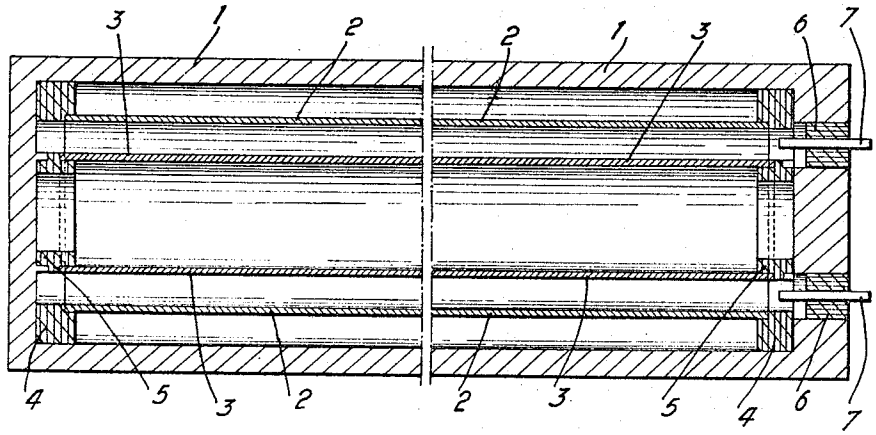
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RADIATION DETECTOR MADE FROM TITANIUM OR ZIRCONIUM

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1

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RADIATION DETECTOR MADE FROM TITANIUM OR ZIRCONIUM

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ABSTRACT OF THE DISCLOSURE

Radiation detectors made from titanium or zirconium and having three coaxial cylindrical metallic members spaced apart by insulator rings at the ends of the members are described herein.

The present invention concerns radiation detectors which are to be submitted to a neutron flux such, for example, as ionization chambers and particularly those employing boron or boron trifluoride.

As metals in the construction of such detectors, there are used at present mainly aluminum and its alloys, magnesium and its alloys, or stainless steels.

Now, the present tendency is to use this type of detector at higher and higher temperatures. The first two materials, aluminum and its alloys and magnesium and its alloys, are unsatisfactory for high temperature use. As for the third, if it can be used at high temperatures, it presents the serious disadvantage of becoming activated when it is submitted to a neutron flux. Moreover, the three materials mentioned present the disadvantage of having linear coefficients of expansion which are very different from those of the insulators commonly used in detectors which presents a problem if it is desired to use detectors at high temperatures.

The present invention has for its objective the provision of novel industrial products which are detectors of the type discussed herein, which do not present the disadvantages caused by the use of metals and alloys listed above and which can be used quite safely at high temperatures.

The detectors according to the invention are distinguished from previously known or suggested detectors by the fact that all or even part of their metallic elements are constructed of titanium or zirconium.

Thanks to the use of these two metals, the metallic elements of the detectors according to the invention present a good mechanical behaviour at high temperatures, contrary to elements derived from magnesium or aluminum. Furthermore, titanium and zirconium, unlike stainless steels, have effective neutron activation and absorption cross-sections which are fairly low. Finally, their coefficient of expansion is fairly close to that of the insulators commonly used in the contemplated devices, this coefficient being 8.5×10^{-6} for titanium and 5×10^{-6} for zirconium whereas it is of the order of 7×10^{-6} for alumina, for example.

It is evidently advantageous to use titanium or zirconium in the construction of all the metallic elements of the detectors according to the invention, for example, the casing, the electrodes, the sealed outlets of ionisation

2

chambers for the detection of neutron fluxes, these chambers being supplied with high tension D.C. or A.C. current. If desired titanium or zirconium may be used for only some of the metallic members, and the more common metals may be used to make the other members, particularly those which are submitted to less severe thermal or atomic conditions.

The working of the metals used in the radiation detectors of the present invention does not present any particular problems. Such metals have been worked with success. Certain well known precautions can be taken; soldering may be carried out in an inert atmosphere; brazing is possible.

An ionization chamber embodying the invention is illustrated by way of example in the appended drawing which shows a longitudinal, sectional view of said chamber.

Said chamber is of the conventional type comprising an outer, cylindrical closed metal casing **1** in which are coaxially arranged two spaced cylindrical electrodes **2** and **3**, supported at each end by two ring members **4** and **5** made of insulating material. Electrode **2** is the so-called high potential electrode and electrode **3** the so-called collecting electrode. In one of the end walls of casing **1** are provided two insulating, gas-tight plugs **6** through which extend tubes **7** adapted for the gas tight passage of electrical connections for conferring to electrode **2** a high potential with respect to collecting electrode **3**.

According to the invention, casing **1** and electrodes **2** and **3** are made of titanium or zirconium.

What we claim is:

1. A radiation detector comprising three spaced apart coaxial cylindrical metallic members, constructed of a Group IV metal from the group consisting of titanium and zirconium, the metallic members comprising an outer cylindrical metal casing having first and second closed ends, and defining in said second end two spaced holes, a first cylindrical electrode having open opposite axial ends concentrically disposed within said casing and spaced radially and axially inward of the casing, and a second cylindrical electrode having open opposite axial ends concentrically disposed within the first electrode and spaced radially inward therefrom; the detector further comprising first and second ceramic insulating ring members disposed within first and second ends of the casing, the ring members having grooved inward faces receiving the electrodes and holding the casing and eelctrodes in spaced coaxial relationship, gas tight insulating plug tightly fitted in holes in the second end of the casing, and electrical conduit means extending through the gas tight insulating plugs.

2. A radiation detector comprising three spaced apart coaxial cylindrical metallic members, constructed of a Group IV metal from the group consisting of titanium and zirconium, the metallic members comprising an outer cylindrical metal casing having first and second closed ends and defining in the second end two spaced holes, the first cylindrical electrode having open opposite axial ends concentrically disposed within said casing and spaced radially and axially therefrom, and a second cylindrical electrode having open opposite axial ends concentrically disposed within the first electrode and spaced radially inward therefrom; the detector further comprising first and second ceramic outer insulating ring members disposed within first and second ends of the casing and posi-

tioned between the ends of the casing and the first electrode, thereby supporting and spacing the first electrode from the casing, first and second inner ring members disposed within first and second ends of the casing and positioned between first and second electrodes and the ends of the casing, thereby supporting and spacing the second electrode from the first electrode and from the casing, the ceramic insulating ring members having a coefficient of expansion similar to the metallic members, gas tight insulating plugs disposed within openings in the second end of the casing, and electrical conduit means extending through the gas tight insulating plugs.

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