Jan. 4, 1972 J. A. ANTONELLI ET AL 3,632,516

SELF-HEATING LATHER

Filed Sept. 25, 1968

FIG. 1

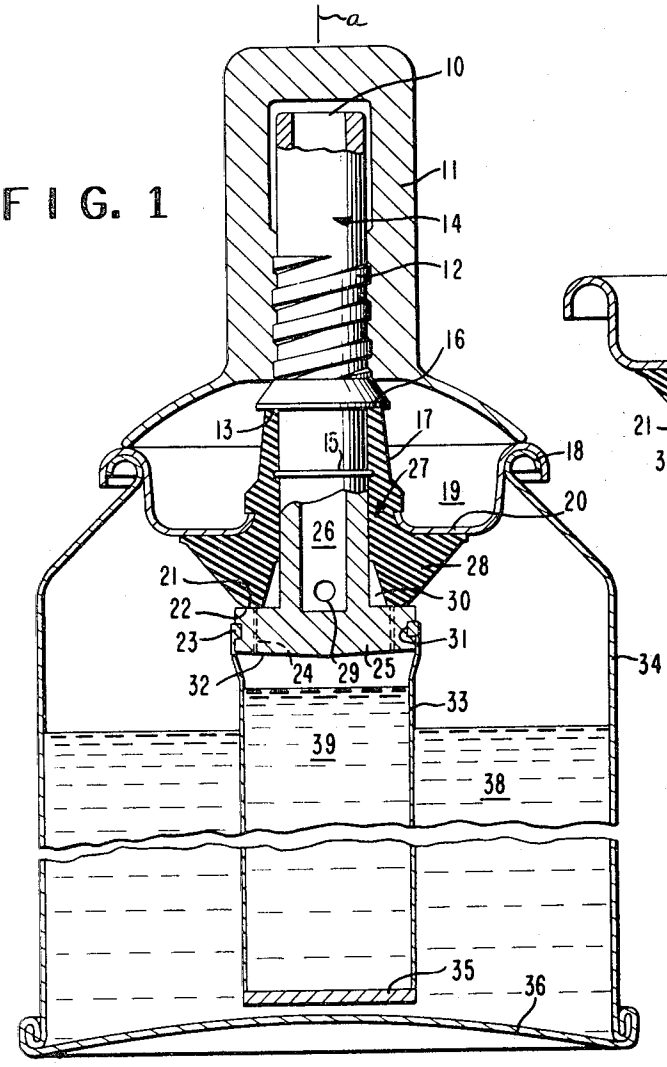


FIG. 2

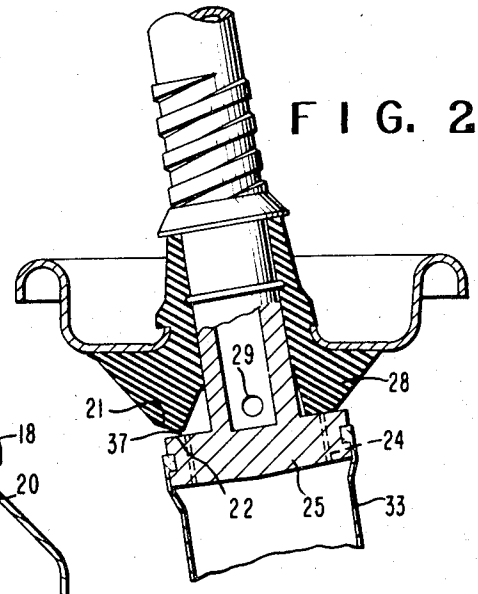
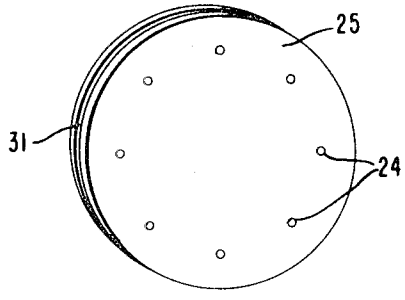


FIG. 3



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SELF-HEATING LATHER

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ABSTRACT OF THE DISCLOSURE

A package for preparing and dispensing heated foam, which comprises a container having an outlet and a valve adapted to control the dispensing of foam from the outlet and having separately contained therein (a) hydrogen peroxide oxidant and (b) a reductant composition comprising a soap solution containing:

(1) potassium thiosulfate and a catalytic amount of sodium tungstate, or
(2) a mixture of potassium thiosulfate and potassium sulfite and a catalytic amount of sodium tungstate;

components (a) and (b) being present in amounts which when co-dispensed produce a heat generating redox reaction which imparts a warming effect upon the dispensed foam; said container having a volatile organic propellant therein in an amount sufficient to dispense said lather under pressure.

BACKGROUND OF THE INVENTION

(1) Field of the invention

This invention relates to a package and process for dispensing self-heating lather or foam in which heat is generated by a redox reaction.

(2) Description of the prior art

The field of hydrogen peroxide-based hot lathers at present is predominated by several systems each of which, while apparently adequate, possesses certain inherent limitations which are avoided or overcome by the system of the present invention with a resultant marked increase in overall comfort and efficiency.

One of these systems, Seglin et al., French Pat. 1,468,909, discloses the catalytic decomposition of hydrogen peroxide, which necessitates the presence of substantially more concentrated solutions of hydrogen peroxide than are found in redox systems. Concentrated solutions of greater than 50 and even 83 wt. percent hydrogen peroxide are recommended for efficient results. In addition, a comparison of the relative heat of reaction in the system (22.6 kcal./mole) and a redox system such as hydrogen peroxide-potassium sulfite system (87.7 kcal./mole) reveals that in equal volumes the hydrogen peroxide concentration of the decomposition system must be 3.9 times that of the redox system. The presence of hydrogen peroxide in such high concentration might well prove dangerous even under normal conditions and use. Should, for example, the catalyst or valve of a decomposition system malfunction, strong solutions of hydrogen peroxide could be expelled upon the skin or eyes of the user inflicting severe damage. Another equally serious possibility would be that of an explosion of the dispenser

if the hydrogen peroxide and catalyst should accidentally come in contact with one another through failure of the inner hydrogen peroxide compartment or some similar occurrence. In this event, large quantities of oxygen, more than sufficient to burst an ordinary aerosol dispenser, would be generated inside the dispenser. In comparison, essentially no oxygen is generated in the redox system of the present invention, should such a failure occur.

Another system, Moses et al., U.S. Pat. 3,341,418, employs a redox reaction with non-electrolyte reductants contained in a soap solution and hydrogen peroxide or urea hydrogen peroxide oxidants. The particular reductants utilized are thiourea and various thiobarbituric acid derivatives. The reaction of hydrogen peroxide with thiourea is accompanied by an unpleasant mercaptan-like odor which makes the reaction quite unsatisfactory in the heating of lather and, additionally, the thiobarbituric acid derivatives employed are expensive and not readily available.

Another common system is found in Hayes et al., U.S. Pat. 3,326,416 and employs heating by redox reaction with hydrogen peroxide oxidant and potassium sulfite reductant. The high concentration of potassium sulfite necessary to effect a satisfactory temperature increase has a rapid corrosive effect on the container can. However, if the concentration of potassium sulfite is reduced, unsatisfactory temperature increases are attained. In the present invention the electrolyte concentration is low and yet the temperatures attained are satisfactory.

Since it is desirable to dispense as much warm lather or foam as possible from a container, most of the volume of the can should be filled with the lather soap solution. Based on calculations utilizing theoretical heat of reaction, Table 1 illustrates the calculated minimum concentrations of reactants of the prior art required to heat the dispensed lather to a 30° C. increase in temperature, assuming the ratio of the volume of hydrogen peroxide to solution containing the reductant is 1:4.

TABLE 1.—CALCULATED MINIMUM CONCENTRATIONS OF REACTANTS

		Reductant, required concentration in soap solution	Hydrogen peroxide required concentration
1	$H_2O_2 \longrightarrow H_2O + \frac{1}{2} O_2$	None catalyst only	15.1 wt. percent.
2	$H_2O_2 + SO_3^= \longrightarrow H_2O + SO_4^=$	5.41 wt. percent K_2SO_3	4.64 wt. percent.
3	$4 H_2O_2 + S_2O_3^= \longrightarrow 2 SO_4^= + 3 H_2O + 2H^+$	1.84 wt. percent $K_2S_2O_3$	5.28 wt. percent.

It follows from Table 1 that in reaction 1 high concentrations of hydrogen peroxide must be used to obtain adequate heating from a reasonable volume of hydrogen peroxide. As has already been pointed out, accidental release of hydrogen peroxide from its compartment to the catalyst would result in explosion of the dispenser. In fact, it can be readily calculated that more than 9 times the 6 fl. oz. volume of an ordinary dispenser, of oxygen, will be generated from the minimum required amount of H_2O_2. When the dispenser is filled nearly full, leaving little room for the generated gas, it is readily appreciated that the developed pressure would be very high.

Potassium thiosulfate would appear, from consideration of the small amounts required as shown in Table 1, to be an excellent reductant. Further, the thiosulfate salt can be introduced into soap solution to about 12.5 wt. percent, a concentration theoretically more than adequate to heat the lather without gelling the soap solution. However, the reaction of the salt with hydrogen peroxide is, in fact, unsatisfactorily slow, losing, as will be shown in Examples 12 and 13 below, nearly half the total heat of reaction to the surroundings.

Therefore, it is seen that there are several requirements which a hot shave lather reaction should meet. The re-

actants and products must, of course, be physiologically acceptable. From a functional point of view, the reactants must produce sufficient heat to bring the lather to a comfortable temperature and the reaction must take place at ambient temperature. Also, the reaction must liberate its heat rapidly because slow reactions cause unreasonable amounts of heat to be lost to the surroundings during the reaction, thereby lowering the temperature to which the lather is eventually brought. The foregoing requirements are met by the compositions of the present invention.

SUMMARY OF THE INVENTION

The present invention comprises a container package having a foam outlet and a valve adapted to control the dispensing of foam therefrom, and containing:

(A) An aqueous dispersion of a foamable composition selected from soluble anionic soaps, wetting agents and fibrous alumina present in an amount of between 4 and 30% based on the weight of total composition,

(B) Hydrogen peroxide which is capable of reacting with rapid generation of heat when contacted with a reductant,

(C) A reductant composition capable of reacting at room temperature with said hydrogen peroxide to produce heat, said reductant composition being selected from the group consisting of:

(a) Potassium thiosulfate and a catalytic amount of sodium tungstate

(b) A mixture of potassium thiosulfate and potassium sulfite and a catalytic amount of sodium tungstate; materials (B) and (C) being isolated from sach other when said valve is closed; said package being equipped with conveyor means comprising a duct and source of fluid pressure selected from a compressed gas or a volatile organic propellant selected from saturated aliphatic hydrocarbons or water-insoluble chlorine and fluorine-substituted hydrocarbons having a vapor pressure of about 15 to 65 p.s.i.g. at 21° C., said source of fluid pressure being present in an amount sufficient to convey material (A) to said outlet and dispense it therefrom as a foam when said valve is open, and means to provide intimate contact between materials (A), (B), and (C) while material (A) is being conveyed toward said outlet.

The process aspect of the invention is described as follows:

In the process for dispensing heated lather from a pressurized dispenser, said lather being heated by a redox reaction between separately contained but co-dispensed hydrogen peroxide oxidant and a reductant composition contained in a soap solution, the improvement comprising the use of a reductant composition selected from the group consisting of:

(A) Potassium thiosulfate and a catalytic amount of sodium tungstate,

(B) A mixture of potassium thiosulfate and potassium sulfite and a catalytic amount of sodium tungstate.

Another embodiment of the invention comprises a warm aqueous foam composition obtained by intimately contracting an aqueous foamable composition with H_2O_2 and a reductant composition described as above.

DESCRIPTION OF THE DRAWING

A container employed in this invention is illustrated in the drawing attached hereto in which

FIG. 1 shows a dispenher in central vertical section and partially broken away; a portion of the valve stem between its ends is shown in front view. The dispensing valve is in the closed position;

FIG. 2 shows a portion of the dispenser of FIG. 1 in which the dispensing valve is in the open position; and

FIG. 3 shows an enlarged perspective view of the lower face of the valve head of FIG. 1.

DESCRIPTION OF THE INVENTION

Any dispensing container may be employed in the package of this invention provided the container maintains the oxidant and the reductant in separate compartments prior to dispensing them. One such container is depicted in the drawing and is described as follows.

In FIG. 1, outer container **34**, which is adapted for storing a liquid under pressure, is a can of the type commonly used in aerosol foam dispensers. The upper portion of can **34** is rounded and tapered to form a circular opening surrounded by a rolled bead **18** spun from the metal of the can. The rolled edge of bowl-shaped cover **19** tightly engages bead **18**, and after the contents of the can are inserted, it is crimped therewith to form a pressure-proof seal. Top wall **20** of can **34** has an aperture which is outwardly flanged about axis *a* perpendicular to wall **20**, in this aperture is lockingly and sealingly fitted a tilt-opening self-closing dispensing valve. The dispensing valve comprises a tubular seal **17** made of a resilient elastic rubber composition fitted sealingly in aperture **27**; the valve also comprises a tubular stem **14** made of a relatively rigid plastic composition fitted coaxially (on axis *a*) and sealingly in seal **17**. The "rigid" stem has relatively little elastic deformation under load compared with that of resilient seal **17**. Stem **14** terminates inside of can **34** in disc-shaped valve head **25** and terminates outside of can **34** in dispenser outlet **10**. By gently pressing the side of stem **14** near the outlet, the stem can be tilted about a pivot point located between its two ends (near the bottom of ring **15**) as the stem is tilted, its lower portion moves laterally within annular gap **30**. When the tilting pressure is removed from the valve stem, the stem is returned to the erect, closed position by the resilient elastic rubber seal.

The exterior portion (above aperture **27**) of stem **14** has (a) a laterally extending shoulder **16** which abuts against the upper end face **13** of seal **17** at a level remote from that of wall **20** and (b) a laterally extending ring **15** in locking contact with a matching groove in the inner wall of seal **17**.

Collapsible inner container **33** is a flexible plastic tube which is smaller than can **34** and has a beaded upper end **23** sealingly fitted in annular groove **31** in the side wall of valve head **25**. Thus, there is a chamber outside of tube **33** and within can **34** in which liquid **38** can be stored in isolation from the liquid in the tube. Lower face **32** of valve head **25** forms the top wall of collapsible container **33**. In a sense, end face **21** also forms part of the top wall of container **33** since it serves as a closure for channels **24** when the valve is closed. The heat-sealed lower end **35** of tube **33** almost touches bottom wall **36** of can **34**.

Tubular seal **17** has an enlarged lower portion **28** which has a large washer-like sealing surface in contact with the inner side of wall **20** adjacent aperture **27**, and which terminates inside of can **34** in an annular end face **21** at a level remote from the level of top wall **20**; and valve head **25** has a laterally extending annual shoulder **22** in sealing contact with end face **21**, thereby forming a breachable seal. When the valve is closed, the resilient material of seal **17** is slightly compressed at end face **21**. The inside diameter (inner wall) of the lower portion **28** of tubular seal **17** in a region adjacent end face **21** is enlarged so that this portion of the seal is separated from the lower portion of stem **14** by an annular gap or chamber **30** (counterbore recess) which is in communication with dispenser outlet **10** through lateral port **29** and central passage **26** of stem **14**. Port **29** is provided by drilling a hole diameterically through the valve stem just above shoulder **22**. Annular chamber **30** is partitioned by the breachable seal from the chamber containing liquid **38**.

As shown in FIG. 3, valve head **25** is preforated with eight channels **24**. In this embodiment of the invention, the channels were drilled with a No. 73 drill so that the

channels are equidistant from each other and from the edge of the valve head. These channels provide communication between the interior of collapsible tube **33** and (a) end face **21** of tubular seal **17** when the valve is closed and (b) gap **30** when the valve is open.

It can be seen in FIG. 2 that the interior of the chamber containing liquid **38** and the interior of tube **33** are in communication with annular chamber **30** (and therefore port **29**, passage **26** and outlet **10**) only when stem **14** is tilted enough to breach the seal and thereby provide a gap **37** between end face **21** of the seal and annular shoulder **22** of the valve head.

Cap **11** has internal threads to match external threads **12** of the upper portion of stem **14**. When the cap is in place, its lower edge abuts upon bead **18**; thus stem **14** is locked in the erect position.

The dispenser shown in FIG. 1 is adapted for storing liquid **38** (including a propellant) in can **34** and a different liquid **39** in tube **33**, and for dispensing these two liquids simultaneously and intermittenly through outlet **10**. When using the dispenser, cap **11** is removed and the dispenser is inverted so that the upper portion of can **34** is filled with liquid; stem **14** is tilted to open the valve, and liquids **38** and **39** become mixed as they flow into gap **30** through gap **37** en route to outlet **10**. The flow of both liquids into gap **30** steps the instant the valve stem is permitted to return to the erect position and starts again the instant the valve stem is tilted.

The foamable composition of the aqueous dispersion of a foamable composition can be any known foam-producing agent capable of forming a foam when discharged from the pressurized container. The type and concentration of agent is readily determined by one skilled in the art. For shaving foam, however, the composition usually contains about four to about thirty percent by weight of foam producing agent. Useful such agents are exemplified by the soluble anionic soaps, for example the potassium, ammonium and soluble amine soaps of stearic acid, as well as vegetable oil soaps, various synthetic materials known as wetting agents or surfactants and fibrous alumina monohydrate in combination with a foam coactant. These materials can be used either individually or in combination. The use of the fibrous alumina/foam coactant is described in U.S. application Ser. No. 692,730, filed Dec. 22, 1967, now abandoned. The foamable composition should be non-gelling at room temperature, and can contain additives known in the art such as glycerine, light mineral oil, perfume, anti-freeze agents, silicone fluids, viscosity controlling agents and the like.

The reactants of the present invention are stored separately within the dispenser, one reactant (the reductant composition) being maintained in the aqueous dispersion of a foamable composition. When this reductant composition is the mixture of potassium thiosulfate and potassium sulfite in the presence of catalytic amounts of sodium tungstate, the mole ratio of the potassium thiosulfate to potassium sulfite is not critical; however, preferably the mole ratio should be about 0.4 to 0.9. Also for good results, the amount of the reductant composition in the aqueous dispersion should range from 3% to 8% by weight. The amount of catalyst present should range from .05% to .85% by weight of the reductants employed. The other reactant (hydrogen peroxide oxidant) is stored in an inner container, preferably a collapsible compartment within and smaller than the outside container, the amount of hydrogen peroxide oxidant stored therein being chemically equivalent to or less than the amount of reductant present. The liquid reactants are dispensed simultaneously through an outlet after passing through the valve at the top of the outer container. In general, the dispersing ducts of the container are adjusted so that an excess of the reductant with catalyst—up to 20%—is combined with the hydrogen peroxide in order to avoid the possibility of an excess amount of hydrogen peroxide being discharged into the foam composition. The redox reaction which results from this co-dispensing supplies heat to the dispensed shave lather.

The source of fluid pressure for moving the foam-forming mixture to and through the package outlet can be a duct leading from a compressed gas supply into the container or it can be a volatile organic material (referred to in the art as a "propellant") stored within the container. The useful propellants include those known to be operable in an aerosol-type package, for example, iso-butane, straight-chain saturated aliphatic hydrocarbons, and water-insoluble chlorine and fluorine substituted hydrocarbons having a vapor pressure of about 15 to 65 p.s.i.g. at 21° C. About 3–25% of propellant is usually required based on the combined weight of propellant and foamable composition. After adding the propellant to the chamber containing the foamable composition and before dispensing the foam, the package is preferably shaken briefly to obtain a colloidal dispersion of the propellant in the foamable composition.

As is known to those skilled in the art, the selection of propellants and other materials for use in aerosol packages is made on the basis of such consideraations as safety, toxicity and skin reactions of concern in the particular application.

EXAMPLES

The following examples are intended to be merely illustrative of the invention and not in limitation thereof. Unless otherwise indicated, all quantities are on a weight basis.

The standard soap formulation used in the following examples is not critical to the operability of the invention; for other formulations, as used in the art, are operable.

The standard soap formulation of the following examples was prepared in two parts, here designated A and B. Percent compositions are based on the total composition comprising parts A and B.

Part A

A mixture consisting of:

Acetylated lanolin [1]	0.8
Cetyl alcohol	0.5
Sorbitol monostearate [2]	0.5
Mineral oil	0.5
Polyoxyethylene sorbitan monostearate [3]	4.5
Sorbitol,[4] 70 wt. percent in water [5]	3.0

[1] "Modulan," American Cholesterol Products Co., Edison, N.J.
[2] "Arlacel" 60, Atlas Chemical Industries, Wilmington, Del.
[3] "Tween" 60, Atlas Chemical Industries, Wilmington, Del.
[4] "Sorbo" 70, Atlas Chemical Industries, Wilmington, Del.
[5] Alternatively added to part B.

was heated with stirring to 50° C. When all components were melted, lauric acid (1%) was added. With continued stirring and while heating to 70° C., stearic acid (7.0%) was sifted into the mixture. When the mixture was homogeneous it was allowed to cool. At about 50° C. perfume (0.4%), according to preference, was added and mixed.

The mixture could at this stage be stored at room temperature until needed but had to be rewarmed before blending with part B. Part B contains the reductant composition (described as material (C) in this invention) and was prepared as follows:

Part B

Deionized water was heated to 50° C. and reductants (material (C) variable percent, see examples)[1], potassium hydroxide (1.2%) and triethanolamine (3.5%) were dissolved in the water.

Part A at 50–55° C. was added to Part B, also at about 50–50° C., preferably below the surface, with mild stirring to prevent excessive foaming. The mixture was allowed to cool.

[1] The sum of water and reductant(s) (material C) in the examples is 77.1%.

The pH of all soap solutions was about 8 before reaction and about 7 after reaction as measured with pH paper. Raising the pH of the soap solution, of course, promotes the reaction of thiosulfate ion with hydrogen peroxide.

The hydrogen peroxide solutions used in these examples were prepared by dilution with deionized water of commercial 30% hydrogen peroxide containing conventional inhibitors.

In the examples, except as otherwise indicated, 20 grams of the above-described soap solutions containing reductant(s) in proportions stated in each example were reacted with 5 g. aqueous hydrogen peroxide of the stated concentration. The 4:1 wt. ratio of the reactant solutions corresponds to the ratio of reactant solutions metered in a common two-compartment dispenser.

The room temperature soap solution was added to a 50 cc. magnetically stirred beaker and a small thermometer was suspended in the solution. After thermometer equilibration, the hydrogen peroxide also at room temperature was added all at once. The temperature of the stirred solution was measured at various time intervals.

The efficiency figures expressed in percent are arrived at by multiplying the peak temperature increase (C. °) by the weight (g.) of the sum of the hydrogen and soap solution (to yield useful heat in calories-assuming heat capacity=1) and dividing this product by the calculated heat of reaction theoretically liberated by the reactants of the experiment. In experiments in which non-equivalent amounts of reactants were used, the number of moles actually reacting was taken for calculation of the theoretical heat of reaction.

Weight percent of reductants in the examples is based on the weight of the soap solution. Weight percent of hydrogen peroxide is the concentration of hydrogen peroxide in its solution.

Examples 1 through 6 demonstrate an embodiment of the invention for liberating the large potential heating effect of $S_2O_3^=$ oxidation. It is seen that the addition of catalytic amounts of sodium tungstate to the soap solution improves the H_2O_2 oxidation of $S_2O_3^=$.

EXAMPLE 1

$K_2S_2O_3$ (3.0 wt. percent) in soap solution was reacted with H_2O_2 (8.2 wt. percent) in the presence of $Na_2WO_4 \cdot 2H_2O$ (0.25 wt. percent) where the percent of theoretical equivalents of H_2O_2 percent was 95.5. The resultant efficiency of the reaction was 72.3% and the peak temperature increase was 27° C. reached in a time of 30 seconds.

EXAMPLE 2

$K_2S_2O_3$ (3.0 wt. percent) in soap solution was reacted with H_2O_2 (8.2 wt. percent) but the $Na_2WO_4 \cdot 2H_2O$ concentration was increased to (0.50 wt. percent) still with the percent of theoretical equivalents of H_2O_2 present at 95.5. The increase in catalyst concentration over 0.25% of Example 1 was almost negligible in effect. The resultant efficiency was 74.9% and the peak temperature increase was 28° C., attained in a time of 30 seconds.

It should be noted that 0.25 and 0.50% sodium tungstate dihydrate in soap solutions containing 3% $K_2S_2O_3$ in Examples 1 and 2 greatly accelerated the reaction, causing the mixtures to reach peak temperatures in 30 seconds as opposed to 180 seconds in uncatalyzed reaction as in Example 12. The ΔT, increased 35% and 40% by addition of catalyst, was satisfactory.

EXAMPLE 3

Addition of 0.25% $Na_2WO_4 \cdot 2H_2O$ catalyst to 4% $K_2S_2O_3$ in the soap solution is described as follows:

$K_2S_2O_3$ (4.0 wt. percent) in soap solution was reacted with H_2O_2 (8.2 wt. percent) in the presence of $Na_2WO_4 \cdot 2H_2O$ (0.25 wt. percent) where the percent of theoretical equivalents of H_2O_2 present was 71.7. The efficiency attained was 82.9% with a peak temperature increase of 31° C. reached in an elapsed time of 15 seconds.

EXAMPLE 4

This example demonstrates that increase in catalyst concentration over 0.25% is without substantial effect beyond somewhat shortening the time to peak temperature. It should be noted that less than the theoretical amount of hydrogen peroxide was used as indicated.

$K_2S_2O_3$ (4.0 wt. percent) in soap solution was reacted with H_2O_2 (8.2 wt. percent) in the presence of 0.50 wt. percent $Na_2WO_4 \cdot 2H_2O$. The percent of theoretical equivalents of H_2O_2 present was 71.7. The efficiency and peak temperature attained were the same as those of Example 3, i.e., 82.9% and 31° C., and the time to peak temperature increase was reduced from 15 to 10 seconds.

EXAMPLE 5

This example parallels Example 3 in all respects except that a larger proportion of the equivalent amount of hydrogen peroxide was used.

$K_2S_2O_3$ (4.0 wt. percent) in the soap solution described above was reacted with H_2O_2 (10.0 wt. percent) in the presence of $Na_2WO_4 \cdot 2H_2O$ (0.25 wt. percent) where the percent of theoretical equivalents of H_2O_2 present was 87.5. The efficiency attained was 79.0%. The peak temperature increase of 36° C. was reached in a time of 15 seconds.

EXAMPLE 6

$K_2S_2O_3$ (4.0 wt. percent) in soap solution was reacted with H_2O_2 (11.0 wt. percent) in the presence of $Na_2WO_4 \cdot 2H_2O$ (0.25 wt. percent) where the percent of theoretical equivalents of H_2O_2 present was 96.2. A peak temperature increase of 38° C. was reached in 10 seconds with an efficiency figure of 75.7%.

EXAMPLE 7

This example and the following example demonstrate the effectiveness of sodium tungstate in $S_2O_3^=/SO_3^=$ combined reductant system. It is seen that 0.25% sodium tungstate effects a reaction satisfactory in all respects.

A mixture of $H_2S_2O_3$ (2.0 wt. percent) and K_2SO_3 (3.0 wt. percent) in the soap solution were reacted with H_2O_2 (8.2 wt. percent) in the presence of $Na_2WO_4 \cdot 2H_2O$ (0.25 wt. percent) where the percent of theoretical equivalents of H_2O_2 present was 99.0. A peak temperature increase of 29° C. was attained in 15 seconds with an efficiency figure of 74.4%.

EXAMPLE 8

A mixture of $K_2S_2O_3$ (2.0 wt. percent) and K_2SO_3 (3.0 wt. percent) in the soap solution were reacted with H_2O_2 (8.2 wt. percent) but this time in the presence of $Na_2WO_4 \cdot 2H_2O$ (0.50 wt. percent) where the percent of theoretical equivalents of H_2O_2 present was 99.0. In this reaction a peak temperature increase of 32° C. was reached in 10 seconds with an efficiency percentage of 82.1.

EXAMPLE 9

A 6 fl. oz. aerosol container fitted with an inner compartment substantially as disclosed previously herein was employed as follows:

Hydrogen peroxide (25 g., 13 wt. percent aq. solution) was placed in the inner compartment and the soap solution (132 g.) described above containing 5 wt. percent K_2SO_3 and 3 wt. $K_2S_2O_3$ was placed in the soap compartment. Since the valve of the dispenser metered 4 parts by weight of soap solution for each part of weight of hydrogen peroxide solution, the ratio of equivalents of oxidant to reductants is 1.0. A slight excess of reductant is usually preferred.

A 40/60 (wt.) mixture (13 cc. liquid, room temperature) of dichlorodifluoromethane and 1,2-dichlorotetrafluoroethane was injected into the closed can through the valve.

Three portions of lather were successively discharged from the room temperature can to a 2¼ inch diameter x 1¼ inch deep paper cup fitted with an iron-constantan thermocouple of low heat capacity installed near the center of the cup. The temperature was measured each 15 seconds by potentiometer.

The results were the following:

Sample No.	ΔT (° C.)	Time to peak temp. (sec.)	Efficiency (percent)
1	43	45	70.3
2	46	45	75.2
3	47	45	77.0

The foamed lather cooled to body temperature (37° C.) in an approximately 20° C. room in about 10 minutes.

EXAMPLE 10

This example shows in two concentrations of hydrogen peroxide the performance replication of pressurized dispensers using $K_2S_2O_3$–Na_2WO_4 reductant, over a period of 46 days.

Two six ounce aerosol cans were charged as in example 2 with soap solution (133 g.) containing 4.0 wt. percent $K_2S_2O_3$ and 0.25 wt. percent $Na_2WO_4 \cdot 2H_2O$. Hydrogen peroxide (30 g. each) was charged to the inner compartments (in can 1, 8 wt. percent H_2O_2; can 2, 10 wt. percent H_2O_2). Propellant (18 g.) consisting of a 40/60 (wt.) mixture of dichlorodifluoromethane and 1,2-dichlorotetrafluoroethane was injected into the closed cans through the valves.

Samples of lather, about 8 g. each, were discharged from time to time to a paper cup for temperature measurement as in Example 9. Peak temperatures were reached about 15 seconds after discharge.

The results are shown in Table 2.

TABLE 2

Sample No.	Elapsed Time (days)	Can No. 1 peak temp. (° C.)	Can No. 2 peak temp. (° C.)
1	0	48	52
2	0	52	53
3	1	52	54
4	1	52	54
5	1	54	54
6	1	53	56
7	1	52	56
8	1	52	56
9	1	53	57
10	5	53	54
11	5	53	54
12	6	54	55
13	8	52	56
14	11	54	53
15	21	53	54
16	46	51	54

Examples 11–13 describe the results obtained with various art compositions.

EXAMPLE 11

K_2SO_3 (4 wt. percent) reductant in soap solution was combined with H_2O_2 (3.5 wt. percent) where percent of theoretical equivalents of H_2O_2 present was 102. While the resultant percent efficiency was 73.3 the reaction was, in fact, unsatisfactory because the peak temperature increase attained was only 13° C. which is far too low to provide effectively heated lather and additionally the time to peak temperature was 60 seconds which is unsatisfactorily slow.

EXAMPLE 12

The reductant employed in the soap solution was $K_2S_2O_3$ (3.0 wt. percent) and was combined with H_2O_2 (8.2 wt. percent) where the percent of theoretical equivalents of H_2O_2 present was 95.5. Although theoretically $K_2S_2O_3$ in 3 percent concentration should deliver sufficient heat, this was found not to be the case. The peak temperature increase obtained was an unsatisfactorily low, 20° C., and the time to peak temperature was excessively long, 180 seconds, with an efficiency of only 53.5%.

EXAMPLE 13

This example combined $K_2S_2O_3$ (4.0 wt. percent) reductant in soap solution with H_2O_2 (8.2 wt. percent) where the percent of theoretical equivalents of H_2O_2 present was 71.7. As in Example 12, the results were unsatisfactory with a peak temperature increase of only 25° C., and extremely long time to peak temperature of 120 seconds and an efficiency of only 66.9%.

The novel package and process are useful in a variety of applications where it is desired to prepare and dispense a warm aqueous foam. The invention is especially useful for preparing warm aqueous foam or lather for such applications as conditioning areas of a person to be shaved, and washing the skin or hair. Such utility is particularly beneficial to campers, yachtsmen, and others who often do not have ready access to hot water. Use of the novel package makes shaving fast, easy and comfortable.

The novel package and process are adapted for preparing warm foam quickly, efficiently and without a source of electricity, steam or hot water, and with no awkward attachments.

Although the chemical components of the invention have been described in terms of its potassium salts, it is evident that any alkali metal or ammonium sulfite or thiosulfite salt would be operable. It is further understood that as many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, the invention is not limited to the specific embodiments thereof.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A package adapted for preparing and dispersing heated lather, which comprises a container having a foam outlet and a valve adapted to control the dispensing of foam therefrom, the materials in said container consisting essentially of

(A) an aqueous dispersion of a foamable composition selected from soluble soaps, and surfactants selected from the group consisting of sorbitan monostearate, polyoxyethylene sorbitan monostearate, water soluble soaps and mixtures thereof present in an amount of between 4 and 30% based on the weight of total composition,

(B) hydrogen peroxide which is capable of reacting with rapid generation of heat when contacted with a reductant,

(C) a reductant composition present in an amount between 3 and 8% based on the weight of (A) present, said reductant composition being capable of reacting at room temperature with the said hydrogen peroxide to produce heat, and said reductant composition being selected from the group consisting of

(a) potassium thiosulfate and a catalytic amount of sodium tungstate, and

(b) a mixture of potassium thiosulfate and potassium sulfite and a catalytic amount of sodium tungstate

the amount of (B) present being chemically equivalent to or less than the amount of (C) present and

the materials (B) and (C) being isolated from each other when said valve is closed,

said package being equipped with conveyor means comprising a duct and source of fluid pressure selected from a compressed gas or a volatile organic propellant selected from saturated aliphatic hydrocarbons or water-insoluble chlorine and fluorine-substituted hydrocarbons having a vapor pressure of about 15 to 65 p.s.i.g. at 21° C., said source of fluid pressure being present in an amount sufficient to convey material (A) to said outlet and dispense it therefrom as a foam when said valve is open, and means

to provide intimate contact between materials (A), (B), and (C) while material (A) is being conveyed toward said outlet.

2. A package according to claim 1 in which the reductant composition is potassium thiosulfate in the presence of catalytic amounts of sodium tungstate.

3. A package according to claim 1 in which the reductant composition is a mixture of potassium thiosulfate and potassium sulfite in the presence of catalytic amounts of sodium tungstate.

4. A package according to claim 1 in which the amount of catalyst present in material (C) ranges from .05% to .85% by weight of said material (C).

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