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3,268,445

LUBRICATING COMPOSITION HAVING IMPROVED THERMAL STABILITY

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This invention relates to an improved lubricating composition and more particularly to a lubricant suitable for use at high and ambient temperatures.

The trend in design of modern aircraft has accentuated the need for lubricants which will lubricate anti-friction bearings operating at high rotational speeds and high temperatures. Considerable progress has been made in recent years in producing improved aircraft lubricants. For example, a number of lubricants are now available for lubricating bearings operating at 10,000 to 20,000 revolutions per minute at temperatures up to about 400° F. However, great difficulty has been encountered in producing a lubricant which will effectively lubricate bearings operating at speeds up to 20,000 revolutions per minute and at temperatures up to about 600° F. for prolonged periods of time.

In order to produce a lubricant, whether a liquid or a composition having the consistency of a grease, which will effectively lubricate bearings operating at temperatures up to 600° F. it is necessary to employ as the fluid component a material which is highly resistant to thermal degradation at temperatures up to 600° F. In addition, the fluid component must have the ability to lubricate and remain fluid both at high and ambient temperatures over a prolonged period of time without excessive volatilization, gumming or coking. If a composition having the consistency of a grease is prepared, the thickening agent employed in conjunction with the fluid must remain solid and also be resistant to thermal degradation at temperatures up to 600° F.

While some mineral oils especially hydrotreated mineral oils are sufficiently stable to provide adequate lubrication when used under moderately elevated temperatures, the volatility of mineral oils is such that they do not give adequate lubrication at temperatures in the order of 600° F. Synthetic oils are substantially more resistant to thermal degradation than mineral oils. Synthetic oils, particularly the polyorgano siloxanes known as the silicone oils in addition to being more resistant to thermal degradation than mineral oils also have high viscosity indices making their use at high and ambient temperatures especially desirable. Notwithstanding these desirable characteristics, the synthetic oils are also prone both to volatilization and solidification when heated at 600° F. over prolonged periods.

We have found that the thermal stability of a synthetic oil particularly polyaryl ethers can be enhanced by adding thereto an alkaline earth metal hydroxide.

Exemplary of the polyaryl ethers which are improved according to the invention are the liquid polyphenyl ethers, i.e., m-bis(m-phenoxyphenoxy)benzene and m-bis(m-phenoxyphenoxy)phenyl ether.

The alkaline earth metal hydroxides which are employed according to the invention can be either chemically pure or commercial grades thereof. The hydroxides of the metals calcium, barium, strontium and magnesium

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can be powdered or finely divided such as colloidal calcium hydroxide, colloidal barium hydroxide, colloidal strontium hydroxide and colloidal magnesium hydroxide. Of these compounds, calcium hydroxide is especially preferred in preparing lubricating compositions of the invention. The amount of the alkaline earth metal compound which we use may vary depending upon the particular lubricating base employed and upon the characteristics desired in the ultimate composition. In improving a synthetic oil, a sufficient amount of the alkaline earth metal compound is used to improve the thermal stability of the oil. In general, the amount of the alkaline earth metal compound employed, is about 0.1 to about 3 percent by weight based on the weight of the total composition.

The lubricating composition of this invention can contain conventional lubricant additives, if desired, to improve other specific properties of the lubricant without departing from the scope of the invention. Thus, the lubricating composition can contain a filler, a corrosion and rust inhibitor, an extreme pressure agent, an antioxidant, a metal deactivator, a dye and the like. Whether or not such additives are employed and the amounts thereof depend to a large extent upon the severity of the conditions to which the composition is subjected and upon the stability of the synthetic lubricating oil base in the first instance. When such conventional additives are used they are generally added in amounts between about 0.01 and 5 percent by weight based on the weight of the total composition.

In order to compare the improvement obtained upon the addition of an alkaline earth metal hydroxide to a polyorgano siloxane containing diphenylmethylsilyl end groups (QF-6-7024) and to a liquid polyphenyl ether, m-bis(m-phenoxyphenoxy)benzene, viscosities of each were examined both before and after heating at 600° F. for extended periods. The results obtained are summarized by the data in Table I. Inasmuch as the uncompounded oils become quite viscous after heating to 600° F. for 96 hours or more, the reported values for these viscous materials are considered to be approximate values but nevertheless are comparative with each other since the viscosities were obtained by identical procedures.

TABLE I

Composition, percent By Weight	Viscosity, SUS at 150° F. After Indicated Hours at 600° F.			
	0	48	96	120
Synthetic Lubricating Oil (QF-6-7024)	310	550	3,200	6,802
+1.0% Ca(OH) ₂	310	460	880	1,208
m-Bis(m-phenoxyphenoxy) benzene	280	600	6,280	70,000
+1.0% Ca(OH) ₂	280	440	550	715

The strikingly improved thermal stability of the polyphenyl ether composition of the invention containing 1 percent by weight of calcium hydroxide is self-evident from the above data. It will be noted that whereas the calcium hydroxide did not change the initial viscosity of the lubricating oil, the calcium hydroxide effectively reduced the amount of viscosity increase when the composition was heated to 600° F.

While our invention has been described with reference to various specific examples and embodiments it will be understood that the invention is not limited to such examples and embodiments and may be variously practiced within the scope of the claims hereinafter made.

We claim:

1. A lubricating composition capable of functioning at temperatures up to about 600° F. consisting essentially of a dispersion in a liquid polyphenyl ether of a small amount, sufficient to improve the thermal stability of said ether, of an alkaline earth metal hydroxide. 5

2. A lubricating composition capable of functioning at temperatures up to about 600° F. consisting essentially of a dispersion in a liquid polyphenyl ether of about 0.1 to about 3 percent by weight of calcium hydroxide.

3. The lubricating composition of claim 2 wherein the polyphenyl ether is m-bis(m-phenoxyphenoxy) benzene. 10

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