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INSIDE COATED LAMP BULB

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This invention relates to a coated article and to the method of producing the same and more particularly to a glass or vitreous article having an opalescent or colored lustrous appearance and the method of producing such appearance by the use of a coating as set forth in our copending application, Serial No. 736,855, filed Sept. 10, 1924, for coating compositions.

While the invention will be described as applied to an incandescent electric lamp bulb, it is to be understood that it is not so limited and may be applied equally well to a large variety of objects, such as lighting fixtures, globes, shades, etc.

Opalescent effects have heretofore been produced by using opal glass, that is, a glass to which cryolite is added during the manufacture thereof. Such a glass is expensive and moreover, with extensive use of the lamps, the glass tends to decompose with a liberation of gases probably silicon fluoride (SiF_4) which are injurious to the lamp and shorten the life thereof. Furthermore, the light absorption of opal glass is extremely high and is not uniform due to the uneven thickness of the bulb. This results in the light emitted from the lamp being of low and unequal intensity.

It has also been proposed to produce opalescent effects by etching the glass with hydrofluoric acid or other etching solutions. Extreme care must be taken, however, in the handling of such materials and their use is therefore extremely objectionable. Moreover, the effects produced are not lustrous nor of a pearly character.

Heretofore the difficulties encountered in using opal glass or etched glass were overcome by coating the exterior surface to produce an opalescent effect.

While this lamp is of excellent appearance and the coating thereon is very durable, it is desirable for certain purposes that the outer surface of the lamp be smooth and vitreous. This permits the lamp to be more readily cleaned and gives it a lustrous appearance. Moreover, it has been found advisable in coating lamps as set forth in said application, to increase the resistance of the coating to atmospheric conditions by baking it on the lamp bulb and treating it with a fixing solution such as ammonium chloride. This operation is somewhat inconvenient and unless care is taken with the use of the fixing solution, the bases of the lamps become badly corroded thereby.

One of the objects of the present invention is to produce a hollow glass or vitreous article having an opalescent on colored lustrous appearance and a smooth vitreous exterior surface.

Another object is to produce an incandescent electric lamp bulb having an internal superficial light diffusing coating.

Another object is to produce an inside coated lamp bulb which will have the property of diffusing the light with a minimum absorption thereof.

Another object is to produce a light diffusing bulb for an incandescent lamp in which the loss of light due to the blackening of the bulb by vaporization from the filament will be greatly reduced.

Another object is to produce an incandescent lamp having a smooth superficial coating of even thickness on the interior surface thereof.

Another object of the invention is to provide a process of producing opalescent highly lustrous effects on hollow vitreous articles.

Another object is to provide a method of coating an incandescent lamp bulb on the interior surface with a material capable of producing light diffusing opalescent or colored effects.

Other objects and advantages will hereinafter appear.

In accordance with this invention, a coating composition or enamel is applied to the interior surface of a hollow glass article such as an incandescent lamp. The coating composition may comprise a pigment, a binder, a filler and an ingredient which serves to reduce the melting point of the glass to which a composition is applied and to cause the composition to assume a smooth even coating on such object. The binder may be of such nature that when opalescent effects are desired, the pigment will be obtained by

dehydration thereof although when colored effects are desired, a separate pigment may be added to the composition.

The pigment should be more or less opaque in order to render the surface to which it is applied, light diffusing and produce an opalescent or pearly effect; the filler should be composed of more or less translucent material so as not to obstruct the passage of the light to any considerable degree and the binder should be of the nature suitable for uniting the pigment and filler together and to the object to which the enamel may be applied. All of the ingredients of the composition must be stable or capable of combining to form compounds which are stable at the operating temperature of the lamp. Furthermore, it must be capable of withstanding the heat required to seal the mount into the lamp.

A further requirement is that under the temperature which the lamps attain in operation and the high vacuum which is produced therein, the coating must not give off objectionable gases or vapors which will be deleterious to the filament or lower the efficiency of the lamp. Furthermore, the composition when applied to the lamp, must assume a smooth even coating of sufficient thickness and opacity to give a pearly white appearance or a lustrous colored effect with a minimum obstruction of light. A still further requirement of the composition or enamel is that it will not substantially affect the melting point of the glass since otherwise, when the coating is applied to incandescent lamp bulbs, difficulties might be encountered in sealing the mount into the bulb.

It is highly desirable in order to obtain the best results, that the solid ingredients be in a finely divided form since a more intimate mixture is thereby obtained and a smoother and more even coating secured. The filler, for opalescent effects, should preferably be white and more or less translucent and the specific gravity of the binder should be relatively high in order that a mixture of the required consistency for securing proper coatings may be obtained with the use of a minimum amount of filler. The coating moreover, should have the property of setting upon the application of heat, into a compact hard and homogeneous mass containing no volatile constituents.

A composition which has been found to meet all the requirements for a coating of this nature may be composed of the following ingredients and proportions, although it is to be understood that variations may be made therein without departing from the invention. 200 grams of a filler comprising a very fine grade of pure white kaolin is mixed with 25 grams of an alkali which may be chemically pure sodium hydroxide and 1,000 c. c. of a binder composed of an aqueous solution of an alkali silicate, preferably sodium silicate having a specific gravity of about 1.275.

The kaolin or filler serves to give body to the composition and to give it the right consistency for being properly applied to the objects to be coated.

The alkali serves a two-fold function. It has the property of rendering the enamel more mobile without substantially altering its density and therefore causes it to assume a smooth even thin coating. It also reduces the fusing temperature of the glass thus overcoming the tendency of the other ingredients to increase the melting point so that the finished or coated article will have a melting point not substantially different from the clear glass.

The sodium silicate acts both as a binder and as a pigment for the production of opalescent effects. It is important that the binder has a high specific gravity since the water content thereof, is thereby lowered and there is less moisture present to be removed before the mount is sealed into the bulb. Moreover, by using a binder having a high specific gravity, the amount of filler required to give the compound the required consistency is thereby reduced and a whiter coating produced.

The pigment, when opalecent effects are desired, may be supplied entirely by the sodium silicate and the filler. When the sodium silicate is dehydrated in a manner which will presently appear, the sodium silicate is left as a fine white opaque material which serves as a pigment for producing the desired effects. Due to the fact that the pigment is formed partially out of the solution, it is very intimately and evenly mixed with the other ingredients of the coating thereby resulting in a uniform distribution over the surface and giving the coating a more uniform whiteness.

When viewed through the glass, as it must be when coated on the inside of a bulb or other hollow object, a soft lustrous effect similar to that of the pearl is produced. The appearance is more pleasing than in the case of lamps made from opal glass or when coated on the exterior.

In addition to the pleasing appearance obtained by aplying the coating to the inside of the bulb, a more material advantage is obtained in that when such lamps are employed for outdoor use, the coating composition is protected against discoloration or fading under the action of the rays of the sun. It is common knowledge that coatings, when disposed on the outer surfaces of lamps and exposed to sunlight, will, by reason of the ultra-violet radiations, become discolored or faded, whereas with the inside coated lamps, the interposed layer of glass absorbs the detrimental radiations protecting the coating so that it is substantially free from discoloration

or is non-fading throughout the life of the lamp.

If it is desired to produce a colored coating, a suitable pigment may be added to the composition, the amount of which depends upon the particular pigment used and the intensity of the color desired. When a pigment is added, it is necessary, of course, to reduce the amount of the filler accordingly, in order that the proper consistency of the enamel may be maintained. The pigment used must be highly resistant to heat and capable of withstanding the temperatures attained in the sealing-in and exhaust operations of manufacturing the lamp.

The mixture is placed in a mixing vessel or ball mill and thoroughly agitated until a homogeneous mixture is obtained. The coating may be applied to the interior of the lamp bulb or other hollow objects by pouring or spraying or in any other suitable manner. It is essential, however, that the composition or enamel be of the proper consistency in order that good results may be obtained. However, if the composition is of the proper consistency, it may be applied to the objects in almost any manner and a satisfactory coating secured. The composition may be poured into the bulb or sprayed therein and the excess allowed to drain therefrom by gravity. If desired, the bulb or other object may be agitated or its interior subjected to a vacuum to assist in removing the excess enamel although this is not necessary since the excess will drain by gravity from the object in a very few seconds.

The articles or substances which have been coated, are subjected to heat treatment at an elevated temperature of from 200 to 450° C., for three or four minutes to dehydrate the binder and bake the coating thus causing it to become firmly united to the object. The heat also removes all occluded gases which are contained in the coating and reduces the sodium silicate solution to a fine white crystalline form.

It is essential that all the water vapor be removed from the coating since the slightest amount of moisture will have a deleterious effect on the filament.

However, any gases or water vapor remaining in the coating after the baking operation will be removed during the exhausting of the lamp since the bulb is highly heated at that time.

It is advisable, however, in the case of incandescent electric lamp bulbs, that they be made into completed lamps within a reasonable short time after the coating is applied and baked thereon, since if the coating is allowed to stand exposed to the atmosphere, it may gather moisture and other impurities which will have a deleterious effect on the filament. Very satisfactory results have been obtained, however, using bulbs which were coated more than a week prior to being made up into the completed lamp.

It is believed that this inside coating, in addition to producing an opalescent and diffusing effect, of very high quality, may also have a certain action in preventing blackening of the bulb. This action may be due to the increased area of the inside of the bulb, caused by the minute irregularities in the coating, whereby the vaporized filament material, assures a thinner film. We do not, however, care to limit ourselves to any particular theory in explanation of this action.

Moreover, the blackening of the bulb is less effective in absorbing the light in an inside coated bulb, than in an exteriorly coated bulb. The outside coating backed up by the glass of the bulb serves as a reflector to reflect back into the bulb, a portion of the light emitted by the filament. A portion of the light is absorbed by the blackening on the bulb when the light first passes through the inside surface of the bulb and a further portion is absorbed when the light is reflected back into the bulb. This is known as double absorption and is eliminated in the inside coated bulb.

As stated above, it is to be understood that this invention is not limited to the coating of incandescent lamp bulbs nor to the exact ingredients and proportions of the coating composition set forth therein nor to the exact method of applying the coating, but is susceptible to many modifications and adaptations.

What is claimed is:

1. An incandescent, decorative electric lamp comprising an hermetically sealed bulb having on the interior surface of the light transmitting portion a visible superficial translucent coating of finely divided inorganic material.

2. An incandescent electric lamp comprising a bulb having on the interior surface of the light transmitting portion a visible superficial translucent coating of finely divided inorganic material substantially non-fading throughout the life of the lamp.

In testimony whereof, we have hereunto subscribed our names this 11th day of September, 1924.

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