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ALUMINUM SOAPS

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The present invention relates to aluminum soaps, and more particularly to aluminum soaps especially adapted for use in lubricating greases.

Aluminum soaps such, for example, as aluminum stearate, aluminum naphthenate, etc., have obtained widespread use as gelling agents for mineral oils in the preparation of lubricating greases for the particular properties which these soaps impart to such greases. Among the desirable properties characteristic of such greases are their high heat resistance and their waterproof character. Further, aluminum soap-base greases possess a high degree of transparency and clarity, properties which are of importance from the standpoint of sales value. However, a serious defect of many of the prior art aluminum soap-base greases has been the instability of these greases in storage in retaining their initial viscosity; and also the instability of such greases to high shearing pressures. Under such conditions, the greases have a tendency to lose their viscosity and become more fluid. This naturally results in a lowering of the lubricating efficiency of the grease.

By the present invention, there are provided new aluminum soaps particularly adapted for use as gelling agents in the preparation of lubricating greases, which greases, while exhibiting the desirable characteristics of aluminum soap-base greases in general, are further characterized by their exceptional stability under storage conditions and under shearing pressures and stresses. By the present invention, therefore, there are also provided improved aluminum soap-base greases.

The aluminum soaps of the present invention are aluminum soaps of a plurality of soap-forming acids, the said soap-forming acids consisting, for the major portion thereof, of a saturated higher fatty acid material of at least 16 carbon atoms and, for the minor portion thereof, of dimerized linoleic acid and a saturated organic carboxylic acid containing from 4–10 carbon atoms.

The saturated higher fatty acid material which is employed as the major portion of the soap forming acids in the preparation of the aluminum soaps of the present invention is preferably stearic acid or hydrogenated fish oil fatty acids. However, any of the saturated higher fatty acids or hydrogenated animal or vegetable oils may satisfactorily be utilized as, for example, palmitic acid, arachidic acid, behenic acid and fully hydrogenated tallow fatty acids.

The dimerized linoleic acid utilized as a portion of the soap forming acids is a dimeric polymer of linoleic acid and consists essentially of dilinoleic acid.

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The third component of the soap-forming acids utilized in preparing the aluminum soaps of the present invention may be either a monobasic or a dibasic saturated organic carboxylic acid of from 4–10 carbon atoms. As examples of such acids there may be mentioned azelaic acid, caprylic acid, 2 ethylhexoic acid, adipic acid, sebacic acid, pelargonic acid, succinic acid, malonic acid and glutaric acid. Naphthenic acids having up to 10 carbon atoms have also been found useful in obtaining aluminum soaps having the properties of those of the present invention.

To obtain aluminum soaps having the specific gelling properties of those of the present invention with respect to the preparation of aluminum soap-base greases, it is essential that the various soap-forming acids be present in certain definite proportions. For example, it has been found that that portion of the soap-forming acids comprising the saturated higher fatty acid material should be utilized within the ratio of from 98–75% by weight of the total amount of the soap-forming acids. The remainder of the soap-forming acids therefore will constitute from 2–25% by weight of the total amount of the soap-forming acids. It has also been found that of the remaining soap-forming acids which constitute those employed in preparing the aluminum soaps of the present invention, that is, the dimerized linoleic acid and the saturated organic carboxylic acid having from 4–10 carbon atoms, each of these acids should be present in an amount constituting not less than 1% by weight and not more than 15% by weight based upon the total amount of soap-forming acids. Any substantial deviation, in the preparation of the aluminum soaps, from the proportions of the soap-forming acids specified above, or the omission of any one of the said soap-forming acids utilized in preparing the aluminum soaps of the present invention results in an aluminum soap which does not have the particularly desirable properties or characteristics of those made according to the present invention, when employed as the gelling agent for mineral oils in the preparation of lubricating greases. Such greases display a decided lack of stability to working, and also to non-bleeding in storage.

The following examples are illustrative of aluminum soaps made in accordance with the present invention.

Example 1

	Parts by weight
Stearic acid	85
Dimerized linoleic acid	8
Azelaic acid	7
Caustic soda	23
Aluminum sulfate—18 water	65

In the preparation of an aluminum soap utilizing the materials of Example 1, the acids and the caustic soda are reacted at approximately 70° C. in approximately 400 parts by weight of water to form the sodium soap of the acids. A solution of the aluminum sulfate in 585 parts by weight of water is then added to the solution of the sodium soap to precipitate the corresponding aluminum soap therefrom; such precipitation being carried out at a temperature of approximately 68–70° C. The precipitate is then collected by filtration, washed to remove insoluble inorganic salts, and dried to a water content of less than approximately 1% by weight. For use in the preparation of an aluminum soap-base lubricating grease, the dried aluminum soap is generally pulverized.

Further examples of formulations satisfactorily employed in the preparation of the aluminum soaps of the present invention are as follows. The procedure set forth in Example 1 for the preparation of the aluminum soap is followed in each of the following examples.

Example 2

	Parts by weight
Hydrogenated fish oil fatty acids	85
Dimerized linoleic acid	10
2 ethyl hexoic acid	5
Caustic soda	23
Aluminum sulfate—18 water	65

Example 3

Hydrogenated fish oil fatty acids	90
Dimerized linoleic acid	7
Caprylic acid	3
Caustic soda	23
Aluminum sulfate—18 water	65

Example 4

Stearic acid	88
Dimerized linoleic acid	8
Azelaic acid	4
Caustic soda	23
Aluminum sulfate	65

Example 5

Hydrogenated fish oil fatty acids	75
Dimerized linoleic acid	15
Adipic acid	5
Caustic soda	23
Aluminum sulfate—18 soda	65

The aluminum soaps of the present invention, as typified by the above illustrative formulations, are excellent gelling agents for oils, and in particular for mineral oils in the preparation of lubricating greases. One virtue of the soaps is their great economy of use as compared to previously available soaps since greater yields of lubricating greases are obtained with less aluminum soap. Additionally, lubricating greases prepared with the aluminum soaps of the present invention display higher melting points for a particular concentration of the soaps than was heretofore ordinarily obtainable. Such lubricating greases are, further, non-bleeding in storage, and in use display far greater stability to working shear than do the hitherto available aluminum soap greases.

In general, the aluminum soaps of the present invention may be used in proportions within the range in which previous aluminum soaps have been used in preparing lubricating greases; that is, a range of from approximately 2% to approximately 20% by weight of the finished grease. The amount employed, of course, will be determined by the particular properties and characteristics desired in the finished grease. Preparation of such greases may also be carried out according to well known procedures in the art. For example, the aluminum soap may be mixed in the cold with the oil utilized until the soap is well dispersed. The mixture is then heated with stirring to a temperature of approximately 260–280° F., and is usually held at such temperature for several hours with stirring. Thereupon the grease thus formed is allowed to cool, and upon cooling is ready for commercial use.

The following are examples of lubricating greases embodying the present invention and having the desirable properties characteristic of such greases.

Example 6

	Parts by weight
Aluminum soap of Example 1	4.0
Mineral oil (100 S. U. V. at 100° F.)	96.0
	100.0

Example 7

Aluminum soap of Example 2	6.0
Mineral oil (200 S. U. V. at 100° F.)	94.0
	100.0

These greases were clear, transparent and of smooth texture, and were found to be non-bleeding in storage. These greases were also found to have good stability to high shearing pressures; and excellent viscosity retention upon ageing in storage. The above formulations may be varied as to the content of the aluminum soap, and as to the type mineral oil utilized, to obtain lubricating greases of various desired properties and characteristics. The usual additives may also be incorporated in such greases.

While the above described products and processes constitute preferred embodiments of the invention, changes may be made therein without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. As a new composition, an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98–75% by weight of a saturated higher fatty acid of at least 16 carbon atoms and for approximately 2–25% by weight of dimerized linoleic acid and an acid of the group consisting of saturated organic carboxylic acids of from 4 to 10 carbon atoms, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

2. As a new composition, an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98–75% by weight of stearic acid and for approximately 2–25% by weight of dimerized linoleic acid and an acid of the group consisting of saturated organic carboxylic acids of from 4–10 carbon atoms, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

3. As a new composition, an aluminum soap of a plurality of soap-forming acids, said acids con-

sisting for approximately 98–75% by weight of a saturated higher fatty acid of at least 16 carbon atoms and for approximately 2–25% by weight of dimerized linoleic acid and azelaic acid, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

4. As a new composition, an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98–75% by weight of a higher saturated fatty acid of at least 16 carbon atoms and for approximately 2–25% by weight of dimerized linoleic acid and caprylic acid, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

5. As a new composition, an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98–75% by weight of a higher saturated fatty acid of at least 16 carbon atoms and for approximately 2–25% by weight of dimerized linoleic acid and 2-ethyl hexoic acid, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

6. As a new composition, an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98–75% by weight of a higher saturated fatty acid of at least 16 carbon atoms and for approximately 2–25% by weight of dimerized linoleic acid and adipic acid, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

7. As a new composition, an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98–75% by weight of a higher saturated fatty acid of at least 16 carbon atoms and for approximately 2–25% by weight of dimerized linoleic acid and sebacic acid, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

8. A lubricating grease comprising mineral oil and from approximately 2% to approximately 20% by weight of the grease of an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98%–75% by weight of a saturated higher fatty acid of at least 16 carbon atoms and for approximately 2%–25% by weight of dimerized linoleic acid and an acid of the group consisting of saturated organic carboxylic acids of from 4 to 10 carbon atoms, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

9. A lubricating grease comprising mineral oil and from approximately 2% to approximately 20% by weight of the grease of an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98%–75% by weight of stearic acid and for approximately 2%–25% by weight of dimerized linoleic acid and an acid of the group consisting of saturated organic carboxylic acids of from 4–10 carbon atoms, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

10. A lubricating grease comprising mineral oil and from approximately 2% to approximately 20% by weight of the grease of an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98%–75% by weight of a saturated higher fatty acid of at least 16 carbon atoms and for approximately 2%–25% by weight of dimerized linoleic acid and azelaic acid, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

11. A lubricating grease comprising mineral oil and from approximately 2% to approximately 20% by weight of the grease of an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98%–75% by weight of a higher saturated fatty acid of at least 16 carbon atoms and for approximately 2%–25% by weight of dimerized linoleic acid and caprylic acid, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

12. A lubricating grease comprising mineral oil and from approximately 2% to approximately 20% by weight of the grease of an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98%–75% by weight of a higher saturated fatty acid of at least 16 carbon atoms and for approximately 2%–25% by weight of dimerized linoleic acid and 2-ethyl hexoic acid, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

13 A lubricating grease comprising mineral oil and from approximately 2% to approximately 20% by weight of the grease of an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98%–75% by weight of a higher saturated fatty acid of at least 16 carbon atoms and for approximately 2%–25% by weight of dimerized linoleic acid and adipic acid each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

14. A lubricating grease comprising mineral oil and from approximately 2% to approximately 20% by weight of the grease of an aluminum soap of a plurality of soap-forming acids, said acids consisting for approximately 98%–75% by weight of a higher saturated fatty acid of at least 16 carbon atoms and for approximately 2%–25% by weight of dimerized linoleic acid and sebacic acid, each of the latter two acids constituting not less than 1% and not more than 15% by weight of the total amount of the said soap-forming acids.

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