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SODA BASE GREASE

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This invention relates to the production of lubricating greases and is more particularly concerned with a sodium soap composition which is both stable at high temperatures and is highly resistant to dissolution in water.

The use of sodium soaps for the thickening of lubricating oils is an old and well-known technique in the art of grease making. These sodium greases have not been as widely used as their high temperature resisting qualities would seem to warrant because of their instability in the presence of water. It is well appreciated that conventional sodium base greases are not generally to be used in any installation which is subject to weathering, where it may be acted upon by water, or where the surrounding atmosphere may be maintained at a high degree of humidity. The storage of these greases also presents troublesome problems in the matter of avoiding water absorption, separation and dissolution. It is for these reasons that the art has turned to the somewhat less desirable calcium base greases or to highly specialized lubricants containing lithium and aluminum soaps.

The principal object of the invention is to provide a sodium base grease in which the normal dispersion phase relation is inverted so that each particle of water-soluble soap is coated with relatively insoluble lubricating oil wherefore the final product will have a much higher resistance to dissolution in water than conventional soda greases.

It is a further and more specific object of the invention to provide for the thickening of mineral oils with sodium soaps, which method results in a product having all of the desirable qualities which are associated with sodium base greases produced in accordance with conventional practices, and in addition has the very desirable and unusual property of being highly resistant to the action of water, or moist atmosphere.

We have discovered that the foregoing and other objects of the invention may be attained by heating a mixture of sodium stearate and a steam refined cylinder oil, of which at least a substantial proportion is a Mid-Continent mixed base oil, to a final temperature of the order of 550–600° F. This high temperature treatment seems to have the effect of inverting the normal phase relation between the oil and soap and to result in the coating of the soap particles with mineral oil. In the final product, this oil coating acts as a barrier or shield to exclude water from the highly soluble soap, so that the grease may be used in the

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presence of water without any substantial dissolution or separation.

An example of a grease embodying our invention has the following formula:

	Percent by Weight
Mid-Continent steam refined stock (150 vis. at 210°)	79.5
Sodium stearate (commercial grade)	20.0
Tributyl phosphite	0.5

In preparing this grease we heated the oil to a temperature of about 200°, and then added in the tributyl phosphite which acts as an anti-oxidant, and the sodium stearate, in that order. This mixture was then heated intensely and with vigorous agitation to a final temperature of 550–600° F. It will be evident to those familiar with the art, that in the course of this treatment the oil will be brought to a temperature approaching its flash point, and care must be taken to avoid the burning of the soap. The final heating should therefore be accomplished as rapidly as possible, and under careful control. As soon as the desired final temperature was attained, heating was discontinued, and the product was quickly chilled to room temperature. We have found that best results are obtained by cooling the finished grease in thin layers so that its temperature is reduced uniformly and quickly. This may be accomplished very satisfactorily and economically by the use of chilled rolls which gather thin layers of the high temperature product from a sump, or over which the hot mixture may be poured in thin layers. We fully appreciate, however, that the same results may be achieved by cooling the hot grease in very shallow pans.

The chilled ribbons or sheets of grease which were prepared in the foregoing manner, were worked mechanically to an even, uniform consistency. This more or less conventional step in the grease making process may be carried out in an ointment mill, an orifice mill, or in any other suitable way.

The final product was a smooth, buttery grease of fairly hard character having an A S T M worked penetration of about 209 mm. at 77° F. Its high temperature resisting characteristics are well indicated by its high dropping point of 425° F., and by the fact that the product showed substantially no bleeding at 350° F. and less than 5% separation at somewhat higher temperatures.

The foregoing are characteristics which are to be expected of any good sodium base grease. Of

far more interest is the high degree of insolubility of the product in water. This property was tested in accordance with the procedures laid down in Navy specification AN G5A, the product exhibiting a water absorption of 50% by comparison with the 100% which is considered acceptable under the specification in question. This means, of course, that our inverted phase soda base grease is useful under conditions of operation where the highly specialized and expensive lithium-aluminum greases would normally be employed to combat water solubility and at the same time to resist high temperature effects.

It is of note that the lubricating oil of the foregoing example composition was 100% Mid-Continent base steam refined cylinder stock. The invention is not limited exclusively to the use of oil of this origin, for we may add Pennsylvania base lubricating oil to the mixture for the purpose of increasing its viscosity index. Coastal oils and oils of other origin may also be added to the product where that is desirable. We have found, however, that the oil mixture should contain at least 20% of Mid-Continent stock, and preferably more, together with various percentages of oils of other origin. It has not been found possible, for example, to prepare a satisfactory grease in which the oil was drawn entirely from Pennsylvania stock.

In preparing greases from lubricating oil mixtures containing from 20 to 60% of Mid-Continent stock, we have found that best results are obtained by heating the Mid-Continent oil separately to a temperature of about 200° preparatory to adding the oxidation inhibitor and sodium stearate, after which this mixture is raised to the desired final temperature. The Pennsylvania or other lubricating stock is preferably heated separately to an appropriately high temperature, and is then introduced into the high temperature Mid-Continent base grease mixture, after which the entire body of grease is quickly chilled and worked in the manner previously described.

In preparing our inverted soda base greases we prefer to employ a commercial grade of sodium stearate rather than a mixture of natural fats and alkalies. The process is thus a true grease-making one, rather than a conjoint formation of soaps and grease, and our finished grease is accordingly free of glycols, glycerine, water, and other deleterious matter. We further find that the use of the commercial stearates allows us to maintain a better control of the characteristics of the final product, and enables the duplication of properties in different batches of grease to a degree which is never attained when natural fats are employed.

The tributyl phosphite acts of course as an antioxidant for which purpose this substance has been found altogether suitable. It will be recognized by those skilled in the art, however, that other antioxidants may be employed to achieve the same results.

The foregoing example composition represents but one of many greases which may be prepared in accordance with the invention. Thus we have found that a large number of useful products of varying consistencies and properties may be compounded in accordance with the following general formula:

	Percent by weight
Lubricating oil stock	90–70
Sodium stearate (commercial grade)	10–30
Antioxidant	0– 0.5

In making up these greases, we follow the procedure which has been set forth above in connection with the example composition—that is to say, we employ a Mid-Continent oil of appropriate viscosity, but not necessarily the one given above, or a mixture of lubricating oils containing at least 20% by volume of Mid-Continent stock, and heat it to a temperature of about 200° F. preparatory to the addition of the other ingredients and to the formation of the grease at a high temperature of from 550 to 600° F. In all of these cases we find it essential to chill the final product in thin layers, and then to work it mechanically to that uniform consistency which is determined generally by the percentage of soap employed.

Having described our invention, what we claim as new and useful is:

1. A lubricating grease comprised mainly of lubricating oil containing at least 20 per cent by weight of refined Mid Continent base stock, and from about 10 to 30 per cent by weight of sodium stearate, in which the oil-stearate mixture is subjected to a finishing temperature of from 550° to 600° F., and is followed by quick chilling, to render the final product highly resistant to dissolution in water.

2. A lubricating grease comprised mainly of lubricating oil containing at least 20 per cent by volume of Mid-Continent base steam refined cylinder stock, and from about 10 to 30 per cent by weight of sodium stearate, in which the oil-soap mixture is subjected to a finishing temperature of from 550° to 600° F., followed by quick chilling to render the final product largely insoluble in water.

3. A lubricating grease comprising an intimate mixture of from 90 to 70 percent by weight of refined Mid-Continent base lubricating oil, of about 10 to 30 percent by weight of sodium stearate, and from 0 to about 0.5 per cent by weight of an antioxidant, in which the resulting mixture is subjected to a finishing temperature of from 550° to about 600° F., followed by quick chilling in thin streams, to render the final product highly resistant to dissolution in water.

4. A lubricating grease comprised essentially of from 70 to 90 per cent by weight of mineral lubricating oil containing not less than 20 per cent by volume of refined Mid-Continent base stock, from 30 to 10 per cent by weight of sodium stearate, and from 0 to about 0.50 per cent by weight of an antioxidant, in which the resulting mixture is subjected to a final temperature of from 550° to 600° F., and is then quickly chilled, whereby the final product is highly resistant to dissolution in water.

5. A lubricating grease comprised essentially of from 70 to 90 per cent by weight of mineral lubricating oil containing from 20 to 60 per cent by volume of refined Mid-Continent base stock, from 30 to 10 per cent by weight of sodium stearate, and about 0.50 per cent by weight of an antioxidant, in which the oil is heated to an initial temperature of about 200° F. prior to the addition of the other ingredients, and in which the resulting mixture is heated to a final temperature of from 550° to 600° F., followed by quick cooling, to render the final product highly resistant to dissolution in water.

6. A lubricant grease composed essentially of about 79.5 per cent by weight of steam refined Mid-Continent lubricating oil, about 20.0 per cent by weight of sodium stearate, and about 0.5 per cent by weight of an antioxidant, in which the resulting mixture is subjected to a finishing temperature of from 550° to 600° F., and is then

quickly chilled to render the final product highly resistant to dissolution in water.

7. A lubricant grease composed essentially of about 79.5 per cent by weight of mineral lubricating oil containing at least 20 per cent by volume of steam refined Mid-Continent base stock, about 20.0 per cent by weight of sodium stearate, and about 0.5 per cent by weight of an antioxidant, in which the resulting mixture is subjected to a final temperature of from 550° to 600° F., and is then cooled quickly in thin sheets, wherefore to render the final product highly resistant to dissolution in water.

8. A lubricant according to claim 6 in which said antioxidant is tributyl phosphite.

9. The method of preparing sodium base grease which comprises the steps of heating mineral lubricating oil containing at least 20 per cent by volume of refined Mid-Continent mixed base stock, said oil representing from 90 to 70 per cent by weight of the final grease, adding from about 10 to 30 per cent by weight of sodium stearate to the hot oil, heating the resulting grease mixture to a final temperature of from 550° to 600° F., and then quickly chilling the grease.

10. The method of preparing sodium base grease which comprises the steps of heating from 90 to 70 per cent by weight of refined Mid-Continent base lubricating oil, adding about 0.5 per cent by weight of an antioxidant and from about 10 to 30 per cent by weight of sodium stearate to the hot oil, heating the resulting grease mixture to a final temperature of from 550° to 600° F., and then quickly chilling the grease.

11. The method of preparing sodium base grease which comprises the steps of heating a body of lubricating oil containing at least 20 per cent by volume of refined Mid-Continent mixed base stock, said body of oil representing from 90 to 70 per cent by weight of the finished grease, adding about 0.5 per cent by weight of an antioxidant and from about 10 to 30 per cent by weight of sodium stearate to the hot oil, heating the resulting grease mixture to a final temperature of about 550°–600° F., and then quickly chilling the grease.

12. The method of preparing sodium base grease which comprises the steps of heating a body of refined lubricating oil containing at least 20 per cent by volume of refined Mid-Continent mixed base stock to a temperature of about 200° F., said oil representing from 90 to 70 per cent by weight of the finished grease, adding about 0.5 per cent by weight of an antioxidant and from 10 to 30 per cent by weight of commercial sodium stearate to the hot oil, heating the resulting grease mixture to a final temperature of about 550–600° F., and then quickly chilling the grease.

13. The method of preparing sodium base grease which comprises the steps of heating a body of lubricating oil containing from 20 to 60 per cent by volume of refined Mid-Continent base steam refined cylinder stock to a temperature of about 200° F., such oil representing from 70 to 90 per cent by weight of the final grease, adding about 0.5 per cent of an antioxidant and from 30 to 10 per cent by weight of commercial sodium stearate to the hot oil, heating the resulting grease mixture to a final temperature of about 550–600° F., and then quickly chilling the grease.

14. The method of preparing a sodium base grease which comprises the steps of heating a body of lubricating oil containing at least 20 per cent by volume of Mid-Continent base steam refined cylinder stock to a temperature of about 200° F., said oil representing about 79.5 per cent by weight of the final grease, adding about 0.5 per cent of an antioxidant and about 20 per cent by weight of commercial sodium stearate to the hot oil, heating the resulting grease mixture to a final temperature of about 550–600° F., and then quickly chilling the grease.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,005,553	Miller et al.	June 18, 1935
2,038,688	Taylor et al.	Apr. 28, 1936
2,086,870	Hilliker	July 13, 1937
2,188,864	Jolly	Jan. 30, 1940
2,198,567	Gundy	Apr. 23, 1940