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SODA SOAP GREASE

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This invention relates to soda soap greases and to new and improved methods for the manufacture of such greases.

It is an object of the invention to produce soda soap greases of the driving journal compound type having improved qualities including a hard but non-brittle consistency, a very smooth and non-grainy structure, a high degree of plasticity, good pressing characteristics, extreme pressure properties, and a very high softening time. I consider this last property highly important for reasons to be pointed out later.

A further object of the invention is to produce other soda soap greases having at least some of these properties. Another object of the invention is to provide new and improved methods for the manufacture of such products. A still further object of the invention is to provide a method for the manufacture of driving journal compounds and other soda soap greases. Further and more detailed objects, advantages and uses of my invention will become apparent as the description thereof proceeds.

It has been found that driving journal compounds of improved properties can be manufactured by blowing the fat and mineral oil with air for a prolonged period to oxidize these materials prior to the addition of soda to form a grease. I have found that far superior results can be obtained in far less time by pretreating the fatty material and mineral oil with a controlled amount of sulfur prior to or during the manufacture of the soap.

Driving journal compounds made by this sulfurization method are characterized by a desirable toughness, a resistance to working down, a high softening time, a relatively high penetration for their softening time, a very unusually high plasticity similar to that of a molding clay, and good extreme pressure properties.

The success of this grease-making procedure is in sharp contrast to previous efforts to manufacture sulfurized soda soap greases. If the fat is sulfurized alone without the mineral oil the caustic later added to saponify the fat liberates a large part of the sulfur and produces a very grainy soft soap. On the other hand the sulfurization of the mineral oil without the fat does not produce the desired properties. Thus it is important to sulfurize the fatty material and the mineral oil in the presence of each other. This gives the desired properties and does not interfere with the grease-making operation. It is, of course, possible to sulfurize only a portion of the fatty material and mineral oil used in making

these greases and to add this sulfurized portion to an additional amount of unsulfurized material. However, it is better to sulfurize substantially all of the fatty material and at least a major part of the mineral oil in admixture with each other. Equal parts of fatty material and mineral oil can be sulfurized or other proportions can be used, for instance from 1 part fatty material and 3 parts mineral oil to 1 part mineral oil and 3 parts fatty material.

I have found that the amount of sulfur which should be used is critical and ranges in general from about 1% to about 4% of the total oil and fatty material used in the finished lubricant. Quantities of sulfur substantially lower than 1% do not give the desired properties to any very substantial degree while quantities substantially in excess of 4% result in a driving journal compound which tends towards graininess and which is somewhat brittle, particularly when the product is made by the fire kettle rather than by the steam kettle technique.

The mineral oil and fatty material can be of any of those used in the manufacture of driving journal compounds and other soda soap greases. In general a heavy mineral oil and a low grade animal fat should be used. One of the advantages of my invention is that excellent products can be made using low grade fats rather than the better grades. The term "fatty material" includes both the fatty glycerides and the fatty acids which are equivalent to each other for purposes of the invention, but I prefer to use fats rather than fatty acids.

In practicing my invention, the mineral oil and fatty material in admixture with each other are treated with sulfur, as previously indicated, and are heated to a temperature of from about 200° F. to about 500° F., but preferably from about 250° F. to about 400° F. Thus, for instance, I have heated such a mixture at 250° F. while gradually adding sulfur over a period of one hour and have then raised the temperature to about 400° F. during a further period of heating. During the heating, part of the sulfur comes off as hydrogen sulfide while a larger portion of it is retained in combination with the mineral oil and fat. The sulfur probably functions by increasing the unsaturation and inducing polymerization.

Due to the retained sulfur, the final product has desirable extreme pressure properties.

The amount of sulfur retained varies, of course, both with the amount of sulfur added and with the time of heating but, generally speaking, there is little advantage in heating for more than two

or three hours although prolonged heating is not generally harmful. I prefer that the period of heating be from about 1 hour to about 5 hours, for instance 2 hours. The following table gives the amount of combined sulfur resulting from heating a typical oil-fat mixture with various indicated percentages of sulfur, under an atmosphere of CO₂ for various periods of time:

Hours heated	Percent of sulfur added			
	0	1	3	4
	Percent	Percent	Percent	Percent
0	.21			
1		1.0	2.5	
2		.98	2.5	2.85
3			2.4	
4				2.69

Having made the sulfurized oil-fat mixture, the caustic (sodium hydroxide) is added while the mixture is relatively cold. Under these conditions the soap forms slowly as the grease is heated and a perfectly smooth product results. No foaming takes place at temperatures such as those normally used in manufacturing driving journal compounds in steam kettles. On the other hand, if the caustic is added to the hot mixture, foaming and oil separation take place. Furthermore, "grain" forms and can be worked in again only by prolonged heating.

One typical manufacturing technique using a fire kettle includes heating a mixture of sulfurized oil, fat and caustic in the presence of a suitable amount of water for about 4 hours at about 350° F. followed by heating for about 4 more hours at 500° F. When using a steam kettle suitable driving journal compounds can be prepared by exactly the same process except that the final four hours heating at about 500° F. can be dispensed with.

The amounts of oil, fat and caustic used can be those conventionally employed. Thus, for instance, they can be calculated to give a final product which is about 45% soda soap and about 55% mineral oil although these proportions can be modified extensively as is well known to the art. However, the technique is particularly applicable to products containing from about 35% to about 50% soda soap, at least the bulk of the remainder being mineral oil.

I have found that the most desirable amount of sulfur is about 3% of the weight of the oil and fatty material. This amount of sulfur gives a driving journal compound of excellent texture, penetration, and resistance to working down. The product is very smooth and fine grained. It not only presses unusually well but also cuts cleanly.

One of the most important properties is an excellent softening time which is an index of quality from the service standpoint. Softening time is measured by a test in which a cylinder of driving journal compound about ½ inch in diameter and about ⅜ inch long is heated in an oil or mercury bath to the test temperature and then subjected to a weighted cylinder designed to give unit pressures on the driving journal compound comparable to those to which the compound is subjected in actual operations when it is forced by a spring against a hot bearing. This test gives an index of structure which correlates much better with service quality than do the penetration and consistency tests previously used. Thus for instance using a weight of 85 grams and a temperature of 350° F. a driving journal com-

pound made without sulfurization gave a softening time (time required to flatten the test cylinder) of 300 seconds while one made similarly after treatment with 3% sulfur gave a softening time of 450 seconds. The A. S. T. M. penetrations, on the other hand were about 35 and 28 mm. respectively. Thus I produce a grease having a long softening time under service conditions but which is relatively soft at room temperature, plastic and of good structure.

If oxidation of the fatty material and oil is used instead of sulfurization, the heating times and temperatures being similar, the softening time typically is about 282 seconds instead of 450 while the A. S. T. M. penetration is practically identical, 27 mm. instead of 28 mm.

The foregoing figures are for steam kettle operation. This has the advantage of short grease-making cycle and absence of foaming. It also gives a non-corrosive product. However, fire kettle technique can be used, and while there are some disadvantages, a product having a softening time as high as 10,000 seconds can be obtained without materially changing the A. S. T. M. penetration.

My invention is particularly applicable to hard high soda soap greases of the driving journal compound type but is also applicable to soft low soda soap greases which can be made by merely grading in additional mineral oil to give any desired soap content.

While I have described my invention in connection with certain specific embodiments thereof, it is to be understood that these are by way of example and not by way of limitation and I do not mean to be bound thereby but only to the scope of the appended claims.

I claim:

1. A method of manufacturing a soda soap grease which comprises sulfurizing in the presence of each other at least a portion of the mineral oil to be used in said grease and at least a portion of the fatty material to be used in said grease to a sulfur content of from about 1% to about 4% of the total mineral oil and fatty material used and then saponifying the sulfurized fatty material with soda.

2. A method of manufacturing a soda soap grease comprising sulfurizing a mixture of at least a portion of the mineral oil to be used and at least a portion of the fatty material to be used in said grease with from about 1% to about 4% of sulfur at a temperature of from about 200° F. to about 500° F., cooling the sulfurized material and then adding sodium hydroxide to saponify the sulfurized fatty material.

3. A method of manufacturing a driving journal compound comprising heating a mixture of at least a portion of the mineral oil to be used and at least a portion of the fatty material to be used in said grease with sulfur to obtain a sulfurized material having a sulfur content of from about 1% to about 4% of the total mineral oil and fatty material used and then adding sodium hydroxide to saponify the sulfurized fatty material.

4. A method of manufacturing a driving journal compound comprising heating a mixture of at least a portion of the mineral oil to be used and at least a portion of the fat to be used in said grease with from about 1% to about 4% of sulfur for at least about one hour at a temperature of from about 200° F. to about 500° F. and then adding sodium hydroxide to saponify the sulfurized fatty material.

5. A method of manufacturing a driving journal compound comprising heating a mixture of at least a portion of the mineral oil to be used and at least a portion of the fat to be used in said grease with from about 1% to about 4% of sulfur at a temperature of from about 200° F. to about 500° F. and then saponifying the sulfurized fatty material with soda under steam kettle conditions.

6. The method of manufacturing a driving journal compound comprising sulfurizing to a sulfur content of from about 1% to about 3% a mixture of at least a portion of the mineral oil to be used and at least a portion of the fatty material to be used in said grease, cooling the sulfurized material and then saponifying the sulfurized fatty material with soda.

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