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TANTALUM-TITANIUM GETTER ELEMENT

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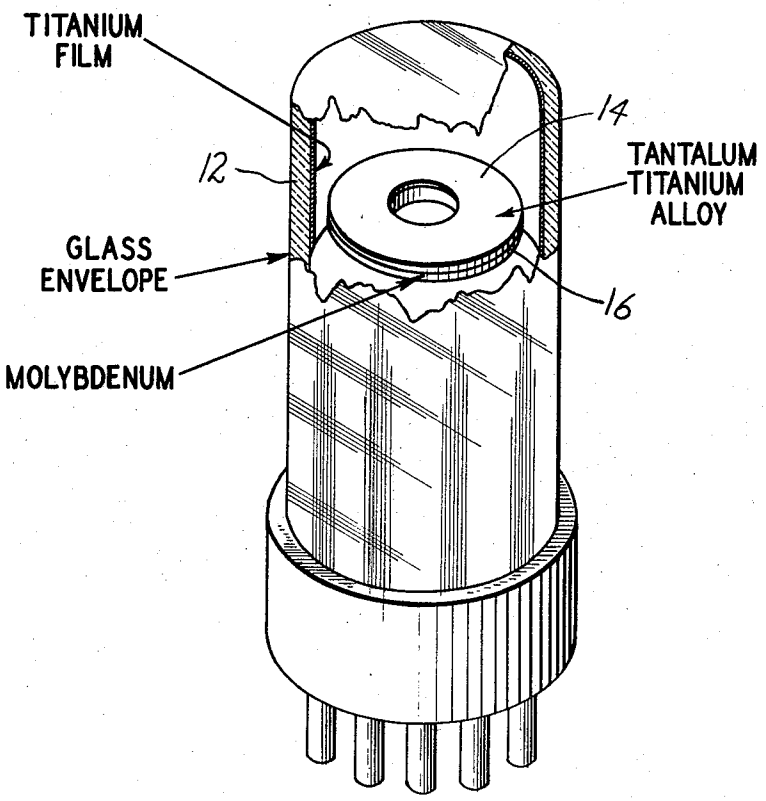

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TANTALUM-TITANIUM GETTER ELEMENT

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This invention relates to a getter especially suited for cleaning up residual gases in an evacuated electronic device.

In the manufacture of evacuated devices such as vacuum tubes, one of the final and most important steps of the process is the forming of a vacuum within the tube in order that the tube elements will operate in an atmosphere free of air and other contaminating gases. Although mechanical evacuation by pumping means is a preliminary phase of the process that accounts for the major part of the vacuumizing, still there are limitations on any such pumping means, the best of which leaves a certain amount of residual gas remaining after pumping. Such gases are carbon monoxide, carbon dioxide, nitrogen, hydrogen and also water vapor, the presence of which are detrimental to tube operation and tend to limit the life of its elements.

In accomplishing a more thorough cleaning up or gettering of the residual gases remaining after mechanical evacuation, the gas adsorption quality of certain metals is utilized by application of a thin coating of such metals to the tube's interior surface. The most widely used getter material is barium. It is conventionally applied to the inner surface of the tube enclosure in a thin film by thermal evaporation within the tube. Thus, in the usual process, a barium-containing getter is formed into desired shape and mounted within a tube. After sealing and evacuation of the tube, the getter is heated or "flashed" usually by electric resistance or inductive heating, thereby causing it to evaporate and coat the exposed surface of the tube with a layer of barium particles.

For certain uses, getters other than barium are desirable. Titanium, for instance, has properties which would make it an excellent getter material and one useful at higher temperatures than barium. Moreover, titanium does not amalgamate with mercury and can be used in mercury-containing devices for which barium is not suitable. Unfortunately, however, the melting point of pure titanium is such that a getter composed of the pure metal, heated by conventional heating means to flash it, collapses before the deposition of a sufficient quantity of titanium to accomplish the desired effect.

It is the principal object of this invention to provide a getter element comprising titanium, from which element titanium may be sublimed and deposit on the surface of an evacuated device without melting the titanium-tantalum alloy, and without physical destruction of the getter element.

In the accompanying drawing:

The figure is a verticall, partial section taken through a vacuum tube with a getter element embodying the invention mounted therein.

The invention is based on the discovery that titanium may be evaporated from an alloy of titanium and tantalum upon heating the alloy to the evaporation temperature of titanium without destruction of the structure of the alloy member.

Binary alloys of titanium and tantalum containing

about 5% to 75% titanium are satisfactory for the purposes of the invention. They may be wrought to sheet form or drawn to wire. A preferred range of compositions is 20% to 50% titanium, the remainder tantalum. Specific alloys that have been used successfully are binary titanium-tantalum alloys containing about 25% titanium and about 40% titanium. Although the alloys are as pure as possible, it is of course understood that some impurities may be present in the alloy.

Illustrative of the invention, a getter assembly comprising a titanium-tantalum alloy may be mounted within a vacuum tube **12** as shown in the figure. The titanium-tantalum alloy member is in the form of a disc **14**, having at its center a hole approximately half its outside diameter and being about 0.002 inch in thickness. To this disc, preferably welded thereto is a similarly shaped disc **16**, of molybdenum or other refractory metal such as tungsten or tantalum and the like, having a vapor pressure much lower than that of titanium at elevated temperatures, and having the same inner and outer dimensions. The primary purpose of this disc is to provide a shield to prevent deposition of the getter material below it. The so-welded wafer was then provided with mounting wires and secured within a glass vacuum tube envelope by fastening to the tube center column. The wafer, in mounted position, was in a horizontal plane with the molybdenum disc on the bottom side.

The tube was sealed and mechanically pumped to evacuate the bulk of air therefrom. Heat was then applied to the getter in conventional manner. At or about a temperature of 1800° C. the titanium in the titanium-tantalum alloy sublimed and condensed on the upper surface of the tube while the getter disc retained its shape.

As has been stated above, the invention makes use of sheet or wire produced from a titanium-tantalum alloy. The alloy from which such sheet or wire is produced may be prepared by arc-melting technique. It is also possible to prepare the alloy by powder metallurgy methods, and getters of appropriate shape may utilize alloys so prepared.

What is claimed is:

1. An evacuated vessel having mounted therein a getter element composed of a binary alloy of titanium and tantalum, the titanium constituent of said alloy being the effective gettering agent of said element, the tantalum constituent of said alloy serving to prevent collapse of said element when the same is heated to the sublimation temperature of titanium, said temperature being above the melting point of titanium but below the melting point of said alloy whereby said element is effective to provide an active deposit of titanium upon the surface of said vessel, said alloy containing 5% to 75% titanium, the remainder tantalum.

2. The vessel defined by claim 1 wherein said binary alloy contains 20% to 50% titanium, the remaining part tantalum.

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