LIGHT, DISTANCE, TIME AND RELATIVITY

It seems to me that Alex Jones (April) is limiting his thinking to light being a solid particle rather than a packet of energy shunted linearly by successive l.s.ms: such a packet is just as corpuscular as the limiting sub mass which eventually delivers it, and it is the packet which we call a photon. If his "particle" is small enough it appears possible that it could be hammered successively by the same l.s.m. at the frequency of radiation.

On the other hand, if the particle is large enough to be entered by the l.s.m., then the spin energy of the latter would wind it up and so increase its relativistic mass by accelerating it gravitationally, and that in the opposite direction to the hammering if both effects came from the same massive source.

I suggest that Mr Jones is only totally correct about e.m. Doppler and the propulsive effect of the radiation if the spin energy of the l.s.m. which carry it be zero, something which is of very low probability and certainly a degree of freedom which must not be denied.

Nor am I happy about the time dilation quoted by Alan Watson (also April) as being unequivocally shown: movement can be considered to be throughput of energy and is only distance per unit time in terms of classical mechanics. Certainly I accept the apparency of time dilation, but it could equally well be an accelerative effect due to a gravitational gradient of spinning l.s.ms.

As to Prof. Archibald Medes standing on his hairless head down under, the specialist sciences differentiate by probing linearly (and thus radially) into little bits of totality (can we apply a specific date in April?) and we have to integrate their findings in order to discover the nature which is within us: self-analysis is limited to and by our own experience. Mathema is an athema, and devoid of causality as every monetarist should have learned by now.

Therefore, if we are to tidy up the matter, we must first accept that energy has two degrees of freedom whence the picture seems to become clear: time is the constant "rate" by which we judge changes in energetic behaviour and measure the life of mass between its creation and its catastrophe, but because energy is only deduced to exist it appears that time dilates: this seems to me to be the working basis for Relativity.

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I have now had the chance to study in more detail the very important paper that I mentioned in a footnote in my recent letter (February, p.42). The author, Prof. Michael Sachs, quotes only extracts from Einstein's own published writings. These confirm Sach's impression from personal discussion that Einstein had changed his mind: he no longer believed that the mathematical space-time transformation of relativity implied physical consequences such as length contraction, time dilation, and the assymmetric ageing of the Twins Paradox.

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TRANSISTOR FULL-WAVE RECTIFIER CIRCUITS

Mr Lewis (*E & WW*, March 1986, pp.22-24) rightly draws attention to the value of using transistors with op-amps to perform full-wave rectification or, to give the operation its less specific description, absolute value generation.

The circuit shown in Fig. 1 is Mr Lewis's final circuit, while the circuit shown in Fig. 2 is a related circuit developed by the authors several years ago and described in detail elsewhere ('Versatile precision full-wave rectifier', R.W.J. Barker and B.L. Hart, *Electronics Letters* 13, No. 5, March 1977, pp.143-144). We would like to comment on the relative performance of the two arrangements.

In the circuit of Fig. 1, the output waveform symmetry for both I^+ and I^- is critically dependent on the matching of resistors R_{S1} and R_{S2}. It is true that one of these may be made variable for 'trimming' purposes. However, this does mean the complication of a setting-up procedure. Furthermore, the trimming will be dependent on the source resistance at A.
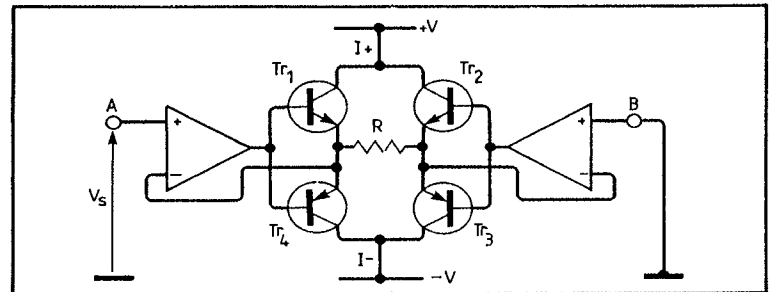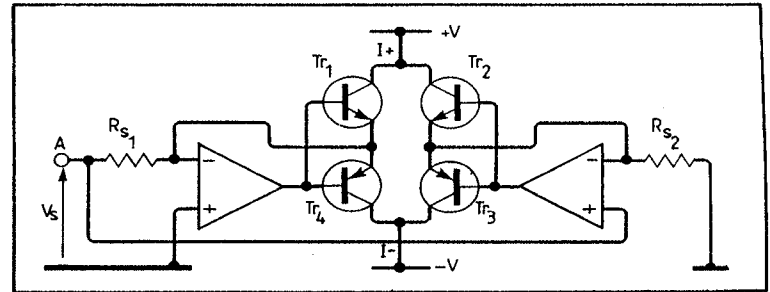
In the case of the circuit of Fig. 2, no resistor matching is required, because only a single resistor is used. Thus, waveform symmetry is assured without the requirement of a setting-up procedure. As the input impedance seen at point A is very high, the circuit operation is virtually independent of the source resistance at A. In addition, different values of R can be switched in to give a programmable transconductance, if required.

Finally, it should be noted that both arrangements can provide for differential input operation. Thus, if a second input is applied in both circuits at point B, the output current is a function of the absolute value of the difference between the signals. We have used this property to remove unwanted mains interference in the rectification of a low-level signal.

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CLASS B OUTPUT

I thank Mr Wrigley for his interesting comments (May, p.22). Yes, my circuit does seem superficially similar to the design published by Mr P. Lambrechts in *Hi-fi News* in October 1971. But there are major differences.

My purpose was to design an amplifier that did not require (skilled) bias adjustment and at the same time to avoid low-level non-linearities. This was not a design feature of the 'Edwin' amplifier although it had a fixed bias.

My design uses fairly high-power transistors in the driver stage at the highest practical current. The 'Edwin' amplifier uses standard driver transistors at a current not that much greater than a typical Class B amplifier.

My design requires the driver transistor to be mounted on the same heat sink as the output devices. This not only dissipates the heat, but also reduces temperature-generated distortion. T.g.d is the distortion that occurs when a transistor junction heats and cools rapidly due to fast changing variations in current × voltage. It can be reduced by heat sink, which can dissipate the heat quickly, and by better temperature tracking between devices which are closely related in the circuit.

I found Mr Wrigley's comments on the sound quality of his amplifier very revealing. I do not think the Edwin output stage would sound better than a typical Class AB stage with other stages being equal, but in a couple of ways that design was far ahead of its time. One very advanced feature, possibly not realised at the time, is the lack of electrolytic capacitors. The other is the use of a dual matched input differential (CA 3046) which permits close temperature tracking between Tr_1 and Tr_2. I wonder how much this improves the sound.

I am grateful to Mr Wrigley for his comments on the sound of his amplifier. If he would like to improve the sound quality of his