Dec. 25, 1962 G. H. BOUCHARD 3,070,722

ELECTROLUMINESCENT DEVICE

Filed Dec. 30, 1954

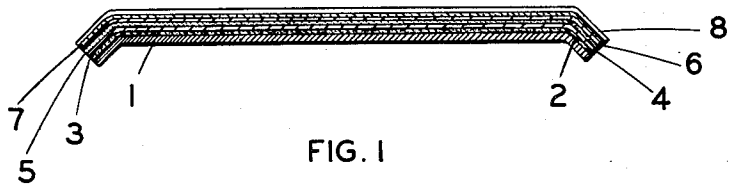


FIG. 1

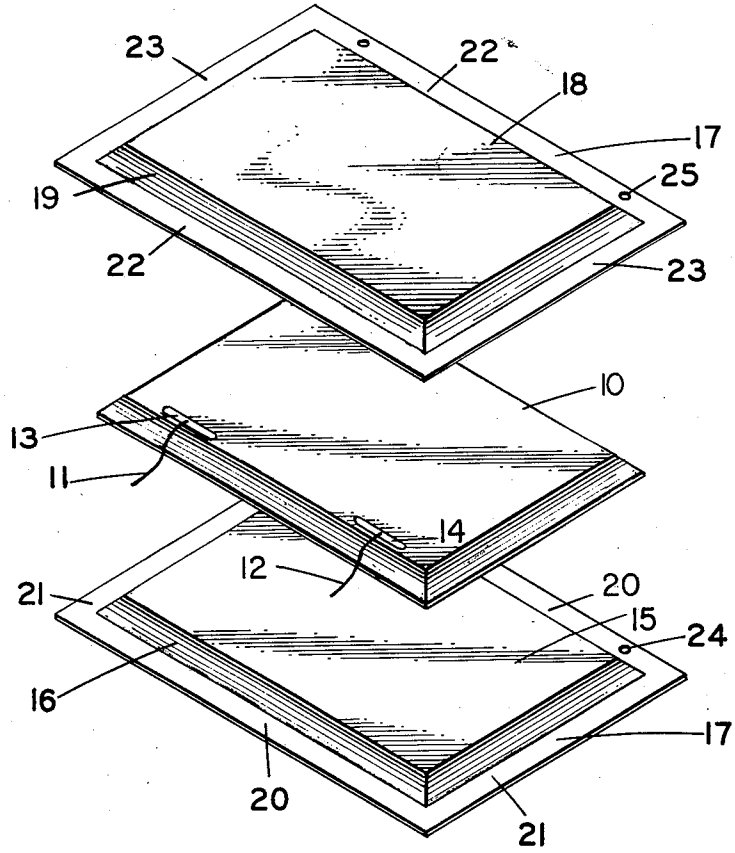


FIG. 2

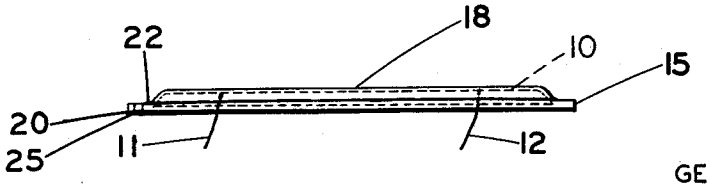


FIG. 3

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ELECTROLUMINESCENT DEVICE

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1 Claim. (Cl. 313—108)

This invention relates to electroluminescent lamps, in which the application of a voltage, especially a varying voltage, will cause the phosphor to luminesce.

In high ambient humidities, such lamps often deteriorate in lumen output during life because of moisture creeping into the lamp in the vicinity of the phosphor.

The present invention reduces the deterioration by providing a hermetically-sealed plastic enclosure for the lamp. A front plastic plate and a back plastic plate are fitted around the lamp, the plates having flat edges extending outward from the device, and sealed together. Lead-in wires or lead-in contacts are sealed through the plastic. The material is preferably thermoplastic so that the edges can be sealed merely by heating them to a high enough temperature, for example, by dielectric welding. The resultant seal makes the device completely waterproof.

A further advantage of the device is that the sealed plastic edges provide a region in which holes and the like can be made, for example by punching or drilling therethrough, to facilitate attachment of the lamp to a wall or panel by screws or hangers.

The plastic case or at least its front portion should be of light-transmitting material, in order to allow the light to emanate from the device. The plastic case can be made in whole or in part of a colored plastic, if desired, to filter out unwanted colors of light, as might be necessary in a red or yellow darkroom light, for example. Instead of using a colored plastic, a colored filter may be inserted inside the case between the luminous surface and the plastic cover, or a colored coating can be applied to the plastic. Various decorative or otherwise useful designs, in either black and white or color, can be incorporated in the device in the same manner as the color.

If it is not desired to make the plastic case sufficiently thick to be moisture proof, a non-hygroscopic paste or liquid, such as a silicone oil or any other material which does not diffuse into or attack the plastic case or the lamp itself, can be sealed inside the case.

Other objects, advantages and features of the invention will be apparent from the following specification taken in connection with the accompanying drawing, in which:

FIGURE 1 is a cross-section through an electroluminescent lamp of one type, showing the various layers in exaggerated thickness for convenience;

FIGURE 2 shows the three main parts of the device in position to be assembled; and

FIGURE 3 shows a side view of the completed device.

In FIGURE 1, the steel plate **1**, with beveled edges **2**, carries a coating of porcelain enamel **3** which can be applied in a manner customary in the enamelling art, and can be a double coating, for example a ground coat with enamel over it, although shown for convenience as a single coating. A transparent conductive coating **4**, of stannous chloride for example, is applied over the enamel. A coating **5** of a ceramic material with electroluminescent phosphor particles embedded therein is next applied, and over that another transparent conductive coating **6**, and a ceramic glaze **7** over the latter. A resin coating **8**, which can be an epoxy resin, covers the glaze **8**.

The lamp of FIGURE 1 is shown as lamp **10** in FIGURE 2, with lead-in wires **11, 12** soldered to the contacts **13, 14**. A plastic piece **15**, having a raised portion **16** fitting into the bottom re-entrant portion **17** of the lamp **10** is shown therebelow, and a plastic piece **18** having a portion **19**, raised on its top and reentrant on its bottom, is shown above lamp **10**.

The three pieces are fitted one over the other and their corresponding edges **20** and **22**, **21** and **23** sealed together by heating. The edges **20—22**, have the holes **24, 25** therein, and hole **24** being in register with the corresponding hole **25** in piece **18**. If desired, the holes **24, 25** can be drilled, punched or otherwise made in the edges **20, 22** after the latter are sealed together to form a single sealed edge **20—22**, as shown in FIGURE 3. The lead-in wires **11, 12** extend out between the flat edges **20, 22** forming the unit shown in FIGURE 3.

Various transparent or translucent plastics for example, polyvinyl chloride, methyl methacrylate, polyethylene and the like, can be used for the pieces **15** and **18**. The use of a thermoplastic material, rather than a thermosetting material, permits the edges to be sealed together by heating. In one example, the plastic material was polyvinyl chloride and had a thickness of about $\frac{1}{32}$ inch, but it can be thinner or thicker if desired. The flat edges were sealed by dielectric heating, that is by placing one electrode above and in register with the superposed edges to be sealed, another below them, and pressing them together while an alternating current voltage, of say 120 volts, was applied therebetween. Other suitable heating methods can be used.

The porcelain enamel coating **3**, in one example, had a thickness of about seven mils, the other layers each had a thickness of about one mil, except for the stannic chloride which will be only a fraction of a mil when applied by the usual methods. Such a lamp can be operated on 120 volts, 60 cycles per second, alternating current. If high voltage, say 600 volts, is to be used the phosphor-ceramic layer **5** can be thicker, say three or four mils. The resin coating **8** had about $\frac{1}{25}$ gram per square inch of an alkyd styrene urea copolymer resin.

The various coatings **3, 4, 5, 6** and **7** can be applied as explained in the copending applications Serial Nos. 282,003 and 365,617 filed respectively on April 12, 1952, and July 2, 1953, by Richard M. Rulon or in any other suitable manner.

Various changes and modifications of the embodiment described can be made without departing from the scope of the invention. For example, in the particular embodiment described, the plate **1** has bevelled edges and a reentrant back, but a flat plate **1** can be used instead, and in that case, the plastic backing piece **18** can also be flat, the front plastic piece **15** having a raised portion to accommodate the lamp. A flat plastic back plate can be used even with a plate **1** having bevelled edegs, if desired, but a back plate **18** having a raised portion will hold the plate **1** more satisfactorily in that case. The lamps are shown with a generally flat rectangular shape, but they can have any desired shape, for example, of flat circular shape.

The lamps are shown as having a particular set of layers or coatings **5—8**, but lamps with different sets of layers can be used.

Although the coating of phosphor and dielectric is shown as being applied as in the copending applications of R. M. Rulon, it can also be applied in other manners, for example by being settled out of an alcohol suspension.

What I claim is:

An electroluminescent device comprising: a metal plate with its edges bevelled to make one side reentrant; electrode layers and a layer of electroluminescent phosphor and ceramic on the non-reentrant side of said metal

plate; a plastic back plate having a raised portion fitting into the reentrant portion of said metal plate and having edges extending outwardly from said metal plate around the perimeter thereof; a plastic front plate having a reentrant portion fitting over the front of said metal plate and having edges extending outwardly from said metal plate around the perimeter thereof, said edges being in register with corresponding edges of said plastic back plate and being sealed thereto to form a complete seal around said plate.

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