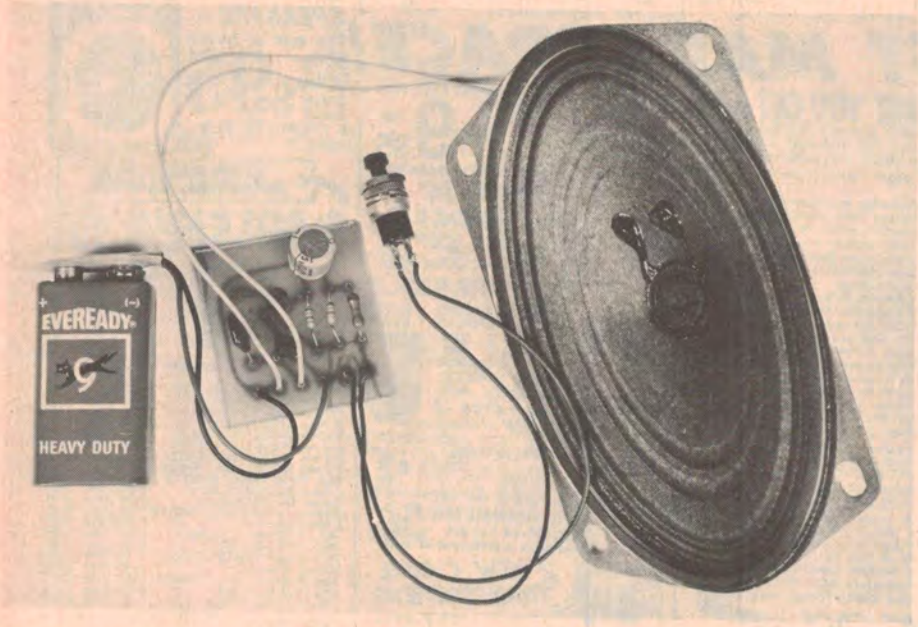
Simple siren is fun to build and interesting to play with

You can simulate an air raid siren, or that of a fire engine, with this simple project. Learn while you build, too.



ELECTRONIC CIRCUITS that simulate everyday sounds are always popular with beginners. We receive many requests, and quite a few circuit suggestions, for such things. This project comes from a circuit idea sent in by Mr. W.T. Geary of Rossmoyne in Perth, W.A.

The circuit employs a cunning, yet simple oscillator, the frequency of which is made to rise and fall in pitch by charging and discharging a capacitor.

How it works

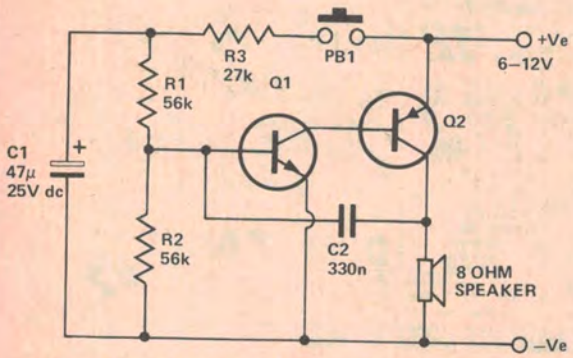
For the moment, let's ignore what C1 does and look at the circuitry around Q1 and Q2. These two transistors, an NPN and a PNP type respectively, are connected as a non-inverting amplifier. That is, a rising voltage (positive-going) on the base of Q1 will cause the voltage across the speaker to rise towards the positive rail. Conversely, a falling voltage (negative-going) on the base of Q1 will result in a falling voltage across the speaker.

This circuit has been arranged to have positive feedback applied via the capacitor C2. This means that some of the output signal is fed back to the input in the same phase. The amplifier must have sufficient gain to overcome any losses in the feedback components. That's no problem in this circuit. As the input and output are in phase, the feedback (i.e: C2) is simply connected between the collector of Q2 and the base of Q1.

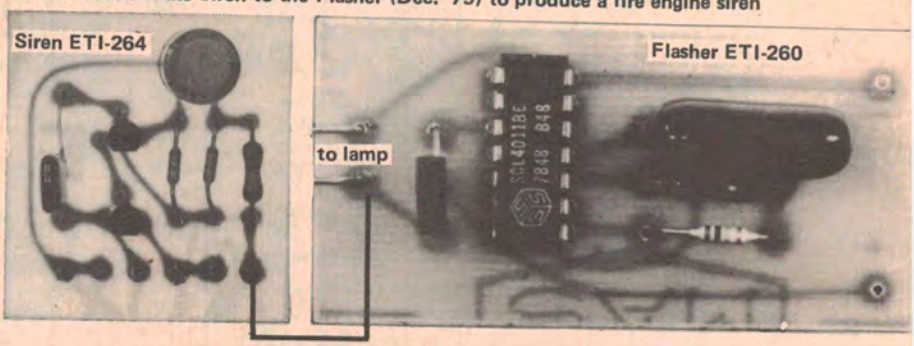
When the pushbutton, PB1, is pushed (still remembering that C1 is 'not there'), Q1 will be forward biased and collector current will start to flow. It must flow via the base-emitter junction of Q2, thus Q2 will start to turn on. The voltage across the loudspeaker will start to rise. The feedback capacitor, C2, will start to charge then causing Q1, and thus Q2, to 'turn on' harder. The voltage across the loudspeaker will rise more . . . and so on until both Q1 and Q2 are 'hard on' and the voltage across the loudspeaker is pretty much that of the supply. All this occurs very rapidly.

The amplifier now has no gain and Q1 will commence to turn off, causing Q2 to turn off. As the voltage across the speaker will then begin to fall, the feedback via C2 will cause the voltage on the base of Q1 to fall, turning it off further, along with Q2. This proceeds until Q1 and Q2 both turn off. C2 will discharge via R2 and the speaker, removing the feedback.

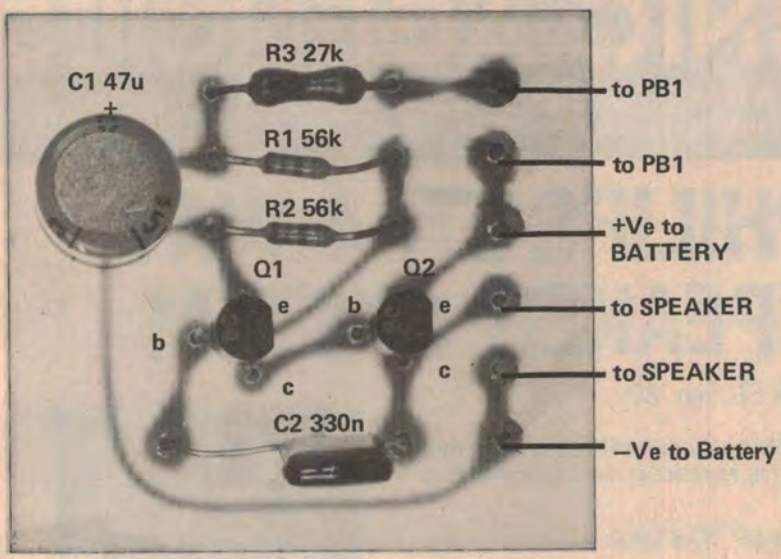
Now Q1 will start to turn on again, and the whole cycle will repeat. In fact, it repeats at many thousands of cycles per second, the frequency of oscillation being largely determined by C2, the resistor values and the supply voltage. Increasing the value of C2 will decrease the frequency of oscillation and vice versa. The operation of this circuit, simple though it appears, is quite



How to connect the Siren to the Flasher (Dec. '79) to produce a fire engine siren



The pc board pattern is on page 113



complex, requiring some fancy mathematics to understand it properly. The above explanation should be clear enough for most purposes.

Now, let's see what C1 does. When the pushbutton is operated, C1 will initially appear as a short circuit and the oscillator will not work. However, C1 will begin to charge via R3 until the voltage across it is sufficient to forward bias Q1, starting the oscillator. But, it will start at a low frequency, increasing as the voltage across R1/R2 increases. When the pushbutton is released, C1 will discharge via R1 and R2 and the oscillator frequency will fall. As the pushbutton is alternately pressed and released, the pitch of the sound from the loudspeaker will rise and fall in sympathy.

Construction

This is fairly straightforward as there is nothing critical about placement of the components. However, take care with the orientation of the electrolytic capacitor (C1) and the two transistors. Although this circuit can be readily assembled on a piece of matrix board (as per the actual circuit diagram!) we elected to use a pc board. The speaker, battery and pushbutton are all attached via flying leads as shown in the photograph. Note that the pushbutton is a momentary-contact, push-to-make type and that a 10 ohm speaker will also work in this circuit.

When connecting the battery or supply, make sure you have the leads the right way round as reverse connection could destroy the transistors.

Try these changes

If you increase the value of capacitor C1 you can make this circuit sound like an air raid siren. Swap the pushbutton for a toggle switch. When you turn it on, the pitch will rise slowly over some seconds until it reaches a maximum frequency. Try a value of 470u or 1000u for C1. You can increase the maximum pitch of the sound by decreasing the value of C2. Try a 270n. For a lower maximum pitch, increase the value of C1 to say 470n or even 680n.

To make a continuous 'fire engine' siren you'll need to build up the flasher, Project 260, described in our December 1979 issue (page 58). The pushbutton will not be needed, instead, connect R3 of this siren to the emitter of Q1 in the flasher as shown in the accompanying diagram. The two projects should share the same supply, of course. You can omit the lamp in the flasher if you wish.

Now, as the flasher cycles on and off, the siren will operate, rising and falling in pitch in sympathy . . . and you have a fire engine siren. ●

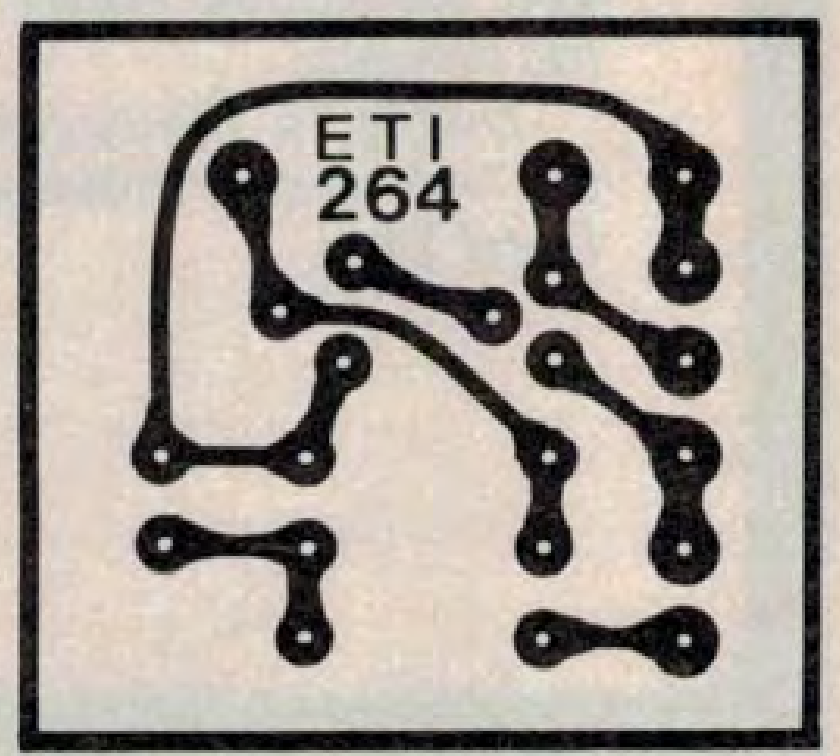
PARTS LIST - ETI 264

Resistors all ½W, 5%
R1, R2 . . . . . 56k
R3 . . . . . 27k

Capacitors
C1. . . . . 47μ, 25V electrolytic
C2. . . . . 330n greencap

Semiconductors
Q1 . . . . . BC108, BC548, DS548 or similar
Q2 . . . . . BC178, BC558, DS558 or similar

Miscellaneous
PB1. . . . . momentary pushbutton, push-to-make type, eight ohm speaker, ETI 264 pc board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