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PHOSPHORUS- AND NITROGEN-CONTAINING LUBRICANT ADDITIVES

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U.S. Cl. 252—49.9 7 Claims

ABSTRACT OF THE DISCLOSURE

The addition of an additive made by reacting a phosphonate with oleamide to a lubricant imparts improved frictional characteristics thereto. In addition, levels of corrosion and chatter and squawking noises resulting from interrupted power transmission are eliminated or reduced to acceptable levels.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to lubricant compositions, and more particularly relates to those compositions which have been improved by adding thereto a small amount of an additive whose function it is to improve the oxidation or friction properties of the lubricant composition.

Description of the prior art

Power-transmitting units are useful for many purposes. One such unit is the automatic transmission found in an automobile for moving power from the engine to the differential. Such units depend for their success upon the smooth transfer through the transmission to the drive shaft of the power generated by the engine. To provide smooth and continuously effective operation, the lubricant used must possess a number of properties. Not only must it have the desired properties with respect to oxidation, corrosion, extreme pressure, oiliness, detergency, and the like, but it must also have good frictional properties. Lack of suitable frictional properties in the lubricant will result in interrupted power transmission, generally manifested by chatterlike noises from the unit. Excessive wear and early breakdown are likely to result unless the necessary frictional properties are supplied by appropriate additives.

U.S. 3,070,546 discloses lubricant compositions containing a combination of a carboxy amide, e.g. oleamide, with a salt of a phosphorodithioic acid. However, no art is known disclosing the composition of this invention.

SUMMARY OF THE INVENTION

Accordingly this invention provides a lubricant composition comprising a major amount of lubricant and an amount sufficient to improve the friction properties thereof of the product made by heating a mixture containing from about 25% to about 75% of a phosphonate and from about 75% to about 25% of oleamide, all by weight.

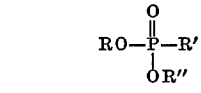
DISCUSSION OF SPECIFIC EMBODIMENTS

The desirable features enumerated hereinabove may be attained by adding to the lubricant from about 0.01% to about 2% by weight of the oil-soluble product obtained from a phosphonate, as defined below, and oleamide.

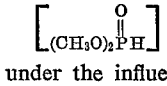
The base lubricants which are useful with the additives of this invention may be any lubricating oil, whether natural or synthetic. The natural oils include paraffinic, naphthenic and aromatic oils or mixture of them. Among the synthetic oils are polyolefin (synthetic hydrocarbon) fluids, polyoxyalkylenes, polyacetals, polysiloxanes, polyesters and the like. The polyesters are those made from polyhydric alcohols and monocarboxylic acids such as from pentaerythritol or neopentyl glycol and its homologs and aliphatic monocarboxylic acids having from 4 to 9 carbon atoms. Also useful are those polyesters made from polycarboxylic acids (e.g. sebacic acid) and monohydric alcohols (e.g. 2-ethylhexanol).

The base lubricant contemplated may also be a grease formulated by adding a grease-forming quantity of a thickening agent to one of the oils mentioned above. For this purpose a wide variety of materials may be employed. These thickening agents or gelling agents may include any of the conventional metal salts or soaps which are dispersed in the lubricating oil in grease-forming quantities in such degree as to impart to the resulting grease the desired consistency. Other thickening agents that may be employed in the formulation may comprise non-soap thickeners, such as modified clays and silicas, aryl ureas, calcium complexes and various other materials.

The phosphonate used in the invention has the formula

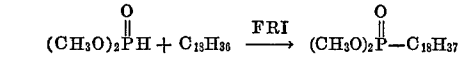


wherein R is an alkyl containing from 1 to 4 carbon atoms, preferably 1 carbon atom, R′ is a straight chain alkyl containing from about 14 to about 20 carbon atoms, preferably about 18 carbon atoms, and R″ is H or R. These can be prepared in ways known to the art. For example, methyl octadecylphosphonate can be prepared by reacting dimethyl phosphonate



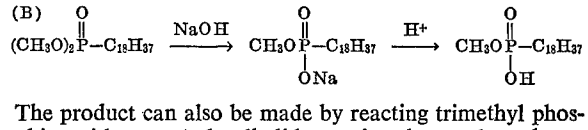
with 1-octadecene under the influence of a free radical initiator (FRI) as illustrated below.

(A)



This is followed by treating the resulting product with sufficient NaOH to react to react with one of the CH_3O groups, thus forming a monosodium salt, followed by acidification, as follows:

(B)



The product can also be made by reacting trimethyl phosphite with an octadecylhalide to give the product shown in (A) above. The final product can be made in the usual way, i.e. using the procedure shown in (B) above.

The oleamide used in the practice of this invention was conventional and easily obtainable by known methods which need not be set forth.

In a more specific sense, the procedure for preparing the product used in this invention to reduce frictional levels in a lubricant is simple and straight forward. A mixture is prepared containing from about 25% to about 75% by weight of the phosphonate and from about 75% to about 25% by weight of oleamide. The preferred mixture is about 75% by weight of phosphonate and about 25% by weight of oleamide. This mixture is heated at from about 50° to about 200° C., preferably about 100° to about 160° C., more preferably about 110° to about 125° C. for a time sufficient to effect a reasonable reaction rate at the temperature chosen. This time may range from about ½ hour to 10 or 20 hours.

With respect to the temperature, it is desirable, though not necessary as seen from the ranges presented, that it be high enough to boil out the water or the lower alkanol as it is formed. In lieu of this, the water or alkanol should be removed following completion of the reaction. It may also be desirable to remove any unreacted reactants, but other than these steps, the product needs no purification since the crude, stripped product has the requisite activity required for the purposes of this invention.

Having described the invention in general terms, the following specific example is offered for purposes of illustration and only for illustration, and no intention to limit the invention is to be inferred therefrom.

Example 1

To 430 g. of methyl octadecylphosphonate there was added 143.5 g. of oleamide. The mixture was warmed and agitated until it was homogeneous, and then it was heated for 2 hours at 110° C. On cooling to room temperature the reaction product was a soft waxy solid.

EVALUATION OF PRODUCTS

The product of Example 1 was evaluated in a test measuring the extent of friction modification for automatic transmission fluids. An excellent friction modifier must possess the following characteristics. In a curve plotting coefficient of friction against rubbing speed of plates of the transmission, a positive friction curve should be obtained for a temperature range of 100° to 275° F. This means that the dynamic coefficient of friction be higher than the static coefficient of friction at any speed. This characteristic should also be maintained at all temperature levels. Fluids having no friction modifier or poor modifiers have flat or negative curves. The fluid should not deteriorate the friction material on the clutch plate surface and the fluid should possess a high oxidative and thermal stability as well as homogeneity on storage at ambient temperatures.

In the Low Velocity Friction Apparatus Test, a base mineral oil composition, containing minor amounts of anti-oxidants and detergents which do not contribute to desirable friction properties, was tested as the transmission fluid. The particular oil used in the test was a blend comprising 86% of a solvent refined paraffinic neutral hydrocarbon oil having a viscosity of 40 SUS at 210° F. and 14% of the same type of hydrocarbon oil having a viscosity of 47 SUS at 210° F. The apparatus comprised a container in which was placed the test fluid having immersed therein a steel ring disc. The upper surface was covered by a friction material, a commercially available phenolic-impregnated paper. The disc was held by a strain gauge. A second steel disc, rotatable by a motor, was placed on top of the first, in contact with the friction material so that the interface was in the fluid. The pressure on the friction material surface was 120 p.s.i. The upper disc was rotated at various speeds (5, 15, 20, 30 and 40 feet per minute) and the resulting readings on the strain gauge were recorded. The coefficients of friction were calculated from these readings. The tests were conducted at 100°, 200° and 275° F., and a friction-speed curve was drawn for each temperature at which the tests were run.

The results of this test are tabulated as follows:

Additive	Weight, percent	Type [1]	Static difference [2]
None [3]		A	0.05
Example 1	0.5	D	0.03
Oleamide	[4] 0.5	D [5]	0.03
Do	[6] 0.125	A [7]	0.06

[1] A=Negative curve, the static coefficient of friction is greater than the dynamic coefficients like the 100° F. curve obtained for the base fluid; B=curves for all test temperatures close together with practically zero slope, no inflection; C=all temperature curves positive, dynamic coefficients exceed static coefficient, maximum variation of static coefficients with temperature exceeds 0.03; D=all temperature curves positive, maximum variation of coefficients with temperature is 0.03; E=all temperature curves positive, maximum variation of static coefficients with temperature is 0.02.

[2] Difference between static coefficient of friction at 100° F. and at 275° F.

[3] Contained a zinc phosphorodithioate, dispersant, detergent and a seal swelling agent.

[4] After 24 hours at room temperature the fluid containing this concentration of oleamide was not homogeneous; insoluble material was present.

[5] Curves almost flat.

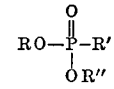
[6] Concentration of oleamide which could be calculated for the product of Example 1.

[7] Curve for 200° F. was negative; curve for 275° F. was practically horizontal; curve for 100° F. was the only positive curve obtained. All of the coefficients however were substantially lower than those obtained for the base fluid showing an effect on friction but unsatisfactory performance.

Although the present invention has been described with certain specific embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of this invention as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the appended claims.

We claim:

1. A lubricant composition comprising a major proportion of a lubricating oil or grease and an amount sufficient to improve the frictional properties thereof of a product made by reacting a phosphonate of the formula



wherein R is an alkyl containing from 1 to 4 carbon atoms, R′ is a straight chain alkyl of from about 14 to about 20 carbon atoms and R″ is hydrogen or R, with oleamide, the reaction being carried out by heating a mixture of from about 25% to about 75% by weight of phosphonate and from about 75% to about 25% by weight of oleamide at from about 50° C. to about 200° C. for a time sufficient to effect reaction.

2. The composition of claim 1 wherein R′ is a straight chain alkyl of 18 carbon atoms.

3. The composition of claim 2 wherein R is methyl and R″ is H.

4. The composition of claim 1 containing from about 0.01% to about 2% by weight of said product.

5. The composition of claim 1 wherein the reactant phosphonate and oleamide are present in the reaction mixture to the extent of 75% by weight and 25% by weight, respectively.

6. The composition of claim 1 wherein the lubricating oil is a mineral oil.

7. The composition of claim 1 wherein the lubricating oil is a synthetic lubricating oil.

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