

# GUITAR EFFECTS PEDAL

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THERE are numerous guitar effects pedals available today, but there are still many areas of sound treatment in which it is possible for the amateur to produce something which is not just a copy of a commercial effect.

The Guitar Effects Pedal to be described makes use of voltage control techniques. There are two treatments, a voltage controlled amplifier and a voltage controlled filter; either of which can be selected by a switch. These are controlled by an oscillator which produces triangle, square and rising and falling ramps at controllable frequency and amplitude. The combination of four waveforms and two treatments gives eight basic effects, all of which can be considerably modified by adjustment of the controls.

## WAVEFORM GENERATOR

The basic rising ramp wave is generated by IC1 and 2 (see Fig. 1). Integrator IC1 ramps upwards at a rate set by the speed control until it exceeds a limit set by comparator IC2. Then, a large reset current flows through D1 and R2 until the integrator is back to its starting point.

When the waveform switch is in the falling ramp position, IC3 acts as a unity gain inverter to give the required waveform.

In the square position, IC3 acts as a comparator. This gives a square wave of  $\pm 8V$  at the i.c. output, which is reduced by R14 to the same level as the other waveforms.

The triangle wave is shaped from the ramp wave by TR1. When out of saturation, this has a gain of  $-1$ . It is biased by VR2 so that for half the cycle it is saturated, when it has a gain of  $+1$ . The triangular wave at the collector of TR1 is amplified by IC3, VR3 is adjusted to offset the d.c. introduced by TR1 and its associated components.

*Practical Electronics Sound Design*

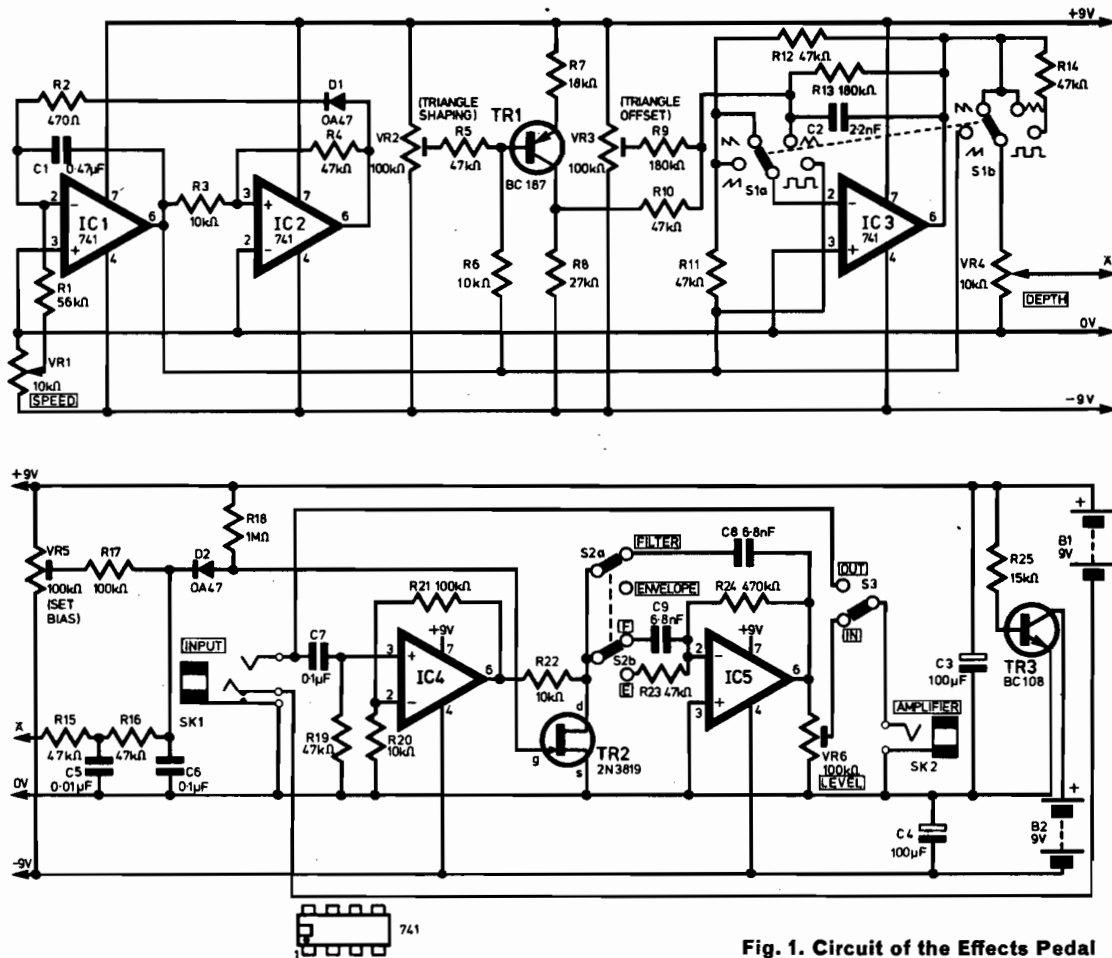


Fig. 1. Circuit of the Effects Pedal

## COMPONENTS . . .

### Resistors

R1 56k $\Omega$	R14 47k $\Omega$
R2 470 $\Omega$	R15 47k $\Omega$
R3 10k $\Omega$	R16 47k $\Omega$
R4 47k $\Omega$	R17 100k $\Omega$
R5 47k $\Omega$	R18 1M $\Omega$
R6 10k $\Omega$	R19 47k $\Omega$
R7 18k $\Omega$	R20 10k $\Omega$
R8 27k $\Omega$	R21 100k $\Omega$
R9 180k $\Omega$	R22 10k $\Omega$
R10 47k $\Omega$	R23 47k $\Omega$
R11 47k $\Omega$	R24 470k $\Omega$
R12 47k $\Omega$	R25 15k $\Omega$
R13 180k $\Omega$	

All  $\frac{1}{2}$  watt 10% carbon

### Semiconductors

IC1-IC5 741 (5 off)
TR1 BC187
TR2 2N3819
TR3 BC108
D1-D2 OA47 (2 off)

### Potentiometers

VR1 10k $\Omega$ log	VR4 10k $\Omega$ linear
VR2 100k $\Omega$ linear	VR5 100k $\Omega$ linear
VR3 100k $\Omega$ linear	VR6 100k $\Omega$ linear

### Capacitors

C1 0.47 $\mu$ F
C2 2.2nF
C3-C4 100 $\mu$ F elect. 25V (2 off)
C5 0.01 $\mu$ F
C6 0.1 $\mu$ F
C7 0.1 $\mu$ F
C8-C9 6.8nF (2 off)

### Miscellaneous

B1-B2 9V PP3 (2 off), S1—2 pole, 4 way switch, S2—2 pole, 2 way switch, S3—single pole changeover, SK1—jacket socket with make contacts, SK2—standard jack socket

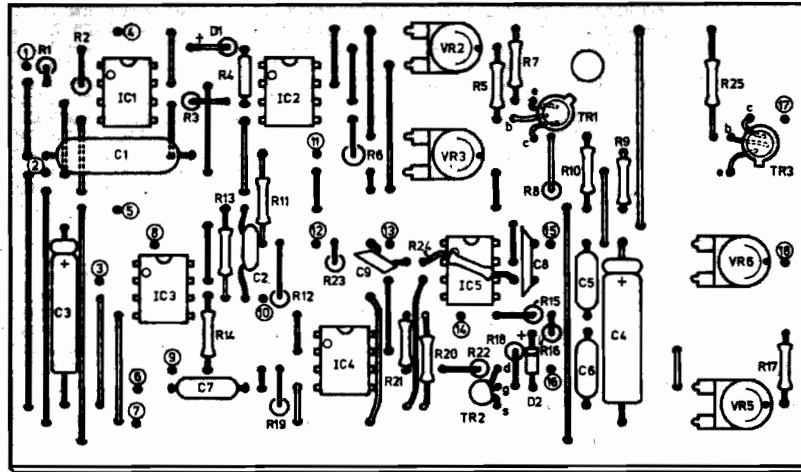


Fig. 2. Component layout and track cuts

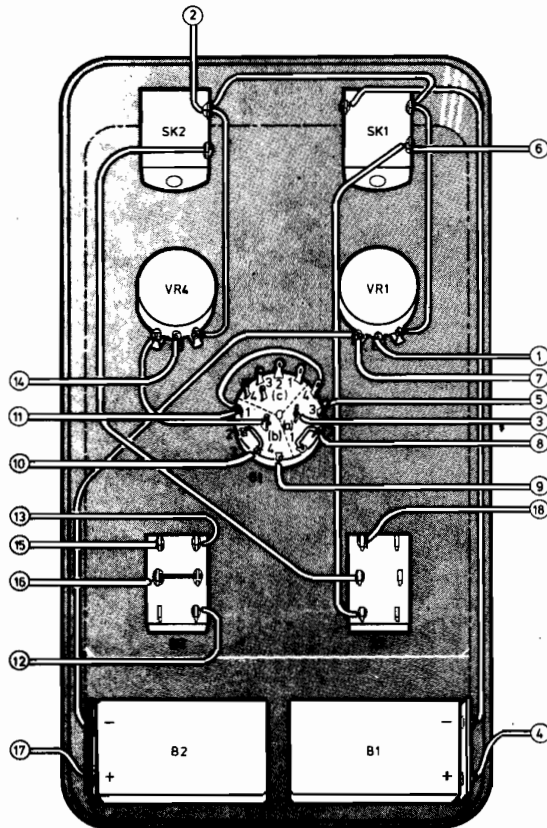


Fig. 3. Control panel wiring details

#### VOLTAGE CONTROLLED FILTER

When S2 is in the filter position, IC5 has multipath feedback with a minimum at a single frequency. The overall response is then bandpass peaking at that frequency, which can be changed by changing the voltage on the gate of the f.e.t.

#### VOLTAGE CONTROLLED AMPLIFIER

R22 and TR2 form an attenuator, and since the effective resistance of the f.e.t. can be varied by changing the gate voltage, the degree of attenuation can be changed. IC5 becomes an amplifier with a gain of 10 with S2 in the envelope position; this amplifies the previously attenuated signal.

In both the v.c.a. and the v.c.f. the f.e.t. is being used as a voltage controlled resistor. The effective resistance between the drain and source depends on the amount of negative bias on the gate. As the amount required varies from transistor to transistor, preset VR5 is included.

The control voltage from VR4 is also fed to the gate via a low-pass filter R15, R16, C5 and C6. This removes the sharp edges from the signal and so reduces the breakthrough of the control into the output.

#### BATTERY SWITCHING

There are two batteries to be switched on by the insertion of a jack plug to SK1. It is possible to get sockets which have a single make connection, which is used to turn on the positive supply. This turns on TR3, which then turns on the negative rail. The leakage through TR3 when it is off is negligible.

## CONSTRUCTION

Most of the components are mounted on a piece of Veroboard 67mm × 112mm (Fig. 2). These are rather tightly packed as there is a lot to be fitted on. The board is screwed into a plastic bracket to hold it in place.

The unit can be housed in any convenient case, which should be earthed to prevent hum. This could be done by soldering onto the back of a pot.

The batteries are prevented from moving with a sheet of foam rubber.

## SETTING UP

Turn all presets to mid-positions. While monitoring the waveform at the output of IC3, with the waveform switch set to "triangle", adjust VR2 for the best triangle wave shape. A scope is useful for this. Now set VR3 for 0V d.c. at IC3 output.

Set S2 to "filter". With the depth control at maximum, adjust VR5 for the best sound—a smooth change in filter frequency without it breaking into oscillation.

Finally set VR6 so that the volume of the treated signal is the same as in the straight through position.

## PLAYING TECHNIQUE

All the effects are repetitive, so it is best used on sustained chords or single notes. Apart from that, there are no set rules to stick to.

It will be noticed that rising and falling ramps have opposite effects on the two treatments; this is so that subjectively more interesting changes can be made simply by switching effects with one's feet. Thus a rising ramp selected on the switch will produce a decaying sound on the v.c.a.

A fast decaying ramp on the v.c.a. produces a sound like a mandolin; the same control into the filter gives a bubbling, which slows down into a repeated "Waa-Waa". A very slow triangle into the filter can be applied to any playing including fast runs.

The unit can of course be used to treat any instrument, with due attention to the matching of signal levels. ★