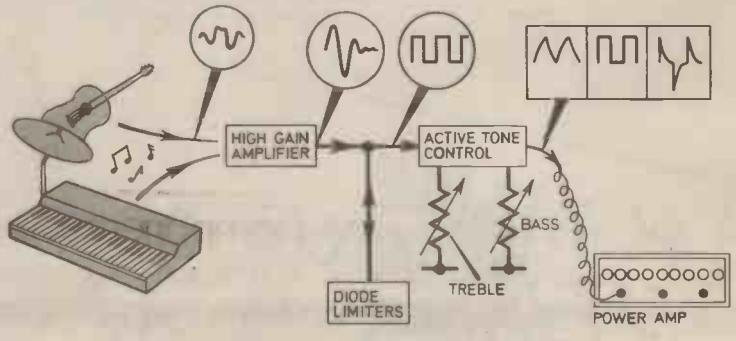
FUZZ TONE UNIT

By E. LYNDSELL

STILL high on the popularity list of musical effects units is that old campaigner the "fuzz box". There have been many designs published in this and other magazines to produce the "fuzz sound" but most have little or no control over the tone of the sound produced. Admittedly, there have been "tone" or "effect" controls on some of these designs but these merely control the amount of fuzz or the sustain.

This design differs from the rest by adding the facilities of bass and treble boost and cut to the "fuzzed" signal thereby allowing a whole range of tonal qualities to choose from.

HOW IT WORKS



Electrical signals from a musical instrument, usually electric guitar or organ, are first fed into a high impedance high gain amplifier. The output signal is modified by the diode limiters allowing a maximum peak signal of about 200mV to pass, resulting in a severely distorted waveform. It is this kind of distortion that produces the well known fuzz sound.

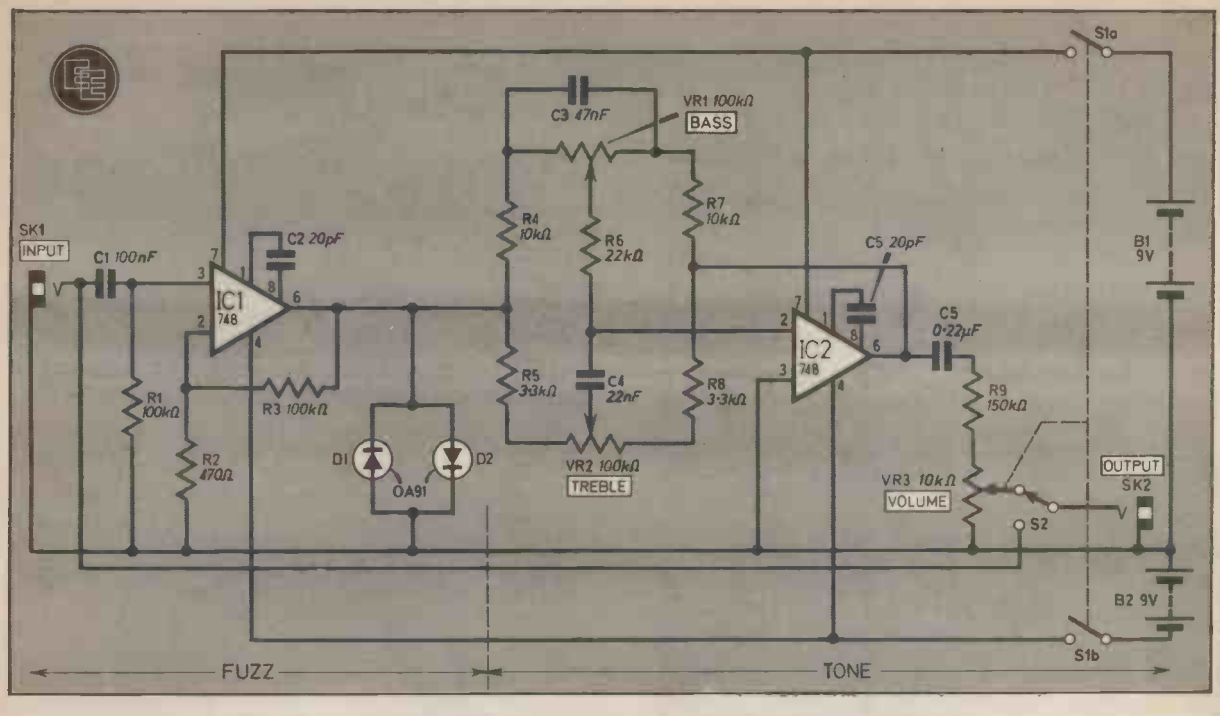
The clipped signal is next fed to an active tone control section which allows the bass and treble frequencies to be boosted or cut as required. The resulting signal is then passed to the power amplifier.

CIRCUIT DESCRIPTION

The complete circuit diagram of the Fuzz Tone is shown in Fig. 1. It can be seen to consist of two distinct sections: (a) a high gain non-inverting amplifier IC1 with diode limiters across its output feeding (b) an active tone control of the Baxandall type constructed around IC2.

Input to the unit is at SK1 via d.c. blocking capacitor C1. Resistor R1 sets the input impedance of the unit at 100 kilohms making it suitable for almost all electronic guitars, organs, etc.

The gain of the first stage is set by the ratio R3 to R2 being



The complete circuit diagram of the Fuzz Tone Unit.

equal to (1+R3/R2) which with the values chosen is seen to be approximately 200.

Because diodes, D1 and D2 are germanium types, they start conducting heavily when the voltage appearing across them exceeds about 200 millivolts, so signals with an amplitude greater than about 200 millivolts reaching the diode limiter will produce a clipped waveform and therefore produce the fuzz sound. In other words, all *input* signals greater than about 1 millivolt will produce the fuzz sound, accompanied by sustain. The latter is proportional to the input level.

The tone section of the Fuzz Tone is a variety of the well known Baxandall arrangement which provides both boost and cut of the treble and bass frequencies keeping mid-band gain constant.

The feedback around IC2 is frequency dependent producing maximum gains and cut at about 100Hz (bass) and 10kHz (treble). The amount of gain or (cut) depends on the settings of VR1 and VR2. The input signal to the tone section is unaffected for midway settings of VR1 and VR2.

Resistor R9 and potentiometer VR3 form a variable attenuator allowing an output signal up to about 550 millivolts peak which

Components

FOR GUIDANCE ONLY

ESTIMATED COST OF COMPONENTS * excluding V.A.T.

£5.50 excluding case

Resistors

R1	100kΩ
R2	470kΩ
R3	100kΩ
R4	10kΩ
R5	3·3kΩ
R6	22kΩ
R7	10kΩ
R8	3·3kΩ
R9	150kΩ

All ¼W carbon ± 10%

Potentiometers

VR1, 2	100kΩ carbon lin. (2 off)
VR3/S1	10kΩ carbon log. with ganged d.p.d.t. switch

Capacitors

C1	100nF plastic or ceramic
C2	20pF ceramic or polystyrene
C3	47nF plastic or ceramic
C4	22nF plastic or ceramic
C5	20pF ceramic or polystyrene
C6	220nF plastic or ceramic

See **Shop Talk** page 311

Semiconductors

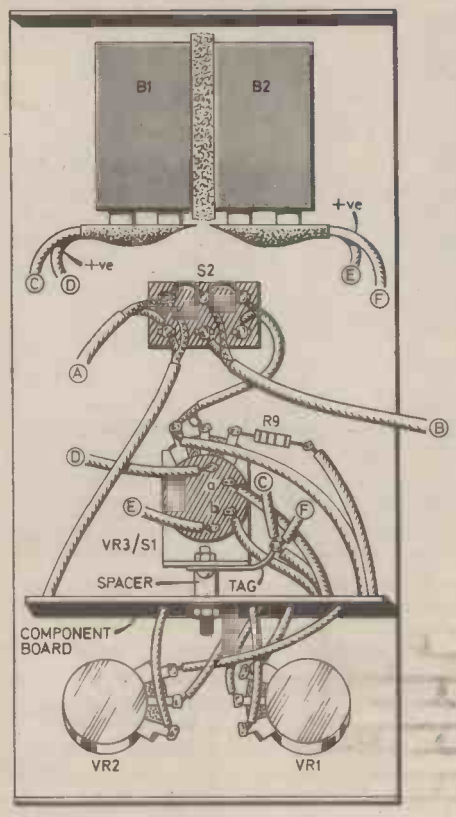
IC1, 2	748 operational amplifier 8 pin d.i.l. (2 off)
D1, 2	OA91 or similar germanium types (2 off)

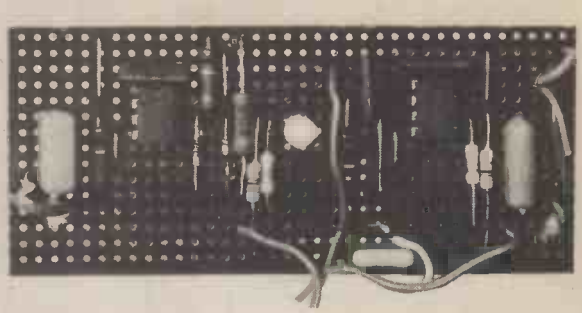
Miscellaneous

SK1, 2	standard jack socket (2 off)
S2	s.p.d.t. successional action footswitch
B1, 2	9V type PP3 (2 off)

Stripboard: 0·1 inch matrix 15 strips by 36 holes; control knobs (3 off); connectors for batteries (2 off); material for case; screened cable; mounting bracket material; connecting wire; solder; 6BA fixings.

FUZZ TONE UNIT





Photograph showing prototype component board removed from unit.

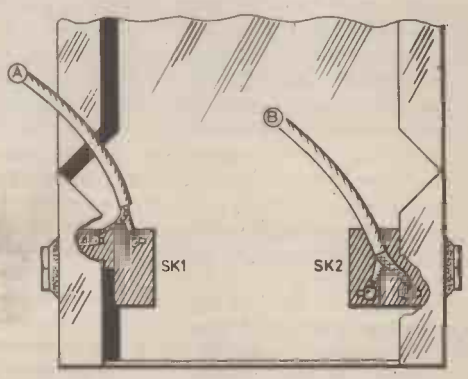
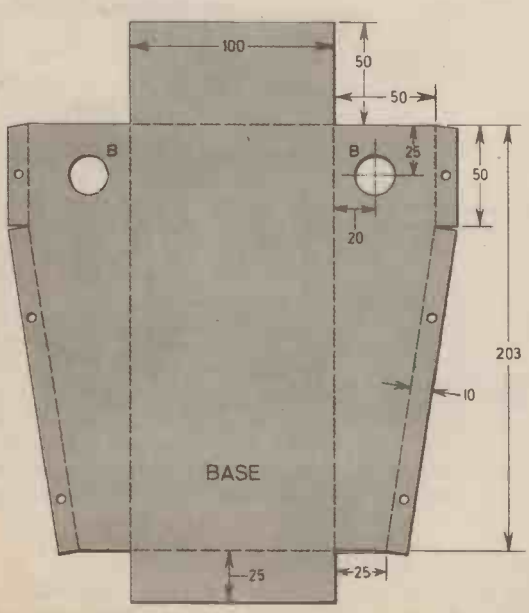


Fig. 4. Layout of the components within the case and on the lid with wiring up details.



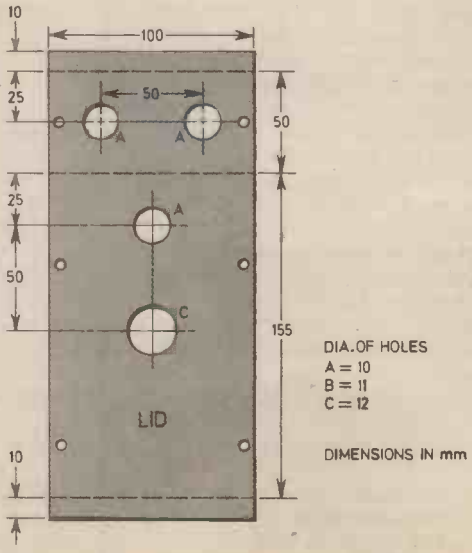


Fig. 3. Marking out details for the case. Both base and lid are shown. Note that the bend lines are shown dotted. The lid in the prototype was fitted to the base by self tapping screws.

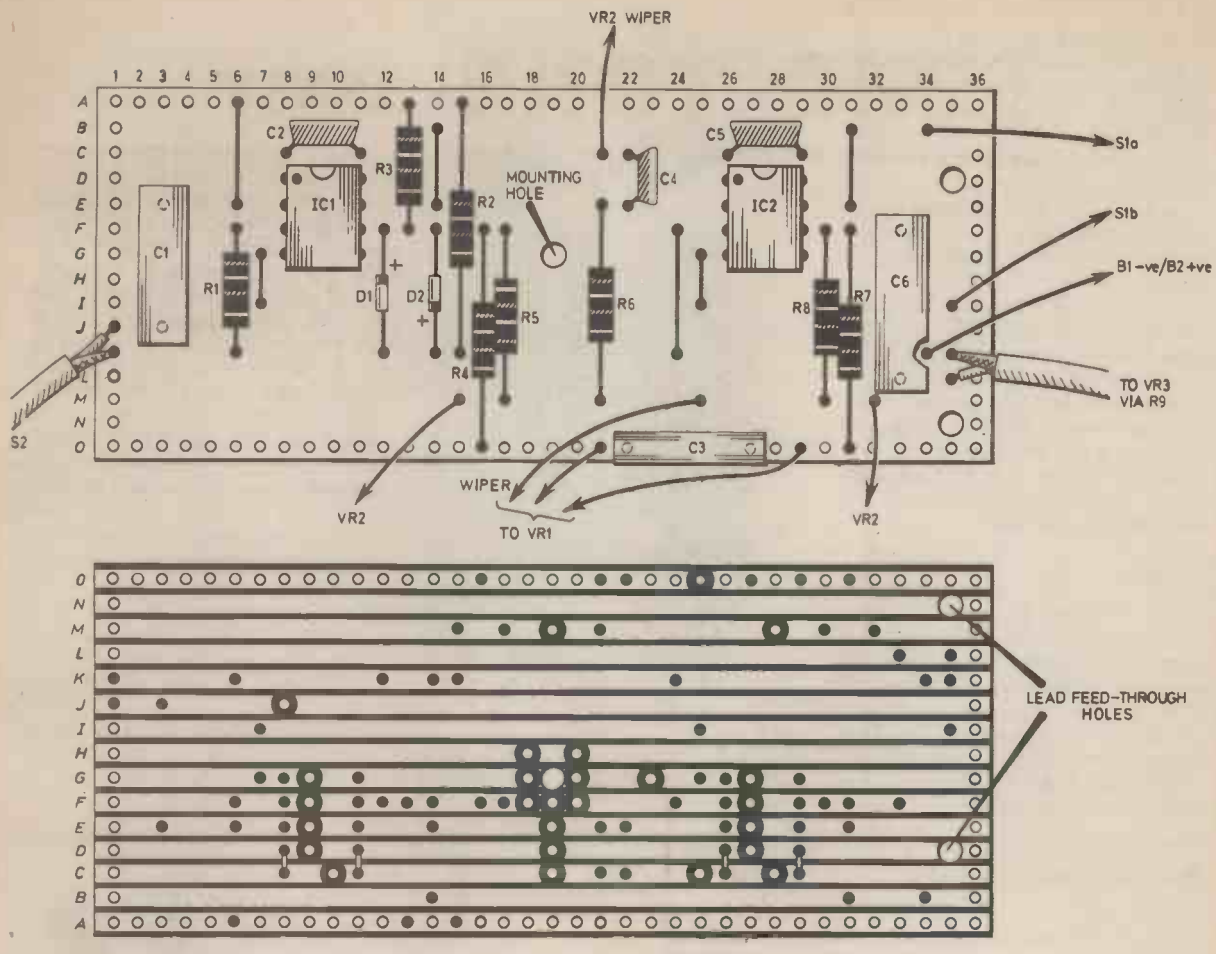


Fig. 2. The layout of the components on the stripboard and breaks to be made on the underside.

is more than sufficient for all amplifiers likely to be used.

A footswitch S2 has been incorporated in the design to allow the unit to be rapidly brought into effect or by-passed as required. The input impedance is high enough for the unit to be left connected to the instrument in the by-pass position thereby allowing S2 to be a s.p.d.t. footswitch which is more easily obtained than the d.p.d.t variety. The unit is switched on and off by a d.p.d.t. switch ganged to the volume control VR3. Remember to switch off the unit when not in use.

COMPONENT BOARD

The prototype Fuzz Tone was constructed on a piece of 0·1 inch matrix stripboard size 15 strips x 36 holes. Details of this board are shown in Fig. 2 which shows the layout of the components on the topside of the board, drilling details and the breaks to be made along the copper strips on the underside.

You will see from the photograph that i.c. sockets have not been used to hold IC1 and IC2, but the use of sockets (or Soldercon pins) is recommended to avoid damage to the devices through heat from the soldering iron. The use of sockets allows easy replacement should this prove necessary.

Begin construction by cutting the board to size, drilling the fixing hole and feed through holes and then making the breaks along the strips as indicated in Fig. 2. Position and solder, the sockets, resistors, capacitors and suitable lengths of flying leads to the board. Lastly, using a heat shunt on the diodes, D1 and D2, position and solder in place. It is advisable to use screened cable where shown. Place IC1 and IC2 in their respective sockets.

CASE AND WIRING UP

The case was made specifically for the job. It consists of two sections, lid and base, and dimensions and construction details are shown in Fig. 3. The prototype case was made from 18 gauge mild sheet with welded edges but this material is probably not suitable for the amateur constructor.

A suitable alternative would be 16 gauge aluminium folded as indicated, with Araldite fillets laid along the inside open-edge joints for strength. The external edges can later be filed round to improve the appearance of the case when the adhesive has set firm.

Begin by marking out the aluminium sheet and then drilling the holes for the jack sockets, potentiometers, footswitch and lid fixing holes. Next cut to shape and fold as indicated in Fig. 3 and photograph. The lid is held in position on the base by six

small self-tapping screws.

A small bracket is required for holding the component board in place. The bracket is placed on the shank of VR3 and is held steady when the potentiometer fixing nut is tightened.

Next fix all the components in position including the component board, and wire up according to Fig. 4.

A further bracket can be made on the same principle as that used for the component board, to hold the batteries in place. It would be held steady under S2. Alternatively, Blu-Tak can be used as in the prototype.

When wiring up is complete, screw the lid in position and the unit is ready for use.

IN USE

An additional screened lead will need to be made up or purchased to connect the unit to the amplifier. The unit is placed in line between the musical instrument and the amplifier. The Fuzz Tone is switched on by rotating VR3 clockwise, further rotation increases the volume.

A view of the Fuzz Tone Unit from above showing importance of pointers on the knobs.

Switch S2 will either be in the by-pass position (no effect) or the fuzz position. With it in the latter position, set VR1 and VR2 and VR3 for the required tone and volume. Anti-clockwise rotation of VR1 and VR2 produces bass and treble cut whereas clockwise rotation produces boost. Press S2 and release, the unit should now be in the by-pass position. The level control (VR3) may need adjustment, to make the two levels comparable.

As the unit is to stand on the floor when in use, it is a good idea to fix some rubber feet on the case base to prevent it slipping about when being operated. Also, attention should be paid to selecting the knobs. Ideally these should have some form of pointer, be flat on top and of robust construction. A scale printed around the controls will be useful. The reason for these specifications is that the controls may be "foot-controlled" by the user during a performance.

The prototype unit was given a couple of coats of aerosol paint and Letraset used to label the unit and its controls. ⌑

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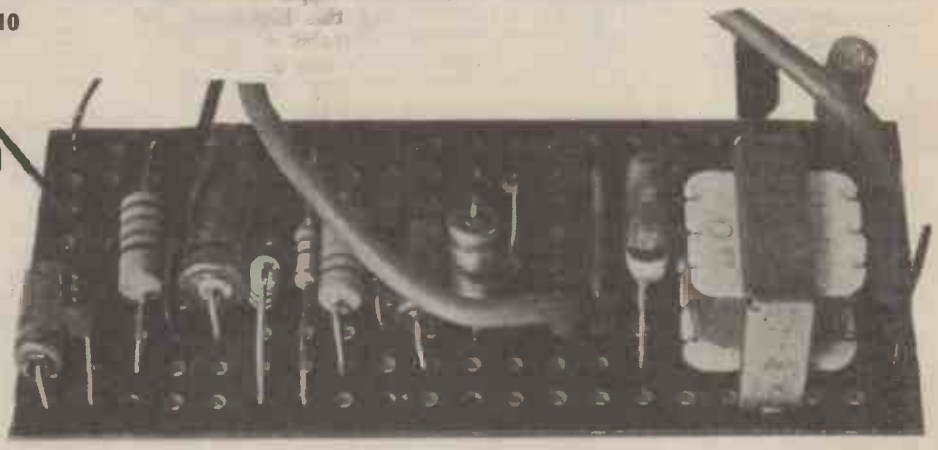
Phone/Door Bell Repeater



Photograph of the prototype component board above, and the completed loudspeaker unit ready for use shown below.

TESTING

After checking all the wiring thoroughly, connect a battery to unit and switch on. Incidentally, there is a space for the PP3 battery at the bottom of the case beneath the speaker.

Upon switching on, a tone should be produced by the unit for a few seconds while the capacitors in the circuit settle to their normal quiescent charges. Once this tone has died away, blowing into the microphone should cause the tone to return. Then it will slightly and gradually fall in pitch, and then after a few seconds it will cease.

The unit is then ready for use. It is not particularly sensitive and it is necessary to place the microphone close to the monitored equipment. This is not really a disadvantage though, as it ensures that extraneous noises do not trigger the unit and so mislead the user. ⌑