C4 (the "C_e" of Fig. 3). The signal is now passed through amplifier IC1 which has an approximate gain of 47—thence to the output stage (Tr3) and also to the switching circuit (Tr5/Tr6) via Tr4, which is a buffer amplifier.

The switch, consisting of Tr5, Tr6 and their associated components, looks like an ordinary amplifier until it is realised that Tr5 is biased hard "off". It will not turn "on" until +2·6V is applied to its base—when this voltage is present it turns on very rapidly and becomes a high-gain amplifier buffered by Tr6.

The output from Tr6 is now rectified by D1/D2 and becomes the required negative d.c. control voltage; it is proportional to the input to Tr5 but is, as pointed out previously, only present when the "threshold" of +2·6V at the base of Tr5 is being exceeded.

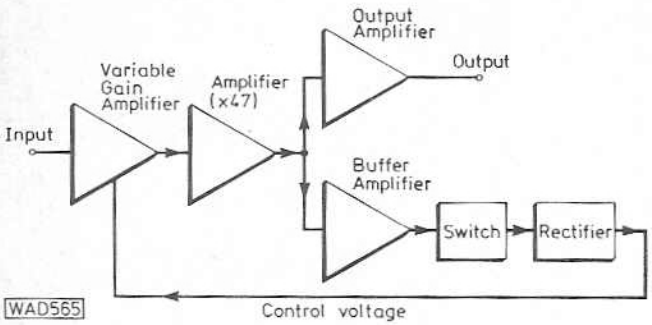

Fig. 2: Limiter block diagram

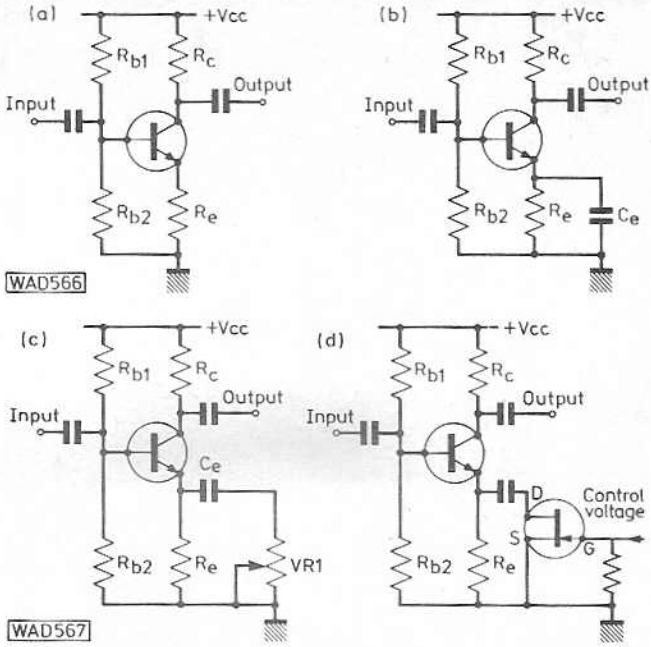

Fig. 3: Development of a voltage-controlled amplifier (d) from the basic common-emitter amplifier circuit (a)

This control voltage is smoothed by C14 and loaded by R27 and VR3, a variable resistor which enables the user to set the "decay time". This is the time taken by the limiter to return to unity gain after an instantaneous peak of audio in excess of the threshold has subsided; the time taken, in fact, for C14 to discharge via R27 and VR3. The "attack time" (the time which elapses before the circuit responds to an instantaneous peak) can be defined as the product of the output impedance of switch Tr5/Tr6 and the value of C14. The Z_{out} of the switch, and therefore the attack time, is small because Tr6 is used in the common-emitter configuration.

To reduce distortion, negative feedback is introduced to the v.c.a. via R15 and C8.

Setting Up

The designed threshold level of the prototype limiter was 0·775V into 600Ω (0dBm); the "production" version described in this article is, however, a high-impedance development (around 50kΩ) of the original.

For accurate setting-up to an absolute level, an a.f. signal generator and voltmeter are required. Set the generator to the desired threshold voltage and, having connected it to the limiter input, observe the voltage across C14. Now adjust VR1 until the meter deflects, "back off" slightly and then set VR2 so that the output has the same amplitude as the input signal. If instability should result, an increase in the value of R15 should effect a cure.

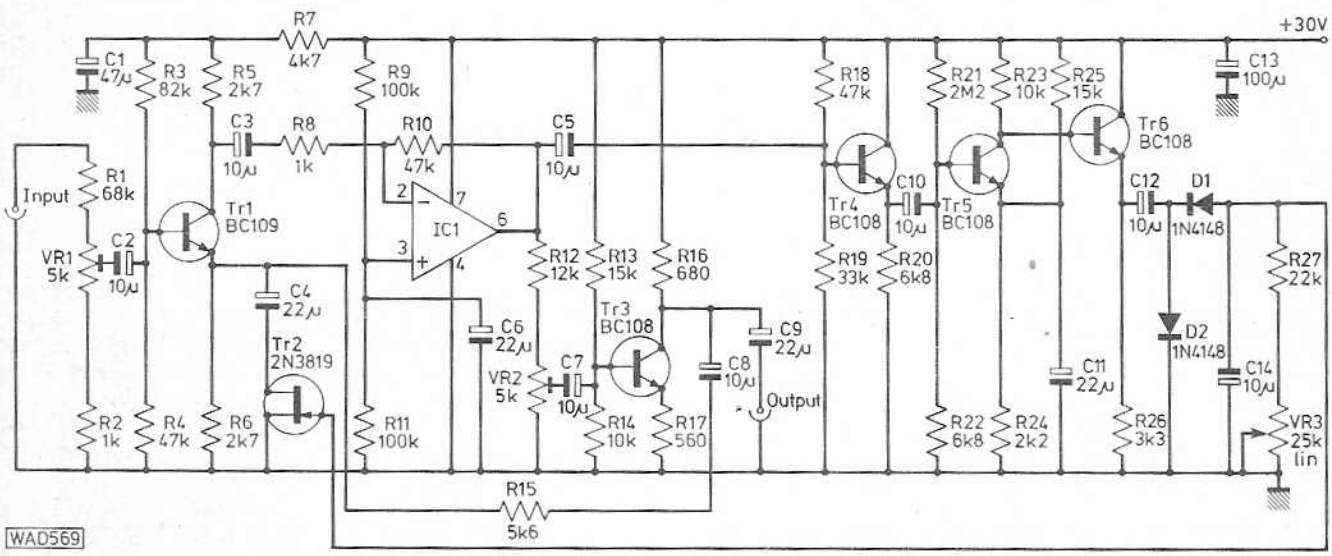

Fig. 4: Limiter circuit diagram