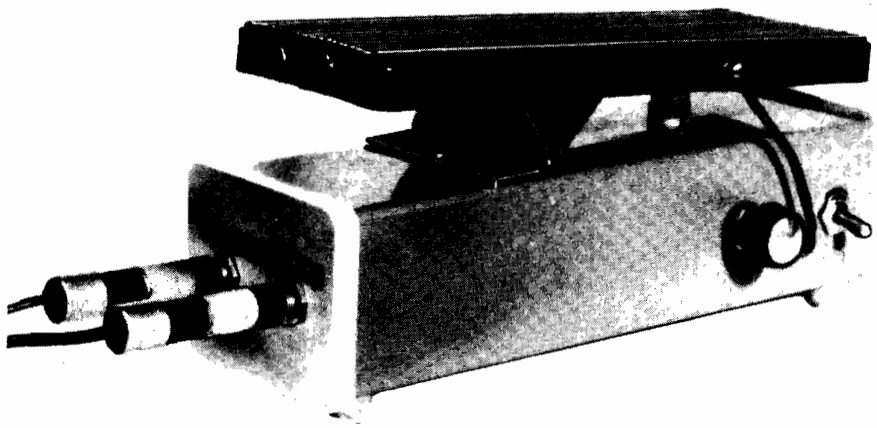
WAA-WAA



PEDAL UNIT

By B.H. BAILY

HARDLY a half-hour programme of "pop" music passes without the sound of the now-popular Waa-Waa effect. This extraordinary sound may lead the listener to believe that a fairly complicated circuit must be used.

Do not be deceived! The model described can be produced for a modest outlay and takes only an hour or two to build.

PRINCIPLE

The secret of the Waa-Waa lies in the use of a selective amplifier; that is to say, an amplifier which applies boost to a selected band of frequencies within the audio range, while amplifying the remaining frequencies to a lesser degree. The position of the boosted band, relative to the rest of the band, can be shifted up and down in frequency by operation of a foot pedal.

CIRCUIT DESCRIPTION

The circuit (see Fig. 1) uses only one transistor, type 2N2926, of green spot (high gain) classification. This is connected into a circuit, which, despite its unusual appearance at first glance, is basically a phase-shift oscillator, except that feedback is restricted to a value which is just insufficient to maintain self-oscillation.

COMPONENTS . . .

Resistors
R1, R2, R4, R5 47kΩ (4 off) R6 1MΩ
R3 220kΩ (see text) R7, R8, R9 56Ω (3 off)
All 10% ½W carbon

Potentiometers
VR1 2kΩ linear pre-set VR2 100kΩ log.

Capacitors
C1, C2 0·1μF plastic (2 off) C4, C5 3,300pF (2 off)
C3 0·047μF plastic C6 0·01μF plastic
All 160V polyester

Transistor
TR1 2N2926 (green spot)

Battery
BY1 9V (PP3 or equivalent)

Switches
S1 Single pole on/off toggle
S2 Single pole, press on, release off push-button

Sockets
JK1, JK2 Standard two-terminal jack sockets (2 off)

Miscellaneous
Four-way group board. p.v.c. covered wire. Wood. Wood screws. Rubber household adhesive, plastic trim beading, ribbed rubber sheeting, 64mm hinge. Plastics box, outside measurements 254mm × 64mm × 76mm, from D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset

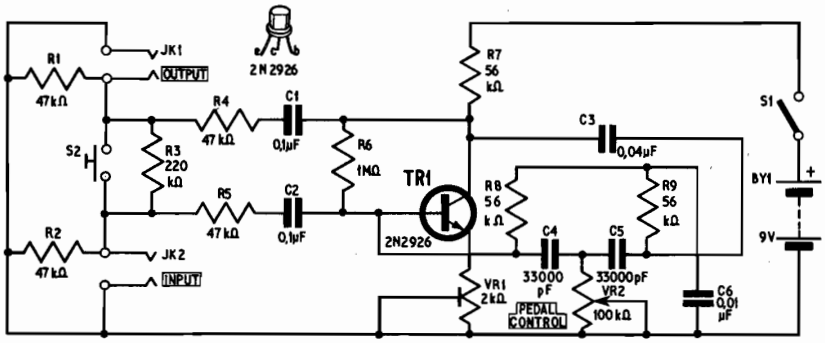


Fig. 1. Circuit diagram of the Waa-Waa pedal. R3 is adjusted on test to give minimum change in overall volume when S2 is operated

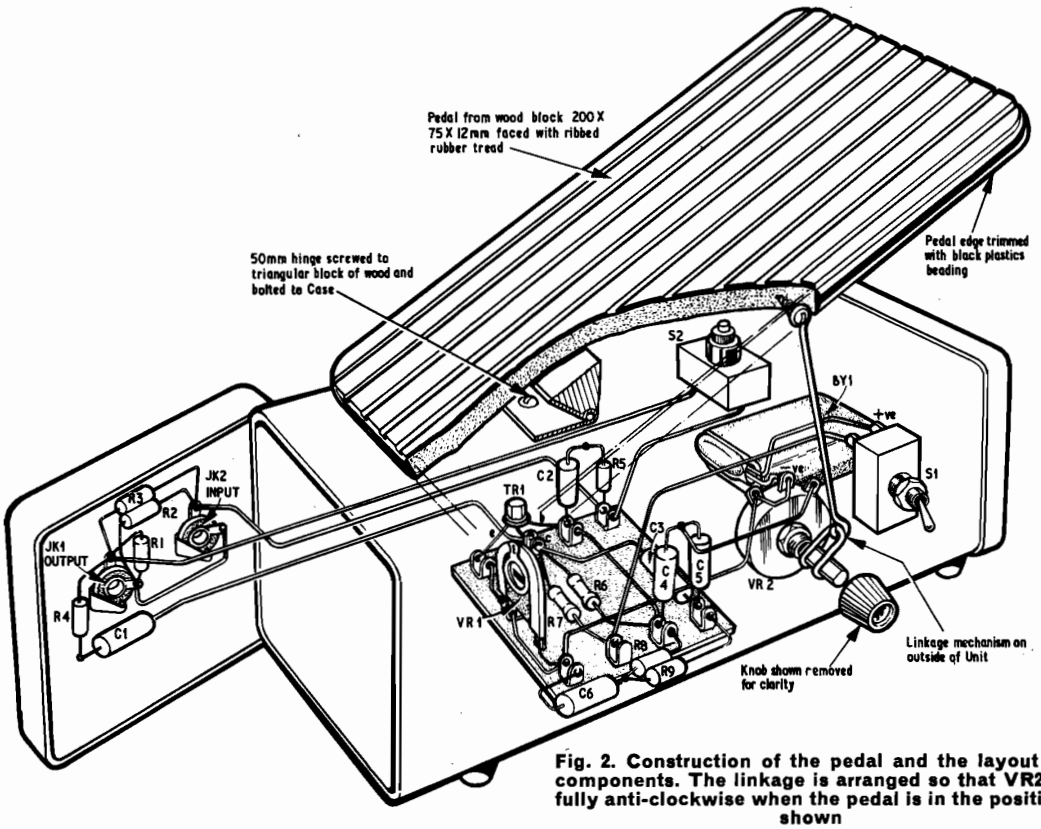
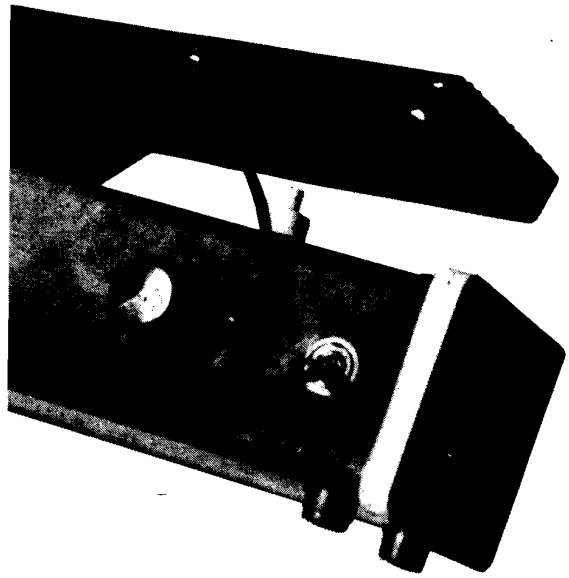


Fig. 2. Construction of the pedal and the layout of components. The linkage is arranged so that VR2 is fully anti-clockwise when the pedal is in the position shown



View of the pedal linkage. To avoid stress, the cut-out button (S2) should be positioned carefully so that it operates just before the pedal stops against the top of the case

When a signal is applied to the transistor base, the circuit behaves as a selective amplifier, and affords higher gain to all harmonics lying within a certain defined band than to those outside this band. The selective band lies between limits which are spaced on either side of the natural resonance of the circuit.

This natural frequency may be varied by changing the resistance of VR2, which is connected between the junction of C4/C5. Using the capacitor values shown, the value of this component should be variable between zero and about 50 kilohm. However, it was found necessary to use a 100 kilohm log-law potentiometer in this position, since the simple mechanical linkage allows only partial rotation of the potentiometer shaft. Hence, with the chosen component, it was found possible to get a maximum value of about 50 kilohm while having to rotate the shaft less than half its normal travel, from the fully anticlockwise position. Minimum resistance raises the boosted frequency band, whilst increasing resistance lowers the band.

BUFFER CIRCUITS

Since the input and output connections are made to the oscillatory circuit in rather a direct manner, it was found necessary to build in buffer circuits. These, while "matching" the input impedance to the more common 50 kilohm, allow for some variation in input and output matching with a minimum of variation in the performance of the circuit. The buffer resistor network is composed of R1, R2, R3, R4, and R5.

The emitter resistor VR1 is a preset potentiometer, which allows the sensitivity of the circuit to be adjusted. This control allows the feedback to be adjusted to the required near-oscillation point for optimum results.

Battery consumption is of the order of 100 microamps, which ensures many months of normal use from the PP3 battery.

CONSTRUCTION

The circuit of the prototype Waa-Waa unit was built on a four-way two-row group board. The 400V capacitors were used since space was not at a premium, but lower voltage types could be used instead to conserve space. However, avoid using the very low voltage disc-type (below 50V) capacitors in this circuit, because these often have a high leakage current and are unsuitable in the critical phase-shift circuit.

The components group board is mounted inside a case upon which is fitted the pedal. In the prototype a proprietary plastics box 154mm × 64mm × 76mm was used—see Fig. 2. However, a suitably strong case could be made from aluminium or wood, if preferred. Contact adhesive is used to fix the group board to the case.

THE PEDAL

The pedal was made from a piece of 13mm × 76mm × 203mm wood, pivoted by a hinge mounted on a short length of 25mm triangular cross-section strip.

The method of assembly should be first to screw the hinge to the triangular strip, and then screw the other half of the hinge to the box or base. Next, the pedal can be pinned and glued to the strip from above. The pedal is then ready to receive its trim. P.V.C. trim was used, and a small piece of ribbed rubber sheeting was obtained from a garage service department to give the pedal a professional and non-slip top finish. The details of the pedal construction are clearly shown in Fig. 2.

LINKAGE

The linkage from the pedal to the shaft of VR2 was fashioned from two short lengths of 10 s.w.g. galvanised fencing wire. One length of wire was formed into a crank by wrapping it around a sawn-off length of potentiometer shaft in a vice. It was then removed and pushed over VR2 shaft, and pinched on tightly with pliers. Fitting a small control knob prevented the wire coming off, while the half-flat section on the shaft prevented rotational slippage.

The other length of wire was bent to form a small loop at each end. One loop was secured under the head of a wood screw driven into the side of the pedal, and the other loop passed over the crank end, which was then doubled back to secure it.

Positions for the control VR2, the pedal pivot, and the link screw, as well as the finished linkage length,

must be found by experiment since they are fairly critical. Final adjustments can be made after completion by slightly bending the crank and link to ensure that the "up" position of the pedal exactly corresponds to the fully anticlockwise position of VR2.

SETTING-UP

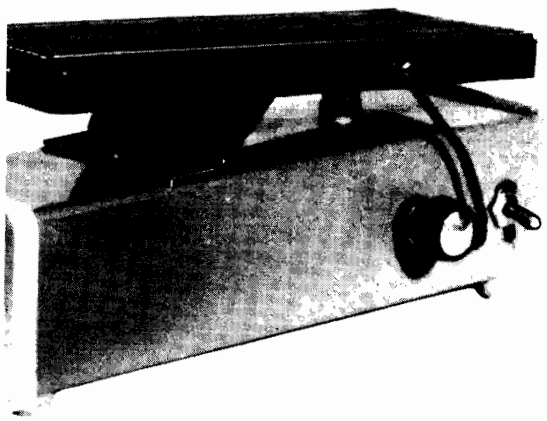
To set the position of VR1, connect the unit to the instrument and amplifier with which it will normally be used. The amplifier must be connected to the output jack, and the guitar or organ to the input jack. Connect unit to battery and switch on.

Adjust preset potentiometer VR1 to minimum resistance, and a howl should be heard from the loudspeaker of the amplifier. Back VR1 off slowly, until the howl just ceases, and rock the pedal slowly up and down over its full range. If the howl recurs at any position, turn VR1 back a fraction more. You should hear a slight *Waa-Waa* sound imposed on the background hiss, but no howl.

Ideally, VR1 should be mounted in a fairly accessible position, since it is just possible that it may require slight re-adjustment if the unit is used with other equipment. Should the Waa-Waa effect lack "life" on an instrument, it may be necessary to advance VR1 setting closer to the point of oscillation to obtain the right effect.

USE OF UNIT

The unit may be used with any electronic musical instrument which gives an output rich in harmonics, e.g. guitar (not bass), organ, harmonica (with microphone), etc.



Details of the foot pedal hinge mounted on the triangular wooden block

The push-button S2 under the pedal allows the operator to cut out the effect completely if he desires, without having to reach down and disconnect the unit. The switch short-circuits the input direct to the output when the pedal is pushed fully down. The full range of frequencies is then passed to the output, with virtually no modification. The value of R3, nominally 220 kilohm may require to be selected carefully to ensure minimum change in overall volume when the switch is operated. ★

Completed circuit ready for insertion into the plastic case