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ANTIFOAMANT COMPOSITION

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This invention relates to the reduction of the foaming tendencies of mineral lubricating oils. It is more particularly concerned with providing extreme pressure lubricating oils having little or no tendency to form a stable foam.

As is well known to those familiar with the art, many lubricating oils have marked tendencies to foam while in use. If the foam is of a stable nature, there is a danger that it will eventually displace the lubricating oil in the lubrication system. As a consequence, circulation of sufficient lubricant will be poor, and, more seriously, there will be insufficient lubricant available to lubricate bearing surfaces, and the like. Foaming is most pronounced in lubricating oils used under extreme pressure conditions, particularly in oils for lubricating hypoid gears in motor vehicles. During operation of such vehicles, the rapid movement of the gears tends to aerate the oil. If a stable foam is formed, insufficient oil is available to lubricate the gear teeth. Most gear oils, per se, tend to foam. However, the foaming tendencies thereof are often greatly enhanced by the addition of additives for the purpose of increasing film strength, i. e., the extreme pressure additives.

It has now been found that the foaming tendencies of mineral lubricating oils can be sharply reduced, economically and simply. It has now been discovered that the foaming tendencies of mineral lubricating oils can be virtually eliminated by adding thereto minor amounts of certain polyhydroxy alcohols and of the reaction product of an alkyl phenol and P_2O_5, within a critical range of ratios by weight.

Accordingly, it is a broad object of the present invention to provide non-foaming mineral lubricating oils. Another object is to provide a combination of certain dihydroxy compounds with the reaction product of an alkyl phenol and P_2O_5, in critical ratios, which combination eliminates foaming tendencies of mineral lubricating oils. A further object is to provide a non-foaming mineral lubricating oil containing a minor amount of this critical combination of additives. A specific object is to provide a non-foaming extreme pressure lubricant containing minor amounts of the aforementioned combination of additives. Other objects and advantages of the present invention will become apparent to those skilled in the art, from the following detailed description.

The present invention provides a mineral lubricating oil containing between about 0.05 per cent and about 2.5 per cent, by weight, of an antifoamant composition consisting of between about 1 per cent and about 40 per cent, by weight, of a dihydroxy compound selected from the group consisting of alkylene glycols and polyalkylene glycols, and between about 99 per cent and about

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60 per cent, by weight, of the reaction product formed by reacting about 3 moles of an alkylphenol having a total of between about 8 carbon atoms and about 12 carbon atoms in the alkyl radicals thereof, with about one mole of phosphorus pentoxide, at a temperature of between about 75° C. and about 125° C.

In general, any mineral lubricating oil which has foam forming tendencies is improved by the addition of the compositions of this invention. Depending upon the intended application of the lubricant, the viscosity of the oil can vary from about 1 to about 10,000 centistokes at 100° F. The extreme pressure lubricating oils are especially preferred. These oils usually have viscosities of between about 10 and about 1500 centistokes at 100° F.

The dihydroxy compounds utilizable in the antifoamant compositions of this invention are the alkylene glycols and the polyalkylene glycols. The glycols, as is well known, are dihydric alcohols having the general formula, HO—R—OH, wherein R is an alkylene radical usually of between about 2 carbon atoms and about 12 carbon atoms. The polyalkylene glycols are dihydric ether alcohols having the general formula

$$HO-\left(RO\right)_n-H$$

wherein n is a small whole number of at least 2, and R is as before. Especially preferred are ethylene glycol and polyethylene glycol. The polyethylene glycol has the structural formula

$$HO-\left(C_2H_4O\right)_n-H$$

wherein n is a small whole number of at least two. The number, n, can be as high as 160 or more. In other words, any polyalkylene glycol is utilizable, regardless of molecular size. For the purposes of this invention, mixtures of alkylene glycols and/or polyalkylene glycols can be used, as well as a single glycol. Non-limiting examples of the glycol component are ethylene glycol, propylene glycol, dipropylene glycol, diethylene glycol, triethylene glycol, pentaethylene glycol, pentamethylene glycol, decamethylene glycol, hexa-decamethylene glycol, and heptadecaethylene glycol.

The alkylphenol-P_2O_5 reaction products used in the compositions of this invention are the reaction products produced by reacting an alkylphenol with phosphorus pentoxide in a molar proportion of about 3:1, respectively. The phenol reactant can be a mono- or a polyalkyl phenol, provided that the total number of carbon atoms in the alkyl radicals is at least 8 and not more than 12. The alkyl groups can be straight chained or branched chained in structure. Furthermore,

if the phenol reactant is a polyalkylated phenol, the alkyl groups can be like groups or unlike groups. Non-limiting examples of the alkylphenol reactants are dibutylphenol, di-t-amylphenol, di-n-hexylphenol, amylpropylphenol, disecondaryamylphenol, t-octylphenol, triisopropylphenol, nonylphenol, decylphenol, and dodecylphenol.

The reaction between the alkylphenol reactant and P_2O_5 is usually carried out at temperatures of between about 75° C. and about 125° C. The time of reaction will vary from about one hour to about 15 hours, depending upon the particular reactants used. Examples of the preparation of the reaction products contemplated herein are set forth in the copending application of Otto et al., Serial Number 143,156, filed February 8, 1950. It must be noted, however, that alkylphenol-P_2O_5 reaction products having more than 12 carbon atoms in the alkyl groups of the alkylphenol are not utilizable herein. Thus reaction products made from tetradecylphenol and from "wax phenol" were found unsatisfactory for the purposes of the present invention.

The antifoamant compositions of this invention consist of a dihydroxy compound (hereinafter called a glycol) and an alkylphenol-P_2O_5 reaction product, as defined hereinbefore. These compositions must contain between about 1 per cent and about 40 per cent, by weight, of the glycol. The balance, i. e., between about 99 per cent and about 60 per cent, by weight, is the alkylphenol-P_2O_5 reaction product. In other words, the weight ratio of the glycol to the alkylphenol-P_2O_5 reaction product must fall within the range of between about 1:99, respectively, and about 40:60, respectively, i. e., between about 0.01 and about 0.67. Combinations having ratios outside these limits are ineffective in the present invention. A weight ratio of about 2:98, i. e., about 0.02, is especially preferred.

The amount of the aforedescribed combinations which is added to the lubricating oil will vary between about 0.05 per cent and about 2.5 per cent, by weight of the oil. Preferably, the concentration will vary between about 0.1 per cent and about 1.5 per cent, by weight. It has been found that concentrations below 0.05 per cent are effective to some extent. However, substantially complete elimination of foaming tendencies is not achieved at these concentrations.

It must be strictly understood that the non-foaming oil compositions of this invention can be produced in two ways. By one method, the glycol and the alkylphenol-P_2O_5 reaction product can be blended together in the aforedescribed ratios, and the resulting combination added to the mineral lubricating oil in the concentrations set forth hereinbefore. Alternatively, the glycol and the alkylphenol-P_2O_5 reaction product can be added to the oil individually, provided, however, that they are ultimately present in the oil in the ratios set forth hereinbefore, and that the combined concentration falls within the aforedescribed range. When added separately, the dihydroxy compound, i. e., the glycol, is added to the oil at concentrations of between about 0.0005 per cent and about one per cent, by weight, and preferably at concentrations of between about 0.001 per cent and about 0.4 per cent, by weight. Similarly, the alkylphenol-P_2O_5 reaction product is added to the oil at concentrations of between about 0.03 per cent and about 2.48 per cent, by weight, and preferably at concentrations of between about 0.06 per cent and about 0.99 per cent, by weight. It is very important, however, when working within these ranges, (1) that the ratio of glycol to reaction product be maintained, and (2) that the combined concentrations fall within the range set forth hereinbefore. Thus, in one case 0.001 weight per cent of diethylene glycol was added to an oil containing 0.5 weight per cent of the di-t-amylphenol-P_2O_5 reaction product. Although the concentrations of the additives in this blend fall within the ranges specified, it will be noted that the ratio of the glycol to the reaction product was only about 0.2:99.8, i. e., about 0.002. Since the ratio must fall within the range of between about 1:99 and about 40:60, i. e., between about 0.01 and about 0.67, it will be appreciated that the ratio in this case, fell outside the effective range. This blend exhibited foaming tendencies. When the concentration of diethylene glycol was increased to 0.01 weight per cent, however, the oil did not foam. The ratio, in the latter case, was about 2:98, i. e., about 0.02, and within the range of weight ratios prescribed herein. On the other hand, an oil blend containing 0.01 per cent of glycol, by weight, and 0.03 per cent, by weight, of an alkylphenol-P_2O_5 reaction product would not be an antifoam oil of this invention. Although the individual concentrations fall within the prescribed ranges, and even though the ratio of 25:75 is within the range specified, the total concentration of 0.04 per cent falls below the minimum concentration of the composition of 0.05 per cent, as defined hereinbefore.

As mentioned previously, a preferred embodiment of the present invention is a non-foaming extreme pressure lubricating oil. Since the alkylphenol-P_2O_5 reaction products impart extreme pressure characteristics to lubricating oils, they are frequently used as at least one component of an extreme pressure lubricant composition. However, in order to achieve good extreme pressure properties in an oil, the alkylphenol-P_2O_5 reaction product must be present in somewhat larger amounts than set forth hereinbefore, namely, at concentrations of about 0.1 per cent and 1.5 per cent, by weight. A preferred concentration is about 0.5 per cent. Accordingly, in order to render these extreme pressure oils non-foaming, the dihydroxy compound will be added at concentrations of between about 0.001 per cent and about one per cent, by weight. When operating within these ranges, the ratios defined hereinbefore must be maintained. The concentration of the anti-foamant combination present in these oil compositions will be between about 0.1 per cent and about 2.5 per cent, by weight. An improved extreme pressure lubricating oil of the type contemplated within the preferred embodiment of this invention is disclosed in the Otto et al. copending application, Serial Number 143,156, filed February 8, 1950. Briefly described, these mineral lubricating oils contain (1) between about one per cent and about 10 per cent, by weight, of a product obtained by chemically substituting a part only of the chlorine in a chlorinated aliphatic material with a thiocarbonate group, (2) between about 0.1 per cent and about 3 per cent, by weight, of dihydroabietyl malate, and (3) between about 0.1 per cent and about 1.5 per cent by weight of an alkylphenol-P_2O_5 reaction product. Reference should be made to this application for details of the compositions contemplated. These compositions have excellent extreme pressure properties. They do, however, exhibit a tendency to foam. Such

compositions are rendered non-foaming by the present invention. It has been found that the antifoamant compositions of this invention, when added to such extreme pressure lubricants, do not hinder the extreme pressure additives present therein from performing their allotted functions. As disclosed in the Otto et al. application, the alkylphenol can have a total of less than eight and more than twelve carbon atoms in the alkyl groups, for extreme pressure purposes. Thus, for example a wax-alkylated phenol-P_2O_5 reaction product is operable as an extreme pressure agent. In such a case, another alkylphenol-P_2O_5 reaction product within the ranges contemplated herein must be added with the dihydroxy compound to achieve non-foaming characteristics.

The effectiveness of the antifoamant compositions of this invention is not impaired by the presence of other additives in the lubricating oil blend. The non-foaming oil compositions of this invention can contain a wide variety of other oil addition agents for the purpose of improving other characteristics of the oil. Accordingly, extreme pressure addition agents, antirust agents, oiliness agents, pour point depressants, detergents, and the like, well known to those skilled in the art, can be added to a lubricating oil along with the antifoamant compositions of this invention.

Oil concentrates are also contemplated herein. Thus, blends containing upwards of 2.5 per cent, as much as about 49 per cent, by weight, of the antifoamant compositions of this invention, in a suitable mineral oil, can be used. These concentrates can subsequently be diluted with a base oil, in order to achieve an ultimate blend containing the desired concentration of the antifoamant composition.

The following specific examples are for the purpose of illustrating the antifoamant compositions of this invention. It must be strictly understood that this invention is not to be limited to the alkylphenol-P_2O_5 reaction products and the dihydroxy compounds disclosed therein, or to the concentrations used. As will be apparent to those skilled in the art, other dihydroxy compounds and alkylphenol-P_2O_5 reaction products, and other concentrations thereof, can be used, as has been set forth hereinbefore.

The test procedure used to determine the foaming characteristics of the lubricating oil is the CRC Foam Test—Designation L–14, which is described in the CRC Handbook. In brief, this test involves blowing air through a sample of the oil under test at 75° F. for 5 minutes. The sample is contained in a graduated cylinder. At the end of the blowing period, the volume of foam is noted. The volume of foam at the end of a 10-minute collapse period, as also called for in the test, is not reported herein. The non-foaming oils of this invention show no foam at the end of the blowing period. Thus, no collapse period is required.

The base oil used to illustrate the compositions of this invention is a solvent-refined residual oil. This oil has an A. P. I. gravity of about 27.5, a Saybolt Universal viscosity of 1075 at 100° F. and 90–95 at 212° F., a pour point of +25° F., and a flash point of 460° F.

In the following examples, three commercial mixtures of polyethylene glycols supplied commercially by the Carbide and Carbon Chemicals Corporation were used, as well as relatively pure alkylene glycols and polyethylene glycols. In general, these glycols are mixtures of polyethylene glycols having an average molecular weight approximating the number given in its designation. Thus, Polyethylene Glycol-200 is a mixture of polyethylene glycols having an average molecular weight of around 200. The molecular weight of tetraethylene glycol is 194. However, Polyethylene Glycol-200 contains not only tetraethylene glycol, but a mixture of glycols ranging from diethylene glycol to as high as decaethylene glycol. Polyethylene Glycol-300 is a mixture of polyethylene glycols covering the range centering about heptaethylene glycol, and having an average molecular weight of about 300. Polyethylene Glycol-6000 ("Carbowax") is a wax-like mixture of high molecular weight polyethylene glycols having an average molecular weight of about 7000. The formula for a polyethylene glycol having this molecular weight would be

$$HO\left(C_2H_4O\right)_{160}H$$

Further information on these glycols is set forth in the technical booklet, "Carbowax Compounds and Polyethylene Glycols," published by the Carbide and Carbon Chemicals Corporation, New York, New York.

The alkylphenol-P_2O_5 reaction products were prepared by the method described in the Otto et al. application, referred to hereinbefore.

GLYCOL+DIAMYLPHENOL-P_2O_5 PRODUCT

Examples 1 through 3

Combinations of triethylene glycol and the reaction product of three moles of di-t-amylphenol with one mole of phosphorus pentoxide were prepared in weight ratios of 1:99, 10:90, and 50:50. Each combination was blended in portions of the base oil at various weight concentrations. The resulting blends, when subjected to the foam test, showed the foaming characteristics set forth in Table I.

Examples 4 through 6

Combinations of Polyethylene Glycol-200 and of the di-t-amylphenol-P_2O_5 reaction product defined in Examples 1–3 were prepared in weight ratios of 2:98 and 10:90. Also, a combination of Polyethylene Glycol-6000 and the di-t-amylphenol-P_2O_5 reaction product was prepared in a weight ratio of 2:98. Each combination was blended with portions of the base oil at various weight concentrations. The resulting blends, when subjected to the foam test, showed the foaming characteristics set forth in Table I.

Examples 7 through 9

Combinations of propylene glycol and the di-t-amylphenol-P_2O_5 reaction product, of pentamethylene glycol and the di-t-amylphenol-P_2O_5 reaction product, and of decamethylene glycol and the di-t-amylphenol-P_2O_5 reaction product were prepared, each in a weight ratio of 2:98. Each combination was blended in a portion of the base oil, at a concentration of 0.5 per cent, by weight. The resulting blends, when subjected to the foam test, showed the foaming characteristics set forth in Table I.

GLYCOL+OCTYLPHENOL-P_2O_5 PRODUCT

Example 10

A combination consisting of 2 per cent, by weight, of ethylene glycol and 98 per cent, by weight, of the reaction product of three moles of octylphenol (mixed isomers) with one mole of

phosphorus pentoxide was blended in a portion of the base oil at a concentration of 0.5 per cent, by weight. This blend showed no foaming, when tested in the foam test.

Examples 11 and 12

Combinations of triethylene glycol and of the octylphenol-P_2O_5 product described in Example 10, were prepared in ratios of 2:98 and 37:63. Each combination was blended with portions of the the base oil at various weight concentrations. The resulting blends, when subjected to the foam test, showed the foaming characteristics set forth in Table I.

GLYCOLS+VARIOUS ALKYLPHENOL-P_2O_5 PRODUCTS

Example 13

A combination consisting of 2 per cent, by weight, of triethylene glycol and 98 per cent, by weight, of the reaction product of three moles of nonylphenol (mixed isomers) with one mole of phosphorus pentoxide was blended in a portion of the base oil at a concentration of 0.5 per cent, by weight. This blend showed no foaming, when subjected to the foam test.

Example 14

A combination consisting of 2 per cent, by weight, of triethylene glycol and 98 per cent, by weight, of the reaction product of three moles of tetradecylphenol with one mole of phosphorus pentoxide was blended in a portion of the base oil at a concentration of 0.5 per cent, by weight. This blend showed 90 ml. of foam, when subjected to the foam test.

Example 15

A combination consisting of 2 per cent, by weight, of triethylene glycol and 98 per cent, by weight, of the reaction product of three moles of wax-alkylated phenol with one mole of phosphorus pentoxide was blended in a portion of the base oil at a concentration of 0.5 per cent, by weight. When subjected to the foam test, this blend showed 510 ml. of foam.

It will be apparent, from the foregoing examples, that combinations of glycols with certain alkylphenol-P_2O_5 reaction products eliminate the foaming tendencies of mineral oils, when added thereto in definite amounts and in definite proportions. Any glycol appears to be operable within the scope of this invention. However, alkylphenol-P_2O_5 reaction products using tetradecylphenol and higher alkylphenols are ineffective. It will be noted that a weight ratio of glycol to reaction product as low as 1:99 is an effective ratio. However, as demonstrated hereinafter, weight ratios lower than this are not. At the other end of the range, a weight ratio of 50:50 is not effective, whereas a ratio of 37:63 is. It will be noted, furthermore, that in all cases a combination of glycol and alkylphenol-P_2O_5 reaction product in the effective ratios will be effective when blended in the oil at concentrations of about 0.1 per cent, and ineffective at concentrations of 0.01 per cent. It has been found that, in general, the effectiveness of a combination of this invention falls off at concentrations below about 0.05 per cent.

It has been found that the glycols and the alkylphenol-P_2O_5 reaction products, when added alone to the oil, are ineffective. This is demonstrated by the foam test results on oil blends containing the one or the other material alone, or one of them in combination with other additives. This is illustrated in the following examples:

SINGLE COMPONENTS

Examples 16 and 17

A blend consisting of 0.01 per cent, by weight, of diethylene glycol in a portion of the base oil was subjected to the foam test. Foam to the extent of 650 ml. was observed. A blend of 0.01 per cent of triethylene glycol in a portion of the base oil showed 590 ml. of foam in the foam test, at the end of the blowing period.

Example 18

A blend in a portion of the base oil of 0.5 per cent, by weight, of the reaction product of three

TABLE I

Example	Conc. of comp., wt. per-cent	A [1]	B [2]	A/B' [3]	Foam after 5-min. blowing, ml.
Blank oil					400–600
1	0.5	TEG [4]	Diamylphenol	1:99	Nil
	.1	TEG [4]	do	1:99	Nil
	.01	TEG [4]	do	1:99	450
2	.5	TEG [4]	do	10:90	Nil
	.1	TEG [4]	do	10:90	Nil
	.01	TEG [4]	do	10:90	280
3	.5	TEG [4]	do	50:50	380
4	.5	PEG–200 [5]	do	2:98	Nil
	.1	PEG–200 [5]	do	2:98	Nil
	.01	PEG–200 [5]	do	2:98	100
5	.1	PEG–200 [5]	do	10:90	Nil
	.01	PEG–200 [5]	do	10:90	230
6	.5	PEG–6,000 [6]	do	2:98	Nil
	.1	PEG–6,000 [6]	do	2:98	Nil
	.01	PEG–6,000 [6]	do	2:98	50
7	.5	Propylene glycol	do	2:98	Nil
8	.5	Pentamethylene glycol	do	2:98	Nil
9	.5	Decamethylene glycol	do	2:98	Nil
10	.5	Ethylene glycol	Octylphenol	2:98	Nil
11	.5	TEG [4]	do	2:98	Nil
12	.5	TEG [4]	do	37:63	Nil
	.1	TEG [4]	do	37:63	Nil
	.01	TEG [4]	do	37:63	10
	.001	TEG [4]	do	37:63	280
13	.5	TEG [4]	Nonylphenol	2:98	Nil
14	.5	TEG [4]	Tetradecylphenol	2:98	90
15	.5	TEG [4]	Waxphenol	2:98	510

[1] A=glycol component.
[2] B=alkylphenol reacted with P_2O_5 in a 3:1 molar proportion.
[3] B'=alkylphenol-P_2O_5 reaction product.
[4] TEG=triethylene glycol.
[5] PEG–200=polyethylene glycol of 200 M. W.
[6] PEG–6,000=polyethylene glycol of 6,000 M. W.

moles of di-t-amylphenol with one mole of phosphorus pentoxide was prepared. This blend, when subjected to the foam test, showed 500 ml. of foam, at the end of the blowing period.

EXTREME PRESSURE LUBRICANTS

Examples 19 through 27

Three extreme pressure lubricating oil compositions were prepared in accordance with the disclosure of the Otto et al. application, supra. These oils contained 5.0 per cent, by weight, of a chlorinated xanthate produced by reacting chlorinated kerosene with sodium ethyl xanthate, 1.0 per cent, by weight, of dihydroabietyl malate, and 0.5 per cent, by weight, of an alkylphenol-P_2O_5 reaction product. Various glycols were added to portions of these oils in concentrations of 0.01 per cent and 0.001 per cent, by weight. Since the alkylphenol-P_2O_5 reaction product was present in a concentration of 0.5 per cent, the resultant ratios of glycol thereto were about 2:98 and 0.2:99.8, respectively. The composition of these extreme pressure oils and the foam test data thereof, are set forth in Table II.

TABLE II

Example	Glycol	Conc., wt. per-cent	B [1]	Conc., wt. per-cent [2]	Wt. ratio [3]	Conc. of xanthate, wt. per-cent [4]	Conc. of DHM, wt. per-cent [5]	Foam after 5-min. blowing, ml.
	None		Diamylphenol	0.5		5.0	1.0	400–500
19	DEG [6]	0.01	do	.5	2:98	5.0	1.0	Nil
	DEG [6]	.001	do	.5	0.2:99.8	5.0	1.0	320
20	TEG [7]	.01	do	.5	2:98	5.0	1.0	Nil
	TEG [7]	.001	do	.5	0.2:99.8	5.0	1.0	290
21	Propylene	.01	do	.5	2:98	5.0	1.0	Nil
22	Pentamethylene	.01	do	.5	2:98	5.0	1.0	Nil
23	Decamethylene	.01	do	.5	2:98	5.0	1.0	Nil
	None		Octylphenol	.5		5.0	1.0	400–500
24	PEG–200 [8]	.01	do	.5	2:98	5.0	1.0	Nil
25	PEG–300 [9]	.01	do	.5	2:98	5.0	1.0	Nil
26	PEG–6000 [10]	.01	do	.5	2:98	5.0	1.0	Nil
27	TEG [7]	.01	Nonylphenol	.5	2:98	5.0	1.0	Nil

[1] B=alkylphenol reacted with P_2O_5 in a 3:1 molar proportion.
[2] Concentration of alkylphenol (B) = P_2O_5 reaction product.
[3] Ratio of wt. of glycol to wt. of alkylphenol = P_2O_5 reaction product.
[4] Xanthate is reaction product of chlorinated kerosene with potassium ethyl xanthate.
[5] DHM=dihydroabietyl malate.
[6] DEG=diethyleneglycol.
[7] TEG=triethyleneglycol.
[8] PEG–200=polyethylene glycol of 200 M. W.
[9] PEG–300=polyethylene glycol of 300 M. W.
[10] PEG–6000=polyethylene glycol of 6,000 M. W.

As will be apparent from the data in Table II, the effectiveness of the combination of glycol and alkylphenol-P_2O_5 reaction product, in accordance with this invention is not impaired by the presence of other additives. These examples also demonstrate that the combination can be prepared effectively by adding the glycol and the alkylphenol-P_2O_5 reaction product separately. It will be noted, however, that the ratios defined hereinbefore must be maintained. This is demonstrated by the fact that a ratio of about 0.2:99.8 was not effective.

Although the present invention has been described with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope thereof, as those skilled in the art will readily understand. Such variations and modifications are considered to be within the purview and scope of the appended claims.

What is claimed is:

1. A mineral lubricating oil containing between about 0.05 per cent, by weight, and about 2.5 per cent, by weight, of an antifoamant composition consisting of between about 1 per cent and about 40 per cent, by weight, of a dihydroxy compound selected from the group consisting of alkylene glycols and polyalkylene glycols, and between about 99 per cent and about 60 per cent, by weight, of the reaction product formed by reacting about 3 moles of an alkylphenol having a total of between about 8 carbon atoms and about 12 carbon atoms in the alkyl radicals thereof, with about one mole of phosphorus pentoxide, at a temperature of between about 75° C. and about 125° C.

2. A mineral lubricating oil containing between about 0.05 per cent, by weight, and about 2.5 per cent, by weight, of an antifoamant composition consisting of between about 1 per cent and about 40 per cent, by weight, of a polyethylene glycol, and between about 99 per cent and about 60 per cent, by weight, of the reaction product formed by reacting about 3 moles of an alkylphenol having a total of between about 8 carbon atoms and about 12 carbon atoms in the alkyl radicals thereof, with about one mole of phosphorus pentoxide, at a temperature of between about 75° C. and about 125° C.

3. A mineral lubricating oil containing between about 0.05 per cent, by weight, and about 2.5 per cent, by weight, of an antifoamant composition consisting of between about 1 per cent and about 40 per cent, by weight, of ethylene glycol, and, between about 99 per cent and about 60 per cent, by weight, of the reaction product formed by reacting about three moles of an alkylphenol having a total of between about eight carbon atoms and about twelve carbon atoms in the alkyl radicals thereof, with about one mole of phosphorus pentoxide, at a temperature of between about 75° C. and about 125° C.

4. A mineral lubricating oil containing between about 0.05 per cent, by weight, and about 2.5 per cent, by weight, of an antifoamant composition consisting of about 2 per cent, by weight, of ethylene glycol and about 98 per cent, by weight, of the reaction product formed by reacting about three moles of octylphenol with about one mole of phosphorus pentoxide, at a temperature of between about 75° C and about 125° C.

5. A mineral lubricating oil containing between about 0.05 per cent, by weight, and about 2.5 per cent, by weight, of an antifoamant composition consisting of between about 1 per cent and about 40 per cent, by weight, of triethylene glycol and between about 99 per cent and about 60 per cent, by weight, of the reaction product formed by reacting about three moles of octylphenol with

about one mole of phosphorus pentoxide, at a temperature of between about 75° C. and about 125° C.

6. A mineral lubricating oil containing between about 0.05 per cent, by weight, and about 2.5 per cent, by weight, of an antifoamant composition consisting of between about 1 per cent and about 40 per cent, by weight, of triethylene glycol and between about 99 per cent and about 60 per cent, by weight, of the reaction product formed by reacting about three moles of diamylphenol with about one mole of phosporus pentoxide, at a temperature of between about 75° C. and about 125° C.

7. A mineral lubricating oil containing: (1) between about 0.1 per cent, by weight, and about 2.5 per cent, by weight, of an antifoamant composition consisting of between about 1 per cent and about 40 per cent, by weight of a polyethylene glycol and between about 99 per cent and about 60 per cent, by weight, of the reaction product formed by reacting about three moles of an alkylphenol having a total of between about eight carbon atoms and about twelve carbon atoms in the alkyl radicals thereof, with about one mole of phosphorus pentoxide, at a temperature of between about 75° C. and about 125° C.; (2) between about one per cent and about 10 per cent, by weight, of a product obtained by chemically substituting a part only of the chlorine in a chlorinated aliphatic material with a thiocarbonate group; and (3) between about 0.1 per cent and about 3 per cent, by weight, of dihydroabietyl malate.

8. A mineral lubricating oil containing: (1) about 0.5 per cent, by weight, of an antifoamant composition consisting of about 2 per cent, by weight, of diethylene glycol and about 98 per cent, by weight, of the reaction product formed by reacting about three moles of diamylphenol with about one mole of phosphorus pentoxide, at a temperature of between about 75° C. and about 125° C.; (2) about 5 per cent, by weight, of the product obtained by chemically reacting a chlorinated kerosene with potassium ethyl xanthate; and (3) about one per cent, by weight, of dihydroabietyl malate.

9. A mineral lubricating oil containing: (1) about 0.5 per cent, by weight, of an antifoamant composition consisting of about 2 per cent, by weight, of triethylene glycol and about 98 per cent, by weight, of the reaction product formed by reacting about three moles of diamylphenol with about one mole of phosphorus pentoxide, at a temperature of between about 75° C. and about 125° C.; (2) about 5 per cent, by weight, of the product obtained by chemically reacting a chlorinated kerosene with potassium ethyl xanthate; and (3) about one per cent, by weight, of dihydroabietyl malate.

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