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LUBRICANT WITH HIGH TEMPERATURE STABILITY

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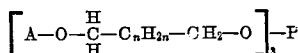
9 Claims. (Cl. 252—53)

The present invention relates to the art of lubrication and more specifically to lubricants with high temperature stability such as to make them desirable for use in automotive engine lubrication and otherwise where high temperature stability is required. The invention will be understood from the following description.

Mineral lubricating oils have been widely used as lubricants for many years, but within the last few years the severity of the conditions under which they are used has so greatly increased that in many cases unblended oils have proved to be wanting in certain properties and recourse has been had to improvement by the addition of blending agents to increase one or more desirable properties. The great majority of types of blending agents, however, have not been wholly satisfactory because while they may improve one particular property of the oil, they may equally well decrease its effectiveness in some other respect. Such agents as have been used are generally employed in specific types of equipment and there are no generally universal agents, or class of agents, which are good for all or even a majority of the conditions likely to be met.

Agents have now been found, however, which come closer to the ideal than any yet proposed in that they make an improvement in almost all of the desired properties of an oil for the lubrication of automotive engines. Thus, in an engine oil, the lubricant is preferably highly refined and this in itself ordinarily makes it more sensitive to oxidation and decomposition. To be satisfactory, the oil should have a low oxidation rate. It should be capable of carrying higher loads than the unblended oils, and give a clean engine especially in respect to piston rings, ring grooves and the like. It must also minimize or reduce deposition of carbon and the varnish like deposits which are frequently found in engines.

One class of agents which has proved to be highly satisfactory for use in engine oils is that of the phosphite esters having the following general formula:



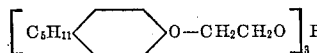
In this formula, A represents an aryl group which may be phenyl, naphthyl or similar cyclic groups. Such groups include alkylated aryl radicals such as cresyl, tolyl, xylyl or similar propyl-, butyl-, or amyl-phenyl radicals. These radicals may also contain hydroxyl groups. In the formula, n represents an integer, preferably 0, or a small number 1, 2 or 3.

The materials described above are added to mineral lubricating oils in proportion from .1 to about 1 or 2% by weight. They may be employed as the sole addition agents because they have excellent properties not only of oiliness but also for reducing oxidation, preventing ring sticking, reducing carbon deposition and the like, and they may be used in conjunction with other materials to further enhance these properties, for example, additional oxidation inhibitors of other types, sludge dispersers, pour inhibitors and the like. They may be used also in connection with metallic soaps, particularly those of aluminum, calcium, zinc, nickel, chromium and the like, for the particular purpose for which these materials are ordinarily used. The lubricating oil may be of any desired type useful for the particular purpose at hand, derived either from the paraffinic, asphaltic or naphthenic crudes, and the viscosity is chosen for the particular purpose. The present products may be used in greases, slushing compounds, semi-fluid lubricants and likewise in waxes and white oils.

The following examples of the present compounds may be considered illustrative of the invention:

Example I

A good grade of mineral lubricating oil was chosen as a blank in the above test and $\frac{1}{4}\%$ of B-amyl phenoxyethyl phosphite



was added thereto. This material was freely soluble and did not change the appearance of the oil in any way. The original oil and the blend were then tested to determine their oxidation rates by blowing with a definite quantity of oxygen at a definite rate and measuring the amount of oxygen absorbed by difference at 15 minute intervals. Temperature during the test was held at 200° C.

Sample	Oxidation rate
Blank.....	82-60-48
Blank+addition agent	15-17-19-21

The products were also submitted to a test on the Almen machine for load carrying ability. The unblended oil failed at a load of about 4 weights while the blended oil carried the full 15 weights called for by the test. In both of these tests the loading was gradual. When the blended

oil was submitted to the same test under shock load conditions, which are necessarily much more severe, it was found to be able to carry 7 weights.

Example II

An engine test was then run on two oil samples similar to those described above and an additional test was run on a sample of the oil containing triamylphenyl phosphite, to show a direct comparison between the simple aryl phosphite and the corresponding material containing the additional oxy group and to show the effect of this particular modification. The tests were in every way comparable and were conducted on the C. F. R. engine. The test was run for 14 hours and at the end of each test the engine was taken down completely and carefully inspected. The vulnerable portions of the engine were then rated and assigned definite numerical demerit numbers depending on their condition as found. Thus each piece of the engine was compared with the corresponding piece when the other oil samples were used and a comparison was thus obtained between each specific type of material and for each possible failure or fault. In addition to the above, the various demerits were then added together and these afforded a composite rating of the entire engine condition with the three different samples. The three oils are identified as follows:

Sample I—Unblended hydrocarbon oil

Sample II—Same + $\frac{1}{4}\%$ $\left(\text{C}_5\text{H}_{11} \text{---} \text{C}_6\text{H}_4 \text{---} \text{O} \text{C}_2\text{H}_4\text{O} \right)_3\text{P}$

Sample III—Same + $\frac{1}{4}\%$ $\left(\text{C}_5\text{H}_{11} \text{---} \text{C}_6\text{H}_4 \text{---} \text{O} \right)_3\text{P}$

The data gathered in the tests are given in the following table, but it should be remembered that in all cases the lower numbers indicate the better performance:

Sample	Piston overall	Rings stuck	Degree sticking	Ring slits	Ring grooves	Carbon under piston	Varnish skirt	Carbon formed
I.....	4.81	3	810	7.33	6.00	4.5	5	7.35
II.....	1.30	0	0	1.00	3.00	3	2	1.11
III.....	2.47	1	90	4.83	3.50	4	4	3.30

Thus it appears that the phosphite addition agent containing ether oxygen is markedly superior to the unblended oil as well as to the oil containing the simple phosphite ester. The general engine condition reflected in the first column of the table is greatly superior. The piston condition is likewise better. Less carbon is formed and

most notably the rings, grooves and slits are completely free while in the other tests considerable sticking occurred. There was likewise an improvement in the amount of varnish on the piston skirt and a considerable decrease in the amount of carbon formed. There could be no doubt of the superiority of the particular addition agent claimed herein.

The present invention is not to be limited by any theory of the mechanism by which the addition agent effects the improvement nor to any particular addition agent, but only to the following claims in which it is desired to claim all novelty inherent in the invention.

We claim:

1. Composition of matter comprising a hydrocarbon of low volatility and between 0.1% and 2% by weight of a phosphite ester of the following formula:



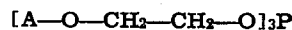
in which A is an aryl radical and n is an integer including zero.

2. Product according to claim 1 in which A is an aryl hydrocarbon radical.

3. Product according to claim 1 in which A is a monocyclic aromatic radical.

4. Product according to claim 1 in which A is a phenyl radical.

5. Composition of matter comprising a mineral lubricating oil and between 0.1% and 2% by weight of a phosphite ester of the following formula:



where A is an aryl radical.

6. Product according to claim 5 in which A is a monocyclic radical.

7. Product according to claim 5 in which A is an aromatic radical.

8. Product according to claim 5 in which A is an alkylated monocyclic aromatic radical.

9. Composition comprising a mineral lubricating oil and a small quantity of betaamyl phenoxy ethyl phosphite.

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