

[54] **GLASS ANODE GEIGER-MULLER TUBE** 2,898,496 8/1959 Clark, Sr. 313/93
 [75] **Inventor:** Lawrence P. Tessler, Dayton, Ohio 3,329,854 7/1967 Miwa et al. 313/93
 [73] **Assignee:** The United States of America as 3,483,377 12/1969 Borkowski et al. 313/93 X
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 Air Force, Washington, D.C.

[22] **Filed:** Dec. 11, 1973

[21] **Appl. No.:** 423,858

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[52] **U.S. Cl.** 313/93; 250/374; 313/61 D;
 313/218; 313/311
 [51] **Int. Cl.** H01j 39/04; H01j 39/30
 [58] **Field of Search** 313/61 D, 93, 101, 218,
 313/311, 357; 250/374

[56] **References Cited**

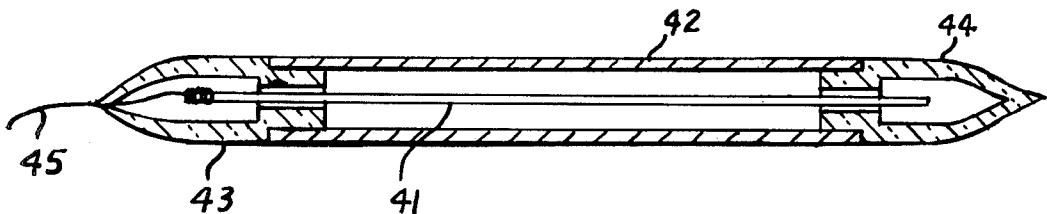
UNITED STATES PATENTS

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[57] **ABSTRACT**

A halogen quenched, Geiger-Muller tube having a glass supported stannic oxide coated tubular glass anode centrally positioned in a cylindrical platinum iridium cathode is disclosed.

5 Claims, 8 Drawing Figures



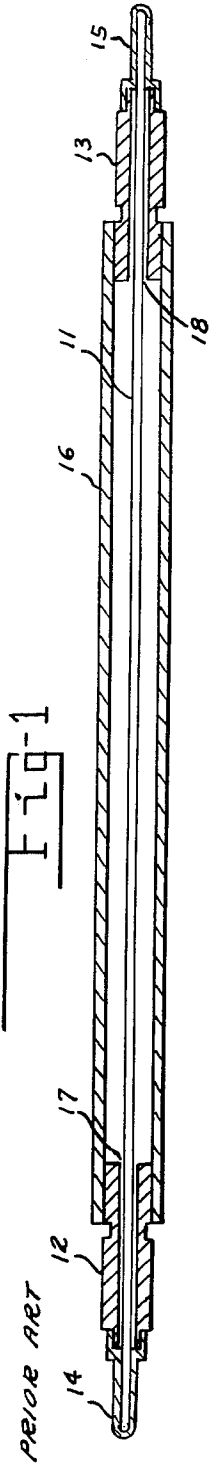


Fig-2

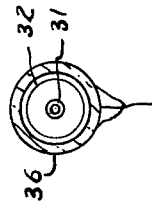


Fig-2

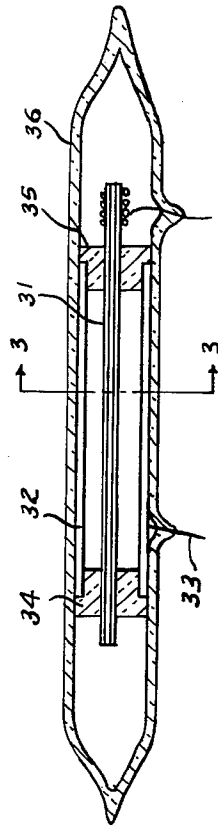


Fig-4

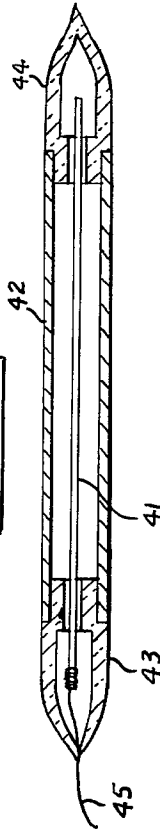


Fig-5



Fig-6

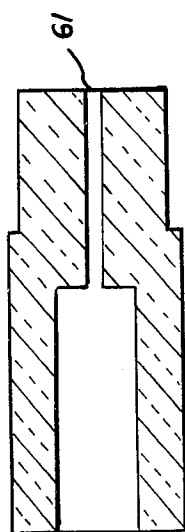


Fig-7

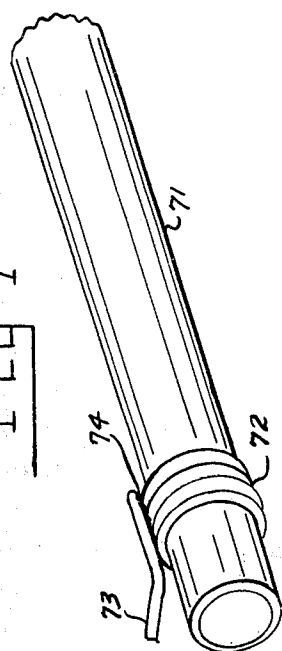
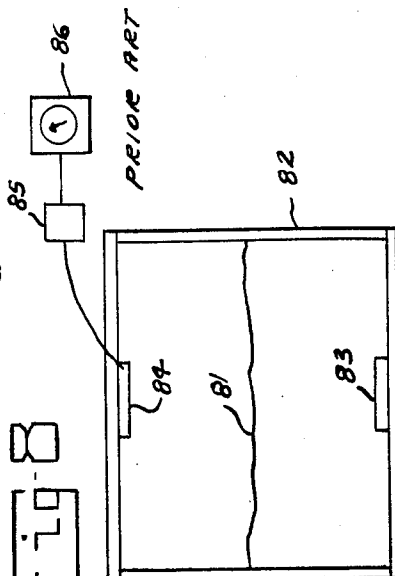


Fig-8



GLASS ANODE GEIGER-MULLER TUBE

RIGHTS OF THE GOVERNMENT

The invention described herein may be manufactured and used by or for the Government of the United States for all governmental purposes without the payment of any royalty.

BACKGROUND OF THE INVENTION

The field of the invention is in the Geiger-Muller tube art.

The prior art Geiger-Muller tubes, when subjected to vibration, have been quite susceptible to failure from fatiguing of the metal anodes. In addition, when halogen quenching gas is used in the tubes the metal anodes are attacked and deteriorated by the halogen gas, particularly when the tubes are in a high temperature environment.

Typical examples of prior art radiation detector tubes (Geiger-Muller tubes) are demonstrated by the following U.S. Pats. and patentees: Nos. 2,481,506, Gamertsfelder; 2,962,615, Anton; 2,974,247, Anton; 3,297,896, Anton; and 3,346,754, Natanagara et al.

SUMMARY OF THE INVENTION

A halogen quenched Geiger-Muller tube constructed with a non-fatiguing SnO_2 coated glass tube anode, a platinum-iridium cathode, a platinum-iridium conductor connecting to the anode, and with glass seals and supports provides an improved Geiger-Muller tube having long life, that is resistant to high temperatures, and strong vibrations.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a pictorial cross-section view of a typical prior art Geiger-Muller tube;

FIG. 2 is a representative pictorial view of a glass envelope embodiment of the invention;

FIG. 3 is a pictorial cross-section of the tube shown in FIG. 2;

FIG. 4 is a representative pictorial view of an embodiment of the invention having a metal envelope;

FIG. 5 is a pictorial view showing one means of making electrical contact with the anode;

FIG. 6 is an enlarged section view of a typical glass end-seal and anode support member;

FIG. 7 is a pictorial view of a welded electrical contact to the anode; and

FIG. 8 is a representative pictorial view of prior art systems applicable to utilizing the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Typical current state of the art Geiger-Muller tube construction is shown in FIG. 1. The stretched solid wire anode 11 is suspended by ceramic insulators 12 and 13 having attached thereto metal electrical terminals 14 and 15. The terminals are fused or otherwise sealed in electrical contact with the anode wire. The metal cathode 16 is formed into a gas-tight seal with the insulators 12 and 13. The tube is partially evacuated and contains a quenching gas as is well known in the art. Electrical contact is made to the metal shell (cathode) 16 and to either one or both terminals 14 and 15. Radiation enters the tube through the cathode shell. When the tube is positioned in a vibrating environment the wire anode 11 is very prone to fatiguing and failure

at points 17 and 18. The relatively short life of the tube is also accelerated by the reaction of the quenching gas on the wire anode. Halogen type quenching gases are generally preferred and they are the most destructive to the wire anode, particularly if the tube is placed in an environment having an elevated temperature.

In the embodiments of the invention shown in FIGS. 2 and 4 the anodes 31 and 41, respectively, are hollow glass tubes having a tin oxide (SnO_2) coating over their entire lengths. The coating of the tin oxide on the surface of the glass tube can be done by any of the well known conventional means. One such suitable means is to heat the tube to approximately 500°C and to pass SnOCl_2 gas over the hot glass tube. U.S. Pat. Nos. 3,647,531 and 3,705,054 both to patentees Matsushita et al disclose suitable coating methods. The SnO_2 has been found to be the preferred electrical conductive coating for the glass anode because it is impervious to attack by halogen quenching gas, the preferred type quenching gas for Geiger-Muller tubes. The glass tube anode is preferably fabricated from pyrex (borosilicate) glass (such as Corning Glass number 7740). Typical, but not critical, dimension of the tin oxide coated glass anode are lengths of 6 inches, 0.030 inch outside diameter with 0.005 inch wall thickness. Alternatively, but generally not as desirable, conductive glass anodes may be constructed by sputtering a coating of 85% Pt, 15% Ir on the glass tube or the anode may be constructed from a capillary tube fabricated from glass which has a high bulk conductivity.

FIG. 5 shows the generally preferred way to make electrical contact to the tin oxide coated anode 51 by winding a few turns of 85% Pt, 15% Ir wire 52 around the tube and tightly twisting the ends together. An alternative and more complicated way is shown in FIG. 7. In this way the tin oxide coated tube 71 has a few turns of 85% Pt, 15% Ir wire 72 wound around the tube over the tin oxide. A sufficient current is passed through the turns of wire, under tension, to fuse the turns together and on cooling to shrink into firm contact with the tin oxide coating. A conductive lead wire 73 also of 85% Pt, 15% Ir is then spot welded to the fused turns.

The internal cathode 32 in the glass envelope embodiment shown in FIG. 2, and the metal envelope cathode 42 in the embodiment shown in FIG. 4 are typically fabricated from a 85% Pt, 15% Ir cylinder having an outside diameter of approximately one-fourth inch, a wall thickness of approximately 0.005 inch, and a length of approximately four inches. This provides an electrically conductive, thin cylindrical shell, that is permeable to radiation. The electrical lead wire 33 that is spot welded to the cathode in the embodiment shown in FIG. 2 is also 85% Pt, 15% Ir wire. A suitable wire diameter for all the electrical leads and the contacting wire to the anodes is 0.005 inch wire.

In the embodiment shown in FIG. 2 the anode 31 and the cathode 32 are supported in the pyrex glass tube 36 by the glass supports 34 and 35. The tube is evacuated, filled and sealed off at either end in the conventional manner. The fit around the internal elements of the tube are loose enough that the evacuation and free flow of gases readily takes place throughout the tube. Alternatively, holes may be placed longitudinally through the glass insulators 34 and 35 to provide for the free flow of gas when the fits between the elements are made so close as to prohibit the flow of gases.

The metal envelope tube as shown in FIG. 4 is generally preferred to the glass envelope tube of FIG. 2. Electrical connection to the cathode and the supporting of the tube is conventionally made by inserting the tube into fuse type spring clips that surround the cathode in the area over the glass end-seals. In this embodiment the glass end pieces 43 and 44 (as shown before sealing in FIG. 6) are inserted in the previously described Pt-Ir tube 42 and conventionally hermetically sealed thereto. The anode 41 with lead wire 45 attached, as in FIG. 5 or FIG. 7 is inserted from the left through both end pieces. The bore 61 through the end pieces is slightly larger in diameter than the diameter of the anode. A 0.031 inch diameter bore for a 0.030 inch diameter anode is typical. Conventional Soda Glass (such as Kimble type R-6) is suitable material from which to fabricate the end pieces. The left end piece 43 of the tube is heated and pinched off to form a seal around the lead wire 45. The right end 44 of the tube is then connected to a conventional vacuum and fill system and the tube filled with a mixture of a conventional inert gas and a halogen quenching gas. Typical conventional gas mixtures are Neon, Argon, and either Bromine or Chlorine. Bromine has been found to be generally preferred to chlorine. After conventionally filling the tube with the gas the right end piece 44 is pinched off in the conventional manner to provide a gas tight seal.

A typical conventional usage of embodiments of this invention is shown in schematic block form in FIG. 8. It is desirable to know the fluid level 81 in container 82. A radioactive source 83 such as "Krypton 85" is placed at the bottom of the container. (It may also cover both the bottom and side walls). An embodiment 84 of a Geiger-Muller tube as taught by this invention is placed

in the conventional manner in the top of the container. Conventional electronic circuits 85 correlate the amount of radiation reaching the tube with the amount of fluid in the container and display the equivalent fluid level reading on indicator 86.

I claim:

1. A radiation detector Geiger-Muller tube comprising:

- a. a cathode of conductive, radiation permeable material in the form of a thin cylindrical shell;
- b. an electrically conductive anode comprising a glass tube;
- c. means for centrally supporting the said anode in the said cathode in insulative relationship;
- d. means for forming an enclosed space between the said cathode and the said anode;
- e. a gaseous mixture including a halogen gas contained in the said space;
- f. means for making electrical contact to the said anode and to the said cathode.

2. The Geiger-Muller tube as claimed in claim 1 wherein the said conductive cathode is fabricated from an alloy of approximately 85 percent platinum and approximately 15% iridium.

3. The Geiger-Muller tube as claimed in claim 2 wherein the said anode is a tin oxide coated borosilicate glass tube.

4. The Geiger-Muller tube as claimed in claim 3 wherein the said means for making electrical contact to the said anode includes a wire conductor of an alloy of approximately 85% platinum and 15% iridium.

5. The Geiger-Muller tube as claimed in claim 4 wherein the said halogen is Bromine.

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