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METAL FOIL LEAD-IN CONDUCTOR FOR ELECTRIC LAMP

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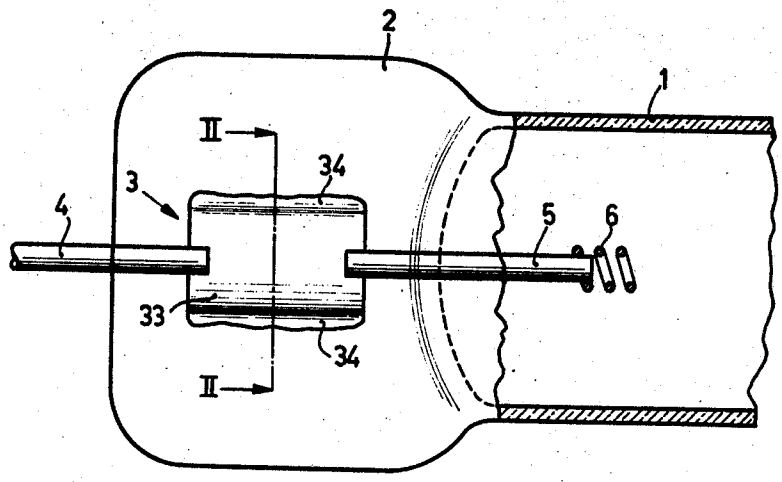

FIG.1

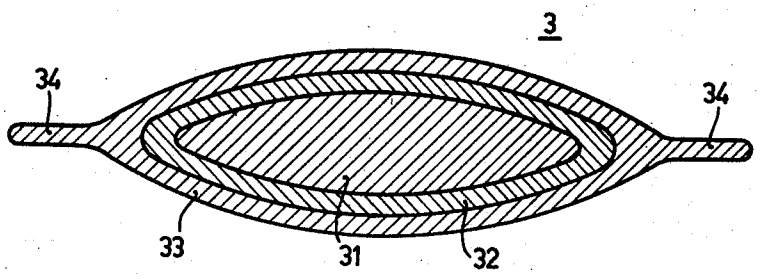

FIG.2

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METAL FOIL LEAD-IN CONDUCTOR FOR ELECTRIC LAMP

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This invention relates to electric lamps having at least one strip-shaped foil of refractory metal sealed into quartz or a similar material and having a thickness greater in the middle than at the edges.

A material similar to quartz is to be understood herein to mean a material having a coefficient of expansion less than 20×10^{-7}.

Molybdenum is usually employed as the refractory metal, but tungsten, platinum, iridium, etc. or, if desired, alloys thereof also enter into account for this purpose.

The combination used in the majority of cases comprises a molybdenum foil sealed into quartz in a vacuum-tight manner.

The foils having a greater thickness at the center permit the passage of stronger electric current than would be possible with foils of uniform thickness.

It is known for wire-shaped conductors sealed into glass to be protected against oxidation by means of a layer of chromium, nickel, cobalt, iron, thorium, zirconium, platinum, silicon, etc. provided on the wire.

The use of such protective layers on strip-shaped foils which are thicker at the center than at the edges does not cause any appreciable difficulty in sealing into glass.

However, when such foils are sealed into quartz or a similar material having a coefficient of expansion less than 20×10^{-7}, it is very difficult to obtain a seal which is vacuum-tight and oxidation-proof.

An object of the invention is to improve this.

According to the invention, the foil is covered with a metallic layer providing protection against oxidation, which is such that the core, which consists of refractory metal, has a thickness at the center which is more than 15 microns and less than 70 microns, and that this core carries a layer of from 1 to 8 microns thick which has formed by alloying the protective metal with the metal of the core, and that furthermore this layer is covered with a layer 0.5 to 4 microns thick of the protective metal and/or the oxide thereof and possibly the core metal, the melting point of the last-mentioned layer being lower than the softening temperature of the quartz or the similar material.

In order that the invention may be readily carried into effect, one embodiment thereof will now be described in detail, by way of example, with reference to the accompanying diagrammatic drawing, in which:

FIGURE 1 shows one end of a lamp provided with a seal according to the invention, and

FIGURE 2 is a cross-sectional view of the sealing body, taken along the plane II—II of FIGURE 1.

FIGURE 1 shows a cylindrical wall **1** of an electric lamp of quartz, for example an infra-red radiator, the extremity **2** of which is pinched closed about a strip-shaped sealing foil **3** having secured to it current-supply wires **4** and **5**. An incandescent spiral **6**, a few turns of which only are shown, is secured to the end of the wire **5** which extends into the cylindrical space of the lamp.

As can be seen from FIGURE 2, the sealing foil comprises a core **31** of almond-shaped cross-section, an intermediate layer **32** covering this core, and an outer layer **33** showing protuberances **34** at the sides.

In the example shown, the core **31** consists of molybdenum, the intermediate layer **32** of a molybdenum-chromium-alloy having a molybdenum content decreasing outwardly, and the outer layer **33** of chromium and/or chromium oxide and possibly a small percentage of molybdenum. The melting point of a molybdenum-chromium-alloy is usually lower according as the molybdenum content is less. Prior to sealing, the foil comprises only the core **31** and the layer **32**. The high temperature of about 2000° C. which is used in forming the pinch, causes melting away of the portion of the layer **32** remote from the core **31**, which has a melting point lower than that of the portion adjacent the core, resulting in the formation of the outer layer **33**, distinctly visible under a microscope, with the associated thin transparent protuberances **34**. During pinching, a proportion of the chromium at the areas **33** and **34** can change to the chromium-oxide giving protection against further oxidation. As a matter of fact, a little molybdenum may also be present at these areas. However, the content thereof is so small that the said melting away has not been prevented.

The core of the sealing foil having a width of about 4 mms. and a length of about 8 mms. in the direction of the wires **4** and **5** is about 22 microns thick at the center of the cross-section. It has been empirically found that this thickness must not be less than 15 microns, since otherwise the foil is liable to tear during sealing. On the other hand, this thickness must not be more than 70 microns to prevent the vacuum-tightness of the seal from being hazarded.

The outer layer **33** has a thickness of about 2 microns. For protection against oxidation, this layer must have a thickness of at least 0.5 micron, while for a vacuum-tight seal a thickness of at most 4 microns is permissible.

The intermediate layer **32** has a thickness of about 2 microns. This layer must have a thickness of at least 1 micron to produce a sufficiently thick layer **33**, while a thickness of more than 8 microns would hazard the vacuum-tightness.

In the example shown, the width of the protuberances **34** at the sides is about 1.5 mms. It has surprisingly been found that this width provides an indication about the qualtity of the seal.

When the protuberances are materially narrower, protection against oxidation of the molybdenum core is not guaranteed, whereas the presence of protuberances which are materially wider, for example extend to the edge of the pinch, may be an indication of insufficient vacuum-tightness of the seal.

What is claimed is:

1. A lead-in conductor for an electric lamp comprising a foil sealed in a quartz-like material, said foil having a thickness greater in its mid-section than at its edges, said foil comprising a core of refractory metal, an oxidation-protective outer layer surrounding said core, and a layer intermediate the outer layer and the core consisting of a metal which is capable of forming an alloy with the core metal and which is capable of forming a protective oxide, said core having a thickness at its mid-section of between 15 and 70 microns, the outer layer having a thickness of about 0.5 to 4 microns, and the intermediate layer having a thickness of about 1 to 8 microns, said outer layer having a melting point which is lower than the softening temperature of the quartz-like material.

2. A lead-in conductor for an electric lamp comprising a foil sealed in a quartz-like material, said foil having a thickness greater in its mid-section than at its edges, said foil comprising a core of refractory metal, an oxidation-protective outer layer surrounding said core, and a layer intermediate the outer layer and the core consisting of a

metal which is capable of forming an alloy with the core metal and which is capable of forming a protective oxide, said core having a thickness at its mid-section of between 15 and 70 microns, the outer layer having a thickness of about 0.5 to 4 microns, and the intermediate layer having a thickness of about 1 to 8 microns, said outer layer having a melting point which is lower than the softening temperature of the quartz-like material, said foil having proturberances at its edges constituted by the material of the outer layer.

3. A lead-in conductor for an electric lamp comprising a foil sealed in a quartz-like material, said foil having a thickness greater in its mid-section than at its edges, said foil comprising a core of molybdenum, an oxidation-protective outer layer surrounding said core, and a layer intermediate the outer layer and the core consisting of a metal which is capable of forming an alloy with the core metal and which is capable of forming a protective oxide, said core having a thickness at its mid-section of between 15 and 70 microns, the outer layer having a thickness of about 0.5 to 4 microns, and the intermediate layer having a thickness of about 1 to 8 microns, said outer layer having a melting point which is lower than the softening temperature of the quartz-like material.

4. A lead-in conductor for an electric lamp comprising a foil of refractory metal sealed in a quartz-like material, said foil having a thickness greater in its mid-section than at its edges, said foil comprising a core of molybdenum an oxidation-protective outer layer of chromium surrounding said core, and a layer intermediate the outer layer and the core consisting of an alloy of molybdenum and chromium, said core having a thickness at its mid-section of between 15 and 70 microns, the outer layer having a thickness of about 0.5 to 4 microns, and the intermediate layer having a thickness of about 1 to 8 microns, said outer layer having a melting point which is lower than the softening temperature of the quartz-like material.

5. A lead-in conductor for an electric lamp comprising a foil of refractory metal sealed in a quartz-like material, said foil having a thickness greater in its mid-section than at its edges, said foil comprising a core of molybdenum an oxidation-protective outer layer of chromium oxide, and a layer intermediate the outer layer and the core consisting of an alloy of chromium and molybdenum, said core having a thickness at its mid-section of between 15 and 70 microns, the outer layer having a thickness of about 0.5 to 4 microns, and the intermediate layer having a thickness of about 1 to 8 microns, said outer layer having a melting point which is lower than the softening temperature of the quartz-like material.

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