

Letters to the Editor

The Editor does not necessarily endorse opinions expressed by his correspondents

High-input impedance amplifier circuits

With respect to the article in the July issue on high-input impedance amplifier circuits, your author appears to have fallen into a trap when reaching the subject of "reducing the shunting effect of transistor collector output resistance". While it is true to say that the effect of this component of the input resistance can be reduced by bootstrapping, it is not true to say that this can be done with a single stage. This is because with an h_{fe} of $\gg 1$, the emitter current variations also appear in the collector circuit, and therefore C_F in diagram 3(b) acts as an a.c. short circuit. It is a question not only of C_F feeding the emitter voltage to the collector, but also vice-versa, so that since the two source currents are virtually the same, they naturally cancel out to a large extent.

To verify that this was true, the circuit 4(a) was built, using a similar high-gain small signal silicon transistor. The performance without, and then with the $10\mu F$ C_F fitted was (1) no C_F , gain = 0.95, R_{in} 500k; (2) $C_F = 10\mu F$, gain = 0.11, $R_{in} = 95k$. As can be seen from the results, the effect of fitting C_F is just the opposite of that required, and its use effectively prevents the circuit from working. That is not to say that the technique of bootstrapping the collector is worthless—rather, that it cannot be applied over one stage as suggested. If the output is taken from a subsequent stage, such as circuit 4(c), there is no reason why the technique should not work, as the current fed via C_2 to the collector of Tr_1 is taken from Tr_2 emitter, and is therefore drawn from the supply through the collector of Tr_2 which is not connected to C_2 .

P. A. JOHNSON,
Farnborough, Hants.

Loudness control for a stereo system

May I make two brief observations on the technological side, and a comment on the aesthetic issue?

Mr. Lovelock, in his July article, criticises *a priori* the universal practice, even of the most reputable manufacturers, but revealingly admits at a late stage that he has never owned a commercially available amplifier. As regards matching of 'law' in ganged components, let us leave aside

his theoretically based quibbles and ask: Do you know anyone who *in practice* has to adjust the inter-channel balance every time he alters the volume level? I don't.

As regards reliability of carbon-track pots., of course we have all met prematurely noisy controls, and yet even equipment designed to the highest standards incorporates these components (the Quad unit even has the volume control, a ganged carbon pot., combined with the on-off switch!) without running into trouble even though equipment of this class lasts a very long time. The answer to this paradox, of course, is that you get noise when you make the slider carry d.c., as in cheap radio sets where the volume control is connected direct to the grid of the first audio amplifier and carries a tiny current arising from the bias circuit.

On the aesthetic issue, I offer the iconoclastic suggestion that user-operated tone controls (unless they be preset once for all for particular listening-room acoustics) are superfluous. Granted that we tend to listen to reproduced music at a level lower than the theoretically correct one, it is not a gross discrepancy we are here dealing with—not a move from the arena to the upper gallery of the R.A.H., a change so drastic that whole lines of the score become inaudible! We are considering, rather, a drop of up to, say, 10dB. Over such a range I believe that *when listening to music* (as distinct from taking part in audiometric testing on single tones), the 'mind's ear' amply compensates for frequency-dependent differential sensitivity of the physiological mechanism. I feel sure that the agreeableness of a recording or broadcast is dictated by (a) the sheer technological excellence, (b) the balance of instruments and/or voices, and (c) the amount and quality of reverberation, *to the exclusion of minor deviations from a level frequency/response graph*; and I confidently assert that any recording which noticeably requires frequency correction will turn out to be well below acceptable standard on one or more of the other counts which are *not* capable of correction by the listener, so why bother with fiddling about?

IAN LESLIE,
London N.10

Concerning the first point raised by Mr. Leslie, although I have never owned a

commercially available amplifier (and hence been subjected to the 'brainwashing' suggested in a previous letter), I have known several people who have. They have suffered from noise over the much used centre portion of the track, and have had to adjust balance control for 20dB adjustment of gain. I have myself owned an expensive stereo solid-state tape recorder which did not carry d.c. in the track, and one carbon control became unbearably noisy in six months, the second (on the other channel) after eleven months.

On the matter of tone-controls I agree with Mr. Leslie. I consider them to be a once-for-all adjustment for the characteristics of the room, and it is because I wish to leave them as pre-sets that I desired a compensating loudness control.

I would also agree with Mr. Leslie that for a variation of output of up to 10dB, there is no need for a compensated control. It is quite usual, however, to find two people who require the same programme reproduced in the same room at 20dB difference, and this is where one commences to get the R.A.H. effect mentioned.

Finally, I would question Mr. Leslie's policy of despair. Only a minority of recordings come up to the standards which he specifies, and I agree with him that they make one dissatisfied with all of the others. Since the normal person has to listen to recordings which are less than perfect for a proportion of his time, however, there seems no good reason why an attempt should not be made to minimize the aesthetic displeasure arising. He concludes "why bother with fiddling about?", and it was precisely to avoid the need for such frequent adjustment that an automatic compensation was designed.

R. T. LOVELOCK.

Mr. Lovelock has complained of the lack of matching in carbon gain controls and drawn upon himself the wrath of a component manufacturer.

Having been faced by a similar problem myself, I have devised a very simple method of improving the situation. If a resistor is connected from one end of a gain control to the moving contact, the characteristic will be altered. If the connection is made to the top of the control, the effect will be to raise the curve, and if it is made to the bottom the effect will be to lower it. The effect will be greatest at the end remote from that at which the connection is made, and of course the ends of the characteristic curve will stay put. With mismatched stereo gain controls, a resistor should be connected from the moving contact to the top of one control, and from the moving contact to the bottom of the other. This will raise the lower part of one curve and lower the upper part of the other curve. By proper choice of resistors, the curves can be brought into coincidence at two intermediate points, and the mismatch overall will be greatly reduced.

A side effect of the modification will be to make the end-to-end resistances of the controls non-constant, and the possible effects of this should be watched. Also, in calculating the values of the resistors