

[54] **METHOD OF MANUFACTURE OF NUCLEAR RADIATION SOURCES**

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[58] Field of Search 117/107.2 R, 106 A, 106 R, 117/220, 69; 176/82

[56]

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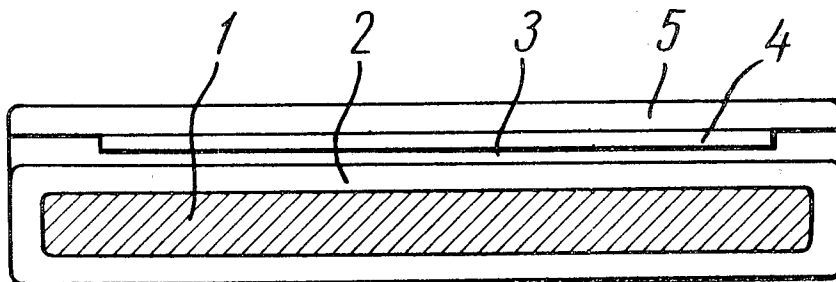
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ABSTRACT

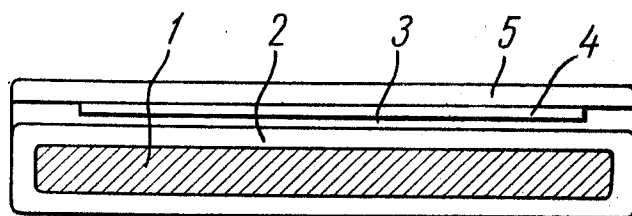
A method of manufacturing a radioactive source comprising applying a radioactive material onto a substrate, then heating the radioactive material and the substrate to form a radioactive layer applied to the substrate. In order to apply a metal oxide sealing layer onto the radioactive layer, the radioactive layer is heated and a film of a chloride of titanium, tin, zirconium, aluminum or chromium is applied onto the heated radioactive layer and the chloride metal film is hydrolyzed to form the oxide sealing layer.

5 Claims, 1 Drawing Figure



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METHOD OF MANUFACTURE OF NUCLEAR RADIATION SOURCES

CROSS-RELATED APPLICATION

This Application is a division of copending Application Ser. No. 765,274 filed Oct. 2, 1968 and now abandoned.

The present invention relates to methods of manufacture of nuclear radiation equipment and more specifically, to radioactive sources for removing electrostatic charges and for calibrating measuring instruments.

Existing radioactive sources are fabricated by applying a sealing layer in the form of a fused enamel on a radioactive layer applied onto an enameled metallic substrate.

The manufacture of radioactive sources by the above-mentioned method is laborious, complicated and a slow operation, while the sources suffer from lack of hermeticity, resulting in contamination of the surroundings. Also, in such sources much of the radiation is absorbed by the fairly thick layer of fused enamel.

It is an object of this invention to provide a method of manufacturing a radioactive source in which no diffusion of the radioactive material to the surface of the source occurs.

It is another object of this invention to provide method in which a mechanically strong radioactive source is produced.

Still another object of this invention is to provide a method for producing a radioactive source in which the loss of nuclear radiation in the sealing layer is minimized to 10-18 per cent.

It is also an object of this invention to provide a simple and productive method for manufacturing said radioactive sources, which does not use critical materials.

With the above and other objects in view, a radioactive source is produced comprising a sealing layer which is a film of oxides of titanium, tin, zirconium, aluminum and chromium, used either separately or in combination.

In the manufacture of radioactive sources, this film of metal oxides is produced by hydrolysis of the chlorides of these metals on a heated radioactive layer applied onto a substrate.

The foregoing makes it possible to manufacture inexpensive, high-quality radioactive sources which may be widely used for removal of electrostatic charges in various industries.

Other objects and advantages of the invention will become more fully apparent from the following description of a specific embodiment when read in connection with the accompanying drawing the sole FIGURE of which shows a cross-sectional view of the source of the present invention.

A radioactive source, according to the invention, comprises a substrate 1 coated by a layer of priming silicate enamel 2. From one side the priming enamel 2 is overlaid by a coat of finish enamel 3 on to which is applied the radioactive material 4, the said material being an alloy of finish enamel 3 and a radioactive substance. The radioactive material 4 is coated by a sealing layer 5 which is a film of a metallic oxide, such as titanium dioxide. As an alternative, the layer 5 may be obtained from oxides of tin, zirconium, aluminum and chromium, used either separately or in combination.

The substrate 1 of the radioactive source may be a glazed ceramic material, and also steel onto which the radioactive material is directly applied.

The method of manufacturing the herein proposed radioactive source consists in the following.

The radioactive material is applied to the finish coat of enamel 3 on the already enameled substrate 1. The radioactive material may be applied as a solution of a definite acidity, or as an oxide (mixed with enamel) by electrophoresis. The choice of the method for the application of the radioactive material is determined by the weight of one curie of the radioisotope used.

The application of the radioactive material as a solution is well known.

In the application of the radioactive material by electrophoresis, the substrate 1 is preliminarily given a coat of a metal readily soluble in molten enamel. The radioactive material as an oxide, along with the enamel to be applied together with it, is finely comminuted. Electrophoresis is carried out for 0.5 to 2 minutes. The design of the electrophoresis apparatus depends on the configuration of the source being made. The applied radioactive material, after the liquid phase has been driven off by drying, is fused with the finish enamel 3 at a temperature of 800° to 900°C, with the formation of a radioactive layer 4 which has a smooth, bright surface, free from defects such as pin-holes, burned spots, blisters, and the like. On cooling, the source is washed in running water to remove the loose radioactive material.

The source is sealed off with the metal oxides, such as titanium dioxide, by producing a film of a metal oxide on the radioactive layer 4 heated to a temperature of 200° to 650°C, by means of vapor-phase hydrolysis of the chloride of a given metal, such as titanium tetrachloride. The sealing operation is continued until a sealing layer is produced in the form of a film of titanium dioxide, or of any other metal used.

If the sealing layer is to be current-conducting, the layer can be obtained by hydrolysis of tin tetrachloride with the formation of tin dioxide in the form of a film.

A sealing layer in the form of a film of metallic oxide may be obtained by liquid-phase hydrolysis of the respective metallic chlorides, and also by pyrolysis of organometallic compounds.

The radioactive source manufactured by the present method, does not contaminate the surroundings, is safe to handle, is strong mechanically, and is stable chemically and thermally.

While the invention has been described in connection with a preferred embodiment, it will be understood that various modifications and adaptations may be made without departing in any way from the spirit and scope of the invention, which will be readily comprehended by those skilled in the art.

Such modifications and adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims that follow.

What is claimed as new and desired to be secured by Letters Patent is:

1. A method of manufacturing a radioactive source, comprising applying a radioactive material onto a substrate; heating said radioactive material and said substrate to form a radioactive layer applied to said substrate; heating the radioactive layer applied to said substrate; and hydrolyzing a metal chloride by vapor phase

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hydrolysis to form a metal oxide sealing layer on the heated radioactive layer.

2. A method as claimed in claim 1 wherein said substrate is coated with enamel prior to application of the radioactive material thereto.

3. A method as claimed in claim 2 wherein said radioactive material is applied onto the enamel coated substrate in combination with a finish enamel.

4. A method as claimed in claim 2 wherein said radio-

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active material is applied onto the substrate by fusing said radioactive material with the enamel at a temperature of 800°-900°C.

5. A method as claimed in claim 1 wherein the radioactive material and substrate are heated to a temperature of 200°-650°C to enable the hydrolysis of the metal chloride.

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