SCR ELECTRIC FENCE CHARGER

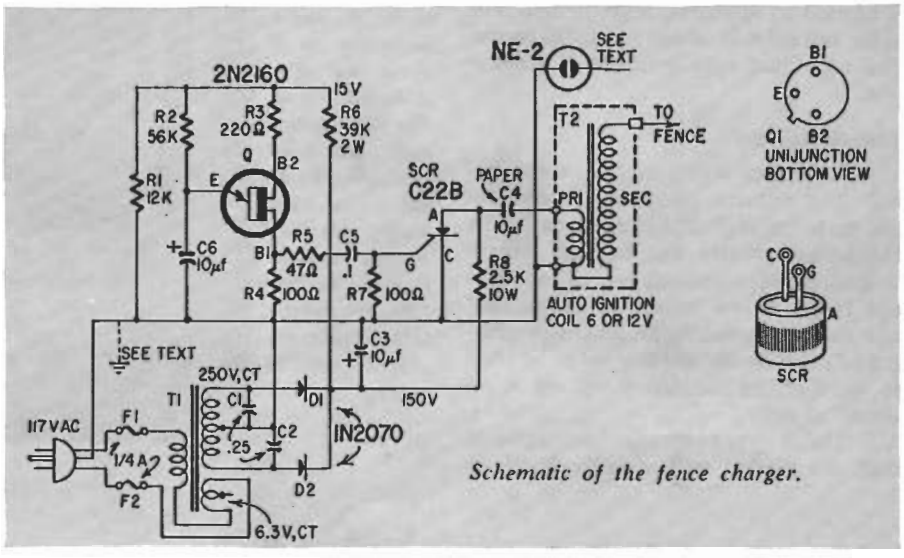
Safe, simple, reliable electric fence charger uses common parts.

By EARL T. HANSEN

AN ELECTRIC FENCE ENERGIZER MUST be effective, dependable, economical and, above all, safe. This unit is. The energy supplied to the fence is a high-voltage pulse from a standard automobile ignition coil. Dependability and long life are assured by all-solid-state design. Cost of parts is less than $15, not including the ignition coil. Working from the ac line is far more economical than battery operation, so it is worth while to extend the fence wire to a sheltered power source.

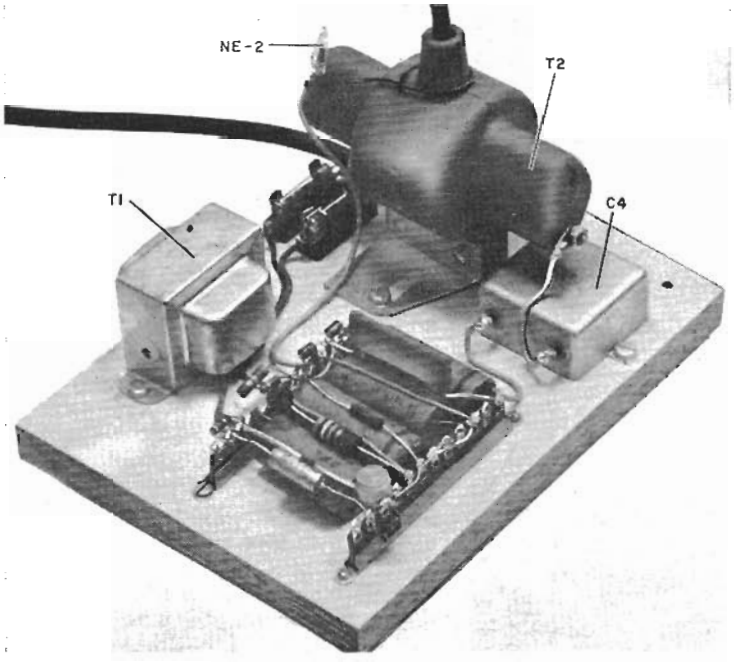
This system is safe for several reasons. The short-duration-pulse principle has been proved safe. Energy is present for only 1 millisecond during each second. This short duty cycle cannot cause a burn of any significance, or cause muscles to "freeze" to the wire. The short-circuit current and total energy are limited to a safe value by the characteristics of the coil and capacitor. Ac line voltage is prevented from reaching the fence in two ways: transformer isolation, and an earth ground on the ignition coil which would blow a fuse in the event of a shorted transformer or wiring error. Failure of one or more components would blow a fuse or stop the unit from working. In no case could a dangerous voltage be present at the output.

Transformer T1 and the associated circuitry form a 150-volt dc power supply. The 6.3-volt ac winding is connected in series-aiding with the primary, to reduce the secondary voltage slightly. C1 and C2 serve a dual purpose. Most important is to protect diodes D1 and D2 from transients which can occur in this type of equipment. The capacitors also reduce the primary current by improving the power factor. This is important if a long ac feed line is used. C4 is charged to 150 volts through R8. The SCR remains cut off and appears as an open circuit to the charge, until triggered on.



Schematic of the fence charger.

C1, C2—0.25 μf, 400 volts
C3, C6—10 μf, 150 volts
C4—10 μf, paper or oil-filled, 150 volts or more
C5—0.1 μf, 100 volts
D1, D2—1N2070, or equivalent 400-volt silicon rectifier
F1, F2—¼-amp slow-blow fuses and holders
NE-2 or equivalent small neon lamp (optional, see text)
Q—2N2160, 2N2646 or equivalent unijunction transistor
R1—12,000 ohms
R2—56,000 ohms
R3—220 ohms
R4, R7—100 ohms
R5—47 ohms
R6—39,000 ohms, 2 watts
R8—2,500 ohms, 10 watts
All resistors ½ watt 20% unless otherwise noted
SCR—G-E C22-B, or equivalent 200-volt silicon controlled rectifier, 3 amp or more
T1—Pri. 117 volts; sec. 250 vct, 25 ma. 6.3 volts, any current (Knight 62 G 008, Stancor PS-8416 or equivalent)
T2—Any good 6- or 12-volt automobile ignition coil
Ac cord and plug, wire, base and miscellaneous hardware

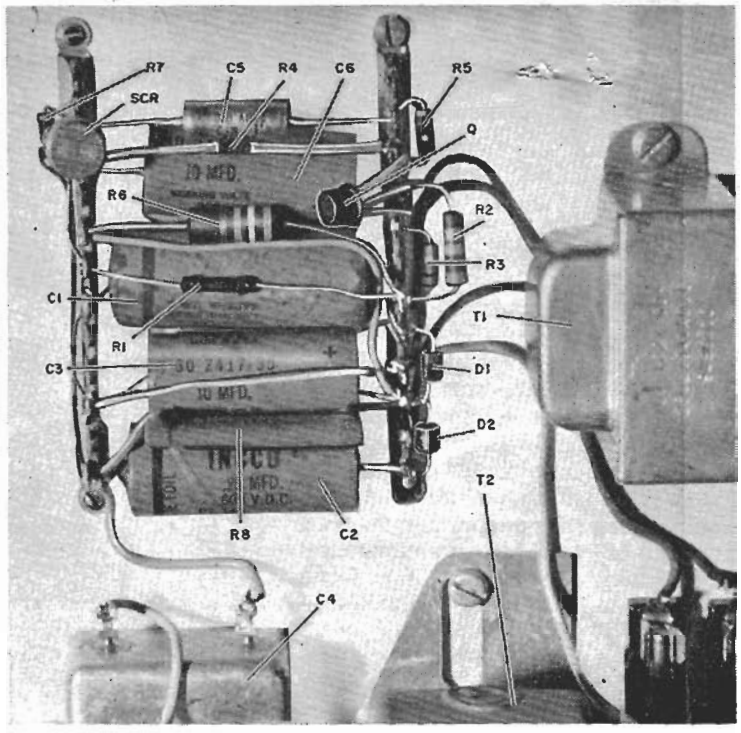


The SCR fence charger. The line cord has 3 wires with 3-prong plug. If your electrical system does not have 3-wire outlets or grounded conduit, be sure to use direct external ground.

Q is a unijunction transistor in a relaxation oscillator circuit. R6 and R1 form a voltage divider to supply 15 volts to the oscillator. C6 charges through R2. When the charge on C6 reaches the breakdown point, Q conducts hard and discharges C6 from emitter to base 1 through R4. The resulting pulse developed across R4 is applied to the SCR gate through R5 and C5. The triggered SCR discharges C4 through the primary of T2.

Since the turns ratio of T2 is approximately 100:1, a 15-kilovolt pulse appears on the secondary (when un-

loaded). The capacitive loading of the fence reduces this to half or less. As a part of the discharge cycle, the resonant characteristics of C4 and T2 cause the anode of the SCR to go negative, turning it off. C5 differentiates the initial pulse from Q. This assures a trigger pulse of shorter duration than the output pulse and allows a clean turnoff of the SCR. The peak short-circuit current is limited to approximately 50 ma. The pulse duration is about ½ millisecond. The repetition rate is about 2 per second.



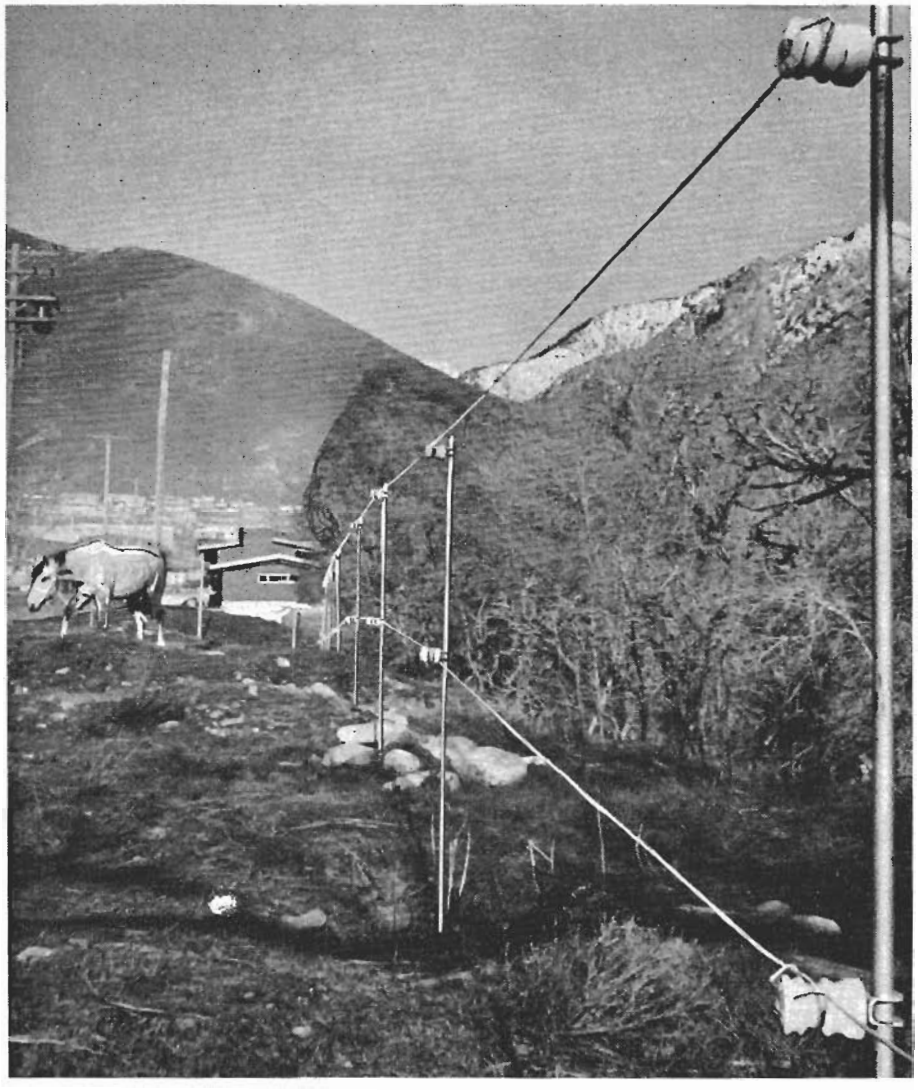
Details of small-parts wiring. Two solder-lug strips support all the pigtail components and provide test-points at every junction. A paper capacitor is a must for C4. A bath-tub unit like that shown may not be readily available. Molded paper tubulars may be paralled to make a satisfactory substitute of the required capacitance.

Construction

A wooden base simplifies construction and reduces cost, and is entirely adequate for sheltered use. None of the component values are critical, except to assure a high enough power and voltage rating. Parts layout is not critical and may be varied as desired. The phasing of the 6.3-volt winding must be tried to see that the secondary voltage is *reduced* slightly.

Three types of standard ignition coils were tried with equally good results. The new high-ratio transistor types were not tried, and are not recommended. The polarity of the primary is not important. However, if the terminal common to both primary and sceondary is known, make it the ground connection.

Simple electric fence keeps horse inside his plot.



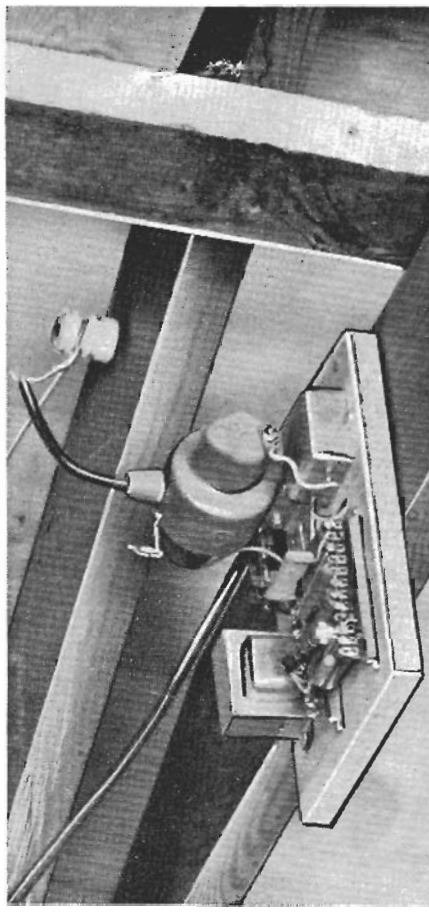
Electrolytic (polarized) capacitors are *not* satisfactory for use as C4; paper or oil-filled types are recommended. (Electrolytics were tried but the SCR would not always turn off after the discharge cycle when the output was shorted to ground.) Values less than 10 μf may be used, with a decrease in output energy.

The anode (case) of the SCR may be connected by clamping, or by soldering if you take care not to overheat it. Heat sinks are not required for either of the semiconductors. The short duty cycle causes no heating.

The neon bulb (NE-2) is an optional visual monitor. Its ungrounded lead is a few inches of wire positioned an inch or two away from T2's secondary output lead. The bulb flashes during normal operation but ceases if the fence becomes grounded.

If a three-prong grounded ac outlet is not available at the planned location of the unit, the internal ground circuit *must* be brought out separately and connected to a *good* earth or waterpipe ground.

When the completed unit is first turned on, it may not operate immediately. It may take a few minutes for C4 to "form" after a period of shelf idleness. During operation there is a slight ticking sound and the unloaded output should produce a ½-inch or longer



Fence charger installed on joist in barn. Insulated high-voltage lead can be seen coming from coil T2; it's soldered to fence wire suspended from knob insulator.

spark. The pulse rate may be increased up to 5 per second by decreasing R2. Faster rates will not allow C4 to charge fully and the output will be reduced.

Using the fence charger

Electric fence materials and practices are standard and will not be discussed here. The unit pictured has been in operation for several months, energizing a quarter mile of fence with no trouble. It controls a frisky horse very well. Operation is not affected by temperature extremes. The system is effective in the wettest weather. The maximum length of fence that can be energized effectively is not known. However, the output energy of this charger is equal to that of the best commercial line-powered units.

Radio and TV interference is negligible and cannot normally be detected 100 feet away on the broadcast-band or higher frequencies. However, there can be noticeable interference if poor fence insulation allows visible or audible sparking to occur. This of course should be repaired. Power consumption is less than 20 watts. Prolonged short circuit of the output will not damage the charger. END