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STABILIZED LUBRICANT COMPOSITION

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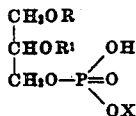
The present invention relates to lubricating compositions, and more particularly to lubricating oils containing metal salts or soaps as detergents, oxidation inhibitors, anti-corrosion agents and the like, which compounds tend to form a haze in the oil in the presence of moisture.

An object of this invention is to prevent the formation of haze in oils containing metal salts or soaps, and especially in oils containing metal salts of acid esters of acids of phosphorus.

A further object of this invention is the use of phosphatides or mixtures of the same to prevent the formation of haze in lubricating oils containing metal salts, and particularly the alkaline earth metal salts of acid esters of the thio-acids of phosphorus.

It has been proposed heretofore to add to lubricating oils various metal salts or soaps to function as detergents, antioxidants or anti-corrosion agents, and it has been found that the alkaline earth metal salts, and particularly the barium salts of the acid esters of the acids of phosphorus were highly effective in this capacity, the only disadvantage being that these compounds tended to form a haze in the oil in the presence of moisture.

I have discovered that the formation of haze in oils containing a metal salt of an acid ester of an acid of phosphorus may be reduced or prevented by the addition to the oil of a relatively small quantity of a phosphatide such as lecithin or cephalin. The phosphatides belong to the class of compounds having the general formula



wherein R and R¹ are similar or dissimilar fatty acid radicals such as those derived from stearic, palmitic, or oleic acids, and where X represents an amino alcohol group. In the case of lecithin, X or the amino alcohol group is choline



and in the case of cephalin X is colamine



The exact cause of the formation of haze has not been definitely established, but it is believed to be due to the action of moisture upon the metal salt of the acid ester of the acid of phosphorus, whereby a hydrated compound is formed which is less soluble in the oil than the original compound. The action of the phosphatide or lecithin in reducing or preventing the formation of haze is at present unknown.

In accordance with my invention, I incorporate in a hydrocarbon oil, such as a lubricating oil of suitable viscosity, a detergent or inhibitor comprising a metal salt of an acid ester of an acid of phosphorus and a phosphatide, such as lecithin, in an amount sufficient to prevent the formation of haze due to the effect of moisture upon the soap contained in the oil. The detergents, or inhibitors may be employed in various quantities depending upon the type of oil used and the service to which the oil is to be put. For ordinary service in internal combustion engines of passenger cars, light trucks, and the like, quantities of inhibitor of the order of 0.01 per cent to about 1 per cent by weight have been found satisfactory.

On the other hand, for heavy duty service in Diesel engines, tractor engines, and heavy truck or bus engines, considerably more inhibitor is required, i. e., amounts of the order of 1 per cent to 5 per cent, and in many cases between 5 per cent and 10 per cent. The quantity of phosphatide required to reduce or prevent the formation of haze will vary depending upon the composition or nature of the inhibitor and the amount of such inhibitor incorporated in the oil. In general, the quantity of phosphatide required will range from about 10 per cent to 100 per cent of the quantity of the inhibitor added to the oil.

The inhibitors which are employed in accordance with this invention in conjunction with the phosphatide comprise one or a mixture of two or more metal salts of acid esters of an acid of phosphorus, and particularly the alkaline earth metal salts of acid esters of a thio-acid of phosphorus. The metals may be exemplified by Ca, Ba, Sr, Mg, Na, K, Li, Cu, Zn, Pb, Sn, Ni, Co and Al. The "acids of phosphorus" include orthophosphoric acid, meta phosphoric acid, pyrophosphoric acid, orthophosphorous acid, meta phosphorous acid, pyrophosphorous acid, and the thio-phosphoric and thiophosphorous acids. The acid esters comprise the mono- or di alkyl, cycloalkyl, aryl, alkylated aryl, hydroaryl, and mixed alkyl-aryl esters of the acids of phosphorus, or mixtures of such esters. The alkyl groups include methyl, ethyl, propyl, isopropyl, butyl, isobutyl, tertiary butyl, amyl, isoamyl, hexyl, heptyl, octyl, and the higher homologues such as lauryl, cetyl, stearyl, oleyl, and the like. The aryl, alkylated aryl and

hydroaryl groups may be exemplified by phenyl, naphthyl, anthryl, cresyl, tolyl, xylyl, cyclohexyl, and naphthenyl. The mixed groups comprise propyl phenyl, butyl phenyl, amyl phenyl, hexyl naphthyl, cetyl cresyl, lauryl xylyl, as well as the mixed alkyl functions ethyl propyl, ethyl butyl, butyl hexyl, hexyl lauryl, and the like.

Specific examples of the metal salts of the acid esters of the acids of phosphorus are given in the following table.

Barium salt of di lauryl acid ester of thiophosphoric acid
Barium salt of lauryl hexyl acid ester of thiophosphoric acid
Calcium salt of lauryl hexyl acid ester of thiophosphoric acid
Zinc salt of lauryl hexyl acid ester of thiophosphoric acid
Zinc salt of dicyclohexyl acid ester of thiophosphoric acid
Zinc salt of lauryl cyclohexyl acid ester of thiophosphoric acid
Aluminum salt of distearyl acid ester of phosphoric acid
Aluminum salt of hexyl stearyl acid ester of phosphoric acid
Aluminum salt of lauryl cresyl acid ester of phosphoric acid
Calcium salt of phenyl stearyl acid ester of phosphoric acid.

The metal salts of the acid esters of the acids of phosphorus may be used in conjunction with a phosphatide, or may be used in admixture with other inhibitors or detergents such as metal sulfonates, metal salts of phenol or phenol sulfides, metal stearates, metal naphthenates or the like, in conjunction with a phosphatide.

My invention may be further illustrated by the following examples, which, however, are not to be construed as limiting the scope thereof. In these examples, samples of motor lubricating oil containing a metal salt of an acid ester of an acid of phosphorus, as well as samples of the oil containing the metal salt and in addition various amounts of lecithin, were in one case subjected to storage under normal conditions, and in the second case, were contacted with a minute amount of added water (1 drop of water per 100 cc. of oil sample), and then stored. The samples were examined periodically to determine the length of time before haze appeared in the oil. The results are shown in the following table.

Oil composition	Days storage before haze formation	
	Normal storage	In contact with water
Oil+0.5% Ba salt of lauryl hexyl acid thiophosphate.....	Less than 1	Less than 1
Oil+0.5% Ba salt of lauryl hexyl acid thiophosphate+0.25% lecithin.....		
Oil+0.5% Ba salt of lauryl hexyl acid thiophosphate+0.5% lecithin.....		
Oil+0.5% Ba salt of dihexyl acid thiophosphate.....	Less than 1	Less than 1
Oil+0.5% Ba salt of dihexyl acid thiophosphate+0.5% lecithin.....		
Oil+0.5% Zn salt of lauryl hexyl acid thiophosphate.....	7	Less than 1
Oil+0.5% Zn salt of lauryl hexyl acid thiophosphate+0.25% lecithin.....		
Oil+0.5% Zn salt of lauryl hexyl acid thiophosphate+0.5% lecithin.....		

The effect of lecithin upon lubricating oils con-

taining a metal salt of an acid ester of an acid of phosphorus, when such oils are subjected to oxidation is shown in the following table. The oxidation test comprised heating 100 cc. of the oil sample, to which had been added 0.1% of iron naphthenate as an oxidation catalyst, at a temperature of 340° F. for 18 hours, while bubbling air through the sample at a rate of 300 cc. per minute. At the completion of the heating period, the neutralization number of the sample was determined by conventional methods. In the table, inhibitor A is a barium salt of lauryl hexyl acid thiophosphate and barium phenol sulfide, and inhibitor B is a barium salt of lauryl mixed hexyl acid thiophosphate and barium phenol sulfide.

Oil composition	Neut. No.
S. A. E. 30 motor oil.....	12.0
S. A. E. 30 motor oil+0.25% inhibitor A.....	6.3
S. A. E. 30 motor oil+0.5% inhibitor A.....	5.0
S. A. E. 30 motor oil+0.25% inhibitor A+0.25% lecithin.....	2.1
S. A. E. 30 motor oil+0.25% inhibitor A+0.5% lecithin.....	1.4
S. A. E. 30 motor oil+0.5% inhibitor A+0.25% lecithin.....	1.5
S. A. E. 30 motor oil+0.5% inhibitor A+0.5% lecithin.....	1.6
S. A. E. 30 motor oil+0.25% inhibitor B.....	6.2
S. A. E. 30 motor oil+0.5% inhibitor B.....	3.0
S. A. E. 30 motor oil+0.25% inhibitor B+0.25% lecithin.....	1.3
S. A. E. 30 motor oil+0.25% inhibitor B+0.5% lecithin.....	1.1
S. A. E. 30 motor oil+0.5% inhibitor B+0.25% lecithin.....	1.2
S. A. E. 30 motor oil+0.5% inhibitor B+0.5% lecithin.....	1.0

It will be apparent from the results given hereinabove that lecithin exerts a beneficial influence upon oils containing metal salts of acid esters of acids of phosphorus not only from the standpoint of preventing the formation of haze but also of decreasing the formation of acidity in the oils due to oxidation.

Furthermore, while the combination of these metal salts and lecithin is particularly adapted for use in connection with lubricants for internal combustion engines to maintain general engine cleanliness, such combination of compounds is also of utility in oils for cutting or shaping metals, in greases and gear lubricants, and in other compositions wherein stability against oxidation is of prime importance.

I claim:

1. A lubricant comprising hydrocarbon oil containing a metal salt of an acid ester of an acid of phosphorus, said salt being present in an amount which would normally result in the formation of a haze in said oil in the presence of moisture, and a phosphatide in an amount sufficient to prevent said haze.

2. A lubricant comprising hydrocarbon oil containing an alkaline earth metal salt of an acid ester of an acid of phosphorus, said salt being present in an amount which would normally result in the formation of a haze in said oil in the presence of moisture, and a phosphatide in an amount sufficient to prevent said haze.

3. A lubricant comprising hydrocarbon oil containing an alkaline earth metal salt of an acid ester of a thio-acid of phosphorus, said salt being present in an amount which would normally result in the formation of a haze in said oil in the presence of moisture, and a phosphatide in an amount sufficient to prevent said haze.

4. A lubricant comprising hydrocarbon oil containing a barium salt of an acid ester of a thio-acid of phosphorus, said salt being present in an amount which would normally result in the formation of a haze in said oil in the presence of moisture, and a phosphatide in an amount sufficient to prevent said haze.

5. A lubricant comprising hydrocarbon oil containing a barium salt of a dihexyl acid ester of thiophosphoric acid in an amount which would normally result in the formation of a haze in said oil in the presence of moisture, and lecithin in an amount sufficient to prevent said haze.

6. A lubricant comprising hydrocarbon oil con-

taining a barium salt of a hexyl lauryl acid ester of thiophosphoric acid in an amount which would normally result in the formation of a haze in said oil in the presence of moisture, and lecithin in an amount sufficient to prevent said haze.

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