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FILTER AID FOR PREPARING DISPERSIONS IN LUBRICATING OIL

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9 Claims. (Cl. 252—33.4)

The present invention relates to a process of improving filtration in the preparation of lubricating oil compositions having improved acid neutralizing characteristics. Lubricating oil compositions prepared by the process herein are particularly useful in neutralizing acids formed in internal combustion engines by oxidation.

This application is a continuation-in-part of application Serial No. 261,919, filed December 15, 1951, now abandoned.

During normal operation of internal combustion engines, acids are formed in the lubricating oil itself and in the combustion chamber. The acids formed in the lubricating oil itself are normally caused by oxidation of the lubricating oil during engine operation. The resulting organic acids and peroxides break down the lubricating oil and contribute to wear by corrosion. The combustion chamber acids normally come from the combustion products of the fuel. For example, when high sulfur fuels are used in diesel engines, sulfuric acid is formed from the sulfur. This sulfuric acid finds its way into the crankcase along with the blow-by gases.

Large amounts of detergents are being incorporated in lubricating oil compositions for use as dispersing agents, and a portion of these detergents are incidentally used as neutralizing agents for these acids. For example, calcium cetyl phenate is incorporated into a lubricating oil composition primarily to serve as a detergent. However, a portion of this calcium cetyl phenate reacts with the sulfuric acid formed from high sulfur fuels to form calcium sulfate, neutralizing the effect of the acids, and removing part of the detergent from its intended purpose.

Rather than use relatively expensive organic compounds to neutralize the acids formed during the operation of an engine, it would be more practical to use other less expensive materials for this purpose. Likewise, it is more economical to use a detergent in a lubricating oil composition primarily for its intended purpose than for the purpose of neutralizing acids. Furthermore, the other materials described hereinbelow which can be used to neutralize acids in lubricating oils will neutralize larger amounts of acids per unit weight than the organic detergents.

As taught by Lindstrom and Woodruff in United States Patent No. 2,676,925, lubricating oils having acid-neutralizing characteristics are obtained by dissolving (or dispersing) alkaline earth metal oxides and hydroxides in dihydric alcohols. The dihydric alcohol solutions (or dispersions) are then thoroughly blended with lubricating oils containing dispersants (e. g., polyvalent metal sulfonates), and the resulting composition is filtered.

Because of what appears to be a gel formation, the filtration rate in the Lindstrom-Woodruff process oftentimes is slow and cumbersome, requiring considerable time. It is therefore a primary object of this invention to set forth a means of improving this filtration rate.

It is another object of this invention to provide a method for inhibiting the formation of a gel prior to the

filtration of dispersions of metal oxides and hydroxides in lubricating oils.

It is a further object of this invention to set forth a method for facilitating the filtration of dispersions of polyvalent metal oxides and hydroxides in lubricating oils when said dispersions are prepared by the use of dihydric alcohols.

These and other objects of this invention will be apparent from the ensuing description and the appended claims.

According to the present invention, applicant has discovered that the filtration step in the process of preparing lubricating oil compositions having unexpectedly high acid neutralizing characteristics can be facilitated by the use of a filtering agent; that is, by the use of an alkyl phenol (or the calcium salt thereof).

In the formation of the lubricating oil compositions herein, metal oxides and hydroxides are used as initial reactants. Thus, the lubricating oil compositions of this invention are prepared by dissolving an alkaline earth metal base (i. e., an oxide or hydroxide) in a dihydric alcohol (e. g., ethylene glycol). This solution is then incorporated into a lubricating oil containing an oil-soluble alkaline earth metal dispersant (e. g., an alkaline earth metal sulfonate) and a filtering agent (e. g., an alkyl phenol or a calcium salt thereof), after which the mixture is heated to remove the free dihydric alcohol, and filtered, forming a clear, filterable lubricating oil composition. These lubricating oil compositions contain dispersions of alkaline earth metal materials which behave in a manner similar to metal oxides and hydroxides.

However, although the metal oxides or hydroxides are the initial reactants, the dihydric alcohol (i. e., an alkylene glycol) is believed to combine therewith to form an alkaline earth metal material which seems to be an alkaline earth metal basic salt. Thus, as used herein, the alkaline earth metal material, i. e., the basic salt, means the product resulting from the reaction of the alkaline earth metal base and the dihydric alcohol. This alkaline earth metal material also can be described as a glycoxide or a glycolated metal base. (The noted reaction is described in "Organic Reagents in Inorganic Analysis," by Ibert Mellan, pages 304, published by Blakiston Publishing Co., 1941.) For ease of describing the present invention, the term "glycoxides" will be used herein as meaning the reaction product of alkaline earth metal oxides (or hydroxides) and dihydric alcohols.

Alkyl phenols which are used according to this invention to facilitate filtration in the preparation of dispersions of alkaline earth metal glycoxides in lubricating oils are alkyl phenols containing no more than three alkyl groups on the benzene nucleus, each alkyl group containing from 4–30 carbon atoms. It is preferred to use an alkyl phenol containing one alkyl group, which alkyl group contains from 12 to 18 carbon atoms.

Examples of alkyl phenols which may be used according to this invention to facilitate the filtration of dispersions of polyvalent metal oxides and hydroxides in lubricating oils include: butyl phenol, amyl phenol, hexyl phenol, octyl phenol, decyl phenol, dodecyl phenol, tetradecyl phenol, octadecyl phenol, hexadecyl phenol, di-butyl phenol, di-octyl phenol, di-hexadecyl phenol, di-octadecyl phenol, tri-butyl phenol, tri-octadecyl phenol, eicosane phenol, triacontyl phenol, and alkyl phenols wherein the alkyl groups are derived from alkylene polymers, etc.

The amount of alkyl phenols used to increase the filtration rate depends on the amount of alkaline earth metal glycoxides dispersed in the lubricating oils. The mol ratio of alkyl phenol (or the calcium salts thereof) to the alkaline earth metal oxide (or hydroxide) initially added to

the dihydric alcohol can vary from about 0.1 to about 1.5. It is preferred that the mol ratio of alkyl phenol (or the calcium salts thereof) to the alkaline earth metal oxide (or hydroxide) have a value in the range of 0.50 to 1.0.

Lubricating oils which are useful as base oils in the process herein include a wide variety of lubricating oils such as oils which can be manufactured by solvent treating, acid treating, etc., various crude oils, such as paraffinic, naphthenic, or mixed base crude oils, or such as those which can be obtained by synthesis (e. g., the Fischer-Tropsch process). Lubricating oils also include those derived from coal products and synthetic oils, e. g., alkylene polymers (such as polymers of propylene, butylene, etc., and mixtures thereof), alkylene oxide type polymers, dicarboxylic acid esters and liquid esters of acids of phosphorus. Synthetic oils of the alkylene oxide type polymer which may be used include those exemplified by alkylene oxide polymers (e. g., propylene oxide polymers) and derivatives, including alkylene oxide polymers prepared by polymerizing alkylene oxides (e. g., propylene oxide) in the presence of water or alcohols, e. g., ethyl alcohol, and esters of alkylene oxide type polymers, e. g., acetylated propylene oxide polymers prepared by acetylating the propylene oxide polymers containing hydroxyl groups.

Dispersants which can be used in the process according to this invention include the metal sulfonates exemplified as follows: calcium white oil benzene sulfonate, barium white oil benzene sulfonate, magnesium white oil benzene sulfonate, calcium dipolypropene benzene sulfonate, barium dipolypropene benzene sulfonate, magnesium dipolypropene benzene sulfonate, calcium mahogany petroleum sulfonate, barium mahogany petroleum sulfonate, magnesium mahogany petroleum sulfonate, calcium triacontyl sulfonate, magnesium triacontyl sulfonate, calcium lauryl sulfonate, barium lauryl sulfonate, magnesium lauryl sulfonate, etc.

The dispersants can be used in amounts of about 0.1% to 10%, by weight, of said finished composition. However, it is preferred to use from about 0.3% to about 2.0%, by weight, because lubricating oil compositions containing these amounts markedly improve the over-all rating of an engine.

Expressed in millimols per kilogram of final lubricating oil composition, the dispersants can be used in amounts of about 1 millimol per kilogram to about 110 millimols per kilogram, with a preferred range of about 3 millimols per kilogram to about 20 millimols per kilogram.

The dihydric alcohols used in obtaining the lubricating oil composition of this invention are glycols containing less than 5 carbon atoms; in particular, these glycols include vicinal-alkane diols having less than 5 carbon atoms. Suitable dihydric alcohols include, for example, ethylene glycol, propane diol-1,2; butane diol-2,3; butane diol-1,2; etc. Ethylene glycol is preferred, because thereby, greater amounts of metal base are incorporated in the lubricating oil compositions.

The amount of dihydric alcohols used will depend in part upon the dihydric alcohol itself and, as noted hereinabove, on the alkaline earth metal oxides or hydroxides which are used in the preparation of dispersions of the alkaline earth metal glycoxide. In general, the use of a low molecular weight dihydric alcohol (e. g., ethylene glycol) results in obtaining a greater amount of the basic materials dispersed in the lubricating oil than the use of a higher molecular weight dihydric alcohol (e. g., propylene glycol), when both are used in the same amounts by weight. It is preferred to select a dihydric alcohol in which the dispersants and the alkaline earth metal oxides or hydroxides have the greatest solubility. In the formation of solutions of alkaline earth metal basic materials in glycols, it is beneficial to use certain ratios by weight of the dihydric alcohol to the alkaline earth metal oxide or hydroxide. These ratios may vary from about 50:1 to about 2:1, 30:1 to about 10:1 being preferred.

The amount of alkaline earth metal basic materials (i. e., the alkaline earth metal glycoxides) which are dispersible in the lubricating oil compositions herein is dependent on the amount of dispersant which is present. Normally, one part by weight of a dispersant can stably disperse as much as 0.2 part or more by weight of the alkaline earth metal basic materials. For example, one part by weight of an alkaline earth metal mahogany petroleum sulfonate can stably disperse 0.2 part by weight of an alkaline earth metal basic material. Expressed otherwise, one mol of an alkaline earth metal mahogany petroleum sulfonate can stably disperse at least 1.75 mols of an alkaline earth metal basic material. Thus, the alkaline earth metal basic materials and dispersants are present in the lubricating oil compositions in such amounts that the basic material/dispersant mol ratios have values of at least 1.75, and as high as 4.0; preferably from about 2.0 to about 3.0.

In terms of the alkaline earth metal oxides and hydroxides which are initially incorporated into the lubricating oil compositions, the amounts of these oxides and hydroxides can vary from about 0.22% to about 7.0%, by weight.

The metal of the dispersant may be the same as the metal of the basic material dispersed; or the metal of the dispersant may be different from the metal of the basic material dispersed. For example, a calcium sulfonate may be used in a lubricating oil composition to stabilize a dispersion of a barium basic material, or a calcium sulfonate may be used in a lubricating oil composition to stabilize a dispersion of a calcium basic material.

Alkaline earth metal basic materials are dispersed in lubricating oil compositions in accordance with this invention by heating a mixture of a dispersant, an alkaline earth polyvalent metal oxide and/or hydroxide, a dihydric alcohol, and an alkyl phenol (or the calcium salt thereof) in the lubricating oil to a temperature of about 175° F. to about 400° F. (250° F. to 350° F. being preferred) for a period of time sufficient to promote the reaction between the alkaline earth metal oxide or hydroxide and the dihydric alcohol, to disperse the metal basic material in the lubricating oil composition, and to remove substantially all of the remaining apparently unreacted dihydric alcohol, after which the mixture is filtered to remove any apparently unreacted alkaline earth metal oxide or hydroxide. The filtration agent (i. e., alkyl phenol or the calcium salt thereof) may be incorporated into the lubricating oil composition any time prior to the filtration step.

Although no theory is set forth to explain the phenomenon of this invention, it is believed that the agents used as filtration aids inhibit the formation of gel-like substances which slow down the filtration rate. The method set forth herein can be used whenever filtration is impeded by gel-like substances resulting from dispersions of alkaline earth metal glycoxides in lubricating oils.

The examples hereinbelow illustrate the effectiveness of alkyl phenols in increasing the filtration rate during the preparation of dispersions of alkaline earth metal glycoxides in lubricating oils. The dispersion in oil was filtered as follows: An 11 cm. Buchner funnel was set in a filter flask, a filter paper inserted, and 25 g. of Celite spread as evenly as possible over the paper. A vacuum was then applied to the filter flask so that the absolute pressure within the flask was maintained at about 300 mm. of mercury.

In the absence of an alkyl phenol as an aid to filtration, only a few drops of a dispersion of calcium glycoxide in mineral oil could be obtained in the filter flask. Even a constant scraping of the Celite surface did not assist in any further filtration.

Example 1.—High molecular weight alkyl phenol as filtration aid

A mixture of 10 grams of calcium hydroxide and 171 grams of glycol was allowed to blend together over a period of 1 hour. To this mixture was added 48.5 grams of an alkyl phenol having a molecular weight of 340 (the alkyl radical being derived from propylene polymers) and 104 grams of a California solvent-refined paraffin base mineral oil solution of calcium mahogany petroleum sulfonate (the oil solution contained 1.65% calcium). The whole mixture was heated to a temperature of 400° F. at an absolute pressure of 50 mm. of mercury to remove the ethylene glycol. The filtered mineral oil dispersion contained 4.44% calcium, showing 2.79% more calcium in the mineral oil than before. No difficulty was experienced in filtering the reaction mixture.

Example 2.—High molecular weight alkyl phenol as filtration aid

A mixture of 10 grams of calcium hydroxide and 171 grams of ethylene glycol was agitated by vigorous stirring over a period of 1 hour. To this mixture was added 22 grams of the same alkyl phenol of Example 1 and 104 grams of a California solvent-refined paraffin base mineral oil solution of a mahogany petroleum sulfonate. The oil solution contained 1.65% calcium. The whole reaction mixture was heated to a temperature of 400° F. at 50 mm. of mercury absolute pressure to remove the ethylene glycol. Although the viscosity of the resulting mixture was quite high, the mixture filtered well. The filtered mineral oil solution contained 4.51% calcium, showing 2.86% more calcium than before.

Example 3.—Di-tetradecyl phenol as filtration aid

A mixture of 7.8 grams of calcium hydroxide and 127 grams of ethylene glycol was thoroughly agitated. To the resulting solution was added 77.3 grams of a California solvent-refined paraffin base mineral oil solution of calcium mahogany petroleum sulfonate (the oil solution had a calcium content of 1.64%) and 45 grams of di-tetradecyl phenol having a molecular weight of 475. (The alkyl group on this phenol was derived from propylene polymers having an average of 14 carbon atoms per alkyl group.) The reaction mixture was heated to a temperature of 400° F. at an absolute pressure of 50 mm. of mercury to remove the ethylene glycol, after which the reaction mixture was filtered and 75 grams of the filtered product were obtained in 30 minutes by slowly scraping the Celite surface. The mineral oil solution had a calcium content of 3.83%, showing the presence of 2.19% more calcium than before.

Example 4.—p-Tertiary amyl phenol as filtration aid

A mixture of 10.5 grams of calcium hydroxide and 164 grams of ethylene glycol was thoroughly agitated together, after which was added a solution of 20.2 grams of p-tertiary amyl phenol in 40 grams of a California solvent-refined base oil having a viscosity of 356 SSU at 100° F. To this whole mixture was added 140 grams of a California solvent-refined paraffin-base mineral oil solution of calcium mahogany petroleum sulfonate. (This mineral oil solution contained 1.17% calcium.) After the ethylene glycol had been removed by heating to 400° F. at an absolute pressure of 50 mm. of mercury, the reaction mixture was filtered. The filtration was rapid, 120 grams of the filtered calcium hydroxide dispersion in mineral oil being obtained in a period of 2.5 minutes. There was no need to scrape the Celite surface. The filtered mineral oil solution contained 3.76% calcium, which was 2.59% more calcium than the initial mineral oil solution of calcium mahogany petroleum sulfonate.

Numerous variations of the method presented here may be employed in preparing the dispersions of this invention. For example, the polyvalent metal oxides or hydroxides may be blended with the dispersants in the lubricating oil containing the filtration agent prior to being mixed with the dihydric alcohol; or the dihydric alcohol, the dispersant, and the filtration agent may be blended together first, or all of the ingredients may be blended together at once. It is preferred to mix the dihydric alcohols and the metal oxides or hydroxides first to obtain a colloidal dispersion or solution of the metal oxides or hydroxides in the polyhydric alcohols before mixing with the lubricating oil, dispersant, and filtration agent.

I claim:

1. In the process of preparing dispersions of alkaline earth metal glycoxides in lubricating oils by forming an admixture of a lubricating oil, a dihydric alcohol containing less than 5 carbon atoms, from 0.02% to 7.0%, by weight, based on the oxide, of an inorganic substance selected from the group consisting of alkaline earth metal oxides and hydroxides, and from 0.1% to 10% by weight of an alkaline earth metal sulfonate, heating said admixture to a temperature in the range of about 175° F. to about 400° F., removing unreacted dihydric alcohol by distillation, and filtering said admixture, the improvement comprising blending into said lubricating oil composition prior to filtration, an alkyl phenol having no more than three alkyl groups attached to the benzene nucleus, each alkyl group containing from 4 to 30 carbon atoms, and wherein the mole ratio of said alkyl phenol to said inorganic substance has a value from about 0.1 to about 1.5, wherein the weight ratio of dihydric alcohol to said inorganic substance is from 30:1 to 10:1, and wherein the mole ratio of said metal inorganic substance to said sulfonate has a value from about 1.75 to about 4.0.

2. In the process of preparing dispersions of alkaline earth metal glycoxides in lubricating oils by forming an admixture of a lubricating oil, a dihydric alcohol containing less than 5 carbon atoms, from 0.02% to 7.0%, by weight, based on the oxide, of an inorganic substance selected from the group consisting of alkaline earth metal oxides and hydroxides, and from 0.1% to 10% by weight of an alkaline earth metal sulfonate, heating said admixture to a temperature in the range of about 175° F. to about 400° F., removing unreacted dihydric alcohol by distillation, and filtering said admixture, the improvement comprising blending into said lubricating oil composition prior to filtraton, an alkyl phenol having no more than three alkyl groups attached to the benzene nucleus, each alkyl group containing from 12 to 18 carbon atoms, and wherein the mole ratio of said alkyl phenol to said inorganic substance has a value from about 0.1 to about 1.5, wherein the weight ratio of dihydric alcohol to said inorganic substance is from 30:1 to 10:1, and wherein the mole ratio of said metal inorganic substance to said sulfonate has a value from about 1.75 to about 4.0.

3. In the process of preparing dispersions of alkaline earth metal glycoxides in lubricating oils by forming an admixture of lubricating oil, a dihydric alcohol containing less than 5 carbon atoms, from 0.02% to 7.0%, by weight, based on the oxide, of an inorganic substance selected from the group consisting of alkaline earth metal oxides and hydroxides, and from 0.3 to 2% by weight of an alkaline earth metal sulfonate, heating said admixture to a temperature in the range of about 175° F. to about 400° F., removing unreacted dihydric alcohol by distillation, and filtering said admixture, the improvement comprising blending into the lubricating oil composition prior to filtration, an alkyl phenol having one alkyl group attached to the benzene nucleus, said alkyl group containing from 4 to 30 carbon atoms, and wherein the mole ratio of said alkyl phenol to said inorganic substance has a value from about 0.1 to about 1.5, wherein the weight ratio of dihydric alcohol to said inorganic substance is from 30:1 to 10:1, and wherein the mole ratio of said

metal inorganic substance to said sulfonate has a value from about 2.0 to about 3.0.

4. In the process of preparing dispersions of calcium glycoxide in lubricating oils by forming an admixture of a lubricating oil, a dihydric alcohol containing less than 5 carbon atoms, from 0.02% to 7% by weight, based on the oxide, of an inorganic substance selected from the group consisting of calcium oxide and calcium hydroxide, from 0.1% to 10% by weight of a calcium sulfonate, wherein the mole ratio of said inorganic substance to said sulfonate is from about 2.0 to about 3.0, and the weight ratio of said dihydric alcohol to said inorganic substance is from 30:1 to 10:1, heating said admixture to a temperature in the range of 175° F. to about 400° F., removing unreacted dihydric alcohol by distillation, and filtering the admixture, the improvement comprising blending into the lubricating oil composition prior to the filtration step an alkyl phenol having one alkyl group attached to the benzene nucleus, said alkyl group containing from 4 to 30 carbon atoms, and wherein the mole ratio of said alkyl phenol to said inorganic substance has a value from about 0.1 to 1.5.

5. In the process of preparing dispersions of calcium glycoxide in lubricating oils by forming an admixture of a lubricating oil, ethylene glycol, from 0.02% to 7% by weight, based on the oxide, of an inorganic substance selected from the group consisting of calcium oxide and calcium hydroxide, from 0.1% to 10% by weight of a calcium sulfonate, wherein the mole ratio of said inorganic substance to said sulfonate is from about 2.0 to about 3.0, and the weight ratio of said ethylene glycol to said inorganic substance is from 30:1 to 10:1, heating said admixture to a temperature in the range of 175° F. to about 400° F., removing unreacted ethylene glycol by distillation, and filtering the admixture, the improvement comprising blending into the lubricating oil composition prior to the filtration step an alkyl phenol having one alkyl group attached to the benzene nucleus, said alkyl group containing from 4 to 30 carbon atoms, and wherein the mole ratio of said alkyl phenol to said inorganic substance have a value from about 0.1 to 1.5.

6. In the process of preparing dispersions of calcium glycoxide in lubricating oils by forming an admixture of a lubricating oil, ethylene glycol, from 0.02% to 7% by weight based on the oxide thereof of an inorganic substance selected from the group consisting of calcium oxide and calcium hydroxide, from 0.3% to 2% by weight of a calcium sulfonate, wherein the mole ratio of said inorganic substance to said sulfonate is from about 2.0 to about 3.0, and the weight ratio of said ethylene glycol to said inorganic substance is from 30:1 to 10:1, heating said admixture to a temperature in the range of 175° F. to about 400° F., removing unreacted ethylene glycol by distillation, and filtering the admixture, the improvement comprising blending into the lubricating oil composition prior to the filtration step an alkyl phenol having one alkyl group attached to the benzene nucleus, said alkyl group containing from 4 to 30 carbon atoms, and wherein the mole ratio of said alkyl phenol to said inorganic substance has a value from about 0.1 to 1.5.

7. In the process of preparing dispersions of calcium glycoxide in lubricating oils by forming an admixture of a lubricating oil, ethylene glycol, from 0.02% to 7% by weight, based on the oxide, of an inorganic substance selected from the group consisting of calcium oxide and calcium hydroxide, from 0.1% to 10% by weight of a calcium sulfonate, wherein the mole ratio of said inorganic substance to said sulfonate is from about 2.0 to about 3.0, and the weight ratio of said ethylene glycol to said inorganic substance is from 30:1 to 10:1, heating said admixture to a temperature in the range of 250° F. to about 350° F., removing unreacted ethylene glycol, and filtering the admixture, the improvement comprising blending into the lubricating oil composition prior to the filtration step an alkyl phenol having one alkyl group attached to the benzene nucleus, said alkyl group containing from 4 to 30 carbon atoms, and wherein the mole ratio of said alkyl phenol to said inorganic substance has a value from about 0.1 to 1.5.

8. In the process of preparing dispersions of calcium glycoxide in lubricating oils by forming an admixture of a petroleum lubricating oil, ethylene glycol, from 0.02% to 7% by weight, based on the oxide, of an inorganic substance selected from the group consisting of calcium oxide and calcium hydroxide, from 0.3% to 2% by weight of a calcium mahogany petroleum sulfonate, wherein the mole ratio of said inorganic substance to said sulfonate is from about 2.0 to 3.0, and the weight ratio of said ethylene glycol to said inorganic substance is from 30:1 to 10:1, heating said admixture to a temperature in the range of 175° F. to about 400° F., removing unreacted ethylene glycol by distillation, and filtering the admixture, the improvement comprising blending into the lubricating oil composition prior to the filtration step an alkyl phenol having no more than three alkyl groups attached to the benzene nucleus, each alkyl group containing from 4 to 30 carbon atoms, and wherein the mole ratio of said alkyl phenol to said inorganic substance has a value from about 0.1 to 1.5.

9. In the process of preparing dispersions of calcium glycoxide in lubricating oils by forming an admixture of a petroleum lubricating oil, ethylene glycol, from 0.02% to 7% by weight, based on the oxide, of an inorganic substance selected from the group consisting of calcium oxide and calcium hydroxide, from 0.3% to 2% by weight of a calcium mahogany petroleum sulfonate, wherein the mole ratio of said inorganic substance to said sulfonate is from about 2.0 to about 3.0, and the weight ratio of said ethylene glycol to said inorganic substance is from 30:1 to 10:1, heating said admixture to a temperature in the range of 175° F. to about 400° F., removing unreacted ethylene glycol by distillation, and filtering the admixture, the improvement comprising blending into the lubricating oil composition prior to the filtration step an alkyl phenol having one alkyl group attached to the benzene nucleus, said alkyl group containing from 4 to 30 carbon atoms, and wherein the mole ratio of said alkyl phenol to said inorganic substance has a value from about 0.1 to 1.5.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,878,185 March 17, 1959

George L. Weamer

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 43, for "pages" read — page —; column 3, line 62, before "alkaline" insert -- alkaline earth metal basic salts; that is, dispersions of the —; column 4, line 22, for "0.22%" read — 0.02% —.

Signed and sealed this 11th day of August 1959.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents