United States Patent [19]

Woollard

[11] **3,790,332**

[45] **Feb. 5, 1974**

[54] **LIQUID CANDLES**

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[22] Filed: **Jan. 17, 1972**

[21] Appl. No.: **218,248**

[30] **Foreign Application Priority Data**

Feb. 2, 1971 Great Britain 3700/71

[52] **U.S. Cl.** **431/126,** 431/291, 431/298, 44/59

[51] **Int. Cl.** **F23q 2/32**

[58] **Field of Search** 431/126, 298, 291; 44/59

[56] **References Cited**

UNITED STATES PATENTS

1,184,511	5/1916	Bourgeois	431/291
2,925,333	2/1960	Thompson	44/59
2,246,346	6/1941	Carroll	431/298
2,166,881	7/1939	Voss	431/126
192,294	6/1877	Simmonds	431/298
3,265,239	8/1966	Kohan et al.	220/64
397,011	1/1889	Leynen-Hougaerts	431/298
3,424,540	1/1969	Swedenberg	431/126
2,551,574	5/1951	Fredericks	431/126
3,107,511	10/1963	Hamsag-Garshanin et al.	431/126
3,150,510	9/1964	Klopfenstein	431/126

FOREIGN PATENTS OR APPLICATIONS

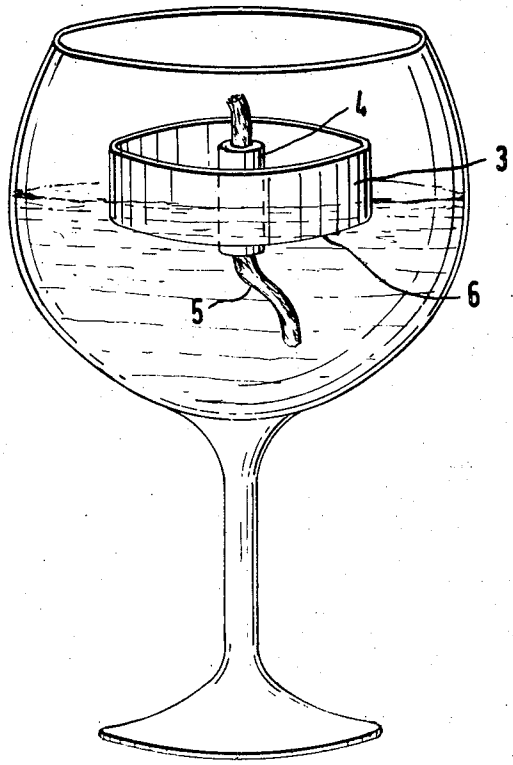
449,555	7/1968	Switzerland	431/126

Primary Examiner—Carroll B. Dority, Jr.

[57] **ABSTRACT**

A liquid candle capable of burning with a coloured flame is formed by floating a wick holder comprising a float and a wick on a body of combustible liquid within an open-top, for example, glass container, the liquid having a high flash point and containing in solution a flame-colouring amount of at least one flame-colouring additive. The float portion of the wick holder holds the wick with its lower part within the liquid and its upper part, which forms a burning end, spaced from the surface of the body of liquid to an extent which prevents ignition thereof during use. The liquid can contain a dye to enhance its appearance, and optionally also a perfume.

11 Claims, 3 Drawing Figures



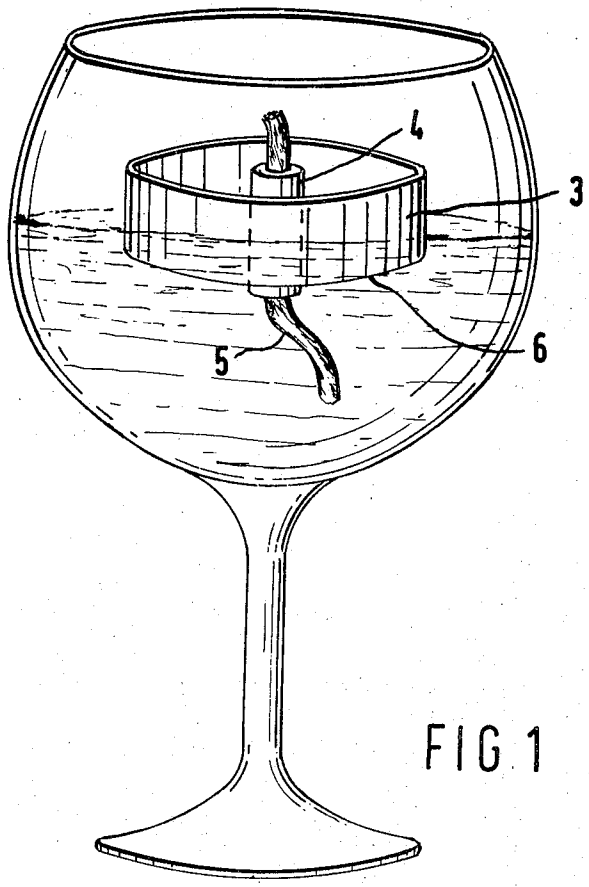


FIG. 1

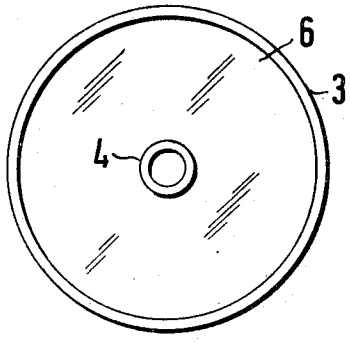


FIG. 2

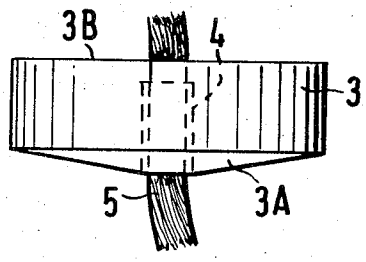


FIG. 3

LIQUID CANDLES

BACKGROUND OF THE INVENTION

With conventional solid candles containing flame-colouring additives in the solid combustible material constituting the body of the candle tne natural luminosity of the flame produced by combustion of the solid material itself overwhelms to a greater or lesser extent the colouring action of the additive(s). For example, a conventional wax candle burns with a pronounced yellow flame, and the introduction of any flame-colouring additives into the wax (other than yellow or golden flame-colouring additives) results in little more than a coloured edge to the flame. Other solid combustible materials, for example, solid polyethylene glycols, as are potentially suitable for the commercial production of coloured flame candles of acceptable cost, albeit of relatively high cost compared with wax, have been found to have other disadvantages such as difficulty of moulding, poor flame colours - yellow still tends to predominate, and hydroscopisity, which latter gives rise to very poor storage properties.

SUMMARY OF THE INVENTION

The present invention provides a new approach to the problem of providing, in a straight forward and aesthetically acceptable manner, a candle-like device capable of burning with a truly coloured flame. This approach is based on the concept of using a combustible liquid instead of a solid, the liquid being burned with the aid of a floating wick. The resulting combination is termed a "liquid candle." It has now been found that such a liquid candle capable of burning with a coloured flame can be formed by providing in combination an open-top container, a body of combustible liquid disposed therein, said liquid consisting essentially of an alcohol having a high flash point and the ability to burn on a wick with free burning characteristics and said liquid containing in solution a flame-colouring amount of at least one flame-colouring additive, and, floating on said liquid, a wick holder comprising a float and a wick, the float holding said wick with the lower part of said wick within said liquid and the upper part thereof projecting above said float to form an exposed burning end of said wick which is spaced from the surface of said liquid to prevent ignition thereof during use. Advantageously, said combustible liquid is coloured by the incorporation of a light-stable colouring matter such as one or more dyes therein, the colour of the liquid being chosen, for example, in relation to the colour of the flame produced when the liquid candle is burned so as to provide an attractive combination.

Surprisingly, it has been found that liquid candles can be formed in accordance with the invention which are pleasing in appearance and which burn with an intense, attractively coloured flame having none of the disadvantages hitherto associated with the known, so-called coloured flame candles. By employing alcohols of high flash point as the basis of the combustible liquids, the liquids can be stored easily under conditions in which they remain stable until required for use; and an attractive, safe candle-like device can be formed by pouring the liquid into an open-top, glass or transparent plastics container and floating the wick holder on the surface of the liquid. The novel and attractive appearance of such a liquid candle, coupled with its safety and high functional efficiency in operation, constitutes an important advance in the candle-manufacturing art and enables the latter to meet the large demand for coloured flame candles which has existed for many years.

The open-top containers used in forming liquid candles in accordance with the invention can be of any suitable size or shape as dictated by appearance considerations, and, whilst containers of transparent or translucent plastics material can be used, glass containers are preferred. The wick holder can also be of any suitable size or shape, and it can comprise a float of tray - or cup-like form, for example, of circular shape, having a central, upstanding tubular portion through which the wick passes and within which the upper part of the wick is held, which can be floated on the surface of the combustible liquid either way up depending on its shape.

The combustible liquid used in carrying out the present invention contains in solution an appropriate amount of one or more additives which render it capable of burning on a wick with a coloured flame. In addition the liquid has the following critical characteristics:

1. A high flash point which renders the liquid safe to use in a liquid candle under any normal ambient temperature conditions likely to be encountered by users, the term "high flash point" being defined herein as a flash point which is such that the liquid does not ignite and burn when a small flame is applied directly (i.e., in the absence of a wick) to a body of said liquid under said ambient temperature conditions. In practice, a minimum flash point (open cup) of 100° C provides ample safeguards in this respect, and accordingly liquids having a minimum flash point (open cup) of 100° are preferred. 2. An ability to burn on a wick with free burning characteristics. The latter is a term well understood in the art, but to avoid any misunderstanding the term is used herein to mean an ability to continue burning for at least one-half hour from initial ignition.

By forming said combustible liquid from an alcohol one can ensure that it will burn on a wick in the absence of said flame-colouring additive(s) with a flame having no pronounced luminosity, particularly in the yellow part of the spectrum. As will be known by those in the art a yellow luminous emission can be difficult to suppress completely, but unless a liquid candle capable of burning with an intense yellow or golden flame, is desired, the combustible material should be such that the yellow content of the flame when it burns should be appreciably less intense than that of the flame of a conventional hydrocarbon wax candle if a truly coloured flame is to be obtained. Hitherto, however, no satisfactory way of achieving this desideratum has been found which is satisfactory, straightforward in practical application and pleasing to the user.

DETAILED DESCRIPTION OF THE INVENTION

The liquid candles of the present invention are formed from combustible liquids which consist of or include as the major component thereof an alcohol of high flash point, for example, ethylene glycol (ethane diol), glycerol, diethylene glycol, carbital and butyl carbitol or a mixture of alcohols. Commercial ethylene glycol sold by Shell Chemical Company has been found to be eminently satisfactory from the point of view of performance and cost. It is advantageous for the combustible liquid to have a significant water tolerance before burning properties are noticeably affected, and this is another advantage of ethylene glycol. In fact,

surprisingly, ethylene glycol has been found to have outstanding properties as a combustible liquid for carrying out the present invention since it combines excellent burning characteristics on a wick with the ability to give attractive, intensely coloured flames, and it also possesses high satisfactory float-support characteristics which facilitate the use of a floating wick holder as required to form the liquid candles of the invention. Glycerol and diethylene glycol can also be used to form acceptable liquid candles, although these liquids do not appear to have the unique balance of properties of ethylene glycol (ethane diol).

Any suitable liquid - soluble substances capable of imparting a desired flame colouration may be used in carrying out the present invention, particularly the metal salts which are known in the art as flame-colouring additives for solid candles, provided they are soluble in said liquid. Preferably one or more light-stables dyes are incorporates in the combustible liquid in order to make the liquid candle more attractive to the user, especially when it is formed, as is preferred, with the aid of an open top glass container for the liquid. Such dyes should, of course, be soluble in the liquid and not all conventional candle body colourants are suitable in this respect. Suitability can be determined readily by simple experiment, but by way of illustration it is noted that the dyes marketed by Williams (Hounslow) Limited of Hounslow, Middlesex, England under the trade name "Alcovar" have been found to be particularly suitable for use in ethylene glycol. Such dyes, in the colours green, red and violet, can be used in concentrations of from 0.0025 percent to 0.01 percent, by weight, depending on the colour intensity required; and they are stable to light for long periods and are without appreciable effect on the flame colours. The glass container may be of any desired shape consistent with the purpose it serves, and liquid candles formed in this way are particularly advantageous for household decorative purposes and like uses. The combustible liquid can also be perfumed, if desired; any suitable perfume of acceptable cost may be used providing it is soluble in the combustible liquid and has no deleterious affect on the burning characteristics thereof, and does not give rise to any objectionable end products, for example, odourwise when burned. By way of illustration it can be mentioned that a perfume marketed by Dragoca (Great Britain) Ltd., of Lady Lane Industrial Estate, Hadleigh, Essex, England, under the trade designation ER 0/0098 has given satisfactory results in ethylene glycol based combustible liquids.

Many flame-colouring chemicals are known in the art in connection with prior proposals for making conventional (solid) candles for burning with a coloured flame, and the nature and characteristics of such chemicals and the flame colourations achievable with various metals are well known in the art. However, the use of a combustible liquid opens up the possibility of using, as additives in accordance with the present invention, other compounds of the metals hitherto used, provided the selected additive (s) will dissolve, in the concentration(s) needed, in the combustible liquid; consequently, the present invention is in no way limited to the use of conventional flame-colouring additives the properties of which are necessarily dictated by the need for compatibility with the solid candle material. The chemical(s) used in a particular case will depend on the flame colour required, and the relative cost and ease of handling when a choice is available. Examples include boric acid and salts of many metals, for example, lithium, sodium, potassium, strontium, and barium. The salts may be, for example, acetates (which are often particularly suitable), chlorides, nitrates, citrates, tartrates and carbonates. The ability to dissolve the additive(s) in the liquid in the cold or with only slight heating is advantageous. Mixtures of flame-colouring chemicals may be used in order to produce desired colours or novel, "two tone" affects. The concentration of the flame-colouring chemical(s) required will depend on the particular chemical(s) used, but can be determined readily by trial. In general, the range of concentration is quite wide, Although from the point of view of achieving clean burning, it is preferable to use the smallest amount consistent with obtaining a good colouration. Guidance in regard to the quantities of additives which can be used will be obtained from the formulations exemplified hereinafter. However, the following additives in the concentration ranges quoted have been found to be particularly effective with ethane diol for producing flame colours which are particularly popular with users of the liquid candles of the present invention:

Green: 1.3 to 1.7% wt. of boric acid

Red: 0.2 to 0.4% wt. of lithium acetate, preferably together with an equal amount of potassium chloride

Lilac: 0.2 to 0.5% wt. of potassium chloride

Combustible liquids containing one or more flame-colouring additives and optionally also one or more dyes may be supplied to users in capped containers from which the liquid can be poured into any suitable open-topped container of the user's choice to form, with a floating wick holder, a liquid candle in accordance with the invention. For asthetic appeal the capped container may be shaped, and perhaps also textured, to look like a conventional solid candle. A wick holder, together with a wick which is conveniently already fitted thereto, can be supplied to the user together with the capped container of combustible liquid, together, if desired, with a glass open-top container. The wick holder can be of a plastics material, for example, a urea formaldehyde resin or it can be of metal, for example, aluminium. Whilst the size, shape and dimensions of the holder should be such that it will float safely on the combustible liquid, a degree of decoration is advantageous from the appearance aspect. For example, the base of the wick holder can be cone-shaped to some extent. Preferably, the wick holder is made from a non-inflammable material, and aluminium is preferred; in such case the aluminium holder can be anodised in a variety of colours to enhance its appearance. Alternatively, the wick holder can be made of glass. Although the wick holder can be designed so that it can also form a cap for the container of combustible liquid, it is considered preferable to supply separate wick holders.

One example of a suitable form of wick holder is illustrated in the drawing accompanying the provisional specification, in which FIG. 1 shows a perspective side view and FIG. 2 a plan view. The wick holder comprises a float in the form of a cap 3 having an upstanding tubular portion 4 for holding the wick 5. The base 6 of the cap 3 to which the portion 4 is secured, or of which is forms an integral part, as, for example, when the cap is moulded in a plastics material, is apertured

to enable the wick 5 to pass through it. In use a short length of the wick 5 protrudes from the tubular portion 4 to form a burning end. If the wick holder is used as a screw cap for a container of liquid, the cap 3 is provided with an internal screw thread, and when in use as screw cap a plug or like seal is inserted in the cap 3 to seal off the tubular portion 4, thereby preventing spillage of the liquid and access of atmosphereic air (in particular moisture therefrom) to the liquid.

A preferred form of wick holder is illustrated in FIG. 3 of the accompanying drawing. The wick holder comprises a float in the form of a tray 3 having a dished base portion 3A of cone shape to enhance the appearance of the float. An upstanding tubular portion 4 is provided for holding the wick 5, and the upper end of the tubular portion 4 is located below the level of the rim 3B of the tray 3. Advantageously the wick holder is of anodised aluminium and the following dimensions of a typical wick holder can be given by way of illustration as follows: tray diameter: 1½inches; tray height: three-fourths inch, plus up to one-fourth inch for the dished base portion; height of tubular portion: one-half inch; and diameter of tubular portion: one-fourth inch (outside) and one-eighth inch (inside).

The wick holder can be of other forms or shapes depending on requirements. It is envisaged that one or more wick holders can be marketed in combination with a container of combustible liquid and an open-top glass as a presentation pack for customers.

Certain flame colouring chemicals, for example, lithium nitrate, lithium acetate, potassium chloride and sodium chloride can produce an accumulation of incombustible ash on the wick during burning and the shape of the floating wick holder is advantageously such that any material falling from the wick is caught and prevented from coming into contact with the combustible liquid where it might act as a secondary wick. It is also possible by simply pulling more wick through the tubular portion of the wick holder to restore normal burning characteristics if, after a period of burning, accumulations on the wick, affect the performance of the liquid candle; normally, the burning time before any retrimming is needed will be at least one hour depending on the flame-colouring additive(s) used, and with some additives and/or concentrations of additives it is not really necessary at all. The optimum combinations and concentrations of the various additives which give the desired flame colourations with the minimum of ash formation on the wick can be ascertained by experiment.

The wick itself can consist of conventional cotton candlewick or taper which has not been treated with any of the wick conditioning chemicals normally used in candle manufacture which might otherwise introduce contaminants affecting the flame colour. (In any case such wick conditioning would be an unnecessary in carrying out the present invention). A loose plait or twisted taper cotton is preferred.

Liquid candles in accordance with the present invention can be expected to have many hours of life. For example, a 100 ml. of combustible liquid can burn for up to about 8 hours depending on the flame size, which can be controlled by adjusting the length of wick showing above the tubular portion of the wick holder. In the latter respect about one-fourth inch gives a good result. In order to avoid a falling off in performance after a period of use due to absorption by the combustible liquid of moisture from the air, it is advisable to keep the glass or other open-topped container of the candle covered when not in use.

The present invention is illustrated by the seven typical formulations of the following examples. These are all based on commercial ethylene glycol (ethane diol), and the specified additives were dissolved therein in the cold or, if necessary, by heating:

EXAMPLE 1.

ETHANE DIOL	90–99% wt.
BORIC ACID	1–10% wt.

plus a green dye.

This formulation gives a bright green flame. Large amounts of boric acid should be avoided since these tend to produce a white film on the side of the glass after prolonged burning which looks rather unsightly. The extent of this film depends largely on the shape of the glass used, but a concentration of boric acid of 2 percent wt. or less, and advantageously about 1.5 percent wt., is to be preferred.

EXAMPLE 2

ETHANE DIOL	95–99.9% wt.
LITHIUM ACETATE	0.1–5% wt.

plus a red dye.

A vivid red flame is produced. From the ash formation point of view, it is advantageous to keep the concentration of lithium acetate low, for example, at about 0.25 percent wt, and even better results are obtained by using it in combination with about an equal amount of potassium chloride. Lithium nitrate can also be used, but in such case the concentration is also best kept low to reduce the tendency for ash to accumulate on the wick; for example 1.0 percent wt. has been found satisfactory.

EXAMPLE 3

ETHANE DIOL	99% wt.
POTASSIUM CHLORIDE	0.5 to 1% wt., preferably 0.5% wt.

plus a lilac dye.

This formulation gives a lilac colour, which becomes increasingly vivid after about 10 minutes burning. Ash can build up on the wick, and the reduction in potassium chloride concentration to 0.5 percent wt. reduces this tendency while still maintaining a satisfactory colouration.

EXAMPLE 4

ETHANE DIOL	99.9% wt.
SODIUM CHLORIDE	0.1% wt.

plus an orange dye.

This formulation gives a bright golden flame. Larger amounts of sodium chloride e.g., 0.2 percent wt. lead to more ash formation and are best avoided.

EXAMPLE 5

ETHANE DIOL	99.2% wt.
BORIC ACID	0.5% wt.
LITHIUM ACETATE	0.3% wt.

This formulation gives a flame with an orange/red interior and a green edging.

EXAMPLE 6.

ETHANE DIOL	98.8% wt.
SODIUM CHLORIDE	0.2 % wt.
BORIC ACID	1.0% wt.

This formulation gives a golden flame with a green edge.

EXAMPLE 7

ETHANE DIOL	99.5% wt.
POTASSIUM CARBONATE	0.5% wt.

This formulation gives a lilac flame.

EXAMPLE 8

Similar results to those quoted above in regard to Examples 1 to 7 may be obtained by substituting for the ethane diol other alcohols such as glycerol.

The amounts of flame-colouring additives used with such other alcohols are essentially similar to those quoted for ethane diol, optimum amounts within the ranges quoted being readily determined by simple experiment on the basis of the colour and intensity of colour required in relation to cost considerations and ease of forming the required alcohol solutions thereof.

I claim as my invention:

1. A liquid candle capable of burning with a coloured flame which comprises

a. an open top container containing a body of combustible liquid of high flash point therein,

b. said liquid consisting essentially of an alcohol having a minimum flash point of 100° C. and the ability to burn on a wick with free burning characteristics and

c. said liquid containing, in solution, a flame-coloring amount of an ash producing flame coloring additive containing a metal salt, and

d. floating on said liquid, a wick holder comprising a float and a wick,

e. the float having a dished-base portion floating with its uppermost surface clear of said liquid, said base portion including an upstanding wall portion extending therefrom and an upstanding tubular portion holding said wick with the lower part of said wick within said liquid and the upper part of said wick projecting about said float to form an exposed burning end of said wick which is spaced from the surface of said liquid to prevent ignition thereof during use.

2. A liquid candle as claimed in claim **1**, wherein said liquid also contains in solution light stable dye colouring matter.

3. A liquid candle as claimed in claim **1**, wherein said liquid also contains in solution a perfume.

4. A liquid candle as claimed in claim **1**, wherein said liquid contains at least one metal acetate as flame-colouring additive.

5. A liquid candle, as in claim **1**, wherein the combustible liquid is ethane diol.

6. A liquid candle, as in claim **5**, wherein the ethane diol contains from 1.3 to 1.7 percent by weight of boric acid as a flame-coloring additive.

7. A liquid candle, as in claim **5**, wherein the ethane diol contains from 0.2 to 0.4 percent by weight of lithium acetate as a flame-coloring additive.

8. A liquid candle, as in claim **7**, wherein the ethane diol contains from 0.2 to 0.4 percent by weight of potassium chloride as an additional flame-coloring additive.

9. A liquid candle, as in claim **5**, wherein the ethane diol contains from 0.2 to 0.5 percent by weight of potassium chloride as a flame-coloring additive.

10. A liquid candle, as in claim **1**, wherein the float has a sidewall upstanding from the base portion to a height greater than the tubular portion.

11. A liquid candle, as in claim **1**, wherein the base of the float is a convex conical form.

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