United States Patent [19]

Cyba et al.

[11] **3,755,171**

[45] **Aug. 28, 1973**

[54] **LUBRICANT ADDITIVE MIXTURE**

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[22] Filed: **June 18, 1971**

[21] Appl. No.: **154,619**

[52] **U.S. Cl.** ..... **252/51.5 R,** 252/50, 252/401, 252/403

[51] **Int. Cl.** **C10m 1/20,** C10m 1/32

[58] **Field of Search** ..... 252/50, 51.5 R, 401, 252/403

[56] **References Cited**

UNITED STATES PATENTS

3,110,671	11/1963	Cyba	252/50
3,017,258	1/1962	Pollitzer	252/403 X

FOREIGN PATENTS OR APPLICATIONS

523,795	4/1956	Canada	252/51.5 A

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[57] **ABSTRACT**

Lubricant containing a mixture of a di-(sec-alkylamino)-diphenylpropane or di-(cycloalkylamino)-diphenylpropane and polymeric condensation product of epihalohydrin compound and amine.

4 Claims, No Drawings

LUBRICANT ADDITIVE MIXTURE

BACKGROUND OF THE INVENTION

Lubricants, including both lubricating oils and greases, are used in many different applications and under different operating conditions. These operating conditions become increasingly more severe as our technology continues to advance. Accordingly, extensive research has been directed toward the discovery of improved lubricants and improved additives therefore. In one method, this study has led to the use of mixtures of additives and preferably to non-ash forming additives. While many improved additives and mixtures have been discovered, there still is a need for other improved additives.

DESCRIPTION OF THE NVENTION

The present invention is based on the discovery that improved results are obtained when using a mixture of particularly substituted diaminodiphenylpropane and the polymeric condensation product of an epihalohydrin compound and an amine having at least four carbon atoms. In one embodiment the present invention relates to a lubricant containing a mixture of di-(sec-alkylamino)-diphenylpropane or di-(cycloalkylamino)-diphenylpropane and the polymeric condensation product of an epihalohydrin compound and a mono- or polyamine having an alkyl or cycloalkyl moiety of at least four carbon atoms.

In a specific embodiment the present invention relates to a lubricant containing from about 0.01 percent to about 10 percent by weight of a mixture of (1) from about 25 percent to about 75 percent by weight of 4,4'-di-(sec-C_3-C_{50} alkylamino)-diphenylpropane or 4,4'-di-(cycloalkylamino)-diphenylpropane in which the cycloalkyl moiety contains from 4 to 20 carbon atoms in the ring and (2) from about 75 percent to about 25 percent by weight of the polymeric condensation product of epihalohydrin compound or a mono- or polyamine containing from four to about 50 carbon atoms.

Any suitably substituted diaminodiphenylpropane is used as one component of the additive mixture. In a preferred embodiment, this is a 4,4'-di-(sec-alkylamino)-diphenylpropane in which the sec-alkyl moiety contains from three to about 50 carbon atoms. Illustrative compounds in this embodiment include 4,4'-di-(isopropylamino)-diphenylpropane, 4,4'-di-(sec-butylamino)-diphenylpropane, 4,4'-di-(sec-pentylamino)-diphenylpropane, 4,4'-di-(sec-hexylamino)-diphenylpropane, 4,4'-di-(sec-heptylamino)-diphenylpropane, 4,4'-di-(sec-octylamino)-diphenylpropane, 4,4'-di-(sec-nonylamino)-diphenylpropane, 4,4'-di-(sec-decylamino)-diphenylpropane, 4,4'-di-(sec-undecylamino)-diphenylpropane, 4,4'-di-(sec-dodecylamino)-diphenylpropane and corresponding compounds in which the akyl moiety contains from 13 to about 50 carbon atoms each. In another embodiment, this component of the additive mixture comprises the corresponding 2,4'-di-(sec-alkylamino)-diphenylpropane.

In another embodiment, this component of the additive mixture comprises a 4,4'-di-(cycloalkylamino)-diphenylpropane in which the cycloalkyl moiety contains from four to about 20 carbon atoms in the ring. A particularly preferred compound in this embodiment is 4,4'-di-(cyclohexylamino)-diphenylpropane. Other

compounds in this embodiment comprise 4,4'-di-(cyclobutylamino)-diphenylpropane, 4,4'-di-(cyclopentylamino)-diphenylpropane, 4,4'-di-(cycloheptylamino)-diphenylpropane, 4,4'-di-(cyclooctylamino)-diphenylpropane, 4,4'-di-(cyclononcylamino)-diphenylpropane, 4,4'-di-(cyclodecylamino)-diphenylpropane, 4,4'-di-(cycloundecylamino)-diphenylpropane, 4,4'-di-(cyclododecylamino)-diphenylpropane, and corresponding compounds in which the cycloalkyl ring contains from 13 to about 20 carbon atoms each. Here again, another embodiment comprises the corresponding 2,4'-di-(cycloalkylamino)-diphenylpropane.

Another component of the additive mixture comprises a polymeric condensation product of an epihalohydrin compound and a mono- or polyamine containing at least four carbon atoms and more particularly from four to about 50 carbon atoms. A preferred epihalohydrin compound is epichlorohydrin. Other epichlorohydrin compounds include 1,2-epi-4-chlorobutane, 2,3-epi-4-chlorobutane, 1,2-epi-5-chloropentane, 2,3-epi-5-chloropentane, etc. While the chloro derivatives are preferred, it is understood that the corresponding bromo and iodo compounds may be employed but not necessarily with equivalent results.

In one embodiment the amine reacted with the epihalohydrin compound is an alkyl monoamine. Illustrative examples of preferred amines in this embodiment include butyl amine, pentyl amine, hexyl amine, heptyl amine, octyl amine, nonyl amine, decyl amine and more particularly longer chain primary alkyl amines as undecyl amine, dodecyl amine, tridecyl amine, tetradecyl amine, pentadecyl amine, hexadecyl amine, heptadecyl amine, octadecyl amine, nonadecyl amine, eicosyl amine, heneicosyl amine, docosyl amine, tricosyl amine, tetracosyl amine, pentacosyl amine, hexacosyl amine, heptacosyl amine, octacosyl amine, nonacosyl amine, triacontyl amine, hentriacontyl amine, dotriacontyl amine, tritriacontyl amine, tetratriacontyl amine, pentatriacontyl amine, hexatriacontyl amine, heptatriacontyl amine, octatriacontyl amine, nonatriacontyl amine, tetracontyl amine, etc. The above amines may be of straight chain, secondary, alkyl or branched configuration. Conveniently the long chain amines are prepared from fatty acids or more particularly from mixtures of fatty acids formed as products or by-products. Such mixtures are available commercially, generally at lower prices, and, as another advantage of the present invention, the mixtures may be used without the necessity of separating individual amines in pure state.

An example of such a mixture is hydrogenated tallow amine which is available under various trade names including "Alamine H26D" and "Armeen HTD." These products comprise mixtures predominating in alkyl amines containing 16 to 18 carbon atoms per alkyl group, although they contain a small amount of alkyl groups having 14 carbon atoms.

Illustrative examples of secondary amines, which may be reacted with the epihalohydrin compound, include di-(dodecyl) amine, di-(tridecyl) amine, di-(tetradecyl) amine, di-(pentadecyl) amine, di-(hexadecyl) amine, di-(heptadecyl) amine, di-(octadecyl) amine, di-(nonadecyl) amine, di-(eicosyl) amine, etc. In another embodiment, which is not necessarily equivalent, the secondary amine will contain one alkyl group having at least 12 carbon atoms and an-

other alkyl group having less than 12 carbon atoms. Illustrative examples of such compounds include propyl dodecyl amine, butyl dodecyl amine, amyl dodecyl amine, butyl tridecyl amine, amyl tridecyl amine, etc. Here again, mixtures of secondary amines are available commercially, usually at a lower price, and such mixtures may be used in accordance with the present invention. An example of such a mixture available commercially is "Armeen 2HT" which consists primarily of dioctadecyl amine and dihexadecyl amine.

In another embodiment the amine to be reacted with the epihalohydrin compound is a polyamine. A particularly preferred amine in this embodiment is a N-alkyl-1,3-diaminopropane in which the alkyl group contains from six to 50 carbon atoms. Illustrative examples of preferred amines in this embodiment include N-octyl-1,3-diaminopropane, N-nonyl-1,3-diaminopropane, N-decyl-1,3-diaminopropane, N-undecyl-1,3-diaminopropane, N-dodecyl-1,3-diaminopropane, N-tridecyl-1,3-diaminopropane, N-tetradecyl-1,3-diaminopropane, N-pentadecyl-1,3-diaminopropane, N-hexadecyl-1,3-diaminopropane, N-heptadecyl-1,3-diaminopropane, N-octadecyl-1,3-diaminopropane, N-nonadecyl-1,3-diaminopropane, N-eicosyl-1,3-diaminopropane, N-heneicosyl-1,3-diaminopropane, N-docosyl-1,3-diaminopropane, N-tricosyl-1,3-diaminopropane, N-tetracosyl-1,3-diaminopropane, N-pentacosyl-1,3-diaminopropane, N-hexacosyl-1,3-diaminopropane, N-heptacosyl-1,3-diaminopropane, N-octacosyl-1,3-diaminopropane, N-nonacosyl-1,3-diaminopropane, N-triacontyl-1,3-diamonopropane, etc. Here again, mixtures are available commercially, usually at lower prices, of suitable compounds in this class and advantageously are used for the purposes of the present invention. One such mixture is "Duomeen T" which is N-tallow-1,3-diaminopropane and predominates in alkyl groups containing 16 to 18 carbon atoms each, although the mixture contains a small amount of alkyl groups containing 14 carbon atoms each. Another mixture available commercially is N-coco-1,3-diaminopropane which contains alkyl groups predominating in 12 to 14 carbon atoms each. Still another example is N-soya-1,3-diaminopropane which predominates in alkyl groups containing 18 carbon atoms per group, although it contains a small amount of alkyl groups having **16** carbon atoms. It is understood that the corresponding N-alkyl-diaminobutanes, N-alkyl-diaminopentanes, N-alkyl-diaminohexanes, etc., may be employed.

In still another embodiment the amine contains a cyclo-alkyl moiety and includes, for example, compounds as cyclohexyl amine, N-C_1-C_{40}-sec-alkyl-cyclohexyl amine, N-cyclohexyl-diamino-alkane, in which the alkane moiety contains from two to about six carbon atoms, and corresponding compounds in which the cyclohexyl group is replaced by a cycloalkyl of four, five or seven to 12 carbon atoms in the ring. In still another embodiment two different amines may be reacted with the epihalohydrin compound, the second amine being selected from those hereinbefore set forth or comprising an alkylene polyamine including, for example, ethylene diamine, diethylene triamine, triethylene tetramine, tetraethylene pentamine, etc., similar propylene and polypropylene polyamines, butylene and polybutylene polyamines, etc.

The epihalohydrin and amine are reacted in any suitable manner. In a preferred embodiment these are reacted in substantially equal mole proportions, although an excess of one reactant may be utilized. Accordingly, these may be reacted in a mole proportion of from 1 to 2 mole proportions of one reactant per one mole proportion of the other reactant. In one embodiment the reactants are prepared as solutions in suitable solvents, particularly alcohols such as ethanol, propanol, butanol, etc., and one of the solutions is added gradually, with stirring, to the other solution, and reacted at a temperature of from about 60° to about 210° F. and preferably from 120° to about 210° F., and for a sufficient time to effect polymer formation, which generally will range from about 2 and more particularly from about 4 to 24 hours or more.

The diaminodiphenylpropane and the epihalohydrin-amine reaction product are used in any suitable proportions in the additive mixture. In general, these will comprise from about 25 percent to about 75 percent by weight of one component and from 75 percent to about 25 percent by weight of the other component. While the diaminodiphenylpropane and the epihalohydrin-amine reaction product may be added separately to the lubricant, it generally is preferred to prepare a suitable mixture thereof and to add the mixture to the lubricant. Each component separately or the mixture may be prepared as a solution in a suitable solvent for convenience in handling and measuring. Any suitable solvent may be used and preferably comprises aromatic hydrocarbons including, for example, benzene, toluene, xylene, ethylbenzene, cumene, etc., or mixtures thereof and particularly aromatic naphtha, aromatic bottoms product, etc. When a solvent is employed, the solution may contain from about 10 percent to about 90 percent and preferably from about 25 percent to about 75 percent by weight of active ingredients.

As hereinbefore set forth, the additive mixture of the present invention is used in lubricants, which may be lubricating oil or grease. The additive mixture will be used in a concentration of from about 0.01 percent to about 10 percent and more particularly from about 0.1 percent to about 5 percent by weight of the lubricant. The additive mixture is added to the lubricant in any suitable manner and preferably with intimate mixing in order to obtain uniform distribution thereof in the lubricant. In some cases the additive mixture may be added to the lubricant during manufacture thereof. For example, when used in grease, the added mixture may be added to one or more of the components of the grease before final compositing thereof.

It is understood that the additive mixture of the present invention may be used along with other additives incorporated in the lubricant. For example, a metal deactivator, dye, viscosity index improver, pour point depressant, antifoaming additive, lubricity and extreme pressure additive, antiscuffing additive, etc., may be incorporated in the lubricant. When desired, the additive mixture of the present invention may be prepared as a mixture with one or more of these other additives and incorporated in this manner into the lubricant.

The additive mixture of the present invention is used in any lubricant in order to improve the properties thereof. Most lubricants undergo deterioration during transportation, storage and/or use due to oxidative, thermal and/or other deterioration. This deterioration results in deposit formation and such deposit formation, not only reduces the lubricity properties of the oil, but also will clog pipelines, filters or other equipment

through which the lubricating oil is passed. As another advantage to the present invention, the additive mixture serves to disperse the deposits and thereby permits satisfactory circulation of the lubricating oil.

The lubricating oil may be of natural or synthetic origin. The mineral oils include those of petroleum origin and are referred to as motor lubricating oil, railroad type lubricating oil, marine oil differential oil, diesel lubricating oil, gear oil, cylinder oil, specialty products oil, cutting oil, drawing oil, metal working lubricant, etc. Other oils include those of animal, marine or vegetable origin.

The lubricating oils generally have a viscosity within the range of from 10 SUS at 100° F. to 1,000 SUS at 210° F. (SAE viscosity numbers include the range from SAE 10 to SAE 160). The petroleum oils are obtained from paraffinic, naphthenic, asphaltic or mixed base crudes. When highly paraffinic lubricating oils are used, a solubilizing agent also may be used if of advantage.

Synthetic lubricating oils are of varied types including aliphatic esters, polyalkylene oxides, silicones, esters of phosphoric and silicic acids, highly fluorine-substituted hydrocarbons, etc. Of the aliphatic esters, di-(2-ethylhexyl)-sebacate is being used on a comparatively large commercial scale. Other aliphatic esters include dialkyl azelates, dialkyl suberates, dialkyl pimelates, dialkyl adipates, dialkyl glutarates, etc. Specific examples of these esters include dihexyl azelate, di-(2-ethyl-hexyl)-azelate, di-3,5,5-trimethylhexyl glutarate, di-3,5,5-trimethylpentyl glutarate, di-(2-ethylhexyl)-pimelate, di-(2-ethylhexyl)-adipate, triamyl tricarballylate, pentaerythritol tetracaproate, dipropylene glycol dipelarganate, 1,5-pentane-diol-di-(2-ethylhexanonate), etc. The polyalkylene oxides include polyisopropylene oxide, polyisopropylene oxide diether, polyisopropylene oxide diester, etc. The silicones include methyl silicone, methylphenyl silicone, etc., and the silicates include, for example, tetraisooctyl silicate, etc. The highly fluorinated hydrocarbons include fluorinated oil, perfluorohydrocarbons, etc.

Additional synthetic lubricating oils include (1) neopentyl glycol esters in which the ester group contains from three to twelve carbon atoms or more, and particularly neopentyl glycol propionates, neopentyl glycol butyrates, neopentyl glycol caproates, neopentyl glycol caprylates, neopentyl glycol pelargonates, etc., (2) trimethylol alkane esters such as the esters of trimethylol ethane, trimethylol propane, trimethylol butane, trimethylol pentane, trimethylol hexane, trimethylol heptane, trimethylol octane, trimethylol nonane, trimethylol decane, trimethylol undecane, trimethylol dodecane, etc., and particularly triesters in which the ester portions each contain from three to 12 carbon atoms and may be selected from those hereinbefore specifically set forth in connection with the discussion of the neopentyl glycol esters, (3) complex esters composed of dibasic acids and glycols, especially neopentyl, neohexyl, etc., glycols further reacted with monobasic acids or alcohols to give lubricants of viscosities at 210° F. of from 4 to 12 centistokes or higher, and (4) tricresylphosphate, trioctylphosphate, trinonylphosphate, tridecylphosphate, etc., as well as mixed aryl and alkyl phosphates.

Greases generally are made by compositing one or more thickening agents with an oil of natural or synthetic origin. Metal base synthetic greases are furth classified as lithium grease, sodium grease, calcium grease, barium grease, strontium grease, aluminum grease, etc. These greases are solid or semisolid gels and, in general, are prepared by the addition to the lubricating oil of hydrocarbon soluble metal soaps or salts of higher fatty acids as, for example, lithium stearate, calcium stearate, aluminum naphthenate, etc. The grease may contain one or more thickening agents such as silica, carbon black, talc, organic modified Bentonite, etc., polyacrylates, amides, polyamides, aryl ureas, methyl N-n-octadecyl terephthalomate, etc. Another type of grease is prepared from oxidized petroleum wax, to which the saponifiable base is combined with the proper amount of the desired saponifying agent, and the resultant mixture is processed to a grease. Other types of greases in which the features of the present invention are used include petroleum grease, whale grease, wool grease, etc., and those made from inedible fats, tallow, butcher's waste, etc.

Oils of lubricating viscosity also are used as transmission fluids, hydraulic fluids, industrial fluids, etc., and the novel features of the present invention are used to further improve the properties of these oils. During such use the lubricity properties of the oil are important. Any suitable lubricating oil which is used for this purpose is improved by incorporating the additive mixture of the present invention.

Oils of lubricating viscosity also are used as cutting oils, rolling oils, soluble oils, drawing compounds, etc. In this application, the oil is used as such or as an emulsion with water. Here again, it is desired that the oil serves to lubricate the metal parts of saws, knives, blades, rollers, etc., in addition to dissipating the heat created by the contact of the moving metal parts.

Oils of lubricating viscosity also are used as slushing oils. The slushing oils are employed to protect finished or unfinished metal articles during storage or transportation from one area to another. The metal articles may be of any shape or form including steel or other metal sheets, plates, panels, coils, bars, etc., which may comprise machine parts, engines, drums, piston rings, light arms, etc., as well as farm machinery, marine equipment, parts for military or other vehicles, household equipment, factory equipment, etc. A coating which may be visible to the eye, or not, as desired, covers the metal part and protects it from corrosion.

The following examples are introduced to illustrate further the novelty and utility of the present invention but not with the intention of unduly limiting the same.

EXAMPLE I

This example describes an additive mixture of 4,4'-di-(sec-butylamino)-diphenylpropane and the polymeric condensation product of epichlorohydrin and hydrogenated tallow amine. The 4,4'-di-(sec-butylamino)-diphenylpropane was prepared by the reactive alkylation of 4,4'-diaminodiphenylpropane with methyl ethyl ketone in the presence of a platinum containing catalyst and hydrogen. The hydrogenated tallow amine used in the preparation of the polymeric condensation product is marketed commercially as "Armeen HTD" and, as hereinbefore set forth, is a mixture of primary amines predominating in 16 to 18 carbon atoms per alkyl group. The condensation is effected by first forming a solution of two mols of epichlorohydrin in 600 cc. of a solvent mixture comprising 400 cc. of xylene and 200 cc. of 2-propanol. A separate

solution of two mols of Armeen HTD is prepared in an equal volume of xylene. One mol of the latter solution is added gradually to the epichlorohydrin solution, with stirring and heating at 130°—140° F. for a period of 2.5 hours. Then another mole of Armeen HTD is added gradually to the reaction mixture, stirred and reacted at 175° F. for 2.5 hours. One mole of sodium hydroxide then is added with stirring and heating at 185°–195° F. for 3.5 hours, after which another mole of sodium hydroxide is added and the mixture stirred and reacted at 185°–195° F. for 1 hour. Following completion of the reaction, the mixture is cooled, filtered, and the filtrate then is distilled under vacuum to remove the alcohol and xylene. The resultant product is a hard, waxy, brittle solid of light amber color containing 3.11 meq./g. of basic nitrogen.

The 4,4′-di-(sec-butylamino)-diphenylpropane and the polymeric condensation product are mixed together in approximately equal weight concentrations.

EXAMPLE II

The additive mixture of this example comprises 60 percent by weight of 4,4′-di-(sec-butylamino)-diphenylpropane and 40 percent by weight of the condensation product of equal mole proportions of epichlorohydrin and N-tallow-1,3-diaminopropane. The N-tallow-1,3-diaminopropane is available commercially as "Duomeen T" and predominates in alkyl groups containing 16 to 18 carbon atoms each as hereinbefore set forth. The polymeric condensation product is prepared in substantially the same manner as described in Example I and the product is recovered as a heavy viscous dark oil containing approximately 14.2 meq/g. of basic titratable nitrogen.

EXAMPLE III

The additive mixture of this example comprises 75 percent by weight of 2,4′-di-(sec-dodecylamino)-diphenylpropane and 25 percent by weight of the polymeric reaction product of equal mole proportions of epichlorohydrin and N-coco-1,3-diaminopropane which, as hereinbefore set forth, contains alkyl groups predominating in 12 to 14 carbon atoms.

EXAMPLE IV

The additive mixture of this example comprises equal weight concentrations of 4,4′-di-(cyclohexylamino)-diphenylpropane and the condensation product of equal mole proportions of epichlorohydrin and N-cyclohexyl-1,2-diaminoethane.

EXAMPLE V

This example illustrates the use of the additive mixture of Example I in a synthetic lubricant. This synthetic lubricant is pentaerythritol ester available commercially as "Hercoflex 600" and is stated to be monomeric pentaerythritol ester having an acid number of 0.10 maximum, a saponification number of 410, a refractive index at 20° C. of 1.453 and a specific gravity at 25/25° C. of 0.997.

The evaluation was made in accordance with an Oxygen Stability Test, in which a 100 cc. sample of the synthetic lubricating oil is placed in a bath maintained at 260° C. and air is blown therethrough at a rate of 5 liters or air per hour. The sample of synthetic lubricating oil is examined periodically and the time to reach an acid number of 5 is reported. It is apparent that the longer the time required to reach an acid number of 5, the more stable is the sample of the lubricating oil. In other words, it takes longer for the more stable oil to deteriorate.

In addition to determining the acid number of 5, the said number at 22 hours and the percent viscosity change were also determined. The results of these evaluations, along with the evaluation of a sample of the lubricating oil without additive, are reported in the following table:

TABLE I

Run No.	Additive	Hours to Acid No. Of 5	Acid No. at 22 hours	% Viscosity change at 26 hours
1	none	6	13.9	111
2	1% by weight of 4,4′-di-(sec-butylamino)-di-pehnylpropane	12	8.5	75
3	1% by weight of 4,4′-di-(sec-butylamino)-di-phenylpropane plus 1% by weight of the polymeric condensation product prepared as described in Example I.	26	3.9	68.4

When a sample of the polymeric reaction product was evaluated alone in a synthetic lubricating oil in a concentration of 1% by weight, there was only a slight increase in the hours to acid number of 5. In one case, this increase was only 2 hours.

For comparative purposes, run 2 in the above table reports the results when using the di-(sec-butylamino)-diphenyl-propane alone. It runs 2 and 3 the di-(sec-butylamino)-diphenyl-propane was used in a concentration of 0.0033 moles per 100 cc. of lubricating oil, which concentration is equal to approximately 1% by weight of the lubricating oil. It will be noted that this additive by itself was moderately effective. In contrast, the additive mixture of Example I gave a much longer time before reaching an acid number of 5, a much lower acid number at 22 hours and a lower percent viscosity change. Thus, the additive mixture gave improved results beyond those which normally would be expected and thus may be considered as a synergistic effect.

EXAMPLE VI

The synthetic lubrication oil of this example is dioctyl sebacate which is marketed under the trade name of "Plexol 201." The additive mixture of Example II is incorporated in this lubricating oil in the concentration of 2 percent by weight and serves to increase the hours to acid number 5 and to reduce the change in viscosity after 26 hours.

EXAMPLE VII

The synthetic lubricant of this example is trimethylol propane triester which is available under the trade name of "Cellutherm." The additive mixture of Example III is incorporated in the synthetic lubrication oil in a concentration of 2.5 percent by weight and, when evaluated in the above manner, will extend the hours to acid number of 5 and also will reduce the percent of viscosity change at 26 hours.

EXAMPLE VIII

The additive mixture prepared as described in Example IV is used in a concentration of 1 percent by weight as an additive in grease. The additive mixture is incorporated in a commercial Mid-continent lubrication oil having an SAE viscosity of 20. Approximately 92 percent of the lubricating oil then is mixed with approximately 8 percent by weight of lithium stearate. The mixture is heated to about 450° F. with constant agitation. Subsequently, the gease is cooled, while agitating, to approximately 248° F., and then the grease is further cooled slowly to room temperature.

The stability of the grease is tested in accordance with ASTM D-942 Method, in which method a sample of the gease is placed in a bomb and maintained at a temperature of 212° F. Oxygen is charged to the bomb, and the time required for a drop of 5 pounds pressure is taken as the Induction Period.

We claim as our invention:

1. Additive mixture of from about 25 percent to about 75 percent by weight of 4,4'-di-(sec-butylamino)-di-phenylpropane and from about 75 percent to about 25 percent by weight of the polymeric condensation product of equal mole proportions of epichlorohydrin and hydrogenated tallow amine.

2. Lubricant containing from about 0.01 percent to about 10 percent by weight of the additive mixture of claim **1.**

3. The lubricant of claim **2** in which said lubricant is lubricating oil.

4. The lubricant of claim **2** in which said lubricant is grease.

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