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ELECTRICAL DISCHARGE DEVICE

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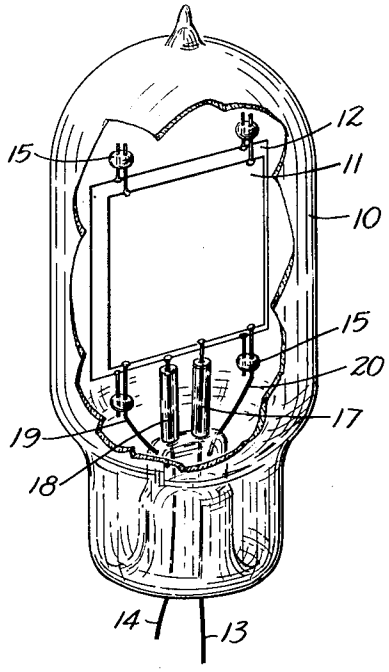

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ELECTRICAL DISCHARGE DEVICE

Application filed December 6, 1929. Serial No. 412,004.

This invention relates to electrical discharge devices and more particularly to the contacts or electrodes employed in such devices.

It is well known that in discharge devices a sputtering or disintegration of the electrodes occurs, due to the electrical discharge whereby the useful life of the electrode is materially shortened. When the electrodes are used in discharge tubes the loosened particles deposit on the surrounding walls and in time produce a film thereon which absorbs or entraps the molecules of gas within the tube thereby reducing the pressure and dissipating the gas to such an extent that there is not a sufficient amount remaining to conduct the current from one electrode to the other. Furthermore when the discharge tube is used for its luminosity, as for example, a neon lamp, the disintegrated particles form a film on the enclosing glass vessel thus limiting its useful life.

An object therefore of this invention is to produce an electrode having greatly increased durability and a resulting constancy of activity.

In accordance with one feature of this invention this object is attained by making the electrodes from an alloy composed of aluminum and beryllium, the properties of which are such that the disintegration or sputtering of the electrodes is reduced to a minimum.

In accordance with another feature of this invention an electrode having a melting point higher than that of an alloy of aluminum-beryllium is made by calorizing a base of cheaper metal, for example, iron or nickel with an alloy of aluminum and beryllium.

Nickel, iron, aluminum and beryllium have been used in the manufacture of such electrodes for discharge devices and of these beryllium suffers the least disintegration when subjected to the electrical discharge which takes place within the tube. It has been found however, that at low pressures such as are employed, for example, in neon tubes beryllium alloys in accordance with this invention disintegrate far less than their pure constituents. While beryllium is preferably alloyed with aluminum, yet favorable results have also been obtained by alloying beryllium with one or more other metals which have adherent oxides and high melting points such as chromium, magnesium, etc. It has been found that such alloys not only disintegrate less than their pure constituents but that when they do disintegrate, the more resistant element beryllium tends to accumulate on the surface of the electrode so that from then on the actual result is the same as though the electrode was composed entirely of beryllium. This alloying of beryllium with aluminum not only effects a considerable saving over the cost of using pure beryllium but also provides other advantages such as securing a harder cathode, less gas absorption in the cathode itself and less warping of the electrodes.

Beryllium alloys however, form a eutectic mixture and in many instances an electrode having a higher melting point may be desired. This is secured in accordance with the present invention by calorizing a metallic core such as iron or nickel with an alloy of aluminum and beryllium. This method of applying a surface finish is described in detail in U. S. Patent 1,663,561 granted to O'Neil on March 27, 1928 and has an advantage over a superficial coating such as produced by plating or spraying in that the applied metals are more adherent and capable of withstanding a higher temperature.

For a clearer understanding as to the type device in which such electrodes are especially applicable, reference may be had to the accompanying drawing which shows a discharge device embodying the features of this invention and having a portion of the enclosing glass vessel removed to more clearly show the arrangement of the component parts.

Referring to the drawing there is shown an air-tight enclosing glass container 10 which is filled with neon or other suitable gas or vapor at the proper pressure. A pair of electrodes 11 and 12 of which the smaller electrode 11 is the anode and the larger electrode 12 the cathode, are supported in the container 10 by supporting wires 19 and 20 and are held in spaced relation by glass beads

15. A pair of lead-in wires 13 and 14 provide connections between a suitable external source of power, and the electrode plates 11 and 12 within container 10. The portions of the lead-in wires which extend into the container are protected by insulating tubes 17 and 18, thus preventing a glow discharge from taking place when a potential difference is impressed across them.

In accordance with the present invention the electrodes 11 and 12 are made of an alloy in which beryllium is preferably combined with aluminum. Under usual operating conditions such alloys containing 20% to 40% beryllium have been found satisfactory and under certain other conditions as, for example, in tubes where the electrical discharge is less severe, alloys containing lower percentages of beryllium are satisfactory. Under particularly severe operating conditions alloys containing even larger percentages of beryllium may be found of advantage in spite of the increased cost. While beryllium is preferably alloyed with aluminum, satisfactory results have also been obtained by alloying substantially the same percentages of beryllium with one or more other metals having high melting points and the oxides of which are adherent such as chromium, magnesium, etc.

As an alternative electrode for certain uses such as where an electrode having an exceedingly high melting point is required beryllium is combined with one or more of the above mentioned metals and the alloy thus formed is calorized on a core of a cheaper metal such as iron or nickel.

In operation when a difference in potential is impressed across the electrodes, a glow discharge takes place at the anode 11 and as the potential is increased this glow discharge increases until it completely surrounds the cathode 12. When electrodes in accordance with this invention are used there is far less sputtering or disintegration of the electrodes, hence the particles thus freed are at a minimum in which case it will take a much longer time to produce a film on the enclosing container, which film not only diminishes the life of the tube from a luminosity standpoint, but also entraps or absorbs the molecules of gas within the container thereby reducing the pressure to such an extent that there is not a sufficient amount remaining to conduct current from one electrode to the other.

What is claimed is:

1. In an electrical discharge device, an electrode composed of an alloy containing from 20% to 40% beryllium as one of its constituents.

2. In an electrical discharge device, an electrode comprising a metallic core calorized with an alloy of aluminum and beryllium.

3. An electrical discharge device comprising an air-tight chamber, a plurality of electrodes disposed therein, said electrodes comprising a metallic core calorized with an alloy of aluminum and beryllium and means for applying a potential between said electrodes.

In witness whereof, I hereunto subscribe my name this 4th day of December, 1929.

EDWIN F. KINGSBURY.