RUST INHIBITING LUBRICATING OIL COMPOSITIONS

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1 Claim. (Cl. 252—32.5)

This invention relates to rust inhibiting lubricating oil compositions, and more particularly to lubricating oil compositions of this kind which contain small concentrations of each of (a) a dimer acid derived from an unsaturated fatty acid containing from 6 to 22 carbon atoms and from 2 to 3 ethylenic linkages per molecule, and (b) an alkyl ammonium dialkyl orthophosphate.

Commercial lubricating oils, particularly those which are required to function in the presence of water, such as turbine oils and paper machinery lubricating oils, should possess rust inhibiting characteristics not only while fresh, but also after aging or long periods of service, i.e., after prolonged contact of the oil with oxygen at high, oxidizing temperatures.

Dimerized unsaturated fatty acids, or dimer acids, are only moderately effective as rust inhibitors in "fresh" lubricating oils, i.e., lubricating oils which have not been aged in the manner indicated. Quite surprisingly, in view of the relative ineffectiveness of dimer acids as rust inhibitors in fresh lubricating oils, we have found that dimer acids are highly effective rust inhibitors in aged lubricating oils.

Since many known rust inhibitors are effective only in fresh oils and are incapable of providing the necessary protection to aged lubricating oils, except perhaps in very high concentrations, the discovery of the rust inhibiting characteristics of dimer acids in aged lubricating oils is important. Nevertheless, the use of dimer acids to impart rust inhibiting properties to commercial lubricating oils while fresh and after aging is somewhat impractical, since undesirably large concentrations of the dimer acids are required to achieve this objective.

We have found that lubricating oil compositions possessing rust preventive properties both while fresh and after aging can be obtained with the use of small, practical additive concentrations by incorporating in the base oil minute amounts of a combination of a dimer acid and an alkyl ammonium dialkyl orthophosphate. The invention specifically includes lubricating oils containing from 0.005 to 0.1 percent by weight of the composition of each of (a) a dimer acid derived from an unsaturated fatty acid containing from 6 to 22 carbon atoms and from 2 to 3 ethylenic linkages per molecule, and (b) an alkyl ammonium dialkyl orthophosphate whose N-alkyl group contains from 7 to 18 carbon atoms, and whose remaining alkyl groups contain from 3 to 10 carbon atoms. In a preferred embodiment, the rust preventive lubricating oil contains the concentrations indicated above of (a) a dimer of linoleic acid, and (b) lauryl ammonium, 3-methylbutyl, 2-ethylhexyl orthophosphate.

Commercial lubricating oils often contain, in addition to rust inhibitors, anti-oxidants, such as 2,6-di-t-butyl-4-methylphenol, silicone foam inhibitors, pour point depressors, viscosity and viscosity index improvers, detergents, dyes, sludge inhibitors, and the like. Such improvement agents may be used without detriment in conjunction with the rust inhibitors of the herein disclosed lubricating oil compositions, and the use of such improvement agents is specifically included by the invention.

Lubricating oils which form suitable base oils for the herein disclosed oil compositions include lubricating oils not only of the paraffinic type but also of the naphthenic type, which oils may have been refined by solvent treatment, acid treatment, aluminum chloride treatment, or other conventional refining treatments. The invention is especially valuable in connection with highly refined paraffinic lubricating oils such as are obtained, for example, by aluminum chloride treatment of paraffinic lubricating distillates.

Briefly, the dimer acids utilized in the invention are dimers, i.e., bimolecular addition products of conjugated or unconjugated dienoic or trienoic fatty acids containing from 6 to 22 carbon atoms prior to dimerization. Dimeric acids derived from dienoic and trienoic fatty acids are known and can be prepared by conventional methods which form no part of this invention.

More particularly, dimerized acids included by this invention are prepared from di- or trienoic fatty acids having the generic formula $\text{C}_n\text{H}_{2n-2}\text{C}=$COOH, where $n$ is an integer of from 5 to 21 and $x$ is 3 or 5. As will be evident, such monomeric acids contain from 6 to 22 carbon atoms and contain 2 or 3 ethylenic linkages as the ratio of carbon to hydrogen increases, i.e., as $x$ increases from 3 to 5.

Dimerized acids corresponding to the bimolecular addition products of the foregoing monomeric acids include those represented by the generic formula:

\[
\begin{align*}
\text{O} & -\text{H} \\
\text{CH}_2\text{CH} & -\text{CH}_2 \text{CH} \\
\text{X} & -\text{H} \\
\text{C} & =\text{C} \text{H}_2 \text{CH}\text{CH}_2 \text{CH} \\
\text{X} & -\text{H} \\
\text{O} & -\text{H}
\end{align*}
\]

where $x$ is an integer of from 10 to 42 and where $x$ is an even integer of from 6 to 10. The dimer acids are therefore dibasic or dicarboxylic acids having from 12 to 44 carbon atoms.

Representative members of the class of dimerized acids included by this invention are dimers of dienoic acids such as sorbic (hexadienoic), linoleic (octadecadienoic), humeric (nonadecadienoic), and eicosic (eicosadienoic) acids. Representative of dimeric acids derived from trienoic acids are dimers of linolenic and eicosatrienoic (octadecatrienoic) acids. Dimer acids derived from dienoic and trienoic acids containing from 16 to 22 carbon atoms, and especially those containing 18 carbon atoms and those containing conjugated ethylenic linkages, are preferred for reasons of economy of manufacture and the general excellence of compounded lubricating oils containing such acids.

It is not necessary that the unsaturated fatty acid molecules of the bimolecular addition product be identical. Dimers of mixed composition such as can be obtained by dimerizing mixed dienoic, mixed trienoic, or mixed dienoic and trienoic acids such as may be derived from certain naturally occurring oils, e.g., linseed oil and soybean oil, are satisfactory.

The alkyl ammonium dialkyl orthophosphates included by this invention are approximately neutral, oil-soluble addition salts of primary amines and dialkyl esters of orthophosphoric acid. Thus, the present invention in-
cludes amine salts represented by the following generic formula:

$$\text{R}_1 \text{R}_2 \text{N}^+ \text{R}_3 \text{O}^- \text{R}_4$$

where \( \text{R} \) is a straight, or branched chain, alkyl radical containing from 8 to 18 carbon atoms, and the \( \text{R}_1 \) substituents are alkyl radicals containing from 3 to 10 carbon atoms.

Salts of the above-described class are formed by neutralizing the selected dialky] ester of orthophosphoric acid with substantially equimolar proportions of a primary, secondary or tertiary alkyl amine, the pH of the resulting reaction product being adjusted to a value of between 5.5 and 7.5. The neutralization reaction normally takes place spontaneously at room temperature, sometimes with the evolution of heat. However, additional heat may in some instances be desirable in order to complete the reaction. This reaction should not be allowed to exceed substantially the boiling point of water, and preferably it should be kept below 180° F. in order to avoid appreciable decomposition of the alkyl amine salt reaction product. The reaction is normally complete in less than 30 minutes.

Representative examples of specific alkyl ammonium dialky] orthophosphates included by the invention are octyl, decyl, dodecyl, tetradecyl and octadecyl ammonium dipropyl, di-n-amyl, diisoamyl, di-n-octyl, diisoctyl, isoamyl, isoocetyl and di-n-capryl orthophosphates.

The test procedure for this invention may be added to the lubricating oil base in either order or simultaneously, either per se, or in the form of mineral oil concentrates. The latter practice is sometimes desirable in order to facilitate compounding of the lubricating oil.

As indicated, each of the rust inhibitors included by this invention may be employed in the lubricating oil composition in an amount ranging from 0.005 to 0.1 percent by weight of the composition. Desirably the respective rust inhibitors are utilized in the composition in a weight ratio of between about 1:3 to about 3:1.

Concentrations of the herein disclosed rust inhibitors within the foregoing range are sufficient to impart outstanding corrosion inhibiting properties to lubricating oil compositions both in a fresh condition and after extensive periods of aging during service. Of course, the relative required concentrations of each individual inhibitor may vary somewhat, both according to the nature of the base oil and according to the conditions to which the oil is subjected. It is an important advantage of the invention that rust inhibiting characteristics may be imparted to the oil in both fresh and aged condition with the use of a lower concentration of dimer acid, and with the use of a lower total rust inhibitor concentration, than the dimer acid concentration normally required to produce these results. Moreover, since the dimer acid contributes to rust inhibition in the fresh oil, the concentration of the orthophosphate in the composition may also be below that normally required to impart rust inhibiting properties to the fresh oil.

The rust preventive properties of lubricating oil compositions compounded in accordance with the present invention have been demonstrated, both before and after aging of the oil, by subjecting said lubricating oil compositions to the standard ASTM distillate water corrosion test D 665-52 T and to the procedure of ASTM test D 943-47 T, and by comparing the effectiveness of the oils so tested with similarly tested lubricating oils of different composition.

The foregoing standard tests are described in detail in the ASTM Standards of Petroleum Products and Lubri-
similar advantages, can be compounded, using other additive combinations selected from the disclosed classes.

It is understood that many modifications of the herein disclosed invention may be resorted to without departing from the spirit or scope thereof. Accordingly, we intend to be limited only by the scope of the claim appended hereto.

We claim:

A composition comprising a major amount of a mineral lubricating oil, and about 0.024 percent by weight of the composition of dimerized linoleic acid, and about 0.016 percent by weight of the composition of a salt of a primary alkyl amine containing 8 to 18 carbon atoms per molecule and 3-methylbutyl, 2-ethylhexyl orthophosphate.

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