ring the bell and win a prize!

One of the favourite attractions at fair-grounds has always been some variation of 'bash-the-block-with-a-mallet'. Originally, this was a purely mechanical device, although of recent years technology has advanced to the stage where no self-respecting fair-ground attraction is complete without a dazzling display of flashing lights. However, electronics have now progressed to the point where a portable version is possible — suitable for desk-top use.

In olden times, the strongest men in the village used to demonstrate their prowess by walloping an innocent wooden peg with a heavy mallet. Through a more-or-less intricate system of sturdy levers, this resulted in the launching of a metal ball towards the heavens; the mightier the wallop, the higher it rose.

Real muscle-men could deliver a sufficiently hard blow to send the ball right up to the top of the structure, where it would hit a bell with an almighty clang. This won them a prize and, more importantly, the esteem of all those who witnessed the feat.

Nowadays, of course, the battle for superiority is more likely to be fought out indoors — specifically, at parties and business meetings. The desk-top model described in this article should therefore fulfil a major need. Operated as it is by fist-power instead of by means of a blunt instrument, it can also prove useful as an ideal 'fury-indicator' for managers. In fact, every executive should have one.

The circuit

Before even starting to design the circuit, a suitable force sensor must be found. This should not only be sufficiently sturdy; it should also be reasonably cheap and readily available. The solution chosen may be somewhat inelegant, but it has proved highly satisfactory in practice.

The sensor consists of a piece of conductive foam plastic, of the type currently in use for packing CMOS IC's. The specific resistance of this foam drops dramatically when the foam is compressed — this is not particularly surprising, in view of the fact that the carbon particles in the foam become more tightly packed as the volume decreases. Remember the carbon mike?

The mechanical construction is shown in figure 1. The foam is placed between two metal plates (with wires attached) and this 'sandwich' is placed in a suitable wooden holder. A two-piece wooden block serves to spread the force

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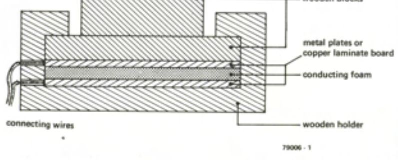

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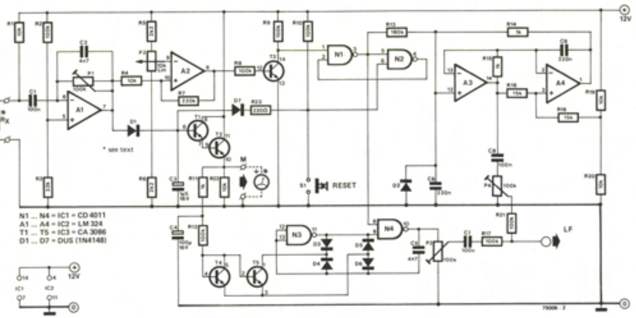

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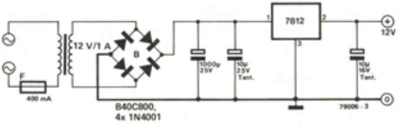

of the blow evenly over the upper metal plate. For most ordinary mortals, with the possible exception of karate experts, it is advisable to glue some softer material over the upper surface of the target area – hitting a solid wooden block with the bare hand, hard, is not everybody's idea of fun!

Having settled the details of the sensor, it can now be reduced to a small rectangle marked R_X and included in the circuit shown in figure 2. The sensor, R_X, and R1 together form a potential divider. A sudden change in the resistance R_X causes a sudden jump in the voltage at the R_X/R1 junction. This voltage 'spike' is passed through C1 to the input of opamp A1. The gain of this amplifier stage can be preset by means of P1, to suit the characteristics of the sensor and the (expected) strength of the potential customers. The output from A1 (a positive-going spike) is passed to a peak detector and to a trigger circuit.

The peak detector consists of D1 and C3. The highest voltage level appearing at the output of A1 as a result of a blow on the sensor is 'stored' in C3. This voltage is buffered by the super-emitter-follower T1/T2 and is available as the output voltage U_p. It can be used to drive a pointer instrument (e.g. an AVOmeter) or a LED voltmeter, as will be described later.

The trigger circuit consists of A2, R4 . . . R7 and P2. The trigger threshold (and thus the strength of the blow required to 'score') can be set with P2. The output from A2 is fed, via T3, to a set/reset (RS) flip-flop consisting of N1 and N2. This flip-flop controls the 'ding' generator, A3/A4, which is derived from the 'electronic gong' (see the 'Summer Circuits' 1978 issue, circuit no. 13). The output can be fed, via P4, to a power amplifier; if a suitably 'hefty' amplifier and loudspeaker are used, a very gratifying 'bong' will be produced.

To further enhance the audible effect, a VCO (voltage controlled oscillator) is also included. The peak output voltage, U_p, is fed via R11 to C4. C4 will therefore charge up slowly to U_p, causing the VCO (T4, T5, N3, N4 and the associated diodes, resistor and capacitor) to produce a slowly-rising wail. However, the VCO can only operate if the

Figure 1. The sensor consists basically of conducting foam, sandwiched between two metal plates and mounted in a wooden box. Copper laminate board can, of course, be used instead of the metal plates.

Figure 2. Complete circuit for 'Ring the bell and win a prize'.

Figure 3. A suitable 12 V power supply.

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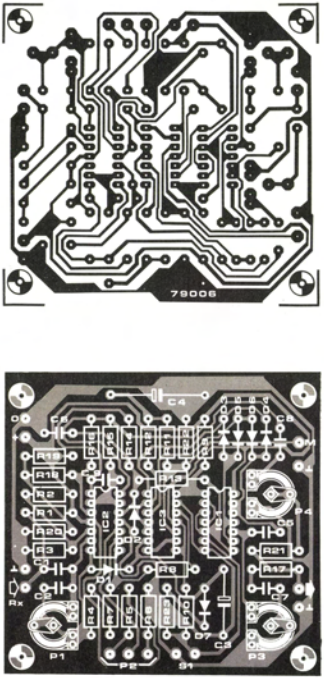

Figure 4. Printed circuit board and component layout for the circuit shown in figure 2 (EPS 79006).

Parts list

Resistors:

R1,R4,R10,R21,R22 = 10 k
R2,R8,R12,R13,R14,R15,
R23 = 100 k
R3 = 33 k
R5,R6 = 2k2
R7 = 220 k
R9 = 220 Ω
R11,R17,R18 = 1 k
R16 = 180 k
R19,R20 = 15 k
P1,P3,P4 = 100 k preset potentiometer
P2 = 10 k linear potentiometer

Capacitors:

C1,C6,C8 = 100 n
C2,C5 = 4n7
C3 = 1µ5/15 V
C4 = 100 µ/15 V
C7,C9 = 220 n

Semiconductors:

T1 . . . T5 = IC3 = CA 3086
D1 . . . D7 = DUS
N1 . . . N4 = IC1 = CD 4011
A1 . . . A4 = IC2 = LM 324

Miscellaneous:

S1 = pushbutton, single-pole, make
R_x = conducting foam plastic, approximately 3" square (7 x 7 cm).

RS flip-flop N1/N2 has been triggered.
The circuit can be reset by means of S1: C3 is rapidly discharged and the RS flip-flop is reset.

Final notes

The most sensational effect can be obtained by using a LED voltmeter to indicate the U_p output level. A suitable circuit is the 'UAA 180 LED voltmeter' described in Elektor 33, January 1978, p. 1-20.
Both the circuit described here and the LED voltmeter will operate on a simple 12 V supply like the one shown in figure 3.