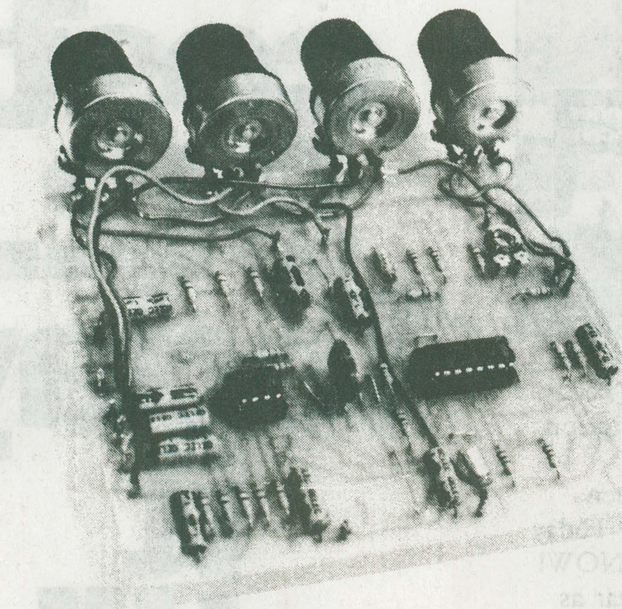
PROJECT

Voltage Controlled Filter

Highpass, lowpass and bandpass filters for creating sound effects.

JOHN BECKER



The principle of operation of the voltage controlled filter (vcf) is shown in the circuit diagram, Fig. 1, and is similar to that for the low pass filter. Frequencies are extracted from an AC signal by varying capacitor charge rates. In this case there are two capacitors and three stages.

The signal comes into op amp IC2a which acts as a mixer stage. Its output is taken in by the first filter around IC1a and IC1b. Capacitor C1 absorbs some of the upper frequencies. Part of the output is fed back to IC1a, another part is forward to the second filter stage at IC1c and IC1d. More of the upper frequencies are taken out by capacitor C15 , and further feedback is made to IC2a.

Due to the nature of the current transfer, three frequency pass parameters are developed. Upper frequencies appear at IC2a, and this is the High Pass (HP) output.

At first sight this may seem odd, as it might be expected that the signal here should contain low frequencies as well. The fact that it does not is due to the current transfer characteristics of the entire network.

The far end of the circuit at IC1d is the Low Pass (LP) output. In the middle at IC1b, frequencies between high and low pass appear. This is the Band Pass (BP) output.

The spectral range of the three sections is governed by the amount of current going into the control nodes at pins 1 and 16. Since these are coupled, they both see the same current as delivered from the chosen sources previously discussed.

Filter response in respect of varying values of node current and capacitance value is shown in Graph 3. The maximum and half level regions shown relate to the signal strength seen at the outputs compared to the original level.

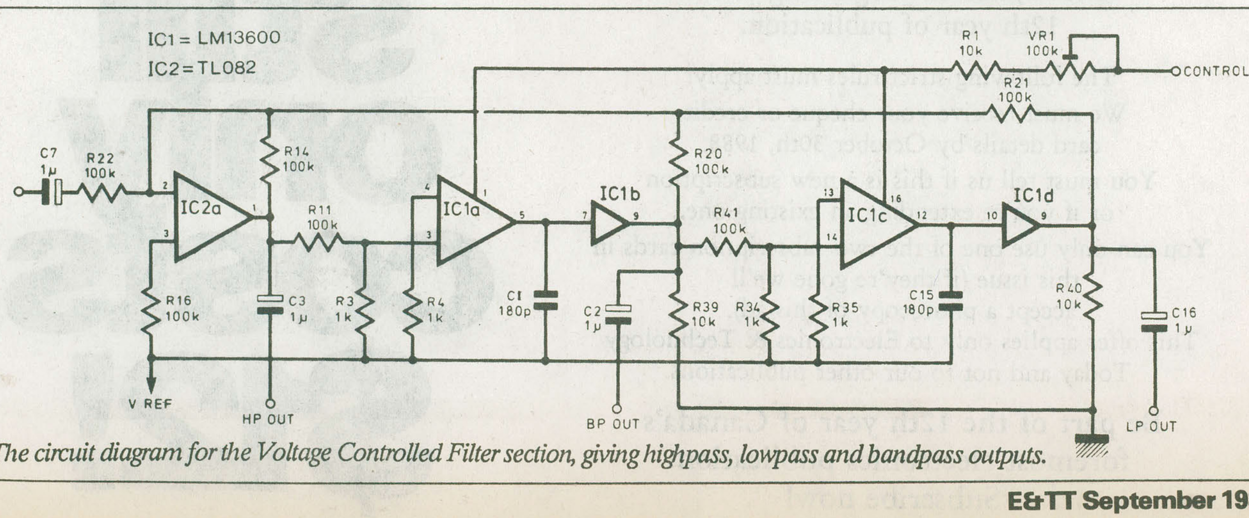


Fig. 1. The circuit diagram for the Voltage Controlled Filter section, giving highpass, lowpass and bandpass outputs.

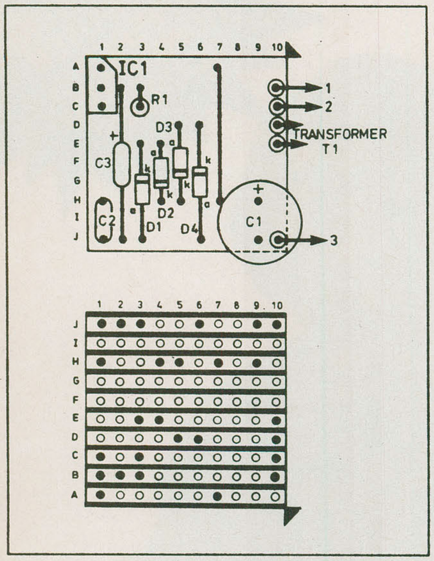


Fig. 4. Component layout and details of wiring to the transformer secondary winding and to the DIN socket.

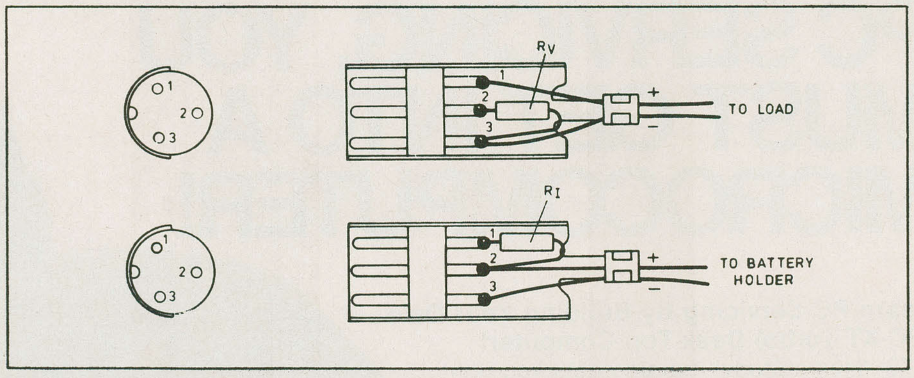


Fig. 5. Wiring to the DIN plugs for power supply and charger mode. It is suggested that the resistor leads be covered with insulating sleeving to avoid shorting to the other pins.

Constrctuion

The circuit is built up on a small piece of 0.1in. matrix stripboard, size 10 strips by 10 holes. There are no track breaks on the board and the component layout is shown in Fig.4.

Commence construction by mounting the diodes and link wire on the board followed by the capacitors. The regulator IC1 should be soldered on last and a small heatsink bolted on to it. When mounting the diodes and electrolytic capacitor C1 be sure to observe the correct polarity of these devices.

The completed circuit board is housed in a power supply unit box with an integral 3 pin plug. The miniature mains transformer was fitted first by bending its mounting tags round the box's internal moulding and the circuit board was connected to it using stiff wires. If a 0-6V,0-6V secondary winding is used, the wires to the circuit should be connected to the OV of one winding and the 6V of the other, with the remaining two tags connected together.

In the prototype unit the DIN connecting socket was a non- chassis type and a short lead was attached to the socket, fed through a small hole in the case side and soldered to pins on the circuit board. If a chassis type socket is used a suitable hole should be drilled in the case and short wires soldered from the circuit board pins to the socket tags. As the components are such a tight fit inside the case it might be best if constructors kept to the external-lead type DIN socket method.

Connecting Leads

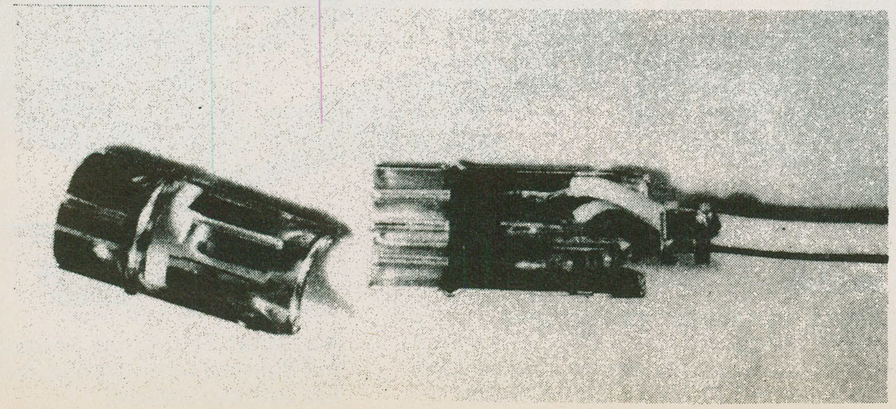
The construction of the battery charging and power supply leads are shown in Fig. 5. Some care is needed when mounting the resistor in the plugs to ensure that the leads do not touch any terminals. For this reason plastic-barrelled plugs should be used, and wrapping the resistor in insulating tape is not a bad idea either.

For charging large batteries higher power resistors are used (half or quarter watt types - see Table 3) and these may not fit in the plug barrel. If this happens the resistor should be mounted on the battery holder, and a three-wire plug lead will then be needed.

NiCADS

The life of your NiCADs can be drastically shortened if they are mistreated, so some care is needed. They should not be used in very low current applications such as clocks and LCD calculators where a dry cell would only be replaced once a year.

NiCADs should never be short circuited as they have very low internal resistance and can, if shorted, deliver very high currents which may destroy the cell itself. The recommended charging times should be kept to, but no real harm results in charging for too long. Ordinary zinc-carbon or alkaline cells are not meant to be recharged, and damage may result; recharging of these should not be attempted. ■



PARTS LIST

Resistors
- R1 470
- Ri See Table 3
- Rv See Table 2

Capacitors
- C1 1000u, 35V
- C2 0.1u
- C3 1u tantalum bead

Semiconductors
- D1-4 1N4001 or equiv
- IC1 LM317 adjustable regulator

Miscellaneous

12V 500mA transformer such as Hammond 166G12 or similar. If a plugpack case is not available, the circuit can be put in any utility case and a line cord attached.

3-pin DIN socket and suitable power plugs, stripboard (Vectorboard), battery holders.