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[56]

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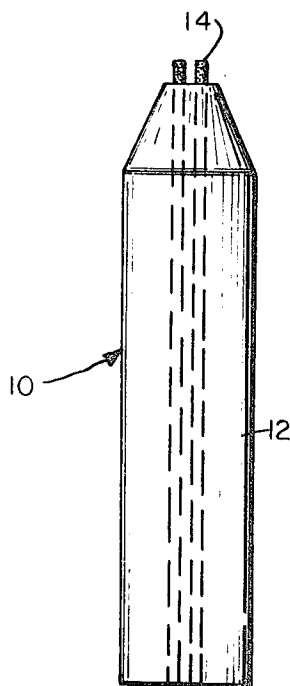
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Attorney—Christen & Sabol

[54] **COLORED FLAME CANDLE**
8 Claims, 5 Drawing Figs.

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431/288, 44/7.5
[51] Int. Cl. **F23q 2/32**
[50] Field of Search 431/4, 126,
288; 44; 7.5

ABSTRACT: A candle comprising a combustible body having a major proportion of polyethylene glycol, trimethylol propane, tristearyl citrate or mixtures thereof, and at least two spaced combustible wicks embedded in said body; the body may contain also minor amounts of flame modifier and/or heat-decomposable flame-coloring ingredient.



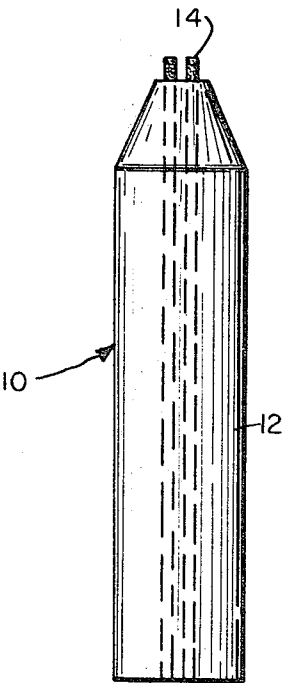


FIG. 1

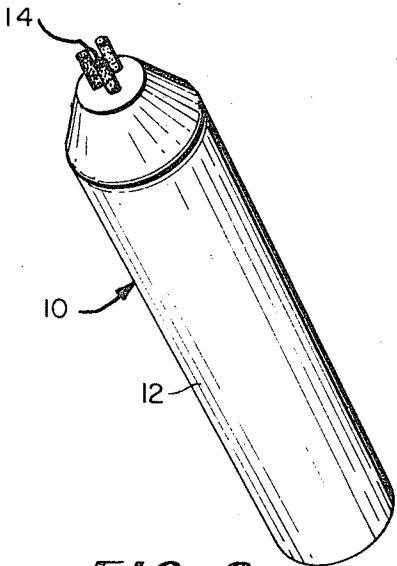


FIG. 2

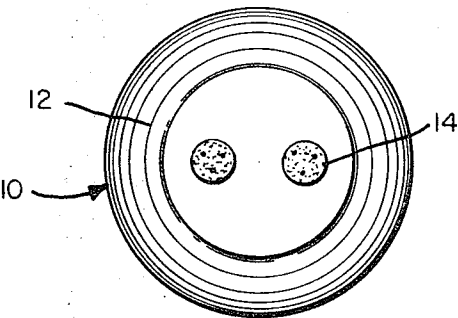


FIG. 3

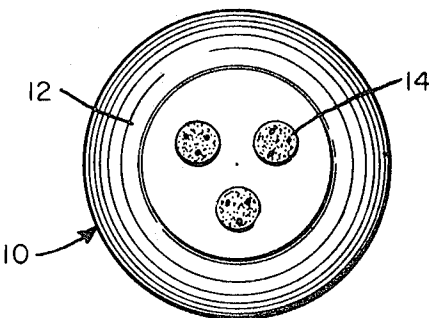


FIG. 4

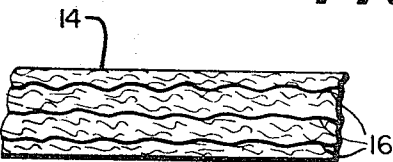


FIG. 5

COLORED FLAME CANDLE

The present invention relates to candles. More particularly, the present invention relates to candles which, while containing little or no conventional candle fuel such as solid paraffin hydrocarbons, vegetable waxes or animal fats, are equal to conventional candles in burning characteristics and superior in allowing a distinctive color to be imparted to the flame.

In burning, the conventional candle of, for example, paraffin has three well-defined zones or profiles. The innermost zone is gaseous and nonluminous, a product of the fuel. The second portion is a blue-green luminous zone associated with the complete decomposition of the vapor or complete combustion within the zone. This zone has the maximum temperature. The approximate volume of the above two zones comprises about 20 percent of the overall flame volume. The last zone is an extended luminous yellow region associated with incandescent carbon particles. The carbon particles are believed to be due to an imbalance between the amount of fuel and the required oxygen for complete combustion.

Conventional candle fuels leave much to be desired, particularly when used to produce candles providing a colored flame. Firstly, the conventional paraffins and waxes do not burn at a temperature high enough to activate the commonly used metallic flame-coloring ingredients. Secondly, the above-described extended luminous yellow region of the conventional candle flame tends to distort or mask the desired color.

Many attempts have been made in the past to produce candles capable of burning with flames of various colors, but none have been completely successful. The majority of prior art colored flame candles are not suited to economical mass production. In others, the materials used produce noxious vapors or excessive smoke which obscures the flame color. Some fuels tend to deposit unconsumed residues on the conventional wick while others result in sputtering or undue spilling or dripping while burning. Many of the fuels proposed other than conventional paraffins and waxes burn with flames having dimensions far inferior to those of conventional candle flames. Finally, the flame-coloring ingredients tend to collect in and clog the conventional wick thereby decreasing or preventing the flow of fuel to the flame area. As one manner of overcoming this deficiency, wickless candles have been proposed but without practical or commercial success. It has also been proposed to use wicks of larger section and less close in texture than those used in conventional wax candles. It has been found, however, that with these wicks, the flames are not controllable and it is not possible to approximate conventional flame dimensions.

It is therefore an object of the present invention to provide a candle of high quality which overcomes the above prior art disadvantages.

Another object of the present invention is to provide a candle which contains little or no conventional candle fuel but which provides a flame of dimensions comparable to that of conventional candles.

Still another object of the present invention is to provide a candle which will burn with a nonluminous or only faintly luminous flame.

It is a further object of the present invention to provide such a candle which lends itself readily to treatment for producing an intensely colored flame.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description taken in conjunction with the accompanying drawing wherein:

FIG. 1 is a side view of a candle in accordance with the present invention;

FIG. 2 is a perspective view of a candle similar to that shown in FIG. 1 and illustrating an alternative embodiment of the present invention;

FIG. 3 is a top view of the candle of FIG. 1;

FIG. 4 is a top view of the candle of FIG. 2; and

FIG. 5 is an enlarged side view, partly in section, of a wick used in one embodiment of the candle.

Referring to the drawing wherein like reference characters designate like or corresponding parts throughout the different views, and referring particularly to FIGS. 1-4, the numeral 10 generally designates a candle which comprises a combustible body 12 consisting essentially of at least a major proportion of a member selected from the group consisting of polyethylene glycol having a molecular weight between about 1,000 and 6,250, trimethylol propane, tristearyl citrate and mixtures thereof, and at least two spaced combustible wicks 14 embedded in said body. The present invention is predicated on the discovery that the fuel source and wick construction of the candle are both critical and interrelated in achieving a successful candle, and especially if the candle is to contain a flame-coloring ingredient.

The fuel source of the candle must be such that the flame produced by the basic candle, i.e., without any flame-coloring ingredients or substances capable of producing such ingredients, represents substantially complete combustion. In other words, the flame must be free, or substantially free, from partially consumed carbon or carbon compounds which give the luminous yellow color to a conventional candle flame. Ideally, the flame is colorless or of a pale blue tint. However, in providing some colors, the presence of some yellow flame may be tolerated or even desired. Wick construction is equally critical since, in order that the candle function properly, it is essential that the fuel and, when used, the flame-coloring ingredient be drawn through the wicks to the primary flame area. The fuel and flame-coloring ingredients must not, therefore, be those which might clog the wicks by blocking the capillaries which carry the necessary fuel to the flame. Sufficient fuel must be provided so that the dimensions of the flame approximate those of the conventional candle flame.

The candles of the present invention burn with a colorless or substantially colorless flame of good dimensions. The temperature of the flame is sufficiently high to activate metallic flame-coloring ingredients when they are used. The candles burn without production of noxious vapors or smoke and leave no unconsumed residue. The fuel of the candles does not clog the wicks.

According to an important characteristic of the present invention, the combustible body 12 consists essentially of at least a major proportion of a polyethylene glycol having a molecular weight between about 1,000 and 6,250, trimethylol propane, tristearyl citrate or mixtures thereof.

In a preferred embodiment the combustible body 12 consists essentially of polyethylene glycol. Normally solid polyethylene glycols having a molecular weight between 1,000 and 6,250 and a solidification point between 35° and 62° C. may be used as such for the candle fuel. More preferably, the candle fuel consists essentially of 100 parts by weight polyethylene glycol having a molecular weight between 1,000 and 6,250 and from 10 to 50 parts by weight of a polyethylene glycol or methoxypolyethylene glycol having a molecular weight between about 200 and 750. These latter lower molecular weight compounds are liquid at room temperature and serve to increase the fluidity of the higher molecular weight glycols in the molten state and thus enhance the flame strength when the fuel is burned.

When mixtures of polyethylene glycol, trimethylol propane and tristearyl citrate are used as the combustible body, the proportions of ingredients are not especially critical. The latter two ingredients, however, burn with a slightly yellow flame and where absence of luminosity is important, proportions of trimethylol propane and/or tristearyl citrate should be kept below 50 parts and preferably below 30 parts by weight for 100 parts by weight of polyethylene glycol.

All of the above fuels may also contain modifiers to enhance flame strength and dimensions and to improve the burning properties of the fuel when flame-coloring ingredients are included in the candles. Such modifiers include metaldehyde,

trioxane and gelled liquid paraffins which may be used in amounts of from 5 to 50 parts by weight for each 100 parts by weight of the major fuel component. The gelled liquid paraffin is preferably a highly refined light paraffinic petroleum distillate having a distillation range from about 205° to about 255° C. which has been gelled with from 0.5 to 5 parts by weight of the distillate of an organic acid salt of an alkali metal; e.g. lithium oxalate, lithium stearate and mixtures thereof.

All of the above fuels may also be enhanced by the addition to 100 parts of from 1 to 15 parts by weight of a compatible chlorinated hydrocarbon containing from 25 percent to 50 percent by weight of chlorine. The fuels then burn with a light greenish-blue flame. It has been found that with this fuel, use of cotton wicks intertwined with from 5 percent to 10 percent by weight of a low gauge metallic copper wire provides a flame of deep greenish-blue. The color may be further enhanced by addition of a copper salt to the candle.

According to another important characteristic of the present invention, the candle body contains at least two spaced combustible wicks 14 embedded therein. The wicks are preferably spaced a distance at least equal to the cross-sectional dimension of the individual wicks and up to one-eighth inch or more depending on the size of the completed candle. When three wicks are used, they are preferably spaced equidistant from one another in a triangulated configuration and this embodiment is shown in FIGS. 2 and 4. While four or more wicks may be used, for practical purposes two or three wicks are preferred. The composition of the wicks is not critical and conventional combustible wicks may be used. Preferably, the wicks made of cotton are of from 25 to 35, and preferably of 30 ply construction. In the wick 14 shown in FIG. 5, 5 percent to 10 percent by weight of metallic copper wire 16 is intertwined therein.

The candles of the present invention may be cast, molded or dipped in the usual way and to any size desired. Preferably, the individual wicks are first provided with an initial coating of fuel and then assembled to form the novel spaced wick construction of the present invention. The assembled wicks are then combined with additional fuel in any conventional manner. In the present invention, each candle contains at least two wicks spaced from each other throughout the entire length of the candle.

When it is desired to impart a distinctive color to the candles of the present invention, conventional and well-known heat-decomposable flame-coloring ingredients may be added. For example, inorganic and organic salts of strontium, barium, potassium, copper, zinc, selenium, calcium, sodium, lithium, caesium, aluminum and magnesium provide various colored flames when burned in candles. Salts of barium and copper provide green and bluish-green flames, salts of strontium, calcium and lithium provide red and red-orange flames, salts of selenium and caesium provide blue flames, salts of zinc, aluminum and magnesium provide white flames, salts of sodium provide bright yellow flames and salts of potassium provide violet flames. Inorganic salts of the above metals include the nitrates, sulfates, halides (especially the chlorides), carbonates, perchlorates and ammonium perchlorates. Organic metallic salts include those disclosed in U.S. Pat. No. 2,771,764 and U.S. Pat. No. 3,107,511. In addition, boric acid and boron containing compounds such as those disclosed in U.S. Pat. No. 3,150,510 provide green flames of varying hues and intensities.

All of the above flame-coloring ingredients are suitable for use in the present invention and they may be incorporated either in the combustible body of the candle, in the wicks, or both. For example, the flame-coloring ingredient in a finely divided state may be added with stirring to the fuel comprising the combustible body and this mixture is then used to form the candle. Alternatively, the wicks may be saturated with a concentrated solution or suspension of the flame-coloring ingredient and then dried. Amounts of flame-coloring ingredient to be used range from trace amounts to 10 percent by weight or more based on the weight of the candle. Preferable

amounts range from 0.1 to 2.0 percent by weight of the candle. Mixtures of flame-coloring ingredients may be used to obtain intermediate colors and shades.

In practicing the invention, the following examples are given as illustrative and are not to be taken as limiting. Examples 2—4 are intended as illustrating the preferred embodiment and best mode of the present invention.

Example 1

A control candle was prepared for use as a standard for comparison of flame color, flame dimensions and general candle properties. A mixture of 100 parts by weight petroleum paraffin wax and 10 parts by weight stearic acid was melted and cast around a centered wick of 30 ply unbleached cotton into a candle having a diameter of one-half inch. The candle burned with a luminous yellow flame approximately 1 1/4 inches in height and one-half inch in diameter.

Example 2

A candle was prepared in accordance with the procedure of Example 1 using for the candle body a mixture of 100 parts by weight of polyethylene glycol 6,000 having a molecular weight of about 6,250 and 43 parts by weight of methoxypolyethylene glycol having a molecular weight of about 550. Upon burning, the candle yielded a substantially colorless, nonluminous flame having dimensions about 25 percent of the control. A second candle, prepared with two wicks spaced about one-eighth inch apart, burned with substantially increased flame dimensions. A third candle was prepared with three wicks spaced about one-eighth inch apart in a triangulated arrangement. The resultant flame had dimensions comparable to that of the control candle. With both multiple-wick candles, the flames were substantially colorless with a very slight bluish tint.

Example 3

A candle with two spaced wicks was prepared in accordance with the general procedure of Example 1 using for the candle body a mixture of 100 parts by weight of polyethylene glycol having a molecular weight of about 4,000, 20 parts by weight of polyethylene glycol having a molecular weight of about 400 and 2.0 parts by weight of strontium nitrate. The candle prepared with two wicks spaced about one-eighth inch apart burned with a scarlet flame of good flame dimensions.

Example 4

A candle with three spaced wicks was prepared in accordance with the general procedure of Example 1 using for the candle body a mixture of 100 parts by weight of polyethylene glycol having a molecular weight of about 1,000, 50 parts by weight of methoxypolyethylene glycol having a molecular weight of about 750 and 1.0 part by weight of lithium carbonate. The candle prepared with three wicks spaced about one-eighth inch apart in a triangulated configuration burned with a reddish-orange flame of excellent flame dimensions.

Example 5

Three candles (A, B and C) were prepared in accordance with the procedure of Example 3 using as candle bodies the following ingredients:

Ingredient	Parts by weight		
	A	B	C
Trimethylol propane.....	100	100	40
Trioxane.....		5	40
Polyethylene glycol 6000.....			60

Candle A exhibited excellent candle properties having flame dimensions almost equivalent to those of the control. The flame had a slight yellowish color. Candle B produced a slightly yellowish flame having dimensions equivalent to the control. Candle C exhibited a colorless flame of substantially improved dimensions over those of Example 2.

Example 6

A candle was prepared according to the procedure of Example 1 using tristearyl citrate as the fuel body. The candle burned with a pale yellowish flame having dimensions about 60 percent of the control. The use of two spaced wicks increased the flame dimensions to those of the control candle.

Example 7

One hundred parts by weight of a paraffinic petroleum distillate having a distillation range from 205° to 255° C. were gelled by mixing with a mixture of 0.5 part by weight lithium stearate and 0.5 part by weight lithium oxalate. A candle was prepared with two wicks and a fuel body of 100 parts by weight of polyethylene glycol 6,000 and 20 parts by weight of the gelled distillate.

Example 8

Example 7 was repeated with the exception that the petroleum distillate was gelled with 3 parts by weight of lithium stearate.

The candles of Examples 7 and 8 burn with excellent flame dimensions. The flame was mostly orange with a luminous yellow inner core. These candles are especially useful with flame-coloring ingredients providing a red flame.

Example 9

Three candles (D, E and F) were prepared in accordance with the procedure of Example 3 using as candle bodies the following ingredients:

Ingredient	Parts by weight		
	D	E	F
Polyethylene glycol 6000.....	100	100	100
Methoxypolyethylene glycol 550.....	43	43	43
Arochlor 5460.....		15	15
Trioxane.....			15

The wicks were 30 ply unbleached cotton braid. The wicks of candles E and F contained 5 percent by weight metallic copper wire intertwined therewith.

Arochlor 5460 is a solid transparent yellow polychlorinated polyphenyl resin.

Flame dimensions for all three candles were equal to those of Example 3. The flame color of candles E and F was bluish-green.

Example 10

Three candles (G, H and I) were prepared in accordance with the procedure of Example 3 using as candle bodies the following ingredients:

Ingredient	Parts by weight		
	G	H	I
Trimethylol propane.....	100	100	100
Lithium stearate.....	0.5		0.5
Chlorowax 50.....		10	
Lithium oxalate.....			0.5

The wicks were 30 ply cotton. The wicks of candle H included 5 percent by weight metallic copper wire intertwined therewith.

Chlorowax 50 is a liquid chlorinated paraffin containing approximately 50 percent by weight chlorine.

The flames of all three candles had dimensions equal to those of Example 3. The flame color of candle G was yellow with the outer rim tinged with orange. The flames of candles H and I were greenish-blue.

Example 11

Two candles (J and K) were prepared in accordance with the procedure of Example 3 using as candle bodies the following ingredients:

Ingredient	Parts by weight	
	J	K
Trimethylol propane.....	100	100
Cupric chloride.....	10	5

The wicks were 30 ply cotton, the wicks of candle K containing 5 percent by weight metallic copper wire intertwined therewith.

The cupric chloride imparts a dark green color to the candle body. The flames of the two candles had good dimensions and a bluish-green color.

Examples 2—11 were repeated using varying amounts of other flame-coloring ingredients including boric acid, barium oxalate, potassium chloride, strontium citrate and barium perchlorate. In these examples, however, the wicks were impregnated with concentrated solutions of the ingredients and dried prior to utilization thereof in forming the candles. All of the candle flames were of good dimension and of the color associated with the flame-coloring ingredient.

Having fully described the novel candles of the present invention, the need therefor and the best methods devised for their preparation, it is not intended that the present invention be limited except within the spirit and scope of the appended claims.

It is claimed:

1. A candle comprising a combustible body consisting essentially of at least a major proportion of a fuel selected from the group consisting of polyethylene glycol having a molecular weight between about 1,000 and 6,250, trimethylol propane, tristearyl citrate and mixtures thereof, and at least two spaced combustible wicks embedded in said body.

2. The candle according to claim 1 containing three spaced combustible wicks.

3. The candle according to claim 1 wherein the combustible body consists essentially of 100 parts by weight of a polyethylene glycol having a molecular weight between about 1,000 and 6,250 and from 10 to 50 parts by weight of a member selected from polyethylene glycols and methoxypolyethylene glycols having a molecular weight between 200 and 750.

4. The candle according to claim 3 containing also from trace amounts to 10 percent by weight of the candle of a heat-decomposable flame-coloring ingredient.

5. The candle according to claim 1 wherein the combustible body consists essentially of 100 parts by weight of said fuel and from 5 to 50 parts by weight of a flame modifier selected from the group consisting of metaldehyde, trioxane, a light paraffinic petroleum distillate having a distillation range from about 205° to about 255° C. gelled with from 0.5 to 5 parts by weight of the distillate of an organic acid salt of an alkali metal and mixtures thereof.

6. The candle according to claim 1 wherein the combustible body consists essentially of 100 parts by weight of said fuel and from 1 to 15 parts by weight of a compatible chlorinated hydrocarbon containing from 25 percent to 50 percent by weight of chlorine.

7. The candle according to claim 6 wherein the combustible wicks contain from 5 percent to 10 percent by weight of metallic copper wire intertwined therein.

8. The candle according to claim 1 containing also from trace amounts to 10 percent by weight of the candle of a heat-decomposable flame-coloring ingredient.