Oct. 15, 1946. A. S. KESTON 2,409,498

GEIGER-MÜLLER COUNTER

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Fig. 1.

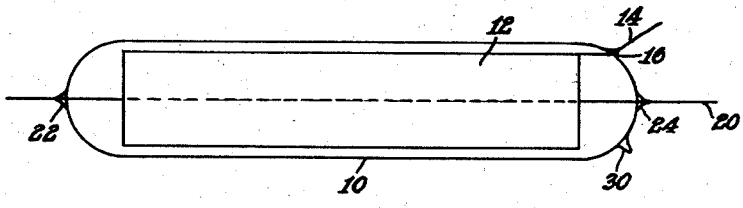
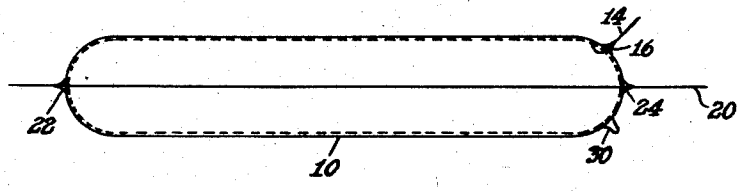


Fig. 2.



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GEIGER-MÜLLER COUNTER

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4 Claims. (Cl. 250—83.6)

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This invention relates to the measurement of radioactive substances, X-rays and other ionizing radiation, and more particularly it relates to a stable self-quenching counter of the Geiger-Müller type.

The tubes of self-quenching Geiger-Müller counters are generally filled with a mixture of gases, such as air and argon, or a mixture of an organic vapor such as alcohol and a permanent gas such as argon. Such counters are generally usable over shorter or longer ranges of voltage.

An object of this invention is to provide a new and improved counter of the Geiger-Müller type.

Another object of this invention is to provide a counter which is easy to make and of long life.

A further object of this invention is to provide a counter which has good resolving power.

A further object of this invention is to provide a counter which is usable over relatively broad ranges of voltage.

A still further object of this invention is to provide a counter which gives no change of count with increased voltage over certain regions.

Other and additional objects will appear hereafter.

The objects of this invention are accomplished, in general, by filling the tube of a Geiger-Müller counter with the vapor of an organo-metallic compound.

The present invention will be more clearly understood by reference to the following detailed description when taken in connection with the accompanying drawing, in which:

Figure 1 is an elevation of one form of Geiger-Müller counter embodying the features of this invention; and

Figure 2 is an elevation of another form of Geiger-Müller counter embodying the features of this invention.

Referring now to the drawing wherein like reference numerals designate like parts, the reference numeral 10 designates a glass tube in which there is disposed a silver cylinder 12. The silver cylinder 12 is suspended by a tungsten wire 14 which is secured in the wall of the tube at 16. A tungsten wire 20 extends through the silver cylinder 12 and is secured in the glass tube at the points 22 and 24. The interior of the glass tube 10 is filled with vapor of tetramethyl lead under a pressure of about 1.8 to 2.0 cm. (mercury).

In an illustrative procedure for making the counter tube above described, the cylinder 12 and the wires 14 and 20 are assembled in the tube 10 as shown in the drawing. The tube is evacuated with a single-stage mercury pump from an opening, designated by the reference numeral 30. After evacuation to the desired pressure, tetramethyl lead vapor is permitted to flow into the tube 10 from a reservoir, the reservoir containing the tetramethyl lead having been previously evacuated without first freezing the compound so that any volatile impurities would be removed. Because of the toxic properties of the tetramethyl lead, a cold trap is inserted between the oil pump and the mercury pump so that none of the vapor will leak out into the room or into the oil pump. After the required quantity of tetramethyl lead is introduced, the opening 30 is sealed.

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In another embodiment of the invention and as shown in Figure 2, the cylinder 12 is omitted and the wall of the tube 10 silvered. In this embodiment, the wire 14 is secured to the silvered wall of the tube 10. The tube 10 is approximately ¾ of an inch in diameter, and the tungsten wire 20 is 4 mills in diameter. A tube of such dimensions is filled with tetramethyl lead to about 1.8 to 2.0 cm. pressure by the same process previously described. This pressure gives good sensitivity and its usable voltage range starts at about 1500 volts.

The usable voltage range for most of the silvered wall counters containing 1.8 to 2.0 cm. pressure is more than 500 volts. The counters of the instant invention, in addition, show ranges of 150 to 250 volts even with moderately fast counts where there is practically no change in count with voltage. Unlike argon-alcohol counters, which show a very steep rise from threshold to plateau, the instant counters require a much larger change in voltage to get from threshold to plateau. The tetramethyl lead counters show their plateaus even after extended use.

Though in the preferred embodiment of the invention tetramethyl lead is preferred, it is understood that the invention is not restricted to such specific metal alkyl. In general, other metal alkyls, such as, for example, dimethyl mercury, can be used. As shown by the periodic system, the metals of the metal alkyls (organometallic compounds) herein disclosed are members of series 9 having an atomic weight of at least 200 and are non-radioactive. Instead of using tetramethyl lead alone, a mixture thereof with an organic vapor, such as ethyl alcohol, may also be used. An illustrative example of such a mixture may comprise 50% (mol) of tetramethyl lead and 50% (mol) of alcohol at a total pressure of 2 cm. Another mixture containing tetramethyl lead, ethyl alcohol and argon also has given good results. An illustrative example of

such mixture comprises 10% of tetramethyl lead, 80% of argon and 10% of alcohol at a total pressure of 10 cm.

In the specific embodiments hereinbefore described, the tubes were filled to a pressure of 1.8 to 2.0 cm. (mercury). The invention is not restricted to such pressure range. In general, satisfactory results are obtained when the pressure is from 0.8 to 2.5 cm. (mercury) or even higher, i. e. higher temperature when the vapor pressure of tetramethyl lead is higher.

In one of the foregoing specific embodiments of the invention, the cylinder 12 was described as being made of silver and the wires 14 and 20 as being made of tungsten. It is to be understood that the invention is not restricted to such specific materials. The cylinder 12 may also be formed of silver-plated metals, gold, gold-plated metals, platinum, etc.; and the wires may be formed of other conducting materials. Similarly, the tube 10, which is preferably made of glass, may be made of any insulating material.

In that embodiment of the invention wherein the cylinder 12 is omitted, the tube 10 may be made of metal or, when made of glass or other insulating material, may be provided with a conducting metallic surface.

It is to be understood that the invention is not restricted to any precise form and construction of counters but is, in general, applicable to all such counters.

The instant invention provides a self-quenching Geiger-Müller counter characterized by high resolving power, long pateaus and good sensitivity, and having wide ranges where the counter is practically independent of the voltage applied to the tube. The counters of the instant invention may be used in the same manner and for the same purposes for which Geiger-Müller counters are used.

Since it is obvious that various changes and modifications may be made in the above description without departing from the nature or spirit thereof, this invention is not restricted thereto except as set forth in the appended claims.

I claim:

1. A Geiger-Müller counter tube filled with a vapor comprising an organo-metallic compound consisting of an alkyl compound of a non-radioactive metal of series 9 of the periodic system and having an atomic weight of at least 200.

2. A Geiger-Müller counter tube filled with a vapor comprising an organo-metallic compound consisting of a methyl compound of a non-radioactive metal of series 9 of the periodic system and having an atomic weight of at least 200.

3. A Geiger-Müller counter tube filled with a vapor comprising tetramethyl lead and under a pressure of from 0.8 to 2.5 cm. (mercury).

4. A Geiger-Müller counter tube filled with a vapor comprising tetramethyl lead and under a pressure of from 1.8 to 2.0 cm. (mercury).

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