June 3, 1952 B. B. SCHNEIDER 2,599,352

RADIATION DETECTOR

Filed March 8, 1947

Fig. 1.

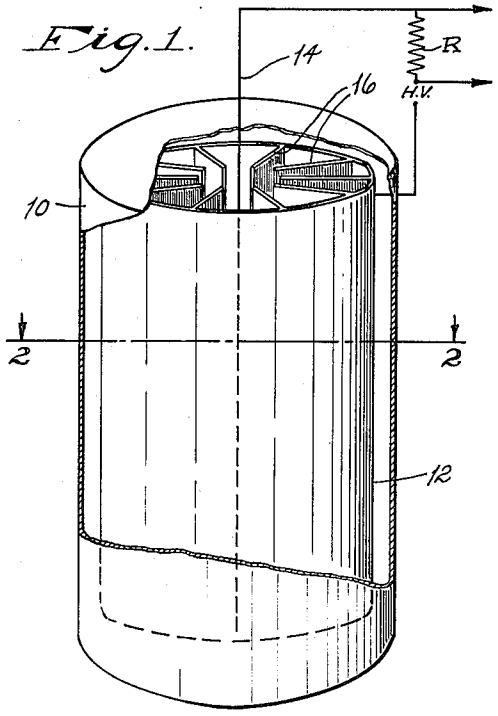


Fig. 2.

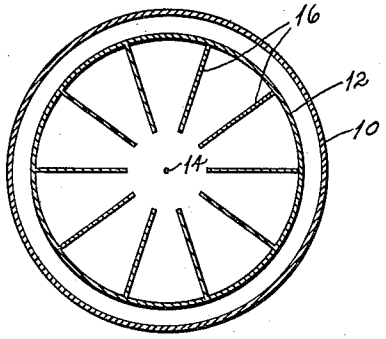


Fig. 3.

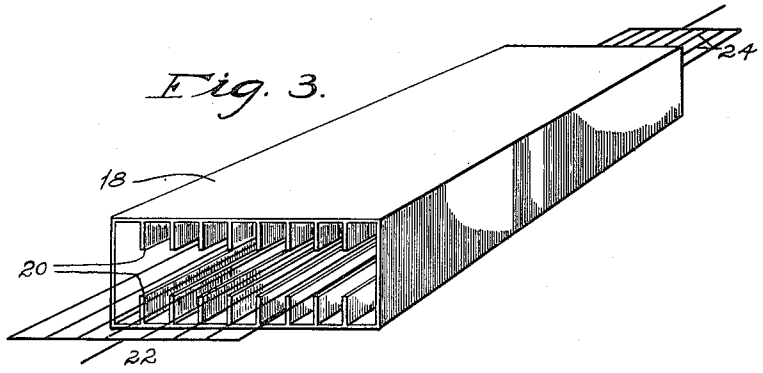
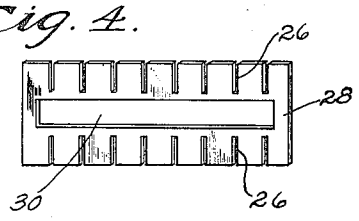


Fig. 4.



INVENTOR.
BENJAMIN B. SCHNEIDER
BY
Daniel Stryker
ATTORNEY

Patented June 3, 1952 2,599,352

UNITED STATES PATENT OFFICE

2,599,352

RADIATION DETECTOR

Benjamin B. Schneider, Chicago, Ill., assignor to Texaco Development Corporation, New York, N. Y., a corporation of Delaware

Application March 8, 1947, Serial No. 733,324

2 Claims. (Cl. 313—93)

1

This invention relates to radiation detectors, more particularly to gamma ray detectors of the counter or pulse-producing type. The principal object of the invention is the provision of a detector of this type which will have considerably greater effective cathode area or surface and thus a higher efficiency than the conventional Geiger-Muller counter.

As is well known, the conventional Geiger-Muller counter consists of a metal tube usually cylindrical in shape constituting the cathode and a thin anode wire disposed along the longitudinal axis of the cathode and insulated therefrom. These electrodes are enclosed in an envelope, commonly a glass tube, containing a gas at a pressure of a few centimeters of mercury. The anode wire is maintained usually at a positive potential with respect to the cathode, this potential being nearly but not quite high enough to cause a discharge to take place. If a gamma ray strikes the cathode member an electron may be ejected from the cathode metal into the gas filling causing ionization of the gas and a discharge of the counter with a current flow of the order of a few microamperes. This causes a large voltage drop across a resistance connected in series with the high voltage supply and the anode and by suitable amplification a mechanical recorder or other device capable of registering the discharges of the counter may be actuated.

In the United States Letters Patent to Hare and Herzog, No. 2,397,073, granted March 19, 1946, a gamma ray counter is disclosed which has a considerably higher efficiency than the conventional Geiger-Muller counter. The counter disclosed in that patent comprises essentially a plurality of thin cathode plates arranged in a bank and disposed in parallel separated relation. Between each adjacent pair of plates and in parallel thereto is disposed a grid of a plurality of fine wires. The plates are connected together electrically to form the cathode of the device and the wire grids may be connected together to form the anode or if desired, the grids may be provided with separate leads so that their output may be separately amplified. It is of course necessary to carefully mount the cathode plates of the Hare-Herzog device so that they will be properly and rigidly spaced. Since the multiple plate cathode disclosed in the aforementioned patent contains a much greater effective surface from which electrons can be ejected than the conventional counter with its cylindrical cathode, assuming the volumes of the two counters are the same, a much higher efficiency can be obtained. The device of the present invention also provides a large effective cathode surface while also permitting the entire cathode to be formed as a unitary rigid structure.

In accordance with one embodiment of the invention the cathode of the counter is formed of a tubular metallic member which may be cylindrical and from the inner surface of which a plurality of thin metallic fins or wings project radially inwardly toward the longitudinal axis of the cylinder. A fine wire comprising the anode is stretched along the longitudinal axis and the width of the cathode fins is such that their inner edges will be parallel to and spaced equidistantly from the anode wire. When a high potential is impressed across the cathode and the anode an electrical field will result between the anode and the inner edges of the cathode fins, this field being uniform throughout the length of the counter.

2

In another embodiment of the invention the cathode is formed of a metallic tube which may be rectangular in cross-section. From the opposite wider inner surfaces of the tube a plurality of fins or wings extend inwardly toward each other and through the space between the inner edges of these fins a grid of a plurality of parallel anode wires is stretched. Because of the rectangular shape of the cathode in this embodiment several of the counter units may be disposed adjacent each other and a large effective cathode surface can then be provided in a minimum of space. Likewise, in the embodiment described in the foregoing paragraph a plurality of the cylindrical units may be disposed in adjacent parallel relation and all of the units mounted within a single casing containing the gas filling.

For a better understanding of the invention, reference may be had to the accompanying drawing in which

Figure 1 is a vertical perspective view, partly in section of a detector comprising one embodiment of the invention,

Figure 2 is a sectional view taken on the line 2—2 of Figure 1,

Figure 3 is a view in perspective of another embodiment and,

Figure 4 is a front view of a spacer element which may be used in the embodiment of Figure 3.

In Figures 1 and 2 of the drawing an envelope or casing 10 is shown as containing a tubular cylindrical member 12 which forms a part of the cathode of the detector. Along the longitudinal axis of the member 12 an anode wire 14 is disposed, this wire being connected to one end of a resistance R. As shown in Figure 1 the high voltage supply is connected between the other end of the resistance R and the cathode cylinder 12 and as stated hereinbefore, the voltage drop across the resistance is amplified and recorded by any suitable means, not shown, to provide an indication of the discharges of the counter.

Extending radially inwardly from the inner surface of the cylinder 12 are a plurality of thin metallic fins or wings 16. The inner edges of

these fins are parallel to and spaced equidistantly from the anode wire 14 and may be attached rigidly, by any suitable means, to the cylinder 12. When the high voltage is impressed across the electrodes an electrical field results between the anode wire 14 and the fins 16. The anode wire 14 is, of course, insulated from the cathode 12 and from the casing 10 if the latter is metallic as by means of any suitable insulating bushings, not shown. The cylinder 12 and the fins 16 may be formed of any suitable metal and it has been found that brass sheet having a thickness of about 16 mils is a suitable material for these elements. It has also been found that a tungsten wire about 3 mils in thickness provides a satisfactory anode. The casing 10 will be filled with a gas or a gaseous mixture, and a mixture of about 97% argon and 3% petroleum ether at a pressure of about 20 inches of mercury has proven satisfactory. Another gas mixture which has been found very satisfactory consists of about 97% argon and 3% anhydrous ammonia.

In the embodiment illustrated in Figure 3 of the drawing the cathode of the detector is formed as a tubular element 18 which may be rectangular in cross-section. Projecting inwardly from opposite inner surfaces of the element 18 are a plurality of metallic fins 20, these fins extending toward each other in pairs and providing a central space also rectangular in shape. Extending through the space between the inner edges of the fins 20 is a grid 22 formed of a plurality, eight in this instance, of anode wires 24, these wires being arranged parallel to each other and each wire being preferably disposed in the plane of and midway between an opposing pair of fins. The fins 20 may be secured rigidly to the inner surfaces of the cathode element 18 or they may be placed in slots 26 formed in spacer elements 28, one of which is illustrated in Figure 4. Each of these spacer elements 28 is formed of electrically insulating material and is provided along the two longer edges with a plurality of the slots 26 in which the cathode fins 20 fit snugly. More or less of the spacer elements may be used depending upon the length of the counter and, in assembling, the fins and the spacer elements may be assembled first and then pushed into the tubular element 18. With this type of construction it will of course be necessary for the fins 20 to be connected together electrically and to the element 18. Each spacer element 28 is also provided with an elongated slot or opening 30 through which the anode wires 24 extend.

It is not necessary that the tubular member 18 be formed as rectangular in cross-section but when in the shape shown in Figure 3 several of these units may be arranged side by side or in any desired manner. When so arranged a large amount of effective cathode surface will be provided in a minimum of space. The detectors of both the embodiments shown in Figures 1 and 3 can be made of any desired length and it has been found that elongated detectors of this type are well suited to the radioactive logging of bore holes and wells.

It is believed that but little further description of the operation is necessary. A gamma ray in striking the cathode walls 12 or 18 or one of the fins 16 or 20 may eject an electron into the gas filling to cause ionization of the gas and thus a discharge of the counter which can be registered

by measuring the voltage drop across the resistance R shown in Figure 1. By providing the fins 16 and 20, the effective cathode area is materially increased while at the same time a good electrical field results between the anode wires and the inner edges of the fins.

Although no casing has been shown for the counter electrodes illustrated in Figure 3 it is understood that these electrodes will either be mounted within a properly shaped casing corresponding to 10 of Figure 1, or that the ends of the tubular cathode element 18 will be closed and sealed so that the cathode tube 18 will itself serve as the casing.

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. A radiation detector comprising a metallic cylindrical cathode member, an anode wire extending along the longitudinal axis of said cathode member, means for impressing an electrical potential across said cathode member and said anode, a plurality of elongated metallic fins disposed parallel to and projecting radially inwardly toward said anode wire from the inner surface of said cathode member, said cathode member having an electrically closed conductive surface extending substantially the length of said fins, the inner edges of said fins being parallel to and spaced equidistantly from said anode wire so that the strength of the electrical field will be the same between the anode wire and the inner edge of each of said fins, and a housing for said members adapted to contain a gaseous filling.

2. A radiation detector comprising a sealed housing containing a gaseous filling, a thin metallic cylindrical member disposed within said housing and forming a cathode member, a plurality of elongated, thin, metallic fins projecting radially inwardly in parallel relation from the inner surface of said cylindrical member, the inner edges of said fins defining an elongated space substantially round in cross section and extending longitudinally through said cathode member, said cathode member having an electrically closed conductive surface extending substantially the length of said fins, an anode wire extending along the longitudinal axis of said elongated space, and means for impressing an electrical potential across said cathode member and said anode wire, the strength of the electrical field resulting between the anode wire and the inner edge of said fins being uniform throughout the length of the cathode member.

BENJAMIN B. SCHNEIDER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,397,073	Hare	Mar. 19, 1946
2,425,533	Herzog	Aug. 12, 1947

OTHER REFERENCES

Review of Scientific Instruments, vol. 4, Dec. 1933, pgs. 676–678.