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Crowell

[11] **3,928,768**

[45] **Dec. 23, 1975**

[54] **THERMAL IMAGING TUBE HAVING A PYROELECTRIC TARGET AND ANNULAR POTENTIAL STABILIZING ELECTRODE**

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[52] **U.S. Cl.** ..... **250/333;** 250/213 VT; 250/338; 250/370

[51] **Int. Cl.²** **H01J 31/49**

[58] **Field of Search** ..... 250/330–334, 250/338, 370, 484, 213 VT; 313/390, 380, 387, 388

[56] **References Cited**

UNITED STATES PATENTS

2,900,569	8/1959	Cope	313/39
2,999,177	9/1961	Null et al.	250/332
3,054,917	9/1962	Eberhardt	313/388
3,259,791	7/1966	Jensen et al.	313/387
3,278,783	10/1966	Brissot et al.	250/338
3,774,043	11/1973	Le Carvennec	250/333

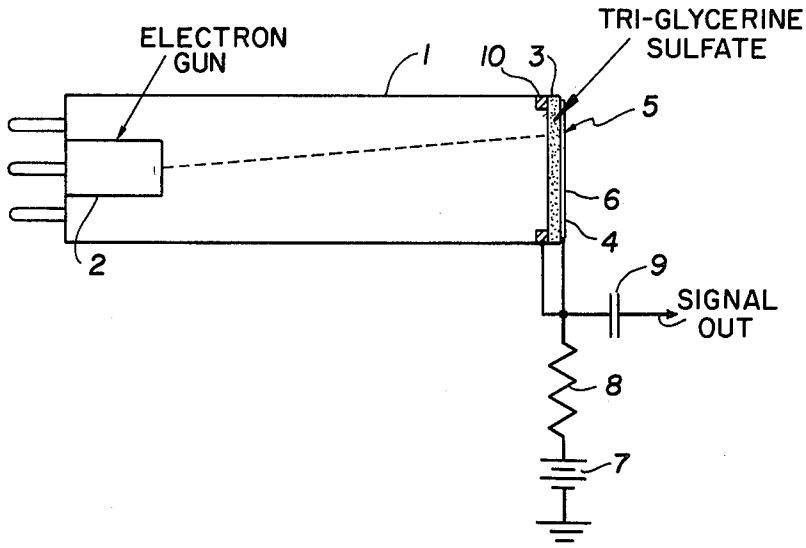
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[57] **ABSTRACT**

A pyroelectric vidicon having an annular metal electrode on the beam side of the target for maintaining the perimeter of the target at a fixed potential.

2 Claims, 3 Drawing Figures



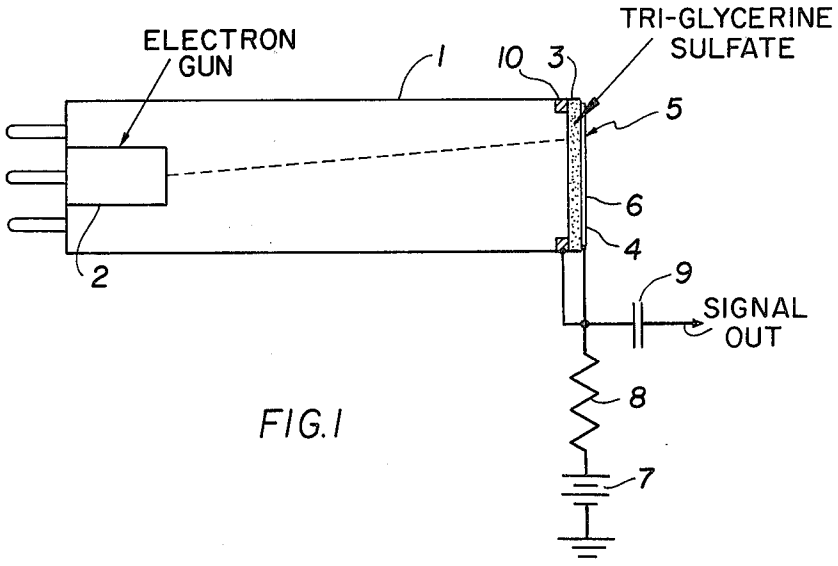


FIG. 1

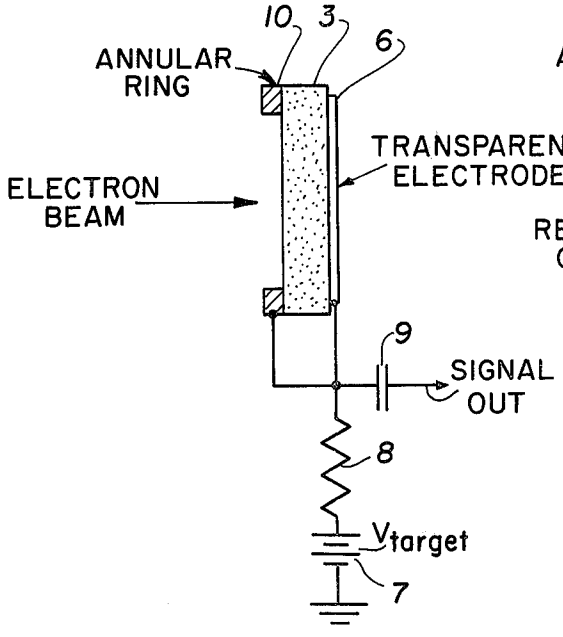


FIG. 2

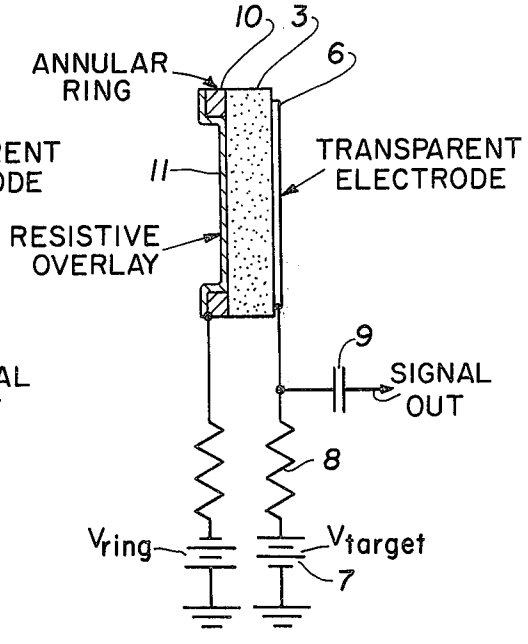


FIG. 3

THERMAL IMAGING TUBE HAVING A PYROELECTRIC TARGET AND ANNULAR POTENTIAL STABILIZING ELECTRODE

The Government has rights in this invention pursuant to Contract No. DAAK02-73-C-0335 awarded by the Department of the Army.

This invention relates to a thermal imaging tube, or a camera tube employing a pyroelectric target.

Such camera tubes have been described in U.S. Pat. No. 3,774,043. One of the problems with such a tube is that the target builds up residual charges which must be removed, for example as described in U.S. Pat. No. 3,812,396.

A further problem that arises in such tubes is that even with the removal of residual charges, the perimeter of the target may charge up in a positive direction, and actually charge up above the first cross-over of the secondary electron emission curve. If this happens, the tube becomes inoperative and steps must be taken to remove the spurious charge in order to make the tube operative again.

Accordingly, it is a principal object of the invention to provide a thermal imaging tube, or camera tube employing a pyroelectric target in which the perimeter of the target is maintained at a fixed voltage in order to avoid positive charge build-up.

A further object of the invention is to provide a camera tube employing a pyroelectric target which is operational without a substantial delay after potentials are applied to make it operational.

These and further objects of the invention will appear as the specification progresses.

According to the invention, an annular evaporated metal electrode is provided on the electron beam side of the target which is connected to a source of fixed potential relative to the cathode of the electron gun.

In one embodiment, this annular electrode is connected to the same potential as the transparent electrode on the other side of the target.

In another embodiment, a resistive layer is evaporated over the entire beam side of the target. With this arrangement, it is possible to poll the target without any beam current by simply applying a voltage drop across the target by connecting the annular ring to ground potential, and the transparent electrode to −10 volts.

More importantly, this circuit can be used to maintain the proper polled state if the beam is turned off for an extended period of time. This mode of operation permits the tube to be operational immediately after it is energized; whereas, if the target has to be polled after the tube is energized, it may take up to five minutes to make the tube operate in a satisfactory manner.

The invention will be described in more detail with reference to the accompanying drawing in which:

FIG. 1 is a diagrammatic view of a tube according to the invention;

FIG. 2 is a sectional view of one embodiment of a target for the tube; and

FIG. 3 is a sectional view of another embodiment of a target for the tube.

In FIG. 1 a conventional camera tube is shown having an evacuated envelope **1**, an electron gun **2** for providing an electron beam which is deflected by deflection means (not shown) to scan a pyroelectric target **3** of tri-glycerine sulfate (TGS) mounted on a transparent end-wall **4** through which heat-radiation **5** from an object (not shown) is incident on the target. A very thin transparent electrode **6**, formed by a thin layer of conductive tin oxide evaporated on the inside surface of the window **5**, is provided between the target and the window.

The transparent electrode is connected to a source of potential **7** through a resistor **8** across which a signal is developed in response to scansion of the target by the electron beam. This signal is coupled to an output by a capacitor **9**.

In order to insure that the perimeter will always be kept at a fixed voltage, and not charge up to, or above the first cross-over of the secondary emission curve and thereby make the tube inoperative an annular metal electrode **10** is provided at the periphery of the target on the beam side. This annular metal electrode is connected to the transparent electrode **6** (see FIG. **2**) so that it will always be at a fixed voltage, i.e. the voltage on the transparent electrode.

FIG. **3** shows another embodiment in which a resistive layer of cadmium telluride (Cd Te) **11** is evaporated over the beam side of the target. With this arrangement, it is possible to poll the target without any beam current by simply applying a voltage drop across the target by connecting the annular ring **10** to ground potential and the transparent electrode to −10 volts. In this mode of operation, the tube is operational immediately after energization.

What is claimed is:

1. A thermal imaging tube comprising an evacuated envelope, an electron gun within said envelope for producing an electron beam, a thermally responsive target of pyroelectric material positioned at one end of said tube to receive said electron beam on one surface thereof and a thermal image on the opposite face thereof for producing a potential image corresponding to said thermal image which can be scanned by said electron beam, an annular conductive member encircling the periphery of said target on the side facing the electron beam, means to apply a potential to said target at which said beam lands on said target, and means to apply a potential to said annular member which is not greater than the potential applied to the target and at which positive electrical charge build-up at the periphery of said target is prevented and said target is capable of being polled from an external source.

2. A thermal imaging tube as claimed in claim **1** in which the surface of said target facing the electron beam is covered with a layer of electrically resistive material.

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