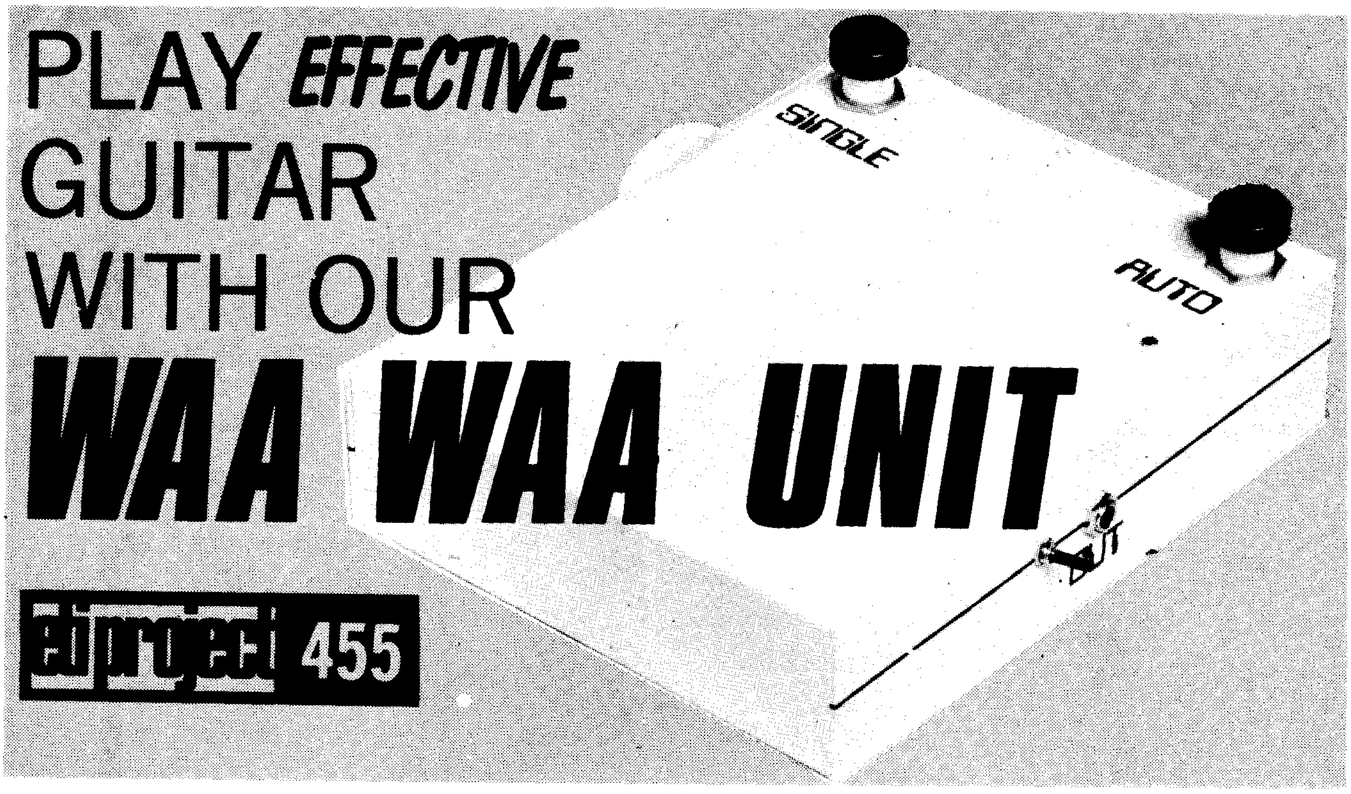
PLAY *EFFECTIVE* GUITAR WITH OUR WAA WAA UNIT



eti project 455

PERHAPS THE MOST used of all the various guitar effects is that of the 'Waa-Waa' unit. The sound of this circuit has been screaming from speaker stacks for many a decibel-ridden year now, and no doubt will continue to do so for a while yet.

Our unit described here will, we hope, contribute to this longevity!

Basically the chracteristic sound of a Waa-Waa unit is produced by sweeping a band-pass filter across the audio spectrum of a guitar. A frequency range of approx 70Hz–6kHz. This can be done in various ways, but is usually tailored to be operated by a foot pedal. However, these pieces of hardware are both expensive and hard to obtain other than full of electronics.

BACK PEDALLING

Since our design was to be for the home constructor, we decided against the use of a pedal, and instead we have substituted two foot switches. These are much cheaper and should be easy to get hold of. Ours came from the surplus bins at HL Smiths.

By avoiding the pedal, we created a problems for ourselves, in that we could no longer operate the filter with a variable resistor. Instead it is made to sweep across the range by the switching into circuit of three capacitors, which alters the resonant frequency of the filter.

GETTING WOUND UP

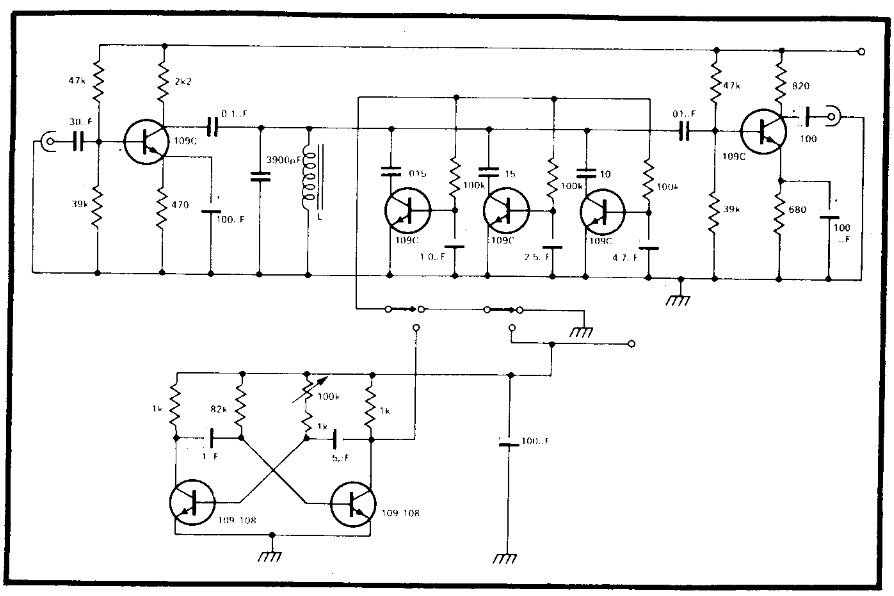
Coils are generally to be avoided, if for no other reason than that they are so much trouble to wind, but in this case there really wasn't any other way! At least we used a ready wound coil from one of our earlier projects (Graphic Equaliser) so that problems were sidestepped as much as possible. Should you be one of these strange people who derive pleasure from enmeshing yourself in yards and yards of wire, we have repeated details in the parts list. Good luck.

ON THE LEVELS

The input impedance of the unit is about 2k and the first stage gain such that the device operates best with an input of around 10–20mV. Signals much higher will cause the stage to distort the incoming signal. If you wish to cause distortion of course, then go ahead (did someone mutter 'Fuzz to you too'?) If not then a volume control of at least 2k is a good idea if the input exceeds 50mV. Output impedance is low and will match any amplifier.

USE AND ABUSE

Using the unit should pose no real problems, and there is no setting up to be done. Operating the single switch will result in a 'waa' on the next note played through the circuit. It is best not to hold the siwitch closed, but to release it quickly. After a short while it becomes easy (relatively!) to add the effect to any required note or chord. Depressing the auto switch couples the filter to the oscillator, and thus produces a 'waa-Waa' sound



interest in the use of optical fibres for communications. The major difficulties of attenuation and bandwidth have been solved but before fibres find widespread applications there are many other problems to be faced, such as jointing and cabling, but these are not likely to be difficult. The first use of fibres is likely to be for special links such as data or television transmission, with trial installations in the telephone network following by the end of this decade.

Equipment developed and built at Southampton University for the BBC was used in the first commercial application of optical fibre communications by any national network in January 1973, when an entire colour television programme from the Royal Institution was sent through 1.25 km of fibre before being broadcast. The electrical signals from the colour camera were taken to drive circuits feeding into a light-emitting diode, which turned the fluctuations of electric current into fluctuations in light intensity passing along the fibre. Light emerging from the fibre was directed onto a fast-acting light detector so as to reproduce faithfully the original electrical signal, and the output from the detector was amplified and fed to the television transmitter. Thus the pictures on all the domestic receivers had been transmitted through a long length of fibre. Needless to say there was no deterioration in the normal picture quality.

POTENTIAL

The simple but realistic demonstration described above showed that glass fibres can be used for long-distance communication. Various forms exist and while the ideal fibre has perhaps not yet been made, suitable ones are already available. Light detectors are no problem. Although present-day diode lasers are not yet reliable enough, they are getting better all the time and light-emitting diodes can also be used.

If optical-fibre transmission lines are put into use what effect will they have on our everyday lives? Initially the result would not be spectacular but it would mean that telephone system costs would not rise as fast as they would do otherwise, and telephoning might become easier. Videophones which require 300 times the frequency space of conventional telephones, might become feasible. Branches of banks are connected to a central computer to enable a rapid and up-to-date check to be kept of all accounts, a service so valuable that perhaps in the future offices and factories of most firms may be inter-connected in the same way, thus increasing the amount of data transmission throughout the country. Already attempts are being made to provide computerised references for research workers, and the logical extension of this would be to commit all journals and books to some form of computer store. It would then be possible to do away with most school, college, industrial and public libraries in favour of video links to a relatively few regional centres. The advantages would be many.

There are many other fascinating possibilities. If a glass fibre cable can be made as cheaply as the telephone wires that come into the home from the local exchange, then the meagre bandwidth we presently have could be greatly increased.

The private citizen could have a communication capability, or bandwidth, exceeding that of any commercial or private enterprise today. He could have direct access to a national or regional computing centre and could dial the computerised library of the future from his armchair, to have pages from books displayed on his own TV screen.

If we miss our favourite TV programme perhaps we could dial it from a video store at a time convenient to us rather than to the television authorities.

Viewed objectively the present method of disseminating news by means of newspapers is crazy. We cut down acres of forest, ship thousands of tons of wood pulp all over the world. When the papers are printed, trains and trucks and vans in every country carry hundreds of tons of newspapers in all directions and thousands of paper boys and girls deliver them to homes. After that there is the problem of disposing of them. Great damage is done to the environment and there is a great waste of natural resources. Sending news by electrical or optical means is easier and much more efficient. It would be more sensible to dial our newspapers from home and read them on the television screen.

There are lots of other exciting ideas — it has even been suggested that instead of *commuting* to work we will *communicate* to work. These developments will depend on our ability to understand, design and produce new and better materials, and to make communicating with light a practical reality. ●

independent of the input, at a rate set by VR1, for as long as the switch is held down.

With no controls operated, the section of the filter which remains in circuit means that a 'teble boost' occurs on the signal. If you don't want this effect, then a third switch wired to take the signal away from the waa-waa is needed, and should not be difficult to add.

BUILDING UP

Construction of the unit is made easier by using the PCBs, but layout is not that important, and something like veroboard would serve the purpose. We split up the circuit onto two boards to facilitate the fitting of the small multivibrator auto control into the guitar itself. This system has the advantage that the rate control for the auto-waa is then easy to alter while playing. The lead between the two parts of the circuit need not be screened, as it carries no audio signal just the supply to the oscillator, and the square wave switching signal to the filter.

The sound of the effect in use is set by the capacitors in the filter section, and these can be experimented with to change the nature of the resulting sound.

HOW IT WORKS

L and C4 form a band-pass filter with resonant frequency equal to

$$f = \frac{1}{2\Pi\sqrt{L.C4}}$$

With the values shown here this value is about 6kHz. The R-C networks R5–C6 R6–C8 R7–C10 act as time delays to switch on Q2,3,4 respectively in sequence following the depression of SW2.

This switches C5, C7, C9 across the filter in turn, pulling the resonance point across the audio band. The time constants are such that the order of switch on is Q2, Q3 and Q4.

This resonance changes from 6kHz–2k7Hz–950Hz–to 400Hz when Q4 switches on. Upon releasing the switch the electrolytics discharge through the 100k resistors to earth, switching off the transistors.

Automatic switching is provided by the multivibrator, the frequency of which is set by VR1. When the 'auto' switch, S1, is depressed a slow square wave of about 8V is applied to the charging resistors. Thus the transistors are pulsed on and off. C13 is to decouple the supply to the oscillator to prevent problems with variations as the oscillator switches state.

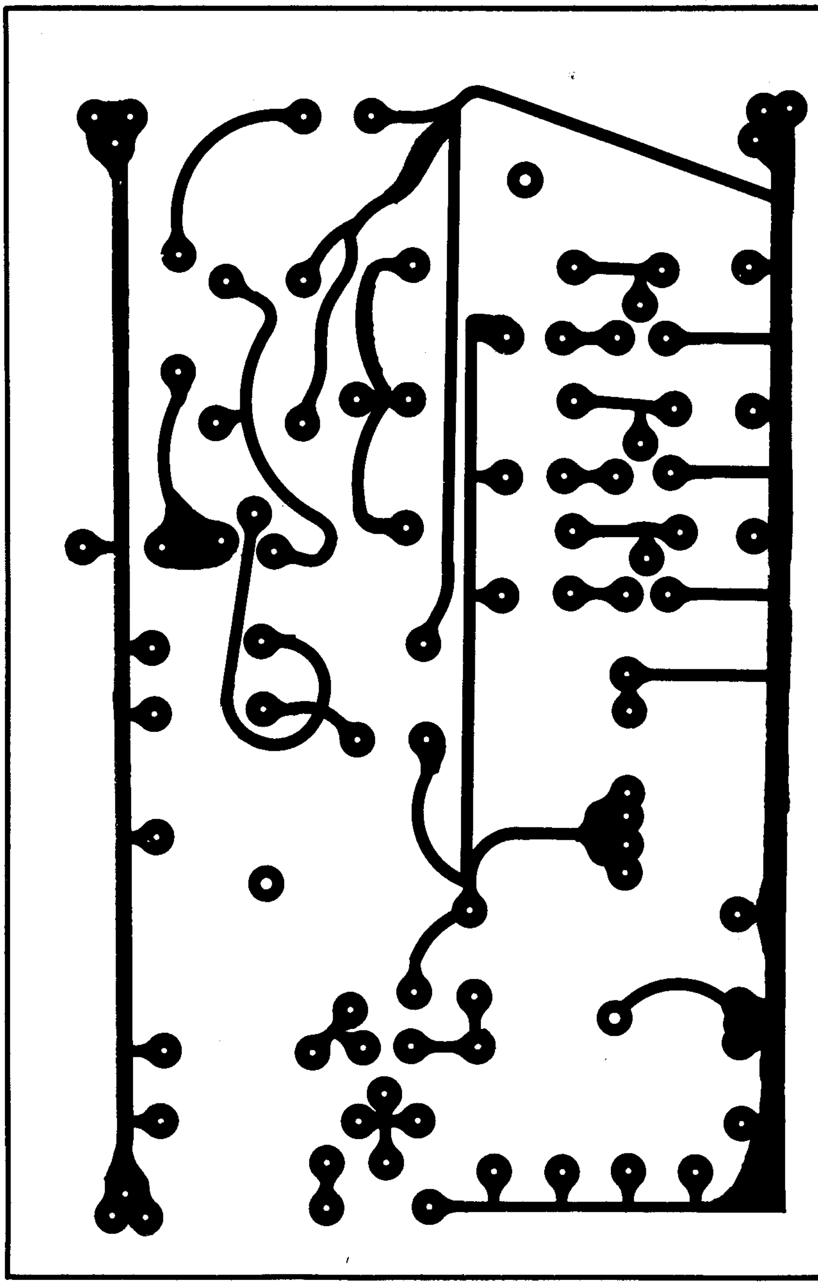


Fig. 2. P.C.B. Layout for main board (Full size)

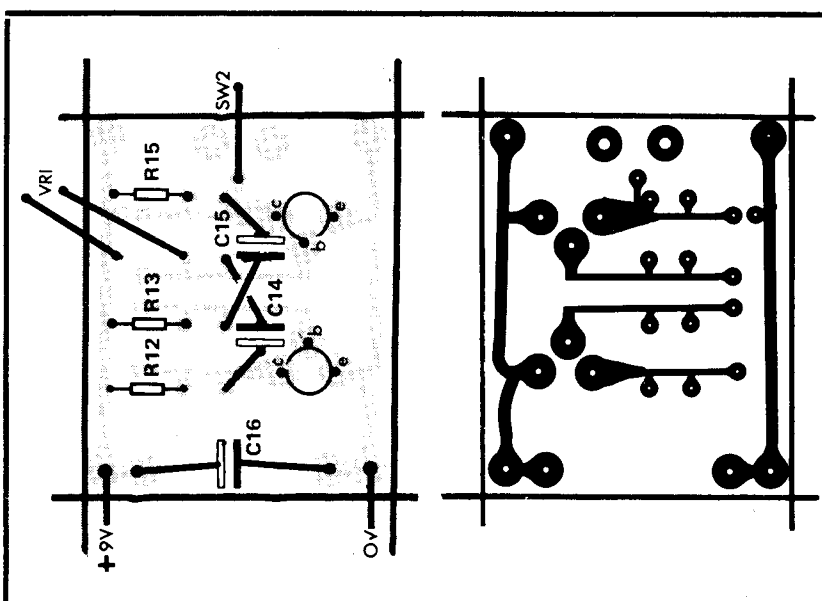


Fig 3. Oscillator Board and overlay (Full size).

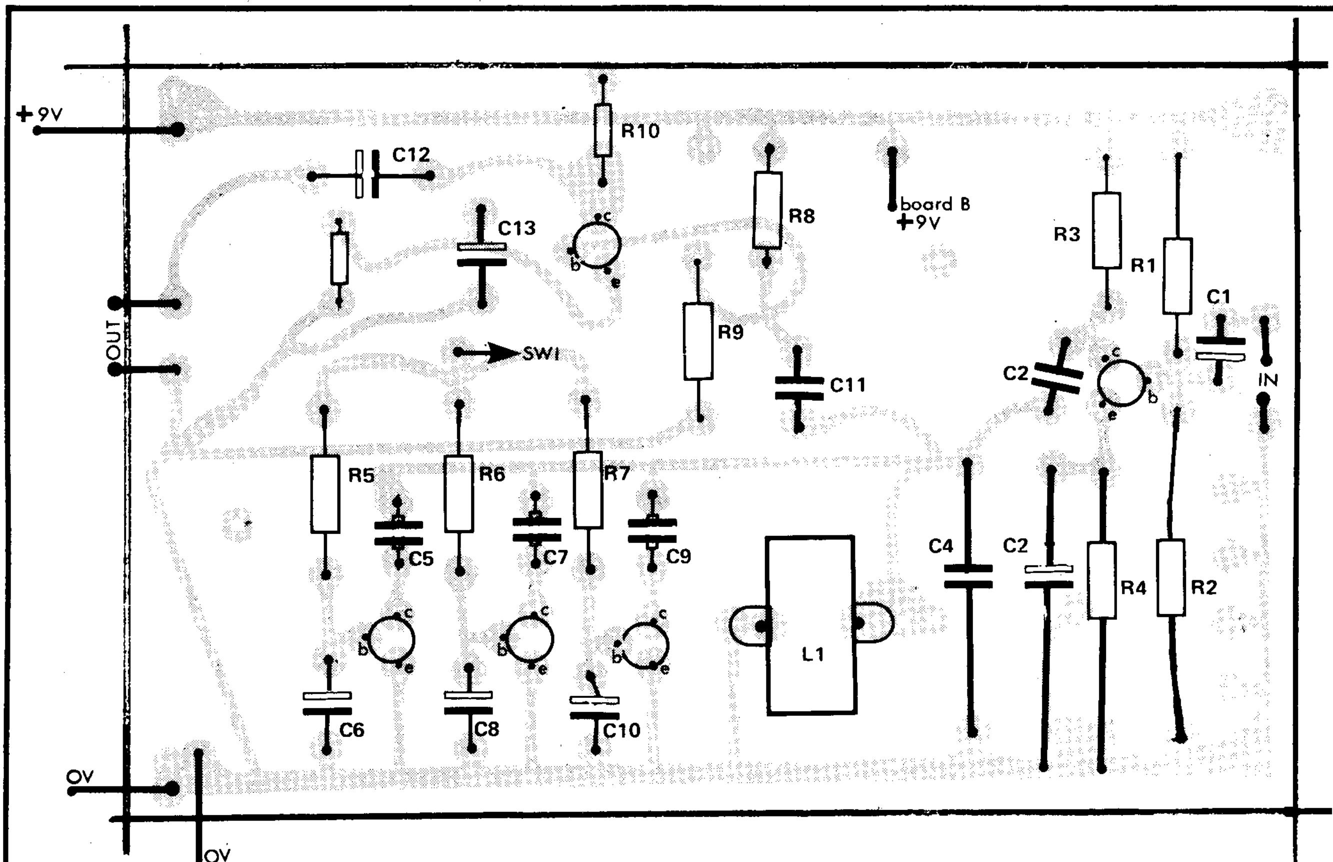


Fig. 3. Component overlay

PARTS LIST

R1,8	–	47k
R2,9	–	39k
R3	–	2k2
R4	–	470R
R,5,6,7	–	100k
R10	–	820R
R11	–	680R
R12,14,15	–	1k
R13	–	82k
	–	
C1	–	30µF
C2	–	0.1µF
C3,12,13,14	–	100µF
C4	–	3900pF
C5	–	.015µF
C6,15	–	1.0µF
C7	–	.15µF
C8	–	2.5µF
C9	–	1.0uF
C10	–	4.7µF
C11	–	.01µF
C16	–	5µF
Q1,5	–	BC109C
Q2,3,4,6,7	–	BC109 or similar

L – 180mH – available from Maplin Electronics as 'L5' for the ETI Graphic Equaliser at £1.26 ready wound. Add 20p 20p p and p. Can be wound as 424t of 38swg on Mullard LA 4543 core and DT2534 bobbin.

SW1, SW2 – Single pole changeover foot switches
Aluminium case to suit. On/off switch, 9V battery. ¼" jack sockets (2 off).

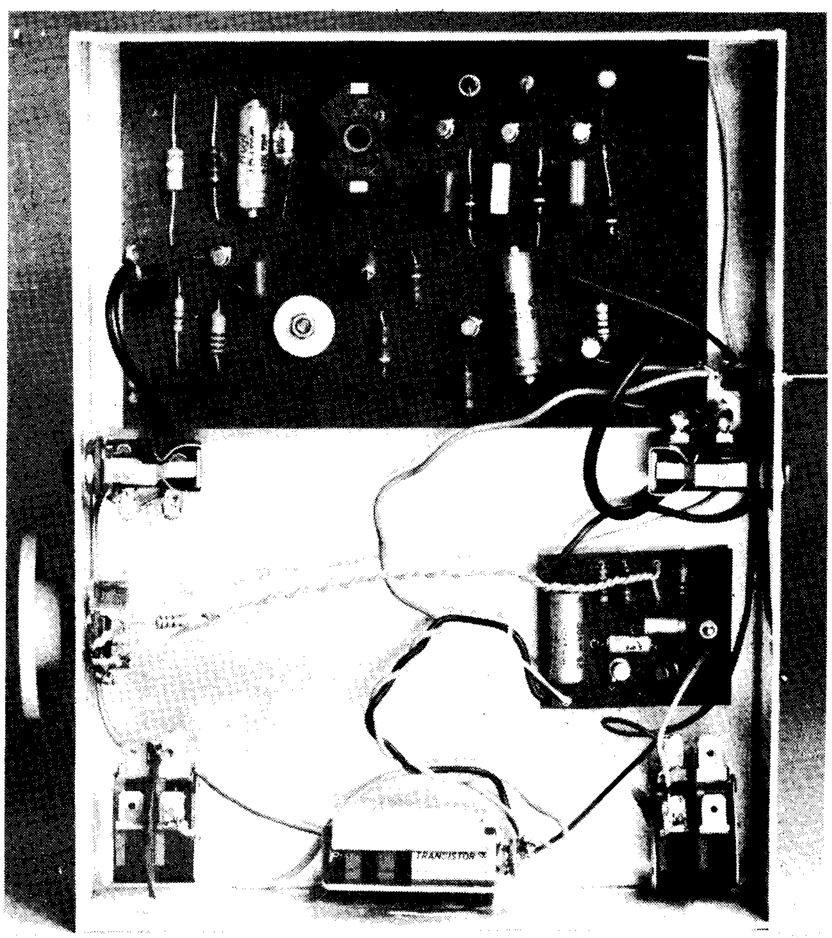


Fig. 4. Internal view of the unit.