May 12, 1953 C. J. BORKOWSKI 2,638,560

IMPROVED WINDOW FOR ALPHA PARTICLE COUNTERS

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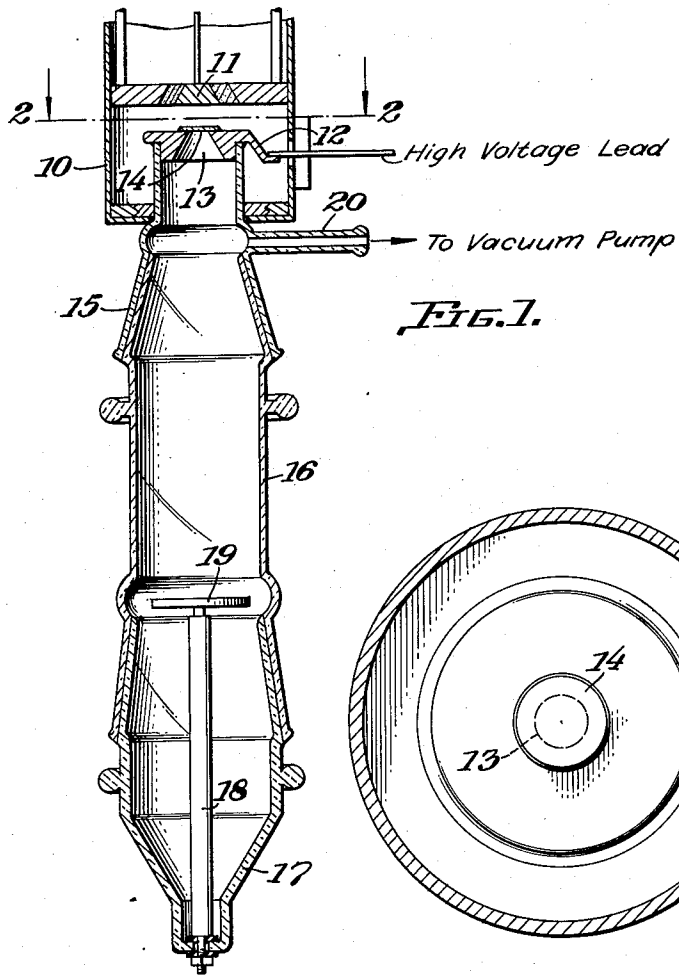


FIG. 1.

FIG. 2.

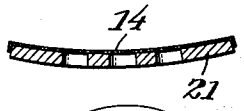


FIG. 4.

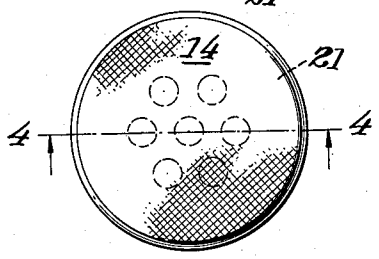


FIG. 3.

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IMPROVED WINDOW FOR ALPHA PARTICLE COUNTERS

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5 Claims. (Cl. 313—93)

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The present invention relates to radioactivity responsive devices and particularly to such devices for accurately counting alpha particle emitters wherein a window material transparent to alpha particles separates an ionization chamber and the alpha emitter.

For accurate counting of very active alpha particle emitters it has been found desirable to provide a counting chamber having a low geometry so that the actual counting rate is low enough to permit resolution of individual counts. In such counters it is convenient to achieve low geometry by positioning the sample relatively remote from the counter window so that the window subtends a very small solid angle at the sample. Under these circumstances and due to the short range of alpha particles in air it is necessary to provide for a low pressure hereinafter called vacuum, for the path between the sample and the window. Thus, the window should have practically no absorption for alpha particles and at the same time be able to withstand the substantial pressure difference between the vacuum and the gas in the counter chamber. Other types of counters also demand the same general qualities for windows.

The primary object of the present invention is to provide a counter having a window which is not only substantially transparent to alpha and soft beta particles but also robust enough to withstand substantial pressure differentials.

Another object of the invention is the provision of a window material for counters which is easy to prepare and is flexible enough for convenient handling and application.

Another object of the invention is the provision of a method for preparing the window material of the invention.

Other objects and advantages of the invention will become apparent from the following description when read in connection with the accompanying drawing in which the invention is illustrated as embodied in a low geometry type of alpha counter.

In the drawing Fig. 1 is a side elevation in section of a counter incorporating the invention, Fig. 2 is a section along line 2—2 in Fig. 1, and Figs. 3 and 4 are, respectively, a plan and a sectional elevation of a modified window assembly of the invention.

As shown in Fig. 1 an ionization chamber 10 which may be at atmospheric pressure is provided with an insulated collecting electrode 11 and a high voltage electrode 12 including a perforation 13 constituting an entrance window for

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alpha particles into the chamber 10. In order that a pressure difference may be maintained on opposite sides of the window in member 13, the window is covered with a film 14 of a material impervious to gas but which is transparent to alpha particles.

The high voltage electrode 12 is supported by a hollow glass member 15 having at its lower end a standard taper to form a joint with an interchangeable glass extension tube 16. The tube 16 receives a cup-shaped member 17 provided with a pedestal 18 supporting a sample holder 19.

It is thus seen that a sample to be counted if placed on the sample holder 19 is remote from the window film 14 to provide a long path for alpha particles emitted by the sample. Absorption along this path is substantially eliminated by removing gas molecules therefrom through a tube 20 to a vacuum pump, not shown.

In accordance with the invention the window film 14 is a nylon foil which has been stretched in all directions to increase its tensile strength, to reduce its thickness and to decrease its cold flow properties; so stretching the film radially outward in all directions effects orientation in the nylon film. I have found that an ordinary nylon (i. e., specifically, a polymeric condensation product of hexamethylenediamine and adipic acid) film of from five to eight milligrams per square centimeter can be reduced to a thickness of about one milligram per square centimeter by stretching it radially in all directions and that the resulting film has the tensile strength to withstand the pressure in chambers such as described above. Such a film has practically no absorptivity for alpha particles and soft beta rays and in addition possesses the admirable quality of flexibility which facilitates its handling and application.

It is to be understood that in the claims the term alpha particle is to include within its scope soft beta rays.

As shown in greater detail in Figs. 3 and 4 wherein a modified window structure 21 is shown, the window film 14 is cemented to the surface of the perforated disk 21 and if desired may be turned over the edges of the disk 21. It will be noted that the disk 21 is provided with seven perforations to increase the window area without increasing the unit area of the film 14 which is unsupported.

It will be understood that the particular counter described in detail was chosen for the purpose of explaining a representative embodiment of the invention and that other well known

counters may with advantage incorporate the invention.

I claim:

1. In an alpha-particle-responsive radiation-sensitive device, an improved window for serving as an ingress for entering alpha particles, which comprises a nylon film, substantialy distended, in its plane, outwardly in all radial directions with respect to the approximate geometric center of said window.

2. In an alpha-particle-responsive radiation-sensitive device, an improved window for serving as an ingress for entering alpha particles, which comprises a film of nylon comprising essentially a polymeric condensation product of hexamethylenediamine and adipic acid, said film being substantially distended, in its plane, outwardly in all radial directions with respect to the approximate geometric center of said window.

3. In an alpha-particle-responsive radiation-sensitive device, an improved window for serving as an ingress for entering alpha particles and adapted to withstand a substantial pressure differential, which comprises a film of nylon comprising essentially a polymeric condensation product of hexamethylenediamine and adipic acid, said film being substantially distended, in its plane, outwardly in all radial directions with respect to the approximate geometric center of said window.

4. In an alpha-particle-responsive radiation-sensitive device, an improved window of surface density of substantially one milligram per square centimeter for serving as an ingress for entering alpha particles and adapted to withstand a substantial pressure differential, which comprises a film of nylon comprising essentially a polymeric condensation product of hexamethylenediamine and adipic acid, said film being substantially distended, in its plane, outwardly in all radial directions with respect to the approximate geometric center of said window, from an original undistended condition of surface density substantially within the range of from 5 to 8 milligrams per square centimeter.

5. An alpha particle counter comprising an ionization chamber, a window in the chamber for admitting alpha particles and adapted to be subjected to a substantial pressure differential, said window comprising a thin film of nylon comprising essentially a polymeric condensation product of hexamethylenediamine and adipic acid, said film being substantially distended, in its plane, outwardly in all radial directions with respect to the approximately geometric center of said window.

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