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VAPORIZATION OF METALS

Filed Nov. 10, 1942

Fig. 1.

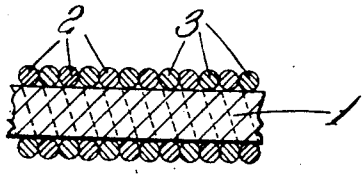


Fig. 2.

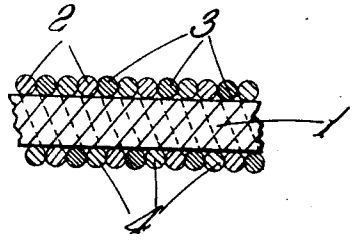
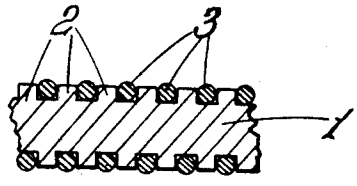


Fig. 3.



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VAPORIZATION OF METALS

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10 Claims. (Cl. 250—27.5)

For the vaporization of metals, a suitable technique appears to be that of taking a high melting core arranged for being heated electrically and covering it wholly or in part with the metal to be vaporized, the covering metal being for instance deposited as a uniform layer or wound on the core in the form of wire. On passing a suitable current through the assembly, volatilisation of the covering metal is to be expected. In practice, however, satisfactory results are not obtained because the molten covering metal forms discrete globules or nodules. At the points where such globules form, the core remains comparatively cool, whereas other points which are bare become overheated.

According to the invention, to overcome this difficulty the core is provided with or constitutes a channel in which the fusion and vaporization of the metal to be vaporized can proceed in a uniform manner. For this purpose the core may be provided in its surface with an open wound simple or multiple helix of high melting point material. The spacing helix may be integral with the core or may be applied separately. For example, the spacing helix may be a refractory insulating material. Alternatively one or more core wires and a wire of the metal to be vaporized (or a wire of each metal if more than one metal are to be vaporized simultaneously) may be wound together in the form of a stranded cable.

In a preferred form of the invention, a wire of the material to be vaporized and a wire of high melting point material are wound in parallel on the core, the winding operations preferably being performed simultaneously.

In the case of vaporizing a metal such as zirconium, the core and the spacing helix may both consist of tungsten. Generally, the choice of core and spacing helix is limited only by the requirement that these components must remain coherent at the temperature necessary for the volatilisation of the metal to be vaporized.

For some purposes it is desirable to use simultaneously two or more getters of different properties, e. g. zirconium and tantalum. In this case, according to the present invention it is preferred to use a multiple helix wound with wires of the separate getters and at least one wire of a further metal such as tungsten as the support for the getter wires. The separate getters may be disposed in a common channel on the surface of the core or in separate channels.

Instead of applying the metal to be vaporized in the form of a wire, it may be in any other convenient form. Thus, for instance, the metal in powder form may be mixed with a refractory binder and applied to the core between the turns of the spacing helix.

The method and apparatus for vaporizing metals according to the invention can be employed with advantage for the production of thin layers of metals by condensation of the vapor produced on suitable surfaces. The invention also provides a convenient means for producing a gettering mirror in evacuated apparatus, by sealing the core and spacing helix together with the metal constituting the getter within the envelope in which fixation of the residual gases is desired. Current can be applied to the assembly either directly or by induction to the extent necessary to vaporize only a sufficient amount of the getter to restore the vacuum at any time. In other words, the getter is only partly vaporized at each operation so that successive gettering operations can be performed with the same gettering device.

Certain constructional forms in which the invention can be put into practice are indicated schematically in the accompanying diagrammatic sectional drawing in which:

Figure 1 is a sectional view in accordance with one embodiment of the invention,

Fig. 2 illustrates a modification of the embodiment shown in Fig. 1 for the volatilization of two metals.

Fig. 3 is a cross-sectional view illustrating another embodiment of the invention.

Fig. 1 shows a core 1 e. g. of tungsten on which is wound a spacing helix 2 e. g. of tungsten which is open wound to provide a channel accommodating the wire 3 to be vaporized e. g. zirconium and tantalum.

Fig. 2 shows a core 1 e. g. of tungsten on which is wound a spacing helix 2 and two separate wires 3 and 4 which are to be vaporized, e. g. a zirconium wire and a tantalum wire respectively.

Fig. 3 shows an analogous arrangement to Fig. 1, but in which the spacing helix 2 is integral with the core 1; naturally the integral helix may be sufficiently open to admit two wires as in Fig. 2.

In the embodiments shown in Figs. 1 to 3 inclusive a single spiral helix construction has been illustrated. However, it is apparent that a construction consisting of multiple spiral helices is equally applicable for the purposes of the invention. In such a construction there may be two or more sets of elements 2, 3 and 4 helically wound around the core 1 in adjacent relationship.

Those embodiments in which the wires are combined in the form of a stranded cable (with or

without a core) are not illustrated, since the manner in which stranded cables are constructed is well known.

We claim:

1. A method of vaporizing metal comprising the steps of providing on the surface of a refractory core a helical channel having wall portions of refractory material, introducing the metal to be vaporized into said channel, and electrically heating the portions of the channel to vaporize said metal.

2. A method of vaporizing metal comprising the steps of helically channelling the surface of a refractory core, introducing the metal to be vaporized into the channel so formed, and electrically heating the core to vaporize said metal.

3. A method of vaporizing metal comprising the steps of providing on the surface of a refractory core a helical channel having wall portions of refractory material, introducing into said channel a wire element of the metal to be vaporized and a wire element of another metal, and electrically heating the refractory metal element and vaporizing the metal of the vaporizable wire element.

4. A method of vaporizing metal comprising the steps of helically winding about a refractory core adjacently positioned wire elements of a refractory metal and of metal to be vaporized, and electrically heating the refractory metal wire element to vaporize the metal of the vaporizable wire element.

5. A device for vaporizing metal comprising a body of refractory material arranged for being heated electrically, said body having an open wound helical channel having wall portions of refractory material, and a filling of the metal to be vaporized in said channel.

6. A device for vaporizing zirconium comprising a tungsten core, a tungsten element forming an open wound helical channel on said core, and a zirconium filling in said channel.

7. A device for vaporizing metal comprising a core of refractory material arranged for being heated electrically and having an integral helical channel on the surface thereof, and a wire element of the metal to be vaporized within said channel.

8. A process for producing a thin layer of metal on a body comprising the steps of providing on the surface of a refractory core a helical channel having wall portions of refractory material, introducing a vaporizable metal into said channel, electrically heating the portions of the channel to vaporize the metal and condensing the vaporized metal on said body.

9. A device for gettering comprising a body of refractory material arranged for being heated electrically, said body having an open wound helical channel having wall portions of refractory material, and a filling of a vaporizable getter metal in said channel.

10. A method of gettering comprising the steps of providing on the surface of a refractory core a helical channel having wall portions of refractory material, introducing a vaporizable getter metal in said channel, introducing the so treated core into an envelope, and electrically heating the portions of the channel to vaporize only a portion of said getter metal.

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