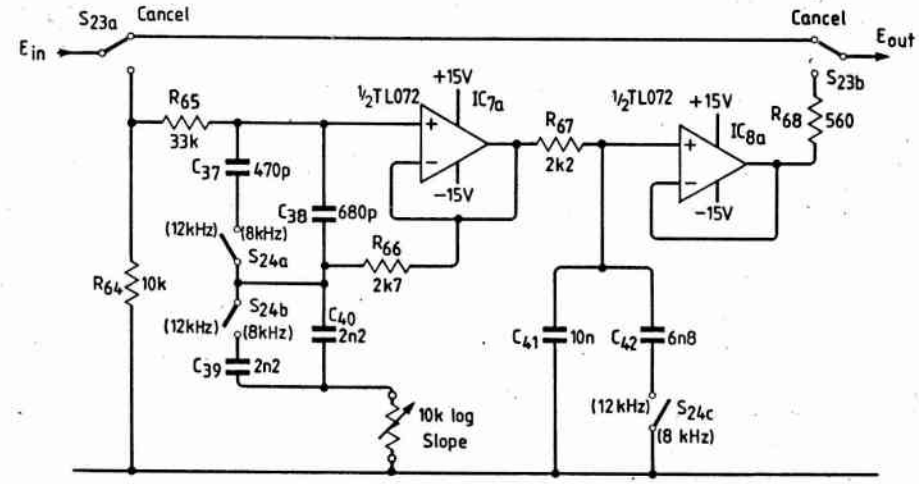

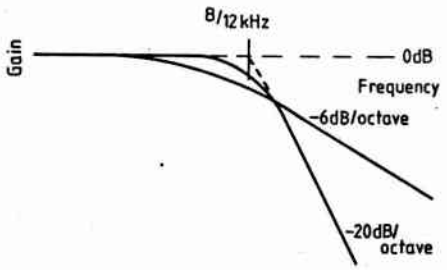

Fig. 13. Variable-slope treble filter using bootstrap circuit (see appendix).

been permitted!) on loudspeakers – things which I had not previously heard on the discs in question.

It also, and I suppose there must be a fly in every ointment, showed that some records, which I had previously thought to be very good, had substantial unobserved faults – such as the most irritating (once heard) background breathing of a noise reduction circuit, where the increase in hiss once the music increased in volume reminded me strongly of listening to a string quartet playing on a shingle sea shore, where the waves came in as soon as the instruments began to play, and receded again when they stopped.

However, on balance, I think a good headphone amplifier is a 'good thing', and preferably should be placed ahead of the power amplifier, to shorten the audio chain. The snag, for me, was that I already had a very good, though complex, headphone amplifier, and I wanted one which was equally good but simpler to build. Fortunately, the low-distortion i.c. allows a simplification in this area too, and allows a smooth transient response on resistive and reactive loads, and a distortion below 0.01% on all loads down to 8 ohms, up to 3V r.m.s. output. The amplifier will operate in class A under almost all headphone load conditions, especially since the lower-impedance 'phones will generally require a smaller output voltage swing.

To avoid the possible injection of asymmetrical signal components into the smoothed and regulated 15V supply lines used to feed the remainder of the preamplifier, I have drawn the large current (40-50mA/channel) supply to the output transistors from the unregulated ±25V line in the power supply unit. This does not contribute any measurable 50 or 100Hz component to the output, though I confess that I was tempted to put in an extra pair of 7815/7915 regulators just to feed the headphone amplifiers. The gain of four seems about the right value to give a similar level on 'phones or on speakers through the power amplifier.

I have shown the circuit diagram for this unit in Fig. 15. The output transistors (four in all, since only one channel is shown) are mounted, with insulating washers, on a piece of aluminium sheet, some 6×2in overall, bent into a U-shape to take two transistors on either side. No further mounting fixtures are then required for this plate, which can be painted black, with advantage. The voltage regular i.cs in the power supply can employ a similar heat sink.

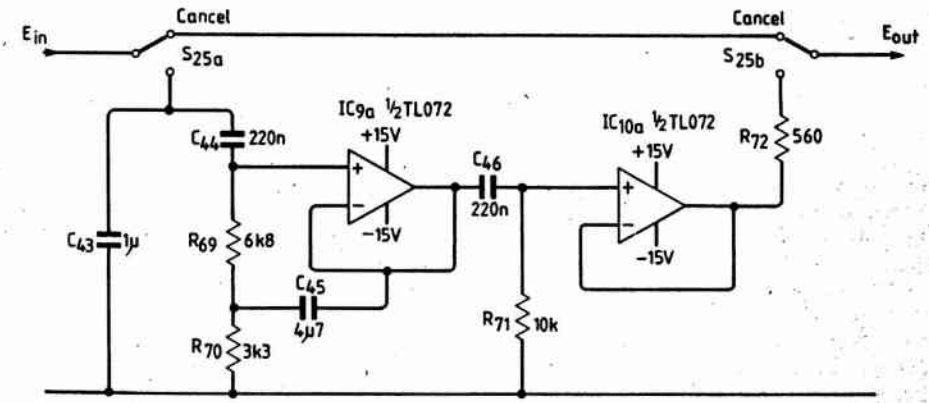

Fig. 14. Rumble filter for different cut-off frequencies – see appendix.

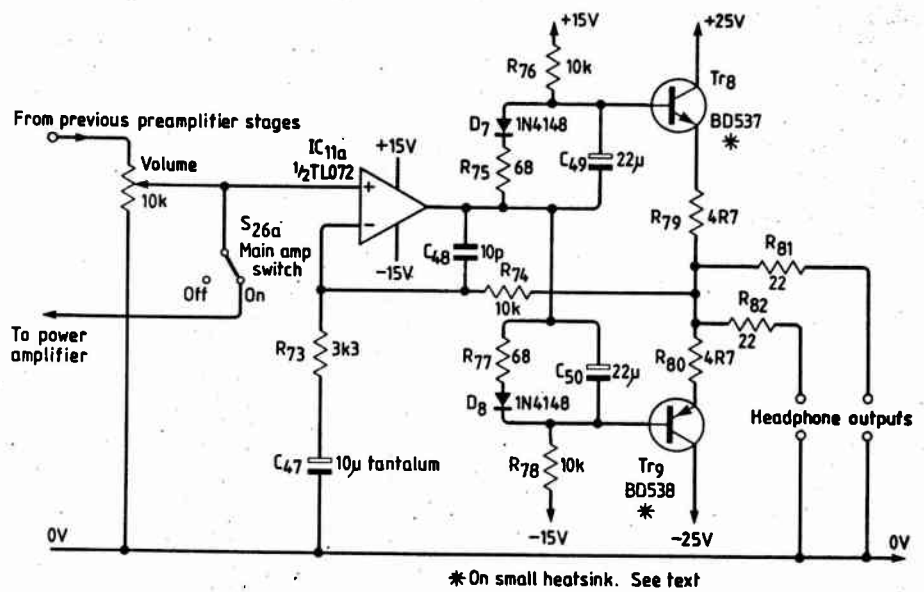

Fig. 15. Class A headphone amplifier – one channel shown.