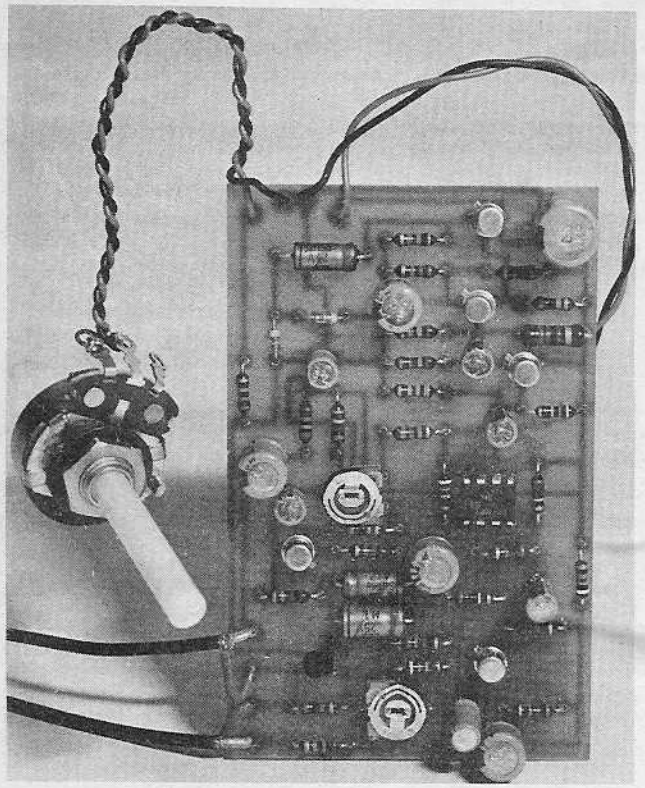
AUDIO LIMITER

M. MAURICE



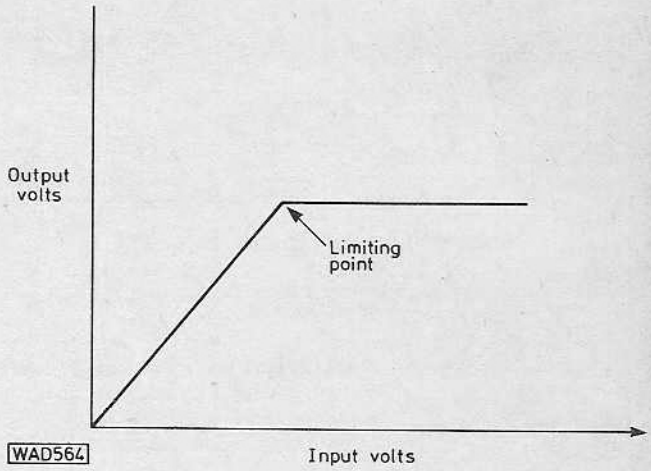


Fig. 1: Ideal limiting characteristic

Any audio limiter is, in essence, an electronic device which accepts an a.f. signal at its input and ensures that the voltage of the same signal at the output does not exceed a previously selected value. Well-designed and working correctly it should have no other effect whatsoever.

It is best regarded perhaps as an interface between the audio source and a subsequent stage which processes the signal in some way. It can guard against the overloading of an amplifier (avoiding distortion, damage to speaker cones, etc.), or of a modulator (preventing overmodulation and spurious emissions) or of any other audio device which requires an input guaranteed not to exceed a certain "threshold" voltage.

The ideal limiter therefore has unity gain up to the threshold point (see Fig. 1) beyond which it becomes an automatic attenuator (or, if you prefer, an amplifier with negative gain!). It introduces a loss which matches, dB for dB, any further increase in input signal amplitude; the output remains constant with its wave shape identical to that of the input.

This article describes an effective and reasonably low-cost way of realising the idea.

Circuit

Fig. 2 shows the block diagram of the limiter. The three most significant parts are a voltage-controlled amplifier (v.c.a.), an electronic switch and a rectifier circuit.

Taking these three basic "blocks" in turn, let us consider the operation of the v.c.a. first. Fig. 3(a)–(d) shows how the classic common-emitter amplifier is modified by the addition of a capacitor (C_e) across R_e (Fig. 3(b)) which increases its gain from R_c divided by R_e to

$$\frac{h_{FE} \times R_c}{h_{IE}}$$

where h_{FE} and h_{IE} are the parameters of the transistor. If a variable resistor is placed in series with C_e as in Fig. 3(c), the gain becomes R_c divided by the combined parallel resistance of R_c and VR1 and therefore becomes dependent on the setting of VR1. In order to control the stage gain by means of a d.c. voltage (Fig. 3(d)) VR1 is replaced by an f.e.t. which acts in the same role—the drain-source resistance increases in proportion to the voltage applied to its gate.

Referring now to the main circuit diagram (Fig. 4), it is Tr1 that is the voltage-controlled stage with Tr2 as the f.e.t. playing the part of the variable resistor in series with