TM 11-951

WAR DEPARTMENT TECHNICAL MANUAL

RECTIFIERS

RA-36-J, -K, -L,

-N, and -Q,

AND RECTIFIER 6RB6B17

WAR DEPARTMENT • JUNE 1945

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TM 11-951

This manual supersedes TM 11-951, 8 June 1943; TM 11-951Q, 6 August 1943; and TM 11-951N, 10 June 1943.

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Refer to FM 21-6 for explanation of distribution formula.

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—Front panel, meters, rectifier bulbs, internal reactors, rear of control panel, external reactor, any batteries on charge.

2. Cut—All connecting cords, leads, and internal wiring.

3. Burn—Packing cases, instruction books, other documents, wire, connecting cords, diagram on back of door or panel.

4. Bend—Unit base, cabinet, brackets, panel.

5. Bury or scatter—Any or all of the above pieces after damaging.

DESTROY EVERYTHING

SAFETY NOTICE

Operation of this equipment involves the use of voltages which are dangerous to life. Operating personnel must observe safety precautions at all times.

Always make sure that the control switch is in the OFF position when removing the bulbs or fuses. Also, disconnect all power supply cords and battery circuit leads before servicing the interior of the rectifier, or attempting major disassembly.

Keep flames, lighted cigars, and cigarettes away from the storage batteries while they are being charged, as hydrogen gas given off by the batteries is highly inflammable.

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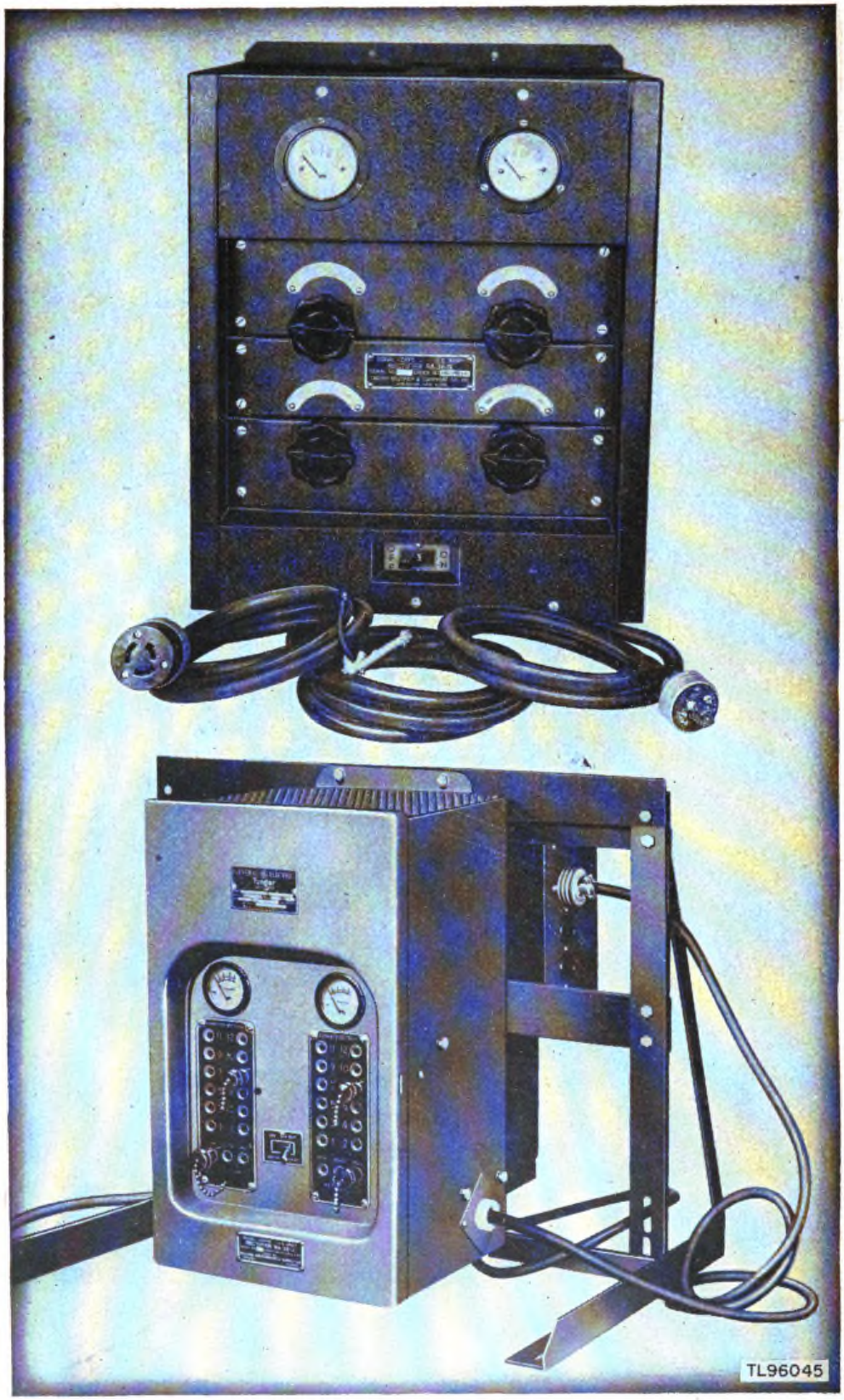


Rectifier RA-36-N (top), and Rectifier RA-36-J, -K, -L, -N, and -Q.

This manual supersedes TM 11-951, 8 June 1943; TM 11-951Q, 6 August 1943; and TM 11-951N, 10 June 1943.

PART ONE

INTRODUCTION

Section 1. DESCRIPTION OF RECTIFIERS RA-36-J, -K, -L, -N, AND -Q, AND RECTIFIER 6RB6B17

1. General

a. DESCRIPTION. Rectifiers RA-36-J, -K, -L, -N, and -Q, and rectifier 6RB6B17 are complete battery-charging rectifiers, each assembled and mounted in a fabricated sheet-steel case. All units except rectifier 6RB-6B17 include a filter reactor which is mounted separately. These rectifiers are full-wave, tungar bulb type rectifiers, built to charge lead-acid type storage batteries. For description of the two types of controls used, see paragraph 13. The filter reactor is an iron-core choke coil. When used with these rectifiers to charge batteries associated with telephone systems, the filter reactor minimizes objectionable hum, which may be induced into the communications circuits.

b. RATING. These rectifiers operate from a 105- to 125-volt, a-c, 50- to 60-cycle, single-phase power source, and consume a maximum of 1,500 watts. They will supply d-c power to charge 3 to 24 lead-acid storage batteries (6 to 48 volts) at an adjustable rate of 2 to 12 amperes. The maximum number of 2-volt cells which can be charged in one series circuit at the 12-ampere rate with any of these rectifiers, is 36.

c. PURPOSE. Rectifiers RA-36-J, -K, -L, -N, and -Q, and rectifier 6RB6B17 are used principally for continuous or intermittent charging of batteries in telephone central office sets. Rectifiers RA-36-J, -K, -L, -N, and -Q, and rectifier 6RB6B17 may also be used for miscellaneous battery charging.

d. MOUNTING. When used with the telephone central office sets listed in paragraph 5, Rectifiers RA-36-J, -K, -L, -N, and -Q are mounted on Rack FM-30. When used for miscellaneous battery charging, Rectifiers RA-36-J, -K, -L, -N, and -Q, and rectifier 6RB6B17 may be mounted on the wall or on other suitable supports.

e. NOMENCLATURE. In this manual, Rectifier RA-36-(*) refers to Rectifiers RA-36-J, -K, -L, -N, and -Q; Rectifier RA-36-(1) refers to Rectifiers RA-36-J, -K, -L, and -Q; and rectifier 6RB6B17 is referred to

by that nomenclature. Rectifiers RA-36-J, -K, -L, and -Q are identical, the suffix letters indicating different procurements.

2. Table of Major Components

Major components with their dimensions and weights, are given in the table below.

Quantity	Name	Width (in.)	Height (in.)	Depth (in.)	Weight (lb.)
1	Rectifier RA-36-N	15¼	21	11⅝	90
1	Rectifier RA-36-(1)	11½	20$^{3}/_{16}$	11⅝	82
1	Rectifier 6RB6B17	11½	20$^{3}/_{16}$	11⅝	82
	Including:				
1	External reactor*	6½	10½	8⅞	60
	Running spares				
6	Rectifier bulbs	3 (diam)	6⅜	.....	⅛
8	Fuses, 15-amp	1 (diam)	.....	.....	.....
2	TM 11-951	5½	8½	.....	.....

* Not furnished with rectifier 6RB6B17.

Note. Running spares are for initial issue only and are not to be requisitioned as a kit or in groups.

3. Description of Major Components

a. All components of Rectifier RA-36-(*) and rectifier 6RB6B17 are accessible from the front. Controls and ammeters for two separate half-wave rectifier circuits are mounted on the front panel. A two-winding tapped-primary and tapped-secondary transformer enables batteries to be charged while in use without regard to ground connections.

b. Rectifier RA-36-N (fig. 1) has four tap switches for controlling the charging rate. (See par. 13.) (The top front panel is the meter panel which swings down making accessible the rectifier bulbs, fuses, and input-voltage-compensating terminal strip. Below the transformer and bolted to the back wall of the rectifier case are two iron-core reactors. (See fig. 10.) Three rubber-covered cords extend from the bottom of the rectifier case for connection to the a-c power source, battery circuit, and external reactor. (See par. 10.) This unit is wired to operate as a full-wave rectifier only.

c. Rectifier RA-36-(1) (fig. 2) has two plug boards for controlling the charging rate. The front door swings open making accessible the rectifier bulbs, fuses, and input-voltage compensating terminal strips. Two rubber-covered cords (a-c input and d-c output connections) extend from the sides near the bottom of the rectifier case. Two insulated leads extend from the bottom of the case for connection to the external reactor. This unit is wired to operate as a full-wave rectifier only.

d. Rectifier 6RB6B17 (fig. 3) is a commercial model similar to Rec-

tifier RA-36-(1), described in *c* above except for differences noted in paragraph 4.

4. Differences in Models

a. Rectifier RA-36-N differs from Rectifier RA-36-(1) as follows:

(1) Size and appearance. (See par. 2.)

(2) Method of controlling charging rate. (See par. 13.)

b. Rectifier 6RB6B17 differs from Rectifier RA-36-(1) as follows:

(1) Connecting leads differ. Five insulated leads extend from the bottom of the rectifier, two for connection to the a-c power source, and three for connection to the battery circuit. (See fig. 3.)

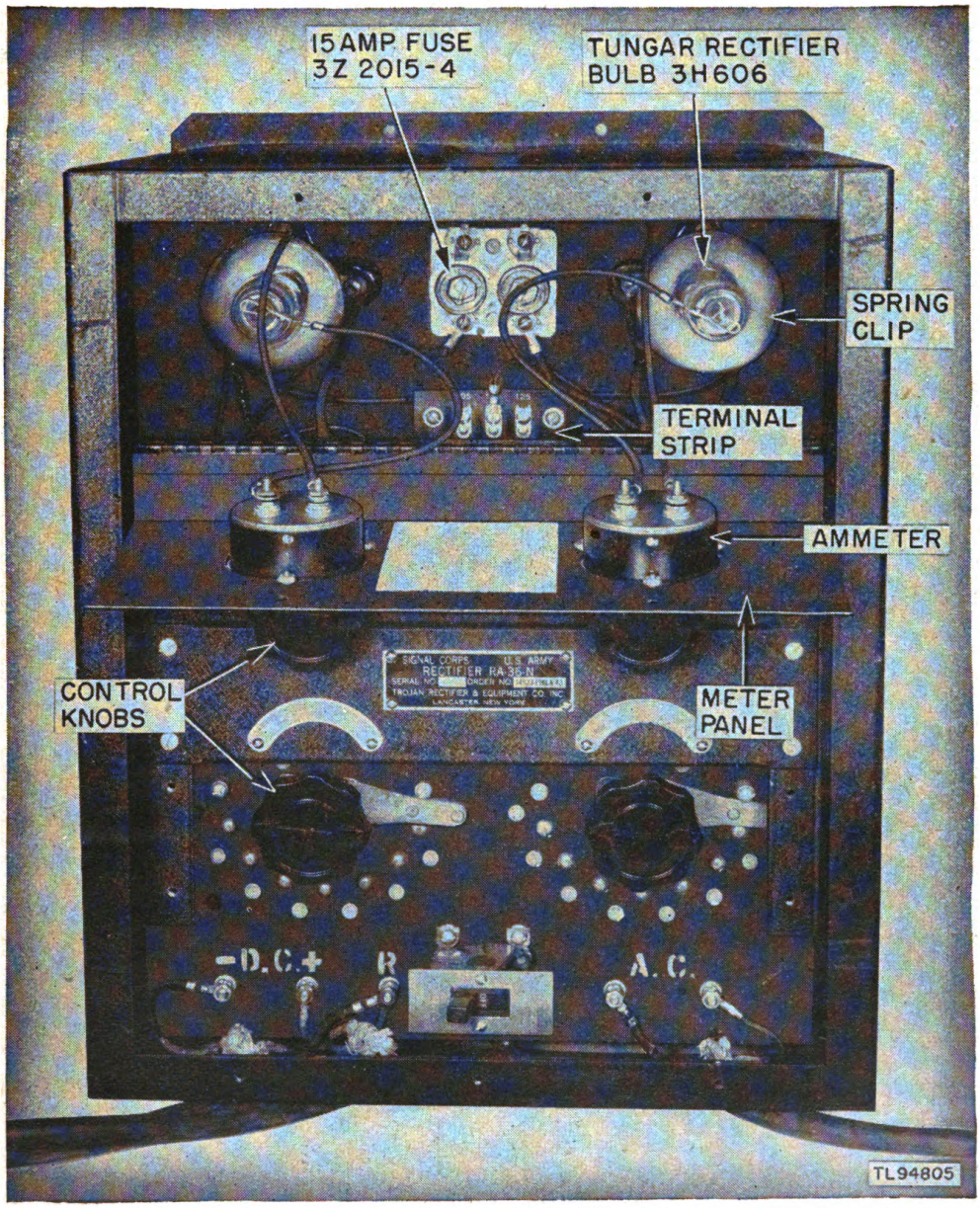


Figure 1. Rectifier RA-36-N, panel open.

(2) External reactor is omitted.

(3) In miscellaneous charging applications rectifier 6RB6B17 can be connected to the batteries being charged either as two separate half-wave rectifiers or as one full-wave rectifier. (See par. 11*c*.)

c. Differences in operating procedure, disassembly, and maintenance of the rectifiers covered in this manual are described concurrently in the text matter which follows.

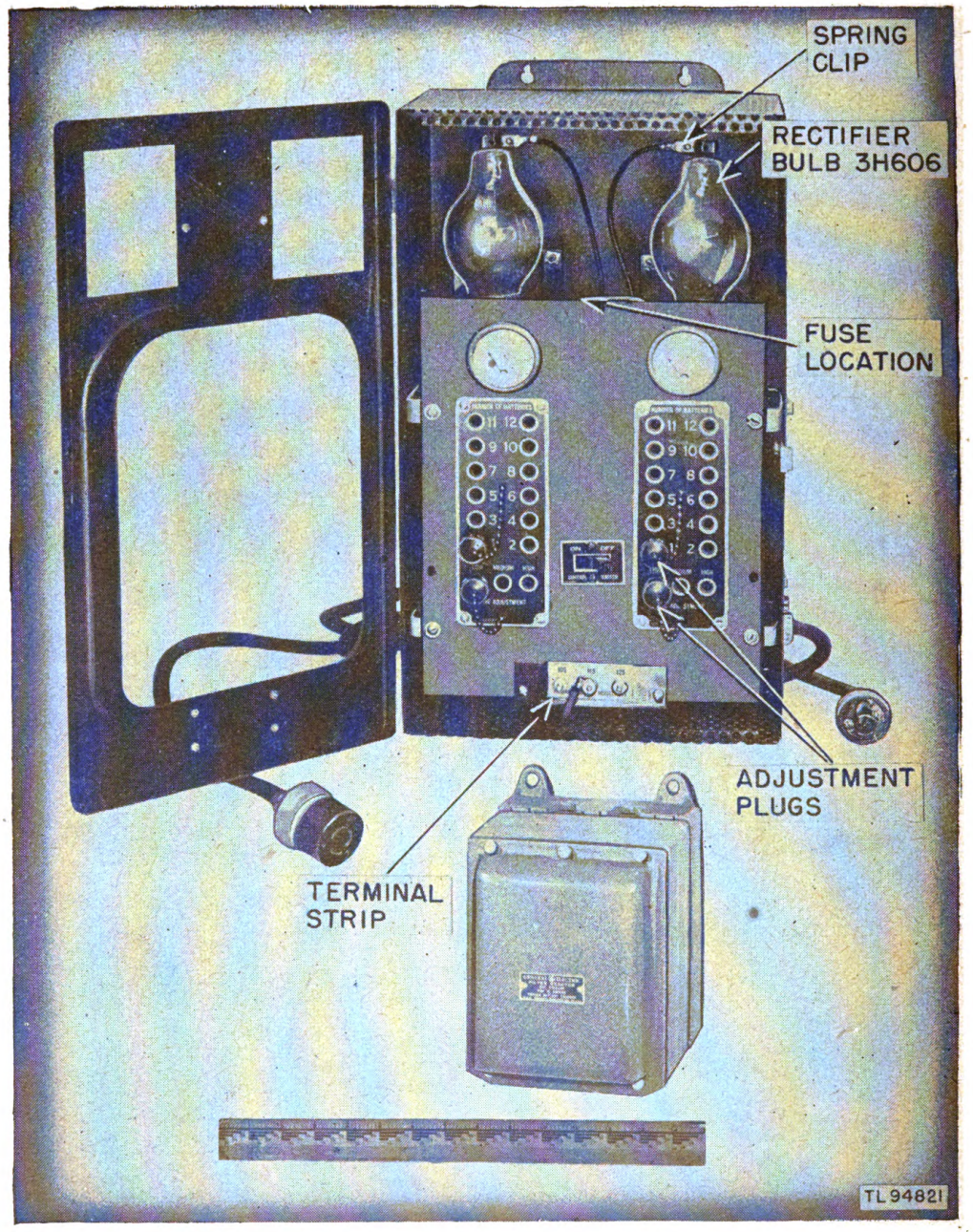


Figure 2. Rectifier RA-36-(1), door open.

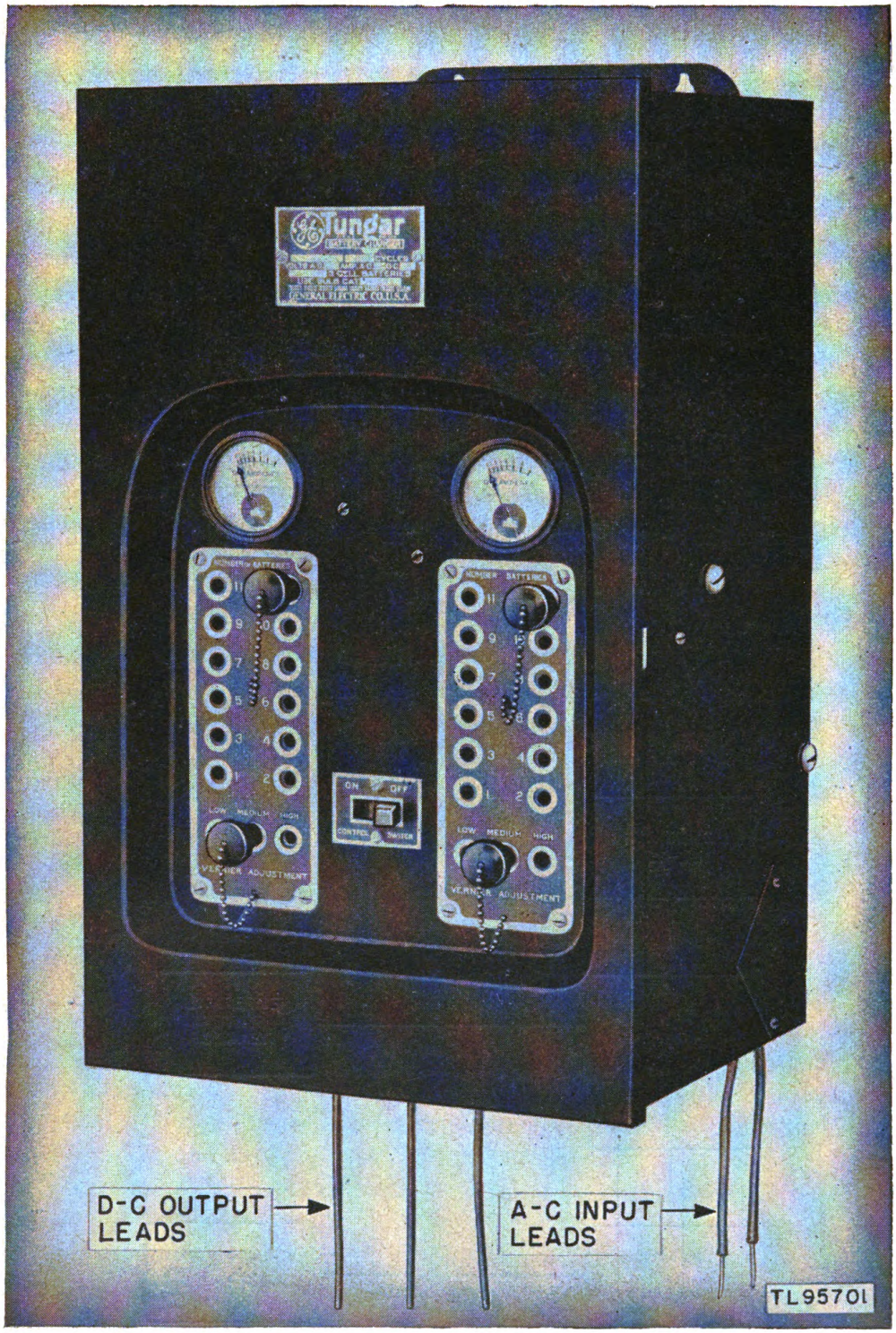


Figure 3. Rectifier 6RB6B17, showing input and output leads.

Section II. APPLICATION OF RECTIFIER RA-36-(*) AND RECTIFIER 6RB6B17

5. Use with Other Equipment

a. Rectifier RA-36-(*) is a component part of Telephone Central Office Sets TC-1, TC-2, TC-5, and TC-10. It is used with Cabinet BE-75 and Panel BD-90 or BD-98 to charge the lead-acid type storage batteries in this equipment. (See fig. 4.) For additional information on these telephone central office sets consult the appropriate Technical Manuals listed in appendix II.

b. Rectifier 6RB6B17 is intended to be used for charging storage batteries in telephone central applications but requires, as an accessory, an external filter reactor of the type used with Rectifier RA-36-(*) when used for this purpose.

6. Other Uses

Rectifier RA-36-(*) and rectifier 6RB6B17 may be used for miscellaneous storage battery charging. (See par. 13.)

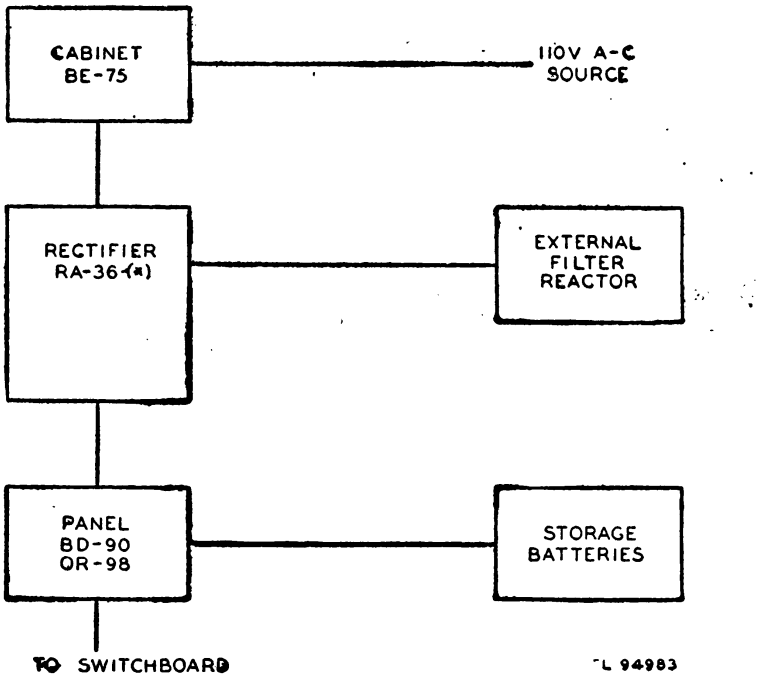


Figure 4. Application of Rectifier RA-36-(*) in Telephone Central Office Sets TC-1, TC-2, TC-5, and TC-10.

Section III. INSTALLATION AND ASSEMBLY OF RECTIFIER RA-36-(*) AND RECTIFIER 6RB6B17

7. Siting

Rectifier RA-36-(*) and rectifier 6RB6B17 should be located in a shelter where they will be protected against the weather and against very high or low temperatures. Location must be protected from dirt, moisture, and acid fumes. The rectifiers should not be mounted over batteries being charged.

8. Unpacking, Uncrating, and Equipment Check

Equipment must remain in its export packing until it is to be used. The equipment should be put in use within 6 months of the date of packing. If it is to be kept in storage for a longer period of time, it should be uncrated, inspected, and moisture- and fungiproofed where necessary. If the export packing is damaged, the same moisture- and fungiproofing precautions should be followed. Use particular care when unpacking or handling the equipment, because it may be damaged easily when not protected by the packing case. Do not apply pressure to any exposed parts on the panel. In repacking this unit, follow the steps outlined below.

a. Rectifier Mounted on Rack FM-30 in Case CS-73. Rectifier RA-36-(*) may be received already mounted on Rack FM-30, together with Cabinet BE-75 and the external reactor. Proceed as follows:

(1) Place the packing case in operating position, or as near to it as is convenient for uncrating.

(2) Cut all steel straps.

(3) Remove the $8\frac{5}{16}$-inch cap screws located near the bottom of the case, four in front and four in back.

(4) Open the case by lifting off the top. Use the handles fastened to each side, being careful to lift directly up to avoid possible damage to the panel. After the case is removed, screw the bolts back into their original location, and save the case for future reshipment.

(5) Remove all waterproof and moistureproof wrappings, if any are used.

(6) Remove the filter reactor, rectifier bulbs, and fuses which are packaged separately but packed in this same case. Place them aside carefully for use with the rectifier.

Note. The external reactor may already be mounted on Rack FM-30.

(7) Rectifier RA-36-(*) is now ready for operation.

b. RECTIFIER RA-36-(*) PACKED SEPARATELY. (1) Place the packing case as near to the point of installation as is convenient for uncrating.

(2) Cut all steel straps.

(3) Remove all nails on the top and sides of the case using a nail puller or claw hammer. *Prying the sides off may result in damage to the equipment.*

(4) Remove the top and sides of the case and all wooden vertical supports.

(5) Remove the reactor, rectifier bulbs, and fuses which are packaged separately, and place them to one side.

(6) Remove waterproof and moistureproof wrappings from the rectifier.

(7) Remove the inner metal strap and the cotton tapes by cutting.

(8) Rectifier RA-36-(1) is held in place in its packing case by vertical angle irons. Remove all vertical angle irons by removing the six screws holding the rectifier to the angle irons and the bolts holding the angle irons to the wooden base (Rectifier RA-36-(1).) Replace the six screws in the rectifier case.

(9) The rectifier can be removed from the base by lifting it straight up. It is ready for mounting on Rack FM-30 or a wall or any other suitable place.

9. Installation

a. If the rectifier, external reactor, and Cabinet BE-75 are received already mounted on Rack FM-30 and packed in Case CS-73, removing the case leaves the equipment mounted on the base of the packing case ready for either field or permanent operation.

b. If Rectifier RA-36-(*) and the filter reactor are received separately, they can be mounted on Rack FM-30 or can be mounted separately on the wall with No. 12 screws. (See figs. 5 and 6.)

c. Mount rectifier 6RB6B17 on a wall or other suitable support. See figures 5 and 6 for mounting dimensions.

10. Connections and Interconnections

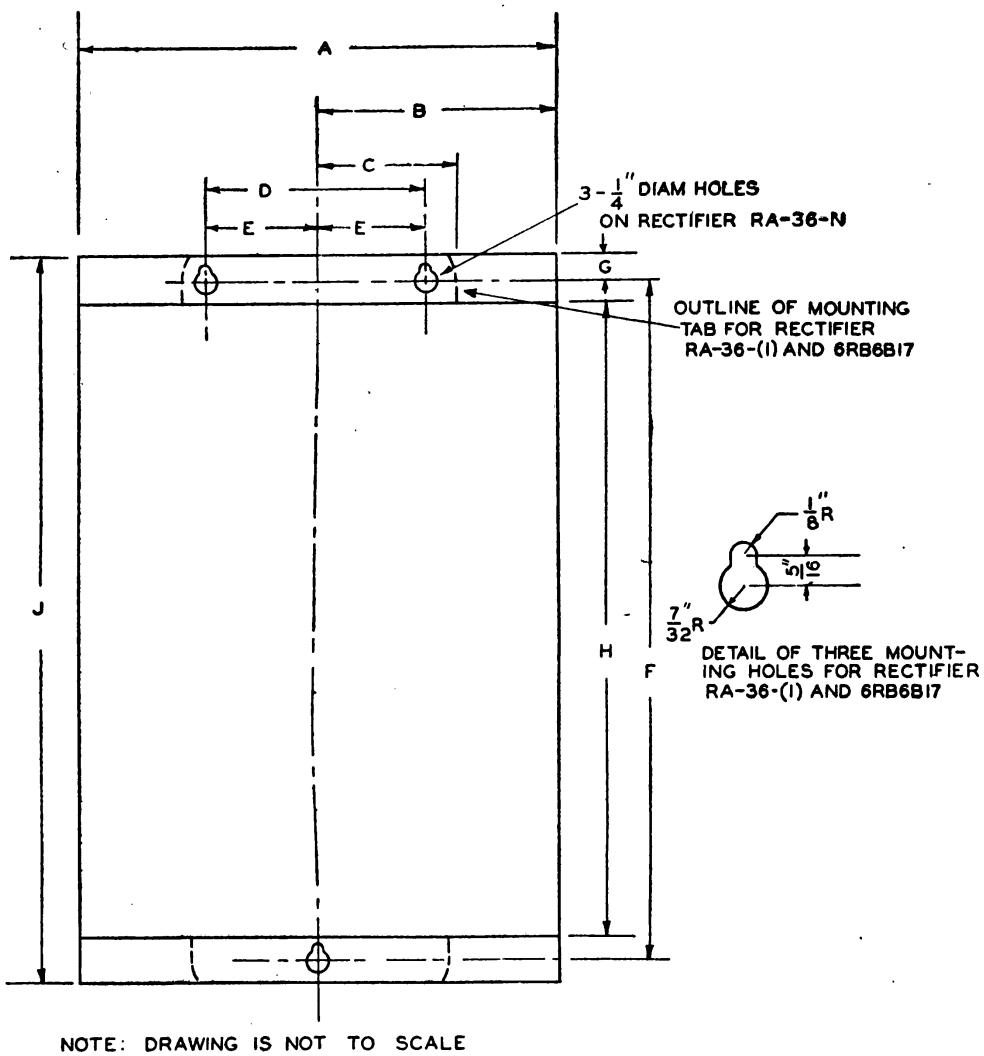
a. INPUT-VOLTAGE-COMPENSATING TERMINAL STRIP. *Before making any connections, establish definitely that the source of power is 105- to 125-volts, 50- to 60-cycle, a-c.* The transformer primary in all models of Rectifier RA-36-(*) and rectifier 6RB6B17 has three taps brought out to three terminals, marked 105, 115, and 125, located on an input-voltage-compensating terminal strip. Measure the supply voltage and check to see that the flexible lead on this strip is connected to the terminal whose marking most nearly corresponds to the voltage supply. Reconnect the lead if necessary.

(1) On Rectifier RA-36-(1) and rectifier 6RB6B17 the terminal strip is located on the bottom of the panel. (See fig. 2.)

(2) On Rectifier RA-36-N the terminal strip is located on the top of the panel. (See fig. 1.)

b. External Connections to Components of Telephone Central Office Sets TC-1, TC-2, TC-5, and TC-10. Be sure the OFF-ON switch is in OFF position before making external connections.

(1) *Rectifier RA-36-N.* Rectifier RA-36-N is supplied with three rubber-covered cords extending from the bottom of the rectifier case for interconnection to Cabinet BE-75 and Panel BD-90 or BD-98, whichever is used.



DIMENSIONS IN INCHES	A	B	C	D	E	F	G	H	J
RECTIFIER RA-36-(1) AND 6RB6B17	11 1/2	5 3/4	3 3/4	5	2 1/2	20	5/8	19	21
RECTIFIER RA-36-N	15 3/4	7 7/8		5	2 1/2	20	7/16	19	21

TL 96046

Figure 5. Rectifier RA-36-(*) and rectifier 6RB6B17, dimensional outline.

(*a*) The cord on the right side with the male plug is the a-c input cord. Plug this cord into one of the a-c output receptacles on Cabinet BE-75.

(*b*) The cord on the left side with the female connector is the d-c output cord. Plug this cord into the receptacle on Panel BD-90 or BD-98.

(*c*) The cord in the center is for splicing to the leads from the external filter reactor. Tape each splice securely with rubber tape and friction tape.

(2) *Rectifier RA-36-(1).* Rectifier RA-36-(1) is supplied with two rubber-covered cords extending from the sides and two short leads extending from the bottom of the rectifier case. (See fig. 11.)

(*a*) The cord extending from the right side with the male plug is the a-c input cord. Plug this cord into Cabinet BE-75.

(*b*) The cord extending from the left side with the female connector is the d-c output cord. Plug this cord into the receptacle provided on Panel BD-90 or BD-98.

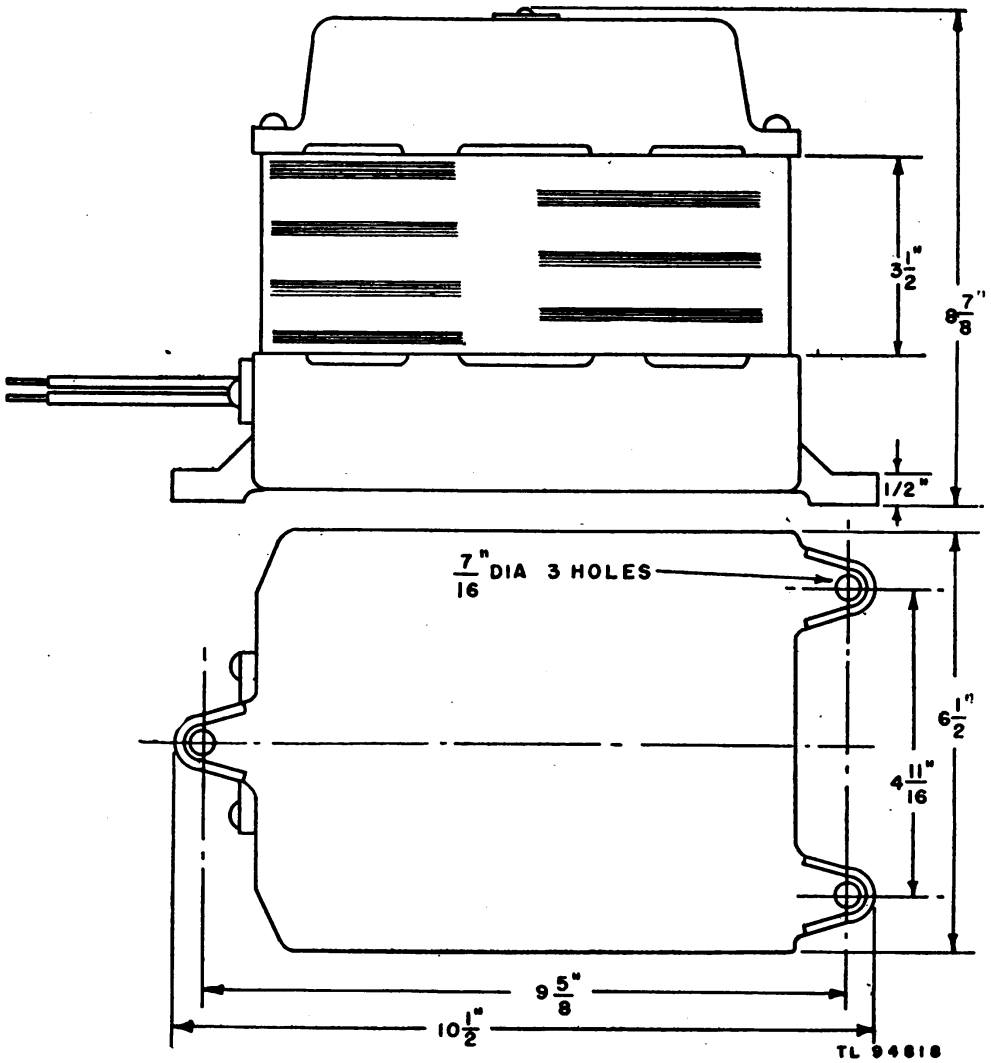


Figure 6. Filter reactor, dimensional outline.

(*c*) The two leads extending from the bottom of the rectifier case are to be spliced to the leads from the external filter reactor.

c. External Connections for Rectifier 6RB6B17 for Telephone Central Applications. (1) *General.* Rectifier 6RB6B17 is not supplied with rubber-covered cords. Five leads extend from the bottom of the rectifier case. (See fig. 3.)

(*a*) Connect the two leads on the right side of rectifier case to the a-c supply source as follows:

1. Remove the small square metal plate on the lower right-hand side of the rectifier case by removing the two screws.
2. Pull the a-c input leads of the rectifier out through the side hole.
3. Bring the a-c supply cord or leads through the opening for the a-c input leads in the bottom of the rectifier case. Use stranded wire no smaller than No. 10 B and S gauge for the incoming a-c supply line.
4. Pull these leads out through the side hole and splice them to the rectifier a-c leads. Connect the white lead from the rectifier to the ground wire of the a-c input leads. Tape the splice securely and push the connected wires back through the hole. Replace the metal plate.

(*b*) Connect the three d-c output leads on the left side of the rectifier case to the battery circuit as follows: Splice the two outside leads to one conductor of a two-conductor rubber-covered cord. This is the negative (—) lead of the d-c output. Splice the center lead to the other conductor. This is the positive (+) lead.

(2) *External reactor.* No external reactor is furnished. If one is used it must be connected in series with the d-c output circuit of rectifier 6RB6B17.

d. Connections for Miscellaneous Charging. When using Rectifier RA-36-(*) and rectifier 6RB6B17 for miscellaneous battery charging (fig. 7) make the following connections:

(1) The batteries must be connected in series, voltage adding.

(2) The negative (—) end of the batteries must be connected to the negative (—) lead from the rectifier.

(3) The positive (+) end of the batteries must be connected to the positive (+) lead from the rectifier.

Note. In this application rectifier 6RB6B17 can be used as two half-wave rectifiers, if desired. The center lead of the three output leads is the common positive (+); the other two leads are negative (—) leads, one for each rectifier circuit.

(4) For typical examples of battery connection, see figure 7. In example A, each battery gets one-half the total charging current. In example B, each battery gets the total charging current. In example C, batteries 1 through 7 get the total charging current and batteries 8 through 17 get one-half the total charging current.

(5) In Rectifier RA-36-(*) the two negative leads are connected inter-

nally. In rectifier 6RB6B17, three output leads come out of the case as the diagram shows. *It makes no difference in the application of the rectifiers for miscellaneous charging, however, whether the two negative leads are connected together or not, provided both legs of the batteries contain the same number of cells.*

(6) The external reactor is unnecessary where batteries being charged are not connected to telephone lines and where the hum induced in talking circuits is otherwise unimportant.

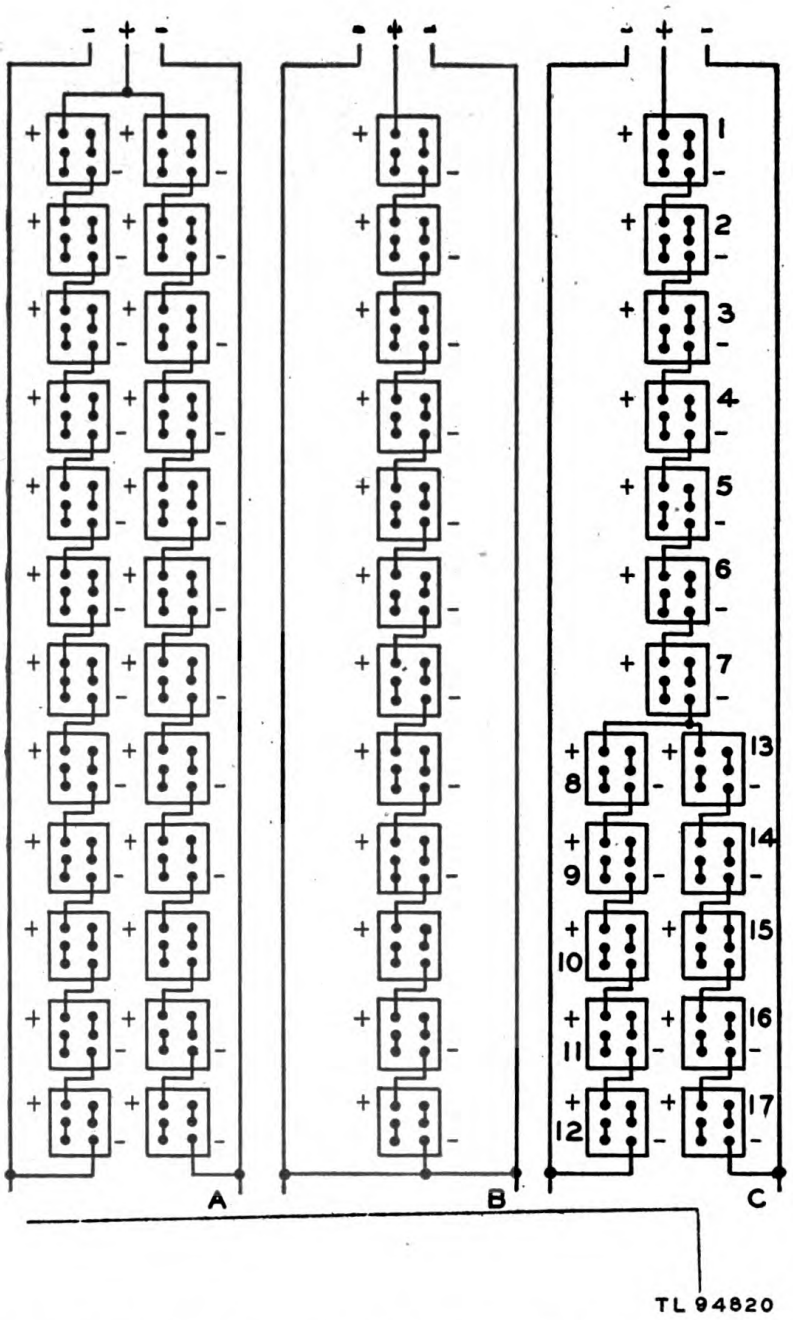


Figure 7. Diagram of possible battery connections in charging circuit.

11. Installation of Tubes, Fuses, and Preparation for Use

Be sure the ON-OFF switch is in the OFF position when performing the following steps.

a. RECTIFIER RA-36-N. Remove the two screws in the top of the rectifier front panel directly above the meters, and open this hinged panel. Open and close this panel carefully because of the meters on it. (See fig. 1.) Remove two rectifier bulbs (fig. 8) from their cartons and screw them tightly into the two bulb sockets accessible. Connect the spring clips, attached to the leads from the meters, to the wires extending through the tops of the bulbs. See that the right-hand clip is connected to the right-hand bulb and the left-hand clip to the left-hand bulb. Screw two of the fuses supplied tightly into the fuse receptacle. Check that the lead on the small input voltage-compensating terminal strip is tightly fastened. (See par. 10.) Check that the control knobs work freely enough for operation. Finally, close the panel and fasten with screws.

b. RECTIFIER RA-36-(1) AND RECTIFIER 6RB6B17. Open the door in front of the rectifier (fig. 2), which is hinged at the left side and fastened on the right side by a spring fastener. Remove two rectifier bulbs from their cartons and tightly screw them into the two bulb sockets accessible. Connect the spring clips attached to leads from the fuse receptacle to the wires extending through the tops of the bulbs. Be sure the right-hand clip is connected to the right-hand bulb, and the left-hand clip to the left-hand bulb. Screw two of the fuses supplied tightly into the fuse receptacle. Check that there are four plugs, each fastened to the panel by a short chain. Finally, close the door.

12. Repacking Information

a. In repacking Rectifier RA-36-(*) for shipment within the scope of the using arm or service, or for storage, use the following procedure. If the rectifier and its major components are mounted on Rack FM-30, the rack should be bolted to the base of Case CS-73. Remove bulbs and fuses and check that all doors and moving parts are fastened solidly. Lower the top of the case in place on its base being careful not to strike any parts on the rectifier control panel. Fasten the case top in place with the $8\frac{5}{16}$-inch cap screws furnished, four at the front and four at the back, and the unit is ready for shipment.

b. If the unit is not mounted on Rack FM-30 and Case CS-73 is not furnished Rectifier RA-36-(*) can be packed for short troop movements in the following manner.

(1) Remove the rectifier bulbs and fuses and replace each in the carton supplied for the spares. Close the door.

(2) Coil all interconnecting cords neatly and tie them together.

(3) Replace the rectifier and external reactor in the original packing case, if it is still available, or in some suitable container which will protect

the unit from dust, moisture, and breakage. If possible, wrap the rectifier and reactor in a piece of canvas, and place the cartons containing the spare fuses and bulbs in the same box.

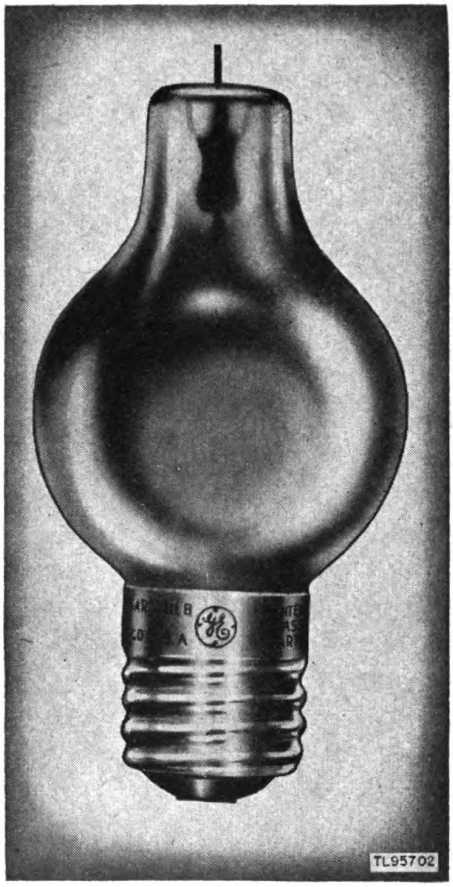


Figure 8. Tungar rectifier bulb.

PART TWO

OPERATING INSTRUCTIONS

Note. For information on destroying this equipment to prevent enemy use, see the destruction notice at the front of this manual.

Section IV. CONTROLS AND THEIR USE

13. Controls and Their Use

a. GENERAL. Rectifier RA-36-(*) and rectifier 6RB6B17 are each equipped with two sets of controls for regulating the charging rate of the two half-wave rectifier circuits and two ammeters for registering the amount of current flowing. These controls adjust the secondary voltage by means of taps in the transformer secondary. The controls on the left side, control the output of one circuit and those on the right side, the other. The total reading of both meters indicates the total charging current. For example, if each meter reads 6 amperes, the total charging rate is $6 + 6 = 12$ amperes. Each model should be started or stopped by means of the ON-OFF toggle switch. The controls should be at the lowest possible position before turning on the unit.

b. RECTIFIER RA-36-N. The charging rate of each circuit is controlled by two tap switches operated by arrowed control knobs. (See fig. 1.) The lower knobs are for coarse adjustment and the upper knobs are for fine adjustment. The two upper knobs should be operated at the same time in order to keep the current readings in the two meters the same at all times. The same rule applies to the two lower knobs. If the arrows on the corresponding knobs point in the same direction, the current in both circuits will probably be the same. The tap switches must be manipulated with a comparatively loose grip on the knob so that the contact blade will readily click from one position to the next. Transfer from one contact to the next is made with a quick snap of the switch. This will reduce contact arcing. It will also allow the contact arm to locate itself correctly on each succeeding contact. The lowest setting is obtained by turning all controls counterclockwise so that the arrows point to the extreme left; the highest setting is obtained with arrows pointing to extreme right. These tap switches may be adjusted while the toggle switch is in the ON position. However, the toggle switch must be in the OFF position when any changes are made in the battery connections.

c. Rectifier RA-36-(1) and Rectifier 6RB6B17. Two plug boards, each having a fine-adjustment and a coarse-adjustment plug attached, are furnished on these rectifiers for controlling the charging rate. The upper 12 holes in each plug board are for coarse adjustment. The lower three holes marked LOW, MEDIUM, and HIGH provide the fine adjustment for each circuit. Both coarse and fine adjustment plugs for each circuit should be placed in the same numbered holes on both plug boards at the same time to keep the current reading in both meters the same. All settings of plugs specified in tables or directions in this manual are approximate. For correct charging rates, meters must be read. All plugs must be placed firmly in proper holes. The toggle switch must be in the OFF position when any change is made in the position of the coarse adjustment plugs, or in the battery connections.

d. Charging Batteries in Telephone Central Office Set TC-1, TC-2, TC-5, and TC-10.

(1) *Rectifier RA-36-(1).* The coarse-adjustment plugs should be inserted in the numbered hole on each plug board which corresponds to the voltage of the battery to be charged, divided by 6. Thus the setting for a 24-volt battery (11-amp rate) would be the No. 4 hole, and for a 48-volt battery (12-amp rate) would be the No. 8 hole. These figures then indicate the number of equivalent 6-volt, 3-cell batteries in the circuit being charged at the maximum rate. This arrangement will allow adjustment of the total charging rate of the rectifier from 6 amperes to 12 amperes. Current adjustment may be made by plugging each fine adjustment plug into the hole marked LOW, MEDIUM, or HIGH, while the rectifier is operating. Further increase or decrease in charging output is obtained by shutting off the rectifier and moving the coarse adjustment plug up or down one number.

(2) *Rectifier RA-36-N.* There is no specified setting for the large-step and small-step knobs. They should be manipulated simultaneously until the desired charging rate is obtained as shown on the meters.

e. Miscellaneous Battery Charging. Use the chart in figure 9 when employing Rectifier RA-36-(1) or rectifier 6RB6B17 for miscellaneous battery charging.

(1) Determine the total voltage on the series circuit of batteries to be charged using 2 volts per cell. These are the bottom numbers on the chart. Determine the rate at which it is desired to charge these batteries. This number will be found on the left side of the chart. Where these two lines intersect, follow the heavy curve downward and the coarse (number) and fine (letters L, M, H) adjustments will be found.

(2) As figure 9 would indicate then, a maximum of twelve 3-cell batteries, or thirty-six 2-volt cells, can be charged in one series circuit at one time. Furthermore, when the batteries are in a low state of charge and the cell voltages are 2 volts or less, these batteries can be charged at a 12-ampere rate. However, as the voltage builds up to a maximum of

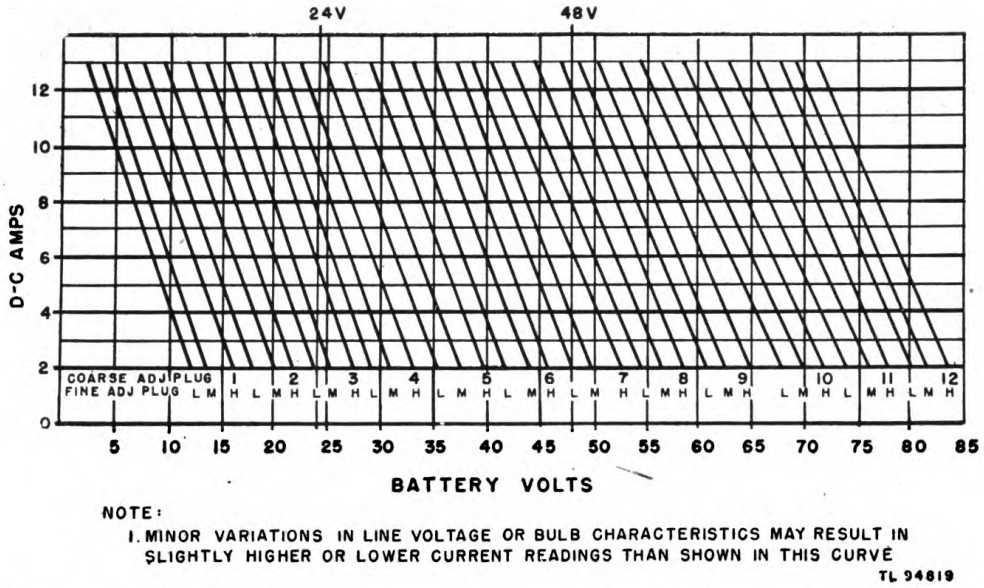


Figure 9. Charging rate adjustment curves for Rectifier RA-36-(1) and rectifier 6RB6B17.

2.3 volts in each cell being charged, the total voltage developed by this string of batteries will reach 82.8 volts which is a back voltage bucking the rectifier. The curve shows that the maximum charging rate will drop to a 5-ampere total. While thirty-six 2-volt cells is the maximum number possible in one series leg, another leg of equal size could be connected in parallel in which case the total charging current would be divided between the two legs.

Section V. OPERATION

14. Starting Procedure

With the toggle switch in the OFF position make sure that the tap-switch knobs in Rectifier RA-36-N are in a minimum position or turned so that the arrow points to the left. On other models make sure that both fine-adjustment plugs are pulled out. Check all external connections.

a. Switch the toggle to the ON position and check whether the rectifier bulbs are lighted.

b. If so, switch the toggle off, close the door or panel, connect the batteries in circuit, and make the charging rate adjustments according to instructions in paragraph 13*d* and *e*.

c. Switch the toggle to the ON position and make the final adjustment on the charging rate by adjusting tap-switch knobs further or plugging fine-adjustment plugs to the position desired. Final adjustment depends on the charging rate wanted as shown on meters.

15. Operating Instructions

a. General. 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 or batteries being used. See TM 11-430 for complete information on approved charging methods and correct charging rates for Battery BB-46, used with Rectifier RA-36-(*) in telephone central office installations.

(1) These rectifiers may be used for continuous charging to furnish a steady charging current which will be adequate to replace the drain on the batteries used in the central office system.

(2) Rectifier RA-36-(*) may also be used for intermittent charging when it is necessary to charge the batteries as quickly as possible. Adjust the charging rate so that it does not exceed 12 amperes and check the batteries hourly during the charging process.

b. Precautions Regarding Batteries Being Charged. (1) Make sure all battery connections are tight to avoid any sparking.

(2) Use no open flame near charging batteries. Liberated gases are highly inflammable.

(3) Cut down the charging rate if batteries gas violently or the temperature of the battery solution rises above 110° F.

(4) When charging batteries for long periods, that is, overnight, reduce the charging rate to avoid damage to the batteries.

(5) Test the state of charge of the battery by measuring specific gravity of the solution in the battery with a hydrometer. The battery manufacturer's specification will give the specific gravity which indicates a fully charged battery. (See TM 11-430.) When the specific gravity reading of all cells of the battery remains constant at approximately this value for 5 hours at a low charging rate, it may be assumed that the battery is fully charged.

(6) Unless a fast charge is essential, it is suggested that the charging rate be decreased as the battery reaches full charge.

(7) Keep the level of the electrolyte above the top of the plates by adding distilled water. Do not add water after the battery is completely charged.

c. Indications of Rectifier Operating Correctly. (1) A hum is audible.

(2) Rectifier bulbs give off a brighter light with blue glow.

(3) Ammeters show equal amounts of current.

d. Precautions Regarding Rectifier. (1) Always turn the toggle switch to the OFF position, and turn the tap-switch knobs to the extreme left, or pull out the fine-adjustment plugs before making any other necessary adjustments.

(2) Always turn the tap-switch knobs to the extreme left or remove the fine-adjustment plug before starting the rectifier or when making

any change on the number of batteries being charged. If the operator is unfamiliar with the operation of this rectifier, the possibility of overloading the unit will be eliminated.

(3) Do not allow either circuit to charge at a rate greater than 6 amperes or the rectifier bulb will be damaged.

16. Stopping Procedure

a. Throw the toggle switch to the OFF position.

b. Turn the tap-switch knobs to the extreme left, or pull out the fine adjustment plugs.

Section VI. EQUIPMENT PERFORMANCE CHECK LIST

17. Purpose and Use of Check List

a. GENERAL. The equipment performance check list (par. 18) will help the operator to determine whether Rectifier RA-36-(*) and rectifier 6RB6B17 are functioning properly. The check list gives the item to be checked, the conditions under which the item is checked, the normal indication, tolerance of the correct operation, and the corrective measures that the operator can take.

b. ACTION OR CONDITION. For items in the preparatory section of the equipment performance check list, this column gives conditions that must exist. These conditions can be determined by visual inspection and very simply remedied so that no comments are necessary in the other columns. In the START section of this list, this column gives the action that should be taken or condition that should exist. In the EQUIPMENT PERFORMANCE section of this list, this column gives the conditions that should be checked. In the STOP section of this list, this column gives the actions that should be taken.

c. NORMAL INDICATIONS. In this column the conditions are given that should exist if the apparatus is operating correctly.

d. CORRECTIVE MEASURES. In this column the steps are given that can be taken by the operator to determine and correct the cause of incorrect operation if indications on the unit do not agree with those called for in the preceding column. If the unit is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. The rectifier will be turned in for repairs. Checks will be made in the order given in this column of the equipment performance check list. However, if the tactical situation demands that the equipment be kept in use and it is not entirely inoperative, the operator must maintain the unit in operation.

e. CHECKING. (1) Items 1 to 11 should be checked every time the unit is put into operation.

(2) Items 12 and 13 should be checked at least once every hour.

(3) Item 14 should be checked at least once every 4 hours. In hot climates the check should be performed more often.

(4) Items 15 to 17 should be checked every time the unit is stopped.

(5) Operator should familiarize himself with the correct operation of the unit, and symptoms of correct and incorrect operation, so that any deviation from normal operation will become apparent as quickly as possible.

(6) Handling bulbs must be avoided immediately after stopping the unit as serious burns may result from their heat.

(7) To check continuity of cords, leads, or the external or internal reactors, Test Set TS-26/TSM, Voltohmmeter I-166 or equivalent, may be used. For a quick check, if momentarily shorting out a reactor establishes a circuit, that reactor is defective.

18. Equipment Performance Check List

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	OFF-ON toggle switch.....	Should be in OFF position...		
	2	Charging rate controls.....	Should be in position for charging batteries.		
	3	All battery connections.....	Must be tight.....		
	4	Level of battery solution....	Must be at least ¼ inch above top of plates.		
	5	Rectifier bulbs.....	Must be tight in sockets.....		
	6	Fuses	Must be tight in receptacle...		
	7	Clip on top of bulbs.....	Must be secure.....		
	8	All electrical contacts and connections including controls.	Must be clean.....	Inspect visually.....	Use fine sandpaper.
STARTING	9	Toggle ON-OFF switch.....	Turn to ON position.....	Rectifier bulbs light up.....	Check input plug connected to live source of 110 volts. Check to see that fuses are good and screwed tight. Check to see that bulb is good and screwed tight. Clean contacts and bulb sockets with fine sandpaper.
	10	Charging rate controls.....	Set to approximate position for number of batteries in circuit.	Audible hum is heard. Tubes glow more brightly with blue tint. Ammeters register flow of current.	Check continuity of battery circuits. Make sure clips are fastened tightly on end of bulbs. Make sure all connecting cords are firmly in place. Make sure circuit breakers in Cabinet BE-75 are closed. Make sure all adjustment plugs are tight.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STARTING	11	Ammeters	Check meter reading.....	Should read 6 amperes or less.	Check that number of cells in circuit is within specified amount and that cells are connected correctly regarding polarity. Tap ammeter lightly to make sure needle is not stuck. Make adjustment of charging rate controls. Check connection on input-voltage-compensating terminal strip to make sure it agrees with input voltage as read with an a-c voltmeter. If doubtful set it 1 tap higher.
PERFORMANCE	12	Charging rate.....	Check ammeter.....	Should read 6 amperes or less.	Increase or decrease charging rate. Check battery circuit. If meter reads zero check fuses and bulbs. Replace if necessary.
	13	Batteries	Inspect	No violent gassing occurs.... Temperature of battery solution is below 110° F.	Decrease charging rate.

	Item No.	Action or condition	Normal indications	Normal indications	Corrective measures
PERFORMANCE	14	Battery electrolyte.....	Check electrolyte level.....	Level should be 1/4" to 3/8" above top of plates.	Add distilled water.
	15	Battery condition.....	Check charge.....	Hydrometer reading should show full charge according to battery manufacturer's specifications, for last 5 hours of charging.	Continue charging. (If batteries do not become charged after a reasonable time or do not hold their charge, examine for dead or defective cell. Do not let a battery run down because charging rates are too low, or do not ruin the battery by overcharging.)
STOPPING	16	Toggle OFF-ON switch.....	Move to OFF position.....		
	17	Charging rate adjustment controls.	Turn tap-switch knob to extreme left position or pull out fine adjustment plugs.		

PART THREE

PREVENTIVE MAINTENANCE

Section VII. PREVENTIVE MAINTENANCE TECHNIQUES

19. Meaning of Preventive Maintenance

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment, when turned off, to eliminate major break-downs and unwanted interruptions in service, and to keep the equipment operating at top efficiency. To understand what is meant by preventive maintenance, it is necessary to distinguish between preventive maintenance, trouble shooting, and repair. The prime function of preventive maintenance is to *prevent* break-downs and, therefore, the need for repair. On the other hand, the prime function of trouble shooting and repair is to locate and correct *existing* defects. The importance of preventive maintenance cannot be overemphasized. It is vitally important that operators and repairmen maintain their rectifiers properly.

Note. All operations specified here are first- and second-echelon maintenance (organization operators and repairman). In case of higher echelon repairs the unit must be returned to appropriate higher echelon (such as Signal Depot Company or Signal Base Maintenance Company) facilities.

20. Description of Preventive Maintenance Techniques

a. GENERAL. Most electrical parts used in Rectifier RA-36-(*) and rectifier 6RB6B17 require routine preventive maintenance. Those requiring maintenance differ in the amount and kind required. Because hit-or-miss maintenance techniques cannot be applied, definite and specific instructions are needed. This section of the manual contains these specific instructions and serves as a guide for personnel assigned to perform those of the six basic maintenance operations, which are applicable to these rectifiers. The six operations are: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the lettering system for the six operations will be as follows:

F—Feel.

I—Inspect.

T—Tighten.
C—Clean.
A—Adjust.
L—Lubricate.

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

b. FEEL. The feel operation is used most often to determine if electrical connections, bushings, etc., are overheated and does not apply to the equipments covered by this manual.

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

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

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

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

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

d. TIGHTEN, CLEAN, AND ADJUST. These operations are self-explanatory. Specific procedures to be followed in performing those which are applicable to this equipment are given wherever necessary throughout part three. Whenever a loose connection is tightened, it should be moistureproofed and fungiproofed again by applying the varnish with a small brush. See section X for details of moistureproofing and fungiproofing.

No adjustments are ordinarily required to be made on these rectifiers in the course of routine preventive maintenance.

Caution: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

e. LUBRICATE. Lubrication of these rectifiers refers to the application of grease or oil to sliding electrical contacts or rotating shafts of tap switches, and to the application of a light oil to door hinges or other sliding surfaces on the equipment. Aside from occasional oiling of these parts, no other lubrication is required on Rectifier RA-36-(*) and rectifier 6RB6B17.

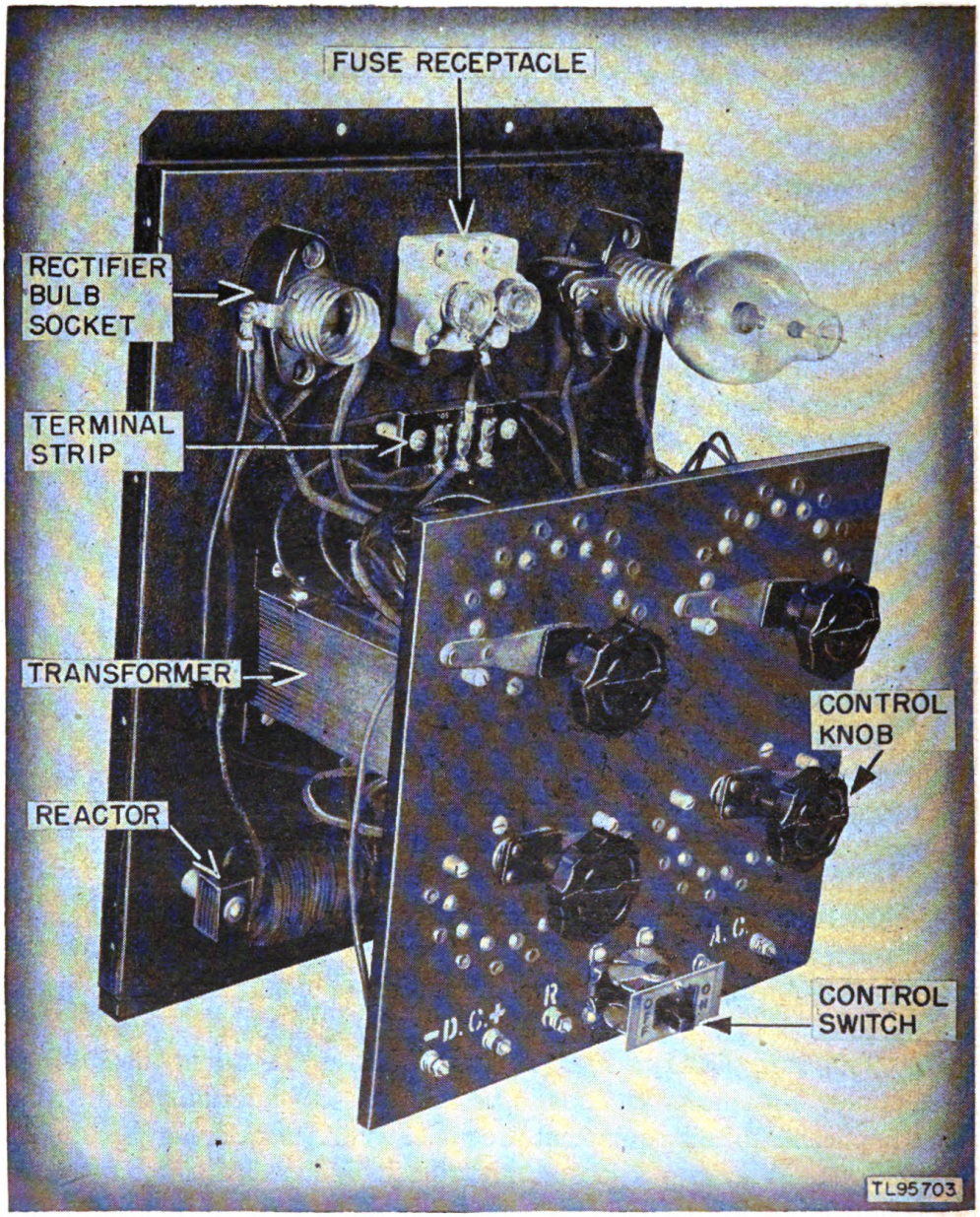


Figure 10. Rectifier RA-36-N, internal front view.

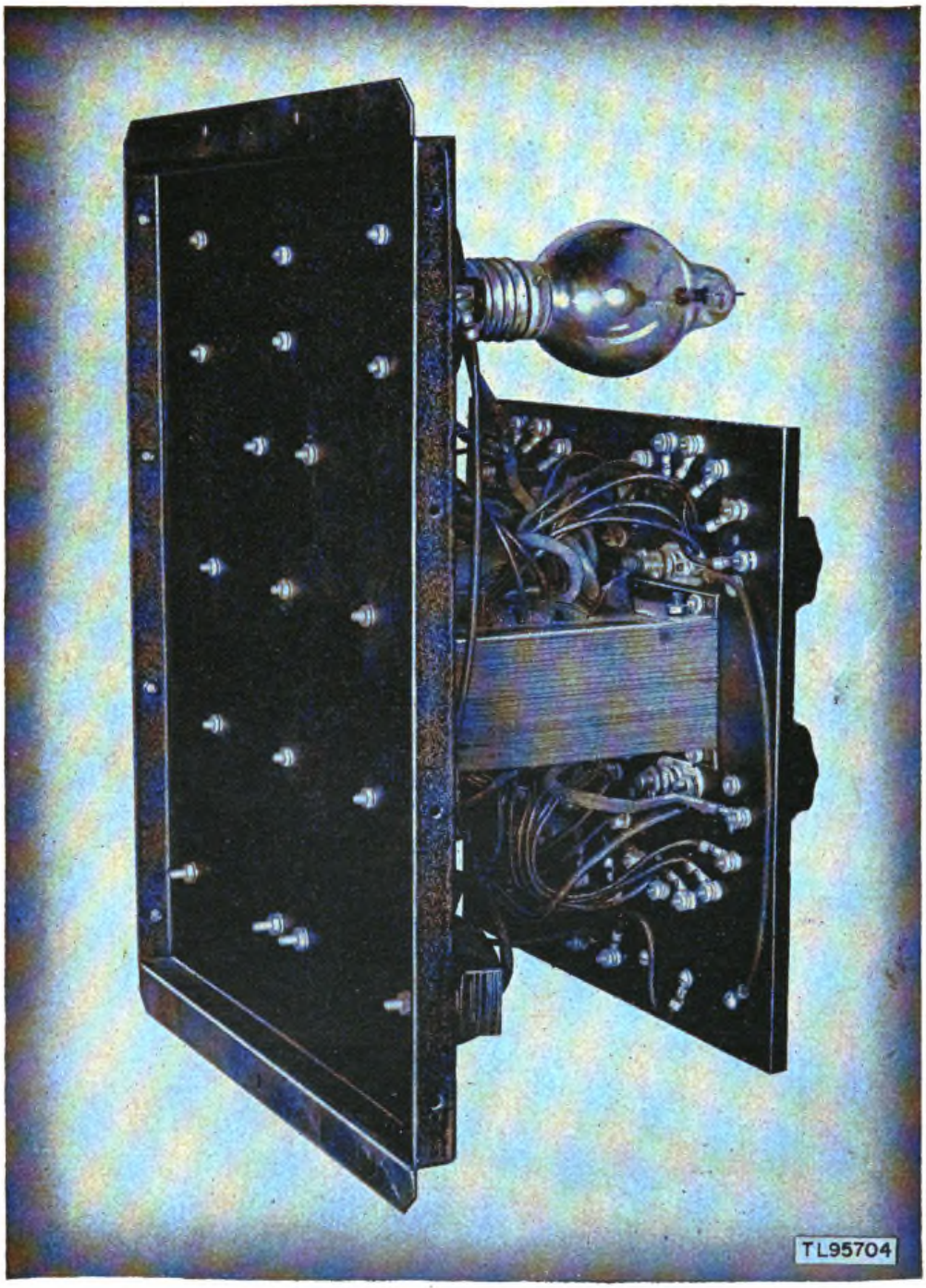


Figure 11. Rectifier RA-36-N, internal rear view.

21. Disassembly to Reach Unexposed Parts for Preventive Maintenance

Disassembly necessary for preventive maintenance can be performed on Rectifier RA-36-(*) and rectifier 6RB6B17 in the following manner.

a. Rectifier RA-36-N, interior, can be reached as follows:

(1) Remove the two top screws on the front panel.

(2) Open this hinged panel and remove the clips from the top of the

two rectifier bulbs. Open and close this panel carefully to prevent damage to the meters on it. (See fig. 1.)

(3) Remove all panels from the case.

(4) Remove the eight screws, nuts, and lockwashers (four on each side of the backplate of the unit) holding the case to the backplate. These screws can be removed by holding a screw driver in the screw slots at the side and loosening the nut with a pair of pliers, from the back of the case.

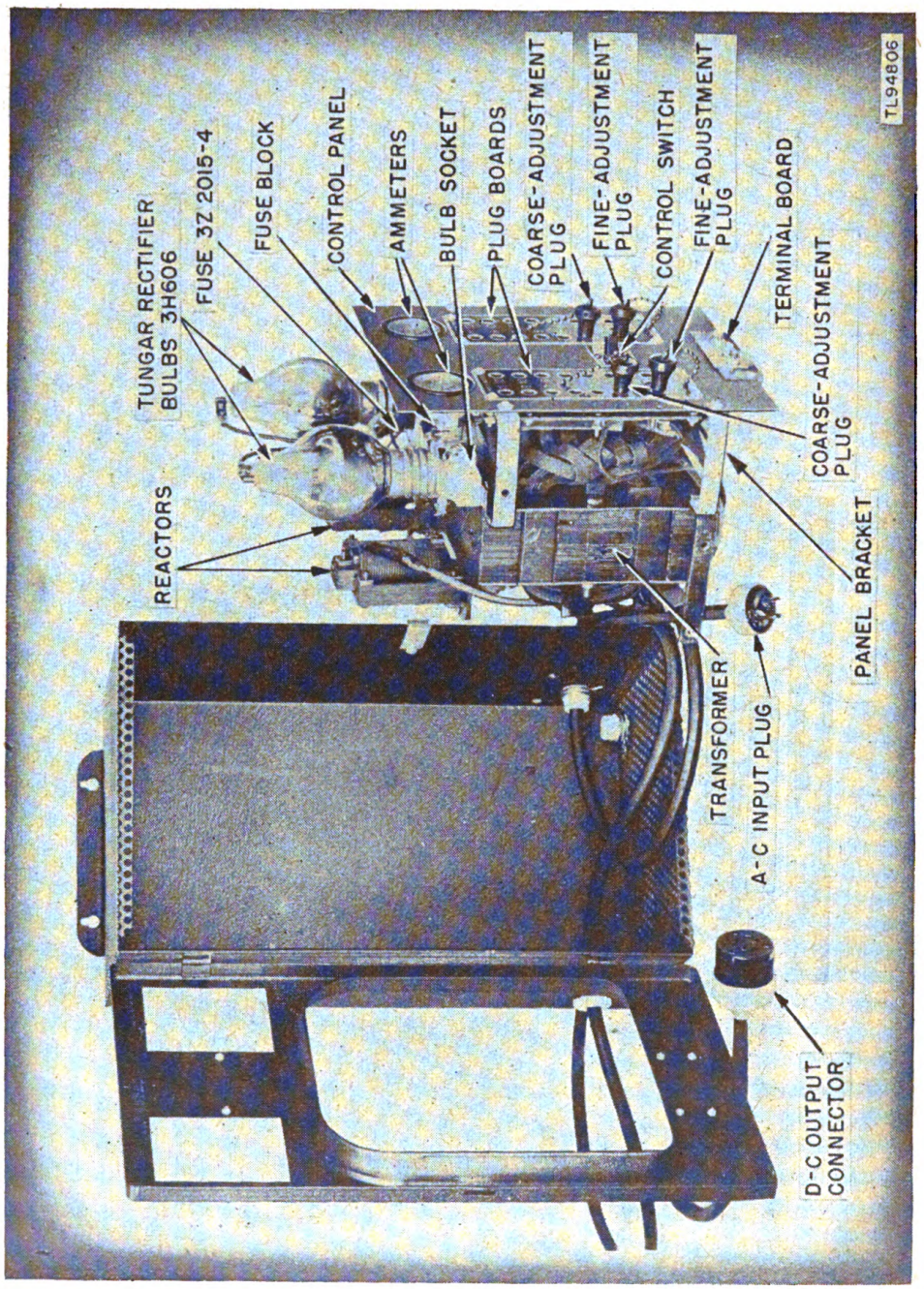


Figure 12. Rectifier RA-36-(1) and rectifier 6RB6B17, casing partly removed.

The case can then be separated from the backplate. This exposes all parts behind the panel for preventive maintenance of the interior.

b. The interior of Rectifier RA-36-(1) and rectifier 6RB6B17 can be reached as follows:

(1) Open the front door which is held closed by a spring clip.

(2) Remove the three bolts on each side of the case and remove the complete unit from the case. This exposes all parts behind the panel for preventive maintenance of the interior.

(3) To examine the condition of connections behind the panel, the panel can be removed from the rest of the assembly by removing the four screws on front of the panel.

c. The external filter reactor is not to be disassembled for preventive maintenance:

Section VIII. ITEMIZED PREVENTIVE MAINTENANCE

22. Introduction

For ease and efficiency of performance, it is suggested that preventive maintenance on Rectifier RA-36-(*) and rectifier 6RB6B17 be broken down into operations that can be performed at different time intervals. In this section the preventive maintenance work to be performed on the unit at specified time intervals is broken down into units of work called items. The general techniques involved and the application of the FITCAL operations in performing preventive maintenance on individual parts are discussed in section VII. These general instructions are not repeated in this section. When performing preventive maintenance, see section VII if more information is required for the following items. All work is to be performed with the power disconnected from the equipment. After preventive maintenance has been performed on a given day, the equipment should be put into operation and checked for satisfactory performance. (See par. 18.)

23. Common Materials Needed

The following materials will be needed in performing preventive maintenance.

Screw driver.
Pair of pliers.
Common hand tools.
Clean cloth.
#0000 sandpaper.
Crocus cloth.
Solvent, Dry Cleaning, Federal Specification P-S-661a.

Note. Gasoline will not be used as a cleaning fluid for any purpose. Solvent, Dry Cleaning, is available as a cleaning fluid through established supply channels. Oil, Fuel, Diesel, may be used for cleaning purposes when dry-cleaning solvent (SD) is not on hand. Carbon tetrachloride will be used as a cleaning fluid only in the following cases: where inflammable solvents cannot be used because of the fire hazard, and for cleaning electrical contacts including relay contacts, plugs, commutators, etc.

24. Item 1, Interior of Rectifier Case

For detailed information on disassembly to reach unexposed parts for preventive maintenance see paragraph 21.

I, Transformer, coils, and all leads.
IT, All mounting screws for interior components.
IT, All electrical connections, terminals, rectifier bulbs, fuses, and clip on top of bulb.
IC, All interior components and interior of case.

Note. Dust can be best removed by using a clean, soft cloth or compressed air. All screws and nuts can be tightened with a screw driver and pliers. All electrical connections can be tightened the same way or resoldered. Any break in insulation should be mended with friction tape and rubber tape. Any discolored part indicates overheating. Section V for possible corrections to prevent burn out.

25. Item 2, Tap Switches on Rectifier RA-36-N

IC, Contact Points.
L, Tap switch shaft.

Note. Clean contact points with dry-cleaning solvent (SD) or burnishing tool if necessary. Monthly, if necessary, apply one or two drops of light oil to each switch shaft where it passes through the bearing plates.

26. Item 3, Adjustment Plugs on Rectifier RA-36-(1) and Rectifier 6RB6B17

IC, Plugs and plug tap holes.

Note. Electrical contact surfaces must be clean; use dry-cleaning solvent or fine sandpaper.

27. Item 4, Front Panel of Rectifier RA-36-(*) and Rectifier 6RB6B17

IC, Panels, control switches, knobs, and meter glasses.
IT, All screws accessible.

Note. Use correct size screw driver for tightening operation, if tightening is necessary. Use clean, soft cloth for cleaning operation.

28. Item 5, Exterior of Rectifier Case and External Reactor

IT, Mounting Bolts.
IC, Case.
IT, Bolts on each side of case (Rectifier RA-36-(1) and rectifier 6RB6B17).
IT, Screws on each side of case at rear (Rectifier RA-36-N).
IC, External reactor, exterior.

IT, Mounting bolts and screws on top of external reactor.
L, Hinges.

Note. Use correct size wrench, pliers, or screw driver for tightening operations. Use clean, soft cloth for cleaning operation. Lubricate hinges monthly, if necessary, with one or two drops of oil.

29. Item 6, Interconnecting Cords

IC, Cords.
IC, Connector.
IC, Cap plug.

Note. Electrical contact surfaces must be clean (par. 20); use dry-cleaning solvent or fine sandpaper if inspection shows cleaning necessary. Broken cap plugs or connectors should be replaced. Exposed wire or frayed insulation should be repaired with friction tape and rubber tape. Clean all rubber with dry cloth only.

30. Item 7, Battery Connecting Loads

IC, Leads.

Note. Exposed wire or frayed insulation will be repaired with friction tape and rubber tape. Clean all rubber with dry cloth only.

31. Preventive Maintenance Check List

Item No.	Operations	Item	WHEN PERFORMED							Echelon
			Before operation	After operation	Daily	Weekly	Monthly	Semiannually	Yearly	
1	ITC	Interior of rectifier case					X			2d
2	IC	Tap switches on Rectifier RA-36-N	X			X				1st
	L	Tap switch shaft					X			2d
3	IC	Adjustment plugs on Rectifier RA-36-(1) and Rectifier 6RB6B17	X			X				1st
4	ITC	Front panel of Rectifier RA-36-(*) and Rectifier 6RB6817			X					1st
5	ITC	Exterior of rectifier case and external reactor	X		X					1st
	L	Hinges					X			1st
6	IC	Interconnecting cords			X					2d
7	IC	Battery connecting leads				X	-			1st

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

Section IX. LUBRICATION

Note. Except for occasional oiling of tap switches and hinges, lubrication is not required for Rectifier RA-36-(*) and rectifier 6RB6B17.

Section X. MOISTUREPROOFING AND FUNGIPROOFING

32. General

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

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

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

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

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

e. Moisture provides leakage paths between battery terminals.

33. Treatment

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

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

34. Rectifier RA-36-N

a. PREPARATION. (1) Make all repairs and adjustments necessary for proper operation of the equipment.

(2) Disconnect interconnecting cords connected to unit from other equipment.

b. DISASSEMBLY. (1) Remove the rectifier and the large filter reactor from the support on which it is mounted.

(2) Remove the two screws that are located above the meters in the hinged top section of the meter panel (frontispiece).

(3) Lower the upper section of the meter panel and remove the rectifier bulbs (the rectifier bulbs are not to be treated). (See fig. 1.)

(4) Place the battery charger on its back, and remove the screws holding the middle and bottom sections of the front panel. Remove the panels. (See fig. 1.)

(5) Disconnect the wire leads from the terminals of the two ammeters, and remove the ammeters from the meter panel. (See fig. 1.)

(6) Remove the two fuses (these are not to be treated). (See fig. 1.)

(7) Disconnect the a-c and d-c power cords from the equipment at the bottom of the inner panel. Tag each lead as it is removed, in order to be able to identify them for reassembling. Place a tag on the lead that is connected to the d-c negative terminals, and mark the tag d-c. Place a tag on the leads that are connected to the a-c terminals, and mark the tag a-c. (See fig. 14.)

(8) Remove the eight screws, nuts, and lockwashers (four on each side at the baseline of the unit) holding the case to the base. Remove the case by raising it straight up until it clears the internal chassis of the equipment.

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

d. MASKING. (1) Mold paper covers for the rectifier bulb sockets and fasten the covers in place with masking tape. (See fig. 13.)

(2) Mold a paper cover for the porcelain fuse block and fasten the cover in place with masking tape. (See fig. 13.)

(3) Mold a paper cover for the ON-OFF control switch and fasten the cover in place with masking tape. (See fig. 13.)

(4) Cover each brass contact button on the four tap-changing switches with masking tape. (See fig. 13.)

(5) Cover the switch shaft of the four tap switches, where the shaft passes through the bearing plate, with masking tape. (See fig. 14.)

(6) Mask the d-c, a-c, and R terminals with masking tape. (See fig. 13.)

(7) Mask the terminals lugs on the a-c and d-c power cords, and reactor cord. (See fig. 15.)

(8) Mask the three terminals on the a-c input terminal strip. (See fig. 13.)

(9) Cover all exposed screw holes in the case, panels, and chassis with masking tape. (See fig. 15.)

(10) Cover with masking tape the two clips that were disconnected from the rectifier bulbs. (See fig. 14.)

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

f. VARNISHING. (1) Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, spec. No. 71-2202 (stock No. 6G1005.3), or equal). Allow each coat to dry for 15 or 20 minutes at the temperature specified in *e* above before applying the next coat.

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

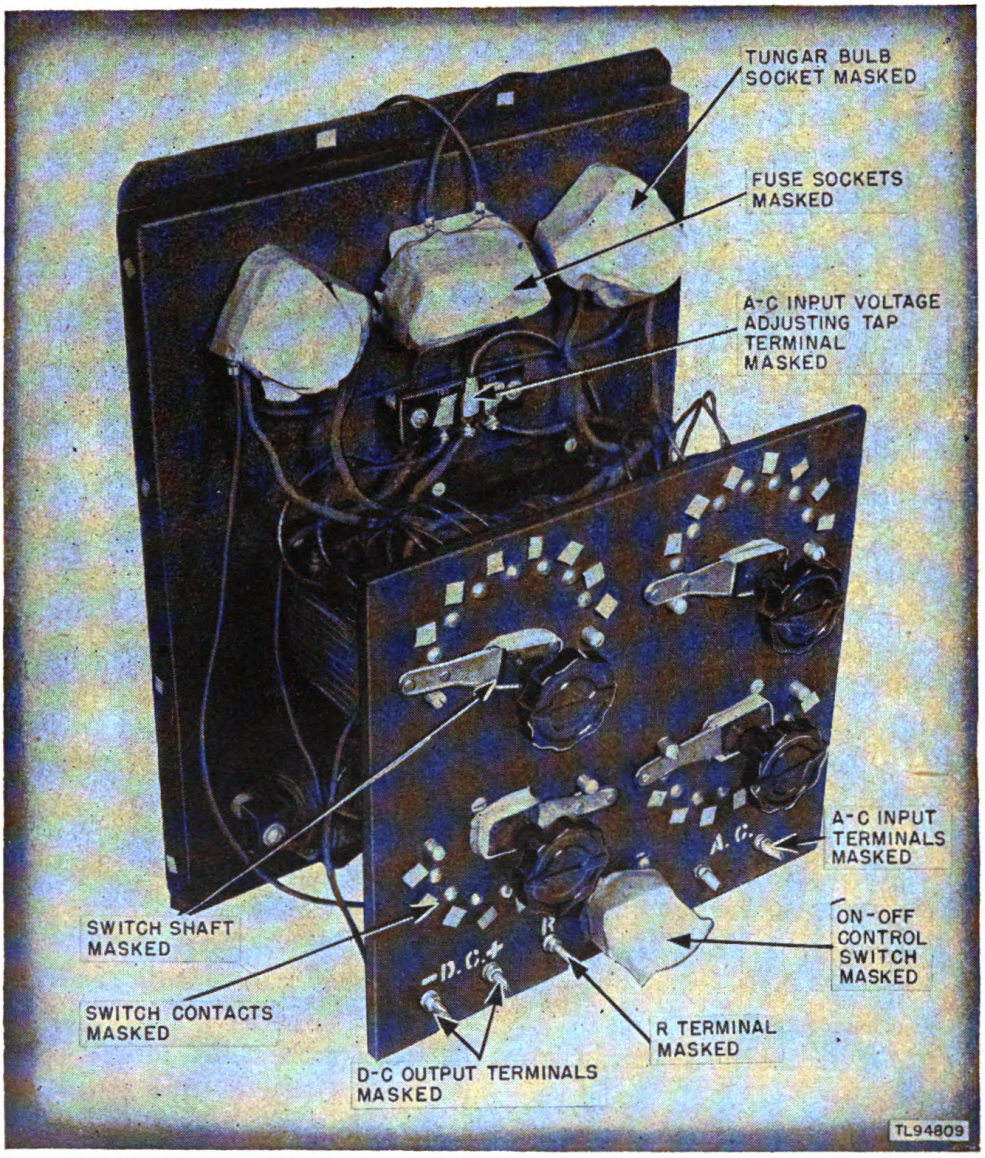


Figure 13. Rectifier RA-36-N, masking, front view, internal.

(3) Spray the case, panels, base, chassis, and component parts of the equipment, except as noted.

(4) Varnish the transformers and internal reactors by brush. Apply as thick a coating as possible to the coils. Allow the varnish to penetrate into all openings between layers of the coils. Apply a thick coating of varnish to all laminations. Make certain that all areas and openings are completely covered.

(5) Brush coat all points missed by the spray on parts mentioned.

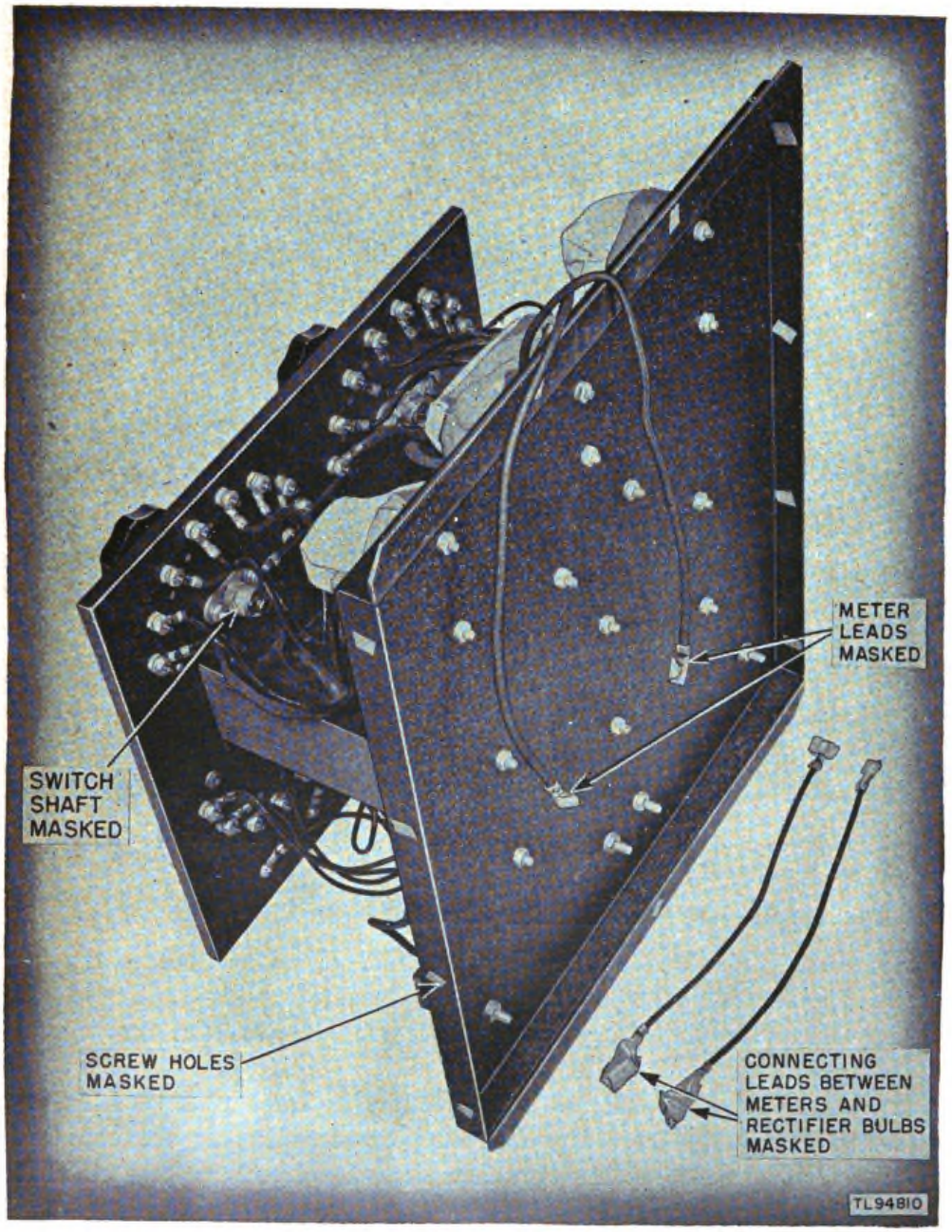


Figure 14. Rectifier RA-36-N, masking, rear view, internal.

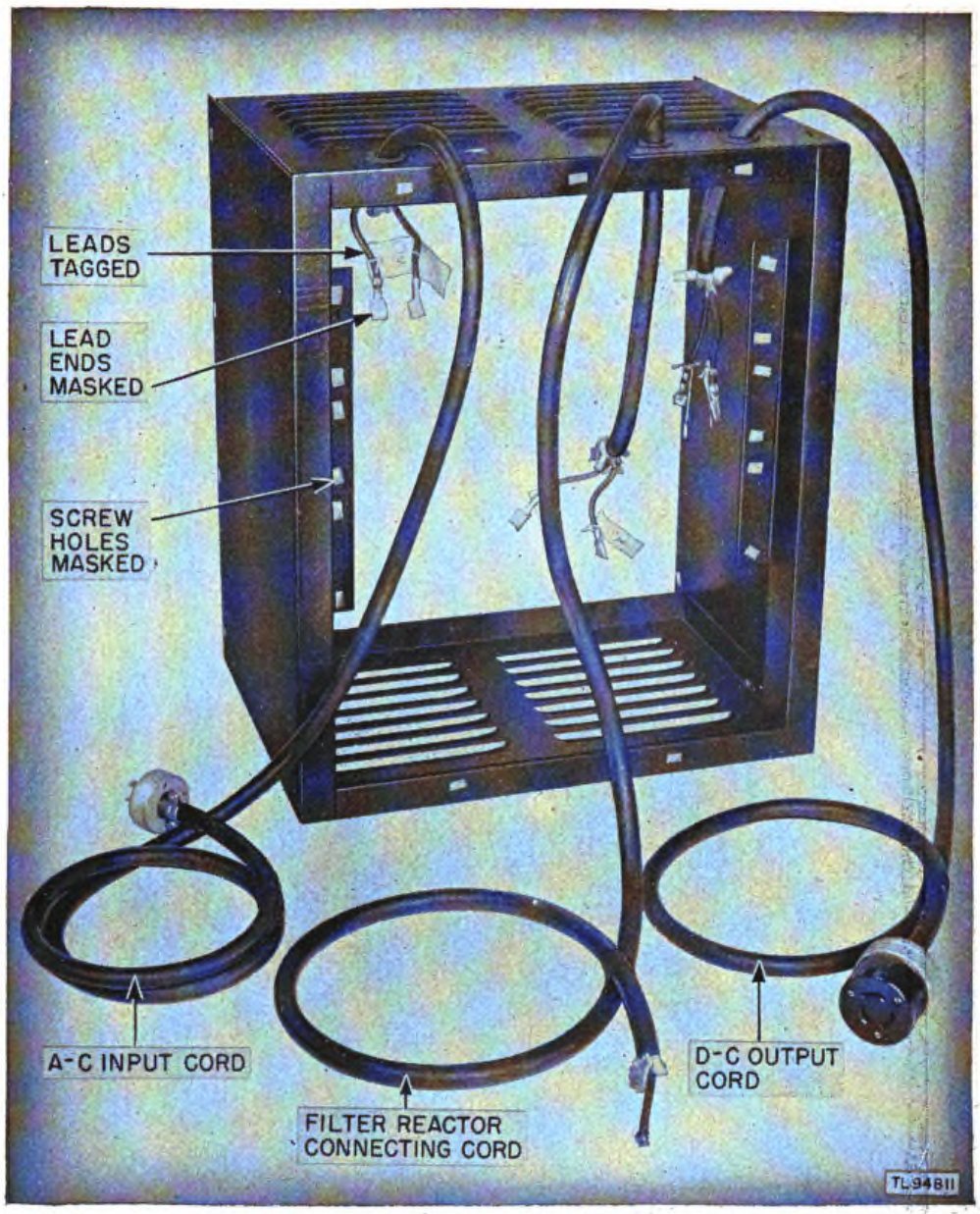


Figure 15. Rectifier RA-36-N, masking, cabinet and cords.

35. Rectifier RA-36-(1) and Rectifier 6RB6B17

a. PREPARATION. (1) Make all repairs and adjustments necessary for proper operation of the equipment.

(2) Disconnect interconnecting cords, connected to the unit, from other equipment.

b. DISASSEMBLY. (1) Remove the rectifier and the external filter reactor from Rack FM-30 or any other support on which they are mounted.

(2) Remove the three bolts on each side of the rectifier case and lift out the chassis. (See fig. 12.)

(3) Remove the two rectifier bulbs. (See fig. 2.)

(4) Remove the four bolts that fasten the front panel to the chassis. (See fig. 12.)

(5) Remove the two screws that fasten the primary-voltage-adjustment terminal strip to the bottom of the panel, and lift the strip free of the panel. (See fig. 12.)

(6) Remove the four screws located in the four corners of each of the two charging rate adjustment panels (plug boards) mounted on the front panel, and remove plug boards and capacitor. (See fig. 16.)

(7) Remove the two screws used to mount the ON-OFF control switch. (See fig. 16.)

(8) Remove the wires from the ammeters and remove the ammeters (to be treated). (See fig. 12.)

(9) Disconnect and remove input, output, and external reactor cords.

(10) Remove fuses (not to be treated). (See fig. 2.)

(11) Remove the four panel mounting brackets from the transformer (to be treated). (See fig. 12.)

(12) Lift the two phenolic plug boards containing the contacts for the charging-rate-adjustment plugs away from the transformer and, at

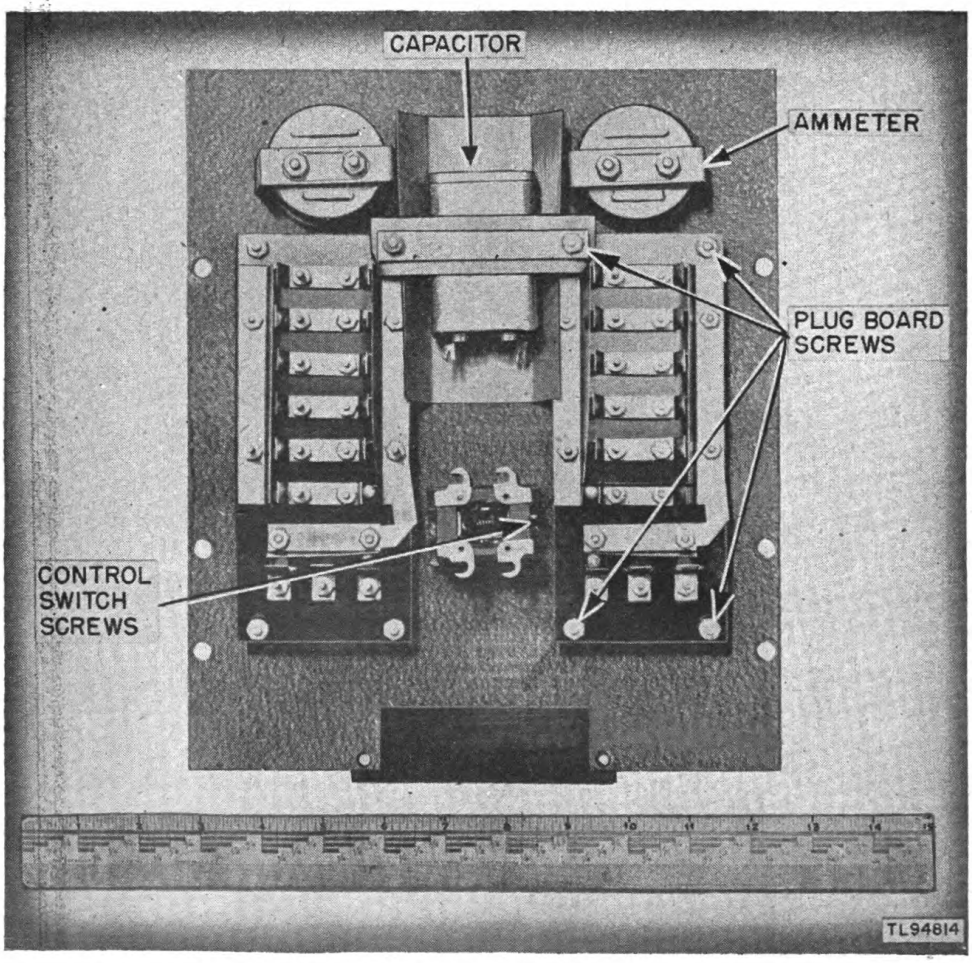


Figure 16. Rectifier RA-36-(1) and rectifier 6RB6B17, rear view of control panel.

the same time, straighten out the lead wires and turn the phenolic strips over. Do not disconnect any of the wires. (See fig. 17.)

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

d. MASKING. (fig. 17). (1) Mold paper to cover the ON-OFF control switch, and fasten the paper in place with masking tape.

(2) Mold paper to cover the fuse sockets, and fasten the paper in place with masking tape.

(3) Mold paper to cover the rectifier bulb sockets, and fasten paper in place with masking tape.

(4) Mask the two long pairs and the one short pair of copper strips, found in the back of each of the two phenolic strips containing the contacts for the charging-rate-adjustment plugs, with masking tape. (Cover only those portions of the copper strips which make contact with the plugs.)

(5) Mask all mounting holes in the case, chassis, and plug boards, exposed through removal of the component, with masking tape.

(6) Cover the terminal lugs of the four meter leads and all leads disconnected in one or more places, where disconnected, with masking tape.

(7) Cover the two clips disconnected from the rectifier bulbs with masking tape.

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

f. VARNISHING. (1) Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, spec. No. 71-2202 (stock No. 6G1005.3), or equal). Allow each coat to dry for 15 or 20 minutes at the temperature specified in *e* above, before applying the next coat.

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

(3) Spray the case, panels, base, chassis, and component parts of the equipment, except as noted.

(4) Varnish the transformers and internal reactors by brush. Apply as thick a coating as possible to the coils. Allow the varnish to penetrate into all openings between layers of the coils. Apply a thick coating of varnish to all laminations. Make certain that all areas and openings are completely covered. (See fig. 17.)

(5) Brush coat all points missed by the spray on parts mentioned in (3) above.

(6) Remove paper mask from the ON-OFF control switch, and brush coat the plastic parts of the switch. (See fig. 17.)

(7) Do not spray the meters. Brush coat the backplate and the joint between the backplate and the meter shell of each meter. In the same manner, paint the heads of all retaining screws and the joints between the glass and the meter shell. Make certain that these joints are well

sealed with varnish. The varnish should be applied sparingly with a small brush. Do not varnish the meter terminals.

(8) Brush coat the external filter reactor. *Do not disassemble it.*

g. REASSEMBLY. (1) Remove all paper coverings and masking tape, being careful not to peel varnish from nearby areas.

(2) Clean all contacts, if necessary, with a burnishing tool.

(3) Reassemble the equipment in the reverse order of disassembly, and test its operation.

h. MARKING. Mark the letters MFP and the date of treatment directly under the ON-OFF control switch nameplate on the front panel. Make sure the front door, in a closed position, does not obscure the marking.

Example: MFP—8 Dec 44.

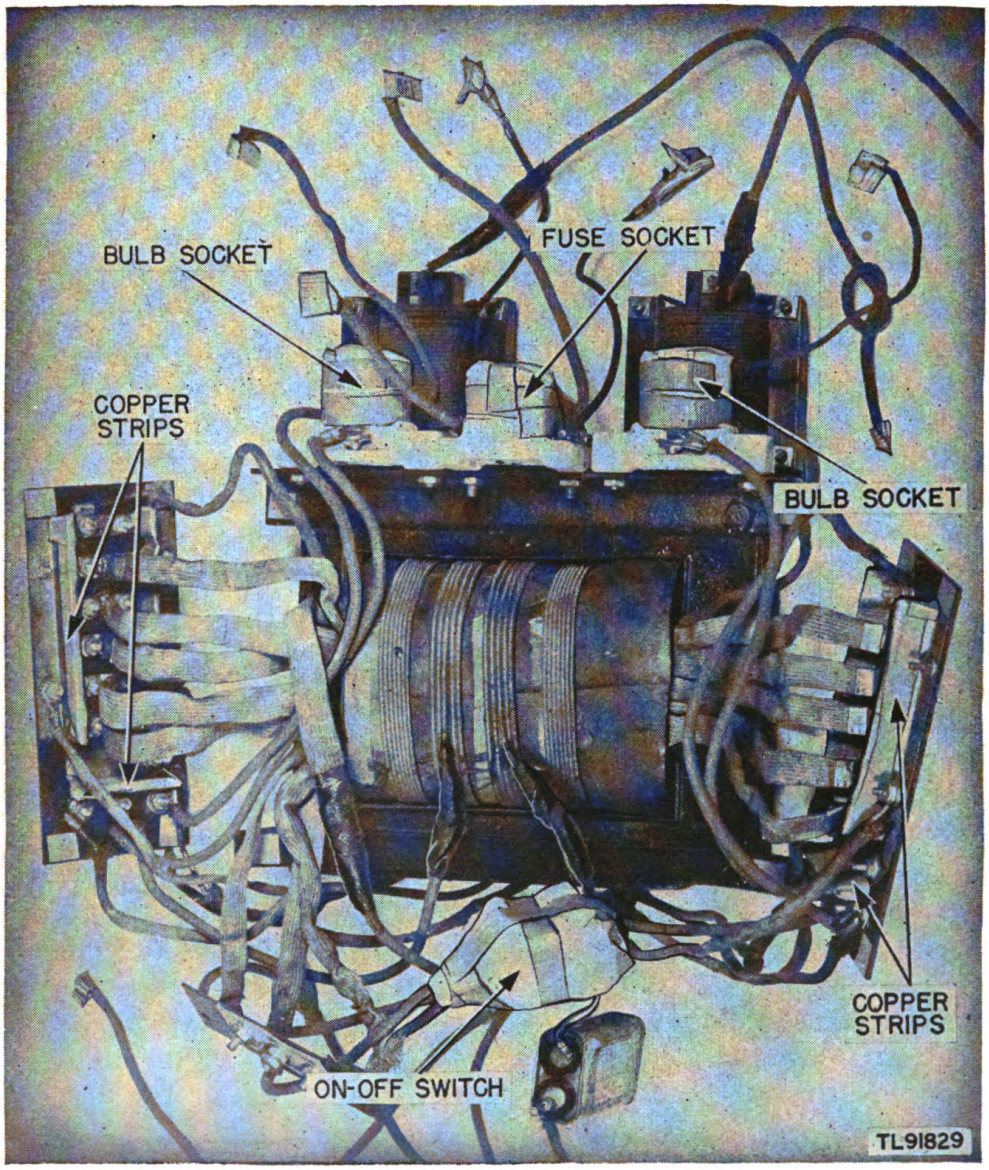


Figure 17. Rectifier RA-36-(1) and rectifier 6RB6B17, masking transformer assembly.

PART FOUR

AUXILIARY EQUIPMENT

(Not used)

PART FIVE

REPAIR INSTRUCTIONS

Note. Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on WD AGO Form 468 (Unsatisfactory Equipment Report); by Army Air Forces, on Army Air Forces Form 54 (unsatisfactory report). If either form is not available, prepare the data according to the sample form reproduced in figure 24.

Section XI. THEORY OF EQUIPMENT

36. General

a. Rectifier RA-36-(*) and rectifier 6RB6B17 consist of two half-wave rectifiers using two tungar rectifier bulbs. Figure 18 shows a simplified wiring diagram. On one-half of the a-c cycle the current flows in one direction through one of the tubes, and on the other half of the cycle, the current flows in the same direction through the other tube. The rectifying action of the tube allows the current to flow in one direction only. This gives a d-c output which is used to charge batteries. Each of the two complete charging circuits includes a portion of the transformer secondary winding, a current control device, and a rectifier bulb.

b. Rectifier RA-36-(1) operates as follows (fig. 20):

(1) The function of the transformer is to provide the voltage and power required to heat the filaments of the tungar rectifier bulb and produce the current in the charging circuits. As shown in the wiring diagram (fig. 20) the a-c input is connected to the ends of the transformer primary winding, one side passing through one section of the control switch to the terminal board. The capacitor is connected across the a-c supply line to cut the effect of possible line voltage surges caused by interruptions in the a-c power.

(2) The transformer secondary windings are insulated from the primary circuit, and the large secondary winding supplies the voltage for the charging circuits. The filament circuits of the rectifier bulbs are supplied from the separate windings PQR and XYZ.

(3) The rectifier is a full-wave rectifier consisting of two half-wave rectifiers. Both half-wave rectifiers have a common positive side which

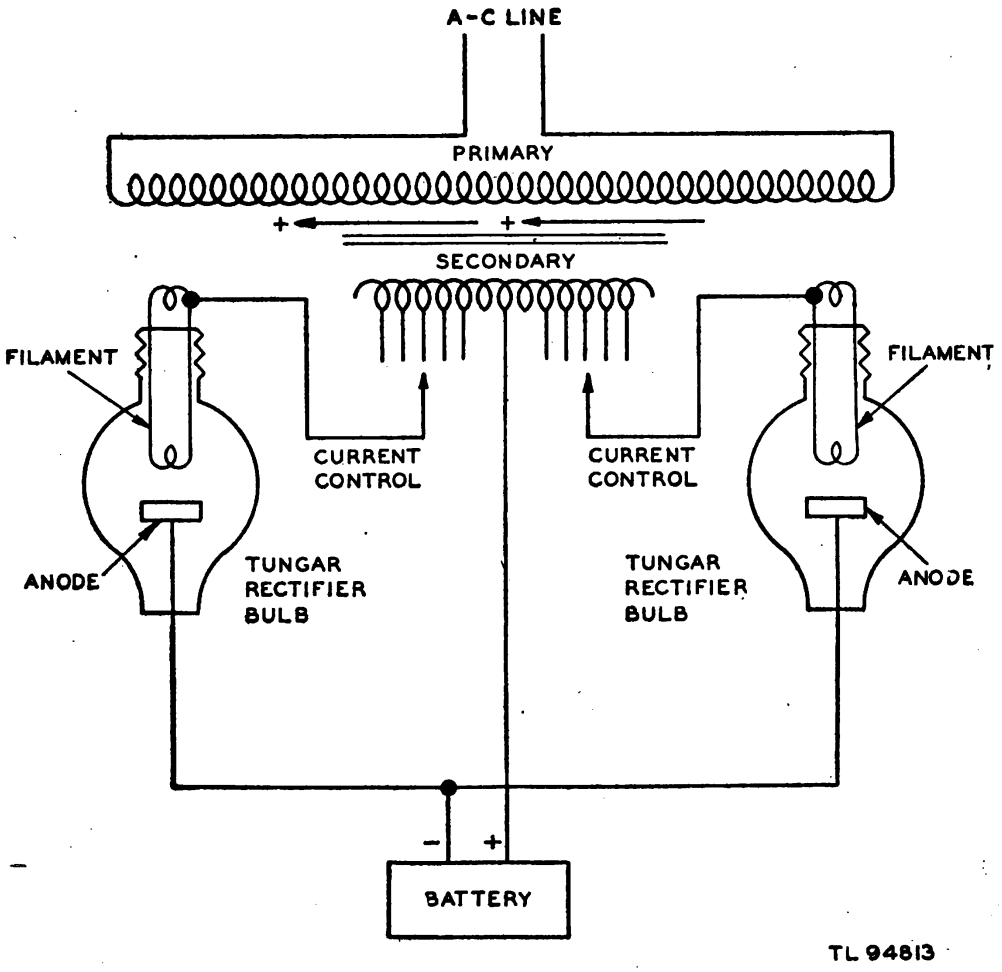


Figure 18. Simplified wiring diagram of rectifier circuit.

is traced from the center tap N of the secondary through one side of the control switch, then to the external filter reactor and on out to the output receptacle.

(4) The negative side of the charging circuit is traced as follows. Looking at the left half of the wiring diagram, six taps, A through F, are found on the end of the secondary, which are connected to corresponding contacts A through F on the back of the left-hand plug board. For simplicity, these lines are not shown on the diagram. When the left-hand coarse-adjustment plug is placed in hole 1, the portion of the secondary AN is cut into the charging circuit through contact A across the coarse-adjustment plug to the left-hand terminal strip. The circuit passes directly down to the fine-adjustment terminal strip. With the fine-adjustment plug placed in the LOW hole, the circuit continues up to the shell of the rectifier bulb. The winding PQ is connected directly to the bulb filament. The negative side of the charging circuit now continues from the anode of the rectifier bulb through one fuse to the ammeter and internal reactor to the negative side of the battery-charging receptacle. This

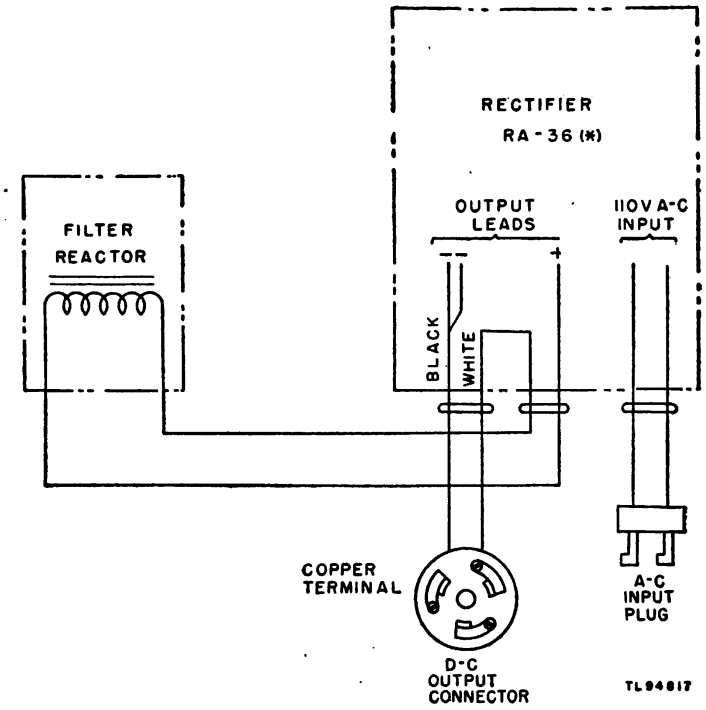


Figure 19. Rectifier RA-36-(*), external reactor connections.

connection will provide a charging rate of about 2 amperes for a 12-volt battery.

(5) To raise the charging rate one step, the fine-adjustment plug is moved to the MEDIUM hole, adding the turns of the small winding PQ to the secondary. By moving the fine-adjustment plug to HIGH, winding QR as well as PQ is added to the circuit, raising the charging rate another step.

(6) For the next increase, the fine-adjustment plug is moved to LOW and the coarse-adjustment plug is changed to hole 2. The charging circuit now traces from A on the transformer secondary to A on the left-hand plug board, through winding TU to the fine-adjustment terminal strip, and then to the rectifier bulb. Winding TU has more turns and higher voltage than PQR, which has been cut out, so the charging rate goes up.

(7) The next two increases are obtained by moving the fine-adjustment plug to MEDIUM and HIGH as mentioned before.

(8) To continue stepping up the charging rate, the coarse-adjustment plug is moved to the next number and the fine-adjustment plug moved to the LOW, MEDIUM, or HIGH positions. For further adjustments, see figure 9.

c. The wiring diagram for Rectifier RA-36-(1) applies to rectifier 6RB6B17 with the following exceptions:

(1) Input and output cords are not included, so the two positive leads

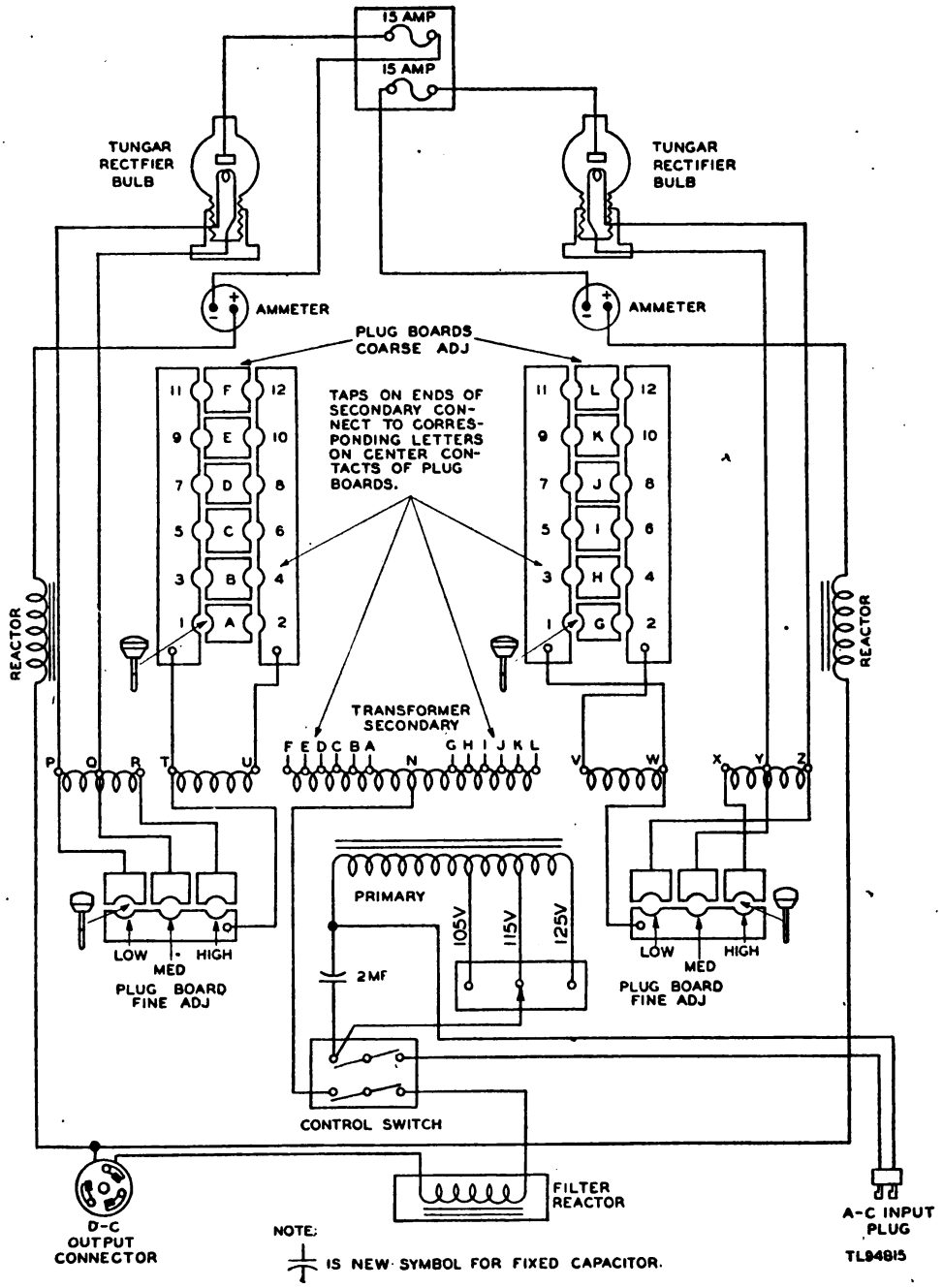


Figure 20. Rectifier RA-36-(1) and rectifier 6RB6B17, wiring diagram.

connecting to the d-c output plug merely extend through the bottom of the rectifier case.

(2) The external filter reactor is not included with this rectifier so the wire shown running from the control switch to the external filter reactor, runs instead directly out through the bottom of the rectifier case as the negative (—) lead.

d. The circuit in Rectifier RA-36-N (fig. 21) is the same as that of Rectifier RA-36-(1) in theory but differs in one respect. The charging

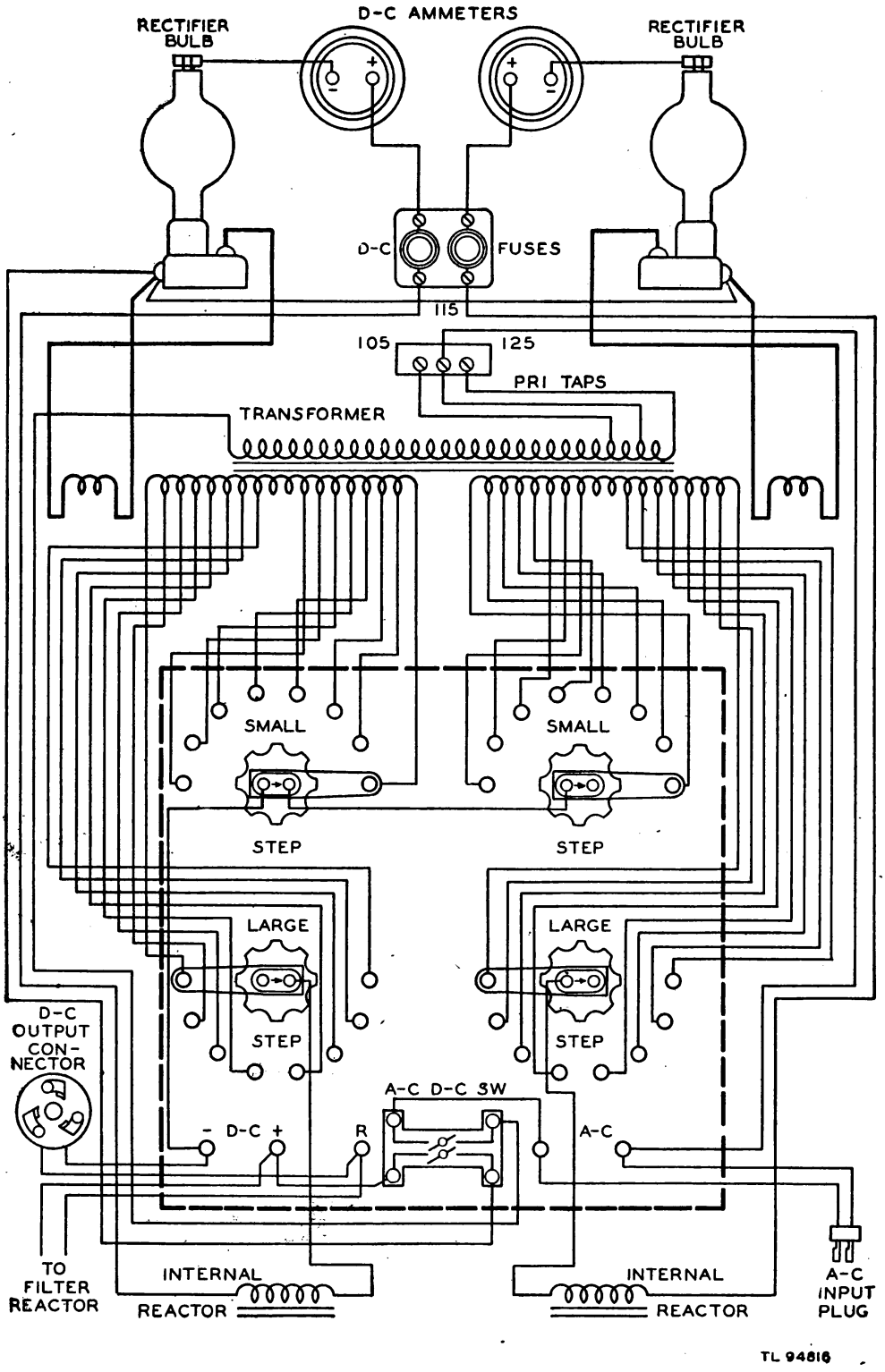


Figure 21. Rectifier RA-36-N, wiring diagram.

rate in this rectifier is controlled by tap switches. The voltage developed in each leg of the secondary is controlled again by tapping the secondary. The selection of the tap to be used is determined by the tap switch, one for fine adjustments and one for coarse adjustments, in each circuit. (For information on the operation of the tap switch see par. 13.)

Section XII. TROUBLE SHOOTING

37. General Trouble-shooting Information

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

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

(1) Simplified wiring diagram of a full-wave, bulb-type rectifier. (See fig. 18.)

(2) Complete circuit or wiring diagrams for location and names of component parts.

(3) Illustrations showing rectifier partly disassembled.

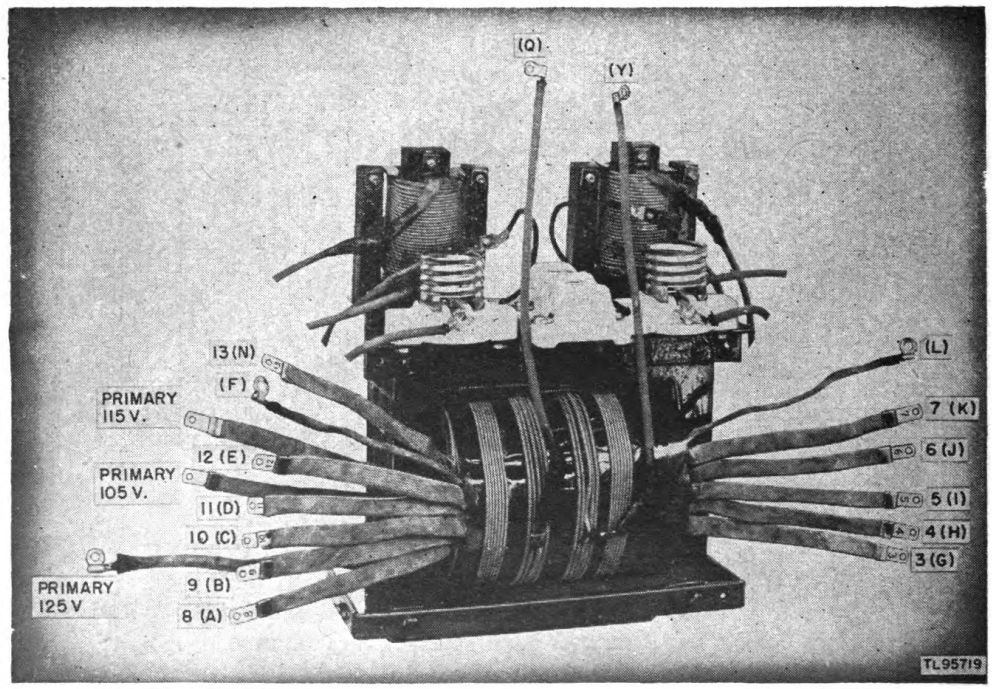


Figure 22. Rectifier RA-36-(1) and rectifier 6RB6B17, transformer, front view.

(4) Equipment performance check list. (See par. 18.)
(5) Preventive maintenance check list. (See par. 31.)

b. RECTIFIER RA-36-(1) AND RECTIFIER 6RB6B17. The following information applies particularly to these models.

(1) Wiring diagram. (See fig. 19.)
(2) Subassemblies. (See figs. 12, 16, 22, and 23.)
(3) Rectifier removed from case. (See fig. 12.)
(4) Disassembly information. (See par. 21.)

c. RECTIFIER RA-36-N. The following information applies particularly to this model.

(1) Wiring diagram. (See fig. 21.)
(2) Subassemblies. (See figs. 6, 10, and 11.)

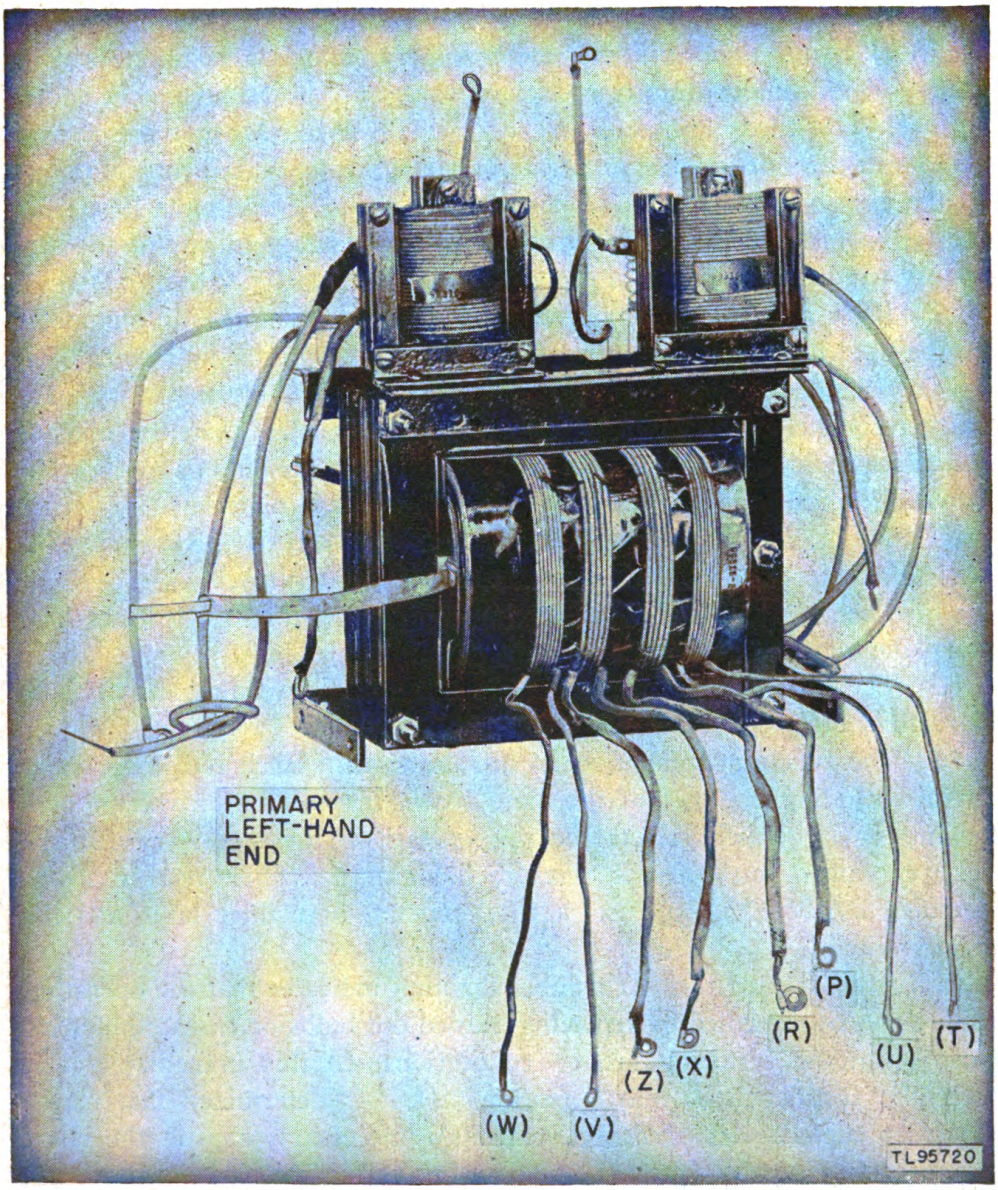


Figure 23. Rectifier RA-36-(1) and rectifier 6RB6B17, transformer, rear view.

(3) Rectifier with front panels removed. (See fig. 1.)
(4) Disassembly information. (See par. 21.)

38. Trouble-shooting Procedure

a. GENERAL. The first step in servicing an inoperative rectifier unit is to sectionalize the fault. Sectionalization involves tracing the cause of failure to the defective circuit. Use the equipment performance check list (par. 18) to determine possible causes of malfunctioning. Having found the defective circuit, the defective element can be located by visual inspection or by use of a voltmeter or ohmmeter. Look for drippings from insulations in coils: burned, discolored, or warped parts; burned out fuses or bulbs; or loose wires or leads.

b. CONTINUITY CHECKS. Test set TS-26/TSM is available for use with RA-36-(*).

(1) *With the unit connected to the supply voltage,* a voltmeter can be used to determine continuity or lack of continuity in the secondary transformer. Use the voltohmeter in Test Set TS-26/TSM, or a meter with a 125-volt scale or greater, and test for voltage between the contact points on the plug boards or tap switches of these units. See figures 19 and 21 for test points. If this test shows there is no voltage in any of the secondary windings the defect is probably in the primary.

(2) *With the unit disconnected from the supply voltage,* an ohmmeter can be used to determine continuity of all circuits in the equipment. Follow instructions in paragraph 21 to perform disassembly necessary. Infinity resistance indicates an open circuit. Zero or less than one ohm of resistance indicates a shorted element. A cold rectifier bulb in good condition will indicate infinity resistance from filament to plate.

b. CIRCUIT INFORMATION FOR TROUBLE SHOOTING. Rectifier RA-36-(*) and rectifier 6RB6B17 consist of five series circuits.

(1) The transformer primary circuit includes the transformer primary, the toggle switch, and connecting cords and leads.

(2) The two filament circuits include the filament winding and filament of rectifier bulb with connecting leads.

(3) The two remaining circuits are the same. Each is a long series circuit including one-half of the main secondary winding, a voltage controlling device which selects the proper tap on the secondary for the voltage wanted, an internal reactor, the external filter reactor (with Rectifier RA-36-(*)), a fuse, a d-c ammeter, a rectifier bulb, and the toggle switch.

d. REMEDIAL ACTION. If trouble shooting indicates that the operating failure can be remedied by replacing burned out bulbs or fuses, tightening loose wires, or restoring broken connections, do this immediately and place the rectifier back into operation. If it is determined that major repair or replacement of defective parts is necessary, consult the chart of emergency repairs (par. 41) if time or the tactical situation does not permit sending the equipment back to a higher echelon.

Section XIII. REPAIRS

39. Replacement of Parts

All of the parts of Rectifier RA-36-(*) and rectifier 6RB6B17 are readily accessible for replacement when the unit is removed from the case and the panels are removed. (See par. 21.) Tools necessary for replacement of parts are listed in paragraph 23. When leads are removed from a part in replacing it, they should be tagged to assure correct reconnection, unless the leads have already been marked by the manufacturer. This practice is recommended especially where replacement requires the disconnection of numerous wires. When trouble shooting indicates a defective part, consult Army Signal Forces Signal Supply Catalog SIG 8-RA-36 for parts procurable for replacement. If the part is indicated as procurable, procure and replace it. If the part is indicated as not procurable, send the rectifier to a higher echelon for repair unless an emergency repair is indicated by the tactical situation.

40. Emergency Repairs—Trouble Location

Trouble may exist in Rectifier RA-36-(*) and rectifier 6RB6B17 at a time when the equipment is most vitally needed. By becoming familiar with the circuit diagram of the model being used, the operator may be able to sectionalize and localize the fault and make a temporary repair to keep the equipment in operation during the period of emergency. The following paragraph gives a chart of major troubles that may occur in parts, and temporary repairs which may be made by the operator.

41. Chart of Emergency Repairs

Defect	Temporary Repair
1. Defective (loose or broken) lead	1. Bare and clean both ends of broken lead; fasten together and make connection fast by soldering or clamping together in some suitable manner.
2. One defective transformer filament winding (in RA-36-N only).	2. Disconnect defective filament winding, and place both filaments in parallel across good filament winding.
3. Defect (open circuit) in main secondary winding between taps.	3. Place jumper between taps in question and compensate for difference in voltage between two circuits by adjusting charging rate controls, keeping ammeter reading no higher than 6 amperes, if possible.
4. Defective reactor	4. Place jumper across defective reactor and continue operation. Control charging rate.
5. Defective (shorted) capacitor (across a-c input) on Rectifier RA-36-(1) and rectifier 6RB6B17.	5. Remove connections and continue operations.
6. One ammeter defective	6. If there is no continuity in meter (open circuit) place jumper across meter.
7. Defective toggle switch	7. If there is no continuity in either leg of switch when closed, place jumper across leg establishing continuity, bearing in mind this connection when stopping unit.
8. Any other major defect in one of the two charging circuits.	8. Unit may be operated temporarily as a half-wave rectifier. If necessary, disconnect defective circuit from transformer secondary.

42. Rustproofing and Repainting

When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surface as follows:

a. Use #00 or #000 sandpaper to clean the surface down to the bare metal. Obtain a bright, smooth finish.

Caution: The use of steel wool, although permitting rapid removal of rust, is not recommended. Minute particles of steel wool frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. When numerous scars and scratches warrant complete repainting, remove the rectifier unit from the case, remove panels and doors, and spray paint over the entire case. Remove rust from the case by cleaning corroded metal with dry-cleaning solvent. In severe cases it may be necessary to use dry-cleaning solvent to soften the rust and sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

43. Unsatisfactory Equipment Report

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, WD AGO Form 468 should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form 54 should be filled out and forwarded through channels.

c. If either form is not available, prepare the data according to the sample form reproduced in figure 24,

WAR DEPARTMENT

UNSATISFACTORY EQUIPMENT REPORT

FOR	TECHNICAL SERVICE: Signal Corps — MATÉRIEL	DATE: 10 Aug. 1944
FROM	ORGANIZATION: 25 Signal Repair Co.	STATION: A.P.O. 95, N.Y., N.Y.
TO	NEXT SUPERIOR HEADQUARTERS: Signal Office-Third Army — STATION	TECHNICAL SERVICE

COMPLETE MAJOR ITEM

NOMENCLATURE	TYPE	MODEL
Rectifier RA-36-N	Tungar Rectifier	N

MANUFACTURER	U. S. A. REG. No.	SERIAL No.	DATE RECEIVED
Trojan Rectifier and Equip Co.	Order No. 1493-P-43	A.P.-3141356	5 Jan 1944

EQUIPMENT WITH WHICH USED (If applicable): Telephone Central Office Set TC-2

DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE

PART NO.	TYPE	MANUFACTURER	DATE INSTALLED
3Z985-85	Off On Control Switch	Arrow-Hart & Hegeman Co.	5 Jan 1944

DESCRIPTION OF FAILURE AND PROBABLE CAUSE (If additional space is required, use back of form): Contact points are burned by arcing when switch is opened

DATE OF INITIAL TROUBLE	TOTAL TIME INSTALLED			TOTAL PERIOD OF OPERATION BEFORE FAILURE				
	YEARS	MONTHS	DAYS	YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
3 Aug 1944	—	—	—	—	6	28	—	—	—

BRIEF DESCRIPTION OF UNUSUAL SERVICE CONDITIONS AND ANY REMEDIAL ACTION TAKEN: Expediency results in elimination of charge reduction before opening switch

TRAINING OR SKILL OF USING PERSONNEL			RECOMMENDATIONS (If additional space is required, use back of form)
POOR	FAIR	GOOD ✓	Connect capacitor 1 MF or larger across D-C terminals

ORIGINATING OFFICER

TYPED NAME, GRADE, AND ORGANIZATION	SIGNATURE
JAMES MOE, CAPT. SIG C 25 SIG REPAIR CO.	James Moe

FIRST ENDORSEMENT

TO CHIEF	TECHNICAL SERVICE: Signal Officer, Washington 25, D.C.	OFFICE	
NAME, GRADE, AND STATION		STATION	DATE

Instructions

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

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

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

U. S. GOVERNMENT PRINTING OFFICE 16—41540-1

TL97011

Figure 24. Unsatisfactory equipment report.

APPENDIX I

MAINTENANCE PARTS

For maintenance parts information, see appropriate pamphlets of Army Service Forces Signal Catalogs SIG 7-TC-2 or SIG 7-TC-10 or SIG 7-TC-5, Organizational Spare Parts, and SIG 8-RA-36, Higher Echelon Spare Parts.

APPENDIX II

REFERENCES

1. Army Regulations

AR 380-5, Safeguarding Military Information.

2. Parts List

Sig 1, Signal Supply Catalogue.
Sig 2, Signal Supply Catalogue, Index.
Sig 3, List of Items for Troop Issue.
Sig 4-1, Allowances of Expendable Supplies.
Sig 4-2, Allowances of Expendable Supplies for Schools, Training Centers, and Boards.
Sig 5, Stock List of all Items.
Sig 7, Organizational Spare Parts.
Sig 8, Higher Echelon Spare Parts.

3. Painting and Preserving

SB 11-76, Signal Corps Kit and Materials for Moisture- and Fungi-resistant Treatment.
TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.

4. Other Technical Publications

FM 21-6, List of Publications for Training.
FM 21-7, List of War Department Films, Film Strips, and Recognition Film Slides.
TM 11-430, Batteries for Signal Communication Except Those Pertaining to Aircraft.
TM 11-335, Telephone Central Office Set, TC-1.
TM 11-338, Telephone Central Office Set, TC-10.
TM 11-340, Telephone Central Office Set, TC-2.
TB Sig 25, Preventive Maintenance of Power Cords.
TB Sig 66, Winter Maintenance of Signal Equipment.
TB Sig 72, Tropical Maintenance of Ground Signal Equipment.
TB Sig 75, Desert Maintenance of Ground Signal Equipment.

5. Forms

WD AGO Form 468, Unsatisfactory Equipment Report.
Army Air Forces Form 54, Unsatisfactory Report.

6. Abbreviations

a-c .....alternating current
amp .....ampere
B & S ....Browning and Sharpe
d-c .....direct current
fig. .....figure
mf .....microfarad
par. .. ...paragraph
v .....volt

WD AGO War Department, Adjutant General's Office

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