

[54] SOAP BASED CHAIN CONVEYOR
LUBRICANT

[75] Inventors: **Otto T. Aepli**, Southgate; **Malachy E. Sorgenfrei**, Trenton; **Harold L. Conaway**, Wyandotte, all of Mich.

[73] Assignee: **BASF Wyandotte Corporation**, Wyandotte, Mich.

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[52] U.S. Cl. **252/34.7, 252/33.3, 252/33.6, 252/42.1, 252/49.3, 252/49.5, 252/49.8**

[51] Int. Cl. **C10m 3/40, C10m 3/18, C10m 3/04**

[58] Field of Search **252/34.7, 42.1, 49.3, 49.5, 252/33.6, 49.8, 41, 33.3**

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Primary Examiner—Delbert E. Gantz
Assistant Examiner—I. Vaughn
Attorney, Agent, or Firm—Bernhard R. Swick; Joseph D. Michaels; Robert E. Dunn

[57] **ABSTRACT**

- Chain Conveyor Lubricant:
- a. water base
 - b. fatty acid soap
 - c. sequestering agent
 - d. alcoholic coupling agent
 - e. anionic surfactant
 - f. nonionic surfactant
 - g. monostearyl acid phosphate.

6 Claims, No Drawings

SOAP BASED CHAIN CONVEYOR LUBRICANT BACKGROUND

1. Field of the Invention

This invention relates to the improved soap based chain conveyor lubricants and more particularly to lubricants which are aqueous compositions containing fatty acid soaps and surfactants.

2. Description of the Prior Art

In breweries, soft drink bottling operations and food processing plants, conveyor belts are used to move the bottles, jars, cans and the like along the bottling line. In order to keep the conveyor chains clean and provide lubrication, it is customary to use a lubricant such as a soap based lubricant. However, these lubricants have often tended to foam to such an extent that the labels affixed to the bottles are wetted by the foam thereby giving them a poor appearance and/or are partially removed. Additionally, the use of these lubricants have resulted in the accumulation of unsightly amounts of foam on the floors and other areas.

In view of the prior art, it is an object of this invention to provide a soap based chain conveyor lubricant having improved defoaming properties. It is still another object of this invention to provide a soap based chain conveyor lubricant having improved lubricating properties.

These and other objects will become apparent from the following detailed description.

SUMMARY OF THE INVENTION

In accordance with this invention, there is provided an aqueous lubricating concentrate for lubricating continuously moving conveyor systems wherein said concentrate contains a fatty acid soap and a surfactant, the improvement comprising the addition to said composition of monostearyl acid phosphate in an amount from about 0.15 to about 1.75 weight percent of the concentrate. The concentrate when diluted with water is then ready for use as a lubricating composition.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The typical chain conveyor lubricant for convenience and economy in transporting and storing is manufactured and sold as a concentrate which is then diluted with water in proportions by volume of from about 1:50 parts concentrate to water to about 1:500 parts concentrate to water for usage. The lubricant concentrate typically consists of from about 20 to about 80 percent water, about 0 to 15 percent sequestering agent, about 0 to 30 percent anionic surface active agent, about 2 to 40 percent fatty acid soap, about 0 to 40 percent coupling agent, about 0 to 15 percent nonionic surface active agent. Usually it is more preferred that the concentrate contain about 30 to about 70 percent water, about 2 to 15 percent sequestering agent, about 2 to 30 percent anionic surface active agent, about 4 to 20 percent fatty acid soap, about 0 to 20 percent coupling agent and about 2 to 10 percent nonionic surface active agent.

According to this invention monostearyl acid phosphate is added to the foregoing composition to obtain the objects of the present invention. Typically the monostearyl acid phosphate is added in an amount from 0.15 to 1.75 percent of the concentrate exclusive of the water present. More preferably the amount of

monostearyl acid phosphate will be from about one-half to about 1.5 weight percent.

It is preferred to employ as the sequestering agent salts of ethylene diamine tetracetic acid. These sequestering agents may be added to the composition in the form of the salts or the acid may be added along with a sufficient amount of metallic hydroxide or alkanolamine to neutralize the acid.

Any sequestering agent which will complex calcium and magnesium ions from water may be employed in this invention. Additional suitable sequestering agents are trans-1,2-diaminocyclohexane tetracetic acid monohydrate, diethylene triamine pentacetic acid, sodium salt of nitrilotriacetic acid, pentasodium salt of N-hydroxyethylene diamine triacetic acid, trisodium salt of N,N-di(beta-hydroxyethyl) glycine, and sodium salt of sodium glucoheptonate.

Where the formula is diluted in tap water, conventional metallic soap dispersants may be necessary or desirable in addition to the sequestering agents.

Anionic surface active agents which may be employed include linear alkyl benzene sulfonic acids, alpha-olefin sulfonates, alkyl diphenyl oxide disulfonates, sodium N-methyl-N-alkyl-taurate, alkyl sulfonated amides, di(2-ethylhexyl) sulfosuccinate, dioctyl sodium sulfosuccinate, sodium sulfonate of oleic acid, anionic phosphate esters, alkyl ether sulfates, alkyl polyethyleneoxy esters, alcohol sulfates such as sodium lauryl sulfate, the product of chlorosulfonation of paraffin hydrocarbons, e.g., octadecenyl sulfonate and the condensate of a fatty acid chloride with an amine.

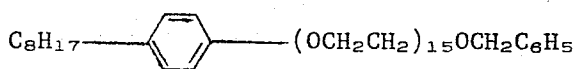
For the sake of simplicity in formulating the composition, instead of adding fatty acid soap as such it is preferred to simply add fatty acid in amount from about 2 to 30 weight percent for the broad composition or 4 to 15 percent by weight in the preferred composition and then add a sufficient amount of an alkali metal (from the first column of the periodic table) hydroxide, ammonium hydroxide or an alkanolamine to neutralize the fatty acid to produce the fatty acid soap. Where the sequestering agent is also added in the acid form, the foregoing hydroxide or alkanolamine is added in sufficient amount to neutralize both the sequestering agent acid and the fatty acid. Preferred fatty acids for this purpose are tall oil fatty acids with low rosin content of about 0.5 to 0.9 percent by weight and which generally comprise approximately 52 percent by weight oleic acid, 45 percent by weight linoleic acid, 1 percent by weight linolenic acid, and 2.3 percent by weight saturated acid. Coconut oil fatty acids, generally comprised of 50 percent lauric, 20 percent myristic, 10 percent oleic, 10 percent palmitic, 8 percent of other saturated fatty acids, and about 2 percent unsaturated fatty acids are also desirable for this purpose. Additional useful fatty acids include those derived from tallow, soya beans, corn, cottonseed, palm, and blends or hydrogenated forms of the basic type of fatty acid to give desired characteristics such as low solubilization temperature, viscosity, and reduced corrosion tendency.

Sodium, ammonium or potassium hydroxide and mono, di, and triethanolamine or isopropanolamine are the preferred source used for neutralizing and converting fatty acids and sulfonic acid derivatives to soap or amides. Potassium hydroxide and monoethanolamine are preferred for their ability to produce compounds with a pH and foam generating capacity suitable for conveyor lubricants.

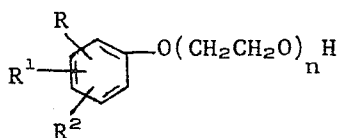
The nonionic surface active agents which are advantageously employed in the compositions of the invention are generally the polyoxyalkylene adducts of hydrophobic bases wherein the oxygen/carbon atom ratio in the oxyalkylene portion of the molecule is greater than 0.40. Those compositions which are condensed with hydrophobic bases to provide a polyoxyalkylene portion having an oxygen/carbon atom ratio greater than 0.40 include ethylene oxide, butadiene dioxide and glycidol, mixtures of these alkylene oxides with each other and with minor amounts of propylene oxide, butylene oxide, amylene oxide, styrene oxide, and other higher molecular weight alkylene oxides. Ethylene oxide, for example, is condensed with the hydrophobic base in an amount sufficient to impart water dispersibility or solubility and surface active properties to the molecule being prepared. The exact amount of ethylene oxide condensed with the hydrophobic base will depend upon the chemical characteristics of the base employed and is readily apparent to those of ordinary skill in the art relating to the synthesis of oxyalkylene surfactant condensates.

Typical hydrophobic bases which can be condensed with ethylene oxide in order to prepare nonionic surface active agents include mono- and polyalkyl phenols, polyoxypropylene condensed with a base having from about 1 to 6 carbon atoms and at least one reactive hydrogen atom, fatty acids, fatty amines, fatty amides and fatty alcohols. The hydrocarbon ethers such as the benzyl or lower alkyl ether of the polyoxyethylene surfactant condensates are also advantageously employed in the compositions of the invention.

Among the suitable nonionic surface active agents are the polyoxyethylene condensates of alkyl phenols having from about 6 to 20 carbon atoms in the alkyl portion and from about 5 to 30 ethenoxy groups in the polyoxyethylene radical. The alkyl substituent on the aromatic nucleus may be octyl, diamyl, n-dodecyl, polymerized propylene such as propylene tetramer and trimer, isoctyl, nonyl, etc. The benzyl ethers of the polyoxyethylene condensates of monoalkyl phenols impart good properties to the compositions of the invention and a typical product corresponds to the formula:



Higher polyalkyl oxyethylated phenols corresponding to the formula:



wherein R is hydrogen or an alkyl radical having from about 1 to 12 carbon atoms, R¹ and R² are alkyl radicals having from about 6 to 16 carbon atoms and n has a value from about 10 to 40, are also suitable as nonionic surface active agents. A typical oxyethylated polyalkyl phenol is dinonyl phenol condensed with 14 moles of ethylene oxide.

Other suitable nonionic surface active agents are conjugated polyoxyalkylene compounds containing in their structure at least one hydrophobic oxyalkylene chain in which the oxygen/carbon

atom ratio does not exceed 0.40 and at least one hydrophilic oxyalkylene chain in which the oxygen/carbon atom ratio is greater than 0.40.

Polymers of oxyalkylene groups obtained from propylene oxide, butylene oxide, amylene oxide, styrene oxide, mixtures of such oxyalkylene groups with each other and with minor amounts of polyoxyalkylene groups obtained from ethylene oxide, butadiene dioxide, and glycidol are illustrative of hydrophobic oxyalkylene chains having an oxygen/carbon atom ratio not exceeding 0.40. Polymers of oxyalkylene groups obtained from ethylene oxide, butadiene dioxide, glycidol, mixtures of such oxyalkylene groups with each other and with minor amounts of oxyalkylene groups obtained from propylene oxide, butylene oxide, amylene oxide and styrene oxide are illustrative of hydrophilic oxyalkylene chains having an oxygen/carbon atom ratio greater than 0.40.

Further suitable nonionic surface active agents are the polyoxyethylene esters of higher fatty acids having from about 8 to 22 carbon atoms in the acyl group and from about 8 to 30 ethenoxy units in the oxyethylene portion. Typical products are the polyoxyethylene adducts of tall oil, rosin acids, lauric, stearic and oleic acids and the like. Additional nonionic surface active agents are the polyoxyethylene condensates of higher fatty acid amines and amides having from about 8 to 22 carbon atoms in the fatty alkyl or acyl group and about 10 to 30 ethenoxy units in the oxyethylene portion. Illustrative products are coconut oil fatty acid amines and amides condensed with about 10 to 30 moles of ethylene oxide.

Other suitable polyoxyalkylene nonionic surface active agents are the alkylene oxide adducts of higher aliphatic alcohols and thioalcohols having from about 8 to 22 carbon atoms in the aliphatic portion and about 3 to 50 oxyalkylene portion. Typical products are synthetic fatty alcohols, such as n-decyl, n-undecyl, n-dodecyl n-tridecyl, n-tetradecyl, n-hexadecyl, n-octadecyl and mixtures thereof condensed with 3 to 50 moles of ethylene oxide, a mixture of normal fatty alcohols condensed with 8 to 20 moles of ethylene oxide and capped with benzyl halide or an alkyl halide, a mixture of normal fatty alcohols condensed with 10 to 30 moles of a mixture of ethylene and propylene oxides, a mixture of several fatty alcohols condensed sequentially with 2 to 20 moles of ethylene oxide and 3 to 10 moles of propylene oxide, in either order; or a mixture of normal fatty alcohols condensed with a mixture of propylene and ethylene oxides, in which the oxygen/carbon atom ratio is less than 0.40 followed by a mixture of propylene and ethylene oxides in which the oxygen/carbon atom ratio is greater than 0.40 or a linear secondary alcohol condensed with 3 to 30 moles of ethylene oxide, or a linear secondary alcohol condensed with a mixture of propylene and ethylene oxides, or a linear secondary alcohol condensed with a mixture of ethylene, propylene, and higher alkylene oxides. As couplers or hydrotropes which may be employed in this invention, or perhaps they could be equally described as homogenizers or phase control agents, the following are typical examples of useful agents for this purpose: propylene glycol, isopropyl alcohol and ethylene glycol.

The compositions of this invention are prepared by standard well-known open kettle mixing techniques known in the industry.

The practice of this invention is illustrated by, but not limited by, the examples given below. Unless otherwise noted, temperature is expressed in degrees Centigrade and parts are parts by weight.

In determining foam characteristics and lubricity (pounds gate pressure) a 12 foot section of continuous bottle conveyor, driven by a one-third horse power motor is loaded with 50 water-filled 6.5 fluid ounce bottles. The test lubricating composition is diluted in a proportion by weight of 1:100. This dilute solution is then applied at a single application point at the end of the conveyor distal to the drive, thus simulating operating conditions of the section of the actual bottle conveyor. The relative efficiency of the lubricant is determined by the force in pounds of gate pressure exerted by the stationary bottles on a spring balance at the end of the conveyor as the chain moves under the load. Compositions with poor lubricity will result in a higher gate pressure due to the force transmitted to the bottle column by the friction of the chain passing under the bottle load. Generally, a lubricant yielding a gate pressure of greater than 12 pounds on the balance with the standard load will exhibit poor lubricity under actual use conditions.

The current load in watts of the drive motor is also proportional to the lubricity of the lubricant as related to the friction between the bottle load and the conveyor chain. The foam generating capacity of the test formula is determined by the height of the suds that build up between adjacent bottles. Lubricants giving a gate pressure of less than 12 pounds and an electrical load of less than 105 watts have been shown to perform satisfactorily in actual conveyor systems. The results of lubricity and foam generating capacity of the below listed compositions are indicated in Table I below.

EXAMPLE I

A quantity of phosphate-free aqueous commercial conveyor chain lubricant containing a non-ionic surfactant and a fatty acid soap was divided into two parts. One portion was marked sample A and used as a control. To the other portion, marked sample B, was added and uniformly dispersed therein one percent by weight of monostearyl acid phosphate (hereinafter for convenience called MSAP in this and the following examples). Each sample was tested in the bottle conveyor test described above.

EXAMPLE II

A conveyor chain lubricant was prepared without MSAP (sample A) and with 1 percent by weight MSAP (sample B) by adjusting the amount of water. The lubricants contained on a percent by weight basis:

	Sample A	Sample B
Water	43.0	42.0
Sodium salt of ethylenediamine tetracetate	4.0	4.0
Propylene glycol	12.0	12.0
Dodecylbenzene sulfonic acid	20.0	20.0
Monoethanolamine	6.0	6.0
MSAP	—	1.0
Coconut fatty acid	10.0	10.0

-Continued

	Sample A	Sample B
Nonionic surfactant A	5.0	5.0
	100.0	100.0

EXAMPLE III

A conveyor chain lubricant was prepared without MSAP (sample A) and with 1 percent by weight MSAP (sample B) by adjusting the amount of water. On a percent by weight basis the lubricant contained:

	Sample A	Sample B
Water	60.0	59.0
Sodium salt of ethylenediamine tetracetate	4.0	4.0
Tall oil fatty acid	10.0	10.0
MSAP	—	1.0
Isopropyl alcohol	7.0	7.0
Monophosphate ester of nonionic surfactant A	10.0	10.0
Nonionic surfactant B	3.0	3.0
Potassium hydroxide	2.0	2.0
Isopropylamine	4.0	4.0
	100.0	100.0

EXAMPLE IV

A conveyor chain lubricant was prepared without MSAP (sample A) and with 1 percent by weight MSAP (sample B) by adjusting the amount of water. On a percent by weight basis the lubricant contained:

	Sample A	Sample B
Water	57.5	56.5
Tall oil fatty acid	10.0	10.0
MSAP	—	1.0
Isopropyl alcohol	7.0	7.0
Monophosphate ester of nonionic surfactant A	10.0	10.0
Nonionic surfactant B	3.0	3.0
Potassium hydroxide	2.0	2.0
Isopropylamine	4.0	4.0
Trisodium salt of nitrilotriacetate	6.5	6.5
	100.0	100.0

Nonionic surfactant A is an oxyalkylated alcohol wherein the alcohol is a mixture comprising 85% by weight of a C₁₀ alcohol, 8.5% by weight of a C₁₂ alcohol and 6.5% by weight of a C₁₄ alcohol; the oxyalkyl is a mixture of 68 parts of ethylene oxide and 12 parts of ethylene oxide, total oxyalkyl weight content - 80%, weight ratio of ethylene oxide to propylene oxide 5.67 to 1.

Nonionic surfactant B is an ethylenediamine initiated oxypropylene oxyethylene polymer wherein the molecular weight of the poly(oxypropylene) hydrophobe

portion is about 2500 and the poly(oxyethylene) portion about 15 percent of the poly(oxypropylene) present.

TABLE I

CONVEYOR LUBRICANT TEST RESULTS (Dilution ratio 1:100)		
1. Dilution water hardness zero p.p.m. (CaCO ₃)		
Example	Lubricity (Pounds Gate Pressure)	Foam Characteristics
I A	4.0-4.5	high foam
I B	3.5-4.0	low-moderate foam
II A	3.5-4.0	very high foam
II B	3.0-3.5	moderate high foam
III A	4.0-4.5	very high foam
III B	3.5-4.0	low-moderate foam
IV A	5.0-5.5	moderate
IV B	3.0-3.5	low
2. Dilution water hardness 120 p.p.m. (CaCO ₃)		
I A	4.5-5.0	moderate-high foam
I B	3.5-4.0	low-moderate foam
II A	3.5-4.0	high foam
II B	3.0-3.5	moderate foam
III A	3.5-4.0	moderate foam
III B	3.5-4.0	very low foam
IV A	4.5-5.0	low-moderate
IV B	3.0-3.5	low

In the foregoing tests the use of MSAP substantially reduced foam build-up on the bottles on the conveyor regardless of which lubricant was used. Additionally the lubricity of the lubricant was usually improved by the use of MSAP.

The foregoing examples and methods have been described in the foregoing specification for the purpose of illustration and not limitation. Many other modifications and ramifications will naturally suggest themselves to those skilled in the art based on this disclosure. These are intended to be comprehended as within the scope of this invention.

Having thus described the invention, what it is desired to claim and secure by Letters Patent is:

1. In an aqueous lubricating composition concentrate for lubricating continuously moving conveyor systems

wherein said concentrate consists essentially of by weight of about 30 to about 70 percent water, about 2 to 15 percent sequestering agent, about 2 to 30 percent anionic surface active agent, about 4 to 20 percent fatty acid soap selected from the group consisting of fatty acid alkali metal soap, fatty acid alkanol amine soap and fatty acid ammonia soap, zero to 20 percent coupling agent selected from the group consisting of propylene glycol, isopropyl alcohol and ethylene glycol, and about 2 to 10 percent nonionic surface active agent, the improvement comprising adding monostearyl acid phosphate to said concentrate in an amount from about 0.15 to about 1.75 weight percent of said concentrate whereby improved defoaming properties are obtained.

2. The concentrate according to claim 1 wherein the amount of monostearyl acid phosphate is from about 1/2 to about 1.5 weight percent.

3. The concentrate according to claim 1 wherein said fatty acid soap is obtained by incorporating in said concentrate a fatty acid in an amount from about 2 to 30 weight percent along with an agent selected from the group consisting of alkali metal hydroxide, ammonium hydroxide and alkanolamines in amount sufficient to react with the fatty acid to produce the fatty acid soap.

4. A lubricating composition consisting essentially of the concentrate according to claim 1 and water in a volumetric proportion of concentrate to water of about 1:50 to about 1:500.

5. The lubricating composition according to claim 4 wherein said concentrate contains from about 1/2 to about 1.5 weight percent of monostearyl acid phosphate.

6. The lubricating composition according to claim 4 wherein said concentrate fatty acid soap is obtained by incorporating in said concentrate a fatty acid in an amount from about 2 to about 30 weight percent along with an agent selected from the group consisting of alkali metal metal hydroxide, ammonium hydroxide and alkanolamines in an amount sufficient to react with the fatty acid to produce the fatty acid soap.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,860,521
DATED : January 14, 1975
INVENTOR(S) : Otto T. Aeppli, Malachy E. Sorgenfrei and
Harold L. Conaway

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 62 and 63, the expression
"12 parts of ethylene oxide" should read
--12 parts of propylene oxide--.

Signed and Sealed this

second Day of December 1975

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks