

**INSTRUCTION BOOK**

**FOR**

**12Z**

**REMOTE AMPLIFIER**

**COLLINS RADIO COMPANY**  
**CEDAR RAPIDS, IOWA**

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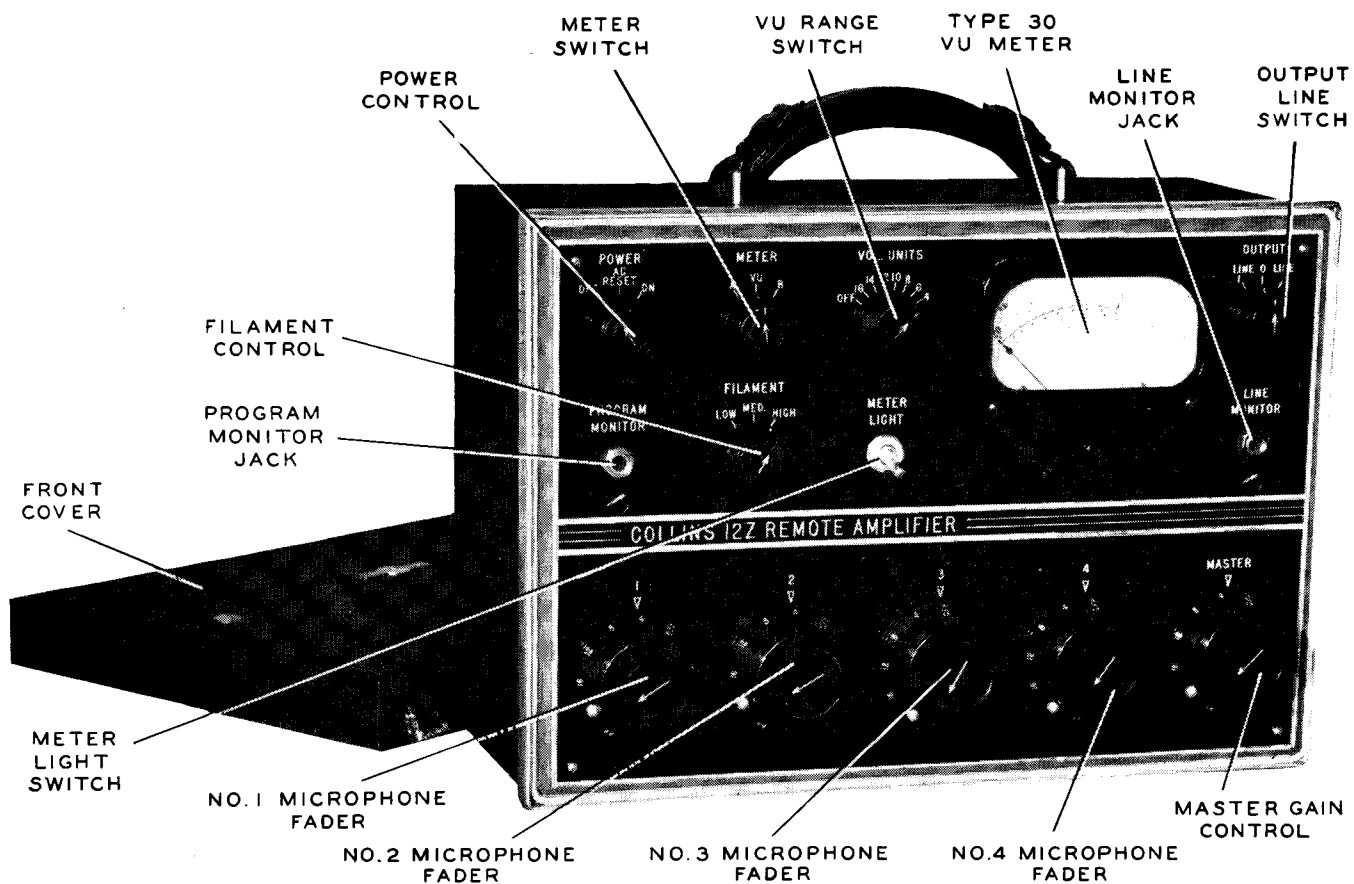


Figure 1-1. 12Z Amplifier, Front Cover Removed



Figure 1-2. 12Z Amplifier, Front

## SECTION I

## GENERAL DESCRIPTION

## 1.1. GENERAL.

This instruction book has been compiled as a guide to the proper installation, adjustment, operation and maintenance of the Collins Type 12Z-2 and 12Z-3 Remote Amplifiers.

The Collins 12Z Remote Amplifier greatly simplifies the problem of "on the spot" broadcasts. The amplifier is built into a small carrying case, is light in weight and can be easily carried by one person. The 12Z includes four input channels with individual controls, a master control, a-c power supply and a battery power supply built into a single compact unit. The batteries are automatically switched into operation whenever the a-c power source fails. Two output circuits are provided, one for program and one for telephone. If the program line fails, a twist of the OUTPUT line control will reverse the lines and the program will be fed into the second line.

The dust covers are attached to the chassis by means of Dzus fasteners. A screwdriver or a coin can be used to operate these fasteners. Refer to figures 1-2 and 1-3. A leather reinforced canvas case is provided to protect the equipment when being taken from one location to another. The receptacles for the microphone, terminals for the lines and the receptacle for the a-c power cord plug are accessible from the rear of the amplifier.

The mixing controls are of the low impedance "T" type to give low insertion loss. The master gain control is a high impedance potentiometer. All controls have an attenuation of 2 db per step. A range switch and meter switch connect a Weston Model 862 meter to the proper circuit for measuring the output level in VU or the tube filament and plate voltages. Jacks are provided for monitor headphones.



Figure 1-3. 12Z Amplifier, Rear

## 1.2. REFERENCE DATA.

DIMENSIONS: 14½" wide, 11½" high, 8¼" deep.  
 WEIGHT: 40 pounds, including batteries.  
 FREQUENCY RESPONSE: 30-15,000 cps, ±1 db.  
 INPUT IMPEDANCE: 30 to 50 ohms for the 12Z-2 and 200 to 250 ohms for the 12Z-3.  
 GAIN: Approximately 90 db.  
 OUTPUT IMPEDANCE: 600 ohms. (150 ohm available upon special order.)  
 DISTORTION: Less than 1% at operating levels.  
 NOISE: More than 60 db below program level.

POWER OUTPUT: 50 milliwatts (+17 dbm\*).  
 POWER SOURCE: 110 volts a-c, 50/60 cps, single phase or self contained batteries. (135 volts "B" battery and 7.5 volts "A" battery).

## 1.3. VACUUM TUBE COMPLEMENT.

QUANTITY	TUBE TYPE	FUNCTION
1	9001	Input Amplifier
1	9001	Interstage Amplifier
1	6AK6	Output Amplifier
1	7Y4	Rectifier

\* 1 milliwatt, 600 ohm base.

## SECTION II

## THEORY OF OPERATION

## 2.1. MECHANICAL DETAILS.

The 12Z amplifier is built on a panel and chassis constructed entirely from aluminum and aluminum alloy sheet. The front and rear dust covers are formed and welded of dural sheet and are attached to the chassis by means of Dzus fasteners. A screwdriver or a coin can be used to operate these fasteners. The amplifier chassis is shock-mounted on four Lord mountings to reduce microphonic effects.

The amplifier can be removed for inspection or servicing by removing four screws on the corners of the small amplifier unit and disengaging the four plugs that fit into it. To remove the power supply chassis, it is necessary to remove two of the "A" batteries from beneath the power supply. The four screws that hold the power supply in place are then accessible. When the screws have been loosened the power supply may be taken out.

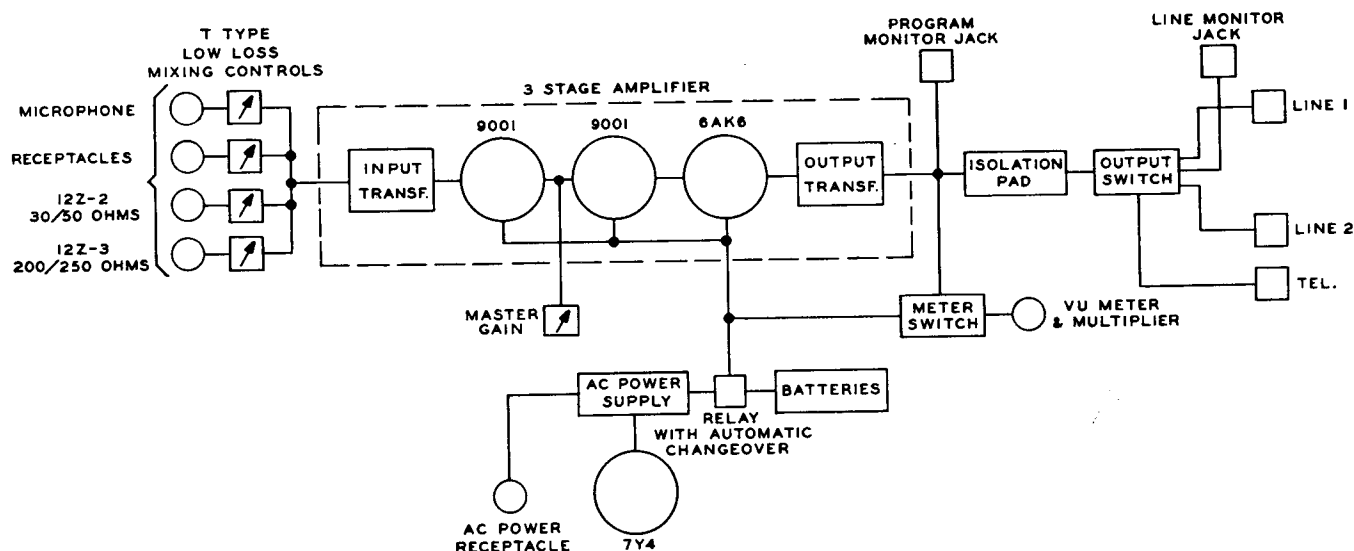


Figure 2-1. Amplifier Block Diagram

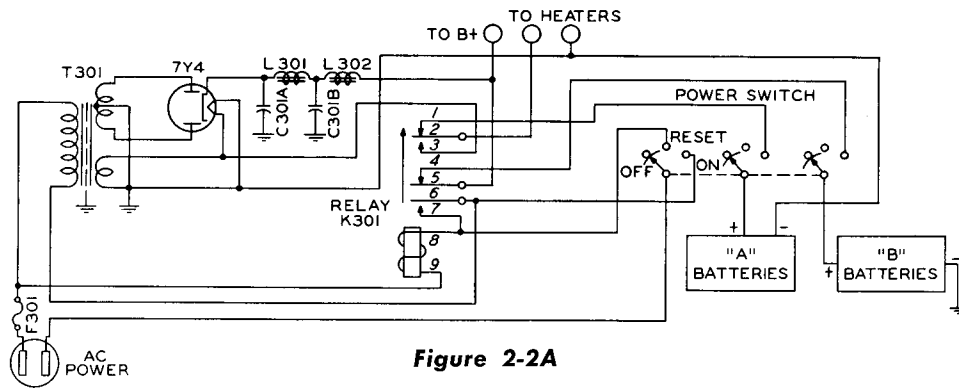


Figure 2-2A

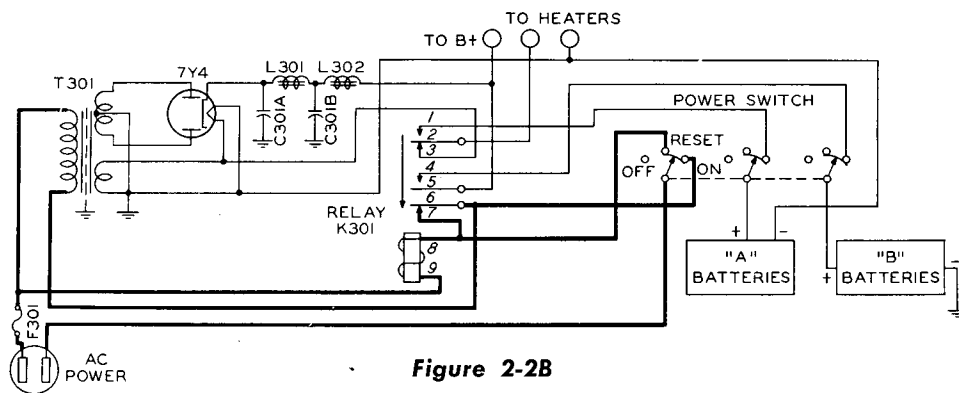


Figure 2-2B

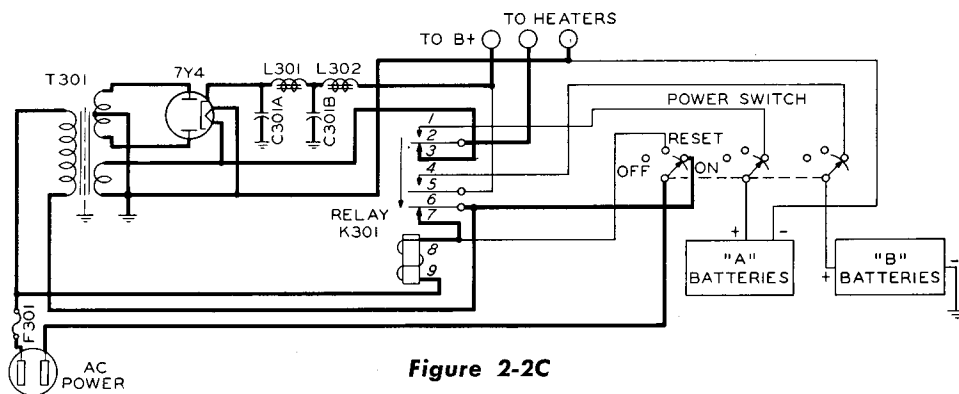


Figure 2-2C

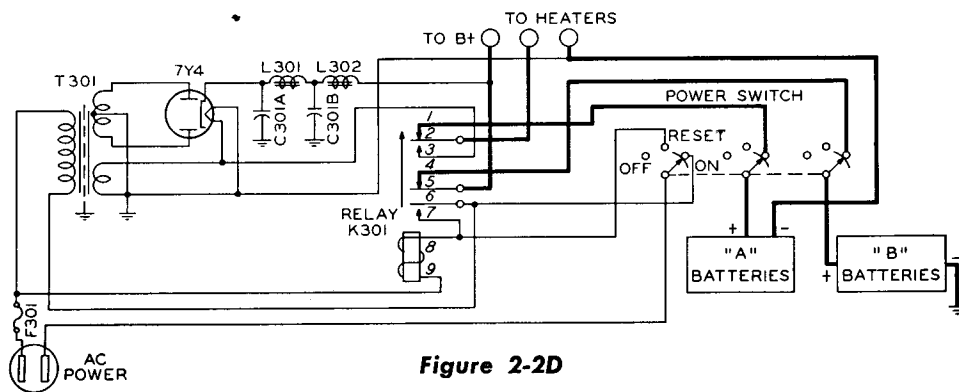


Figure 2-2D

Figure 2-2. Simplified Circuit of Power Supply Operation

## 2.2. ELECTRICAL DETAILS.

**2.2.1. General.**—The 12Z amplifier has three stages of audio amplification, an a-c power supply and self contained batteries.

**2.2.2. Audio Amplifier.**—The speech amplifier consists of three stages of amplification. The first two stages employ Type 9001 pentode tubes and a Type 6AK6 pentode power amplifier tube, connected as a triode, is used in the output stage. Low level mixing is used preceding the input transformer, and four mixing circuits are provided. Four receptacles on the rear of the amplifier permit the use of as many as four microphones. The use of low level mixing restricts the microphone which can be used to those having an output impedance of from 30 to 50 ohms for the 12Z-2 and those having 200 to 250 ohms impedance for the 12Z-3. This is generally allowable in portable equipment in view of the reduction in size and weight which results. An output switch is provided to select either of two output lines. A pair of terminals, intended for use with a telephone, is automatically connected to the line not used for the program.

**2.2.3. Metering Circuits.**—A Weston Model 862 VU meter is provided. This instrument, conforming to the standards adopted by the major networks, reads

directly in volume units (on steady tone, numerically equal to db above 1 mw reference level). A range switch extends the range from a plus 4 VU to plus 16 VU in 2 VU steps. The same instrument is used for reading filament and plate voltages, the desired circuit being selected by means of a switch. Normal voltages are indicated by a reading of "0" on the VU scale on the instrument.

**2.2.4. Power Supply.**—The 12Z equipment includes two power supplies, an a-c power supply and batteries. The a-c power supply uses a Type 7Y4 full wave high vacuum rectifier. The filter system consists of reactors L-301, L-302 and capacitors C-301A and C-301B. The battery requirements for the 12Z are 135 volts of "B" battery and 7.5 volts of "A" battery. A control is provided to adjust the filament voltage when batteries are used. This equipment is designed so that the batteries are automatically switched into operation if the a-c source fails. Refer to figure 2-2. Figure 2-2A shows the position of relay K-301 when the power switch is in the OFF position. Figure 2-2B, relay K-301 is energized as the power switch is rotated through the RESET position. Figure 2-2C, the power switch is in the ON position and relay K-301 is held energized by contacts 6 and 7 of K-301. Figure 2-2D, the line voltage has failed and has opened relay K-301 thus switching the batteries into operation.

## SECTION III

## INSTALLATION AND INITIAL ADJUSTMENTS

## 3.1. UNPACKING.

All equipment supplied with the 12Z unit is shipped in one carton. Remove all of the packing material and lift the unit out carefully. Inspect the unit for loose screws or bolts. Be certain all con-

trols, such as switches, dials, etc., work properly. All claims for damage should be filed promptly with the transportation company. If a claim for damage is to be filed, the original packing case and material must be preserved.

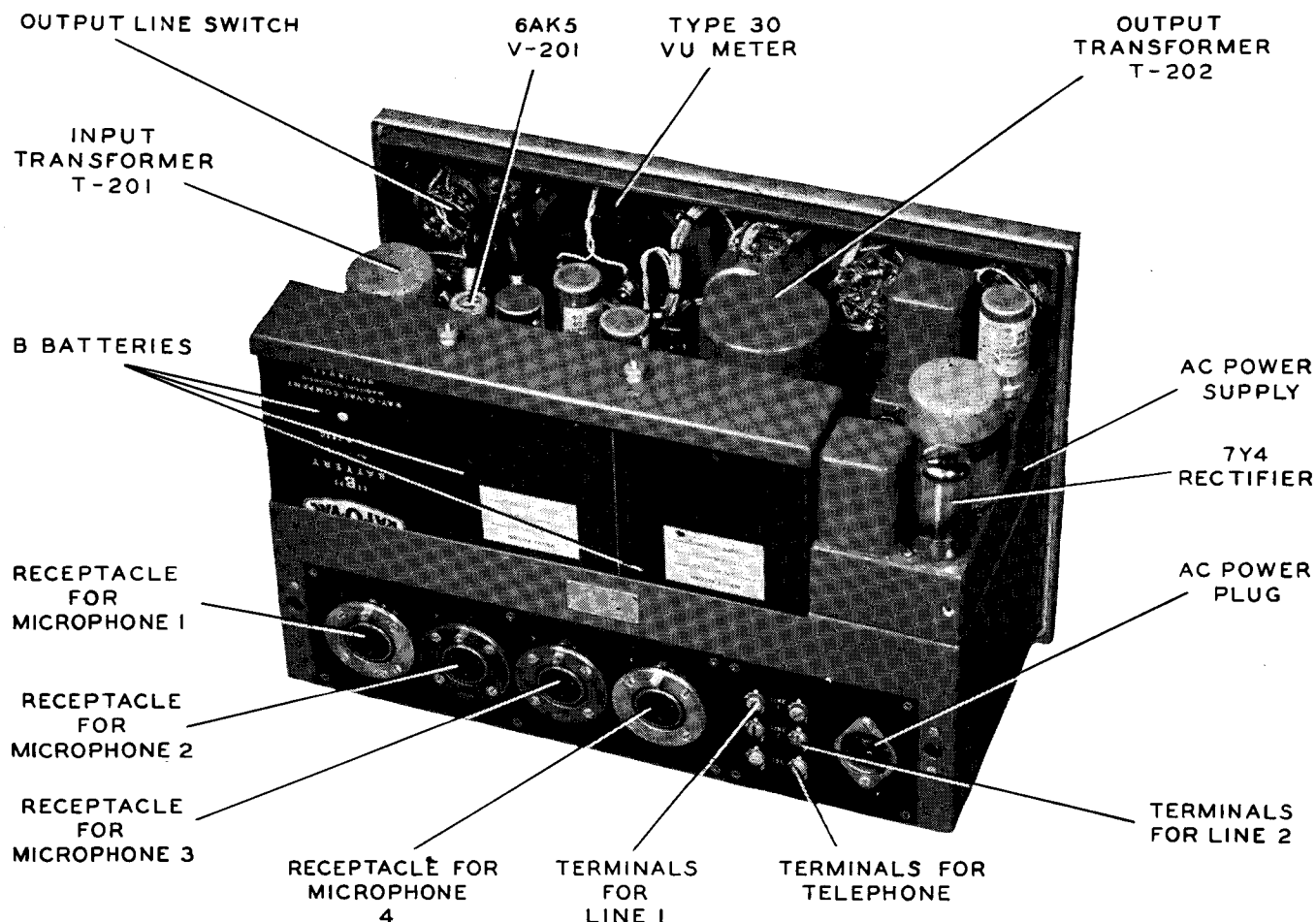


Figure 3-1. 12Z Amplifier, Top — Dust Cover Removed

## 3.2. PLACING AMPLIFIER IN OPERATION.

It is suggested that the procedure described below be followed in detail when the amplifier is placed in operation for the first time:

(1) Remove front and rear covers by rotating the Dzus fasteners 90 degrees counterclockwise with a coin or screwdriver.

(2) Install the batteries. The "A" batteries are held in the bracket on the bottom of the chassis. The "B" batteries are supported on top of the main

chassis. Refer to figure 3-2. When placing the batteries in the amplifier, the polarity should be observed.

(3) The "B" battery plugs are wired so as to connect the "B" batteries in series and the "A" battery plugs are wired so that they connect the "A" batteries in series. Refer to figure 5-7, page 5-6.

(4) Refer to figure 5-3, page 5-4. Insert the Type 9001 tubes into their sockets. Insert the Type 6AK6 tube into its socket. Place the Type 7Y4 rectifier



tube in its socket in the power supply. If the tubes are in their sockets when the unit is received, check to be sure each is firmly seated.

(5) Place the tube shield over the 9001 tube that was inserted into the input amplifier tube socket.

(6) Replace the rear cover and fasten to the chassis by rotating the two fasteners clockwise 90 degrees.

(7) Connect the microphone leads to the microphone plugs that are furnished with the amplifier.

#### Note

The microphone for the 12Z-2 must be between 30 and 50 ohms impedance. The microphone for the 12Z-3 must be between 200 and 250 ohms impedance.

(8) Insert the microphone cord plugs into the receptacles.

(9) Connect the output line to the pair of terminals designated LINE 1 and the telephone line to the terminals designated LINE 2.

(10) Rotate the POWER switch to the ON position.

(11) Rotate the METER switch to position A. Adjust the FILAMENT switch to a position where the indicator or the VU meter will read "0" on the VU scale. Usually with new batteries, the VU meter will read "0" with the FILAMENT switch in the HIGH position.

(12) Plug the power cord plug into the receptacle at the rear of the amplifier, the other plug into a source of 110 v a.c., and the 12Z is ready for operation.

When the equipment is to be transported or is not in use, the power cord should be wrapped around the fader knobs before the front cover is attached.

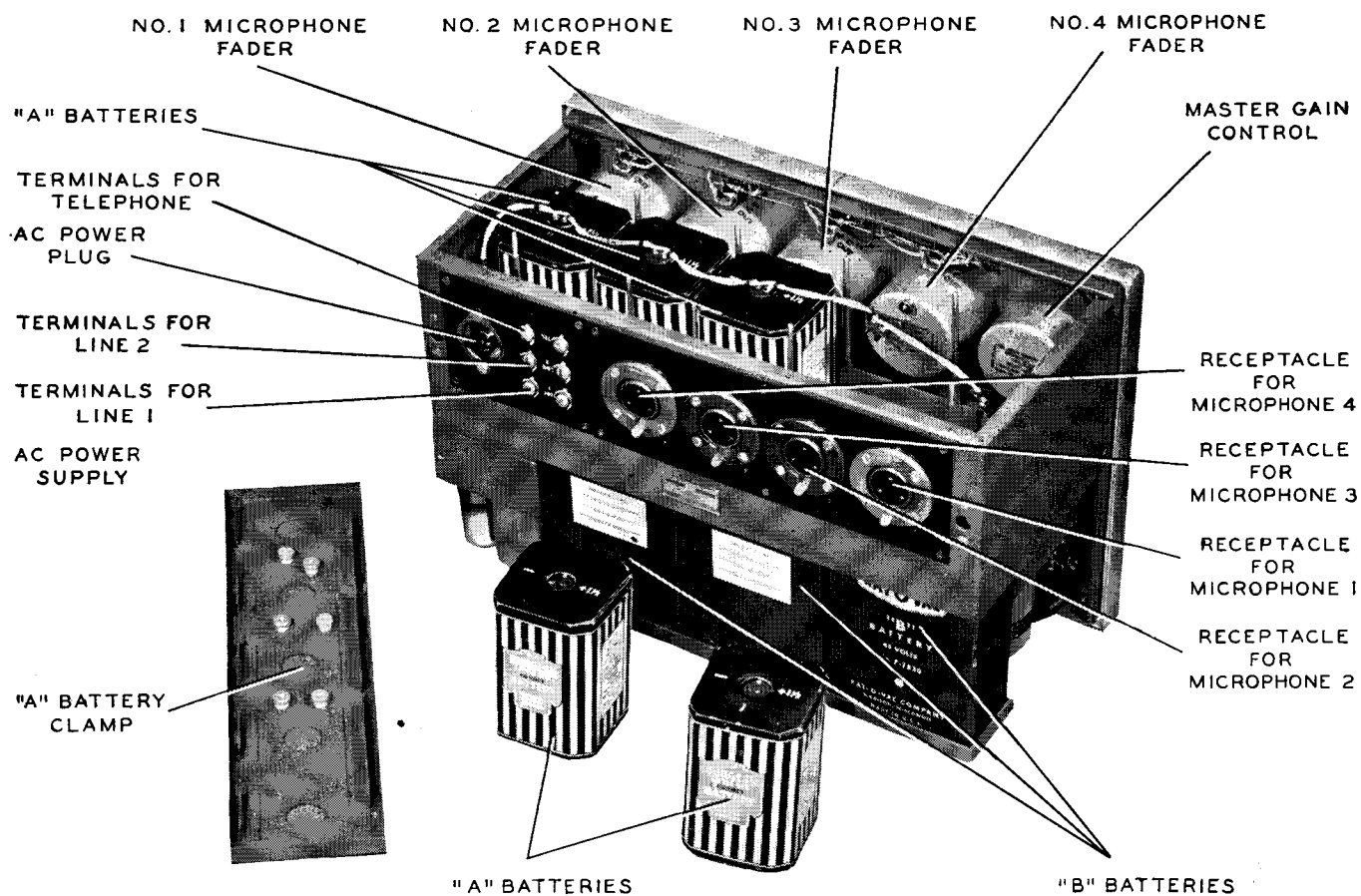


Figure 3-2. 12Z Amplifier, Bottom — Dust Cover Removed

#### CAUTION

WHEN REPLACING FILAMENT BATTERIES, PLACE THE RETAINING PLATE OVER THE BATTERIES AND TIGHTEN THE KNURLED NUTS BEFORE INSERTING THE BATTERY CONNECTOR PLUGS.

## SECTION IV

## OPERATION

## 4.1. GENERAL.

The 12Z amplifier has been designed to provide simplicity and reliability of operation, and only controls and features which are strictly essential have been included.

## 4.2. ROUTINE OPERATION.

## 4.2.1. Panel Controls.

**MIXING CONTROLS.**—The four mixing controls are marked 1, 2, 3 and 4. Each control is a tapered "T" type control, designed for minimum insertion loss. For the best signal to noise ratio on programs, keep the microphone faders as near maximum as possible. Those faders that are not in use should in all cases be rotated to the OFF position. The master gain control is a high resistance, step-by-step potentiometer located in the grid circuit of the second stage.

**METER SWITCH.**—The METER switch connects the VU meter across the "A" battery circuit in position A, across the "B" battery circuit in position B and across the audio output in the position marked VU. In the latter case the control marked VOL. UNITS provides range extension from plus 4 to plus 16 VU in 2 VU steps.

**POWER SWITCH.**—The POWER switch is a three position switch. The positions are OFF, AC-RESET and ON. When putting the 12Z equipment into operation, rotate the power switch to the ON position. As the switch is rotated to ON, it automatically sets relay K-301 so that a power line failure will automatically switch in the batteries. Once the batteries have been switched into operation, it is necessary to operate the POWER SWITCH to the AC-RESET position and then to the ON position in order to put the 12Z back on a-c operation. In the event batteries are not used, the POWER switch should be rotated to the AC-RESET position instead of to the ON position.

**FILAMENT CONTROL.**—The FILAMENT control is a three position switch with positions indicated as LOW, MED, and HIGH. When the "A" batteries are new, the FILAMENT control is usually set on the HIGH position to give the proper voltage. However, proper operating voltage for the "A" batteries can be read on the VU meter and the FILAMENT control can be adjusted accordingly. A reading of "100" or "0" on the meter scale indicates proper filament voltage. When the meter reading drops to "90" the batteries should be replaced.

(FILAMENT control is presumed to be set on LOW.)

**OUTPUT SWITCH.**—The OUTPUT switch connects the audio output to LINE 1, to LINE 2 or to a terminating resistor in the center position. The switch automatically connects the telephone to the line that is not being used for the program. If a level above +10 db is required at the output terminals of the 12Z, it is recommended that the isolation pad in the circuit be removed.

**4.2.2. Monitoring Jacks.**—Two monitor headphone jacks are provided. One jack is the PROGRAM MONITOR jack and is connected across the amplifier output, the other jack is the LINE MONITOR JACK and is connected across the line. When the amplifier is feeding the line, the two jacks are essentially in parallel.

**4.2.3. Batteries.**—Dry batteries for use with the 12Z are standard items manufactured by at least ten large battery manufacturers. The "A" battery requirement is 0.45 amp at 7.5 volts. Meter lights require 0.06 amp additional current. The "A" battery life will be at least 50 hours under average operating conditions. The "B" battery requirement is 12 ma at 135 volts. "B" battery life will exceed 100 hours. The following table lists the various "A" batteries known to be suitable for use in the 12Z:

"A" BATTERIES

Manufacturer	Quantity Required	Mfg's Type No.	Total Service Hours	
			2 hours per day	Continuous
Burgess	5 (series)	4F	50	30
Eveready	5 (series)	742	50	30

Other "A" batteries that are specified by their manufacturers as being interchangeable with those listed above are:

Ray O Vac P94A	General 4F1	Usalite 634	Advance 247	Bright Star 462
Winchester 4816	Bond 4826	Philco P94	Sears Roe. 5089	Mont. Ward 5021

The following table lists the various "B" batteries known to be suitable for use in the 12Z:

"B" BATTERIES

Manufacturer	Quantity Required	Mfg's Type No.	Total Service Hours	
			4 hours per day	Continuous
Burgess	3 (series)	M30	110	80
Eveready	3 (series)	482	110	80

Other "B" batteries that are specified by their manufacturers as being interchangeable with those listed above are:

Ray O Vac P7830	Usalite 640	Advance 284	Bright Star 30-33	Win- chester 6210	Bond 6220	Sears Roebuck 5079
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All of the above data on service life was supplied by the battery manufacturers, and no liability is assumed by the Collins Radio Company for failure of the batteries to deliver the indicated service. Tests made by the Collins Radio Company indicate that any of the batteries listed in the tables will deliver 30 to 50 hours of useful life under normal conditions in the 12Z. It is recommended that the "A" batteries be replaced when their voltage under normal load is 5.6 volts, and "B" batteries should be replaced at an end point of 120 volts, although experience with any particular make of batteries may indicate that a different end voltage should be used.

If a-c operation only is required, batteries can be omitted, but automatic line failure protection is then lost. Without batteries the equipment weight will be reduced to 29 pounds, compared with 40 pounds

when batteries are included. When the batteries are not used the battery plugs should be taped up.

**4.2.4. Metering Circuit.** — A Weston Model 862 VU meter is used with appropriate series resistance to measure filament voltage and plate supply voltage. Rectifier type instruments are inherently not as accurate as d-c instruments, and it may be advisable to calibrate the d-c readings with a separate instrument of known accuracy. The readings in the following table indicate the d-c voltage corresponding to various VU readings on the meter scale and are accurate within about 5%.

	Working Range on D-C Operation						
VU Reading	-1.5	-1.0	-0.5	0	+0.5	+1	+1.5
"A" Voltage	5.35	5.62	5.95	6.3	6.67	7.05	7.5
"B" Voltage	113	120	127.5	135	143	151	160
	Working Range on A-C Operation						

The filament voltage should never be allowed to exceed 6.3 volts. It may be reduced to 5.6 volts without impairing performance.

#### IMPORTANT

In the event that the operator should forget to turn off the power switch, a filament interlock switch S106 will prevent battery drain when the unit is not in use. This switch is located directly below the program monitor jack and is operated by the Dzus fastener when the front cover is secured in place.

## SECTION V

### MAINTENANCE

This radio equipment has been constructed of materials considered to be the best obtainable for the purpose and has been carefully inspected and adjusted at the factory. Sealed capacitors and transformers are used throughout. The use of electrolytic capacitors has been restricted to the cathode and power supply circuits. A minimum amount of maintenance will be required.

#### 5.1. FUSE REPLACEMENT.

The  $\frac{1}{4}$  amp fuse, F-301, is located on the top right hand side of the power supply chassis. Remove the rear dust cover to gain access to the fuse holder.

#### 5.2. TUBE REPLACEMENT.

The performance of the 12Z depends to some extent upon the characteristics of the tubes used. Each amplifier is shipped (unless otherwise ordered) with a set of tubes which have been tested and found to operate satisfactorily in the amplifier. Replacement tubes can be obtained at any time from the Collins Radio Company or can be obtained from any tube dealer. In the latter case it is advisable to try several tubes, retaining the one having the lowest noise level in each position.

#### 5.3. TROUBLE SHOOTING.

**GENERAL.**—In case of failure or improper operation of the amplifier, an attempt should be made to localize the fault. In many cases the defect will result in abnormal plate current or voltage measurements and these readings may give a clue to the source of trouble. By means of systematic checking, the trouble can be narrowed down to a single stage, after which inspection and localized checking with test instruments can be used to isolate the fault.

**DISTORTION.** — Excessive amplitude distortion can be caused by a defective tube or by improper

operating voltages. All tubes accompanying the amplifier are checked for proper operation before leaving the factory. Over a period of time the characteristics may change; it is therefore advisable to check the condition of the tubes occasionally to insure correct operation.

**NOISE.**—Noise in the 12Z amplifier can be divided into two classes: (1) Hum and (2) Intermittent noises. Hum is usually present to some degree in any amplifying system. The magnitude of the hum depends upon circuit design and unit construction. In the 12Z these undesirable effects have been reduced to a negligible value, even at full gain.

##### (1) HUM.

Induction will occur only when the unit is near a very strong alternating magnetic field. For this reason, the amplifier should be located several feet away from any such fields. Hum caused by defective tubes can best be located by substitution of other tubes known to be in good condition. It is suggested that one or more spare tubes of each type be kept available. A defective power supply can cause hum due to insufficient filtering of the high voltage supply. The filter condensers should be checked to determine whether they are open circuited if hum from this source is suspected.

**(2) INTERMITTENT NOISE.** — Intermittent noises are usually caused by faulty connections either in circuit wiring or in a circuit component. A good procedure to follow in locating such trouble is to listen to the noise in headphones while removing first the input connections, then the first tube, then each tube in turn until the noise stops. It is quite likely that the noise is associated with the components or wiring connected to the tube last removed. The associated apparatus and wiring should be checked carefully and if necessary, parts thought to be defective should be replaced with others known to be in good condition.

## 5.4. VOLTAGE AND RESISTANCE MEASUREMENTS.

All measurements are made from terminals to ground.

Part	Terminal	Resistance (ohms)	Voltage	
			AC Supply	Battery
X-201	1	6500	0	0
	2 & 7	1800	1.25	1.25
	3	.25	(AC) 3.15	0
	4	.25	(AC) 3.15	6.3
	5	250M	75	65
	6	500M	30	26
X-202	1	1 Meg	0	0
	2 & 7	1900	.75	.75
	3	.25	(AC) 3.15	0
	4	.25	(AC) 3.15	6.3
	5	400M	85	75
	6	600M	20	17
X-203	1	450M	0	0
	2, 5 & 6	100M	140	128
	3	.25	(AC) 3.15	0
	4	.25	(AC) 3.15	6.3
J-204	1	.25	(AC) 6.3	6.3
	2	0	(AC) 0	0
	3	0	0	0
	4	80M	150	140
X-301	6	2100	(AC) 175	
	3	2100	(AC) 175	
	7	10M	200	
	1	.25	(AC) 3.5	
	8	.25	(AC) 3.5	
J-301	1	—	{ 115	—
	2	—	} AC 60 cycles	—
	3	—	(AC) 115	—
	4	0	0	0
	5	.25	(AC) 3.15	6.3
	6	.25	0	6.3
	7	—	—	—
	8	80M	—	135
	9	—	0	0
	10	.25	(AC) 6.3	0
	11	0	(AC) 0	0
	12	80M	150	135

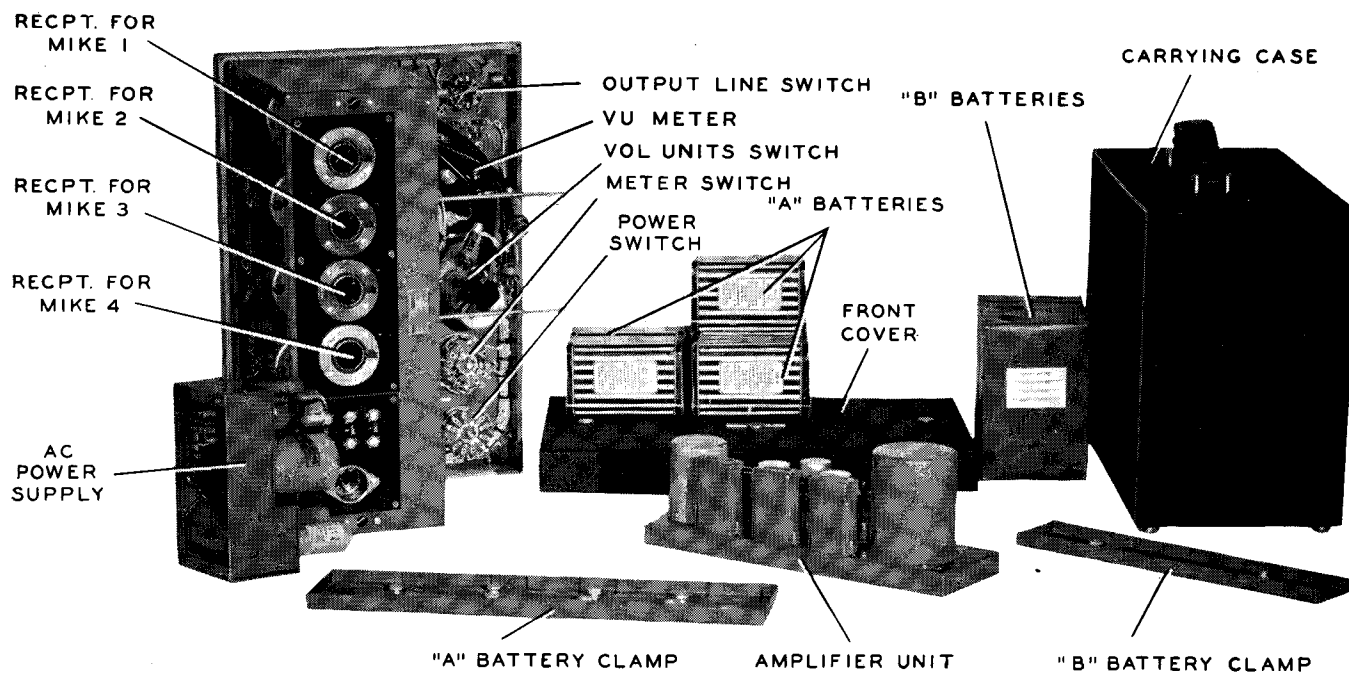


Figure 5-1. 12Z Amplifier, Assemblies Removed

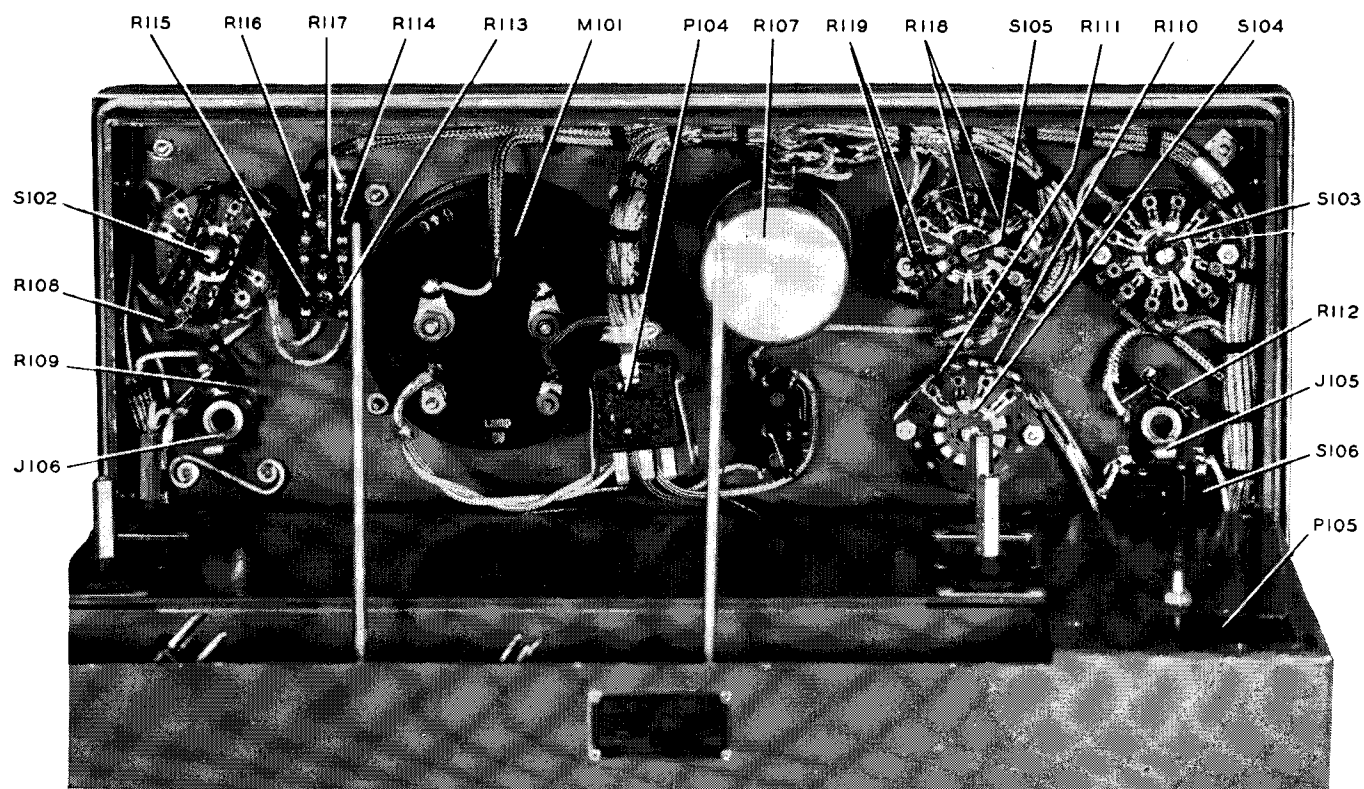


Figure 5-2. Main Assembly, Top

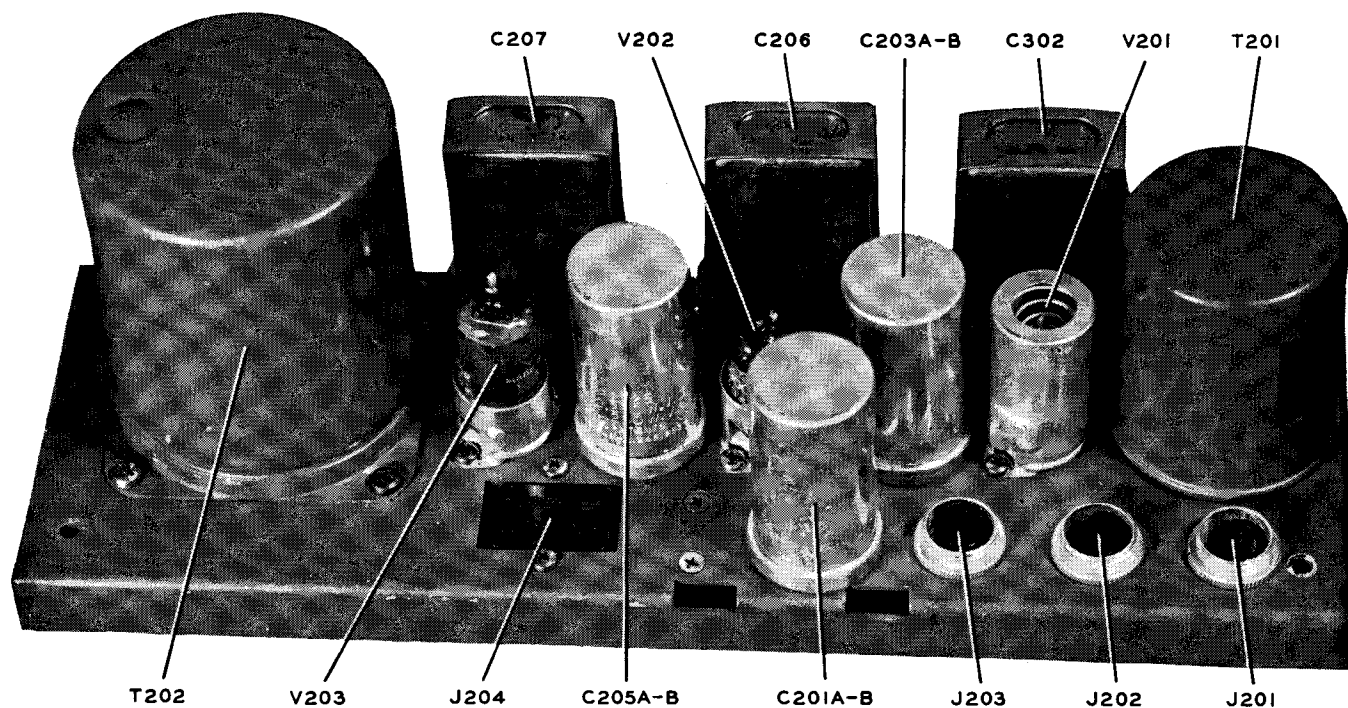


Figure 5-3. Audio Amplifier, Top

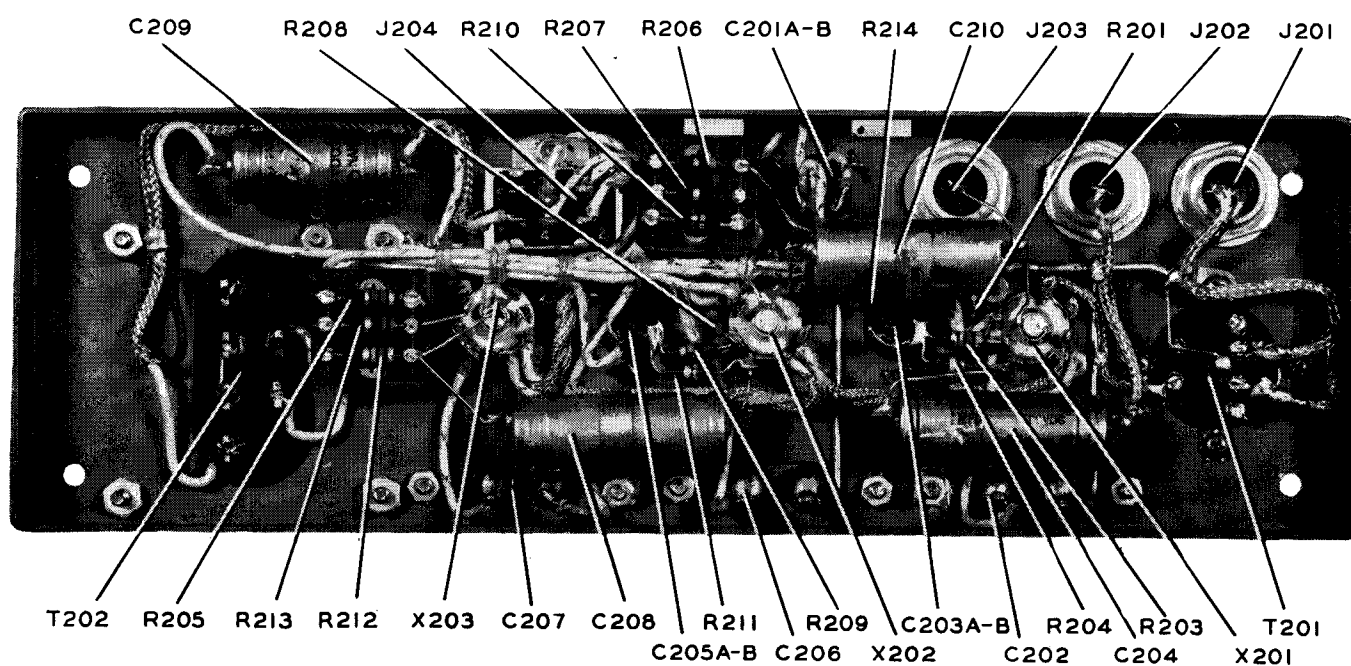


Figure 5-4. Audio Amplifier, Bottom

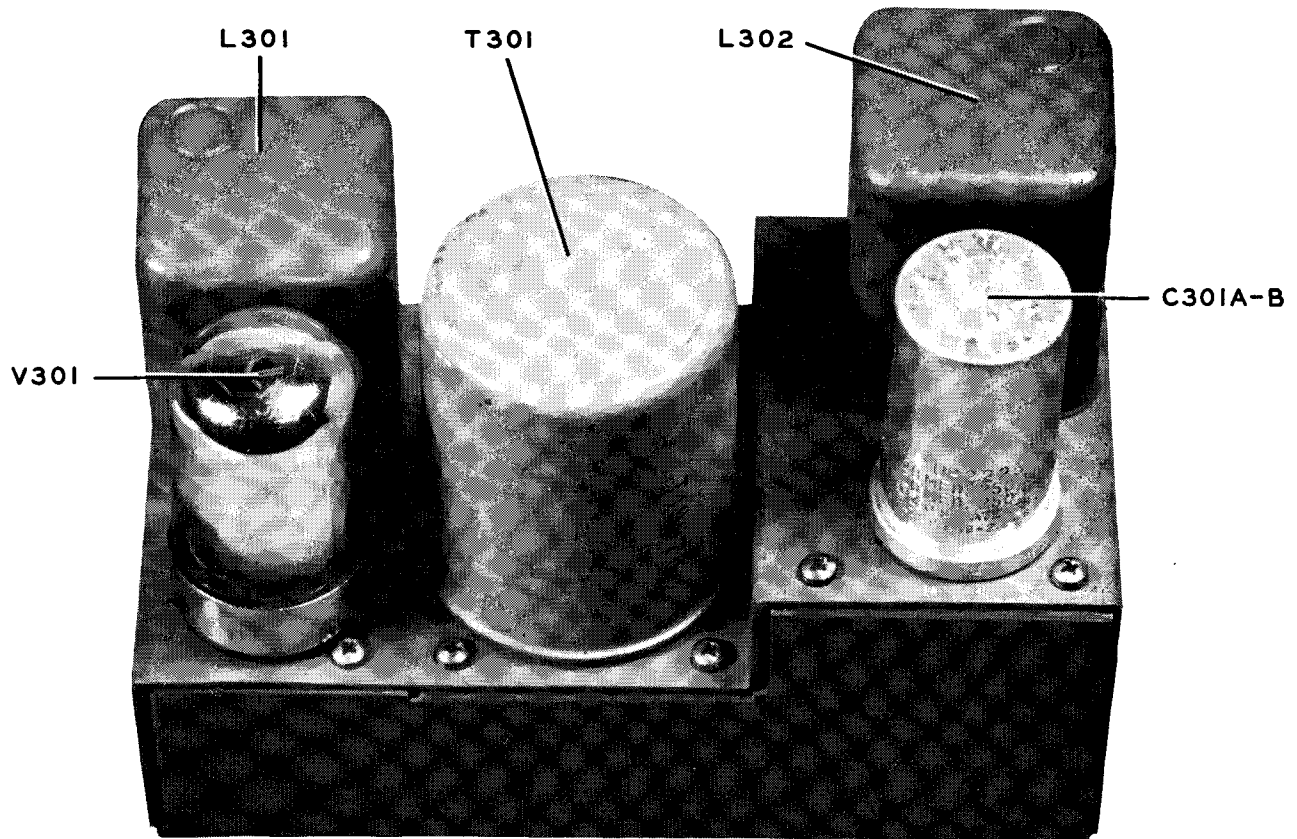


Figure 5-5. Power Supply, Top

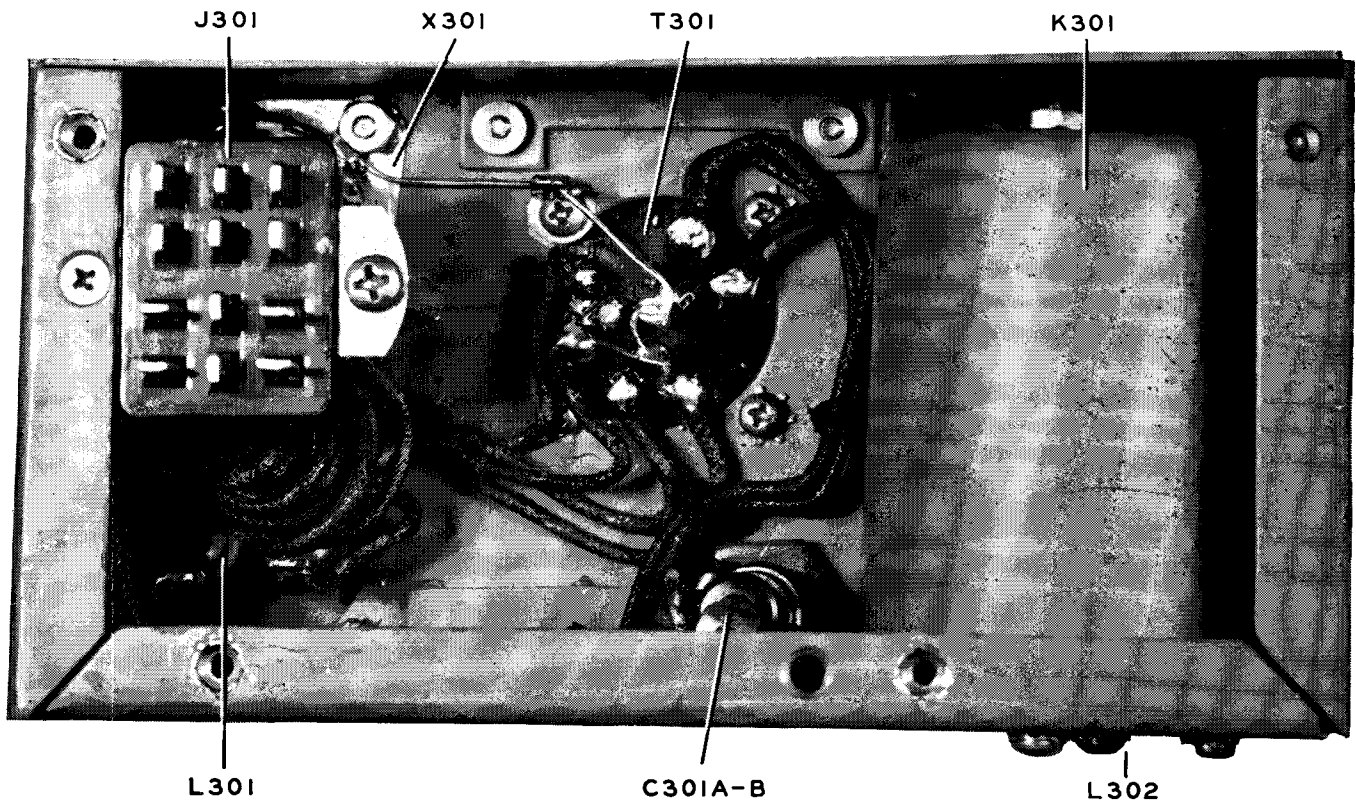


Figure 5-6. Power Supply, Bottom



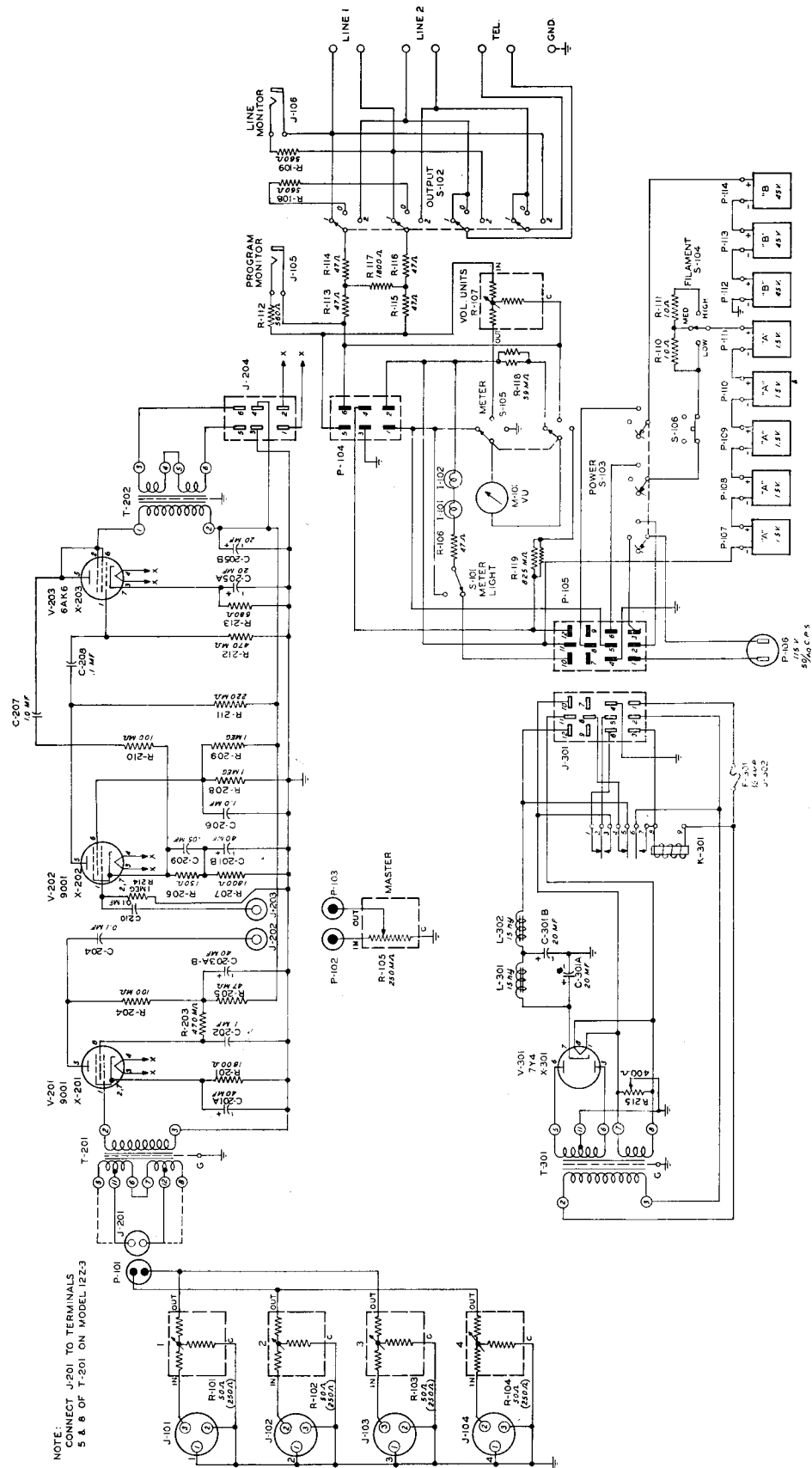


Figure 5-7. 12Z Schematic Diagram

# SECTION VI

## PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C-201	C-201A, C-201B	CAPACITOR: 40-40 mf —15% +100%; dual section dry electrolytic; 25 WV; 1" diam; 2" long.	183 1005 00
C-201A	Cathode bypass V-201	Section of C-201	
C-201B	Cathode bypass V-202	Section of C-201	
C-202	Screen bypass V-201	CAPACITOR: 1 mf +40% —15%; fixed paper; 600 WV; 1200 TV; 41/64" x 1-5/16" x 2-1/4".	930 0022 00
C-203	Plate bypass V-201	CAPACITOR: 20-20 mf —15% +100%; dual section; dry dielectric; 250 WV 1" diam; 2" long.	183 1006 00
C-203A	Plate bypass, V-201	Section of C-203	
C-203B	Plate bypass, V-201	Section of C-203	
C-204	Coupling	CAPACITOR: 0.1 mf ±20% foil paper liquid impregnated; 600 WV; 1200 TV; 5/8" diam; 2" long.	930 0007 00
C-205	C-205A, C-205B	CAPACITOR: 20-20 mf —15% +100%; dual section; dry electrolytic; 250 WV; 1" diam; 2" long.	183 1006 00
C-205A	Cathode bypass V-203	Section of C-205	
C-205B	Plate bypass, V-203	Section of C-205	
C-206	Screen bypass, V-202	CAPACITOR: 1 mf +40% —15%; fixed paper; 600 WV; 1200 TV; 41/64" x 1-5/16" x 2-1/4".	930 0022 00
C-207	Blocking	CAPACITOR: 1 mf +40% —15%; fixed paper; 600 WV; 1200 TV; 41/64" x 1-5/16" x 2-1/4".	930 0022 00
C-208	Coupling	CAPACITOR: 0.1 mf ±20%; foil paper liquid impregnated; 600 WV; 1200 TV; 5/8" diam; 2" long.	930 0007 00
C-209	Bypass	CAPACITOR: .05 mf +20% —10%; 600 WV; 1200 TV; tubular; single section; foil paper; liquid impregnated.	930 0010 00
C-210	Transient filter	CAPACITOR: paper; .1 mf ±20%; 600 WV; 1200 TV; hermetically sealed metal case 2" long x 5/8" diam. overall	930 0007 00
C-301	C-301A, C-301B	CAPACITOR: 20-20 mf —15% +100%; dual section; dry electrolytic; 250 WV; 1" diam; 2" long.	183 1006 00
C-301A	Filter	Section of C-301	
C-301B	Filter	Section of C-301	
E-201	For V-201	SHIELD: tube; miniature short; spring in tap; twist-lock; .915" diam x 1-3/8" h overall.	141 0001 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
E-301	#1 Microphone fader R-101	KNOB: black bakelite; engraved 0° to 40° in 10 steps; 4° per step and "OFF"; for 1/4" diam shaft; two 10-32 set screws spaced 90° 2-1/4" diam x 1-1/16" thk.	502 8717 002
E-302	#2 Microphone fader R-102	KNOB: black bakelite; engraved 0° to 40° in 10 steps; 4° per step and "OFF"; for 1/4" diam shaft; two 10-32 set screws spaced 90° 2-1/4" diam x 1-1/16" thk.	502 8717 002
E-303	#3 Microphone fader R-103	KNOB: black bakelite; engraved 0° to 40° in 10 steps; 4° per step and "OFF"; for 1/4" diam shaft; two 10-32 set screws spaced 90° 2-1/4" diam; x 1-1/16" thk.	502 8717 002
E-304	#4 Microphone fader R-104	KNOB: black bakelite; engraved 0° to 40° in 10 steps; 4° per step and "OFF"; for 1/4" diam shaft; two 10-32 set screws spaced 90° 2-1/4" diam; x 1-1/16" thk.	502 8717 002
E-305	Master gain R-105	KNOB: black bakelite; engraved 0° to 40° in 10 steps; 4° per step and "OFF"; for 1/4" diam shaft; two 10-32 set screws spaced 90° 2-1/4" diam; x 1-1/16" thk.	502 8717 002
E-306	Power control S-103	KNOB: black bakelite; engraved arrow; for 1/4" diam shaft; 10-32 set screw; 1-1/8" diam x 5/8" thk.	507 2684 20
E-307	Meter switch, S-105	KNOB: black bakelite; engraved arrow; for 1/4" diam shaft; 10-32 set screw; 1-1/8" diam x 5/8" thk.	507 2684 20
E-308	VU Range switch, R-107	KNOB: black bakelite; engraved arrow; for 1/4" diam shaft; 10-32 set screw; 1-1/8" diam x 5/8" thk.	507 2684 20
E-309	Output line S-102	KNOB: black bakelite; engraved arrow; for 1/4" diam shaft; 10-32 set screw; 1-1/8" diam x 5/8" thk.	507 2684 20
E-310	Filament S-104	KNOB: black bakelite; engraved arrow; for 1/4" diam shaft; 10-32 set screws; 1-1/8" diam x 5/8" thk.	507 2684 20
F-301	AC line fuse	FUSE: 1/4 amp. 250 v; glass enclosed cartridge; 1/4" diam; 1-1/4" long.	264 4020 00
I-101	Meter lamp	LAMP: 2 v .06 amp; miniature bayonet base.	262 0043 00
I-102	Meter lamp	LAMP: 2v .06 amp miniature bayonet base	262 0043 00
J-101	Microphone connector	CONNECTOR: 3 term socket 2" diam x 1-1/4" thk. 4 wall mtg holes on 13/16" radius.	370 2060 00
J-102	Microphone connector	CONNECTOR: 3 term socket 2" diam x 1-1/4" thk. 4 wall mtg holes on 13/16" radius.	370 2060 00
J-103	Microphone connector	CONNECTOR: 3 term socket 2" diam x 1-1/4" thk. 4 wall mtg holes on 13/16" radius.	370 2060 00

## PARTS LIST

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ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
J-104	Microphone connector	CONNECTOR: 3 term socket 2" diam x 1-1/4" thk. 4 wall mtg holes on 13/16" radius.	370 2060 00
J-105	Program monitoring jack	JACK: Phone jack; midget; jack for 2 conductor plug with 1/4" diam barrel; 15/16" diam; 1" long.	358 1090 00
J-106	Line monitoring jack	JACK: Phone jack; midget; jack for 2 conductor plug with 1/4" diam barrel; 15/16" diam; 1" long.	358 1090 00
J-201	Microphone connector	CONNECTOR: 2 female contacts; high dielectric black bakelite; 7/8" diam; 11/16" long; 5/8-27 mtg thd.	369 1004 00
J-202	Master control connector	CONNECTOR: 1 female contact; high dielectric black bakelite; 7/8" diam; 11/16" long; 5/8-27 mtg thd.	369 1003 00
J-203	Master control connector	CONNECTOR: 1 female contact; high dielectric black bakelite; 7/8" diam; 11/16" long; 5/8-27 mtg thd.	369 1003 00
J-204	Power source and output connector	CONNECTOR: 6 contact socket; 25/32" x 1" x 1-1/4" chassis mtg.	366 2060 00
J-301	Power connector	PLUG: 12 prong connector; 1-7/32" x 1-1/2" x 1-1/4" chassis mtg.	365 2120 00
J-302	Fuse holder	RECEPTACLE: Fuse holder; extractor post; 15 amp; 11/16" diam; 2-17/64" long 1/2-24 mtg. thd.	265 1003 00
K-301	Change over relay	RELAY: Small circuit control; SPDT; one pole normally closed and one pole normally open; 115 v; 785 ohms $\pm 10\%$ ; 1-1/4" x 1-13/32" x 1-9/16".	972 1019 00
L-301	Filter choke	CHOKE: 15 hy $\pm 20 - 0\%$ ; 60 ma; 1600 ohms; 1500 TV; filter reactor; 1-1/2" x 1-1/2" x 2-1/8".	678 0082 00
L-302	Filter Choke	CHOKE: 15 hy $\pm 20 - 0\%$ ; 60 ma; 1600 ohms; 1500 TV; filter reactor; 1-1/2" x 1-1/2" x 2-1/8".	678 0082 00
M-101	DC circuit and output metering	METER: volume level; scale -20 to +3 VU and 0 to 100; two 2v .06 amp lamps in series interior illumination; 4-1/4" lg x 3-15/16" wd. x 1-7/8" thk. overall.	456 0002 00
P-101	Microphone connector plug	PLUG: 2 prong; for 5/16" max diam cable; body 1-3/8" lg x 11/16" diam with 1/4" lg spring.	369 1005 00
P-102	Master control connector plug	PLUG: single pin insert; for 1/4" max diam cable; body 1-3/8" lg x 11/16" diam with 3/4" lg spring.	369 1002 00
P-103	Master control connector plug	PLUG: single pin insert; for 1/4" max diam cable; body 1-3/8" lg x 11/16" diam with 3/4" lg spring.	369 1002 00
P-104	Power source and output connector plug	PLUG: 6 prong; 1/2" diam cable opening; 1-5/16" lg x 11/16" wd x 1-7/8" h overall; with lock and cable clamp.	365 8063 00
P-105	Power connector plug	SOCKET: 12 term female chassis mtg; 1-1/4" lg x 15/16" wd x 3/4" thk.	366 2120 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
P-106	AC power plug	PLUG: 2 prong male; flush mtg; 10 amp 250 v; 15 amp 125 v; 1-29/32" lg x 1-1/4" wd x 1" h overall.	368 3700 00
P-107	"A" battery plug	PLUG: 2 prong; for 1.5 v battery; bake-lite base; 11/16" diam x 11/16" h overall.	372 1007 00
P-108	"A" battery plug	PLUG: 2 prong; for 1.5 v battery; bake-lite base; 11/16" diam x 11/16" h overall.	372 1007 00
P-109	"A" battery plug	PLUG: 2 prong; for 1.5 v battery; bake-lite base; 11/16" diam x 11/16" h overall.	372 1007 00
P-110	"A" battery plug	PLUG: 2 prong; for 1.5 v battery; bake-lite base; 11/16" diam x 11/16" h overall.	372 1007 00
P-111	"A" battery plug	PLUG: 2 prong; for 1.5 v battery; bake-lite base; 11/16" diam x 11/16" h overall.	372 1007 00
P-112	"B" battery plug	PLUG: 3 prong; for 45 v battery; bake-lite base; 11/16" diam x 11/16" h overall.	372 1008 00
P-113	"B" battery plug	PLUG: 3 prong; for 45 v battery; bake-lite base; 11/16" diam x 11/16" h overall.	372 1008 00
P-114	"B" battery plug	PLUG: 3 prong; for 45 v battery; bake-lite base; 11/16" diam x 11/16" h overall.	372 1008 00
R-101 (12Z-3)	T pad (12Z-3)	RESISTOR: "Tee" attenuator; 250/250 ohm; tapered; 20 step; 2 db per step; case 2-3/32" lg x 2-5/16" diam; 1/4" diam shaft 15/16" lg.	378 0010 00
R-101 (12Z-2)	T pad (12Z-2)	RESISTOR: "Tee" attenuator; 50/50 ohm; tapered; 20 step; 2 db per step; case 2-3/32" lg x 2-5/16" diam; 1/4" diam shaft 15/16" lg.	378 0009 00
R-102	T pad (12Z-3)	RESISTOR: "Tee" attenuator; 250/250 ohm; tapered; 20 step; 2 db per step; case 2-3/32" lg x 2-5/16" diam; 1/4" diam shaft 15/16" lg.	378 0010 00
R-102	T pad (12Z-2)	RESISTOR: "Tee" attenuator; 50/50 ohm; tapered; 20 step; 2 db per step; case 2-3/32" lg x 2-5/16" diam; 1/4" diam shaft 15/16" lg.	378 0009 00
R-103	T pad (12Z-3)	RESISTOR: "Tee" attenuator; 250/250 ohm; tapered; 20 step; 2 db per step; case 2-3/32" lg x 2-5/16" diam; 1/4" diam shaft 15/16" lg.	378 0010 00
R-103	T pad (12Z-2)	RESISTOR: "Tee" attenuator; 50/50 ohm; tapered; 20 step 2 db per step; case 2-3/32" lg x 2-5/16" diam; 1/4" diam shaft 15/16" lg.	378 0009 00
R-104	T pad (12Z-3)	RESISTOR: "Tee" attenuator; 250/250 ohm; tapered; 20 steps; 2 db per step; case 2-3/32" lg x 2-5/16" diam; 1/4" diam shaft 15/16" lg.	378 0010 00

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ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
R-104	T pad (12Z-2)	RESISTOR: "Tee" attenuator; 50/50 ohm; tapered; 20 step; 2 db per step; case 2-3/32" lg x 2-5/16" diam; 1/4" diam shaft 15/16" lg.	378 0009 00
R-105	Gain control	RESISTOR: 250,000 ohm potentiometer; tapered; 20 step; 2 db per step; last step infin; case 1-7/8" lg x 2-5/16" diam; 1/4" diam shaft 15/16" lg.	378 0008 00
R-106	Meter light voltage dropping	RESISTOR: 47 ohm $\pm 10\%$ ; 1/2 watt; 4.8 WV.	745 1030 00
R-107	VU meter range extension	RESISTOR: "Tee" attenuator; 7500 ohm input; 3900 ohm output; 8 steps; 2 VU per step; detent; case 1-3/4" lg x 1-3/4" diam; 1/4" diam shaft 1/2" lg; 3/8-32 thd bushing 1/2" lg.	378 4070 00
R-108	Load Resistor	RESISTOR: 560 ohm $\pm 10\%$ ; fixed; 1/2 watt; 17 WV.	745 1076 00
R-109	Monitoring jack series resistor	RESISTOR: 560 ohm $\pm 10\%$ ; fixed; 1/2 watt; 17 WV.	745 1076 00
R-110	Filament dropping resistor	RESISTOR: 1.0 ohm $\pm 10\%$ ; fixed; wire wound; 1/2 watt; 1000 TV; .240" diam; 41/64" long.	707 0048 00
R-111	Filament dropping resistor	RESISTOR: 1.0 ohm $\pm 10\%$ ; fixed; wire wound; 1/2 watt; 1000 TV; .240" diam; 41/64" long.	707 0048 00
R-112	Monitor jack series resistor	RESISTOR: 560 ohm $\pm 10\%$ ; fixed; 1/2 watt; 17 WV.	745 1076 00
R-113	Part of 600 ohm 3 db pad	RESISTOR: 47 ohm $\pm 10\%$ ; fixed; 1/2 watt; 4.8 WV.	745 1030 00
R-114	Part of 600 ohm 3 db pad	RESISTOR: 47 ohm $\pm 10\%$ ; fixed; 1/2 watt; 4.8 WV.	745 1030 00
R-115	Part of 600 ohm 3 db pad	RESISTOR: 47 ohm $\pm 10\%$ ; fixed; 1/2 watt; 4.8 WV.	745 1030 00
R-116	Part of 600 ohm 3 db pad	RESISTOR: 47 ohm $\pm 10\%$ ; fixed; 1/2 watt; 4.8 WV.	745 1030 00
R-117	Part of 600 ohm 3 db pad	RESISTOR: 1800 ohm $\pm 10\%$ ; fixed; 1/2 watt; 30 WV.	745 1097 00
R-118	Parallel meter resistor	RESISTOR: 39,000 ohm $\pm 2\%$ ; fixed pair; 1/2 watt.	720 0001 00
R-119	Parallel meter resistor	RESISTOR: Fixed pair; 822,000 ohm $\pm 2\%$ ; 1/2 watt.	720 0002 00
R-201	Cathode resistor, V-201	RESISTOR: 1800 ohm $\pm 10\%$ ; fixed; 1/2 watt; 30 WV.	745 1097 00
R-202		RESISTOR: Not used.	
R-203	Screen dropping resistor, V-201	RESISTOR: 470,000 ohm $\pm 10\%$ ; fixed; 1/2 watt; 350 WV.	745 1198 00
R-204	Plate dropping resistor, V-201	RESISTOR: 100,000 ohm $\pm 10\%$ ; fixed; 1/2 watt; 224 WV.	745 1170 00
R-205	Decoupling resistor, V-201	RESISTOR: 47,000 ohm $\pm 10\%$ ; fixed; 1/2 watt; 153 WV.	745 1156 00

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ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
R-206	Cathode resistor, V-202	RESISTOR: 150 ohm $\pm 10\%$ ; fixed; $\frac{1}{2}$ watt; 8.7 WV.	745 1051 00
R-207	Cathode resistor, V-202	RESISTOR: 1800 ohm $\pm 10\%$ ; fixed; $\frac{1}{2}$ watt; 30 WV.	745 1097 00
R-208	Screen resistor, V-202	RESISTOR: 1 megohm $\pm 10\%$ ; fixed; $\frac{1}{2}$ watt; 350 WV.	745 1212 00
R-209	Screen resistor, V-202	RESISTOR: 1 megohm $\pm 10\%$ ; fixed; $\frac{1}{2}$ watt; 350 WV.	745 1212 00
R-210	Negative feed-back resistor	RESISTOR: 100,000 ohm $\pm 10\%$ ; fixed; $\frac{1}{2}$ watt; 224 WV.	745 1170 00
R-211	Plate dropping resistor, V-202	RESISTOR: 220,000 ohm $\pm 10\%$ ; fixed; $\frac{1}{2}$ watt; 332 WV.	745 1184 00
R-212	Grid resistor, V-203	RESISTOR: 470,000 ohm $\pm 10\%$ ; fixed; $\frac{1}{2}$ watt; 350 WV.	745 1198 00
R-213	Cathode resistor, V-203	RESISTOR: 6800 ohm $\pm 10\%$ ; fixed; $\frac{1}{2}$ watt; 18 WV.	745 1079 00
R-214	Transient filter	RESISTOR: 1 ohm $\pm 10\%$ ; $\frac{1}{2}$ watt; 350 WV.	745 1212 00
S-101	Meter light switch	SWITCH: DPDT; toggle; 30 v — 10 amps; 125 v — 3 amps; 250 v — 1 amp; $1\frac{17}{32}$ " x $2\frac{27}{32}$ " x $1\frac{13}{32}$ ".	266 3003 00
S-102	Line output switch	SWITCH: Band change; 4 circuit, non-shorting, 3 position; 2 decks with fixed stops; $1\frac{3}{8}$ " x $1\frac{1}{2}$ " x $1\frac{11}{16}$ ".	259 0021 00
S-103	Power switch	SWITCH: Band change; 3 circuit, shorting, 3 position; fixed stop; $1\frac{5}{8}$ " x $1\frac{7}{8}$ ".	259 0018 00
S-104	Filament switch	SWITCH: Band change; 2 circuit, non-shorting, 3 position; fixed stops; $1\frac{5}{8}$ " x $1\frac{7}{8}$ ".	259 0019 00
S-105	Meter switch	SWITCH: Band change; 2 circuit, non-shorting; 3 position; fixed stop; $1\frac{5}{8}$ " x $1\frac{7}{8}$ ".	259 0019 00
S-106	Interlock switch	SWITCH: Snap; SPDT and SFST; 1 NO and 1 NC; case $1\frac{1}{4}$ " lg x $\frac{1}{2}$ " wd x $\frac{1}{2}$ " h; plunger on side of case.	260 0003 00
T-201	Microphone transformer	TRANSFORMER: Input audio; Pri: 50/250 ohm CT; 500 TV; Sec: 50,000 ohm; 500 TV; sealed case $2\frac{1}{2}$ " lg x $1\frac{15}{16}$ " diam; solder post term.	677 0065 00
T-202	Output transformer	TRANSFORMER: Output audio; Pri: 10,000 ohm; 1500 rms TV; Sec: 600 ohm; 1000 rms TV; sealed case $3\frac{3}{8}$ " h x $2\frac{9}{16}$ " diam; mtg holes $2\frac{3}{32}$ " x $2\frac{3}{32}$ "; solder post term.	677 0066 00
T-301	Power transformer	TRANSFORMER: Power; 50/60 cps; Pri: 115 v; 1600 TV; Sec #1: 140 v dc at 12 ma in circuit; Sec #2: 6.3 v 1.2 amp; 1600 TV; sealed case $2\frac{1}{2}$ " h x $1\frac{15}{16}$ " diam; solder post term.	672 0064 00

## PARTS LIST

## Section VI

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
V-201	Input amplifier tube	TUBE: Type 9001; detector amplifier pentode; 7 pins; miniature.	257 0045 00
V-202	Driver tube	TUBE: Type 9001; detector amplifier pentode; 7 pins; miniature.	257 0045 00
V-203	Output tube	TUBE: Type 6AK6; power pentode; 7 pins; miniature	257 0041 00
V-301	Rectifier tube	TUBE: Type 7Y4; high vacuum full wave rectifier; miniature.	255 0183 00
X-201	Socket for 9001 tube	SOCKET: Miniature shielded; 7 prongs; $\frac{5}{8}$ " x 1-7/64" x 1-3/8".	220 1003 00
X-202	Socket for 9001 tube	SOCKET: Miniature shielded; 7 prongs; $\frac{5}{8}$ " x 1-7/64" x 1-3/8".	220 1003 00
X-203	Socket for 6AK6 tube	SOCKET: Miniature shielded; 7 prongs; $\frac{5}{8}$ " x 1-7/64" x 1-3/8".	220 1003 00
X-301	Socket for 7Y4 tube	SOCKET: Loctal; bakelite with steel mtg plate; 1-5/8" lg x 1-3/16" wd x 25/32" thk.	220 1002 00
BT-101	Filament supply	BATTERY: Dry; 1.5 v; approx 100 hrs service at 280 ma with voltage drop to 1.0 v; std 1.5 v socket; 2-9/16" sq x 4" h.	015 0020 00
BT-102	Filament supply	BATTERY: Dry; 1.5 v; approx 100 hrs service at 280 ma with voltage drop to 1.0 v; std 1.5 v socket; 2-9/16" sq x 4" h.	015 0020 00
BT-103	Filament supply	BATTERY: Dry; 1.5 v; approx 100 hrs service at 280 ma with voltage drop to 1.0 v std 1.5 v socket; 2-9/16" sq x 4" h.	015 0020 00
BT-104	Filament supply	BATTERY: Dry; 1.5 v; approx 100 hrs service at 280 ma with voltage drop to 1.0 v; std 1.5 v socket; 2-9/16" sq x 4" h.	015 0020 00
BT-105	Filament supply	BATTERY: Dry; 1.5 v; approx 100 hrs service at 280 ma with voltage drop to 1.0 v; std 1.5 v socket; 2-9/16" sq x 4" h.	015 0020 00
BT-106	Plate supply	BATTERY: Dry; 45 v; approx 100 hrs service at 17.5 ma with voltage drop to 24 v; std 45 v socket; 3-1/2" long x 1-23/32" wd x 5-7/16" h.	015 0021 00
BT-107	Plate supply	BATTERY: Dry; 45 v; approx 100 hrs service at 17.5 ma with voltage drop to 24 v; std 45 v socket; 3-1/2" lg x 1-23/32" wd x 5-7/16" h.	015 0021 00
BT-108	Plate supply	BATTERY: Dry; 45 v; approx 100 hrs service at 17.5 ma with voltage drop to 24 v; std 45 v socket; 3-1/2" lg x 1-23/32" wd x 5-7/16" h.	015 0021 00



## GUARANTEE

This equipment is guaranteed against defects in material, workmanship or manufacture, for a period of one year from the date of delivery. Our obligation under this guarantee is limited to repairing or replacing any item which shall prove, by our examination, to be thus defective, provided the item is returned to the factory for inspection with all transportation charges paid. Before returning any item believed to be of defective material, workman-

ship or manufacture, a detailed report must be submitted to the company giving exact information as to the nature of the defect. The information shall include, in as much detail as possible, all subject material listed under instructions for replacement of parts. Upon receipt of the report by the company, detailed instructions as to how the equipment is to be returned will be issued. *Do not return any material until instructed to do so by the company.*

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## REPLACEMENT OF PARTS

In case a replacement under the guarantee is desired, a full report must be submitted to the company. This report shall cover all details of the failure and must include the following information:

- (A) Date of delivery of equipment.
- (B) Date placed in service.
- (C) Number of hours in service.
- (D) Part number of item.
- (E) Item number (obtain from Parts List or Schematic Diagram).
- (F) Type number of unit from which part is removed.
- (G) Serial number of unit.
- (H) Serial number of the complete equipment.
- (I) Nature of failure.

- (J) Cause of failure.
- (K) Remarks.

When requisitioning replacement parts, the following information must be furnished:

- (A) Quantity required.
- (B) Part number of item.
- (C) Item number (obtain from Parts List or Schematic Diagram).
- (D) Type number of unit.
- (E) Serial number of unit.
- (F) Serial number of equipment.

NOTE: Blank Service Report forms will be found in the appendix of this instruction book.

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