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CANDLE

Donald C. Walker, Lansing, Ill., assignor to Standard Oil Company, Chicago, Ill., a corporation of Indiana

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This invention relates to candles and more particularly to candles which can be made to burn at any desired rate.

In many instances where candles are used it is desirable to be able to control the rate at which the candle burns. Some degree of control over the burning rate of a candle can be achieved by varying the thickness of the wick, as by increasing the wick size to make the candle burn at a faster rate and decreasing it to reduce the burning rate. As a method of decreasing the burning rate, however, decreasing the size of the wick suffers from several disadvantages. From a physical standpoint the size of the wick cannot be decreased beyond a certain point, since it then becomes too fragile for easy handling during the manufacturing operation. Moreover, a candle having an extremely fine wick is prone to erratic burning. Minute impurities in the wax comprising the body of the candle can block the rise of molten wax in the wick and thus cause the flame to burn in an erratic manner or even to die out of its own accord.

It is an object of this invention to provide a candle having a reduced burning rate which is achieved without decreasing the size of the wick. Another object is to produce a candle whose burning rate can be controlled by the addition of controlled amounts of polybutenes to the wax comprising the body of the candle. A further object is to provide a method for the manufacture of candles having reduced rates of burning. Other objects will be apparent to those skilled in the art from the following description of my invention.

I have discovered that the burning rate of a wax candle can be reduced to a controlled extent by the addition of up to about 10% by weight, preferably from about 1% to about 5%, of a polybutene having a molecular weight within the range from about 50,000 to about 500,000, preferably from about 100,000 to about 300,000, to the wax comprising the body of the candle. The extent of reduction in the burning rate is dependent on both the amount of polybutene added and its molecular weight, i. e., other things (wick size, type and melting point of the wax, diameter of the candle, etc.) being equal, the burning rate of the candle is decreased by increasing the amount of polybutene of a given molecular weight or by increasing the molecular weight while keeping the quantity added constant. By means of my invention it is possible to decrease the burning rate without the necessity for decreasing the diameter of the wick. In this manner the difficulties normally attending the use of an extra-fine wick are obviated.

The polybutenes which are contemplated for use in my invention include polymers of 1-butene, 2-butene, and isobutylene. Methods for the production of these polybutenes are well known in the art. In general, these methods involve condensing the olefin feed at a low temperature with a Friedel-Crafts type of catalyst such as boron fluoride or aluminum chloride.

The polybutenes suitable for use in accordance with my invention have a molecular weight within the range from

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about 50,000 to about 500,000. I have found that if the molecular weight is less than about 50,000 the addition of polybutenes has relatively little effect on the burning rate of the candle. If on the other hand the molecular weight exceeds about 500,000 it becomes difficult to dissolve the polybutene in the wax. For these reasons I prefer to use polymers having molecular weights within the range from about 100,000 to about 300,000, since these are readily incorporated in the wax which forms the body of the candle and at the same time relatively small amounts thereof have an appreciable effect on the burning rate of the candle, e. g., a reduction in burning rate of about 5% or more when used in amounts of about 0.5% by weight. The polymer is added to the wax in an amount ranging from about 0.1% to about 10% by weight, and preferably within the range from about 1% to about 5%, the amount to be used in a given case depending on the degree of reduction in burning rate which is desired and on the molecular weight of the polybutene within the defined range. I have found that the addition of a polybutene of the defined class in an amount ranging from about 12% to about 50%, depending on the molecular weight, causes the burning rate to decrease to such an extent that the candle burns only with great difficulty, or not at all.

My invention is applicable to candles having a body made of any of the normally solid waxy materials commonly used for candle manufacture, including petroleum wax, ceresin wax, montan wax, beeswax and spermaceti. When petroleum waxes are used it is customary to employ a paraffin wax fraction having a melting point between about 115° and 170° F., preferably between about 125° and 140° F., although other types of petroleum wax such as motor oil wax and microcrystalline wax can also be present in admixture with the paraffin wax.

The wax used in molded, hand-dipped, and decorative candles usually contains stearic acid in an amount from about 1% to 50% by weight and preferably from about 10% to 40%. The stearic acid, which can be single-, double-, or triple-pressed, is added for the purpose of hardening the candle composition, raising the bending (or softening) point, and lowering the melting point. My invention is equally applicable to candles made of wax containing stearic acid and to those wherein no stearic acid is used.

The polybutenes can be incorporated in the wax by heating the latter to a temperature in the vicinity of 400° F., adding the polybutene and stirring until a homogeneous mixture is obtained. A preferred method, however, comprises making a solution of the polymer in a hydrocarbon solvent such as hexane, toluene, or naphtha, dissolving the wax in this solution, and stripping off the solvent by heating the mixture to a temperature of about 250° F. Alternatively, the solvent can be stripped off at a lower temperature by vacuum distillation. This latter method avoids the use of high temperature and the presence of objectionable oxidation products which may be formed in the wax thereby.

My invention is particularly useful for prolonging the burning of candles used in spring-loaded holders. These holders, usually of small size, completely encase the candle and contain an internal spring which forces the candle upward against a stop at the top of the holder, so that the position of the flame remains fixed. Such holders are commonly provided with a shade and are used for decorative purposes rather than for illumination. A candle of relatively small size, yet capable of burning for an extended period of time, can be used to great advantage in a holder of this type.

As has been pointed out above, the addition of polybutene polymers in amounts exceeding about 10% by

weight reduces the burning rate to such an extent that the candle burns with difficulty, if at all. This effect can be advantageously used to make a candle which is self-snuffing, i. e., one which will extinguish itself when the flame reaches a predetermined position along the length of the candle, by forming the candle in two sections with the lower section containing a gross amount of polybutene polymers, i. e., between about 12% and 50%, depending on the molecular weight of the polybutene. For example, a candle with a lower section comprising about 15% of a polybutene having a molecular weight of about 300,000 automatically extinguishes itself when the flame reaches the section of the body which contains the high proportion of polybutene, and can be used to advantage in applications where the candle is left unattended for long periods of time and where for reasons of safety or otherwise, it is desired that it stop burning before being entirely consumed.

The effect of the addition of polybutenes on the burning rate of wax candles is illustrated by the following experimental data. The table below shows the burning rates of five candles, the wax bodies of which contained varying amounts of isobutylene polymer having a molecular weight of about 300,000. The candles were of identical size, about $4\frac{1}{2}$ inches long and $\frac{9}{64}$ inch in diameter, and contained 15-strand braided wicks. The wax used was a refined petroleum paraffin wax having a melting point of 135–137° F. In each case the candle contained 3% by weight of double-pressed stearic acid. The burning rate was obtained by weighing the candle and then burning it in a draft-free space until only a stub of about one inch in length was left, at which time the stub and the accumulated drippings (if any) were weighed. The burning rate was calculated by dividing the total loss in weight by the time during which the candle was burning. The percentage figures in the following table and in the appended claims are percentages by weight, based on the final composition, unless otherwise indicated.

TABLE

Candle No.	Composition of Candle Body			Burning Rate
	Wax	Stearic Acid	Polybutene	
	Percent	Percent	Percent	Grams/hour
1.....	97	3	0	7.77
2.....	96	3	1	5.85
3.....	95	3	2	4.25
4.....	94	3	3	3.24
5.....	93	3	4	2.55

The data of the table show that the burning rate was reduced to about $\frac{1}{3}$ of its original value by the addition of 4% of polyisobutylene having a molecular weight of about 300,000. The burning rate can be decreased in a similar manner by using smaller quantities of a poly-

butene having a molecular weight greater than 300,000 (i. e., between 300,000 and 500,000) or larger quantities of a polybutene having a molecular weight less than 300,000, i. e., within the range of 50,000 to 300,000. For example, burning rates equivalent to those given in the table can be achieved by using a polymer having a molecular weight of about 100,000 in amounts about 1.5 to 2.5 times those given in the table. Although at these decreased burning rates the size of the flame naturally decreases, nevertheless the candle burns smoothly, without any evidence of a tendency to self-extinguishment such as might be expected if smaller wicks are used.

While I have described my invention with reference to specific embodiments thereof, the same are given by way of illustration only. Modifications and variations will be apparent from my description to those skilled in the art.

Having described my invention, I claim:

1. A candle having a reduced burning rate which comprises essentially a wick and a normally solid wax body, said wax body comprising from about 0.1% to about 10% of a polybutene having a molecular weight from about 50,000 to about 500,000.

2. The candle of claim 1 wherein said normally solid wax is petroleum wax having a melting point within the range of about 115° to about 170° F., and wherein said polybutene is present in an amount between about 1% and about 5%.

3. A candle having a reduced burning rate which comprises essentially a wick and a normally solid wax body, said body comprising petroleum wax, from about 0.1% to about 10% of an isobutylene polymer having a molecular weight within the range of about 100,000 to about 300,000 and from about 1% to about 50% of stearic acid.

4. The candle of claim 3 wherein said body comprises between about 1% and about 5% of said isobutylene polymer and wherein said petroleum wax is a paraffin wax having a melting point between about 115° and about 170° F.

5. A self-snuffing candle which comprises essentially a wick and a wax body, said body being divided along its length into two unequal sections, a major upper section comprising from about 0.1% to about 10% of a polybutene having a molecular weight from about 50,000 to about 500,000 and a lower minor section comprising said polybutene in an amount from about 12% to about 50% and sufficient, when the candle is burned, to cause the flame to be extinguished when it reaches said minor section.

References Cited in the file of this patent

Warth: The Chemistry and Technology of Waxes, Reinhold Publishing Corporation, New York, New York, copyright 1956, pages 504–506 and 511 only are needed.