143-TYPE AMPLIFIER

CONTENTS

1. GENERAL

1.01 This section describes a series of amplifiers known as the 143-type, which includes three different models. The electrical and mechanical features of each of these amplifiers are discussed in detail. Installation information is also included.

1.02 These amplifiers are primarily intended for high audio power output applications such as in paging and announcing systems on a customer's premises.

1.03 The 143A amplifier is the basic amplifier and is common to all models of the 143 series. The B and C models are merely modifications of the 143A amplifier by the addition of various units to the latter. The 143A amplifier may also be used as a medium gain, bridging power amplifier for general monitoring purposes.

1.04 The 143B amplifier is a high gain power amplifier designed to operate from a microphone or other low-level input source.

1.05 The 143C amplifier is a medium gain power amplifier designed primarily for operation from a telephone line or other high level source.

1.06 Each of these amplifiers contains its own power supply which requires a 105-125 volt, 50-60-cycle source of power, and is equipped with a 3-ampere fuse of the thermal cutout type. Maximum power input is 335 watts. The 143A amplifier has two single-sided stages of amplification, a phase inverter stage, a push pull cathode follower stage and a parallel push pull power stage. The 143B amplifier consists of the basic amplifier and an additional 2-tube, 3-stage preamplifier, coded 141A. The 143C amplifier consists of the basic amplifier and a 713A apparatus unit. All three models have substantially flat gain-frequency characteristics from 50 to 15,000 cycles.

1.07 A wide range of input impedances is provided, and the input impedance depends upon the model and its strapping arrangement. Each amplifier is designed to operate into a wide range of load impedances, the value of which depends upon the strapping of the output transformer.

1.08 The 143-type amplifier, as supplied for use with Western Electric electron tubes in the output stage, will deliver into its optimum load impedance 75 watts (+49 dbm) of power with not more than 5% distortion over the frequency range of 50 to 7500 cycles. It may be reconnected for use with either Western Electric or commercial type electron tubes to give 50 watts (+47 dbm) with not more than 5% distortion from 50 to 7500 cycles.

1.09 Each of the three models of the 143-type amplifier is shipped for horizontal or shelf mounting, and is furnished with a continuously adjustable gain or volume control and a power switch mounted on the side of the chassis. When the 143-type amplifier is to be rack mounted, a 407B-15 panel, which is not part of the 143-type amplifier as shipped, must be obtained and installed locally as a front mat. In this case it is necessary to rotate the volume and power controls 90° to a position where they will be available through the cutout of the 407B-15 panel.

1.10 In addition to the continuously adjustable master gain control, the 143B amplifier has a screwdriver-operated gain control which is associated with the input stage (141A preamplifier), and is adjustable in three steps of 10 db each.

1.11 The maximum gains of these amplifiers vary, depending upon the model and the particular input arrangement used. Table 1, on Page 11 shows the gains obtained with various input arrangements.

1.12 The apparatus units of the three models are mounted on a 18-13/16 in. by 12-1/8 in. chassis and the height of each amplifier is approximately 8-1/2 in. When rack mounted using the 407B-15 panel, the amplifier occupies 12-1/4 in. of vertical space. The weight of the basic or 143A amplifier is 46-1/2 pounds.

1.13 Fig. 1 shows a front view of the 143A amplifier. The other two models are similar in appearance except that additional apparatus units are mounted on the left side of the chassis.

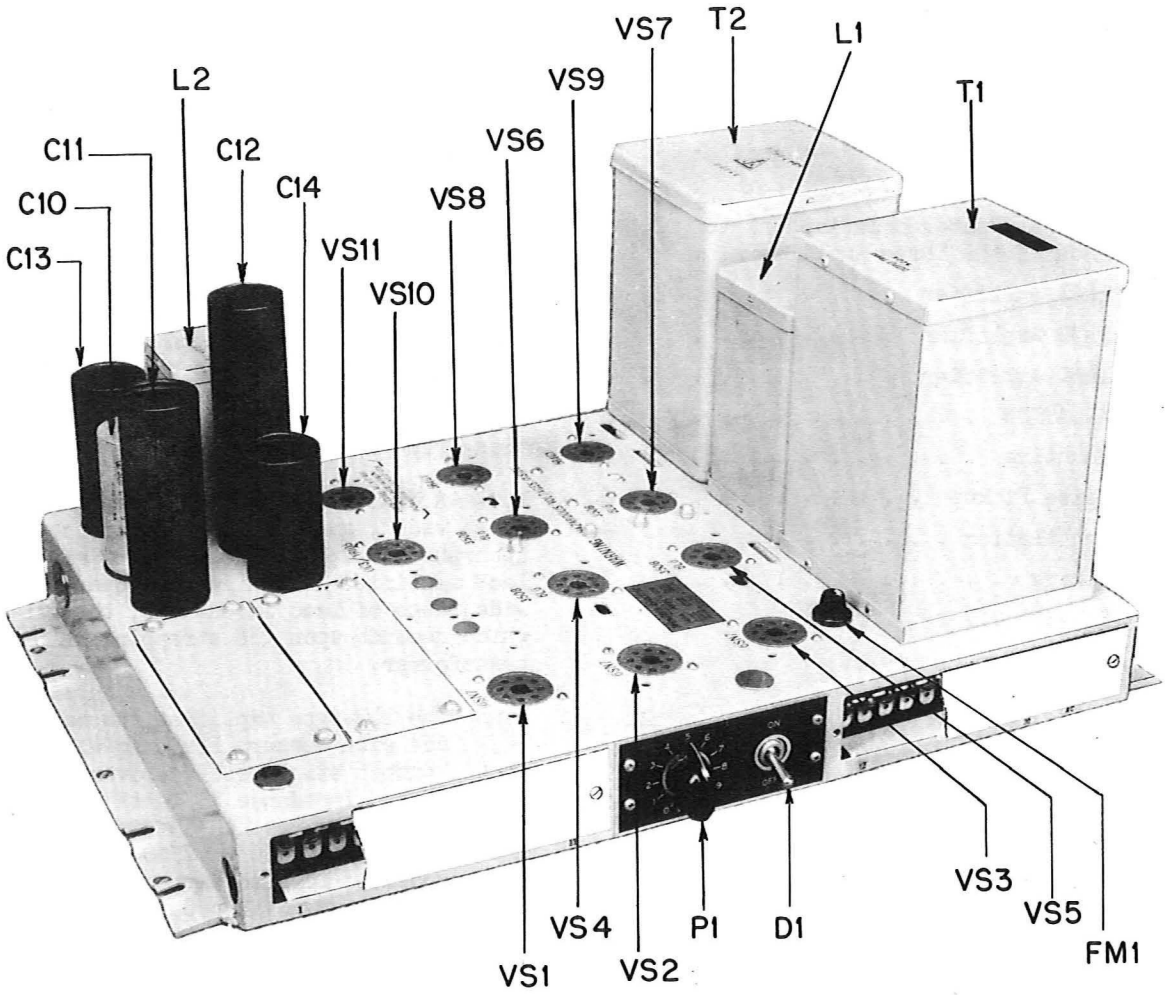


Fig. 1 - 143A Amplifier

1.14 Commercial types of electron tubes are used in these amplifiers except in the parallel push pull output stage where either commercial or Western Electric type tubes can be used depending upon the output power required.

1.15 Detailed performance data for each of the three amplifiers operating under various conditions are shown in Table 1.

2. TRANSMISSION AND CIRCUIT FEATURES

2.01 The schematic circuit diagram of the 143A amplifier is shown in Fig. 2 on Page 13. Fig. 4, on Page 15, is a schematic circuit diagram of the input circuit arrangement of the 143B amplifier. Figs. 3 and 5 show the circuit arrangements of the 143B and 143C amplifiers, respectively, in block diagram form.

(A) General Features Common to All Three Amplifiers

Basic Amplifier Circuit

2.02 As previously mentioned, the 143A amplifier circuit is common to all three models. It is basically a 5-stage amplifier employing a parallel push pull arrangement in the last stage.

First and Second Stage Tube Connections and Interstage Circuits

2.03 The grid of tube V1a is connected to the movable arm of potentiometer P1. The cathode is connected to a feed-back circuit from the output of the second stage.

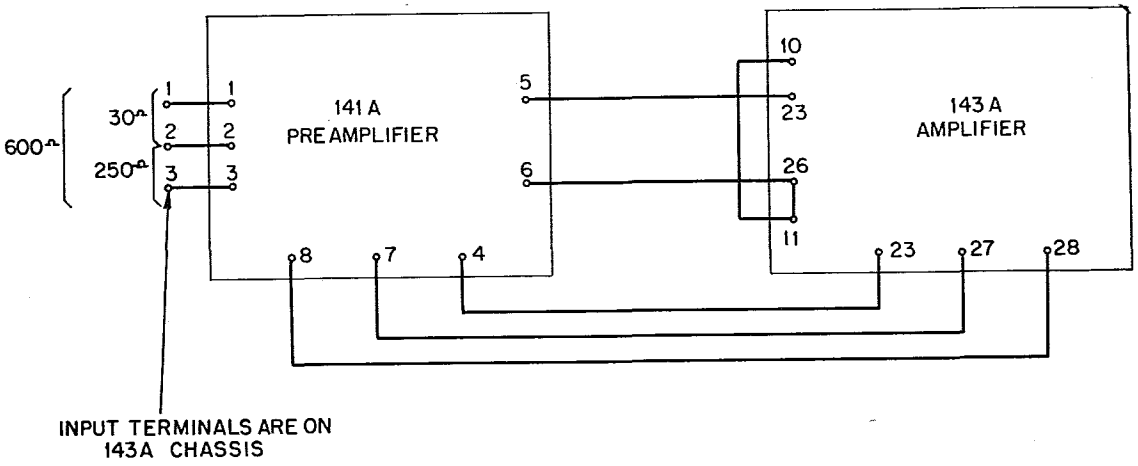


Fig. 3 - 143B - Block Diagram

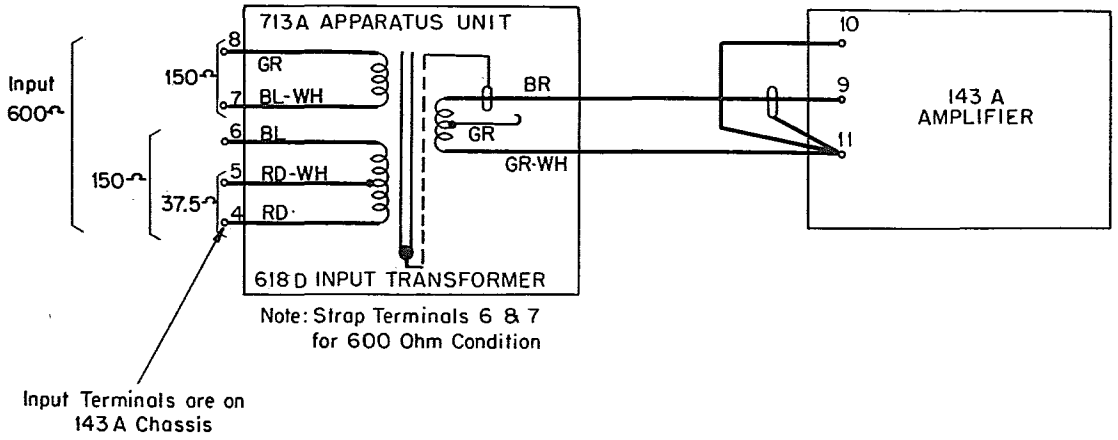


Fig. 5 - 143C Amplifier - Block Diagram

2.04 The interstage circuit consists essentially of resistance coupling through plate load resistor R4, coupling capacitor C2 and grid resistor R6.

2.05 The plate of tube V1b is connected to the feed-back circuit which returns to the cathode of the first stage. The interstage circuit is similar to that between the first two stages; R8, C4, and R9 serve the same purposes as R4, C2, and R6, respectively.

Phase-Inverter Stage and Interstage Circuit

2.06 This stage consists of V2a and V2b. Tube V2a amplifies the signal to V3a and also feeds the signal to the grid of V2b via coupling capacitor C5. The grid of V2a is coupled to the preceding stage through R10. The latter is a stabilizing resistor to reduce capacitive effects and prevent any tendency toward oscillation. The cathode is connected to the return side of a feed-back circuit from the output transformer.

2.07 Tube V2b is connected in such a manner that its sole function is to cause the signal applied to the grid of V3b to be 180° out of phase with, and at the same level as, that applied to the grid of V3a. The grid bias on V2b is such that this tube operates essentially at unity gain.

2.08 The interstage circuit consists of plate resistors R16 and R17, coupling capacitors C7 and C8 and grid resistors R18 and R19. An equalizing network (C6) is used to reduce the gain slightly at about 20,000 cycles to prevent oscillation.

Cathode Follower Stage

2.09 This stage consists of V3a and V3b and is employed to present a low impedance to the output stage which does not always operate in Class A. Bias supply is obtained from a voltage divider (R33, R34, R35, and R40) which is connected between ground and a negative potential furnished from a separate rectifier tube V11. This supply may be altered by strapping out R34 when non-Western Electric tubes are used.

Output Circuit

2.10 The plate voltage to the last stage tubes is supplied through the midpoint of the primary winding of the output transformer T1. The ends of this winding are connected through resistors to the plates of V4, V5, V6, and V7. Resistors R22 to R31, inclusive, are included to suppress any tendency toward oscillation in the output stage. The plate voltage used depends upon the output power required. If power in the order of 75 watts is needed, the plate-to-ground voltage for Western Electric 350B electron tubes will be about 415 volts. If a maximum power of about 50 watts is sufficient, either the 350B tubes or commercial 6L6 tubes may be used. Where the latter are used, several wiring changes must be made. In this condition the plate-to-ground voltage will be about 365 volts.

2.11 Control grid bias for the output tubes is obtained from a separate supply (rectifier tube V11).

2.12 Screen grid supply for the output tubes is obtained from the main power supply, with additional filtering, and kept at a constant potential by voltage regulator V10.

2.13 The output transformer has five secondary windings, four of which may be connected in a number of ways so that each of the amplifiers can be arranged for operation into a large range of load impedances from 1.5 ohms to 250 ohms, or into a 70-volt loudspeaker distribution circuit. Feedback is taken from the secondary side (fifth winding), and the other secondary windings may be arranged to be connected in series or parallel to obtain a required output impedance. The output impedance of the amplifier, as seen looking back into it from any one of the output terminal arrangements, is approximately 1/4 of the load impedance of that particular output arrangement or transformer strapping. Resistor R41 (across amplifier terminals 19 and 20) reduces excessively high inductive voltage surges which might occur when a 143-type amplifier is driven hard with no load connected to the output. Voltage breakdowns between terminals on the output transformer, or between lead connections inside the power amplifier tubes may result if these surges are permitted to occur. Capacitor C16 (also across terminals 19 and 20) provides a greater margin against the occurrence of singing when the amplifier has no load or is very lightly loaded. Earlier production models of the 143-type amplifier did not employ R41 and C16. It may be advisable to modify such amplifiers locally.

Feed-back Circuit

2.14 Referring to the schematic, Fig. 2, there are two main feed-back circuits. One circuit is from a winding on the secondary side of transformer T1 through resistor R15 to the cathode of V2a. The other main feed-back circuit is from the plate of V1b through resistor R5 to the cathode of V1a.

Electron Tube Arrangements

2.15 The tubes used in the amplifying circuit of the 143A amplifier are of the 6.3-volt heater type. The heaters of the seven tubes (V1-V7, inclusive) are wired in parallel with the heater of one of the rectifier tubes (V11) and are connected to the 6.3-volt winding of the power transformer (T2). Commercial types of electron tubes are used, except in the output stage where either commercial or Western Electric tubes may be used, depending upon the output power required.

2.16 Two rectifier tubes (V8 and V9) of the filamentary type, and a voltage regulator tube (V10) are employed. These also are of the commercial type.

2.17 The code numbers, quantity and designation are given in Table 2 for all tubes required in the basic amplifier. The additional tubes needed for the 143B amplifier are also included.

Table 2

Type	Quantity	Designation
6SN7GT	4	V1, V2, V3, V11
WE350B or 6L6*	4	V4, V5, V6, V7
5R4GY	2	V8, V9
0C3/ /VR105	1	V10
+ 6J7 or 1620	1	V1 (in the 141A preamplifier)
+ 6SN7GT	1	V2 (in the 141A preamplifier)

* May be used only where outputs up to 50 watts are satisfactory.
\+ Used only in the 143B amplifier.

Warning: The tubes should not be handled while the amplifier is in operation, due to the danger of burns, particularly in the case of the rectifier and final stage amplifier tubes. Also, the warning stamped on the chassis adjacent to tube socket VS11 should be observed. Removal of the tube in this socket while the amplifier is in operation may cause damage to the output stage electron tubes and to other circuit components.

External Connections

2.18 External connections to the 143-type amplifiers are made to recessed terminal strips (terminals 1 to 22) at the front edge of the chassis. The terminals extend through the strips, permitting connections to be made either at the front or rear of the strips. Terminals 23 to 28 will be found on the resistor terminal strip on the wiring side of the chassis. Holes are provided at the ends of the chassis to permit entrance of the external wiring. The recessed terminal strips are protected by screw fastened cover plates which can be removed when making connections. These plates should be replaced before power is applied to the amplifier.

2.19 Terminals 1 through 8, inclusive, are not used on the 143A amplifier. They are used as input terminals on the B and C models as shown in Figs. 3, 4, and 5, and Table 1, and in modifications of the 143A amplifier as described in Section E47.188.2. The normal connections for the remaining terminals are as follows:

Terminal Numbers	External Connections
* 9 (and 11)	High impedance input on 143A amplifier
*10 (and 11)	High impedance input on 143A amplifier
11 and 12	Ground
13 through 20, inclusive	Output terminals
21 and 22	105-125-volt, 50-60-cycle ac power source
23	Basic input terminal (see Figs. 2 and 3. Normally strapped to terminal 9 on 143A amplifier)
24	Basic input terminal normally strapped to terminal 10 (see Fig. 2)
25 and 26	Plate supply (205-250 volts dc) for preamplifiers (25 positive and 26 ground)
+27 and 28	Heater supply (6.3 volts ac) for preamplifiers

* If only one input is used, the other ungrounded terminal (10 or 9) should be connected to terminal 11 (see Fig. 2).

\+ This supply must not be grounded since its center tap is connected to a bias voltage within the amplifier. This bias voltage is usually beneficial in reducing noise generated in the preamplifier electron tubes.

Noise

2.20 When the 143-type amplifier is adjusted for maximum gain, and it is operating correctly, the noise at the output terminals should not be higher than the figures given in Table 3.

Table 3

Amplifier (Properly Terminated)	Noise (Using 2B Noise Measuring Set*) Flat Weighting
143A or C	60 dba
143B	90 dba

* Shielded connecting cords and a good ground on terminal 11 of the amplifier must be used.

(B) Special Features Individual to Each of the Three Amplifiers

143A Amplifier

2.21 This amplifier when used as the basic model has two high impedance input channels (terminals 9 and 11, and terminals 10 and 11) which may be operated from a variety of input sources. Each input has an internal impedance of over 250,000 ohms, and may be operated from any source impedance from zero to 250,000 ohms. Each input essentially consists of resistors R1 and R2, respectively. If only one input is used, the other ungrounded terminal (10 or 9) should be connected to terminal 11. Fig. 2 shows the arrangement. This amplifier is equipped with a continuously adjustable potentiometer (P1).

143B Amplifier

2.22 This is a high gain amplifier consisting of a 143A amplifier and a preamplifier coded 141A. Fig. 3 shows a block diagram of the 143B amplifier. In addition to the master gain control (P1) in the common amplifier there is an additional control which is part of the 141A preamplifier and is adjustable in three steps of 10 db each. Referring to Fig. 4, it will be seen that the input circuit, which comprises the 141A preamplifier, consists of a 3-stage low level amplifier. Its gain is adjustable from 40 to 70 db. The input transformer will accommodate microphones or other low level devices having a nominal source impedance of 30, 250 or 600 ohms. This transformer has a permalloy core and case. It is mounted on the amplifier chassis by means of a clamp that may be loosened to allow the transformer to be rotated to a position of minimum noise pickup when the amplifier is exposed to a magnetic field. Resistor R4 is common to the cathodes of both the first amplifier tube V1 and tube V2b. Current in the cathode circuit of V2 is of such phase and amplitude as to introduce stabilized feedback in the cathode circuit of V1. Resistors R5, R6, and R7 may be switched in multiple with R4, thereby changing the amount of feedback voltage, and at the same time, varying the gain in steps of 10 db. The output of the 141A preamplifier is a cathode follower, and no output transformer is used for coupling to the input of the 143A amplifier.

143C Amplifier

2.23 This amplifier consists of the basic 143A amplifier and a 713A apparatus unit. A block diagram of this amplifier is shown in Fig. 5. The 713A apparatus unit consists of a 618D input transformer that provides a choice of several line level inputs. This transformer is magnetically shielded by a container of high permeability material against electromagnetic pickup, and may be rotated to a position of minimum pickup if exceptionally strong fields are encountered.

2.24 It will be observed that a high impedance input (terminals 10 and 11) is available on the 143B and 143C amplifiers. It is not normally used since it appears on the basic or 143A amplifier in each case.

3. INSTALLATION

(A) Mounting

3.01 The amplifiers are mounted either vertically or horizontally in an apparatus cabinet or on a relay rack.

(B) Noise Pickup

3.02 A shielded power transformer is employed in 143-type amplifiers. The noise pickup from one amplifier into an adjacent one will be negligible.

3.03 The 143B and 143C amplifiers are furnished with input transformers that are shielded against electromagnetic pickup as described in Paragraphs 2.22 and 2.23. No appreciable magnetic pickup will be encountered with any of these amplifiers when mounted several inches from any disturbing source of power equipment.

(C) Ventilation

3.04 The temperature rise in the 143-type amplifier is independent of whether it is connected for 50-watt or for 75-watt output. However, the operating temperature of the amplifier does depend upon the average power delivered by the amplifier. Continuous operation of a 143-type amplifier transmitting speech or music results in average internal dissipation essentially the same as when the amplifier is delivering 20 watts of single-frequency sine wave power. Under such conditions a single amplifier may be operated at a room ambient temperature of approximately 109° F, assuming free air circulation such as that normally available when the amplifier is vertically mounted in an open relay rack or well ventilated cabinet.

3.05 Several 143-type amplifiers may be mounted vertically in an open relay rack or in an enclosed equipment cabinet without forced ventilation provided approximately 100° F room ambient temperature is not exceeded, if at least 100 square inches of open area is provided both above the top amplifier and below the bottom amplifier in an enclosed cabinet structure. The number of amplifiers possible under several conditions is tabulated below. This applies regardless of the output power use, provided that only the transmission of speech or music is involved. It is recommended that a minimum spacing of 3-1/2 inches be maintained between relay rack mounted amplifiers, when this is feasible.

Number of 143-Type Amplifiers

Open Relay Rack	Enclosed Cabinet
3	2

(D) Wiring

3.06 In order to avoid noise pickup in the input leads, it is recommended that shielded conductors be used between the amplifier input source and the amplifier input terminals, particularly when the 143B amplifier is involved. Twisted pair shielded copper wire with insulation over the shields may be used. The shield should be grounded to terminal 11, only, on the amplifier. A good building ground should be connected to either terminal 11 or 12.

3.07 Earlier production models of 143-type amplifiers employed KS-13820 power transformers. Some of these amplifiers were also equipped with KS-13822 and KS-13823 retardation coils in place of the presently used KS-14256 and KS-14257 coils. The windings of all of these coils are brought out to terminals. While the presently employed power transformer, KS-14254, has its windings brought out to terminals, the earlier or KS-13820 transformer used colored leads. The relationship is indicated below:

KS-14254 Terminal Numbers	KS-13820 Lead Colors
1	Black
2	Black-Yellow
3	Black-Red
4	Brown
5	Brown
6	Red
7	Orange
8	Red-Yellow
9	Orange
10	Red
11	Yellow
12	Yellow
13	Green
14	Green-Yellow
15	Green

3.08 Fig. 2 shows a wiring diagram of the 143A amplifier. Fig. 4 shows a similar diagram for the 141A preamplifier.

4. PARTS LIST

4.01 The item designations shown in Table 4 on Page 8 are those indicated on the schematic diagram for the basic amplifier as shown in Fig. 2 on Page 13. Table 5 on Page 9 shows the additional parts required for the 143B amplifier. This, in effect, is a list of parts for the 141A preamplifier. Table 6 on Page 9 shows the additional parts for the 143C amplifier.

Table 4

List of Parts for 143A Amplifier

Item	Description
	Allen Bradley Co. Resistors or Equivalent
R1, R2, R9, R18, R19	Type EB 0.24 meg. ±5%
R3, R11	Type EB 2400 ohms ±5%
R5	Type EB 0.1 meg. ±5%
R6	Type EB 0.51 meg. ±5%
R7	Type EB 1500 ohms ±5%
R12	Type EB 0.47 meg. ±5%
R13	Type EB 2.2 meg. ±5%
R14	Type EB 39,000 ohms ±5%
R15	Type EB 15,000 ohms ±5%
R17	Type EB 51,000 ohms ±5%
R20, R21	Type GB 20,000 ohms ±5%
R4	Type GB 0.1 meg. ±10%
R10, R16	Type EB 0.1 meg. ±10%
R8	Type HB 51,000 ohms ±5%
R22, R24, R28, R30	Type EB 100 ohms ±10%
R26, R27	Type EB 180 ohms ±10%
R23, R25, R29, R31	Type HB 27 ohms ±10%
R41	Type HB 10,000 ohms ±10%
R33	Type GB 12,000 ohms ±5%
R34	Type EB 2000 ohms ±5%
R35	Type EB 5100 ohms ±5%
R38, R39	Type GB 0.1 meg. ±10%
R40	Type EB 1000 ohms ±10%
	International Resistance Co. Resistors or Equivalent
R37	Type MW4 20,000 ohms ±10%
R36.1	Type MW4 5000 ohms ± 10% 4.5 watts)
R36.2	Type MW4 1500 ohms ± 10% 1.2 watts) 7800 ohms ± 10% Total
R36.3	Type MW4 1300 ohms ± 10% 0.8 watt)
	Cornell Dubilier Capacitors
C1, C2, C4, C5, C7, C8	Type TVG - 6S5-6 0.05 mf ±10%
C6	Type 5W 0.00027 mf ±10%

Item	Description
	Sprague Electric Co. Capacitors
C9, C15	Sprague D-13822 Electrolytic 10 mf 150 V. 5/8 in. x 1-5/8 in. Tubular with insulating cover
C10	Type DEW Electrolytic 40 mf 475 V. 1-3/8 in. x 2-3/4 in. maximum with insulating washer, mounting nut, lock washer and cover (Sprague D-13818)
C11	Type DEW Electrolytic 30 mf 475 V. 1-3/8 in. x 4-1/4 in. maximum with insulating washer, mounting nut, lock washer and cover (Sprague D-13813)
C12	Type DEW Electrolytic 30 mf 300 V; 80 mf 450 V. 1-3/8 in. x 4-3/4 in. maximum with insulating washer, mounting nut, lock washer and cover (Sprague D-13812)
C13	Type DEW Electrolytic 80 mf 300 V. 1-3/8 in. x 3-1/4 in. maximum with insulating washer, mounting nut, lock washer and cover (Sprague D-13814)
C14	Type DEW Electrolytic 100 mf 150 V. 1-3/8 in. x 2-1/4 in. maximum with insulating washer, mounting nut, lock washer and cover (Sprague D-13820)
C16	Type 76-P Prokar capacitor 0.047 mf, 600 V.

Item	No. Req.	Description
L1	1	KS-14257 Retardation Coil (Western Electric Co.)
L2	1	KS-14256 Retardation Coil (Western Electric Co.)
T1	1	520A Output Transformer (Western Electric Co.)
T2	1	KS-14254 Transformer (Western Electric Co.)

Table 4 (Cont'd)

Item	No. Req.	Description
	2	Cat. #51026) Dot plug) button nic.
	3	Cat. #48182) plt. fin.) United-Carr) Fastener) Corp.
	1	Cat. #342001 Fuse Mounting (Littelfuse Inc., Chicago, Ill.)
P1	1	JA-5041 Potentiometer, 0.5 meg., lug option #1, bushing and shaft designation P-2040, electrical designation A-5041, supply with lock washer and nut. (Allen Bradley Co.)
	1	Knob S-292-3L (Kurz-Kasch Inc.)
D1	1	Switch SPST 86993 GC (Arrow-Hart & Hegemann)
	11	T-9881 Electron Tube Socket (Cinch Mfg.Co.)
F1	1	Bussman Type MDX-4 (3 Amp.)

Table 5

List of Additional Parts for 143B Amplifier

Item	Description
	Allen Bradley Co. Resistors or Equivalent
R1	Type EB 1.0 meg. ±10%
R2	Type EB 0.1 meg. ±10%
R3	Type EB 1600 ohms ±5%
R4	Type EB 910 ohms ±5%
R5	Type EB 15 ohms ±5%
R6	Type EB 68 ohms ±5%
R7	Type EB 300 ohms ±5%
R8, R10	Type EB 1 meg. ±10%
R9	Type EB 0.24 meg. ±5%
R11, R14, R19	Type EB 0.1 meg. ±10%
R12	Type EB 2700 ohms ±10%
R15, R16	Type EB 0.82 meg. ±10%
R17	Type EB 0.47 meg. ±10%
R13	Type HB 5100 ohms ±5%
R18	Type HB 8200 ohms ±5%
	Sprague Electric Co. Capacitors or Equivalent
C1, C2	64P11 0.02 mf
C3, C4	PPX24B20 0.1 mf
C5	PPX24B15 0.03 mf
C6	DFP 50 mf 150 V
C7	DFP 10 mf 50 V, 20 mf 350 V, 20 mf 450 V, 20 mf 25 V
	Miscellaneous Hardware

No. Req.	Description
1	(T1) 618B Input Transformer (Western Electric Co.)
1	(D1) SPO-58101 Type 3214 4-Position Switch (P. R. Mallory Co.)
1	Special Aerovox Mounting Ring Type E, 1-1/2 in. dia.
4	61P Rubber Grommet (Pierce Roberts, Trenton, N.J.)
2	KS-13364, List 3 Electron Tube Socket (Western Electric Co.)
1	Grid Cap Shield (#1552 from Insuline Corp., Long Island City, N.Y.)

Table 6

List of Additional Parts for 143C Amplifier

Item	Description
T1	713A Apparatus Unit 618D Input Transformer (Western Electric Co.). Special Aerovox Mtg. Ring Type E 1-1/2-in. dia. Obtain from Aerovox Corp., New Bedford, Mass., with 0.138-32 in. x 1-1/4 in. R.H.M. Steel Screw #6 (0.138) 0.055 in. x 0.40 in. Steel Lock Washer and #6 (0.138) 32 in. x 5/16 in. Hex. Steel Nut. All Zinc Plate Finish

AMPLIFIER (See Note 1)	MAXIMUM 1000-CYCLE GAIN WHEN OPERATING BETWEEN NOMINAL SOURCE AND LOAD IMPEDANCES	GAIN CONTROL	AMPLIFIER TERMINALS TO WHICH INPUT SHOULD BE CONNECTED	INPUT CIRCUIT - TERMINAL STRAPPING ARRANGEMENT	SOURCE IMPEDANCE		IMPEDANCE LOOKING INTO THE INPUT TERMINALS OF EACH AMPLIFIER	LOAD IMPEDANCE INTO WHICH EACH AMPLIFIER IS DESIGNED TO OPERATE (See Note 2)	INTERNAL OUTPUT IMPEDANCE	NOISE MAX. GAIN (See Note 3)	FREQUENCY CHARACTERISTICS	MAXIMUM POWER OUTPUT (See Note 4)
					Nominal	Operating Range						
143A High Impedance Input Arrangement No. 1 " " No. 2	52 db	Continuously Adjustable	9 & 11 10 & 11	None	600 Ω	0-250,000 Ω	Greater than 250,000 Ω	1.5 - 250 Ω or 70 Volt Loudspeaker Distribution Ckt.	Approx. 1/4 of Load Impedance	60 dba	± 1 db 50-15,000 ~	75 Watts (+49 dbm) with Less Than 5% Distortion Over Range of 50-7500 ~
143B Low Level Transformer Input Arrangement No. 1 " " No. 2 " " No. 3	117 db	Preamp. Gain Control Adjustable in 3 Steps of 10 db Each, and a Continuously Adjustable Potentiometer	1 & 3 2 & 3 1 & 2	None	600 Ω 250 Ω 30 Ω	± 40% of Nominal	Greater than 10 Times Nominal Impedance Over Most of Frequency Range			90 dba	± 1 db 50-10,000 ~ ± 2 db 50-15,000 ~	
High Impedance Input Arrangement No. 4	52 db	Continuously Adjustable Pot. Only		Strap 10 & 11 When Input Arrangement No. 4 is Not Used	600 Ω	0-250,000 Ω	Greater than 250,000 Ω			60 dba	± 1 db 50-15,000 ~	
143C Line Level Transformer Input Arrangement No. 1 " " No. 2 " " No. 3 " " No. 4	71 db	Continuously Adjustable	4 & 5 4 & 6 7 & 8 4 & 8	Strap 6 & 7	37.5 Ω 150 Ω 150 Ω 600 Ω	± 40% of Nominal	Approx. 6 Times Nominal Impedance Over Most of Frequency Range			60 dba	± 1.5 db 50-10,000 ~	
High Impedance Input Arrangement No. 5	52 db	Continuously Adjustable		Strap 10 & 11 When Input Arrangement No. 5 is Not Used	600 Ω	0-250,000 Ω	Greater than 250,000 Ω			60 dba	± 1 db 50-15,000 ~	

Note 1: The input arrangement numbers are arbitrary. They are intended to show the number of possible input arrangements on each amplifier. Similar input arrangement numbers between amplifiers have no intended meaning.

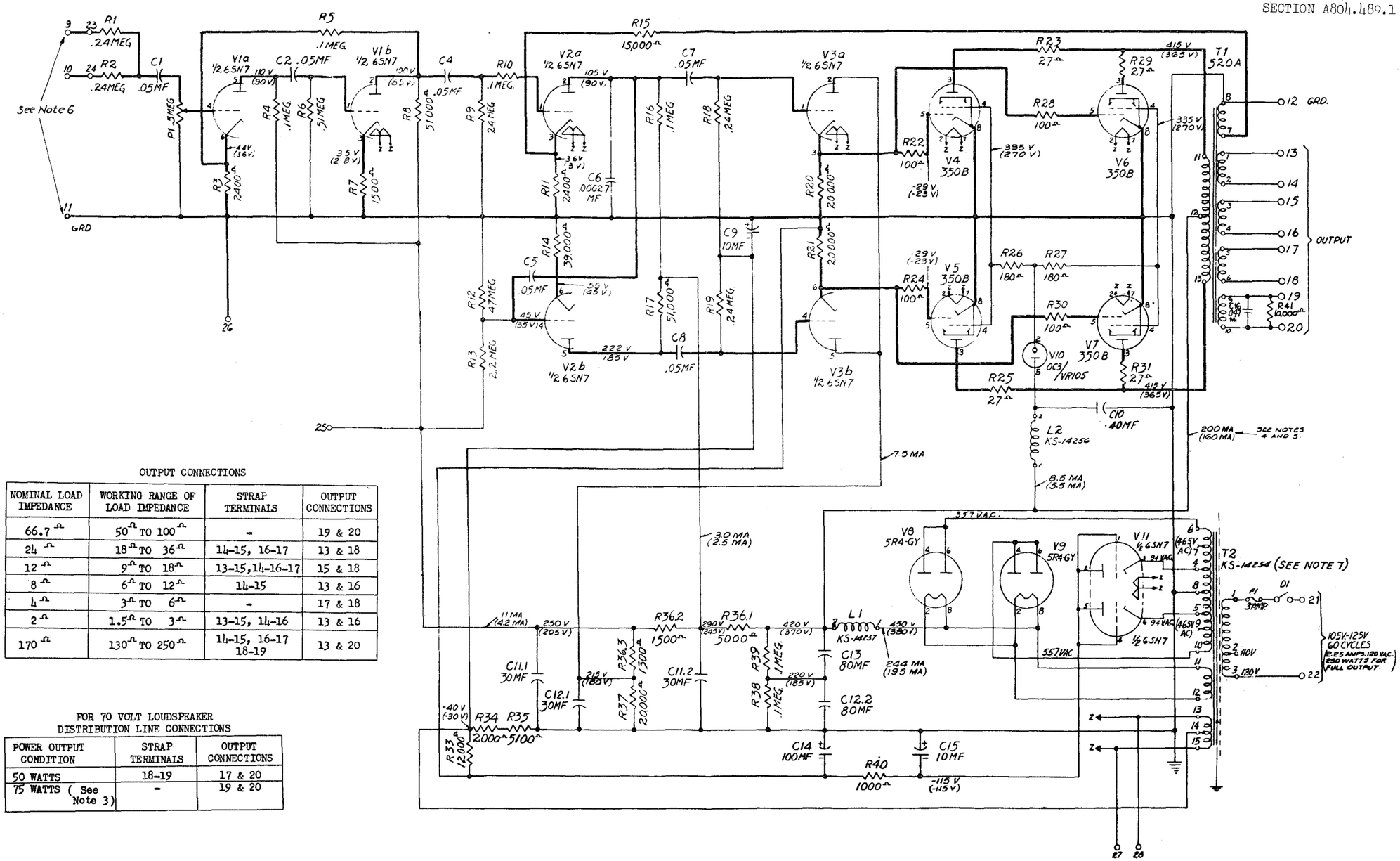
Note 2: The schematic diagram shows a table of output connections.

Note 3: Using 2B noise measuring set with flat weighting.

Note 4: The amplifier can be reconnected for 50 watts maximum output with less than 5% distortion from 50 to 7500 cycles.

TABLE 1

143-Type Amplifier - Typical Operating Characteristics



OUTPUT CONNECTIONS

NOMINAL LOAD IMPEDANCE	WORKING RANGE OF LOAD IMPEDANCE	STRAP TERMINALS	OUTPUT CONNECTIONS
66.7 Ω	50 Ω TO 100 Ω	-	19 & 20
24 Ω	18 Ω TO 36 Ω	14-15, 16-17	13 & 18
12 Ω	9 Ω TO 18 Ω	13-15, 14-16-17	15 & 18
8 Ω	6 Ω TO 12 Ω	14-15	13 & 16
4 Ω	3 Ω TO 6 Ω	-	17 & 18
2 Ω	1.5 Ω TO 3 Ω	13-15, 14-16	13 & 16
170 Ω	130 Ω TO 250 Ω	14-15, 16-17 18-19	13 & 20

FOR 70 VOLT LOUDSPEAKER DISTRIBUTION LINE CONNECTIONS

POWER OUTPUT CONDITION	STRAP TERMINALS	OUTPUT CONNECTIONS
50 WATTS	18-19	17 & 20
75 WATTS (See Note 3)	-	19 & 20

NOTE 1: CIRCUIT SHOWN CONNECTED FOR USE WITH 350B TUBES. (75 WATTS POWER OUTPUT)

NOTE 2: TO USE 6L6 TUBES (50 WATTS POWER OUTPUT) THE FOLLOWING CHANGES ARE NECESSARY:

(A) SHORT CIRCUIT R34.

(B) ON TRANSFORMER T2 TRANSFER LEAD ON TERMINAL 6 TO TERMINAL 7 AND LEAD ON TERMINAL 10 TO TERMINAL 9.

NOTE 3: RATED 75 WATTS FOR SPEECH AND MUSIC ONLY.

NOTE 4: THE VOLTAGES AND CURRENTS SHOWN REPRESENT TYPICAL VALUES FOR A QUIESCENT CONDITION WITH AVERAGE TUBES AND OPERATED FROM 60 ~ 120 VOLT POWER SOURCE. THE D-C VOLTAGES SHOULD BE MEASURED WITH A VOLTMETER OF 20,000 OHMS PER VOLT. VOLTAGES ARE MEASURED FROM POINTS SHOWN TO TERMINAL 26 AND SHOULD BE WITHIN ± 20%.

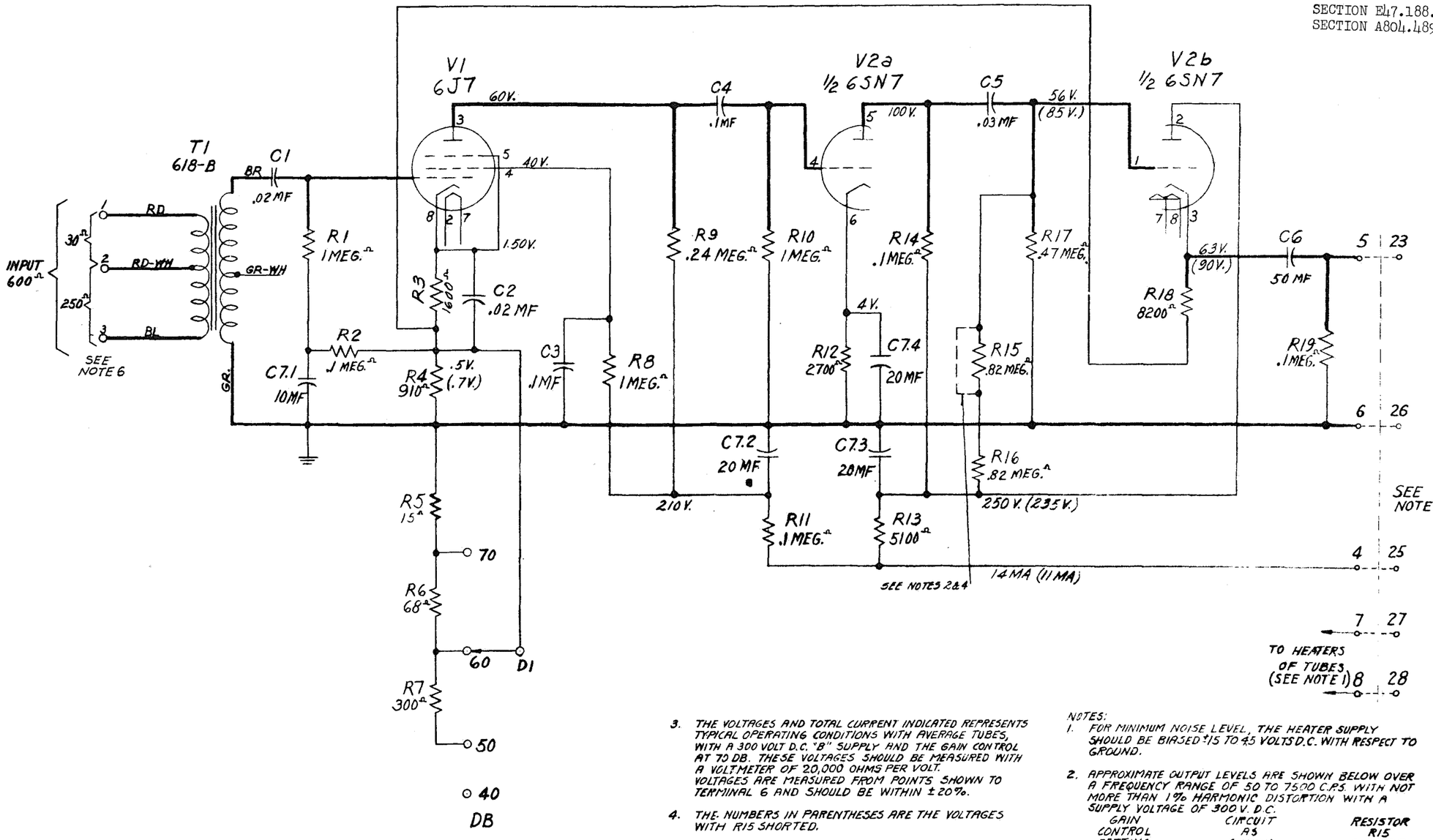
NOTE 5: THE NUMBERS IN THE PARENTHESES ARE THE VALUES FOR THE 50 WATT CONDITION.

NOTE 6:

AMPLIFIER	REMOVE STRAP BETWEEN TERM.	STRAP TERMINALS
143B	9-23	10 TO 11
143C	9-23	10 TO 11

NOTE 7: REFER TO TEXT WHEN T2 IS KS-13820.

Fig. 2 - 143A Amplifier - Schematic Diagram



NOTES:

1. FOR MINIMUM NOISE LEVEL, THE HEATER SUPPLY SHOULD BE BIASED +15 TO 45 VOLTS D.C. WITH RESPECT TO GROUND.
2. APPROXIMATE OUTPUT LEVELS ARE SHOWN BELOW OVER A FREQUENCY RANGE OF 50 TO 7500 C.P.S. WITH NOT MORE THAN 1% HARMONIC DISTORTION WITH A SUPPLY VOLTAGE OF 300 V. D.C.

GAIN CONTROL SETTING	CIRCUIT AS SHOWN 600 OHM LOAD	RESISTOR R15 SHORTED
40	+11 DBM	+14 DBM
50	+11	+14
60	+10	+13
70	+6	+11

3. THE VOLTAGES AND TOTAL CURRENT INDICATED REPRESENTS TYPICAL OPERATING CONDITIONS WITH AVERAGE TUBES, WITH A 300 VOLT D.C. "B" SUPPLY AND THE GAIN CONTROL AT 70 DB. THESE VOLTAGES SHOULD BE MEASURED WITH A VOLTMETER OF 20,000 OHMS PER VOLT. VOLTAGES ARE MEASURED FROM POINTS SHOWN TO TERMINAL 6 AND SHOULD BE WITHIN ±20%.
4. THE NUMBERS IN PARENTHESES ARE THE VOLTAGES WITH R15 SHORTED.
5. IN CASES WHEN THE "B" SUPPLY VOLTAGES IS OTHER THAN 300 VOLTS, THE VOLTAGES INDICATED ARE MULTIPLIED BY THE RATIO OF THAT VOLTAGE AND 300.
6. THESE TERMINALS ARE ON THE CHASSIS OF THE 143 A AMPLIFIER.

Fig. 4 - 143B Amplifier - Input Circuit Arrangement
(141A Amplifier Schematic)