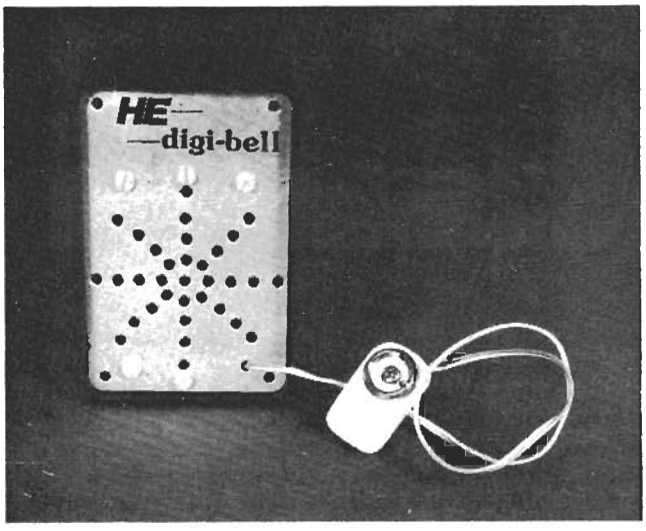
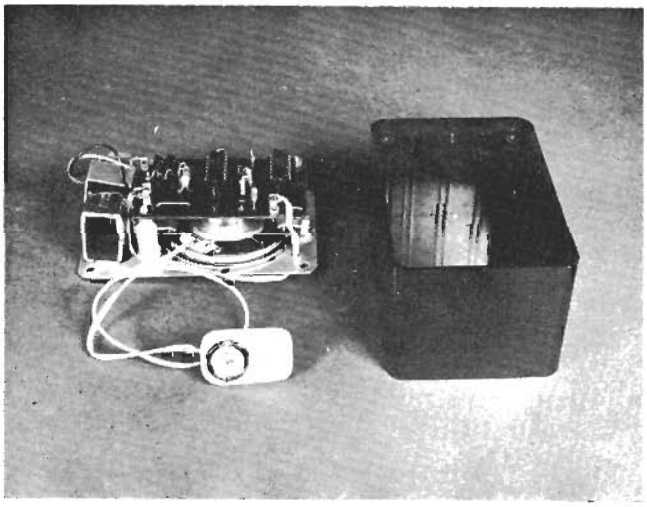
DIGIBELL PROJECT

No more pressing door bells with the HE Digi-Bell, it's just touch and go, the 'chime' will never be ignored.



UNTIL RECENTLY doorbells have all relied upon a mechanical action to strike a bell or chime. With the advent of reliable ICs the electronics industry has been attemptimg to innundate us with microprocessor based song-boxes. Any type of doorbell must fulfill one basic function, however, that is to attract the householder's attention to the fact that someone is at the door. It doesn't matter how many tunes it may play, if it can't be heard or even worse, is ignored altogether it's use as a doorbell is somewhat suspect.

There are two distinct methods of attracting someone's attention (audibly that is) the most obvious is volume, nothing wrong with the theory but it does rather lack elegance. Hopefully we will never be accused of that. The second method involves the peculiarities of the human ear. We are more sensitive to certain frequencies or combinations of frequencies than others.



The compact design of the HE Digibell.

inclusion of a touch-switch as opposed to the normal mechanical push-button. The sensor uses the resistance of the skin to activate a short time delay which sounds the 'Bell' for a short time after the finger is removed.

Construction

All the electronics are mounted on a single PCB. The usual precautions must be taken when handling CMOS devices. Ensure all the polarised components are fitted the right way round. In the prototype the PCB was mounted above the speaker on pillars. The touch-plate was made from a small piece of plastic. The outer contact was an old knurled nut from a standard toggle switch, (use a plated type to avoid corrosion). The centre contact was made from a plated dome-headed 6-32 screw. Both contacts were filed and the connecting wires soldered directly. The knurled nut can then be fixed to the plastic plate by an epoxy adhesive.

Operation

Because the Digi-Bell uses CMOS IC's, the stand-by current is extremely low, around 2-5 uA, so an on-off switch is unnecessary. It's a good idea to use a mercury or alkaline battery, so the unit will function for several months.●

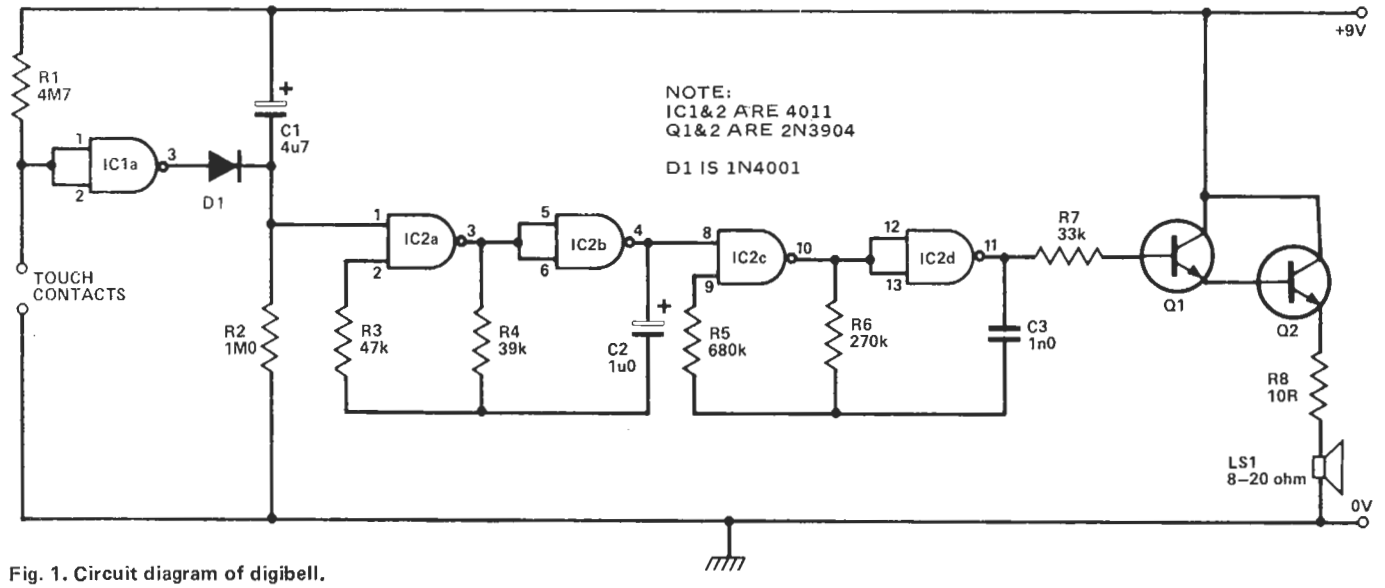


Fig. 1. Circuit diagram of digibell.

HOW IT WORKS

The circuit of the Digi-Bell can be broken down into three distinct sections.

Touch Switch

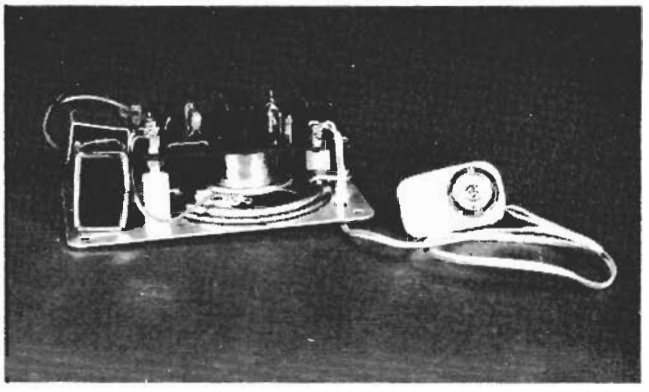
The touch switch uses skin-resistance to trigger the 'bell'. IC1 (quad, dual input NAND gate) has both inputs of gate (a) tied together. This now becomes a NOT gate. (If logic 1 (+9V) is present at the input, logic 0 (0V) will appear at the output and vice-versa, therefore it is an inverter). The input pins 1 and 2 are connected to the +9V line (logic 1) via R1, so there will be logic 0 on the output (pin 3). If a resistance less than R1 (eg a finger, typically 10-50 k ohms) is connected between the input pins and the 0 V line, the logic stage will change and the output will rise to +9V. A CR network C1, R2 holds the output high for a short period (about 1 second per microfad of C1). The output from the CR network is taken to the first in a pair of astables.

The Oscillators

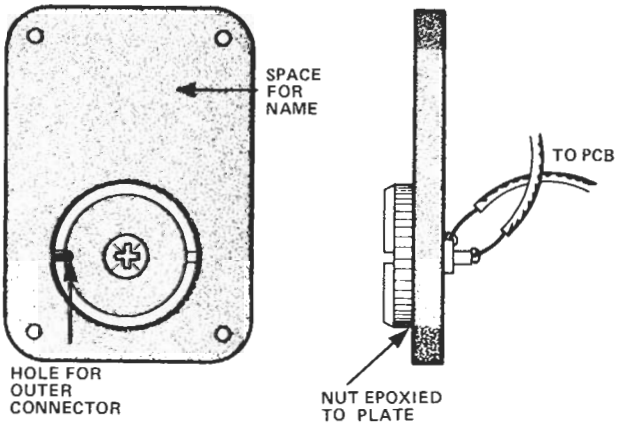
The output from the touch switch 'enables' the first astable (free running square-wave generator) which has a frequency of around 10 Hz. This in turn enables the second astable, with a frequency of 5 kHz, so the resulting output will be a 5 kHz squarewave, gated at 10 Hz.

Audio Output

The output from IC2 (c+d) pin 11 is fed to a Darlington Pair (current amplifier) comprising Q1, Q2, they drive a low impedance loudspeaker LSI. A 20 ohm speaker was found to give the greatest volume, although a lower impedance speaker will work but below 8 ohms damage to the output stage might occur.



A loudspeaker sandwich. The PCB is bolted to the front panel, with the loudspeaker between the two.



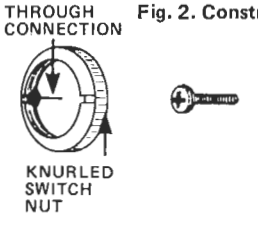


Fig. 2. Constructional details of the touch plate.

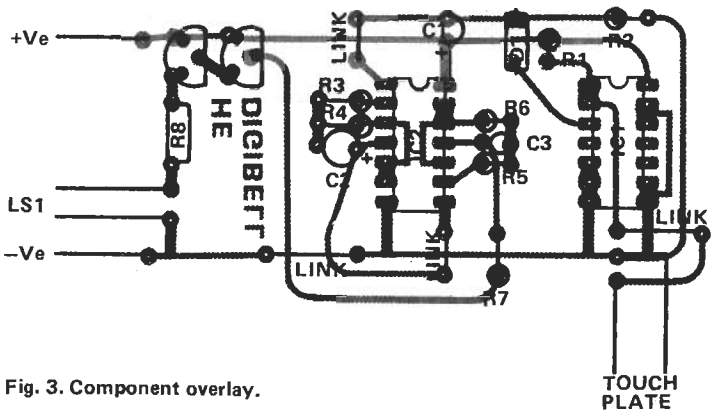
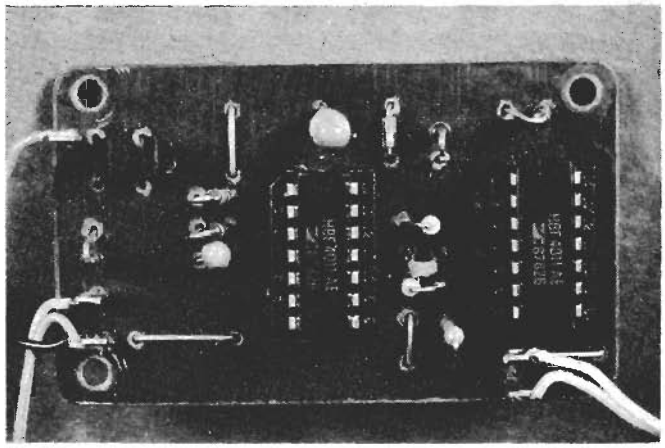


Fig. 3. Component overlay.



Top view of the PCB. Note that resistors are mounted vertically to save space.

PARTS LIST

RESISTORS (All ¼W, 5%)

R1	4M7
R2	1M0
R3	47k
R4	39k
R5	680k
R6	270k
R7	33k
R8	10R

CAPACITORS

C1	4u7 Tant (See How It Works)
C2	1u0 Tant.
C3	1n0 Ceramic.

SEMICONDUCTORS

IC1, 2	CD4011
Q1, Q2	2N3904
D1	IN4001

MISCELLANEOUS

PCB to suit, small piece of plastic, knurled nut, 6.32 screw, battery, 9V (Mallory etc.), loudspeaker.

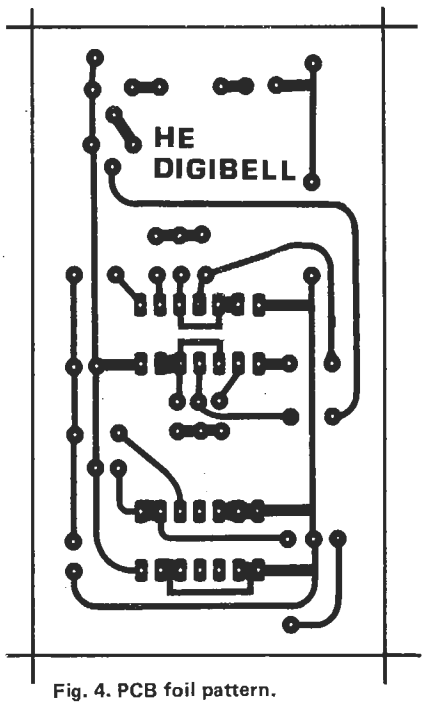


Fig. 4. PCB foil pattern.