A SIMPLE GEIGER COUNTER

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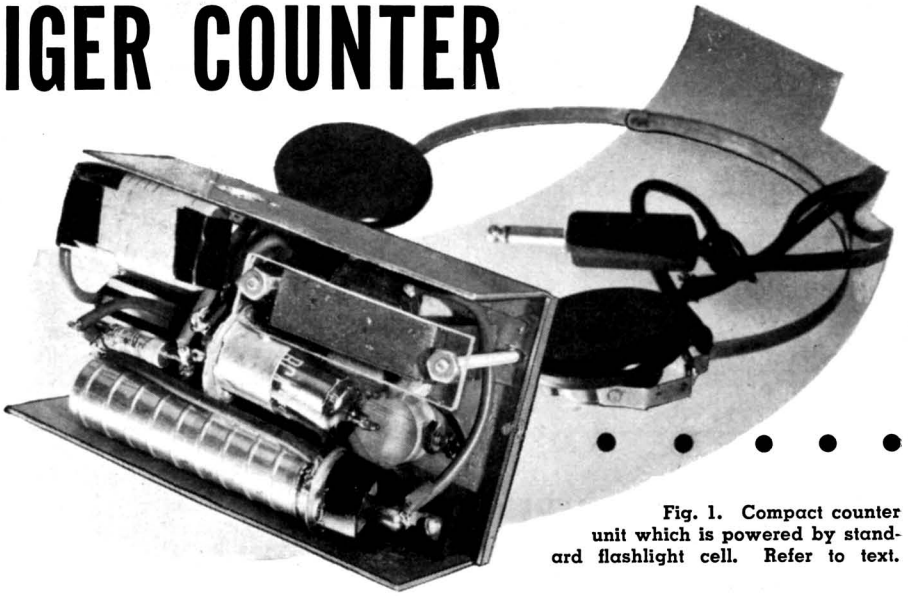


Fig. 1. Compact counter unit which is powered by standard flashlight cell. Refer to text.

A compact and light counter in which a flashlight battery is used in a new circuit to generate 1000 volts for the Geiger tube. A storage system is used to permit operation with very small current drain. Standard parts are used.

OCCASIONALLY one has need of a simple, convenient counter to get a qualitative idea of the presence of radiation. On the other hand, one may be interested in the Geiger counter as a system. This counter may be built inexpensively from parts found in most experimenters' homes. We have used this counter to measure activity in the experimental physics area at the Hansen-High-Energy Physics laboratory (Stanford University) after conducting electron scattering experiments. It has also been an interesting companion on several prospecting trips.

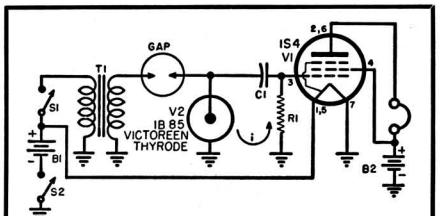
There are several unique features of technical interest (Fig. 2). The high voltage supply uses a minimum of parts. It is built with a *Microswitch* (or equivalent), an ordinary speaker output transformer, an easily-made spark gap, and a 1.5 volt flashlight cell which is also used to heat the amplifier filament. With simple mechanical switching it delivers 700 to 1000 volts for the Geiger tube. The substitution of manpower for expensive batteries is a special convenience if one is using the counter for prospecting.

The spark gap construction is somewhat arbitrary. We found it convenient to cut an inch of lucite from a 1" diameter cylindrical rod. A quarter inch hole in the side allowed room for the gap which was made by tapping in at right angles to the quarter inch hole for two 6/32 bolts. The 6/32 bolts were filed and stoned to pin point sharpness (see Fig. 4). The points are set about .2 mm apart, but this adjustment is not too critical and should be experimented with. The base of the lucite cylinder is tapped for mounting.

To operate, one closes the *Microswitch* 10 or 12 times. The large induced voltage in the secondary of the output transformer breaks down the gap and adds charge to the condenser C_1 at each switching. This gap action is also self rectifying and we thus eliminate a rectifier tube. One listens in the phones for the appearance of counts either from cosmic ray mumesons, or electrons, or the gamma rays from a watch with a luminous dial. The charging process is discontinued before the voltage builds up beyond the Geiger plateau (see Fig. 3). If the tube is over-voltaged, one hears many more than normal counts during the charging. Repeated over-voltage shortens the tube life (approximately 10^9 counts) or damages it. The condenser C_1 is fairly well isolated on the Geiger tube side and the charge in it will now run the counter from 5 to 30 minutes, depending on the quality of components and, somewhat, on the humidity. An occasional push on the *Microswitch* will allow operation to continue. C_1 is a .05 μfd., 600 volt *Sprague* unit; the tube socket is Isolantite. When a particle passes through the counter, a current flows in the direction of the arrow (Fig. 2) and a fairly loud click is heard in the phones.

The counter can be housed in any convenient way, keeping the high voltage circuit well insulated from other parts. It can be built in a very small space if desired (Fig. 1). —30—

Fig. 2. Complete schematic of Geiger counter. It requires few parts and is small.



R_1—10 megohm, ¼ w. res.
C_1—.05 μfd., 600 v. cond.
S_1—Microswitch (or equivalent)
S_2—S.p.s.t. toggle switch
T_1—Universal type output trans. 5000 to 8000 ohm pri. to 4 to 8 ohm sec.
B_1—1½ v. flashlight cell
B_2—22½ v. hearing-aid battery
Gap—See text and Fig. 4
1—Headphone
V_1—1S4 tube
V_2—1B85 thyrode (Victoreen)

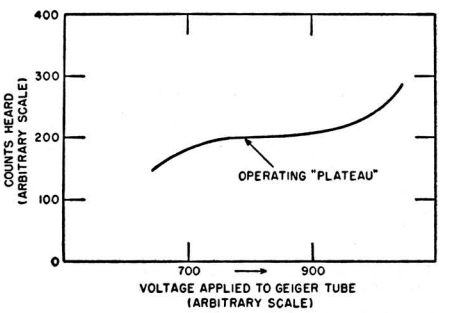


Fig. 3. Geiger tube operational curve.

Fig. 4. Mechanical details of the "gap."