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Whitaker

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[54] **VAPOROUS LAMP**

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[73] Assignee: **The National Cash Register Company**, Dayton, Ohio

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[52] U.S. Cl. **219/275**, 219/273, 219/473, 219/538, 252/316

[51] **Int. Cl.** **F22b 1/28**

[58] **Field of Search** 219/271, 272, 273, 219/274, 275, 276, 473, 474, 538; 252/316; 117/36.1; 21/120, 119; 20/120

[56] **References Cited**

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2,741,812	4/1956	Tellier	20/120
1,803,334	5/1931	Lehmann	219/473
2,243,669	5/1941	Clync	219/271
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3,016,308	1/1962	Macaulay	252/316 X
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3,341,466	9/1967	Brynko et al.	252/316
3,427,250	2/1969	Haas et al.	252/316
3,578,482	5/1971	Whitaker et al.	252/316 X
3,617,334	11/1971	Brockett et al.	117/36.1

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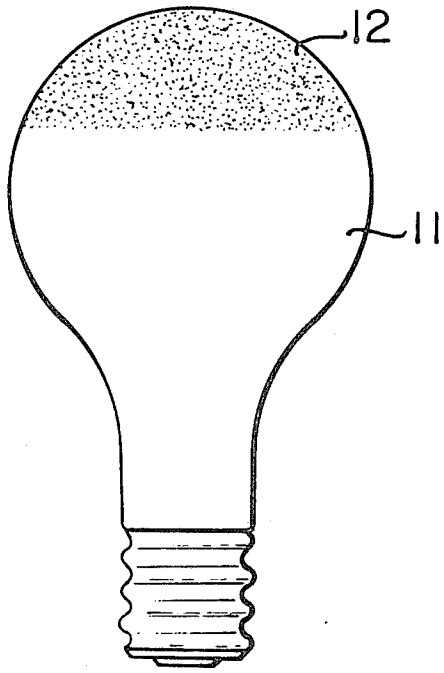
Primary Examiner—Volodymyr Y. Mayewsky
Attorney—E. Frank McKinney et al.

[57] **ABSTRACT**

A lamp or lighting device is disclosed for use in dispensing vapors over a sustained period. Vaporizable material is contained in minute capsules; and heat resulting from operation of the lamp causes a controlled release of vapors.

5 Claims, 7 Drawing Figures



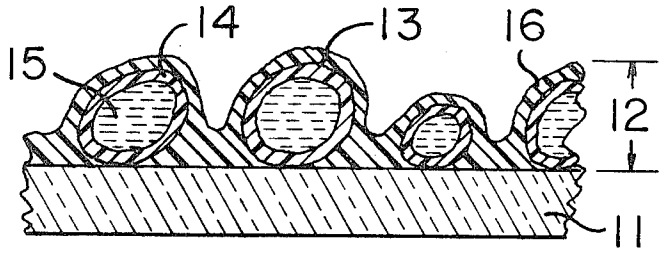


FIG. 1

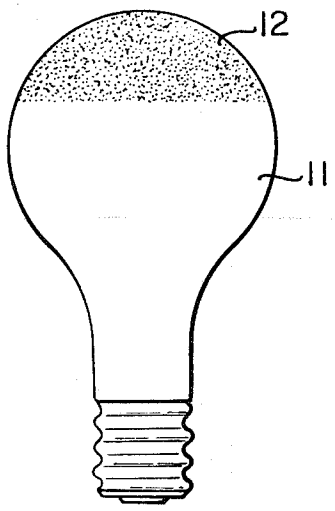


FIG. 2

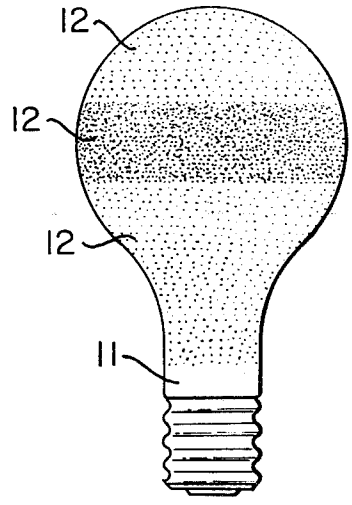


FIG. 3

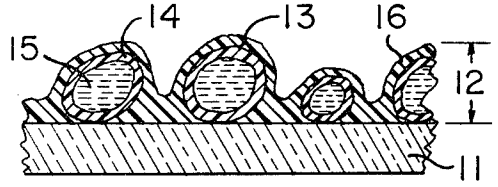


FIG. 4

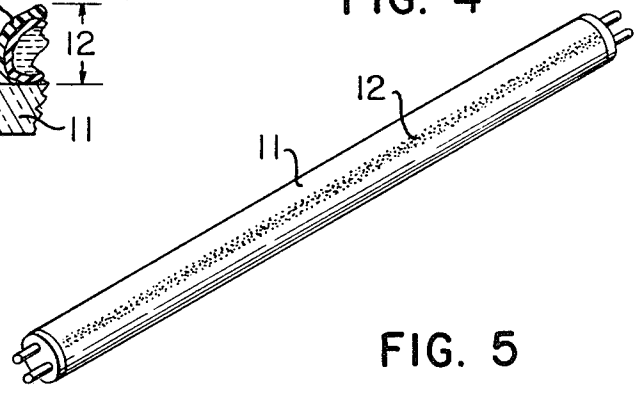


FIG. 5

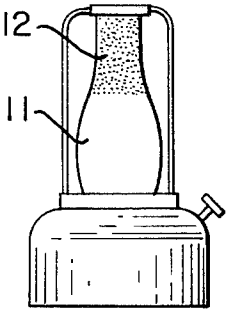


FIG. 7

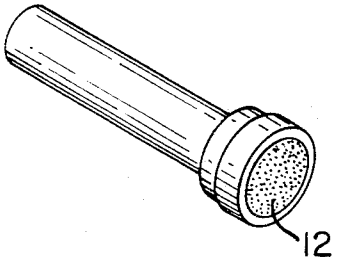
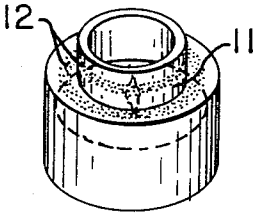


FIG. 6



VAPOROUS LAMP

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to a device which serves a dual purpose of providing light and of dispensing vapor. It is often desired or required to distribute vapors of some material to the air of a room or buliding or to the atmosphere of some other area. In the use of many materials, the distribution can take the form of evaporation and consequent incorporation of vapor into the atmosphere. Evaporation is, of course, enhanced by an application of heat and heat is generated by lighting devices; but if the material to be vaporized is not somehow protected from overly rapid evaporation, the vapor is initially concentrated and short-lived, quickly "tailing off" to a mere residual amount having little effect. When used in conjunction with most lighting devices of an intensity adequate for general illuminating purposes, unprotected vaporizable material is particularly fugitive. It has now been discovered that vaporizable materials can be contained in minute capsules and thereby be protected against rapid or premature evaporation.

It is, therefore, an object of this invention to provide a lamp or lighting device having minute capsules containing vaporizable material associated therewith.

It is further an object of this invention to provide such a vaporous lamp wherein the encapsulated vaporizable material is vaporized in a prolonged manner due to the barrier of the capsule walls.

It is another object of this invention to provide a vaporous lighting device wherein there is included, a light source substantially surrounded by a solid envelope of material coated by a multitude of minute capsules each containing a vaporizable material.

2. Description of the Prior Art

The broad concept of utilizing a lamp as a heat source for vaporizing a particular material is taught in U.S. Pat. No. 1,535,486 issued Apr. 28, 1925 to J. W. Lundy. In that patent, electric bulbs and fixtures are disclosed which have special receptacles to contain volatile materials. The receptacles are disclosed to be open and the volatile materials are subject to being spilled. There is no provision in that patent for prolonging vaporization of the volatile material. The lamps of the Lundy patent require either specially shaped bulb envelopes or independent fixtures of special design.

U.S. Pat. No. 1,803,334, issued May 5, 1931 to G. Lehmann, discloses a combination lamp and perfume vaporizer wherein there are concentric inner and outer envelopes of glass material. The inner envelope completely encloses an electric filament light source and the outer envelope completely encloses and contains an amount of fragrance absorbed into a wicking material of some sort. While the fragrance is here-protected, the protection is of a gross nature, requires specially adapted lamp fixtures, and is delicate and costly, by its very nature.

Several other patents refer to diffusion of volatile materials by contact with electric bulbs, but none disclose the use of capsules as containers for the volatile materials as herein claimed. Those other patents include U.S. Pat. No. 2,243,669, which pertains to fragrances contained in the base of a conventional but specially constructed electric lamp and U.S. Pat. No. 2,898,649, which pertains to a fragrancing device for use in automobile cigarette lighters comprising a conventional light bulb contacting a wick wetted with the fragrance.

SUMMARY OF THE INVENTION

It is often desired or required to distribute vaporizable materials to some atmosphere, either within an enclosure or simply within the limits of some diffusion or distribution means. Often the distribution is to be accomplished at a time when the area to be affected is also being occupied by persons living or working therein. To spray the material would disrupt activities, cause unpleasantly high initial concentrations, or otherwise create unacceptable inconveniences. As occupancy of an area usually also requires some use of artificial lighting means, a suitable device for distribution of some volatile material will couple the function of illumination with that of heating to cause vaporization. The present invention is especially adapted, in one embodiment, to provide a prolonged source of vaporous material distributed by virtue of heat supplied in operation of a lamp without appreciably affecting the intensity of illumination therefrom.

Required features of the article of the present invention include a light source and an envelope surrounding the light source. The envelope has a coating thereon which includes a multitude of minute capsules containing a vaporizable material.

The article of this invention, including the vaporizable material contained in capsules as it does, provides the substantial benefit and convenience of an "on-off" vapor supply. The exact mechanism of release of material from the capsules is not known; but the release is believed to be achieved either by gradual diffusion of the vaporous material through the pores of an unbroken multitude of capsule walls or by complete release from individual capsules as a result of heat-stimulated capsule wall rupture. In any event, extinguishing the light source removes the principal cause for release of the material—diffusion drive through capsule wall pores under one theory and capsule wall rupture under the other. It is believed that the material is probably released in accordance with a combination of the theories of diffusion and rupture. What is important is to realize that release of material is the present invention is not similar to simple evaporation so that distribution of the material depends not simply upon vapor pressure of the material at a particular temperature; but upon porosity or brittleness or composition of capsule walls. In other words, the controlling factor in release of vaporizable vpaorizable material is not solely a rate of evaporation but is actually determined by intrinsic characteristics of the containing capsule walls.

One alternative to a coating of capsules which might be urged for use in the present invention is a coating of a dried emulsion of volatizable material wherein the volatizable material is originally included in a continuous phase of polymeric binder material dissolved by some evaporable solvent. Such a dried emulsion coating is characterized by hvaing minute particles or droplets distributed throughout a continuous phase of solid polymeric film. A dried emulsion film has been found to exhibit an inherent infirmity not present in this invention. Any film, when subjected to film-breaching forces, can be expected to rupture at its weakest point. In the case of a dried emulsion film, the protective polymer is thinnest at the very point where protection is most required. A fissure in the film of dried emulsion

will run directly through the droplets or particles of volatizable material thus exposing the material to rapid loss by direct evaporation. The coating of this invention, on the other hand, includes the additional protective reinforcement of capsule walls surrounding each volatizable particle; and when a binder polymer is included in the film, any fissure in the coating will occur solely in the binder polymer leaving capsule walls unaffected.

This invention is broad in its application to lamps. Lamps, which are structures which include a light source and an envelope at least substantially surrounding the light source, are generally eligible. By light is meant electromagnetic radiation in a wavelength range which includes, but is not necessarily limited to, radiation capable of raising the temperature of an absorbing body. Light sources can include: resistance filaments common to incandescent lamps, gas-filled or not; open flames such as in candles or lanterns; and other means of electron excitation such as is exhibited in fluorescent lamps and cathode ray tubes.

The envelopes which surround the light sources are usually and referredly some light-transmitting material such as glass or plastic. The envelope need not completely surround or enclose the light source; and if the envelope includes light transmitting material, it need not be entirely light transmitting. The envelope can be transparent, translucent or opaque or combinations of those. It can be colored or not and can include coatings in addition to the capsule coating of this invention. Additional coatings can be used, for example, to enhance heat absorbance and the envelope must always be situated near enough to the light source that radiation absorbed by the envelope will provide adequate heat to stimulate the release of vaoors from the capsules.

The vaporizable materials eligible for use in this invention generally include any solid or liquid material which has a sufficient vapor pressure to produce effective amounts of vapor at only moderately increased temperatures. Moderate increases in temperature are envisioned to embrace the range of only a few or sometimes up to a hundred or more centigrade degrees above normal ambient temperatures. Actually, the degree of temperature increase is unimportant to the present device because any small temperature increase will provide some benefit. Of course, temperatures should be avoided which undesirably melt or char the capsule walls or the polymeric binder coating material, if present. By designation of the function of the eligible vaporizable materials, it is apparent that considerations of temperature increases are relatively unimportant. The eligible materials include fragrances, deodorants, inhalant medicines, pest repellants, pesticides, germicides and the like. Such materials tend to be rather fugitive and to evaporate quickly and are, therefore, ideally adapted for use in this invention. Given vapor pressure characteristics similar to materials in the above-named categories, other materials such as flavors, fertilizers, chemical reactants, bleaching agents, and the like, are also eligible. The vaporizable materials can be contained in the capsules as a solution in a liquid solvent and the volatility of the capsule contents can be adjusted by combining different solvents having different vapor pressure characteristics, as is done now, for example, in the perfume arts. Materials which are solid are useful to the extent that they melt and vaporize or vaporize from solution or vaporize from the solid by subliming.

The minute capsules which contain the vaporizable compounds can have capsule walls of any polymeric material which is not either dissolved or reacted by the capsule contents or melted by heat from the light source. Of course, the capsules cannot exist long enough for coating onto the lamps if the walls are breached by action of the capsule contents. Also, the melting temperature of polymers or combinations of polymers is easily ascertained and it is a simple matter to choose capsule wall materials having an appropriate melting temperature.

The minute capsules can range in size from only a few microns to a few thousand microns;—such being embraced by the meaning of the word minute. The preferred capsule size is from about 5 or 10 microns to about 5,000 microns and the most preferred capsule size is less than about 300 microns. In most uses for the lamp of this invention, the capsules are preferredly smaller than can be resolved by the unaided human eye. However, larger capsules can be advantageously used to supply decorative effects in addition to the release of vaporizable material. With regard to decorative effects, it should be noted that capsules of any size can be applied to lamp envelopes in a predetermined image shape or other decorative representation.

Specific materials eligible for use as capsule walls include natural and synthetic polymers whether water soluble or not. Selection of a particular capsule wall material generally depends upon the process used to accomplish the encapsulation. Capsule wall materials include: gelatins, gum arabic, starches, carrageenan, urea-formaldehyde resins and melamine-formaldehyde resins, poly(alkylvinylether-co-maleic anhydride), poly(ethylene-co-maleic anhydride), poly(vinyl alcohol), poly(vinyl pyrrolidone), poly(ethylene oxide), albumin, poly(acrylic acid) and poly(methacrylic acid), ethyl cellulose, polystyrene, polyacrylonitrile, cellulose acetate butyrate, cellulose acetate phthalate, cellulose nitrate, epoxy resin, polyurethane, polyethylene and the like. The capsules can be manufactured using any of several known encapsulating processes including chemical methods of interfacial polymerization (U.S. 3,432,327) or phase separation (U.S. Pat. No. 3,415,758); U.S. Pat. No. 2,800,475) or solvent exchange (U.S. Pat. No. 3,516,943) or meltable dispersion (U.S. Pat. No. 3,161,602) or mechanical methods of film impingement (U.S. Pat. No. 3,015,128) or spray-drying (U.S. Pat. No. 3,016,308).

The capsules can be coated onto the lamp envelope from any appropriate liquid vehicle system. Appropriate liquid vehicle systems can include polymeric binder materials or not as required or desired for the particular application. While polymeric binders serve as adhesive material between capsules and the lamp envelope and are preferred, capsules made from wall materials which swell and become tacky in some particular liquid system can be coated without a separate binder material;—the tacky capsule wall providing a bond between the capsules and the envelope. As an example, capsules manufactured by a process of complex coacervation in an aqueous vehicle (U.S. Pat. No. 3,341,466) can be coated directly onto a lamp envelope from the liquid in which the capsules were manufactured. It should be noted that the capsule walls can also be colored by a pigment or dye light absorbing material and that, in

cases where different varieties of capsules contain different kinds of vaporizable material, the walls of one variety of the capsules can be colored or covered by a light or heat absorbing material to provide sequential release of capsule contained materials;—the materials in the heat-absorbing capsules being released prior to the material in capsules having walls which absorb relatively less heat.

Polymeric binder materials can be dissolved in some evaporable liquid which will not dissolve the capsule wall materials. A capsule coating system is prepared by dispersing capsules into the solution of polymeric binder material and the capsules are applied by simply wetting the envelopes with the coating system and evaporating the liquid solvent. The dispersion of capsules is similar to and can be considered equivalent to a paint; and it can be applied in the same manner as a paint is applied. The capsules can be sprayed, dipped, brushed, printed and the like. Also, capsules can be applied to lamp envelopes by wetting the envelope or coating the envelope with a wet adhesive and then contacting the envelope with dry-walled capsules. Other materials can be used in the capsule dispersion to provide additional properties to the dispersion normally provided by use of such other materials. Surfactants can be added to alter the coating and wetting character of the dispersion. Dirers can be added if the polymeric binder is a curable material. Pigments or dyes can be added to provide color and also to lend light absorbent quality to the coating so that the heating effect can be intensified to increase distribution of the vaporizable material.

Specific examples of polymeric binder materials include all of the specific polymeric materials previously listed herein as eligible for use as capsule walls. Also to be named, are commonly known coating resins such as alkyd resins, silicone resins, polyester resins, isocyanate-adduct resins, latex coatings and the like.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 and 2 represent incandescent electric lamps of the present invention.

FIG. 3 depicts an enlarged cross-section of the coating of the invention.

FIG. 4 represents a fluorescent electric lamp of the invention.

FIGS. 5 and 6 and 7 represent other lamp embodiments of the invention.

The incandescent lamps of FIG. 1 demonstrate an embodiment of the invention wherein the envelope **11** completely surrounds a resistance filament light source and the coating **12** partially covers the envelope **11.** The lamp of FIG. 2 is the same as that of FIG. 1 with the exception that the coating **12** substantially completely covers the envelope **11.** Incandescent lamps, of course, include both, those with gas-filled and evacuated envelopes.

FIG. 3 is a greatly enlarged cross-section representation of a portion of a lamp of this invention. Capsules **13** are adhered to the envelope **11** by polymeric binder material **16** to yield the coating **12.** The capsules **13** include the vaporizable material **15** as contents and a polymeric material as the capsule wall **14.** The envelope **11** is shown to be of transparent material but, as previously state, translucent or even opaque material is eligible. The other elements of this figure have also been discussed previously herein.

FIG. 4 depicts a fluorescent lamp having a strip of coating **12** along the surface of the envelope **11.** FIG. 5 depicts an additional embodiment of the invention in use of a lantern having a chimney as the envelope **11** herein shown to be partially covered by the coating **12.** FIG. 6 depicts a candle lamp having a bowl which contains the candle and extends upward into a chimney as the envelope **11.** The coating **12** is shown to be applied in stripes. FIG. 7 depicts a conventional battery-powered lantern with a cap affixed to the lantern head wherein the face of the cap is completely covered by the coating **12.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

EXAMPLE 1

In this example, a coating composition is prepared by dissolving 5 grams of poly(vinyl alcohol) in an aqueous dispersion of 10 grams of capsules and 85 grams of water. The poly(vinyl alcohol) is the polymeric binder and is sold by E.I. du Pont de Nemours and Co., Inc., Wilmington, Delaware under the trademark designation "Elvanol 72–60." The capsules contain a carnation fragrance as the vaporizable material. The capsules range in average diameter from about 10 microns to about 40 microns, have walls which include gelatin and gum arabic, and are made by a process of complex coacervation.

A vaporous lamp is prepared by dipping a 100 watt incandescent electric light bulb into the coating composition and then drying the coating at room temperature. The so-prepared vaporous lamp gives off substantially no aroma when the lamp is "off"; but, when lighted, there is a continual emanation of carnation fragrance. Vaporous lamps, constructed as above-described, have provided fragrance for more than a year in a periodic test operation despite the fact that the envelope of a 100 watt incandescent lamp becomes very hot during operation.

EXAMPLE 2

In this example, a fluorescent tube of about 20–24 watt size is brush-coated in a stripe along its length with a coating composition which includes a polymeric binder of ethyl cellulose dissolved in toluene and capsules containing menthol as inhalant or room freshener dispersed therein. The capsule walls include a condensation polymer of resorcinol and formaldehyde and the capsules are in a size range of about 100 microns to about 300 microns in average diameter. The vaporizable material is released at such a slow rate, due to its being encapsulated, that the capsule coating will remain effective for several months of constant use.

EXAMPLE 3

In this example, a vaporous lamp is constructed in substantial conformity to FIG. 6 wherein a candle flame is the light source and a chimney to the lamp if the envelope. The capsules are manufactured to contain oil of citronella by a complex coacervation process and the coating composition is the capsule manufacturing system with no additional polymeric binder material. The capsule manufacturing system includes small amounts of residual gelatin in solution and swollen gelatin of the capsule walls which is adequate to adhere the capsules to the envelope. The capsules are coated

onto the envelope and burning the candle provides the insect repellancy characteristic of citronella.

As an extra feature of the various embodiments of this invention, a colored pigment or dye is added to the coating composition to provide the lamp coating with a more heat-absorbent character. For instance, a small amount of a finely-divided red pigment is added to the coating of this Example to more effectively warm the coated capsules.

EXAMPLE 4

The chimney is removed from a lantern of the variety depicted by FIG. 5 and is spray-painted by a coating composition which includes a small amount of capsules containing a pine oil fragrance or campfire fragrance. The capsules, while being coated over the entirety of the chimney, are in such small concentration that they are difficult to see and do not obscure the light from the lantern. As a variant, capsules containing pine oil and capsules containing a campfire fragrance are both coated onto the chimney envelope to provide a combination of fragrances.

What is claimed is:

1. A vaporous lamp comprising a source of electromagnetic radiation in a wavelength range and in an intensity which includes radiation capable of increasing the temperature of a radiation-absorbing body by up to 100 C. °, a light transmitting envelope at least substantially surrounding the source and, adhered onto the envelope, a coating of a multitude of minute capsules wherein each capsule is a radiation-absorbing body, has an average diameter of about 5 to 5000 microns, contains a vaporizable compound, is located on the envelope in relation to the source to absorb radiation and undergo a temperature increase, and has a polymeric capsule wall material inert with and undissolved by the vaporizable compound and unmelted and uncharred by the temperature increase.

2. The lamp of claim 1 wherein the lamp is electrically operated.

3. The lamp of claim 1 wherein the capsules are less than about 500 microns in average diameter.

4. The lamp of claim 1 wherein the coating includes a binder of polymeric material providing adhesive means between the envelope and the minute capsules.

5. The lamp of claim 4 wherein the binder includes a light absorbing material.

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