

High Quality . . . Ten Watts . . . Small Package

Adequate for the average home system, this unit which was originally designed for broadcast monitor applications is relatively inexpensive, simple to construct, yet capable of excellent reproduction.

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THE audio amplifier described in this article was designed originally for use as a program monitoring amplifier in conjunction with a broadcast station audio console. Because of its compactness, its possibilities for numerous other applications became apparent as it approached its final form and reached the production department.

The photographs of Figs. 1 and 2 are of the original laboratory model. The component parts are assembled on an aluminum sheet $5 \times 8\frac{1}{2}$ in. The reason for this type of construction is that the unit was to be mounted on a chassis side by side with other equipment constructed on aluminum plates of the same $8\frac{1}{2}$ -inch dimension. Construction, of course, can be in the conventional chassis or cabinet form but regardless of the manner selected it is recommended that there be little deviation from the parts placement shown in the model.

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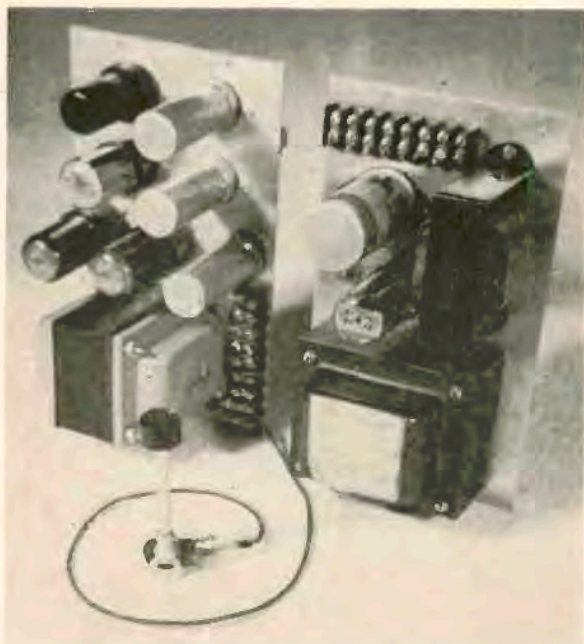


Fig. 1. The author's amplifier and power supply. Note the use of separate filter capacitor cans.

Referring to the Fig. 1 (left), the layout is as follows. At the top is the 6SJ7 input stage. Beneath it is the 6SN7 voltage amplifier-phase splitter tube, followed by the pair of 6V6 output tubes working into the output transformer located at the bottom. The electrolytic capacitors can be seen mounted alongside the tubes. All small parts are mounted beneath the plate, mostly with point-to-point wiring as shown in Fig. 2 (right). The other unit in the photos is the power supply, of which more later.

The schematic is shown in Fig. 3. The input stage is a 6SJ7 voltage amplifier with provision for coupling to the signal source provided by capacitor C_1 and through the 0.1-meg potentiometer, or volume control, R_1 . The 6SJ7 is followed by a 6SN7 twin triode tube, the first half functioning as a straight amplifier and the second half as a phase splitter. The output stage consists of a pair of 6V6 tubes in push pull. The negative feedback loop extends from the secondary winding of the output transformer to the



Fig. 2. Underside of the amplifier. The volume control is on an extension cable to permit flexibility in mounting.

cathode of the second voltage amplifier stage.

It is to be noted that direct coupling is employed between the plate of the second stage and the grid of the phase splitter. This contributes to the stability of the amplifier as this point in the circuit is included within the feedback loop, and the direct coupling reduces phase shift.

The constructor should recognize that with this phase splitter the cathode of V_{12} is at a relatively high positive potential with respect to ground, and because of the direct coupling, the grid of V_{12} is at the same positive potential as the plate of the driver triode, V_{11} . The bias on the grid of V_{12} is then determined by these two positive potentials, and is, therefore, dependent on the values of R_3 , R_{11} and R_{12} , so these are fairly critical components. The phase splitter resistors R_{11} and R_{12} should be as closely matched as possible. In the unit described here, the plate voltage of V_{11} is 79 volts, which of course, is also the potential on the grid of V_{12} . The voltage from V_{12} cathode to ground is 84 volts. The difference between these two voltages—that is, 5 volts—is the bias on the grid of V_{12} with respect to its cathode. Resistors R_{11} and R_{12} and capacitors C_1 and C_2 should also be fairly well balanced.

The response characteristics of this little amplifier are quite good. A signal input of 80 millivolts will drive the unit

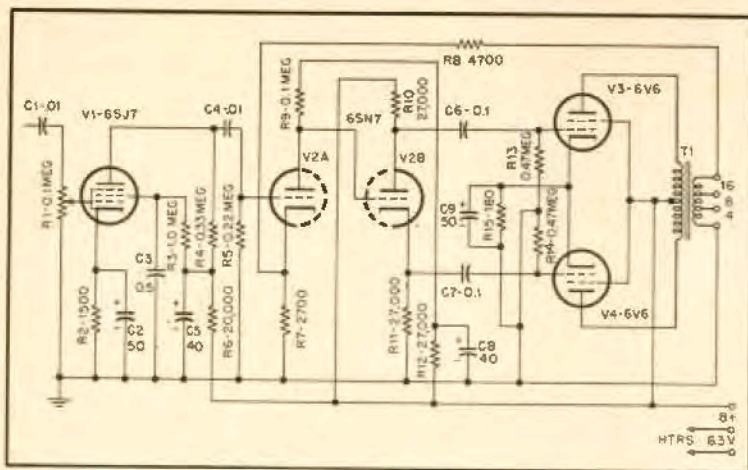


Fig. 3. Schematic of the amplifier section.

to 10 watts output across a 4-ohm load. The frequency response is flat within ± 1 db from 30 to 20,000 cps. Distortion at 1000 cps for 2 watts output is 0.7 per cent at 4 watts 0.8 per cent, 8 watts gave a 1 per cent reading, with 2 per cent measured at 10 watts. Measurements were made with a Hewlett-Packard distortion analyzer.

To the constructor who does not hesitate about pushing tubes a little harder the following may be of interest. It was observed that by increasing the supply voltage to 300 volts, which is 15 volts above the maximum rating for the screens, distortion at 2 watts measured 0.68 per cent, 4 watts 0.78 per cent, 8 watts 0.84 per cent, 10 watts 0.88 per cent, 12 watts 1.4 per cent, 13 watts 1.6 per cent and at 14 watts 3 per cent.

This compact amplifier can be utilized by the audio enthusiast as a companion piece with a preamplifier-equalizer-control unit as it can be built nicely into a sound system for record reproduction and AM/FM tuner outputs. With proper transformer input coupling it may be employed in broadcast and studio applications as a bridging amplifier across balanced low-impedance lines.

Power Supply

The power supply voltages for this 10-watt amplifier were furnished by the main power supply of the audio console with which it was associated. However, so that the unit could be used as a general purpose amplifier, an individual power supply is shown which will furnish the filament and d.c. voltages. This supply was assembled on an aluminum plate of the same dimensions as used for the amplifier, that is, $5 \times 8\frac{1}{2}$ inches, and is seen in Figs. 1 and 2. The constructor will, of course, have his own ideas as to the layout desired. The schematic of the power supply is shown in Fig. 4.

The power transformer secondary provides 350 volts a.c. each side of center tap and is rated at 125 milliamperes. The filter choke is also rated at 125 mil-

liamperes, which is approximately 25 milliamperes higher than the current requirements of the amplifier, so that the power supply can also be used to power a preamplifier in a complete audio reproducing system as well. Sufficient filtering is provided by the choke coil, L_1 , and the 20- μ f capacitors.

Resistor R_{10} serves as a bleeder resistor, contributing to improved power supply regulation. R_{11} is a voltage dropping resistor to provide the proper d.c. voltage to the amplifier as well as additional filtering. The value of this resistor may be varied to obtain higher or lower supply voltage.

The total current required for the amplifier filaments is 1.8 amperes. The current rating of the 6.3-volt filament winding of the transformer specified for the power supply unit is 4.5 amperes, which is sufficient leeway to furnish power to preamplifier tubes.

A 100-ohm, 2-watt wirewound hum-balancing potentiometer is shown across the filament winding of the power supply and will prove helpful in reducing a.c. hum voltage to a minimum. This control is a necessity if the supply is used to power low-level preamplifier stages. The center arm of this potentiometer may be connected to ground, or

it may be connected to the cathodes of the 6V6 output stage to obtain a positive biasing source to the heater circuit. If a.c. hum difficulties should prove to be particularly troublesome, a higher positive heater biasing source may be obtained by increasing the value of R_{11} .

As can be seen in the photographs, this power supply unit requires little space and will power not only the 10-watt amplifier described, but will handle a complete audio reproducing system, from phono input to loudspeaker.

PARTS LIST

C_1, C_4	.01 μ f, 400 v, paper
C_2, C_3, C_{11}	50 μ f, 50 v, electrolytic
C_5	0.5 μ f, 400 v, paper
C_6, C_8	40 μ f, 450 v, electrolytic
C_9, C_7	0.1 μ f, 400 v, paper
C_{10}, C_{12}, C_{13}	20 μ f, 450 v, electrolytic
L_1	Filter choke, 7 Hy, 125 ma.
R_1	0.1-meg potentiometer, audio taper
R_2	1500 ohms, $\frac{1}{2}$ watt
R_3	1.0 meg, $\frac{1}{2}$ watt
R_4	0.33 meg, $\frac{1}{2}$ watt
R_5	0.22 meg, $\frac{1}{2}$ watt
R_6	22,000 ohms, $\frac{1}{2}$ watt
R_7	2700 ohms, $\frac{1}{2}$ watt
R_8	4700 ohms, $\frac{1}{2}$ watt
R_9	0.1 meg, $\frac{1}{2}$ watt
R_{10}, R_{11}	27,000 ohms, 1 watt
R_{12}	27,000 ohms, $\frac{1}{2}$ watt
R_{13}, R_{14}	0.47 meg, $\frac{1}{2}$ watt
R_{15}	180 ohms, 2 watts
R_{16}	12,000 ohms, 25 watts
R_{17}	500 ohms, 15 watts
R_{18}	0.47 meg, 2 watts
R_{19}	33,000 ohms, $\frac{1}{2}$ watt
R_{20}	100-ohms potentiometer, linear taper
T_1	Output transformer, 8000 ohms plate-to-plate, 4-, 8-, and 16-ohm secondary (Triad S-31A or equivalent)
T_2	Power transformer, 350-0-350 at 125 ma, 5 v at 3 a, 6.3 v at 4.5 a.
V_1	6SJ7
V_2	6SN7
V_3, V_4	6V6
V_5	5Y3GT

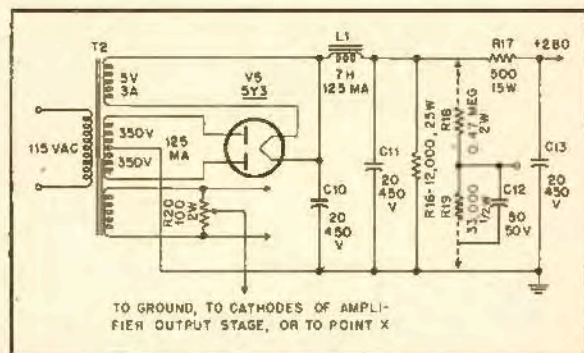


Fig. 4. Schematic of the power supply.