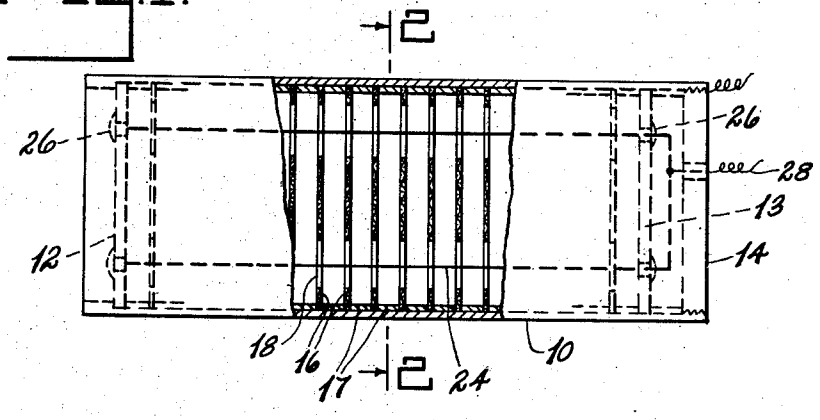
Oct. 13, 1959 G. HERZOG 2,908,839

RADIATION DETECTOR CATHODE

Filed June 15, 1953

Fig. 1.



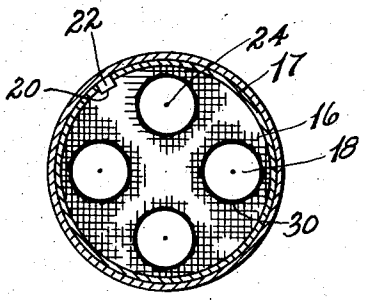


Fig. 2.

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RADIATION DETECTOR CATHODE

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3 Claims. (Cl. 313—93)

This invention relates to the detection of penetrative radiation and, more particularly, to the cathode of a gamma ray detector of the electrical pulse-producing, gas amplification type and a method of making the same. The principal object of the invention is the provision of a cathode for such a detector which is more efficient than those used heretofore.

In U.S. Letters Patent No. 2,397,071, granted March 19, 1946, to D. G. C. Hare, a radiation detector of the electrical pulse-producing or counter type is disclosed, which detector has proven to be many times more efficient in the detection of gamma rays than other counter-type or ionization chamber detectors of the same volume. The detector described in the Hare patent comprises essentially a cathode and an anode disposed within a chamber containing an ionizable gas filling, the cathode being formed of a plurality of spaced, parallel metallic discs or plates arranged in a bank and the bank of plates being provided with one or more series of aligned holes. An anode wire is disposed along the axis of the holes in each series. The plates or discs are connected together electrically to form the cathode, and the anode wires are connected together electrically to form the anode of the detector. The cathode plates or discs described in the patent are formed of a suitable metal such as brass, and each plate is a few mils in thickness. A gamma ray, in penetrating one of the cathode plates, may cause an electron to be ejected from an atom of the cathode material, and this electron may then produce ionization of the gas filling to provide an electrical pulse, as is well understood by those familiar with this art. The probability of an electron being ejected from an atom of the cathode material when the atom is struck by a gamma ray increases, of course, with increasing thickness of the cathode wall, since there are then more atoms in the path of each gamma ray. However, due to the short range of the ejected electrons in the cathode material, a cathode plate should be but a few mils in thickness.

The efficiency of a gamma ray detector of this type will depend upon the amount of effective cathode area exposed to the ionizable gas, and it has been found that the efficiency of a detector can be increased by forming the cathode plates of wire mesh rather than of a solid material, since the total surface area of a wire mesh plate is greater than the area of the two sides of a flat, solid plate of the same diameter. Experiments have shown that wire mesh cathode plates formed of 35 brass wires to the inch, each wire being .006 inch in diameter, when used in a gamma ray detector of the type disclosed in the above-mentioned Hare patent, provide a detector efficiency at least 10 percent greater than where the same number of solid brass plates are used in a counter of the same volume.

As described above, each of the cathode plates is provided with one or more round holes, and the plates are assembled in such a way that the corresponding holes in the plates are in alignment with an anode wire stretched along the axis of each series of holes. Since

a high potential is impressed across the cathode and the anode of the detector, the potential being almost, but not quite high enough to cause sparking between the two electrodes, it is obviously essential that the holes in the cathode plates be accurately aligned and that they be perfectly round with smooth edges or peripheries so that every portion of the periphery of a cathode hole will be equidistant from the axially disposed anode wire.

In accordance with the invention in one embodiment thereof, a mesh plate is tinned with solder at the place or places where the holes are to be formed, the tinned area being slightly larger than the diameter of the hole. The holes are then formed in any suitable manner, as by stamping through the tinned area, and since the solder holds in rigid position the ends of the mesh wires projecting toward the hole the edge or periphery of the hole will be smooth and every portion thereof equidistant from the center of the hole. In a slightly different method the holes can be formed in the mesh plate, as by stamping and the edges of the holes then tinned. If desired, the edges of the holes can subsequently be reamed to insure roundness.

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

Fig. 1 is an elevation partly in section of a radiation detector of the form shown generally in the aforementioned Hare patent; and

Fig. 2 is a sectional view on the line 2—2 of Fig. 1.

Referring to the drawing, a cylindrical shell or case **10** of brass or the like is shown as closed near its ends by means of closeure plates **12** and **13**. A third plate **14** is shown as screwed into the right-hand end of the case **10**. Disposed within the case **10** and arranged in parallel separate relation is a plurality of wire mesh discs or plates **16** separated by spacer rings **17** and each of the plates being shown in this instance as provided with four holes **18**. The periphery of each of the discs **16** is provided with a small indentation **20**, and this indentation and the holes **18** are positioned in the discs so that when they are assembled, the holes in each disc will line up with the holes in the other discs to provide four separate series of holes. To this end the case **10** is provided on its inner surface with a rib **22** extending longitudinally of the case, and this rib cooperates with the disc indentations **20** to align the discs, as has been described. An anode wire **24** of substantially 3 mils in thickness is stretched between insulators **26** in the plates **12** and **13**, and these wires are connected together electrically to a lead **28** and form the anode of the detector. The plates **16** are connected together electrically through the rings **17** and case **10**, and the bank of plates **16** forms the cathode, a connecting lead from which is shown at **29**. Although it is possible to use as the cathode material wire mesh of different sizes, it has been found that mesh formed of 35 brass wires to the inch, each wire being .006 inch in diameter, is satisfactory.

It is well known that where holes are formed in wire mesh, either by punching, drilling or any other form of metal cutting, the ends of the cut wires tend to fray and a counter made in this manner with no further attention given to the edges of the holes would in all probability not function properly. If even one of the wires cut in forming the holes projected as little as a few thousandths of an inch farther toward the anode wire **24** than the other wires, the electrical field would be concentrated at this point and sparking between the projecting wires and the anode would occur.

The above-mentioned difficulty has been overcome by placing a small amount of solder **30** on each mesh disc and tinning an area slightly larger in diameter than the diameter of the hole to be cut. When the four areas

have been tinned in a disc such as is illustrated in the drawing, the disc may be placed in a punch press and the four holes punched out. The solder will hold the projecting ends of the wires in fixed position, and the edge of each hole will be as smooth as though the holes had been cut in a solid sheet of metal.

If desired, the holes can be cut in the mesh plates prior to the tinning operation, and in this case that portion of the mesh immediately surrounding each hole will be tinned in any suitable manner. After the tinning metal has hardened, the holes may be reamed to size, and the finished plate will then be substantially the same as a plate in which the mesh has been tinned prior to the cutting of the holes.

While the drawing illustrates a cathode plate having four holes, it is to be understood that this is by way of illustration only and that each plate of any one detector may have one or several holes. In the large gamma ray counters used in the logging of well bores, the cathode plates are frequently provided with seven holes, whereas in many of the smaller counters each plate has but one hole at its center.

Although the invention has been described particularly with reference to the tinning of the holes in mesh plates used in gamma ray detectors, it is to be understood that the invention is also applicable to other uses and, in fact, wherever it is desired to provide a round hole having a smooth periphery in any sheet of wire mesh.

Although "solder" has been referred to herein, it is to be understood that other metals can be used, which are not of themselves radioactive and which can be melted to form a good bond with the wire mesh. The term "tinning" is intended to cover the use of any such metal.

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

I claim:

1. A cathode for a detector of penetrative radiation comprising a flat sheet of wire mesh provided with at least one round hole through the axis of which an anode wire may be disposed, that portion of the wire mesh immediately surrounding the hole being provided with a solid ring-shaped coating of a soft metal, said soft metal serving to hold rigidly in place the ends of the mesh wires projecting toward the hole.

2. A device as described in claim 1 in which the mesh sheet is disc-shaped and the periphery of the disc is provided with a similar coating of soft metal to stiffen the disc and to maintain in place the outer ends of the mesh wires.

3. In a radiation detecting device comprising a plurality of cathode plates disposed in separated relation and connected together electrically to form a cathode member, each plate being provided with at least one hole and the holes in the plates being disposed in alignment, and an anode member comprising a wire extending through said aligned holes and insulated from said cathode plates, the improvement wherein at least one of said cathode plates comprises a flat sheet of wire mesh provided with at least one round hole through the axis of which said anode wire is disposed and wherein that portion of the wire mesh immediately surrounding the hole is provided with a solid ring-shaped coating of a soft metal, whereby the soft metal serves to hold rigidily in place the ends of the mesh wires projecting toward the hole.

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