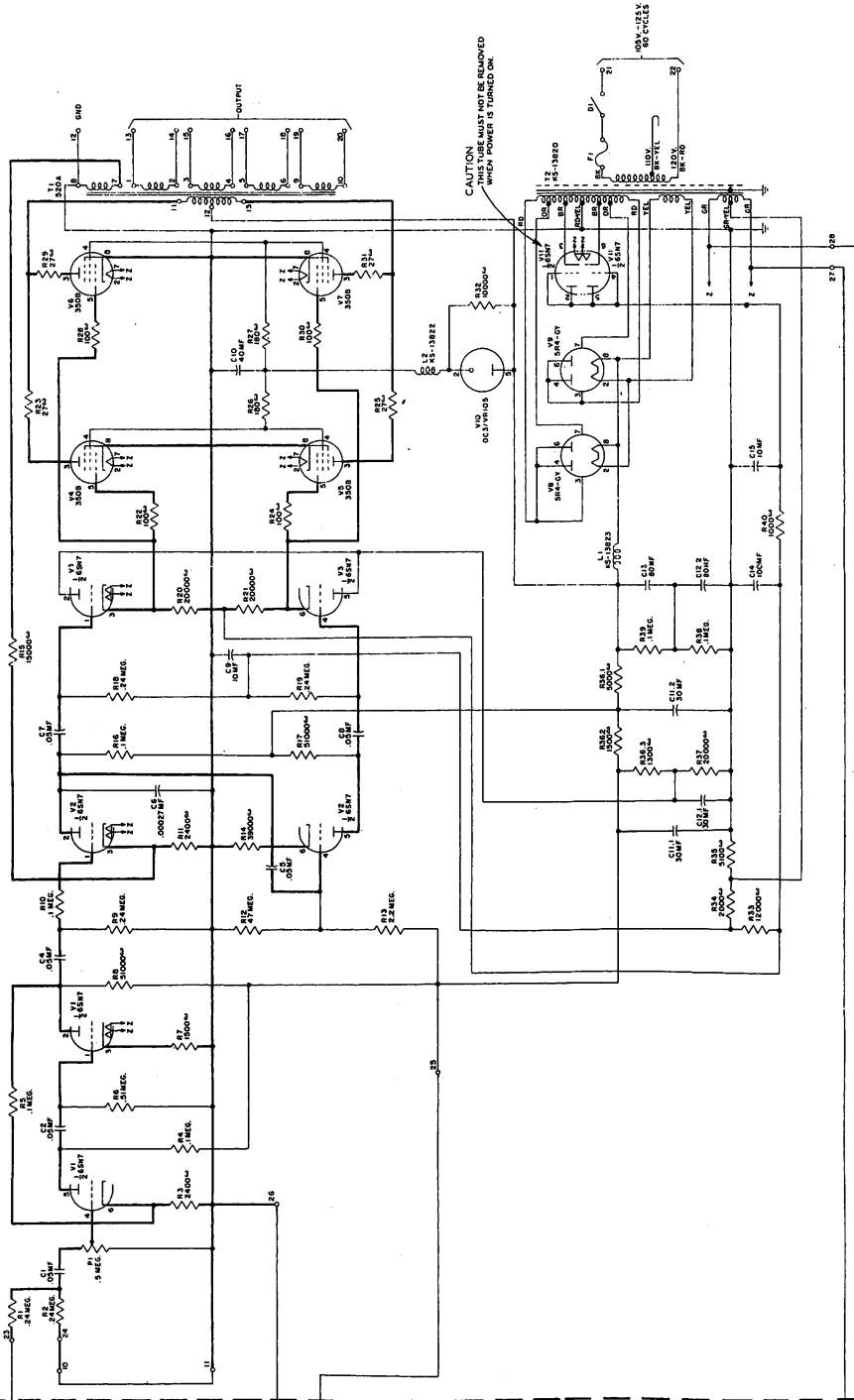


143-A AMPLIFIER



POWER SUPPLY	OUTPUT CONNECTIONS	TERMINALS	CONNECTIONS
50 WATT	50 WATT	18-19	17 & 20
75 WATT	75 WATT	18-19	17 & 20

POWER SUPPLY	OUTPUT CONNECTIONS	TERMINALS	CONNECTIONS
50 WATT	50 WATT	18-19	17 & 20
75 WATT	75 WATT	18-19	17 & 20

NOTE:
 1. CIRCUIT SHOWN CONNECTED FOR USE WITH 300B TUBES.
 2. TO USE AS A 150-VA WATT POWER OUTPUT THE FOLLOWING:
 A. SHORT CIRCUIT R34.
 B. REMOVE 50 WATT AND 75 WATT TERMINALS FROM POWER SUPPLY.
 C. REWIND 6X4 TUBE FOR PROGRAM SERVICE ONLY MAXIMUM R.M.S. OUTPUT RATING 75 WATT ON 1/2 HOUR ON, 1/2 HOUR OFF RESET.
 3. IN CASES WHERE THE B+ SUPPLY VOLTAGE IS OTHER THAN 300 VOLTS, VOLTAGE AND 300.

Western Electric

143-TYPE AMPLIFIERS

PART I

General

The Western Electric 143-Type Amplifiers are designed for use in program monitoring, paging and announcing systems, wired music systems and sound distribution systems. The amplifiers are available in three variations; the principal differences being in the input circuits which permit a wide choice of applications. They are constructed on the chassis of a basic 143A Amplifier. The amplifier has two high impedance input circuits, which accommodate facilities for microphone or other low level input sources, line inputs, and combinations of both. The output circuit is so arranged that it will operate satisfactorily into load impedances from 1.5 to 36 ohms, 50 to 100 ohms, 130 to 250 ohms and 300 to 600 ohms, and into a 70 volt loud-speaker distribution circuit. The internal output impedance is low compared with the load impedance, due to the use of stabilized feedback which includes the output transformer in the feedback path.

Typical Characteristics

These amplifiers have the following typical characteristics in common:

Load Impedance

1.5 to 36 ohms, 50 to 100 ohms, 130 to 250 ohms, and 300 to 600 ohms. Nominal impedances, 2, 4, 8, 12, 24, 66.7 and 170 ohms.

Loudspeaker Distribution — Line Circuit

70 volts.

Internal Output Impedance

Approximately one-fourth of nominal load impedance.

Output Power

As shipped for use with Western Electric 350B Vacuum Tubes in the output stage, 75 watts (+49 dbm) with not more than 5% distortion, 50 to 7500 cycles. May be reconnected for use with either Western Electric 350B or non-Western Electric 6L6 Tubes to give 50 watts (+47 dbm) with not more than 5% total harmonic distortion, 50 to 7500 cycles.

Power Supply

105 to 125 volts, 60 cycles a-c, 335 watts maximum. Fused with 5 ampere fuse.

Dimensions

18 1/8" long, 12 1/2" wide, 8 1/2" high.

Mounting

Relay rack mounting (12 1/4" panel space). Requires a 407B Panel for front mat.

Weight

Approximately 46 1/2 pounds.

Finish

Chassis — light gray.

The following are typical characteristics of the individual types of 143 Amplifiers:

143A AMPLIFIER

Gain

52 db with 600 ohm source. (Other input shorted or terminated in low impedance.)

Source Impedance

0 to 250,000 ohms.

Internal Input Impedance

Greater than 250,000 ohms.

Instruction Bulletin No. 1249, Issue No. 1

Output Noise

—30 dbm unweighted.

Frequency Response

± 1 db, 50 to 15,000 cycles.

Gain Control

Continuously variable master gain control. Chassis drilled for channel controls.

143B AMPLIFIER

Gain

Low level transformer input: 117 db.
Line level grid input: 52 db with 600 ohm source.

Source Impedance

Low level transformer input: 30, 250 or 600 ohms nominal. Source impedance may vary ± 40% from nominal values without appreciable change in frequency characteristics. Grid circuit input 0 to 250,000 ohms.

Internal Input Impedance

Low level transformer input: greater than 10 times nominal source impedance over most of the frequency range.

Line level grid circuit: greater than 250,000 ohms.

Output Noise

0 dbm at maximum gain: —25 dbm at 90 db gain.

Frequency Response

Low level transformer input: ± 1 db, 50 to 10,000 cycles. ± 2 db, 50 to 15,000 cycles.
Line level grid circuit input ± 1 db, 50 to 15,000 cycles.

Gain Control

Continuously variable master gain control. Chassis drilled for channel controls. Three steps of 10 db each on 141A Amplifier.

143C AMPLIFIER

Gain

Line level transformer input: 71 db.
Line level grid circuit input: 52 db with 600 ohm source.

Source Impedance

Line level transformer input: 37.5, 150 or

600 ohms. Source impedance may vary ± 40% from nominal values without appreciable changes in frequency characteristics. Grid circuit input 0 to 250,000 ohms.

Internal Input Impedance

Line level transformer input approximately 6 times the nominal source impedance over most of the frequency range.

Line level grid circuit input greater than 250,000 ohms.

Output Noise

—30 dbm unweighted.

Frequency Response

Line level transformer input: ± 1.5 db, 50 to 10,000 cycles.
Line level grid circuit input: ± 1 db, 50 to 15,000 cycles.

Gain Control

Continuously variable master gain control. Chassis drilled for channel controls.

143-TYPE AMPLIFIERS 143A AMPLIFIER

General

This section contains information which applies to all 143-type Amplifiers and also information which is specific to the 143A Amplifier. Following sections of this bulletin contain information specific to the 143B and 143C Amplifiers.

The 143A Amplifier has a two-channel line level grid input circuit which may be operated from a variety of input sources.

INSTALLATION

Vacuum Tubes

The basic 143A Amplifier requires the following vacuum tubes which should be inserted in the sockets as designated by the markings on the chassis.

Quantity	Western Electric	Receiver Type
4	—	6SN7GT
4	350B	6L6
2	—	5R4GY
1	—	OCS/VR105

These tubes are not supplied with the amplifier and must be ordered separately. (For information on the use of the 6L6 or 350B Tubes see the section on Output Power.)

CAUTION: The control grid bias voltage for the output stage vacuum tubes (V4 to V7 inclusive) is supplied from a vacuum tube rectifier (V11). To avoid the possibility of damage to the output stage vacuum tubes and to other circuit components due to operation without this bias the following caution, also stamped on the chassis adjacent to VS11, should be observed.

CAUTION: THIS TUBE MUST NOT BE REMOVED WHEN POWER IS TURNED ON.

During operation this bias voltage may become too low if the cathode emission of V11 is reduced. This may occur particularly after the amplifier has been in service for some time and will be manifested by reduction in amplifier output level, distortion of output signal and excessive heating of circuit elements including the output stage vacuum tubes, V4 to V7 and the power transformer, T2.

It is recommended that the voltages in the output stage be measured periodically to check this possibility and that V11 be replaced if the successive readings indicate progressive departure from earlier readings particularly if the readings depart more than 20 per cent from the nominal values given on the schematic.

ON-OFF Switch

The On-Off switch is located on a control plate at the center of the front edge of the chassis. The switch must be in the OFF position when changing tubes or making any connections to the amplifier.

Volume Control

The volume control is a continuously adjustable 0.5 megohm master volume control, and is located on the control panel to the left of the On-Off switch.

Input Connections Specific to the 143A Amplifier

Terminals
9 and 11 Line level grid input. Terminal 11 is ground.
10 and 11 Line level grid input. Terminal 11 is ground.

External Connections Common to the 143-Type Amplifiers

External connections to the 143-type Amplifiers are made to terminal strips (terminals 1 to 22) which are recessed 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 that can be removed when making connections. These plates should be replaced before power is applied to the amplifier.

Terminals

21 and 22 105 to 125 volts, 60 cycles a-c. The maximum power required is 385 watts. Fused with a 3 ampere thermal output fuse. As supplied, the amplifier is connected for line voltages averaging 115 to 125 volts.

If the line voltage averages between 105 and 125 volts the BK-RD wire from Transformer T2 should be removed from terminal 22 and taped to prevent accidental contact with any other part of the amplifier. The BK-YEL wire

Terminals

from Transformer T2, which will be found taped, should be soldered to terminal 22.
23 and 24 Strapped to 9 and 10, respectively.
25 +300 volts d-c for plate supply for one 141A or two 116B Amplifiers.
26 -300 volts.

Circuit

27 and 28 Heater supply for external amplifiers. The center tap of this supply is connected to a biasing voltage within the amplifier. This is usually beneficial in reducing noise generated within pre-amplifier vacuum tubes.
11 Ground.

Terminals

27 and 28 Heater supply for external amplifiers. The center tap of this supply is connected to a biasing voltage within the amplifier. This is usually beneficial in reducing noise generated within pre-amplifier vacuum tubes.
11 Ground.

OUTPUT CONNECTIONS FOR ALL 143-TYPE AMPLIFIERS

With the amplifier in the 75 watt condition the output connections should be made in accordance with Table 1.

TABLE 1

Nominal Load* Impedance (Ohms)	Working Range of Load Impedance (Ohms)		Output Connections
	Nominal Load*	Load Impedance	
170	130 to 250	14-15, 16-17	13 and 20
66.7	50 to 100	18-19	19 and 20
24	18 to 36	14-15, 16-17	13 and 18
12	9 to 18	13-15, 14-16-17	15 and 18
8	6 to 13	14-15	13 and 16
4	3 to 6	—	17 and 18
2	1.5 to 3	13-15, 14-16	13 and 16

For 70 Volt Loudspeaker Distribution Circuit

Power Output Condition	Strap Terminals	Output Connections
75 watts	— — —	19 and 20
50 watts	18-19	17 and 20

* Values of nominal impedances given are for 75 watt condition. For 50 watt condition, values should be multiplied by 1.25.

Output Power

The 143-type Amplifier as supplied is connected for use with Western Electric 350B Vacuum Tubes in the output stage, and will deliver 75 watts of program power with less than 5% distortion over the frequency range of 50 to 7500 cycles when operating into nominal load impedance.

used as a power amplifier of single frequency tone at a power level of 75 watts over extended periods of time for the purpose of driving motors or clocks or similar devices. Its single frequency rating at 75 watts is on the basis of "one-half hour on, one-and-one-half hours off." It can, of course, be used satisfactorily at its full rating of 75 watts of program on a continuous basis.

NOTE: The amplifier in its 75 watt condition is capable of delivering power peaks of 75 watts. It should not be

If operation at less than 75 watts is wanted, the amplifier can be reconnected for 50 watt operation. The rating will then be 50 watts program or single frequency tone on a continuous basis, with less than 5% distortion over the range from 50 to 7500 cycles when operating into the stated load impedances. For 50 watt operation the following changes must be made:

1. Either 350B or 6L6 Tubes may be used in the output stage.
2. Short circuit R34.
3. At vacuum tube sockets V8 and V9 remove the straps between terminals 3 and 4 and add straps between terminals 6 and 7.

Installation

When the output of the amplifier is disconnected from its load, quite high voltages can be developed across the output transformer primary by input surges such as may be caused by dropping a microphone or phonograph pickup. In systems where loudspeakers can be switched on and off in such a way that the output is sometimes open, it is recommended that a two-watt resistor of the proper value to draw 1/2 watt of power be connected across the output terminals of the amplifier if such a resistor is not included in the amplifier as received. If the 70 volt output circuit is being used the value of this resistor would be 10,000 ohms. (Amplifiers of recent manufacture include R41 for this purpose.) Such a resistor is not required and may be omitted or removed if the installation is such that an output load of one-half watt minimum is always connected to the amplifier.

70 Volt Loudspeaker Distribution Circuit

The Western Electric 143-type Amplifiers have output connections for operating into loudspeaker loads on the basis of a constant voltage distribution circuit. Seventy volts has been adopted for the constant voltage.

When reference is made to a 70 volt distribution circuit, it does not mean that the

voltage across the circuit is always 70 volts any more than that the power drawn from a 50 watt amplifier is always 50 watts. Seventy volts is the maximum voltage on program peaks at the output of the amplifier. Acceptance of this standardized voltage means that the rated load impedances of amplifiers of different power capacities have been chosen so that the voltage of the program peaks is the same for a low power amplifier as for a high power amplifier. For a strict definition we may say that an amplifier output is arranged for 70 volt operation if, when the amplifier is terminated in its rated load impedance and is supplying single frequency power to the load equal to the power rating of the amplifier, the rms voltage across the load is 70 volts.

In a loudspeaker distribution circuit such as this, each loudspeaker will have an associated auto-transformer which permits the impedance to be adjusted for a value proper for use on a 70 volt circuit. Thus if a loudspeaker is rated at 10 watts, the 10 watt auto-transformer connection is used which makes its impedance such that it will draw 10 watts of power if connected to the 70 volt output of, say, either a 10 watt or a 100 watt amplifier. The same loudspeaker can be arranged to take lower power by the use of a different connection on the associated auto-transformer.

In practice, the connections for a number of loudspeakers become very simple. First the power needed for each loudspeaker location is determined, and the auto-transformer connection chosen which will give this power on a 70 volt circuit. The power for all the loudspeakers is added up and an amplifier chosen which is capable of supplying at least this much power. All loudspeaker auto-transformer inputs may then be connected in parallel to the 70 volt output of the amplifier without any further considerations of impedance relations.

The Western Electric 25A, 26A and 27A Auto-transformers are recommended for use with a 70 volt loudspeaker distribution circuit.

Ventilation

The temperature rise in the 143 type Amplifier is independent of whether it is connected for 50 watts or for 75 watts output. However, the operating temperature of the

Location	Maximum Temperature
Electrolytic Capacitors on Top of Chassis	65°C (149°F)
Power Transformer Primary Winding	115°C (239°F)
Air Temperature Inside of Chassis	(a) 75°C (167°F) (b) 85°C (185°F)

Continuous operation of a 143 type Amplifier transmitting single frequency, sine wave power not exceeding 20 watts output or speech or music results in average internal dissipation essentially the same as when the amplifier is operated in the standby condition (amplifier energized but with no input signal). Under such conditions a single amplifier may be operated at a room ambient temperature of 43°C (approximately 109°F), assuming free air circulation such as that normally available when the amplifier is vertically mounted in an open relay rack or ventilated cabinet.

When the 143 type Amplifier transmits a single frequency and delivers more than 20 watts output, either a reduction in maximum ambient temperature or an intermittent duty cycle is necessary. For example, with an output of 50 watts, the room ambient temperature should not exceed 32°C (approximately 90°F). For further example, with an output of 50 to 75 watts, an amplifier may be operated at 43°C (approximately 109°F) provided the duty cycle is one-half hour on followed by one-and-one-half hours off. (The amplifier may be left turned on during the one-and-one-half hour period, but the input signal must be off.)

Several 143 type Amplifiers may be mounted vertically in an open relay rack or in an enclosed equipment cabinet without forced

ventilation provided 38°C (approximately 100°F) room ambient temperature is not exceeded, if at least 100 square inches of open area are 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:

Measurement Method	Number of 143 Type Amplifiers
Air temperature at capacitor surface 1" from chassis using thermometer or thermocouple.	Open Relay Rack Cabinet
Winding temperature measured by change of resistance method.	20 Watts Single Frequency, or Speech and Music
Thermometer or thermocouple in air space or (a) between C9 and C15 and the chassis (b) above resistance strip and between the power switch and the volume control.	3

ventilation provided 38°C (approximately 100°F) room ambient temperature is not exceeded, if at least 100 square inches of open area are 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:

Output of Each Amplifier	Number of 143 Type Amplifiers
20 Watts Single Frequency, or Speech and Music	Open Relay Rack Cabinet
50 to 75 Watts Single Frequency and 1/2 Hour or 1 1/2 Hours Standby, Duty Cycle	2

While this table assumes no spacing between amplifiers, it is recommended that a minimum spacing of 3 1/2 inches be maintained between rack mounted amplifiers, when this is feasible, to provide more operating margin.

Other apparatus may be mounted in spaces between 143 type Amplifiers. However, if it is heat generating equipment, and particularly if concentrated heat sources are included, temperature checks are recommend-

116B AMPLIFIER NO. 2
143B AMPLIFIER

- RD from input transformer 4
- RD-WH from input transformer 5
- BL from input transformer 5
- BL-WH from input transformer 6
- BR 27
- YEL 28
- RD (or RD-WH) 25
- GR 24
- BK 11

This condition is ordinarily met when the amplifier is rack mounted and the front cover with the 407B Panel. The cover plates over the recessed terminal strips should be left in place at all times when the amplifier is in operation.

Operation with Other Apparatus

When operation from low level sources is required, the 143B Amplifier is recommended. However, the 143A and 143C Amplifiers can be adapted for this service by the addition of a 141A Amplifier or two 116B Amplifiers in the case of the 143A, or one 141A or one 116B Amplifier in the case of the 143C Amplifier. Instructions for the installation of a 141A Amplifier are given in the instruction bulletin covering the 141A Amplifier, and in Part II of this bulletin.

Use with 116B Amplifier

If so desired, two 116B Amplifiers can be mounted on the 143A Amplifier chassis. This arrangement provides two channels with electronic mixing, and separate channel volume controls continuously adjustable.

Assemble the 116B Amplifiers on the chassis of the 143A Amplifier. The volume control potentiometers can be mounted on the chassis using two of the holes which were provided for this purpose, or they can be operated from a remote location by extending the connecting wires.

116B AMPLIFIER NO. 1

- | | | |
|---------------------------------|-----------------------|--|
| <i>116B Amplifier</i> | <i>143A Amplifier</i> | |
| <i>Wire Color</i> | <i>Terminal No.</i> | |
| RD from input transformer | 1 | |
| BL | 2 | |
| BL-WH | 3 | |
| BR | 27 | |
| YEL | 28 | |
| RD or RD-WH from terminal strip | 25 | |
| GR | 23 | |
| BK | 11 | |

ed. Account should also be taken of the possible effect of heat from the amplifiers on other apparatus in the same rack. For example, when three amplifiers are mounted on a rack and operated, without forced ventilation, in the standby condition (or transmitting speech and music), air temperature rises above the top amplifier, ranging from 15°C over the capacitors to 38°C above the transformers or vacuum tubes, may be expected.

Where higher room ambients, larger number of amplifiers or other severe heat conditions are contemplated, forced ventilation is recommended. For example, a blower having 60 to 100 cubic feet per minute capacity, assuming effective use of the circulated air, should permit operation of four or five amplifiers in a single rack or cabinet with 20 watts single frequency output continuously from each or with 50 to 75 watts single frequency output from each on the one-half hour on, one-and-one-half hour standby, duty cycle.

The foregoing is a general guide. When limiting conditions are approached, and in other cases where high temperature conditions may be expected, it is recommended that temperatures be measured. Temperature rises should be measured after the equipment has been in continuous operation a sufficient time to achieve stability (approximately eight hours or longer) and should be considered, in conjunction with the maximum room temperature expected, to determine the probable maximum temperatures to be experienced. In this connection it should also be noted that ambient temperature rises, due to heat dissipation from the amplifiers, may be experienced in small rooms with restricted ventilation.

Safety Precautions

The local inspection authority should be consulted regarding requirements for approved installation. In general, in order to meet these requirements, no terminals or wiring involving the a-c supply or secondary power shall be exposed to accidental contact.

General

The 143B Amplifier consists of the basic 143A Amplifier with a 141A Amplifier mounted on its chassis. It thus provides a low level transformer input for microphone or phonograph use, and a line level grid circuit input. The following description of the 143B Amplifier is concerned only with those features of the amplifier which differ from the basic 143A Amplifier.

Details of the 141A Amplifier are contained in Instruction Bulletin No. 1186 which is a part of this bulletin.

Vacuum Tubes

The 143B Amplifier requires the following vacuum tubes which should be inserted in the sockets as designated by the markings on the chassis.

Quantity	Western Electric	Receiver Type
5	6SN7GT
4	350B	6L6
2	5R4GY
1	OC3/VR150
1	6J7

These tubes are not supplied with the amplifier and must be ordered separately. (For information on the use of the 6L6 or 350B Vacuum Tubes see the section on Output Power of the 143-type Amplifier.)

Power should never be applied to the 143B Amplifier unless all tubes are in place in their sockets. Failure to observe this may cause the line fuse to blow.

It is of great importance that the metal grid cap shield be in place over the top of the 6J7 Vacuum Tube in the 141A Amplifier.

Maintenance

No maintenance is ordinarily required except for routine cleaning of the amplifier and the testing and replacement of vacuum tubes when necessary. Should the amplifier fail to operate properly, the trouble can be traced by means of the schematic diagram and the wiring diagram.

Associated Parts

It is recommended that a spare set of vacuum tubes, and at least one spare 3 ampere fuse be kept on hand.

For rack mounting, a Western Electric 407B-15 Panel is required as described in the section on "Mounting".

For connections to loudspeakers, the Western Electric 25A, 26A and 27A Auto-transformers are recommended.

These parts and replacements can be obtained through the nearest distributor.

Additional information regarding system applications of this amplifier, its use in special services or in connection with other equipment can be obtained from the distributor.

Gain Controls

In addition to the continuously adjustable master gain control which is a part of all 143-type Amplifiers, the 141A Amplifier has a screwdriver-operated gain control which is adjustable from 70 to 40 db in increments

of 10 db. This control is described in detail in the accompanying instruction bulletin covering the 141A Amplifier.

Input Connections (Low Level)

- 1 and 2 Nominal 30 ohms
- 2 and 3 Nominal 250 ohms
- 1 and 3 Nominal 600 ohms

Source impedance may be $\pm 40\%$ from these values with little effect on the response characteristics.

Input Connections (Line Level)

- 10 and 11 Line level grid circuit input with internal impedance greater than 250,000 ohms. (Note: Strap connecting terminals 10 and 11 must be removed before using this input circuit.)

It is recommended that connections between the amplifier input source and the 143B Amplifier input terminals be made with twisted pair shielded copper wire with insulation over the shields. Ground the shield to terminal 11.

The Western Electric 143B Amplifier can accommodate other input connections. One arrangement is the addition of the 718A Apparatus Unit.

This apparatus unit consists essentially of a small, gray enameled, metal box provided with mounting flanges and a removable back plate, and having a 618D Input Transformer assembled on top of the box. The bottom of the box is open. Mounting holes and marking for a volume control are also provided in the top of the box. In addition the front of the box is drilled for mounting a switch or volume control, or both. Mounting screws are furnished. Volume controls and switch are not furnished with the unit.

143-TYPE AMPLIFIERS 143C AMPLIFIER

General

The Western Electric 143C Amplifier consists of the basic 143A Amplifier and an in-

put transformer that is designed for operation from telephone lines. It thus provides a line level transformer input and a line level grid circuit input. The following description of the 143C Amplifier is concerned only with those features of the amplifier which differ from the basic 143A Amplifier.

Input Connections

Terminals

- 4 and 5 37.5 ohms nominal. (Terminal 5 is the center tap of the 150 ohm (4-6) transformer winding.)
- 4 and 6 150 ohms nominal. (Terminal 5 is the center tap of this winding.)
- 7 and 8 150 ohms nominal.
- 4 and 8 600 ohms nominal. (Terminals 6 and 7 must be strapped for the 600 ohm condition.)
- 10 and 11 Line level grid circuit input with internal input impedance greater than 250,000 ohms. Note: The strap between terminals 10 and 11 must be removed before this input circuit can be used.

The source impedances of the above may be $\pm 40\%$ from the nominal values without appreciable change in frequency characteristics.

It is recommended that the connections between the amplifier input source and the 143C Amplifier input terminals be made with shielded twisted pair copper wire with insulation over the shields. The shields should be connected to terminal 11.

Remote Gain Control

When used for wired music service it is sometimes desirable to have a gain control located at a distance from the amplifying equipment, such as the cashier's desk or other convenient location. The circuit shown in Figure 5 is one arrangement that can be

used. It should be noted that when a remote gain control is used, it is the general practice to isolate the control from the telephone lines by an additional repeating coil. When making connections to telephone lines the local telephone company should be consulted for local practices and for recommended strapping of repeating coils.

Additional Equipment

A 141A Amplifier can be added to the 143C

PART II

143A AMPLIFIER INPUT CIRCUIT VARIATIONS

A number of variations in the input circuit to the 143A Amplifier are possible. The circuits of some of these variations are shown in the chart, Figures 6 and 7, which also indicates the equipment required for each circuit and the mechanical layout of the equipment on the chassis for rack mounting of the 143A Amplifier, and for horizontal mounting of this amplifier for some of the variations. Some of these variations are available as standard items and may be ordered as 143B or C Amplifiers. The information herewith is primarily intended as a guide for customer use in providing the arrangements covered. The following Circuit Descriptions give the uses of each circuit and a brief description of its electrical properties. Following this is a section on Components Required which gives a description of and ordering information on the parts needed. The next section on Mounting Arrangements gives instructions for mounting the components.

Circuit Description

This section gives a description of each of the circuits shown in the charts, Figures 6 and 7. The use of the circuit is described and also properties of the entire amplifier when each input arrangement is used. Information on source impedances is given in the chart. When no range of impedances is given, the impedance may vary from the nominal value of $\pm 40\%$, without appreciable

change in the frequency characteristic. *Standard 143A*—The 143A Amplifier as shipped provides for two line level circuit inputs. The electrical characteristics of the amplifier in this condition are given in the table in the front of this bulletin. *VARIATION 1*—This variation adds a 141A Amplifier. It is used when a low level transformer input is required for microphone or phonograph input. This circuit has been coded the 143B Amplifier and its characteristics may be found in the table in the front of this bulletin. *VARIATION 2*—This variation adds a 618D Input Transformer. It may be used when a line level transformer input is required for connection to telephone lines or other sources of comparable level. This circuit has been coded the 143C Amplifier and its characteristics are given in the table in the front of this bulletin. *VARIATION 3*—This variation adds a 618C Input Transformer. It may be used when a line level transformer input is required which may be operated from a large range of source impedances. *Gain*—High gain input: Approx. 72 db from 600 ohm source. Bridging input: Approx. 59 db from 600 ohm source. *Gain Control*—Master potentiometer in the, 143A Amplifier. *VARIATION 4*—This variation adds a 285S Input Transformer. It may be used in

place of the 618D Input Transformer of VARIATION 2 when a high quality balanced and shielded input circuit is required for operation from telephone lines or other source of comparable impedance.

Gain—Approx. 66 db from 600 ohm source.

Gain Control—Master potentiometer in the 143A Amplifier.

VARIATION 5—This variation adds one 116B Amplifier and its associated gain control. It may be used when one low level transformer input is required for operation from microphone or phonograph. The gain control potentiometer may be located at a distance from the amplifier if desired.

Gain—Approx. 107 db.

Gain Control—Potentiometer associated with 116B Amplifier.
Master potentiometer in the 143A Amplifier.

VARIATION 6—This variation adds two 116B Amplifiers and their associated gain controls. It is used when two low level transformer inputs are required for operation from microphones or phonographs. The two inputs may be operated simultaneously if desired, or either may be cut off with its gain control potentiometer. The gain control potentiometers may be located at a distance from the amplifier if desired.

Gain—Approx. 107 db.

Gain Control—On individual channels by potentiometers associated with 116B Amplifiers.
Master potentiometer in 143A Amplifier controls both channels.

VARIATION 7—This variation adds a 618C Input Transformer and a gain control potentiometer having 38 db of control in 2 db steps. It may be used in place of VARIATION 3 when a stepped gain control is required.

VARIATION 8—This variation adds a 116B Amplifier and a transformer. It may be used when a low level transformer input and also a line level transformer input are

required. It consists of a combination of VARIATION 5 with VARIATION 2, 3 or 4, and the characteristics are the same as given for these variations.

Components Required

The equipment required for the several circuit variations as listed in Figures 6 and 7 is in a somewhat abbreviated form. Additional description and complete ordering information are given here as required. However, suitable equivalents may be used. Certain items included are not called for in Figures 6 and 7 but may be useful if associated panels or brackets are used for mounting them.

Potentiometer.—This is the gain control for the 116B Amplifier when a short shaft (5/8") is required for panel mounting. This item is not required in any arrangement shown on Figures 6 and 7 but will be useful if remote gain controls are employed with 116B Amplifiers. See also Mounting Instruction F. It is a 4000 ohm potentiometer with a switch attached.

Order as follows:

One Allen Bradley, Type JS, U4022, FS-2040, 4000 ohm Potentiometer with M2898 Lockwasher and M2786 Nut.

Potentiometer, Item 5.—This is the gain control for the 116B Amplifier with a long shaft (2 1/2") for rack use. It is a 4000 ohm potentiometer with a switch attached.

Order as follows:

One Allen Bradley, Type JS, U4022, FS-3232, 4000 ohm Potentiometer with M2898 Lockwasher and M2786 Nut.

Knob, Item 10.—This is used with the potentiometers.

Order as follows:

One Kurz-Kasch No. 292-3L Knob.

Attenuator.—This is a stepped attenuator, 19 steps of 2 db each and "OFF" position, 250,000 ohms, with designation plate, and with a short shaft (5/8"). If this attenuator is used externally as with a horizontally mounted amplifier, its location should be such

that short wires are used to it as discussed under wiring.

Order as follows:

One Tech-Lab. No. A-1330-2 Attenuator.

Attenuator, Item 12.—This is the same as the above except that a long shaft (2 1/4") is furnished for rack use.

Order as follows:

One Tech-Lab. No. A-1330-1 Attenuator.

Mounting, Item 13.—When a 618-type Input Transformer is to be mounted, the following hardware is required.

One Aerovox Mounting Ring, Type E, 1 1/2" diameter.

One 6-32 x 1 1/4" Round Head Machine Screws.

Two 6-32 x 3/8" Round Head Machine Screws.

Three 6-32 Nuts.

Three No. 6 Lockwashers.

Bushing, Item 15.—This is a bushing to mount in a 13/32" hole and accommodate a 1/4" shaft. It should be used in the 407B-15 Panel when the long shafts of potentiometers, etc. extend through this panel.

Order as follows:

One Mallory UB241 Bushing and Nut.

Panel, Item 16.—This is an aluminum gray panel, 12 1/4" high, for use as a front mat when a 143-type Amplifier is rack mounted.

Order as follows:

One 407B-15 Panel.

Mounting Arrangements

Provision is made to mount additional equipment on the input end of the 143A Amplifier in two removable plates and in several extra mounting holes in the chassis. A 141A Amplifier may be mounted in place of the two removable plates; a 116B Amplifier may be mounted in place of either of the plates. In addition the under side of each plate is marked with drilling instructions for mounting transformers, potentiometers, and switches. The extra holes in the chassis may be used to mount two potentiometers, or one switch and one potentiometer.

The following gives detailed instructions

for mounting the equipment required for the input circuit arrangements shown in the chart in Figures 6 and 7. In this chart, each circuit has accompanying diagrams showing the location of the extra equipment for rack mounting of the 143A Amplifier, and reference to mounting instructions given in this section. In addition, the chart shows location of equipment for horizontal mounting of the amplifier for VARIATION 1 to VARIATION 4. No provision is made in the 143A Amplifier for mounting the controls of VARIATION 5 to VARIATION 8 on the chassis if the amplifier is mounted horizontally. If such arrangements are wanted, the controls must be mounted on a separate panel or bracket. The attenuator of VARIATION 7 must be mounted close to the associated equipment because the high impedance wiring must be kept short. This limitation does not apply to the potentiometers of VARIATIONS 5, 6 and 8, which may be located at a distance from the amplifier if desired.

Tools which may be required for this work are standard screwdrivers and wrenches, a #8 Allen wrench for the set screws in the knobs and a small Phillips screwdriver. In some cases a means of drilling holes in metal panels will be required.

Mounting Instruction A—Rack Mounted 143A Amplifier

When the 143A Amplifier is to be rack mounted, a 407B-15 Panel is used as a front mat. Since the 143A Amplifier as shipped has its power switch and volume control on the side of the chassis in a position for horizontal mounting, it is necessary to rotate these controls 90° to a position where they will be available through the cutout in the 407B-15 Panel. This may be done as follows:

1. Remove the knob of the volume control by loosening its set screw with a #8 Allen wrench.
2. Remove the etched plate by removing the four #4 Phillips screws holding it in position. This loosens the bracket holding the controls.
3. The bracket should now be rotated 90°

to its mounting position on the two mounting spacers on the chassis. Two #8 screws furnished with the 407B-15 Panel should be passed through these spacers and into the tapped holes in the bracket.

4. Fasten the etched plate to the bracket with the four #4 screws removed in step 2, and replace the volume control knob.
5. The holes in the chassis through which the controls formerly protruded should be closed with the plug buttons supplied with the 407B-15 Panel.

The rear of the 407B-15 Panel is marked with drilling information for holes that are in line with certain mounting holes on the amplifier. This is for use only when additional parts are mounted on the chassis as described below.

Mounting Instruction B—141A Amplifier

To mount a 141A Amplifier on the 143A Amplifier chassis, first remove the two blank cover plates near the input end of the chassis. The 141A Amplifier is mounted in place of these plates on top of the chassis, oriented so that the vacuum tubes are toward the end of the chassis. Mounting screws, lockwashers and plain washers are furnished with the 141A Amplifier.

Mounting Instruction C—116B Amplifier

One or two 116B Amplifiers may be mounted on the 143A Amplifier chassis, each in place of one of the blank cover plates on the chassis. Remove the cover plate and place the 116B Amplifier in its place on top of the chassis, with the input transformer toward the side of the chassis where the controls are mounted. Mounting screws and washers are furnished with the 116B Amplifier.

Mounting Instruction D—715-Type Apparatus Units

The 713A Apparatus Unit may be mounted in place of either of the blank cover plates. Four screws are furnished with the Apparatus Unit as mounting screws.

Mounting Instruction E—618-Type Input Transformer

A 618-type Input Transformer may be mounted on the chassis which is drilled for wires and mounting screws. The transformer is held in place by an Aerovox Type E, 1½" diameter Mounting Ring, held tight with a 6-32 x 1¼" round head machine screw and associated nut and lockwasher. The mounting ring is fastened to the chassis by two 6-32 x ¾" round head machine screws, nuts and lockwashers. (See Item 13.) This transformer may also be mounted on one of the blank cover plates, which, however, must be drilled in accordance with the marking on its under side. The added series resistors with the 618C Input Transformer (See Variations 3 and 7) may be supported by using spare input terminals of the 143A Amplifier as discussed under wiring.

Mounting Instruction F—Potentiometers

Three holes are available in the amplifier chassis next to the cover plates, normally closed with plug buttons; the center hole is for wiring, and either of the others may be used for mounting purposes. The potentiometer (Item 5) is mounted so that the long shaft extends through the front panel. The 407B-15 Panel is marked on the rear with drilling information for shaft holes which line up with the end mounting holes of the three in the amplifier chassis. Bushings, Item 15, should be used in these holes to support the shaft. A designation plate may be used on the front of the panel if desired. Marking is also provided on the rear of the 407B-15 Panel for mounting holes for this designation plate.

Potentiometers for use with the 116B Amplifier may be used as remote controls, if desired. In any event they may be mounted externally from the 143A Amplifier, using either the long-shaft unit, Item 5, or a short-shaft unit.

Mounting Instruction G—285-Type Input Transformer

Some 285-Type Input Transformers (not including the 285S) may be mounted on the

chassis which is drilled for wires and mounting screws. The transformer should be fastened to the chassis with two No. 8-32 x ¾" Screws.

When the 285S Input Transformer is mounted on one of the blank plates furnished as a part of the 143A Amplifier it will be necessary to drill an additional hole in the plate to those indicated for the 285L Input Transformer on the plates as received.

Mounting Instruction H—Attenuator, Item 12

The attenuator, used in VARIATION 7, is arranged for single hole mounting and is supplied with designation plate. It may be mounted through either end hole of the three extra holes in the chassis, with the shaft extending through the front panel. The 407B-15 Panel is marked on the rear with drilling information for shaft holes which line up with these mounting holes in the amplifier chassis. A bushing should be used in this hole to support the shaft and hold the designation plate in place. Other mounting than this for this attenuator (or for a shorter-shaft attenuator) requires consideration of lead length as discussed under wiring.

Wiring

The various input arrangements may all be wired with straps on the 143A Chassis. VARIATION 1 to VARIATION 7 have complete connection shown in the circuits on Figures 6 and 7 and may be wired accord-

ingly. VARIATION 8 has only part of the connections shown. Wiring not shown in VARIATION 8 should be the same as VARIATION 5 and VARIATION 2, 3 or 4.

The wiring for VARIATION 3 or 7 will be facilitated if the resistors in series with the primary of the 618C Input Transformer are wired using spare input terminals of the 143A Amplifier as tie-points for the ends of the resistors connecting to the transformer. This is indicated schematically on Figures 6 and 7.

If the attenuator of VARIATION 7 is to be used with a horizontally mounted amplifier, it must be located so that short wires can be used, in order to keep down pickup into its high impedance circuit.

Remote Gain Control

When used for wired music service it is sometimes desirable to have a gain control located at a point remote from the amplifying equipment, such as the cashier's desk or other convenient location. The circuit shown in Figure 5 is one arrangement that can be used. It should be noted that when a remote gain control is used, it is the general practice to isolate the control from the telephone lines by an additional repeating coil. When making connections to telephone lines the local telephone company should be consulted for local practices and for recommended strapping of repeating coils.

TYPICAL CUSTOMER'S APPARATUS LIST

NOTE: General list for 143-A, B and C Amplifiers with additions as noted below:

143-A AMPLIFIER

Catalog Description Apparatus

Allen Bradley Co. Resistors or Equivalent

- R1, R2, R9, R18, R19 Type EB .24 meg. \pm 5%
- R3, R11 Type EB 2400 ohms \pm 5%
- R5 Type EB .1 meg. \pm 5%
- R6 Type EB .51 meg. \pm 5%
- R7 Type EB 1500 ohms \pm 5%
- R12 Type EB .47 meg. \pm 5%
- R13 Type EB 2.2 meg. \pm 5%
- R14 Type EB 39,000 ohms \pm 5%
- R15 Type EB 15,000 ohms \pm 5%
- R17 Type EB 51,000 ohms \pm 5%
- R20, R21 Type EB 20,000 ohms \pm 5%
- R4, R10, R16 Type EB .1 meg. \pm 10%
- R8 Type GB 51,000 ohms \pm 5%
- R22, R24, R28, R30 Type EB 100 ohms \pm 10%
- R26, R27 Type EB 180 ohms \pm 10%
- R23, R25, R29, R31 Type HB 27 ohms \pm 10%
- R41 Type HB 10,000 ohms \pm 10%
- R33 Type EB 12,000 ohms \pm 5%
- R34 Type EB 2,000 ohms \pm 5%
- R35 Type EB 5,100 ohms \pm 5%
- R38, R39 Type GB .1 meg. \pm 10%
- R40 Type EB 1,000 ohms \pm 10%

International Resistance Co. Resistors or Equivalent

- R37 Type MW 4 20,000 ohms \pm 10%
- R36.1 Type MW 4 5,000 ohms \pm 10% 4.5 Watts } 7,800 ohms
- R36.2 Type MW 4 1,500 ohms \pm 10% 1.2 Watts } \pm 10%
- R36.3 Type MW 4 1,300 ohms \pm 10% .8 Watts } Total

Cornell Dubilier Condensers

- C1, C2, C4, C5, C7, C8 Type TVG-6S5-6 .05 MF \pm 10%
- C6 Type 5W .00027 MF \pm 10%

Sprague Electric Co. Condensers

- C9, C15 Type Dee Electrolytic 10 MF 150 V. $\frac{1}{2}$ x 1 $\frac{1}{2}$ " Tubular with insulating cover
- C10 Type DEW Electrolytic 40 MF 475 V. 1 $\frac{1}{2}$ x 2 $\frac{1}{2}$ " maximum with insulating washer, mounting nut, lockwasher and cover (Sprague D-13818)
- C11 Type DEW Electrolytic 30 MF 475 V. 30 MF 475 V. 1 $\frac{1}{2}$ x 4 $\frac{1}{4}$ " maximum with insulating washer, mounting nut, lockwasher and cover (Sprague D-13813)

Desig. No.

Catalog Description Apparatus

- C12 Sprague Electric Co. Condensers—(Cont'd)
Type DEW Electrolytic 30 MF 300 V; 80 MF 450 V. 1 $\frac{1}{2}$ x 4 $\frac{3}{4}$ " maximum with insulating washer, mounting nut, lockwasher and cover (Sprague D-13812)
- C13 Type DEW Electrolytic 80 MF 300 V. 1 $\frac{1}{2}$ x 3 $\frac{1}{4}$ " maximum with insulating washer, mounting nut, lockwasher and cover (Sprague D-13814)
- C14 Type DEW Electrolytic 100 MF 150 V. 1 $\frac{1}{2}$ x 2 $\frac{1}{4}$ " maximum with insulating washer, mounting nut, lockwasher and cover (Sprague D-13820)
- C16 Type 76-P Prokar condenser .047 MF, 600 V.
- L1 KS-13823 Retardation Coil (Western Electric Co.)
- L2 KS-13822 Retardation Coil (Western Electric Co.)
- T1 520-A Output Transformer (Western Electric Co.)
- T2 KS-13820 Transformer (Western Electric Co.)
- P1 Cat. #51026 } Dot plug button nic. plt. fin.
Cat. #48182 } United-Carr Fastener Corp.
Cat. #342001 Fuse Mounting (Littelfuse Inc., Chicago, Ill.)
- D1 JA-5041 Potentiometer, .5 meg., lug option #1, bushing and shaft designation. P-2040, electrical designation A-5041, supply with lockwasher and nut. (Allen Bradley Co.)
- F1 Knob S-292-3L (Kurz-Kasch Inc.)
Switch SPST 86993 GC (Arrow-Hart & Hegemann)
T-9881 Vacuum Tube Socket (Cinch Mfg. Co.)
Cat. #312003 Fuse (3 Amp.) (Littelfuse Inc.)
or
Bussman Type AGC (3 Amp.)

143-B AMPLIFIER

In addition to the general list, refer to the apparatus list for the 141-A Amplifier in Instruction Bulletin No. 1186.

143-C AMPLIFIER

General list, plus the following items:

Catalog Description Apparatus

Desig. No.

- T1 718-A Apparatus Unit
618-D Input Transformer
Special Aerovox Mfg. ring type E 1 $\frac{1}{2}$ " dia. Obtain from Aerovox Corp., New Bedford, Mass., with .138-.32 x 1 $\frac{1}{4}$ " R.H.M. steel lockwasher and #6 (.138)-.32 x $\frac{1}{4}$ " Hex. Steel Nut. All Zinc Plate Finish.