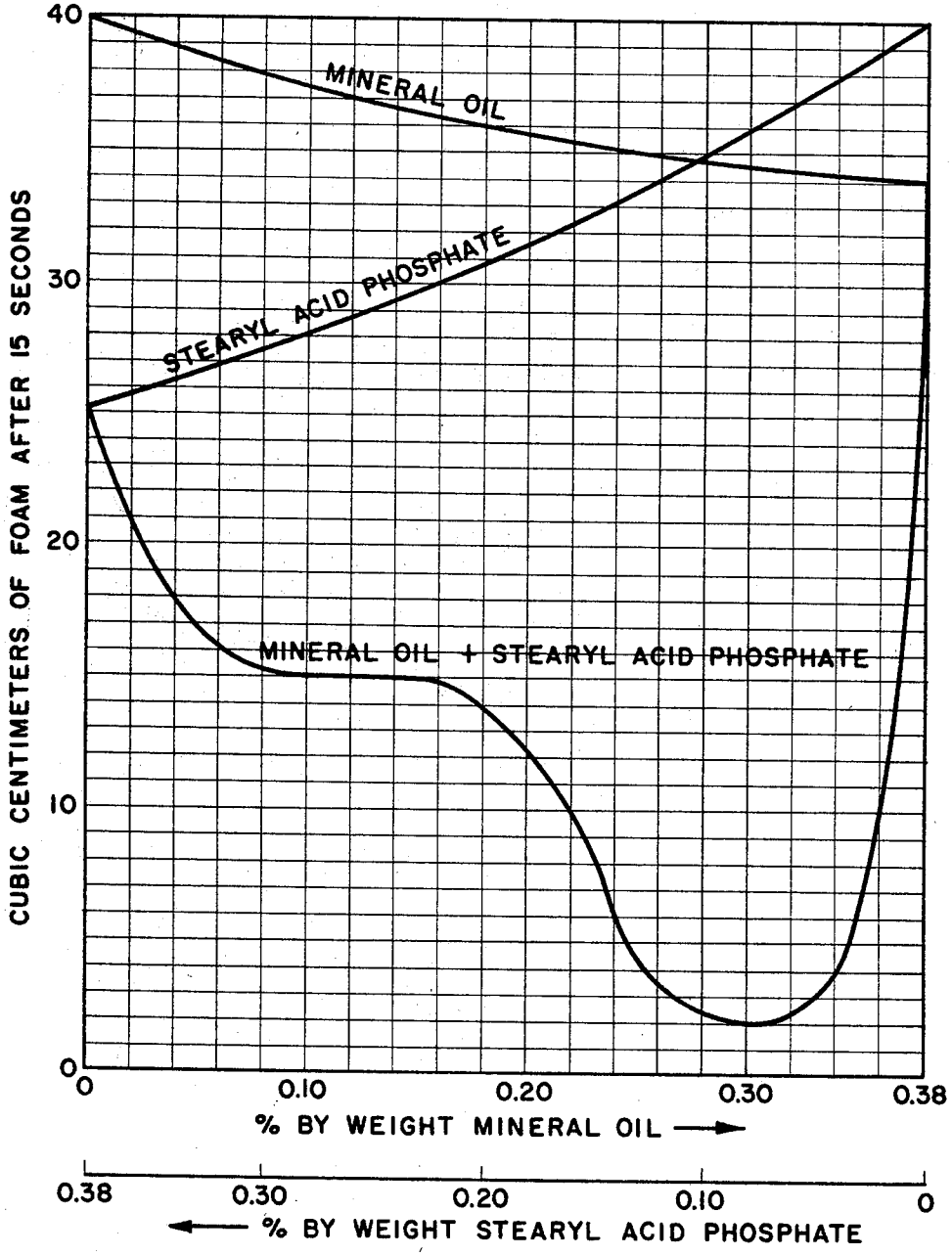
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DEFOAMING AGENT

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Fig. 1



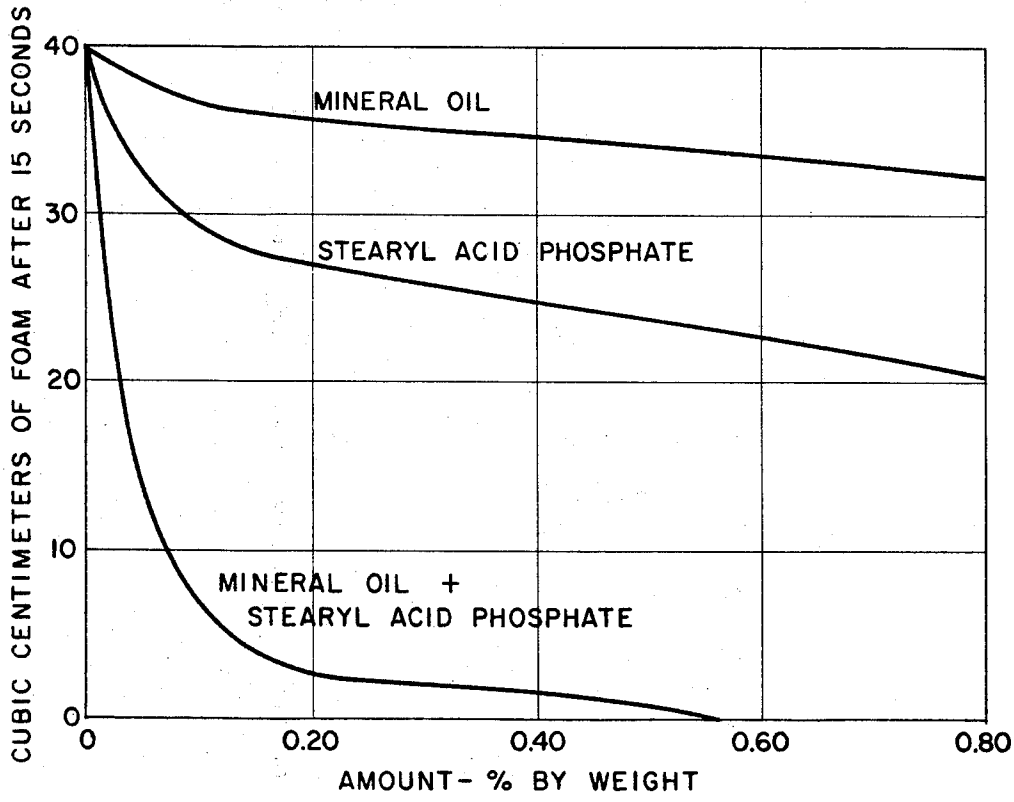
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Fig. 2



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DEFOAMING AGENT

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11 Claims. (Cl. 252—99)

ABSTRACT OF THE DISCLOSURE

Defoaming agent suitable for use in detergent compositions, the defoaming agent comprising 5% to 95% mineral oil and 5% to 95% of monoalkyl or dialkyl acid phosphates wherein each alkyl chain contains from 16 to 20 carbon atoms.

This invention relates to a defoaming agent comprised of a synergistic combination of long chain alkyl acid phosphates and mineral oil and the incorporation of this combination into various detergent materials to provide controlled foaming compositions.

Many substances have the tendency to foam or suds when subjected to agitation, heat or other operations necessary in manufacturing, processing and various cleaning operations. The creation of foam in mixing and processing equipment can be an annoying and costly nuisance. It can slow production, stall pumps and upset metering devices. Excessive foaming can also cause a loss of at least some of the cleaning power of soaps and detergents. While various defoaming agents have been proposed, there remains an increasing demand for defoaming agents having improved and more efficient foam inhibiting and foam suppressing characteristics.

The physics of foam formation and prevention is not yet clearly understood. Various theories of the mechanics of foam inhibition have been advanced, none of which is universally accepted or applicable in every instance. These theories do indicate, however, that an important relationship exists between the defoaming properties of a substance and the respective surface tensions of the defoaming agent and the foaming medium. Other physical phenomena are also involved, for example, surface activity, solubility, viscosity, elasticity of the film surrounding bubbles, and the rate of drainage of these films. These factors create a tremendously complex interrelation. Because of the complexity of foam control, it is the general industrial practice to approach foaming problems with an empirical, trial and error method.

Accordingly, it is an object of this invention to provide an improved defoaming agent.

Another object of the invention is to provide preferred detergent compositions which contain surface active agents and a defoaming agent.

A still further object of this invention is to provide preferred detergent compositions which when utilized in an aqueous system are substantially non-foaming and which, additionally, inhibit the formation of other types of foam in the system.

Yet another object of this invention is to provide preferred detergent compositions suitable for use in aqueous, high protein content systems which are substantially non-foaming and which, additionally, inhibit protein foam.

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. All parts and percentages herein are by weight.

The drawings attached hereto are provided as an illustration of the effectiveness of this invention. FIGURE 1 is a graph which illustrates a preferred composition and the defoaming characteristics of this invention. FIGURE 2 is a graph which illustrates the effective amounts of defoaming agent to be utilized in a specific foaming medium and the synergistic coaction between mineral oil and stearyl acid phosphates.

It has now surprisingly been discovered, according to the present invention, that the foregoing objects are attained with a defoaming agent comprised of a mixture of from about 5% to about 95% by weight of mineral oil and from about 5% to about 95% by weight of a saturated or unsaturated, straight or branched chain, mono- or dialkyl acid phosphate wherein the alkyl moieties each contain from about 16 to about 20 carbon atoms. It has also been found, according to the present invention, that this foam inhibiting composition can be admixed with detergent compositions to facilitate the inhibition and suppression of detergent foam.

Although other liquid hydrocarbons can be used conjointly with the alkyl acid phosphates of this invention, mineral oil is the preferred oil. Mineral oil is a colorless, transparent, oily liquid that is obtained from crude petroleum by refining. Essentially all of the unsaturated and aromatic hydrocarbons and other impurities are removed, and the resulting oil product is clear and water-white or nearly water-white.

The United States Pharmacopoeia classifies mineral oil into two types of white mineral oil or liquid petrolatum. One type, which has a kinematic viscosity of not more than 37 centistokes at 37.8° C. (100° F.), is termed light; the other, with a kinematic viscosity of not less than 38.1 centistokes, is termed heavy. Since viscosity is usually expressed in Saybolt seconds, this distinction between grades should be understood as follows: A white mineral oil that has a Saybolt viscosity of not more than 172 at 100° F. is referred to as light white mineral oil, while one that has a Saybolt viscosity of not less than 177 at 100° F. is termed heavy white mineral oil. Either heavy or light mineral oil or a combination of these oils can be utilized with advantage in this invention.

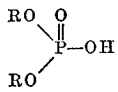
When standards for mildness and odor comparable to mineral oil are followed, other oils can be substituted for the mineral oil. Examples of other oils which may be used in the practice of this invention are vegetable oils such as sesame oil, cottonseed oil or corn oil. Other acceptable vegetable oils are sweet almond oil, olive oil, wheat germ oil, rice bran oil and peanut oil. Animal oils that may be utilized in this foam inhibiting composition are lanolin, neat's foot oil, bone oil, sperm oil, cod liver oil and the like.

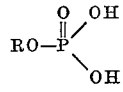
All of these oils can be used either alone or in conjunction with each other. They can be mixed with each other in any suitable ratio and can be specifically formulated for particular uses.

The oil component of the defoaming agent of this invention can comprise from about 5% to about 95% by weight of the defoaming agent. As a preferred embodiment of this invention, the oil component is utilized in

amounts of from about 53% to about 95% by weight of the defoaming agent.

The other essential component of this defoaming agent is a monoalkyl or dialkyl acid phosphate wherein the alkyl moieties are saturated or unsaturated, straight or branched alkyl chains containing from about 16 to about 20 carbon atoms. These compounds correspond to the general formulas





wherein R is a saturated or unsaturated, straight or branched alkyl chain containing from about 16 to about 20 carbon atoms. The monoalkyl acid phosphates and the dialkyl acid phosphates can be utilized alone or in combination in any proportion with each other in the practice of this invention.

The alkyl acid phosphates of this invention are neutralized by bases. The salts are formed with little hydrolysis at room temperature. Dilute 1% aqueous alkaline solutions of the salts do not show any appreciable hydrolysis when held at 90° C. for several hours. It should, therefore, be understood that the alkali metal salts, e.g., the sodium and potassium salts, of the alkyl acid phosphates described herein are generally present in alkaline solutions. These alkali metal salts coact synergistically with the mineral oil to inhibit and suppress foam just as the alkyl acid phosphates and mineral oil in an acid or weak alkaline medium coact synergistically to inhibit and suppress foam. In the following discussion, therefore, when reference is made to the term, alkyl acid phosphates of this invention, that term is meant to encompass both the alkyl acid phosphates and the alkali metal salts of the alkyl acid phosphates of this invention.

Specific examples of alkyl acid phosphates suitable for use in this invention are monopalmityl acid phosphate, dipalmityl acid phosphate, monostearyl acid phosphate, distearyl acid phosphate, monoarachidyl acid phosphate, diarachidyl acid phosphate, monopalmitoleyl acid phosphate, dipalmitoleyl acid phosphate, monooleyl acid phosphate, dioleyl acid phosphate, monoarachidonyl acid phosphate, diarachidonyl acid phosphate, the mono-sodium salts and the di-sodium salts thereof, and the mono-potassium salts and the di-potassium salts thereof. The specific alkyl acid phosphates and the alkali metal salts thereof can also be utilized in combination with each other in any proportions.

In a preferred embodiment of this invention, the alkyl moieties contain about 18 carbon atoms. It is also preferred that the dialkyl acid phosphates or a mixture of monoalkyl and dialkyl acid phosphates be utilized in this invention. An especially preferred mixture consists of approximately equimolar quantities of monoalkyl acid phosphate and dialkyl acid phosphate. Other mixtures of these phosphates, however, also work well. The most preferred alkyl acid phosphates for use in this invention are monostearyl acid phosphate and distearyl acid phosphates.

The physical states of the acid phosphates suitable for use in this invention range from semi-solid to solid. As an example, oleyl acid phosphate, an approximately equimolar mixture of monooleyl acid phosphate and dioleyl acid phosphate, is a semisolid at room temperature although several days may be required for a molten sample to partly solidify. It is a hard solid at 7° C. and completely liquid at 45° C. Conversely, an equimolar mixture of monostearyl and distearyl acid phosphate is a hard, waxy, readily flaked solid. It melts and freezes over a range from 60–70° C. A "high mono" grade of stearyl acid phosphate has a slightly higher melting temperature than does the mixture of mono- and distearyl acid phosphates.

Other physical properties of the alkyl acid phosphates are set forth in the following table. Both of the illustrated alkyl acid phosphates are approximately equimolar mixtures of, respectively, mono- and dioleyl and mono- and distearyl acid phosphates.

TABLE I.—PHYSICAL PROPERTIES OF ALKYL ACID PHOSPHATES

Typical data	Oleyl acid phosphate	Stearyl acid phosphate
Color	(1)	(1)
Percent P_2O_5	15	17
Acid number	175	207
Refractive index 25° C.	1.464	
Viscosity, Saybolt seconds, 25° C.	650	
Specific gravity, 25/4° C.	0.947	1.034

[1] Water white.

The alkyl acid phosphates of this invention do not show sharp decomposition temperatures. These compounds are reasonably stable at 100° C. and show little decomposition when held at that temperature for up to two hours. Measurable decomposition occurs if held at 150° C. for one hour and all of these compounds decompose quickly at temperatures over 225° C.

In readily available commercial form, the alkyl acid phosphates of the invention contain, but without adverse effects, some condensed phosphates, such as pyrophosphates, polyphosphates and mono- and dialkyl orthophosphates. Small amounts of free alcohol and phosphoric acid may also be present. These commercial products may also contain some alkyl chain lengths which are outside the hereinbefore set forth ranges. The alkyl acid phosphates having alkyl chain lengths outside the ranges of this invention do not hinder the performance of the defoaming agent of this invention. However, they do not add to the effectiveness of this invention and, therefore, the presence of those alkyl acid phosphates is not particularly desirable in the practice of this invention.

The alkyl acid phosphates of this invention can comprise from about 5% to about 95% by weight of the defoaming agent of this invention. In a preferred embodiment of this invention, the alkyl acid phosphates comprise from about 5% to about 47% of this novel defoaming agent.

It is shown in FIGURE 1 that the foam suppressing capacity of the mixture of mineral oil and stearyl acid phosphates is greatly in excess of the suppressing capacity of either component separately. Neither component, i.e., mineral oil and stearyl acid phosphates, when utilized per se up to 0.38% by weight in the detergent composition hereinafter described attains the excellent foam suppressing capacity of the synergistic mixture of these components claimed herein. The various combinations of mineral oil and stearyl acid phosphates illustrated in FIGURE 1 are dramatically more effective than the additive effects of the same amounts of mineral oil and stearyl acid phosphates used separately. It is surprising that this synergistic coaction should occur only within the narrow carbon chain range of the alkyl acid phosphates of this invention.

It is equally surprising that the composition of this invention has such a clearly defined preferred embodiment as illustrated by FIGURE 1. FIGURE 1 shows that the foam suppressing capacity of the defoaming agent of this invention is significantly increased when the stearyl acid phosphates comprise from about 0.018% to about 0.18% by weight of the detergent composition described hereinafter and the mineral oil comprises from about 0.20% to about 0.362% by weight of the detergent composition described hereinafter. It is, therefore, understood that, within this preferred range, the stearyl acid phosphates comprise from about 5% to about 47% by weight of the defoaming agent of this invention and mineral oil comprises from about 53% to about 95% by weight of the defoaming agent. Within this preferred embodiment, the foam suppressing capacity of the defoaming agent of this invention is surprisingly and materially greater than the ex-

cellent synergistic coaction of this invention in its broader aspects. In fact, within the preferred embodiments of this invention, foam suppression may be increased by over 30% when compared with other embodiments of this invention. The preferred ranges illustrated by FIGURE 1 also pertain equally to mixtures of other alkyl acid phosphates and mineral oil of this invention.

In FIGURE 1, it is understood that the amount of mineral oil present in the detergent composition increases from left to right while the amount of stearyl acid phosphate increases from right to left. Therefore, at any point on the X axis, the percent by weight of either the mineral oil or the stearyl acid phosphates or both in the detergent composition can be readily obtained. The line labeled mineral oil illustrates the foam suppressing capacity of mineral oil per se in the hereinafter described detergent composition; the line labeled stearyl acid phosphate, likewise, indicates the foam suppressing capacity of the stearyl acid phosphates per se. The line labeled mineral oil+stearyl acid phosphate illustrates the synergistic foam suppressing capacity of the defoamng agents of this invention. The percentages of each component of the defoaming agent in the hereinafter described detergent can be obtained on the X axis.

The tests which serve as the supporting data for FIGURE 1 were performed in the following manner. A mechanically mixed granular detergent composition containing the following components was prepared:

	Percent by weight
Sodium tripolyphosphate	20.0
Sodium carbonate	27.0
Anhydrous sodium metasilicate (SiO_2:Na_2O=1:1)	24.0
Disodium phosphate	15.0
Potassium dichlorocyanurate	11.0
	97.0

The remaining 3% was comprised of 2.62% of an ethoxylated liquid nonionic synthetic detergent (Antarox BL–344, manufactured by General Aniline & Film Corporation) and 0.38% of various mixtures of light, white, mineral oil, United States Pharmacopoeia Grade, and an equimolar combination of monostearyl acid phosphate and distearyl acid phosphate. The mixtures of nonionic, mineral oil and stearyl acid phosphates were heated to about 70° C. At this temperature, the stearyl acid phosphates were liquified. The liquid mixtures were subsequently sprayed on the detergent granules.

Ten gram portions of these detergent compositions containing various mixtures of mineral oil and stearyl acid phosphates were mixed with 1000 cubic centimeter (cc.) portions of water at 21° C. After the detergent compositions were thoroughly admixed in the water, 100 cc. portions of the detergent solution were poured into 500 cc. rubber stoppered graduated cylinders. Similar detergent solutions containing only mineral oil and only stearyl acid phosphates in varying amounts were prepared. The cylinders were each inverted 10 times at the rate of one inversion every two seconds. The solutions were allowed to stand for 15 seconds and the cubic centimeters of foam remaining were recorded. The results of this testing procedure are illustrated in FIGURE 1. In these tests, a difference in foam height of 5 cc. should be considered as significant especially when in the range of from 0–25 cc. of foam after 15 seconds. A difference of 5 cc. in this range can be the difference betwen a successful and an unsuccessful product in many industrial and household applications.

It is particularly surprising that only the mono- and dialkyl acid phosphates containing from about 16 to about 20 carbon atoms in combination with mineral oil exhibit the surprising synergistic effects of this invention. The alkyl acid phosphates which are not within the hereinbefore related alkyl chain length ranges of this invention do not exhibit this exceptionally high degree of foam suppression when in combination with the same mineral oil that is exhibited by the alkyl acid phosphates claimed herein.

The defoaming agent of this invention can be used per se through the full range of pH values to inhibit the formation of foam and is especially valuable in the range of pH values of the detergent compositions with which it can be employed. It should not, however, be used at temperatures in excess of 225° C. as the alkyl acid phosphates may decompose under such conditions and the synergistic foam inhibiting capacity of the mixture will be lost.

In an especially preferred embodiment of this invention, the foam inhibiting composition of this invention is incorporated into a detergent composition. Controlled foaming, low-foaming or non-foaming detergent compositions are desirable for machine dishwashing and clothes washing, as well as, a wide variety of home and industrial uses. The defoaming agent of this invention can be incorporated into any of the several commercially desirable detergent composition forms, for example, granule, flake, tablet, and liquid forms.

It has been found that the defoaming agents of this invention are compatible with and perform excellently in conjunction with a very wide range of active detergent substances, and mixtures thereof and, additionally, are compatible with a wide range of detergency builders and adjuvants normally used in detergent compositions. The detergent substances include soap, anionic synthetic non-soap detergents, nonionic synthetic detergents, ampholytic synthetic detergents, and zwitterionic synthetic detergents and mixtures thereof.

Examples of suitable soaps are the sodium, potassium and alkylolammonium salts of higher fatty acids (C_{10}–C_{20}), particularly useful are the sodium and potassium salts of the mixtures of fatty acids derived from coconut oil and tallow, i.e., sodium or potassium tallow and coconut soap.

The other suitable detergent substances are outlined more at length as follows:

(A) Anionic synthetic non-soap detergents can be broadly described as the water-soluble salts, particularly the alkali metal salts, of organic sulfuric reaction products having in their molecular structure an alkyl radical containing from about 8 to about 22 carbon atoms and a radical selected from the group consisting of sulfonic acid and sulfuric acid ester radicals. (Included in the term alkyl is the alkyl portion of higher acyl radicals.) Important examples of the synthetic detergents which form a part of the preferred compositions of the present invention are the sodium or potassium alkyl sulfates, especially those obtained by sulfating the higher alcohols (C_8–C_{18} carbon atoms) produced by reducing the glycerides of tallow or coconut oil; sodium or potassium alkyl benzene sulfonates, in which the alkyl group contains from about 9 to about 15 carbon atoms, including those of the types described in United States Letters Patents Nos. 2,220,099 and 2,477,383 (the alkyl radical can be a straight or branched aliphatic chain), sodium alkyl glyceryl ether sulfonates, especially those ethers of the higher alcohols derived from tallow and coconut oil; sodium coconut oil fatty acid monoglyceride sulfates and sulfonates; sodium or potassium salts of sulfuric acid esters of the reaction product of one mole of a higher fatty alcohol (e.g., tallow or coconut oil alcohols) and about 1 to 6 moles of ethylene oxide; sodium or potassium salts of alkyl phenolethylene oxide ether sulfate with about 1 to about 10 units of ethylene oxide per molecule and in which the alkyl radicals contain from 8 to about 12 carbon atoms; the reaction product of fatty acids esterified with isethionic acid and neutralized with sodium hydroxide where, for example, the fatty acids are derived from coconut oil; sodium or potassium salts of fatty acid amide of a methyl tauride in which the fatty acids, for example, are derived from coconut oil; and others known in the

art, a number being specifically set forth in United States Letters Patents Nos. 2,486,921, 2,486,922 and 2,396,278.

Another excellent anionic detergent, by way of example only, comprises by weight from about 30% to about 70% of Component A, from about 20% to about 70% of Component B, and from about 2% to about 15% of Component C, wherein:

(a) Said Component A is a quaternary mixture of double-bond positional isomers of water-soluble salts of alkene-1-sulfonic acids containing from about 10 to about 24 carbon atoms, said mixture of positional isomers including by weight about 10% to about 25% of an alpha-beta unsaturated isomer, about 30% to about 70% of a beta-gamma unsaturated isomer, about 5% to about 25% of a gamma-delta unsaturated isomer, and about 5% to about 10% of a delta-epsilon unsaturated isomer;

(b) Said Component B is a mixture of water-soluble salts of bifunctionally-substituted sulfur-containing saturated aliphatic compounds containing from about 10 to about 24 carbon atoms, the functional units being hydroxy and sulfonate radicals with the sulfonate radical always being on the terminal carbon and the hydroxyl radical being attached to a carbon atom at least two carbon atoms removed from the terminal carbon atoms; and

(c) Said Component C is a mixture comprising from about 30–95% water-soluble salts of alkene disulfonates containing from about 10 to about 24 carbon atoms, and from about 5% to about 70% water-soluble salts of hydroxy disulfonates containing from about 10 to about 24 carbon atoms, said alkene disulfonates containing a sulfonate group attached to a terminal carbon atom and a second sulfonate group attached to an internal carbon atom not more than about six carbon atoms removed from said terminal carbon atom, the alkene double bond being distributed between the terminal carbon atom and about the seventh carbon atom, said hydroxy disulfonates being saturated aliphatic compounds having a sulfonate radical attached to a terminal carbon, a second sulfonate group attached to an internal carbon atom not more than about six carbon atoms removed from said terminal carbon atom, and a hydroxy group attached to a carbon atom which is not more than about four carbon atoms removed from the site of attachment of said second sulfonate group.

(B) Nonionic synthetic detergents can be broadly defined as compounds produced by the condensation of alkylene oxide groups (hydrophilic in nature) with an organic hydrophobic compound, which may be aliphatic or alkyl aromatic in nature. The length of the hydrophilic or polyoxyalkylene radical which is condensed with any particular hydrophobic group can be readily adjusted to yield a water-soluble compound having the desired degree of balance between hydrophilic and hydrophobic elements.

As an example, a class of nonionic synthetic detergents is made available on the market under the trade name of "Pluronic." These compounds are formed by condensing ethylene oxide with an hydrophobic base formed by the condensation of propylene oxide with propylene glycol. The hydrophobic portion of the molecule which, of course, exhibits water insolubility, has a molecular weight of from about 1500 to 1800. The addition of polyoxyethylene radicals to this hydrophobic portion tends to increase the water solubility of the molecule as a whole and the liquid character of the product is retained up to the point where polyoxyethylene content is about 50% of the total weight of the condensation product.

Other suitable nonionic synthetic detergents include:

(1) The polyethylene oxide condensates of alkyl phenols, e.g., the condensation products of alkyl phenols having an alkyl group containing from about 6 to 12 carbon atoms in either a straight chain or branched chain configuration with ethylene oxide, the said ethylene oxide being present in amounts equal to 5 to 25 moles of ethylene oxide per mole of alkyl phenol. The alkyl substituent in such compounds may be derived from polymerized propylene, diisobutylene, octene, or nonene, for example.

(2) Those nonionic synthetic detergents derived from the condensation of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylene diamine. For example, compounds containing from about 40% to about 80% polyoxyethylene by weight and having a molecular weight of from about 5,000 to about 11,000 resulting from the reaction of ethylene oxide groups with a hydrophobic base constituted of the reaction product of ethylene diamine and excess propylene oxide, said base having a molecular weight of the order of 2,500 to 3,000, are satisfactory.

(3) The condensation product of aliphatic alcohols having from 8 to 22 carbon atoms, in either straight chain or branched chain configuration, with ethylene oxide, e.g., a coconut alcohol-ethylene oxide condensate having from 5 to 30 moles of ethylene oxide per mole of coconut alcohol, the coconut alcohol fraction having from 10 to 14 carbon atoms.

(4) Long chain tertiary amine oxides corresponding to the following general formula, $R_1R_2R_3N\rightarrow O$, wherein R_1 is an alkyl radical of from about 8 to about 18 carbon atoms, and R_2 and R_3 are each methyl or ethyl radicals. The arrow in the formula is a conventional representation of a semipolar bond. Examples of amine oxides suitable for use in this invention include dimethyldodecyl amine oxide, dimethyloctylamine oxide, dimethyldecylamine oxide, dimethyltetradecylamine oxide, dimethylhexadecylamine oxide.

(5) Long chain tertiary phosphine oxides corresponding to the following general formula $RR'R''P\rightarrow O$ wherein R is an alkyl, alkenyl or monohydroxyalkyl radical ranging from 10 to 18 carbon atoms in chain length and R' and R'' are each alkyl or monohydroxyalkyl groups containing from 1 to 3 carbon atoms. The arrow in the formula is a conventional representation of a semi-polar bond. Examples of suitable phosphine oxides are: dodecyldimethylphosphine oxide, tetradecyldimethylphosphine oxide, tetradecylmethylethylphosphine oxide, cetyldimethylphosphine oxide, stearyldimethylphosphine oxide, cetylethylpropylphosphine oxide, dodecyldiethylphosphine oxide, tetradecyldiethylphosphine oxide, dodecyldipropylphosphine oxide, dodecyldi (hydroxymethyl) phosphine oxide, dodecyldi (2-hydroxyethyl) phosphine oxide, tetradecylmethyl-2-hydroxypropyl phosphine oxide, oleyldimethylphosphine oxide, and 2-hydroxydodecyldimethylphosphine oxide.

(C) Ampholytic synthetic detergents can be broadly described as derivatives of aliphatic secondary and tertiary amines, in which the aliphatic radical may be straight chain or branched and wherein one of the aliphatic substituents contains from about 8 to 18 carbon atoms and one contains an anionic water solubilizing group, e.g., carboxy, sulfo, sulfato, phosphato, or phosphono. Examples of compounds falling within this definition are sodium-3-dodecylaminopropionate and sodium-2-dodecylaminopropane sulfonate.

(D) Zwitterionic synthetic detergents can be broadly described as derivatives of aliphatic quaternary ammonium, phosphonium, and sulfonium compounds, in which the aliphatic radical may be straight chain or branched, and wherein one of the aliphatic substituents contains from about 8 to 18 carbon atoms and one contains an anionic water solubilizing group, e.g., carboxy, sulfo, sulfato, phosphato, or phosphono. Examples of compounds falling within this definition are 3-(N,N-dimethyl-N-hexadecylammonio) propane-1-sulfonate and 3-(N,N-dimethyl-N-hexadecylammonio - 2 - hydroxy propane-1-sulfonate which are especially preferred for their excellent cool water detergency characteristics.

The soap and non-soap anionic, nonionic, ampholytic and zwitterionic detergent surfactants mentioned above can be used singly or in combination in the practice of the present invention. The above examples are merely specific illustrations of the numerous detergents which

can find application within the scope of this invention. Other surfactants within the prescribed classes can also be used.

The defoaming agents of this invention are also compatible with a wide variety of builder's materials such as the water-soluble alkaline builder salts either of the organic or inorganic types. When the builder salts are utilized in the detergent compositions described herein, they should comprise from about 0% to about 90%, preferably from 10% to 90%, by weight of the detergent composition. The ratio of builder salts to organic detergent is preferably from about 1:4 to about 20:1, more preferably from about 0.7:1 to about 9:1.

Examples of suitable water-soluble inorganic alkaline detergency builder salts are alkali metal carbonates, borates, phosphates, polyphosphates, bicarbonates and silicates. Specific examples of such salts are sodium and potassium tetraborates, bicarbonates, carbonates, tripolyphosphates, pyrophosphates, orthophosphates, and hexametaphosphates. Examples of suitable organic alkaline detergency builder salts are: (1) Water-soluble aminopolycarboxylates, e.g., sodium and potassium ethylenediaminetetraacetates, nitrilotriacetates, and N-(2-hydroxyethyl)-nitrilo diacetates; (2) Water-soluble salts of phytic acid, e.g., sodium and potassium phytates—see U.S. Patent 2,739,942; (3) Water-soluble salts of ethane-1-hydroxy-1,1-diphosphonate, e.g., the trisodium and tripotassium salts—see U.S. Patent 3,159,581; (4) Water-soluble salts of methylene diphosphonic acid, e.g., trisodium and tripotassium methylene diphosphonate and the other salts described in the copending application of Francis L. Diehl, Ser. No. 266,025, filed Mar. 18, 1963, now U.S. Patent 3,213,030; (5) Water-soluble salts of substituted methylene diphosphonic acids, e.g., trisodium and tripotassium ethylidene, isopropylidene, benzylmethylidene, and halomethylidene diphosphonates and the other substituted methylene diphosphonates disclosed in the copending application of Clarence H. Roy, Ser. No. 266,055, filed Mar. 19, 1963; (6) Water-soluble salts of polycarboxylate polymers and copolymers as described in the copending application of Francis L. Diehl, Ser. No. 269,359, filed Apr. 1, 1963, now U.S. Patent 3,308,067. Specifically, a polyelectrolyte builder material comprising a water-soluble salt of a polymeric aliphatic polycarboxylic acid having the following structural relationships as to the position of the carboxylate groups and possessing the following prescribed physical characteristics: (a) a minimum molecular weight of about 350 calculated as to the acid form; (b) an equivalent weight of about 50 to about 80 calculated as to acid form; (c) at least 45 mole percent of the monomeric species having at least two carboxyl radicals separated from each other by not more than two carbon atoms: (d) the site of attachment to the polymer chain of any carboxyl-containing radical being separated by not more than three carbon atoms along the polymer chain from the site of attachment of the next carboxyl containing radical. Specific examples are polymers of itaconic acid, aconitic acid, maleic acid, mesaconic acid, fumaric acid, methylene malonic acid, and citraconic acid and copolymers with themselves and other compatible monomers such as ethylene; and (7) mixtures thereof.

Mixtures of organic and/or inorganic builders can be used and are generally desirable. Especially preferred are the mixtures of builders disclosed in the copending application of Burton H. Gedge, Ser. No. 398,705, filed Sept. 23, 1964, e.g., ternary mixtures of sodium tripolyphosphate, sodium nitrilotriacetate, and trisodium ethane-1-hydroxy-1,1-diphosphonate.

The defoaming agents of this invention are also compatible with a wide variety of the various minor amounts of materials utilized in detergent compositions to make the product more attractive or more effective. The following are mentioned by way of example. A soluble sodium carboxymethylcellulose may be added in minor amounts to inhibit soil redeposition. A tarnish inhibitor such as benzotriazole or ethylenethiourea may also be added in amounts up to about 2%. Fluorescers, perfume and color may be added in amounts up to about 1%. An alkaline material or alkali such as sodium hydroxide or potassium hydroxide can be added to the detergent compositions of this invention. Suitable additives also include chlorinating and bleaching agents; e.g., trichlorocyanurate, dichlorocyanurate, sodium and potassium dichlorocyanurate, and the corresponding isocyanurates, chlorinated trisodium phosphate, sodium and lithium hypochlorite and dichlorodimethylhydantoin; borax hydrates, hydrotropes, brightening agents, and sodium sulfate.

The defoaming agent of this invention can be incorporated into the above described detergent compositions in a number of ways. When a liquid detergent substance, e.g., a nonionic organic detergent, is utilized in the detergent compositions, it has been found advantageous to mix the liquid detergent, the mineral oil and the alkyl acid phosphate; heat the mixture to a temperature at which the alkyl acid phosphate will be liquified; and then spray this liquid mixture onto flakes, granules or agglomerates containing the other detergent ingredients. The defoaming agent can also be sprayed per se onto the detergent composition. However, the physical operations become more difficult as less liquid is utilized in the spraying operation.

In a normal crutching operation preparatory to spray-drying a granular detergent, the foaming agents of this invention can be incorporated into the slurry along with the various detergent ingredients. The slurry can then be spray-dried in the usual manner. Care must be taken in the spray-drying operation to utilize temperatures below the decompostion temperature of the alkyl acid phosphates being utilized. In much this same manner, the defoaming agents can be incorporated into a detergent slurry containing trimetaphosphate. When sodium hydroxide is added to this detergent slurry, the trimetaphosphate ring structure is broken and hydrated sodium tripolyphosphate is formed. The heat from this reaction foams the slurry and dries it. After a subsequent drying step, excellent detergent granules are obtained which have the defoaming agent of this invention incorporated therein.

The defoaming agent of this invention can be utilized in an effective amount in various foaming mediums. The effective amount will, of course, vary with the desired foam or suds level. The effective amount will also vary when an active detergent substance is utilized and will vary with the type of active detergent substance, and the type of liquid system involved. Other factors which can cause variations in the effective amount of the defoaming agent are the temperature of the liquid medium, the concentration of the detergent composition, the amount of agitation, the pressure on the system and the type of soil in the liquid medium.

When the defoaming agent of this invention is utilized with various detergent compositions, the effective amount varies. As little as 0.15% of the total detergent composition can be comprised of the defoaming agent of this invention to achieve good foam inhibition and suppression in detergent compositions containing low foaming nonionic synthetic detergents. In high foaming systems such as those based on anionic soap and non-soap detergents, as much as 8% of the defoaming agent can be required to achieve good foam inhibition and suppression. It is, thus, understood that the effective amount of defoaming agent can vary and is determined by the particular foaming problem sought to be alleviated.

The following detergent formulations are examples of the types of detergent compositions in which the defoaming agent of this invention can be used. The amount of defoaming agent present in the detergent formulations varies because of the specific detergent composition being utilized, the desired foam height, the specific application for the detergent composition, etc.

An excellent detergent composition especially suited

for dishwasing comprises by weight, in accordance with this invention, as follows:

	Percent
Alkaline builder, e.g., sodium tripolyphosphate, trisodium nitrilotriacetate	15 to 60
Chlorine bleach, e.g., chlorinated trisodium phosphate	10 to 30
Sodium silicate having an SiO_2:Na_2O ratio of from about 1:1 to about 3:1	5 to 30
Water	10 to 30
Nonionic synthetic detergent	2 to 10
Defoaming agent of this invention	0.15 to 3.0
Sodium carbonate	0 to 40

An excellent industrial detergent comprises, in accordance with this invention, as follows:

	Percent
Alkaline builder, e.g., sodium tripolyphosphate	10 to 60
Chlorine bleach, e.g., potassium dichlorocyanurate	3 to 20
Sodium silicate having an SiO_2:Na_2O ratio of from about 1:1 to about 3:1	5 to 50
Defoaming agent of this invention	0.15 to 2.0
Sodium carbonate	0 to 60
Nonionic synthetic detergent	0 to 10
Water	0 to 5

A detergent composition, in accordance with this invention, that is excellent for laundering clothes comprises as follows:

	Percent
Alkaline builder, e.g., sodium tripolyphosphate	30 to 60
Organic synthetic detergent	10 to 30
Water	0 to 15
Defoaming agent of this invention	1 to 8
Sodium silicate having an SiO_2:Na_2O ratio of from about 1:1 to about 3:1	0 to 10
Sodium sulfate	0 to 25

A detergent composition suitable for hard surface cleaning comprises, in accordance with this invention as follows:

	Percent
Alkaline builder, e.g., sodium tripolyphosphate	10 to 50
Organic synthetic detergent	1 to 15
Water	3 to 15
Defoaming agent of this invention	0.5 to 5
Trisodium phosphate	0 to 40
Sodium carbonate	0 to 50
Borax decahydrate	0 to 40

FIGURE 2 is a graph which illustrates varying amounts of the defoaming agent of this invention utilized in a specific medium, and which, additionally, illustrates the synergistic foam suppressing action of the combination of mineral oil and stearyl acid phosphates. The percentage of defoaming agent present in the detergent composition hereinafter described is measured along the X axis. The effect of the defoaming agent is measured along the line labeled mineral oil+stearyl acid phosphate. The defoaming effect of these components, when utilized separately, is measured along the lines, respectively labeled, mineral oil and stearyl acid phosphate. The particular aqueous foaming medium considered in FIGURE 2 was 100 cc. of 1.0% aqueous active detergent solution. The detergent composition was comprised of:

	Parts by weight
Sodium tripolyphosphate	20.0
Sodium carbonate	27.0
Anhydrous sodium metasilicate	24.0
Disodium phosphate	15.0
Potassium dichlorocyanurate	11.0
Ethoxylated liquid nonionic synthetic detergent (Antarox BL–344)	2.62

The defoaming agent was used in one of its preferred embodiments, i.e., a mixture of about 78% light, white mineral oil, United States Pharmacopoeia Grade, and about 22% of an equimolar combination of monostearyl acid phosphate and distearyl acid phosphate. The same testing procedure used in preparing FIGURE 1 was utilized in these tests. Varying amounts of the defoaming agents of this invention were utilized. As illustrated by FIGURE 2, good foam suppression was attained with about 0.15% defoaming agent by weight of the total detergent composition. With 0.58% defoaming agent, no foam remained in the graduated cylinder after 15 seconds.

The following specific examples are given in order to further clarify and illustrate this invention and are not intended to limit the scope of this invention in any way. In all examples light, white mineral oil, United States Pharmacopoeia Grade, was used.

Example I

Industrial detergent compositions were prepared and tested by use of the inversion test. The basic detergent composition comprised:

	Parts by weight
Anhydrous sodium tripolyphosphate	20.0
Sodium carbonate	27.0
Disodium phosphate	15.0
Anhydrous sodium metasilicate	24.0
Potassium dichlorocyanurate	11.0

To this basic detergent composition was added various foaming agents. In Table II, below, RA–30 is an ethoxylated higher alcohol nonionic synthetic detergent, Antarox BL–344 is an ethoxylated liquid nonionic synthetic detergent. A synergistic mixture of the stearyl acid phosphates, mineral oil and nonionic synthetic detergent was sprayed on the basic detergent composition. The nonionics were the principal foaming materials although in Runs 9–11, protein in the form of skim milk or egg solids was present in the system.

The inversion test was performed by preparing 1% solutions of the basic detergent composition which contained the foaming material, mineral oil and/or stearyl acid phosphate. After the detergent composition was thoroughly admixed in the water, 100 cc. of the detergent solution was poured into a 500 cc. rubber stopper graduated cylinder. The cylinder was inverted ten times

TABLE II—INVERSION TEST NO. 1

Run	Water temperature (° F.)	Parts by weight foaming agent	Percent stearyl acid phosphate [1]	Percent mineral oil	Foam height (cc.)		
					Start	30 sec.	2 min.
1	100	3% RA-30	0.09	----------	20	15	10
2	100	3% RA-30	0.15	----------	20	15	10
3	100	3% RA-30	0.15	0.50	30	10	0
4	100	3% RA-30		0.60	55	25	20
5	100	2% RA-30	0.10	0.50	25	0	0
6	100	4% RA-30	0.20	0.50	45	10	2
7	90	2.7% Antarox BL-344	0.08	0.30	45	0	0
8	100	2.5% RA-30	0.13	0.50	35	4	0
9	90	2.0% RA-30, 3.0% skim milk	0.10	0.40	35	0	0
10	80	2.7% Antarox BL-344, 0.5% egg solids	0.08	0.30	30	3	0
11	80	2.7% Antarox BL-344, 2.0% skim milk	0.08	0.30	30	0	0
12	100	3.0% Antarox BL-344		0.60	45	20	15

[1] Equimolar mixture of monostearyl acid phosphate and distearyl acid phosphate.

at the rate of one inversion every two seconds. Foam height was measured immediately after the last inversion, indicated as "Start" in Table II; after 30 seconds and after two minutes.

As is evident from Table II, Runs 1, 2, 4 and 12 did not contain the synergistic defoaming agent of the present invention. It will be noted that these runs did not exhibit the excellent foam suppressing action shown by Runs 3, 5–11 which utilized the synergistic defoaming agent comprised of a mixture of mineral oil and stearyl acid phosphates in the proportions specified herein.

The equimolar mixture of monostearyl acid phosphates and distearyl acid phosphates and mineral oil in amounts as shown below were included in the basic detergent composition.

A 0.3% aqueous solution of the above described detergent was prepared and 250 cc. of this solution was poured into a 500 cc. graduated cylinder. The cylinder was placed in a Burrel Shaker for one minute. The shaker agitated the various solutions in a uniform manner and caused them to foam. The time at which the foam broke sufficiently so that the water could be seen from the top of the cylinder was recorded. (See Table IV.)

TABLE IV—SHAKER TEST

Run	Percent stearyl acid phosphate	Percent mineral oil	Temperature (° F.)	Seconds to clear		
				Series I	Series II	Series III
1	0.18	----------	110	60	68	65
2	0.18	----------	130	60	40	45
3	0.18	0.30	110	30	35	28
4	0.18	0.30	130	20	20	22
5	----------	0.30	110	72	74	77
6	----------	0.30	130	64	68	61

Example II

The basic detergent composition described in Example I was used in this example. Three parts by weight, comprising 2.62 parts Antarox BL–344 (see Example I), 0.08 of an equimolar mixture of monostearyl and distearyl acid phosphate and 0.30 part mineral oil, were sprayed on that basic detergent composition. A 1% aqueous solution was prepared from this resulting detergent composition. About 100 ml. of this solution was sprayed under 70 pounds per square inch pressure into a 500 cc. graduated cylinder. The amount of foam was recorded immediately after the spraying operation, after 30 seconds and after 1 minute as shown in Table III.

TABLE III—SPRAY TEST

Run	Foaming agent	Percent stearyl acid phosphate	Percent mineral oil	Foam height (cc.)		
				Start	30 sec.	1 min.
1	2% skim milk			77	58	33
2	1% egg solids			32	20	20
3	2.62% Antarox BL-344	0.08	0.30	72	3	2
4	2.62% Antarox BL-344, 2% skim milk.	0.08	0.30	82	9	6
5	2.62% Antarox BL-344, 1% egg solids.	0.08	0.30	37	15	6

Runs 1 and 2 illustrate the foaming tendencies of protein, e.g., skim milk and egg solids, when admixed with the basic detergent composition which did not contain the defoaming agent of this invention. Run 3 illustrates the foaming tendencies, in this particular test, of Antarox BL–344 in combination with the basic detergent composition of Example I and the defoaming agent of this invention. Skim milk (Run 4) and egg solids (Run 5) were added to 1% aqueous compositions as described above. A significant suppression of foam was realized. (Compare Run 1 with Run 4 and Run 2 with Run 5.)

Example III

Detergent compositions especially suited for dishwashing were prepared and tested by use of the shaker test described hereinafter. The basic detergent composition was a drum dried agglomerate comprising:

	Parts by weight
Sodium tripolyphosphate	45
Chlorinated trisodium phosphate	22
Sodium silicate (SiO_2:Na_2O=2.9:1)	20
Water	27
Nonionic synthetic detergent (Tallow alcohol ethoxylated with 11 ethylene oxide units)	5

The synergistic coaction of mineral oil and stearyl acid phosphates is well illustrated by Runs 3 and 4. At 130° F. the mixture of this invention inhibits foam nearly three times better than either mineral oil or stearyl acid phosphate alone. At 110° F. the defoaming agent of this invention is about twice as effective as either component of the defoaming agent used separately in the same amount.

Example IV

A detergent composition, i.e., an abrasive cleaner, was prepared as follows: 13.3 parts by weight of a detergent mixture comprising:

	Parts by weight
Sodium tripolyphosphate	49.0
Sodium sulfate	13.9
Linear alkyl benzene sulfonate wherein the alkyl group contains from 10–18 carbon atoms	17.3
Silicate solids (SiO_2:Na_2O=2:1)	6.1
Sodium toluene sulfonate	2.0

were added to 16.7 parts of chlorinated trisodium phosphate and 65 parts of silica flour. To this basic detergent composition was added 5 parts by weight as shown in Table V below. In all cases, 4 parts of this addition to the basic detergent composition were flozan sodium carbonate. One part was made up of a combination of water, mineral oil and an equimolar mixture of monostearyl acid phosphate and distearyl acid phosphate. The mineral oil and stearyl acid phosphates were sprayed on the flozan sodium carbonate and then admixed with the basic detergent composition. In Runs 1–3, respectively, of Table V, water, mineral oil and stearyl acid phosphate were separately admixed with the basic detergent composition. It should be understood that the water and flozan sodium carbonate neither contribute to nor inhibit the formation or suppression of foam.

The results of Table V were obtained from inversion tests. A 1.25% solution of the detergent composition

in 100 cc. of water was prepared in a 500 cc. graduated cylinder. The cylinder was inverted 30 times in one minute. The solution was allowed to stand for 1 minute at which time a comparison of foam heights was made.

TABLE V—INVERSION TEST NO. 2

Run	Parts flozan sodium carbonate	Parts stearyl acid phosphate	Parts mineral oil	Parts water	Foam height after one minute (inches)
1	4.0			1.0	4.5
2	4.0		1.0		4.5
3	4.0	1.0			3.4
4	4.0	0.15	0.70	0.15	1.3

As noted from the above results, the combination of mineral oil and stearyl acid phosphate is very substantially more effective in suppressing foam than either component when used separately. Run 4, additionally, illustrates that the defoaming agent of this invention is decidedly more effective than the additive foam suppressing action of mineral oil and stearyl acid phosphate when used alone.

Example V

A detergent composition comprising:

	Parts by weight
Borax decahydrate	35.0
Trisodium phosphate dodecahydrate	23.0
Sodium tripolyphosphate	19.0
Sodium carbonate	7.8
Sodium linear alkyl benzene sulfonate wherein the alkyl group contains from 10–18 carbon atoms	5.3
Sodium sulfate	5.2

was prepared and tested according to the procedures outlined in Example IV. A 1.25% aqueous solution was prepared and subjected to the inversion test. After standing for one minute, 126 cc. of foam remained. A combination of 0.6 part mineral oil and 0.2 stearyl acid phosphate was substituted for 0.8 part sodium carbonate. Again the inversion test was performed with a 1.25% aqueous solution. The foam height after the expiration of one minute was 54 cc. The excellent foam suppression of the defoaming agent of this invention was, again, apparent.

Example VI

The defoaming agent of this invention was tested in a detergent composition comprising:

	Parts by weight
Sodium tallow alcohol sulfate	9.5
Sodium linear alkyl benzene sulfonate wherein the alkyl group contains from 10–18 carbon atoms	7.8
Diethanol amide	2.1
Sodium tripolyphosphate	49.4
Sodium silicate (SiO_2:Na_2O=1.6:1)	5.9
Sodium sulfate	13.7
Water	10.0

Similar detergent compositions were prepared containing, respectively, 4 parts by weight of mineral oil, 4 parts by weight of an equimolar mixture of monostearyl acid phosphate and distearyl acid phosphate, and 3.2 parts of mineral oil combined with 0.8 part of an equimolar mixture of monostearyl acid phosphate and distearyl acid phosphate.

A solution containing 0.5 gram of the above detergent composition in 100 cc. of water at 75° F. was prepared. The inversion test of Example I was used in this example. The results are summarized in Table VI below.

TABLE VI—INVERSION TEST NO. 3

Run	Parts stearyl acid phosphate	Parts mineral oil	Foam height (cc.)	
			Start	1 min.
1			250	250
2		4	250	250
3	4		225	215
4	0.8	3.2	145	140

Table VI illustrates the foam inhibition effects of the defoaming agent of this invention. This defoaming agent reduces the initial foam height of this high foaming detergent composition by nearly one-half. It is dramatically more effective than either component when used separately and is also decidedly more effective than any additive effects of the individual components of the defoaming agent.

Example VII

Example VI was substantially repeated with a detergent comprising:

	Parts by weight
Sodium linear alkyl benzene sulfonate wherein the alkyl group contains 10–18 carbon atoms	17.3
Sodium tripolyphosphate	46.5
Monoethanol amine	0.5
Sodium silicate (SiO_2:Na_2O=1.6:1)	6.0
Sodium toluene sulfonate	2.0
Sodium sulfate	15.0
Water	9.5
Minors	4.2

The same foam inhibition effects as noted in Example VI were demonstrated in this example. The mixture of stearyl acid phosphate and mineral oil was more effective than either of the components used alone and, additionally, was more effective than the additive effect of the components.

What is claimed is:

1. A synergistic defoaming agent consisting essentially of, by weight, from about 5% to about 95% of mineral oil and from about 5% to about 95% of an alkyl acid phosphate selected from the group consisting of saturated straight chain monoalkyl acid phosphates, unsaturated straight chain monoalkyl acid phosphates, saturated branched chain monoalkyl acid phosphates, unsaturated branched chain monoalkyl acid phosphates, saturated straight chain dialkyl acid phosphates, unsaturated straight chain dialkyl acid phosphates, saturated branched chain dialkyl acid phosphates, unsaturated branched chain dialkyl acid phosphates, and mixtures thereof, each alkyl group having from about 16 to about 20 carbon atoms.

2. The defoaming agent of claim **1** consisting essentially of, by weight, from about 53% to about 95% mineral oil and, from about 5% to about 47% of the alkyl acid phosphates.

3. A detergent composition having controlled foaming properties consisting essentially of an organic water-soluble non-soap synthetic detergent having pronounced detergent power selected from the group consisting of anionic, nonionic, zwitterionic, ampholytic synthetic detergents and mixtures thereof, and an effective amount of the synergistic defoaming agent of claim **1**.

4. A detergent composition especially suited for washing dishes consisting essentially of, in parts by weight:

(1) from about 15% to about 60% of an alkaline builder,

(2) from about 10% to about 30% of a water-soluble chlorine bleach,

(3) from about 5% to about 30% of a sodium silicate having an SiO_2:Na_2O ratio of from about 1:1 to about 3:1,

(4) from about 10% to about 30% water,

(5) from about 2% to about 10% of a water-soluble nonionic synthetic detergent,

(6) from about 0.15% to about 3.0% of the defoaming agent of claim **1**,

(7) from 0% to about 40% sodium carbonate.

5. A detergent composition suited for industrial use consisting essentially of, in parts by weight:

(1) from about 10% to about 60% of an alkaline builder,

(2) from about 0% to about 20% of a water-soluble chlorine bleach,

(3) from about 5% to about 50% of a sodium silicate having an SiO_2:Na_2O ratio of from about 1:1 to about 3:1,
(4) from 0% to about 60% sodium carbonate,
(5) from 0% to about 5% water,
(6) from 0% to about 10% of a water-soluble nonionic synthetic detergent,
(7) from about 0.15% to about 2% of the defoaming agent of claim **1**.

6. A built detergent composition especially suited for laundering clothes consisting essentially of, in parts by weight:
(1) from about 30% to about 60% of an alkaline builder,
(2) from about 10% to about 30% of an organic synthetic detergent selected from the group consisting of anionic, nonionic, zwitterionic, ampholytic synthetic detergents and mixtures thereof,
(3) from 0% to about 15% water,
(4) from 0% to about 10% of a sodium silicate having an SiO_2:Na_2O ratio of from about 1:1 to about 3:1,
(5) from 0% to about 25% of sodium sulfate,
(6) from about 1% to about 8% of the defoaming agent of claim **1**.

7. A built detergent composition especially suited for cleaning hard surfaces consisting essentially of, in parts by weight:
(1) from about 10% to about 50% of an alkaline builder,
(2) from about 1% to about 15% of an organic synthetic detergent selected from the group consisting of anionic, nonionic, zwitterionic, ampholytic, synthetic detergents and mixtures thereof,
(3) from about 0% to about 15% water,
(4) from about 0.5% to 5% of the defoaming agent of claim **1**,
(5) from 0% to about 40% of trisodium phosphate,
(6) from 0% to about 50% of sodium carbonate,
(7) from 0% to about 40% of borax decahydrate.

8. A detergent composition having controlled foaming properties consisting essentially of an organic water-soluble non-soap synthetic detergent having pronounced detergent power selected from the group consisting of anionic, nonionic, zwitterionic, ampholytic synthetic detergents, and mixtures thereof, and from about 0.15% to about 8.0% of the defoaming agent of claim **2** by weight of the detergent composition.

9. The defoaming agent of claim **2** wherein the alkyl acid phosphates are selected from the group consisting of monooleyl acid phosphate, dioleyl acid phosphate, monostearyl acid phosphate, distearyl acid phosphate and mixtures thereof.

10. A detergent composition having controlled foaming properties consisting essentially of an organic water-soluble non-soap synthetic detergent having pronounced detergent power selected from the group consisting of anionic, nonionic, zwitterionic, ampholytic synthetic detergents, and mixtures thereof, and from about 0.15% to about 8.0% of the defoaming agent of claim **9** by weight of the detergent composition.

11. The detergent composition of claim **5** consisting essentially of the non-soap synthetic detergent of claim **3**, an effective amount of the synergistic defoaming agent of claim **1** and from about 10% to 90% by weight of the detergent composition of a builder selected from the group consisting of:
(1) Inorganic salts selected from the group consisting of sodium and potassium (a) tetraborates, (b) bicarbonates, (c) carbonates, (d) tripolyphosphates, (e) pyrophosphates, (f) orthophosphates, (g) hexametaphosphates, and (h) mixtures thereof
(2) organic salts selected from the group consisting of sodium and potassium (a) ethylenediaminetetraacetates, (b) nitrilotriacetates, (c) N-(2-hydroxyethyl)-nitrilodiacetates, (d) phytates, (e) ethane-1-hydroxy-1,1-diphosphonates, (f) isopropylidene diphosphonates, (g) benzylmethylidene diphosphonates, (h) halomethylidene diphosphonates (i) mixtures thereof.

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