	Band C		12		104
	Band D		0		98
	Band E		0		95
	Band F		0		97

44. Procedure in case of set failure.—***Caution:*** *Do not change fuses or make repairs with the high voltage on.* With this radio equipment, which receives severe field service, failure to operate is usually due to worn, broken, or disconnected cords, plugs, or sockets, run-down storage battery, worn dynamotor brushes, or defective tubes. These items should be checked first. If failure of both transmitter and receiver occurs simultaneously, the trouble is usually in the primary power source or leads connected thereto. If only one component fails to operate, determine first if it is receiving proper supply voltages. This usually determines whether the trouble is inside or outside of the component. Check fuses in the equipment at an early stage in "trouble shooting." Do not continue to burn out fuses before looking elsewhere to determine the basic source of trouble.

45. Locating trouble.—The following causes of set trouble may be present in the event that the component fails to function properly:

a. Radio receivers of the BC-312 series.

Symptom	*Cause*
(1) No filament voltage.	Poor battery.
	Open power lead.
	Short-circuited power lead.
	Poor plug contact.
	Burned-out fuse.
	Burned-out tube filament.
	Damaged bypass capacitor.
	Loose connection inside the receiver.

The first five of the above causes should be checked before the receiver chassis is removed from its cabinet.

Symptom	*Cause*
(2) No plate voltage.	Poor battery.
	Open or short-circuited cord.
	Poor plug contact.
	Burned-out fuse.
	Defective dynamotor.
	Defective filter in dynamotor DM-17-A [1] or DM-21-B (dynamotor rotates).
	Loose connection inside the receiver.
	Short-circuited bypass capacitors.
	Open resistors.

The first four of the above causes should be checked before the receiver chassis is removed from its cabinet.

Symptom	*Cause*
(3) No audio frequency output.	Headset plug not completely inserted in jack.
	Defective headset, headset plug, or headset cord.
	Defective tube.[2]
	Loose connections inside of receiver.
	Damaged capacitors.
	Damaged resistors.
	Defective jack insulation.
	Break-down on radio frequency coils, leads, or switches.
	Defective band change switch.

The first two causes of trouble should be checked before the receiver chassis is removed from its box. The last two causes will be indicated by lack of signal audio output although some audio noise output is present.

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[1] To check, remove lead from terminal 2 of dynamotor terminal strip and check the actual brush voltage. If normal voltage is read, connect lead to lead removed from terminal B—. If receiver operates, the filter is damaged.

[2] Tubes used in radio receiver BC-312 or BC-312-C may be checked with the tube checker of test set I-56-A. If found serviceable, they should be replaced in the identical sockets of the receiver from which they were removed.

Symptom	*Cause*
(4) No change in intensity level when SEND REC switch is on SEND position and the transmitter is being keyed.	Antenna relay inoperative. Jumper in plug PL-114 open.
(5) Erratic noise in receiver.	Defective headset or headset cord. Defective dynamotor. Temperature controls chattering.[1] Antenna relay chattering. Dust or dirt in the receiver. A loose connection in the receiver. Defective capacitors or resistors in receiver.

The first possible cause of trouble should be checked before the receiver chassis is removed from its box.

b. Radio transmitter BC-223 or BC-223-A.

Symptom	*Cause*
(1) No filament voltage.	Poor battery. Open power lead. Short-circuited power lead. Defective TONE VOICE CW switch. Burned-out fuse. Damaged bypass capacitor. Dynamotor starting relay not functioning properly. Loose connections inside transmitter.
(2) No plate voltage.	Poor battery. Open or short-circuited cord. Poor plug contact. Burned-out fuse. Defective dynamotor. Loose connections inside transmitter. Short-circuited bypass capacitors. Open resistors. Damaged choke coil.

[1] This cause of trouble may be located or eliminated by operation of the HEATER ON OFF switch. (Found on BC-312 only.)

Symptom	*Cause*
(3) No radio frequency output.	No external grounds.
	Damaged master oscillator or power amplifier tubes.
	Damaged antenna ammeter.
	Inoperative keying relay.
	Defective TONE VOICE CW switch.
	Damaged choke coil.
	Damaged coupling capacitor.
	No plate voltage.
	Excessive bias voltage (open grid resistor).
(4) No modulation.	Damaged audio amplifier or modulator tubes.
	Improper or excessive bias.
	Poor microphone.
	Damaged transformers.
	Inoperative interrupter BZ-7.

46. Repairs.—Repairs other than the following will not be attempted by using personnel unless specifically authorized under the provisions of appendix C, Signal Corps General Catalog.

a. Cords.—Cords may become defective because of an open circuit in one or more conductors, or a short circuit between two or more conductors, or between any conductor and ground. These defects most frequently occur at the point of attachment of the cord to its corresponding plug. These points should be examined and necessary repairs made where possible. In the event that the damage occurs any great distance from either end of the cord, it is normally impossible to make a serviceable permanent repair of the cord. A new cord should be obtained and installed. However, in an emergency, the defective portion of the cord may be cut out and jumpers used to restore the necessary circuits until a new cord can be obtained. Certain cords such as cords CD-261, CD-262, and CD-263 are shielded cables each consisting of flexible shielded conduit containing an inner conductor supported by a series of spaced insulating beads. These cords may be damaged by crushing or bending sharply. If it is found necessary to attach a terminating fitting on a concentric transmission line, before cutting the shield or conductor to length, the shield should be forced to its shortest length and the conductor should be pulled tightly to straighten out any kinks. Temporary repair may sometimes be made by careful shaping to hold the inner conductor away from the outer shield. If these cords have been badly damaged and the conductor cannot be straightened, they should be replaced as soon as practicable.

b. Headsets.—The failure of a headset to operate properly is usually due to a defective cord or plug which may be reparable. However, if the damage is within the phones, a new headset should be secured and the defective unit shipped to the proper agency for repair.

c. Dynamotor DM-17-A or DM-21-B.—Normally, if the dynamotor has become defective, it should be removed and replaced. Replacements are obtained through the usual channels. The replacement of brushes, turning down of commutators, freeing of bearings, and all repairing of defective receiver dynamotors are done at Signal Corps repair shops or Signal Corps radio sections at air depots. If the dynamotor cannot be replaced, or in an emergency, local repairs are allowable. When local repairs are made, careful sanding-in of new brushes to fit the commutator, proper spring adjustment, and a running-in period are necessary to insure quiet receiver operation. If results following local replacement of brushes are unsatisfactory, the dynamotor should be returned to a depot for overhaul when it can best be spared. Commutators not unduly worn may be cleaned by using a fine grade of sandpaper and/or wiping off thoroughly with carbon tetrachloride. If the bearings are not damaged but merely need freeing, a drop of light oil is added to each. If the trouble is due to an open or short-circuited winding, grooved commutators, or some other serious defect, the dynamotor should be replaced.

d. Dynamotor unit PE-55.—The probable causes of trouble in this unit are loose or defective brushes, locked or damaged bearings, dirty or undercut commutator, and open or short-circuited windings. These should all be checked and treated in the same manner as described for dynamotor DM-17-A or DM-21-B. Brush springs are furnished for local replacement in this unit.

Section V

LIST OF PARTS

47. Radio set components, weights, and dimensions.—The following composite table includes radio sets of the SCR–210 and SCR–245 series. Dimensions and weights, where unappreciable, are omitted.

SCR–210–A	SCR–210–B	SCR–210–C	SCR–210–D	SCR–210–E	SCR–210–F	SCR–210–G	SCR–210–H	SCR–210–J	SCR–245–A	SCR–245–B	SCR–245–C	SCR–245–D	SCR–245–E	SCR–245–F	SCR–245–G	SCR–245–H	SCR–245–J	SCR–245–K
1									2	2	1					2		
1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1										1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1			1	1	1			1
	1				1													
2									2	2	2	2				2		
2									2	2	2	2				2		
									2	2	2	2	2	2	2	2		
									2	2	2	2	2	2	2	2		
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																	2	2
	2	2	2	2	2	2	2	2					2	2	2		2	2
	2	2	2	2	2	2	2	2					2	2	2		2	2
									1	1	1	1	1	1	1	1	1	1
									2									
1									1	1	1							
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									1	1								

SCR-245-L	SCR-245-M	SCR-245-N	SCR-245-P	Article	Dimensions (inches)					Unit weight (pounds)
					Height	Width	Depth	Length	Diameter	
			2	Adapter FT-177 or FT-177-A (Note 1)	½	2	2			0.18
1	1	1	1	Box BX-19	1¾	12¼	4¼			2.5
1	1	1	1	Box BX-20	2⅜	11¾	6			3.0
1	1	1	1	Box BX-21	13½	10	11¼			2.5
1				Bracket FT-212						
				Brush, high-voltage (spare for dynamotor DM-17-A).						
				Brush, low-voltage (spare for dynamotor DM-17-A).						
				Brush, high-voltage (spare for dynamotor DM-19-A).						
				Brush, low-voltage (spare for dynamotor DM-19-A).						
2	2			Brush, high-voltage (spare for dynamotor DM-19-B).						
2	2			Brush, low-voltage (spare for dynamotor DM-19-B).						
		2	2	Brush, high-voltage (spare for dynamotor DM-19-D).						
		2	2	Brush, low-voltage (spare for dynamotor DM-19-D).						
2	2	2	2	Brush, high-voltage (spare for dynamotor DM-21-A or DM-21-B).						
2	2	2	2	Brush, low-voltage (spare for dynamotor DM-21-A or DM-21-B).						
1				Cabinet CH-60						
1	1	1	1	Case CS-56	10⅛	11⅝	5¾			14.0
				Connector, bulkhead						
				Control box BC-321 including one cord CO-173.	6½	5⅛	3			3.50
				Cord CD-201				60⅝		.36
				Cord CD-261						
				Cord CD-262				144		3.6
				Cord CD-263				48		1.2
				Cord CD-266				48		.8
				Cord CD-269				30		.5
				Cord CD-270				18		.3
				Cord CD-277				96		.6
				Cord CD-278				18		.4
				Cord CD-281				36		.6
				Cord CD-283				24		.4

SCR-210-A	SCR-210-B	SCR-210-C	SCR-210-D	SCR-210-E	SCR-210-F	SCR-210-G	SCR-210-H	SCR-210-J	SCR-245-A	SCR-245-B	SCR-245-C	SCR-245-D	SCR-245-E	SCR-245-F	SCR-245-G	SCR-245-H	SCR-245-J	SCR-245-K
	1												1					
	1		1	2	1	2	1	1										
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1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1		1
									1	1	1					1		
									1	1	1		1	1	1	1		1
			1												1			
													1	1	1			1
									1	1	1	1	1	1	1	1	1	1
4	4	4	4	4	4	4	4	4					4	4	4	4	4	4
	2	2		2	2	2	2											
								2										
2			2						2	2	2	2	2	2	2	2	2	2
	2	2	2	2	2	2	2	2					2	2	2		2	2
											1	2				1	1	
											1	2				1		
							4					1					1	
	1	1	1	3		3							1	1	1		2	3

SCR 245 L	SCR 245 M	SCR-245-N	SCR-245-P	Article	Dimensions (inches) Height	Width	Depth	Length	Diameter	Unit weight (pounds)
				Cord CD-284						
	2	2		Cord CD-307-A						
1				Cord CD-314				30		1.5
2	2	2		Cord CD-318						
		1		Cord CD-356						
				Cord CD-357						
				Cord CD-360						
				Cord CD-361						
				Cord CD-411						
		1		Cord CD-420						
				Cord CD-422						
	1			Cord CD-423						
1				Cord CD-433						
		1		Cord CD-434						
1				Cord CD-435						
				Cord CD-436						
				Cord CD-437						
			1	Cord CD-441						
				Cord CD-442						
	1			Cord CD-445						
	1			Cord CD-447						
	1	1		Cord CD-448						
			1	Cord CD-470						
				Cord CO-165-A				18		0.38
1				Cord CO-166-A				36		.75
	1			Cord CO-170-A						
				Cord CO-172				24		.4
				Cord CO-176				36		.60
				Cord CO-188-A						
				Cord CO-189						
				Cord CO-190						
1				Cord CO-257						
		1		Cord CO-260						
			1	Cord CO-273-A						
1	1	1	1	Cover BG-67						
1	1	1	1	Cover BG-75	10¼	18½	8½			1.25
				Cover BG-76	14⅜	20¾	10			1.25
1	1	1	1	Cover BG-77	11⅛	11⅛	9			.5
				Cover BG-85						
1	1	1	1	Cover BG-86						
				Crystal holder FT-171 with crystal (Note 2).	3	1½	1			.25
1	1	1	1	Dynamotor unit PE-55, including: 1 dynamotor DM-19-A or DM-19-B. 4 fuse FU-30 (1 in use, 3 spare). 8 fuse FU-26 (1 in use, 7 spare). 1 mounting FT-185.						
4	4	4	4	Fuse FU-21 or FU-21-A (spare)						
	2	2		Headset HS-18						
				Headset HS-23						
2				Headset P-19						
2	2	2	2	Instructions, radio installation						
				Insulator IN-89 (spare)						
				Insulator IN-90						
	4		2	Insulator IN-98						
		3		Insulator IN-101						

SCR-210-A	SCR-210-B	SCR-210-C	SCR-210-D	SCR-210-E	SCR-210-F	SCR-210-G	SCR-210-H	SCR-210-J	SCR-245-A	SCR-245-B	SCR-245-C	SCR-245 D	SCR 245 E	SCR 245 F	SCR 245 G	SCR 245 H	SCR 245 J	SCR 245 K
2								5										
					2		2											
												2						
1									1	1								
	1				1								1					
												1						
									1	1	1		1	1	1	1		1
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
									2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
																	1	
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
									2	2	2	2	2	2	2	2	2	
																		2
									1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
									1	1	1	1						
1									1	1	1	1				1		
	1	1	1	1	1	1	1	1					1	1	1		1	1
									1	1	1	1				1		
													1	1	1		1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set					1 set	1 set	1 set	1 set	1 set	1 set
1																		
									2									
									1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
1	1	1		1		1	1		2	2	1		1	1				1
									1	1	1	1	1	1	1	1	1	1
									1	1	1	1	1	1	1	1	1	1

SCR-245-L	SCR-245-M	SCR-245-N	SCR-245-P	Article	Dimensions (inches)					Unit weight (pounds)
					Height	Width	Depth	Length	Diameter	
			2	Insulator IN-104						
2	2			Insulator IN-111						
				Insulator jacket M-188						
				Jack JK-34-A						
1				Junction box TM-188. (Note 3)						
				Key J-37						
1	1	1	1	Key J-45						
2	2	2	2	Lamp LM-27						
2	2	2	2	Lamp LM-33						
1	1	1		Mast base MP-37. (Note 4)						
				Mast base bracket						
2	2	2	2	Mast section MS-49				35	½	0.16
2	2	2	2	Mast section MS-50				36	½	.38
2	2	2	2	Mast section MS-51				36	⅝	.48
2	2	2	2	Mast section MS-52				36	⅝	.66
2	2	2	2	Mast section MS-53				36	¾	.81
			2	Microphone T-17	6¼	2⅝	2½			.88
2	2	2		Microphone T-30-A						
1	1	1	1	Mounting FT-172	2½	2⅛	1			.25
1	1	1	1	Mounting FT-178	2½	2⅛	12			.25
				Mounting plate FT-176	10¼	34	¼			8.75
				Radio receiver BC-312, including: 1 dynamotor DM-17-A. 3 fuse FU-21 (2 in use, 1 spare). 2 lamp LM-27. 1 mounting FT-162.	9¼	18	7			40.0
1	1	1	1	Radio receiver BC-312-C, including: 1 dynamotor DM-21-B. 3 fuse FU-21-A (2 in use, 1 spare). 2 lamp LM-27. 1 mounting FT-162. (Note 5).	9¼	18	7			40.0
				Radio transmitter BC-223, including: (Note 6). 1 calibration chart. 1 lamp LM-33. 1 mounting FT-173.	14½	20⅛	8¾			26.5
1	1	1	1	Radio transmitter BC-223-A, including: (Note 6). 1 calibration chart. 1 lamp LM-33. 1 mounting FT-173.	14½	20⅛	8¾			26.5
1	1	1	1	Roll BG-56 (or BG-56-A for mast sections).	28	1½				2
1 set	1 set	1 set	1 set	Screws, nuts, and lock washers						
				Shield MP-38. (Note 4)	2	3	3			2
				Spacers for control box BC-321	4	½	⅛			.07
1 set	1 set	1 set	1 set	Springs, brush holder (spare for dynamotor DM-19-A or DM-19-B or DM-19-D).						
	1	1	1	Terminal block TM-183 (for terminal box).	1¾	5½	1			.5
1	1	1	1	Transmitter tuning unit TU-17. (Note 6).	8⅞	10	3½			8.75
1	1	1	1	Transmitter tuning unit TU-18. (Note 6).	8⅞	10	3½			8.75

SCR-210-A	SCR-210-B	SCR-210-C	SCR-210-D	SCR-210-E	SCR-210-F	SCR-210-G	SCR-210-H	SCR-210-J	SCR-245-A	SCR-245-B	SCR-245-C	SCR-245-D	SCR-245-E	SCR-245-F	SCR-245-G	SCR-245-H	SCR-245-J	SCR-245-K
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
----	-----	-----	-----	-----	-----	-----	-----	-----	4	4	4	4	4	4	4	4	4	4
----	-----	-----	-----	-----	-----	-----	-----	-----	6	6	6	6	6	6	6	6	6	6
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10 ft.	-----	-----	-----	-----	-----	-----	-----	-----	10	10	10	10	-----	-----	-----	-----	-----	-----
----	20 ft.	20 ft.	20 ft.	20 ft.	20	20	20	20	-----	-----	-----	-----	20	20	20	20	20	20
10	-----	-----	-----	-----	-----	-----	-----	-----	20	20	-----	-----	-----	-----	-----	-----	-----	-----
10	-----	-----	-----	-----	-----	-----	-----	-----	20	20	-----	-----	-----	-----	-----	-----	-----	-----
10	-----	-----	-----	-----	-----	-----	-----	-----	10	10	-----	-----	-----	-----	-----	-----	-----	-----
10	-----	-----	-----	-----	-----	-----	-----	-----	10	10	-----	-----	-----	-----	-----	-----	-----	-----
10	-----	-----	-----	-----	-----	-----	-----	-----	10	10	-----	-----	-----	-----	-----	-----	-----	-----
10	-----	-----	-----	-----	-----	-----	-----	-----	10	10	-----	-----	-----	-----	-----	-----	-----	-----
10	-----	-----	-----	-----	-----	-----	-----	-----	10	10	-----	-----	-----	-----	-----	-----	-----	-----
10	-----	-----	-----	-----	-----	-----	-----	-----	10	10	-----	-----	-----	-----	-----	-----	-----	-----

NOTES

1. Adapter FT-177 may be substituted for this item in radio sets SCR 245-A, SCR-245-B, SCR-245-H, and SCR-210-A. In radio sets SCR-245-C and SCR-245-D, adapter FT-177 cannot be used.

2. The quantity of crystal holder FT-171 and the frequency of the crystals therein will be as previously authorized for each using organization.

3. Sets of these types issued prior to September 1, 1939 required one junction box (no type number furnished by the Ordnance Department), one terminal block TM-183, and jack JK-34-A (or JK-34) furnished by the Signal Corps in lieu of one junction box TM-188, which is an assembly of these items.

4. Mast base MP-14 or MP-14-A may be substituted for this item. In radio set SCR-210-A when MP-14 or MP-14-A is used, shield MP-38 must be substituted for shield MP-33.

5. Radio receiver BC-312-C, in which case one adapter FT-197 must be used.

6. The serial number and order number of the calibration chart and of the transmitter tuning units TU-17 and TU-18 must be the same as those of the radio transmitter BC-223 with which they are used.

7. Transmitter tuning unit TU-25-A will be issued only as authorized for any using organization.

SCR-245-L	SCR-245-M	SCR-245-N	SCR-245-P	Article	Dimensions (inches)					Unit weight (pounds)
					Height	Width	Depth	Length	Diameter	
-----	-----	-----	-----	Transmitter tuning unit TU-25-A. (Note 7).						
4	4	4	4	Tube VT-62 (2 in use, 2 spare)	-----	-----	-----	-----	-----	.165
6	6	6	6	Tube VT-63 (3 in use, 3 spare)	-----	-----	-----	-----	-----	.13
4	4	4	4	Tube VT-65 (2 in use, 2 spare)	-----	-----	-----	-----	-----	.1
2	2	2	2	Tube VT-66 (1 in use, 1 spare)	-----	-----	-----	-----	-----	.1
8	8	8	8	Tube VT-86 (4 in use, 4 spare)	-----	-----	-----	-----	-----	.1
2	2	2	2	Tube VT-87 (1 in use, 1 spare)	-----	-----	-----	-----	-----	.1
2	2	2	2	Tube VT-88 (1 in use, 1 spare)	-----	-----	-----	-----	-----	.1
-----	-----	-----	-----	Wire W-124	-----	-----	-----	-----	-----	-----
20	20	20	20	Wire W-128	-----	-----	-----	-----	-----	-----
-----	-----	-----	-----	Wire W-131	-----	-----	-----	-----	-----	.12
-----	-----	-----	-----	Wire W-132	-----	-----	-----	-----	-----	.24
-----	-----	-----	-----	Wire W-133	-----	-----	-----	-----	-----	.12
-----	-----	-----	-----	Wire W-134	-----	-----	-----	-----	-----	.12
-----	-----	-----	-----	Wire W-135	-----	-----	-----	-----	-----	.12
-----	-----	-----	-----	Wire W-136	-----	-----	-----	-----	-----	.12
-----	-----	-----	-----	Wire W-137	-----	-----	-----	-----	-----	.12
-----	-----	-----	-----	Wire W-138	-----	-----	-----	-----	-----	.12

48. Replaceable parts.—*a. Radio receiver BC–312.*

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
C_1	3D289	Capacitor CA–289	Variable air; 3–25 μμf	Band A trimmer 1st r. f.	SC–A–1728
C_2	3D291	Capacitor CA–291	Variable air; 6–100 μμf	Band B trimmer 1st r. f.	SC–A–1728
C_3	3D291	Capacitor CA–291	Variable air; 6–100 μμf	Band C trimmer 1st r. f.	SC–A–1728
C_4	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band D trimmer 1st r. f.	SC–A–1728
C_5	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band E trimmer 1st r. f.	SC–A–1728
C_6	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band F trimmer 1st r. f.	SC–A–1728
C_7	3D289	Capacitor CA–289	Variable air; 3–25 μμf	Band A trimmer 2d r. f.	SC–A–1728
C_8	3D291	Capacitor CA–291	Variable air; 6–100 μμf	Band B trimmer 2d r. f.	SC–A–1728
C_9	3D291	Capacitor CA–291	Variable air; 6–100 μμf	Band C trimmer 2d r. f.	SC–A–1728
C_{10}	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band D trimmer 2d r. f.	SC–A–1728
C_{11}	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band E trimmer 2d r. f.	SC–A–1728
C_{12}	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band F trimmer 2d r. f.	SC–A–1728
C_{13}	3D289	Capacitor CA–289	Variable air; 3–25 μμf	Band A trimmer 1st det.	SC–A–1728
C_{14}	3D291	Capacitor CA–291	Variable air; 6–100 μμf	Band B trimmer 1st det.	SC–A–1728
C_{15}	3D291	Capacitor CA–291	Variable air; 6–100 μμf	Band C trimmer 1st det.	SC–A–1728
C_{16}	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band D trimmer 1st det.	SC–A–1728
C_{17}	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band E trimmer 1st det.	SC–A–1728
C_{18}	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band F trimmer 1st det.	SC–A–1728
C_{19}	3D289	Capacitor CA–289	Variable air; 3–25 μμf	Band A trimmer r. f. osc.	SC–A–1728
C_{20}	3D291	Capacitor CA–291	Variable air; 6–100 μμf	Band B trimmer r. f. osc.	SC–A–1728
C_{21}	3D291	Capacitor CA–291	Variable air; 6–100 μμf	Band C trimmer r. f. osc.	SC–A–1728
C_{22}	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band D trimmer r. f. osc.	SC–A–1728
C_{23}	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band E trimmer r. f. osc.	SC–A–1728
C_{24}	3D290	Capacitor CA–290	Variable air; 4–50 μμf	Band F trimmer r. f. osc.	SC–A–1728
C_{25}	3D294	Capacitor CA–294	Fixed air; 125 μμf	Padder 1st r. f.	SC–D–2575
C_{26}	3D293	Capacitor CA–293	Variable air; 10–210 μμf	Antenna alinement	SC–A–2580

C_{27}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf-400v	1st r. f. bypass	SC-D-1995
C_{28}	(1)	Capacitor	Ganged with C_{34}, C_{46}, C_{82}; 13-226 $\mu\mu f$.	1st r. f. tuning	SC-D-2568
C_{29}	3D195	Capacitor CA-195	Metal-encased as one unit: 0.05 μf-300 v	1st r. f. cathode bypass	SC-D-512
C_{30}	3D195	Capacitor CA-195	Metal-encased as one unit: 0.05 μf-300 v	1st r. f. screen bypass	SC-D-512
C_{31}	3D195	Capacitor CA-195	Metal-encased as one unit: 0.05 μf-300 v	1st r. f. "B" supply bypass	SC-D-512
C_{32}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf-400 v	1st r. f. plate bypass	SC-D-1995
C_{33}	3D266	Capacitor CA-266	Mica; 100 $\mu\mu f$	2d r. f. grid coupling	SC-D-1993
C_{34}	(1)	Capacitor	Ganged with C_{28}, C_{46}, C_{82}; 13-226 $\mu\mu f$.	2d r. f. tuning	SC-D-2568
C_{35}	3D195	Capacitor CA-195	Metal-encased as one unit: 0.05 μf-300 v	2d r. f. cathode bypass	SC-D-512
C_{36}	3D195	Capacitor CA-195	Metal-encased as one unit: 0.05 μf-300 v	2d r. f. screen bypass	SC-D-512
C_{37}	3D195	Capacitor CA-195	Metal-encased as one unit: 0.05 μf-300 v	2d r. f. "B" supply bypass	SC-D-512
C_{38}	3D294	Capacitor CA-294	Fixed air; 125 $\mu\mu f$	Padder, 1st det	SC-D-2575
C_{39}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf-400 v	2d r. f. plate bypass	SC-D-1995
C_{40}	3D294	Capacitor CA-294	Fixed air; 125 $\mu\mu f$	Padder, r. f. osc	SC-D-2575
C_{41}	3D278	Capacitor CA-278	Mica; 5 $\mu\mu f$	Cw osc. coupling	SC-D-1993
C_{42}	3D300	Capacitor CA-300	Mica, aged; 3,000 $\mu\mu f$	Band C padder r. f. osc	SC-D-1993
C_{43}	3D297	Capacitor CA-297	Mica, aged; 1,600 $\mu\mu f$	Band B padder r. f. osc	SC-D-1993
C_{44}	3D299	Capacitor CA-299	Mica, aged; 750 $\mu\mu f$	Band A padder r. f. osc	SC-D-1993
C_{45}	3D266	Capacitor CA-266	Mica; 100 $\mu\mu f$	1st det. grid coupling	SC-D-1993
C_{46}	(1)	Capacitor	Ganged with C_{28}, C_{34}, C_{82}; 13-226 $\mu\mu f$.	1st det. tuning	SC-D-2568
C_{47}	3D266	Capacitor CA-266	Mica; 100 $\mu\mu f$	R. f. osc. coupling	SC-D-1993
C_{48}	3D195	Capacitor CA-195	Metal-encased as one unit: 0.05 μf-300 v	1st det. cathode bypass	SC-D-512
C_{49}	3D195	Capacitor CA-195	Metal-encased as one unit: 0.05 μf-300 v	1st det. screen bypass	SC-D-512
C_{50}	3D195	Capacitor CA-195	Metal-encased as one unit: 0.05 μf-300 v	1st det. "B" supply bypass	SC-D-512
C_{51}	3D323	Capacitor CA-323	Variable air, with shaft; 4-50 $\mu\mu f$	Crystal phasing	SC-A-1728
C_{52}	3D266	Capacitor CA-266	Mica; 100 $\mu\mu f$	1st i. f. grid coupling	SC-D-1993
C_{53}	3D296	Capacitor CA-296	Mica; aged, 400 $\mu\mu f$	1st det., plate	SC-D-1993
C_{54}	3D281	Capacitor CA-281	Molded, paper; 0.01 μf-400 v	1st det., plate bypass	SC-D-1995
C_{55}	3D295	Capacitor CA-295	Mica; 50 $\mu\mu f$	2d i. f. grid	SC-D-1993

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
C_{56}	3D281	Capacitor CA-281	Molded, paper; 0.01 μf-400 v	2d i. f. a. v. c. bypass	SC-D-1995
C_{57}	3D295	Capacitor CA-295	Mica; 50 μμf	1st i. f. plate	SC-D-1993
C_{58}	3D281	Capacitor CA-281	Molded, paper; 0.01 μf-400 v	1st i. f. plate bypass	SC-D-1995
C_{59}	3D302	Capacitor CA-302	Modification of CA-195 0.05 μf-300 v	1st i. f. cathode bypass	SC-D-2567
C_{60}			0.05 μf-300 v	1st i. f. screen bypass	SC-D-2567
C_{61}			0.05 μf-300 v	1st i. f. "B" supply bypass	SC-D-2567
C_{62}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf-400 v	1st det. a. v. c. bypass	SC-D-1995
C_{63}	3D281	Capacitor CA-281	Molded, paper; 0.01 μf-400 v	1st i. f. a. v. c. bypass	SC-D-1995
C_{64}	3D295	Capacitor CA-295	Mica; 50 μμf	Diode input	SC-D-1993
C_{65}	3D295	Capacitor CA-295	Mica; 50 μμf	2d i. f. plate	SC-D-1993
C_{66}	3D281	Capacitor CA-281	Molded, paper; 0.01 μf-400 v	2d i. f. plate bypass	SC-D-1995
C_{67}	3D279	Capacitor CA-279	Mica; 10 μμf	Diode a. v. c. coupling	SC-D-1993
C_{68}	3D301	Capacitor CA-301	Modification of CA-195 0.05 μf-300 v	2d i. f. cathode bypass	SC-D-2567
C_{69}			0.05 μf-300 v	2d i. f. screen bypass	SC-D-2567
C_{70}			0.05 μf-300 v	2d i. f. "B" supply bypass	SC-D-2567
C_{71}	3D218	Capacitor CA-218	Mica; 150 μμf	Diode, r. f. bypass	SC-D-1993
C_{72}	3D193	Capacitor CA-193	Mica; 500 μμf	Diode, r. f. filter	SC-D-1993
C_{73}	3D301	Capacitor CA-301	Modification of CA-195 0.05 μf-300 v	Diode, cathode bypass	SC-D-2567
C_{74}			0.05 μf-300 v	1st audio plate bypass	SC-D-2567
C_{75}			0.05 μf-300 v	a. v. c. filter bypass	SC-D-2567
C_{76}	3D281	Capacitor CA-281	Molded, paper; 0.01 μf-400 v	2d audio coupling	SC-D-1995
C_{77}	3D295	Capacitor CA-295	Mica; 50 μμf	2d i. f. grid	SC-D-1993
C_{78}	3D276	Capacitor CA-276	Metal-encased as one unit 0.1 μf-400 v	Heater bypass	SC-D-512
C_{79}			0.1 μf-400 v	do	SC-D-512
C_{80}			0.1 μf-400 v	2d audio plate bypass	SC-D-512
C_{81}	3D281	Capacitor CA-281	Molded, paper; 0.01 μf-400 v	1st audio coupling	SC-D-1995
C_{82}	(1)	Capacitor	Ganged with C_{28}, C_{34}, C_{46}; 13-226 μμf	R. f. osc. tuning	SC-D-2568
C_{83}	3D277	Capacitor CA-277	Molded, paper; 0.1 μf-400 v	R. f. osc. plate bypass	SC-D-1995

C_{84}	3D280	Capacitor CA-280	Variable air, with shaft; 1-10 μμf	Cw osc. tuning	SC-A-1728
C_{85}	3D253	Capacitor CA-253	Variable air; 4-75 μμf	Cw osc. trimmer	SC-A-1728
C_{86}	3D266	Capacitor CA-266	Mica; 100 μμf	Cw osc. grid	SC-D-1993
C_{87}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf-400 v	Cw osc. plate bypass	SC-D-1995
C_{88}	3D266	Capacitor CA-266	Mica; 100 μμf	R. f. osc. grid	SC-D-1993
C_{89}	3D211	Capacitor CA-211	Mica; 0.002 μf	Thermostat contacts	SC-D-1993
C_{90}	3D211	Capacitor CA-211	Mica; 0.002 μf	Thermostat contacts	SC-D-1993
C_{91}	3D295	Capacitor CA-295	Mica; 50 μμf	1st i. f. plate	SC-D-1993
C_{92}	3D295	Capacitor CA-295	Mica; 50 μμf	Diode input	SC-D-1993
C_{93}	3D295	Capacitor CA-295	Mica; 50 μμf	2d i. f. plate	SC-D-1993
C_{94}	3D298	Capacitor CA-298	Mica, aged; 800 μμf	Crystal filter input	SC-D-1993
C_{95}	3D298	Capacitor CA-298	Mica, aged; 800 μμf	Cyrstal filter input	SC-D-1993
C_{96}	3D286	Capacitor CA-286	Mica; 75 μμf	Cw osc. filter	SC-D-1993
C_{97}	3D286	Capacitor CA-286	Mica; 75 μμf	Cw osc. filter	SC-D-1993
C_{98}	3D275	Capacitor CA-275	Paper; 4 μf	2d audio cathode bypass	SC-D-512
C_{99}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf-400 v	2d r. f. a. v. c. bypass	SC-D-1995
C_{100}	3D294	Capacitor CA-294	Fixed, air; 125 μμf	2d r. f. padder	SC-D-2575
C_{101}	3D266	Capacitor CA-266	Mica; 100 μμf	1st r. f. grid coupling	SC-D-1993
C_{102}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf-400 v	1st r. f. a. v. c. bypass	SC-D-1995
CX	2Z3501-6	Crystal DC-6	470 kc	Crystal filter unit	SC-A-1994
DM	3H1617A	Dynamotor DM-17-A		D-c power pack	SC-D-2576
F_1	3Z1921	Fuse FU-21	10 amp.-25 v	Dynamotor and filaments	
F_2	3Z1921	Fuse FU-21	10 amp.-25 v	R. f. osc. compart. heaters	
J_1	2Z5534	Jack JK-34		1st audio phones	SC-D-439
J_2	2Z5534	Jack JK-34		2d audio phones	SC-D-439
J_3	2Z5533	Jack JK-33		Speaker	SC-D-483
J_4	2Z5533	Jack JK-33		Microphone	SC-D-483
J_5	2Z5534	Jack JK-34		Key	SC-D-439
L_1		Coil		Band A, 1st r. f	SC-D-2556
L_2		Coil		Band B, 1st r. f	SC-D-2556

[1] C_{28}, C_{34}, C_{46}, and C_{82} ganged comprise capacitor CA-292 (3D292).

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
L_3		Coil		Band C, 1st r. f.	SC-D-2556
L_4		Coil		Band D, 1st r. f.	SC-D-2556
L_5		Coil		Band E, 1st r. f.	SC-D-2556
L_6		Coil		Band F, 1st r. f.	SC-D-2556
L_7		Coil		Band A, 2d r. f.	SC-D-2556
L_8		Coil		Band B, 2d r. f.	SC-D-2556
L_9		Coil		Band C, 2d r. f.	SC-D-2556
L_{10}		Coil		Band D, 2d r. f.	SC-D-2556
L_{11}		Coil		Band E, 2d r. f.	SC-D-2556
L_{12}		Coil		Band F, 2d r. f.	SC-D-2556
L_{13}		Coil		Band A, 1st det.	SC-D-2556
L_{14}		Coil		Band B, 1st det.	SC-D-2556
L_{15}		Coil		Band C, 1st det.	SC-D-2556
L_{16}		Coil		Band D, 1st det.	SC-D-2556
L_{17}		Coil		Band E, 1st det.	SC-D-2556
L_{18}		Coil		Band F, 1st det.	SC-D-2556
L_{19}		Coil		Band A, r. f., osc.	SC-D-2556
L_{20}		Coil		Band B, r. f., osc.	SC-D-2556
L_{21}		Coil		Band C, r. f., osc.	SC-D-2556
L_{22}		Coil		Band D, r. f., osc.	SC-D-2556
L_{23}		Coil		Band E, r. f., osc.	SC-D-2556
L_{24}		Coil		Band F, r. f., osc.	SC-D-2556
L_{25}		Coils		Ignition suppressor	SC-D-2571
L_{26}		Coils		Ignition suppressor	SC-D-2571
L_{27}		Coils		Ignition suppressor	SC-D-2571
L_{28}	2Z9802/10 2Z9802/11	Coils of transformer C-202.		1st detector	SC-D-2564

L_{29}	2Z9803/3 2Z9803/4	Coils of transformer C-203.		1st i. f.	SC-D-2564
L_{30}	2Z9804/3 2Z9804/4	Coils of transformer C-204.		2d i. f.	SC-D-2564
L_{31}		Coil		Cw beat oscillator	SC-D-2563
L_{32}		Coil		Filter, cw oscillator	SC-D-2563
LM_1	2Z5893	Neon lamp		Antenna overload protection.	SC-A-1801
LM_2	2Z5927	Lamp LM-27	Pilot lamp	Dial light	SC-D-2573
LM_3	2Z5927	Lamp LM-27	Pilot lamp	Dial light	SC-D-2573
R_1	3Z4564	Resistor RS-164	Wire-wound, insul.; 500 ohms, 1 w	Cathode bias, 1st r. f.	SC-D-970
R_2	3Z4569	Resistor RS-169	Carbon, insul.; 60,000 ohms, ½ w	Screen grid, 1st r. f.	SC-D-970
R_3	3Z4549	Resistor RS-149	Carbon, insul.; 40,000 ohms, ½ w	Screen grid, 1st r. f.	SC-D-970
R_4	3Z4572	Resistor RS-172	Carbon, 100,000 ohms, ⅓ w	A. v. c. filter, 1st r. f.	SC-D-970
R_5	3Z4567	Resistor RS-167	Carbon, 1,000 ohms, ⅓ w	Plate filter, 1st r. f.	SC-D-970
R_6	3Z4573	Resistor RS-173	Carbon, 2 megohms, ⅓ w	Grid, 2d r. f.	SC-D-970
R_7	3Z4564	Resistor RS-164	Wire-wound insul.; 500 ohms, 1 w	Cathode bias, 2d r. f.	SC-D-970
R_8	3Z4569	Resistor RS-169	Carbon, insul.; 60,000 ohms, ½ w	Screen grid, 2d r. f.	SC-D-970
R_9	3Z4549	Resistor RS-149	Carbon, insul.; 40,000 ohms, ½ w	Screen grid, 2d r. f.	SC-D-970
R_{10}	3Z4572	Resistor RS-172	Carbon, 100,000 ohms, ⅓ w	A. v. c. filter, 2d r. f.	SC-D-970
R_{11}	3Z4567	Resistor RS-167	Carbon, 1,000 ohms, ⅓ w	Plate filter, 2d r. f.	SC-D-970
R_{12}	3Z4573	Resistor RS-173	Carbon, 2 megohms, ⅓ w	Grid, 1st det.	SC-D-970
R_{13}	3Z4568	Resistor RS-168	Carbon, 50,000 ohms, ⅓ w	Suppressor bias, 1st det.	SC-D-970
R_{14}	3Z4566	Resistor RS-166	Wire-wound insul.; 350 ohms, 1 w	Cathode bias, 1st det.	SC-D-970
R_{15}	3Z4540	Resistor RS-140	Carbon, insul.; 30,000 ohms, ½ w	Screen grid, 1st det.	SC-D-970
R_{16}	3Z4572	Resistor RS-172	Carbon, 100,000 ohms, ⅓ w	A. v. c. filter, 1st det.	SC-D-970
R_{17}	2Z4525	Resistor RS-125	Carbon, insul.; 1,000 ohms, ½ w	Plate filter, 1st det.	SC-D-970
R_{18}	3Z4572	Resistor RS-172	Carbon, 100,000 ohms, ⅓ w	A. v. c. filter, 1st i. f.	SC-D-970
R_{19}	3Z4564	Resistor RS-164	Wire-wound insul.; 500 ohms, 1 w	Cathode bias, 1st i. f.	SC-D-970
R_{20}	3Z4563	Resistor RS-163	Carbon, insul.; 60,000 ohms, 1 w	Sereen grid, 1st i. f.	SC-D-970
R_{21}	3Z4549	Resistor RS-149	Carbon, insul.; 40,000 ohms, ½ w	Screen grid, 1st i. f.	SC-D-970
R_{22}	3Z4525	Resistor RS-125	Carbon, insul.; 1,000 ohms, ½ w	Plate filter, 1st i. f.	SC-D-970

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
R_{23}	3Z4550	Resistor RS-150	Carbon, insul.; 100,000 ohms, ½ w	A. v. c. filter, 2d i. f.	SC-D-970
R_{24}	3Z4564	Resistor RS-164	Wire-wound, insul.; 500 ohms, 1 w	Cathode bias, 2d i. f.	SC-D-970
R_{25}	3Z4563	Resistor RS-163	Carbon, insul.; 60,000 ohms, 1 w	Screen grid, 2d i. f.	SC-D-970
R_{26}	3Z4549	Resistor RS-149	Carbon, insul.; 40,000 ohms, ½ w	Screen grid, 2d i. f.	SC-D-970
R_{27}	3Z4525	Resistor RS-125	Carbon, insul.; 1,000 ohms, ½ w	Plate filter, 2d i. f.	SC-D-970
R_{28}	3Z4571	Resistor RS-171	Wire-wound, insul.; 750 ohms, 1 w	Cathode bias, diode	SC-D-970
R_{29}	3Z4562	Resistor RS-162	Carbon, insul.; 250,000 ohms, ½ w	A. v. c. filter, diode	SC-D-970
R_{30}	3Z4561	Resistor RS-161	Carbon, 1 megohm, ⅓ w	A. v. c. load	SC-D-970
R_{31}	3Z4565	Resistor RS-165	Wire-wound, insul.; 1,000 ohms, 1 w	Cathode bias, 2d audio	SC-D-970
R_{32}	3Z4562	Resistor RS-162	Carbon, insul.; 250,000 ohms, ½ w	Grid, 1st a. f.	SC-D-970
R_{33}	3Z4531	Resistor RS-131	Carbon, insul.; 50,000 ohms, ½ w	Grid, 2d a. f.	SC-D-970
R_{34} R_{35}	2Z7289	Potentiometer RS-174	500,000 ohms / 50,000 ohms 1 w	Dual volume control	SC-D-1982
R_{36}	3Z4550	Resistor RS-150	Carbon, insul.; 100,000 ohms, ½ w	Minimum bias bleeder	SC-D-970
R_{37}	3Z4550	Resistor RS-150	Carbon, insul.; 100,000 ohms, ½ w	Cw osc. plate	SC-D-970
R_{38}	3Z4578	Resistor RS-178	Metal-encased; 15 w 12 ohms, 14 v	Heater	
R_{39}	3Z4578	Resistor RS-178	Metal-encased; 15 w 12 ohms, 14 v	Heater	
R_{40}	3Z4578	Resistor RS-178	Metal-encased; 15 w 12 ohms, 14 v	Heater	
R_{41}	3Z4539	Resistor RS-139	Carbon, insul.; 30,000 ohms, 1 w	Plate, r. f. osc	SC-D-970
R_{42}	3Z4540	Resistor RS-140	Carbon, insul.; 30,000 ohms, ½ w	Grid, r. f. osc	SC-D-970
R_{43}	3Z4548	Resistor RS-148	Carbon, insul.; 200,000 ohms, ½ w	Grid, cw osc	SC-D-970
R_{44}	3Z4527	Resistor RS-127	Carbon, insul.; 3,000 ohms, ½ w	Cathode, band C, r. f. osc	SC-D-970
R_{45}	3Z4528	Resistor RS-128	Carbon, insul.; 5,000 ohms, ½ w	Cathode, band B, r. f. osc	SC-D-970
R_{46}	3Z4577	Resistor RS-177	Carbon, insul.; 7,500 ohms, ½ w	Cathode, band A, r. f. osc	SC-D-970
R_{47}	3Z4576	Resistor RS-176	Carbon, insul.; 60 ohms, ½ w	Filament shunt, diode	SC-D-970
R_{48}	3Z4569	Resistor RS-169	Carbon, insul.; 60,000 ohms, ½ w	Screen grid, 1st det	SC-D-970
R_{49}	3Z4533	Resistor RS-133	Carbon, insul.; 500,000 ohms, ½ w	R. f. filter, diode	SC-D-970
R_{50}	3Z4540	Resistor RS-140	Carbon, insul.; 30,000 ohms, ½ w	Screen grid, 1st det	SC-D-970

R_{51}	3Z4529	Resistor RS-129	Carbon, insul.; 10,000 ohms, ½ w	Filter load, cw osc	SC-D-970
R_{52}	3Z4575	Resistor RS-175	Carbon, 10,000 ohms, ⅓ w	A. v. c. filter, 1st i. f.	SC-D-970
R_{53}	3Z4573	Resistor RS-173	Carbon, 2 megohms, ⅓ w	Grid, 1st r. f.	SC-D-970
RL_1	2Z7613	Relay BK-13		Antenna grounding	SC-D-1942
SO_1	2Z8794. 1	Socket SO-94		Power supply and control	SC-D-2592
SW_1	3Z8131	Switch SW-131	Toggle	Send-receive	SC-A-1042
SW_2	3Z8310-2	Switch	Ganged	Band change, 1st r. f. grid	SC-D-2553
SW_3	3Z8310-1	Switch	Ganged	Band change, 1st r. f. antenna.	SC-D-2553
SW_4	3Z8310-2	Switch	Ganged	Band change, 2d r. f. grid	SC-D-2553
SW_5	3Z8310-2	Switch	Ganged	Band change, 1st r. f. plate	SC-D-2553
SW_6	3Z8310-2	Switch	Ganged	Band change, 1st det. grid	SC-D-2553
SW_7	3Z8310-2	Switch	Ganged	Band change, 2d r. f. plate	SC-D-2553
SW_8	3Z8310-2	Switch	Ganged	Band change, r. f. osc. grid	SC-D-2553
SW_9	3Z8310-2	Switch	Ganged	Band change, r. f .osc. plate	SC-D-2553
SW_{10}		Switch	Ganged to C_{51}	Crystal switch	SC-D-2564
SW_{11}	3Z8105	Switch SW-105	Toggle	Cw beat osc	SC-A-1042
SW_{12}	3Z8119	Switch SW-119	Rotary	On-off, m. v. c., a. v. c	SC-D-2574
SW_{13}	3Z8131	Switch SW-131	Toggle	Heater switch	SC-A-1042
T_1	2Z9805	Transformer C-205	Audio frequency 5,000/2,500 turn ratio.	1st audio	SC-D-2567
T_2	2Z9760	Transformer C-160	Audio frequency 5,000/1,885 turn ratio.	2d audio	SC-D-2569
THS_1	2Z9182	Temperature control BK-12.	2.3 amp.-14 v, normally closed	Opens at 111° F	SC-A-2590
THS_2	2Z9181	Temperature control BK-11.	1.15 amp.-14 v, normally closed	Opens at 109° F	SC-A-2590

b. Radio receiver BC-312-C.

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
C_{28}	See note	Capacitor	Ganged with C_{34}, C_{46}, C_{82}; 13–226 $\mu\mu$f.	1st r. f. tuning	SC-D-2568
C_{29}	3D195	Capacitor CA-195	Metal-encased as one unit. 0.05 μf–300 v	1st r. f. cathode bypass	SC-D-512
C_{30}	3D195	Capacitor CA-195	0.05 μf–300 v	1st r. f. screen bypass	SC-D-512
C_{31}	3D195	Capacitor CA-195	0.05 μf–300 v	1st r. f. "B" supply bypass	SC-D-512
C_{32}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf–400 v	1st r. f. plate bypass	SC-D-1995
C_{33}	3D266	Capacitor CA-266	Mica; 100 $\mu\mu$f	2d r. f. grid coupling	SC-D-1993
C_{34}	See note	Capacitor	Ganged with C_{28}, C_{46}, C_{82}; 13–226 $\mu\mu$f.	2d r. f. tuning	SC-D-2568
C_{35}	3D195	Capacitor CA-195	Metal-encased as one unit. 0.05 μf–300 v	2d r. f. cathode bypass	SC-D-512
C_{36}	3D195	Capacitor CA-195	0.05 μf–300 v	2d r. f. screen bypass	SC-D-512
C_{37}	3D195	Capacitor CA-195	0.05 μf–300 v	2d r. f. "B" supply bypass	SC-D-512
C_{38}	3D294	Capacitor CA-294	Fixed air; 125 $\mu\mu$f	Padder, 1st det	SC-D-2575
C_{39}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf–400v	2d r. f. plate bypass	SC-D-1995
C_{40}	3D294	Capacitor CA-294	Fixed air; 125 $\mu\mu$f	Padder, r. f. osc	SC-D-2575
C_{41}	3D278	Capacitor CA-278	Mica; 5 $\mu\mu$f	Cw osc. coupling	SC-D-1993
C_{42}	3D300	Capacitor CA-300	Mica, aged; 3,000 $\mu\mu$f	Band C padder r. f. osc	SC-D-1993
C_{43}	3D297	Capacitor CA-297	Mica, aged; 1,600 $\mu\mu$f	Band B padder r. f. osc	SC-D-1993
C_{44}	3D299	Capacitor CA-299	Mica, aged; 750 $\mu\mu$f	Band A padder r. f. ocs	SC-D-1993
C_{45}	3D266	Capacitor CA-266	Mica; 100 $\mu\mu$f	1st det. grid coupling	SC-D-1993
C_{46}	See note	Capacitor	Ganged with C_{28}, C_{34}, C_{82}; 13–226 $\mu\mu$f.	1st det. tuning	SC-D-2568
C_{47}	3D266	Capacitor CA-226	Mica; 100 $\mu\mu$f	R. f. osc. coupling	SC-D-1993
C_{48}	3D195	Capacitor CA-195	Metal-encased as one unit. 0.05 μf–300 v	1st det. cathode bypass	SC-D-512
C_{49}	3D195	Capacitor CA-195	0.05 μf–300 v	1st det. screen bypass	SC-D-512
C_{50}	3D195	Capacitor CA-195	0.05 μf–300 v	1st det. "B" supply bypass	SC-D-512

C_{51}	3D323	Capacitor CA-323	Variable air, with shaft; 4–50 μμf	Crystal phasing	SC-A-1728
C_{52}	3D342	Capacitor CA-342	Mica; 100 μμf	1st i. f. grid coupling	SC-D-1993
C_{53}	3D344	Capacitor CA-344	Mica; 400 μμf	1st det. plate	SC-D-1993
C_{54}	3D371	Capacitor CA-371	Mica; 0.01 μf–450 v	1st det. plate bypass	RL-D-6222
C_{55}	3D344	Capacitor CA-344	Mica; 400 μμf	2d i. f. grid	SC-D-1993
C_{56}	3D371	Capacitor CA-371	Mica; 0.01 μf–450 v	2d i. f. a. v. c. bypass	RL-D-6222
C_{57}	3D344	Capacitor CA-344	Mica; 400 μμf	1st i. f. plate	SC-D-1993
C_{58}	3D371	Capacitor CA-371	Mica; 0.01 μf–450 v	1st i. f. plate bypass	RL-D-6222
C_{59}	3D302	Capacitor CA-302	Modification of CA-195: 0.05 μf–300 v	1st i. f. cathode bypass	SC-D-2567
C_{60}			0.05 μf–300 v	1st i. f. screen bypass	SC-D-2567
C_{61}			0.05 μf–300 v	1st i. f. "B" supply bypass	SC-D-2567
C_{62}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf–400 v	1st det. a. v. c. bypass	SC-D-1995
C_{63}	3D371	Capacitor CA-371	Mica; 0.01 μf–450 v	1st i. f. a. v. c. bypass	RL-D-6222
C_{64}	3D342	Capacitor CA-342	Mica; 100 μμf	2d det. grid	SC-D-1993
C_{65}	3D342	Capacitor CA-342	Mica; 100 μμf	2d i. f. plate	SC-D-1993
C_{66}	3D371	Capacitor CA-371	Mica; 0.01 μf–450 v	2d i. f. plate bypass	RL-D-6222
C_{67}	3D279	Capacitor CA-279	Mica; 10 μμf	Diode a. v. c. coupling	SC-D-1993
C_{68}	3D301	Capacitor CA-301	Modification of CA-195: 0.05 μf–300 v	2d i. f. cathode bypass	SC-D-2567
C_{69}			0.05 μf–300 v	2d i. f screen bypass	SC-D-2567
C_{70}			0.05 μf–300 v	2d i. f. "B" supply bypass	SC-D-2567
C_{71}	3D218	Capacitor CA-218	Mica; 150 μμf	Diode, r. f. bypass	SC-D-1993
C_{72}	3D193	Capacitor CA-193	Mica; 500 μμf	Diode, r. f. filter	SC-D-1993
C_{73}	3D301	Capacitor CA-301	Modification of CA-195: 0.05 μf–300 v	Diode, cathode bypass	SC-D-2567
C_{74}			0.05 μf–300 v	1st audio plate bypass	SC-D-2567
C_{75}			0.05 μf–300 v	A. v. c. filter bypass	SC-D-2567
C_{76}	3D371	Capacitor CA-371	Mica; 0.01 μf–450 v	1st audio plate r. f. bypass	RL-D-6222
C_{77}	Not used				
C_{78}	3D276	Capacitor CA-276	Metal-encased as one unit: 0.1 μf–400 v	Heater bypass	SC-D-512
C_{79}			0.1 μf–400 v	Heater bypass	SC-D-512
C_{80}			0.1 μf–400 v	2d audio plate bypass	SC-D-512
C_{81}	3D281	Capacitor CA-281	Molded, paper; 0.01 μf–400 v	1st audio coupling	SC-D-1995

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
C_{82}	See note	Capacitor	Ganged with C_{28}, C_{34}, C_{46}; 13–226 $\mu\mu f$.	R. f. osc. tuning	SC-D-2568
C_{83}	3D277	Capacitor CA-277	Molded, paper; 0.1 μf–400 v	R. f. osc. plate bypass	SC-D-1995
C_{84}	3D280	Capacitor CA-280	Variable air, with shaft; 1–10 $\mu\mu f$	Cw osc. tuning	SC-A-1728
C_{85}	3D253	Capacitor CA-253	Variable air; 4–75 $\mu\mu f$	Cw osc. trimmer	SC-A-1728
C_{86}	3D266	Capacitor CA-266	Mica; 100 $\mu\mu f$	Cw osc. grid	SC-D-1993
C_{87}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf–400 v	Cw osc. plate bypass	SC-D-1995
C_{88}	3D266	Capacitor CA-266	Mica; 100 $\mu\mu f$	R. f. osc. grid	SC-D-1993
C_{89}	Not used				
C_{90}	do				
C_{91}	do				
C_{92}	do				
C_{93}	do				
C_{94}	3D298	Capacitor CA-298	Mica; aged, 800 $\mu\mu f$	Crystal filter input	SC-D-1993
C_{95}	3D298	Capacitor CA-298	Mica; aged, 800 $\mu\mu f$	Crystal filter input	SC-D-1993
C_{96}	3D286	Capacitor CA-286	Mica; 75 $\mu\mu f$	Cw osc. filter	SC-D-1993
C_{97}	3D286	Capacitor CA-286	Mica; 75 $\mu\mu f$	Cw osc. filter	SC-D-1993
C_{98}	3D275	Capacitor CA-275	Paper; 4 μf	2d audio cathode bypass	SC-D-512
C_{99}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf–400 v	2d r. f. a. v. c. bypass	SC-D-1995
C_{100}	3D294	Capacitor CA-294	Fixed air; 125 $\mu\mu f$	2d r. f. padder	SC-D-2575
C_{101}	3D266	Capacitor CA-266	Mica; 100 $\mu\mu f$	1st r. f. grid coupling	SC-D-1993
C_{102}	3D284	Capacitor CA-284	Molded, paper; 0.05 μf–400 v	1st r. f. a. v. c. bypass	SC-D-1995
CX	2Z3501-6A	Crystal DC-6-A	470 kc	1st r. f. a. v. c. bypass	SC-D-2972
DM	3H1621B	Dynamotor DM-21-B		D-c power supply	SC-A-2581
F_1	3Z1921A	Fuse FU-21-A	10 amp.–25 v	Dynamotor and filaments	
F_2	3Z1921A	Fuse FU-21-A	10 amp.–25 v	Pilot lights	
FL	3Z1890-6B	Filter FL-6-B	Removable unit	Power supply filter	SC-D-1866
J_1	2Z5534A	Jack JK-34-A	PHONES 1ST AUDIO	1st audio phones	SC-D-439

J_2	2Z5534A	Jack JK-34-A	PHONES 2D AUDIO	2d audio phones	SC-D-439
J_3	2Z5533A	Jack JK-33-A	SPEAKER 2D AUDIO	Speaker	SC-D-483
J_4	2Z5533A	Jack JK-33-A	MICRO	Microphone	SC-D-483
J_5	2Z5534A	Jack JK-34-A	KEY	Key	SC-D-439
L_1		Coil		Band A, 1st r. f	SC-D-2556
L_2		do		Band B, 1st r. f	SC-D-2556
L_3		do		Band C, 1st r. f	SC-D-2556
L_4		do		Band D, 1st r. f	SC-D-2556
L_5		do		Band E, 1st r. f	SC-D-2556
L_6		do		Band F, 1st r. f	SC-D-2556
L_7		do		Band A, 2d r. f	SC-D-2556
L_8		do		Band B, 2d r. f	SC-D-2556
L_9		do		Band C, 2d r. f	SC-D-2556
L_{10}		do		Band D, 2d r. f	SC-D-2556
L_{11}		do		Band E, 2d r. f	SC-D-2556
L_{12}		do		Band F, 2d r. f	SC-D-2556
L_{13}		do		Band A, 1st det	SC-D-2556
L_{14}		do		Band B, 1st det	SC-D-2556
L_{15}		do		Band C, 1st det	SC-D-2556
L_{16}		do		Band D, 1st det	SC-D-2556
L_{17}		do		Band E, 1st det	SC-D-2556
L_{18}		do		Band F, 1st det	SC-D-2556
L_{19}		do		Band A, r. f. osc	SC-D-2556
L_{20}		do		Band B, r. f. osc	SC-D-2556
L_{21}		do		Band C, r. f. osc	SC-D-2556
L_{22}		do		Band D, r. f. osc	SC-D-2556
L_{23}		do		Band E, r. f. osc	SC-D-2556
L_{24}		do		Band F, r. f. osc	SC-D-2556
L_{25}		Coils		Ignition suppressor	SC-D-2571
L_{26}		do		do	SC-D-2571
L_{27}		do		do	SC-D-2571

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
L_{28}		Coils of transformer C–282.		1st detector	SC–D–2564
L_{29}		Coils of transformer C–283.		1st i. f.	SC–D–2564
L_{30}		Coils of transformer C–284.		2d i. f.	SC–D–2564
L_{31}		Coil		Cw beat oscillator	SC–D–2563
L_{32}		do		Filter, cw oscillator	SC–D–2563
LM_1	2Z5893	Neon lamp		Antenna overload protection	SC–A–1801
LM_2	2Z5927	Lamp LM–27	Pilot lamp	Dial light	SC–D–2573
LM_3	2Z5927	Lamp LM–27	do	do	SC–D–2573
R_1	3Z4564	Resistor RS–164	Wire-wound, insul.; 500 ohms, 1 w.	Cathode bias, 1st r. f.	SC–D–970
R_2	3Z4569	Resistor RS–169	Carbon, insul.; 60,000 ohms, ½ w.	Screen grid, 1st r. f.	SC–D–970
R_3	3Z4549	Resistor RS–149	Carbon, insul.; 40,000 ohms, ½ w.	Screen grid, 1st r. f.	SC–D–970
R_4	3Z4572	Resistor RS–172	Carbon, 100,000 ohms, ⅓ w.	A. v. c. filter, 1st r. f.	SC–D–970
R_5	3Z4525	Resistor RS–125	Carbon, 1,000 ohms, ½ w.	Plate filter, 1st r. f.	SC–D–970
R_6	3Z4573	Resistor RS–173	Carbon, 2 megohms, ⅓ w.	Grid, 2d r. f.	SC–D–970
R_7	3Z4564	Resistor RS–164	Wire-wound, insul.; 500 ohms, 1 w.	Cathode bias, 2d r. f.	SC–D–970
R_8	3Z4569	Resistor RS–169	Carbon, insul.; 60,000 ohms, ½ w.	Screen grid, 2d r. f.	SC–D–970
R_9	3Z4549	Resistor RS–149	Carbon, insul.; 40,000 ohms, ½ w.	Screen grid, 2d r. f.	SC–D–970
R_{10}	3Z4572	Resistor RS–172	Carbon, 100,000 ohms, ⅓ w.	A. v. c. filter, 2d r. f.	SC–D–970
R_{11}	3Z4525	Resistor RS–125	Carbon, 1,000 ohms, ½ w.	Plate filter, 2d r. f.	SC–D–970
R_{12}	3Z4573	Resistor RS–173	Carbon, 2 megohms, ⅓ w.	Grid, 1st det.	SC–D–970
R_{13}	3Z4568	Resistor RS–168	Carbon, 50,000 ohms, ⅓ w.	Suppressor bias, 1st det.	SC–D–970
R_{14}	3Z4566	Resistor RS–166	Wire-wound, insul.; 350 ohms, 1 w.	Cathode bias, 1st det.	SC–D–970

R_{15}	3Z4540	Resistor RS-140	Carbon, insul.; 30,000 ohms, ½ w	Screen grid, 1st det	SC-D-970
R_{16}	3Z4572	Resistor RS-172	Carbon, 100,000 ohms, ⅓ w	A. v. c. filter, 1st det	SC-D-970
R_{17}	3Z4525	Resistor RS-125	Carbon, insul.; 1,000 ohms, ½ w	Plate filter, 1st det	SC-D-970
R_{18}	3Z4572	Resistor RS-172	Carbon, 100,000 ohms, ⅓ w	A. v. c. filter, 1st i. f	SC-D-970
R_{19}	3Z4564	Resistor RS-164	Wire-wound, insul.; 500 ohms, 1 w.	Cathode bias, 1st i. f	SC-D-970
R_{20}	3Z4563	Resistor RS-163	Carbon, insul.; 60,000 ohms, 1 w	Screen grid, 1st i. f	SC-D-970
R_{21}	3Z4549	Resistor RS-149	Carbon, insul.; 40,000 ohms, ½ w	Screen grid, 1st i. f	SC-D-970
R_{22}	3Z4525	Resistor RS-125	Carbon, insul.; 1,000 ohms, ½ w	Plate filter, 1st i. f	SC-D-970
R_{23}	3Z4550	Resistor RS-150	Carbon, insul.; 100,000 ohms, ½ w.	A. v. c. filter, 2d i. f	SC-D-970
R_{24}	3Z4564	Resistor RS-164	Wire-wound, insul.; 500 ohms, 1 w.	Cathode bias, 2d i. f	SC-D-970
R_{25}	3Z4563	Resistor RS-163	Carbon, insul.; 60,000 ohms, 1 w	Screen grid, 2d i. f	SC-D-970
R_{26}	3Z4549	Resistor RS-149	Carbon, insul.; 40,000 ohms, ½ w	Screen grid, 2d i. f	SC-D-970
R_{27}	3Z4525	Resistor RS-125	Carbon, insul.; 1,000 ohms, ½ w	Plate filter, 2d i. f	SC-D-970
R_{28}	3Z4571	Resistor RS-171	Wire-wound, insul.; 750 ohms, 1 w.	Cathode bias, diode	SC-D-970
R_{29}	3Z4562	Resistor RS-162	Carbon, insul.; 250,000 ohms, ½ w.	A. v. c. filter, diode	SC-D-970
R_{30}	3Z4561	Resistor RS-161	Carbon, 1 megohm, ⅓ w	A. v. c. load	SC-D-970
R_{31}	3Z4623	Resistor RS-223	Wire-wound, insul.; 2,000 ohms, 1 w.	Cathode bias, 2d audio	SC-D-970
R_{32}	3Z4562	Resistor RS-162	Carbon, insul.; 250,000 ohms, ½ w.	Grid, 1st a. f	SC-D-970
R_{33}	3Z4531	Resistor RS-131	Carbon, insul.; 50,000 ohms, ½ w	Grid, 2d a. f	SC-D-970
R_{34} R_{35}	2Z7289	Potentiometer RS-174	0-500, 000 ohms, 0- 50, 000 ohms, 1 w	Dual volume control	SC-D-1982
R_{36}	3Z4550	Resistor RS-150	Carbon, insul.; 100,000 ohms, ½ w.	Minimum bias bleeder	SC-D-970
R_{37}	3Z4550	Resistor RS-150	Carbon, insul.; 100,000 ohms, ½ w.	Cw osc. plate	SC-D-970

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
R_{38}	3Z4569	Resistor RS-169	60,000 ohms, ½ w	Plate circuit loading	SC-D-970
R_{39}	Not used				
R_{40}	Not used				
R_{41}	3Z4539	Resistor RS-139	Carbon, insul.; 30,000 ohms, 1 w	Plate, r. f. osc	SC-D-970
R_{42}	3Z4540	Resistor RS-140	Carbon, insul.; 30,000 ohms, ½ w	Grid, r. f. osc	SC-D-970
R_{43}	3Z4548	Resistor RS-148	Carbon, insul.; 200,000 ohms, ½ w.	Grid, cw osc	SC-D-970
R_{44}	3Z4635	Resistor RS-235	Carbon, insul.; 3,000 ohms, 1 w	Cathode, band C, r. f. osc	SC-D-970
R_{45}	3Z4637	Resistor RS-237	Carbon, insul.; 5,000 ohms, 1 w	Cathode, band B, r. f. osc	SC-D-970
R_{46}	3Z4638	Resistor RS-238	Carbon, insul.; 7,500 ohms, 1 w	Cathode, band A, r. f. osc	SC-D-970
R_{47}	3Z4576	Resistor RS-176	Carbon, insul.; 60 ohms, ½ w	Filament shunt, diode	SC-D-970
R_{48}	3Z4569	Resistor RS-169	Carbon, insul.; 60,000 ohms, ½ w	Screen grid, 1st det	SC-D-970
R_{49}	3Z4533	Resistor RS-133	Carbon, insul.; 500,000 ohms, ½ w.	R. f. filter diode	SC-D-970
R_{50}	3Z4540	Resistor RS-140	Carbon, insul.; 30,000 ohms, ½ w	Screen grid, 1st det	SC-D-970
R_{51}	3Z4529	Resistor RS-129	Carbon, insul.; 10,000 ohms, ½ w	Filter load, cw osc	SC-D-970
R_{52}	3Z4575	Resistor RS-175	Carbon, 10,000 ohms, ⅓ w	A. v. c. filter, 1st i. f	SC-D-970
R_{53}	3Z4573	Resistor RS-173	Carbon, 2 megohms, ⅓ w	Grid, 1st r. f	SC-D-970
R_{54}	3Z4623	Resistor RS-223	Wire-wound, insul.; 2,000 ohms, 1 w.	2d audio bias	SC-D-970
RL_1	2Z7613	Relay BK-13		Antenna grounding	SC-D-1942
SO_1	2Z8794.1	Socket SO-94		Power supply and control	SC-D-2592
SW_1	3Z8131	Switch SW-131	Toggle (SEND REC)	Send-receive	SC-A-1042

SW_2	3Z8310-2	Switch	Ganged (BAND CHANGE)	Band change, 1st r. f. grid	SC-D-2553
SW_3	3Z8310-1	Switch	Ganged (BAND CHANGE)	Band change, 1st r. f. antenna	SC-D-2553
SW_4	3Z8310-2	Switch	Ganged (BAND CHANGE)	Band change, 2d r. f. grid	SC-D-2553
SW_5	3Z8310-2	Switch	Ganged (BAND CHANGE)	Band change, 1st r. f. plate	SC-D-2553
SW_6	3Z8310-2	Switch	Ganged (BAND CHANGE)	Band change, 1st det. grid	SC-D-2553
SW_7	3Z8310-2	Switch	Ganged (BAND CHANGE)	Band change, 2d r. f. plate	SC-D-2553
SW_8	3Z8310-2	Switch	Ganged (BAND CHANGE)	Band change, r. f. osc. grid	SC-D-2553
SW_9	3Z8310-2	Switch	Ganged (BAND CHANGE)	Band change, r. f. osc. plate	SC-D-2553
SW_{10}		Switch	Ganged to C_{51}	Crystal switch	SC-D-2564
SW_{11}	3Z8139	Switch SW-139	Toggle (CW OSC OFF ON)	Cw osc	SC-A-1042
SW_{12}	3Z8119	Switch SW-119	Rotary (OFF MVC AVC)	On-off, m. v. c., a. v. c.	SC-D-2574
T_1	2Z9805	Transformer C-205	Audio frequency 5,000/2,500 turn ratio.	1st audio	SC-D-2567
T_2	2Z9760	Transformer C-160	Audio frequency 5,000/1,885 turn ratio.	2d audio	SC-D-2569

NOTE.—C_{28}, C_{34}, C_{46}, and C_{82} ganged comprise capacitor CA-292 (3D292).

c. Radio transmitter BC–223.

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
11	3D177A	Capacitor CA–177–A	Paper 0.5 μf	Side tone coupling	SC–D–512
12–1	3D183	Capacitor CA–183	Mica; 0.01 μf–1,250 v	Plate bypass	RL–D–6222
12–2	3D183	Capacitor CA–183	Mica; 0.01 μf–1,250 v	Grid bypass	RL–D–6222
13	3D211	Capacitor CA–211	Mica; 0.002 μf–250 v	Meter bypass	SC–D–1993
14–1	3D321	Capacitor CA–321	Pyranol 0.5 μf–1,000 v	Plate bypass	SC–D–512
14–2	3D321	Capacitor CA–321	Pyranol 0.5 μf–1,000 v	Grid bypass	SC–D–512
14–3	3D321	Capacitor CA–321	Pyranol 0.5 μf–1,000 v	Plate bypass	SC–D–512
14–4	3D321	Capacitor CA–321	Pyranol 0.5 μf–1,000 v	Plate bypass	SC–D–512
15–1	3D322	Capacitor CA–322	1 μf–500 v	Audio coupling	SC–D–512
15–2	3D322	Capacitor CA–322	1 μf–500 v	Audio bypass	SC–D–512
15–3	3D322	Capacitor CA–322	1 μf–500 v	Audio bypass	SC–D–512
16–1A			Ganged: 80 $\mu\mu f$	Power amplifier tuning	SC–D–1461
16–2A			Ganged: 100 $\mu\mu f$	Power amplifier tuning	SC–D–1461
16–2B			Ganged: 100 $\mu\mu f$	Power amplifier tuning	SC–D–1461
16–2C	3D325	Capacitor CA–325	Ganged: 100 $\mu\mu f$	Master oscillator tuning	SC–D–1461
16–2D			Ganged: 100 $\mu\mu f$	Master oscillator tuning	SC–D–1461
16–3A			Ganged: 200 $\mu\mu f$	Master oscillator tuning	SC–D–1461
16–3B			Ganged: 200 $\mu\mu f$	Master oscillator tuning	SC–D–1461
17	3D337	Capacitor CA–337	Electrolytic; 16 μf–200 v	Surge quenching	SC–D–1291
18	3Z4537	Resistor RS–137	Vitreous; 25,000 ohms	Keying	RL–D–6223
19	3Z4602	Resistor RS–202	Vitreous; 0.75 ohm	Filament	RL–D–6223
20	3Z4604	Resistor RS–204	Vitreous; 3,500 ohms	Power amplifier and audio amplifier bias.	RL–D–6223
21	3Z4605	Resistor RS–205	Vitreous; 11,500 ohms	Power amplifier bias	RL–D–6223
22–1	3Z4606	Resistor RS–206	Vitreous; 1,000 ohms	Modulator grid load	RL–D–6223
22–2	3Z4606	Resistor RS–206	Vitreous; 1,000 ohms	Modulator grid load	RL–D–6223
23	3Z4612	Resistor RS–212	100 ohms, 1 w	Interrupter	SC–D–970

24-1	3Z4608	Resistor RS-208	100,000 ohms, 1 w	Bleeder	SC-D-970
24-2	3Z4608	Resistor RS-208	100,000 ohms, 1 w	Bleeder	SC-D-970
25-1	3Z4470	Resistor RS-70	5,000 ohms	Audio amplifier plate	RL-D-6223
25-2	3Z4470	Resistor RS-70	5,000 ohms	Master oscillator plate	RL-D-6223
26	2Z7287	Potentiometer RS-152	100 ohms	Tone output control	SC-D-1982
27	2Z9759	Transformer C-159	Audio freq.; 12.5:1 pri. to sec. 50:1 pri. to tertiary.	Audio input	SC-D-1373
28	2Z9823	Transformer C-223	Audio freq.; 2:1 sec. to each pri.	Audio output	SC-D-1420
29	2Z9824	Transformer C-224	Audio freq.; 3:1 sec. to each pri.	Modulating transformer	SC-D-1419
30-A, B	3Z8116	Switch SW-116	2-pole, single throw	On-off	SC-A-1042
31	3Z8132	Switch SW-132	Rotary 16 contacts	Signal	SC-D-1854
32	3Z8133	Switch SW-133	Toggle normally closed	Osc. current-total current	SC-A-1042
33	2Z7616	Relay BK-16	Double coil	Keying	SC-A-877
34	4Z5007	Interrupter BZ-7	Single button	Tone source	SC-D-2587
35	2Z5933	Lamp LM-33	Mazda No. 16	Dial light	
36	2Z5543	Jack JK-43		Microphone	SC-D-1585
37	2Z5544	Jack JK-44		Key	SC-D-1585
38	3F328	Ammeter IS-128	Flush mounting; 0-3 amp r.f	Output current	SC-D-1549
39	3F329	Ammeter IS-129	Flush mounting; 0-300 ma d-c	Plate current	SC-D-1549
40	3Z4607	Resistor RS-207	750 ohms, 1 w	Interrupter	SC-D-970

d. Transmitter tuning unit TU-17.

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
51	3D331	Capacitor CA-331	Variable air; 35 $\mu\mu f$	Trimmer, power amplifier	SC-D-2811
52	3D330	Capacitor CA-330	Variable air; 50 $\mu\mu f$	Neutralizing capacitor	SC-D-2811
53	3D332	Capacitor CA-332	Variable air; 200 $\mu\mu f$	Trimmer, osc	SC-D-2811
54-1	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	R. f. coupling power amplifier	RL-D-6222
54-2	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	R. f. coupling osc	RL-D-6222
55-1	3D174	Capacitor CA-174	Mica; 0.002 μf	R. f. coupling stage	RL-D-6222
55-2	3D174	Capacitor CA-174	Mica; 0.002 μf	R. f. coupling master osc. grid	RL-D-6222
56	3Z4537	Resistor RS-137	Vitreous; 25,000 ohms	Bias oscillator	RL-D-6223
57-1	2C8017/10	Coil, r. f. choke		R. f. choke power amplifier plate.	SC-D-2802
57-2	2C8017/10	Coil, r. f. choke		R. f. choke power amplifier grid.	SC-D-2802
57-3	2C8017/10	Coil, r. f. choke		R. f. choke osc. plate	SC-D-2802
58	2C8017/33	Variometer		Antenna tuning	SC-D-2804
59	2C8017/11	Variocoupler		Output coupling	SC-D-2807
60	2C8017/12	Inductance, oscillator		Oscillator inductance	SC-D-2803
61-1	3Z8137	Switch SW-137	Rotary	Inductance change	SC-D-2812
61-2	3Z8137	Switch SW-137	Rotary	Crystal selector	SC-D-2812
62-1	2Z3531	Crystal holder FT-171	Crystal and crystal holder	Frequency control	SC-A-2813
62-2	2Z3531	Crystal holder FT-171	Crystal and crystal holder	Frequency control	SC-A-2813
62-3	2Z3531	Crystal holder FT-171	Crystal and crystal holder	Frequency control	SC-A-2813
62-4	2Z3531	Crystal holder FT-171	Crystal and crystal holder	Frequency control	SC-A-2813

e. Transmitter tuning unit TU-18.

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
71	3D331	Capacitor CA-331	Variable air; 35$\mu\mu$f	Trimmer, power amplifier	SC-D-2811
72	3D330	Capacitor CA-330	Variable air; 50 $\mu\mu$f	Neutralizing capacitor	SC-D-2811
73	3D332	Capacitor CA-332	Variable air; 200 $\mu\mu$f	Trimmer, osc	SC-D-2811
74-1	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	R. f. coupling power amplifier	RL-D-6222
74-2	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	R. f. coupling osc	RL-D-6222
75-1	3D174	Capacitor CA-174	Mica; 0.002 μf	R. f. coupling stage	RL-D-6222
75-2	3D174	Capacitor CA-174	Mica; 0.002 μf	R. f. coupling master osc. grid	RL-D-6222
76	3Z4537	Resistor RS-137	Vitreous; 25,000 ohms	Bias, oscillator	RL-D-6223
77-1	2C8018/10	Coil, r. f. choke		R. f. choke power amplifier plate.	SC-D-2802
77-2	2C8018/10	Coil, r. f. choke		R. f. choke power amplifier grid.	SC-D-2802
77-3	2C8018/10	Coil, r. f. choke		R. f. choke osc. plate	SC-D-2802
78	2C8018/33	Variometer		Antenna tuning	SC-D-2804
79	2C8018/11	Variocoupler		Output coupling	SC-D-2807
80	2C8018/12	Inductance, oscillator		Oscillator inductance	SC-D-2803
81-1	3Z8137	Switch SW-137	Rotary	Inductance change	SC-D-2812
81-2	3Z8137	Switch SW-137	Rotary	Crystal selector	SC-D-2812
82-1	2Z3531	Crystal holder FT-171	Crystal and crystal holder	Frequency control	SC-A-2813
82-2	2Z3531	Crystal holder FT-171	Crystal and crystal holder	Frequency control	SC-A-2813
82-3	2Z3531	Crystal holder FT-171	Crystal and crystal holder	Frequency control	SC-A-2813
82-4	2Z3531	Crystal holder FT-171	Crystal and crystal holder	Frequency control	SC-A-2813

f. Radio transmitter BC-223-A.

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
11	3D243	Capacitor CA-243	Paper 0.5 μf	Side tone coupling	SC-D-512
12-1	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	Plate bypass	RL-D-6222
12-2	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	Grid bypass	RL-D-6222
13	3D211	Capacitor CA-211	Mica; 0.002 μf-250 v	Meter bypass	SC-D-1993
14-1	3D321	Capacitor CA-321	Pyranol 0.5 μf-1,000 v	Plate bypass	SC-D-512
14-2	3D321	Capacitor CA-321	Pyranol 0.5 μf-1,000 v	Grid bypass	SC-D-512
14-3	3D321	Capacitor CA-321	Pyranol 0.5 μf-1,000 v	Plate bypass	SC-D-512
14-4	3D321	Capacitor CA-321	Pyranol 0.5 μf-1,000 v	Plate bypass	SC-D-512
15-1	3D322	Capacitor CA-322	1 μf-500 v	Audio coupling	SC-D-512
15-2	3D322	Capacitor CA-322	1 μf-500 v	Audio bypass	SC-D-512
15-3	3D322	Capacitor CA-322	1 μf-500 v	Audio bypass	SC-D-512
16-1			Ganged 80 $\mu\mu f$	Power amplifier tuning	SC-D-1461
16-2A	3D325	Capacitor CA-325	Ganged 100 $\mu\mu f$	Power amplifier tuning	SC-D-1461
16-2B	or		Ganged 100 $\mu\mu f$	Power amplifier tuning	SC-D-1461
	3D325A	Capacitor CA-325-A			
16-2C	or		Ganged 100 $\mu\mu f$	Master oscillator tuning	SB-D-1461
16-2D	3D325B	Capacitor CA-325-B	Ganged 100 $\mu\mu f$	Master oscillator tuning	SC-D-1461
16-3A	or		Ganged 200 $\mu\mu f$	Master oscillator tuning	SC-D-1461
16-3B	3D325C	Capacitor CA-325-C	Ganged 200 $\mu\mu f$	Master oscillator tuning	SC-D-1461
17	3D337	Capacitor CA-337	Electrolytic; 16 μf-200 v	Surge quenching	SC-D-1291
18	3Z4537	Resistor RS-137	Vitreous; 25,000 ohms	Keying	RL-D-6223
19	3Z4602	Resistor RS-202	Vitreous; 0.75 ohm	Filament	RL-D-6223
20	3Z4604	Resistor RS-204	Vitreous; 3,500 ohms	Power amplifier and audio amplifier bias.	RL-D-6223
21	3Z4605	Resistor RS-205	Vitreous; 11,500 ohms	Power amplifier bias	RL-D-6223
22-1	3Z4606	Resistor RS-206	Vitreous; 1,000 ohms	Modulator grid load	RL-D-6223

2-2	3Z4606	Resistor RS-206	Vitreous; 1,000 ohms	Modulator grid load	RL-D-6223
23	3Z4612	Resistor RS-212	100 ohms, 1 w	Interrupter	SC-D-970
24-1	3Z4608	Resistor RS-208	100,000 ohms, 1 w	Bleeder	SC-D-970
24-2	3Z4608	Resistor RS-208	100,000 ohms, 1 w	Bleeder	SC-D-970
25-1	3Z4470	Resistor RS-70	5,000 ohms	Audio amplifier plate	RL-D-6223
25-2	3Z4470	Resistor RS-70	5,000 ohms	Master oscillator plate	RL-D-6223
26	2Z7287	Potentiometer RS-152	100 ohms	Tone output control	SC-D-1982
27	2Z9759	Transformer C-159	Audio freq.; 12:51 pri. to sec. 50:1 pri. to tertiary.	Audio input	SC-D-1373
28	2Z9823	Transformer C-223	Audio freq.; 2:1 sec. to each pro.	Modulating transformer	SC-D-1420
29	2Z9824	Transformer C-224	Audio freq.; 2:1 sec. to each pri.	Audio interstage	SC-D-1419
30-A, B	3Z8116	Switch SW-116	2-pole, single throw	On-off	SC-A-1042
31	3Z8132	Switch SW-132	Rotary 16 contacts	Signal	SC-D-1854
32	3Z8133	Switch SW-133	Toggle normally closed	Osc. current-total current	SC-A-1042
33	2Z7616	Relay BK-16	Double coil	Keying	SC-A-877
34	4Z5007D	Interrupter BZ-7-(#)	Single button	Tone source	SC-D-2587
35	2Z5933	Lamp LM-33	Mazda No. 16	Dial light	
36	2Z5533A	Jack JK-33-A		Microphone	SC-D-1585
37	2Z5534A	Jack JK-34-A		Key	SC-D-1585
38	3F328	Ammeter IS-128	Flush mounting; 0-3 amp. r. f	Output current	SC-D-1549
39	3F329	Ammeter IS-129	Flush mounting; 0-300 ma d-c	Plate current	SC-D-1549
40	3Z4607	Resistor RS-207	750, 1 w	Interrupter	SC-D-970
41	2Z8779	Socket SO-79	8-contact; fits PL-149 or PL-159.	Control connections	SC-D-1506
42	2Z8780	Socket SO-80	8-contact; fits PL-150 or PL-160.	Power connections	SC-D-1506

g. Transmitter tuning unit TU-17-B.

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
51	3D377	Capacitor CA-377	Variable air; 55 $\mu\mu f$	Trimmer, power amplifier	SC-D-2811
52	3D330	Capacitor CA-330	Variable air; 50 $\mu\mu f$	Neutralizing capacitor	SC-D-2811
53	3D332	Capacitor CA-332	Variable air; 200 $\mu\mu f$	Trimmer, osc	SC-D-2811
54-1	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	R. f. coupling power amplifier	RL-D-6222
54-2	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	R. f. coupling osc	RL-D-6222
55	3D174	Capacitor CA-174	Mica; 0.022 μf	R. f. coupling stage	RL-D-6222
56	3Z4537	Resistor RS-137	Vitreous; 25,000 ohms	Bias oscillator	RL-D-6223
57-1	2C8017/10	Coil assembly, choke, r. f		R. f. choke power amplifier plate.	SC-D-2802
57-2	2C8017/10	Coil assembly, choke, r. f		R. f. choke power amplifier grid.	SC-D-2802
57-3	2C8017/10	Coil assembly, choke, r. f		R. f. choke osc. plate	SC-D-2802
58	2C8017/33	Variometer assembly		Antenna tuning	SC-D-2804
59	2C8017/11	Coil assembly, coupling		Output coupling	SC-D-2807
60	2C8017/12	Coil assembly, oscillator		Oscillator inductance	SC-D-2803
61-1	3Z8137	Switch SW-137	Rotary	Inductance change	SC-D-2812
61-2	3Z8137	Switch SW-137	Rotary	Crystal selector	SC-D-2812
62-1	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
62-2	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
62-3	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
62-4	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
63	3D365	Capacitor CA-365	Mica; fixed; 100 $\mu\mu f$	R. f. coupling master osc. grid.	RL-D-6222
64	3D401	Capacitor CA-901	Ceramic, fixed; 40 $\mu\mu f$	Compensating	SC-D-4147
65	2C8017B/C1	Compensating coil		Tracking adjustment	SC-D-4987

h. Transmitter tuning unit TU-18-B.

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
71	3D377	Capacitor CA-377	Variable air; 55 $\mu\mu f$	Trimmer, power amplifier	SC-D-2811
72	3D330	Capacitor CA-330	Variable air; 50 $\mu\mu f$	Neutralizing capacitor	SC-D-2811
73	3D376	Capacitor CA-376	Variable air; 100 $\mu\mu f$	Trimmer, osc	SC-D-2811
74-1	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	R. f. coupling power amplifier	RL-D-6222
74-2	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	R. f. coupling osc	RL-D-6222
75	3D174	Capacitor CA-174	Mica; 0.002 μf	R. f. coupling stage	RL-D-6222
76	3Z4537	Resistor RS-137	Vitreous; 25,000 ohms	Bias oscillator	RL-D-6223
77-1	2C8018/10	Coil assembly, choke, r. f		R. f. choke power amplifier plate.	SC-D-2802
77-2	2C8018/10	Coil assembly, choke, r. f		R. f. choke power amplifier grid.	SC-D-2802
77-3	2C8018/10	Coil assembly, choke, r. f		R. f. choke osc. plate	SC-D-2802
78	2C8018/33	Variometer assembly		Antenna tuning	SC-D-2804
79	2C8018/11	Coil assembly, coupling		Output coupling	SC-D-2807
80	2C8018/12	Coil assembly, oscillator		Oscillator inductance	SC-D-2803
81-1	3Z8137	Switch SW-137	Rotary	Inductance change	SC-D-2812
81-2	3Z8137	Switch SW-137	Rotary	Crystal selector	SC-D-2812
82-1	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
82-2	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
82-3	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
82-4	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
83	3D365	Capacitor CA-365	Mica, fixed; 100 $\mu\mu f$	R. f. coupling master osc. grid.	RL-D-6222
84	3D402	Capacitor CA-402	Ceramic, fixed; 15 $\mu\mu f$	Compensator	SC-D-4147
85	2C8017B/C1	Compensating coil		Tracking adjustment	SC-D-4987

i. Transmitter tuning unit TU-25-A.

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
91	3D377	Capacitor CA-277	Variable air; 55 $\mu\mu f$	Trimmer, power amplifier	SC-D-2811
92	3D330	Capacitor CA-330	Variable air; 50 $\mu\mu f$	Neutralizing capacitor	SC-D-2811
93	3D376	Capacitor CA-376	Variable air; 100 $\mu\mu f$	Trimmer, osc	SC-D-2811
94-1	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	R. f. coupling power amplifier	RL-D-6222
94-2	3D183	Capacitor CA-183	Mica; 0.01 μf-1,250 v	R. f. coupling osc	RL-D-6222
95	3D174	Capacitor CA-174	Mica; 0.002 μf	R. f. coupling stage	RL-D-6222
96	3Z4537	Resistor RS-137	Vitreous; 25,000 ohms	Bias, oscillator	RL-D-6223
97-1	2C8018/10	Coil assembly, choke, r. f		R. f. choke power amplifier plate.	SC-D-2802
97-2	2C8018/10	Coil assembly, choke, r. f		R. f. choke power amplifier grid.	SC-D-2802
97-3	2C8018/10	Coil assembly, choke, r. f		R. f. choke osc. plate	SC-D-2802
98	2C8018/33	Variometer assembly		Antenna tuning	SC-D-2804
99	2C8018/11	Coil assembly, coupling		Output coupling	SC-D-2807
100	2C8018/12	Coil assembly, oscillator		Oscillator inductance	SC-D-2803
101-1	3Z8137	Switch SW-137	Rotary	Inductance change	SC-D-2812
101-2	3Z8137	Switch SW-137	Rotary	Crystal selector	SC-D-2812
102-1	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
102-2	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
102-3	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
102-4	2Z3531B	Crystal holder FT-171-B	Crystal and crystal holder	Frequency control	SC-D-5213
103	3D365	Capacitor CA-365	Mica, fixed; 100 $\mu\mu f$	R. f. coupling, no grid	RL-D-6222
104	3D391	Capacitor CA-391	Ceramic, fixed, 20 $\mu\mu f$	Compensating	
105	2C8017B/C1	Compensating coil		Tracking adjustment	SC-D-4987

j. Dynamotor unit PE-55.

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
1-1	3D333	Capacitor CA-333	Paper; 1 µf-1,000 v	Filter high voltage	SC-D-512
1-2	3D333	Capacitor CA-333	Paper; 1 µf-1,000 v	Filter high voltage	SC-D-512
1-3	3D333	Capacitor CA-333	Paper; 1 µf-1,000 v	Filter high voltage	SC-D-512
2-1	3D328	Capacitor CA-328	Paper; 2 µf-600 v	Filter low voltage	SC-D-512
2-2	3D328	Capacitor CA-328	Paper; 2 µf-600 v	Filter low voltage	SC-D-512
3	3H1619A	Dynamotor DM-19-A	500 v	High-voltage source	SC-A-2789
4	3Z1926	Fuse FU-26	250 v-1 amp	High-voltage protective	SC-D-2784
5	3Z1930	Fuse FU-30	250 v-30 amp	Low-voltage protective	SC-D-2784
6	3H1855/38	Coil, filter		Filter low voltage	SC-D-2788
7	3Z4611	Resistor RS-211	2½'' x ⅝''-2.0 ohms	Filament voltage adjusting	RL-D-6223
8	3Z4602	Resistor RS-202	Vitreous, 0.75 ohm	Braking	RL-D-6223
9	2Z7617	Relay BK-17	14 v-3 amp	Fil. and dyn. control	SC-A-887
10	2Z8780	Socket SO-80	8-prong	Output connection	SC-D-1506

k. Control box BC-321.

Reference No.	Stock No.	Name of part	Description	Function	Drawing No.
101-1	2Z7297	Potentiometer RS-218	0-10,000 ohms		SC-D-1982
101-2	2Z7297	Potentiometer RS-218	0-10,000 ohms		SC-D-1982
102-1	2Z5534-A	Jack JK-34-A			SC-D-2339
102-2	2Z5534-A	Jack JK-34-A			SC-D-2339
103	2Z5533-A	Jack JK-33-A			SC-D-2332
104	3Z8127	Switch SW-127			SC-D-2245
105	3E2173	Cord CO-173			SC-D-2639

[A. G. 062.11 (12-31-41).]

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Chief of Staff.

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

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