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OXIDATION INHIBITED MINERAL OIL

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6 Claims. (Cl. 252—52)

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This invention relates to mineral oil inhibited against oxidative deterioration, and more particularly to mineral oil containing an oxidation inhibitor effective to inhibit oxidative deterioration under servere temperature conditions of use.

When mineral oil distillates are used as lubricants, they are generally subjected to elevated temperatures and to oxidation conditions tending to cause deterioration of the oil through formation of acidic oxidation products and sludge, and through discoloration of the oil. In order to inhibit such deterioration, it is customary practice to incorporate with the oil small amounts of chemical compounds having the desired inhibiting effect.

Many oxidation inhibitors have been proposed for lubricating oil. Among the best such inhibitors that have been proposed are certain alkylated phenols, particularly tertiary butyl-substituted phenols such as 2,6-ditertiary butyl-4-methyl phenol. Such alkylated phenols are generally effective to inhibit oxidative deterioration of lubricating oil under ordinary conditions of use.

Certain types of lubricating oil, however, are used under unusually severe temperature conditions, e. g. 250–450° F.; and oxidation inhibitors which are suitable at ordinary temperature conditions of use, e. g. 100–250° F., are frequently much less effective and therefore unsuitable when used in such lubricating oil under such severe temperature conditions.

Lubricating oil suitable for use under severe temperature conditions is required to have certain general specifications. For example, it must have relatively high flash point (A. S. T. M. D92–46), e. g. 350° F. or above, and preferably above the highest temperature to which the oil is to be subjected; otherwise the oil will be too volatile for effective use under severe temperature conditions.

Lubricating oil for certain specific applications involving severe temperature conditions must have additional specifications. For example, lubricating oil for use in automotive fluid couplings, where temperatures of about 400° F. must be withstood, are generally required to have an S. U. viscosity at 100° F. within the approximate range 170–190, and S. U. viscosity at 210° F. not substantially less than 45. The present invention relates to the inhibition against oxidation of such lubricating oil and other lubricating oil suitable for use under severe temperature conditions.

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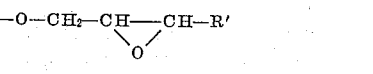
I have discovered that compounds having the formula



where R is an aryl radical and R′ is selected from the group consisting of hydrogen, methyl, and ethyl radicals, are effective oxidation inhibitors for lubricating oil used under severe temperature conditions.

Oxidation inhibitors for use according to the invention should be substantially non-volatile at the temperature at which the oil is used, i. e. they should have normal boiling points higher than the temperature of use of the oil. Phenoxy propylene oxide (1,2-epoxy-3-phenoxy propane, boiling point 452° F.) is an additive compound according to the invention which has high enough boiling point for severe temperature uses ordinarily encountered. Phenoxy propylene oxide is particularly advantageous for use according to the invention; for although phenoxy propylene oxide, as an oxidation inhibitor for oil under ordinary temperature conditions of use, is inferior to at least one widely used alkylated phenol oxidation inhibitor of the prior art, it has been found that on the other hand phenoxy propylene oxide is distinctly superior to that same alkylated phenol oxidation inhibitor as an inhibitor for oil under severe temperature conditions of use.

The amount of additive compound according to the invention used in a given amount of lubricating oil will vary according to the degree of oxidation inhibition desired. Generally, satisfactory results are obtained with 0.01–2.00 weight percent of additive.

The following example illustrates the invention:

The oil tested in this example was a solvent-refined, dewaxed, acid-treated, and clay-treated distillate from mixed-base crude petroleum, the distillate having an S. U. viscosity at 100° F. of about 185 and a viscosity index of about 90. Two samples of this oil were tested for oxidation stability under severe temperature conditions by subjecting each to a temperature of 490° F. in an oven for 125 hours, air being passed through the sample during this period at the rate of two bubbles per second. Before and after the oxidation period, the amount of naphtha-insoluble material in each sample and the S. U. viscosity at 210° F. of each sample were determined.

Sample No. 1 contained one weight percent of 2,6-ditertiary butyl-4-methyl phenol as oxidation inhibitor, and Sample No. 2 contained one weight

percent of phenoxy propylene oxide as oxidation inhibitor. The following table shows the increase in naphtha-insoluble content and in 210° F. viscosity for each sample during the oxidation period.

Sample No.	Percent Increase in Naphtha-Insoluble Materials	Percent Increase in S. U. Viscosity at 210° F.
1	1.3	78
2	0.3	60

The above results show that lubricating oil inhibited with 2,6-ditertiary butyl-4-methyl phenol undergoes greater oxidative deterioration under severe temperature conditions than does the same oil inhibited with phenoxy propylene oxide.

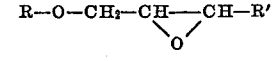
On the other hand, lubricating oil inhibited with 2,6-ditertiary butyl-4-methyl phenol generally undergoes less oxidative deterioration under ordinary temperature conditions of use than does the same oil inhibited with phenoxy propylene oxide. For example, an oil having properties generally like those of the oil tested in the example above, but having S. U. viscosity at 100° F. of about 160, was found to be more stable in the turbine oil oxidation stability test (A. S. T. M. D943–47T), which is conducted at 203° F., when inhibited with 2,6 - ditertiary butyl-4-methyl phenol than when inhibited with phenoxy propylene oxide.

Thus, it is seen that the effectiveness of lubricating oil oxidation inhibitors depends on the conditions to which the oil is subjected during use, and that phenoxy propylene oxide gives superior results in oil used under severe temperature conditions, as compared with a prior art oxidation inhibitor, such as 2,6-ditertiary butyl-4-methyl phenol.

Although, in the preceding example a phenoxy epoxy propane is used as an example of the additive employed, similar results may be obtained when other additive compounds within the scope of the invention are used. Such compounds may be prepared by any suitable method, e. g., by reacting at about 100° C. an excess of an epoxy chloro alkane such as epichlorohydrin, or 1-chloro-2,3-epoxy butane, etc. with an aqueous solution of an alkali metal salt of phenol or other aryl hydroxy compound such as cresol, methyl isopropyl phenol, bromophenol, nitrophenol, naphthol, etc.

I claim:

1. A lubricating composition comprising: a major proportion of mineral lubricating oil suitable for use under severe temperature conditions; and a minor proportion constituting an oxidation inhibiting quantity of a compound having the formula



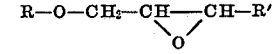
where R is an aryl radical and R′ is selected from the group consisting of hydrogen and methyl and ethyl radicals.

2. Composition according to claim 1 wherein said oil has a flash point of at least about 350° F.

3. Composition according to claim 1 wherein the weight percent of said aroxy epoxy alkane in the composition is about 0.01–2.00%.

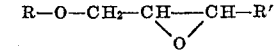
4. Composition according to claim 1 wherein said aroxy epoxy alkane is 1,2-epoxy-3-phenoxy propane.

5. The method of lubricating metal parts which comprises: contacting such parts with mineral lubricating oil at a temperature in the range from 250° F. to 450° F., said oil containing a minor proportion constituting an oxidation inhibiting quantity of a compound having the formula



where R is an aryl radical and R′ is selected from the group consisting of hydrogen and methyl and ethyl radicals.

6. A composition consisting essentially of a major proportion of mineral lubricating oil and a minor proportion constituting an oxidation inhibiting quantity of a compound having the formula



where R is an aryl radical and R′ is selected from the group consisting of hydrogen and methyl and ethyl radicals.

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