Dec. 18, 1962 J. F. WAYMOUTH, JR 3,069,580

FLUORESCENT LAMP

Filed Oct. 28, 1953

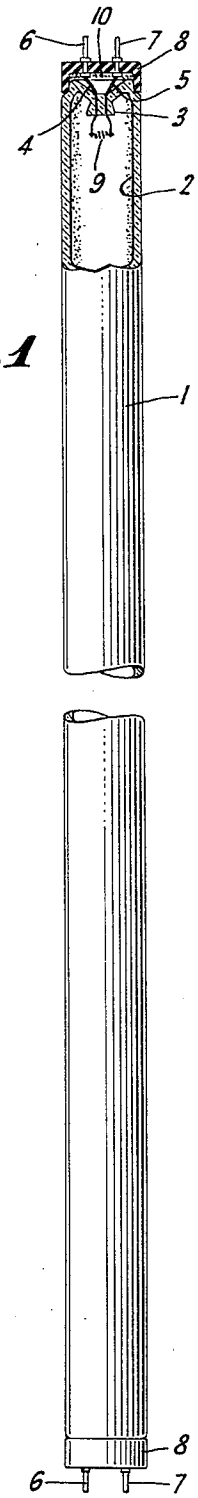
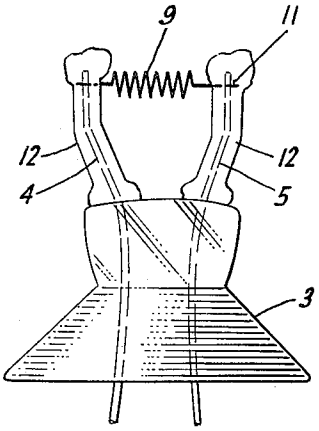


Fig. 1

Fig. 2



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FLUORESCENT LAMP

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This invention relates to electric discharge lamps and to the electrodes used in such lamps, particularly those for use on alternating current, where the same electrode serves as cathode during half the cycle and anode during the other half.

Electrodes for such use generally have a refractory coiled wire carrying electron-emitting materials, such as the oxides of the alkaline earth metals. To avoid overheating the electrode by the electron bombardment occurring during the anode half cycle, it has been proposed to add auxiliary electrodes to take part of the current when the electrode acts as anode. However, I have found that even without such auxiliary electrodes, the coil does not take all of the current during the half cycle it is an anode, and that most of the electron current on that half cycle goes to the lead-in wires which support the cathode, and to the overhanging portions of the cathode which extend outside the space between the lead-in wires.

I have, moreover, discovered that if such portions of the electrode are covered by an insulating covering, so that the cathode coil takes all of the current during the anode half cycle, the cathode operates at a higher temperature, but has a tremendously greater life. This result is unexpected, because when such a covering is used, the end blackening may even increase during the early part of the lamp life, due to increased evaporation of alkaline earth oxides such as barium from the coil. It would ordinarily be expected that the loss of barium would reduce the lamp life, but it does not do so, because instead the lamp life is doubled or tripled. Moreover, any early end blackening that may be present begins to clear up after the first thousand hours or so of life, and becomes less during the remainder of the lamp life.

The presence of a small percentage of zirconium oxide or the like in the electron-emitting coating carried by the coil helps to reduce the evaporation of barium, as explained in U.S. Patent 2,530,394, granted in November 21, 1950, to E. F. Lowry, E. L. Mager and G. W. Keilholtz.

The use of an insulating coating over the lead-in wires and over the portion of the coil not between the lead-in wires, gave the following results in a set of four lamps tested:

Lamp:	Life in hours
1	24,071
2	6,936
3	20,575
4	15,175

Except for the one lamp that failed at 6936 hours, the average life was then about 19,940 hours. Even if the 6936-hour lamp is included in the average, the average is at least 16,600 hours, which is still more than double that of the normal 7500-hours average life of lamps without the insulating coating.

The variation in life from lamp to lamp in the above table is apparently due to differences in the completeness with which water vapor was removed from the cement applied as a covering to the lead-in wires.

The water vapor was removed by heating the applied cement with a hand torch, taking care not to oxidize the tungsten of the coil excessively and not to crack the press, and the amount of residual water vapor left in the cement varied somewhat from lamp to lamp.

Other objects, features and advantages of the invention will be apparent from the following description of one embodiment taken in connection with the accompanying drawings, in which FIG. 1 shows a lamp according to the embodiment described and FIG. 2 shows a view of the mount used in the lamp.

In FIG. 1, the glass tube 1 carries phosphor coating 2 on its interior surface in the manner customary in the art. A stem 3 is sealed to each end of said tube 1 to close off the same and the lead-in wires 4, 5, are sealed through said stem 3. Externally of the tube 1, the lead-in wires 4, 5 are connected electrically and mechanically to the base contact prongs 6, 7, in the usual manner, for example, by soldering. Said prongs 6, 7, extend outwardly from the insulating base shell 8, which is attached to the tube 1 by cement 10.

Inside the tubes 1, a coiled-coil filament 9 of tungsten wire, carrying a filling of electron-emitting oxides, for example as in U.S. Patent 2,258,158, issued October 7, 1951, to E. F. Lowry, is supported near its ends by the lead-in wires 4, 5 which are covered by a coating of an insulating refractory cement 12 such as Sauereisen P–1, that is, a cement containing a refractory material suspended in water-glass. For example, the cement may contain enough calcium oxide, aluminum oxide, magnesium oxide, or some other refractory material, in sodium silicate to form an insultaing coating when dried. Refractory oxides such as aluminum oxide may also be applied in a cellulosic lacquer, as in coatings for radio cathode heaters, the cellulose afterward being removed by baking, as long as the coating is not of a nature to flake off the wires to which it is applied. Other refractory insulating cements may be used.

In applying the insulating coating 12, extreme care must be taken to remove any residual water and water vapor from the cement, because if it is allowed to remain it will make the lamp hard to start and will reduce the life of the lamp, thus defeating the purpose of the invention.

In addition to covering the lead-in wires 4, 5, the cement also covers the joint between the lead-in wires 4, 5 and the filament 9, the covering extending to the end portion 11 of the filament extending outside the space between the lead-in wires 4, 5. The cement insulates all these portions of the electrode and its associated parts from the discharge and prevents the anode current from being collected by them. Since the hot spot which forms upon the filament 9 during operation is generally of several millimeter extent, a gap of a few millimeters can safely be left between the end of the cement coating 12 and the beginning of the electron emitting coating on the filament 9.

The insulation 12 can be provided in other manners then by coating, as long as it is free from gaps or holes large enough to allow appreciable leakage of current therethrough.

What I claim is:

1. An electric gaseous discharge tube consisting essentially of a sealed, elongated, light-transmitting tube, a gas filling at low pressure within said tube, a stem extending into said tube at at least one end thereof, a pair of lead-in wires sealed through said stem and extending a substantial distance toward the other end of said tube, a tungsten wire coil supported between said lead-in wires at a position nearer the other end of said tube than is said stem, said coil being electrically connected near its ends to said lead-in wires, a filling of electron-emissive material carried by said coil only on the middle portion of the coil away from and between the ends of the coil and a coating of insulating material covering said lead-in wires and the ends of said coil and extending therefrom at least to within a few millimeters of the filling of electron-

emissive material on the middle portion of the coil, to shield the ends of the coil from any electrical discharge through said gas and to confine the discharge at the electrode to the portion of the coil carrying the electron-emissive material during the half cycle when the coil acts as an anode and during the half-cycle when it acts as a cathode.

2. An electric gaseous discharge lamp consisting essentially of the elements in claim 1, and a phosphor coating on said tube.

References Cited in the file of this patent

UNITED STATES PATENTS

1,163,705	Thomas	Dec. 14, 1915
1,644,601	Nickel et al.	Oct. 4, 1927
2,007,934	Braselton	July 9, 1935
2,020,724	Fritze et al.	Nov. 12, 1935
2,032,945	Marden	Mar. 3, 1936
2,056,621	Roberts	Oct. 6, 1936
2,084,913	Kauffeldt	June 22, 1937
2,097,157	Jameson	Oct. 26, 1937
2,141,933	Perrott	Dec. 27, 1938
2,142,104	Birdseye	Jan. 3, 1939
2,162,546	Breadner et al.	June 13, 1939
2,354,946	Cohen	Aug. 1, 1944
2,427,096	Gustin	Sept. 9, 1947
2,432,513	Depew	Dec. 16, 1947
2,433,813	Hilliard	Dec. 30, 1947
2,530,394	Lowry et al.	Nov. 21, 1950
2,659,835	Germer	Nov. 17, 1953
2,682,008	Germer	June 22, 1954
2,709,767	Germer	May 31, 1955