TM 11-982

WAR DEPARTMENT TECHNICAL MANUAL

BATTERY CHARGER PE-219

WAR DEPARTMENT 23 APRIL 1945

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TM 11-982, Battery Charger PE-219, is published for the information and guidance of all concerned.

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

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LIST OF ILLUSTRATIONS

DESTRUCTION NOTICE

WHY —To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN—When ordered by your commander.

HOW —1. Smash—Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut—Use axes, handaxes, machetes.

3. Burn—Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives—Use firearms, grenades, TNT.

5. Disposal—Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT—1. Smash—Vibrators, transformers, sockets, coils, chokes, connectors, Jones plug, circuit breaker.

2. Cut—All wiring, cabling, coils, transformer windings.

3. Burn—All parts.

4. Bend—Cabinet, chassis.

5. Bury or scatter—All parts.

DESTROY EVERYTHING

SAFETY NOTICE

With the battery charger turned on, the only possibility of shock is from touching leads to capacitor C-208 or transformer leads to terminals 5 and 10. Voltages as high as 200 volts are present at these points.

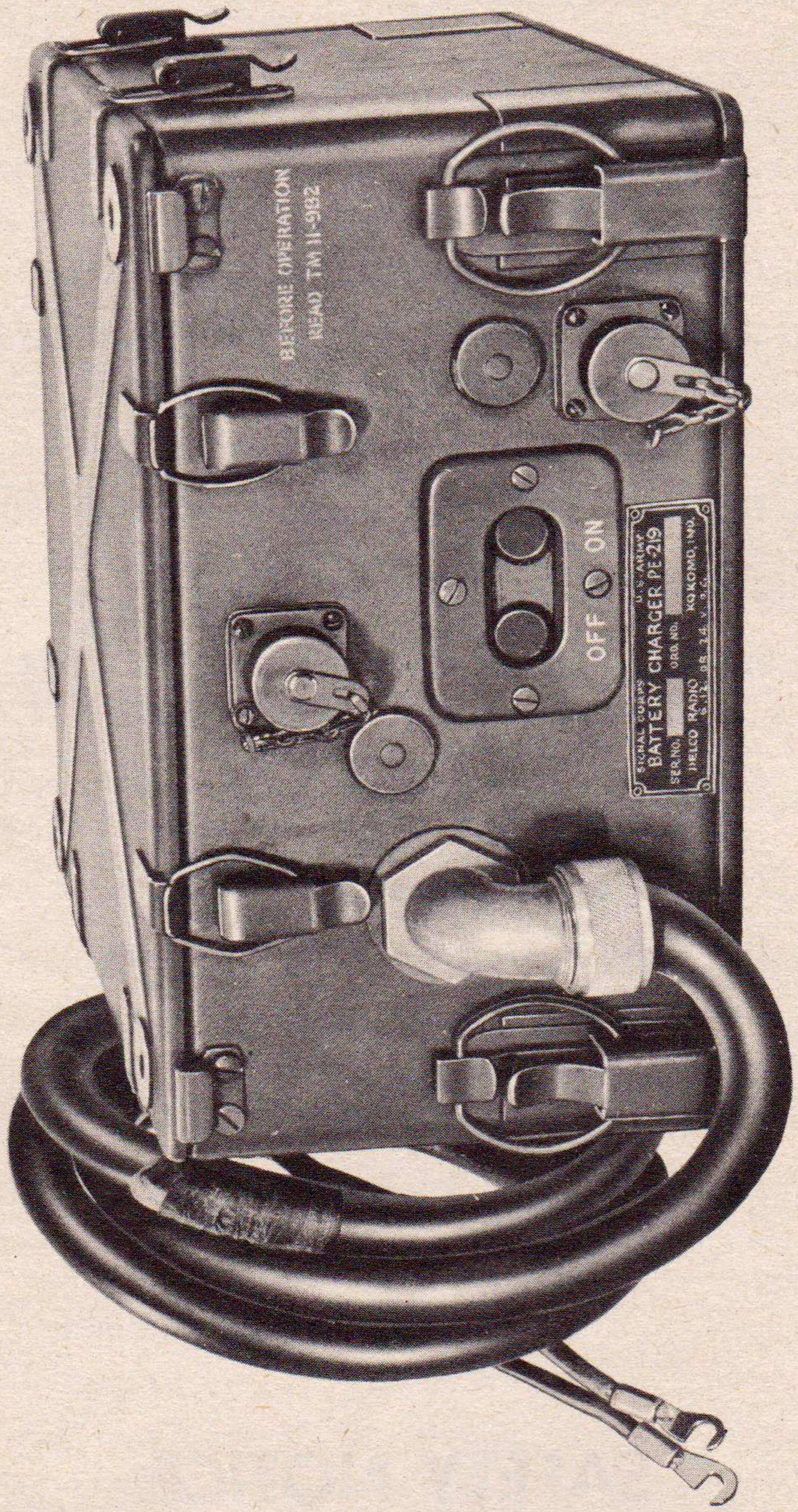

Figure 1. Battery Charger PE-219.

PART ONE

INTRODUCTION

SECTION I. DESCRIPTION OF BATTERY CHARGER PE-219

1. GENERAL.

a. Description. Battery Charger PE-219 (fig. 1) is designed to charge three Batteries BB-54-A in series from a 6-, 12-, or 24-volt d-c (direct-current) source. The unit is housed in a waterproof case and is provided with water-sealed cables and connectors which connect the charger unit to the supply battery, and to the battery that operates the receiver-transmitter. The charger uses one plug-in vibrator which also serves as a rectifier. **No tubes are used in the charger.** Battery Charger PE-219 uses a circuit breaker instead of fuses. The circuit breaker is built into the OFF-ON button control. There is no necessity for adjustment on any part of this battery charger.

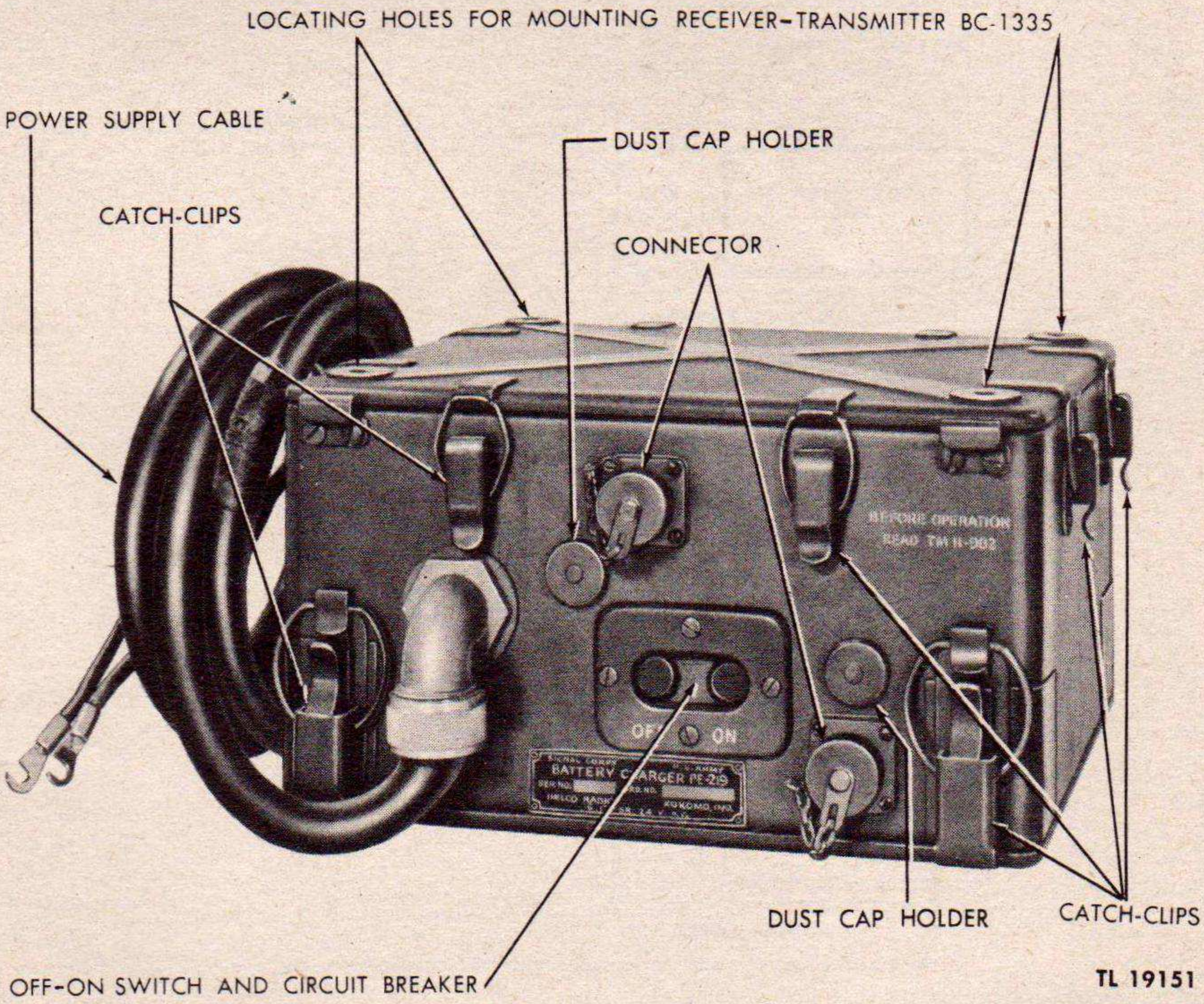

Figure 2. Battery Charger PE-219, labeled overall illustration.

b. Purpose. Battery Charger PE-219 is intended primarily as a component of Radio Set SCR-619, but may be used with other sets which use three Batteries BB-54-A in series and are equipped with matching connectors.

c. Use. Battery Charger PE-219, designed for vehicular mounting will charge a 6-volt radio storage battery whether the battery is disconnected or connected to the radio set. The charger operates whether the radio set is on or off.

2. APPLICATION.

Battery Charger PE-219 is connected directly to a vehicular 6-, 12-, or 24-volt battery or similar power source when used as a charging unit with or without a radio set. Figure 3 is a simple

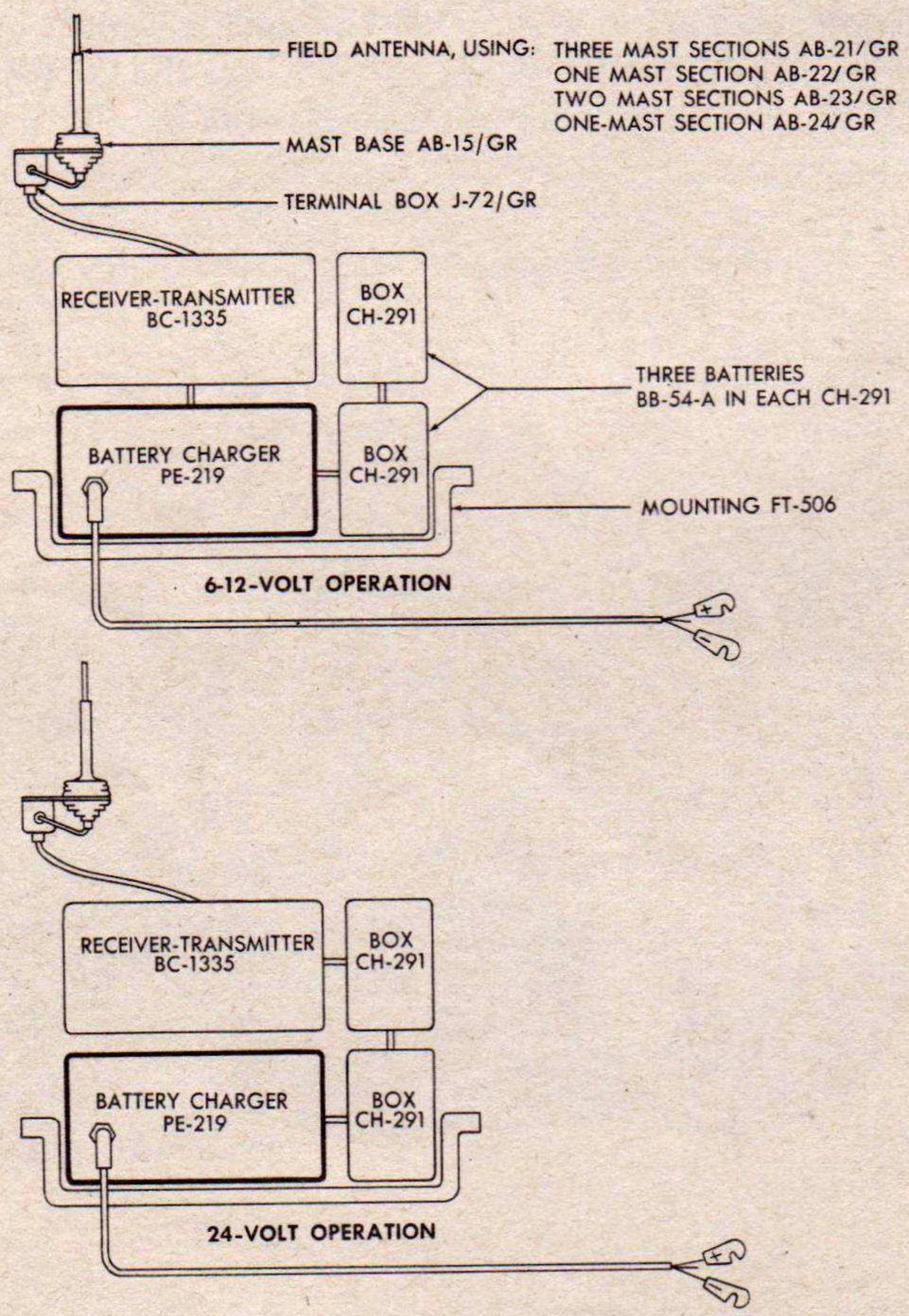

Figure 3. Battery Charger PE-219 installed in Radio Set SCR-619, simplified block diagram.

block diagram of a typical installation, showing the relation of the battery charger to major components of Radio Set SCR-619.

3. TECHNICAL CHARACTERISTICS.

Minimum operating voltage	5.7
Maximum operating voltage	24
Type of current	d-c

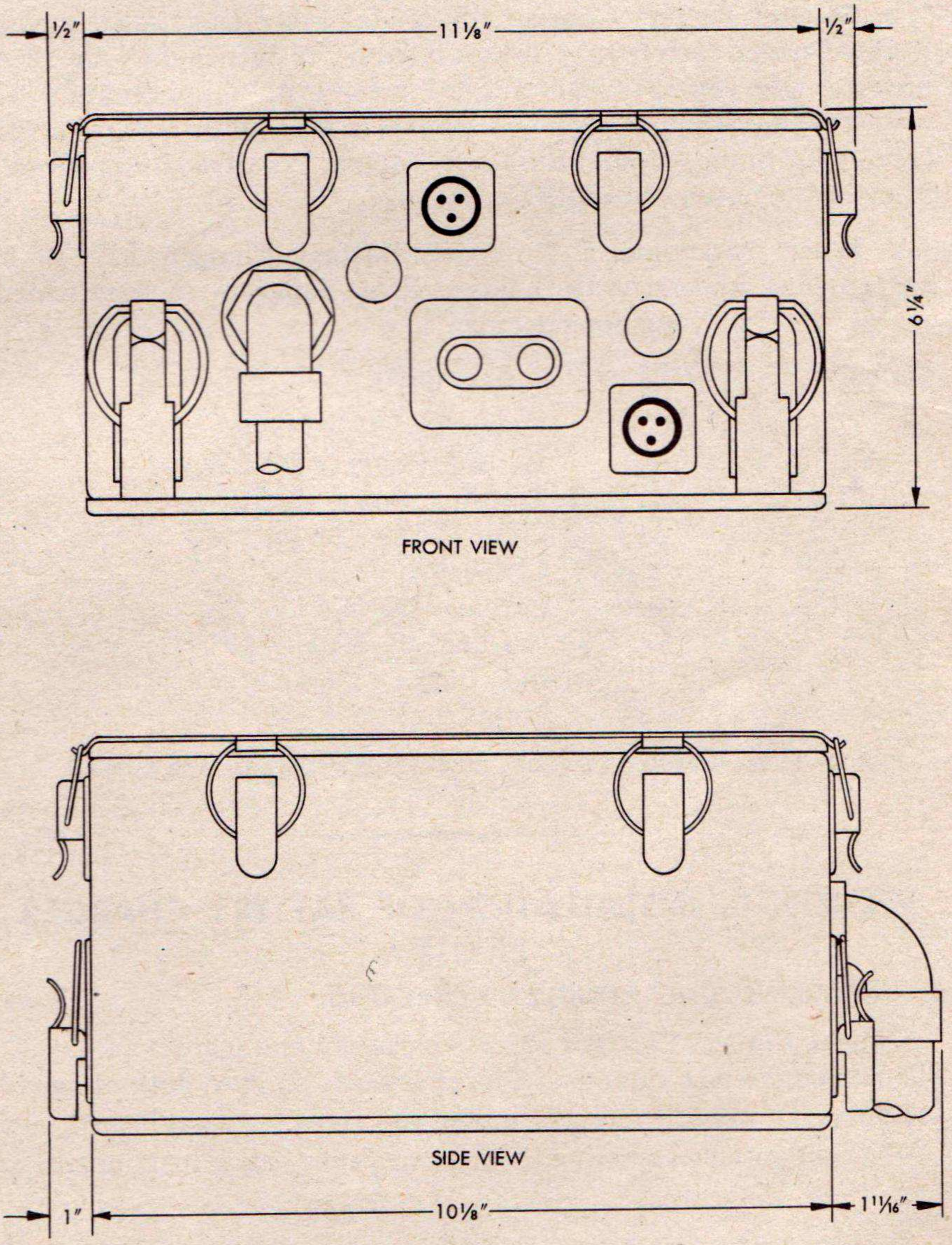

Figure 4. Battery Charger PE-219, dimensional drawing

Vibrator frequency	120 cycles
Input voltage	6, 12 or 24
Output voltage	7
Output	3 to 10 amp

NOTE: Output will vary, depending on state of charge in battery being charged, condition of vehicular battery, and ambient temperature.

4. SHIPPING WEIGHTS AND DIMENSIONS OF PACKED SETS.

a. General. Battery Charger PE-219 is packed as a unit in a corrugated paper carton 13½ inches wide by 16 inches deep by 12½ inches high (fig. 5) with a total weight of approximately 51 pounds. The unit package is a double carton with a vaporproof barrier, or lining, around the inside carton. Figure 4 shows dimensions of the battery charger unpacked.

b. Export Packaging. For export, Battery Charger PE-219 is packed in a wooden crate holding three separate cartons which contain the following components:

Carton No.	Quantity	Description
1	1	Mounting FT-506
2	1	Battery Charger PE-219
3	1	Terminal Box J-72/GR
	1	Cable clamp
	1	Connector
	10 ft.	Cordage CO-134
	1	Cord CG-67/MRQ-2 (9 ft)
	2	Plus lugs
	2	Minus lugs

For further details on export packaging, refer to TM 11-619.

SECTION II. INSTALLATION OF BATTERY CHARGER PE-219

5. UNPACKING, UNCRATING, AND CHECKING.

Unpack Battery Charger PE-219 carefully and inspect for possible damage during shipment. The charger is shipped with all parts installed. To unpack (fig. 5), follow the steps outlined below:

a. Open outside carton with knife or other sharp instrument.

b. Open vaporproof barrier.

c. Open inside carton.

d. Remove corrugated paper protection pad.

e. Remove four bags of silica gel on top of charger.

f. Remove four corner pads that hold unit in place in carton, two paper pads at sides, and plywood panels at front and rear.

g. Take unit out of inside carton.

h. Remove top cover by unfastening eight catch-clips.

i. Take bag of silica gel from top of chassis.

j. Replace top cover. Battery Charger PE-219 is now ready for installation as a unit of Radio Set SCR-619.

6. CONNECTIONS AND INTERCONNECTIONS.

a. General. The vehicular cable supplied with the battery charger is attached with a permanent waterproof connection. This

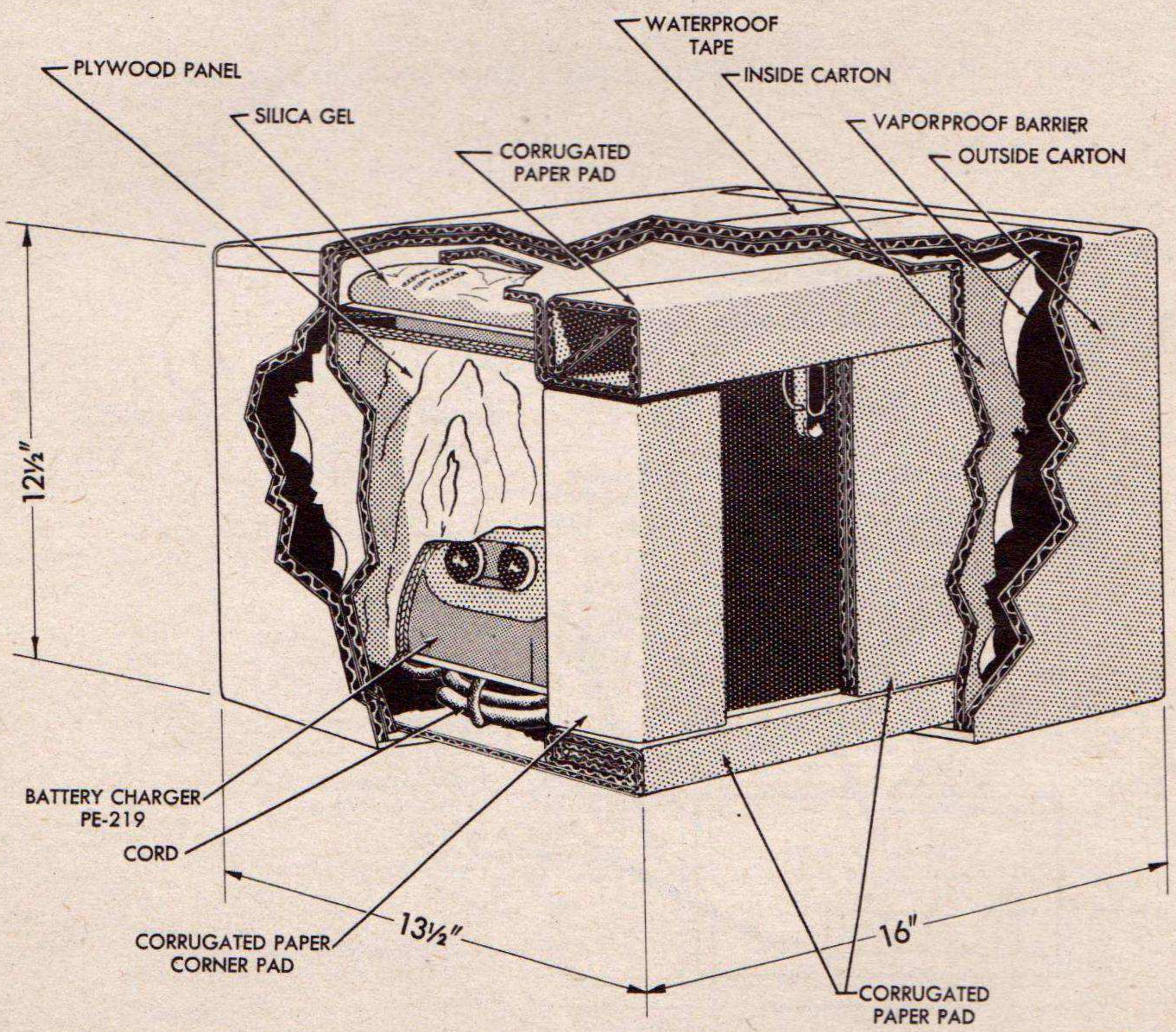

Figure 5. Battery Charger PE-219, packaging details.

is the only connection to the charging battery source. The unit is provided with two female connectors for attaching Cords CD-1294. One of these cords connects the charger to the radio set, and the other connects the charger to the operational battery. Figure 6 shows voltages across the connector plug prongs.

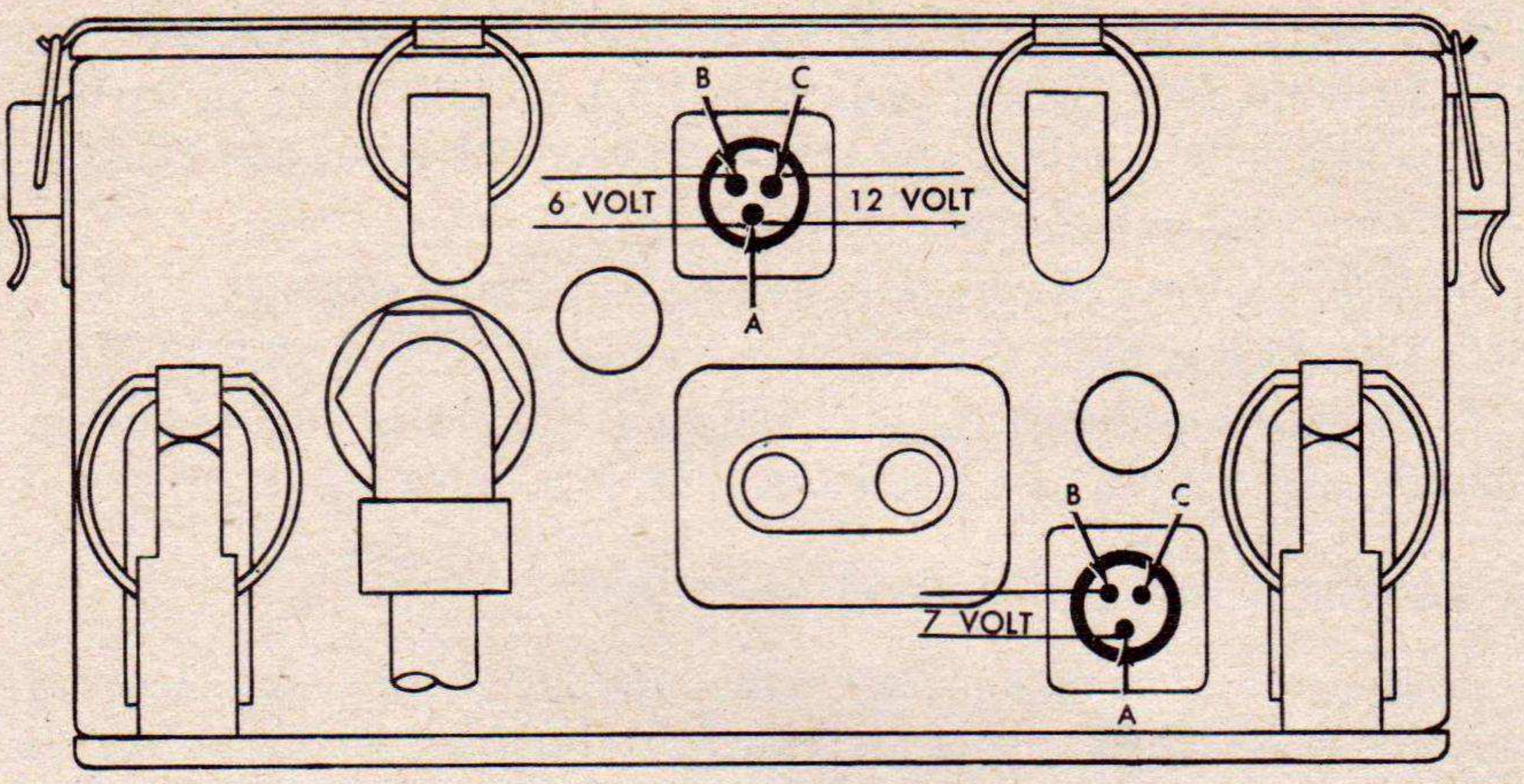

Figure 6. Battery Charger PE-219, voltages across connector plug prongs.

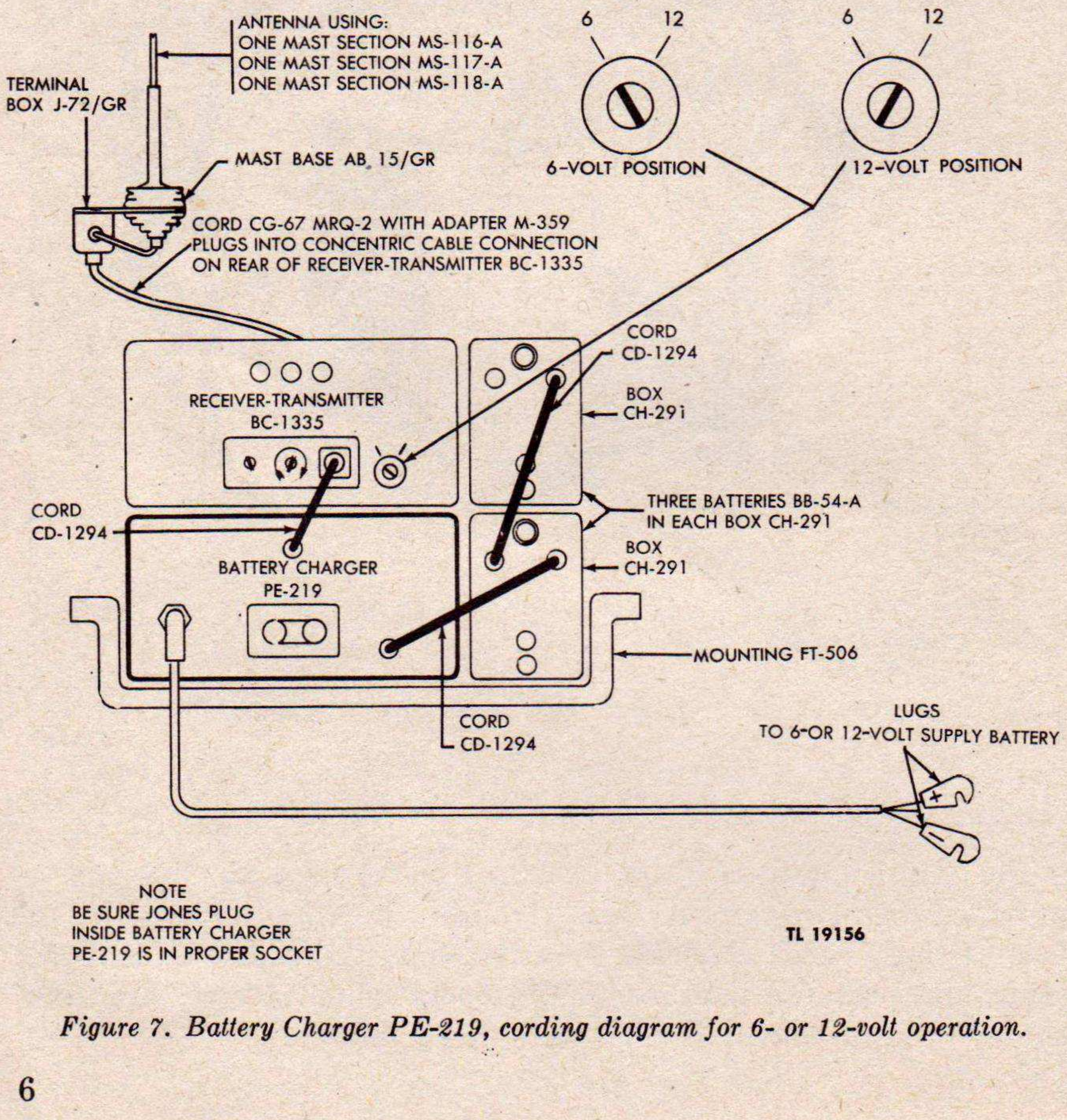

Figure 7. Battery Charger PE-219, cording diagram for 6- or 12-volt operation.

b. Details.

(1) Figure 7 shows the correct connections to be made when the charger is used in a 6- or 12-volt operational battery installation. The radio set is connected to the charger by the connector at the top of the charger panel. When this connection is made the radio set is connected directly to the vehicular battery. The charger is connected to the portable battery (or batteries) from the connector at the lower righthand corner of the charger panel.

NOTE: Opposite terminals on the two battery cases are connected. This is a parallel battery connection.

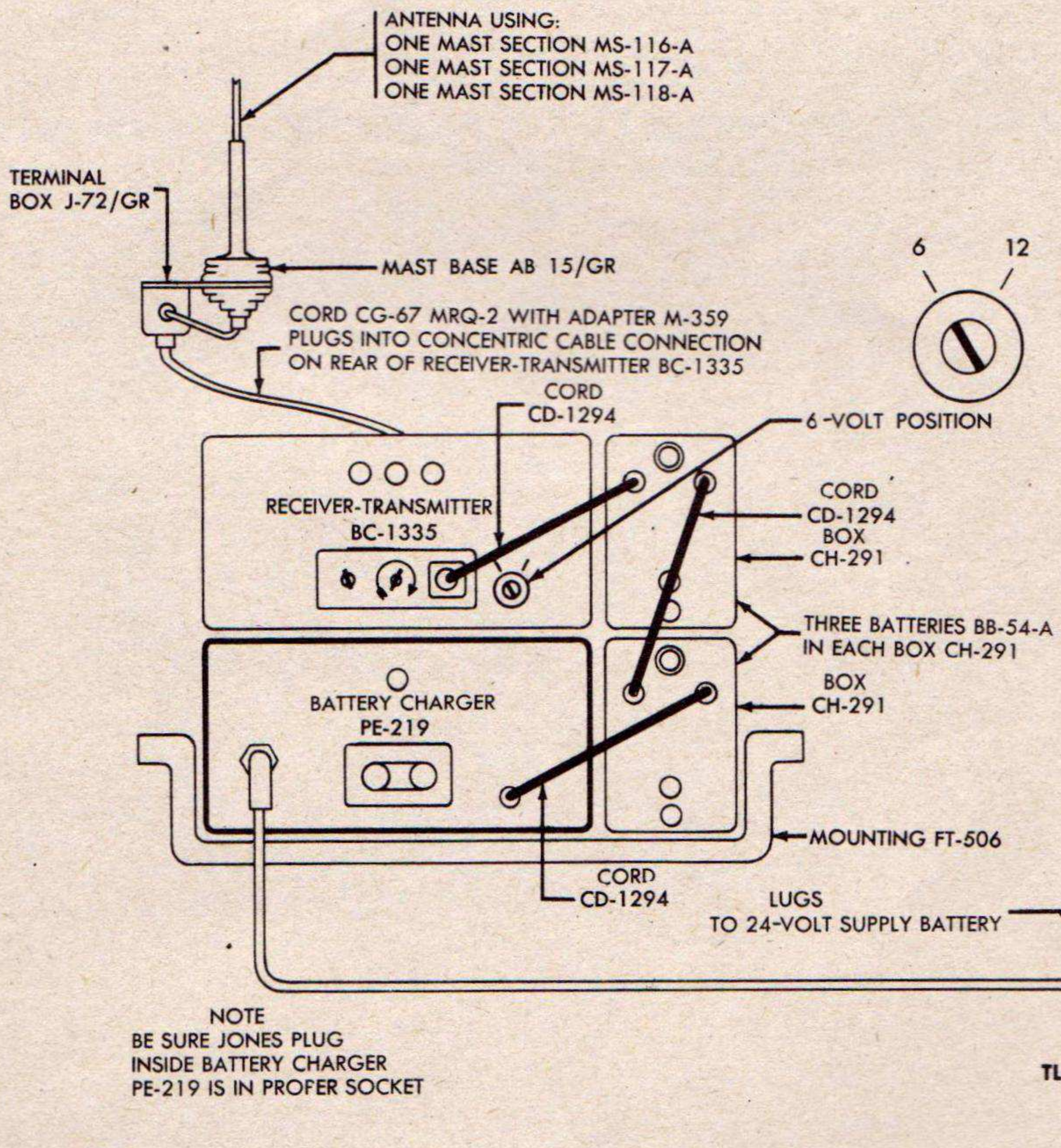

Figure 8. Battery Charger PE-219, cording diagram for 24-volt operation.

(2) Figure 8 shows the method of interconnection when the charger is operating from a 24-volt vehicular battery. The connector at the top of the case is not used and the radio set operates directly from the portable battery. Thus the charger operates directly from the vehicular battery and charges the portable battery which in turn supplies power to the radio set.

(3) In a vehicle having a 6- or 12-volt electrical system, the supply voltage appears directly on the top plug on the front panel. The unit may be connected directly to the receiver-transmitter with Cord CD-1294. With this connection Receiver-Transmitter BC-1335 operates directly from the vehicular battery, while Battery Charger PE-219 charges a portable battery.

7. INSTALLATION ASSEMBLY.

Battery Charger PE-219 is shipped as a complete unit and no assembling is necessary within the unit. To install as a component of Radio Set SCR-619, refer to TM 11-619.

8. REPACKING.

To repack Battery Charger PE-219, reverse the operations outlined in unpacking (par. 5).

PART TWO

OPERATING INSTRUCTIONS

NOTE: For information on destroying the equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

SECTION III. CONTROLS AND THEIR USE

9. CONTROLS AND THEIR USE.

a. General. Operation of Battery Charger PE-219 is controlled entirely by the OFF-ON switch located on the front panel (fig. 9).

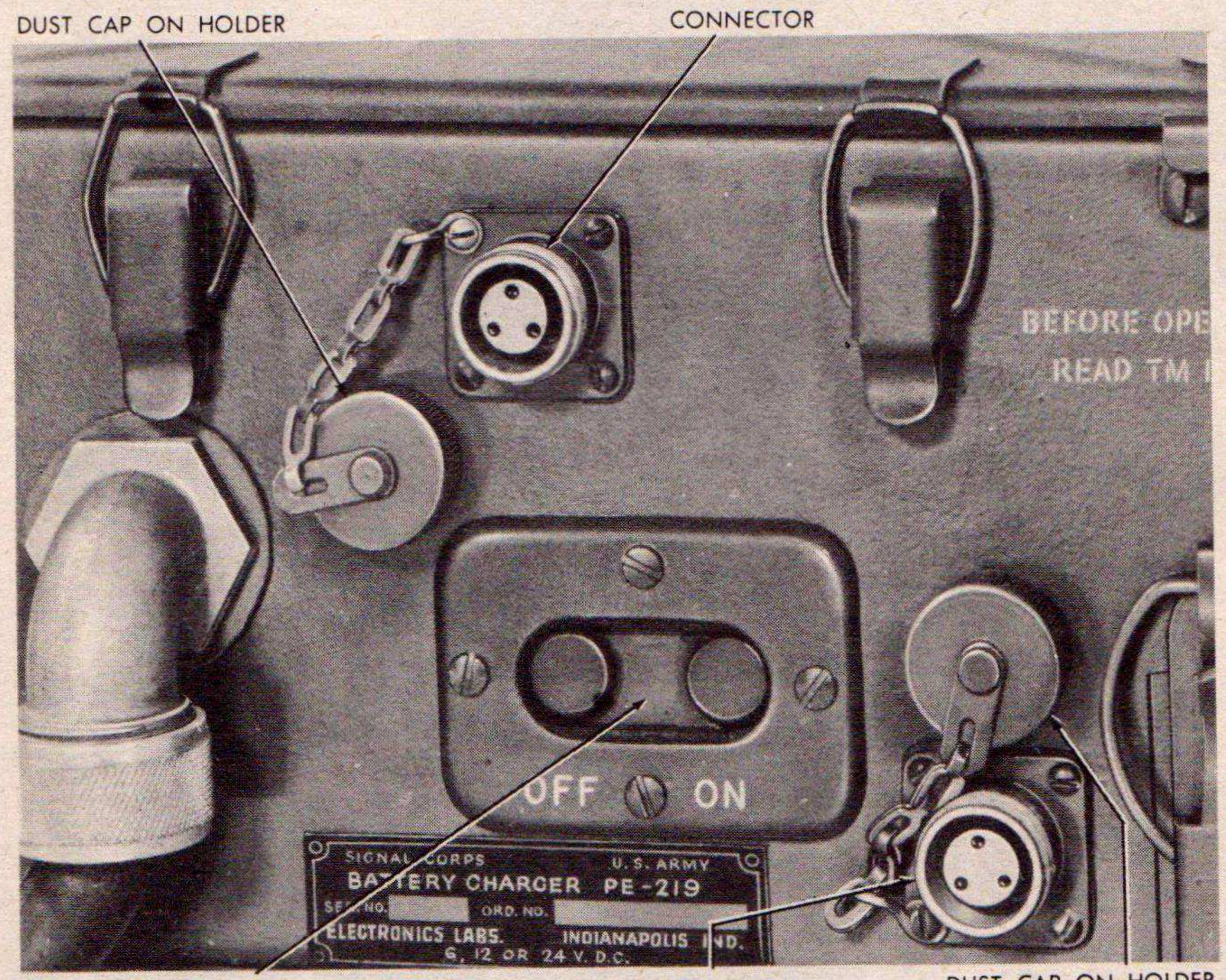

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Figure 9. Battery Charger PE-219, control panel.

b. Jones Plug. Figure 10 shows the location of Jones plug sockets inside the case. To control the input of the power transformer the Jones plug is inserted in the socket which corresponds to the voltage of the vehicular battery.

SECTION IV. OPERATION

10. STARTING PROCEDURE.

a. General. Before starting the charger check the vehicular connection to make sure that the leads are fastened to the proper vehicular battery terminals. The positive (+) lead on the vehicular

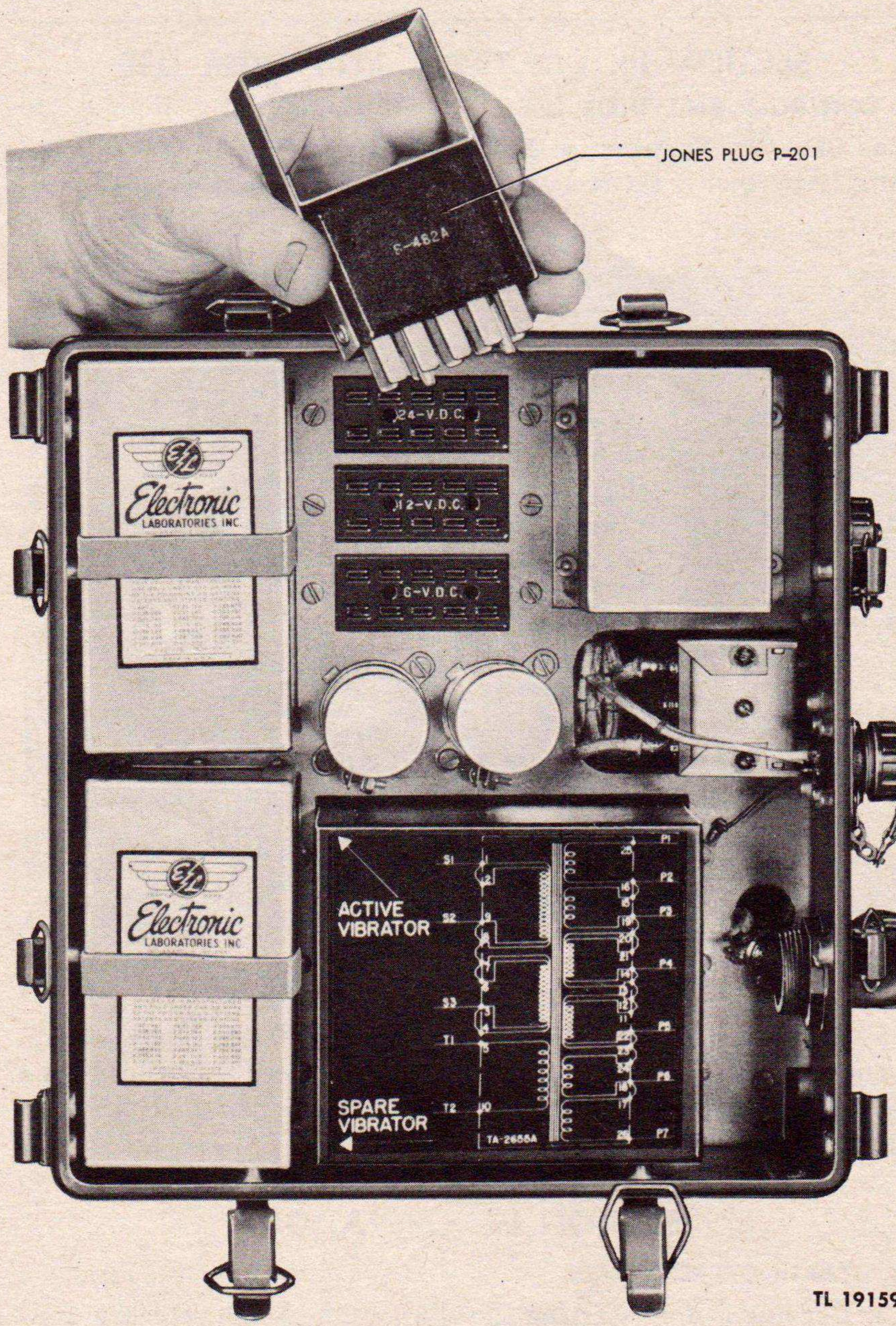


Figure 10. Battery Charger PE-219, Jones plug and sockets.

cable must be attached to the positive side of the vehicular battery, and the negative (–) lead be attached to the negative side. Check to make sure that the Jones plug is inserted in the proper socket.

b. Preliminary. After the battery charger has been installed in the radio set and is properly connected to the vehicular battery, to the radio set, and to the battery to be charged, it is ready to operate.

c. Starting. Start the charger by pressing the ON button located on the front of the panel (fig. 9).

11. OPERATION.

When the battery charger is operating the vibrator causes a slight hum. This hum is the only indication that the charger is operating.

12. STOPPING PROCEDURE.

To stop Battery Charger PE-219, press the OFF button located on the control panel.

13. OPERATING PRECAUTIONS.

When Radio Set SCR-619 is operating through Battery Charger PE-219 from a 24-volt source, the receiver-transmitter is connected to portable batteries which are charged by the charger.

> **NOTE:** Battery Charger PE-219 is **not** provided with an automatic cut-out to prevent overcharging. Watch the condition of the portable battery and stop the charger when the battery is fully charged. In Battery BB-54-A of Radio Set SCR-619, full charge is indicated when the three charge indicator balls are at the top of the electrolyte. Keep the electrolyte at the level indicated by the red lines on the side of the cells, seen through windows in the side of the battery case. **Add water only when the battery is charged.**

SECTION V. EQUIPMENT PERFORMANCE CHECK LIST

14. CHECKING PERFORMANCE OF EQUIPMENT.

Battery Charger PE-219 performs no function which can be observed independently of Receiver-Transmitter BC-1335 or a battery load. When properly connected to the charger, the receiver-transmitter performance will indicate whether the power supply is functioning satisfactorily, provided that no fault exists in the receiver-transmitter.

PART THREE

MAINTENANCE INSTRUCTIONS

SECTION VI. PREVENTIVE MAINTENANCE TECHNIQUES

15. MEANING OF PREVENTIVE MAINTENANCE.

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment, when turned off, to eliminate major break-downs and unwanted interruptions in service, and to keep the equipment operating at top efficiency. To understand what is meant by preventive maintenance, it is necessary to distinguish between preventive maintenance, trouble shooting, and repair. The prime function of preventive maintenance is to **prevent** break-downs and, therefore, the need for repair. On the other hand, the prime function of trouble shooting and repair is to locate and correct **existing** defects. The importance of preventive maintenance cannot be overemphasized. An entire system of radio communication depends upon each set's being **on the air** when it is needed and upon its **operating efficiently.** It is therefore vitally important that radio operators and repairmen maintain their radio sets properly. See TB SIG 123, Preventive Maintenance Practices for Ground Signal Equipment.

NOTE: The operations in sections VI and VII are first and second echelon (organization operators and repairmen) maintenance.

16. DESCRIPTION OF PREVENTIVE MAINTENANCE TECHNIQUES.

a. General. Most of the electrical parts used in Battery Charger PE-219 require routine preventive maintenance. Those requiring maintenance differ in the amount and kind required. Because hit-or-miss maintenance techniques cannot be applied, definite and specific instructions are needed. This section of the manual contains these specific instructions and serves as a guide for personnel assigned to perform the six basic maintenance operations namely: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the lettering system for the six operations will be as follows:

F—Feel*
I—Inspect
T—Tighten
C—Clean
A—Adjust*
L—Lubricate*

*Feel, Adjust, and Lubricate operations are inapplicable to Battery Charger PE-219

The first two operations establish the need for the other four. The selection of operations is based on a general knowledge of field needs. For example, the dust encountered on dirt roads during cross-country travel filters into the equipment no matter how much care is taken to prevent it. Rapid changes in weather (such as heavy rain followed by blistering heat), excessive dampness, snow, and ice tend to cause corrosion of exposed surfaces and parts. Without frequent inspections and the necessary performance of tightening, cleaning, and lubricating operations, equipment becomes undependable and subject to break-down when it is most needed.

b. Feel. The feel operation is used most often to check rotating machinery, such as blower motors, drive motors, etc., and to determine whether electrical connections, bushings, etc., are overheated. Feeling indicates the need for lubrication or the existence of similar types of defects requiring correction. The maintenance man must become familiar with the normal operating temperatures of motors, etc., to recognize signs of overheating.

NOTE: Perform the feel operation as soon as possible after shut-down and always before any other maintenance is done.

c. Inspect. Inspection is the most important operation in the preventive maintenance program. A careless observer will overlook evidences of minor trouble. Although these defects may not interfere with performance of the equipment, valuable time and effort can be saved if they are corrected **before** they lead to major breakdowns. Make every effort to become thoroughly familiar with indications of **normal** functioning, to be able to recognize the signs of a defective set. Inspection consists of carefully observing all parts of the equipment, noticing their color, placement, state of cleanliness, etc. Inspect for the following conditions:

(1) Overheating, as indicated by discoloration, blistering, or bulging of the parts or surface of the container; leakage of insulating compounds; and oxidation of metal contact surfaces.

(2) Placement, by observing that all leads and cabling are in their original positions.

(3) Cleanliness, by carefully examining all recesses in the units for accumulation of dust, especially between connecting terminals. Parts, connections, and joints should be free of dust, corrosion, and other foreign matter. In tropical and high-humidity locations, look for fungus growth and mildew.

(4) Tightness, by testing any connection or mounting which appears to be loose.

d. Tighten, Clean, and Adjust. These operations are self-explanatory. Specific procedures to be followed in performing them are given wherever necessary throughout part three.

CAUTION: Do not tighten screws, bolts, and nuts carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

Whenever a loose connection is tightened, moistureproof and fungiproof it again by applying the varnish with a small brush. See section IX for details of moistureproofing and fungiproofing.

e. Lubricate. Lubrication refers to the application of grease or oil to the bearings of motors or other rotating shafts. It may also mean application of a light oil to door hinges or other sliding surfaces on the equipment.

17. CAPACITORS.

a. Inspect (I).

(1) Inspect the terminals of large fixed capacitors for corrosion and loose connections. Carefully inspect the mountings to discover loose mounting screws, studs, or brackets. Examine the leads for poor insulation, cracks, and evidences of dry rot. Cut away frayed strands on the insulation. If the wire is exposed, wrap it with friction tape. See that the terminals of the capacitors are not cracked or broken.

(2) Thoroughly inspect the case of each large fixed capacitor for leaks, bulges, and discoloration.

b. Tighten (T). Tighten loose terminals, mountings, and connections on the capacitors, when necessary. Do not break the bushing or damage the gasket.

c. Clean (C). Clean the case of fixed capacitors, the insulating bushings, and all connections that are dirty or corroded. The capacitor cases and bushings can usually be cleaned with a dry cloth. However, if the deposit of dirt is hard to remove, moisten the cloth in a dry-cleaning solvent.

18. RESISTORS.

a. General. Two types of resistors are used in Battery Charger PE-219. The connections are either pigtail or solder lug.

b. Inspect (I). Inspect the coating of the vitreous-enameled resistors for signs of cracks and chipping, especially at the ends. Examine the bodies of all types of resistors for blistering, discoloration, and other indications of overheating. Inspect leads and all other connections for corrosion, dirt, dust, looseness, and broken

strands in the connecting wires. Check the security of all mountings. Do not attempt to move the resistor with pigtail connections, because there is danger of breaking the connections at the point where they enter the body of the resistor. Such defects cannot be repaired.

c. Tighten (T). Tighten loose resistor connections and mountings. If a resistor is allowed to remain loose, vibration may break the connection or damage the body.

d. Clean (C).

(1) Clean all carbon resistors with a small brush.

(2) The vitreous-enameled resistors must be kept clean to avoid leakage between the terminals. Wipe them with a dry cloth. However, if the dirt deposit is unusually hard to remove, use a dry-cleaning solvent.

(3) Resistors with discolored bodies cannot be cleaned. Discoloration indicates that there has been overloading and overheating at some time prior to the inspection. The discoloration is probably due to circuit trouble which requires analysis and correction. Trouble-shooting procedures are described in part five.

19. BUSHINGS AND INSULATORS.

a. Description. Insulated bushings are used in the high-voltage circuits. They are constructed of ceramic material with a glazed surface. Because an insulator is no better than its surface, deposits of foreign substances on the surface will reduce the insulation value of the bushing. Therefore, it is very important that all bushings used in the high-voltage circuits be inspected frequently.

b. Inspect (I).

(1) Inspect the physical condition of the insulator bushings. They should be clean without cracks or chips. A highly glazed insulator may develop fine-line surface cracks where moisture and dust will accumulate and eventually form a leakage for a high-voltage flash-over.

(2) As a rule, the bushings are held in position with nuts screwed onto the threaded conductors. These can be replaced very easily. If replacement is not possible because of a shortage of supplies, clean the defective bushing frequently and thoroughly with dry-cleaning solvent. Sometimes it is difficult to see dust on a glazed surface. A satisfactory check can be made by sliding a clean finger across the bushing.

c. Tighten (T). The procedure to be used in tightening loose bushings is self-evident. However, one precaution must be observed. **Avoid forcing the nuts or screws down too tight.** If excessive pres-

sure is exerted on the bushings, damage or breakage is almost certain. If the threads on bushing stud bolts are stripped so they cannot be tightened, replace the entire bushing.

d. Clean (C). Insulating bushings are easily cleaned. Never use abrasive materials because the glazed finish will be destroyed thus permitting moisture to be absorbed. A clean cloth is usually satisfactory. If deposits of grime or dirt on the surface of a bushing are hard to remove, use dry-cleaning solvent. After the surface has been cleaned with a solvent, carefully polish it with a dry cloth. Otherwise, a thin film of the solvent will be left which may impair the effectiveness of the bushing as a high-voltage insulator.

20. COILS.

a. Inspect (I). Inspect the r-f and a-f choke coils for cleanliness of the ceramic coil form and mounting supports. Check all connections.

b. Tighten (T). Tighten any loose coil mountings or connections by resoldering wires or tightening screws.

c. Clean (C). Clean the coil form and coil with a soft brush. Remember the ceramic coil form is actually performing the function of a high-voltage insulator, therefore the same preventive maintenance will apply to the coil as to high-voltage insulators and bushings.

21. MULTIPLE CONNECTORS.

Multiple connectors and plugs are used to connect the internal circuits of Battery Charger PE-219 in accordance with the supply voltage.

a. Inspect (I). Inspect the female ends of the connectors for corrosion and collected dust. Inspect the mountings for cracks and loose connections. Inspect the male ends for loose and broken pins.

b. Clean (C). Clean the male and female ends of the connectors with a brush moistened in dry-cleaning solvent. Remove corrosion with No. 0000 sandpaper, then wipe with a clean cloth.

22. CORDS AND CABLES.

The cables in Battery Charger PE-219 are the life lines of the equipment. Closely observe the condition of the cabling. Operating equipment in all kinds of weather, and moving it on all kinds of roads, subjects cabling to a great deal of punishment.

a. Inspect (I). Inspect the cables for cracked or deteriorated insulation, frayed or cut insulation at the connecting and supporting points, and improper placement which places the cables or connections under strain. Also watch for kinks and improper supports.

b. Tighten (T). Tighten loose cable clamps, coupling rings, and cable connections.

c. Clean (C). Clean dirty or corroded connections on cables. Remove corrosion with No. 0000 sandpaper. Clean the **entire** surface of the connector. Make no attempt to remove individual prongs from cable plugs.

23. CABINET, CHASSIS, AND MOUNTINGS.

The cabinet which houses Battery Charger PE-219 is constructed of aluminum, coated with dull finish OD paint.

a. Inspect (I). Inspect the outside and inside of the cabinet thoroughly, paying strict attention to every detail.

b. Clean (C). Clean each cabinet, outside and in, with a clean, dry cloth. Use dry compressed air to blow out all accumulated dirt and dust. If air filters cannot be cleaned with compressed air, replace them with clean filters.

c. Tighten (T). Tighten all mounting bolts, panel screws, plugs, and control knobs found loose.

SECTION VII. ITEMIZED PREVENTIVE MAINTENANCE

24. INTRODUCTION.

For ease and efficiency of performance, preventive maintenance on Battery Charger PE-219 will be broken down into operations that can be performed at different time intervals. In this section the preventive maintenance work to be performed on the battery charger at the specific time intervals is broken down into units of work called items. The general techniques involved and the application of the FITCAL operations in performing preventive maintenance on individual parts are discussed in section VI. These general instructions are not repeated in this section. When performing preventive maintenance, refer to section VI if more information is required for the following items. Perform all work with the power removed from the equipment. After preventive maintenance has been performed on a given day, put the equipment into operation and check it for satisfactory performance.

25. PREVENTIVE MAINTENANCE TOOLS AND MATERIALS.

The following preventive maintenance tools and materials will be needed:

Common hand tools.
Clean cloth.
#0000 sandpaper.
Dry-cleaning solvent (SD)
Carbon tetrachloride (when used).

NOTE: Gasoline will not be used as a cleaning fluid for any purpose. Solvent, Dry-cleaning, is available as a cleaning fluid through established supply channels. Oil, Fuel, Diesel, may be used for cleaning purposes when dry-cleaning solvent (SD) is not at hand. Carbon tetrachloride will be used as a cleaning fluid only on electrical wiring and electrical mechanisms which cannot be cleaned with an inflammable solvent because of the fire hazard.

26. ITEM 1, EXTERIOR OF CASE.

OPERATIONS.

IC	Housing.
ITC	Water-seal gaskets.
ITC	Catch-clips.
ITC	Screws, bolts, rivets.
IC	Cables.
ITC	Connectors, pins.
ITC	Terminals, lugs, sockets.
ITC	Dust caps.
IC	OFF-ON control.

REMARKS. Clean connectors and pins with a cloth, or if necessary with metal polish or emery cloth. Remove all polish residue, grease, and oil with a soft cloth dampened in dry-cleaning solvent.

27. ITEM 2, INTERIOR OF SET.

OPERATIONS.

IT	Jones plug.
ITC	Coils.
I	Resistors, capacitors, chokes.

28. PREVENTIVE MAINTENANCE CHECK LIST.

The following check list is a summary of the preventive maintenance operations to be performed on Battery Charger PE-219. The time intervals shown on the check list may be reduced at any time by the local commander. For best performance of the equipment, perform operations at least as frequently as called for in the check list. The echelon column indicates which operations are first echelon maintenance and which operations are second echelon maintenance. Operations are indicated by the letters of the word FITCAL. For example, if the letters ITCA appear in the operations column, the item to be treated must be inspected (I), tightened (T), cleaned (C), and adjusted (A).

Item No.	Operations	Item	When performed		Echelon
			Before operation	Weekly	
1	IC	Housing		X	1st
	ITC	Water-seal gaskets		X	2d
	ITC	Catch-clips		X	1st
	IC	Cables	X		1st
	IC	OFF-ON control	X		2d
2	IT	Jones plug	X		2d
	ITC	Coils	X		1st
	I	Resistors, capacitors, chokes	X		1st

F*	I	T	C	A*	L*
Feel	Inspect	Tighten	Clean	Adjust	Lubricate

*The Feel, Adjust, and Lubricate operations are inapplicable to Battery Charger PE-219.

SECTION VIII. LUBRICATION

29. LUBRICATION.

No War Department Lubrication Order is prescribed for Battery Charger PE-219.

SECTION IX. MOISTUREPROOFING AND FUNGIPROOFING

30. GENERAL.

When operated in tropical areas where temperature and relative humidity are extremely high, Signal Corps equipment requires special attention. These are some of the problems:

a. Resistors, capacitors, coils, chokes, transformer windings, etc., fail because of the effects of fungus growth and excessive moisture.

b. Electrolytic action, often visible in the form of corrosion, takes place in resistors, coils, chokes, transformer windings, etc., causing eventual break-down.

c. Hook-up wire insulation and cable insulation break down. Fungus growth accelerates deterioration.

d. Moisture forms electrical leakage paths on terminal boards and insulating strips, causing flash-overs and crosstalk.

e. Moisture provides leakage paths between battery terminals.

31. TREATMENT.

A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection against fungus growth, insects, corrosion, salt spray, and moisture. The treatment involves the use of a moisture- and fungi-resistant varnish applied with a spray gun or brush. Refer to TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, for a detailed description of the varnish-spray method of moistureproofing and fungiproofing and the supplies and equipment required in this treatment.

CAUTION: Varnish spray may have poisonous effects if inhaled. To avoid inhaling spray, use respirator if avalable; otherwise, fasten cheesecloth or other cloth material over nose and mouth. Never spray varnish or lacquer near an open flame. Do not smoke in a room where varnish or lacquer is being sprayed. The spray may be highly explosive.

32. BATTERY CHARGER PE-219.

a. Preparation. Make all repairs and adjustments necessary for proper operation of the equipment.

b. Disassembly.

(1) Remove top cover by opening 8 catch-clips, and bottom cover held by 12 screws.

(2) With an offset screwdriver or pinch bar, remove the Jones plug, vibrator, and spare vibrator mounted in corner of chassis.

(3) Push ON button to close contact so that spray does not get between the points.

c. Cleaning. Clean all dirt, dust, rust, and fungus from the equipment to be processed. Clean all oil and grease from the surfaces to be varnished.

d. Masking (fig. 11). With masking tape cover:

(1) Jones plug socket on top of chassis.

(2) Vibrator and spare vibrator sockets on top of chassis.

(3) Jones plug socket on bottom of chassis.

(4) Vibrator socket on bottom of chassis.

(5) All rubber gaskets and useable rubber.

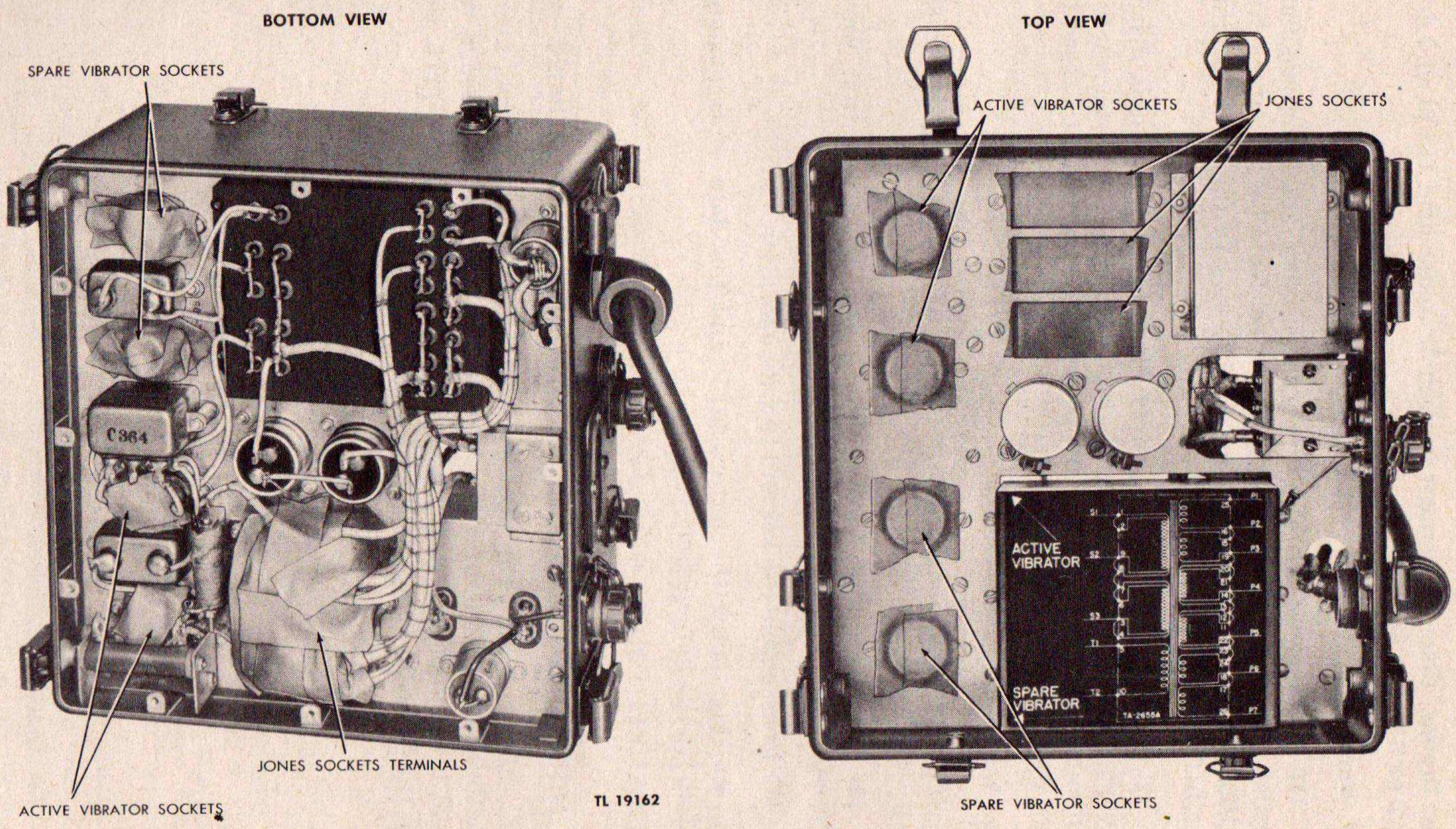


Figure 11. Battery Charger PE-219, masked for varnish-spray treatment.

e. Drying. Place equipment in oven or under heat lamps and dry for 2 or 3 hours at 160°F.

f. Varnishing.

(1) Spray three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, Spec. No. 71-2202 (stock No. 6G1005.3), or equal). Allow each coat to air-dry for 15 or 20 minutes before applying the next coat.

(2) Apply varnish immediately after the equipment is dried. If varnish is not applied immediately, moisture condenses on the equipment. Varnish applied over the moisture peels off readily after the varnish has dried.

g. Reassembly.

(1) Remove all masking tape, being careful not to peel varnish from near-by areas.

(2) Touch up any fixed resistors and capacitors that were covered by the masking tape.

(3) Reassemble the set and test its operation.

h. Marking. Mark the letters MFP and the date of treatment just above the nameplate.

EXAMPLE: MFP—8 Dec 44.

33. MOISTUREPROOFING AND FUNGIPROOFING AFTER REPAIRS.

If, during repair, the coating of protective varnish has been punctured or broken, and if complete treatment is not needed to reseal the equipment, apply a brush coat to the affected part. Be sure the break is completely sealed.

PART FOUR

AUXILIARY EQUIPMENT

NOT USED

PART FIVE

REPAIR INSTRUCTIONS

NOTE: Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on W.D., A.G.O Form No. 468 (Unsatisfactory Equipment Report); by Army Air Forces, on Army Air Forces Form No. 54 (unsatisfactory report). If either form is not available, prepare the data according to the sample form reproduced in figure 19.

SECTION X. THEORY OF EQUIPMENT

34. GENERAL.

Battery Charger PE-219 is designed to charge three batteries BB-54-A in series from a 6-, 12-, or 24-volt vehicular battery or other 6-, 12-, or 24-volt source of direct current. The change to proper internal circuit connections for 6-, 12-, or 24-volt operation is accomplished by inserting a Jones plug in one of three sockets marked 6, 12, and 24 V.D.C. on the top of the chassis. The Jones plug connects the power input circuit to the proper terminals on the power transformer and to connector terminal J-205. This terminal provides a 6- or 12-volt source for operating the radio set directly from a 6- or 12-volt vehicular battery.

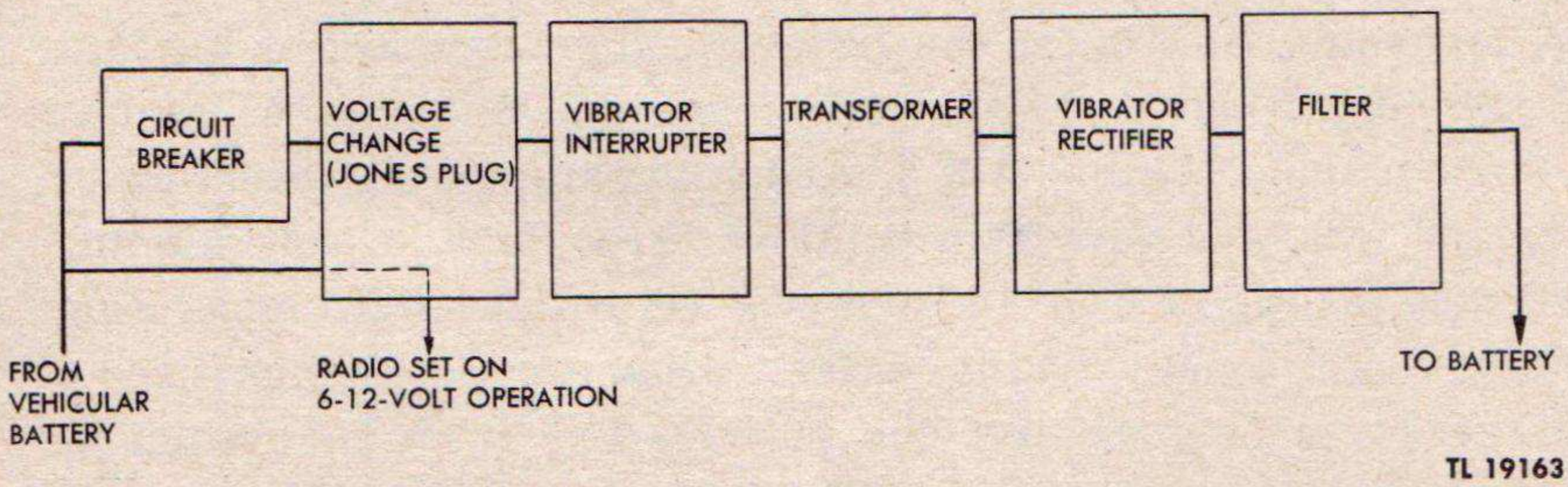


Figure 12. Battery Charger PE-219, simplified block diagram.

The input voltage from the vehicular battery reaches charger circuits through the OFF-ON switch incorporated in the circuit breaker (fig. 12). The circuit breaker is connected to the positive lead from the vehicular battery through the Jones plug. From the circuit breaker, connections are made to the vibrator interrupter contacts. This section of the vibrator interrupts the direct current

which flows to the transformer primary through other connections on the Jones plug. The a-c (alternating current) output from the transformer secondary is fed back to rectifier contacts on the vibrator to produce full-wave rectification. The center tap (positive output) from the transformer secondary is connected to proper filter capacitors and a choke, to filter the d-c output. Connector J-204 on the front of the charger is the output terminal. A tertiary winding and buffer capacitor are provided on the transformer to correct the power factor of the charger.

35. ANALYSIS OF 6-VOLT OPERATION.

Figure 13 shows circuits used in operating Battery Charger PE-219 from a 6-volt power supply. The charger is connected to the 6-volt vehicular battery through cable W-201. The positive lead connects to the circuit breaker winding through the OFF-ON switch. With the Jones plug inserted in socket J-201 (marked 6 V.D.C.) the proper tap on the circuit breaker winding connects to the center tap of the transformer primary through prongs 9 and 10 on the Jones plug. With vibrator contacts closed at position A-4 on the vibrator, direct current will flow from the center tap of the transformer primary (point 14) through the 6-volt winding between points 14 and 22. The current will return through Jones plug prongs 12 and 11 to contact A-4 on the vibrator reed to the ground or negative side of the input line. A portion of the current reaching the center tap of the transformer will flow through Jones plug prongs 4 and 3 to point B-3 on the driver coil of the vibrator, through the vibrator reed, and to the ground or negative side of the input line. As soon as the vibrator coil is energized by the flow of current through its windings, the vibrator will break contact at A-4 and make contact at A-3. The current through the transformer primary will then flow from point 14 through the 6-volt winding between points 14 and 19, and will return through Jones plug prongs 8 and 7 and vibrator contact A-3 to ground. Prongs 5 and 6 on the Jones plug connect the positive line from the vehicular battery directly to terminal B on connector J-205 to allow operation of the receiver-transmitter directly from the vehicular battery. Six volts appear between points A and B at this outlet, since point A is connected at ground or negative potential. The output through the secondary of the transformer is stepped up slightly to charge a 6-volt battery connected to connector J-204, even though the charger may be operating from a vehicular battery producing as little as 5.7 volts.

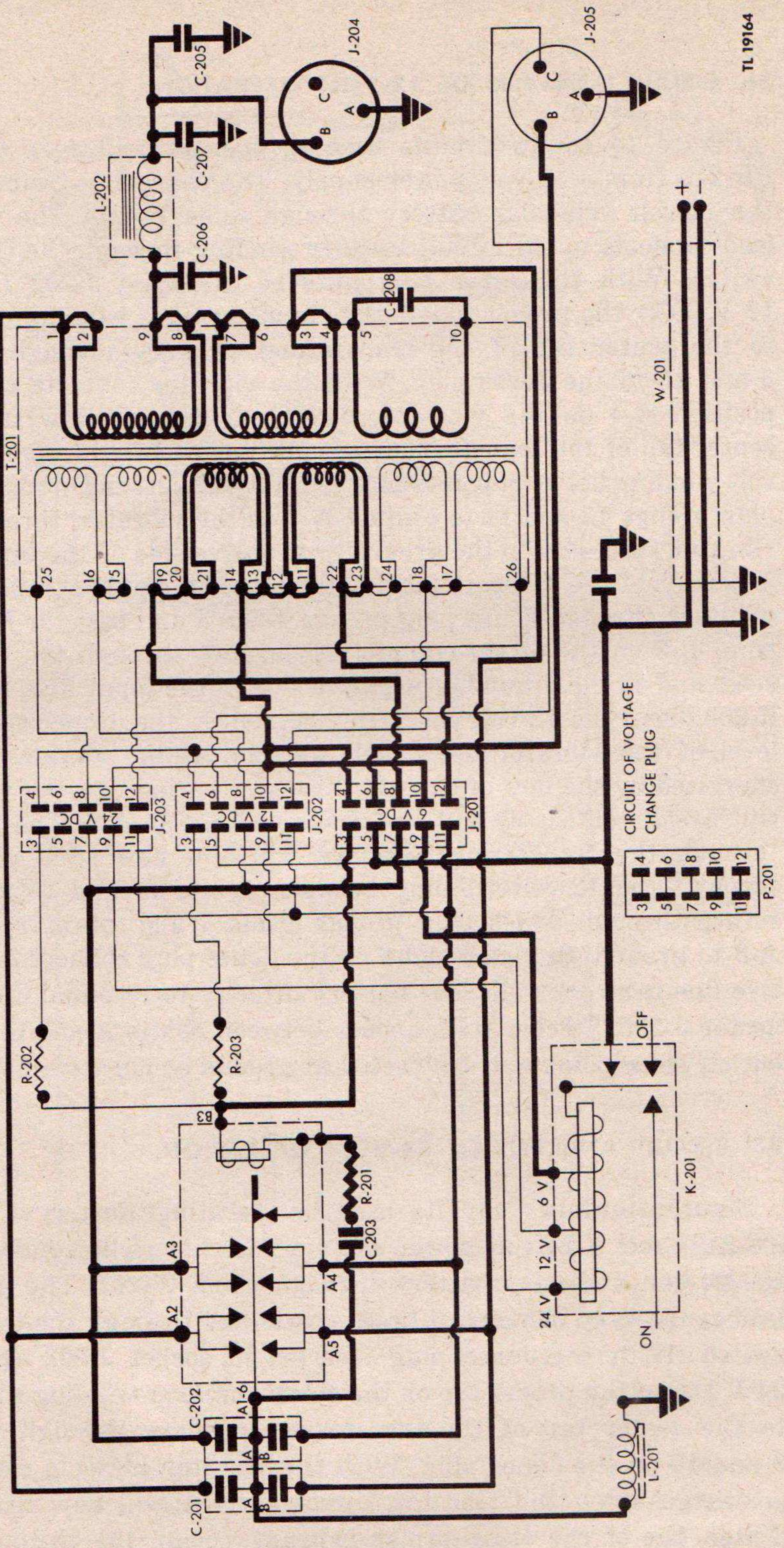


Figure 13. Battery Charger PE-219, circuits used when operating from 6-volt power supply.

36. CIRCUIT ANALYSIS OF 12-VOLT OPERATION.

Figure 14 shows circuits used in operating Battery Charger PE-219 from a 12-volt power supply. The charger is connected to the 12-volt vehicular battery through cable W-201. The positive lead connects to the circuit breaker winding through the OFF-ON switch. With the Jones plug inserted in socket J-202 (marked 12 V.D.C.) the proper tap on the circuit breaker winding connects to the center tap of the transformer primary through prongs 9 and 10 in the Jones plug. With the vibrator contacts closed at position A-4 on the vibrator, direct current will flow from the center tap of the transformer primary (point 14) through the 12-volt winding between points 14 and 18. It will return through Jones plug prongs 12 and 11 to contact A-4 on the vibrator, through the vibrator reed, and to the ground or negative side of the input line. A portion of the current reaching the center tap of the transformer will flow through Jones plug prongs 4 and 3 and resistor R-203 to point B-3 on the driver coil of the vibrator, through the vibrator reed, and to the ground or negative side of the input line. Resistor R-203 drops the 12-volt energizing current to the proper operating level of the vibrator drive coil. As soon as the vibrator coil is energized by the flow of current through its windings, the vibrator will break contact at A-4 and make contact at A-3. The voltage through the transformer primary will now flow from point 14 through the 12-volt winding between points 14 and 15 and will return through Jones plug prongs 8 and 7 and vibrator contact A-3 to ground. Prongs 5 and 6 on the Jones plug connect the positive line from the vehicular battery directly to terminal C on connector J-205. Twelve volts appear between points A and C at this outlet, since point A is connected at ground or negative potential.

37. CIRCUIT ANALYSIS OF 24-VOLT OPERATION.

Figure 15 shows circuits used in operating Battery Charger PE-219 from a 24-volt power supply. The charger is connected to the 24-volt vehicular battery through cable W-201. The positive lead connects to the circuit breaker winding through the OFF-ON switch. With the Jones plug inserted in socket J-203 (marked 24 V.D.C.), the proper tap on the circuit breaker winding connects to the center tap of the transformer primary through prongs 9 and 10 on the Jones plug. With the vibrator contacts closed at position A-4 on the vibrator, direct current will flow from the center tap of the transformer primary (point 14) through the 24-volt winding between points 14 and 26. It will return through

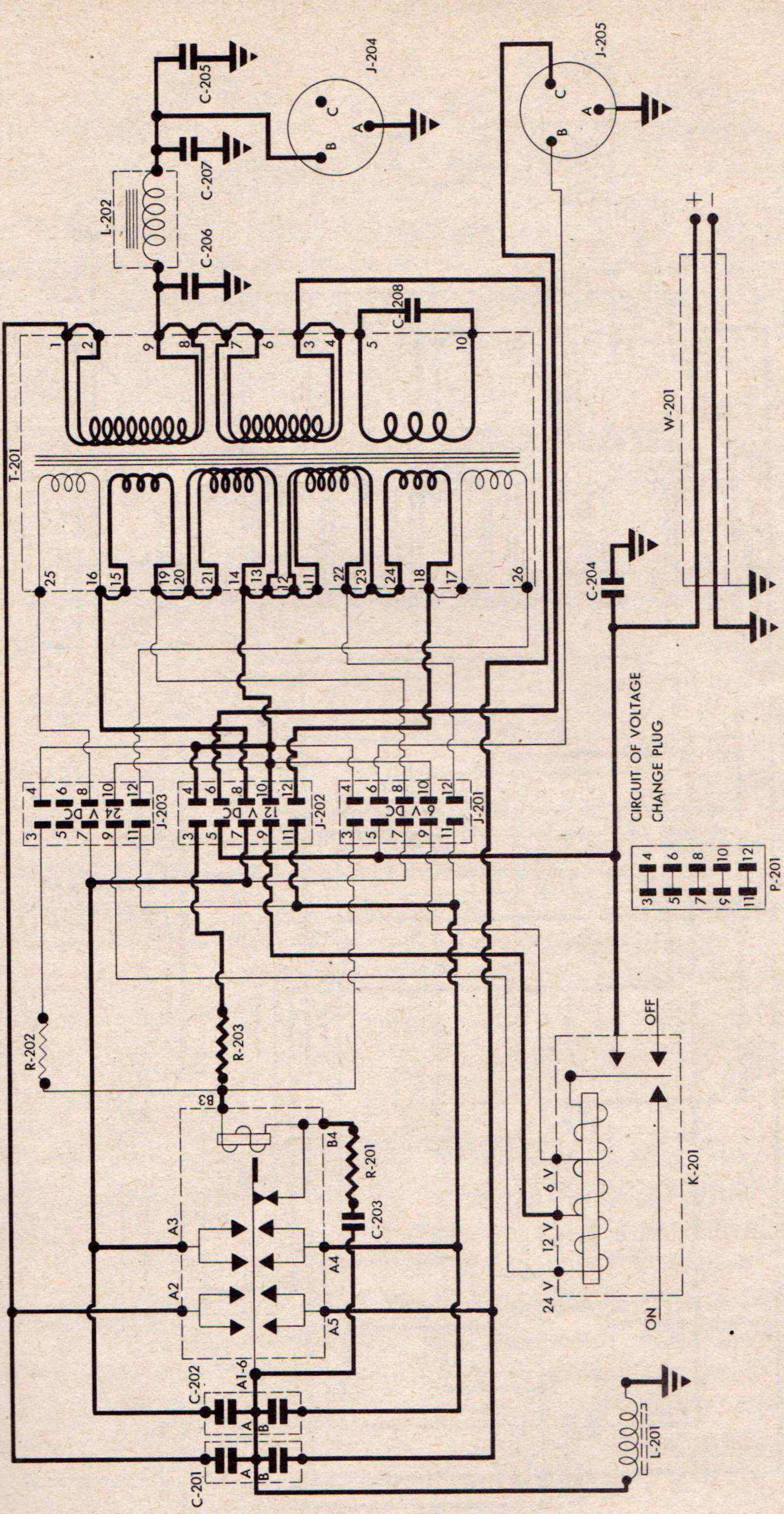


Figure 14. Battery Charger PE-219, circuits used when operating from 12-volt power supply.

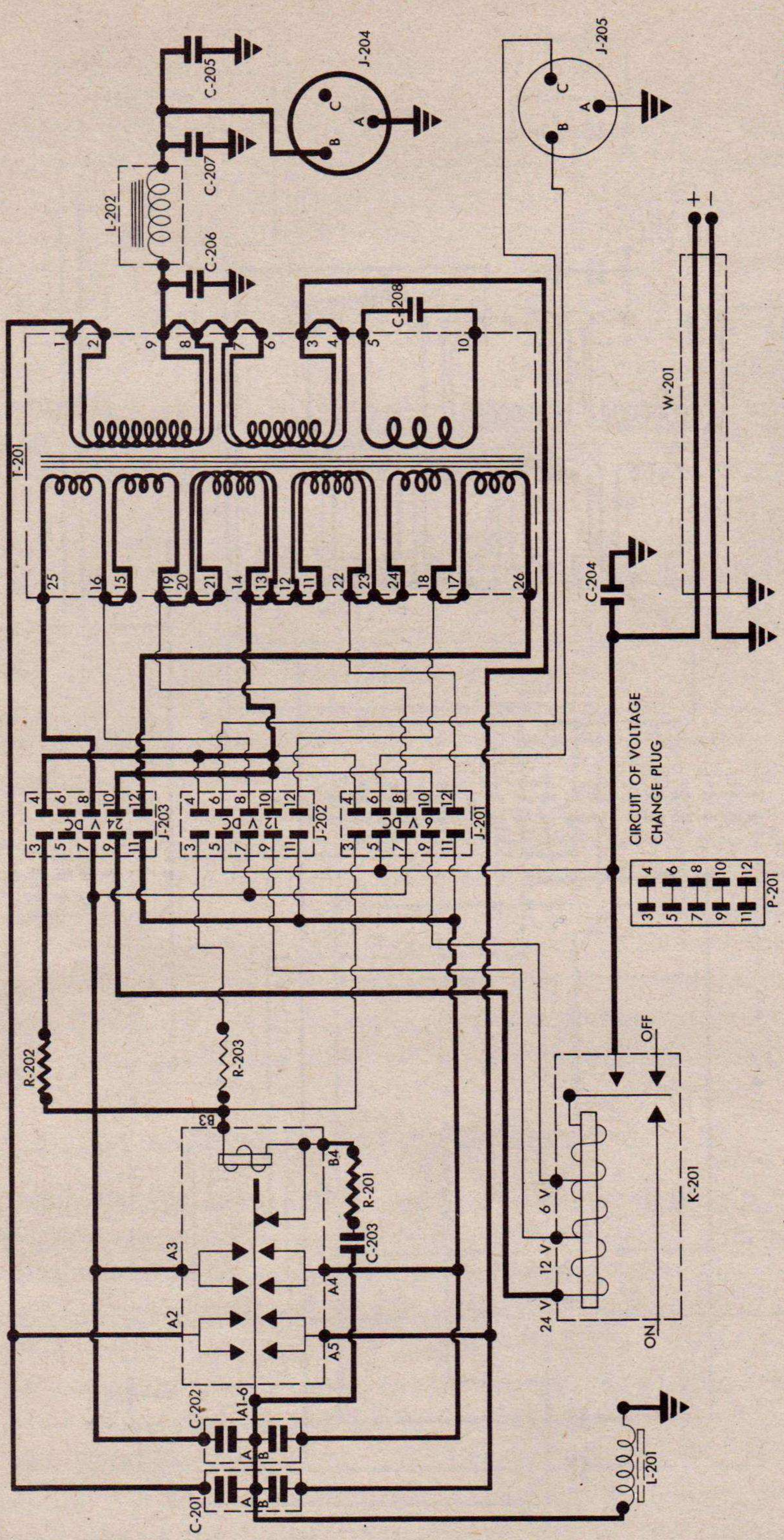


Figure 15. Battery Charger PE-219, circuits used when operating from 24-volt power supply.

Jones plug prongs 12 and 11 to contact A-4 on the vibrator, and thence through the vibrator reed to the ground or negative side of the input line. A portion of the current reaching the center tap of the transformer will flow through Jones plug prongs 4 and 3 and resistor R-202 to point B-3 on the driver coil of the vibrator, through the vibrator reed, and to the ground or negative side of the input line. Resistor R-202 drops the 24-volt energizing current to the proper operating level of the vibrator driver coil. As soon as the vibrator coil is energized by the flow of current through its windings, the vibrator will break contact at A-4 and make contact at A-3. The voltage through the transformer primary will now flow from point 14 through the 24-volt winding betweens points 14 and 25 and will return through Jones plug prongs 8 and 7 and vibrator contact A-3 and to the ground. **Prongs 5 and 6 on the Jones plug socket are not connected thus preventing a 24-volt potential from appearing across connector terminal J-205 when the charger is operated from a 24-volt source.**

38. CIRCUIT BREAKER.

The circuit breaker in Battery Charger PE-219 serves as an overload protector for the three input voltages, and is incorporated in the OFF-ON switch. The holding coil on the circuit breaker is tapped for 6-, 12- or 24-volt input. Each tap is connected to the proper Jones socket in such a manner as to prevent improper connections to the circuit breaker coil. Excessive current flowing through the 6-, 12-, or 24-volt winding causes the circuit breaker to open the positive input lead.

39. VIBRATOR.

The vibrator is a two-section synchronous type. One set of contacts, A-3 and A-4, interrupts the vehicular battery current flowing in the transformer primary through the proper Jones plug connections. A second set of contacts A-2 and A-5, connects directly to the transformer secondary output. These contacts rectify the a-c output by connecting the negative end of the secondary winding to ground through choke L-201. A portion of the current from the center tap of the transformer primary flows through the vibrator driver coil. R-201 and capacitor C-203 prevent sparking at the make-and-break of the driver coil contact.

NOTE: Replace the vibrator if defective. Any attempted adjustments may cause faulty action.

40. JONES PLUG.

The Jones plug is a voltage change plug with 10 prongs or pins connected in pairs (fig. 10). This plug is used in ordinary operation to make the proper internal circuit connections. The plug also provides quick circuit connections when charging from 6-, 12-, or 24-volt operation. In 6-volt operation prong 4 is interconnected to prong 3 to provide a connection from the center tap of the transformer primary directly to the driver coil on the vibrator. In 12-volt operation prongs 4 and 3 connect the center tap of the transformer primary to resistor R-203, and in the 24-volt circuit to resistor R-202. These resistors drop the source voltage to the proper operating voltage of the vibrator driver coil. Prongs 5 and 6 in the Jones plug connect the positive input from the supply battery to the proper output connector on the radio terminal, (connector J-205). In 6-volt operation this connection places 6 volts on terminal B on J-205, and in 12-volt operation places 12 volts on terminal C of J-205. In 24-volt operation, prongs 5 and 6 are not connected (par. 37) since there are no leads to terminals 5 and 6 on Jones plug receptacle J-203. Prongs 7 and 8 on the Jones plug connect the end leads to the proper transformer primary winding from points 19, 16, and 25 to vibrator interrupter contact A-3 and to interference capacitor C-202. Prongs 9 and 10 on the Jones plug connect the positive input which flows through the proper circuit breaker winding from the supply source to the center tap of the transformer primary. Prongs 11 and 12 on the Jones plug connect the end leads of the proper transformer winding from points 22, 18 and 26 to interrupter contact A-4 and to capacitor C-202. Capacitor C-202, located in the negative return lead to the ground, prevents sparking at vibrator contacts A-3 and A-4.

41. TRANSFORMER.

The power transformer is wound with a multiple primary and secondary, and has a high-voltage low-current tertiary winding across which is connected a buffer capacitor. The purpose of this winding and capacitor is to correct the power factor of the circuit. In 6-volt operation the transformer steps up the voltage slightly so as to charge a 6-volt battery from a source which may be as low as 5.7 volts. When used on a 12- or 24-volt source the power transformer steps down the voltage to approximately 7 volts. The primary of the transformer is center-tapped to provide the alternate use of each half of the transformer necessary for full-wave rectification. The positive output from the transformer is taken from the center tap of the secondary; the negative output is taken from the outside tap of the transformer secondary, and connected to

the rectifier contacts, A-2 and A-5, on the vibrator. Each half of the primary works alternately in conjunction with the secondary to produce full-wave rectification.

42. DIRECT-CURRENT FILTER.

A filter consisting of two 1,000-mf capacitors, C-206 and C-207, and choke L-202 is connected to the center tap of the transformer secondary to remove the alternating component of the d-c output voltage, and eliminate a-c hum which might otherwise result. Two 0.25-mf capacitors, C-202 and C-201, are connected on the ground side of the transformer primary and secondary to reduce vibrator sparking, and to further stabilize the battery charger at maximum input voltage. R-f (radio-frequency) feedback is prevented by use of r-f choke L-201, located in the ground lead of the vibrator reed and bypass capacitor C-204 located in the + input lead.

SECTION XI. TROUBLE SHOOTING

43. GENERAL TROUBLE-SHOOTING INFORMATION.

No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible. This section contains general information to aid personnel engaged in the important duty of trouble-shooting.

a. Trouble-shooting Data. Take advantage of the material supplied in this manual to help in the rapid location of faults. Consult the following trouble-shooting data when necessary:

(1) Block diagram of Battery Charger PE-219 (fig. 12).

(2) Complete schematic diagrams (fig. 20).

(3) Simplified and partial schematic diagrams. These diagrams are particularly useful in trouble shooting, because the repairman can follow the electrical functioning of the circuits more easily than on the regular schematics, thus speeding trouble location.

(4) Voltage and resistance data for all socket connections.

(5) Illustrations of components. Front, top, and bottom views which aid in locating and identifying parts.

(6) Pin connections. Pin connections on sockets, plugs, and receptacles are numbered or lettered on the various diagrams.

(a) Seen from the bottom, pin connections are numbered in a clockwise direction around the sockets. On octal sockets the first pin clockwise from the keyway is the No. 1 pin.

(b) Plugs and receptacles are numbered on the side to which the associated connector is attached. To avoid confusion, some individual pins are identified by letters which appear directly on the connector.

b. Trouble-shooting Steps. The first step in servicing a defective battery charger is to sectionalize the fault. Sectionalization means tracing the fault to the component or circuit responsible for the abnormal operation of the equipment. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults such as burned-out resistors, and shorted transformers can be located by sight, smell, and hearing. The majority of faults, however, must be located by checking voltage and resistance.

c. Localization. Paragraph 44 describes the method of localizing faults within the individual components. This paragraph is accompanied by trouble-shooting charts (par. 47) which list abnormal symptoms and their probable causes. The charts also give the procedure for determining which of the probable locations of the fault is the exact one. In addition, figure 16 shows the resistance and voltage at every terminal connection.

d. Voltage Measurements. Voltage measurements are an almost indispensable aid to the repairman, because most troubles either result from abnormal voltages or produce abnormal voltages. Voltage measurements are taken easily, because they are always made between two points in a circuit and the circuit need not be interrupted.

(1) Unless otherwise specified, the voltages listed on the voltage charts are measured between the indicated points and ground.

(2) Always begin by setting the voltmeter on the highest range so that the voltmeter will not be overloaded. Then, if it is necessary to obtain increased accuracy, set the voltmeter to a lower range.

44. PRELIMINARY PROCEDURES.

To locate the cause of trouble in Battery Charger PE-219, remember first that the charger consists of five circuits: circuit breaker, vibrator, Jones plug and sockets, transformer, and filter. Follow operation of these circuits as explained in section X by using the complete schematic diagram (fig. 20), voltage measurements (fig. 16), and parts location illustrations (figs. 17 and 18). Use the over-all schematic at all times. Make instrument tests **only** if the checks without test equipment ha failed to locate trouble. There are three general indications of failure in Battery Charger

PE-219. The circuit breaker may kick out shortly after the charger is turned on; the circuit breaker may remain ON, but no audible hum be heard from the vibrator; or the circuit breaker may remain ON and the vibrator hum, but no charge goes into the portable battery on charge. Preliminary checks for each type of trouble are indicated below:

a. If the circuit breaker kicks out soon after being turned on, proceed as follows:

(1) Check polarity of input cable W-201 connected to the power source. Reversed polarity will cause the circuit breaker to kick out before any serious damage is done. This action of the circuit breaker wil cause the charger to be inoperative.

(2) Check location of Jones plug to make sure that it corresponds to the proper supply voltage.

(3) Check leads or cable to operational battery on charge for short circuits or incorrect polarity. If three Batteries BB-54-A are used in Battery Case CH-291, check connections inside battery case.

b. If the circuit breaker remains on, but no hum is heard from the vibrator, proceed as follows:

(1) Make sure circuit breaker is operating mechanically by pushing the OFF-ON buttons alternately. A distinct click should be heard at each operation.

(2) Check connections to vehicular or other supply battery or to vehicular terminal box. Make sure there is no corrosion at the terminals and that the connections are tight.

(3) Check vibrator by replacing with another vibrator known to be in good operating condition.

NOTE: If the charger does not operate with the second vibrator installed, the fault probably lies elsewhere and must be traced. The vibrator used in Battery Charger PE-219 is designed for approximately 500 hours use and normally should be replaced after that time.

(4) Check input cable W-201 for frayed or broken connections or defective insulation.

c. If the circuit breaker remains on and the vibrator hums but no current reaches the portable battery on charge, proceed as follows:

(1) Check cable connecting charger to operational battery on charge. Examine for faulty connections and frayed or broken leads.

(2) Make sure connections to operational battery on charge are tight and are not corroded.

(3) Check vibrator by replacing it with another known to be in good operating condition. (See note under b(3) above.)

45. TEST INSTRUMENTS.

The following meters are recommended for testing Battery Charger PE-219.

a. Any d-c ammeter with a range of 0 to 50 amperes to check input currents.

b. Any d-c voltmeter with a range of 0 to 30 volts to check input voltage.

c. Any d-c ammeter with a range of 0 to 15 amperes to check charging current in the output circuit.

d. Any 100- (or more) ohm-per-volt a-c voltmeter with a range of 0 to 300 volts to check voltage on the transformer buffer winding.

e. Any a-c voltmeter with a range of 0 to 60 volts to test voltage across power transformer sections.

f. Any low-range ohmmeter to check circuit continuity.

46. CAPACITOR TESTS.

a. General. It is often necessary to check capacitors for leakage or open or short circuits which are caused by break-down of the dielectric between the the plates.

b. Open Capacitor. A capacitor which is suspected of being open can best be checked by shunting a good capacitor across it. In Battery Charger PE-219 circuits, keep the lead to the capacitor as short as the original capacitor lead.

c. Shorted or Leaky Capacitors. Shorted or leaky capacitors may be checked by the kick indication on an ohmmeter. For this method of checking, remove one end of the capacitor from its circuit before attempting to check it, because the capacitor is usually across some other circuit element. Adjust the ohmmeter to its highest range and connect it across the capacitor. If the capacitor is good, the needle flicks over slightly and gradually drops back to zero. This shows that the capacitor has taken a charge and is not shorted. If the needle does not go back to zero, the capacitor is leaky and should be replaced.

47. LOCALIZING TROUBLE WITH TEST EQUIPMENT.

Symptoms	Probable Trouble	Corrections
1. Circuit breaker fails to remain in ON position.	1. Retaining spring broken or defective.	1. Repair, or replace spring if necessary.
	Jones plug in wrong socket.	Check Jones plug position against supply voltage.
	Defective vibrator.	Replace vibrator.
	Excessive supply voltage.	Check supply voltage.
	Shorted portable battery.	Replace portable battery.
	Defective transformer.	Replace.
	Defective capacitor C-206, or C-207.	Replace.
	Defective Jones plug.	Repair or replace.
2. Vibrator fails to start. (NO HUM)	2. Defective circuit breaker.	2. Check circuit breaker, repair or replace.
	Open circuit in Jones plug.	Check continuity in Jones plug.
	Open resistors R-202 and R-203.	Check resistors; replace if necessary.
	Poor connection to vehicle battery terminals.	Clean and tighten battery terminal connections.
	Circuit breaker prematurely tripped.	Press ON button; if trouble persists, recheck item 1 above.
3. Output voltage too low.	3. Vibrator defective.	3. Replace vibrator. Check solder joints and wiring replace or repair.
	High resistance connections or defective wire.	
4. Output voltage too high.	4. Defective portable battery.	4. Check portable battery; replace if necessary.
5. No output voltage on connector to radio set.	5. Defective Jones plug.	5. Repair or replace Jones plug.
	Improper connection to vehicular battery.	Check vehicular battery connections.
	Loose circuit connection.	Check and repair circuit leads.
6. Transformer fails to operate, indicated by no output voltage.	6. Transformer burned out.	6. Replace transformer.
7. Excessive input current.	7. Defective capacitor C-208.	7. Replace capacitor C-208.

48. VOLTAGE MEASUREMENTS.

Voltage measurements from terminal to terminal and from terminals to ground are shown in figure 16. The illustration gives the various voltages which will be found under normal operation between points indicated on Battery Charger PE-219. Terminal numbers indicated on the transformer correspond to terminal numbers shown on the schematic diagram (fig. 20).

CAUTION: In testing voltages, make sure the Jones plug is inserted in the proper socket, depending on the voltage of vehicular battery.

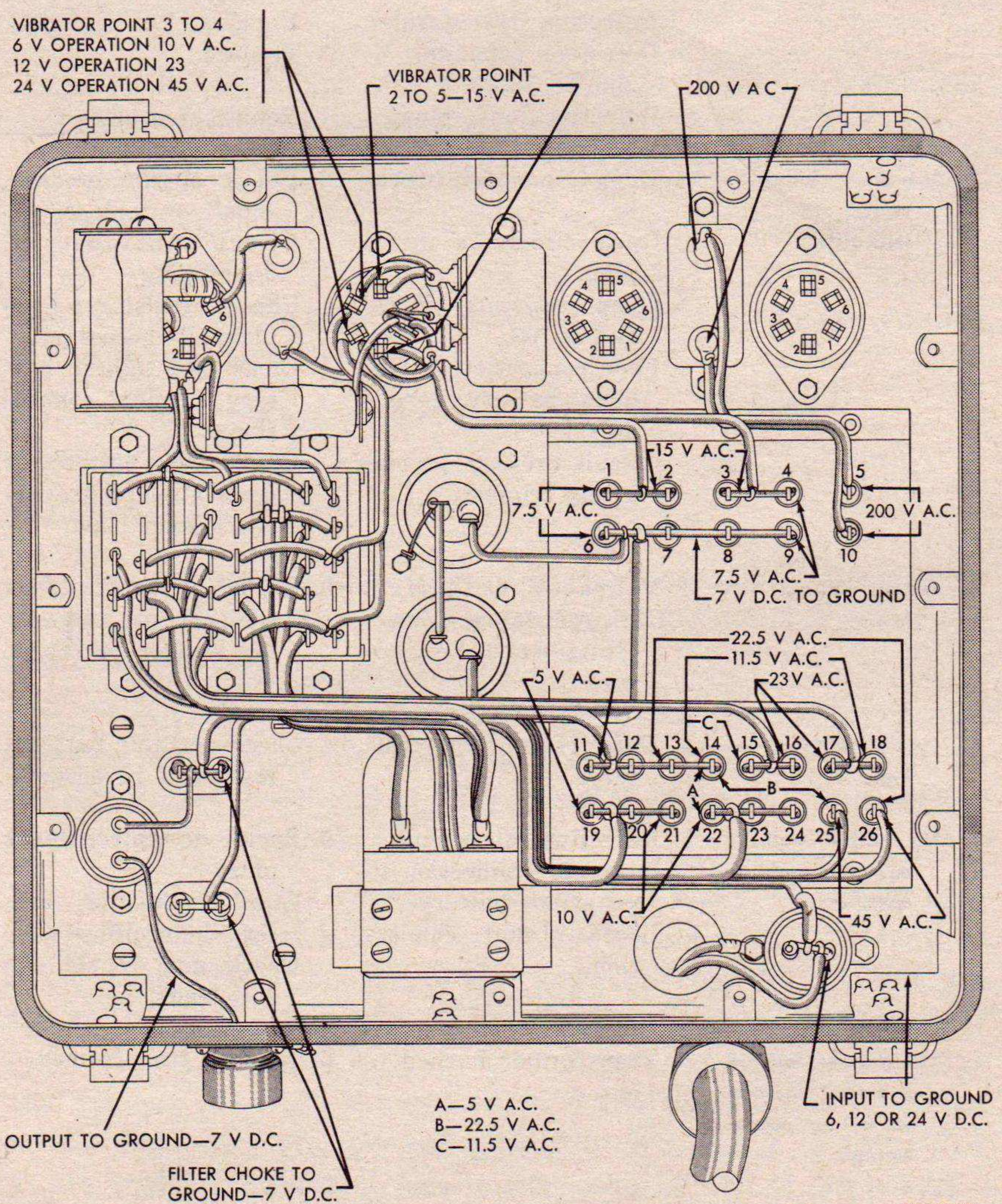


Figure 16. Voltage measurements from terminal to terminal, and from terminal to ground.

a. If the voltages measured at any terminal differ greatly from the values shown in figure 16, check the schematic diagram (fig. 20) to locate the circuit in which the trouble exists. After the circuit is located, identify the elements common to the terminal and test for possible failure.

NOTE: The voltage values given are approximate and vary with different sets, different types of test equipment, and particularly with the condition of the batteries in use.

b. Voltage values are not shown at the Jones socket terminal since measurements from these circuits are taken at other points in the charger.

49. RESISTORS.

a. In general, resistance of circuits in the equipment, except the transformer winding between contacts 5 and 10 and across the three resistors in the circuit, will be very low or very high. Between 5 and 10 on the transformer the resistance should be approximately 27 ohms. If the schematic diagram indicates open circuits (capacitor or no connection) the resistance should be very high but where a closed circuit is indicated, the resistance should be of the order of 10 ohm or less except as outlined above.

b. Three resistors are used in Battery Charger PE-219 (fig. 18). R-202 and R-203 are voltage dropping resistors used in 12- and 24-volt operation to lower the voltage for the vibrator driver coil. Both these are 16 watt wire-wound resistors and are, therefore, easily identified. The third resistor, R-201, is a small carbon resistor fastened to the socket of the active vibrator.

SECTION XII. REPAIRS

50. GENERAL.

Only competent personnel supplied with adequate tools and instruments are authorized to service and repair this equipment. An inexperienced operator attempting to make repairs which should be made by a competent repairman may damage the equipment to such an extent that it has to be sent to a higher echelon for repair.

a. The removal and replacement of defective parts or circuit elements in Battery Charger PE-219 is not difficult; but take great care to avoid damage to the set or to the part being installed. Before attempting repairs, make every effort to obtain proper tools for the job.

b. Often it may be necessary to remove other circuit elements to gain access to the defective part. Make a record of the connections to each element removed, and its position in the set.

c. Clip all leads as short as possible and avoid using more solder than necessary to make a secure connection. **Any solder dropped accidentally inside the charger can cause short circuits.** Exercise extreme care when soldering. Do not heat lugs or connections more than absolutely necessary, as excessive heat damages near-by chokes, capacitors, and wiring.

CAUTION: Never change the location of parts or wiring leads. Exercise utmost care in disassembling and reassembling mechanical units. Secure bolts snugly, but do not overtighten them.

51. HANDLING OF TOOLS.

Careful handling of tools is essential in maintenance of signal equipment. Grasp tools firmly. Do not drop or jar them against breakable parts of the set. Do not strain wires, cables, connections, or couplings unnecessarily. Do not provide space for working on a part by carelessly pushing aside other parts that are in the way.

a. Care of Tools. Work can be performed rapidly and efficiently with well-kept tools. When a job has been completed, wipe the tools with a cloth slightly dampened with oil. Occasionally oil the hinge rivets of pliers and similar tools to keep them working freely. Inspect the handles of driving tools to see that they are tight and free from chips and splinters. When tools are to be stored for a long time, cover the surfaces with Grease, Lubricating, Special (GL) as a preservative. Do not use thin oil because its tendency to break down may permit moisture to corrode or rust the metal.

52. REPLACEMENT OF MAJOR COMPONENTS.

All parts in Battery Charger PE-219 are readily accessible and can be replaced by use of a screwdriver, pliers, and a soldering iron. When a part needs to be replaced, unsolder all soldered connections. Work carefully so that proper connections can be made to the replaced part. Remove screws or bolts that hold the part in place and set them to one side where they can be found easily when a replaced part is to be installed. In removing a part of the charger, be sure not to jar it against other parts of the set. If the part cannot be moved freely, check it to see that all connections are unsoldered, or that it is not held in place by some other part of the set.

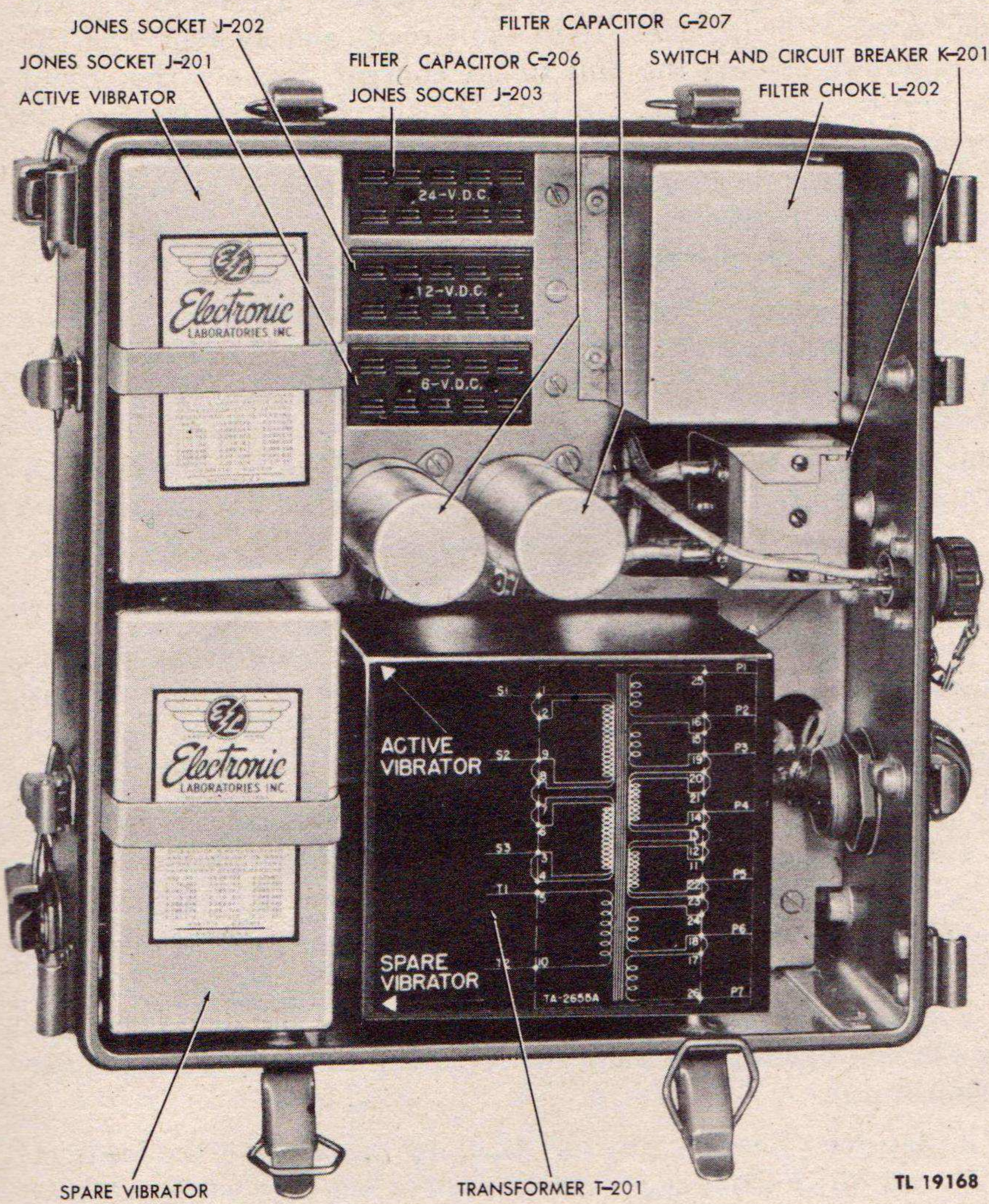


Figure 17. Battery Charger PE-219, top view.

a. Vibrator. The vibrator is the plug-in type. Remove the active vibrator by inserting the fingers beneath the strap across the top of the vibrator and pulling gently but firmly upward. In the same manner remove the spare vibrator from the sockets which hold it. Insert the spare vibrator by starting the connector prongs on the bottom of the vibrator in the active vibrator sockets, and pushing gently until the vibrator is in place. Discard the vibrator that has been removed.

NOTE: Construction of the vibrator is such that adjustment is not recommended. If the vibrator is defective discard it.

b. Circuit Breaker. Replace the circuit breaker by unsoldering the four wires which connect it to the circuit, and by removing the four screws holding the unit to the charger. Remove the circuit breaker through the top. The OFF-ON buttons incorporated in the circuit breaker are operated through a rubber membrane water-sealed to the case. The buttons do not have to be disconnected to remove the circuit breaker unit. Replace the circuit breaker by reversing the procedure outlined for removing it.

c. Transformer. To remove the transformer unsolder all leads which connect the transformer to component parts of the set. It is not necessary to unsolder any terminal jumpers. Remove the six screws that hold the transformer to the chassis. The entire unit can then be lifted out from the top of the set. Replace the transformer by reversing the procedure outlined for removing it.

53. REPLACEMENT OF MISCELLANEOUS PARTS.

a. Filter Choke. To remove the filter choke unsolder the four leads fastened to the choke terminal through the bottom of the chassis. Remove the four screws holding filter choke in place, and remove the unit through the top of the set. Replace the filter choke by reversing the procedure for removing it.

b. Filter Capacitors. Remove filter capacitors by unsoldering the two leads attached on the under side of the set and loosening the screws in their ring clamps, which hold the capacitors in place. Then remove the capacitors from the top of the set.

c. Filter and Bypass Capacitors. Remove filter and bypass capacitors by unsoldering the leads and removing the screws which hold them in place.

d. Resistors. Remove resistor R-201 by unsoldering the leads at each end which connect across the base of one of the active vibrator sockets. This resistor will then lift out, since it is not otherwise attached. Remove resistors R-203 and R-202 by unsoldering the connections from the terminal lugs, and removing the bolts which hold them to the resistor bracket in which they are installed. Replace them by reversing the procedure followed in removing them.

e. Voltage Change Sockets. Replace voltage change (Jones plug) sockets by unsoldering all leads, bending the wires back out of the way carefully, and removing the two screws through the chassis which hold the socket mounting in place.

f. Vibrator Sockets. First remove the vibrator so that any molten solder will not drop on the vibrator prongs. Next unsolder all leads to the vibrator socket. Remove the two bolts which hold the socket

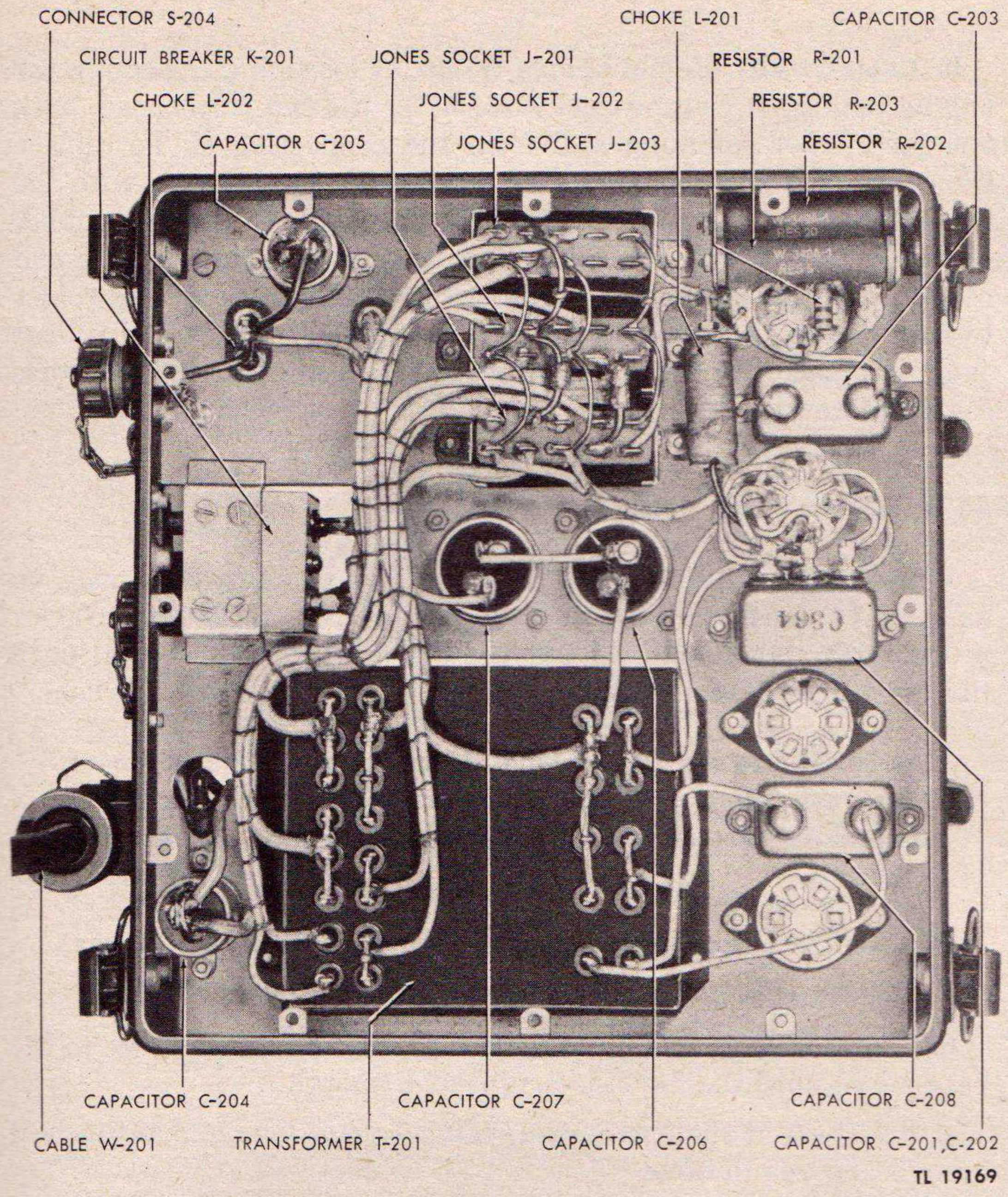


Figure 18. Battery Charger PE-219, bottom view.

to the chassis, and remove the sockets from the bottom of the set. Replace the sockets by reversing the procedure for removing.

g. Radio and Battery Connectors. Battery connector J-204 and radio set connector J-205 are located on the front of the charger. They can be removed by unsoldering the leads to these connectors from the inside of the unit and removing the four screws which hold them in place. The connectors then can be taken off. Before replacing the new connector, inspect the water-seal gasket for resiliency or defects. If it is defective, remove the gasket and replace it with a new one. Then insert the connector through the hole in the gasket, replace the four screws which hold it to the chassis, tighten them, and resolder the connector leads.

h. Cable W-201. Remove cable W-201 by loosening the connector cap by turning it counterclockwise. After the cap is loosened, back out the rubber jamming seal from the connecting el. To replace the cable, first slip the connector cap down over the cable with the threaded side toward the end of the cable. Next slip the rubber jamming gasket over the cable with the small end toward the end of the wire. Then insert the cable in the connecting el, and solder to the connector terminals inside the set. Last, insert the rubber jamming gasket in the el, and tighten the connector ring to insure a good water-seal.

54. RUSTPROOFING AND REPAINTING.

If the finish on the case is badly scarred or damaged, touch up exposed surfaces to prevent rust and corrosion. Using #00 or #000 sandpaper, clean the surface down to the bare metal until the finish is bright and smooth. Apply paint with a small brush.

CAUTION: The use of steel wool is not recommended. Although it removes rust rapidly, the small particles of metal which often fall into the case cause internal electrical shorting or grounding of circuits.

If a complete repainting job is necessary, proceed as follows:

a. Loosen rust and corrosion with dry-cleaning solvent.

b. Using #00 or #000 sandpaper, clean the surface down to the bare metal until the finish is bright and smooth.

c. Spray-paint the entire case, using a paint which is authorized by existing regulations.

55. UNSATISFACTORY EQUIPMENT REPORT.

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, War Department Unsatisfactory Equipment Report, W.D., A.G.O. Form No. 468 should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D.C.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form No. 54 should be filled out and forwarded through channels.

c. If either form is not available, prepare the data according to the sample form reproduced in figure 19.

WAR DEPARTMENT

UNSATISFACTORY EQUIPMENT REPORT

FOR	TECHNICAL SERVICE: Signal Corps — MATÉRIEL		DATE: 1 Feb 45
FROM	ORGANIZATION: 175 Signal Repair Co.		STATION: APO 102
TO	NEXT SUPERIOR HEADQUARTERS: Supply Sec. Hq Fourth Army Sig Sv.	STATION: APO 110	TECHNICAL SERVICE: Signal Corps

COMPLETE MAJOR ITEM

NOMENCLATURE	TYPE	MODEL	
Radio Transmitter BC-123-A	Ground, vehicular	A	
MANUFACTURER	**U. S. A. REG. NO.**	**SERIAL NO.**	**DATE RECEIVED**
American Radio Corp	Order No. 1234-Phila-45	12345	5 Jan 45

EQUIPMENT WITH WHICH USED *(if applicable)*: Radio Set SCR-456-A — Tank, Medium, M4

DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE

PART NO.	TYPE	MANUFACTURER	DATE INSTALLED
Sig C Stk.No.3E47-2	Capacitor C20:fixed; 1-mf; 500 vdcw	American Radio Corp	when manufactured

DESCRIPTION OF FAILURE AND PROBABLE CAUSE *(If additional space is required, use back of form)*:
Capacitor C20 shorts out due to humid operating conditions

DATE OF INITIAL TROUBLE	TOTAL TIME INSTALLED			TOTAL PERIOD OF OPERATION BEFORE FAILURE					
	YEARS	MONTHS	DAYS	YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
15 Jan 45	-	-	-	0	0	5		-	-

BRIEF DESCRIPTION OF UNUSUAL SERVICE CONDITIONS AND ANY REMEDIAL ACTION TAKEN:
Operation in tropics; heavy rainfall. Was replaced and set given moistureproofing and fungiproofing treatment, 20 Jan 45.

TRAINING OR SKILL OF USING PERSONNEL			RECOMMENDATIONS *(If additional space is required, use back of form)*
POOR	FAIR	GOOD	
		X	Substitute capacitor designed for tropical operation

ORIGINATING OFFICER

TYPED NAME, GRADE, AND ORGANIZATION	SIGNATURE
E.A.WILSON, 1st Lt., Sig C. 175 Sig Repair Co.	E.A. Wilson

FIRST ENDORSEMENT

TO CHIEF	TECHNICAL SERVICE	OFFICE	
NAME, GRADE, AND STATION		STATION	DATE

Instructions

1. It is imperative that the chief of technical service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in matériel. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.
2. This form will be used for reporting manufacturing, design, or operational defects in matériel, petroleum fuels, lubricants, and preserving materials with a view to improving and correcting such defects, and for use in recommending modifications of matériel.
3. This form will not be used for reporting failures, isolated material defects or malfunctions of matériel resulting from fair-wear-and-tear or accidental damage nor for the replacement, repair or the issue of parts and equipment. It does not replace currently authorized operational or performance records.
4. Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in AR 750-10 (change No. 3).
5. It will not be practicable or desirable in all cases to fill all blank spaces of the report. However, the report should be as complete as possible in order to expedite neces sary corrective action. Additional pertinent information not provided for in the blank spaces should be submitted as inclosures to the form. Photographs, sketches, or other illustrative material are highly desirable.
6. When cases arise where it is necessary to communicate with a chief of service in order to assure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.
7. This form will be made out in triplicate by using or service organization. Two copies will be forwarded direct to the technical service; one copy will be forwarded through command channels.
8. Necessity for using this form will be determined by the using or service troops.

W. D., A. G. O. Form No. 468
30 August 1944

This form supersedes W. D., A. G. O. Form No. 468, 1 December 1943, which may be used until existing stocks are exhausted.

TL19589

U. S. GOVERNMENT PRINTING OFFICE 16—41546-1

Figure 19. W.D., A.G.O. Form No. 468, sample form.

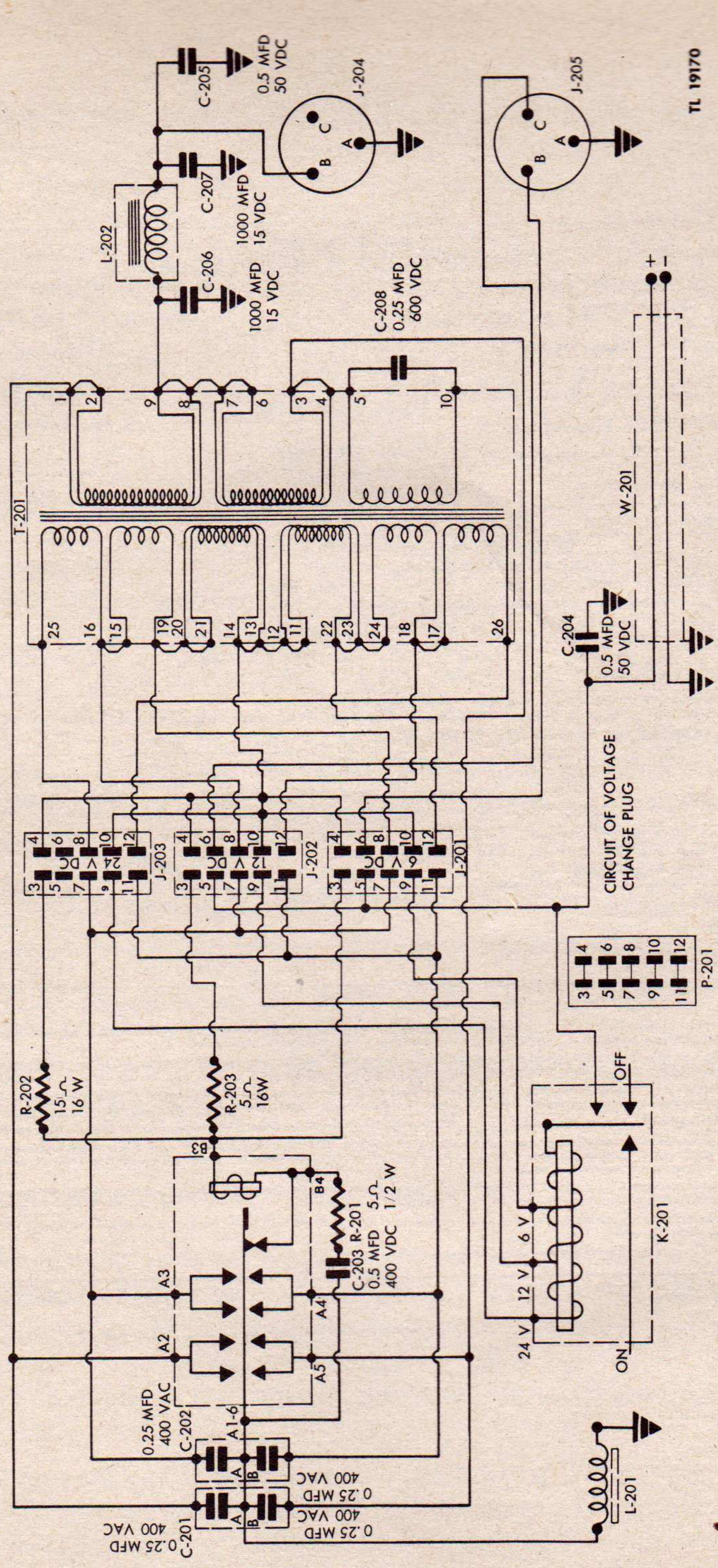
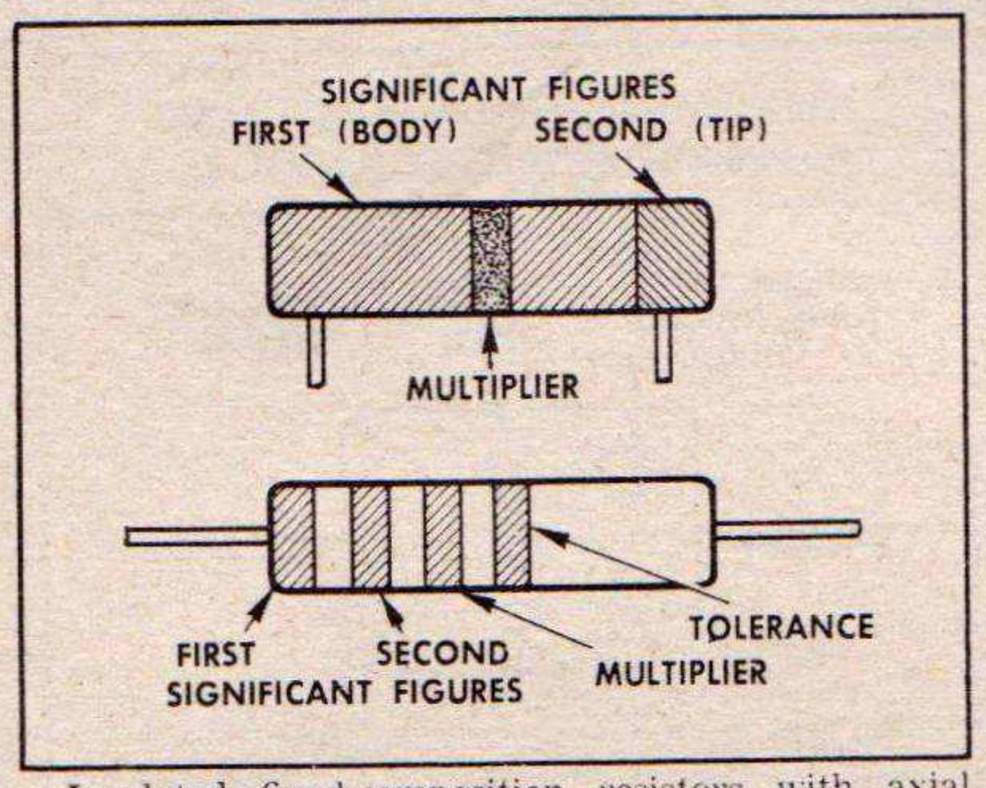


Figure 20. Battery Charger PE-219, complete schematic diagram.

RESISTOR COLOR CODES

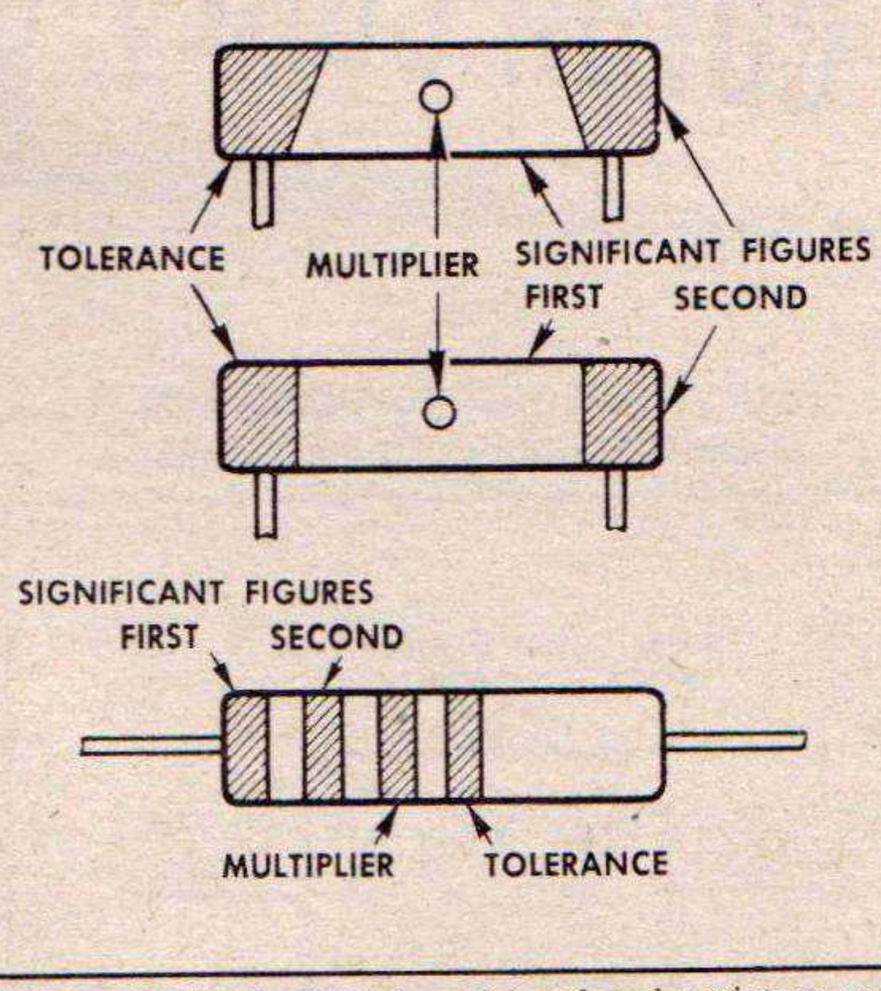
RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS



Insulated fixed composition resistors with axial leads are designated by a natural tan background color. Non-insulated fixed composition resistors with axial leads are designated by a black background color.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000	
GRAY	8	100,000,000	
WHITE	9	1,000,000,000	
GOLD		0.1	5
SILVER		0.01	10
NO COLOR			20

AWS COLOR CODE FOR FIXED COMPOSITION RESISTORS



The exterior body color of insulated resistors may be any color except black. The usual color is natural tan. The exterior body color of uninsulated resistors with axial leads may be either black or white. The exterior body color of uninsulated resistors with radial leads may be black or it may be the color of the first significant figure of the resistance value.

RMA: *Radio Manufacturers Association*

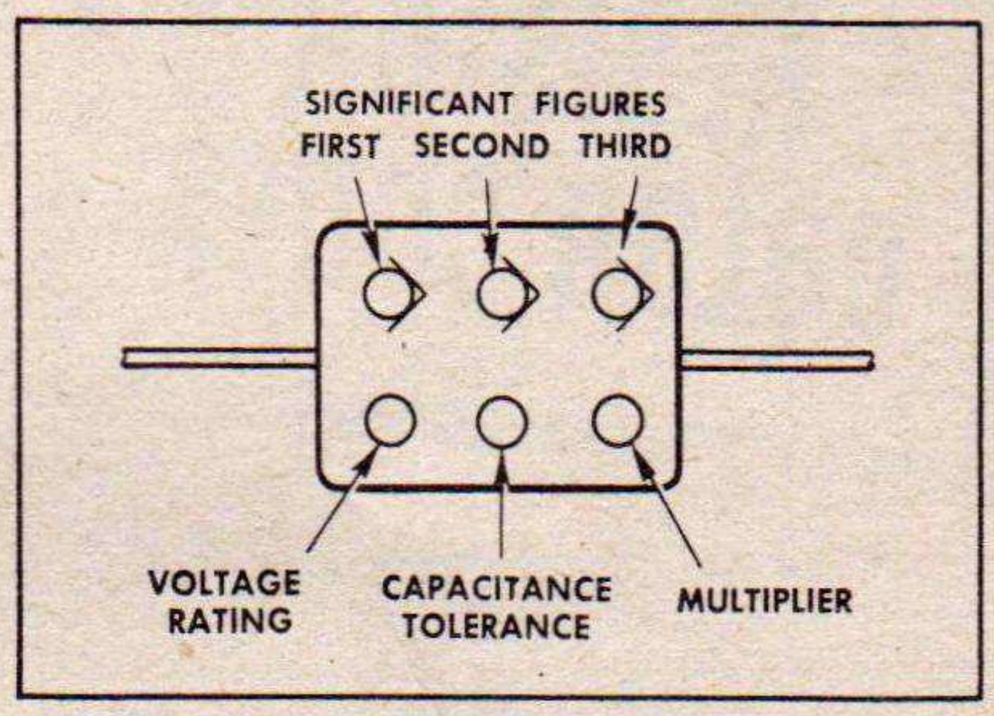
AWS: *American War Standard (American Standards Association)*

TL 13418

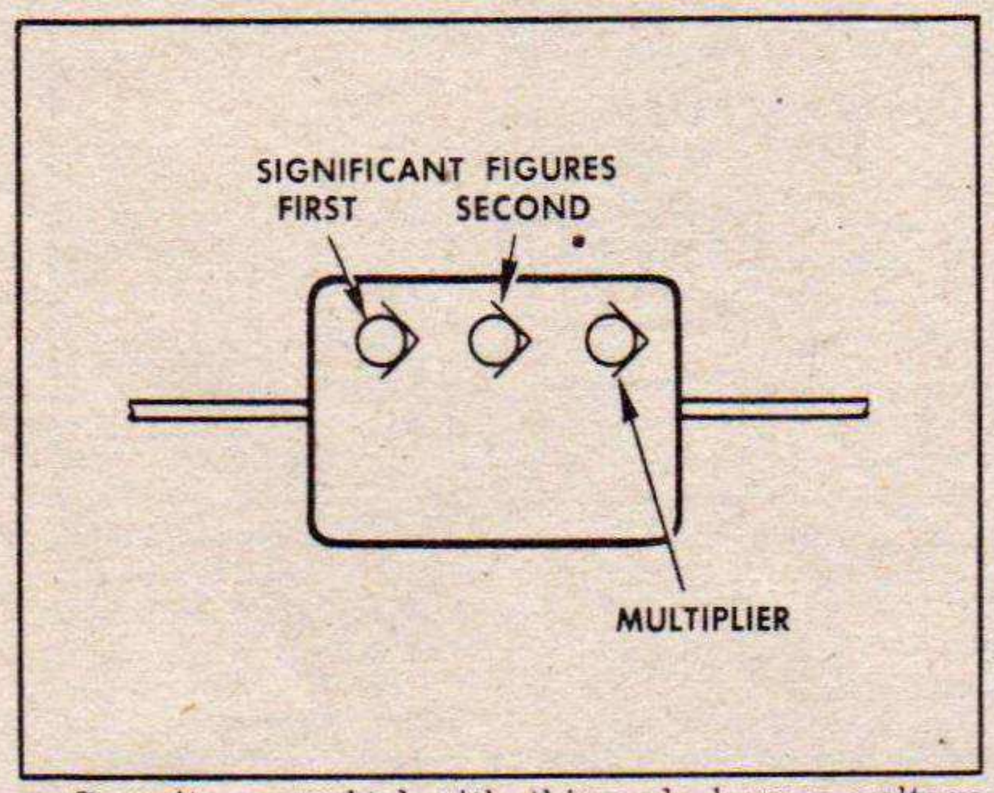
Figure 21. Resistor color codes.

CAPACITOR COLOR CODES

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

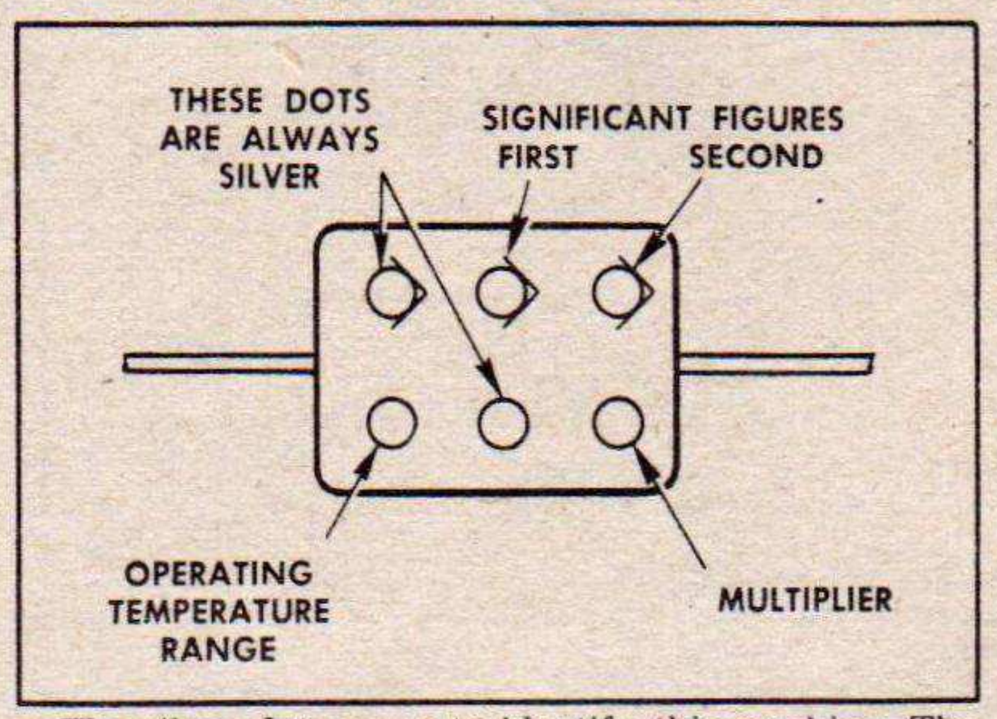


RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts.

AWS 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS

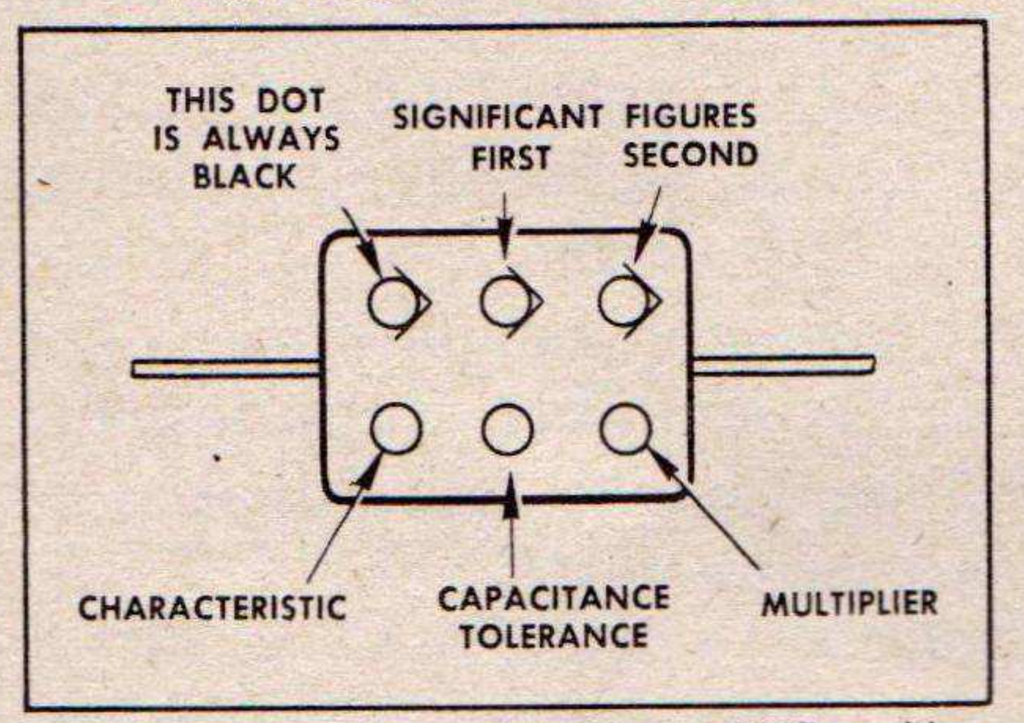


The silver dots serve to identify this marking. The sixth dot shows whether the capacitor has a maximum operating temperature of 167°F (black) or 185°F (brown).

COLOR	SIGNIFICANT FIGURE	MULTIPLIER		VOLTAGE RATING (VOLTS)	CHARACTERISTIC (AWS MICA-DIELECTRIC)
		RMA MICA- AND CERAMIC-DIELECTRIC AWS MICA- AND PAPER-DIELECTRIC	AWS CERAMIC-DIELECTRIC		
BLACK	0	1	1		A
BROWN	1	10	10	100	B
RED	2	100	100	200	C
ORANGE	3	1000	1000	300	D
YELLOW	4	10,000		400	E
GREEN	5	100,000		500	F
BLUE	6	1,000,000		600	G
VIOLET	7	10,000,000		700	
GRAY	8	100,000,000	0.01	800	
WHITE	9	1,000,000,000	0.1	900	
GOLD		0.1		1000	
SILVER		0.01		2000	
NO COLOR				500	

Figure 22. Capacitor color codes.

AWS 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



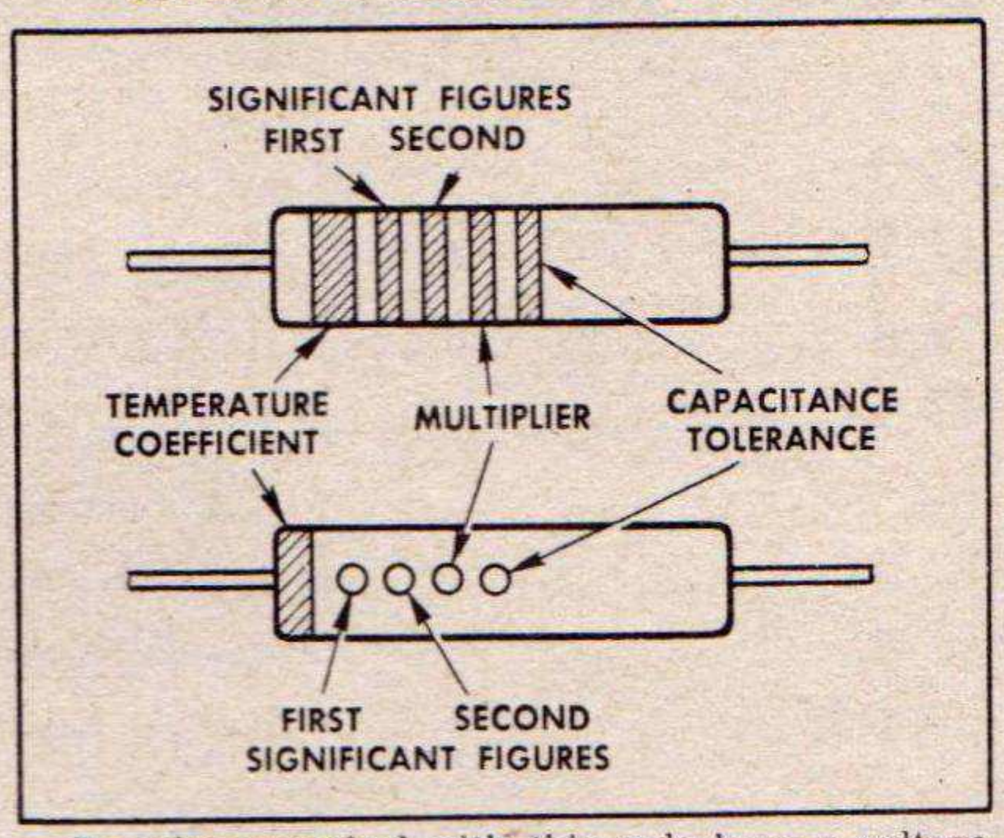
The black dot serves to identify the AWS marking. Capacitors marked with this code are rated at 500 volts, except the following. AWS type CM35 capacitors with capacitances of 6,800, 7,500, and 8,200 micromicrofarads, and AWS type CM40 capacitors with capacitances of 9,100 and 10,000 micromicrofarads are rated at 300 volts.

RMA: *Radio Manufacturers Association*

AWS: *American War Standard (American Standards Association)*

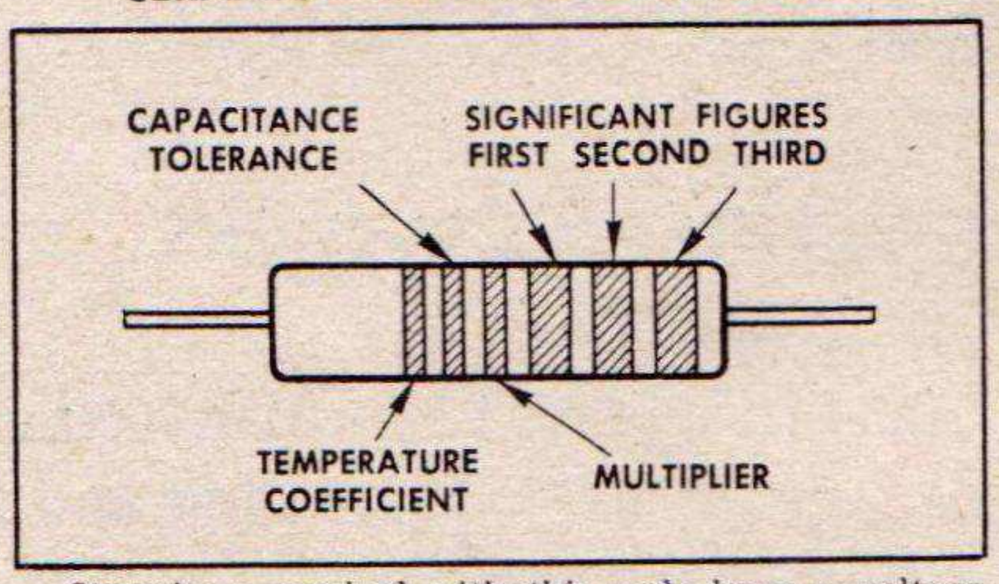
NOTE: These color codes give all capacitances in *micromicrofarads*.

AWS COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts.

RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts.

CAPACITANCE TOLERANCE				TEMPERATURE COEFFICIENT OF CAPACITANCE $\times 10^{-6}$ MMF/MMF/°C
RMA & AWS MICA- AND PAPER-DIELECTRIC (PERCENT)	RMA CERAMIC-DIELECTRIC (PERCENT)	AWS CERAMIC-DIELECTRIC GREATER THAN 10 MMF (PERCENT)	AWS CERAMIC-DIELECTRIC LESS THAN 10 MMF (MMF)	
20	20	20	2.0	0
1	1	1		− 30
2	2	2		− 80
3	3	2.5	0.25	−150
4	4			−220
5	5	5	0.5	−330
6	6			−470
7	7			−750
8	2.5			+ 30
9	10	10	1.0	Not specified
5				
10				
20				TL 13417

SECTION XIII. REFERENCES

56. ARMY REGULATIONS.

AR 380-5 . . . . . Safeguarding Military Information.

57. SUPPLY PUBLICATIONS.

SIG 1 . . . . . Introduction to ASF Signal Supply Catalog.
SIG 2 . . . . . Complete Index to ASF Signal Supply Catalog.
SIG 3 . . . . . List of Items for Troop Issue.
SIG 4-1 . . . . . Allowances of Expendable Supplies
SIG 4-2 . . . . . Allowances of Expendable Supplies for Schools, Training Centers, and Boards.
SIG 5 . . . . . Stock List of All Items.
SIG 6 . . . . . Sets (when published).
SB 11-8 . . . . . Chests for Running Spares.
SB 11-10 . . . . . Signal Corps Kit and Materials for Moisture and Fungi-Resistant Treatment.

58. PAINTING, PRESERVING, AND LUBRICATION.

TB SIG 13 . . . . . Moistureproofing and Fungiproofing Signal Corps Equipment.

59. SHIPPING INSTRUCTIONS.

U. S. Army Spec No.
100-14A . . . . . Army-Navy General Specification for Packaging and Packing for Overseas Shipment.

60. DECONTAMINATION.

TM 3-220 . . . . . Decontamination.

61. DEMOLITION.

FM 5-25 . . . . . Explosives and Demolitions.

62. OTHER PUBLICATIONS.

FM 21-6* . . . . . Lists of Publications for Training.
W.D. Pamphlet 12-6† . . List of Administrative and Supply Publications.
TB SIG 25 . . . . . Preventive Maintenance of Power Cords.
TB SIG 66 . . . . . Winter Maintenance of Ground Signal Equipment.
TB SIG 72 . . . . . Tropical Maintenance of Ground Signal Equipment.
TB SIG 75 . . . . . Desert Maintenance of Ground Signal Equipment.
TB SIG 123 . . . . . Preventive Maintenance Practices for Ground Signal Equipment.

TM 1-455 . . . . . Electrical Fundamentals.
TM 11-227 . . . . . Signal Communication Equipment Directory. Radio Communication Equipment.
TM 11-310 . . . . . Schematic Diagrams for Maintenance of Ground Radio Communication Sets.
TM 11-453 . . . . . Shop Work.
TM 11-455 . . . . . Radio Fundamentals.
TM 11-462 . . . . . Reference Data.
TM 11-483 . . . . . Suppression of Radio Noises.
TM 11-619 . . . . . Radio Set SCR-619.
TM 11-879 . . . . . Receiver-Transmitter BC-1335.
TM 37-250 . . . . . Basic Maintenance Manual.

*Refer to for applicable technical bulletins.
†Refer to for applicable modification work orders.

63. FORMS.

W.D., A.G.O. Form
No. 468 . . . . . (Unsatisfactory Equipment Report).
Army Air Forces Form
No. 54 . . . . . (Unsatisfactory report).

64. ABBREVIATIONS.

a-c . . . . . Alternating-current
amp . . . . . ampere
d-c . . . . . direct-current
r-f . . . . . radio-frequency
v . . . . . volt

65. GLOSSARY.

Refer to the glossary in TM 11-455.

SECTION XIV. MAINTENANCE PARTS

66. MAINTENANCE PARTS FOR BATTERY CHARGER PE-219.

The following information was compiled 4 April 1945. The appropriate section of the ASF Signal Supply Catalog for Battery Charger PE-219 is:

Higher Echelon Spare Parts

Sig 8-PE-219 . . . . . when published

For the latest index of available catalog sections, see ASF Signal Supply Catalog Sig 2.

Ref. Symbol	Signal Corps Stock No.	Name of Part and Description
	3H230-219	BATTERY CHARGER PE-219: vibrator rectifier; 6, 12, 24v; metal case; 11″ lg x 10″ wd x 5¾″h.
K201	3H900-30-8	BREAKER, circuit: magnetic; single pole; 6v DC, 30 amp ±25%; 12v DC, 15 amp ±25%; 24v DC 7 amp ±25%; metal case; 2 7/16″ lg x 1 15/16″ wd x 2 11/32″h over-all; GM Labs No. 12997-1.
	3E7264-1	CABLE ASSEMBLY, power: general purpose; shielded, rubber jacketed; round, 0.550″ diam; 10 ft 6″ lg; two #10 AWG copper cond ea comprising 104 #30 AWG strands; Electronic Labs part/dwg No. A-1370 Assembly; (two terminal lugs).
	2Z1612.26	CAP, connector: aluminum w/chain 2½″ lg; 1″ diam x 9/16″; Amphenol #9760-14; Delco part/dwg No. 7254285.
C206 C207	3DB1000-10	CAPACITOR, fixed: electrolytic; minimum 1,000 mf 15 vdcw; 3½″ lg x 1⅜″ diam; Aerovox No. EP L-10.
C208	3DA250-21.9	CAPACITOR, fixed: paper, oil-filled; 250,000 mmf ±10%; 600 vdcw; 2½″ lg x 1″ wd x ⅞″ thk; Elec Utilities No. 10878-1 (hermetically sealed).
C204 C205	3DA500-193	CAPACITOR, fixed: paper, oil-filled; 500,000 mmf −10% +40%; 50 vdcw; 1 5/16″ lg x 1″ diam; Elec Utilities No. 10643 (hermetically sealed).
C203	3DA500-177	CAPACITOR, fixed: paper, oil-filled; 500,000 mmf ±10%; 400 vdcw; 2½″ lg x 1″ wd x 13/16″ thk; Elec Utilities No. 10432-1 (hermetically sealed).
C201 C202	3DA250-112	CAPACITOR, fixed: paper, oil-filled; 2 sect; 250,000-250,000 mmf ±10%; 400 vdcw; 2½″ lg x 1 1/32″ wd x ¾″ thk; CP50B4FF-254K.
L202	3C323-147B	COIL, AF: filter; parallel wound; parallel layer wound; 20 amp, 0.01 ohm; 1,500v AC; metal case 3 3/16″ lg x 2⅜″ wd x 2 15/16″h; Electronic Labs No. TA-2660A (hermetically sealed).

Ref. Symbol	Signal Corps Stock No.	Name of Part and Description
L201	3C323-147C	COIL, RF: choke; single winding; single layer wound; unshielded; 16 turns #10 AWG enamel copper wire; 1 13/16" lg x 1" OD; Electronic Labs No. A-1734A.
J204 J205	2Z3064-8	CONNECTOR, female contact: 3 round cont; straight; 1 3/16" wd x 1 3/16"h x 29/32" lg; Amphenol AN-3102-14S-7S.
J201	2Z3071-3	CONNECTOR, female contact: 10 rectangular cont; straight; 1 3/16" wd x 1 1/4" thk x 2 5/16" lg less mtg bracket; Jones HP No. S-410 AB (special marking 6v).
J202	2Z3071-3.2	CONNECTOR, female contact: 10 rectangular cont; straight; 1 3/16" wd x 1 1/4"h x 2 5/16" lg less mtg bracket; Jones HB No. S-410 AB (special marking 12v DC).
J203	2Z3071-3.1	CONNECTOR, female contact: 10 rectangular cont; straight; 1 3/16" wd x 1 1/4" x 2 5/16" lg less mtg bracket; Jones HB No. S-410 AB (special marking 24v DC).
P203	2Z3030-13	CONNECTOR, male contact: 10 flat male cont; straight; 2 3/8" lg x 1 1/8" wd x 1 13/16"h less cont; Jones No. P-410FHE.
	3H1495.1	DIAPHRAGM, weatehrseal: black neoprene; 2 19/32" lg x 1 27/32" wd x 1/4" thk; 4 mtg holes 0.109" diam; 2 center holes 0.312" diam; Electronic Labs No. N-643.
	6Z6918-6	FASTENER, latch: truck; steel, olive drab; 2 1/8" lg x 1 3/8" wd x 1/2"h over-all; Corbin No. 15840-1.
	6Z3810-52	FASTENER, latch: truck; steel, olive drab; 2 1/8" lg x 1 5/8" wd x 1/2"h over-all; Corbin No. 15795-G.
	2Z4866.239	GASKET: synthetic rubber; 7/16" OD x 0.0160" ID x 1/16" thk; Delco part/dwg No. 7253516 (cover screw).
	2Z4866.238	GASKET: neoprene; 11" lg x 10" wd x 7/32" thk; Delco part/dwg No. 7253639 (case cover).
	2Z4867.232	GASKET: synthetic rubber; 1 3/16" sq x 1/16" thk; Delco part/dwg No. 7253915 (3/4" diam hole in center) (power connector).

Ref. Symbol	Signal Corps Stock No.	Name of Part and Description
R201	3Z5995-8	RESISTOR, fixed: composition; 5 ohm ±10%; ½w; ⅝" lg x 15/64" diam; IRC No. BW½.
R203	3Z5995-58	RESISTOR, fixed: WW; 5 ohm ±10%; 16w; 2" lg x 7/16" OD; IRC type CG-3-B.
R202	3Z6002-66	RESISTOR, fixed: WW; 20 ohm ±10%; 10w; max dimen 2" lg x 27/32" diam; RW15-H200.
	2Z8676.10	SOCKET, tube: 6-prong steatite; molded bakelite; 2 3/16" lg x 1 3/8" wd x 13/16"h; Amphenol No. RSS 6.
T201	2Z9619-131	TRANSFORMER, power: conversion; pri 6v, 12v, 24v DC; 120 cyc sq wave; secd 15v AC at 5 amp and 250v at 25 ma buffer; steel case; hermetically sealed; 5 25/32" lg x 4 5/16" wd x 4 3/16"h; Electronic Labs No. TA-2655A.
	3H6694.2-2	VIBRATOR UNIT: synchronous; rectifier; input 6 DC, 20 amp; dual 6 prong plugs 4 15/16" lg x 2⅝" wd x 3¼"h over-all; Electronic Labs part No. LTX-1314.
	6L50244BN	WASHER, cup: brass; black nickel pl; cup ID 7/16" x ¼" hole diam x 5/64"h; Delco part/dwg No. 7253421.

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