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INSTRUCTION BULLETIN

FOR

TELEPHONE REPEATER TP-7

Signal Corps, U. S. Army
Order No. 12930 - Phila. - 42

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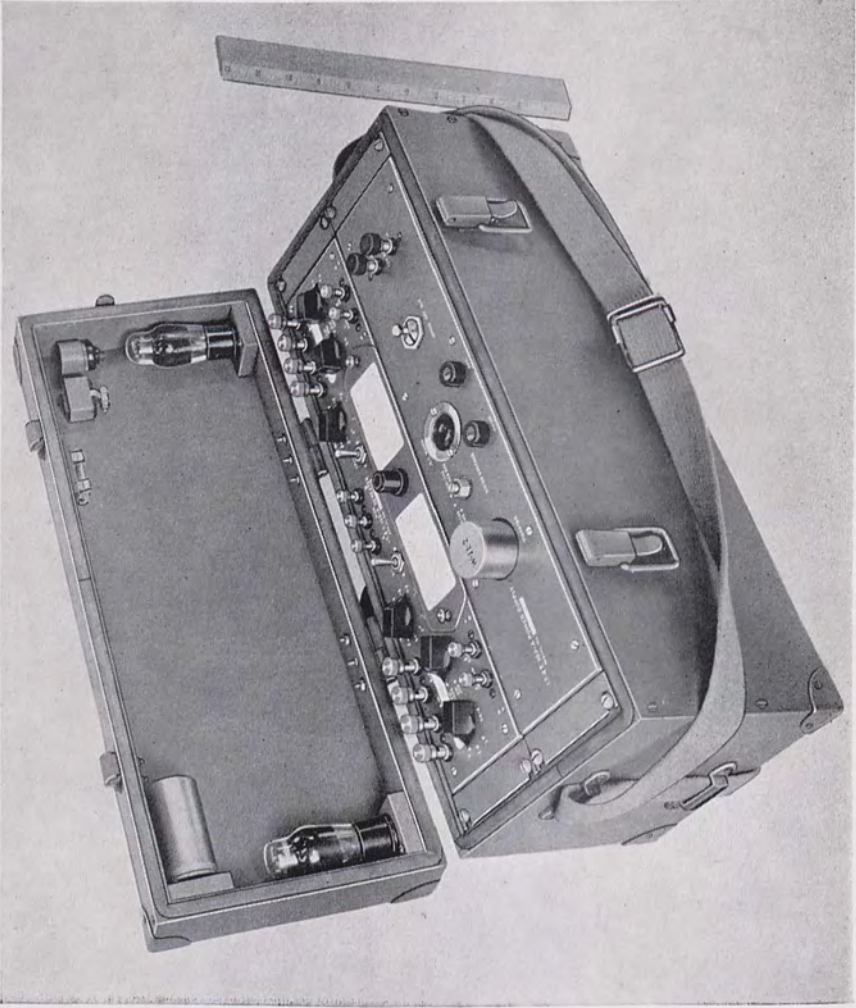
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International Telephone & Radio Mfg. Corp.

UNITED STATES OF AMERICA

October 15, 1942



Telephone Repeater TP-7

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TELEPHONE REPEATER TP-7

1. GENERAL

Telephone repeater TP-7 is intended to use on four wire lines either as a through or a terminal repeater. It is arranged for portable field use or for mounting on a relay rack in an office. It consists essentially of two two-stage amplifiers arranged so that the inputs and outputs can be switched to present either 300 ohm or 1200 ohm impedance to the line as required or 600 ohm impedance when used as a terminal repeater. In order to compensate for variation of the transmission loss with frequency over the line, an equalizer which can be switched is provided. The switched positions make possible a flat gain frequency characteristic or one which slopes to compensate for different lengths of line. Each amplifier has an operating gain of about 35 db at 1000 cycles per second irrespective of the equalizer setting. Under normal operating conditions the repeater is capable of handling a power level of +20 dbm.

A power unit is provided, which supplies the required power for operating the repeater from either the A. C. mains or from a 12 volt battery with a 100 cycle per second vibrator. In addition, a means is provided so that the power may be obtained from local 24 - 130 v batteries.

The current drains for these methods of supplying power are as follows:

<i>Power Supply</i>	<i>Voltage</i>	<i>Current</i>
A. C. (Line)	110	110 milliamperes
A. C. (Line)	220	55 milliamperes
Battery	12	1 ampere
Office Battery	24	150 milliamperes
Office Battery	130	20 milliamperes

2. MECHANICAL DESCRIPTION

2.1 Repeater Unit

The repeater unit comprises a chassis type assembly $17'' \times 5\frac{3}{16}'' \times 3\frac{1}{2}''$ as shown in photographs Fig. 1 and Fig. 2. This chassis has mounted on it the component parts of the two amplifiers and is enclosed in a metal dust cover, as shown in photograph Fig. 3. The location of the necessary gain controls, switches and terminals for making the connections to the lines for operating the repeater are shown in the upper panel of the rack mounted repeater as in photograph Fig. 4.

The equipment for each amplifier occupies one half the length of the chassis. The equalizer coil, input and output coil and gain control with associated switches are mounted in this sequence from either end toward the center. The two tubes of each amplifier are mounted in a well left and right of the vertical center line and are covered by a removable plate so that they are readily accessible. A plug is mounted on the bottom of the chassis for making the power connections by means of the special cable supplied with the repeater.

2.2 Power Unit

The equipment for the power supply is assembled on a chassis similar in design to the repeater unit as shown in photographs Fig. 5a and Fig. 5b and in the bottom panel of Fig. 4. It contains the power transformer, rectifier and filtering arrangements for operating the heaters and plates of the tubes in the repeater from A. C. mains. When a 12 volt storage battery is the source of power, it is used in conjunction with a 100 c. p. s. vibrator to energize the transformer feeding the rectifier. Under this condition the heaters of the vacuum tubes are operated directly from the battery. Terminals, fuses and switches are mounted on the panel of the chassis assembly. A plug for connecting power to the repeater is mounted on the bottom of the chassis.

2.3 Assembled Units

Both the repeater and the power unit have brackets at the ends so that they can be mounted on a relay rack as shown in Fig. 4 or in a case as shown in Fig. 6a. A wooden case is provided for mounting both the repeater unit and the power unit. This case is 20" x 8" x 9 $\frac{1}{4}$ " and is equipped with straps so that it is readily portable, as shown in photographs Fig. 6a and 6b. The case with repeater and power units mounted in it weighs about 38 pounds. When the cover is opened, the terminals, switches and controls are exposed so that they are readily available for making connections and operation, as shown in photograph Fig. 6a. The power from the power unit is supplied to the repeater unit by means of a cable with a socket on each end, which matches the plugs mounted on the units. Two spare tubes, two spare fuses, a socket for connecting the repeater to a 24 v - 130 v supply, a spare vibrator and a spare socket to fit the plug marked A. C. Mains are mounted in the cover of the case.

When the repeater and power unit are mounted together on a relay rack, the same cable with sockets on each end as is used with the case may be used for making the connection to supply the power to the repeater unit, otherwise a longer cable between plugs will be required. In case the repeater is installed where the office batteries are available for operating it, either on an emergency basis or in place of the power unit, a socket is provided which fits the plug in the repeater and can be wired so that the proper connections can be readily made to the batteries, as shown in Fig. 12. This socket is mounted in the cover with the spare parts.

3. CIRCUIT DESCRIPTION

3.1 Repeater Unit

The repeater unit consists of two amplifiers, with an equalizer for each and 3 position switches to change the gain frequency characteristic from flat to different slopes to compensate for line conditions. Switches are also provided to change the input and output impedance of the amplifiers from 300 to 1200 ohms and to connect the input of one amplifier and the output of the other to a two-wire 600 ohm connection for terminal use. The diagrams of Fig. 7b show the different arrangements possible when this repeater is connected on a four-wire line.

The two amplifiers are identical in design. The circuit of one is shown schematically in Fig. 8. The transformer T1A actually consists of a repeating coil and input transformer contained in one case. The equalizer is designed to have a nominal impedance of 600 ohms and is connected between the repeating coil and the input transformer.

The repeating coil has an impedance ratio of 300:600 ohms between the 1-3 and 6-7 windings and 1200-600 ohms between the 1-3, 4-5 windings connected in series and the winding 6-7. The two halves of the 1-3 winding and the windings 1-3 and 4-5 are accurately balanced so that the terminals 2 and 4 may be used as a phantom tap for through signaling at 20 c.p.s.

The proper connections, depending on whether it is the two-wire side of a terminal repeater or on the impedance of the line for four-wire operation, are obtained by means of a 3 position switch shown schematically in Fig. 9 as S-1. Position 1 connects two windings of the T1A input coil of amplifier A to two windings of the T2B output coil of amplifier B so as to give a two way or hybrid coil connection. It will be noted that the windings 4-5 of each coil are connected in series opposing through a condenser so that transmission from the two-wire line divides equally between them. The currents induced in the windings 1-3 of each coil, which are connected in series aiding through the condenser and 600 ohm resistance to form the network circuit, are in opposite directions so that little or no energy is lost in the network depending on the balance between the 600 ohm resistance and the line impedance. The energy from the line is divided between the windings 4-5 of T1A and T2B coils so that one half is transmitted into the input of the A amplifier and one half into the output of the B amplifier and is lost in the plate circuit. On the other hand, for transmission coming from amplifier B, currents are induced in the line and network circuits through the windings 4-5 and 1-3 of the T2B coil. These currents flow into windings 4-5 and 1-3 of the T1A coil in opposite directions so that no energy passes into amplifier A when the terminal equipment is balanced by the network. One half the energy received is transmitted to the two-wire line and one half is lost in the network. For hybrid coil operation, the windings 1-3 and 4-5 of each of the coils T1A and T1B must be accurately balanced. The condenser in the line side of the hybrid coil connection is required to block any direct current on the line and to provide phantom taps which are taken from each side of this condenser. This condenser is balanced in the network circuit by one of approximately equal value. In order to facilitate replacement, if one of these condensers becomes defective, they are selected in groups of approximately equal capacities and marked A, B or C, the effective one should be replaced from the group corresponding to the letter on the one replaced. If one of the same letter is not available, then both should be replaced with a pair from one of the other groups.

Position 2 connects the windings 1-3 of T1A and T2B coils to the

input and output four-wire terminals respectively to give the 300 ohm impedance and connect tap 2 in each case to the terminals marked Ph-In and Ph-Out. Position 3 connects the windings 1-3 and 4-5 of each of the coils in series and to the input and output four-wire terminals to provide the 1200 ohm impedance. It also connects terminal 4 of each of the coils to the terminals Ph-In and Ph-Out.

The input transformer has an impedance ratio to give 600 ohms on the low side when terminated in the 250,000 ohm potentiometer on the high side. This potentiometer is connected to the grid of the V1A (VT 198A) tube so that the gain of the amplifier can be controlled continuously in a range from 0 output to a gain of about 35 db. The V1A tube is resistance coupled to the V2A (VT 198A) tube which, in turn, is connected to the output transformer T2A terminals 8 and 9.

Transformer T2A has a monitoring winding 6-7 which is connected between a monitoring terminal and ground. Terminal 6 is also connected through 11,300 ohms to terminal 9, of the T1A transformer, and to ground through a 600 ohm resistance to give negative feedback in order to stabilize the gain of the repeater for variations in the operating voltages. The impedance ratio of windings 8-9 and 1-3 or 8-9 and 1-3, 4-5 in series is such as to give the optimum impedance termination for the plate of the V2A tube when winding 1-3 is terminated with 300 ohms or winding 1-3, 4-5 in series are terminated in 1200 ohms. The windings 1-2, 2-3 and 1-3, 4-5 are accurately balanced so that coil taps 2 and 4 may be used as phantom taps for connection to the corresponding terminals of the T1A or T2B transformer to bypass signaling currents of 20 c.p.s. Depending on the line impedance, the proper impedance and tap for the A OUT and B IN amplifier is selected by means of a two position switch, S-2 shown in Fig. 9, in the same manner as for A IN and B OUT, except that no two-wire connection is provided. Position 1 is for the 300 ohm and position 2 for the 1200 ohm impedance.

The biasing voltages for the vacuum tubes are obtained from cathode resistances. The voltages at the power terminals are 110 v for the input stage and 130 v for output stage when measured with a high resistance voltmeter and 12 v for two heaters in series.

If none of the elements of the equalizer were connected, the over-all gain between the input and output terminals would be about 57 db at 1000 c.p.s. with a fairly flat gain frequency characteristic between 300 to 10,000 c.p.s. However, the repeater is designed so as to give a maximum gain at 1000 c.p.s. of about 35 db which is the value obtained when the equalizer is set to position 3. A pad of 3.8 db is added to the Pos. 2 setting of the equalizer and a pad of 21.5 db for the Pos. 1 (flat gain) setting in order to maintain 35 db gain on all settings of the equalizer switch. This obviates changing the gain control potentiometer when changes in equalization are made. Position 2 will equalize about 7.5 miles and position 3 about 15 miles of British army field quad cable. The equalizer circuits for each of the three positions are shown in Fig. 10.

The gain control potentiometer is graduated in 10 equal steps and marked from 0 to 10. Gain frequency characteristics of the repeater for different positions of the equalizer and loss frequency characteristics of the cable are shown in Fig. 11.

The repeater is capable of handling an output power of 100 milliwatts or +20 dbm with about 3% harmonics.

A neon lamp with transformer (T-3) is provided to be used as a level indicator. This indicator may be connected across the output of either amplifier by throwing the "level" switch S4 to either A or B side, as shown in Fig. 8. The gain control is then adjusted until the lamp glows, which indicates an output of 6 to 8 dbm.

The monitoring terminals A and B are connected through a switch marked TALK to the monitoring windings and also to the output terminals of the T2A and T2B coils respectively. This arrangement makes it possible to monitor and talk on the line in either direction from the monitoring terminals.

3.2 Power Unit

The circuit for furnishing power for the repeater is shown in Fig. 12. It is arranged for operation either from the A. C. supply of 100-125 or 200-250 v or from a 12 volt battery. When the A. C. is used and connected to the socket marked A. C. Mains, the switch S6 should be thrown to the position marked "MAINS" and the Switch S7, which connects the mains voltage to the transformer T, adjusted to the voltage of supply. This adjustment should always be made with switch S6 open in order to prevent the possibility of extreme voltages at the high voltage winding. The mains voltage is stepped up by the transformer T and the high voltage from terminals 10-11 rectified by the rectifier, filtered and resistances provided to give the required D. C. voltages at the terminals. The heaters are supplied from a 12 volt winding 13-14 connected through one of the poles of S6 switch. When the battery is used, the switch S6 is thrown to position marked BAT and the battery connected to terminals marked 12 v with polarity as marked. This operates the vibrator which, connected to a winding of the transformer, generates the high voltage across terminals 10-11 which is rectified and filtered, as previously, giving the required D. C. voltages. The power for the heaters is furnished directly from the battery through a pole of the S6 switch when thrown in the BAT direction.

After several thousand hours of service, the rectifier resistance goes up due to aging which reduces the 130 and 110 volt A. C. plate battery voltages. At that time the connection on terminal 11 of the power transformer may be removed and connected to the higher potential terminal 12 to compensate for this change.

4. OPERATION

4.1 General

A four wire circuit uses two pairs of wires, one pair for talking in

one direction and the other pair for the other direction. Repeaters are usually installed at the terminals and between at regular intervals where ever possible. The gains of the intermediate repeaters make up for the loss of the line preceding each one. In the case of the terminal repeaters, one side is connected through a hybrid coil arrangement so that transmission can take place in either direction from the switchboard. The loss frequency characteristic of the line is compensated for by the equalizer except in case of the amplifier of the terminal repeaters sending into the line, in which case the gain frequency characteristic is adjusted to be flat because the succeeding line is equalized in the next repeater on the line. Fig. 7a shows schematically a four-wire circuit equipped with repeaters. While the length of the cable between repeaters may vary, this arrangement shows 15 miles of British field quad cable, which is the maximum length of this type of cable that can be equalized up to 10 K. C. with the available repeater gain. Equalization is provided for $7\frac{1}{2}$ and 15 miles of this cable, the proper choice of which will give a satisfactory compromise equalization for any required length up to 15 miles.

4.2 Power Connection

When the repeaters with power units are installed at the spacing determined upon, they may be placed in operation by connecting power from the mains or a 12 volt battery to the power unit. If the mains are used, a power cable with plug and socket connector, as shown in Fig. 13, is provided to connect between the mains outlet and to a plug mounted on the power unit marked A. C. MAINS. If the battery is used, it is connected to the terminals marked 12 V BAT. with the polarity as indicated. The current drains for these methods of supplying power are as follows:

<i>Power Supply</i>	<i>Voltage</i>	<i>Current</i>
A. C. (Line)	110	110 milliamperes
A. C. (Line)	220	55 milliamperes
Battery	12	1 ampere
Office Battery	24	150 milliamperes
Office Battery	130	20 milliamperes

If the repeater unit and power unit are in the case, they have been connected by a cable, with sockets on each end, before mounting in the case, so that power will be supplied to the tubes by operating the power switch marked MAINS OFF BAT to MAINS or BAT, depending on the source of the power. If the units are relay rack mounted, the connections between them should be made by means of this socket ended cable before closing the power switch. Before closing the switch to the MAINS side, the switch marked MAINS VOLTAGE should be adjusted to a point within the range of the supply voltage in order to prevent high voltages which would occur if the switch was on a low voltage point when higher supply voltages are used. A screwdriver or coin is required for making this adjustment in order that once made there is less danger of it being accidentally changed.

If the repeater is located where it can be operated from the central office batteries, the spare socket provided for that purpose should be wired, as shown in Fig. 12, and plugged into the receptacle on the repeater unit.

With power connected to the repeater unit it should operate satisfactorily. However, if the means are available, it is desirable to make a gain test before connecting it to the line.

4.3 Line Connections

The switches marked S1 and S2 should be operated to give the required impedance. For a terminal repeater, S1 should be set at 600 and S2 at 300 for the cable or to 1200 if the line impedance is approximately that value. For an intermediate repeater both S1 and S2 should be set at 300 or 1200, whichever more nearly approaches the line impedance.

The connections between the cable and repeater at each point are shown in Fig. 13 for both the terminal and intermediate repeaters. The connections of the pairs of the quad to the repeaters may be determined by talking tests between adjacent repeaters. The pairs, identified as incoming in either direction, should be connected to the two terminals marked A IN and B IN between them and those identified as outgoing should be connected to terminals marked A OUT and B OUT between them. In the case of a terminal repeater, the pair leading from the switchboard should be connected to the terminals marked 2-W between them.

4.4 Circuit Operation

With these connections made for each repeater the circuit is ready for "lining up," which is done by first setting the equalizer in either direction to correspond to the known length of cable preceding the repeater except in the case of the sending side of the terminal repeater which is always set on step 1 (flat gain). This being done, the proper gain for each repeater may be determined by sending a milliwatt of 1000 c.p.s. tone from the two-wire side of first one and then the other terminal repeater and adjusting the gain of the successive repeaters, with the LEVEL switch closed in the proper direction, until the neon lamp just glows, except that the gain of the receiving side of the distant terminal repeater should be adjusted to give the required net loss as determined, wherever possible, by means of an overall transmission measurement. The minimum net loss is determined by the balance of the terminating circuit against 600 ohms, a point below which the circuit would tend to sing.

4.5 Monitoring and Talking

In order to monitor in either direction a telephone set or monitoring receiver (not furnished with the repeater) should be connected between either the terminal A or B and the middle terminal or between A and B for both directions. In order to talk on the line in either direction, a telephone set should be connected to the terminals A and B and switch marked TALK thrown to A or B the direction required. See Fig. 14.

4.6 Signalling

If it is required to signal with 20 c.p.s. on the phantom, the terminals A IN and A OUT of the pairs marked PH may be connected and also B IN and B OUT of the same pairs, or for cross phantoming A IN is connected to B IN, and A OUT is connected to B OUT. The cross phantoming connections are preferable because it breaks up a possible crosstalk coupling path around the two amplifiers of the repeater.

5. PARTS LIST

5.1 Telephone Repeater TP-7

The Telephone Repeater TP-7 consists of:

<i>Part No.</i>	<i>Name</i>
W93-22	Telephone Repeater Unit
W93-23	Power Unit
W93-21	Outer Case Equipped with Spares
W93-11	A. C. Mains Power Cable
W93-12	Current Supply Cable

5.2 W93-22 Telephone Repeater Unit

<i>Part No.</i>	<i>*Marking On Item</i>	<i>Name</i>
W32-2		Panel
W44-2		Chassis
W33-1		Tube Cover Plate
W43-18		Tube Bracket
W42-7		Dust Cover
W43-9		Mounting Bracket
W28-3		Binding Post Mounting Strip for Line Connections
W28-5		Binding Post Mounting Strip for Monitoring Terminals
W28-4		Binding Post Mounting Strip for "PH" Terminals
W43-11		Resistor Mounting Bracket for Part W30-11 Right Hand
W43-24		Resistor Mounting Bracket for Part W30-11 Left Hand
W19-9		Plug (For current supply)
W17-1		Tube Socket
W19-3		Panel Mounting Socket for Neon Lamp
W93-8		Lamp Cap
W20-7	S1, S3	4 Pole—2 Position Switch
W20-8	S2	5 Pole—3 Position Switch
W93-10	S5	Talking Key
W93-9	S4	Level Indicator Key
W27-1		Binding Posts $\frac{3}{8}$ " Head

<i>Part No.</i>	<i>*Marking On Item</i>	<i>Name</i>
W27-3		Binding Posts 1/2" Head
W26-1		Pointer Knob
W30-11		Resistor Mounting for 12 Resistors
W30-10		Resistor Mounting for 4 Resistors
W7-2	R13	Volume Control 250,000 Ohms
W72-1		Neon Lamp
W72-5	VT 198A	Vacuum Tube Type 6G6-G
W52-6		Volume Control Grounding Clamp
W49-8		Plug Support
W43-12		Condenser Bracket
W43-8		Resistor Mounting Bracket for Part W30-10
W15-6	T2	Output Transformer
W15-4	T1	Input Transformer
W14-2	EQ	Equalizer
W15-3	T3	Level Indicator Transformer
W3-10	C3	Condenser 2 Mfd.
W3-10	C4	Condenser 2 Mfd.
W5-1	C7	Condenser 0.01 Mfd.
W3-11	C5 C6 C8	Condenser Block 0.5 - 0.5 - 0.5 Mfd.
W3-4	C9	Condenser 0.0002 Mfd.
W8-4	R5	Resistor 600 Ohm, 1/2 Watt
W8-4	R6	Resistor 600 Ohm, 1/2 Watt
W8-4	R14	Resistor 600 Ohm, 1/2 Watt
W8-4	R22	Resistor 600 Ohm, 1/2 Watt
W8-10	R10	Resistor 510 Ohm, 1/2 Watt
W8-10	R11	Resistor 510 Ohm, 1/2 Watt
W8-8	R12	Resistor 82 Ohm, 1/2 Watt
W8-14	R15	Resistor 11,300 Ohm, 1/2 Watt
W8-13	R16	Resistor 6200 Ohm, 1/2 Watt
W8-18	R19	Resistor 360,000 Ohm, 1/2 Watt
W8-17	R18	Resistor 43,000 Ohm, 1/2 Watt
W8-6	R1	Resistor 10 Ohm, 1/2 Watt
W8-7	R2	Resistor 56 Ohm, 1/2 Watt
W8-12	R3	Resistor 5600 Ohm, 1/2 Watt
W8-16	R4	Resistor 27,000 Ohm, 1/2 Watt
W8-15	R17	Resistor 20,000 Ohm, 1/2 Watt
W8-19	R21	Resistor 4700 Ohm, 1 Watt
W8-9	R8	Resistor 160 Ohm, 1/2 Watt
W8-9	R9	Resistor 160 Ohm, 1/2 Watt
W8-11	R7	Resistor 1000 Ohm, 1/2 Watt
W8-2	R20	Resistor 430 Ohm, 1/2 Watt
W52-9		10-32 Stud
W50-4		Cable Clamp
W43-13		Bracket for Volume Control

<i>Part No.</i>	<i>*Marking On Item</i>	<i>Name</i>
W59-21		Panel Bearing for 1/4" Shaft

5.3 W93-23 Power Unit

W32-3		Panel
W44-1		Chassis
W42-5		Dust Cover
W49-5		Mounting Plate
W50-5		Collar
W43-8		Resistor Mounting Bracket
W49-6		Plug Mounting Spacer
W15-9	T	Power Transformer
W12-2	L4	Battery Filter Choke
W12-1	L3	Filter Choke Assembly
22DO479	RECT-1	Rectifier
W3-7	C17	Condenser Block
W3-5	C15	Condenser 0.05 Mfd 1000 D. C. W. V.
W3-22	C12 C13 C14	Condenser Block 0.001—0.001—0.001 Mfd.
W3-6	C10	Condenser .05 Mfd. 400 D. C. W. V.
W2-2	C11	Condenser Electrolytic 1000 Mfd.
W5-2	C16	Condenser 0.1 Mfd.
W2-3		Wafer for Mounting Electrolytic Condenser
W8-15	R26	Resistor 20,000 Ohm, 1/2 Watt
W8-15	R27	Resistor 20,000 Ohm, 1/2 Watt
W8-21	R24	Resistor 51,000 Ohm, 1 Watt
W8-20	R23	Resistor 47,000 Ohm, 1 Watt
W11-2	VIB-1	Vibrator—12 Volt D. C. 100 c.p.s.
W17-3		Socket for Vibrator—4 Prong
W20-6	S6	Switch—4 Pole—Double Throw
W20-5	S7	Voltage Adjusting Switch
W19-7		Flush Type Plug
W19-9		Plug 8 Conductor
W79-5		Fuse 0.5 Ampere
W79-4		Fuse 2.0 Ampere
W17-6		Fuse Holder
W28-6		Binding Post Mounting Strip
W27-4		Rubber Covered Binding Post
W60-4		Vibrator Clip
W30-10		Resistor Mtg. for 4 Resistors
W52-9		Stud #6-32
W52-17		Stud #10-32
W43-10		Chassis Mounting Bracket
W43-22		Condenser Bracket

<i>Part No.</i>	<i>*Marking On Item</i>	<i>Name</i>
5.4 W93-21 Outer Case Equipped with Spares		
W93-13		Outer Case
W70-5		Strap
W43-21		Spare Tube and Vibrator Bracket
W17-1		Tube Socket
W17-4		Vibrator Socket
W72-5	VT198A	Vacuum Tube 6G6-G
W11-2	V1B-1	Vibrator
W50-7		Spare Plug Clamp
W19-11		Central Office Battery Cable Socket
W19-6		Extension Cord Connector
W60-5		Fuse Clip
W79-5		Fuse 0.5 Ampere
W79-4		Fuse 2 Ampere
W63-9		Operation Label
W63-8		Schematic Label
W59-14		Escutcheon Pin #18 x 3/8"
W62-1		Instruction Book

5.5 W93-11 A. C. Mains Power Cable

<i>Part No.</i>	<i>Name</i>
W19-6	Connector Socket
W19-8	A. C. Line Plug
W64-98	2 Conductor Flexible Cord
W74-11	Fibre Washer

5.6 W93-12 Current Supply Cable

<i>Part No.</i>	<i>Name</i>
W65-3	6 Conductor Cable
W19-10	Socket 8 Conductor
W42-6	Socket Cover

* A or B stamped on item after the part number designates Channel A or B.

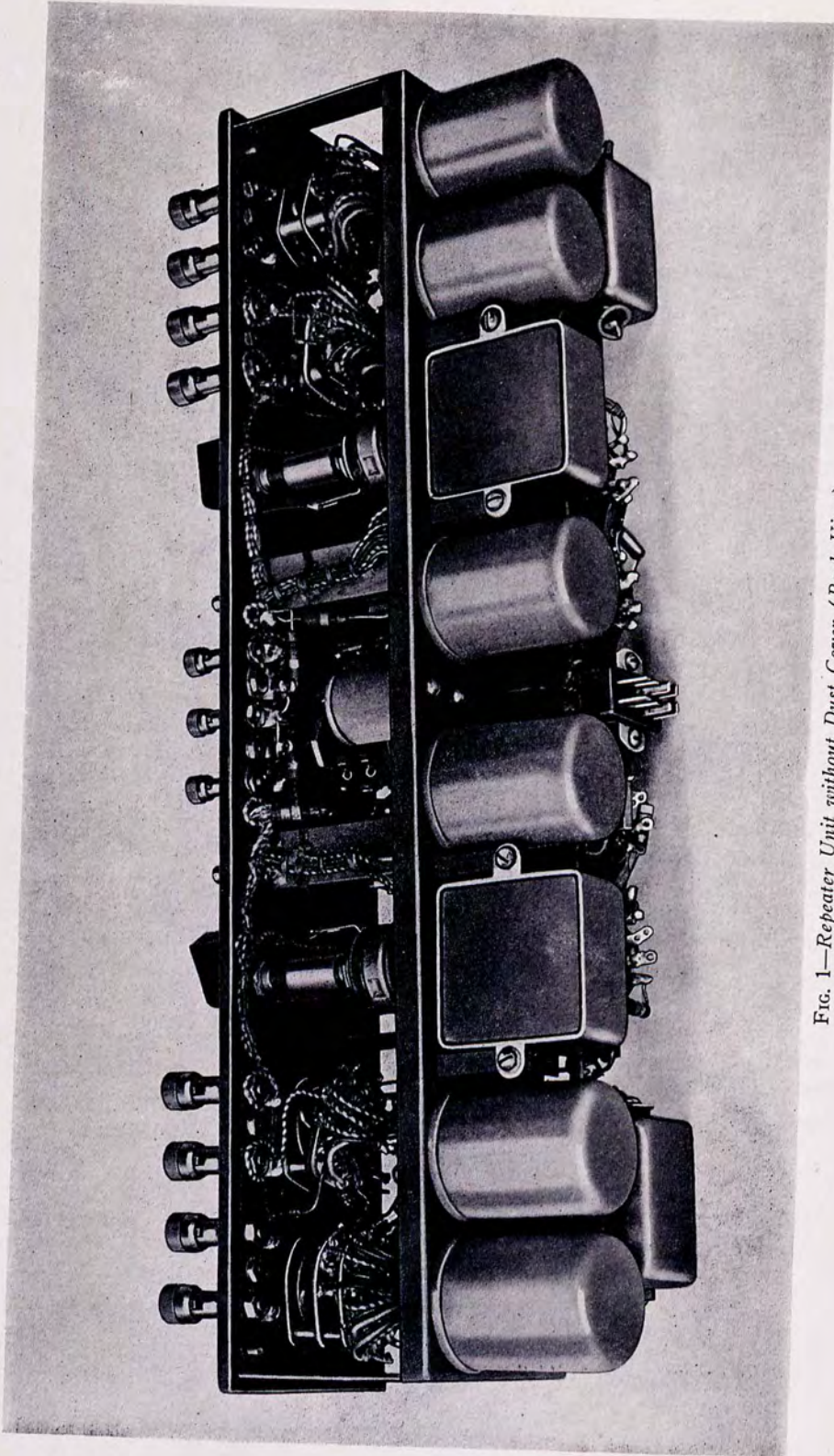


FIG. 1—Repeater Unit without Dust Cover (Back View)

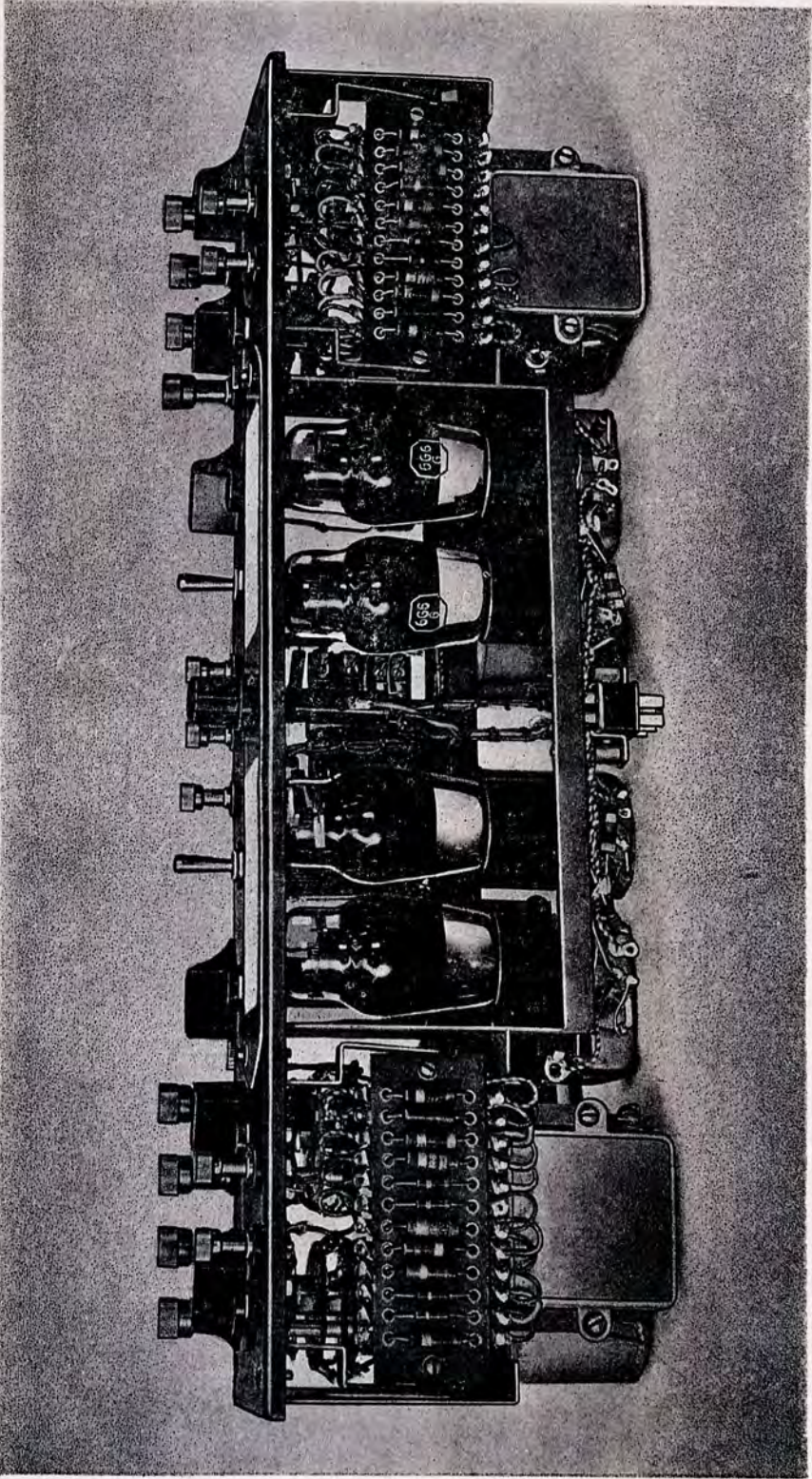


FIG. 2—Repeater Unit without Dust Cover (Front View)

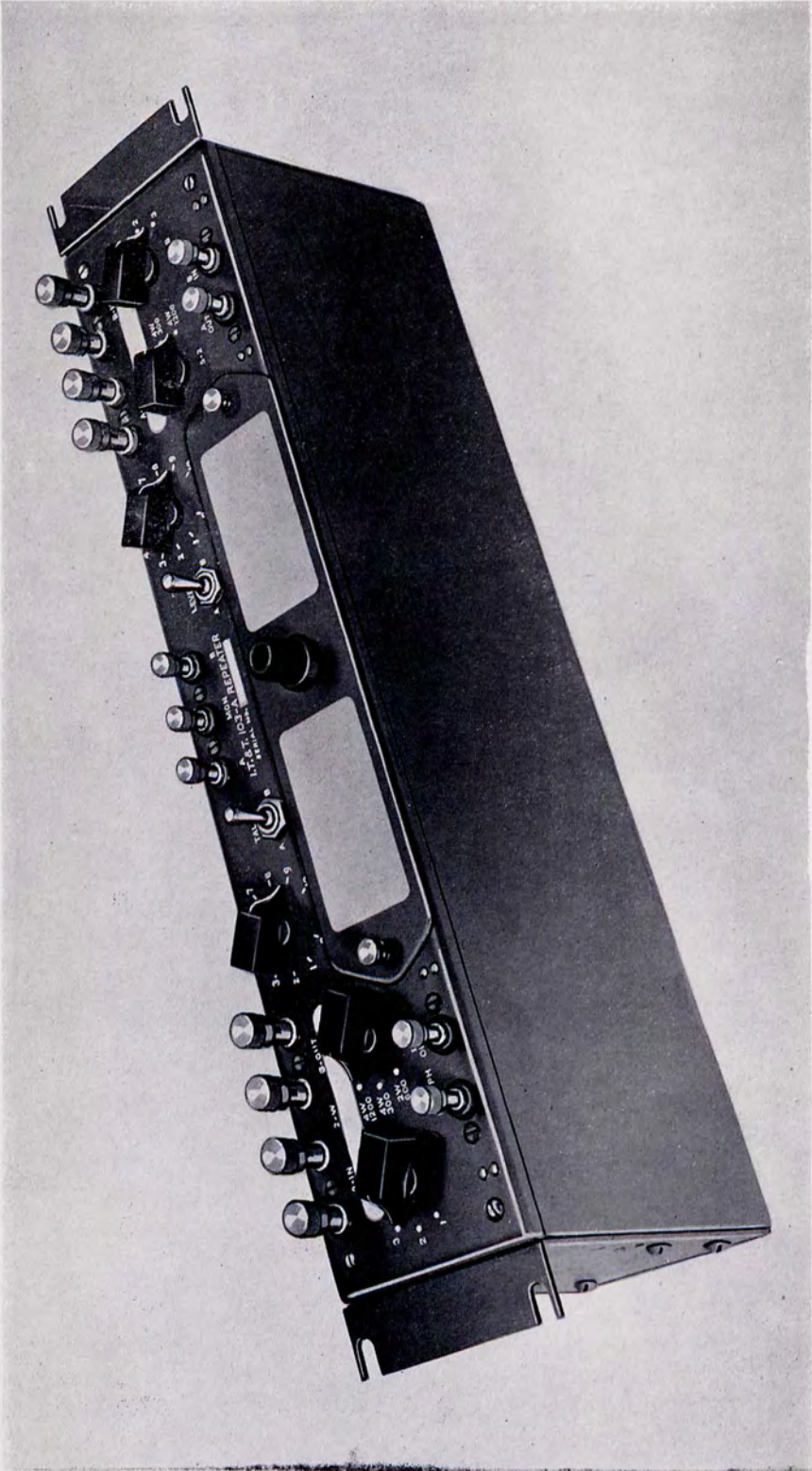


FIG. 3—Repeater Unit

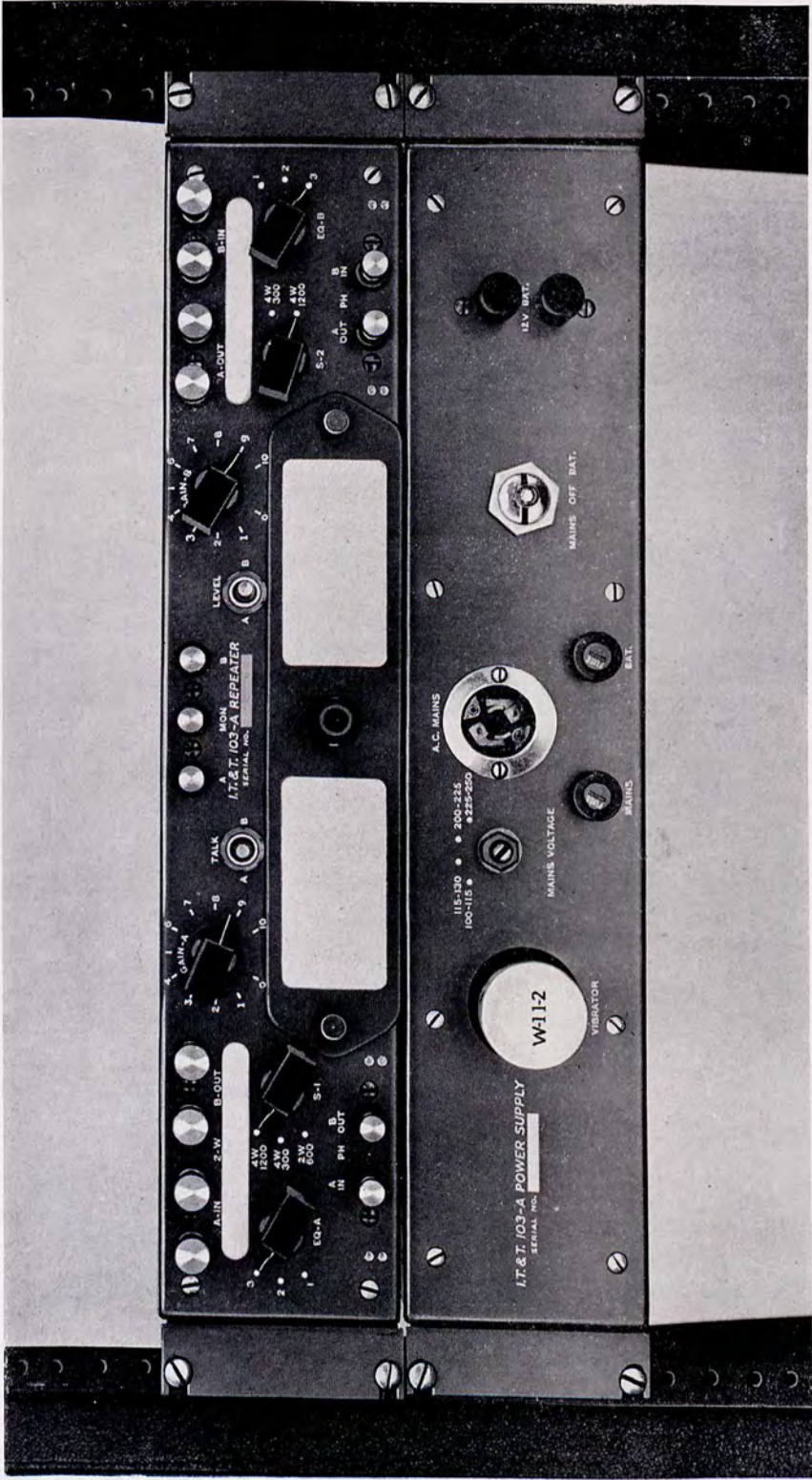


FIG. 4--Relay Rack Mounting of Telephone Repeater TP-7

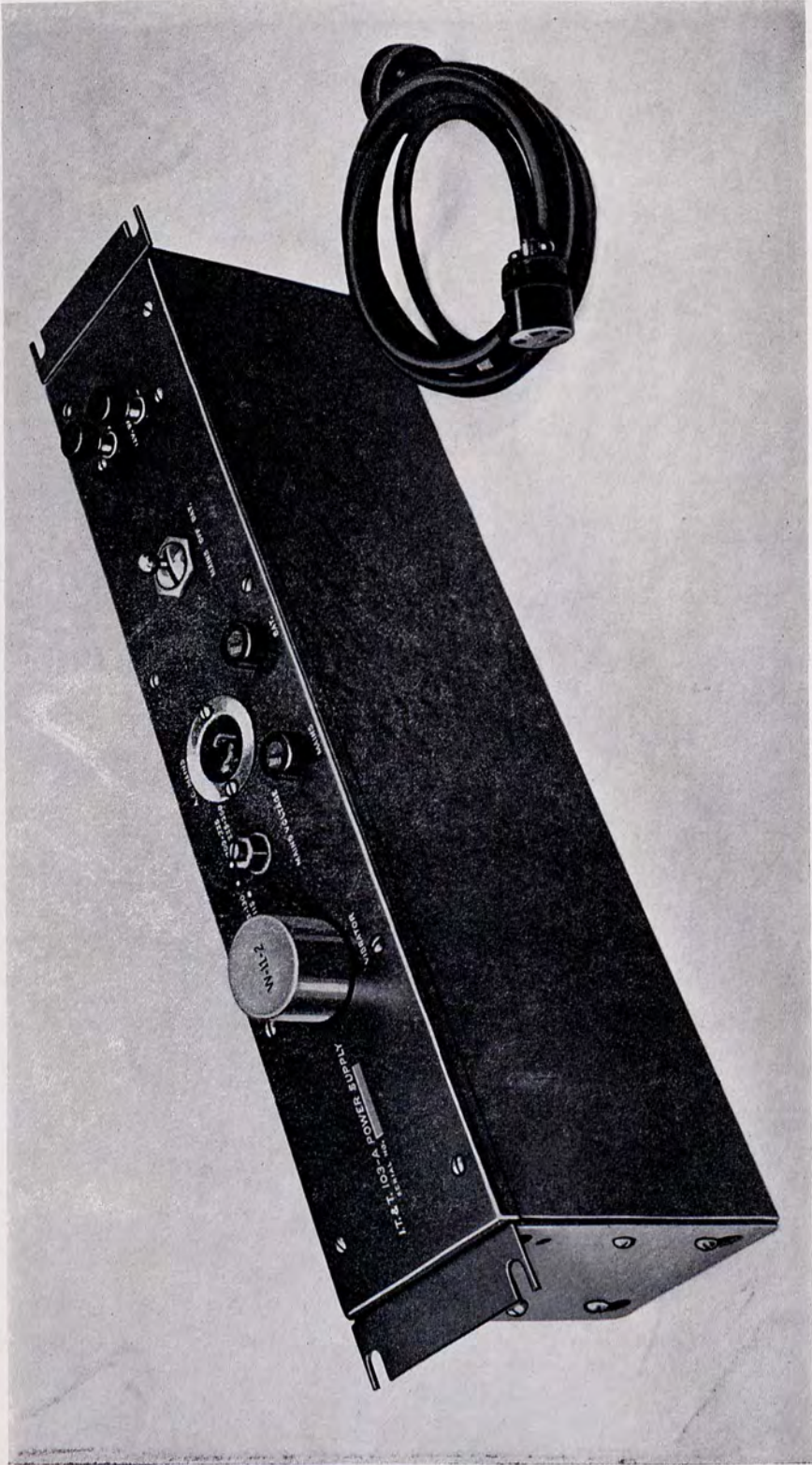


FIG. 5a—Power Unit

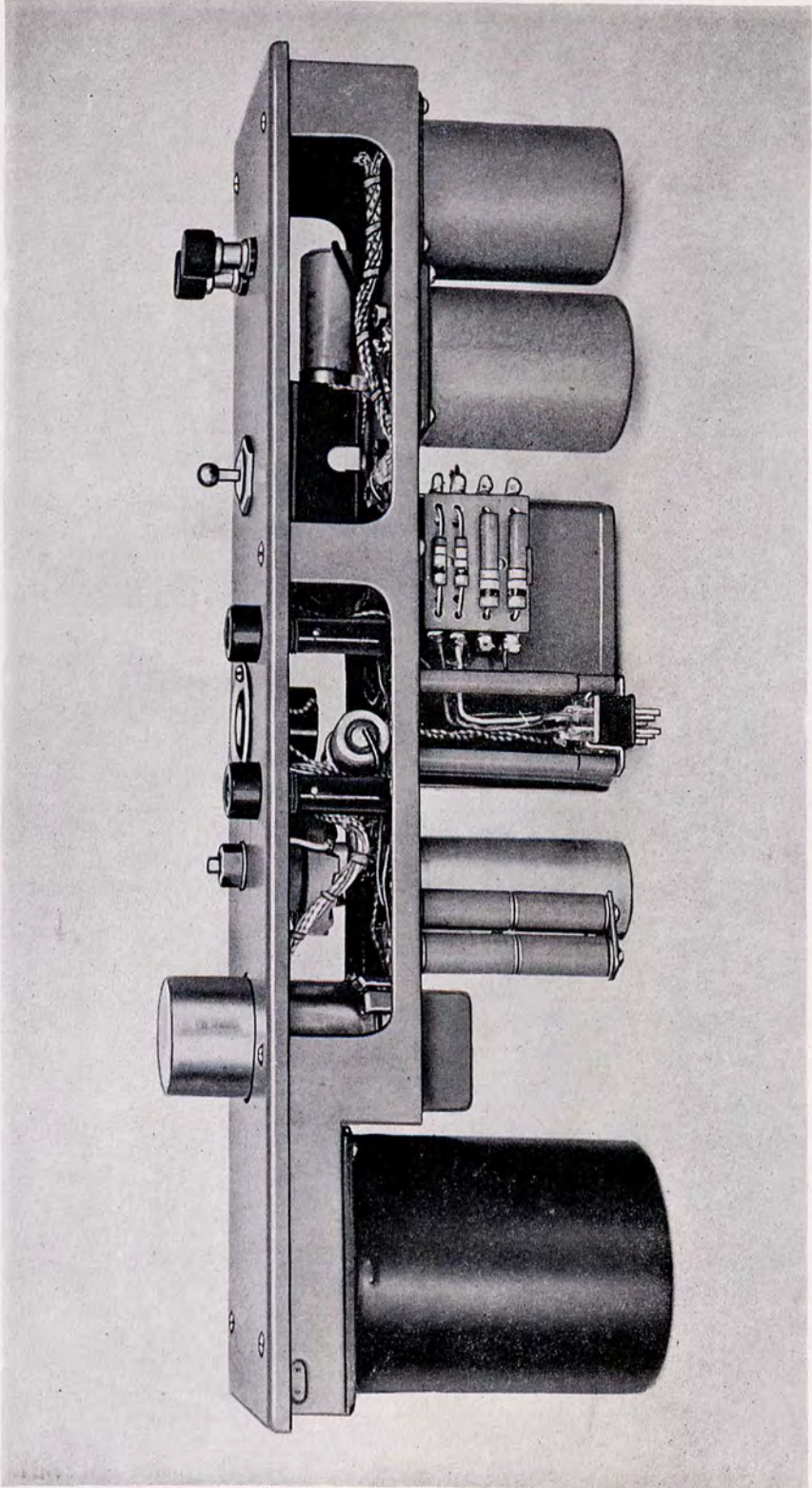


FIG. 5b—Power Unit without Dust Cover

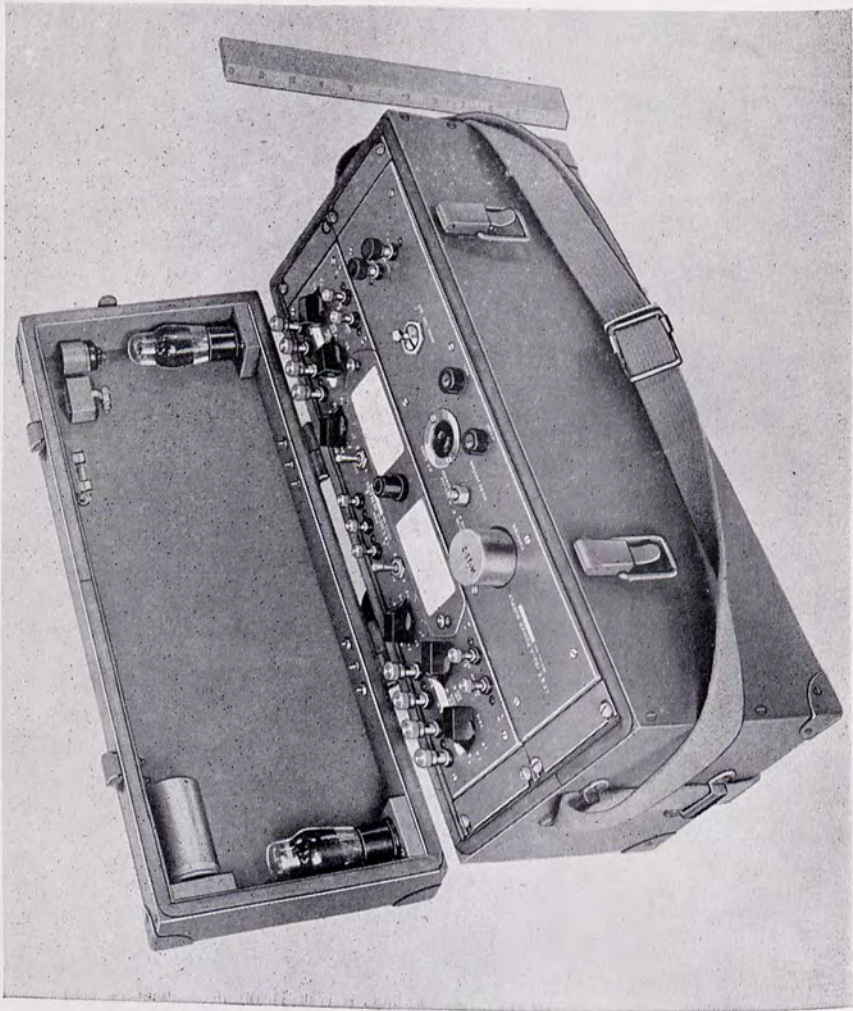


FIG. 6a—Telephone Repeater with Case Cover Open

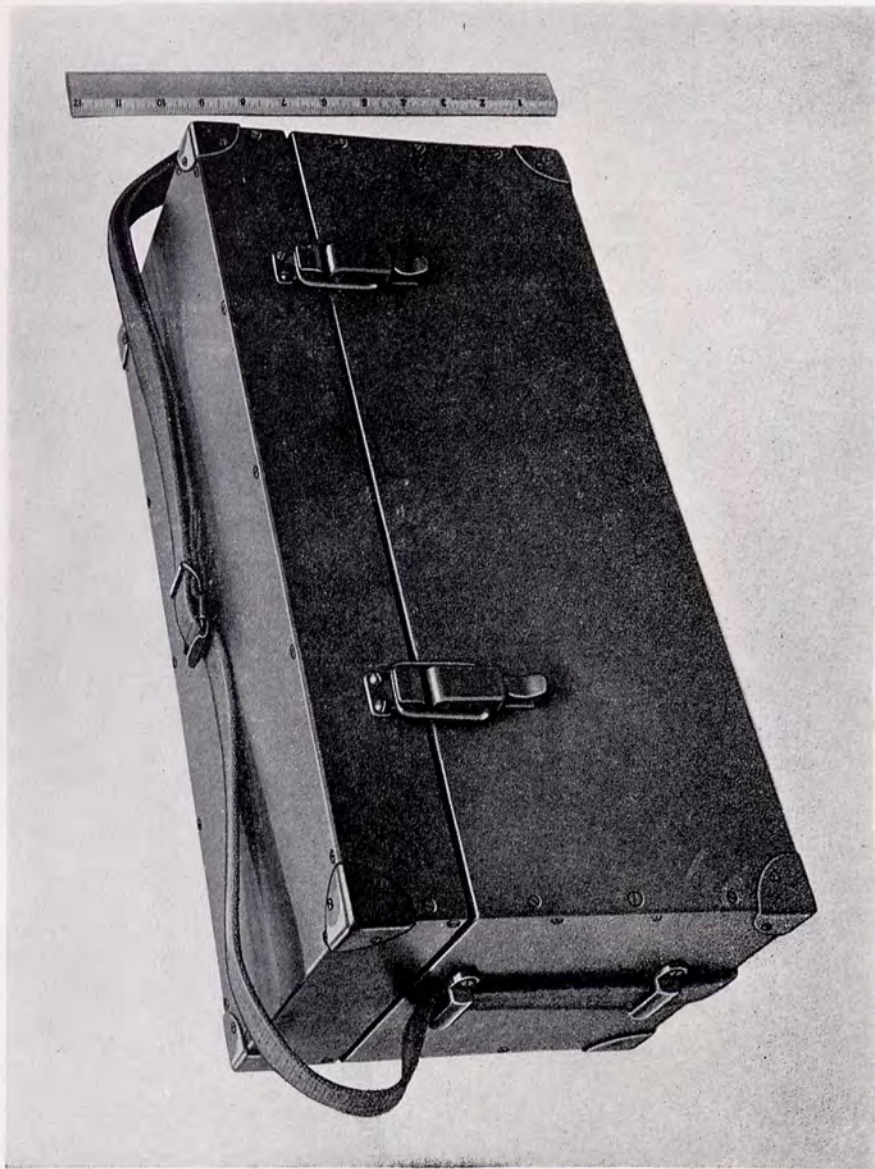


FIG. 6b—Telephone Repeater with Case Cover Closed

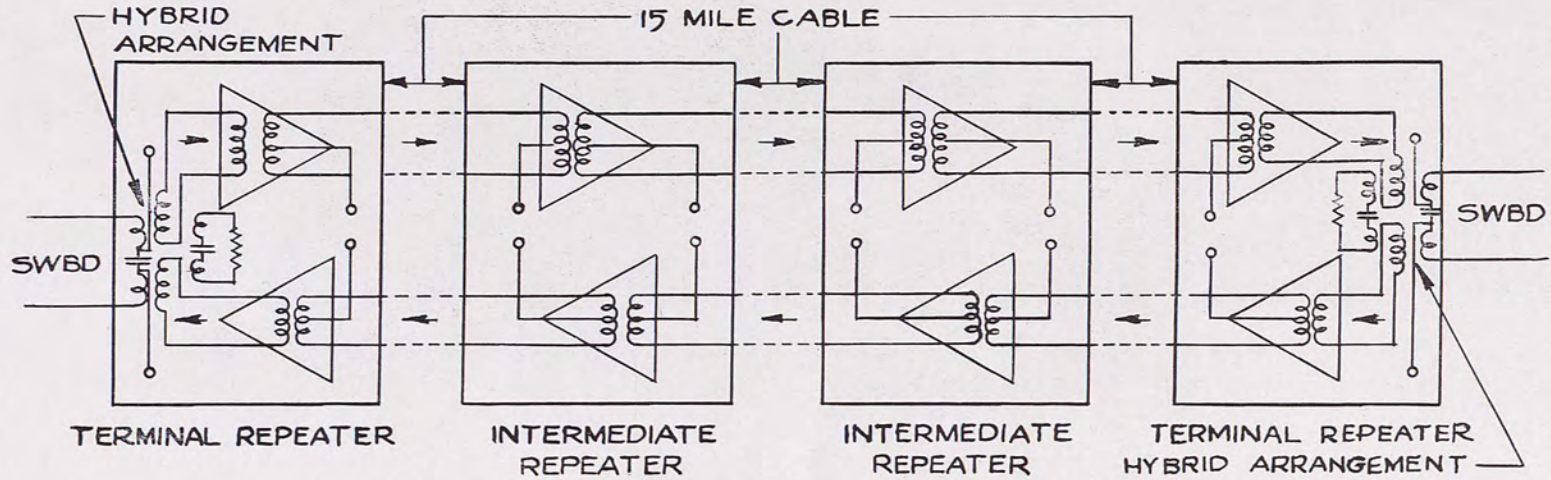
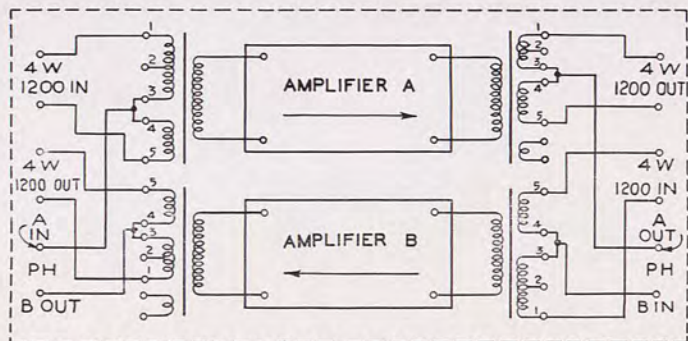
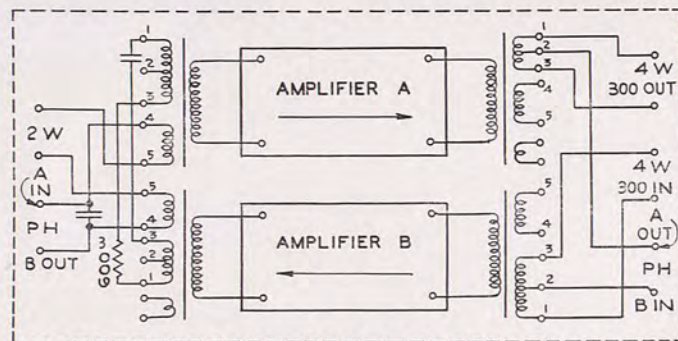


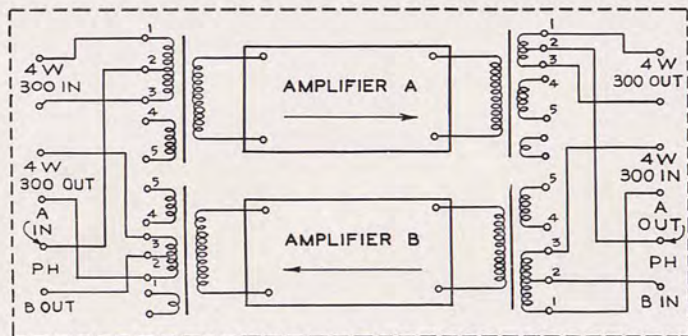
FIG. 7a—Typical Four Wire Circuit



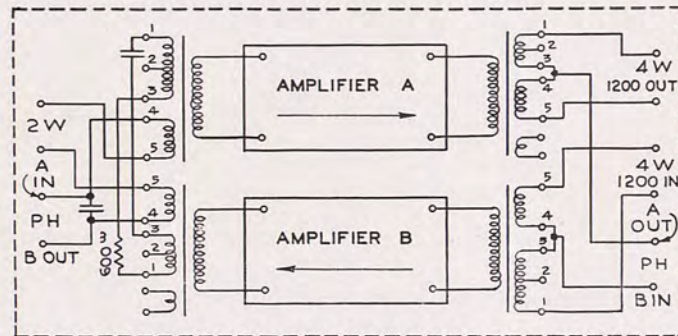
4 WIRE 1200 OHM SETTINGS



2 WIRE 600 OHM AND 4 WIRE 300 OHM SETTINGS



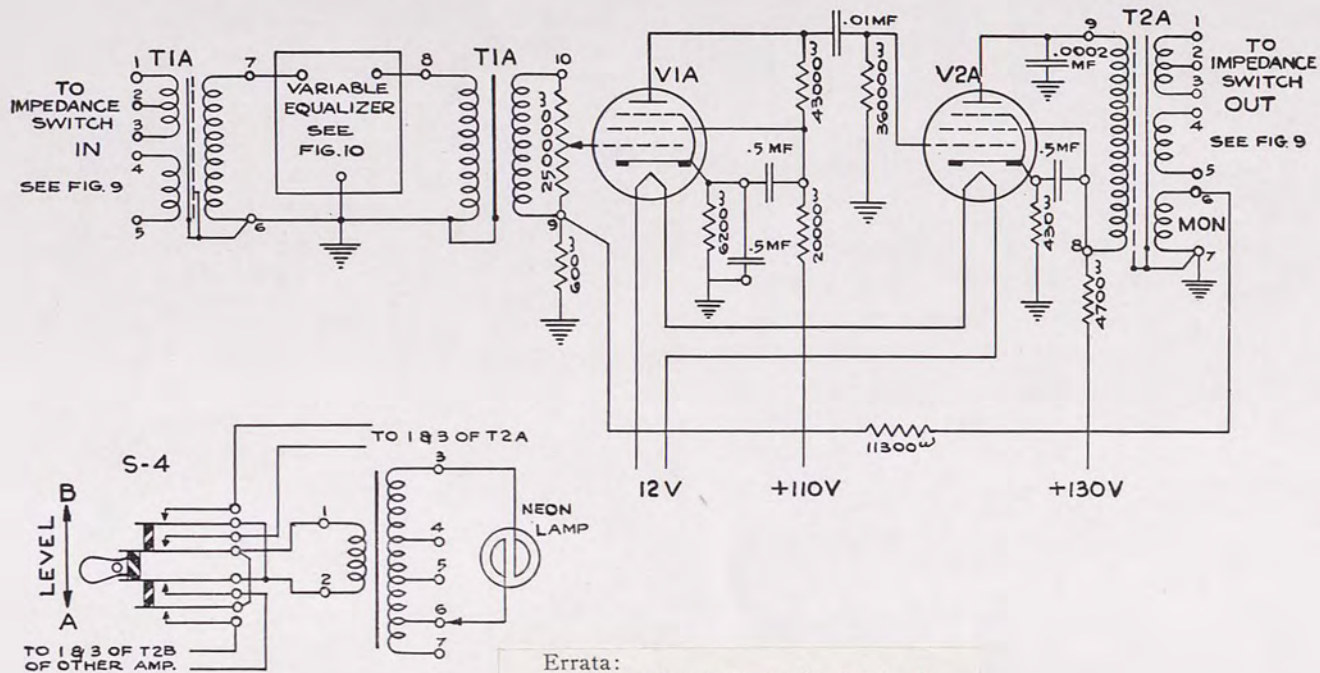
4 WIRE 300 OHM SETTINGS



2 WIRE 600 OHM AND 4 WIRE 1200 OHM SETTINGS

I.T. & R.M.

FIG. 7b—Transformer Connections at the Various Impedance Switch Positions



Errata:
 .5 Mf. condenser in anode circuit of
 V1A connects to earth instead of
 cathode.

I. T. & R. M.

FIG. 8—Simplified Schematic Diagram of Amplifier

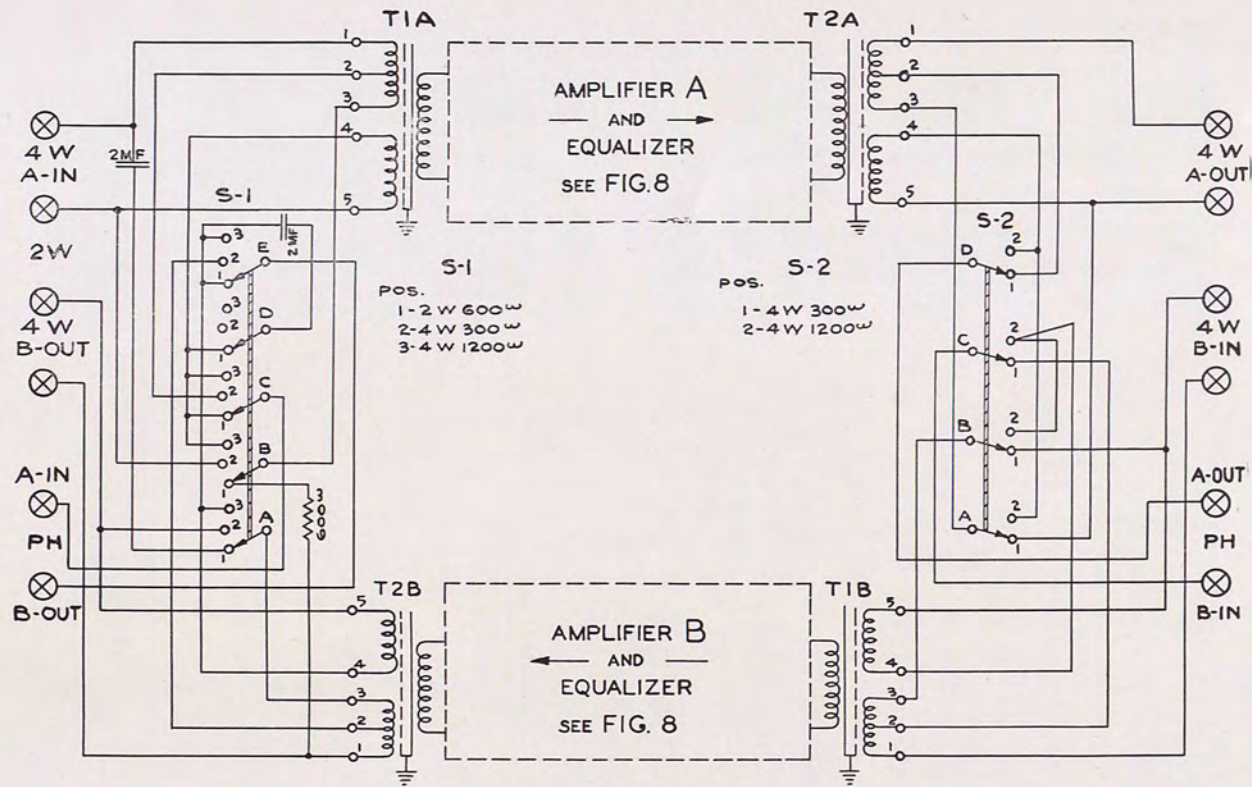
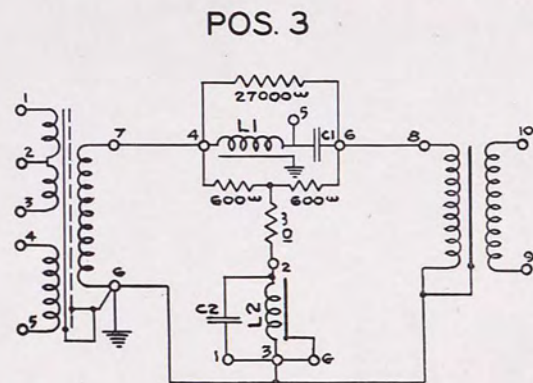
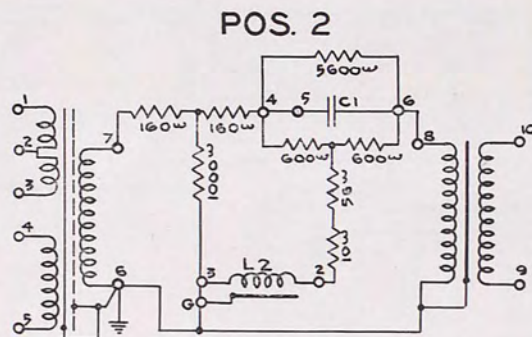
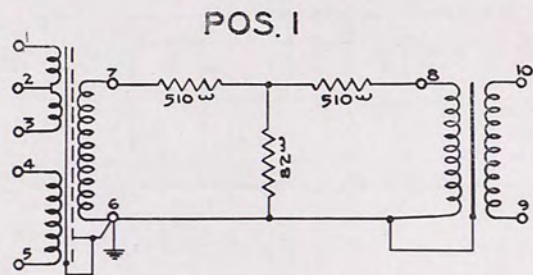


FIG. 9—Connections for Impedance Switches S-1 and S-2



POSITION 1. FLAT GAIN

POSITION 2. EQUALIZATION FOR $7\frac{1}{2}$ MI. CABLE *

POSITION 3. EQUALIZATION FOR 15 MI. CABLE *

* BRIT. FIELD QUAD. CABLE NON LOADED

I. T. & R. M.

FIG. 10—Circuits of Equalization for Each Position of Switch

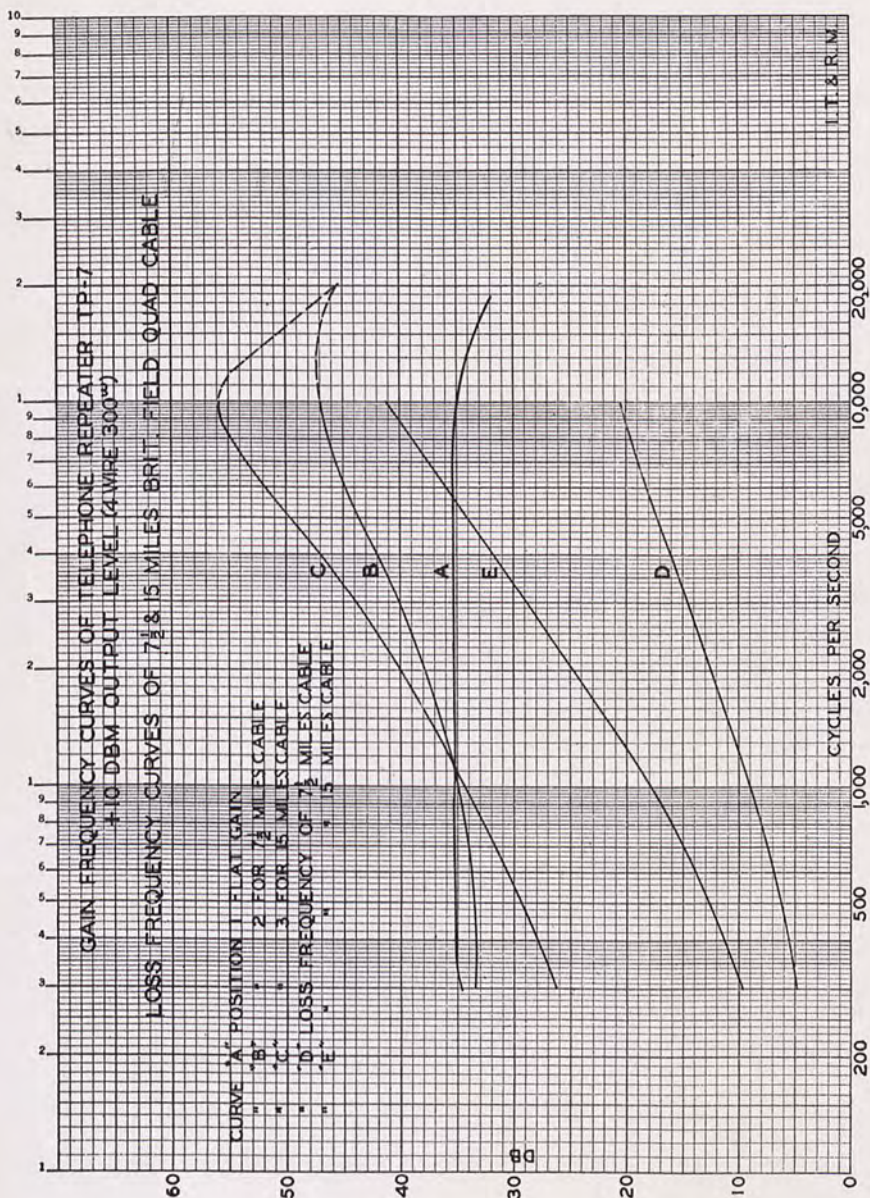


FIG. 11

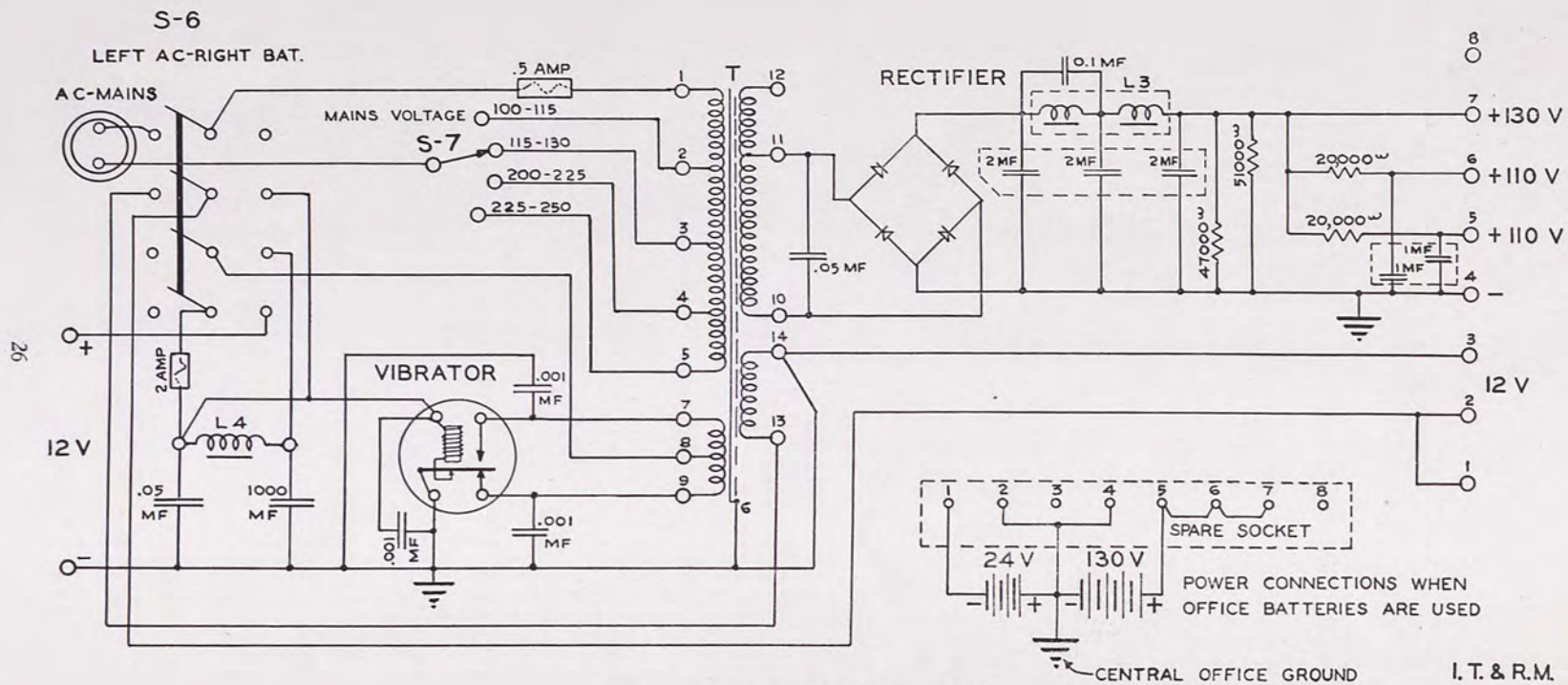


FIG. 12—Schematic of Power Unit

I. T. & R. M.

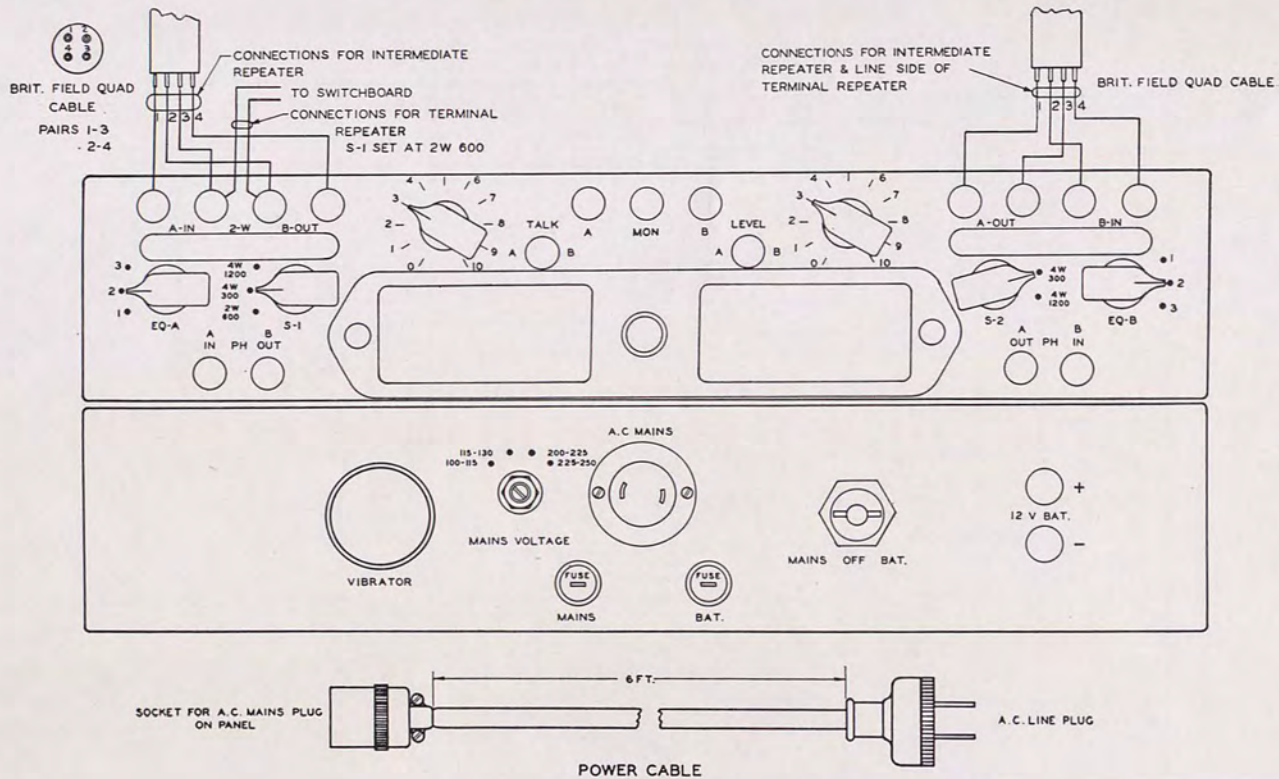


FIG. 13—Panels for Repeater Showing Cable Connections

I. T. & R. M.

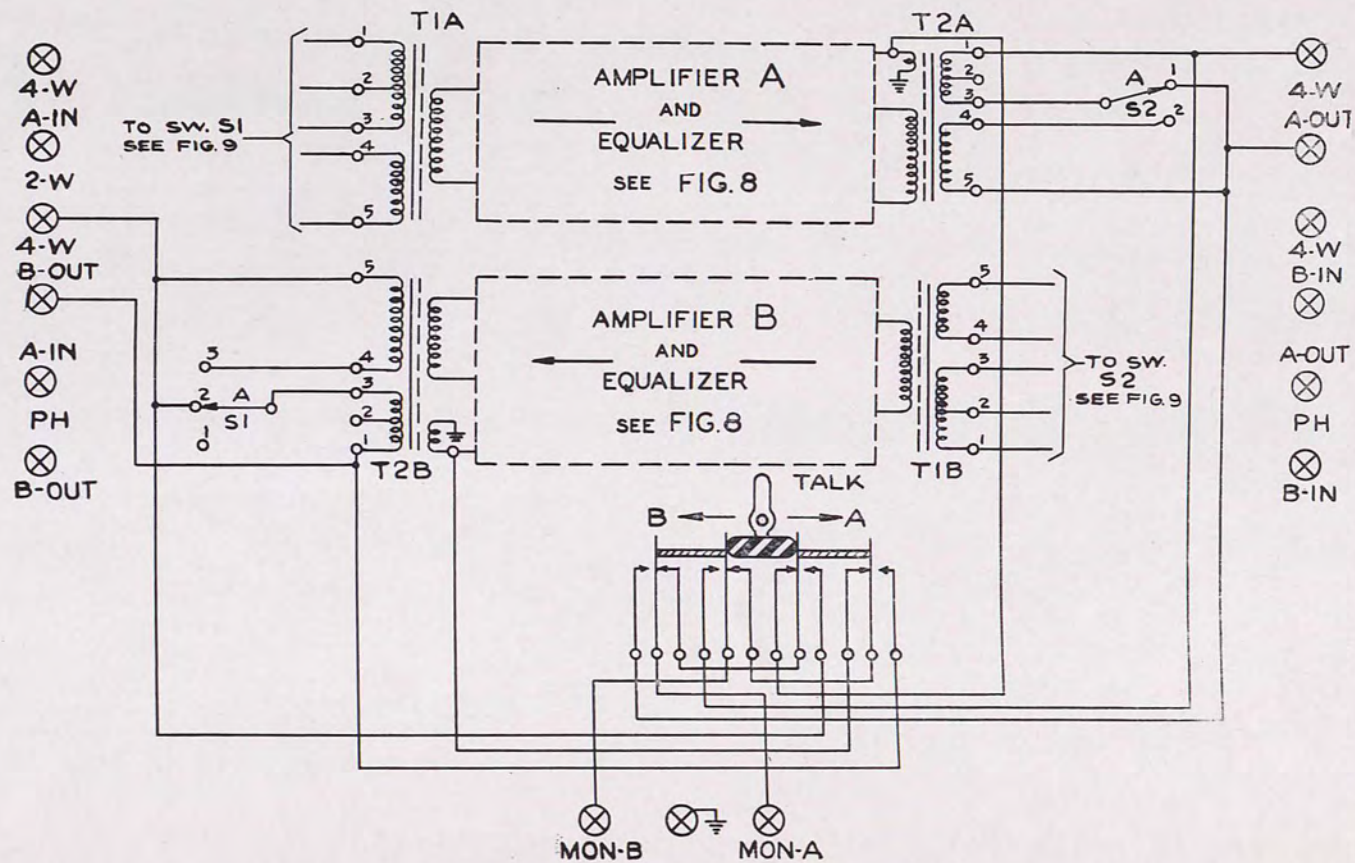


FIG. 14—Connections for Talking and Monitoring

Errata:
 C6A and C6B condensers should return to earth i.e. terminal 3 on the condenser block connects to earth and terminal 5 to cathode. In Fig. B—R2B should be R21B.

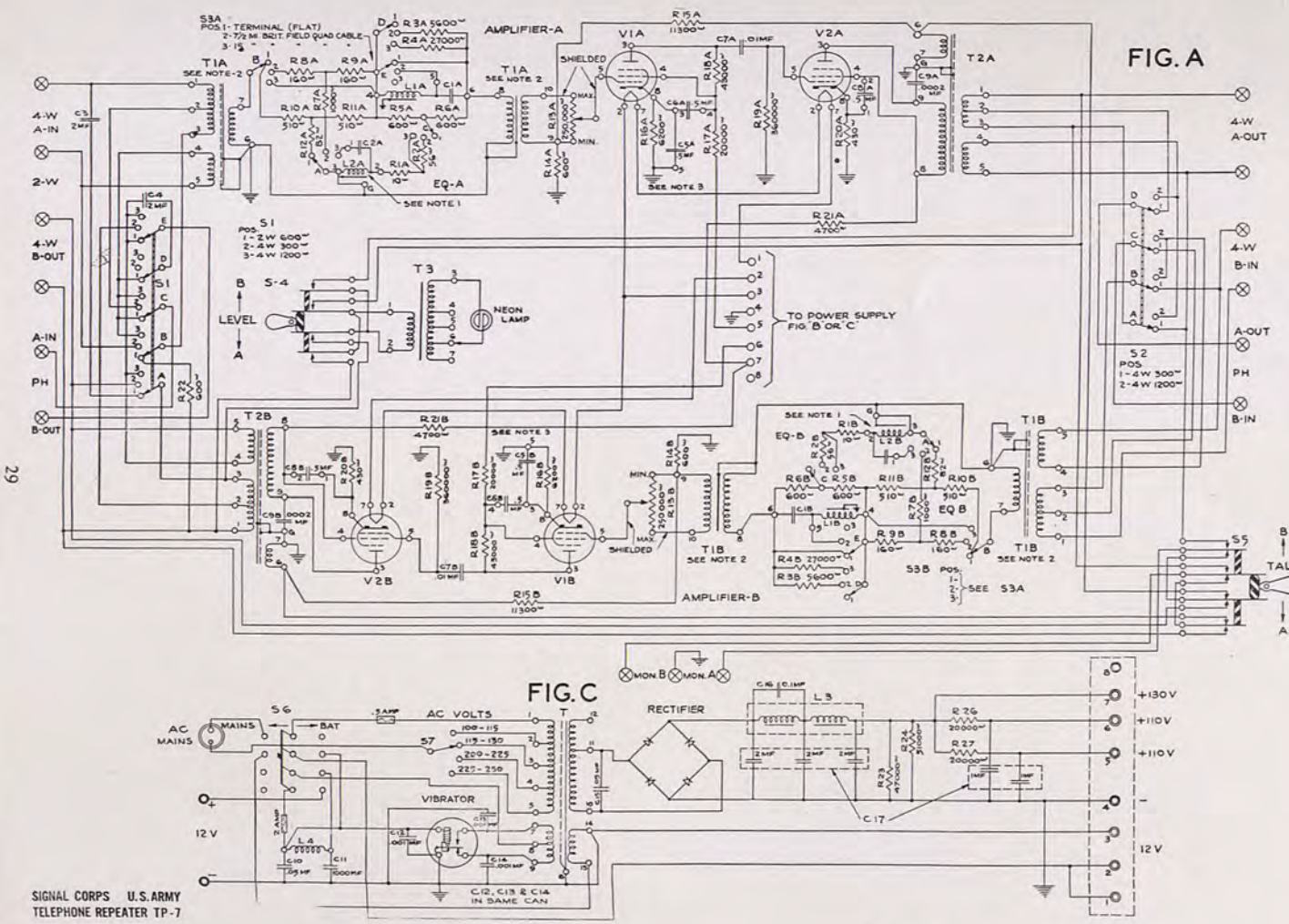


FIG. A

SARE PARTS IN COVER

- 2- 6G6-G VACUUM TUBES
- 1- WII-2 VIBRATOR
- 1- 24-130 V. BATTERY PLUG
- 1- SPARE LINE CONNECTOR PLUG
- 1- 2 AMP FUSE
- 1- .5 AMP FUSE

VACUUM TUBE DATA

	COM'L CODE	5C CODE
V1A	6G6-G	VT-198A
V1B	6G6-G	VT-198A
V2A	6G6-G	VT-198A
V2B	6G6-G	VT-198A

- NOTES:
- ↓ INDICATES CONNECTIONS TO CHASSIS
 - 1- L1A, L2A, C1A & C2A ARE ASSEMBLED IN A CASE WITH TERMINALS AS SHOWN; SIMILARLY L1B, L2B, C1B, & C2B.
 - 2- COILS MARKED 'T1A' ARE ASSEMBLED IN ONE CASE; SIMILARLY FOR 'T1B' COILS.
 - 3- CONDENSER C5A, C6A & C6A ARE IN SAME CAN WITH TERMINALS AS SHOWN. SIMILARLY C5B, C6B & C6B.

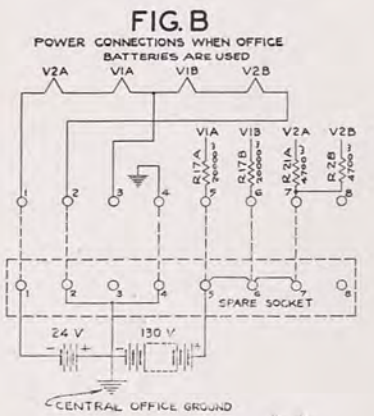


FIG B

POWER CONNECTIONS WHEN OFFICE BATTERIES ARE USED

SCHMATIC

I. T. & T. 103-A TELEPHONE REPEATER
 International Telephone & Radio Mfg. Corp.

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SIGNAL CORPS U.S. ARMY
 TELEPHONE REPEATER TP-7

FIG. 15

NOTES

NOTES