DISCRETE PREAMPLIFIER

Quality-conscious audio buffs still prefer discrete designs. And quite rightly so, because although there are very good operational amplifiers available, discrete designs offer just that little bit extra.

The present preamplifier is a symmetrical Class A design. The input is a double differential amplifier consisting of dual transistors Type MAT02 or MAT03. A stable d.c. operating point is ensured by current sources T_3 and T_4, which use LEDs as reference—D_1 and D_2 respectively.

The current through the LEDs is held stable by current source T_5. It is essential for good thermal stability that the transistors and associated diodes (T_3 and D_1, and T_4 and D_2) are mounted in close contact.

The input signals are applied to push-pull drivers T_6 and T_7, which feed the output stages, consisting of emitter followers T_{10} and T_{11}. Transistors T_8 and T_9 ensure a constant quiescent current through the emitter followers. It is necessary for good thermal stability that T_8 and T_{10}, and T_9 and T_{11}, are mounted in close contact. To this end, their flat sides, with heat conducting paste in between, are juxtaposed. The pairs are held together with a loop of bare copper wire.

Before the mains is switched on, set P_1 to maximum resistance. Switch on the mains, wait for about a minute and then adjust P_1 for a quiescent current through T_{10} and T_{11} of 15 mA, corresponding to a voltage drop of 150 mV across R_{23} and R_{24}.

Since the amplifier is d.c. coupled throughout, the likelihood of a fairly high direct voltage at the output would be great, the more so because the input transistors are not truly complementary. This is, however, obviated by an active d.c. correction that holds the direct voltage at the output at zero in all circumstances. For this purpose, the output signal is passed via low-pass filter R_{26}-C_{13} to integrator IC_1. Tis arrangement does not affect fast variations of the signal. If, however, the output signal has a d.c. component, T_{12} will conduct to some degree, so that the bases of T_1 and T_2 are pulled into a negative direction. In a negative direction, because T_1 (n-p-n) has an inherently greater voltage amplification (×3) than T_2 (p-n-p).

Adjust P_2 immediately on switch-on for as low a direct voltage at the output as possible. From then on, any variations caused by temperature changes will be corrected by IC_1. The speed at which the correction takes place can be increased by giving R_{26} and R_{27} lower values.

It is important for optimum

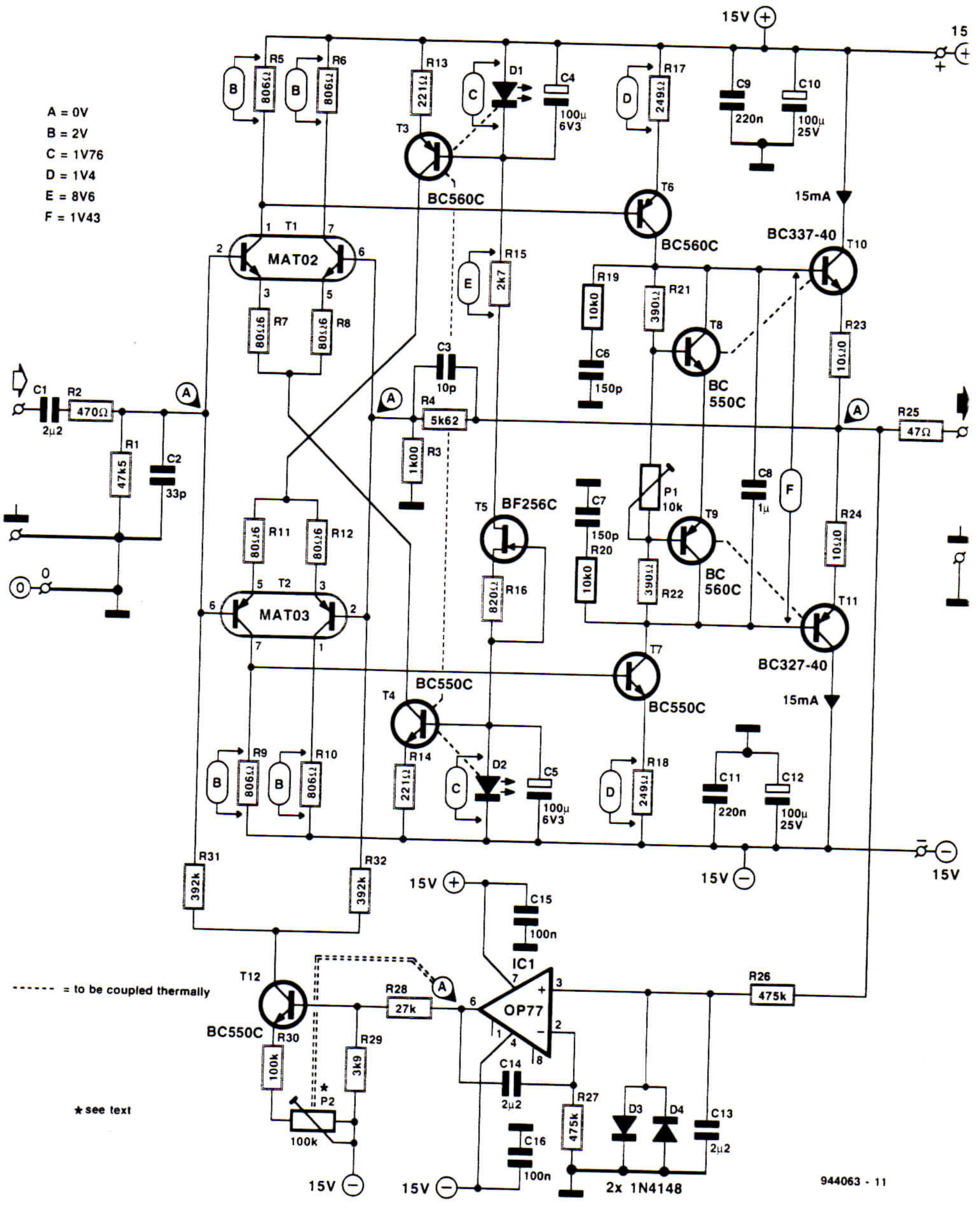

Fig. 1. Circuit diagram of the discrete preamplifier

Some parameters

(measured with an output of 1 V r.m.s. across 47 kΩ)

THD	≤0.00005% (at 1 kHz)
	≤0.0004% (at 20 kHz)
THD + N (B = 22 Hz–80 kHz)	<0.0012% (20 Hz–20 kHz)
Signal-to-noise ratio (B = 22 Hz–22 kHz)	>104 dB
Bandwidth	1.5 Hz–3.7 MHz
Slew rate	about 200 V μs^{-1}
Rise time	about 0.1 μs
Input impedance	47 kΩ
Sensitivity	150 mV
Peak output voltage	about 9 V r.m.s.