Modified High Speed Geiger Counter Circuit

Although the speed of the circuit designed by Neher[1] is quite satisfactory, it suffers from the disadvantages of requiring insulation for the cylinder and shielding if two or more Geiger counters are used to count coincidences. Also, the capacity of the cylinder for large counters introduces a longer reaction time. With the circuit to be described the cylinder of the counter is grounded.

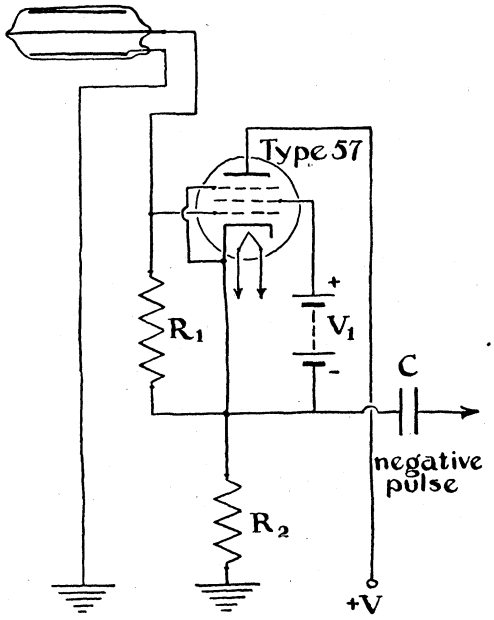

FIG. 1. High speed Geiger counter circuit. $R_1 = 5 \times 10^6$ ohms; $R_2 = 10^6$ ohms; $V_1 = 45$ volts; V = counter threshold $+100$ v; $C = 50$ to $100 \mu\mu f$.

The circuit is shown in Fig. 1. Since there is no bias on the control grid the radio tube is normally in a conducting state. Since the drop in potential across the tube is small, practically the full potential, V, is across the Geiger counter. When an ionizing particle passes through the counter a negative charge flows to the wire and thence to the control grid. The 57 tube then becomes nonconducting and the resistance R_2 pulls the cathode, grid, etc. toward ground potential. Cathode-ray oscillograph figures indicate that in all cases the potential of the cathode drops only to threshold potential or at most only a few volts below. The potential then recovers itself either partially or completely depending upon the time before the beginning of the next pulse. If the threshold of the counter becomes greater than 1500 volts, it is advisable to place a resistance of say 5×10^5 ohms between the high voltage supply and the cathode to by-pass some of the current. This keeps the drop in voltage in the 57 tube from becoming too large, because of the grid current.

The advantages offered by this circuit over the previous one are: (1) The cylinder of the Geiger tube is grounded. (2) High potentials are not applied across the radio tube. (3) No grid bias is necessary. (4) Either a positive or negative pulse may be taken off. (A positive pulse may be obtained from the plate by inserting a resistance of, say, 2×10^5 ohms in the plate lead.) The disadvantages are: (1) An insulated heater supply must be provided. (2) There is a constant drain of about one milliampere on the high voltage supply. If it is desired a self-bias may be used for the screen potential.

Further details will be published in this journal at a later date.

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[1] H. V. Neher and W. W. Harper, Phys. Rev. **49**, 940 (1936).

Multivibrator Geiger Counter Circuit

Recently Getting[1] has described a Geiger counter circuit which may be called a choked multivibrator. Brammer, Miss Hodge and the writer have employed this circuit for more than a year, obtaining the fundamental idea from a paper by Gingrich, Evans and Edgerton.[2] There are several features of its operation which deserve further discussion.

(1) When one is not attempting to secure very high speeds of operation, the constants of the circuit can be varied widely. We have used '32 tubes as well as '57 tubes. We have had no success with the '53 double triode, no doubt because of its large grid current. With either '57 or '32 tubes, plate voltages as low as 135 (with correspondingly low screen grid voltages) are satisfactory.

(2) The circuit shown by Getting is asymmetrical. Referring to his figure, the time constant of the second grid circuit is much lower than that of the first. The constants of our circuits are similar. The advantage is this: when the second tube initiates the return of the circuit to its normal condition after a count, and the output pulse is taken from the plate circuit of the *first* tube, the output capacity can be varied considerably without affecting the total recovery time. This facilitates the use of different recording circuits and mechanisms.

(3) There are two slight modifications which greatly increase the convenience of operation. (a) In practice, when the circuit recovers, the voltage at the plate of the first tube may "overshoot," going below the normal value and finally returning to normal. Unless controlled, this can result in doubling the number of pulses which actuate the recording circuits. The trouble can be cured by merely cutting down the regeneration; a potentiometer replaces the plate resistance of the second tube and the coupling condenser is connected between the first grid and the variable tap of the potentiometer. (b) Similarly, when the output pulse is secured from the plate of the first tube, it can be varied in magnitude by substituting a potentiometer for the plate resistance of that tube.