PUBLIC-ADDRESS AMPLIFIERS

In this chapter two versions of a public-address amplifier are described, one for a 14V and one for a 28V supply. The output power is 15W at less than 4% total-harmonic distortion. The sensitivity is sufficient for the amplifiers to be driven fully by low-impedance microphones, and the performance is more than adequate for the intended application.

The 14V version of the circuit can be regarded as the basic amplifier and will be described first; it is then only necessary to describe the more important differences in the 28V circuit.

The performance of the two versions of the circuit is compared in Table 1. The amplifiers are suitable for operation at ambient temperatures which normally do not exceed 45°C, but occasional rises up to 55°C are permissible.

14V CIRCUIT

The basic amplifier (Fig. 1) is designed for a supply of 14V, which is the average voltage of a fully charged 12V accumulator.

An output stage of the type shown in Fig. 4 of Chapter 14 has been adopted. The output is provided by two matched OC26 operating in the common-emitter configuration in symmetrical class B push-pull.

The output stage is preceded by an OC26 driver and by OC72 and OC71 amplifier stages.

Output Stage

Although in the circuit of Fig. 1 the collectors are connected to the negative line, the transistors operate as common-emitter amplifiers. The advantage of this arrangement, it will be remembered, is that the output transistors can be mounted directly on a common heat sink connected to the negative line.

Emitter resistances of 0·5Ω are necessary for thermal stability at the higher ambient temperatures. To minimise crossover distortion, the quiescent currents are set individually to 30mA at normal ambient temperatures (~ 25°C) by means of RV19 and RV20. Each of these variable resistors forms the upper half of a potential divider biasing the appropriate transistor. The lower half is formed by the resistance of half the secondary.

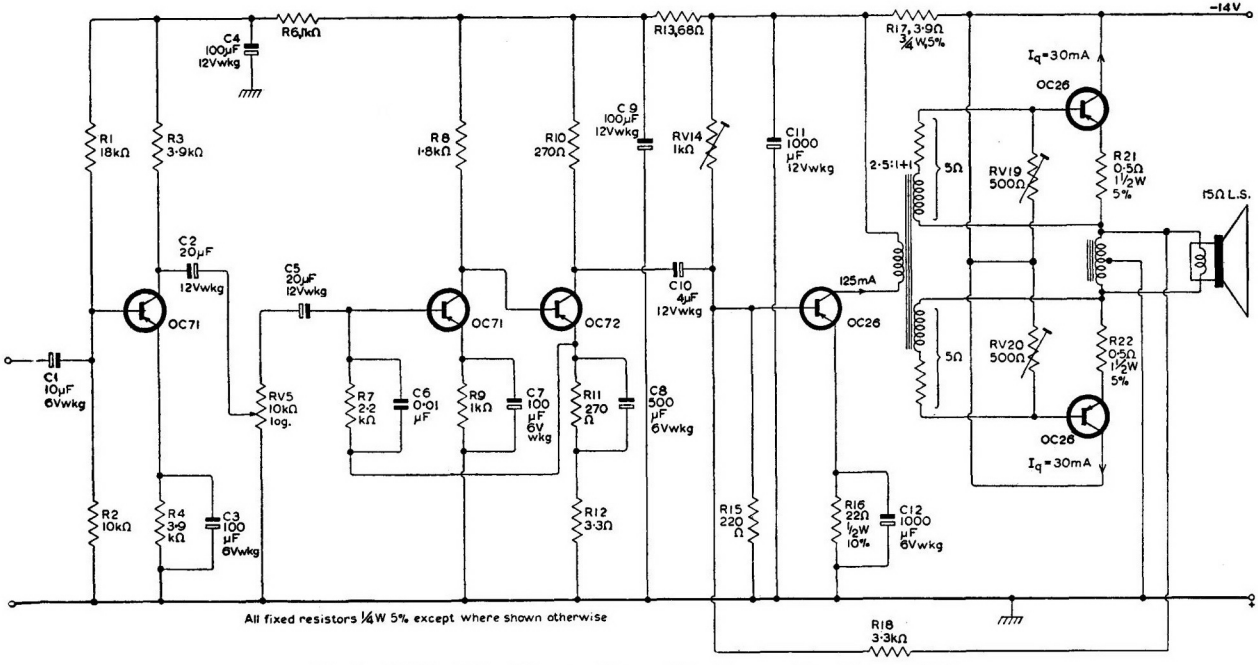

Fig. 1—15W public-address audio amplifier for supply voltage of 14V

The optimum load per transistor is 4·25Ω, of which 0·5Ω is provided by the emitter resistor and 3·75Ω has to be matched to the speaker. A centre-tapped choke, which effectively acts as a 2:1 auto transformer, provides the 4:1 impedance ratio for matching the 15Ω speaker. This choke is cheaper and more efficient than a conventional transformer.

The peak current on full drive is 3·0A, and the maximum transistor dissipation is 5W at an ambient temperature of 55°C. The maximum

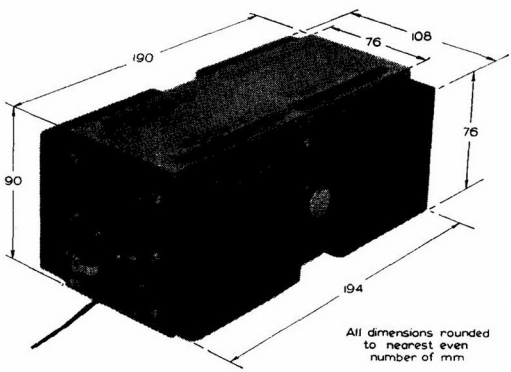

Fig. 2—Approximate dimensions of heat sinks for OC26 output transistors made from 2mm blackened-aluminium sheet metal.

junction temperature is 85°C, with the transistors mounted on a heat sink giving a total thermal resistance from junction to ambient of 6°C/W. The transistors are thermally stable at this junction temperature. Compact and cheap heat sinks can easily be made to give the required total thermal resistance (Fig. 2).

Negative feedback is applied from the output to the base of the driver to minimise distortion.

OUTPUT TRANSFORMER (14V)

For a 15Ω speaker a centre-tapped choke is suitable.

Total d.c. resistance	$< 0{\cdot}2\Omega$
Total inductance	> 100mH

Driver Stage

The driver stage consists of a single OC26 in a conventional class A

circuit. The collector current is adjusted to 125mA by means of RV14. The collector dissipation is considerably less than in the output stage, and the total thermal resistance, from junction to mounting base, only has to be less than 15°C/W. This value is achieved very easily by mounting the transistor with a mica washer on the chassis.

DRIVER TRANSFORMER (14V)

Turns ratio	2·5:1+1 (bifilar secondary)
Primary inductance	> 500mH at 125mA d.c.
Primary d.c. resistance	< 6Ω
Secondary d.c. resistance	5Ω+5Ω

The resistance of each half of the secondary should be 5Ω±10%. If the resistance of the windings is less than this, external resistances must be added to make up the required value.

Amplifying Stages

The first stage is equipped with an OC71 and amplifies the signal from the microphone input. This stage is followed by OC71 and OC72 current-amplifying stages. The circuit is conventional except that the second OC71 is directly coupled to the OC72, and a.c. and d.c. negative feedback is applied over these two stages. This method of coupling requires fewer components and provides better temperature stability than two conventional RC-coupled stages.

Crossover distortion in the output stage increases at higher frequencies. It is therefore preferable to limit the upper cut-off frequency of the amplifier to about 7kc/s. C6 in the feedback loop provides the necessary limiting.

Reproduction of frequencies below 150c/s is not desirable in public-address systems. The smaller value used for C10 (4μF instead of 10μF) provides a convenient method of limiting the low-frequency response.

28V CIRCUIT

Fig. 3 shows the version of the circuit for operation from a 28V supply (usually two fully charged 12V accumulators in series). This circuit is of the transformerless push-pull type shown in Fig. 5 of Chapter 14. The 3·75Ω load impedance is provided directly by the speaker. There are also some differences in component values and ratings between the two versions of the circuit.

If a centre-tapped 28V supply is not available, an artificial centre-tap can be provided. A possible method is to connect two 24Ω, 10W resistors in series across the supply, with the centre-tap decoupled by a 1000μF capacitor of 50V d.c. wkg.

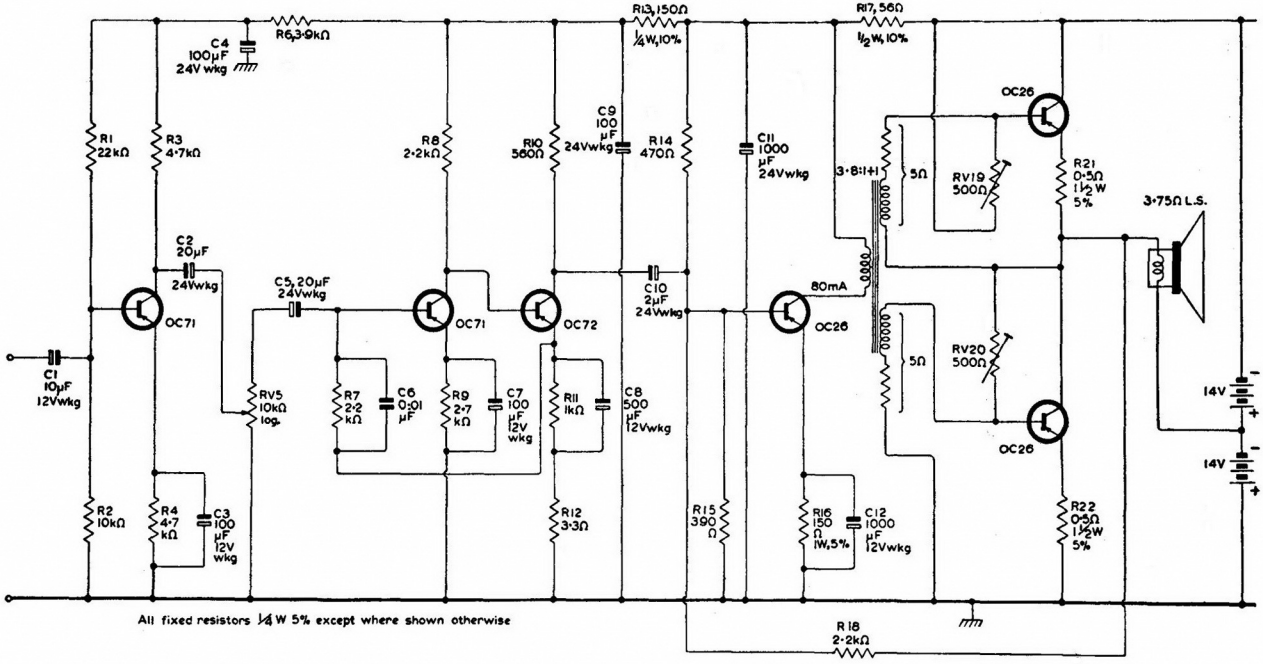

Fig. 3—15W public-address audio amplifier for supply voltage of 28V

DRIVER TRANSFORMER (28V)

Turns ratio	3·8:1+1 (bifilar secondary)
Primary inductance	> 600mH at 80mA d.c.
Primary d.c. resistance	< 8Ω
Secondary d.c. resistance	5Ω+5Ω

The resistance of each half winding of the secondary should be made up if necessary to 5Ω±10%.

TABLE 1

Performance of 14V and 28V Circuits

	14V	*28V*
Current Consumption I_q	220mA	av. 150mA
speech and music	≃800mA	≃400mA
Sensitivity (for full output)	0·2μA	0·1μA
impedance 1kΩ	0·2mV	0·1mV
Distortion (at full output)	< 4%	< 4%
Frequency Response	Flat within 3dB from 150c/s to 7kc/s	

HIGHER OUTPUT POWER

A higher output power, of perhaps 20W, will be available from OC26 circuits, although the sensitivity will necessarily be reduced. While such circuits will be similar in principle to those just described, the transformers and almost all the component values will be different.