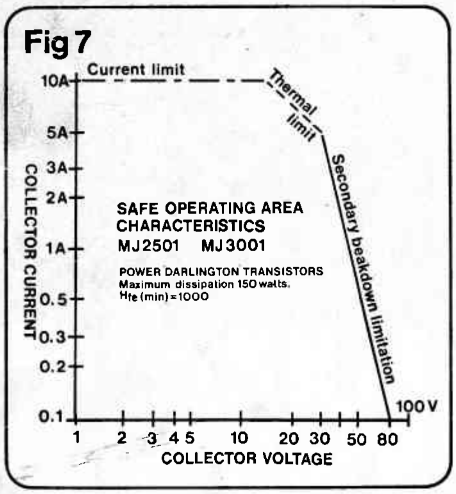

Fig 7 SAFE OPERATING AREA CHARACTERISTICS MJ2501 MJ3001

POWER DARLINGTON TRANSISTORS Maximum dissipation 150 watts. Hfe (min) = 1000

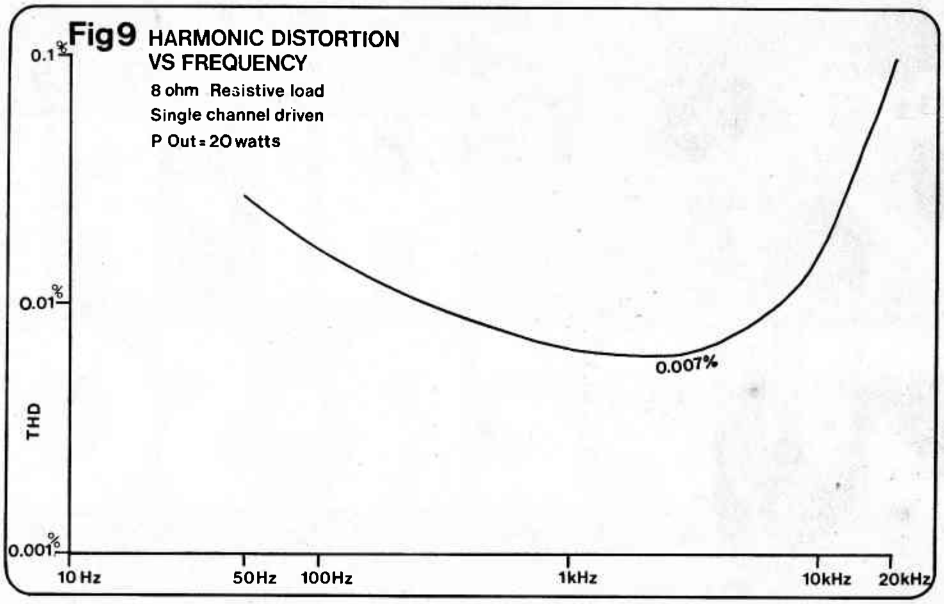

Fig 9 HARMONIC DISTORTION VS FREQUENCY

8 ohm Resistive load
Single channel driven
P Out = 20 watts

slew-rate limiting characteristics, a strong likelihood of transient intermodulation effects, much worse square-wave into reactive load behaviour, and a much less pleasing sound, to my ears at least). Nevertheless, while purchasers buy, and reviewers review, on the strength of the 20 Hz–20 kHz THD figures, the manufacturers will continue to manufacture units with this latter type of HF compensation, and never mind what it sounds like. It is for this reason that I am sceptical about the observation that all amplifiers sound the same.

For those who are interested, I went into the reasons for my preferences in HF stabilisation rather more fully in a letter [*HFN/RR* Jan '78 p 81] in reply to an interesting and informative article by Walter C. Jung[1], who had given a comprehensive analysis of the difficulties inherent in obtaining a good slew-rate performance, with particular reference to the rather unsatisfactory contemporary techniques.

The second 'class-A' amplifier stage is a conventional small signal transistor, TR_3, driving into a constant-current load consisting of TR_2 and TR_4. The actual current through this is adjustable by means of R_7 around the nominal value of 1 mA, in order to obtain a suitable voltage drop across the 1 k series resistor R_8 to bias the two output triplets into the proper operating current, which should be set to 40–60 mA in each channel. The actual quiescent current level is almost independent of the output transistor temperature since it is determined by the forward base-emitter turn-on voltages of the input transistors of the triplet (TR_5 and TR_6). These handle very little power and remain at ambient temperature, and thermal tracking for this is provided by the upper of the two constant current transistors (TR_4), whose base-emitter turn-on voltage actually determines the current through the chain TR_3–R_8–TR_2–R_7.

Some additional switch-on noise muting is provided by R_{22} and C_{10}, which ensure that at the actual moment of switch-on, there is no current at all through the driver chain.

The two feed resistors between the driver and the outputs (R_{10} and R_{12}) prevent 'latch-up' when the amplifier is driven into overload. This is also an insidious cause of unpleasing noises if it is uncorrected in the design, in that it can change a very brief and innocuous clip when a noise pulse occurs—as might well arise due to a speck of dust on a record, with an amplifier being used at fairly high output levels—into a more prolonged and much more obtrusive blotting out of signal followed by a sudden lurch back into operation. I note that 'latch-up' characteristics are also ignored in many reviews—not always because they are absent.

The output feed resistor, R_{20}, reduces the proportion of signals arising in the load which can be fed back into the power amplifier through the 'feed-back' resistor.

The setting up sequence of the power amplifier is simple. Firstly, the trimmer pot R_7 is set to its maximum value, and the amplifier is switched on. After some 10 or 15 seconds R_4 is adjusted so that the voltage present at the junction of R_{17} and R_{18} is half that measured at the HT line, and R_7 is then readjusted so that the current drawn by each channel—most conveniently measured in the emitter lead of TR_7—is in the range 40–60 mA. The unit is then ready for use.

Since, in a number of subtle respects, the ease with which an audio amplifier can be lived-with depends on the performance of the power output stage, the vital question at this stage is 'How does this simple design compare?' The actual performance graphs, of THD against power output and THD against operating frequency are shown in Figs 8 and 9, while the type of square-wave response—at 10 kHz—into resistive and reactive loads, and the type of distortion residues, will be published next month. Because of the fast operation of the output triplets, the turn-on time of the amplifier is slightly better that that given by the 75 watt design in its original form using 2N3442s as output transistors. In a careful side-by-side comparison between these two amplifiers, which have otherwise almost identical specifications, this shows up as a slightly greater delicacy in low-level signal detail. So far, therefore, I don't consider that I have sacrificed quality in the pursuit of simplicity and low cost.

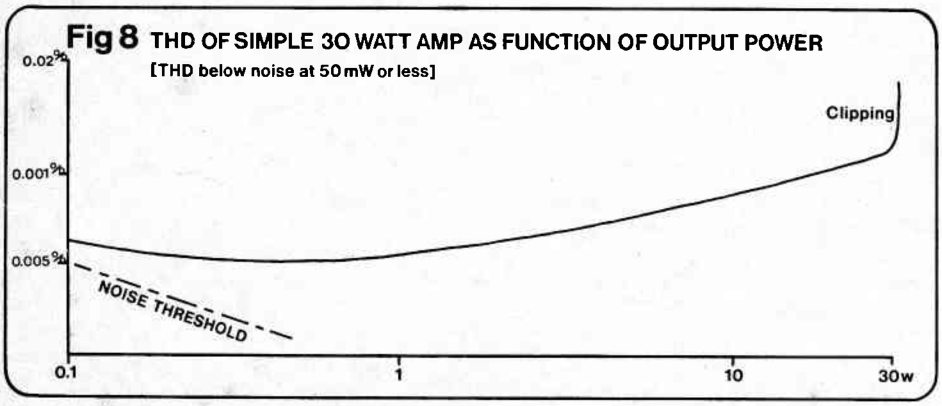

Fig 8 THD OF SIMPLE 30 WATT AMP AS FUNCTION OF OUTPUT POWER

[THD below noise at 50 mW or less]

Next month, I will cover the preamp and RIAA stage design, construction and printed circuit board layouts for preamp and poweramp:

1 Jung W. C. *HFN/RR* Nov. '77 p. 115