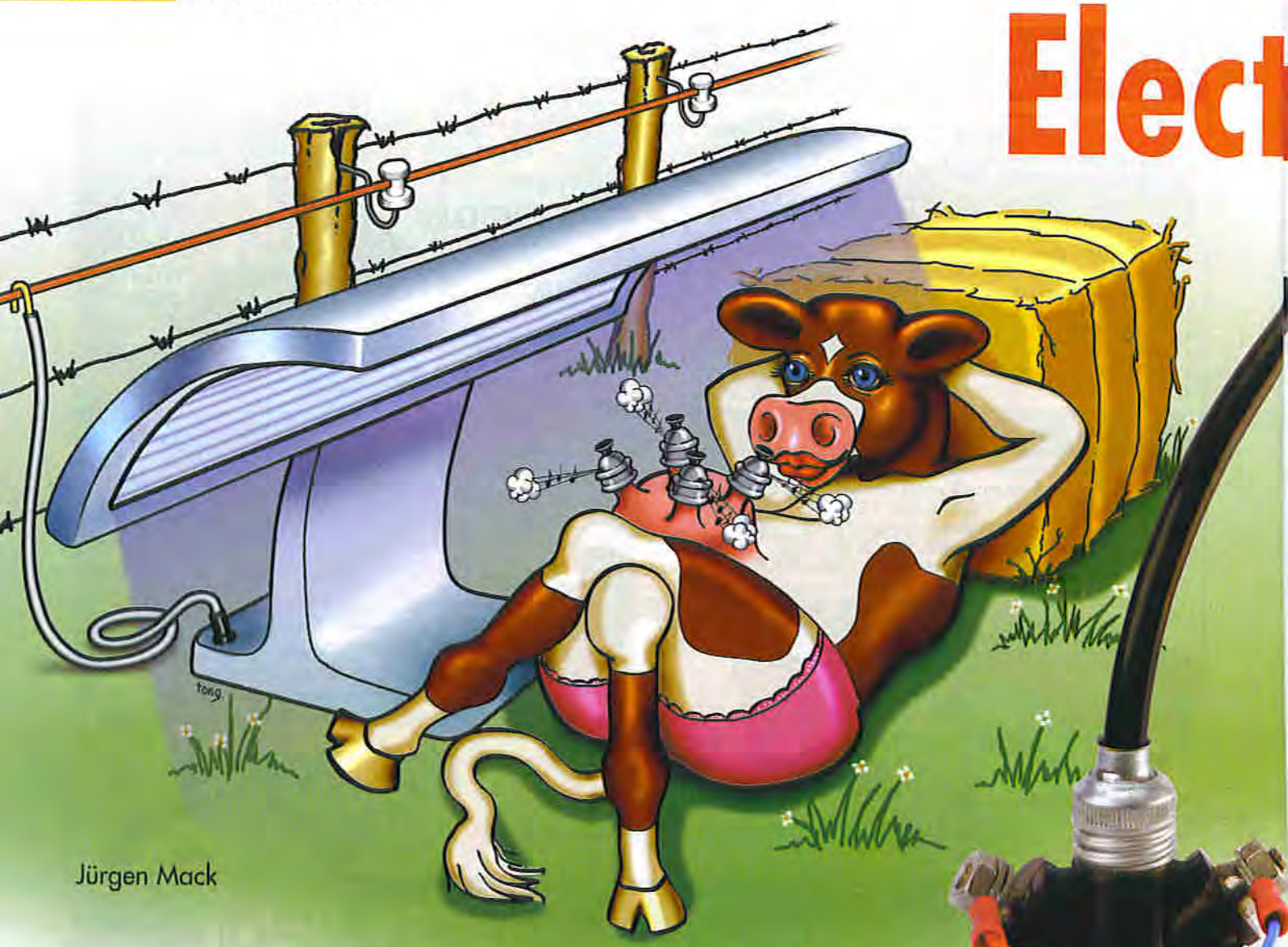
Elect



Jürgen Mack

Jolt capacity for 50 days

Are you bothered by stray cats and dogs prowling and digging in your garden? Or does your own pet require strong persuasion to stay within a restricted area? This electric fence generator may well be the answer to your problems. A simple generator built around a 555 timer and an old ignition coil are sufficient to build a suitable circuit at a small outlay.

ric Fence Energizer

Those of you who have been with us since the mid-1970s may recall the 'disposable' circuits we used to print on the address label used to get the mag to subscribers. One of the more illustrious designs from that dim past was an electrified wire circuit. Now, more than 35 years on, we present its successor — an old idea but using a fresh approach.

Of course, electric fence units can be purchased commercially and these will typically include a water-resistant enclosure. However, honouring 'home construction is more fun' we thought it would be nice to build such a unit ourselves.

A small circuit

As shown by the schematic in **Figure 1**, the circuit proposed here does not require much in the way of components. The one part that may strike you as less usual is the ignition coil. If you find a new coil rather expensive, visit the local car breakers for one salvaged from a vehicle and you'll notice the price difference. The remainder of the components are fairly standard.

The circuit diagram requires very little comment. The circuit is built around the timer IC type 555 (IC1), which is configured here as an oscillator with adjustable pulse/pause ratio.

Since in this case we wish to combine a very short 'on' time with a long 'off' time, two diodes, D2 and D3, are included in the frequency determining network. Using slide switch S1 you can select between three pulse ratios, this is effectively achieved by connecting to different taps in potential divider R1-R5.

The output of the 555 drives a power MOSFET (T1), which in turn connects the ignition coil primary to ground during the pulse 'on' time. This causes a strong voltage surge induced into the secondary, which is connected to the fence wire.

Components D6, C7 and C8 ensure that the timer IC can operate 'on its own' for a short time. This has to do with the fact that an (almost) drained battery may result in the IC being reset, which in turn upsets the pause between the discharge pulses. These would then follow at a too fast rate. To prevent an unwieldy value for C7, we used a CMOS TLC555 instead of the plain vanilla, bipolar NE555.

Finally, a voltage indicator has been added with D1, R7 and D5.

Quick specs

- Discharge energy selectable between 250 mJ, 400 mJ and 450 mJ.
- Low current consumption: 25 mA, 70 mA or 150 mA depending on discharge energy selection.
- Long lasting: 50, 20 or 8 days depending on discharge energy (using a 45 Ah battery and 2/3 discharge).
- 1.5 seconds between pulses (easily adaptable with R5).
- Pulse duration selectable between 16.5 ms, 24 ms and 31 ms.
- Current consumption of control board: max. 1.6 mA.

Further reading

www.foothill.net/~ringram/energzer.htm

Building it

Figure 2 shows the copper track layout and component mounting plan of the PCB designed fore this little circuit. Construction will be mostly plain sailing, although we should mention that

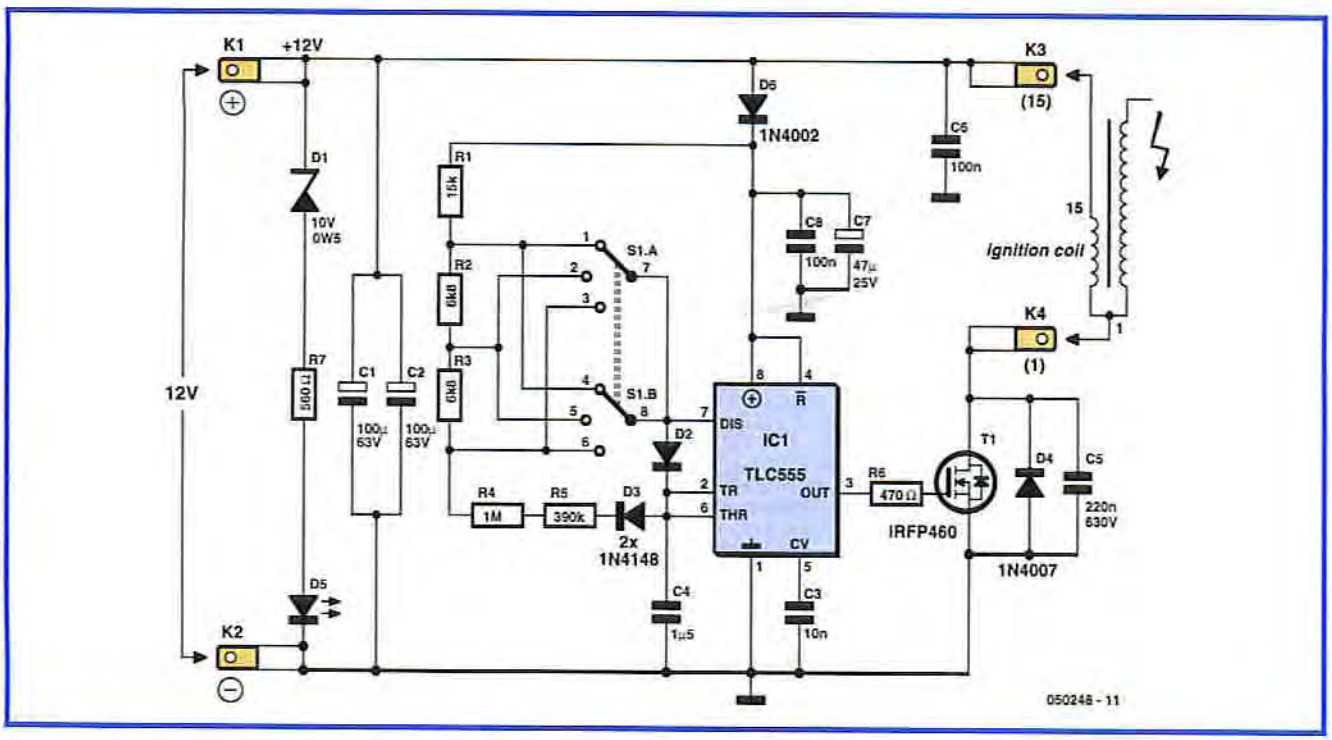


Figure 1. Here a 555 is configured as an astable multivibrator.

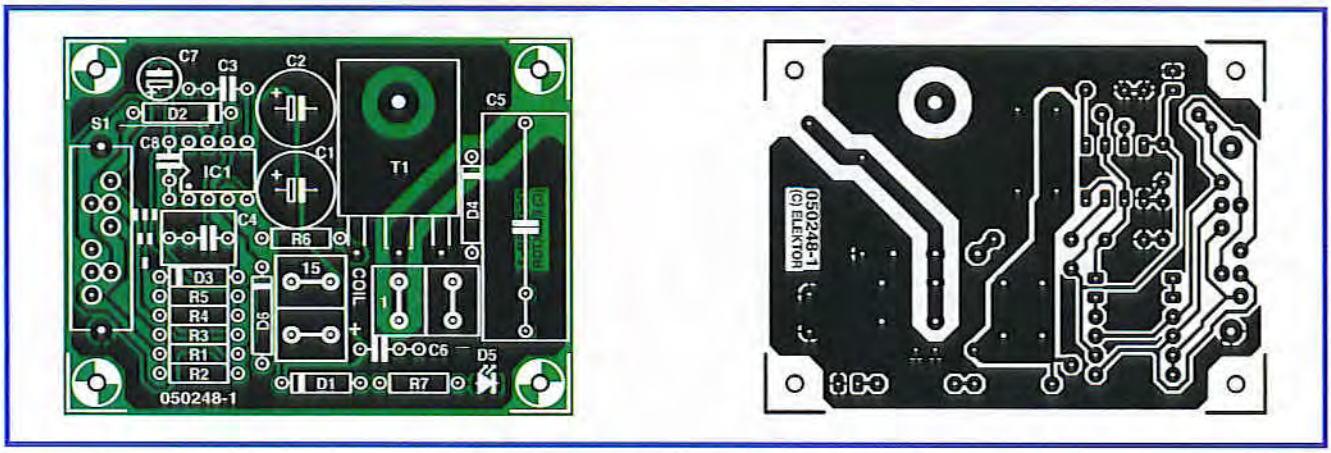


Figure 2. The PCB has remained nicely compact. The coil is much larger!

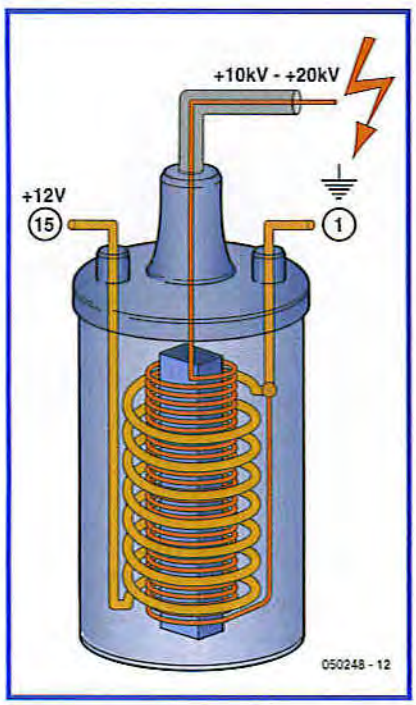


Figure 3. For clarity's sake we have pictured the construction of a vehicle ignition coil. The primary and the secondary share a common ground terminal.

the wire link next to D2 must not be forgotten.

A few remarks should also be given about some of the other components:

For the frequency determining capacitor C4 we used a Siemens MKT type because of its low leakage and longer life expectancy compared with an electrolytic cap. The value of R7 may be changed depending on how brightly you want to see the LED light.

If C5 turns out to 'play hard to get' (locally) then consider using an alternative dimensioning. R1 then becomes 8k2; R2 and R3 4k7 and C5 470 nF / 630 VDC.

A possible alternative to the MOSFET is, for example, the 20N60. Incidentally, the MOSFET is not mounted directly onto the PCB, but at a few mm above the PCB surface using a bolt and two nuts. This mounting method helps the device stay reasonably cool.

If the time between pulses is too long, R5 may be replaced by a wire link.

The ignition coil (**Figure 3**) should preferably be one from an electronic ignition system for 12-V cars. The type we happened to use had a primary resistance of about 0.7 Ω and a self-inductance of 5 mH. To protect the coil against faults in the circuit we strongly recommend using an in-line fuse. After all, if the 555 fails or goes haywire from some reason or other, the ignition coil primary forms a virtual short-circuit on the battery and a very high current will start to flow, eventually causing the coil to be destroyed or, worse, causing a fire.

To increase the reliability of the circuit, it is best to solder the IC directly onto the circuit board, yes that's without a socket. IC socket pins are subject to oxidation in the typical environment the circuit will be used in (outside, in a garden or meadow). For the same reasons of reliability, we're using two paralleled switch contacts instead of just one, reducing the risks of a bad contact disturbing your night rest. If it is desired to operate the switch with the circuit in an enclosure, you may find it useful to mount it at the solder side — just look at the height of C5 and the Fast-on (spade) connectors.

(050248-1)

COMPONENTS LIST

Resistors
R1 = 15kΩ
R2,R3 = 6kΩ8
R4 = 1MΩ
R5 = 390kΩ
R6 = 470Ω
R7 = 560Ω

Capacitors
C1,C2 = 100µF 63V radial
C3 = 10nF
C4 = 1µF5 MKT, lead pitch 5mm or 7.5mm
C5 = 220nF 630V MKT, lead pitch 22.5 or 27.5mm, size 11x30 mm
C6,C8 = 100nF
C7 = 47µF 25V radial

Semiconductors
D1 = zener diode 10V 0.5W
D2,D3 = 1N4148
D4 = 1N4007
D5 = LED, low-current
D6 = 1N4002
T1 = IRFP460PBF (500 V/20 A, TO247AC), e.g., Digi-Key IRFP460PBF-ND
IC1 = TLC555CP (do not use NE555!)

Miscellaneous
K1-K4 = Fast-on (spade) connector, vertical, 2-way PCB mount
S1 = slide switch, PCB mount, 3 x changeover (2 poles, 3 positons), e.g., Conrad Electronics 708097-62
In-line fuse 4A T (slow) with holder
12-V ignition coil (w. length of spark plug cable)
1 wire link (next to D2)
PCB, ref. 050248-1 from The PCBShop