# TM 11-962

## WAR DEPARTMENT TECHNICAL MANUAL



# RECTIFIER
# RA-63-B

**RESTRICTED.** DISSEMINATION OF RESTRICTED MATTER. The information contained in restricted documents and the essential characteristics of restricted materiel may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work, but will not be communicated to the public or to the press except by authorized military public relations agencies. (See also par. 28, AR 380-5, 15 Mar 1944.)

*WAR DEPARTMENT* *15 SEPTEMBER 1944*

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WAR DEPARTMENT

WASHINGTON 25, D. C., 15 September 1944.

TM 11-962, Rectifier RA-63-B, is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
*Chief of Staff.*

OFFICIAL:

J. A. ULIO,
*Major General,*
*The Adjutant General.*

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IC 44; T/O-E 44-147S.

For explanation of symbols, see FM 21-6.

# TABLE OF CONTENTS

# 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**—Rectifier stack, control switch, transformer, case, a-c supply, battery-charging cable plug, circuit breaker.

2. **Cut**—All internal wiring, and all rubber-covered cables.

3. **Burn**—Technical manual, circuit label, wiring diagram label.

4. **Bury or scatter**—Any or all of above pieces after smashing.

# DESTROY EVERYTHING

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# SAFETY NOTICE

**Always turn control switch to OFF position when unit is not in use. Keep flames, lighted cigarettes, and lighted matches away from storage batteries while they are being charged. Hydrogen gas given off during charging is highly inflammable.**

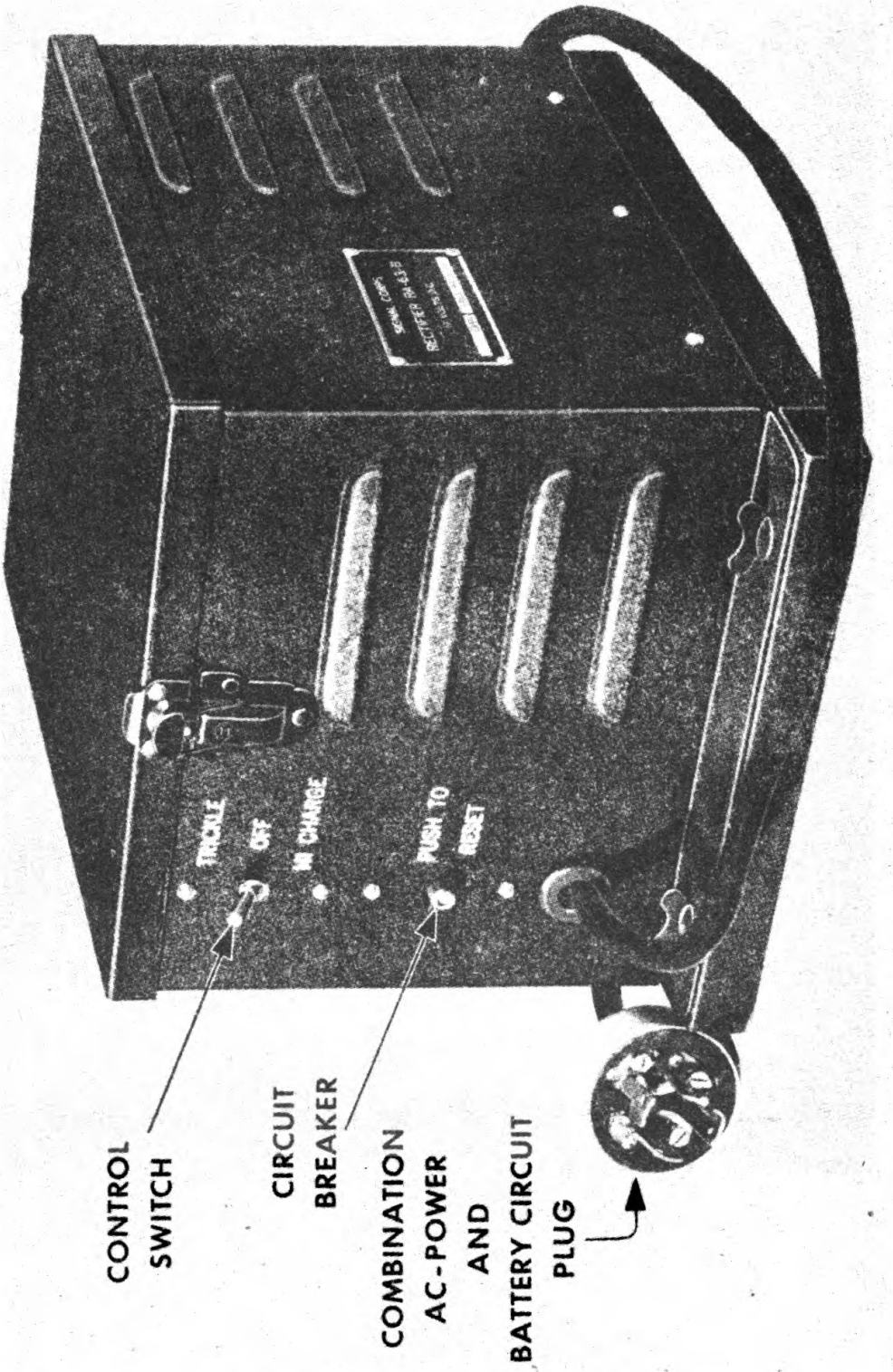



*Figure 1. Rectifier RA-63-B, front view.*

# SECTION I

# DESCRIPTION

## 1. GENERAL.

Rectifier RA-63-B is a full-wave, selenium disk rectifier capable of converting 105- to 125-volt, 1-phase, 60-cycle, a-c power into direct current for charging lead-acid storage batteries. When used with Radio Sets SCR-399-( ) and SCR-499-( ), it provides charging current for the auxiliary battery in Chest CH-109-( ), if connected according to instructions in paragraph 7. The complete unit (fig. 1) is inclosed in a steel case and equipped with base for floor or table mounting. The weight of the rectifier is 27¾ pounds, and the over-all dimensions are 13½ inches long, 9¼ inches wide and 8¾ inches high. Two copies of this manual, TM 11-962, should be packed with Rectifier RA-63-B at all times.

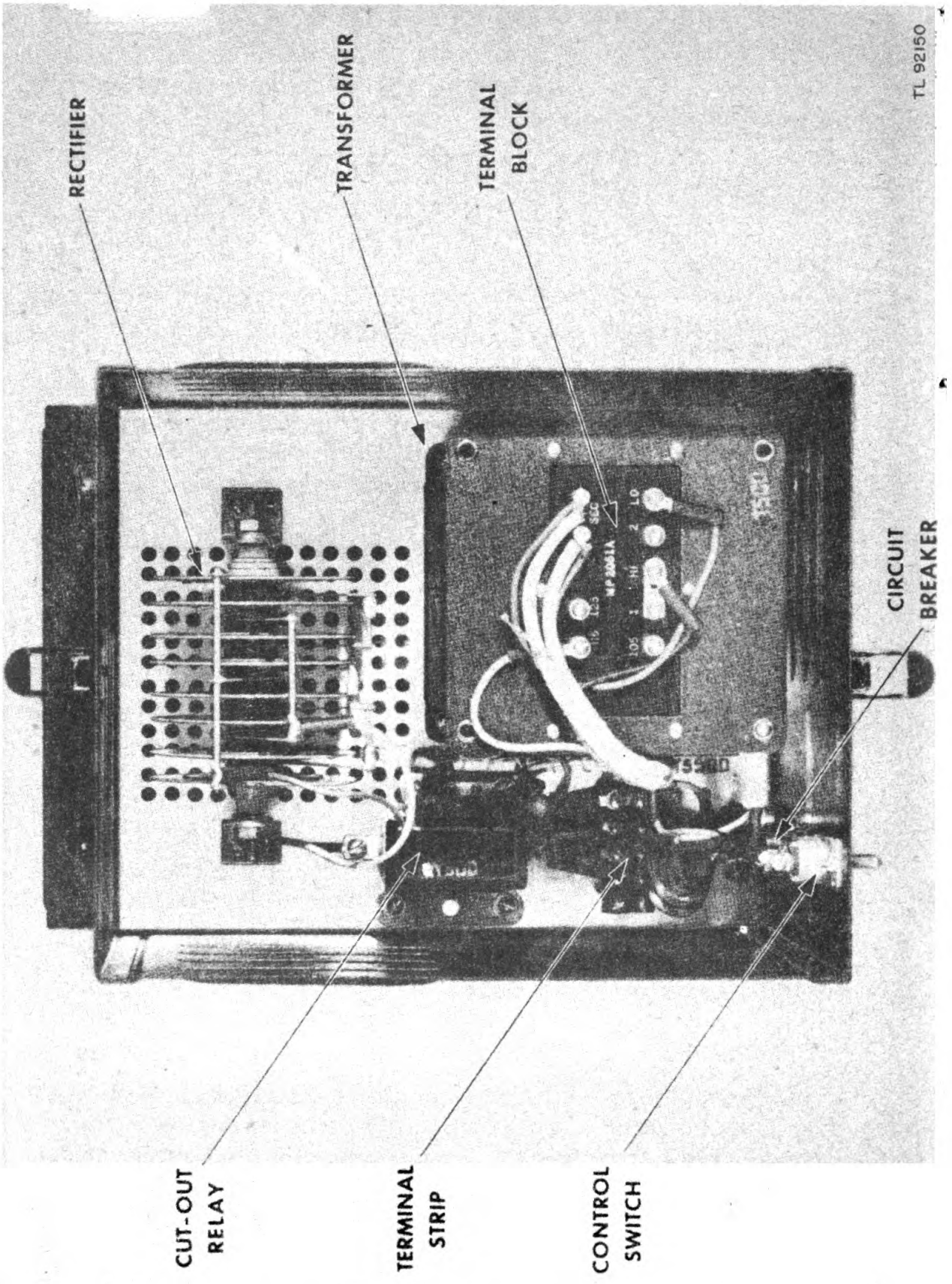
## 2. POWER.

*a. Input.* The input circuit of Rectifier RA-63-B is arranged for a 105- to 125-volt, 1-phase, 60-cycle, a-c power source.

*b. Charging Output.* Rectifier RA-63-B will deliver a charging rate of either 5 amperes or ½ ampere into a 12-volt battery. The charging rate is regulated by a control switch on the rectifier front panel. Positions of switch for respective charging rates are indicated as HI-CHARGE, OFF, and TRICKLE.

## 3. COMPONENT PARTS.

*a. General.* Rectifier RA-63-B consists of a subassembly including one power transformer and its terminal block, one selenium rectifier stack, one cut-out relay, and one terminal strip, all of which are mounted into an inclosing steel casing as shown in figure 2. One single-pole, double-throw d-c output control switch and one circuit breaker are mounted in back of the front panel with their handles extending through the front cover. The top cover of the steel-inclosing case is removable




2 *Figure 2. Internal view of unit assembly from top, with top cover removed.*

for access to the interior of the unit. A circuit label is mounted on the inside of the top cover.

*b. Cording.* Rectifier RA-63-B is provided with a combination a-c power and battery-charging cord and polarity-type plug.

# SECTION II

# INSTALLATION AND OPERATION

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## 4. GENERAL.

When removing Rectifier RA-63-B from its packing case, care should be taken to prevent damage to the charging control switch handle and circuit breaker push button. Place the rectifier in a clean, dry place whenever possible. It is very important to keep the rectifier away from the acid fumes given off by the batteries. Do not install Rectifier RA-63-B near or over the batteries.

## 5. MOUNTING THE UNIT.

Rectifier RA-63-B should always be mounted on a level surface and may be temporarily or permanently installed. To adapt rectifier RA-63-B to permanent installation it is necessary to temporarily remove the base by first loosening the four wing-head fasteners. When this is done the base may be permanently bolted to floor or table by securing the base with bolts through the four nuts provided. The Rectifier case is then again secured to the base by the four wing-head fasteners.

**CAUTION:** BE SURE THAT RECTIFIER IS ATTACHED TO BASE BEFORE PLACING UNIT IN OPERATION TO PROVIDE FOR PROPER VENTILATION.

## 6. CONNECTIONS FOR A-C SUPPLY.

A terminal block (fig. 5) mounted on top of the transformer provides for arranging the a-c power input circuit for 105-, 115-, or 125-volt power. The voltage of the power supply must first be verified. The yellow-colored wire connected at terminal numbered 2 on the terminal strip should then be securely fastened under the respective machine screw (marked 105, 115, or 125) on the transformer terminal block.

## 7. CONNECTING A-C AND D-C LEADS.

The cord and plug provided as a component part of Rectifier RA-63-B contains circuits for both the a-c power input and d-c charging output. The polarity-type plug must be connected to a female receptacle of similar pattern so that the prongs will provide the proper connections from the source of a-c power to the rectifier and from the rectifier to the battery to be charged. When using Rectifier RA-63-B with Radio Sets SCR-399-( ) and SCR-499-( ), connect the plug to socket $SO_{203}$ on Junction Box JB-70-( ). The internal wiring of this junction box provides for charging the auxiliary battery in Chest CH-109-( ) when Rectifier RA-63-B is turned on.

**CAUTION:** ALWAYS BE SURE THAT A-C POWER IS BEING SUPPLIED THROUGH THE PLUG AND CORD TO THE CORRECT TERMINALS ON THE TERMINAL STRIPS; ALSO THAT THE CONTROL SWITCH IS SET ON **OFF** POSITION BEFORE CONNECTING OR DISNECTING THE COMBINATION A-C POWER AND BATTERY-CHARGING PLUG.

## 8. PROCEDURE BEFORE OPERATING.

*a.* Move the control switch to OFF position.

*b.* Be sure that the positive terminal on the battery to be charged is connected to the rectifier circuit through the red-colored wire in the cord to terminal numbered 4 on the terminal strip.

*c.* Be sure that all connections are tight.

**NOTE:** Poor connections cause arcing and sparking.

## 9. NORMAL OPERATING PROCEDURE.

To place Rectifier RA-63-B into operation proceed as follows:

*a.* Move the control switch to HI-CHARGE.

*b.* Depress the circuit breaker push button.

*c.* After battery has received its full charge move the control switch to TRICKLE.

## 10. CONTINUOUS CHARGING WITH RECTIFIER RA-63-B.

*a. Purpose.* The purpose of continuous charging is to furnish a steady charging current 24 hours a day which will be adequate to replace the drain on the battery used.

*b. Charging Rate.* See TM 11-430, Storage Batteries for Signal Communication, Except Those Pertaining to Aircraft, for complete information on approved charging methods and correct charging rates for batteries used with this rectifier. Battery drain will vary according to the operating conditions. Generally it is necessary to supply 10 to 25 percent more current for charging the batteries than is actually drained to compensate for losses because of the condition and age of the battery being used.

*c. Checking Condition of Charge.* Any of the three methods below may be used to determine whether the battery is fully charged:

(1) By using a hydrometer to measure the specific gravity of the electrolyte. Correct gravity reading for battery is given on the label.

(2) By using a d-c voltmeter across the battery terminals during charge or discharge.

(3) By inspection of the battery being charged. When fully charged, the liquid in the cells should be bubbling gently. This is not an accurate method of determining the state of charge of a battery. *Do not use unless necessary.*

*d. Improper Charging.* If the battery does not become fully charged after a reasonable period of time, examine the battery for dead or defective cells. If the battery gases and bubbles violently and the temperature of the liquid in the cells rises, the charging rate is too high. Lower the rate accordingly.

**NOTE:** If battery electrolyte temperature exceeds 110° F during charging, shut off the rectifier and allow battery to cool.

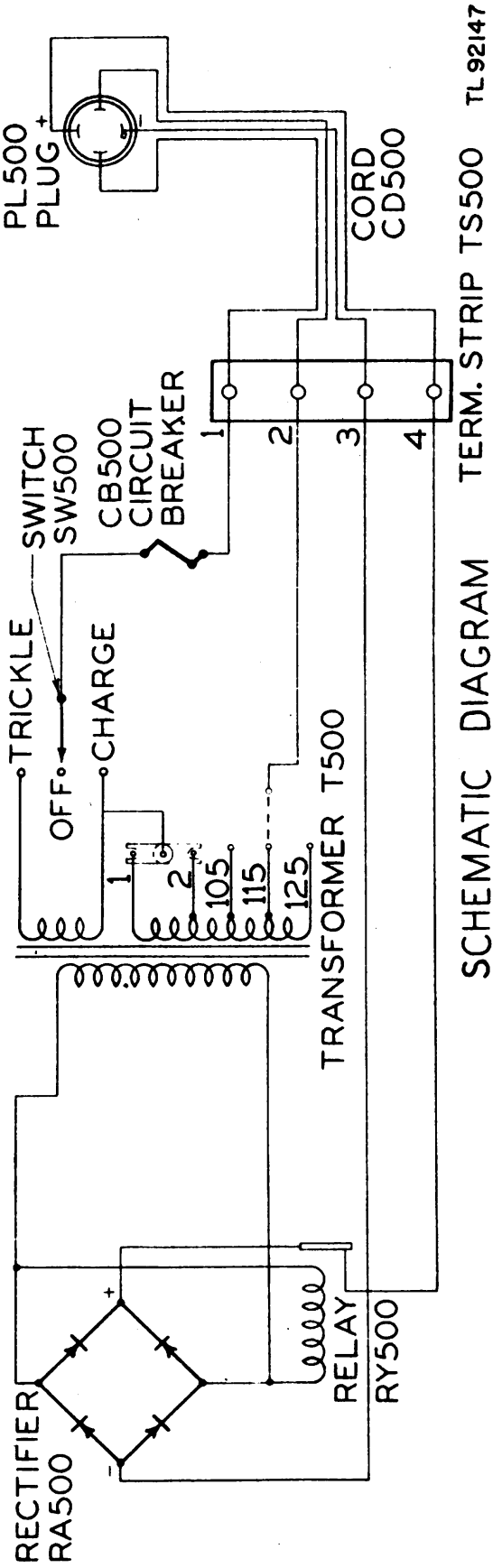


*Figure 3. Schematic diagram.*

*e. Daily Battery Check.* Check the condition of battery at least once a day to make sure that it is receiving the proper charge. Do not let a battery run down because the charging rate is too low, and do not ruin the battery from overcharging.

# SECTION III

# FUNCTIONING OF PARTS

## 11. PRINCIPLE OF OPERATION OF RECTIFIER STACKS.

Rectifier RA-63-B has one selenium rectifier stack in the rectifying circuit consisting of 8 selenium disks mounted on a bolt. These disks have the property of passing current in one direction and blocking it in the other. The stack is connected into the circuit in such a way that half of the disks pass current to the battery circuit when the a-c voltage from the transformer secondary is impressed in one direction, and the other half of the disks pass current when the a-c voltage is impressed in the opposite direction. In this manner, full-wave direct current is passed continually to the battery circuit when the rectifier is operating. Figure 3 is a schematic diagram of the circuit in Rectifier RA-63-B.

## 12. FUNCTIONING OF PARTS.

*a. Transformer.* The function of the transformer is to provide the voltage and power required for the rectifier stacks to produce d-c output for the charging circuit.

(1) PRIMARY CIRCUIT. The primary circuit of the transformer consists of a winding which may be connected for operation from either a 105-, 115-, or 125-volt a-c supply line, as explained in paragraph 6.

(2) SECONDARY CIRCUIT. The secondary circuit of the trans-

former is a single winding with one top an either end for control of the voltage delivered to the selenium rectifier stack.

*b. Circuit Breaker.* The circuit breaker closes and opens the a-c supply line contacts, turning Rectifier RA-63-B on or off. It also provides protection against overloads and short circuits.

*c. Rectifier Stack.* The stack has nine terminals and these terminals are interconnected with busses as follows: 1-5-9, 2-4, 6-8, 3-7. The wire marked BR (fig. 5) is connected to buss 1-5-9 to form the negative d-c lead. The wire marked OR is connected to buss 3-7 to form the positive d-c lead. The wires marked WH are respectively connected to buss 2-4 and 6-8 to provide a-c power to the rectifier stack from the transformer secondary.

*d. Relay.* This unit is provided to break the circuit in the positive d-c lead to battery being charged when any interruption of a-c current occurs.

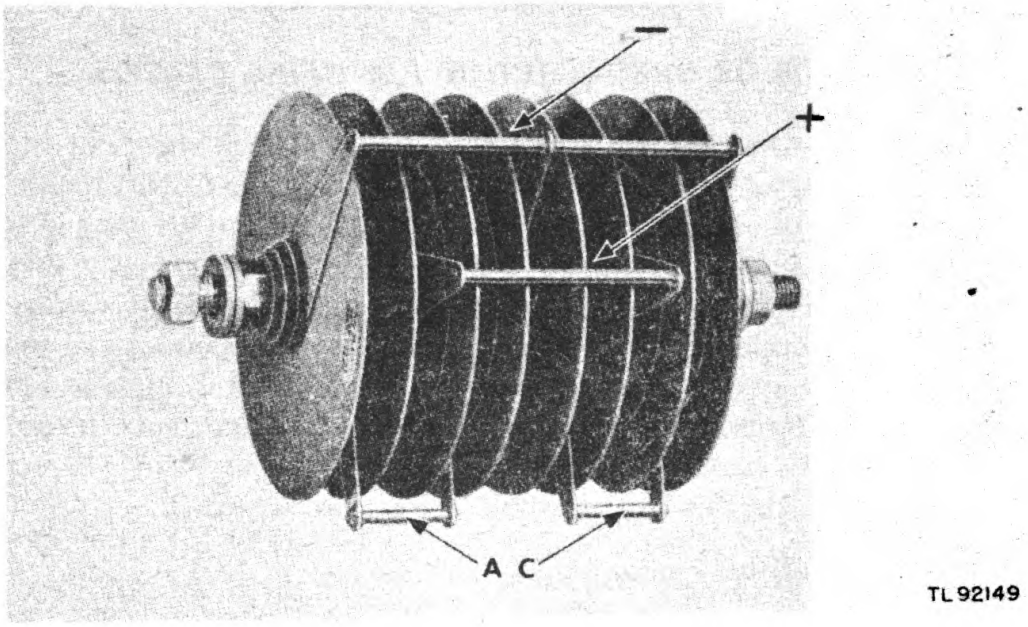


*Figure 4. Rectifier stack, showing terminals.*

*e. Control Switch.* Control switch SW500 is a single-pole, three-position switch. The switch is used to select two ranges of charging current and to remove the a-c power from the input circuit of the charger unit. Operation of the switch for various settings is as follows:

(1) HI CHARGE POSITION. When the switch is set to this position, one side of the a-c input line is directly connected through the switch, the HI and LO primary winding in the power transformer, thereby changing the transformation ratio to give a higher secondary voltage. With the switch set to the HI position, the charging rate is approximately 5 amperes to a discharged battery. This charging rate will reduce gradually to approximately 2.75 amperes as the battery becomes charged.

(2) TRICKLE POSITION. When the switch is set to the TRICKLE position, one side of the a-c power line is connected through the switch, to the LO terminal of the power transformer. This changes the effective number of primary turns, thereby changing the transformation ratio, decreasing the secondary voltage. The charging rate with the switch in the TRICKLE position is approximately 0.4 to 0.6 ampere to a fully charged battery.

(3) OFF POSITION. One side of the a-c power line is coupled to the contact arm of the switch. When the switch is in the OFF position, the contact arm of the switch is in the center position and the a-c input power is automatically removed from the input circuit of the charger unit to discontinue operation.

# SECTION IV

# MAINTENANCE

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**NOTE:** Failure or unsatisfactory performance of this equipment will be reported on W.D., A.G.O. Form No. 468. If form is not available, see TM 38-250.

## 13. ROUTINE MAINTENANCE.

When properly installed according to instructions in paragraphs 4 through 10, Rectifier RA-63-B will require little attention as long as it

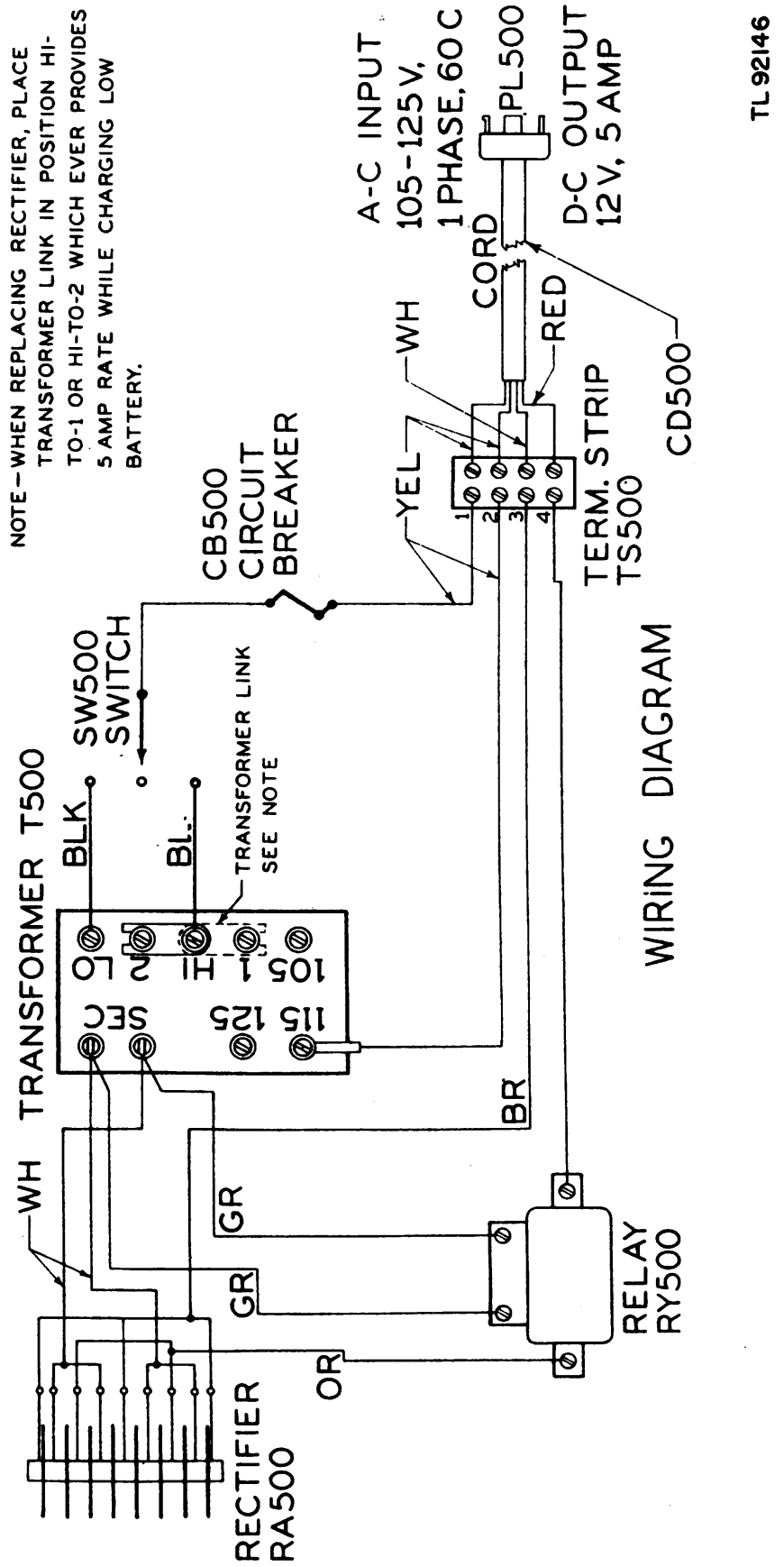


*Figure 5. Practical wiring diagram.*

operates properly. It has no moving parts requiring lubrication. Keep the unit dry and free from dirt and dust. Remove the accumulated dust about once every month with compressed air, a bellows, or a soft long-bristled brush. Be sure to remove all dust and dirt from between the rectifying disks. Check all screws, nuts, and bolts regularly. Tighten them if necessary.

**NOTE:** Rectifier RA-63-B must be properly ventilated to prevent overheating. The ventilating grilles should not be allowed to clog under any circumstances. Base must always be attached to case.

## 14. OPERATING TROUBLES AND REMEDIES.

*a. No D-c Output.*

(1) Check the a-c power source. Be sure plug is properly connected and that the plug is not defective.

(2) Check all connections in the battery circuit.

(3) Check the internal wiring in the rectifier. Make sure that the leads are tightly connected.

(4) Remove the cover from the cut-out relay and be sure that the contact points are clean and that they make good electrical connection.

*b. Circuit Breaker Will Not Stay ON.*

(1) Check the battery circuit and output wiring for short circuit. Remove the trouble if short circuits are found.

(2) Check batteries to see that they are properly connected.

(3) Check for defective rectifier stack. The temperature of the disks will be much higher than normal if the stack is defective. The counter-electrode coating may be pitted, blistered, or melted away from the disk. The varnish coating may be discolored or burnt. Remove and replace the defective stack immediately.

**NOTE:** When replacing rectifier stack, place transformer link in position HI-1 or HI-2, whichever provides 5-ampere rate while charging a low battery.

## 15. TESTING THE TRANSFORMER.

The following test procedures, as indicated on the voltage chart, are

applied to check the transformer windings for open-circuited conditions. The transformer link is positioned as shown on the chart, and the a-c power supply leads are coupled as indicated to obtain the normal voltage indications shown on the chart. In all cases the a-c test voltmeter is coupled across the secondary terminals of the transformer:

| Transformer link coupled to | A-c power leads coupled to | A-c test voltmeter coupled to | Normal a-c voltage indication |
|---|---|---|---|
| HI - 1 | 115 - HI | SEC terminals | 12.75 |
| HI - 1 | 115 - LO | SEC terminals | 11.1 |
| HI - 2 | 115 - HI | SEC terminals | 13.2 |
| HI - 2 | 115 - LO | SEC terminals | 11.2 |

## 16. MOISTUREPROOFING AND FUNGIPROOFING.

None required.

# SECTION V

# SUPPLEMENTARY DATA

## 17. MAINTENANCE PARTS LIST FOR RECTIFIER RA-63-B.

| Ref symbol | Signal Corps stock No. | Name of part and description | Quan per unit | Running spares | Orgn stock | 3d ech | 4th ech | 5th ech | Depot stock |
|---|---|---|---|---|---|---|---|---|---|
| CB 500 | 3H900-2-1 | CIRCUIT BREAKER: thermal primary disconnect; single-pole, single-throw; 2-amp; Spencer Thermostat Co. Klixon PSM-2. | 1 | | | * | * | * | * |
| CD 500 | 1B3030-4 | CORD: 4-conductor, (2 wires, 16 strands No. 30 AWG copper, rubber braid, varnish-insulated, yellow; 2 wires, 19 strands No. 25 AWG copper, rubber braid, varnish-insulated, one red and one white; outside covering black cotton braid; over-all length 52-½"); Essex Wire Co. 543AA-7-A. | 1 | | | * | * | * | * |
| | 6Z3810-14 | FASTENER: spring steel; (9/16" wide x 19/16" long with hole for ¼-20 screw); Tinnerman Products Inc. 1821-M-1. | 4 | | | * | * | * | * |
| | 6Z3810-15 | FASTENER: cowl; (wing oval head stud ¼" x ½"); Shakeproof No. SP-WO-5-15.4. | 4 | | | * | * | * | * |
| PL 500 | 2ZK7114.12 | PLUG: male; 4-prong; Hubbell No. 7411. | 1 | | | * | * | * | * |

*Indicates stock available.

## 17. MAINTENANCE PARTS LIST FOR RECTIFIER RA-63-B (ontd).

| Ref symbol | Signal Corps stock No. | Name of part and description | Quan per unit | Running spares | Orgn stock | 3d ech | 4th ech | 5th ech | Depot stock |
|---|---|---|---|---|---|---|---|---|---|
| RA 500 | 3H4691-63A/S10 | RECTIFIER: selenium; (eight plates 3 5/16"; stud-mounted; over-all length 5 3/4"); Benwood Linze Co. No. 145S1. | 1 | | | * | * | * | * |
| RY 500 | 2Z7585-44 | RELAY: battery-disconnect; single-pole, single-throw; normally open; coil rating 14-v continuous ac; contact rating 5-amp dc; (over-all dimensions 2-1/2" wide x 3 5/8" long x 2" high; mounting centers 1 13/16"); C-H No. 8200-K. | 1 | | | * | * | * | * |
| SW 500 | 3Z9849-20 | SWITCH: power; toggle; single-pole; 6-position; 5-amp, 125-v ac; C-H No. S200-K. | 1 | | | * | * | * | * |
| TS 500 | 2Z9404.1 | TERMINAL STRIP: molded black phenolic; (4 sets terminals on 7/16" centers; No. 6-32 nickel-plated screws; Jones No. 4-141. | 1 | | | * | * | * | * |
| | 6Z1747-21 | CATCH: steel; black; complete with 5 rivets; over-all dimensions when closed 2 7/16" long x 1 1/4" wide, metal 3/64" thick; (3 rivets on bottom part, 2 rivets on top part; contractor Benwood Linze Co.; to secure cover to case; Eagle Lock. | 2 | | | * | * | * | * |
| T 500 | 2Z9611.162 | TRANSFORMER: power; single-phase; 105-125-v, 50-60-cycle, 1-amp; (primary split winding with taps, secondary single winding no taps, 8-amp, 13-v; steel case; bakelite terminal panel; over-all dimensions 5" wide x 5 1/8" diam x 5 3/8" high; mounting centers 4 5/16" x 4 1/2"); Merit Coil & Transformer Co. No. P2051A. | 1 | | | * | * | * | * |

*Indicates stock available.

Order No. 24833-Phila-44-10; 2900 copies; September 1944.