Sept. 29, 1953 W. H. McCURDY ET AL 2,654,041

RADIATION COUNTER

Filed June 1, 1950

Fig. 3.

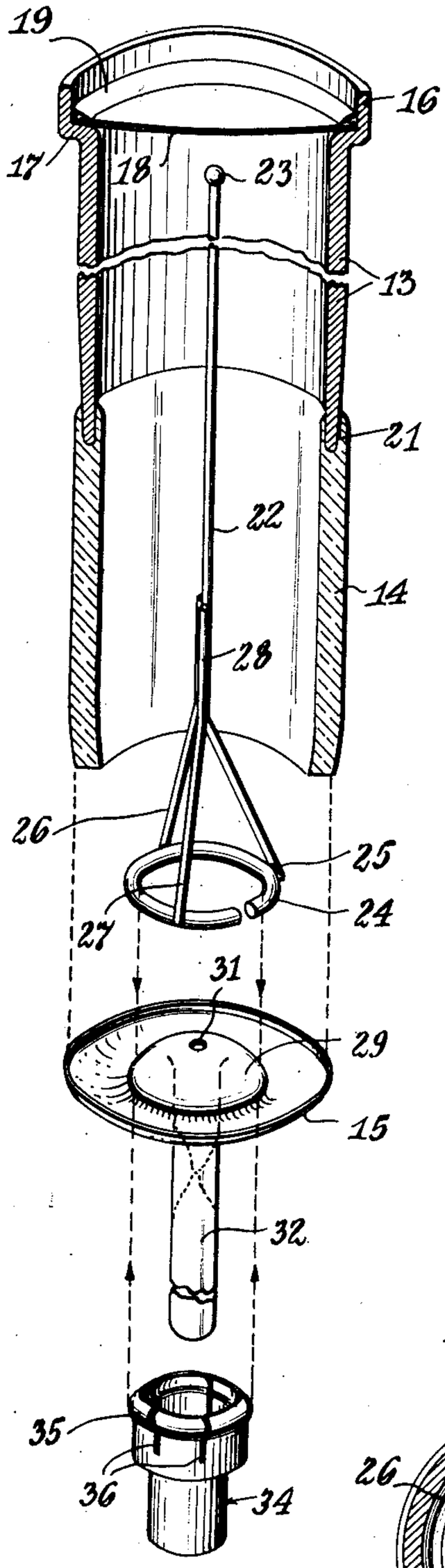



Fig. 1.

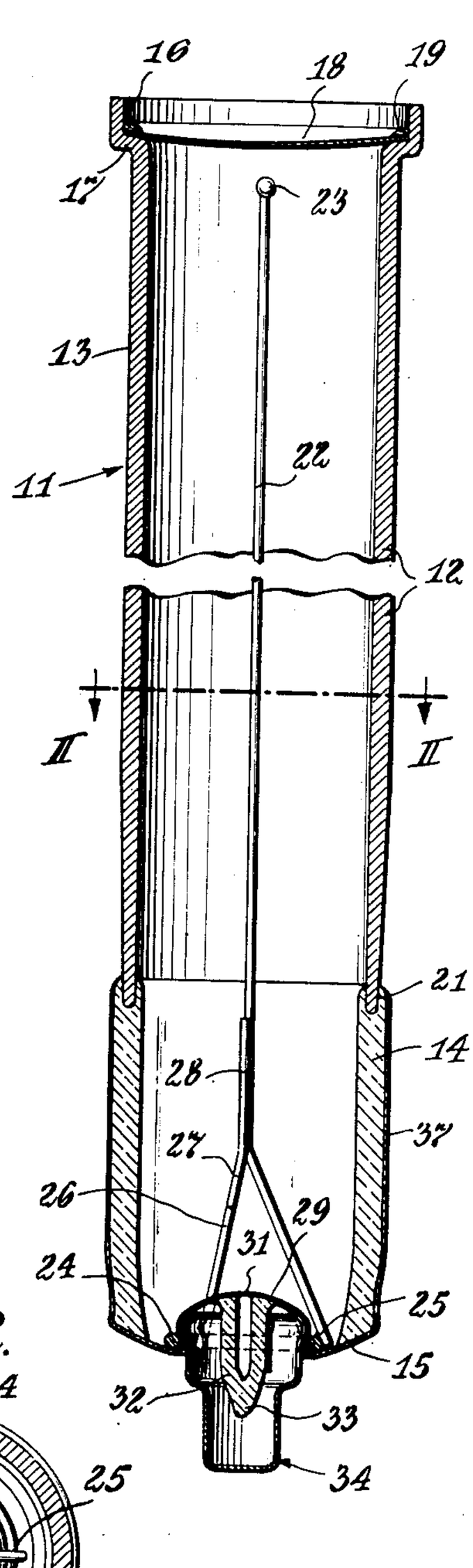
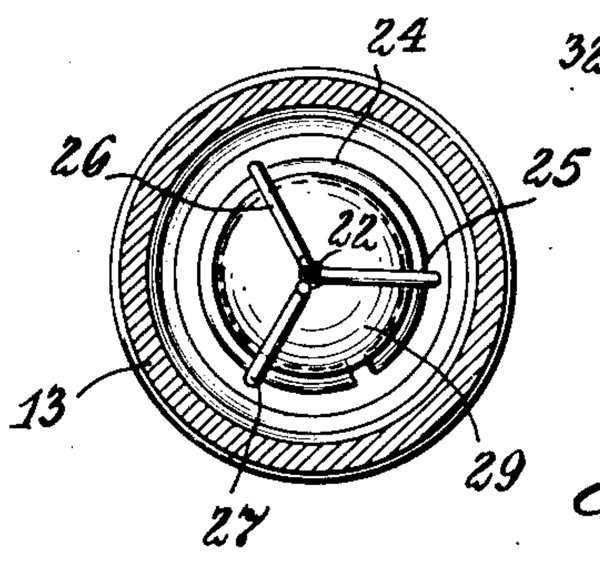



Fig. 2.

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## RADIATION COUNTER

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3 Claims. (Cl. 313—93)

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This invention relates to radiation counters and, more particularly, to those of the Geiger-Mueller type.

The principal object of our invention, generally considered, is to produce simple, cheap and quickly-assembled radiation counters.

Another object of our invention is to provide an improved structure for the anode of a radiation counter comprising a slit chrome-iron ring made so that it snaps onto the interior knob of a standard "lumiline" lamp end cap, two short pieces and one long piece of chrome-iron wire being welded to and extending from said ring, and the free ends of said short pieces being welded to an intermediate portion of the long piece to define a bracing structure for the anode member, like a triangular pyramid projecting axially from the cap.

A further object of our invention is to provide a combination cup for protecting the exhaust tip on a radiation counter and anode connector, said cup being formed to snap into the pocket in the exterior of the cap closing an end of the counter envelope, and having an outstanding prong or tip desirably of a size corresponding with that of a standard ¼" connector cap.

An additional object of our invention is to improve the metallic portion of a radiation counter envelope functioning as the cathode, by expanding one end portion thereof to receive the radiation-permeable window, thereby avoiding the necessity of machining an expanded end portion from heavy walled tubing.

Other objects and advantages will become apparent as the description proceeds.

In the drawing:

Fig. 1 is an axial sectional view, partly broken away, of a radiation counter embodying our invention.

Fig. 2 is a transverse sectional view on the line II—II of Fig. 1, in the direction of the arrows.

Fig. 3 is an exploded view of the counter of Figs. 1 and 2, with portions broken away.

Geiger-Mueller counters as heretofore proposed, have been relatively expensive, particularly in the formation of the anode assembly. For example, such include a chrome iron anode wire, a machined ferrule which is threaded on the inside, also a machined anode connection stud which is made secure in the ferrule by a lock washer. This assembly is lathe-sealed. Before sealing the ferrule is glassed, flared, and finally the assembly is tubulated by hand. This makes the construction costly, as it involves considerable

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mounting and sealing time, as well as expensive machining operations.

It has also been costly to machine the cathode portion of the envelope from heavy walled tubing. The heavy wall was necessary to provide means for sealing the mica window to the body of the cathode.

We propose to purchase thin-walled material and expand the same to provide a ledge in which fits the mica or radiation-permeable window, whereby savings are possible. This flaring or expanding may be accomplished by means of an hydraulic press, a useful machine for the purpose being the Vaille tubing end-forming machine.

Referring to the drawing in detail, like parts being designated by like reference characters, there is illustrated a radiation counter 11 of the Geiger-Mueller type, comprising an envelope 12, a metallic portion 13 of which functions as the cathode, and a vitreous or glass portion 14 of which serves for connection with an end closure member or metallic cap 15.

Instead of forming the metallic portion 12 of thick material and machining an enlarged end, as indicated at 16, it is proposed to make said metallic portion thin and form the end flange 16 by expanding it in a hydraulic press. This flange 16, being of a diameter larger than the body portion 12, results in an annular portion or ledge 17 at the junction, on which rests a mica or other radiation-permeable closure disc 18, the peripheral portion of which is sealed to the flange 16 in a conventional manner, indicated at 19.

The other end portion of the metallic part of the envelope is sealed to the vitreous or glass portion 14 by fusion and embedding, as indicated at 21. The portion 14 is desirably coated exteriorly with a silicone oil or other water-repellant film 37, to prevent surface leakage, after being connected to the anode assembly. The latter is formed as will now be described.

In order to simplify and cheapen the construction, it is proposed to use a closure cap 15 which is identical with that now used as the standard "lumiline" lamp base cap or cup. However, it will be understood that we do not wish to be limited to such construction, as a thin metal member with an interior knob and formed of nickel-cobalt-iron alloy, such as designated "Kovar" by the assignee of the present application, or other metallic material which seals satisfactorily to the glass of the enclosing envelope, may be used.

In a preferred embodiment, however, the anode comprises a relatively long chrome-iron wire 22,

of a length depending on the length of the device being made, and desirably about .03'' in diameter, terminating at its free end in an insulative small ball or knob **23**, and welded to a slit chrome-iron ring **24**, of wire .05'' in diameter, as indicated at **25**. In order to rigidify the connection between the wire **22** and the ring **24**, we preferably employ a pair of relatively short chrome-iron wires **26** and **27**, about 1'' in length, but otherwise like the wire **22**, connected to the ring **24** like the connection between the wire **22** and said ring, but spaced from said wire and each other approximately 120° around the periphery of said ring. All of said wires extend at approximately right angles to the plane of the ring. The free ends of the wires **26** and **27** are then brought toward and welded to an intermediate portion of the wire **22** as indicated at **28**, all of said wires being suitably bent so that the base of the anode member, or where it connects with the ring, is like the outline of a triangular pyramid.

The ring **24** is then snapped over the interior knob **29** on the cap **15**, it being of diameter suitable for that purpose, and securely holds the anode wire **22** in position, axial of the enclosing envelope. The wire of the ring **24** desirably has a radius larger than that of the curvature of the neck of the knob **29** at the place of engagement, so that there are two lines of contact around the periphery, as illustrated in Fig. 1, thereby insuring stability. Said knob, as is illustrated, has an exhaust aperture **31**, and an exhaust tube **32** is fused to the exterior surface of said cap inside of the externally-opening pocket produced by forming the knob **29**.

After providing the anode assembly consisting of the cap, ring, and wire **22** rigidified by the short wires **26** and **27**, the same after inserting the anode wire **22** in the envelope **12**, as illustrated in Fig. 1, is sealed to the free end of the vitreous or glass cylinder **14**, preferably using radio frequency power for heating. It is found that such a seal can be made in approximately 15 seconds. Gas heating is satisfactory.

After exhausting, the envelope is filled with the customary inert gas admixed with a quenching material such as chlorine, alcohol or suitable organic substance. The exhaust tube **32** is sealed off as indicated at **33**, and the stub protected by securing a cup **34** thereover, as indicated most clearly in Fig. 1. This cup may likewise be formed of chrome-iron or other suitable metal, and the periphery is formed with a bead **35** and radial slits **36**, said bead being of such a normal diameter that it will snap into the external pocket formed in the cap **15** and effectively protect the exhaust tip **33**. The end portion of the cup is desirably made the same size as the standard ¼'' connector cap used with devices of this type. The completed counter is usable in a conventional circuit.

Although a preferred embodiment of our invention is disclosed, it will be understood that modifications will be made within the spirit and scope of the appended claims, and that the structure, although specially designed for Geiger tubes, is adapted for other electrical devices having an axially-extending electrode in an elongated envelope.

We claim:

1. In a radiation counter, in combination, a hollow cylindrical thin metal cathode member having one end formed with an outwardly expanded cylindrical flange of a larger diameter than that of, and resulting in an annular ledge at the junction with, the main body of said member, a mica window member engaging said ledge, surrounded by said flange and sealed thereto, a hollow cylindrical insulator member extending from the other end of said cathode member, a metal cap with its peripheral edge sealed to and closing the free end of said insulator member, said cap having a knob-like inner protuberance, and an anode member formed as a rod with its major portion extending axially of said cathode member and carrying a split ring which resiliently engages over said protuberance, said ring being connected directly to an end portion of said rod bent at an angle to the axially extending portion, and rods extending diagonally from points on said ring spaced about 120° from the point of connection of the anode member rod and with their ends respectively connected to said ring and said anode member rod adjacent said bend for bracing the connection to the ring.

2. In a radiation counter, in combination, a tubular envelope comprising a metallic portion in the form of a cylindrical sleeve, a split ring of metal wire about .05'' in diameter, a relatively long wire about .03'' in diameter one end of which is connected thereto at nearly right angles to its plane to function as the anode, a pair of short wires of material corresponding with that of said long wire connected at nearly right angles to said ring, about 120° from said anode wire and each other, the free ends of said short wires being connected to an intermediate portion of said long wire to define a triangular pyramid, terminating in the remainder of said long wire projecting axially from said ring, one end of said sleeve being extended by a hollow vitreous member, a metal end cap closing the free end of said vitreous member, said cap having a hollow knob formed on its interior, said ring resiliently gripping said knob to hold said anode wire in place, an exhaust tube projecting outwardly from the interior surface of said knob which defines an outwardly opening pocket, and a radiation permeable window closing the other end of said envelope.

3. In a radiation counter, in combination, a tubular envelope comprising a metallic portion in the form of a cylindrical sleeve, a split metal ring, a relatively long wire one end of which is connected thereto at nearly right angles to its plane to function as the anode, a pair of short wires connected to nearly right angles to said ring, about 120° from said anode wire and each other, the free ends of said short wires being connected to an intermediate portion of said long wire to define a triangular pyramid, terminating in the remainder of said long wire projecting axially from said ring, one end of said sleeve being extended by a hollow vitreous member, a metal end cap closing the free end of said vitreous member, said cap having a hollow knob formed on its interior, said ring resiliently gripping said knob to hold said anode wire in place, an exhaust tube projecting outwardly from the interior surface of said knob which defines an outwardly opening pocket, a radiation permeable window closing the other end of said envelope, and means covering said exhaust tube comprising a cup member, the periphery of which is formed with a bead and radial slits dividing said bead into segments on the ends of fingers, said bead being of such a normal diameter that it

will snap into such outwardly-opening pocket and resiliently hold said cup in place.

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