cackling egg-timer

Boiling eggs is one of the more delicate of culinary occupations, especially since the ideal consistency of a boiled egg can be the subject of quite heated discussions: the hard-boiled spurn soft hearts, and the difference is a matter of minutes. It is not surprising, therefore, that some fertile brain in the distant past came up with that highly practical invention: the egg-timer.
Of recent years, electronics engineers have devoted a surprising amount of their time, ingenuity and eggspertise into the quest for an electronic version, and circuits are published at regular intervals. However, to the best of our knowledge, the circuit presented here is the first to cackle loudly when the timing period has elapsed!

Electronics is invading the most unlikely fields. After several experiments, with sometimes highly comical results, a member of the Elektor design team has even succeeded in imitating the sound of a self-satisfied hen — using a single CMOS IC. A simple timer, consisting of two further ICs, completes the novel egg-timer.
The block diagram is shown in figure 1. The timer section is fairly conventional. A decade counter receives pulses from a clock generator. Since the period time of the clock generator is 1 minute, the decade counter effectively counts minutes. The counter is started by pressing the 'reset' button. When the time selected by the multi-position switch has elapsed, two things happen: the clock generator is blocked, stopping the count, and the electronic switch (S) is closed. This switch applies power to the second part of the circuit, enclosed in dotted lines: the 'cackle circuit' that imitates the smugly complacement hen. This circuit consists of three square-wave generators, two of which are voltage-controlled (the VCOs).
The three generators are labelled according to the frequency they produce: 'L' for low, 'M' for mid-range and 'H' for high frequency — relatively, of course. The audio signal is derived from the third VCO ('H'). The other VCO, 'M', provides the basic modulation required for the 'bock-bock-bock' effect. The first generator adds two further effects: the repetition rate of the cackling and the duration of each cycle. These two effects, combined, also determine the number of clucks-per-cycle.
If one considers the characteristic

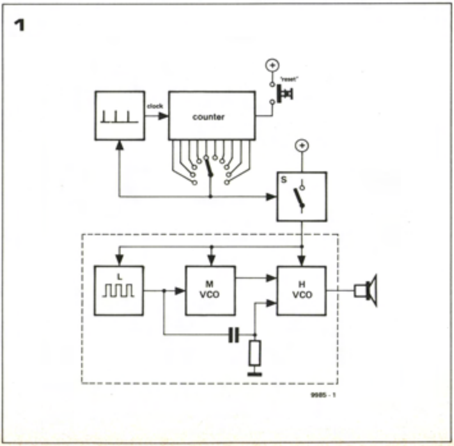
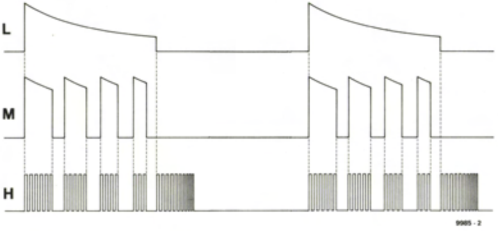


Figure 1. Block diagram of the cackling egg-timer. The section enclosed in dotted lines is the 'cackle generator'.

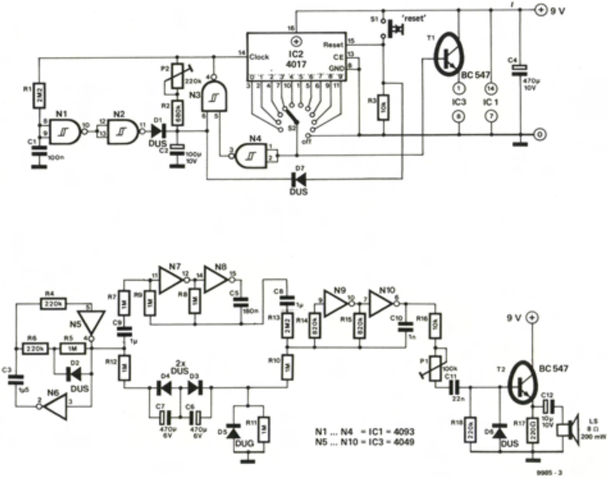
Figure 2. Output waveforms from the three oscillators in the cackle generator.

Figure 3. The complete circuit. The upper portion is the timer; the lower section is the cackle generator.

2


L
M
H
9985 - 2

3


+9 V
S1
'reset'
IC2
4017
Clock
Reset
CE
GND
T1
BC 547
IC3
IC 1
C4
470µ
10V
R1
2M2
N1
N2
D1
DUS
P2
220k
R2
680k
C2
100µ
10V
C1
100n
N3
N4
S2
off
R3
10k
D7
DUS
0
R4
220k
N5
R6
220k
R5
1M
D2
DUS
C3
1µ5
N6
R7
1M
R9
1M
C9
1µ
R12
1M
N7
N8
R8
1M
C5
180n
2x
DUS
D4
D3
C7
470µ
6V
C6
470µ
6V
D5
DUG
R11
1M
C8
1µ
R13
2M2
R10
1M
N9
N10
R14
820k
R15
820k
C10
1n
R16
10k
P1
100k
C11
22n
9 V
T2
BC 547
C12
10µ
10V
R18
220k
D6
DUS
R17
220Ω
LS
8 Ω
200 mW
N1 ... N4 = IC1 = 4093
N5 ... N10 = IC3 = 4049
9985 - 3

Parts list

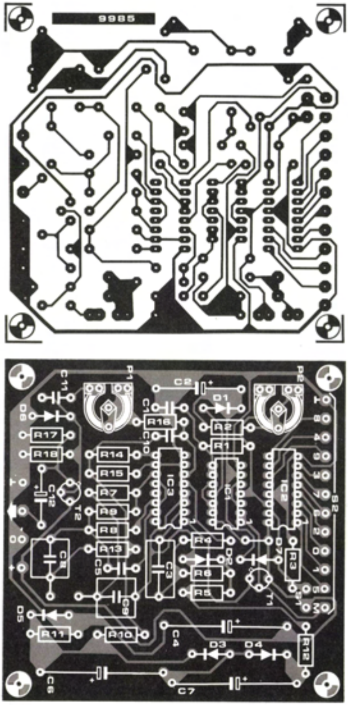
Resistors:
R1 = 100 k
R2 = 680 k
R3,R16 = 10 k
R4,R6,R18 = 220 k
R5,R7 . . . R12 = 1 M
R13 = 2M2
R14,R15 = 820 k
R17 = 220 Ω
P1 = 100 k, preset
P2 = 220 k, preset

Capacitors:
C1 = 10 n
C2 = 100 μ/10 V
C3 = 1μ5
C4 = 470 μ/10 V
C5 = 180 n
C6,C7 = 470 μ/6 V
C8,C9 = 1 μ
C10 = 1 n
C11 = 22 n
C12 = 10 μ/10 V

Semiconductors:
D1 . . . D4,D6 = DUS
D5 = DUG
T1,T2 = BC 107, BC 547 or equ.
IC1 = CD 4093
IC2 = CD 4017
IC3 = CD 4049

Miscellaneous:
LS = 8 Ω/200 mW loudspeaker
S1 = single-deck 11-way switch
S2 = pushbutton, single-pole make

4



cackling produced by domestic fowl after laying an egg, it will be apparent that three or four normal 'bock's are followed by one emphasised and long-drawn-out 'BO-O-O-O-CK' with progressively rising frequency. In the cackle circuit, this effect is obtained by feeding the output from the 'L' generator through an RC-network to the 'H' generator. The delicate interplay of these three generators provides a surprisingly realistic imitation of a proud mother hen. Figure 2 illustrates the signals at various points in the cackle generator.

The circuit

The complete circuit is shown in figure 3. The upper half of the circuit is the timer section; the rest is the cackle generator.

The clock generator for the timer consists of gates N1 . . . N3, with the associated components. It produces an asymmetric square-wave, with a period time (set by P2) of 1 minute. This oscillator can only produce an output signal when the output of N4 is at logic '1', i.e. when the input to N4 is logic '0'.

Assuming that the counter, IC2, is initially reset, it will count the clock pulses and its outputs will swing to logic '1' in turn. When the output selected by S1 is reached, the input to N4 will therefore become logic '1', stopping the oscillator. The count is stopped and, simultaneously, T1 is turned on. This transistor is the 'electronic switch', S, shown in figure 1: it applies power to IC3 in the cackle generator, causing the hen to give voice.

The lower half of the circuit, the cackle generator, may appear rather confusing

Figure 4. Printed circuit board and component layout for the cackling egg-timer (EPS 9985).

Figure 5. When it comes to 'Santatronics', the gift-wrapping is almost as important as the contents. The demonstration model shown here is perhaps somewhat large for normal domestic use, but it may help to stimulate the imagination.

5

at first sight. Reference to the block diagram may help to clarify matters. The free-running generator 'L' consists of N5 and N6; the 'M' and 'H' VCOs are similar circuits using N7/N8 and N9/N10, respectively.
A diode, D2, is included in the 'L' generator to obtain an asymmetrical output signal. This signal is fed, via C9 and R7, to the 'M' VCO. The output from the 'M' VCO now contains most of the information required for the 'bock-bock-bock-bo-o-o-ock' effect. As illustrated in figure 2, the number and length of the 'bock's, the breathing space and the (rising) frequency shift are all determined, with one exception: the modulation for the final, long-drawn-out 'b-o-o-o-ck'. This signal is derived from the output of the 'L' generator via an RC network consisting of R10, R11, R12, C6, C7 and three diodes. Capacitors C6 and C7 and diodes D3 and D4 together are basically equivalent to a bipolar electrolytic. D5 limits the negative swing of the voltage across R11. The outputs from the 'M' generator and from the RC network are summed and applied to the 'H' generator, which produces the actual audio signal.
A single-transistor buffer stage, T2, drives the loudspeaker. The desired volume can be set with P1.

Construction

The electronics involved in the egg-timer can be mounted on the printed circuit board shown in figure 4. The supply voltage (9 V) and the low current consumption make the circuit suitable for battery operation. If a mains supply is used, due care must be taken to reliably insulate the complete unit: it will be used in decidedly damp surroundings, quite possibly beside the kitchen sink!
There are only two adjustments. As mentioned earlier, P1 sets the desired volume. P2 is used to calibrate the timer. The easiest way to do this is to set S1 to position '1' and adjust P2 until the timing interval (i.e. the time between pressing the reset button and the first squawk) is exactly one minute. The switch positions will then correspond to timing intervals in minutes.
There is, of course, no reason why P2 should not be set to give a different timing interval. For instance, if the initial period is set at 1½ minutes, the switch positions will correspond to multiples of this time. Position 2 will be 3 minutes, position 3 will correspond to 4½ minutes, and so on. Position 9 would then be 9 x 1½ = 13½ minutes — ideal for 'bullet'-lovers.
No matter what the setting of P2, position 0 will always correspond to 0 minutes: the hen will give voice as soon as the reset button is operated. This option is included mainly for demonstration purposes.

As with most 'Santatronics' circuits, the 'gift' value is greatly enhanced by the wrapping. Since this is an ideal challenge to individual creativity, no constructional details for a case will be given here. Just a suggestion: a novel idea would be to shape it like an egg or, of course, a hen. Perhaps some further inspiration can be gained from figure 5: our demonstration model, which has been one of the center-pieces at otherwise serious exhibitions! ◼