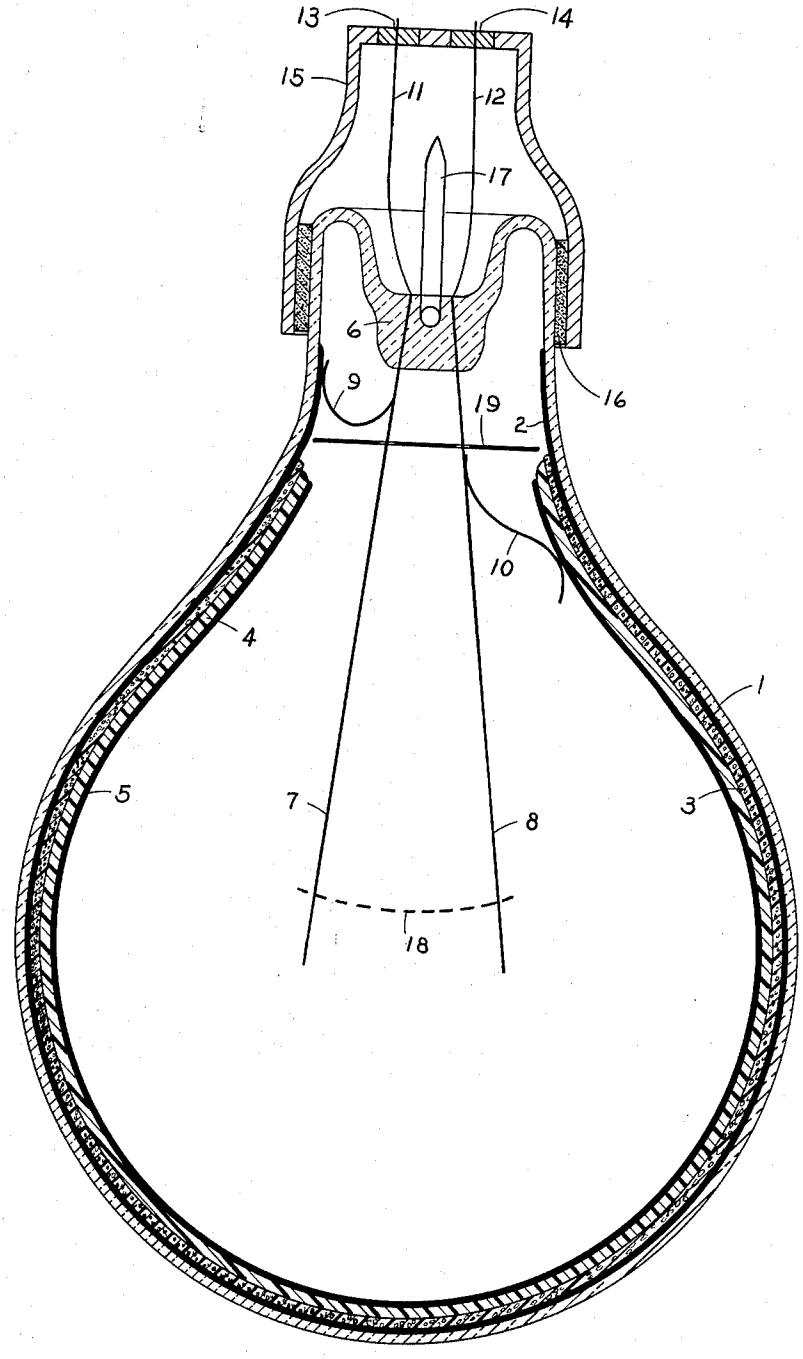
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ELECTROLUMINESCENT BULB

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ELECTROLUMINESCENT BULB

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5 Claims. (Cl. 313—109)

This invention relates to devices for producing light of the type comprising luminescent material sandwiched between two conducting surfaces so as to be excitable to luminescence by the application of an alternating voltage between said surfaces.

The phenomenon of the excitation of the luminescent material in such devices is known as electroluminescence.

In one form of electroluminescent device made hitherto, one conducting surface has usually been provided by a plain glass plate having a transparent conducting coating formed on one side; a layer of a suitable solid insulating material having the powdered luminescent material uniformly dispersed therein formed on the conducting glass surface and the other conducting surface is provided by forming a metallic coating on the layer of insulating material. In another form of electroluminescent device described in copending U. S. Application No. 323,024 of John O. Aicher, entitled "Electroluminescent Cell," filed November 28, 1952, and assigned to the same assignee as the present invention, the luminescent material is confined in a layer adjacent to one of the conducting plates and separated from the other conducting plate by an intervening layer of insulating material.

The object of this invention is to provide a novel construction of electroluminescent lamp which has certain advantages, as will be explained hereafter.

According to the invention, an electroluminescent lamp comprises a sealed bulb which may be made of blown glass, the inner surface of which carries, in the order named, a transparent first conducting coating, an insulating coating consisting of or containing luminescent material, and a second conducting coating, the arrangement being such that by the application of an alternating voltage between said first and second conducting coatings the luminescent material can be excited to emit light which is radiated from the device.

If the luminescent material is not itself sufficiently insulating, it may be uniformly dispersed throughout a transparent insulating material in the said insulating coating; alternatively, the insulating coating comprises two distinct layers, one layer consisting of or containing substantially all the luminescent material and the other layer consisting of a suitable insulating material, the luminescent material layer being preferably directly adjacent to the said first conducting coating. The insulating layer must, of course, be transparent if it intervenes between the layer of luminescent material and the said first conducting coating, and in any other case is preferably transparent, the second conducting coating then preferably being transparent or reflecting on the surface facing the first conducting coating. It will be understood that the term transparent includes translucent.

By the use of a blown glas bulb there can readily be obtained a light source of relatively larger surface area, which is desirable in view of the low brightness at present produceable by electroluminescent devices as compared with ordinary filament lamps or discharge lamps. Also

the bulb serves to protect the components within it, and is ideally suited to sealing. This makes it possible to enhance the performance of the device by evacuating the bulb before sealing, or by filling it before sealing with an atmosphere favorable for the operation of the device, for instance an atmosphere free of humidity which appears to be particularly harmful to electroluminescent phosphors. In addition the use of a blown glass bulb enables many of the techniques and apparatus of filament lamp manufacture to be utilized and the bulbs themselves can in many cases be the same bulbs as used for making ordinary filament lamps.

A device in accordance with the invention may readily be designed for operation on public alternating supply mains and can be provided with a base carrying terminals which will enable the device to be fitted into existing sockets in place of ordinary filament or discharge lamps.

Devices in accordance with the invention in the form in which they can at present conveniently be produced do not emit sufficient light to enable them to be used singly for general illumination, but they are suitable for use as night-lights, or indicator lamps, or for other uses where a low brightness is desirable.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawing showing a vertical section through an electroluminescent bulb.

In this embodiment, a blown glass bulb **1**, of the kind used for the manufacture of filament lamps for general lighting, is provided with a transparent conducting coating **2** on its inner surface, the coating being represented by a dark line, and on this conducting coating is applied a layer of suitable luminescent material **3**, for example zinc sulphide activated by copper. On the layer **3** is provided a layer **4** of transparent insulating material, for example a modified alkyd resin of the type known under the British trade-name of Paralac **10**, and on the layer **4** is applied a conducting coating **5** which is preferably of metal, for example aluminum.

The neck of the bulb is sealed by means of a pressed stem-tube **6**, the press of which carries within the bulb two stout wires **7** and **8**, of which one (**7**) carries a leaf spring **9** which makes contact with the conducting layer **2** on the glass, and the other (**8**) carries a leaf spring **10** which makes contact with the conducting coating **5**. Leads **11** and **12** pass through the pinch and are soldered to terminals **13** and **14** of a bayonet cap **15** which is attached to the neck of the bulb by means of cement **16**.

The deleterious and harmful effects of moisture on electroluminescent phosphors is a problem which is difficult of solution in the case of flat plate or panel type electroluminescent devices. However, in an electroluminescent bulb in accordance with the invention, the problem is solved by evacuating the bulb, which may then be filled with a dry gas such as dry nitrogen at atmospheric pressure and sealed off by means of a stem **17**.

In the manufacture of this device, the conducting coating **2** may be formed by contacting the heated glass surface with the vapor of stannic chloride in the presence of moisture.

The layer of luminescent material **3** may be applied by flushing or spraying onto the glass a suspension of the powdered luminescent material in a solution of a binder in a volatile liquid and then heating to evaporate the liquid; the binder may conveniently consist of the synthetic resin used for forming the layer of insulating material **4**, which layer may be applied by spraying the layer of luminescent material with a solution or suspension of the resin in a volatile liquid and evaporating the liquid.

The zinc sulphide luminescent material used is preferably prepared by mixing zinc sulphide of the highest purity with a solution of copper sulphate to give 0.1 to

0.25% by weight of copper in the dried mixture, the the latter being ground thoroughly and fired at 800–900° C. in a closed boat for several hours.

The conducting coating 5 may be applied by spraying or painting the layer 4 with a suitable conducting material but is preferably applied by the evaporation of a suitable metal such as aluminum. This evaporation may conveniently be effected by attaching a short length of wire of the metal between the leads 7 and 8, as indicated by the dotted line 18 in the drawing, and after evacuation of the bulb, heating the wire by the passage of current through it, with the bulb support neck downwards, so as to evaporate the wire and form the required coating, an insulating baffle 19 attached to the leads 7 and 8 preventing the possibility of the evaporated metal short-circuiting the two conducting coatings at the neck of the bulb. The bulb is then filled with dry nitrogen to atmospheric pressure and sealed, after which the cap 15 is attached to the neck of the bulb.

While a certain specific embodiment of the invention has been shown and described, various modifications thereof are possible, and the appended claims are intended to cover any such modifications coming within the scope of the invention.

The alkyd resin known under the British trade name Paralac 10 is a long-oil linseed oil modified alkyd resin containing pentaerythritol and no added glycerol.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electroluminescent lamp comprising a transparent bulb sealed free of moisture and having a conductive inside surface, a layer containing an electroluminescent material formed over said conductive surface, a conductive layer formed over said electroluminescent material layer, and lead wires sealed into said bulb and connected, one to said conductive surface and the other to said conductive layer.

2. An electroluminescent lamp comprising a vitreous bulb sealed free of moisture, a conductive coating formed on the inside surface of said bulb, a layer containing an electroluminescent phosphor formed over said conductive coating, a conductive layer formed over said electroluminescent layer, and a pair of lead wires sealed into said bulb and connected, one to said conductive coating, and the other to said conductive layer.

3. An electroluminescent lamp comprising a vitreous bulb, a conductive coating formed on the inside surface of said bulb, a layer of dielectric material containing a dispersion of an electroluminescent phosphor formed over said conductive coating, a conductive layer formed over said electroluminescent layer, a pair of lead wires sealed into said bulb and connected, one to said conductive coating and the other to said conductive layer, and a filling of a dry gas sealed within said bulb.

4. An electroluminescent lamp comprising a vitreous bulb, a conductive coating formed on the inside surface of said bulb, a layer of an electroluminescent phosphor in a dielectric binder adherent to said conductive coating, an insulating layer of a dielectric material adherent to said electroluminescent layer, a conductive layer formed over said insulating layer, a pair of lead wires sealed into said bulb and connected, one to said conductive coating and the other to said conductive layer, and a filling of a dry gas sealed within said bulb.

5. An electroluminescent lamp comprising a vitreous bulb, a conductive coating formed on the inside surface of said bulb, a layer of a zinc sulphide phosphor in an alkyd resin adherent to said conductive coating, an insulating layer of an alkyd resin adherent to said phosphor layer, a conductive layer of evaporated metal adherent to said insulating layer, a pair of lead wires sealed into said bulb and connected, one to said conductive coating and the other to said conductive layer, and a filling of a dry gas sealed within said bulb.

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