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WAR DEPARTMENT

U.S. Dept. of Army

TECHNICAL MANUAL

FOR

Allen Model E-2 Unitron Rectifier

March 8, 1943



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WAR DEPARTMENT
WASHINGTON, March 8, 1943

This Technical Manual, published by Allen Electric and Equipment Co. on order No. 20914-PHILA-43, is furnished for the information and guidance of all concerned.

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ALLEN MODEL E-2 UNITRON RECTIFIER

Prepared under direction of the Chief Signal Officer

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DESTRUCTION OF ABANDONED MATERIEL IN THE COMBAT ZONE

In case it should become necessary to prevent the capture of this equipment, and when ordered to do so, *DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED, OR USED BY THE ENEMY, BURN ALL PAPERS AND BOOKS.*

MEANS: —

1. Explosives, when provided.
2. Hammers, axes, sledges, or whatever heavy objects are readily available.
3. Burning by means of incendiaries such as gasoline, oil, paper, or wood.
4. Grenades and shots from available arms.

PROCEDURE: —

1. Obliterate all identifying marks. Destroy nameplates and circuit labels.
2. Demolish all panels, castings, switch-and instrument-boards.
3. Destroy all controls, switches, relays, connecting means and meters.
4. Rip out all wiring in electrical equipment. Smash gas, oil, and water cooling systems in gas-engine generators, etc.
5. Smash every electrical or mechanical part whether rotating, moving or fixed.
6. Break up all operating instruments such as keys, phones, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.

DISPOSAL: —

8. Where possible, and time permits bury all debris or dispose of it in streams or other bodies of water.

SAFETY NOTICE

THIS EQUIPMENT EMPLOYS 115 VOLTS WHICH SHOULD NOT BE CONTACTED BY OPERATING PERSONNEL. BE SURE A-C POWER LINE SWITCH IS "OFF" BEFORE REPLACING BULBS, FUSES OR DOING ANY WORK ON THE INTERIOR OF THE RECTIFIER.

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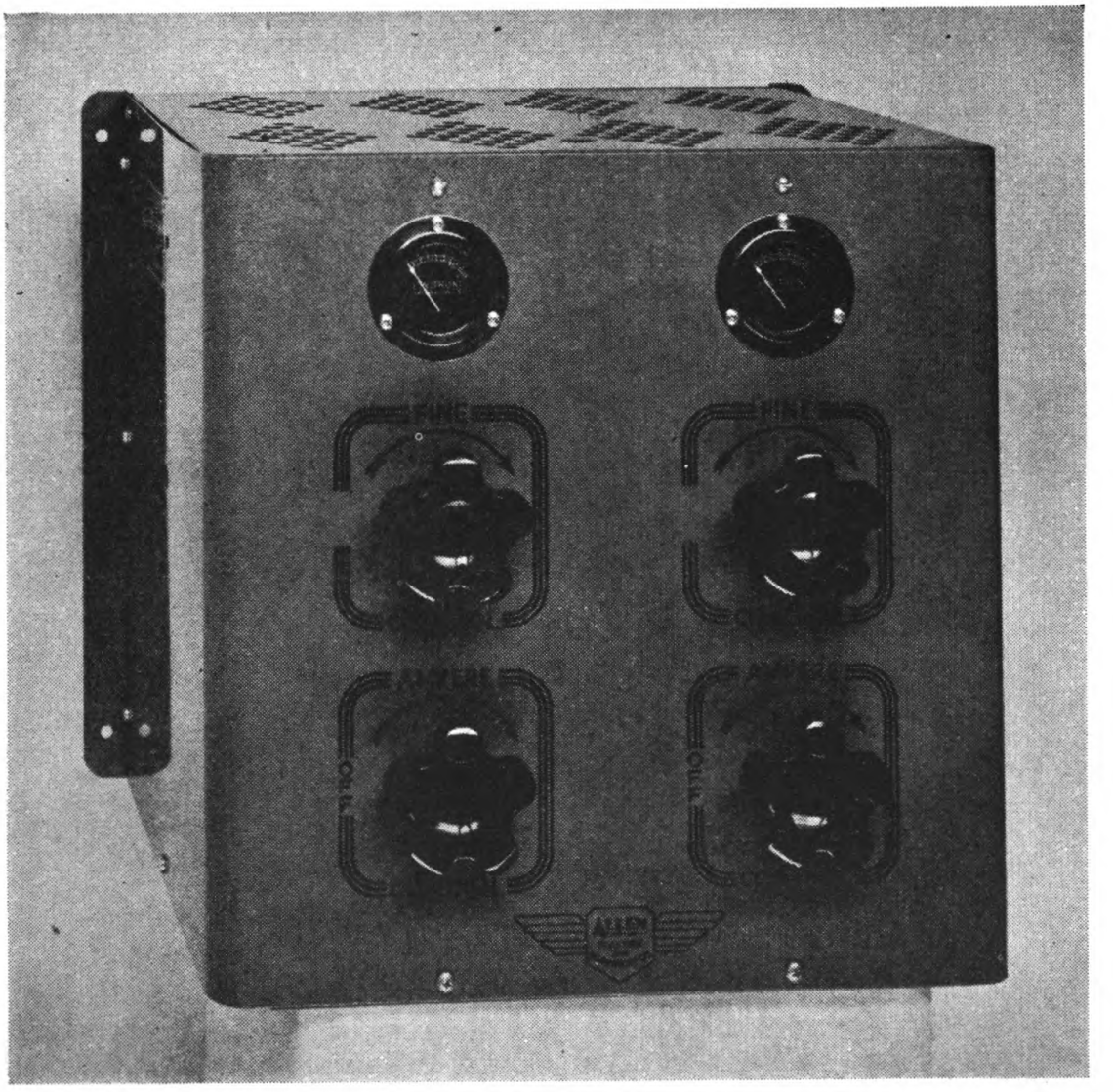


Figure No. 1 Model E-2 Unitron Rectifier
Net Weight 72 lbs. Size 17″ wide, 14¼″ deep, 15″ high

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SECTION I

DESCRIPTION

1. General. — The purpose of the Model E-2 Unitron Rectifier is to convert alternating current (a-c) to direct current (d-c). D-C current always flows in the same direction and is required for the charging of storage batteries. Model E-2 Unitron Rectifier provides also means of regulating and indicating in amperes the flow of current through the battery charging line.

2. Capacity.— The rectifier is designed to charge one or more storage batteries at rates of from 2 to 12 amperes when the total voltage of the batteries on charge is not less than 6 nor more than 65 volts.

3. Voltage and Frequency.— The rectifier is constructed for use from a 115 volt 50 or 60 cycle line, and when operated at full capacity, the power input required is 12½ amperes.

4. Weight and Size.— The net weight of the rectifier is 72 lbs., and the overall dimensions are 17″ wide, 14¼″ deep, 15″ high.

SECTION II

EMPLOYMENT

5. Installation.—

a. Unpacking.— Loosen the two "Phillips" type screws on the front of the rectifier which hold the top hinged cover in place, and remove the two bulbs that are in cartons inside the rectifier. Remove the bulbs from the cartons and examine them to be certain that the glass is not broken. If damaged, a claim should be filed with the transportation company.

b. Mounting.— Attach the rectifier by means of four screws, one at each corner, to the wall or wherever it is to be mounted and as close as possible to the incoming 115 volt 50 or 60 cycle a-c line, so that full voltage will be available at the rectifier. If the wall to which the mounting is to be made is brick or concrete, attach boards using expansion bolts or insert wooden plugs, so that the rectifier can be fastened to the wood.

c. Charging Rack.— The charging rack should be substantial. A suggested construction is wood 2x4's placed on edge, spaced from 1½″ to 2″ apart and 20″ to 24″ above the floor, strongly framed at each end and in the center, and mounted on 4″ x 4″ wood legs. Paint the entire wood surface with acid resisting paint (Asphaltum). Place the rack so that it is not directly under the rectifier, as acid fumes from the batteries while charging are destructive to all metal parts.

6. Preparation for Use.— Turn the two lower control dials of the rectifier to their "OFF" position, and be sure that the voltage of the a-c line is 115 volts 50 or 60 cycle.

a. A-C Wire Size.— The a-c line from the power box to the rectifier should be no less than size No. 8 and if the distance is more than 30 feet, use No. 6. A separate line is advisable, provided all available lines are heavily loaded with other apparatus.

b. A-C Connections.— Connect two wires from the a-c supply line to the two a-c terminals inside the rectifier. No polarity has to be observed. SOLDER

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THE CONNECTIONS.

c. Fuses.— The fuses in the a-c power line fuse box are to be not less than 40 ampere size, and the d-c fuses in the rectifier 15 ampere size. DO NOT USE OVER 15 AMPERE SIZE in the rectifier as to do so removes the protection to the tubes.

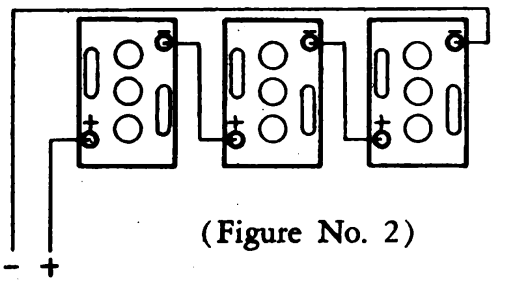
d. D-C Connections.— Use two No. 10 wires for the charging leads, and of sufficient length to reach from the rectifier to the battery line. The positive wire should be red and the negative wire black. If wire of these colors is not available, use red and black paint on the wires for identification. Solder the red wire to the positive d-c lead of the rectifier painted red and the black wire to the negative d-c lead of the rectifier painted black. On the opposite end of the charging leads attach and solder charging clips.

e. Bulbs.— Screw the bulbs firmly into the sockets in the rectifier and attach the wires with Fahnestock clips to the top of each bulb.

7. Operation.—

a. Battery Connections.— Connect the positive wire from the rectifier to the positive post of battery No. 1. Connect the negative post of battery No. 1 to the positive post of battery No. 2 using a short No. 10 jumper wire with a charging clip soldered to each end. Then connect the negative post of battery No. 2 to the positive post of battery No. 3 and so on. The number of batteries that can be so connected will depend on their voltage which should not exceed a total of 65 volts. Connect the negative wire from the rectifier to the negative post of the last battery. The batteries will then be connected in series to the rectifier, as shown in Figure No. 2.

SERIES CONNECTIONS



(Figure No. 2)

b. Charging Circuits.— The rectifier is designed so that the left hand (facing the rectifier) bulb circuit can be used independently of the right hand side, and to charge at any rate from 2 to 6 amperes, or both bulb circuits can be used simultaneously to charge at rates up to 12 amperes.

c. Charging Control.—

(1) *Left Bulb Circuit.*— To start the left side of the rectifier to operating independently of the right bulb circuit, turn the lower left hand control knob to the right (clockwise) until the approximate desired charging rate (2 to 6 amperes) registers on the left hand ammeter. Complete the adjustment by moving the upper left hand control knob until the exact charging rate desired registers on the left hand ammeter. DO NOT EXCEED SIX AMPERES.

(2) *Right Bulb Circuit.*— To start the right side of the rectifier operating, which cannot be operated unless the left hand bulb circuit is also being used, turn the lower right control knob to the right (clockwise) until

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approximately the desired charging rate (2 to 6 amperes) registers on the right hand ammeter. Complete the adjustment by moving the upper right control knob until the exact charging rate desired registers on the right hand ammeter. DO NOT EXCEED SIX AMPERES.

(3) *Both Bulb Circuits.*— By manipulating all of the control dials as explained in the preceding paragraphs 7c, (1) and (2), the sum of the charging rates registered on both ammeters is the charging rate flowing through the batteries. Example — If a 10 ampere rate is desired, regulate the left bulb circuit until the left ammeter registers 6 amperes. Regulate the right bulb circuit until the right ammeter registers 4 amperes. The total rate through the batteries on charge will then be 10 amperes.

(4) *Turning Off Rectifier.*— To stop charging, turn the two lower control dials to OFF by first turning off the lower right dial and then the lower left. The position of the two upper dials has no effect as their purpose is to provide for fine control of the charging rate.

CAUTION: DO NOT REMOVE BATTERY JUMPERS FROM THE BATTERIES OR SHUT OFF THE CURRENT BY A SWITCH IN THE SUPPLY LINE WHILE THE RECTIFIER IS OPERATING.

SECTION III
FUNCTIONING OF PARTS

8. Main Components.— The principal parts of the model E-2 Unitron Rectifier are:—

a. Bulbs. Ref. 1.— The purpose of the bulbs is to change (rectify) alternating current (a-c) to a pulsating direct current (d-c), which is accomplished by suppressing one alternation of the a-c line and permitting the next to flow. The bulb consists of a tungsten filament (cathode) and graphite target (anode) properly suspended and sealed in a glass envelope containing Argon Gas. When the filament is heated through a special winding of the rectifier transformer, a stream of electrons are given off which ionize the gas in the bulb, thereby reducing its resistance to the passage of current in one direction and increasing the resistance in the opposite direction.

b. Transformer. Ref. 14.— The transformer is an insulated type with the primary and secondary wound on a laminated iron core. It is designed for 115 volts a-c and 6 to 65 volts d-c. The taps leading to the control dials are taken from the secondary winding. Two separate windings supply the proper voltage to the filaments of the bulbs. The purpose of the transformer is to provide a means of controlling the d-c voltage output depending on the number of batteries to be charged simultaneously and at the ampere rate desired.

c. Reactance. Ref. 7.— The reactance consists of a laminated iron core with two windings, one for each bulb circuit. Its purpose is to smooth out the voltage and current between the taps of the transformer when increasing or decreasing the charging rate through use of the control dials.

d. Control Switches. Ref. 10, 11, 12, 13.— The four control switches are directly connected to taps from the secondary of the transformer and they control the charging rate through varying the a-c voltage as applied to the rectifier. The two lower switches are for coarse adjustment and the two upper for fine adjustment. The switch (reference 10A) which opens and closes the a-c circuit is incorporated in the lower left hand control switch. The switch (reference 11A) that

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is incorporated in the lower right hand control switch controls the filament voltage to the right hand bulb. When the lower left control switch is at OFF the entire a-c circuit is open.

e. Ammeters. Ref. 6.— The two ammeters are in the bulb circuits, one for each circuit, and register the charging rate through the circuit in which it is wired. When both circuits are being used to charge one line of batteries the sum of the readings of both meters is the charging rate flowing through the battery line.

SECTION IV
MAINTENANCE

9. If Bulbs Do Not Light.— Be sure current is reaching the rectifier. Check the line fuses. Clean bases of bulbs and inside of sockets with sandpaper. Screw bulbs in tightly. Replace the bulbs.

10. If Bulbs Light, but No Current Registers on Ammeters.— Examine connections between the batteries and between rectifier d-c leads and the charging leads. Check the fuses in the rectifier and the contact between the Fahnestock clip and top of the bulbs. Examine contact between fingers and buttons of the control switches. Tap the ammeters lightly. They may be sticky or defective. Try charging only one battery that is known to be good. Replace the bulbs.

11. If Current Registered on Ammeters is Too High and Cannot be Reduced.— Be sure the batteries are connected in the proper polarity. Tap the ammeters lightly. They may be sticky or defective. Ammeters should register on zero when current is off. Replace the bulbs.

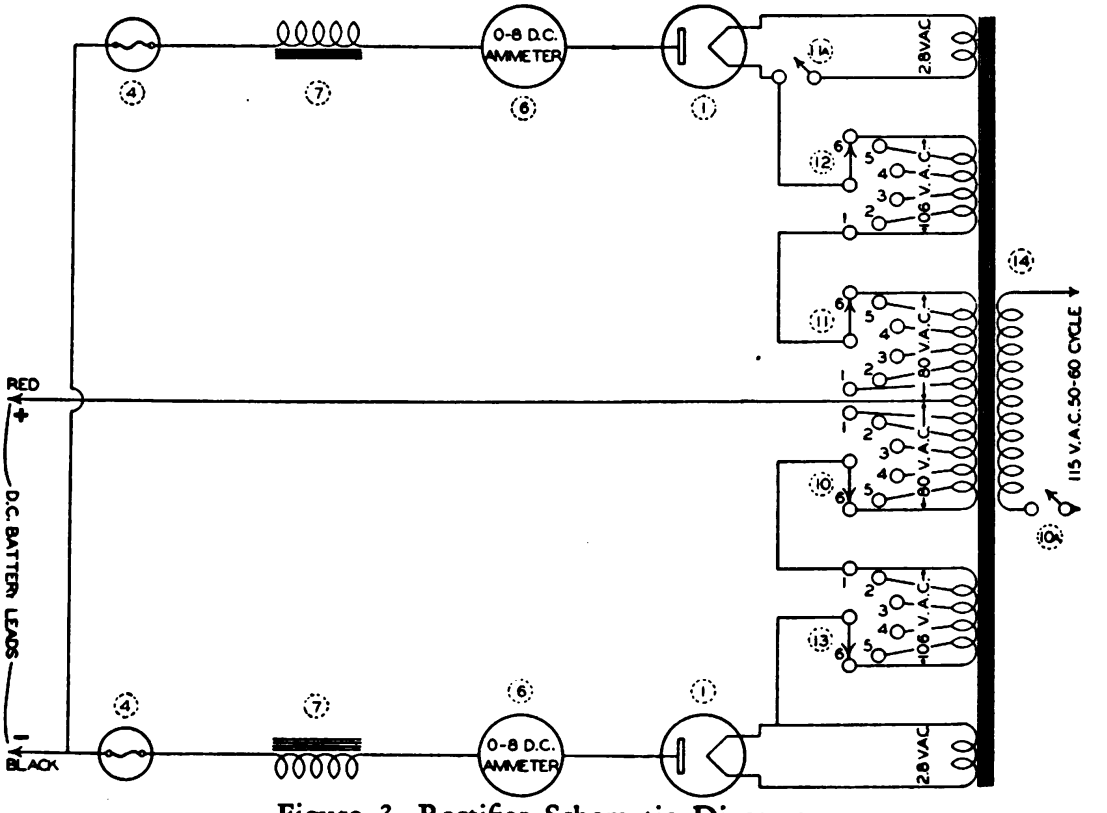


Figure 3. Rectifier Schematic Diagram

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SECTION V

SUPPLEMENTARY DATA

12. Table of Replaceable Parts.—

Ref. No.	Stock No.	Description	Mfg. Code	Contr's Part No.
6		Ammeter-Vane Type 0-8 Amps.	E	1822
1		Bulb, Rectifier — 6 Ampere	G & F	1825
3		Case, Rectifier — Sheet Steel	A	A391
4		Fuse, Plug Type — 15 Ampere	B	1826
5		Knob, Control — Bakelite	C	1798
2		Lead, Bulb Anode — With Clip	A	A5091-1
7		Reactance — Double Coil	A	A400
9		Receptacle, Fuse — Porcelain	H	5092
8		Socket, Bulb — Mogul Type	G	1821
10		Switch, Control-6 Button, lower left	A	A5045
11		Switch, Control-6 Button, lower right	A	A5046
13		Switch, Control-6 Button, upper left	A	A5047
12		Switch, Control-6 Button, upper right	A	A5048
14		Transformer- 1 KVA 6-65 Volts d-c	A	A5051

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13. **Table of Maintenance Parts.**— The following parts are supplied by Allen Electric and Equipment Co., Kalamazoo, Mich., in each approved Maintenance Parts Group in the quantities shown.

Stock No.	Quan.	Description	Mfg. Symbol	Drw. No.	Ref. No.
	3	Ammeter-Vane Type (0-8)	E	1822	6
	30	Bulb, Rectifier — 6 Ampere	G & F	1825	1
	50	Fuse, Plug Type — 15 Ampere	B	1826	4
	2	Knob, Control — Bakelite	C	1798	5
	1	Reactance, Double Coil	A	A400	7
	6	Receptacle, Fuse — Porcelain	H	5092	9
	3	Socket, Bulb — Mogul Type	G	1821	8
	1	Switch, Control-6 Button, Lower Left	A	A5045	10
	1	Switch, Control-6 Button, Lower Right	A	A5046	11
	1	Switch, Control-6 Button, Upper Left	A	A5047	13
	1	Switch, Control-6 Button, Upper Right	A	A5048	12
	1	Transformer - 1 KVA 6-65 Volts d-c	A	A5051	14

14. **List of Manufacturers Names and Addresses.**—

E — Electric Auto-Lite Co. (Moto-Meter Gauge Div.) LaCrosse, Wis.

G — General Electric Co., Bridgeport, Conn.

F — Federal Telephone and Radio Co., Newark, N.J.

B — Bussman Mfg. Co., St. Louis, Mo.

C — Chicago Molded Products Co., Chicago, Ill.

H — Arrow-Hart and Hegeman Co., Hartford, Conn.

A — Allen Electric and Equipment Co., Kalamazoo, Mich.

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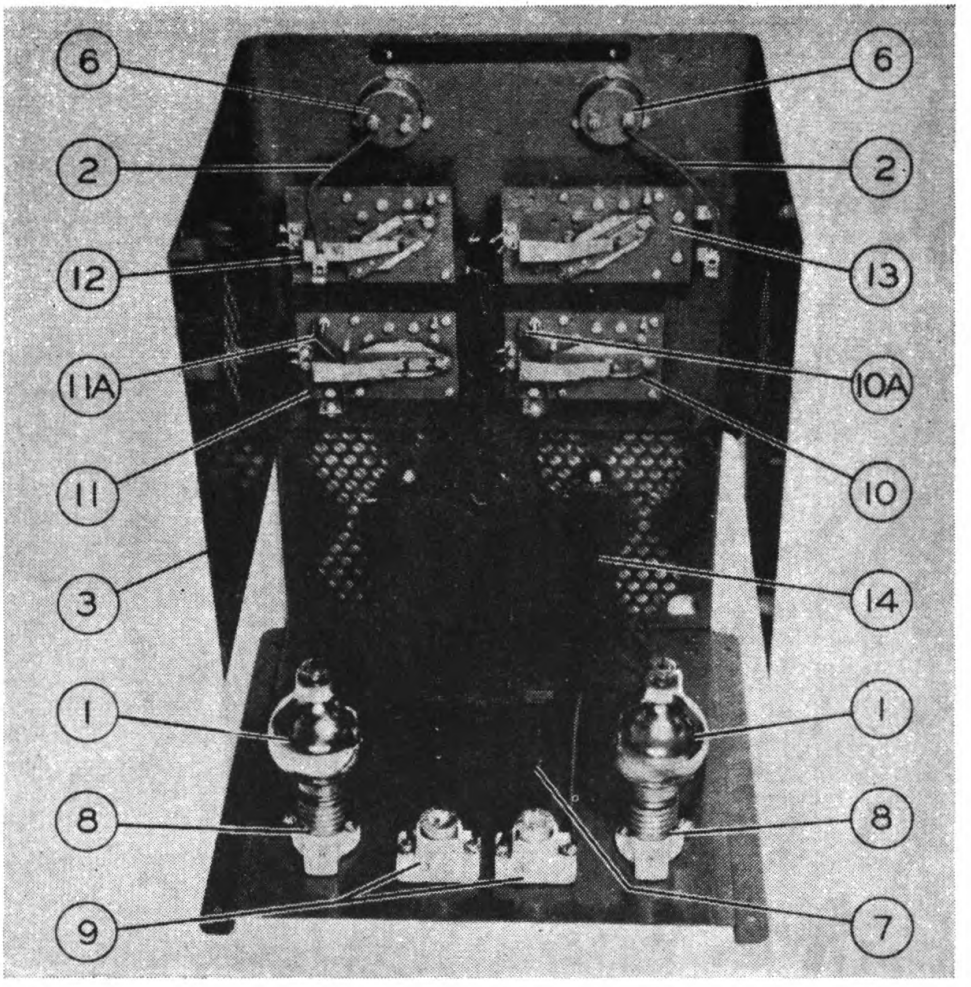


Figure 4. Rectifier Interior

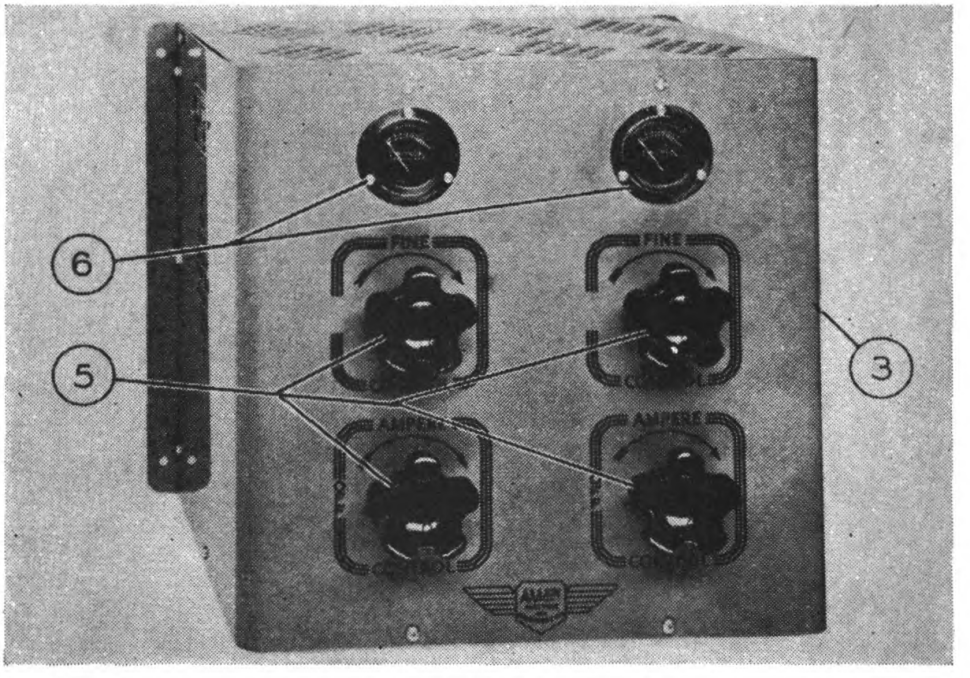


Figure 5. Rectifier Exterior

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A.G. File No. 062.11 January 13, 1942
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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