

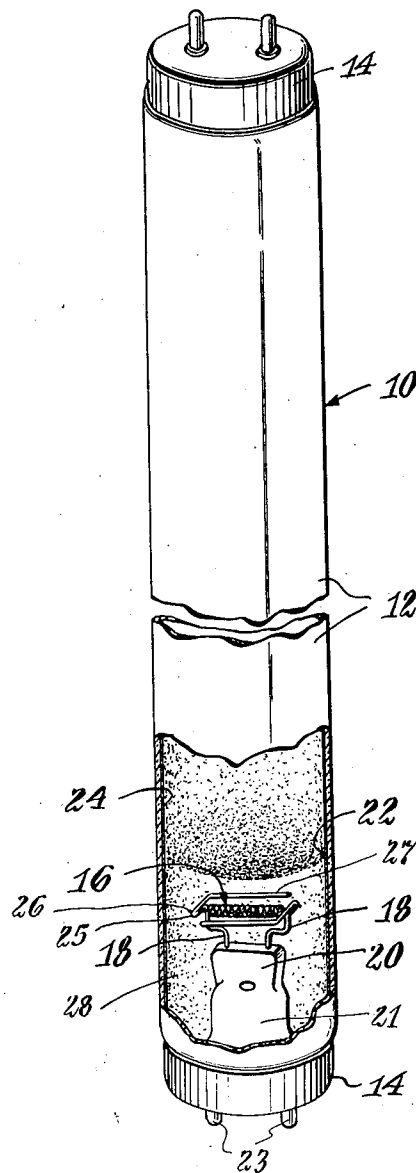
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DISCHARGE LAMP, MOUNT THEREFOR, AND METHOD

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DISCHARGE LAMP, MOUNT THEREFOR, AND METHOD

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This invention relates to discharge lamps and, more particularly, to the construction of the mounts of discharge lamps and especially those in which electron-emission material is fused on coiled-coil filaments.

The principal object of our invention generally considered, is to eliminate or lessen light-absorbing so-called "end bands" which form on the envelopes of discharge lamps, especially those made by the "fused cathode" process, by coating only the lead wires, coil clamps, coil tails and anode wires, that is, all the interior metal parts except the cathodes, with a suspension of zirconium dioxide or other refractory insulating oxide.

Another object of our invention is to apply such refractory insulating oxide to the metal parts, other than the electron-emissive portions, as a suspension in isopropyl alcohol or other mediums sufficiently volatile to evaporate completely with no residue, by electrophoresis, or by spraying or dipping in such insulating material, to break the electrical path between said metal parts and the arc.

Other objects and advantages of the invention will become apparent as the description proceeds.

Referring to the drawing, the sole figure is a perspective view, with parts in section and parts broken away, of a fluorescent discharge lamp embodying our invention.

Extensive tests have shown that lamps embodying the invention described and claimed in Patent No. 2,476,590 to George S. Evans, dated July 19, 1949, resulted in greatly increasing lamp life when used in applications where frequent instant starting is required. The patent discloses the making of the so-called "fused cathode" in producing an electron-emissive coating on electrodes for discharge lamps. The emissive material therein described is barium oxide, and the life of a fluorescent lamp with a barium oxide fused cathode, as produced by the rapid heating of a coating of barium carbonate thereon, is considerably longer, as compared with a lamp utilizing one not fused, particularly where frequent instant starting is required, as in a flashing sign.

Some improvement in life has also been obtained by the use of barium oxide and zirconium dioxide as a fused cathode coating material. In the co-pending application of the present applicants, Serial No. 335,908, filed February 9, 1953, there is disclosed an improvement in electron-emissive material involving the incorporation of some magnesium oxide. The use of such material has extended the instant start life of about 4700 hours obtained using previous materials by about 46.5% to about 6882 hours, with only 10 mg. of emission material per coil.

Lamps currently made by the fused cathode hold about 20 mg. of emission material per coil. Such an amount of emission material raises the lamp life above 10,000 hours. Such fusion process, however, has only been used on lamps designed for special applications in which the main disadvantage of the process, that is, early end banding, is tolerated to gain the advantages of long

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life. But for the fact that end bands appear after a relatively short burning period, the process would probably be used on all instant start lamps with a resultant phenomenal increase in lamp life.

In accordance with our invention, early end banding is eliminated or lessened in lamps made by the fused cathode process, as well as in lamps made by the ordinary non-fusing process. The method essentially consists in coating only the internal metal mount parts, except the electron emission material coated or cathode portions, that is, such parts as the lead wires, coil clamps, coil tails, and anode wires, with a suspension of a refractory metal oxide, preferably zirconium dioxide. However, we do not wish to be limited to this particular material, because other refractory or stable oxides, such as magnesia, may be substituted. The electron emissive material on the cathode must not be coated with such a suspension, but only the other metal parts.

The suspension desirably employed is finely divided zirconium dioxide in isopropyl alcohol. It is desirably applied by brushing the suspension on to only the required area as a continuous coating. However, other suspending means may be used, as it is necessary only that the medium be sufficiently volatile to evaporate completely and leave no residue. Other methods of applying the material, such as spraying or dipping, can be used, provided a continuous coating is obtained.

The discovery that such coating of non-electron-emission portions of the internal metal parts of discharge lamps eliminates or reduces end banding was made after observing that when a freshly exhausted fused cathode lamp was initially seasoned, an arc struck on the lead wires and anodes and moved about, sparking vigorously, until finally it settled to a hot spot on one of the coil tails outside of the clamp or on the main body of the coil. After a short seasoning period, the hot spot in all cases settled on the main body of the coil. On subsequent lamps it was noted before initial seasoning that the anode wires and lead wires had developed a partly blue, partly yellow coating during exhaust processing. After seasoning the coating had apparently disappeared.

Lead wires oxidized in a gas flame used in non-fused lamps did not cause the arc to strike other than on the coil. However, on burning, such lamps developed end bands after a short period of operation. From this we decided that during the fusing process the nickel lead wires were either oxidized or they collected a coating of oxide from oxidized tungsten coil, and in addition may have collected a small amount of barium oxide which acted as an emitter to attract the arc during initial seasoning. The application of the insulating coating, in accordance with our invention, breaks the electrical path between the arc and the metal parts, other than the cathode, thereby solving the problem.

Referring to the drawing in detail, like parts being designated by like reference characters, there is shown a lamp 10 having a translucent envelope 12, with a base 14 at each end thereof. A cold-hot cathode or electron-emission material-coated electrode 16 is supported on each end of the envelope on lead-in conductors 18 sealed through the press 20 of the reentrant stem or flare tube 21. These conductors 18 make electrical connection with contact prongs 23 in a conventional manner, thereby providing means for supplying power to the lamp.

This type of cathode is called a "cold-hot" cathode, since it is started "cold" and operated "hot." In a preferred embodiment of our invention it is a filamentary type cathode in which the refractory metal wire is wound into a minor coil which, in turn, is wound into a major coil to make a coiled-coil common in the art. Such a coiled-coil metal filament is preferably formed of tung-

sten, but may be of other suitable refractory metal such as molybdenum. Fused on the inner coil of this coiled-coil refractory metal filament and adhering thereto is the electron-emission material, preferably such as disclosed and claimed in our application Serial No. 335,908; previously referred to.

The sealed translucent envelope 12 encloses a small amount of mercury 22; to provide mercury vapor, and a filling of inert ionizable gas, such as argon, or a mixture of such gas with another such as neon, to facilitate starting. A representative pressure of inert ionizable gas is about 3.2 mm. and a representative operating mercury vapor pressure is about 10 microns. If the lamp is one of the fluorescent type, the interior of the envelope is coated with luminescent material 28.

Fused cathodes used in instant start fluorescent lamps generally consist of alkaline earth oxides, produced by heating the carbonates, employed singly, or in combination with one or more of the other alkaline earth oxides. The alkaline earth of the cathode is preferably barium oxide, and the cathode is made generally in accordance with the teachings of the aforementioned Evans patent. The cathode mixture or electron-emission material is desirably made in accordance with the teachings of application previously referred to.

In accordance with the present invention, we eliminate or decrease the undesirable formation of end bands by coating the interior metal parts of the mount consisting of the glass part 21 and the metal parts extending inwardly therefrom including the lead-in conductors 18, with a firmly adherent insulating coating, preferably from 5 to 10 mils in thickness, comprising a refractory oxide or oxides, zirconium oxide being a preferred example. End bands are darkened areas on the inner surface of the envelope, over the luminescent material, if carried thereby, near but between the transverse planes of the cathodes, which bands gradually decrease in density as they approach one another, one of said areas being represented at 24. This coating may be applied as a suspension in isopropyl alcohol, or by other methods as previously mentioned, to specifically the lead portions 18, the coil clamps 25, the coil tails 26 and the anode wires or horns 27, if present.

Two groups of fused cathode lamps were made up, each using the same emission material, emission material weight, and exhaust schedule, with the essential difference between the two groups being that in one case the lead wires, coil clamps, coil tails and anodes were coated with a suspension of zirconium dioxide in isopropyl alcohol, and in the other case said parts were not so coated. All of the noncoated lamp ends developed faint end bands after burning for about 35 hours, which bands continued to become darker, while only one end of one of the coated-mount lamps developed a light band after burning for about 140 hours, which band did not change thereafter. All other ends of all of the coated mount lamps were quite clean.

A further advantage of our invention is that, contrary to what was first thought, the protective or insulating coating of refractory insulating material, such as zirconium dioxide, not only had no adverse effect on life, but resulted in a life increase of about 20% over that of uncoated mounts. In other words, the application of a coating to the non-cathode internal metal parts of lamps in one group resulted in an increase in life from 7400 to 8700 hours, that is, 17.5%, and in another group from 5200 to 6350 hours, that is 22.1%. The lamps within each group were similarly constructed, except for the protective coating on the metal parts. The weight of the electron-emission material was greater in the first group of lamps than in the second group above noted, but still less than the amount 20 mg. used in lamps in production which average over 10,000 hrs. life.

Although a preferred embodiment has been disclosed, it will be understood that modifications may be made within the spirit and scope of the invention.

We claim:

1. In a discharge lamp, an envelope, a stem sealed to each end thereof, a pair of leads projecting inwardly from said stem, an electrode supported between the leads of each pair and comprising a refractory metal coiled-coil wire with a fused coating of electron-emission material thereon, and zirconium dioxide coating of from 5 to 10 mils thick on the exposed interior metal portions in said envelope, to eliminate formation of end bands and to prolong the useful life of said discharge lamp.

2. A mount for a discharge lamp comprising a closure member for an end of the envelope thereof, leads extending inwardly from said closure member, a filamentary electrode carried by and with tails clamped in said leads, which leads are extended beyond the clamps to form anode wires, electron-emission material thereon, the exposed portions of said leads, coil clamps, coil tails, and anode wires being coated with zirconium dioxide of from 5 to 10 mils thick to prevent the formation of end bands when mounted in a discharge lamp thus prolonging its useful life.

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