

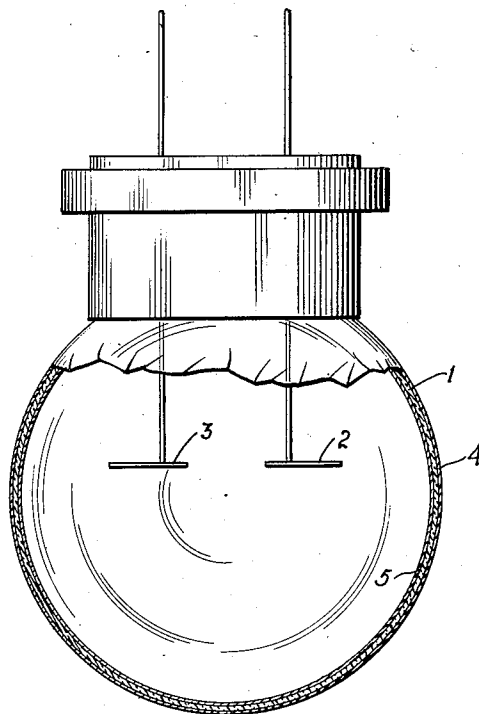
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LAMP

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LAMP

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My invention relates to a new and improved lamp.

One of the objects of my invention is to provide a lamp which will be particularly useful for giving a restricted but sufficient area of illumination in case of a blackout.

Another object of my invention is to provide a glow-discharge lamp which has a filling of argon or nitrogen, so that said glow-discharge lamp yields little or no rays in the visible spectrum, said lamp having a coating or coatings which contains phosphorescent material. Said coating may be located upon either the outer or inner wall of the envelope of the lamp, or on both said walls.

Another object of the invention is to provide a baked enamel coating in which the vehicle or base in which the phosphorescent substance or substances are incorporated, has good adhesion to glass, said coating being hard and resistant. The resinous base of said coating is permeable to the longer ultraviolet rays which pass through ordinary glass. Said coating does not change in color or deteriorate for a long period of time. It is well known that ordinary glass is impermeable to the shorter ultraviolet rays, and that it is permeable to the longer ultraviolet rays.

Another object of the invention is to provide a glow-discharge lamp which has a filling of neon or other gas which yields a substantial percentage of rays in the visible spectrum under the action of a glow-discharge, the coating being made so as to permit some transmission of visible light through the same. In such case, the electric current can be supplied intermittently to the glow-discharge lamp, thus producing different colors when the lamp is switched on and off.

Another object of my invention is to provide a glow-discharge lamp having a coating or coatings which include phosphorescent material, in which said material will remain phosphorescent for a long period of time after said phosphorescent material or materials of said coating or coatings have been suitably energized.

Other objects of the invention will be stated in the annexed description and drawing, the single figure of which illustrates a preferred embodiment thereof.

The drawing diagrammatically illustrates a glow-discharge lamp having an envelope 1, and electrodes 2 and 3. However, the glow-discharge lamp may be of any type and it may be of the electrodeless type.

If the glow-discharge is to be rich in ultraviolet rays, with the production of little or no

rays in the visible spectrum, the filling of the lamp 1 is preferably argon or nitrogen. Argon is superior to nitrogen in this respect since the glow-discharge through a filling of argon at suitable low pressure, produces practically no light in the visible spectrum and such discharge is rich in ultraviolet rays.

If an external coating 4 is to be used, it is made as follows:

10 Polymerized vinyl acetate (polyvinyl acetate) is dissolved in a suitable solvent such as methylene chloride or acetone or the like. I prefer not to employ the vinyl resin which is secured by polymerizing a mixture of vinyl acetate and vinyl chloride or which is secured by polymerizing vinyl chloroacetate. Polyvinyl acetate is a well known product which is made by polymerizing vinyl acetate in the presence of a peroxide catalyst. This polymerized product is a resin which is made in different grades or types. The solution of the polymerized vinyl acetate in methylene chloride which I use, should contain more than 5% by weight of the vinyl acetate.

20 I prefer to use methylene chloride as a solvent because it is extremely volatile and it is not inflammable. A suitable plasticiser is dissolved in the aforesaid solution of the polyvinyl acetate. I prefer to use as a plasticiser, the compound known as triacetin or glyceryl triacetate. The proportion by weight of the triacetin is preferably 7% of the weight of the polyvinyl acetate. I can use other well known plasticisers such as tricresyl phosphate and the like, but in such case I must use more than the above proportion of the 7% by weight of the polyvinyl acetate.

35 The weight of the polyvinyl acetate in said solution should not exceed 10% of the weight of the methylene chloride, and the proportion of the polyvinyl acetate is 5-10% of the weight of the methylene chloride.

40 The viscosity of the polyvinyl acetate solution is an important factor, since polyvinyl acetate is made in various grades or types.

When 86 grams of the suitable polyvinyl acetate are dissolved in a liter of benzene, the viscosity of the solution, at a temperature of 20° C., should be 2.5 centipoise or less.

45 If the solution of polyvinyl acetate has excessive viscosity, it is impossible to spray said solution so as to get an adherent coating of uniform thickness.

The grade or type of the polyvinyl acetate is selected so that the aforesaid solution in methylene chloride has low viscosity, namely, .075 poise (7.5 centipoise) or less.

Any suitable phosphorescent material, such as phosphorescent zinc sulfide, is added to the solution prior to the spraying. The percentage of the luminous zinc sulfide may be as high as 80% by weight of the mixture of the solution and of the zinc sulfide. The percentage by weight of the zinc sulfide may vary from 20% to 80% of the weight of the total mass, which consists of the mixture of said solution with the zinc sulfide. Luminous zinc sulfide comes in crystals of varying size and weight, and these crystals are heavy and sink to the bottom of the solution. It is undesirable to reduce these crystals to greater fineness, as this destroys or injures the phosphorescent property of the zinc sulfide.

The mixture of the zinc sulfide or other phosphorescent substance with the aforesaid solution, is applied to the surface of the glass envelope 1, by means of an air brush, using a pressure in the air brush of about 20 pounds per square inch. During the operation of the air brush, the mixture of the solution and of the luminous zinc sulfide is vigorously agitated in order to produce a uniform mixture. If the air brush is operated by hand, the same can be vigorously vibrated or shaken during the application of the coating material. The tank of the air brush may be provided with any suitable stirring apparatus.

The coating which is thus formed, and which includes the polyvinyl acetate and the plasticizer and the crystals of the phosphorescent material should not exceed 0.017 mm. for maximum phosphorescence. Said coating may be as thin as 0.01 mm. and the invention is not necessarily restricted to the thickness of the coating, save that a very thin coating is preferred for best results.

The methylene chloride evaporates immediately.

The spraying operation is continued in order to provide a continuous coating, if it is desired to use the lamp for blackouts.

I have discovered that when the dissolved vinyl resin, intermixed with the crystals of zinc sulfide, is sprayed under the conditions mentioned herein, using methylene chloride as a solvent, that the outer surface of the coating has a very coarse and matte structure. When such coating is baked, under the conditions stated herein, said coarse and matte structure is preserved, so that the light which is emitted by the crystals is emitted in every direction, thus producing a completely dispersed and diffused light. Such complete dispersion of the light is an important feature of my invention and it depends upon the use of crystals, as distinguished from the fine powder, and also upon the formation of an exposed enamel surface of sufficient irregularity. Therefore, when the light of the improved lamp is projected by an ordinary lamp shade against the floor or against the walls of the room, such light is substantially not reflected. It is also an important feature of the invention, to secure such light from a layer which is external to the glass wall of the bulb, so that the light which is emitted by the crystals is refracted through the irregular exposed surface of the enamel coating.

After the coating has been formed, the coated bulb is baked in an electric oven, in an atmosphere of air, at a temperature of about 100° C.-110° C., for a period of 30-60 minutes. The plasticized polyvinyl acetate is thus baked to form an enamel.

Since polyvinyl acetate is not absolutely resistant to water or to water vapor, the outer coating 4 may be provided with a thin transparent coating of any suitable lacquer, such as a nitrocellulose lacquer, a cellulose acetate lacquer and the like. The invention is not restricted to any particular type of protective lacquer.

The surface of the bulb may be thoroughly cleaned and it is preferably dry, before said surface is coated, although these precautions are not necessary.

The base of polyvinyl acetate has good adhesion to glass. The coating is hard and resistant and, when it is baked, it provides a durable and adherent enamel which firmly retains the crystals of luminous zinc sulfide or the like. Said coating is also permeable to the long ultraviolet rays which pass through ordinary glass. The invention is not necessarily limited to the use of any particular transparent material for making the envelope of the lamp, but said material is preferably ordinary glass of the type which transmits some of the ultraviolet rays, namely, the longer ultraviolet rays.

The improved enamel coating 4 does not become yellow or deteriorate for a long period.

By using a glow-discharge lamp which operates at very low temperature, the enamel coating 4 is maintained hard. The use of such low temperature is necessary, because the enamel coating 4 becomes soft at about 85° C.

The invention can also be applied to lamps which have a filling of neon or other material which yields a large percentage of rays in the visible spectrum, under the action of a glow discharge. In such case, the coating 4 is made sufficiently thin and said coating is preferably in the form of slightly separated spots. The spots of coating are sufficiently thin to permit the passage of a certain percentage of the visible rays. The formation of the coating in very small and in very slightly separated spots is secured by regulating the distance between the nozzle of the air brush and the surface of the light-permeable envelope of the lamp. In the case of a neon lamp, it is possible to supply the current to said lamp intermittently. When current is supplied to the neon lamp the light is of a reddish color. When the current is switched off, the luminous zinc sulfide gives a green phosphorescence.

Instead of using ordinary glass for making the envelope of the lamp, I can use any of the well known types of filter glass, which filter out all the visible rays. This is particularly advantageous when the lamps are used in blackouts, to indicate the exits of theaters, and for other purposes. The material of the inner coating 5 may also be applied by means of the air brush, before the envelope of the lamp is supplied with its gaseous filling and the electrodes.

As an example of material which is sprayed in order to form an inner coating 5, I prepare an aqueous solution of sodium silicate, whose density is from 24°-28° Baumé. I add crystals of zinc sulfide or other suitable phosphorescent material to said solution, in order to form a mixture. The weight of the zinc sulfide is from 20%-80% of said mixture. The mixture is sprayed upon the inner wall of the bulb. Instead of using an aqueous solution of sodium silicate, I can use other compounds of the same class, such as potassium silicate, sodium borophosphate, etc. I can also use organic compounds, such as sodium

glycaborate. The water evaporates from said solutions, when they are sprayed, so as to deposit the inner coating 5.

The base of said coating is sodium disilicate (water glass) or an equivalent substance which is soluble in water, and in which the crystals or particles of phosphorescent material are embedded. The water glass or equivalent substance is very permeable to ultraviolet rays, so that the phosphorescent material is energized without any substantial loss of the energy of the ultraviolet rays. The rays in the visible spectrum which are produced by the phosphorescent substance or substances pass without substantial loss through a wall of ordinary glass.

Whenever proportions or dimensions are specified herein, the same are given only by way of example, and without limiting the invention thereto.

If the glow-discharge lamp has a filling of argon or nitrogen, which yields substantially no light in the visible spectrum, the improved lamp has many advantages for use in blackout, to indicate the exits in a theater, as a signal lamp, and for many other purposes. Such a lamp is operated at a very low temperature and while it is supplied with current, the phosphorescent material of the coating produces a very uniform and diffused light by means of which a person can read or write or perform ordinary duties within a limited radius which depends on the size of the lamp and its supply of energy. Beyond said limited radius, the light which is emitted by such a lamp cannot be seen, even while full current is being supplied to the lamp. When such a lamp is energized by supplying the same with electricity for about 1-2 hours, and the supply of electricity is then discontinued, the phosphorescent material of the coating continues to yield the aforesaid uniformly diffused light for a period of about 8 hours. Such a lamp can therefore be energized by supplying the same with current at any suitable point, and the bulb can then be unscrewed from its socket and it can be used for several hours in places where there is a fire hazard or the like.

While the lamp is being operated with full current discharge, the temperature of the external wall of its envelope does not exceed 80° C.

The use of polyvinyl acetate of proper polymerization is important, in order to secure the above-mentioned low viscosity, as otherwise the solution of the polyvinyl acetate cannot be sprayed so as to form a coating. If the viscosity of the dissolved polyvinyl acetate is too high, threads of material are formed at the nozzle of the air brush, and it is impossible to secure a uniform and adherent coating.

The use of methylene chloride as a solvent is extremely advantageous in connection with the particular type of resin which I employ, because the viscosity of the solution of the resin depends upon the solvent. In addition to its relatively low boiling point of 42° C., the methylene chloride has the added advantage of producing a solution of low viscosity, which can be sprayed to produce a solid coating which can be baked to make an enamel, in which the small particles of phosphorescent material are efficiently held. The particles or crystals of zinc sulfide are embedded in the polyvinyl acetate enamel, and said enamel is permeable to ultraviolet rays in the same range as ordinary glass, and it is also permeable to rays in the visible spectrum. Methy-

lene chloride is also designated as methylene dichloride and dichloro-methane. It is a colorless and volatile liquid.

I have described preferred embodiments of my invention but it is clear that numerous changes and omissions can be made without departing from its spirit.

I claim:

1. A glow-discharge lamp which has a filling which emits light under the action of a glow-discharge, said lamp being operated at a temperature which does not exceed about 85° C., said emitted light being substantially wholly in the non-visible spectrum and including ultraviolet rays of respectively different wave-lengths, the outer wall of the envelope of said lamp having an adherent applied coating which contains particles of phosphorescent material, said phosphorescent material being injured by ultra-violet light whose wave-length is below a certain limit, said coating being permeable to ultra-violet light which energizes said phosphorescent material, said envelope being permeable to longer ultra-violet rays which energize said phosphorescent material and being substantially impermeable to shorter ultra-violet rays which injure said phosphorescent material, said coating becoming soft at temperatures which exceed 85° C., and remaining hard at temperatures up to 85° C.

2. A glow-discharge lamp which has a gaseous and vapor-free filling, said lamp being operated at a temperature which does not exceed 85° C. to emit a glow-discharge from said filling, the wall of said lamp having an adherent baked enamel coating which contains particles of phosphorescent material, the major ingredient of said coating being polymerized vinyl acetate, said coating remaining hard up to substantially 85° C. and softening at temperatures above 85° C., said coating being permeable to ultra-violet rays which energize said phosphorescent material.

3. A lamp according to claim 2, in which a ten percent solution of the polymerized vinyl acetate in methylene chloride has a viscosity which does not substantially exceed 0.075 poise.

4. An electric glow-discharge lamp whose envelope has an adherent baked enamel coating which contains particles of phosphorescent material, said envelope and said coating being permeable to ultra-violet light which energizes said phosphorescent material, said lamp being operable at a temperature which does not exceed 85° C. to produce a glow-discharge of the filling of said lamp, said coating remaining hard up to 85° C., the major ingredient of said coating being polymerized vinyl acetate.

5. A glow-discharge lamp which has a filling which emits visible rays and ultraviolet rays when a glow-discharge is passed through said filling, the envelope of said lamp having separated particles of adherent coating material, said particles of adherent coating material having particles of phosphorescent material therein, the visible phosphorescent rays which are emitted by said particles of phosphorescent material having a color which is different from the color of the visible rays which are emitted by said filling under the action of a glow-discharge, the particles of the coating material being sufficiently separated to enable the visible rays which are emitted by said filling under the glow-discharge to be visible, said particles of coating material being substantially impermeable to visible rays.

6. An electric lamp having an external adherent coating which contains particles of phosphorescent material, the major ingredient of said coating being polymerized vinyl acetate which is permeable to ultraviolet light, the thickness of said coating not substantially exceeding 0.017 mm.

7. A glow-discharge lamp which has a filling which emits light under the action of a glow discharge, the envelope of said lamp having an external adherent baked enamel coating which contains phosphorescent material substantially wholly in substantially unreduced crystal form, said coating being permeable to ultra-violet light, the free surface of said coating being irregular and refracting the light which is emitted

by said crystals substantially in all directions, in order to produce emitted light which is substantially wholly diffused.

8. A glow-discharge lamp which has a gaseous filling which emits only light which is substantially in the invisible spectrum under the action of a glow-discharge, the wall of said lamp having an adherent coating which contains particles of phosphorescent material which are energized to emit visible light by the light which is produced by the action of said glow-discharge, the wall of said lamp and said coating being permeable to the light which is produced by the action of said glow-discharge.

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