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TECHNICAL MANUAL

17-340

RECTIFIER

RA-87-A

APRIL 1952

RECTIFIER

RA-87-A



DEPARTMENTS OF THE ARMY AND
THE AIR FORCE

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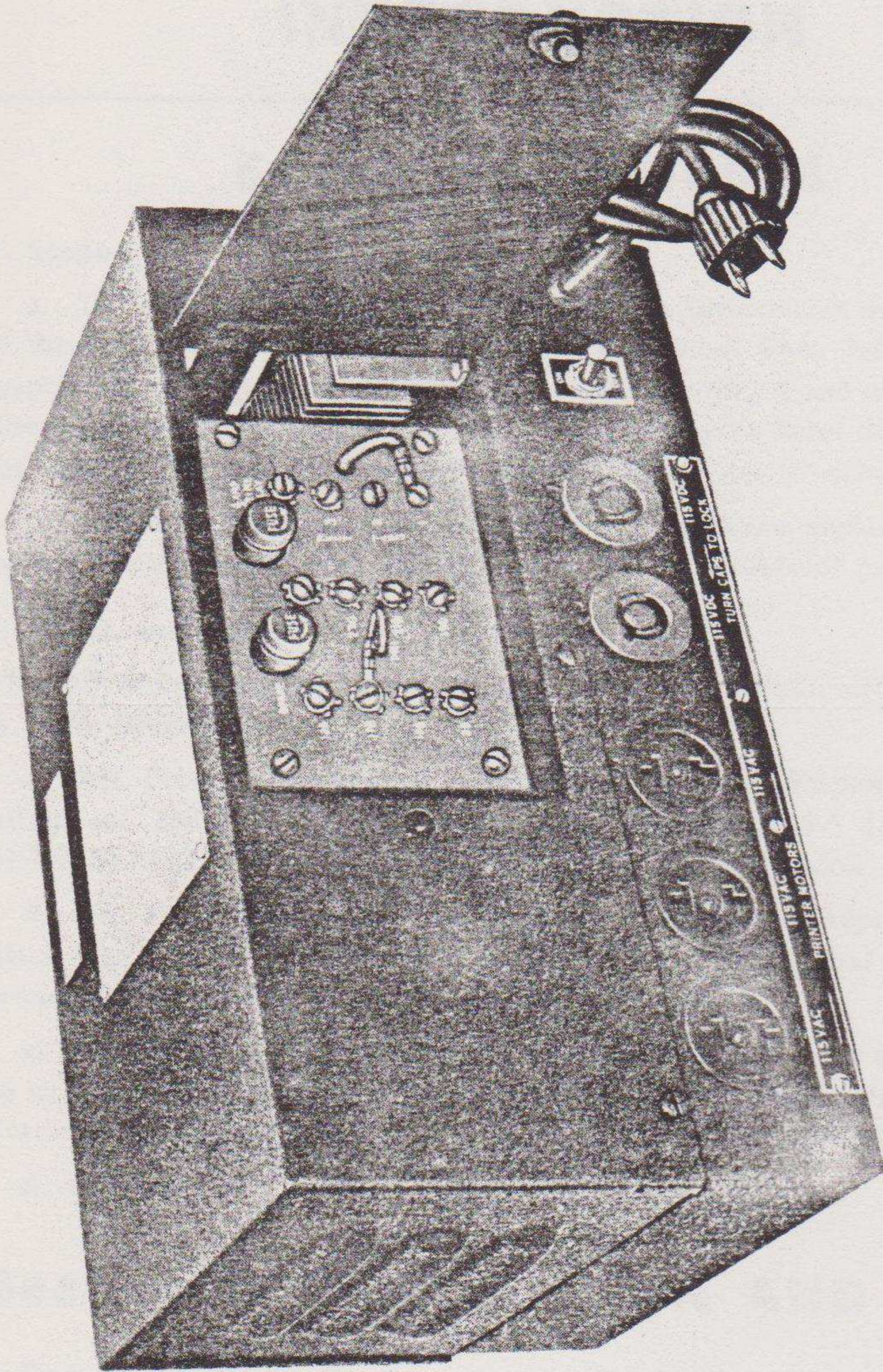
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Figure 1. Rectifier RA-87-A.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the information and guidance of the personnel to whom the equipment is issued. They include a description of the equipment, information on the operation and on the operational and field maintenance of the equipment, and a brief discussion of the theory of operation. They apply only to Rectifier RA-87-A.

b. Appendix I contains a list of current references applicable to the equipment. Appendix II contains an identification table of parts.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army equipment:

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army), NAV DEPT SERIAL 85POO (Navy), and AFR 71-4 (Air Force).

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700-45-5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 and AFR 65-26.

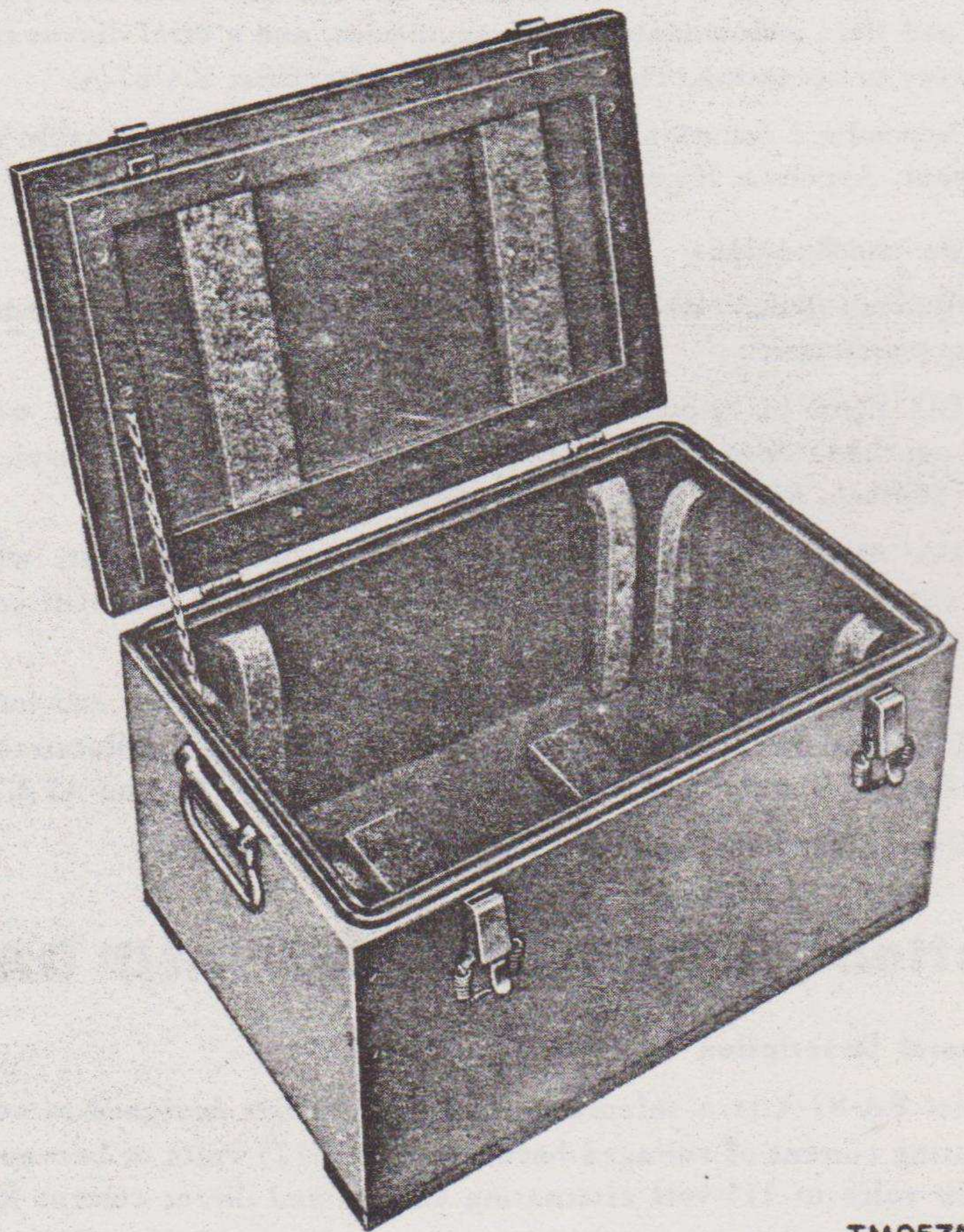
d. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. General Description

Rectifier RA-87-A is a selenium-disk type rectifier designed to convert alternating current of voltages between 95 and 125 volts or between 190 and 250 volts to 115-volt alternating current and direct current for the operation of equipment requiring energy of this voltage. All the components are mounted on a chassis and inclosed in a sheet steel case which may be removed to permit necessary maintenance and repair opera-

tions. The upper section of the case is louvered to provide ventilation and has a small door which permits access to the tap-changing panel and to the fuse which protects the rectifier circuit. Three alternating-current output receptacles and two direct-current output receptacles, a toggle-type ON-OFF switch for starting and stopping the rectifier, and an input cord for connecting the unit to the alternating-current supply are provided. Condensed operating instructions are attached to the exterior of the case and a wiring diagram is secured inside the top of the case. The complete unit is shown in figure 1. Chest CH-158 (fig. 2) is used to protect the unit when it is not in use and during transportation. The chest is not a component of the equipment.



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Figure 2. Chest CH-158.

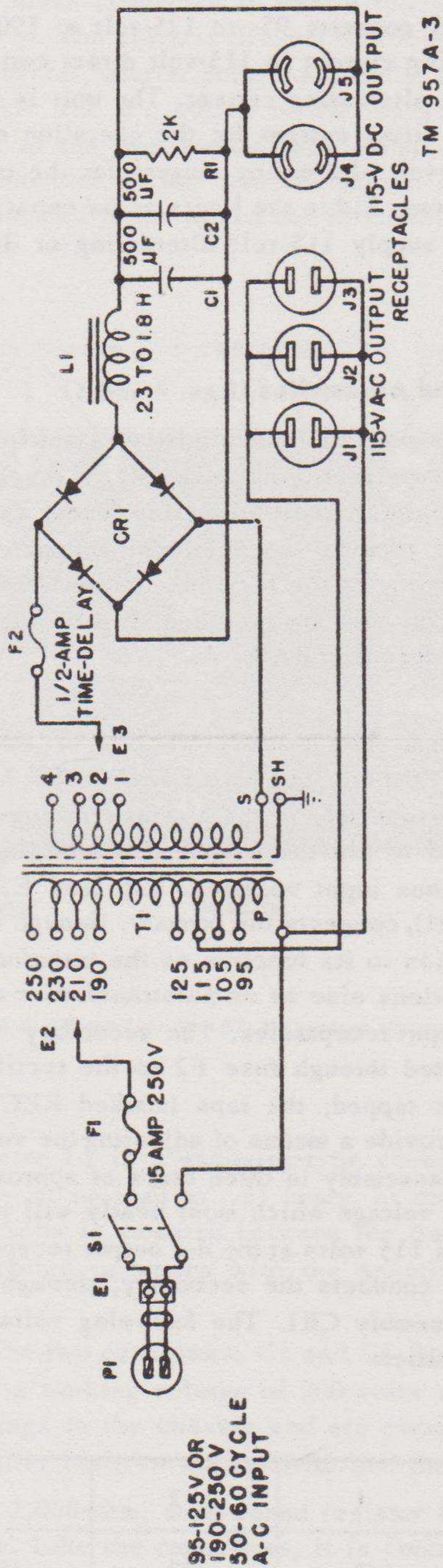


Figure 3. Rectifier RA-87-A, schematic diagram.

4. Purpose and Use

Rectifier RA-87-A converts 95- to 125-volt or 190- to 250-volt, 50- to 60-cycle alternating current to 115-volt direct current and, in addition, provides 115-volt alternating current. The unit is intended primarily to provide 115-volt direct current for the operation of teletypewriter line circuits and 115-volt alternating current for the operation of teletypewriter printer motors. Within the limits of its capacity (par. 11), the unit may be used to supply 115-volt alternating or direct current for any purpose.

5. Major Parts and Assemblies (figs. 4 and 5)

Rectifier RA-87-A consists essentially of a multiple-tapped transformer, a selenium-disk type rectifying assembly, a reactor (filter choke), two capacitors, a resistor, circuit-protecting fuses, and the necessary voltage-changing tap terminal connections. Output receptacles to permit connecting equipment to the rectifier and an ON-OFF switch for starting and stopping the unit are provided. Figure 3 is a schematic diagram of the circuits of Rectifier RA-87-A.

a. TRANSFORMER. The primary winding of transformer T1 is connected through 15-ampere line fuse F1, ON-OFF switch S1, and the input cord and plug assembly to the a-c (alternating-current) supply. This winding is tapped to provide a means of adapting the transformer for operation on various input voltages. Tap lead E2 (marked PRI on the tap-changing panel), connects the primary, through the selected tap, into the line. In addition to its function as the transformer primary winding, this winding functions also as an autotransformer and supplies 115-volt ac at the a-c output receptacles. The secondary winding of the transformer is connected through fuse F2 to the rectifying assembly. This winding, also, is tapped; the taps (marked RECT TAPS on the tap-changing panel) provide a means of adjusting the voltage of the a-c input to the rectifying assembly in three steps of approximately 5 volts each so that the input voltage which most nearly will produce a d-c (direct-current) voltage of 115 volts at the d-c output receptacles may be selected. Tap lead E3 connects the secondary, through the selected tap, to the rectifying assembly CR1. The following voltages may be selected to supply the rectifier:

Tap	1	2	3	4
Volts	147	152	157	162

b. **RECTIFYING ASSEMBLY.** Rectifying assembly CR1 consists of a stack of 36 selenium disks connected to form a full-wave, bridge-type rectifying circuit (fig. 3). The stack is divided into four sections by terminals located at the center, quarter points, and ends; the end terminals are connected together. The a-c output of the transformer secondary winding is connected to the two quarter-point terminals; the positive d-c output lead is connected to the center terminal; and the negative d-c output lead is connected to the joined end terminals.

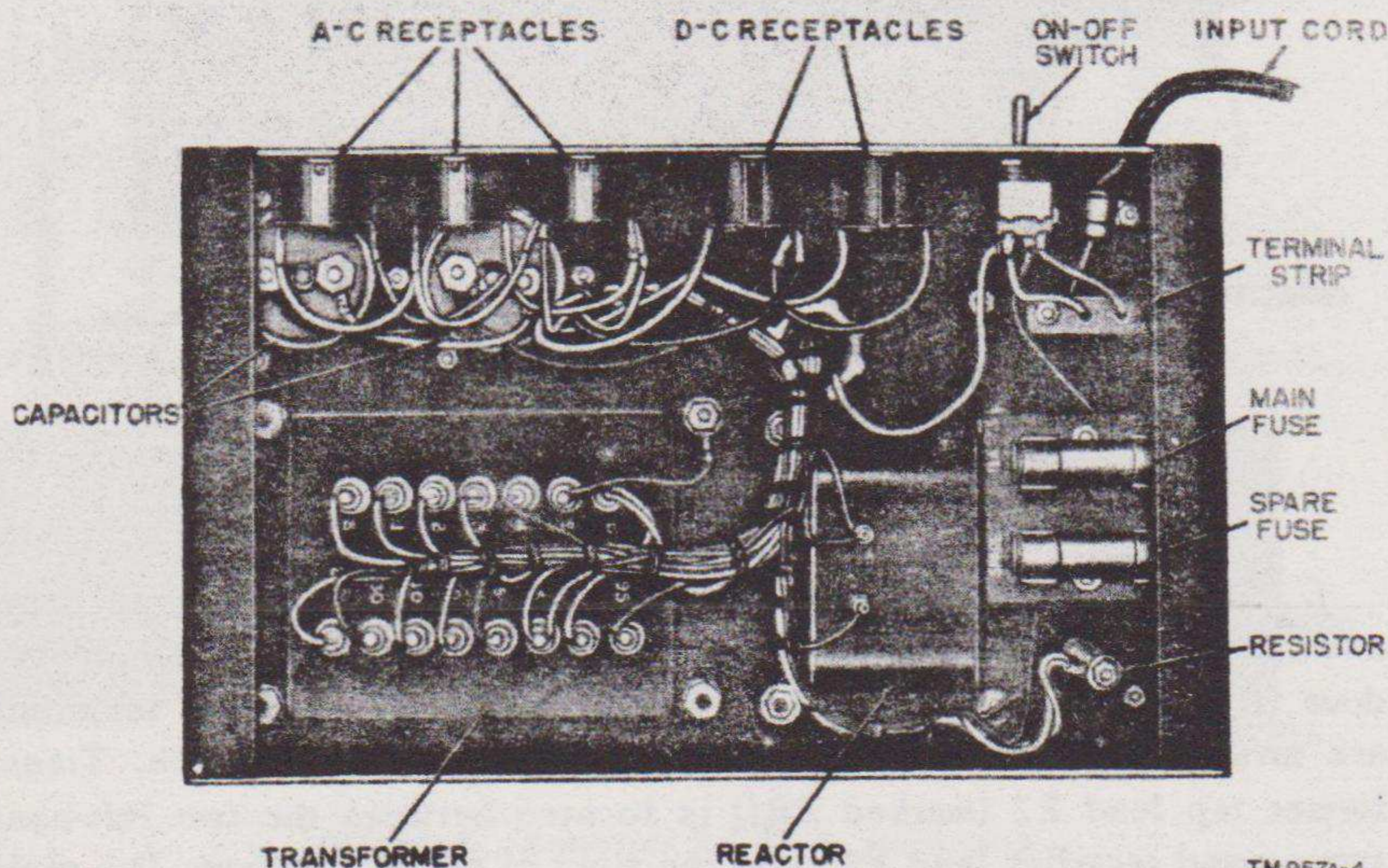


Figure 4. Rectifier RA-87-A, bottom view.

c. **REACTOR.** Reactor L1 is a swinging-type choke. Its inductance varies from 1.8 henrys at no load to .23 henry at maximum load (400 milliamperes). The reactor is mounted between the transformer and the rectifier and is connected in series with the negative output of the rectifier.

d. **CAPACITORS.** The two capacitors, C1 and C2, have a capacitance of 500 microfarads at a working voltage of 200 volts dc. They are attached by mounting rings to the chassis and are connected across the d-c output of the rectifier between the rectifier and the reactor.

e. **RESISTOR.** The 2,000-ohm, wire-wound resistor R1 is secured in place by a long screw. Like the capacitors, it is connected across the d-c output between the rectifier and the reactor.

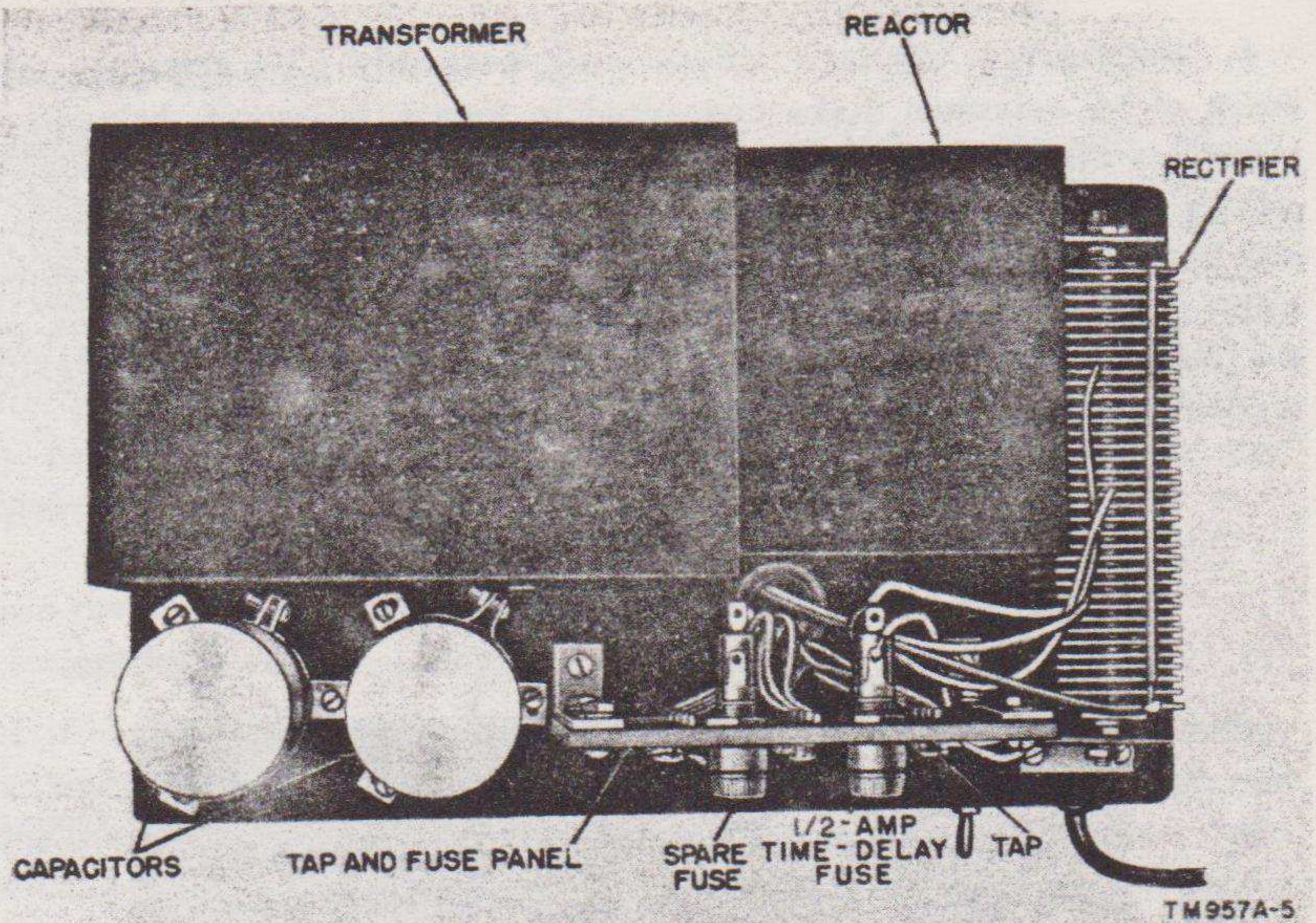


Figure 5. Rectifier RA-87-A, top view.

f. TAP AND FUSE PANEL ASSEMBLY (fig. 6). The tap and fuse panel assembly is mounted near the front of the unit behind a small access door (fig. 1). On a plastic panel, twelve screw-type contact terminals are arranged vertically in three groups of four terminals each. Transformer tap lead E2 (marked PRI) is located between the two left-hand groups and rectifier lead E3 is to the right of the third group. The eight left-hand contacts are the transformer primary winding input tap terminals; they are designated, respectively, beginning at the lower left, 95, 105, 115, 125, 190, 210, 230, and 250 (volts). The four right-hand contacts are the transformer secondary winding output tap terminals; they are labeled RECT TAPS and are numbered, respectively, beginning at the bottom, 1, 2, 3, and 4. The voltage of the input to the rectifier is increased in steps of approximately 5 volts each as lead E3 is moved from tap 1 toward tap 4. Two fuse receptacles are mounted above these groups of terminals. The right-hand receptacle contains a 1/2-ampere, time-delay fuse which is connected into the rectifier input circuit to protect the rectifier; the left-hand receptacle contains a similar fuse which is a spare. Connections to appropriate circuits are made at the rear of the panel.

g. OUTPUT RECEPTACLES. The output receptacles are mounted at the front of the chassis; their connections are made accessible by removing the bottom cover of the case. The three left-hand receptacles (J1, J2, and J3) are the standard type which will accept any kind of

two-prong plug. All three are connected to the 115-volt tap of the primary winding of the transformer. They supply 115-volt alternating current and are marked PRINTER MOTORS. The two right-hand receptacles (J4 and J5) are the *twist-tight* type; they are not polarized receptacles but will accept any standard, parallel-bladed, two-prong plug whether it is or is not of the polarized type. A clockwise twist of the plug after it has been inserted in the receptacle locks the connection tightly. These receptacles are connected to the filtered output of rectifier CR1 and supply 115-volt direct current for the operation of teletypewriter line circuits.

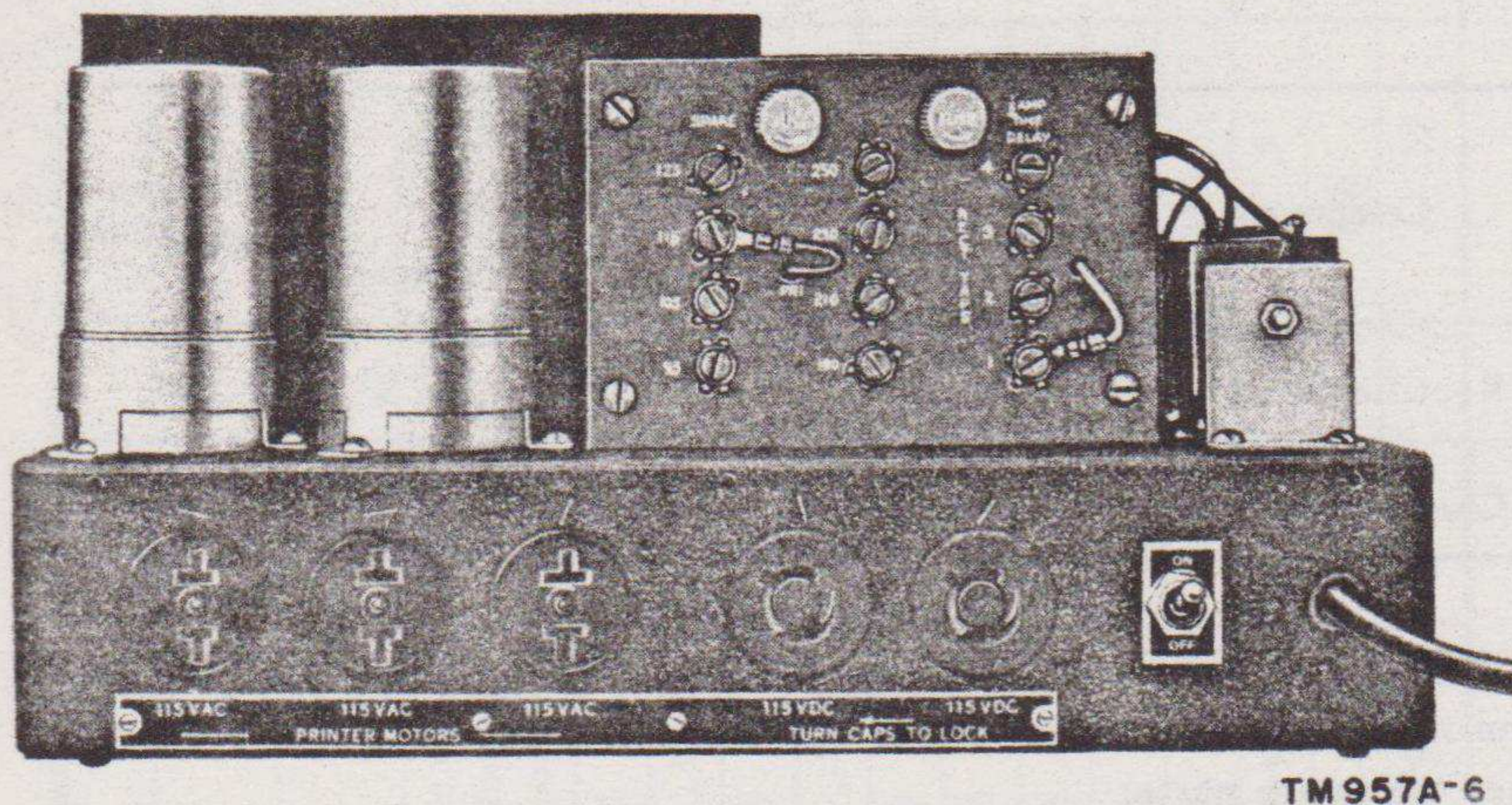


Figure 6. Rectifier RA-87-A, front view.

b. SWITCH. ON-OFF switch S1 is mounted on the front of the chassis; it is the standard double-pole, single-throw, toggle type. This switch is connected into the main a-c input circuit between terminal strip E1 and 15-ampere main fuse F1. The ON-OFF switch is used to open and close the a-c input circuit to stop and start the rectifier without disconnecting the input cord.

i. FUSE PANEL. The main fuse panel is a plastic block secured with screws and spacers to the bottom of the chassis on the right side. Four fuse clips which hold two cartridge, ferrule-type, 15-ampere, 250-volt fuses are mounted on the block. The fuse nearer the front of the chassis is main fuse F1 and is marked 15 A. The fuse nearer the rear and marked SPARE is not connected into any circuit but serves only as a spare.

j. INPUT CORD. Input cord P1 is brought out of the chassis at the right of the ON-OFF switch. It may be connected to any source of 50-to 60-cycle alternating current having a voltage between 95 and 125 volts or between 190 and 250 volts. The cord is connected through terminal strip E1 to the input side of ON-OFF switch S1.

6. Performance Characteristics

The electrical characteristics of Rectifier RA-87-A measured at various points and under various load conditions are given in the table on page 9. In addition to its use in showing the working outputs of the rectifier, the table may be used in checking the functioning of the circuits of the equipment.

7. Tabular Data

a. WEIGHTS AND DIMENSIONS. The following table gives the weight and over-all dimensions of Rectifier RA-87-A and of Chest CH-158:

Component	Dimensions (inches)			Weight (pounds)
	Length	Width	Height	
Rectifier RA-87-A	14 $\frac{3}{8}$	8 $\frac{1}{2}$	7 $\frac{5}{8}$	54
Chest CH-158	18 $\frac{3}{4}$	12 $\frac{11}{16}$	10 $\frac{15}{16}$	20

b. SPARE PARTS. In addition to the extra fuse of each type provided in the spare fuse mountings of the rectifier, the following fuses are furnished as spare parts:

Fuse	Quantity	Amperes	Volts	Use
ECO #1115	1	15	250	Transformer input circuit
Littelfuse 3 AG Slo-blo	3	$\frac{1}{2}$	125	Rectifier input circuit

Note. When Rectifier RA-87-A is a component of Teletypewriter Set TC-16, these spare fuses are packed with Line Unit BE-77-C in a compartment of Chest CH-53-A.

Performance Characteristics

Conditions (with RECT TAP connected to tap 1)	Point of measurement						
	Alternating current				Direct current		
	Line or transformer input	A-C receptacle output	Transformer secondary output	Rectifier output	D-C receptacle output		
No load, 115-v line and tap	Volts	115	146	120	120		
	Amperes	.3	.08	0	0		
No a-c load, full d-c load, 115-v line and tap	Volts	115	143	112	112		
	Amperes	.77	.55	.4	.4		
Full a-c and d-c loads, 115-v line and tap	Volts	111	139	107	107		
	Amperes	5	.55	.38	.38		
No a-c load, full d-c load, 95-v line and tap	Volts	95	142	110	110		
	Amperes	1	.55	.4	.4		
Full a-c and d-c loads, 95-v line and tap	Volts	90	135	104	104		
	Amperes	5.35	.5	.38	.38		
Full a-c and d-c loads, 230-v line and tap	Volts	217	136	105	105		
	Amperes	2.35	.52	.38	.38		

Note: Values are mean and will vary plus or minus 5 per cent.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

8. Uncrating, Unpacking, and Checking

a. UNCRATING AND UNPACKING. Unpack the equipment where it will not be exposed to dust, dirt, or excessive moisture. Do not thrust tools into the interior of the shipping container and do not damage the packing materials more than is necessary to remove the equipment; these materials and the container may be needed for future repacking.

- (1) Cut the metal straps with a suitable cutting tool. Remove the cover of the wooden crate; use a standard nail puller.
- (2) Slit the barrier material; damage it as little as possible. Remove the corrugated fiberboard box from the crate.
- (3) Open the fiberboard box, slit the moisture-vaporproof barrier, and pull out the chest.
- (4) Release the two catches on the chest and raise the cover. Remove the technical manuals and pull out the free end of the input cord.
- (5) Lift the rectifier from the chest; use the louvers at each end as lifting handles.

b. CHECKING. Inspect the rectifier for bent, broken, or loose parts; shake it to determine whether any parts are loose. If any damage is noted or the equipment does not check with the packing lists, fill out and forward DD Form 6 as directed in paragraph 2*a*.

9. Setting Up Equipment

Place the rectifier in a cool, dry, well-ventilated place near the teletypewriter equipment with which it is to be used. Use the chest as a table or support to keep the rectifier off damp ground or dirty floors.

10. Connections and Interconnections

a. A-C INPUT. Check the supply of electrical energy to be sure that it is 95-to 125-volt or 190- to 250-volt, 50- to 60-cycle alternating current. *Never connect the rectifier input cord to a direct-current supply.* To determine the voltage and frequency of the source of energy, consult the nameplates of the power units, the nameplates of any equipments already connected to the supply, or the agency furnishing the energy.

If there is any doubt whether the supply is alternating or direct current, check the supply with a direct-current voltmeter. If the supply is known to be about 115 volts, the voltmeter of any model of Line Unit BE-77 may be used to determine whether the supply is alternating or direct current. Alternating current will cause a very small vibrating or jiggling motion of the meter needle at or near zero; direct current will cause the needle to indicate steadily either to the right or left of zero.

b. TRANSFORMER TAP CONNECTIONS (fig. 6). Before connecting the rectifier to the supply or to the equipment it is to serve, connect movable lead E2 (marked PR1) on the tap changing panel to the primary tap terminal whose voltage marking most nearly corresponds to the known voltage of the a-c supply. If the voltage of the supply is not known, connect this lead to the 250-volt tap. Connect lead E3 to the tap marked 1. Connect the input cord to the a-c supply, place the rectifier ON-OFF switch in the ON position, and check the voltage of the d-c output at the d-c output receptacles. (The d-c voltmeter of any model of Line Unit BE-77 may be used to check the d-c output voltage of the rectifier.)

- (1) *Primary input adjustment.* If the d-c output voltage is not approximately 115 volts, stop the rectifier by placing the ON-OFF switch in the OFF position and connect the movable lead (PR1) to the next-lower-voltage tap. Start the rectifier and again check the d-c output voltage. If necessary, continue to stop the rectifier, change the lead connection, and check the d-c output voltage until the tap which most nearly provides a d-c output of 115 volts is found. This will be the tap whose voltage marking corresponds most nearly to the voltage of the a-c supply.
- (2) *Secondary output adjustment.* If, after the primary tap which most nearly produces a 115-volt d-c output has been selected, the output voltage is less than 115 volts, it may be increased by changing the movable secondary lead E3 connection to the RECT TAPS. The d-c output voltage will increase in steps of approximately 4 volts each as lead E3 is moved successively to secondary tap 2, 3, and 4. Stop the rectifier while the secondary tap lead connection is being changed.

c. TELETYPEWRITER CONNECTIONS. For hook-ups and cording arrangements, consult the technical manuals which pertain to the particular teletypewriter equipment with which the rectifier is to be used. Be sure that the cords which carry energy to the motors of the teletypewriter equipment are plugged into the a-c receptacles of the rectifier (three left-hand receptacles), never into the d-c receptacles. Energy to operate the line circuits is taken from the d-c receptacles; lock the plugs tightly in place by turning them in a clockwise direction.

Section II. OPERATION UNDER USUAL CONDITIONS

11. Precautions

The maximum a-c output of the rectifier is 500 watts (4.35 amperes at 115 volts). Do not connect to the three a-c (left-hand) receptacles a combined load that exceeds this maximum. The maximum d-c output of the rectifier is 46 watts (400 milliamperes at 115 volts). Do not connect to the two d-c (right-hand) receptacles a combined load that exceeds this maximum. In making all d-c connections, be careful not to short-circuit the rectifier output.

12. Operating Procedure

Install and connect Rectifier RA-87-A according to the instructions in paragraphs 9 and 10; the operation of the unit then can be started and stopped by means of the ON-OFF switch. The only noticeable indications that the unit is operating are a faintly audible hum from the transformer and a gradual rise in the temperature of the case. Under full load, the rectifier reaches its maximum temperature after 4 to 5 hours of operation.

CHAPTER III

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION AND PRESERVATION

13. Lubrication

This equipment requires no lubrication except an occasional drop of oil on the hinges and latches of the access door of the rectifier and of the cover of the chest. Use Oil, lubricating, preservative, special (PL-Special) to lubricate these parts.

14. Weatherproofing

Signal Corps equipment, when operated under severe climatic conditions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72. Rectifier RA-87-A has been given moistureproofing and fungiproofing treatment by the manufacturer. Paragraph 29 contains instructions for applying this treatment to the equipment after repair.

15. Painting and Refinishing

If the finish of the equipment has become damaged or worn, it should be restored. Directions for repainting the case and chassis of the rectifier are given in paragraph 28.

Section II PREVENTIVE MAINTENANCE

16. Definition of Preventive Maintenance

Preventive maintenance is a series of systematic operations performed on equipment at regular intervals; it consists of inspections and services designed to keep the equipment always in good operating condition. The primary purpose of preventive maintenance is to prevent failures or break-downs, and so to prevent the necessity for major

repairs. Its faithful performance is of the utmost importance, as the failure or inefficient operation of one piece of equipment may make an entire system inoperative. It is necessary to inspect the rectifier at regular intervals so that minor defects may be discovered and corrected before they cause serious damage and the complete failure of the equipment.

17. Preventive Maintenance Services

a. GENERAL. Since Rectifier RA-87-A has no moving parts and no parts which require special maintenance or service, it requires little attention so long as it operates satisfactorily. Perform the maintenance services described in subparagraphs *b* through *c* below monthly or whenever the equipment has been moved or stored, or has been out of service for a long period of time.

b. CLEANING. All parts and areas of the rectifier must be kept free from dust, dirt, and moisture. Wipe the equipment carefully and thoroughly with a clean, dry cloth. Blow dust and dirt from inaccessible areas (such as those between the disks of the rectifier stack) with dry, cool air. Do not use very hot air as it may damage the capacitors or the rectifier disks. Clean receptacle, terminal, and fuse electrical contacts; use crocus cloth if an abrasive is necessary.

c. INSPECTION. Examine all parts for damage, such as blisters or cracks, and for evidence of extreme overheating. Inspect all parts and connections for signs of corrosion or fungus growth. Inspect all terminals for loose or broken connections. Examine all leads and cables for poor insulation, cracks, or signs of dry rot. See that all components are mounted securely and that all electrical connections are clean and tight. Repair or replace parts and wiring as required. Tighten all mounting screws, nuts, bolts, screw terminals, and other fastenings.

Caution: Before any maintenance or repair work on any connections or wiring, or on any of the internal components of the rectifier is undertaken, make sure the input cord is disconnected from the a-c supply. Before working on or near capacitors C1 and C2, short them out with a well-insulated screw driver or other shorting tool. Failure to observe this precaution may result in injury to personnel and damage to the equipment.

Section III. THEORY

18. Scope

To assist personnel to operate, service, and repair Rectifier RA-87-A properly, the following brief explanation of the theory of the operation of this equipment is provided. The functions and operation of the transformer, the rectifying assembly, and the filtering components are des-

cribed in paragraph 19. Figure 3 is a schematic diagram of the equipment; figure 7 is the wiring diagram.

19. Theory of Operation

a. **TRANSFORMER.** Transformer T1 has two functions. It steps up or steps down, as required, the voltage of the a-c input to provide 147- to 162-volt energy to supply the rectifier, and it increases or decreases the voltage of the input to 115 volts to supply the a-c receptacles. The primary winding of the transformer is tapped at suitable points so that it may be connected to operate from a supply of 95 to 125 volts or 190 to 250 volts to produce in the secondary winding approximately the correct voltage to supply the rectifier. The secondary winding, also, is tapped at several points so that the voltage which most nearly will provide 115-volt d-c may be supplied to the rectifier. The primary winding of the transformer acts also as an autotransformer and, when the input is connected to the proper tap, will supply 115-volt ac at the a-c receptacles.

b. **RECTIFYING ASSEMBLY.** The rectifying assembly consists of a stack of 36 selenium disks mounted on a bolt and furnished with suitable terminals and connections. The selenium disks have the property of conducting electrical energy readily in one direction (during one half-cycle of an alternation) and virtually not at all in the other (during the other half-cycle). The stack of disks of rectifier CR1 is divided into four sections by terminals located at the ends, quarter points, and center. The disks are arranged so that they will conduct energy only from the ends or quarter points toward the center. A-c from the secondary winding of the transformer is connected to the two quarter-point terminals so that energy is carried by the first and third sections of the stack when ac from the transformer is impressed in one direction and by the second and fourth sections when it is impressed in the opposite direction. Thus full-wave rectification is effected and pulsating dc is produced. The center terminal of the stack becomes the positive d-c terminal and the end terminals (which are connected together) become the negative d-c terminal.

c. **REACTOR, CAPACITORS, AND RESISTOR.** This group of components operates to remove the ripple (a-c component) from the rectified ac and to stabilize the d-c voltage. The pulsating dc passes from rectifier CR1 through reactor L1 which is a swinging-type choke; that is, its inductance varies with the load from 1.8 henrys at no load to .23 henry at full load. The reactor acts as a high impedance to the a-c component of pulsating current and a low impedance to the flow of direct current; it removes most of the ripple from the rectified current. The current then passes to capacitors C1 and C2 which provide a low-impedance path for any pulsating current passed by reactor L1. The capacitors keep the current supplied to any fixed load at a nearly constant value. Resistor

R1 is connected across the output of the capacitors to provide a constant load and to act as a bleeder to prevent the voltage of the d-c output from rising excessively when the d-c load is small. As a result of these operations, almost pure direct current with an actual voltage variation of less than 1/2 volt is supplied at the d-c output receptacles.

Section IV. TROUBLE SHOOTING

20. Meaning of Trouble Shooting

The function of trouble shooting is to locate quickly and to correct the cause of faulty operation and failure of equipment. No matter how well equipment is designed and manufactured, faults will develop and failures will occur during operation. Whenever equipment fails to operate satisfactorily, the operator or repairman must be able to locate the cause and correct the trouble as quickly as possible. The trouble charts (par. 22) are provided to assist in recognizing the causes of common faults and in correcting them quickly.

21. Test Equipment

Have the following test equipment available when the circuits of the Rectifier RA-87-A are to be tested or checked:

- 1 pair of test leads with prods.
- 1 a-c-d-c voltmeter with ranges up to 300 volts ac and ranges up to 200 volts dc.
- 1 ohmmeter with a range from 1 ohm to 300,000 ohms.
- 1 a-c ammeter with ranges up to 7.5 amperes.
- 1 d-c ammeter with a range up to 1 ampere.
- 1 a-c load of 500 watts.
- 1 d-c load of 46 watts.
- 1 Oscilloscope BC-1060-A or OS-8A/U.

Note. Multimeter TS-352/U or Test Unit I-176 may be used for testing or checking the circuits of Rectifier RA-87-A.

22. Trouble Location Charts

Some of the faults which may occur in the equipment during operation, their possible causes, the checks to determine the causes, and the corrective measures to be taken when the causes are established, are given in the charts that follow. This information is valuable both in diagnosing the trouble and in suggesting the best and quickest way to remove it. Refer to the schematic diagram (fig. 3) and the wiring diagram (fig. 7) for circuit information. The electrical characteristics of Rectifier RA-87-A under various conditions are given in paragraph 6; the proper resistance values of the major components are given in paragraph 24. Most checking can be done without disconnecting or removing the part, but, whenever a part is suspected to be defective or if the windings may be open or shorted, it must be disconnected. Do not remove parts or disassemble them unless a replacement is to be made.

a. NO A-C OUTPUT VOLTAGE.

Possible cause	Check	Remedy
Open- or short-circuited a-c input cord.	Cord Pl.	Repair Cord.
Poor input cord plug contact.	Plug.	Clean or bend prongs.
Blown out main fuse.	Fuse F1.	Remove short or overload. Install new fuse (15 amp).
Main fuse loose in clip.	Fuse receptacle.	Clean and bend clips.
Loose terminals.	Terminal contacts E2, J1, J2, J3.	Tighten connections.
Defective transformer.	Transformer T1 (par. 24a).	Install new transformer.
Defective ON-OFF switch.	Switch S1.	Repair switch or install new switch.

b. NO D-C OUTPUT VOLTAGE.

Possible cause	Check	Remedy
Blown out rectifier circuit fuse.	Fuse F2.	Remove short or overload. Install new fuse ($\frac{1}{2}$ amp).
Transformer secondary winding open.	Transformer T1 (par. 24a).	Replace transformer T1.
Loose terminals.	Terminal contacts E3, J4, J5.	Tighten connections.
Defective reactor.	Reactor L1 (par. 24d).	Install new reactor.
Defective rectifier.	Rectifier CR1 (par. 24b).	Install new rectifier.
Defective capacitor.	Capacitors C1 and C2 (par. 24c).	Install new capacitor.

c. BOTH A-C AND D-C OUTPUT VOLTAGES INCORRECT.

Possible cause	Check	Remedy
Wrong PR1 tap lead connection.	Primary lead E2 (par. 10b).	Connect lead to proper tap.
A-c input supply voltage changed.	A-c supply.	Change source of supply or move tap E2 to primary tap corresponding to input voltage.

d. ONLY D-C OUTPUT VOLTAGE INCORRECT.

Possible cause	Check	Remedy
Wrong lead connection to RECT TAPS.	Secondary tap connection E3 (par. 10b).	Connect lead E3 to correct tap.

e. EXCESSIVELY HIGH D-C VOLTAGE.

Possible cause	Check	Remedy
Reactor shorted.	Reactor L1 (par. 24d).	Install new reactor.
Resistor open.	Resistor R1 (par. 24e).	Install new resistor.

f. A-C RIPPLE IN D-C OUTPUT.

Possible cause	Check	Remedy
Reactor defective.	Reactor L1 (par. 24d).	Install new reactor.
Capacitor defective.	Capacitors C1 and C2 (par. 24c).	Install new capacitor C1 or C2.
Rectifier defective.	Rectifier CR1 (par. 24b).	Install new rectifier.

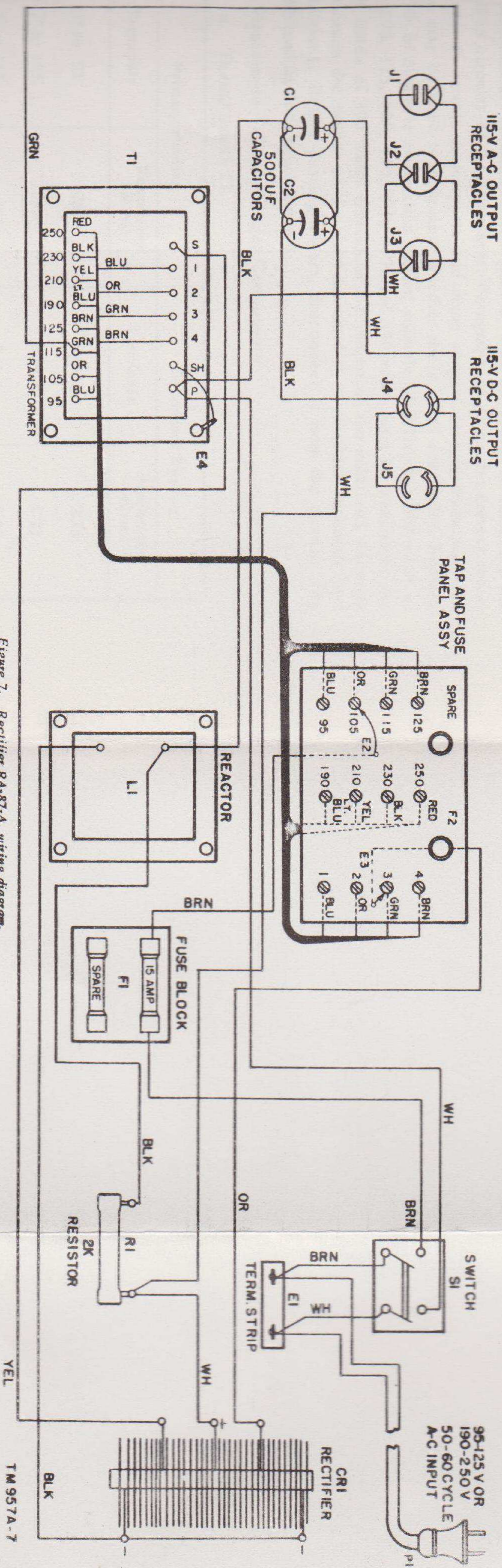


Figure 7. Rectifier RA-87-A, wiring diagram.

CHAPTER 4

FIELD MAINTENANCE INSTRUCTIONS

23. Inspection and Test

Remove the top and bottom covers of the rectifier and inspect the equipment to determine the extent of repair necessary. The test equipment listed in paragraph 21 and the trouble-shooting information given in paragraph 22 will be helpful in testing to determine faulty parts. The table of performance characteristics (par. 6) will be useful in checking the various circuits of the equipment. Paragraph 24 gives the correct resistances of certain major parts and some special test instructions, this data may be used to determine whether these parts are faulty. Sources of 50- to 60-cycle alternating current capable of delivering 600 watts at 95, 105, 115, 125, 190, 210, 230, and 250 volts must be available, and test loads of 500 watts (maximum a-c output of the unit) and 46 watts (maximum d-c output of the unit) are needed to simulate maximum load conditions. Before testing a part, disconnect it from the circuit. Tag each lead as it is disconnected.

24. Resistance Values of Major Components

a. TRANSFORMER T1.

Primary winding		Secondary winding	
Terminals	Resistance (ohms)	Terminals	Resistance (ohms)
P to 95	.88	S to 1	2.14
P to 105	.923	S to 2	2.21
P to 115	.966	S to 3	2.28
P to 125	1.009	S to 4	2.36
P to 190	1.326		
P to 210	1.643		
P to 230	1.961		
P to 250	2.279		

Note. Resistance values are mean and will vary plus or minus 5 percent.

b. RECTIFIER CR1. Disconnect the jumper which connects the end terminals of the stack. Using a battery-operated ohmmeter, measure the resistance of each of the four sections of the stack. The resistance per section should be 17,000 to 19,000 ohms with the test prods connected one way, and 250,000 to 280,000 ohms with the test prod connections reversed.

c. CAPACITORS C1 AND C2. Discharge the capacitors by short-circuiting them with a well-insulated screw driver. Connect the positive terminal of a battery-operated ohmmeter to the positive terminal of the capacitor. Resistance readings will start at approximately 2,000 ohms and will increase gradually to approximately 50,000 ohms.

d. REACTOR L1. Resistance should be from 2.0 to 2.5 ohms.

e. RESISTOR R1. Resistance should be from 1,800 to 2,200 ohms.

25. Removal of Parts

Remove all moistureproofing and fungiproofing lacquer from terminals or contacts by scraping it off or by dissolving it with Solvent, dry-cleaning (SD) and wiping it off with a clean cloth. Disconnect or unsolder only the leads or connections required to free the parts; label the leads carefully to identify them for future reconnection. Any component of the rectifier can be removed easily and individually by unfastening its mounting screws, nuts, and lockwashers. No sequence of removal is necessary, however, it is advisable to unfasten, *but not to disconnect*, the rectifier stack in order to remove the main fuse panel or the terminal strip.

26. Replacement of Parts

Any part which has been removed as described in paragraph 25 can be reinstalled by reversing the removal procedure. Be sure to reinstall all spacers, washers, and lockwashers in their proper places. Refer to the wiring diagram (fig. 7) for proper wire connections. Carefully resolder all electrical connections. Take particular care, in soldering the connections to the terminals on the rectifier stack, that no solder lodges between the disks; this would cause the rectifier to over-heat and to burn out. Coat all resoldered connections with moisture-proof and fungi-proof lacquer (par. 29).

27. Final Test

After replacing or reconnecting any part of the rectifier, make the following tests; use the test equipment listed in paragraph 21 and the a-c input values and load values given in paragraph 23.

a. FUNCTIONAL TEST. Operate the unit for 30 minutes with a d-c output of .4 ampere at 112 to 118 volts and with a load of 500 volt-amperes connected to the a-c receptacles. There should be no indication of overheating or break-down.

b. INPUT TESTS. With various constant sources of input from 95 to 250 volts and the PR1 tap lead connected correspondingly, the d-c output voltage should not vary more than 12 volts when the output current is varied from a value of .015 ampere to .4 ampere. Under the same conditions, the a-c voltage should be 112 to 118 volts.

c. RIPPLE TEST. Adjust and calibrate a cathode-ray oscilloscope to indicate a maximum ripple of 1/2 volt. Using d-c output loads varying from zero to .4 ampere, the a-c ripple in the d-c output should not exceed 1/2 volt.

28. Repainting

The bottom cover may be repainted without preliminary preparation. Before repainting the top cover, unscrew the exterior plates and mask the schematic and wiring diagrams mounted inside the cover. Remove all parts mounted on the chassis before repainting it. Strip off all old paint from the chassis and covers and repaint them. Use synthetic paint primer AN-TT-P-636 or zinc-chromate primer AN-TT-P-656 as an undercoat; use black wrinkle baking enamel 3-188 as a finish coat.

29. Moistureproofing and Fungiproofing After Repair

a. If only a few connections have been disturbed or a single part has been repaired, brush a coat of Lacquer, Fungus-resistant, specification No. 71-2202 (Sig C stock No. 6G1005-3) on all wiring, connections, resistors, and unpainted or unvarnished metal parts that have been replaced or disturbed. Do not apply lacquer to contact terminals, receptacles, contacts, fuses, rubber-insulated cord, or the rectifier stack (which has been pretreated specially).

b. If the condition of the equipment requires that a spray coat be applied generally, mask all movable or external contact terminals, remove all fuses and mask the fuse clips; cover or completely avoid spraying the rectifier stack, the input cord, and the external portions of the equipment. Dry the equipment in a drying oven or under heat lamps for 2 to 3 hours at 160° F. Spray the equipment thoroughly from all angles with fungus-resistant lacquer (subpar. a above) and allow it to dry. Remove all masking, reinsert the fuses, and retest the equipment (par. 27) for proper operation. Mark the equipment MFP inside the access door and the date the treatment was applied; for example: MFP 4 October 1951. For additional information on moistureproofing and fungiproofing, refer to TB SIG 13 and TB SIG 72.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

30. Preparation for Storage or Shipment

Clean the exterior of the unit and blow or brush out all dust and dirt from the interior. Inspect the exterior finish; if it is damaged, refinish the equipment according to the instructions in paragraph 28. Carefully inspect the entire unit to see that all wiring is in good condition, that all connections are clean and tight, and that all components are mounted securely. See that the proper complement of spare fuses (par. 7) is with the equipment. Be sure the equipment is in good condition and ready to operate. Place Rectifier RA-87-A in Chest CH-158; close the case and fasten the latches.

31. Storage and Shipment

If Rectifier RA-87-A is to be stored for a short time or moved a short distance by truck, no crating is necessary. If the unit is to be shipped a considerable distance, pack the equipment in a suitable crate or box (use the original packaging material if it is available) in accordance with the applicable Joint Army-Navy Specifications listed in appendix I.

Section II. DEMOLITION TO PREVENT ENEMY USE

32. Methods of Demolition

a. SMASH. Use sledges, axes, handaxes, pickaxes, hammers, crow-bars, heavy tools.

b. CUT. Use axes, handaxes, machetes.

c. BURN. Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

d. EXPLODE. Use firearms, grenades, TNT.

e. DISPOSE. Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

Note. Use anything immediately available for destruction of this equipment.

33. Destruction of Components

a. Smash (par. 32a) the tap-changing panel, the switch, the receptacles, the rectifier stack, the transformer, the capacitors, reactor, and resistor, the fuses, the case, and the chest.

b. Cut (par. 32b) the input cord and all leads and wiring.

c. Burn (par. 32c) the technical manuals and the chest.

d. Bury or scatter (par. 32e) all remaining parts of the equipment.

DESTROY EVERYTHING

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310-20-3 for field manuals and JANAP's. Check SR 310-20-4 for technical manuals, technical bulletins, supply bulletins, modification work orders, and changes. Check SR 310-20-5 for Army regulations and special regulations.

1. Special Regulations

- SR 310-20-3 Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).
- SR 310-20-4 Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
- SR 310-20-5 Index of Administrative Publications (Army Regulations, Special Regulations, Joint Army-Air Force Adjustment Regulations, General Orders, Bulletins, Circulars, Commercial Traffic Bulletins, Joint Procurement Circulars, Department of the Army Pamphlets, and ASF Manuals).
- SR 700-45-5 Unsatisfactory Equipment Report (Reports Control Symbol CSGLD-247).
- SR 745-45-5 } Report of Damaged or Improper Shipment (Reports
NAV DEPT } Control Symbols CSGLD-66 (Army), SandA-70-6
SERIAL 85POO } (Navy), and AF-MC-U2 (Air Force)).
AFR 71-4 }

2. Supply Publications

- SB 11-47 Preparation and Submission of Requisitions for Signal Corps Supplies.
- SB 11-76 Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.
- SB 11-100 Serviceability Standards for Signal Equipment in Hands of Troops.

3. Technical Manuals on Related Equipment and Test Equipment

TM 11-359	Line Units BE-77, BE-77-A, BE-77-B and BE-77-C.
TM 11-680	Teletypewriter Circuits and Equipment (Fundamentals).
TM 11-2201	Reperforator Teletypewriter Sets TC-16 and TC-17.
TM 11-2222	Transmitter Distributors Teletype Model 14.
TM 11-2223	Typing and Nontyping Reperforators, Teletype Model 14.
TM 11-2626	Test Units I-176, I-176-A, and I-176-B.
TM 11-5527	Multimeter TS-352/U.

4. Painting, Preserving, and Maintenance

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TM 9-2851	Painting Instructions for Field Use.

5. Decontamination

TM 3-220	Decontamination
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6. Packaging and Packing Information

a. MILITARY (JAN) SPECIFICATIONS.

JAN-B-121	Barrier-Materials; Greaseproof.
JAN-D-169(4)	Desiccants (Activated).
JAN-P-100	Packaging and Packing for Overseas Shipment -- General Specification.
JAN-P-101	Packaging and Packing for Overseas Shipment -- Adhesives, Water-Resistant, for Sealing Fiberboard Boxes.
JAN-P-103(1)	Packaging and Packing for Overseas Shipment -- Boxes; Wood Cleated; Solid Fiberboard.
JAN-P-105A	Packaging and Packing for Overseas Shipment -- Boxes, Wood, Cleated, Plywood (For boxes whose weight of contents does not exceed 1000 pounds).
JAN-P-106A	Packaging and Packing for Overseas Shipment -- Boxes; Wood, Nailed (For weight of contents not in excess of 1,000 pounds).

- JAN-P-116(2) Packaging and Packing for Overseas Shipment --
Preservation, Methods of.
- JAN-P-117(2) Packaging and Packing for Overseas Shipment --
Bags, Interior Packaging.
- JAN-P-120(1) Packaging and Packing for Overseas Shipment --
Cartons, Folding, Paperboard.
- JAN-P-125(1) Packaging and Packing for Overseas Shipment --
Barrier-Materials, Water-Proof, Flexible.
- JAN-P-127(3) Packaging and Packing for Overseas Shipment --
Tape, Adhesive, Pressure-Sensitive, Water Re-
sistant.
- JAN-P-131(3) Packaging and Packing for Overseas Shipment --
Barrier-Material; Moisture-Vaporproof, Flexible.
- MIL-B-131A Barrier-Material; Water-Vaporproof, Flexible.
- JAN-P-140 Packaging and Packing for Overseas Shipment --
Adhesives, Water-Resistant, Case-Liner.

b. U. S. ARMY SPECIFICATION.

- 100-2E Marking Shipments by Contractors, Standard Speci-
fications.

c. SIGNAL CORPS INSTRUCTIONS.

- 720-7 Standard Pack
- 726-15 Marking of Interior Containers (for Signal Corps
Equipment).

7. Other Publications

- TB SIG 25 Preventive Maintenance of Power Cords.
- TM 11-453 Shop Work

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Note. The following is an identification table of parts for Rectifier RA-87-A (Sig C stock No. 3H4699-87). The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O&E, T/A, SIG 7 & 8, SIG 7-8-10, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7 & 8-RA-87. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1, Introduction and Index.

Identification Table of Parts

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CABLE, POWER, ELECTRICAL: UL type, SJ cable modified; two #18 AWG stranded conductors; approx 7' lg.	Conducts a-c input from source to transformer primary input circuit.	1B3018-2.28
	CAP, FUSEHOLDER: plastic; marked FUSE; $\frac{5}{8}$ " lg x $\frac{1}{16}$ " dia o/a.	Retains $\frac{1}{2}$ -ampere fuse in holder.	3Z930-2.3
C1, C2	CAPACITOR, FIXED, ELECTROLYTIC: 500 uf +20%, -10%; 200 vdcw; $4\frac{1}{2}$ " lg x 2" dia; Aerovox #2E.	Provides low-impedance path for pulsating current passed by reactor.	3DB500-2
	CLIP, ELECTRICAL: fuse; 2 term; .520 max jaw opening.	Secures 15-ampere main fuse.	3Z1029-1
P1	CONNECTOR, PLUG: rubber; 2 rect male contacts; straight type.	Provides contacts to connect a-c supply to input cord.	3Z3148-1
J4, J5	CONNECTOR, RECEPTACLE: locking type; 2 curved, twist-type female contacts; straight; cylindrical; approx 1.125" h x 1.390" dia.	Provides means of connecting the using equipment to 115-volt d-c output.	6Z7815
J1, J2 J3	CONNECTOR, RECEPTACLE: 2 rect parallel female contacts; straight type; cylindrical; approx $1\frac{1}{8}$ " h x $\frac{1}{16}$ " dia.	Provides means of connecting the using equipment to 115-volt a-c output.	6Z7789.1
F2	FUSE, CARTRIDGE: $\frac{1}{2}$ amp; slo-blo type; $1\frac{1}{4}$ " lg x $\frac{1}{4}$ " dia; Littelfuse type 3AG.	Protects rectifying assembly against excessive input.	3Z2595.7

F1	FUSE, CARTRIDGE: 15 amp; instantaneous type; 2" lg x $\frac{3}{16}$ " dia; Buss cat. #NON-15.	Protects transformer against excessive input.	3Z1903-15
	FUSEHOLDER: extractor post type; accommodates one $1\frac{1}{4}$ " lg x $\frac{1}{4}$ " dia cartridge-type fuse.	Contains $\frac{1}{2}$ -ampere fuse which protects rectifying assembly.	3Z3285-6.7
	GROMMET: black rubber; $\frac{1}{2}$ " hole; $1\frac{1}{16}$ " OD x $\frac{3}{16}$ " ID x $\frac{1}{4}$ " thk.	Protects input cord during its passage through wall of chassis.	6Z4910K
	INSULATOR, BUSHING: rd shoulder type; fiber; outside thread; $\frac{3}{8}$ " lg o/a.	Protects wires during their passage through floor of chassis.	3G100-225
L1	NUT, SELF-LOCKING, ROUND: spanner type; $\frac{1}{2}$ "-NCT-2; $1\frac{1}{16}$ " OD x $\frac{1}{8}$ " thk.	Secures insulating bushing in place.	6Z3858-23
	REACTOR: swinging choke type, 1.8 to .23 henrys; 400 ma dc; 1800 ohms $\pm 10\%$; HS case.	Removes a-c component (ripple) from rectified ac.	3C5574
CRI	RECTIFIER, METALLIC: selenium; full-wave; input 160-v max, single-phase, 60-cyc ac; output 115-v dc, 400 ma max.	Converts a-c input to d-c output.	3H4860
R1	RESISTOR, FIXED, WIRE WOUND: 2000 ohms $\pm 5\%$; 12 w; JAN type RW32G202.	Provides constant load to prevent output voltage from rising excessively when d-c load is light.	3RW26109
S1	SWITCH, TOGGLE; DPST; JAN type ST52K.	ON-OFF switch; starts and stops rectifier without disconnecting input cord from a-c supply.	3Z9863-52K
E4	TERMINAL, LUG: rd tongue end type; for #18 AWG wire.	Used as transformer ground connection.	3Z12046-1

8 Identification Table of Parts (cont)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	TERMINAL, LUG: ring type; for #18 AWG wire; $\frac{7}{32}$ " lg x $\frac{1}{32}$ " wd x $\frac{7}{32}$ " h.	Used as end-terminal of wire to facilitate connection.	3Z12050-5.3
	TERMINAL, LUG: ring type; for #18 AWG wire; $\frac{7}{64}$ " lg x $\frac{5}{16}$ " wd x $\frac{3}{16}$ " h.	Used as end-terminal of wire to facilitate connection.	3Z12050-5.6
	TERMINAL, LUG: ring type; for #18 AWG wire; $\frac{1}{32}$ " lg x $\frac{1}{2}$ " wd x $\frac{1}{4}$ " h.	Used as end-terminal of wire to facilitate connection to capacitors.	3Z12050-5.12
	TERMINAL, STUD: brass; equipped with clamping ears.	Secures transformer tap lead to tapping panel and provides means of connecting movable, voltage-changing tap lead.	3Z12073
	T1 TRANSFORMER, POWER REGULATING: fixed; multiple-tapped; input 95- to 250-v, 50- to 60 cyc, single-phase, .500 kva; output 147- to 162-v (2.5% tolerance), .55 amp; inclosed steel case.	Steps up or down, as required, voltage of a-c input to voltage suitable to supply rectifying assembly.	2Z9607-57

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DEPARTMENT OF THE ARMY TECHNICAL MANUAL

C 1 TM 11-957A

RECTIFIER RA-87-A

CHANGES

No. 1

TM 11-957A

follows:

DEPARTMENT OF THE ARMY

WASHINGTON 25, D. C., 30 December 1952

, 27 March 1952, is changed as

The date on the front cover is changed from April 1952 to March 1952.

4.1. Differences in Rectifiers RA-87-A Procured on Different Orders (Added)

A few minor differences exist between Rectifiers RA-87-A procured on different orders; however, all Rectifiers RA-87-A are essentially alike and may be used interchangeably. The information in this manual applies equally to all Rectifiers RA-87-A unless otherwise specified in this change. The reference symbols which apply to similar components of equipments supplied on different orders differ. Throughout this manual the symbols applicable to Rectifiers RA-87-A supplied on Order No. 6573-Phila-51 are used to identify parts. A conversion table for reference symbols follows.

Component	Ref. Symbol (Order Nos. 25579-Phila-49, 18101-Phila-50, 3131-Phila-51, and 3164-Phila- 51)	Ref. Symbol (Order No 6573- Phila-51)
Transformer	1	T1
Reactor	2	L1
Rectifying assembly	3	CR1
Capacitor	4-1	C1
Capacitor	4-2	C2
Fuse (1/2-amp)	6	F2
ON-OFF switch	7	S1
A-c output receptacle	11-1	J1
A-c output receptacle	11-2	J2
A-c output receptacle	11-3	J3
D-c output receptacle	12-1	J4
D-c output receptacle	12-2	J5
Terminal lug	14	E4
Fuse (15-amp)	17	F1
Resistor	18	R1
Plug connector		P1
Terminal strip		E1
Primary lead		E2
Secondary lead		E3

5. Major Parts and Assemblies (fig. 4, 4.1, 5, 5.1, 6, and 6.1)

Rectifier RA-87-A consists * * * of Rectifier RA-87-A.

* * * * *

f. Tap and Fuse Panel Assembly (figs. 6 and 6.1). The tap and * * * of the panel.

* * * * *

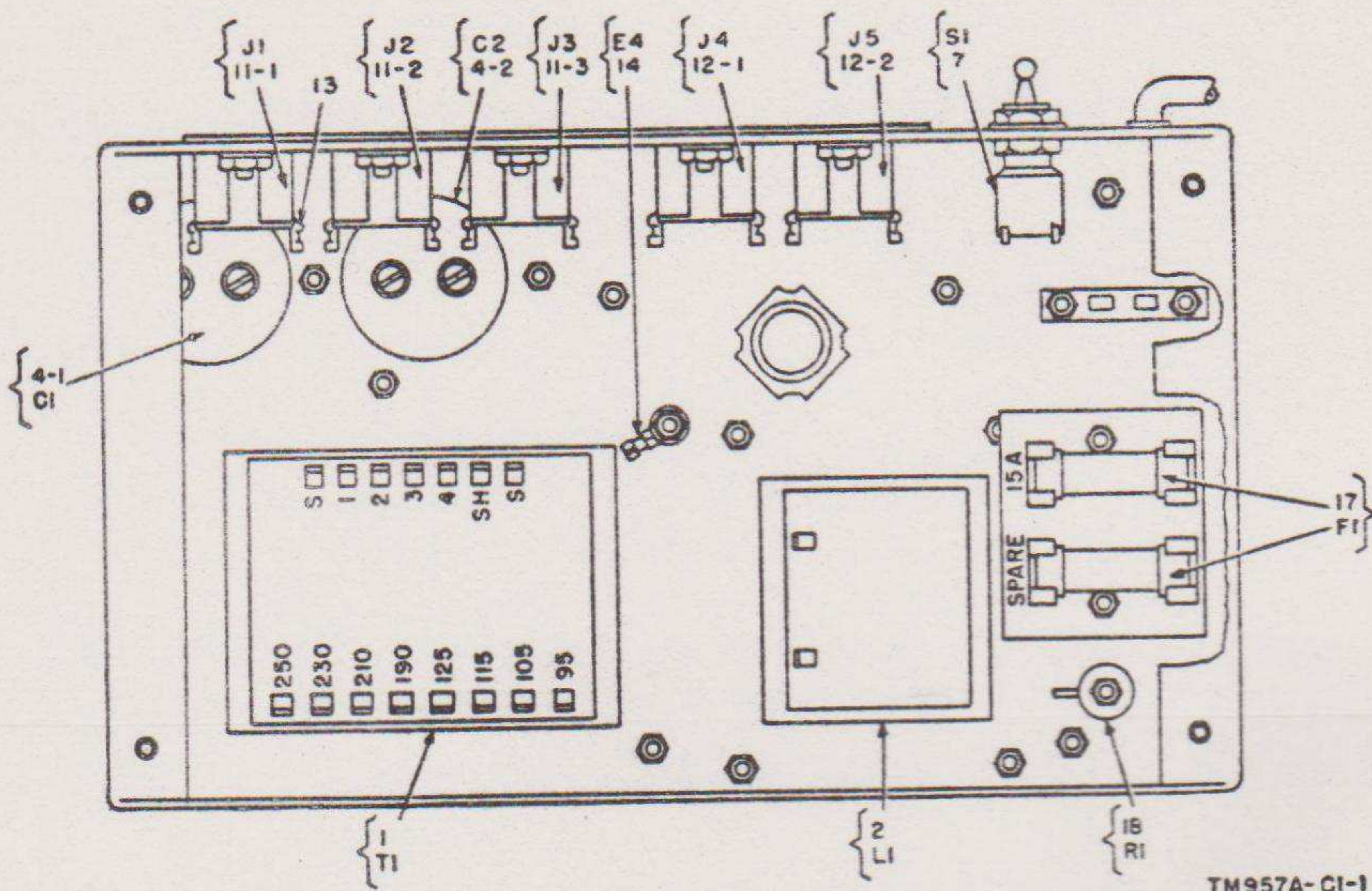


Figure 4.1 (Added). Rectifier RA-87-A. bottom view of chassis, parts location diagram.

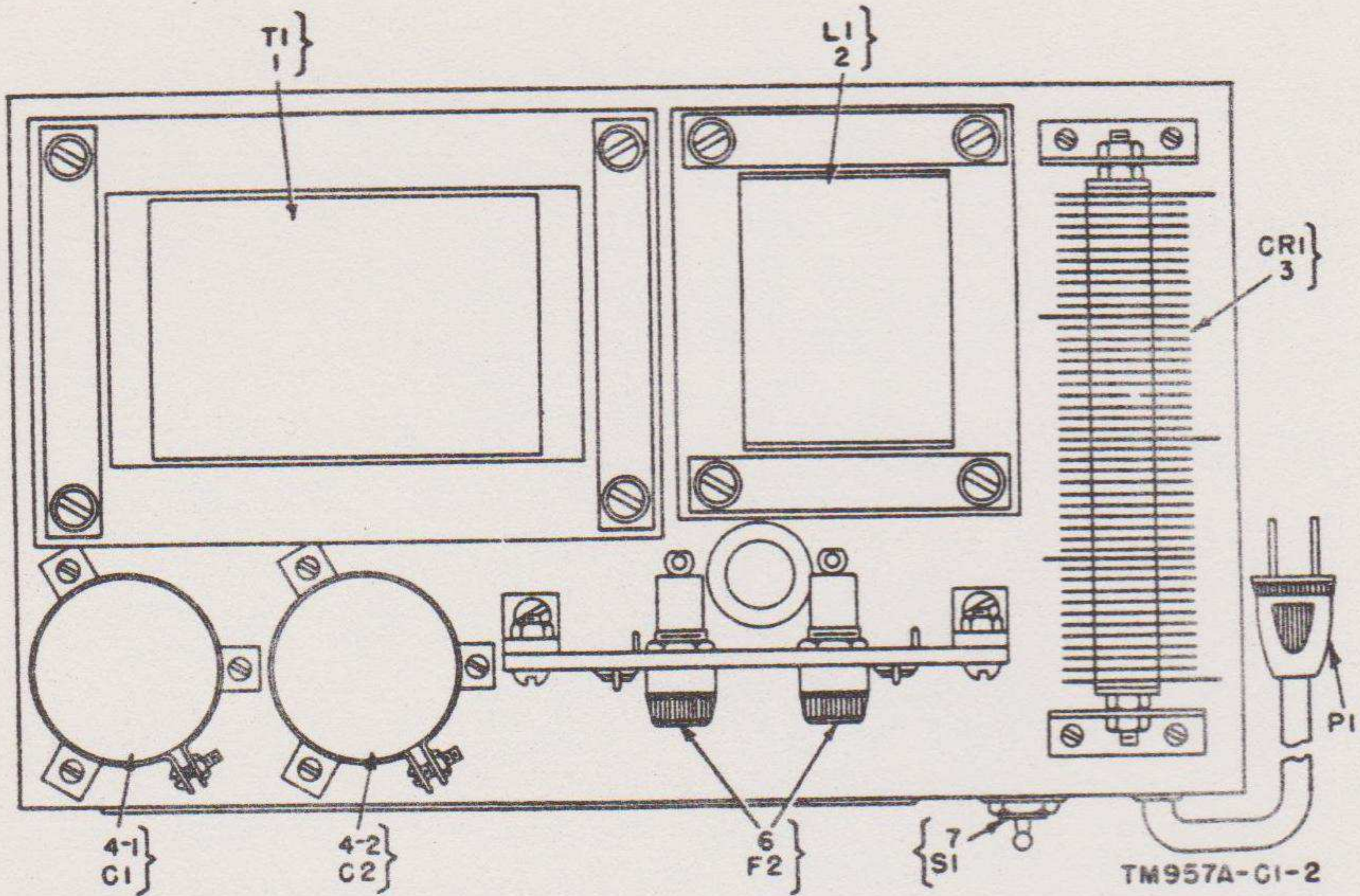


Figure 5.1 (Added). Rectifier RA-87-A, top view of chassis, parts location diagram.

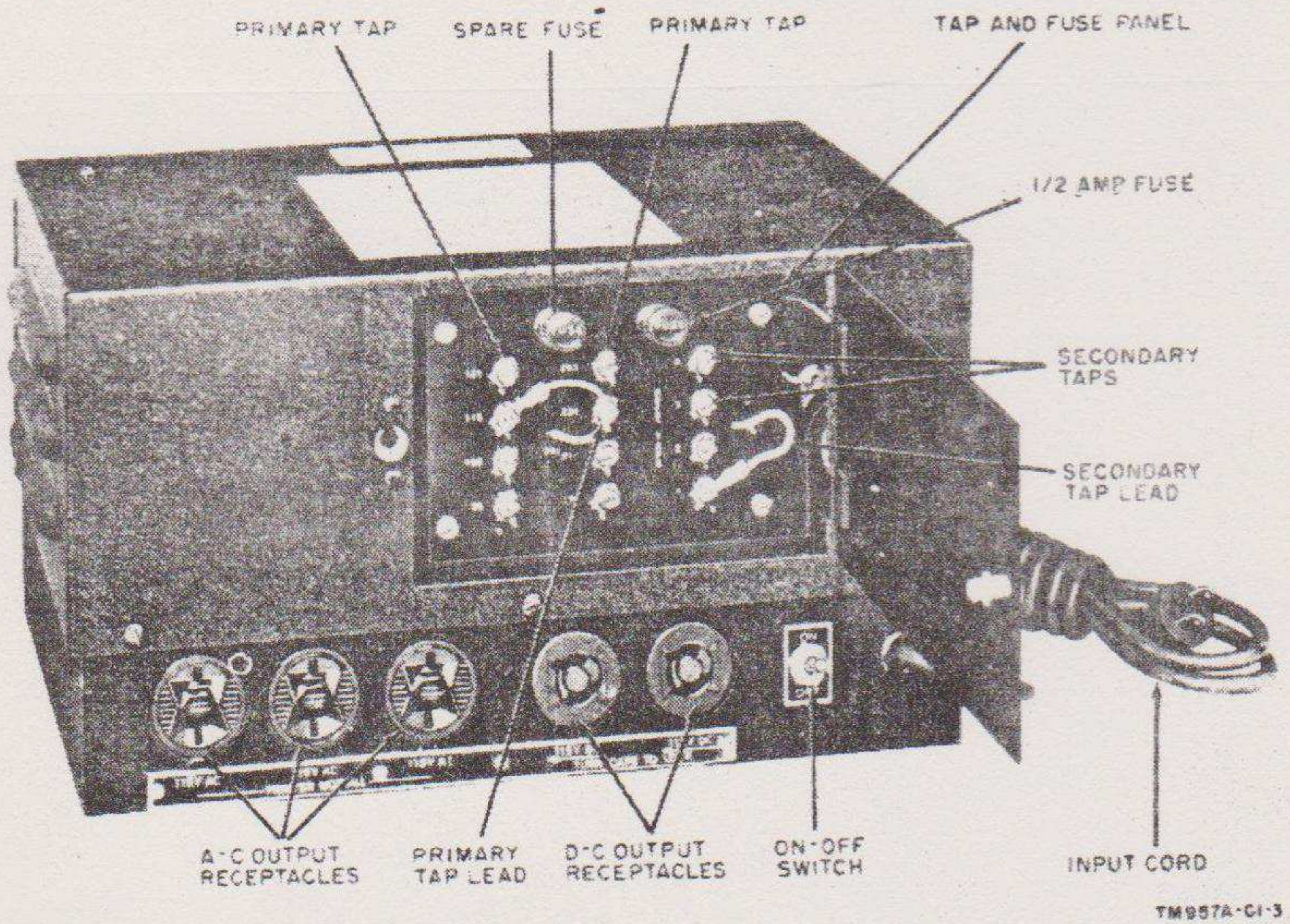


Figure 6. (Superseded). Rectifier RA-87-A, front view.

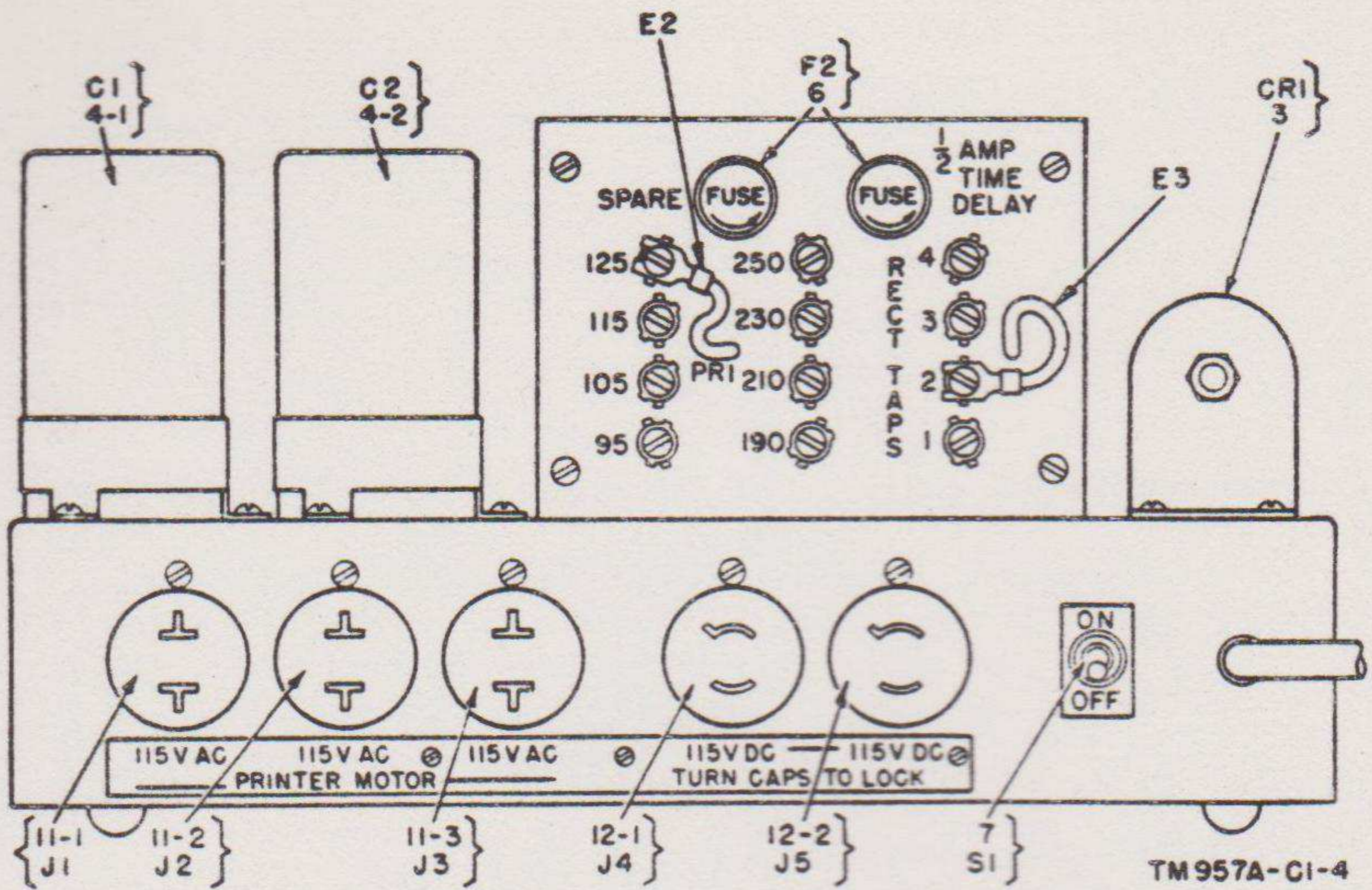


Figure 6.1 (Added). Rectifier RA-87-A, front view of chassis, parts location diagram.

6. Performance Characteristics

The electrical characteristics of Rectifier RA-87-A, measured at various points and under various load conditions, are given in the tables in *a* and *b* below. In addition to their use in showing the working outputs of the rectifier, the tables may be used in checking the functioning of the circuits of the equipment.

a. (Added) Performance Characteristics of Rectifier RA-87-A
(Order Nos. 6573-PHILA-51, 3131-P-51, and 3164-PHILA-51).

Conditions (with RECT TAP connected to tap 1)		Point of measurement				
		Alternating current			Direct current	
		Line or transformer input	A-C receptacle output	Transformer secondary output	Rectifier output	D-C receptacle output
No load, 115-v line and tap.	Volts.....	115	115	146	120	120
	Amperes ..	. 3	0	. 08	0	0
*	*	*	*	*	*	*
Full a-c and d-c loads, 230-v line and tap.	Volts.....	217	106	136	105	105
	Amperes ..	2. 35	4	. 52	. 38	. 38

Note. Values are mean and will vary plus or minus 5 percent.

b. (Added) Performance Characteristics of Rectifier RA-87-A (Order Nos. 25578-PHILA-49 and 18101-PHILA-50).

Conditions		Point of measurement				
		Alternating current			Direct current	
		Line or transformer input	A-C receptacle output	Transformer secondary output	Rectifier output	D-C receptacle output*
No-load, 115-v line and tap.	Volts.....	115	115	147	120	120
	Amperes.....	. 34	0	. 070	. 060	0
No a-c load, full d-c load, 115-v line and tap.	Volts.....	115	115	145	112	111
	Amperes.....	. 84	0	. 490	. 457	. 40
Full a-c and d-c loads, 115-v line and tap.	Volts.....	115	115	145	112	111
	Amperes.....	5. 00	4. 35	. 490	. 457	. 40
Full a-c and d-c loads, 110-v line on 115-v tap.	Volts.....	110	107	137	106	105
	Amperes.....	4. 80	4. 15	. 490	. 455	. 40
No a-c load, full d-c load, 95-v line and tap.	Volts.....	95	115	145	112	111
	Amperes.....	1. 10	0	. 490	. 457	. 40
Full a-c and d-c loads, 95-v line and tap.	Volts.....	95	112	142	109	108
	Amperes.....	5. 80	4. 25	. 490	. 457	. 40
Full a-c and d-c loads, 230-v line and tap.	Volts.....	230	112	145	112	111
	Amperes.....	2. 50	4. 25	. 490	. 457	. 40

*The output voltage at the d-c receptacles may be increased to approximately 115 volts by changing the RECT TAPS connection from tap 1 to tap 4. This will have no effect on the output voltage at the a-c receptacles.

7. Tabular Data

a. Weights and Dimensions. The following table gives the **approximate** weight and over-all dimensions of Rectifier RA-87-A and of Chest CH-158:

* * * * *

8. Uncrating, Unpacking, and Checking

a. Uncrating and Unpacking. Unpack the equipment * * * for future repacking.

* * * * *

(5) Lift the rectifier * * * as lifting handles.

Note (Added). Subparagraph *a* above and paragraph 9 do not apply to Rectifiers RA-87-A supplied on Order Nos. 3131-Phila-51 and 3164-Phila-51. Rectifiers supplied on these orders are shipped mounted in Shelter HO-17-A.

* * * * *

10. Connections and Interconnections

* * * * *

b. Transformer Tap Connections (figs. 6 and 6.1). Before connecting the * * * of the rectifier.)

* * * * *

c. Teletypewriter Connections. For hook-ups and * * * a clockwise direction.

Note (Added). In Rectifiers RA-87-A supplied on Order No. 18101-Phila-50 the a-c receptacles are black and the d-c receptacles are brown.

18. Scope

To assist personnel * * * in paragraph 19. Figure 3 is a schematic diagram of the circuits of the equipment; figure 7 is the wiring diagram for Rectifiers RA-87-A supplied on Order Nos. 6573-Phila-51, 3131-Phila-51, and 3164-Phila-51; figure 7.1 is the wiring diagram for Rectifiers RA-87-A supplied on Order Nos. 25578-Phila-49 and 18101-Phila-50.

19. Theory of Operation

* * * * *

b. Rectifying Assembly. The rectifying assembly * * * dc is produced. In Rectifiers RA-87-A supplied on Order Nos. 6573-Phila-51, 3131-Phila-51, and 3164-P-51, the center terminal of the stack becomes the positive d-c terminal and the end terminals (which are connected together) become the negative d-c terminal. **In Rec-**

tifiers RA-87-A supplied on Order Nos. 25578-Phila-49 and 18101-Phila-50, the polarity is reversed: the center terminal of the rectifier stack is the negative d-c terminal and the end terminals, connected together, become the positive d-c terminal (figs. 7 and 7.1).

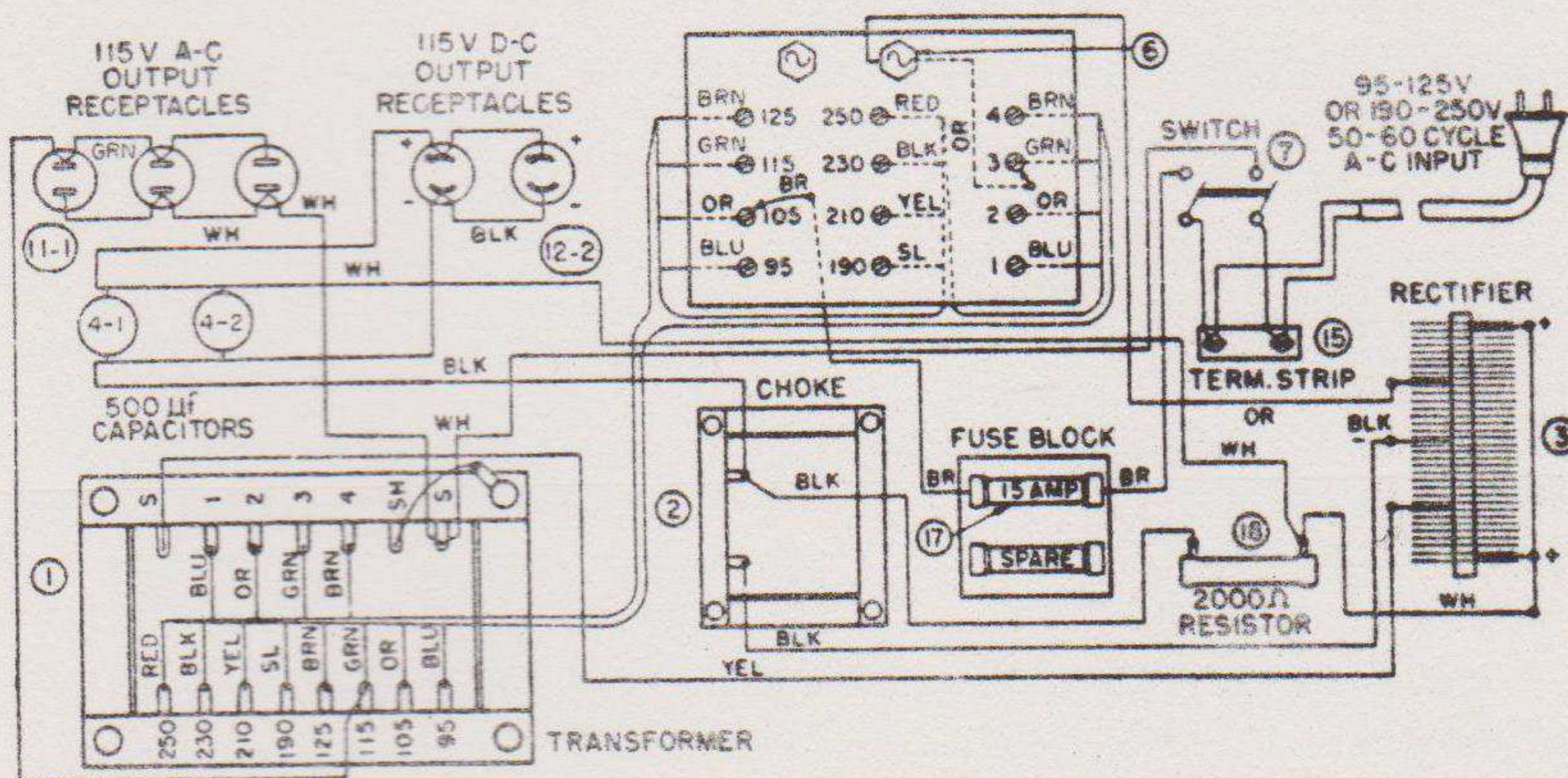
* * * * *

22. Trouble Location Charts

Some of the * * * to remove it. Refer to the schematic diagram (fig. 3) and the wiring diagrams (figs. 7 and 7.1) for circuit information. The electrical characteristics * * * to be made.

* * * * *

Figure 7. Rectifier RA-87-A (Order Nos. 6573-Phila-51, 3131-Phila-51, and 3164-Phila-51), wiring diagram.



NOTE:
WIRES COLOR-CODED ORANGE IN RECTIFIERS SUPPLIED ON ORDER NO. 25578-P-49 ARE COLOR-CODED WHITE/YELLOW (W/Y) IN RECTIFIERS SUPPLIED ON ORDER NO. 18101-P-50.

TM 957A-CI-5

Figure 7.1 (Added). Rectifier RA-87-A (Order Nos. 25578-Phila-49 and 18101-Phila-50), wiring diagram.

24. Resistance Values of Major Components

a. Transformer (Order Nos. 6573-Phila-51, 3131-Phila-51, and 3164-Phila-51).

* * * * *

a.1 (added). *Transformer (Orders Nos. 25578-Phila-49 and 18101-Phila-50).*

Primary winding		Secondary winding	
Terminals	Resistance (ohms)	Terminals	Resistance (ohms)
S to 95.....	. 689	S to 1.....	3. 47
S to 105.....	. 723	S to 2.....	3. 57
S to 115.....	. 758	S to 3.....	3. 68
S to 125.....	. 794	S to 4.....	3. 91
S to 190.....	1. 270		
S to 210.....	1. 438		
S to 230.....	1. 582		
S to 250.....	1. 761		

b. *Rectifier (Order Nos. 6573-Phila-51, 3131-Phila-51 and 3164-Phila-51).* Disconnect the jumper * * * prod connections reversed.

b.1 (added). *Rectifier (Order Nos. 25578-Phila-49 and 18101-Phila-50).* Disconnect the jumper which connects the end terminals of the stack. Using a battery-operated ohmmeter, measure the resistance of each of the four sections of the stack. The resistance per section should be 1,500 to 2,000 ohms with the test prods connected one way and 25,000 to 40,000 ohms with the test prod connections reversed.

c. *Capacitors (Order Nos. 6573-Phila-51, 3131-Phila-51, and 3164-Phila-51).* Discharge the capacitors * * * approximately 50,000 ohms.

c.1 (added). *Capacitors (Order Nos. 25578-Phila-49 and 18101-Phila-50).* Discharge the capacitors and connect an ohmmeter according to the instructions in c above. Resistance readings should be between 5,000 and 10,000 ohms.

* * * * *

26. Replacement of Parts

Any part which * * * their proper places. Refer to the wiring diagrams (figs. 7 and 7.1) for proper wire connections. **When a new rectifying assembly is being installed, be careful to connect the leads so that the polarity is correct.** Carefully resolder all * * * fungiproof lacquer (par. 29).

APPENDIX II IDENTIFICATION TABLE OF PARTS

Note. The following is * * * Introduction and Index.

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
* C1, C2-----	* * * CAP, electrical: plastic; marked FUSE; $\frac{5}{8}$ " lg x $\frac{1}{16}$ " dia o/a. (Order Nos. 6573-Phila-51, 3131-Phila-51, and 3164-Phila-51 only). * * * CAPACITOR, FIXED, ELECTROLYTIC: * * * dia; aerovox #2E.	* * * Retains * * * holder-----	* 3Z930-2.3
* P1-----	* * * CLIP, electrical: fuse; 2 term.; .520 max jaw opening. * * * CONNECTOR, plug: * * * straight type-----	* * * Provides * * * reactor-----	3DB500-2.
* J1, J2, J3-----	* * * CONNECTOR, receptacle: * * * $\frac{1}{16}$ " dia----- * * * FASTENER, latch: trunk type; $2\frac{1}{2}$ " lg x $\frac{15}{16}$ " wd o/a.	* * * Provides * * * fuse----- * * * Provides * * * cord-----	3Z1029-1. 6Z1735.12.
* F2-----	* * * FUSE, CARTRIDGE: * * * type 3AG-----	* * * Protects * * * input-----	3Z2595.7
* L1-----	* * * REACTOR: * * * HS case-----	* * * Removes * * * ac-----	* 3C557Y.
* T1-----	* * * TRANSFORMER, POWER REGULATING: * * * steel case. * * * WEATHERSTRIP: rubber; $\frac{1}{2}$ " wd x $\frac{3}{8}$ " thk-----	* * * Steps up * * * rectifying assembly. * * * Provides weatherproof seal for chest opening.	* 2Z9607-57. 6Z8726-7.