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LUBRICANT

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This invention relates to lubricants and more particularly to the problem of inhibiting foaming therein. Objectionable foaming occurs when air is violently whipped into lubricants. An ordinary illustration of this condition appears in gear housings where the gears are only partially covered with oil so as to turn in an oil-air sphere. Rapid rotation of the gears will then convert the lubricant into a foamy mass lacking the required lubricating properties. In addition to the various objections arising from insufficient lubrication, the volume of the lubricant is very greatly increased, and portions of the foam may be forcibly discharged from the housing. Therefore, excessive foaming may result in actual loss of valuable lubricant, while greatly impairing the lubricating value of the lubricant.

In commercial practice, the hazards and economic losses due to foaming lubricants are recognized as serious problems in this art, but it appears that such foaming has been regarded as an inevitable result of violently whipping air into the lubricant. The usual high grade lubricants, deliberately prepared to meet the special requirements for gear oils, are subject to objectionable foaming. Our investigation of the prior lubricants in this art has failed to disclose any real solution of these specific problems.

The present invention is a result of special study and development work devoted to numerous conditions involved in this subject, the object being to create the cooperative conditions essential to a complete and entirely feasible solution of the old problem. Actual tests have shown that the invention herein described will positively inhibit foaming in the lubricants. The tests show that we have successfully accomplished this outstanding result in a commercially feasible manner, without resorting to complex or expensive mixtures, and without objectionably modifying the normal lubricating value of the oil.

Briefly stated, we found that a very small percentage of an ester of a sulfonated fatty acid when added to ordinary lubricants reduced their tendency to foam. The term "sulfonated" as used herein is intended to cover reactions which may result either in the formation of true sulfonic acids, sulfuric acid esters or both; it being understood that the nature of the resultant product depends largely upon the conditions and the materials which enter into the reaction. Thus the term "sulfonated" is used generically to describe reaction products resulting from the use of sulfating and sulfonating agents.

Various products may be employed. However, we prefer to use an ester of sulfonated carboxylic acid such as the reaction product of the acyl esters of ricinoleic acid or of oleic acid, an unsaturated carboxylic acid, or of 12 hydroxy-stearic acid or other carboxylic acids containing a double bond or hydroxyl group or both when reacted with an energetic sulfonating agent as oleum, chlorosulfonic acid or sulfuric acid ester as butyl sulfuric acid in the presence of a group protecting agent as acetic anhydride. Various combinations of the above reagents may be used, or one may use other reagents known to the art.

However, the resulting product that is preferred is an acyl ester of a sulfonated carboxylic acid having more than 10 carbon atoms in the acid group and containing not more than 12 carbon atoms in the acyl group. Esterification may be in the sulfo group, the carboxyl group, the hydroxyl group, or any desired combination of esterified groups.

Various quantities of such esters may be employed, but in each case, the quantity must be sufficient to inhibit foaming when air is violently whipped into the lubricant. In actual practice, we have found that the quantity of the selected ester may be very small, for example, less than 1%, and preferably less than 0.1%, of the lubricant. We will hereinafter refer to a specific example wherein only 0.05% of an ester of sulfonated carboxylic acid was employed to inhibit foaming in certain petroleum oils which would have otherwise been subjected to very excessive foaming. However, it is to be understood that similar results are obtainable when the foam inhibitors are incorporated in other lubricants, and that the invention is not limited to the popular types of lubricants referred to in the following examples.

In actual practice, the foaming of gear oils is usually caused by the agitation due to rotating gears which whip air into the oil. In each of the following examples, the term "agitation" refers to a very drastic agitation which was deliberately produced at a temperature of 100° F. by a machine known as a "Mix Master" having rotary

paddles turning at a speed of 540 R. P. M. The "foam inhibitor" employed in these specific examples was an acetyl ester of sulfonated ricinoleic acid.

Example 1

Lubricating stock	Volume of lubricant		Volume of agitated mixture after settling	
	Before agitation	After agitation	15 minutes	60 minutes
S. A. E. 140 extreme pressure gear lubricant	c. c. 500	c. c. 1,000	c. c. 980	c. c. 850
Above lubricant containing 0.05% foam inhibitor	500	540	500	500

Example 2

Lubricating stock	Volume of lubricant		Volume of agitated mixture after settling	
	Before agitation	After agitation	15 minutes	60 minutes
S. A. E. 60 aeroplane oil	c. c. 500	c. c. 875	c. c. 825	c. c. 600
Above lubricant containing 0.05% foam inhibitor	500	525	500	500

If desired the selected ester may be blended with a solvent in order to incorporate the ester in the oil. In such case the solvent may be an organic or an inorganic solvent and the one selected would depend upon its solvent value in the ester of sulfonated carboxylic acid and also its solvent value in lubricating oil.

It was found that a small quantity, less than 10%, of amyl acetate had the desirable solvent properties and could be used as the solvent. However, the use of amyl acetate is given here only as a specific example and is not intended to limit the use of solvents to this specific solvent, nor to this type of solvents, because other solvents known to the art possess the same valuable solvent properties.

Finally, it was found that when water was present, as is often the case inside of gear housings, caused by the condensation of moisture from the air, that the foaming tendency of the oil was not increased by the presence of water when an acyl ester of sulfonated carboxylic acid is used to reduce foam formation, but in some cases the action of the foam reducing agent is increased in the presence of very small amounts of water.

It is, however, not to be construed that any solvent is necessary since an acyl ester of sulfonated carboxylic acid as indicated will act as a foam reducing agent in the absence of all solvents. The solvent merely facilitates the incorporating of the foam-inhibiting agent in the oil.

We claim:

1. A lubricant comprising a petroleum lubricating oil wherein foaming is inhibited by an acetyl ester of a sulfonated ricinoleic acid dissolved in said oil, the quantity of said ester being about 0.05% of the lubricant.

2. A mineral oil lubricant containing a foam inhibitor consisting of an acetyl ester of sulfonated ricinoleic acid, the quantity of said ester being less than .1% of the lubricant but sufficient to inhibit foaming of said lubricant.

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