Digitally Programmed Varmint Zapper

Delivers a penetrating yet harmless electric shock to intruding animals

by Fritz Mueller

IF dogs and other small animals wreak havoc with your flowerbeds, or small "varmints" strew the contents of your trash cans over the area, this project is for you.

The Varmint Zapper described here uses a single strand of bare wire to create an "electric" fence. This wire is fed with a sequence of digitally programmed high-voltage pulses to create a penetrating but harmless electrical shock to anything making contact with the bare wire. You can also attach the wire to your garbage can (insulated from ground) or any other metallic enclosure that you want to protect.

Circuit Operation. The operation of the circuit, shown in Fig. 1, is similar to that of the capacitor-discharge ignition systems used in many vehicles.

The 117-volt ac developed across 1:1 isolation transformer *T1* is half-wave rectified by *D3* and charges *C6* via the primary of TV flyback transformer *T2*. The primary should be electrically separated from the high-voltage secondary.

When electronic switch *SCR1*, connected across the *C6-T2* network, is on, it forms a short circuit across the network. Then *C6* rapidly discharges through the transformer primary. The sudden change in current flow produces a high voltage at the secondary of *T2*. In a typical installation, about 15 or 16 kV will be developed. It is this voltage that is applied between the bare wire fence and ground.

The *C6-T2* network forms a resonant circuit. When it bursts into oscillation, the first half cycle of reverse voltage back biases the SCR, thus opening the electronic switch. The positive-going transient is bypassed via *D4*. Capacitor *C5*, damped by the low value of *R9*, attenuates any r-f transients generated by the sudden turn-off of *D4*. Neon lamp *NE1* glows to indicate the presence of the high dc voltage across the *C6-T2* network. Resistor *R10* provides current limiting for *NE1*.

The 10-volt dc required by binary counter *IC1* is developed by dropping resistor *R1*, rectifier *D1*, and filter capacitor C1. It is maintained at 10 volts by zener diode *D5*. Further filtering is added by *R2* and *C2*.

The clock pulses to be counted by *IC1* are developed from the half-wave rectified line voltage from *D2*. Noise is reduced by filter *R3* and *C3* before the pulses are applied to the IC.

The *SCR* is triggered into conduction by the positive-going pulses generated across *R8* each time unijunction transistor *Q2* fires. This occurs when *C4*, charged toward the 10-volt line via *R6*, reaches the UJT trigger level. When *Q1*, connected across *C4*, conducts, the trigger pulses are inhibited. Transistor *Q1* is kept in conduction during each positive half of the supply by bias across *R4*. During the negative half cycles, *Q1* is not biased by *R4*. Binary counter *IC1* is continuously counting line pulses applied to pin 1. Its outputs are connected so that four of its stages provide positive-going pulses through diodes *D6* through *D9* and *R5* to turn *Q1* on and off during the negative half cycles. This results in a rapid sequence of four SCR turn-on pulses followed by a 1.5-second space. The sequence is then repeated.

Each individual shock exceeds about 50 mA for a very short time, and currents of such intensity produce effects best described as "bite" or "sting." What renders the shock harmless without losing effectiveness is timing. Small, nervous animals will be instantly swayed by the first shock. The 2-second program is aimed to impress larger, more stubborn creatures. After the first four shocks, the varmint has time to move away from the unpleasant sensation.

varmint zapper

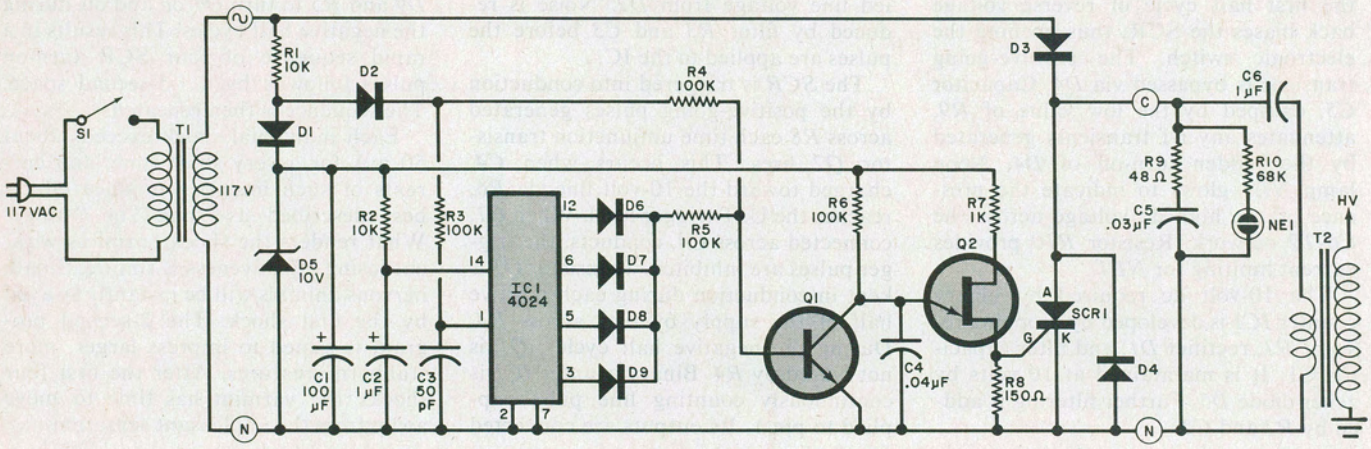


Fig. 1. Digital pulses from IC1 cause SCR1 to discharge C6 through primary of T2 to produce high voltage. Circled letters and symbol refer to foil pattern.

PARTS LIST

C1—100-μF, 10-volt electrolytic
C2—1-μF, 10-volt tantalum
C3—50-pF disc
C4—0.04-μF disc
C5—0.03-μF disc
C6—1-μF, 200-volt paper
D1,D2,D3,D4—200-volt PIV rectifier (1N4001 or similar)
D5—10-volt zener
D6,D7,D8,D9—1N914
IC1—4024 CMOS binary counter
NE1—Neon lamp assembly
Q1—General-purpose npn silicon transistor
Q2—Any UJT
R1—10,000-ohm, ½-watt resistor
R2—10,000-ohm, ¼-watt resistor
R3,R4,R5,R6—100,000-ohm, ¼-watt resistor
R7—1000-ohm, ¼-watt resistor
R8—150-ohm, ¼-watt resistor
R9—48-ohm, ¼-watt resistor
R10—68,000-ohm, ¼-watt resistor
S1—Spst switch
SCR1—200-PIV, 1-ampere SCR
T1—117:117-volt isolation transformer
T2—TV flyback transformer (see text)
Misc.—Suitable enclosure, high-voltage feedthrough, press-on type, bare wire for fence, insulators, mounting hardware.

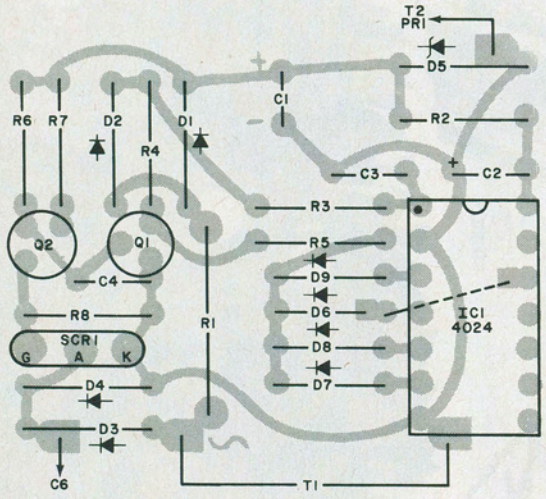
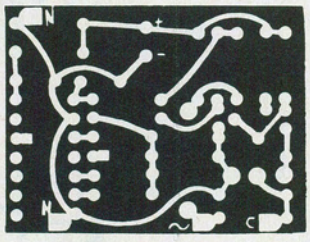


Fig. 2. Actual-size foil pattern for the printed-circuit board is shown below. Component installation diagram at left.



Construction. The circuit can be assembled on a small pc board using the foil pattern shown in Fig. 2. It can also be Wire-Wrapped using conventional techniques. Note that *C5, C6, R9, R10,* the neon lamp, and both transformers are not mounted on the board.

The output transformer, *T2*, can be salvaged from a discarded small-screen TV receiver. You must be able to locate the two primary leads (between 2 and 8 ohms dc resistance), and both sides of the high-voltage winding, one end of which is the CRT anode connecter.

The use of a very high-voltage flyback transformer is not recommended. Corona discharge and possible flashover at the fence insulators may make the system inoperative after a short while. However, you can try using an automotive ignition coil.

Select an enclosure capable of holding the small pc board, the selected flyback transformer, the line isolation transformer and the associated off-board components.

Power switch *S1* and the neon lamp assembly can be mounted on the front side, while the high-voltage lead from *T2* is coupled to a high-voltage feedthrough located on the top of the enclosure. Place a "HIGH VOLTAGE" warning at the feedthrough.

Use. The fence can be formed from a length of bare wire (#17 galvanized steel is recommended) strung between insulators. Plastic rods, or small plastic or glass bottles affixed to wood stakes, can be used as a substitute. Make sure that no part of the bare wire "fence" touches, or comes close to, the actual ground.

To use the fence, connect the bottom end of the *T2* secondary to a good earth ground, then connect the fence to the high-voltage feedthrough. When the power is turned on, the neon lamp should glow indicating the presence of the operating dc voltage across the *C6-T2* network. If the fence is contacted, the neon lamp will blink on and off with each pulse.

The electrified fence can be installed so as to surround the area you want kept free from marauding animals, or, you can connect it directly to an insulated garbage can or other metallic container or enclosure. ◇