TRANSIENT GENERATOR

By R. Gwinn

A LARGE number of acoustic musical instruments have an amplitude envelope which decays during the note, and it is the Transient Generator which synthesises this characteristic electronically. The basic envelope is illustrated in Fig. 1, and shows which components of the profile can be varied. As can be seen, first there is an attack up to a peak, then a decay down to a fixed sustain level, and then when the key is released there is a further decay to zero. The variable parameters are: *Attack* time, *initial decay* time, *sustain level*, and final *decay* time.

CIRCUIT DETAILS

The transient generator needs a TTL compatible input which is logical "1" when a key is depressed, and logical "0" when it is released. Referring to Fig. 2, ICIc and ICId form an edge-triggered latch, which is set via C1 and can be reset via either C2 or TR1. When a key is pressed, the latch is set, and the output of IC1c goes high. TR2 and TR3 turn on, and C3 begins to charge via R6 and VR1, which controls the *attack* rate. The voltage on C3 goes to the emitter follower TR7, which provides a low impedance at the output on VR5.

This rising voltage is fed back via R3 to TR1, and when it gets to its peak of about 5 volts, TR1 passes enough current to reset the latch. This turns off the attack part of the circuit, and IC1b output goes to logical "0". TR6 turns off and TR5 turns on, causing C3 to discharge via R9 and VR3, the *initial decay* time control. This continues until C3 is at the same voltage as the wiper of VR4, setting the *sustain level*. The circuit remains stable in this state until the key is released. The output of IC1a goes high causing TR4 to turn on. Then C3 discharges to earth via R8 and VR2, the final *decay* control.

If the key is released before the *attack* and *initial decay* cycle has finished, the latch is reset by C2, and the circuit goes straight into the *decay* part of the envelope.

A Veroboard layout suitable for this circuit is shown in Fig. 3, which also includes the Keyboard Trigger circuitry of Fig. 5, overleaf.

COMPONENTS . . .

Resistors

R1	39kΩ	R8	100Ω
R2	15kΩ	R9	100Ω
R3	100kΩ	R10	18kΩ
R4	220Ω	R11	10kΩ
R5	3·3kΩ	R12	10kΩ
R6	100Ω	R13	1·8kΩ
R7	10kΩ	R14	470Ω ½W

All resistors are ¼W 5% unless otherwise stated

Potentiometers

VR1	1MΩ log	VR4	1kΩ lin
VR2	1MΩ log	VR5	10kΩ lin
VR3	100kΩ log		

Capacitors

C1 0·047μF
C2 0·047μF
C3 10μF 15V elect.

Semiconductors

TR1, TR2, TR4, TR5, TR6 and TR7 BC108
TR3 BC158
IC1 SN7400 D1 5·1V 400mW Zener

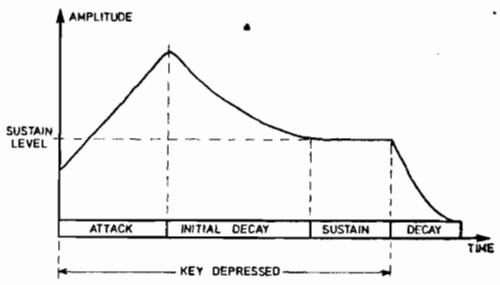

Fig. 1. The Transient Generator amplitude envelope

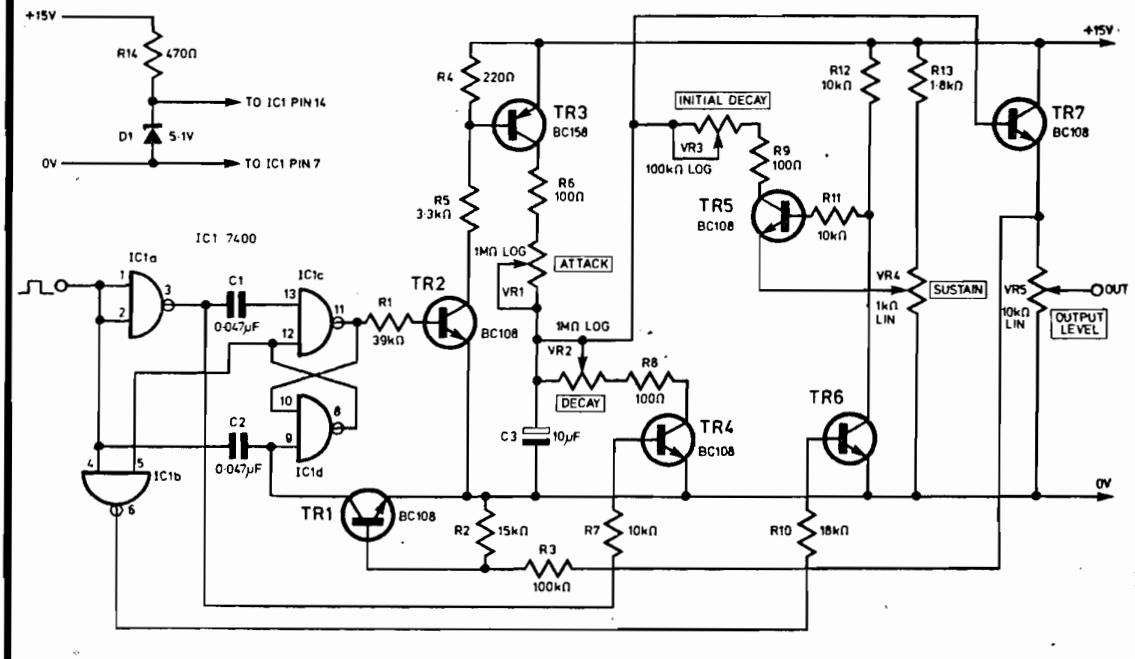

Fig. 2. Circuit diagram of the Transient Generator

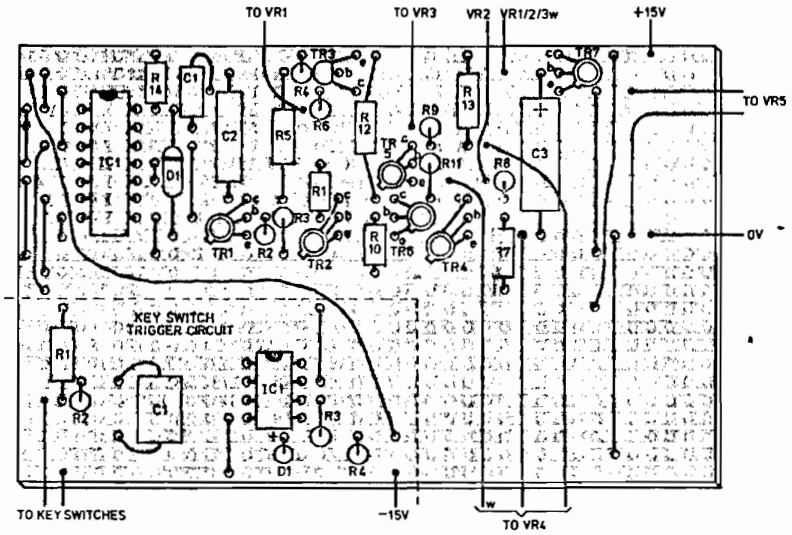

Fig. 3. Veroboard layout suitable for the Transient Generator and also the Key Switch Trigger circuit shown in Fig. 5

TRIGGER CIRCUIT

If the transient generator is being interfaced with an existing synthesiser, a trigger circuit such as the one shown in Fig. 4 should be used. The preset should be set to a voltage in between the voltages corresponding to "key up" and "key down", so that the comparator changes state to follow the input.

This circuit is wired for an input which has the "key down" voltage higher than the "key up". If the reverse is true, the inputs (pins 2 and 3) to the operational amplifier should be swopped over.

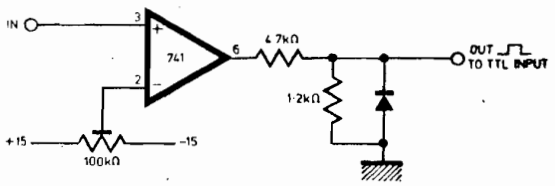

Fig. 4

DIRECT KEYBOARD TRIGGERING

Keyboard switches can give considerable contact bounce problems, and a circuit giving immunity to this is shown in Fig. 5. R2 and C1 form a low-pass filter which reduces the switch-bounce voltages, and feeds the signal to IC1 which is wired as a Schmitt Trigger with a hysteresis of 28 volts. Using this circuit therefore, the transient generator could be run directly from a keyboard.

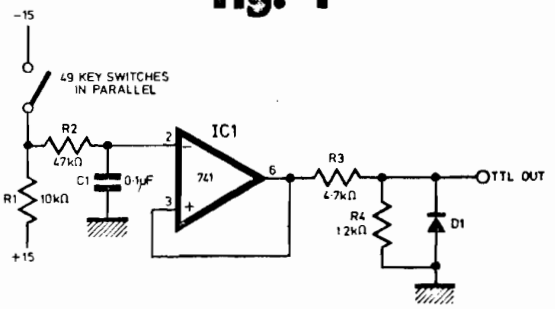

Fig. 5

REPEAT EFFECT

The digital signal from either of these trigger circuits need not go straight to the transient generator. If it is put through an AND gate with an oscillator providing the other input, a repeat effect can be produced. A string of envelopes repeating at the frequency of the oscillator can be gated in by the keyboard. In imitating a mandolin for example, a short *decay* down to zero *sustain level* would be set up on the transient generator, and an oscillator frequency of about 5Hz would be used. A suitable repeat oscillator is shown in Fig. 6.

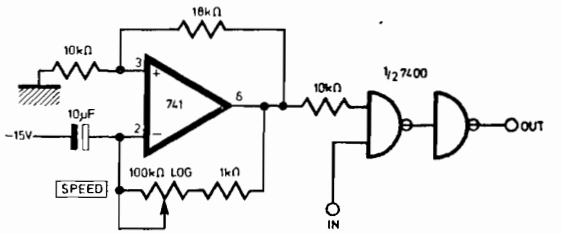

Fig. 6

APPLICATION

The transient generator provides a voltage which is used to alter various parameters in a synthesiser. It was decided that this was more versatile than including a V.C.A. in the module. In its quiescent state, the output is at zero volts, and goes positive when triggered. The envelope generated during its operational cycle is then used to patch into a V.C.A. or V.C.F.

One transient generator, with a filter and, say, two oscillators, is perfectly adequate for a simple synthesiser. A bank of these units, however, with each set to control a different aspect of the note, would be extremely useful in a large system. ★