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TM 11-2520

AR DEPARTMENT TECHNICAL MANUAL

U.S. Dept. of Army
1947

DUAL CHANNEL AMPLIFIER AM-43/FRC

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DEPARTMENT *11 NOVEMBER, 1944*

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DUAL CHANNEL AMPLIFIER AM-43/FRC

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WAR DEPARTMENT,
WASHINGTON 25, D. C., 11 November, 1944.

TM 11-2520, Dual Channel Amplifier AM-43/FRC, is published for the information and guidance of all concerned.

[A. G. 300.7 (13 Apr 44).]

BY ORDER OF THE SECRETARY OF WAR:

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Chief of Staff.

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The Adjutant General.

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(For explanation of symbols see FM 21-6.)

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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, crow bars, 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—Chassis, panel, transformers, chokes, capacitors, resistors, terminal boards, sockets, controls.

2. Cut —All wiring or cables.

3. Burn —This technical manual.

4. Bend —Control bracket.

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

DESTROY EVERYTHING

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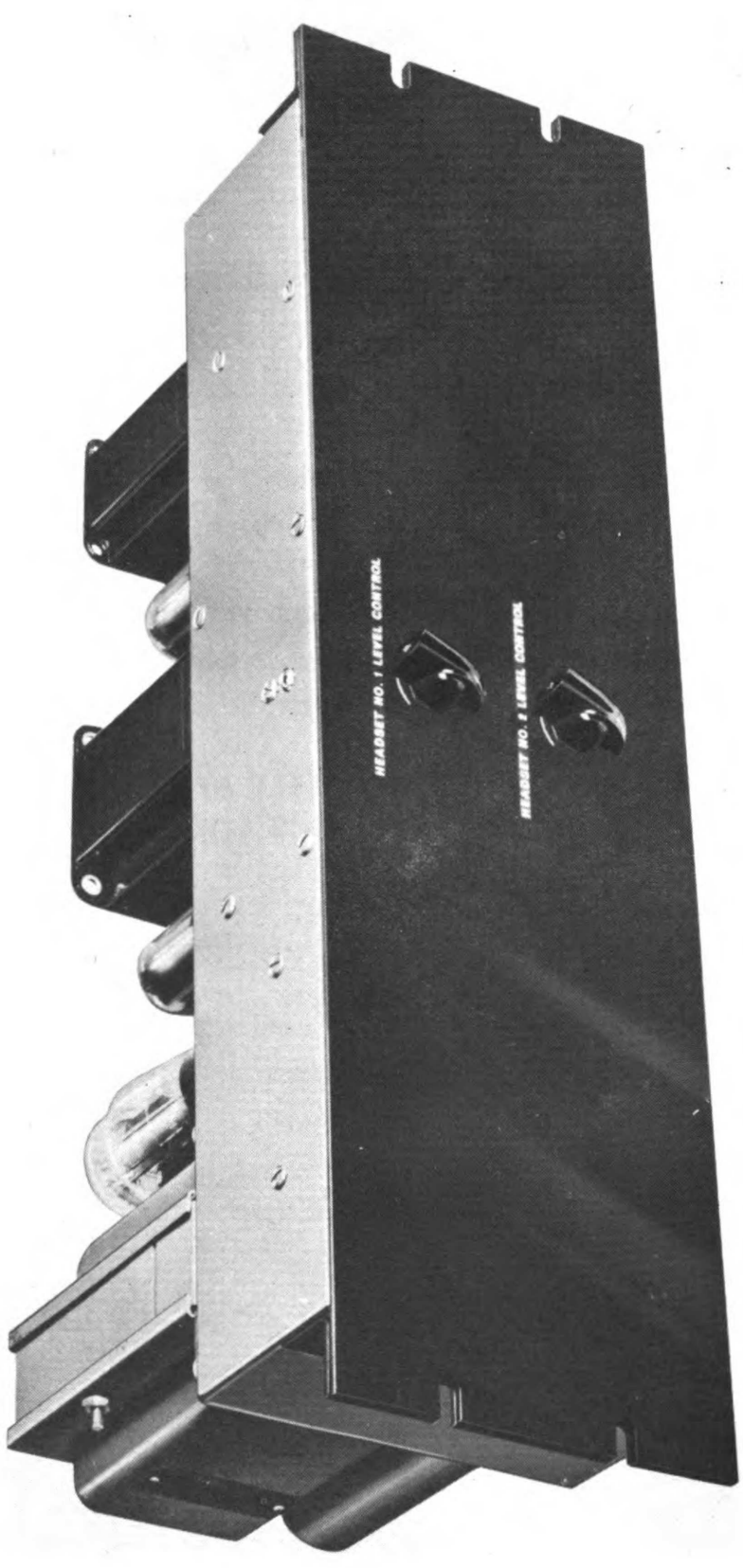


Figure 1. Dual Channel Amplifier AM-43/FRC, front view.

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SECTION I
DESCRIPTION

1. GENERAL.

a. Purpose. Dual Channel Amplifier AM-43/FRC (fig. 1) is an audio-frequency amplifier designed to amplify two speech-frequency channels or tone circuits in the speech-frequency range. Low-level signals, which may pass undetected without the use of the amplifier, may be amplified by this unit to a usable volume. The amplifier is constructed so that both channels can be used simultaneously. This unit is designed primarily for amplification of low-level signals from telephone lines or other similar long transmission lines. It operates into a headset or loudspeaker circuit attached to the output terminals of each channel.

b. Placement. The unit may be used wherever relay-rack facilities are available and there is a source of 110-120 volt a-c power. The amplifier is designed for operation with the vacuum tubes in a horizontal position.

2. LIST OF COMPONENTS, WEIGHTS AND DIMENSIONS.

Quantity	Component	Dimensions (in.)			Weight (lb)
		Length	Width	Height	
1	Dual channel amplifier.	17-¼	10	5	19.7
1	112A-11 special panel.	19	1-⅛	5-¼	3.25

3. DUAL CHANNEL AMPLIFIER AM-43/FRC.

a. The amplifier is designed to mount in a type 112A relay-rack cabinet or equivalent (not provided with the dual channel amplifier).

b. It is constructed on a sheet-metal chassis (fig. 2) 17-¼ inch long x 10 inch wide x 3 inch deep. Holes have been made in the ends of the chassis (fig. 3) for the installation of mounting angles by which the chassis may be attached to the special panel provided.

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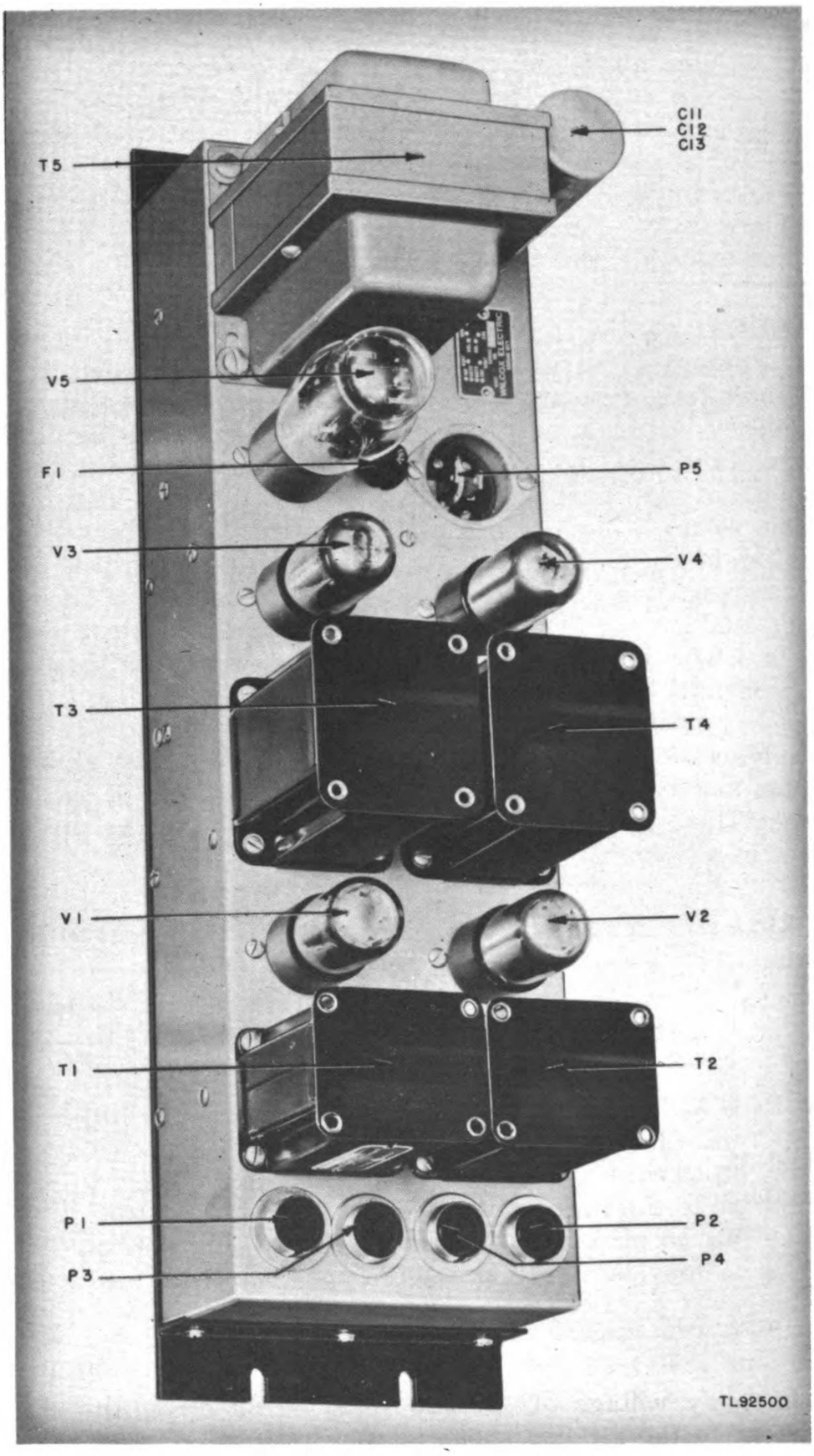


Figure 2. Rear view of amplifier.

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c. With the amplifier and panel mounted in a relay rack, the power plug, input, and output plugs are accessible at the back of the unit (fig. 2). The vacuum tubes are mounted in a horizontal position and are also accessible from the rear of the unit. The headset level controls are mounted on a bracket and may be reversed with the shafts projecting out the back of the unit the same as the vacuum tubes and plugs. Holes have been provided to permit this reversal (fig. 3)

4. RELAY-RACK PANEL.

The 112A-11 relay-rack panel has been provided with the mounting angles noted in paragraph 3b above. These angles are rigidly attached to the panel. Sheet-metal screws (fig. 2) are provided for attaching the chassis to the panel. A level control shaft for adjusting the amplification of each channel projects through the panel. HEADSET NO. 1 LEVEL CONTROL is mounted above the HEADSET NO. 2 LEVEL CONTROL at the middle of the panel (fig. 1).

5. POWER SUPPLY.

The amplifier requires a power source of 110 to 120 volts, 50/60 cycles, alternating current. The power consumption is approximately 25 watts.

SECTION II
INSTALLATION AND OPERATION

6. INSTALLATION.

a. Dual Channel Amplifier AM-43/FRC is shipped with the panel attached. Place the unit in a relay-rack space. Attach the amplifier to the rack, using four No. 12-24 fillister-head screws. Take care to place the unit in the relay-rack in the correct position to provide proper location of the controls and connection plugs.

b. Apply voltage of 110/120 volts, 50/60 cycle, alternating current to the a-c line connector plug (fig 2) (P5)). Separate the input leads to the amplifier from the output leads to prevent

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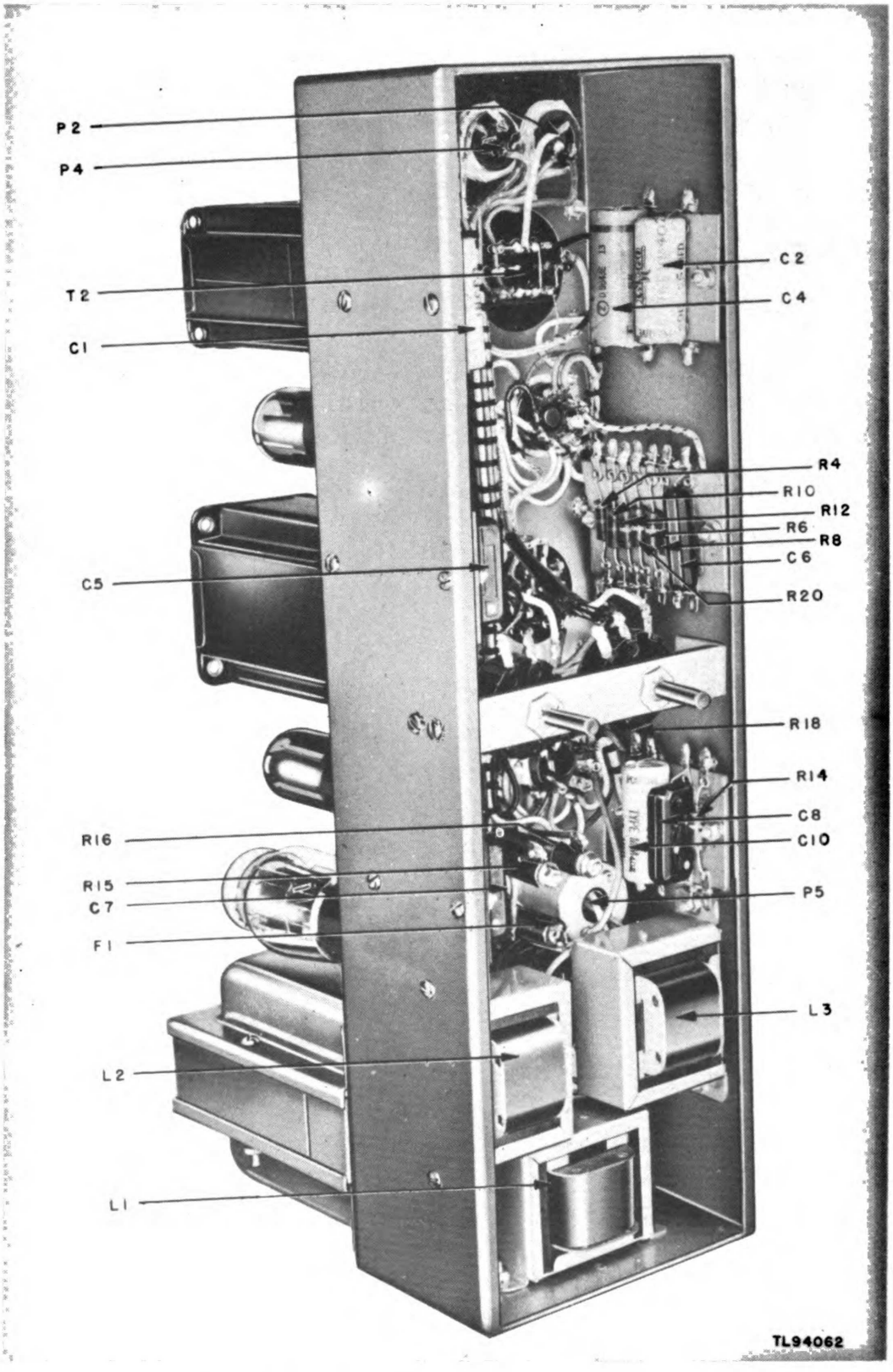


Figure 3. Top front interior view, panel removed.

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feedback and possible oscillations in the amplifier. If it is necessary to locate the input and output leads in the same cable, it is recommended that these leads be independently shielded to prevent coupling between the circuits.

7. OPERATION.

a. Connect leads from headsets or loudspeakers to the output receptacles (fig. 2 (P3 and P4)) on the amplifier, if both channels are to be used. A single channel may be used if desired. The leads should terminate in male plugs to fit the female output receptacles of the amplifier.

b. Connect leads from the transmission lines to the input receptacles (fig. 2 (P1 and P2)) of the amplifier, using plugs listed in paragraph 8**d** below.

c. Connect an a-c power source to the amplifier. A power cord terminating in a female receptacle (paragraph 8**d**) is required to fit the male plug (fig. 2 (P5)) which serves as the power input to the amplifier. The vacuum tubes should light and plate voltage be available as soon as this connection is made. There is no switch in the circuit.

d. Turn the level controls (fig. 1) clockwise until the signals from the two channels are received at the desired amplitude on the headsets or loudspeakers.

SECTION III
FUNCTONING OF PARTS

8. AMPLIFIER CIRCUITS (fig. 5).

a. The complete amplifier consists of two identical three-stage amplifiers. The first two stages of each amplifier section are resistance-coupled, operating into the third stage, which is transformer-coupled to the output terminals. Inverse feedback is employed between the third stage and the second stage.

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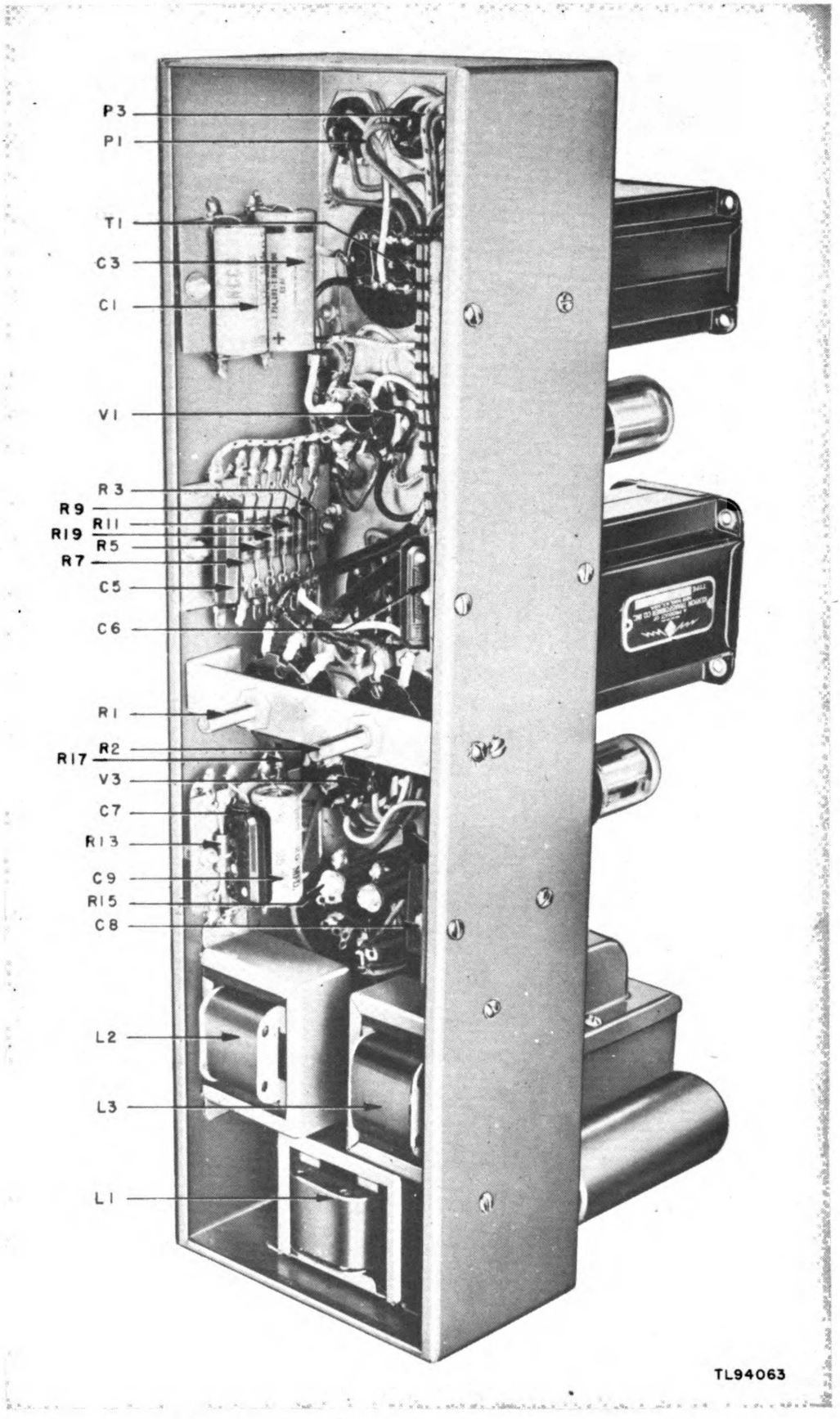


Figure 4. Bottom front interior view, panel removed.

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b. The input transformers T1 and T2 have a 500-ohm primary winding with intermediate taps at 50, 125, 200, 250, and 333 ohms. The secondary winding is 50,000-ohm. A level-control variable resistor is connected across the secondary winding. The vacuum tubes V1 and V2 (Tube VT-231 or JAN-6SN7) are dual triodes. The first triode section operates as the first stage and is resistance-capacitance coupled to the second section, which operates as the second stage in each amplifier.

c. The second stages of V1 and V2 are resistance-capacitance coupled to V3 and V4, respectively. These tubes (Tube VT-107-A or JAN-6V6) in turn operate into independent output transformers T3 and T4, which have secondary windings of 500-ohm impedance tapped at 4, 15, and 200-ohms. The inverse feedback circuit consists of resistor R17 in one amplifier, and resistor R18 in the other, inserted between the plate of the third stage and the cathode of the second stage in each amplifier.

d. The following connector plugs must be used on the leads which connect to the amplifier (par. 7):

Designation	Function	Description
(1) For connection to P1.	Audio Input, Channel 1.	Amphenol MC3M
(2) For connection to P2.	Audio Input, Channel 2.	Amphenol MC3M
(3) For connection to P3.	Audio Output, Channel 1.	Amphenol MC4M
(4) For connection to P4.	Audio Output, Channel 2.	Amphenol MC4M
(5) For connection to P5.	Power Input.	Harvey Hubbell 6630

9. POWER SUPPLY (fig. 5).

a. D-c voltage and the filament voltages are obtained from power transformer T5.

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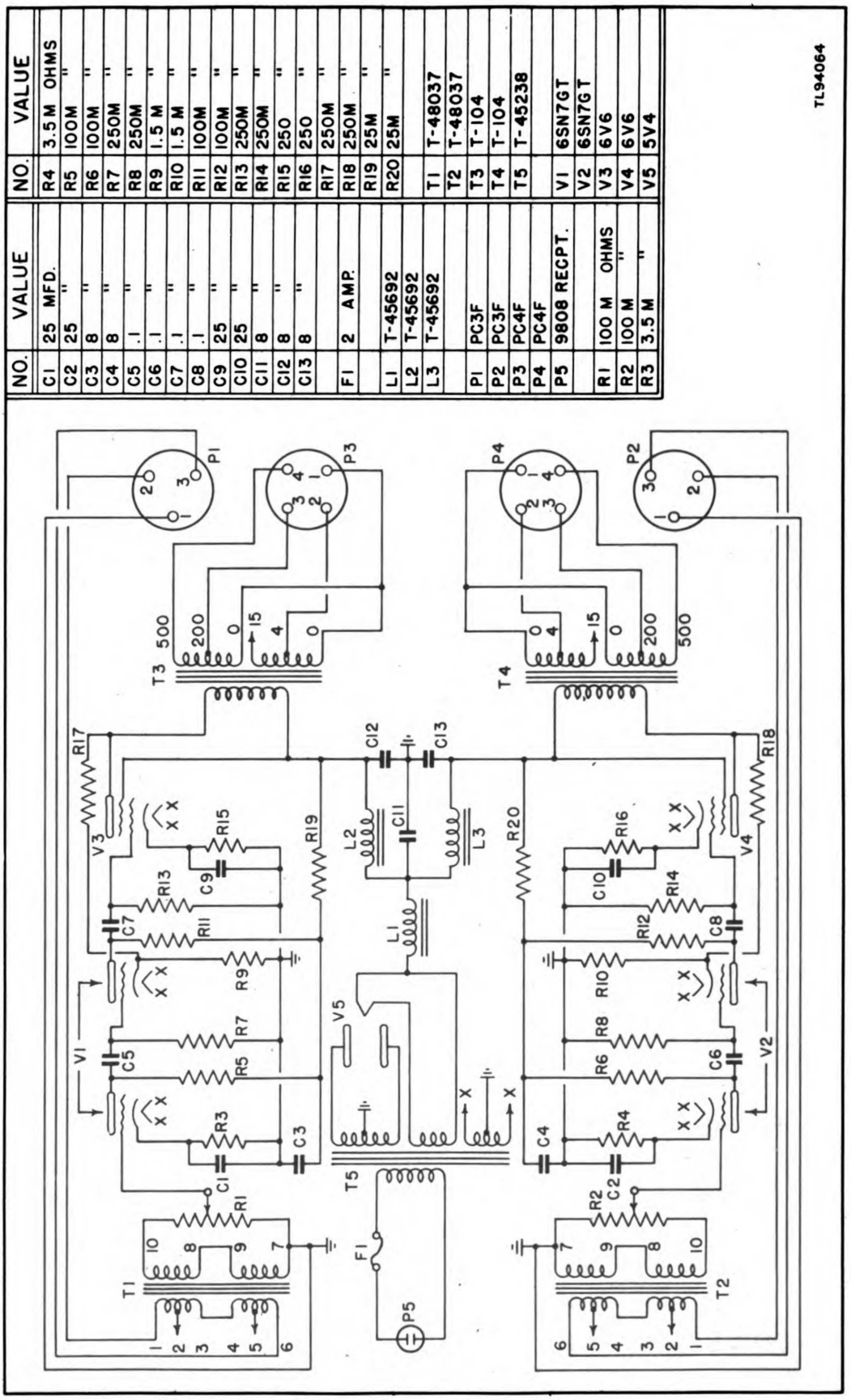


Figure 5. Schematic diagram.

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b. Current for the plate supply circuit is supplied by full-wave rectifier tube V5 (Tube VT-206-A or JAN-5V4) that produces a voltage output of 280 volts. This operates into a common filter reactor, L1, which in turn operates into two filter reactors, L2 and L3. The output of each filter reactor is by-passed to ground by high-value capacitors C11, C12, and C13. The two reactors in the second filter section are employed to prevent inter-action between the two amplifier sections through the power supply.

c. The amplifier is protected by a fuse, F1, in one side of the primary power source (fig. 5). It is mounted in a fusewell-type holder and is readily accessible from the back of the amplifier (fig. 2).

SECTION IV
MAINTENANCE

10. ROUTINE MAINTENANCE.

Check vacuum tubes at regular intervals with any standard tester that will measure mutual conductance. Remove dust and dirt collected at any point with a soft brush or a moderate compressed air jet.

11. PREVENTIVE MAINTENANCE.

For maintenance due to component failure, remove the amplifier from the relay-rack installation. Disconnect all connector plugs before loosening the supporting screws through the front panel slots. Then loosen the retaining set screws in the control knobs (fig. 1) and remove the knobs from the shafts. Remove the three screws at each end of the chassis (fig. 2). This will allow the 112A-11 panel to be removed, exposing the interior of the amplifier for servicing. Reassemble in reverse order.

12. VOLTAGE AND RESISTANCE CHARTS.

Charts for typical voltage and resistance measurements are shown below. These readings will vary slightly from unit to unit, but should not differ more than plus or minus 10 percent. Tests

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were made with a 500-ohm-per-volt voltmeter and all measurements were made from the terminal designated to ground.

Voltages (volts)

Pin No.	V1	V2	V3	V4	V5
1	0	0	0	0	0
2	75	80	2.8 ac	2.8 ac	280
3	3	3.2	205	205	0
4	0	0	220	220	315 ac
5	75	80	0	0	0
6	3.1	3.4	0	0	315 ac
7	2.8 ac	2.8 ac	2.8 ac	2.8 ac	280
8	2.8 ac	2.8 ac	10	10	280

Resistances (ohms)

Pin No.	V1	V2	V3	V4	V5
1	10,000	10,000	0	0	0
2	300,000	300,000	2	2	150,000
3	2,900	2,900	150,000	150,000	open
4	300,000	300,000	150,000	150,000	110
5	250,000	250,000	250,000	250,000	open
6	1,700	1,500	open	open	110
7	2	2	2	2	150,000
8	2	2	250,000	250,000	150,000

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SECTION V
SUPPLEMENTARY DATA

13. MAINTENANCE PARTS LIST FOR DUAL CHANNEL AMPLIFIER AM-43/FRC.

Ref symbol	Signal Corps stock No.	Name of part and description	Quan. per unit	Mfrs. part and code No.	†Station stock	†Region stock
C1, C2 C9, C10	3DB25-11	CAPACITOR: electrolytic; 25-mf; 25 v dc (working).	4	A396 C07 (18)	*	*
C3, C4	3DB8-74	CAPACITOR: electrolytic; 8-mf; 450 v dc (working).	2	D9643E-23 (S5)	*	*
C5, C6, C7, C8	3DA100-112.1	CAPACITOR: paper; 0.1-mf; 400 v dc (working).	4	345-21 (M2)	*	*
C11, C12, C13	3DB8-53.1	CAPACITOR: electrolytic; 3 section; 8-mf; 450 v dc (working) per section.	1	4C-B-247 D04 (18)		*
L1, L2, L3	3C316-28	CHOKE: filter; 10 h @ 100 ma.	3	T-45692 (T4)		*
F1	3Z1927	FUSE: 2-amp; 250-v; type 3AG.	1	3AG (B9)	*	*
R1, R2	2Z7271-29	RESISTOR: variable; 100,000-ohm.	2	1010353 (C4)		*
R3, R4	3Z6250-22	RESISTOR: 3,500-ohm; 1-w.	2	GB-3522 (A5)	*	*
R5, R6 R11, R12	3Z6700-74	RESISTOR: 100,000-ohm; 1-w.	4	GB-1042 (A5)	*	*

† Parts not stocked in station or region stock are carried in depot stock.

* Indicates stock available.

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13. MAINTENANCE PARTS LIST FOR DUAL CHANNEL AMPLIFIER AM-43/FRC. (Contd.)

Ref symbol	Signal Corps stock No.	Name of part and description	Quan. per unit	Mfrs. part and code No.	†Station stock	†Region stock
R7, R8 R13, R14 R17, R18	3Z6625-29	RESISTOR: 250,000-ohm; 1-w.	6	GB-2542 (A5)	*	*
R9, R10	3Z6150-68	RESISTOR: 1,500-ohm; 1-w.	2	GB-1522 (A5)	*	*
R15, R16	3Z6025-42	RESISTOR: 250-ohm; 10-w.	2	A-113 (H3)	*	*
R19, R20	3Z6625-29	RESISTOR: 25,000-ohm; 1-w.	2	GB-2532 (A5)	*	*
SV1, 2, 3, 4, 5	2Z3650.5	SOCKET: tube; octal; bakelite.	5	9950 (C6)	*	*
T1, T2	2Z9631.55	TRANSFORMER: audio line to grid; 500-ohm; ct to 100,000-ohm ct.	2	S-18172 (K3)		*
T3, T4	2Z9632.54	TRANSFORMER: output, plate to line or voice-coil; pri, 10,000-ohm; sec, 500/200/15/8 or 4-ohm.	2	T-104 (K3)		*
T5	2Z9613.48	TRANSFORMER: power; pri, 110-v; sec, No. 1: 700-v ct @ 0.1 amp; sec, No. 2: 5-v @ 2 amps; sec, No. 3: 6.3-v @ 4 amp.	1	T-45238 (T4)		*
V1, V2	2T231	TUBE VT-231.	2	6SN6GT (R2)	*	*
V3, V4	2T107A	TUBE VT-107A.	2	6V6GT (R2)	*	*
V5	2T206A	TUBE VT-206A.	1	5V4G (R2)	*	*

† Parts not stocked in station or region stock are carried in depot stock.

* Indicates stock available.

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14. LIST OF MANUFACTURERS.

Code	Name
A 5	Allen-Bradley Co.
B 9	Bussman Mfg. Co.
C 4	Centralab
C 6	Cinch Mfg. Corp.
H 3	Hardwick-Hindle Inc.
I 8	Industrial Condenser Corp.
K 3	Kenyon Transformer Co.
M 2	Micamold Radio Corp.
R 2	RCA Mfg. Co.
S 5	Solar Mfg. Corp.
T 4	Thordarson Electric Mfg. Co.
W 9	Wilcox Electric Co.

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