United States Patent Office

3,232,872

Patented Feb. 1, 1966

3,232,872

GREASES

Edward M. Kohn, Philadelphia, Pa., assignor to Sun Oil Company, Philadelphia, Pa., a corporation of New Jersey

No Drawing. Filed Feb. 5, 1964, Ser. No. 342,802
4 Claims. (Cl. 252—19)

This invention relates to grease compositions and more particularly to grease compositions having improved extreme pressure properties.

Recently there has been developed a type of multi-purpose grease which has certain outstanding characteristics including those of high water resistance, high melting point, i.e., high dropping point, high oxidation stability, and can be used over a wide range of temperatures. Such greases are known as complex aluminum soap greases.

The primary function of a grease is to lubricate metallic parts which are generally in constant motion one against the other. As a result of such constant motion even though the metal may apparently be completely lubricated by a grease, a wearing of the metallic parts occurs due to friction. If the extreme pressure properties of a grease are improved, the wear on the moving metallic parts lubricated by that grease is reduced. Another measure of improved extreme pressure properties of a grease is the increase in the weld point of the grease. Weld point is defined as the lowest load at which welding will occur as measured in the Four-Ball Extreme Pressure Tester (see Lubrication Engineering, vol. 1, p. 35 (1945)).

Heretofore many types of additives have been added to various types of greases to improve the EP properties thereof, i.e., decreased wear and increased weld point. Examples of additives which have been added to greases for this purpose include metallic salts, powdered metals, lead soaps such as lead naphthenate, graphite, and molybdenum sulfide. Unfortunately those additives which have conventionally been added to greases as EP improvers do not improve the EP properties of the complex aluminum soap greases. On the contrary many of these additives actually degrade the EP properties of the complex aluminum soap grease.

A unique combination of additives has now been found which will improve the EP properties of complex aluminum soap greases. Surprisingly, each of the components of the additive combination of the grease composition of this invention when used individually as an additive for a complex aluminum soap grease degrades the EP properties of the grease.

Briefly stated the grease composition of this invention comprises (a) a major amount of a complex aluminum soap grease having an A.S.T.M. dropping point of at least 400° F. and an A.S.T.M. penetration of at least 250, (b) a minor amount of a hydrated Group VIII metal salt, and (c) a minor amount of a powdered metal selected from the group consisting of zinc, cadmium, and a nickel-silver.

The major component of the novel composition of this invention is as stated above, a complex aluminum soap grease. Such greases are dispersions of complex aluminum soaps in a suitable base oil. The complex aluminum soaps contain at least one hydroxyl anion for each aluminum cation and at least two dissimilar anions substantially organic in character. The aluminum disoaps of the organo anions are water insoluble and generally different in the extent of their individual solubilities in lubricating oils.

Suitable base oils which may be used in the preparation of the complex aluminum soap greases include a wide variety of petroleum derived lubricating oils such as naphthenic base, paraffin base, and mixed lubricating oils, synthetic oils, e.g., alkylene polymers (such as polymers

of propylene, butylene etc., and mixtures thereof), alkylene oxide-type polymers, dicarboxylic acid esters and liquid esters of acids of phosphorus. Synthetic oils of the alkylene-oxide type polymer which may be used include those exemplified by the alkylene oxide polymers (e.g., propylene oxide polymers) and derivatives, including alkylene oxide polymers prepared by polymerizing alkylene oxides, e.g., propylne oxide in the presence of water or alcohols, e.g., ethyl alcohol and esters of alkylene oxide type polymers, e.g., acetylated propylene oxide polymers prepared by acetylating propylene oxide polymers containing hydroxyl groups.

It will be understood that the complex aluminum soap greases per se are not the novel concept of this invention since such greases are known in the art. Methods of preparing such greases are disclosed in U.S. Patents Nos. 2,599,553 and 2,768,188. It will be further understood that the novel compositions of this invention are uniquely directed to complex aluminum soap greases. If other types of greases are substituted for the complex aluminum soap greases in the composition, the improved EP properties are not observed.

The hydrated Group VIII metal salts are used in the novel composition of this invention in a minor amount. Generally an amount of hydrated Group VIII metal salt in the range of from 0.1 to 10.0 weight percent of a total composition when used in conjunction with the other additives of this invention is sufficient to impart to the composition the improved EP properties desired. Greater amounts of the hydrated Group VIII metal salts can be employed, if desired. Such greater amounts do not give any apparent technological improvement, however, and hence the use of such amounts is avoided for economic reasons. It is preferred that an amount in the range of from 1.0 to 5.0 weight percent of the hydrated Group VIII metal salt be used in this invention.

While in general any of the Group VIII hydrated metal salts may be used, it is preferred to use the hydrated salts of iron, cobalt, and nickel, cobalt salts being the most preferred for use in this invention.

The powdered metal is used in the composition of this invention in a minor amount. Generally an amount of powdered metal in the range of from 0.1 to 10.0 weight percent of the total composition when used in conjunction with the other additives of this invention is sufficient to impart to the composition the improved EP properties desired. Greater amounts of the powdered metal can be employed, if desired. Such greater amounts do not give any apparent technological improvement, however, and hence the use of such amounts is avoided for economic reasons. It is preferred that an amount in the range of from 1.0 to 5.0 weight percent of the powdered metal be used in this invention.

While it has been stated above that powdered zinc, cadmium or a nickel-silver can be used in this invention, the preferred powdered metals to be used herein are the nickel-silvers. Nickel-silvers are copper-nickel-zinc alloys and have been known since about 1835. The common name and typical analyses of various nickel-silvers are presented in Table I.

TABLE I

Common Name	Copper, percent	Nickel, percent	Zinc, percent
30% nickel silver	62	30	8
20% nickel silver	66	20	14
18% nickel silver	66	18	16
15% nickel silver	66	15	19
12% nickel silver	66	12	22
10% nickel silver	67	10	23
5% nickel silver	62	5	33
18% nickel silver (spring stock)	55	18	27
12% nickel silver (leaded)	66	12	(1)

[1] 2% lead; 20% zinc.

Additional information re nickel-silvers can be found in the following references:

Copper and Copper Base Alloys, Wilkins and Bunn, New York, 1943, pp. 190–225.

Engineering Alloys, Woldman, American Society for Metals, 1959.

Cross-Index of Chemically Equivalent Specifications and Identification Code, Military Handbook–H, 1B, May 15, 1958.

Zinc, the Metal, Its Alloys, and Compounds, Mathewson, A.C.S. Monograph Series, 1959, pp. 580, 583.

This invention is further illustrated by the following examples.

Example I

A mixture comprising 10 percent by weight of aluminum benzoate stearate and 90 percent by weight of a solvent refined paraffinic base oil having a viscosity of 485 S.U.S. at 100° F. is heated to 450° C. When the temperature reaches 450° F. the application of heat is discontinued and the mixture is allowed to cool to room temperature. The resulting grease is a light brown, translucent, unctuous soft grease having an A.S.T.M. dropping point of 521° F. and an A.S.T.M. penetration of 275.

Example II

The grease as prepared in Example I was used in compounding a series of grease formulations. Each formulation was tested in the Four-Ball Wear Test and Weld Point Test. (These tests and the equipment used therein are described in Lubrication Engineering, vol. 1, p. 35, 1945.) The results of the tests are set forth in Table II.

TABLE II

Sample No.	Additive		4-Ball Wear, mm.	Weld Point, kg.
	Compound	Amount, percent by wt.		
1			0.67	251
2	$CoSO_4 \cdot 7H_2O$	5.0	0.80	251
3	$CoSO_4 \cdot 1H_2O$	5.0	0.72	355
4	18% Nickel-Silver Powder	5.0	0.72	282
5	Zinc Powder	5.0	0.65	251
6	Aluminum Powder	5.0	0.51	224
7	1/1 $CoSO_4 \cdot 7H_2O$ Zinc Powder	5.0	0.48	282
8	1/1 $CoSO_4 \cdot 7H_2O$ 18% Ni-Ag Powder.	5.0	0.50	316

In Table II in Sample Number 1 it is shown that the base grease has a 4-ball wear of 0.67 mm. and a weld point of 251 kg. In Samples 2–5 the 4-ball wear is almost universally greater than that of the base grease alone. In Samples 2, 5, and 6 the weld point is equal to or less than that of the base grease alone. It is thus apparent that the individual additives with the exception of aluminum degrade the 4-ball wear characteristics of the grease and with the exception of cobaltous sulfate monohydrate and nickel-silver powder the weld point remains constant or is decreased. Quite unexpectedly the blends of hydrated cobaltous sulfate and metallic powder used in Sample Numbers 7 and 8 show not only a decreased 4-ball wear but an increase in weld point, thus clearly demonstrating a synergistic effect of the additive combination in the grease formulations of this invention.

When other hydrated Group VIII metal salts described above are substituted for hydrated cobaltous sulfate, and other powdered metals described above are substituted for zinc or the nickel-silvers, substantially identical results are obtained.

Although the grease composition of this invention has been described as comprising a complex aluminum soap grease, a hydrated Group VIII metal salt, and a powdered metal, it will be understood that other and conventional additives can be included in the grease composition such as dyes, other grease modifiers, fillers, oxidation inhibitors, anti-corrodants, anti-thixotropic agents, anti-gelators, stringiness agents, peptizing agents, etc.

I claim:

1. A grease composition comprising
(a) a major amount of a complex aluminum soap grease having a dropping point of at least 400° F. and an A.S.T.M. penetration of at least 250,
(b) 1.0 to 5.0 weight percent of a hydrated cobaltous salt, and
(c) 0.1 to 10.0 weight percent of a powdered zinc.

2. A grease composition comprising
(a) a major amount of a complex aluminum soap grease having a dropping point of at least 400° F. and an A.S.T.M. penetration of at least 250,
(b) 0.1 to 5.0 weight percent of a hydrated cobaltous salt, and
(c) 1.0 to 5.0 weight percent of powdered zinc.

3. A grease composition comprising
(a) a major amount of a complex aluminum soap grease having a dropping point of at least 400° F. and an A.S.T.M. penetration of at least 250,
(b) 0.1 to 10.0 weight percent of a hydrated cobaltous salt, and
(c) 0.1 to 10.0 weight percent powdered 18% nickel-silver.

4. A grease composition comprising
(a) a major amount of a complex aluminum soap grease having a dropping point of at least 400° F. and an A.S.T.M. penetration of at least 250,
(b) 1.0 to 5.0 weight percent of a hydrated cobaltous salt, and
(c) 1.0 to 5.0 weight percent of powdered 18% nickel-silver.

References Cited by the Examiner

UNITED STATES PATENTS

1,758,598	5/1930	Frizell	252—19
1,839,159	12/1931	Newbern	252—26
2,205,990	6/1940	Nelson et al.	252—19
2,211,373	8/1940	Folda	252—19
2,599,553	6/1952	Hotten	252—35
3,007,867	11/1961	Allen et al.	252—26

FOREIGN PATENTS

638,678	5/1962	Canada.
179,344	5/1922	Great Britain.
206,706	11/1922	Great Britain.

DANIEL E. WYMAN, *Primary Examiner.*