Letters to the Editor

PROMPT publication of brief reports of important discoveries in physics may be secured by addressing them to this department. Closing dates for this department are, for the first issue of the month, the eighteenth of the preceding month, for the second issue, the third of the month. Because of the late closing dates for the section no proof can be shown to authors. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents.

Communications should not in general exceed 600 words in length.

A Directional Geiger Counter

H. G. STEVER
California Institute of Technology, Pasadena, California
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DURING the last half-year in a study of the discharge mechanism of fast or self-quenching Geiger counters a new directional Geiger counter was discovered. Out of this study, among other things, come two facts which explain the operation of the directional Geiger counter. First, the discharge of a counter spreads along the unobstructed wire such that the charge collected on the wire in a given pulse is proportional to the length of the counter. Secondly, a small glass bead on the wire of diameter (approximately) a few times the diameter of the wire is sufficient to stop the spread of this discharge along the wire.

The directional Geiger counter consists of an ordinary Geiger counter with beads of glass on the wire dividing the counter into sections, preferably equal. It is to be understood that the beads do not insulate the sections of wire but are merely put around the single central wire. Also it is to be noted that this is an organic-vapor-filled counter with treatment of the copper wall of the cylinder to give very low photoelectric emission efficiency and high work function. Oxidation by heating the counter with NO_2 gas will give such a surface.

TABLE I. *Triple counts per five minutes.*

WITHOUT γ-RAY BACKGROUND	WITH 20,000 γ-RAY SINGLES
1140	1145
1131	1144
1139	1117
1145	1150
1143	1202
Av 1140 ± 15	1152 ± 15

If an ionizing particle passes through one section of the counter this section by normal counter action furnishes a charge q to the wire, this charge depending on the length of the section. The other sections do not enter into the discharge. If an ionizing particle passes through two sections, then the charge furnished to the wire is $2q$ (for equal length sections) and for three sections $3q$ and so on. Hence for a given wire capacity, C, the voltage pulse is nq/c where n is the number of sections through which the particle passed. From this the directional effect is immediately obvious, for if, in the recording circuit, the first amplifier tube is biased so that it passes on only pulses of certain minimum voltage, n_0q/c, where n_0 is the total number of sections, then only ionizing particles which have passed along the tube through all sections will be recorded. This then is a true Geiger counter telescope.

To show this directional effect an electron source was placed at the end of a two-beaded counter, so that singles, doubles and triples were expected. The voltage pulse from the wire was put on the vertical plates of an oscilloscope and a linear sweep on the horizontal. Figure 1 is a one-minute exposure of the oscilloscope screen showing the three heights of pulses. The individual pulses are not distinguishable since it is a time exposure. It is important to note the sharp dividing line between single, double and triple counts.

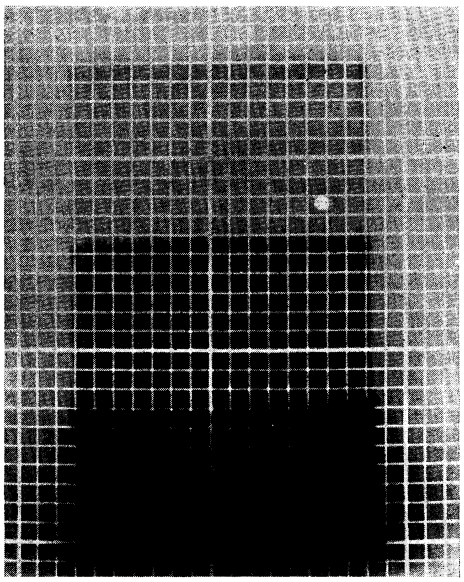

FIG. 1. Time exposure of oscilloscope screen showing singles, doubles and triples.

Table I gives results of a simple experiment to show that this counter may be used to count a directional ionizing ray where there is a large general background radiation with no hindrance from the background. With the electron source at the end of the tube the number of triples was recorded for a five-minute interval. Then on the perpendicular bisector of the axis of the tube a γ-ray source was placed such that the increase in single counts was 20,000 counts per five-minute interval and again the triples were recorded. There were 22 ± 4 triples from the γ-ray source with electron source removed.

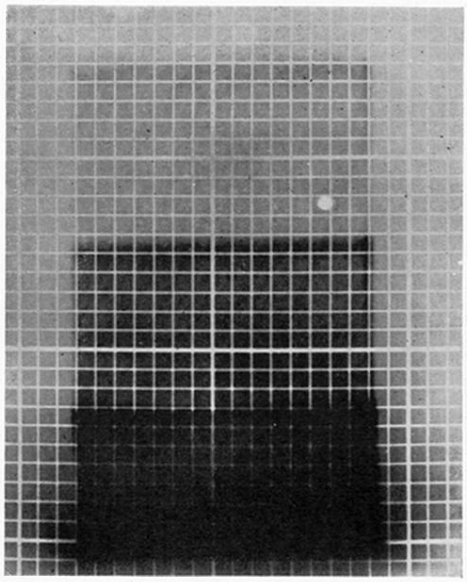

FIG. 1. Time exposure of oscilloscope screen showing singles, doubles and triples.