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.

An Improvement in Geiger-Müller Tube Design

There have been several methods suggested for the construction of Geiger-Müller tubes.[1] The technique yielding the most satisfactory results in this laboratory has been described by Duffendack, Lifschutz and Slawsky.[2] However, tubes constructed in this manner for use with a magnetic spectrograph were not entirely reliable. Their reliability was further impaired by the presence of nearby charged objects. As a negatively charged rod approached the tube a very high counting rate was observed and as the rod receded the counting rate fell below its original value for a short time. With a positively charged rod the opposite effect was observed.

These effects were found to be prominent only in the presence of light. The counters were known to be slightly sensitive to room light normally. Hence it appeared that the increase in counting rate might be due to an increase in the photoelectric emission of electrons from the metallic film deposited on the glass wall during the sputtering of the elements. An analysis of the effect of the charged bodies shows that during the times of increased counting rate the sputtered film was being charged by induction to a potential more negative than its normal average equilibrium potential. To test this hypothesis we constructed a shield consisting of a layer of copper wire wound around the outside walls of the tube and connected to the anode. It was hoped that this would prevent the photoelectrons ejected from the sputtered film and glass walls from reaching the effective counting volume. The tube was then found to be unaffected by any external bodies. It was no longer appreciably sensitive to room light and its background was considerably reduced.

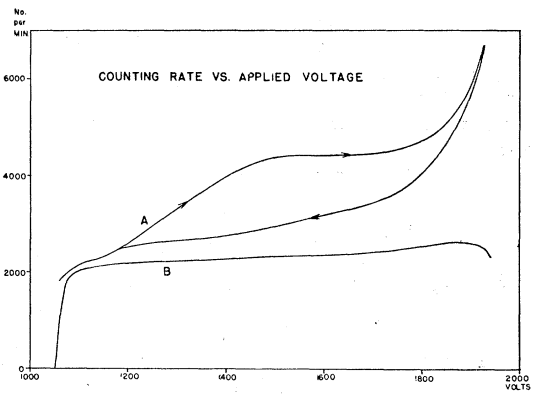

FIG. 1. Counter characteristics with constant source. Curve *A*, unshielded. Curve *B*, shielded.

We had previously noticed that in the determination of the counting rate *vs.* applied voltage the curve obtained in the order of descending voltages invariably was lower than that taken in the reverse order. Measurements were not repeatable because they were dependent upon the voltages that had been previously applied to the counter. Curve *A* of Fig. 1 shows such a behavior. However, with the external copper wire shield at anode potential this same counter showed a long flat plateau, curve *B*, which did not increase rapidly at higher voltages but commenced to decrease at a certain voltage because of an unstable glow discharge within the tube. The plateau was completely stable and repeatable at all times. A similar treatment of five other unsatisfactory counters in every case resulted in a long, flat, stable plateau. This treatment alone does not guarantee good counters for it is still found necessary to clean the tube elements.

A counter having a shield between the cathode and the glass walls was constructed. As the potential on the shield was increased the counting rate with a fixed source decreased asymptotically toward a minimum value until a glow discharge formed around the anode. When the shield was at the potential of the anode, the counting rate had practically reached this minimum value.

In making counters perform in the Neher-Harper circuit it was found satisfactory to connect the external shield directly to the central wire. This, of course, increases the capacity of the tube and hence broadens the pulse. Examination of these pulses, however, shows in most cases a broadening of only fifty percent.

It should be mentioned that in certain circuits the central wire is at ground potential and the cathode at a large negative potential. Counters so arranged in surroundings at ground potential would be shielded in this same manner.

Since this work was carried out it has come to the authors' attention that somewhat similar results have been observed but not reported by G. L. Locher.

This work has been made possible by a grant from the Rackham Trust Fund.

J. L. LAWSON
A. W. TYLER

Department of Physics,
University of Michigan,
Ann Arbor, Michigan,
March 10, 1938.

[1] See for example, L. F. Curtiss, Nat. Bur. Stand. J. Research **4**, 593, 609 (1930), and G. L. Locher, J. Frank. Inst. **216**, 553–558 (1933).
[2] Duffendack, Lifschutz and Slawsky, Phys. Rev. **52**, 1031 (1937).