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FLUORESCENT PANEL LAMP COATING

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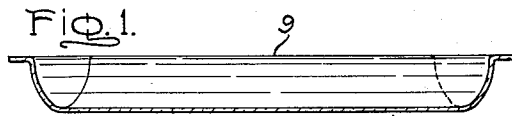


FIG. 2.

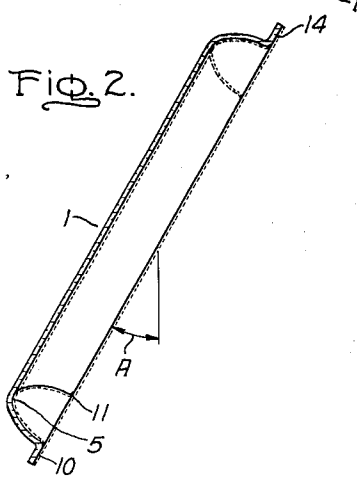


FIG. 3.

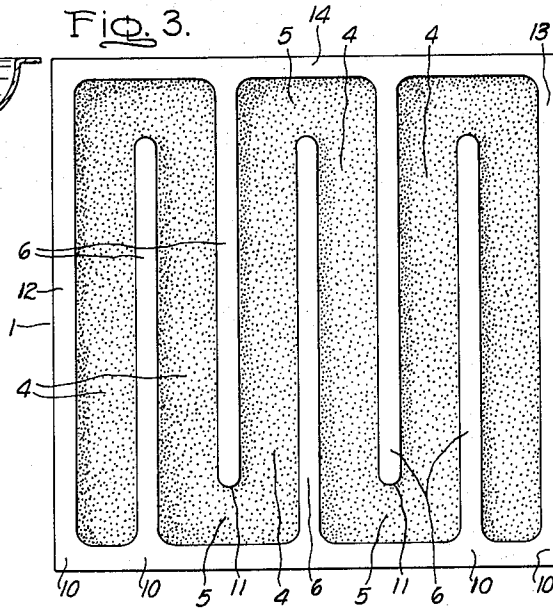


FIG. 6.

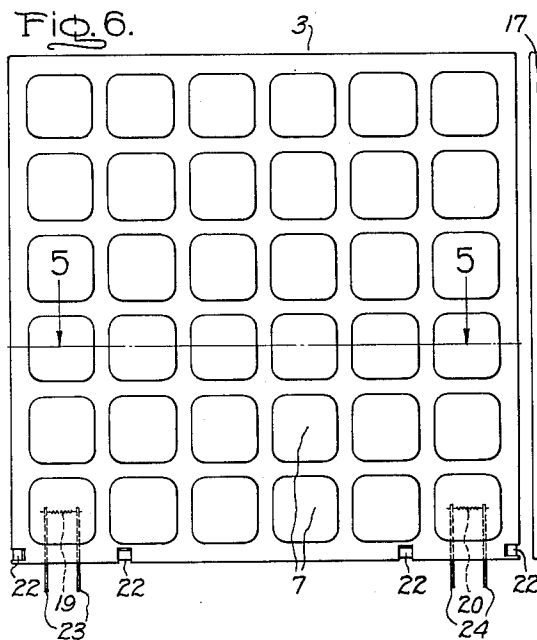


FIG. 4.

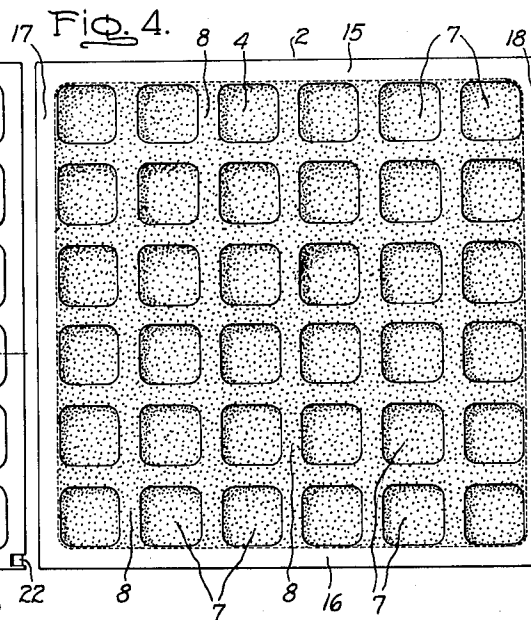
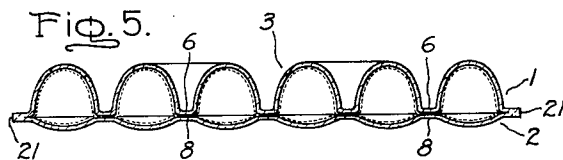


FIG. 5.



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FLUORESCENT PANEL LAMP COATING

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6 Claims. (Cl. 313-109)

This invention relates to fluorescent panel lamps generally and more particularly to the phosphor coating thereof.

In fluorescent panel lamps, the discharge path is a labyrinthine channel formed between two vitreous components sealed together along their margins. Such lamps provide a relatively long discharge in a small area which is an advantage from the point of view of compactness of source and ease of handling. They offer what may be described as an area light source as against a line source as is the case with the usual elongated fluorescent lamp.

In many of the applications presently visualized for a panel lamp, it is intended that only one face of the lamp be exposed to view. For instance, it is contemplated that panel lamps be made in modular sizes corresponding to the dimensions of standard ceiling tiles. Alternatively, it is contemplated that panel lamps be used in shallow fixtures. In either case, the lower plate, which may be referred to as the faceplate of the lamp is exposed to view and an attractive uniform appearance is desired for it. Fluorescent panel lamps, like any fluorescent lamp, are coated internally with a phosphor. The visual appearance therefore depends in large part on the quality and uniformity of the phosphor coating.

The object of the invention is to provide a fluorescent panel lamp phosphor coated in such fashion as to result in a product of attractive appearance particularly as regards the faceplate.

Another object of the invention is to provide a novel process for phosphor coating a fluorescent panel lamp.

The panel lamp with which the present invention is particularly concerned is formed by sealing two molded glass plates, the faceplate and the backplate, together along their margins. The upper components, referred to as the backplate, is molded to define, in cooperation with the faceplate, a labyrinthine discharge channel by means of parallel grooved sections or channelways extending side by side and joined together at alternate ends. The faceplate may be provided with a plurality of shallow embossments of square outline giving it somewhat the appearance of a quilt or checkerboard. The flat areas or lands of glass at the base of the partitions in the backplate are designed to seat on corresponding flat areas or lands between the embossments in the faceplate.

In accordance with my invention, I coat both the faceplate and the backplate with phosphor before they are sealed together along their margins. Desirably the phosphor coating is lehrd prior to sealing the plates together. This makes it possible to have phosphor present on the entire faceplate, including the flat areas or lands under the partitions of the backplate, and such phosphor coating is free of binder or organic material which would contaminate the lamp.

In a preferred process according to my invention the backplate is coated by flowing a phosphor suspension over it, then overturning the plate to allow the excess suspension to drain off along the edges or flats of the internal partitions. After drying, the phosphor is wiped off from the margin and from the flats of the partitions. The faceplate is similarly treated but the phosphor is wiped off from the margin only. The plates are preferably assembled and sealed together in such fashion that any drainage patterns are parallel in both plates and not crossed.

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For other features and for further objects and advantages of the invention, attention is now directed to the following description of a preferred embodiment of a lamp and of the coating process therefor, to be taken in conjunction with the accompanying drawing. The features of the invention believed to be novel will be more particularly pointed out in the appended claims.

In the drawing:

FIG. 1 is a side sectional view of the backplate of a square panel lamp horizontally disposed for filling with phosphor suspension.

FIG. 2 is a similar view showing the lamp inverted at an oblique angle to allow the phosphor suspension to drain out.

FIG. 3 is a plan view of the inside of the backplate coated with phosphor.

FIG. 4 is a plan view of the inside of the faceplate coated with phosphor.

FIG. 5 is a cross section through the lamp taken along line 5-5 in FIG. 6.

FIG. 6 is a plan view of the coated and assembled lamp looking at the faceplate.

Referring to the drawing, there is shown at 1 in FIG. 1 to 3 the backplate of a six-channel fluorescent panel lamp. The complementary faceplate which forms the underside of the lamp exposed to view when the lamp is mounted in a fixture or incorporated into a ceiling, is shown at 2 in FIG. 4. When sealed together along their margins, the two plates form the generally flat square panel lamp shown at 3 in FIGS. 5 and 6. Both plates may be formed from flat sheets of glass by any suitable means, for instance by vacuum molding or by pressing. The upper component or backplate is molded to define, in cooperation with the faceplate, a winding or labyrinthine discharge channel or passage by means of six parallel grooved sections or channelways 4 extending side by side and joined together at alternate ends, as at 5 where the lengthwise folds forming partitions 6 end, thereby forming a continuous grid-like channel. The faceplate is provided with a plurality of shallow embossments 7, of square outline in plan view, giving it somewhat the appearance of a quilt or checkerboard. The quilting of the faceplate improves its appearance, increases the strength of the assembly, and makes for a more uniformly lighted face. FIGS. 3 and 4 are of course views of the inside surfaces of these plates and it is intended that the flats or lands 8 between channelways seat on the corresponding lands 8 extending between embossments in the faceplate.

In order to phosphor-coat the backplate, it may be supported horizontally as indicated in FIG. 1, preferably over a suitable pan to catch any overflow, and the phosphor suspension poured into it to the overflow point as indicated at 9. The purpose is to paint or coat the entire inside surface of the backplate with phosphor suspension or paint and the same result may be achieved by spraying in excess. For the purpose of the present invention, the kind of phosphor used or the type of binder forming the suspension is not important. The phosphors most commonly used are calcium halophosphates activated with manganese or antimony. For the suspension I prefer to use a water soluble binder consisting of an ammoniacal aqueous solution of the copolymer of methyl vinyl ether and maleic anhydride (PVM/MA) and of polyacrylic acid (PAA), as disclosed and claimed in my copending application Serial No. 12,969, filed March 7, 1960, entitled Phosphor Coating Method and assigned to the same assignee as the present invention, now Patent 3,006,781. However other binder solutions may be used, such as for instance the nitro binders at one time commonly used in fluorescent lamp manufacture and consisting of a solution of nitrocellulose in butyl acetate.

The backplate is then tipped over and overturned and inclined as indicated in FIG. 2 with the lands 6 extending up and down. The major part of the contents naturally fall out as soon as tipping is begun but then drainage continues while the plate is inclined as indicated and warm air is blown upon it to dry the coating. By running the lands up and down, the excess tends to drain out of the grooves or channelways and to run along the lands, either all the way to the lower margin at 10, or to the terminations of the lands as at 11. The coating dries out first where it is thinnest and this is in the bottoms of the channelways. The coating dries out last and thickest along the lands and margins and this is where streaks and irregularities are likely to occur. However this is not important because after thorough drying, the lands 6 and the entire margin of the lamp including the bottom margin 10, the side margins 12, 13 and the top margin 14 are wiped or brushed clear of phosphor. The angle A at which the backplate is held to the vertical is not critical; what is desired is that the coating drain out fairly rapidly without pooling anywhere, and it should drip off at the end of the land at 11 rather than running around the loop at 5 and forming a flow streak. For the illustrated backplate, an angle A of approximately 60° is suitable.

The coating of the faceplate is done in similar fashion. It is generally desirable to have the lamp emit a greater proportion of its light downwardly through the faceplate than through the backplate. Therefore a generally thinner phosphor coating is desired on the faceplate and this is readily accomplished by using a less viscous binder solution. In coating the faceplate, the coating will likewise thin out and dry out first and most evenly in the embossments 7. This is desirable because the embossments are the parts which naturally strike the eye first. The drainage will occur primarily along the lands 8 from the top margin 15 towards the bottom margin 16. Any flow streaks that occur in the faceplate will be relatively minor and will occur on the lands 8 running in a direction parallel to the side margins 17, 18. The phosphor coating will tend to be somewhat thicker along the lands in the direction of flow but this is not objectionable for a reason which will appear shortly. After drying, only the margins of the faceplate are wiped clear of phosphor. The phosphor coating is indicated by the speckling in FIGS. 3 and 4.

To make a fluorescent panel lamp, the phosphor is lehrd, that is heated to a sufficiently high temperature to decompose and drive out the organic binder, and the backplate and faceplate are mated and sealed along their margins to form an envelope. This envelope is provided with discharge supporting electrodes 19, 20 at the ends of the channel, and with an ionizable filling consisting of a vaporizable metal such as mercury and an inert gas such as argon. In the usual fluorescent lamp configuration, the filling is an excess of mercury to provide a partial pressure of 5 to 8 microns during normal operation, and argon at a pressure of 2 to 3 millimeters. Such a filling provides in general optimum generation of 2537 Å. radiation for excitation of the phosphor coating. In general I prefer to have the plates sealed together with a ledge seal and the lamp to be made according to the teachings of the copending application of Richard S. Christy, Serial No. 106,829, filed of even date herewith, entitled Panel Lamp and Manufacture Thereof, and assigned to the same assignee as the present invention.

According to a feature of my invention, in assembling the backplate and faceplate for sealing, I match the direction of phosphor flow or drainage in the two plates, that is, side margins are mated together. Mating of a side margin to a bottom or top margin is avoided. This avoids crossed streak lines and makes for better appearance. In coating the plates, the phosphor coating generally dries somewhat thicker at the bottom end than at the top end. I find it then preferable to place the top or thin end of the faceplate so that it overlies the elec-

trodes. In the drawing, this would mean that top margin 15 of the faceplate is matched to bottom margin 10 of the backplate. This is desirable because somewhat less light is generated in the regions of the electrodes. However light is to a certain extent trapped within the envelope by internal reflection and a proportionately greater share of the trapped light escapes where the phosphor coating is thinnest. This arrangement therefore compensates to a certain extent for the lesser generation of light in the electrode regions and provides for more uniform lighting of the faceplate.

According to another feature of my invention, the phosphor coating extends over the entire faceplate including the lands 8 in the faceplate which overlie (or underlie in FIG. 5) the lands 6 in the backplate. In the sealing method according to the aforementioned Christy application, fused ledge seals are formed at the margins as indicated at 21 in FIG. 5, by the application of tremendously high sealing pressures while the glass is heated above the strain point but below the softening point. However at the internal partitions or lands 6, 8 the glass is merely pressed into close conformance by the application of relatively low pressure. This is sufficient to prevent the arc from leaking through or short-circuiting at the junctions under the partitions. Thus phosphor on the lands of the faceplate is imprisoned between the glass surfaces in these regions, as indicated by the dotted inside lining in FIG. 5. This is highly desirable for the sake of appearance; in the absence of phosphor under the lands, clear glass results which stands out darkly in sharp and disagreeable contrast, especially when the lamp is not lit. The somewhat greater thickness of phosphor along the lands of the faceplate is therefore not objectionable but is in fact desirable since it results in a lamp with a faceplate of more uniformly white appearance. I prefer to wipe the phosphor off the lands of the backplate to avoid build-up of an excessive thickness. Since the coating is in any case somewhat thicker over the lands of the faceplate than in the embossments, a fully adequate thickness of phosphor is present.

The notches at 22 in the seal close to the electrodes on the faceplate side are for the purpose of attaching bases to the ledge seal on the backplate side by means of metal clips. Such bases may be of the kind described and claimed in copending application Serial No. 106,827, of Albert F. Pate, Robert A. Kuebler and Harold R. Kestner, filed of even date herewith, entitled Panel Lamp Base, and assigned to the same assignee as the present invention. The inleads 23, 24 of the electrodes 19, 20 will then be connected to the terminals or contact pins of these bases.

While a specific embodiment of the invention as regards structure and process has been described in detail and illustrated, same is intended by way of example only and not in order to limit the invention thereto. Modifications will readily occur to those skilled in the art and it is intended by the appended claims to cover any such as fall within the true spirit and scope of the invention.

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

1. A fluorescent panel lamp comprising a vitreous envelope formed by a backplate and a faceplate sealed together along their margins, said backplate having grooved channelways extending therein with partitions between them to define a labyrinthine discharge channel, and a phosphor coating extending over the entire faceplate including the areas underlying and engaging the partitions in said backplate.

2. A fluorescent panel lamp comprising a vitreous envelope formed by a backplate and a faceplate sealed together along their margins, said backplate having a plurality of grooved channelways extending therein side by side with partitions between them and joined at alternate ends to define a labyrinthine discharge channel, said faceplate having a plurality of shallow embossments formed

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therein with lands extending between the embossments and underlying the partitions between said channelways in the backplate, and a phosphor coating extending over the entire faceplate and including the areas of the lands underlying the partitions in said backplate.

3. A fluorescent panel lamp comprising a vitreous envelope formed by a backplate and a faceplate sealed together along their margins, said backplate having a plurality of grooved channelways extending therein side by side with partitions between them and joined at alternate ends to define a labyrinthine discharge channel, said faceplate having a plurality of shallow embossments formed therein with lands extending between the embossments and underlying the partitions between said channelways in the backplate, phosphor coatings on said plates, said backplate and faceplate being assembled with drainage flow patterns resulting from phosphor coating extending parallel in both plates.

4. A fluorescent panel lamp comprising a vitreous envelope formed by a backplate and a faceplate sealed together along their margins, said backplate having a plurality of grooved channelways extending therein side by side with partitions between them and joined at alternate ends to define a labyrinthine discharge channel, said faceplate having a plurality of shallow embossments formed therein with lands extending between the embossments and underlying the partitions between said channelways in the backplate, electrodes sealed into the ends of said labyrinthine channel, phosphor coatings on said plates, said backplate and faceplate being assembled with drainage flow patterns resulting from phosphor coating extending parallel in both plates and with the end of the faceplate having a thinner phosphor coating located over the electrodes.

5. A fluorescent panel lamp comprising a vitreous envelope formed by a backplate and a faceplate sealed together along their margins, said backplate having a plurality of grooved channelways extending therein side by side with partitions between them and joined at alternate ends to define a labyrinthine discharge channel, said faceplate having a plurality of shallow embossments formed

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therein with lands extending between the embossments and underlying the partitions between said channelways in the backplate, phosphor coatings on the inside surfaces of said plates, said backplate and faceplate being assembled with drainage flow patterns resulting from phosphor coating extending parallel in both plates, said phosphor coating extending over the entire faceplate including the areas of the lands overlying and in engagement with the partitions in the backplate.

6. A fluorescent panel lamp comprising a vitreous envelope formed of two sheets of glass, a backplate and faceplate, sealed together along their margins; said backplate having a plurality of grooved channelways extending therein side by side and joined at alternate ends to define a labyrinthine discharge channel; said channel being formed by folds in said backplate providing partitions between channelways with flat areas of glass at the base of contiguous partitions; said faceplate having a plurality of shallow embossments with lands extending between the embossments and underlying the flat areas in the backplate; and a phosphor coating extending over the entire faceplate and including the lands underlying said flat areas in the backplate.

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