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2,491,683

LUBRICANT COMPOSITION

Filed Aug. 22, 1946

A = POLYFUMARATE

B = ALKYL-AROMATIC COMPOUND

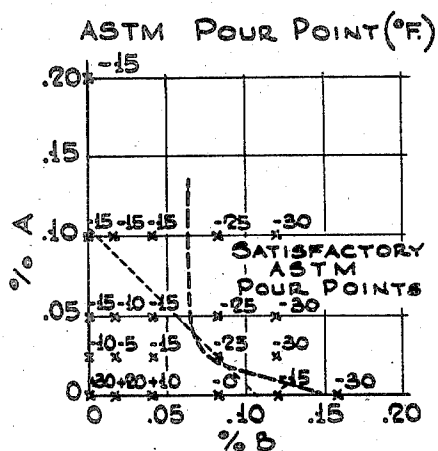
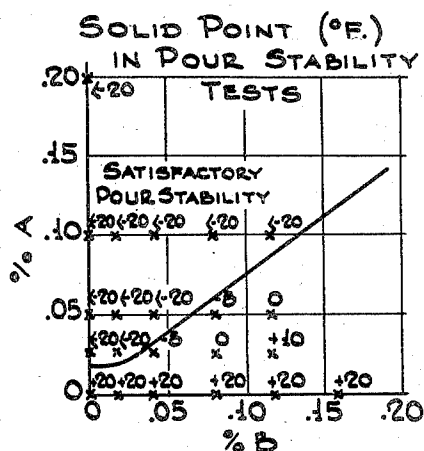


FIG.-1.



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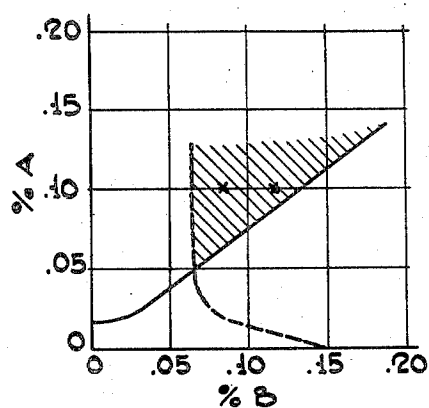


FIG.-3

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LUBRICANT COMPOSITION

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6 Claims. (Cl. 252-56)

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This invention relates to novel compositions and to methods of preparing and using same, and more particularly it relates to lubricating oil compositions containing a paraffinic mineral oil base stock together with small amounts of two different addition agents both of which have some pour depressing properties but neither of which is entirely as satisfactory as may be desired, even when used in relatively large amounts. In other words, relatively small amounts of mixtures prepared according to this invention give unexpectedly better results than can be obtained with even much larger amounts of either individual constituent.

The hydrocarbon base stocks which may be used according to this invention may be any of the waxy or paraffinic hydrocarbon oil fractions such as those derived from petroleum, or synthetic oils made by polymerization of olefins or other unsaturated aliphatic hydrocarbons, and such fractions may be either relatively narrow cut fractions separated from petroleum or other crude hydrocarbon mixtures by distillation or other suitable means, and they may be used in the relatively crude state or after refining by suitable methods such as clay treating, acid treating, solvent extraction, cracking, hydrogenation as well as treatment by various chemical refining agents such as aluminum chloride, etc. The invention is especially applicable to mineral oil base stocks of the lubricating oil boiling range, or to lower boiling fractions such as those of the kerosene or gas oil boiling range which it is desired to thicken to viscosities within the lubricating oil range, as for use in gun recoil oils, shock absorber oils, etc. especially when these are to be used in very cold climates. However, it is to be understood that the invention may also be applied to other paraffinic oils and for other purposes, by using as the base stock lighter mineral oil fractions such as gasoline or naphtha, or by using gas oil fractions as Diesel fuel, or even solid petroleum fractions such as paraffin wax and petrolatum.

Of the two addition agents required to be added to the above types of base stocks according to this invention, the one will, for simplicity, be referred to as a polyfumarate, although by this term it is intended to mean only a polyfumarate of a particular type, namely the type of copolymer described in application 638,435, filed December 29, 1945, of which the present application is a continuation in part. Thus the polyfumarates in question are copolymers of fumaric acid esters.

There are four different methods of carrying

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out the present invention, in respect to the preparation of the copolymers:

- A. By copolymerizing a mixture of two or more dialkyl fumarate esters each one of which contains two like alcohol groups, but the alcohol groups in different esters being different; such a copolymer may be represented by the general formula:



where R and R' are alkyl groups and n indicates the extent of polymerization.

- B. By polymerizing a single mixed ester, i. e. one containing 2 different alcohol groups; such a copolymer may be represented by the formula $(\text{ROOC}-\text{CH}=\text{CH}-\text{COOR}')_n$.
- C. By making a mixture of "A" and "B," such as would result from starting with a mixture of various alcohols and esterifying them with fumaric acid, and then polymerizing the resulting mixture of esters.
- D. By making a mixture of various polymerized and copolymerized esters.

The saturated aliphatic alcohols, otherwise known as alkanols, to be used in preparing the fumaric acid ester for use according to this invention, may have 1 to 30 or more carbon atoms, preferably less than 20 carbon atoms, more preferably about 5 to 18 carbon atoms. Primary alcohols are preferred, although in some cases secondary alcohols for example 5-ethyl nonanol-2 may be used. Straight chained alcohols are generally preferred, but slightly branched alcohols, for example 2-ethyl hexanol, may be employed if desired.

At least one of the alcohol-groups should contain more than 10 carbon atoms; examples of such alcohol groups which may be used include:

Name	No. of C's
Lauryl.....	12
Tetradecyl.....	14
Cetyl.....	16
Octadecyl (stearyl).....	18

Alcohols having an odd number of carbon atoms may also be used, although alcohols having even numbers are more readily available from materials found in nature such as the various vegetable, animal or fish fatty oils or waxes. Alcohols having either even or odd number of carbon atoms may be prepared by hydrogenation of carbon monoxide, or of fatty acids having the

desired number of carbon atoms, such as lauric acid, or esters thereof. Mixed alcohols prepared commercially from natural products, may be used. One such preferred material made by hydrogenation of coconut oil is sold under the trade name "Lorol" and is a mixture of alcohols ranging from 10 to 18 carbon atoms, predominating in lauryl alcohol having 12 carbon atoms. Another related but slightly different mixture is called "Lorol B"; it contains more C₁₈. The composition of these two mixed commercial alcohols is approximately as follows:

Composition of mixtures of commercial alcohols

Component	(Trade Name) Lorol, Weight Per Cent	Lorol B, Weight Per Cent
C ₁₀ Alcohol.....	4.0	3.0
C ₁₂ Alcohol.....	55.5	46.0
C ₁₄ Alcohol.....	22.5	24.0
C ₁₆ Alcohol.....	14.0	10.0
C ₁₈ Alcohol.....	4.0	17.0
Average Number of Carbon Atoms.....	12.8	13.5

It is thus apparent from the above table that Lorol is a mixture of commercial alcohols having an average number of 12.8 carbon atoms and Lorol B has an average of 13.5 carbon atoms.

Thus it is possible to carry out the invention using only alcohols having more than 10 carbon atoms, although generally, it is preferred, and sometimes it is necessary, to use some alcohols having 10 or less carbon atoms. In such a case, any of the commonly available lower alcohols may be used such as the methyl, ethyl, propyl, butyl, amyl, hexyl, octyl, decyl, etc., or commercially available mixed alcohols such as octyl-decyl.

The proportion of alcohol groups having different numbers of carbon atoms in the fumaric ester raw materials to be polymerized should generally be adjusted to average about 5 to 15 carbon atoms, preferably about 7 to 14 carbon atoms, although it will be understood that the precise combination which gives best results may have to be adjusted slightly according to the type of oil base stock in which the polymerized product is intended to be incorporated, and according to the pour depressing potency desired.

There are several different ways of judging pour depressing phenomena. One of these is by making the standard A. S. T. M. (American Society of Testing Materials) pour point test, wherein the oil blend is cooled continuously until it solidifies. Another method is to simulate winter field storage conditions by alternately subjecting the blend of oil containing a small amount of the pour depressor to cold and warm cycles and thereby determine the "pour stability" of the blend. The latter characteristic is of special value in supplementing A. S. T. M. pour point data, because blends of some pour depressors in certain oil base stocks sometimes solidify under winter field conditions at temperatures as much as 50° F. higher than the A. S. T. M. pour points.

Blends containing polyfumarate pour depressants alone exhibit excellent pour stability, but the A. S. T. M. pour points are generally not good enough for many commercial purposes.

The monomers of the fumarates are easily prepared, for example by direct esterification of fumaric acid, or by direct ester interchange, these being well known reactions. Polymerization is generally carried out with peroxide catalysts, for example with benzoyl peroxide, acetyl peroxide,

t-butyl hydroperoxide, t-butyl perbenzoate, etc. Temperatures in the range 50–120° C. are suitable when employing 0.1 to 5.0% by weight of catalyst, and the time may be from 8 to 72 hours or so. Oxygen should be excluded during polymerization, through the use of an inert gas such as nitrogen or carbon dioxide. If desired, an inert solvent may be employed as a diluent to control polymer molecular weight.

The effect of molecular weight on the blending properties of fumarate copolymers is relatively great in the case of viscosity index, and relatively little in the case of pour point. The higher the molecular weight, the greater will be the viscosity index obtained from a given quantity of polymer, and for this reason molecular weights up to 20,000 may be employed where an increase in viscosity index is desirable. For pour depressants, however, molecular weights may be at least as low as 1000 and perhaps lower. Molecular weight may be determined by viscosity measurements on diisobutylene solutions containing 5 mg. polymer per cc., and the Staudinger equation. The degree of polymerization may be judged approximately from the increase in viscosity of the copolymer, i. e., free of any solvent; this viscosity of the Lorol fumarate polymer, for instance, should be about 60 to 3000 seconds Saybolt at 210° F. The fumarate monomers are not pour depressants, and they have substantially no viscosity index improving property.

The other additive to be used according to this invention, which co-operates in some peculiar manner with the above described polyfumarate, is a substance which for the sake of simplicity will be referred to as "alkyl-aromatic compound." By this expression it is intended to include a wide variety of known pour depressors which are made by Friedel-Crafts condensation of a long aliphatic compound, as for instance chlorinated wax, with a low molecular weight aromatic compound preferably of the hydrocarbon type such as naphthalene, benzene, anthracene, or various lower alkylated aromatic compounds, such as toluene, xylene, amylbenzene, etc., or other low molecular weight highly aromatic compounds such as phenol, naphthol, cresol, petroleum phenols, or other hydroxy or amino derivatives of lower aromatic hydrocarbons.

Such condensation products may be made by the process disclosed in the basic Patent 1,815,022, or by various improved modifications known to the art.

One example of a suitable method of preparing this alkyl-aromatic compound is to chlorinate paraffin wax to a chlorine content of about 10 to 15% or more, and then condense about 100 parts by weight of the resultant chlorinated paraffin wax with about 10 to 20 parts by weight, preferably about 15 parts by weight, of naphthalene, preferably in the presence of 0.05 to 5 volumes, preferably 0.1 to 1 or 2 volumes, of inert solvent such as a highly refined kerosene, tetrochloroethane, dichlorobenzene, etc. per volume of mixed reactants, using a small amount, such as about 0.5% to 3% or more of aluminum chloride as catalyst. The reaction may be started at room temperature and, after the catalyst and reactants have all been mixed, the reaction mixture may be heated to a final temperature between about 100° and 200° F., preferably about 125°–550° F. After the reaction has been completed (generally requiring ½ hour to 10 hours or so), residual catalyst is hydrolyzed by adding water, aqueous caustic soda or sodium carbonate

or a lower alcohol such as isopropyl alcohol or ethyl alcohol, or any mixture of such materials, and then after settling and removal of the catalytic sludge, the solvent layer containing the desired condensation product is subjected to distillation under reduced pressure, such as by fire and steam distillation, or a vacuum distillation using an absolute pressure of about 1 to 50 mm. mercury, up to about 600° F., to remove overhead the solvent, unreacted raw materials, and low boiling condensation products, and to obtain as distillation residue the desired high molecular weight wax-naphthalene condensation products. These products have molecular weights ranging from about 1000 to 5000, preferably about 1500 to 3000, and have potent pour depressing properties, particularly as judged by the A. S. T. M. pour point test.

In preparing the above described wax-aromatic compounds, or more broadly speaking alkyl-aromatic compounds one may use other long aliphatic materials as reactants instead of the chlorinated wax, as for instance corresponding olefins made by dehydrochlorination of chlorinated wax or other long aliphatic compounds, preferably having more than 10 aliphatic carbon atoms, such as stearic acid, octadecyl chloride, octadecyl alcohol, cetyl alcohol, etc.

One surprising feature of the present invention is that the two primary additives, namely the polyfumarate and the alkyl-aromatic compound, must be added to the lubricating oil base stock within a particular range of proportions in order to obtain the desired co-operating effect. The amount of alkyl-aromatic compound used should be in the range 0.5 to 2.0 parts by weight for each part of polyfumarate that is employed. The total amount of the mixture used should generally be about 0.05% to 5%, preferably about 0.1% to 2%.

The objects, advantages, and details of the invention will be better understood from a consideration of the following description and experimental data, particularly when read in conjunction with the accompanying drawing, in which Fig. 1 is a chart outlining the field of satisfactory A. S. T. M. pour points, Fig. 2 is a chart outlining the field of satisfactory pour stability, when various concentrations of the two primary additives are used, and Fig. 3 is a chart which outlines the field of the present invention, denoted by the relatively narrow overlapping part of the two satisfactory fields shown in Figs. 1 and 2.

A polyfumarate was made from a fumaric acid ester of a commercial mixture of alcohols marketed under the name "Lorol B," and predominating in lauryl (C₁₂) alcohol, as indicated in the foregoing description. The procedure used consisted in first esterifying fumaric acid with the mixed alcohols to make the "Lorol B" fumarate monomer which was then polymerized at 80° C. with 1.0% by weight of benzoyl peroxide as catalyst, for about 16 hours' reaction time. This polyfumarate will, for convenience, be referred to as material A in the accompanying drawing and some of the pertinent description. The polyfumarate had an average molecular weight of about 2000 (determined on purified polymer which had been separated from unreacted monomer by dissolving in benzene and adding methanol, which precipitated the polymer).

A pour depressor of the alkyl-aromatic compound type was then prepared by condensing about 100 parts by weight of chlorinated paraffin

wax having a chlorine content about 13.5%, with about 15 parts by weight of naphthalene, in the presence of about one-half volume of kerosene solvent per volume of mixed reactants, and in the presence of about 2.5 parts by weight of aluminum chloride catalyst, followed by hydrolysis and removal of catalyst, and distillation of the reaction mixture by fire and steam up to about 600° F. to obtain the desired alkyl-aromatic compound as still bottoms. For convenience, this alkyl-aromatic compound will be referred to in the accompanying drawing as material B.

The above described materials A and B were then blended in various small concentrations (up to 0.2 wt. per cent) in a waxy mineral lubricating oil base stock which consisted essentially of a blend of about 3.5% of a Pennsylvania bright stock in a solvent-refined paraffinic lubricating oil having a Saybolt Universal viscosity at 210° F. of 43.6 seconds, a viscosity index of 94, a cloud point of +34° F. and a pour point of +30° F.

The resulting blends were then tested for A. S. T. M. pour point and for solid point as determined in a pour stability test which approximated closely the sequence of temperatures experienced in the field in cold climates giving rise to severe pour point instability.

The data obtained in these tests are set forth in the following table:

Per cent A (Poly- fumarate)	Per cent B (Alkyl- Aromatic)	A.S.T.M. Pour Point, °F.	Solid Point in Pour Stability Test, °F.
0.0	0.0	+30	+20
0.0	0.016	+20	+20
0.0	0.04	+10	+20
0.0	0.08	0	+20
0.0	0.12	-15	+20
0.0	0.16	-30	+20
0.025	0.0	-10	<-20
0.050	0.0	-15	<-20
0.100	0.0	-15	<-20
0.200	0.0	-15	<-20
0.025	0.016	-5	<-20
0.050	0.016	-10	<-20
0.100	0.016	-15	<-20
0.025	0.04	-15	-8
0.050	0.04	-15	<-20
0.100	0.04	-15	<-20
0.025	0.08	-25	0
0.050	0.08	-25	-8
0.100	0.08	-25	<-20
0.025	0.12	-30	+10
0.050	0.12	-30	0
0.100	0.12	-30	<-20

The A. S. T. M. pour point data are plotted graphically on the chart shown in Fig. 1 of the accompanying drawing, in all three figures of which the per cent concentration of A (polyfumarate) is plotted on the vertical (Y) axis, against per cent concentration of B (alkyl-aromatic compound) on the horizontal (X) axis. Thus in these figures any one point shows the concentration of both materials, and immediately adjacent to that point a numerical figure is given to indicate in Fig. 1 the A. S. T. M. pour point of the blend, and in Fig. 2, the solid point in the pour stability tests of the blend.

Referring particularly to Fig. 1, it is thus noted in the lower left corner that the plain lubricating oil base stock, containing none of either materials A or B, has an A. S. T. M. pour point of 30, whereas (going to the right) the blend containing 0.04% B has a pour point of 10, and successive further additions of B lower the A. S. T. M. pour point on down to 0, -15, and finally down to -30° F.

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in the blend containing 0.16% of material B. -20° F. is considered a very satisfactory A. S. T. M. pour point. On the other hand, going up along the vertical or (Y) axis, it is noted that although 0.025% of material A (polyfumarate) lowers the A. S. T. M. pour point from $+30$ to -10 , doubling this concentration to 0.05% only reduces the pour point to -15° F., below which the A. S. T. M. pour point cannot apparently be reduced no matter how much of material A is added, since 0.10% and 0.20% still only give A. S. T. M. pour points of -15° F. Apparently material A acts very differently from material B in regard to pour depressing properties. Referring now to the blend containing 0.025% of A and none of B, having a pour point of -10° F., it is noted that the addition of 0.016% of B to that blend actually raises the pour point from -10 to -5° F., but that a still further addition up to 0.08% of B then reduces the pour point down to -25° F. which is satisfactory. Similarly, in the blend containing 0.05% of A and none of B, having a pour point of -15° F., the addition of as much as 0.04% of B had no effect at all on the pour point leaving it at -15° F., but doubling this amount of B then lowered the pour point to -25° F. In a blend containing 0.10% of A having a pour point of -15° F., the addition of 0.08% of B likewise gives a pour point of -25° F.

Thus, Fig. 1 shows that although about 0.145% of B was required when used alone to give a pour point of -25° F., only about half that much was required, namely 0.08% of B, if 0.025% of A was added, and it also indicates that as to blends containing A, small additions, e. g. up to 0.05%, of B are either of no value or are detrimental to the A. S. T. M. pour point, but that larger amounts, e. g. 0.08%, are then very effective, even more so than in the absence of material A. The broken or dashed line outlines in a general way the field of "satisfactory A. S. T. M. pour points," meaning those at least as good as about -20° F.

The dotted diagonal line in Fig. 1 represents all points or blends having a total concentration of 0.105% of additive whether it be A alone, B alone, or various mixtures thereof; for instance this line goes through the point representing a blend containing 0.08% of B and 0.025% of A and having a pour point of -25° F. This blend has a surprisingly low pour point considering that other blends containing identically the same amount of total pour depressing additive, have much higher pour points. For instance, the blend containing 0.105% of A alone obviously has a pour point of -15 , and the blend containing 0.105% of B alone has a pour point in the vicinity of -10° F. The two additives co-operate in an unexpected manner, but the reason for this phenomenon is not known.

Fig. 2 shows other phenomena in regard to the solid point ($^{\circ}$ F.) in the pour stability test. Here it is noted (along the horizontal or "X" axis) that the addition of B had no effect on the stable pour solid point, all of the blends being solid at $+20^{\circ}$ F. which was the highest reading in the test. On the other hand, it is noted (along the vertical or "Y" axis) that material A is highly effective since all concentrations ranging from 0.20% down to as little as 0.025%, lower the stable pour solid point of the oil to $+30$ to below -20° F. Thus 0.025% of A can do something which cannot be done with any amount of B in regard to stable pour solid point, whereas it was shown in Fig. 1 that no matter how much of A was used, the A. S. T. M. pour point could not be reduced below -15° F.

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whereas with 0.16% of B alone or a mixture of 0.08% of B and 0.025% of A, the A. S. T. M. pour point could be reduced to -25° F.

Now referring again to Fig. 2, particularly the point on the (Y) axis representing 0.025% of A alone, where the solid point in the pour stability tests is below -20° F., it is quite surprising that although an addition of 0.016% of B to such a blend still gives a solid point below -20° F., a further addition up to 0.08% of B actually raises the solid point of 0° F. and 0.12% raises the solid point to $+10^{\circ}$ F., thus indicating that material B in such a blend is actually harmful to the pour stability when used in a concentration so much greater than that of material A. It is also noted that in regard to a blend containing 0.05% of A alone and having a solid point of below -20° F., the addition of 0.04% of B can be tolerated while still maintaining a solid point below -20° F., and that a further addition up to 0.08% of B then raises the solid point up to -8° F. On the other hand referring to the blend containing 0.10% of A alone, and having similarly a solid point below -20° F., the addition of as much as 0.08% of B can be tolerated satisfactorily while maintaining a solid point below -20° F. It is thus believed that for satisfactory pour stability, the blends must always contain at least 75% as much material A (polyfumarate) as material B (alkyl-aromatic compound), at least in all blends containing 0.05% or more of B. In Fig. 2 the solid line which starts out curved near the lower left corner and then proceeds diagonally toward the upper right corner is drawn to outline in a general way the field of satisfactory pour stability as including all compositions represented by points on the upper left of that solid line.

Thus Fig. 1 shows that there are many different blends of A and B which give satisfactory A. S. T. M. pour points when A and B are used in concentrations represented in the field to the right of the dashed line, and Fig. 2 shows that satisfactory pour stability can be obtained by many blends having compositions represented by points to the upper left of the solid line, but when these two fields are superimposed as in Fig. 3 it is apparent that blends which are satisfactory in regard to both A. S. T. M. pour point and pour stability are represented by only a relatively narrow wedge-shaped zone of overlapping compositions, represented by the shaded portion of the chart in Fig. 3. Particularly the blend containing 0.08% of B and 1.10% of A is highly satisfactory in regard to both A. S. T. M. pour point (-25° F.) and pour stability solid point below (-20° F.). Other highly satisfactory compositions include mixtures containing about 0.06% of A and about 0.07% of B, or about 0.12% of B together with from 0.09 to 0.120% of A.

It should be understood of course that when the oil compositions are to be used in extremely cold climates or other cold conditions, or when the additives in question are to be used in base stocks which contain relatively large amounts of wax, and therefore require larger amounts of pour depressor, greater concentrations of materials A and B may be used, such as for instance 0.15% of B together with from 0.12 to 0.25% of A.

The particular base stock employed in the blends shown in Figs. 1-3 was especially susceptible to pour instability, in winter field tests and in the pour stability test. Other stocks, less susceptible to pour instability, require a somewhat smaller proportion of polyfumarate, for

example one part polyfumarate for two parts alkyl-aromatic, while with stocks which respond readily to the alkyl-aromatic as regards A. S. T. M. pour points, the proportion may be one part polyfumarate for one-half part alkyl-aromatic. In all cases, however, the desired co-operating effect is obtained only within a relatively narrow range of proportions. It should also be noted that the basestock used in the blends shown in Figures 1 to 3 was a waxy paraffinic oil which had not been highly dewaxed, and therefore required a larger total amount of pour depressor than would a base stock which had been dewaxed from a pour point of +30° F. (as in the blends shown in Figures 1 to 3) down to +20° F. or even +10° F. or lower.

When it is desired to pre-mix the polyfumarate and alkyl-aromatic, which is usually the case, for use in a wide variety of base stocks, it is of course preferable to employ such proportions as will satisfy the worst stock to be encountered. As may be seen from Fig. 3, at least 0.75 part of polyfumarate should be employed for each part of alkyl-aromatic in this preferred case. In its broader aspects, however, as noted above, the invention comprises the use of one part polyfumarate for 0.5 to 2.0 parts of alkyl-aromatic.

Instead of using a polyfumarate made from the fumaric acid ester of the mixed alcohols of the "Lorol" "B" type, one may use corresponding esters of the simpler hydrogenated coconut oil alcohols or, as described in the parent application Serial No. 638,435, one may use various other copolymers such as a copolymer of a Lorol fumarate and decylfumarate in various proportions, preferably about 15 to 30% of the decylfumarate. Other simpler copolymers may be used such as polymers of octyl and cetyl fumarates or octyl and stearyl fumarates, the total mixed alcohols having preferably an average of about 10 to 14 carbon atoms.

In preparing lubricating oil compositions of this invention, other types of additives known to the art may be used such as oxidation or corrosion inhibitors, dyes, viscosity index improvers, detergents, sludge dispersers, oiliness or extreme pressure agents, etc.

It is not intended that this invention be limited to the specific materials which have been recited merely for the sake of the illustration but only by the appended claims.

We claim:

1. A lubricating oil composition consisting essentially of a major proportion of waxy mineral lubricating oil, having dissolved therein about 0.07 to 0.20% of a wax-naphthalene pour depressor having a molecular weight of about 1500 to 3000, consisting essentially of a Friedel-Crafts condensation product of about 100 parts by weight of chlorinated paraffin wax having a chlorine content of about 12 to 15% with about 15 parts by weight of naphthalene, said condensation product being substantially non-volatile up to about 600° F. under fire and steam distillation,

and said lubricating composition also containing dissolved therein about 0.05 to 0.25% of a polyfumarate having a molecular weight from about 1000 to about 5000 and consisting essentially of a polymerization product of fumaric acid esters of the mixed alcohols obtained by hydrogenation of coconut oil, the concentration of the wax-naphthalene condensation product being about 0.5 to 2.0 parts by weight to 1 part by weight of the polyfumarate.

2. Composition according to claim 1 in which the concentration of the polyfumarate is at least equal to 75% by weight of the wax-naphthalene condensation product.

3. A composition consisting essentially of a major proportion of a paraffinic lubricant hydrocarbon having dissolved therein as a wax modifier a condensate of a chlorinated aliphatic hydrocarbon of at least 10 carbon atoms and an aromatic compound selected from the class consisting of naphthalene and phenol, said condensate having a molecular weight within a range of from 1500 to 3000 also having dissolved therein a polymerized alkyl fumarate, the proportions of these pour depressants having about 0.5 to 2.0 parts by weight of the former to 1 part of the latter, the total amount of said pour depressant being about 0.05% to 5% by weight of the composition.

4. A composition according to claim 3 in which the composition of polymerized fumarate is at least equal to 75% by weight of the wax-aromatic compound.

5. A lubricating oil composition consisting essentially of a major proportion of a waxy mineral lubricating oil having dissolved therein a chlorwax naphthalene condensation product having a molecular weight of at least 1000, said composition also having dissolved therein a small but pour depressing amount of an alkyl fumarate copolymer containing at least two different saturated alkyl groups, at least one of which has more than 10 carbon atoms and there being an average of about 5 to 15 carbon atoms in said alkyl groups, the proportion of chlorwax naphthalene condensate being about 0.5 to 2 parts by weight to 1 part of polymerized fumarate, the total amount of said additives being about 0.05% to 5% by weight of the composition.

6. A composition as in claim 5 in which the concentration of polymerized fumarate is at least equal to 75% by weight of the concentration of the wax naphthalene condensation product.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,815,022	Davis	July 14, 1931
2,375,516	Blair	May 8, 1945