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GREASE COMPOSITIONS

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1 Claim

ABSTRACT OF THE DISCLOSURE

A lubricating grease containing a combination of a thiophosphate, salicylic acid or a metal salt thereof and an alkyl-substituted aryl sulfonic acid or a metal salt thereof forms a nonstaining grease having good extreme pressure properties, wear resistance, oxidation and corrosion resistance.

The invention relates to grease compositions, and is particularly concerned with those grease compositions which are thickened with a lithium salt of a fatty acid, more particularly lithium 12-hydroxy-stearate.

Greases having good high temperature performance are well known. Such greases comprise a suitable base oil, such as a refined hydrocarbon oil of lubricating grade, a thickening agent such as a fatty acid soap or salt or a non-soap thickening agent, a polar structure modifier for the thickening agent, if necessary, for example glycerol, and conventional additives for improving oxidation resistance, extreme pressure properties and/or corrosion resistance. Such additives include diaryl amines such as phenyl α -naphthylamine for oxidation resistance, metal alkyl or aryl thiophosphates, such as zinc or cadmium dialkyl dithiophosphate for a combination of oxidation resistance and extreme pressure properties, and a metal (e.g., lead) naphthenate for anti-corrosion properties. It has not hitherto been found possible, however, to achieve a completely satisfactory combination of all these properties.

It is an object of the present invention to provide a grease having good high temperature performance, good extreme-pressure properties, good rust inhibition and good wear resisting properties. It is also an object of the invention to provide such a grease which does not stain new paint surfaces.

According to the present invention, there is provided a grease composition comprising a base oil; a thickening agent; a metal dialkyl thiophosphate, a metal diaryl thiophosphate, or a metal monoalkyl, monoaryl thiophosphate; salicylic acid or a metal salt thereof; and an oil-soluble alkyl-substituted aryl sulphonic acid or a metal salt thereof.

The thickening agent is preferably a lithium salt or soap of a fatty acid, more preferably lithium 12-hydroxy stearate, which is incorporated in the grease in an amount necessary to give the required consistency. Alternatively as thickening agent, aluminium complex soaps could be used. Normally, the amount of lithium 12-hydroxy stearate used is between about 7 and 12% by weight based on the total of base oil plus thickening agent. Preferred amounts are between 9 and 11% but as little as 1% or as much as 15%, by weight based on the total of base oil plus thickening agent can be used in some instances. With an aluminium complex the corresponding proportion is preferably between 6% and 12% by weight. Optionally, a polar structure modifier such as glycerol, may be included in the composition in an amount of up to 25%, e.g., from 5 to 25% by weight based on the thickening agent or up to 4%, e.g., from 0.5 to 4% by weight based

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on the total composition. Other polar structure modifiers which may be used include di- and poly-hydroxy compounds wherein the hydroxy groups are attached to carbon atoms which are adjacent or separated by not more than one carbon atom. The structure modifiers therefore include a large number of diols or polyalcohols and also ethoxylated derivatives of fatty alcohols, fatty acids, or diols.

The metal dialkyl or diaryl thiophosphate is preferably an oil-soluble zinc dialkyl dithiophosphate in which the alkyl groups may be the same or different. Zinc isobutyl/ amyl dithiophosphate and zinc ethyl-isobutyl/isopropyl dithiophosphate are preferred. These thiophosphates are preferably incorporated in amount of from 0.2 to 5.0% by weight based on the total of the base oil plus thickening agent and polar structure modifier (if any). As an alternative to a dialkyl or diaryl thiophosphate, a metal monoalkyl, monoaryl thiophosphate, e.g., zinc isobutyl, phenyl dithiophosphate could be used. The thiophosphate should be fully esterified so that the two hydrocarbyl groups attached to the oxygen atoms in the thiophosphate radical should be either both alkyl or both aryl groups or one an alkyl and the other an aryl group.

In the preferred embodiment of this invention a salt of salicylic acid is used, more preferably lead salicylate, but other salts such as mono- or di-lithium salicylate or free salicylic acid may be used. The preferred amount of salicylic acid or salicylate is from 0.1 to 5.0% by weight based on the total of base oil plus thickening agent and polar structure modifier (if any), and amounts from 0.25 to 4.0% by weight are particularly preferred.

Preferably a salt of an oil-soluble alkyl-substituted aryl sulphonic acid is used, more preferably an alkaline earth metal salt of an alkyl-substituted naphthalene sulphonic acid in which the alkyl group or groups each contain from 2 to 22 carbon atoms, in amount of from 0.1 to 5.0% by weight based on the total of base oil plus thickening agent and polar structure modifier (if any). The preferred salts are barium salts but other salts such as calcium or magnesium sulphonates or alkali metal salts, or the free sulphonic acid or amine salts thereof may be used in equivalent amounts if desired.

In order to show the nature and advantages of the invention more clearly a number of examples of the invention will now be described.

A grease composition was prepared by mixing, under the normal conditions for preparing such greases well known to those skilled in the art, the following components:

	Parts by weight
Hydroxystearic acid	10.00
Lithium hydroxide (LiOH.H ₂ O)	1.43
Base oil ¹	87.57
Glycerol	1.00

¹ A solvent extracted naphthenic hydrocarbon oil having a viscosity of 450 S.S.U. at 100° F.

There was thus obtained a grease thickened with approximately 10% by weight of lithium 12-hydroxystearate.

To this grease were added various amounts of (A) a zinc dialkyldithiophosphate in which one of the two alkyl groups was an isobutyl group while the other was an amyl group (B) lead salicylate, and (C) barium di-(nonyl naphthalene sulphonate), and the compositions thus obtained were subjected to the following tests:

Oxidation test (I).—ASTM method D942. Pressure drop measured after 100 hours.

Timken load test (II).—Fed. M 791—6505.

Timken wear test (III).—Fed. M 791—6505.

EMCOR corrosion test (IV).—DIN method 51802. Corrosion measured after 7 days and in certain cases after 12 and 21 days.

SKF high temperature (V).—DIN method 51806 extended to 28 days.

The following table lists the results of these tests:

consisting of lithium salicylate, lead salicylate and salicylic acid, and alkaline earth metal dialkyl naphthalene sulfonate.

Wt. percent of additive			I p.s.i.	II lb.	III mg.	IV		V		
(A)	(B)	(C)				Days	Rating	° C.	Cage wear, mg.	Overall rating
0.0	0.0	0.0	14	10	3	7	3	110	2,450	4
0.25				20	0.3	7	2-3	110	700	3
0.50				25	0.3	7	2-3	120	500	2-3
1.00				25	1.0	7	2-3	120	400	2-3
2.00				35	1.5	7	3	120	400	2-3
2.50				50	1.5	7	3	120	400	2-3
5.00				50	2.0	7	3	120	400	2-3
	0.2		8	15	0.2	7	2-3	110	1,400	3-4
	1.0		5	15	3	7	2-3	120	760	3
	5.0		3		4	7	3	120	600	3
		0.1	14			7	1	110	2,000	4
		0.3		10	3.0	21	0.1	110	2,000	4
		1.0		10	3	21	0	110	2,000	4
		5.0	16			21	0	110	2,000	4
0.2	0.2		3	25	0.1	7	2	130	150	2-3
0.5	0.2		2-3	35	?	7	2	130	100	2-3
0.5	0.3		2	35	?	7	2	130	(1)	2-3
1.0	0.5		1.5	35	1	7	2	130	(1)	2
2.5	1.0		1.0	40	1	7	2-3	130	(2)	1-2
5.0	5.0		0.5	50	1	7	2-3	130	(2)	fail
1.0		0.5	3	35		7	0	120	400	2-3
2.0		0.5	3	40		7	1	120	400	2-3
0.25	0.25	0.1	1.5-2	30	1.5	21	0-1	130	170	2-3
2.5	1.0	0.5	(3)	40	1	21	0	140	(1)	1
									(1)	
5.0	5.0	5.0	0.5	50	<1	21	0	140	(2)	fail
									(2)	

¹ Below 100.

² Fail scoring.

³ Below 1.

It is apparent from the table of results that, although the use of a zinc dialkyl dithiophosphate alone gives good extreme pressure properties and wear resistance, good oxidation and corrosion resistance and high temperature properties are only developed when a salicylate and an alkyl aryl sulphonate are added. These results are remarkable in that the combined effects of the three additives are achieved without any adverse effects on the other properties of the grease. In addition the grease formulation containing all three additives is nonstaining to new paint surfaces on automobile bodies and similar articles.

What is claimed is:

1. A grease composition comprising mineral base oil thickened with lithium 12-hydroxy stearate and containing synergistic proportions of zinc dihydrocarbyl dithiophosphate, a salicylic acid component selected from the group

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