

- b. Remove resistor R-27 and replace it with resistor R-3B (150,000 ohms), connecting it from terminal 4 on the tube V-2 to terminal 2 on the terminal board TB-1.
- c. Connect condenser C-1B (.015  $\mu$ f) and resistor R-5B (82,000 ohms) in parallel across terminals 1 and 2 on terminal board TB-1.
- d. Remove resistor R-26 and replace it with resistor R-2B (56,000 ohms), connecting it from terminal 4 on the tube V-2 to the ground bus.
- e. Remove resistor R-4 and replace it with resistor R-1B (750 ohms), connecting it from terminal 4 on condenser C-16 to the ground bus.

When these changes have been made, the portion of the frequency response curve between 20 and 1000 cycles will be as shown in Figure 9-52 and the portion from 1000 to 15,000 cycles will remain substantially flat. It is important to remember that when the power output level at 60 cycles is 12 watts, the power output level between 1000 and 15,000 cycles is only 3.8 watts. This means that when the alterations outlined above have been made, the effective power output rating of the amplifier (except for some of the very low frequencies) actually has been reduced to 3.8 watts.

Both the high-frequency and low-frequency gain may be increased in the same amplifier, resulting in a frequency response curve as shown in Figure 9-52.

**9-27e. Over-all Gain Reduction**—For special applications, it may be desirable to operate the BA-4 amplifier at a lower gain. This may be done by disconnecting the second stage of the amplifier as follows:

1. Remove the grid lead from the grid cap of the second stage 1620 tube (V-2) and remove the tube from its socket.
2. Tape the clip on the end of the grid lead to prevent a short circuit.
3. Disconnect condenser C-4 from the terminal 1 on the third stage 1620 tube (V-3) by unsoldering the condenser lead at the tube socket.
4. Connect a suitable length of wire from terminal 2 on the variable resistor R-3 to terminal 1 on the third stage 6SN7 tube.

These operations disconnect the second stage of the amplifier and connect the output of the first stage to the grid of the third stage. The unit will now operate as a three-stage amplifier with the same characteristics as the normal four-stage amplifier except as noted under *Technical data for three-stage operation* (p. 298).

**9-27f. Remote Volume Control**—The MI-11274-A volume control is designed to provide a high-resistance bridging input circuit for connection between any low-impedance source and the 250-ohm input terminals of an amplifier.

This control consists of a 250-ohm dual potentiometer, a 470-ohm resistor, two 4700-ohm resistors, and a terminal board assembled as shown in Figure 9-53. The control is designed for panel mounting.

The use of one of these units makes it possible to bridge program material conveniently from any program bus or other low impedance terminated line without disturbing the operating characteristics of the line.

**9-28. Langevin Type 117-A Amplifier**—The type 117-A is a small, plug-in, two-stage, push-pull, fixed-gain unit intended for use as either a program

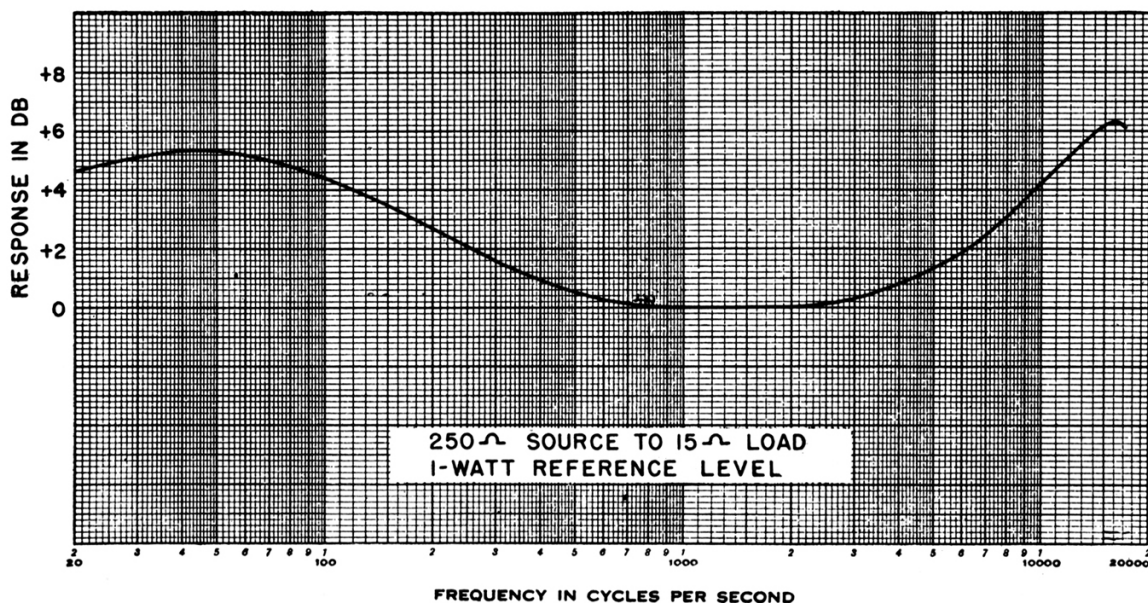


FIG. 9-52. Frequency response of RCA BA-4A amplifier with compensation. (Courtesy RCA.)

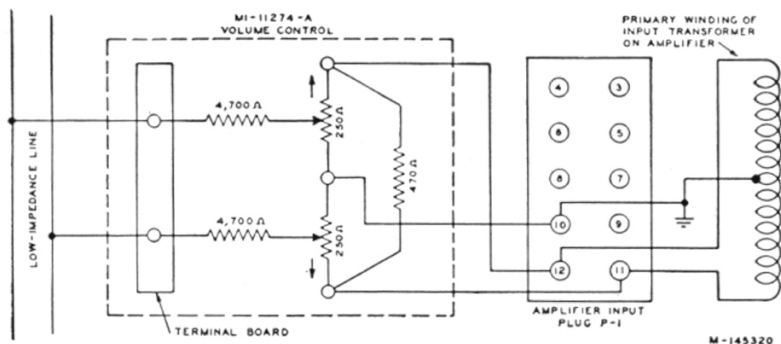


FIG. 9-53. Remote volume control for RCA BA-4A amplifier. (Courtesy RCA.)

or monitor amplifier in broadcast audio facilities, recording facilities, or sound systems. The use of one amplifier type to perform both functions makes possible an extremely flexible installation.

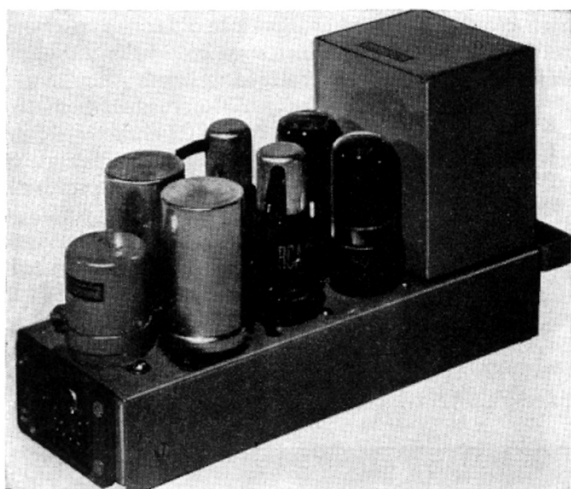


FIG. 9-54. Langevin type 117A program or monitor amplifier.

### 9-28a. Technical Data

1. *Gain*: 50 db.
2. *Input source impedance*: 30/150/250/600 ohms. Center taps are available when strapped for 150 or 600 ohms.
3. *Output load impedance*: 150 or 600 ohms. Center tap is available when strapped for 600 ohms.
4. *Output power*: +30 dbm (1 watt) with less than 0.5 percent rms total harmonic distortion over the range 50 to 15,000 cps and less than 1 percent total harmonic distortion over the range 30 to 15,000 cps. As a monitor amplifier, +39 dbm (8 watts) with less than 1 percent total rms harmonic distortion over the range 50 to 15,000 cps.
5. *Output noise*: Unweighted, equivalent to an input signal of -110 to -114 dbm, depending upon tubes, over the frequency band 50 to 15,000 cps.

6. *Frequency characteristics*:  $\pm 1$  db over the frequency range 30 to 15,000 cps.

7. *External power requirements*: Filament: 6.3 volts a.c. at 1.5 amp. Plate: 300 volts d.c. at 70 ma.

8. *Tube complement*: Two 1620's, two 6V6GT's.

9. *Dimensions*: Length 10 inches, width  $3\frac{1}{4}$  inches, height  $5\frac{1}{2}$  inches, weight  $6\frac{1}{4}$  pounds.

### 9-28b. Connections

Plug Pin Nos.	Circuit
1-2.....	Input*
3.....	Chassis ground
4-6.....	Output†
5.....	Tube current meter (if metering push buttons used)
7.....	Tube current meter (positive) VT-1
8.....	Tube current meter (positive) VT-3
9.....	Tube current meter (positive) VT-2
10.....	Tube current meter (positive) VT-4
11-12.....	Filament 6.3 volts a.c. 1.5 amp
13.....	B- and meter (negative)
14.....	B+ 300 volts d.c.

\* On unbalanced input circuits, the grounded side should be connected to pin 1.

† On unbalanced output circuits, the grounded side should be connected to pin 6.

**9-28c. Metering Circuits**—Metering circuits are designed to measure the cathode current of the individual tubes expressed as a percentage of a normal tube, using a meter having a 200 micro-ampere movement. A series resistor should be added so that the total resistance of the meter and resistor is 1000 ohms. The meter scale should be calibrated so that nominal cathode current (100 percent) will read at 75-percent of full scale.

The amplifier is supplied with the metering connections of the individual tubes brought out to pins on the plug for use with an external meter switch. However, provision has been made for push button meter switches in the handle end of the chassis if it is desired to meter the tubes at the amplifier.

**9-28d. Grounding**—Connect the main ground to pin 3 on the plug receptacle. Ground the negative side of the plate supply in the following manner: When only one amplifier is being used, strap pin 13 to pin 3. When several amplifiers are used

in a system, and obtain plate power from a common source, apply the ground at only one point in the system.

The center tap of the filament supply should be grounded. In some cases, however, it may be necessary to apply positive bias to the filament center tap with respect to ground, in order to reduce hum caused by filament to cathode leakage. In this event, a resistor can be connected across the plate voltage supply so that a portion of the plate voltage, 6 to 12 volts, can be tapped off and fed to the filament center tap.

**9-28e. Impedance**—The 117-A amplifier, as shipped, is connected to work from a source impedance of 600 ohms and into a load impedance of 600 ohms. If other impedances are desired, the amplifier may be restrapped according to the table on Figure 9-55. Strapping for the input is accomplished on the terminal strip; for the output on the output transformer.

Center taps are available on the input of the 117-A amplifier when the unit is strapped for 150 or 600 ohms, and on the output when strapped for 600 ohms. The input center tap can be grounded on the terminal strip. In order to ground the output center tap, run an additional wire from a ground point to the output transformer terminals.

**9-28f. Reduced Plate Voltage**—When the 117-A amplifier is used as a program amplifier, the plate voltage may be reduced to 275 volts with a current drain of approximately 65 ma without appreciably reducing the output power—thus prolonging tube life.

**9-28g. Tube Substitution**—In an emergency, if a 1620 vacuum tube is not available, a 6J7 tube can be substituted. This substitution may result in an increase in output noise level and tube microphonics.

**9-29. Monitoring Loud-speaker**—The finest available type of loudspeaker should be employed for monitoring radio programs. Desirable features for such units include:

1. Essentially uniform frequency characteristics over entire audible range.
2. Good efficiency, to reduce the power required from the driving amplifier.
3. Low values of harmonic and intermodulation distortion.
4. Wide angle of coverage at high frequencies.

The monitoring loud-speaker should preferably be mounted in a position directly above the control room window set at such an angle that it directs the sound to persons seated in their normal operating positions. In this position, the sound from the

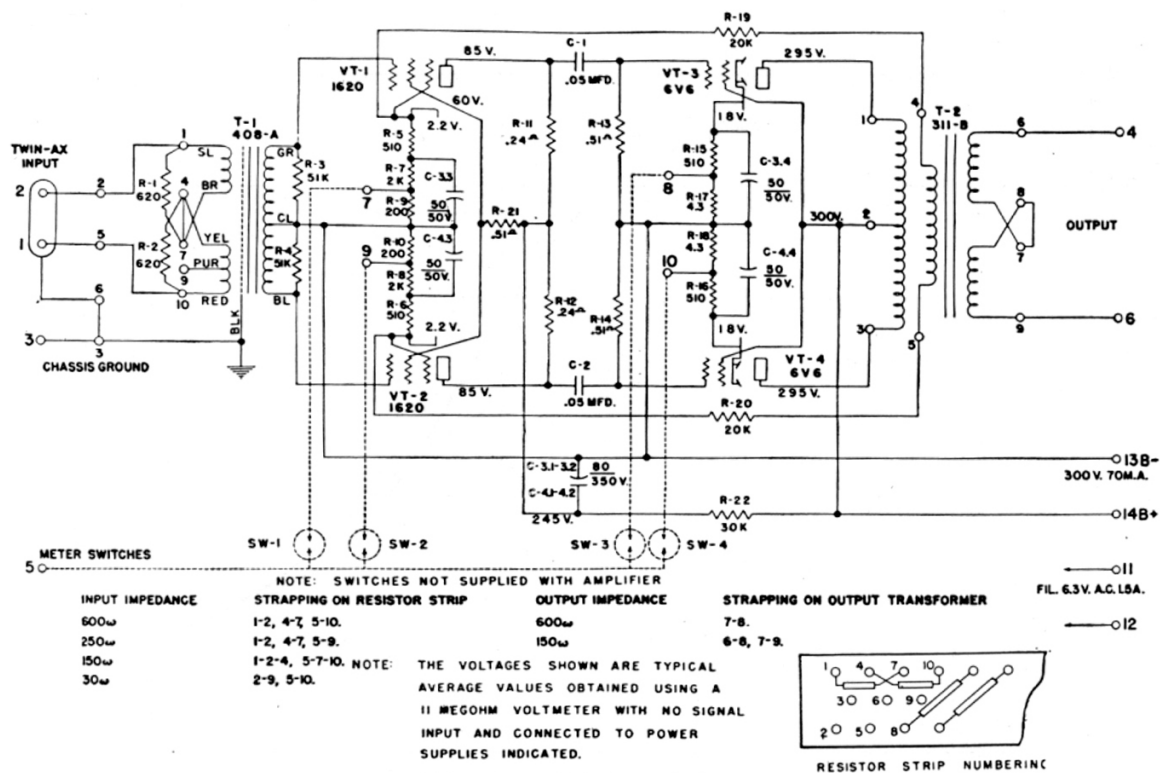


FIG. 9-55. Schematic diagram of Langevin 117A amplifier.

loud-speaker comes from the same direction as the actual performers in the studio, which is desirable and would not be the case if the loud-speaker were mounted on a side or rear wall of the control room. Many types of loud-speakers in current use have directional properties which result in a relatively narrow angle of coverage at high audio frequencies. The use of such a unit will result in unsatisfactory high-frequency reproduction to persons seated even slightly off the axis of the loud-speaker. To offset this, two loud-speakers are often employed, for example, one centered above the control room operator and another centered above the director's desk. When this is done, care must be exercised that the two loud-speakers are correctly phased.

A more desirable solution is the use of a single, dual-unit loud-speaker with a broad angle of coverage at high frequencies. Such units, when mounted at the proper height, will usually provide satisfactory high-frequency coverage for all occupants of the control room.

**9-30. Line Pad**—When the program line to the transmitter is fed directly from the control room, or when a line of any appreciable length is involved, a resistance attenuation network, commonly known as a pad, is inserted between the program amplifier and the line. The purpose of this pad is to isolate the output of the amplifier from the impedance variations of the line.

Figure 9-56 shows the impedance-frequency characteristics of a typical program line several miles in length. The impedance is shown with terminations of both 600 and 150 ohms at the far end. This represents the load into which an amplifier feeding program to the line would have to work if no line pad were employed. The standard volume indicator, to give an accurate reading, must be operated across a 600-ohm circuit. As the impedance of the amplifier load is not constant, but varies considerably as a function of frequency, it is customary to isolate the amplifier from the line by means of a resistance attenuation network. The ability of such a network to smooth out the impedance variations of the line, as seen by the amplifier, can be seen in Figure 9-57, which shows the impedance the amplifier faces with line pads of 6 and 10 db. This data is for the same line illustrated in Figure 9-57 with a 600-ohm termination at the far end. It will be seen that the pad of higher attenuation results in more complete isolation, but as the attenuation in the pad represents an actual loss of audio power and gain, it is common practice to employ a 6-db line pad.

**9-31. Resistance Attenuation Networks**—Resistance attenuation networks, or pads, as they are commonly known, are employed quite often in audio facilities. The use of a line pad to isolate the program amplifier from the impedance variations of the program line has already been discussed. The

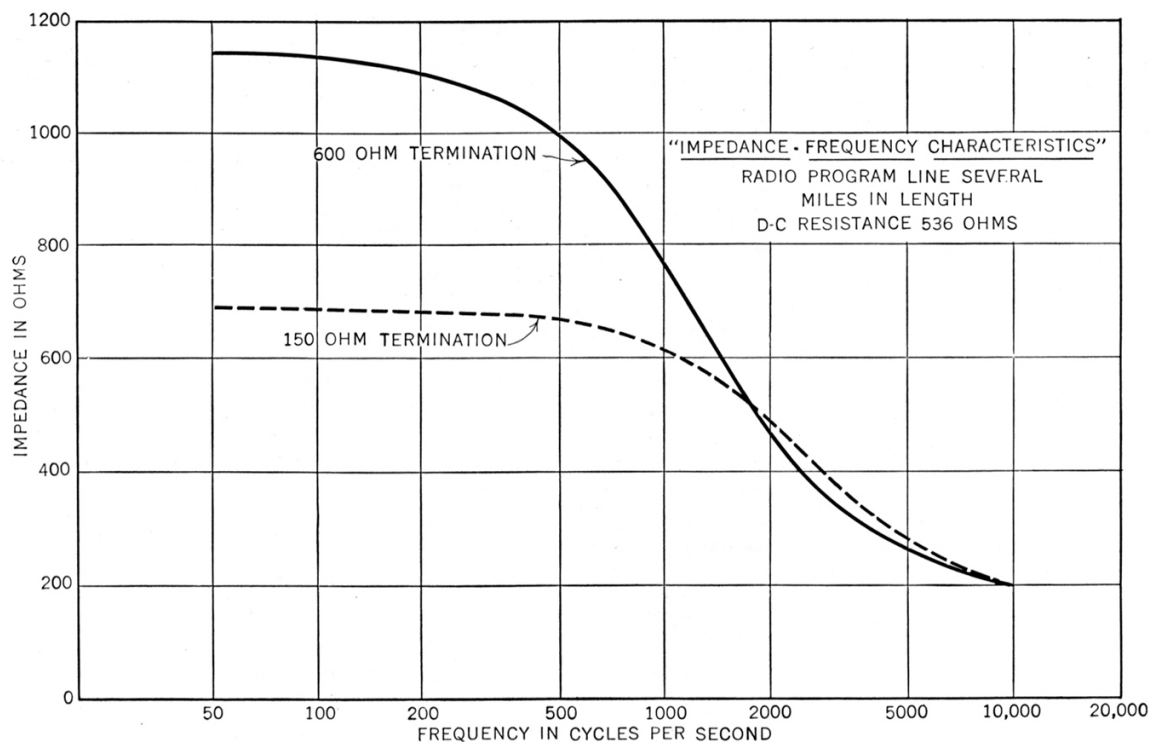


FIG. 9-56. Impedance-frequency characteristics of a typical program loop several miles in length.