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ADDITION AGENTS AND MINERAL OIL LUBRICANT COMPOSITIONS CONTAINING THE SAME

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19 Claims. (Cl. 252—46.6)

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This invention relates to addition agents and mineral oil lubricant compositions containing the same and, more particularly, it is concerned with improvement agents which confer improved antioxidant, corrosion-inhibiting and detergency properties on mineral oil lubricants.

It is recognized in the art that mineral oil lubricants are readily oxidized under service conditions thereby reducing the service life of internal combustion engines and steam turbines. A concomitant effect is corrosion of bearing surfaces. These problems become particularly acute when a highly refined paraffinic base mineral oil is employed as the lubricant.

In the lubrication of internal combustion engines of all types, particularly when severe operating conditions are encountered, mineral lubricating oils frequently prove unsatisfactory because they tend to deposit varnish, gum and sludge on the engine surfaces, such as the cylinder walls, pistons and rings, and also to induce corrosion of bearing materials thereby causing failure of the engine. These problems have become increasingly serious because of the trend toward higher efficiency or higher power output per unit weight of engine, which results in conditions tending to accelerate the deteriorating influences on the mineral oil lubricant. The formation of so-called varnishes and sludges on engine surfaces is a result of oxidation effects on the lubricating oils. The presence of gums, varnishes and sludges is detrimental for many reasons. These substances tend to increase ring sticking and accelerate the formation of further deposits on piston surfaces and in fixed parts of the combustion chamber. The sludges formed in the crankcase of the engine increase the rate of corrosion of bearing surfaces, especially of bearing alloys of the types now in use.

In steam turbines, the corrosion problem is particularly acute because of the presence of water in the mineral oil lubricant and in addition to bearing corrosion, rusting may also be encountered.

It is an object of this invention, therefore to prepare an improvement agent which will obviate the oxidation and corrosion difficulties encountered in the use of mineral oil lubricants.

It is a further object of this invention to provide improved mineral oil lubricant compositions which are stable in storage and use and in which oxidation and corrosion effects are materially inhibited.

In our copending application Serial No. 718,902, filed December 27, 1946, there is disclosed and claimed an addition agent for mineral oil lubricants which confers excellent anti-oxidant, corrosion-inhibiting and pressure-carrying properties on mineral oil lubricants. Such improvement agent is prepared by heating an essentially

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paraffinic base lubricating oil with aluminum chloride, removing aluminum chloride from the reaction product and reacting said product with phosphorus pentasulfide at an elevated temperature to incorporate phosphorus and sulfur therein.

In our Patent No. 2,456,336, issued December 14, 1948, there is disclosed and claimed an improvement agent for mineral oil lubricants which is prepared by heating an essentially paraffinic base lubricating oil with phosphorus pentasulfide in the presence of a surface active silica-containing solid catalyst. It is shown in that patent that when phosphorus pentasulfide is reacted with an essentially paraffinic base lubricating oil in the presence of a surface active silica-containing solid catalyst, the prior aluminum chloride treatment of the lubricating oil as disclosed in our application Serial No. 718,902 may be omitted. It is also shown in our patent that when the prior aluminum chloride treatment of the paraffinic base lubricating oil is combined with reaction of the aluminum chloride treated product with phosphorus pentasulfide in the presence of a surface active silica-containing catalyst, lighter colored products are obtained.

The objects of the present invention are accomplished by providing improvement agents for mineral oil lubricants by reacting an essentially paraffinic base lubricating oil or the aluminum chloride treated product thereof with phosphorus pentasulfide through the use of any of the methods disclosed in our copending application Serial No. 718,902 and our Patent No. 2,456,336 and with an alkyl orthophosphate having at least 5 carbon atoms in the alkyl group. Such improvement agents, as well as the mineral oil lubricant compositions containing them, are believed to be novel and are considered parts of our invention.

The present invention may be regarded as an improvement over the inventions disclosed in our above-identified copending application and patent. While the addition agents disclosed therein confer excellent antioxidant, corrosion-inhibiting and pressure-carrying properties on mineral oil lubricants, they sometimes fail to pass the well known Copper Strip Test (Method 530.31, Federal Specification VV-L-791c, May 12, 1945, page 259) thus indicating the presence of elementary sulfur or the so-called "corrosive" sulfur. While we do not wish to be bound by any theory as to the exact nature of the phosphorus pentasulfide reaction products with an essentially paraffinic base lubricating oil, it is our present belief that either elementary sulfur or incompletely bound sulfur or both are formed in the reaction. In accordance with the present invention, such elementary or incompletely bound sulfur is "neutralized" or "accepted" by combination with the

alkyl orthophosphate added in the preparation of the phosphorus pentasulfide reaction product.

It is still necessary for the purposes of the present invention to employ an essentially paraffinic base lubricating oil as the initial material, because other hydrocarbon materials produce a black, sludge-like, difficultly soluble product regardless of whether the prior aluminum chloride treatment or reaction in the presence of a surface active silica-containing solid catalyst are employed. The reasons for the advantageous effects of the prior aluminum chloride treatment or of the surface active silica-containing solid catalyst on the reaction when an essentially paraffinic base lubricating oil is employed are not fully understood. However, the use of at least one of these methods is essential for the practice of our invention since, if the prior aluminum chloride treatment or the use of a surface active silica-containing catalyst is omitted, the advantageous results of our invention are not obtained. In order to obtain the results of our invention, therefore, it is necessary (1) to employ an essentially paraffinic base lubricating oil, and (2) to conduct the reaction of the oil and alkyl orthophosphate with phosphorus pentasulfide only after aluminum chloride has been reacted with the oil and/or the reaction with phosphorus pentasulfide is conducted in the presence of a surface active silica-containing solid catalyst.

The essentially paraffinic base lubricating oil used as a starting material in accordance with our invention may be derived from any paraffinic crude, such as Pennsylvania, Mid-Continent, or other paraffinic base crudes. The lubricating oil is manufactured from such crudes in accordance with conventional methods and may be refined in accordance with methods known in the art. If it is desired to treat the essentially paraffinic base lubricating oil with aluminum chloride, such treatment is accomplished as described in our copending application Serial No. 718,902. Briefly, such treatment comprises heating the essentially paraffinic base lubricating oil with from 1 to 20 per cent by weight of anhydrous aluminum chloride at a temperature of from 150° to 300° F. while the mixture is vigorously agitated. The time of treatment may vary in accordance with the amount of aluminum chloride used and the temperature of treatment, longer times being required with less aluminum chloride and lower temperatures. In general, the treatment will be completed after four or five hours. After the treatment is completed, agitation is stopped and the sludge containing most of the aluminum chloride settles out from the main body of the oil and is drawn off. The supernatant body of the treated oil may contain further quantities of aluminum chloride finely dispersed therethrough, and in order to insure the removal of all aluminum chloride from the treated oil, agitation with an adsorbent clay followed by filtration may be employed. At the higher temperatures of treatment with aluminum chloride some conversion of the paraffinic base oil to lower boiling products may take place. Although such conversion is slight, the product may be topped if desired, that is, distilled to remove the lower boiling products overhead and to recover as a residue the bulk of the aluminum chloride treated oil having a minimum initial boiling point in the range 490° to 530° F.

The essentially paraffinic base lubricating oil treated with aluminum chloride as disclosed hereinabove may then be reacted with the alkyl orthophosphate and phosphorus pentasulfide. This may be accomplished either by reacting with phosphorus pentasulfide per se, as disclosed in our copending application Serial No. 718,902, or in the presence of a surface active silica-containing solid catalyst as disclosed in our Patent No. 2,456,336.

If it is desired to react the aluminum chloride treated oil and the alkyl orthophosphate with phosphorus pentasulfide per se, this reaction is accomplished by adding from 2 to 20 per cent by weight of P_2S_5 on the mixture of oil and alkyl orthophosphate, preferably 5 to 10 per cent, and heating with agitation at a minimum reaction temperature of 450° F. and a maximum reaction temperature below the temperature where cracking of the oil begins. Hydrogen sulfide is evolved and when the evolution of hydrogen sulfide has nearly ceased, the temperature of the reaction mixture may be increased within the maximum temperature disclosed above, say to about 500° F. for the completion of the reaction.

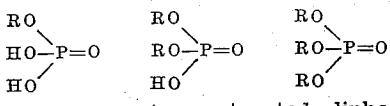
If desired, the aluminum chloride treated paraffinic base lubricating oil and the alkyl orthophosphate may be reacted with phosphorus pentasulfide in the presence of a surface active silica-containing solid catalyst; or, the prior aluminum chloride treatment may be omitted and the essential paraffinic base lubricating oil and alkyl orthophosphate may be reacted with phosphorus pentasulfide in the presence of a surface active silica-containing solid catalyst. The reaction of the essentially paraffinic base lubricating oil and alkyl orthophosphate, whether or not pretreated with aluminum chloride, with phosphorus pentasulfide in the presence of a surface active silica-containing solid catalyst is accomplished by adding 2 to 20 per cent by weight of P_2S_5, preferably from 5 to 10 per cent, to the mixture of essentially paraffinic base lubricating oil and alkyl orthophosphate and heating with agitation at a temperature in the range from 300° F. to a maximum temperature below the temperature where cracking of the oil, that is, pyrolytic decomposition of the oil, begins. Generally the minimum cracking temperature of the oil varies between 490° to 530° F., depending upon the particular oil used. The surface active silica-containing solid catalyst is employed in amounts of from 2 to 25 per cent by weight of the reaction mixture charged and preferably in an amount of 10 per cent by weight. Larger amounts than 10 per cent are ordinarily not necessary, but larger amounts will produce a product having a lighter color. During the course of the reaction hydrogen sulfide is evolved and the phosphorus and sulfur become incorporated in the reaction product. When the evolution of hydrogen sulfide has nearly ceased, the temperature of the reaction mixture may be increased within the maximum temperature mentioned above, say to about 500° F., for completion of the reaction. The mixture is then filtered to remove the catalyst.

The surface active silica-containing solid catalysts may comprise activated clays, silica-alumina cracking catalysts and the like. Thus, activated clays, that is, natural clays such as bentonite, smectite, fluoridin, fuller's earth and the like which have been treated with acid, such as are described in U. S. Patent No. 1,898,165, for example, may be advantageously employed. Synthetic silica-alumina catalysts of the type used for the cracking of hydrocarbon oils, examples of which are described in U. S. Patent No. 2,078,945 and U. S. Patent No. 2,283,173, may also

be employed. Activated silica gel is also suitable. As may be seen, the term "surface active silica-containing solid catalyst" comprises a wide variety of materials, the predominant characteristic of which is the presence of silica in a surface active, that is, activated form.

In accordance with the present invention, an alkyl orthophosphate is admixed with the essentially paraffinic base lubricating oil and the mixture reacted with phosphorus pentasulfide as disclosed hereinabove; or the alkyl orthophosphate may be added to the mixture of the phosphorus pentasulfide and the essentially paraffinic base lubricating oil during the reaction after the evolution of hydrogen sulfide has substantially ceased, but prior to completion of the reaction. The alkyl orthophosphate is ordinarily added in proportions ranging from 10 to 75 per cent by weight of its mixture with the paraffinic base lubricating oil, sufficient to remove free or "corrosive" sulfur in the phosphorus pentasulfide reaction product. Ordinarily not more than 50 per cent of the alkyl orthophosphate is sufficient for most purposes.

The alkyl orthophosphate with which this invention is concerned may be mono-, di-, or trialkyl esters of orthophosphoric acid having the following general formulas:



wherein R represents a saturated aliphatic hydrocarbon radical of at least 5 carbon atoms, preferably from 8 to 18 carbon atoms. The upper limit of 18 carbon atoms is not critical, it being dictated by considerations of commercial availability. In the di- and tri-alkyl esters the R's may be the same or different alkyl radicals.

Some of the esters of this generic class are:

Methyl amyl hydrogen phosphate
Ethyl amyl hydrogen phosphate
Propyl octyl hydrogen phosphate
Amyl decyl hydrogen phosphate
Methyl dodecyl hydrogen phosphate
Methyl hexadecyl hydrogen phosphate
Methyl octadecyl hydrogen phosphate
Lauryl dihydrogen phosphate
Dilauryl hydrogen phosphate
Trilauryl phosphate
Trioctyl phosphate
Isoamyl octyl hydrogen phosphate
Tricetyl phosphate
Cetyl octyl hydrogen phosphate

While any of the esters mentioned above may be used, we prefer to use trialkyl phosphates and, of these, trioctyl phosphate. In view of the fact that these esters of phosphoric acid are commercially available, methods for their preparation need not be described here.

The following examples illustrate the preparation of our new improvement agents.

Example I.—In the presence of 5 per cent by weight of an activated clay catalyst (Filtrol), 50 parts by weight of tri-sec octyl phosphate and 50 parts by weight of an SAE 30 Mid-Continent paraffinic base lubricating oil were treated with 10 per cent by weight of phosphorus pentasulfide by agitating for 1 hour while raising the temperature to 490° F., and agitating at that temperature for two hours or until the evolution of hydrogen sulfide subsided. Then the temperature was raised to 520° F. where it was held for 6 hours with continued agitation of the reactants. The mixture was then cooled and filtered. The properties of this product were as follows:

Gravity, °API	13.2
Phosphorus, per cent	2.8
Sulfur, per cent	3.0
Neutralization No.	13.0
Color, NPA	5.0

Example II.—An additive was prepared in accordance with the procedure of Example I, in which 5 parts by weight of tri-sec octyl phosphate and 25 parts by weight of an SAE 30 paraffinic base lubricating oil were reacted with 12 parts by weight of phosphorus pentasulfide in the presence of 10 per cent by weight of Filtrol. The additive so prepared had the following properties:

Gravity, °API	15
Color, NPA	2.25
Sulfur, per cent	3.2
Phosphorus, per cent	3.0
Neutralization No.	14.0

Example III.—Into a reaction vessel, there were placed 50 parts by weight of an essentially paraffinic base lubricating oil which had been treated with aluminum chloride in accordance with copending application Serial No. 718,902 and 50 parts by weight of tri-sec octyl phosphate. To this mixture were added 12.5 parts by weight of phosphorus pentasulfide. The mixture was agitated and the temperature raised to 490° F. during the course of 1 hour. It was held at that temperature for 2 hours and then raised to 520° F. where it was held for 6 hours. The mixture was then cooled and had the following properties:

Gravity, °API	14.2
Phosphorus, per cent	3.0
Sulfur, per cent	3.2
Neutralization No.	6.0
Color, NPA	4.5

Example IV.—In accordance with the procedure of Example I, 25 parts by weight of tri-sec octyl phosphate and 50 parts by weight of a paraffinic base motor oil were treated with 8 per cent by weigh of phosphorus pentasulfide in the presence of 10 per cent by weight of Filtrol. The additive prepared according to the above had the following properties:

Gravity, °API	14.1
Phosphorus, per cent	2.4
Sulfur, per cent	2.6
Neutralization No.	11.0
Color, NPA	4.5

The reaction products obtained in accordance with the preceding examples are excellent improvement agents for mineral oil lubricant compositions. They are light colored and readily soluble in all types of mineral oils, that is paraffinic, naphthenic or mixed base mineral oils and, as a matter of fact, can be blended with mineral oils in proportions as high as 50 per cent by weight or higher. This excellent solubility of our new improvement agents enables the preparation of concentrated solutions, which may then be diluted down to the proportion desired in the final mineral oil lubricant composition. As stated, our new improvement agents confer excellent anti-oxidant and corrosion-inhibiting properties on the mineral lubricating oils with which they are incorporated, and are characterized by a high degree of potency at

high temperatures. For these purposes, our new improvement agents are generally added to mineral oils in minor amounts, say from 0.1 to 20 per cent by weight of mineral oil, sufficient to confer improved antioxidant and corrosion-inhibiting properties on the mineral lubricating oils with which they are incorporated. Lubricating oils containing our new improvement agents successfully pass the Copper Strip Test.

The following examples illustrate the use of our new improvement agents to obtain improved mineral oil lubricant compositions.

Example V.—A motor oil was prepared by treating a solvent refined SAE 30 motor oil with 1 per cent of the additive prepared in accordance with the procedure of Example I. The following is a summary of the test values in comparison with that of the untreated oil:

	Unimproved Motor Oil	Improved Motor Oil
Gravity: °API	29.0	29.1
Viscosity, SUV: 100° F	521	520
Color, NPA	1.75	1.75
Oxidation and Bearing Corrosion Test Method 257, Gulf:		
Duration of Test: hrs	48	48
Oil Bath Temperature: ° F	347	347
Air Rate: cc./hr	2,000	2,000
Quantity of Oil: cc	300	300
Bearing Type	Cd-Ag / Cu-Pb	Cd-Ag / Cu-Pb
Wt. Change: Grams	−0.1744 / −0.0133	−0.048 / −0.0018
Wt. Change: Percent	−0.96 / −0.08	−0.01 / −0.01
Copper Strip Test	Passes	Passes

Example VI.—An SAE 30 motor oil was treated with 1 per cent of the additive prepared in accordance with the procedure of Example II. Comparison of the tests of the treated oil and untreated oil are:

	Unimproved Motor Oil	Improved Motor Oil
Gravity: °API	29.0	29.1
Viscosity, SUV: 100° F	521	519
Color, NPA	1.75	2.0
Oxidation and Bearing Corrosion Test Method 257, Gulf:		
Duration of Test: hr	48	48
Oil Bath Temperature: ° F	347	347
Air Rate: cc./hr	2,000	2,000
Quantity of Oil: cc	300	300
Bearing Type	Cd-Ag / Cu-Pb	Cd-Ag / Cu-Pb
Wt. Change: Grams	−0.1744 / −0.0133	−0.051 / −0.0020
Wt. Change: Percent	−0.96 / −0.08	−0.01 / −0.01
Copper Strip Test	Passes	Passes

Example VII.—An SAE 30 motor oil was treated with 1 per cent of the additive prepared in accordance with the procedure of Example IV. Comparison of the tests of the treated and untreated motor oil are:

	Uncompounded Lubricant	Lubricant of S. N. 718,902	Lubricant of Pat. 2,456,336	Lubricant of Presen Invention
Gravity: °API	29.3	28.9	28.8	28.9
Viscosity, SUV: 100° F	246	244	245	245
Color, NPA	1.75	1.75	1.75	1.75
Copper Strip Test	Passes	Tarnished	Tarnished	Passes
Falex Wear Test 1000 lb. Gauge 15 min.:				
Wear: No. of Teeth	Fails	0	0	0
Gauge Load at Seizure: Lb	----------	1,750	1,750	2,500

In order to determine the comparative improvement in properties obtained by using the additive of the present invention, additives prepared in accordance with the disclosures of Serial No. 718,902, Patent No. 2,456,336 and the present invention were subjected to the well known Falex Wear Test and the Copper Strip Test. In each instance 2 parts by weight of the additive were compounded with 98 parts by weight of a highly refined motor oil. The uncompounded oil is included for purposes of comparison.

From the above table, it is obvious that not only do the additives of the present invention confer enhanced pressure carrying properties, but lubri-

cants containing them pass the Copper Strip Test.

The "Oxidation and Bearing Corrosion Test, Method 257, Gulf" referred to in the foregoing examples is conducted as follows: An alloy bearing shell of certain commonly used standard dimensions is submerged in 300 cc. of the oil or oil composition to be tested in a 400 cc. Pyrex beaker and heated in a thermostatic oil bath to 370° F. Air is then bubbled through the oil in contact with the bearing shell at a rate of 2000 cc. per hour. At the end of 48 hours the loss of weight and condition of the bearing shell are determined, the bearing shell being washed free of oil and dried before weighing. When determining the effectiveness of various improvement agents, the usual procedure is to run a blank test simultaneously with the oil composition being tested, employing for that purpose a sample of the untreated oil. In this test it is advantageous to employ commercial bearing shells. These shells comprise a suitable metal backing faced with the alloy bearing metal. In this way the actual bearing face is subjected to severe deterioration conditions. By comparison of the results of such tests with actual service tests, we have found them to be in substantial agreement as to the suitability of particular lubricants.

As shown in the above examples, the addition of our new improvement agents to mineral oil lubricant compositions confers excellent anti-oxidant, corrosion-inhibiting and pressure carrying properties. At the same time the compositions so obtained are stable in storage and use and have a color which is substantially unaffected by the addition of the improvement agent. The lubricants obtained pass the Copper Strip Test.

While we have shown in the examples the preparation of compounded lubricating oils, our invention is not limited thereto but comprises all mineral oil lubricant compositions containing our new improvement agents, such as greases and the like. Furthermore, conventional addition agents such as viscosity index improvers, pour point depressants, anti-foam agents and the like may be added without departing from the spirit of the invention.

Resort may be had to such modification and variations as fall within the spirit of the invention and the scope of the appended claims.

We claim:

1. The process of preparing an improvement agent for mineral oil lubricants which comprises heating an essentially paraffinic base lubricating oil with anhydrous aluminum chloride at a temperature of from 150° to 300° F., removing aluminum chloride from the reaction product, and reacting said product and from 10 to 75 per cent by weight of an alkyl phosphate having at least 5 carbon atoms in the alkyl group with phosphorus pentasulfide at an elevated temperature not below 300° F. and not in excess of the minimum cracking temperature of said product to incorporate phosphorus and sulfur therein.

2. The process of preparing an improvement agent for mineral oil lubricants which comprises heating an essentially paraffinic base lubricating oil with anhydrous aluminum chloride at a temperature of from 150° to 300° F., removing aluminum chloride from the reaction product, and reacting said product and from 10 to 75 per cent by weight of an alkyl phosphate having at least 5 carbon atoms in the alkyl group with phosphorus pentasulfide at a temperature of from 450° F. to a maximum temperature below the minimum cracking temperature of said product to incorporate phosphorus and sulfur therein.

3. The process of preparing an improvement agent for mineral oil lubricants which comprises heating an essentially paraffinic base lubricating oil with from 1 to 20 per cent by weight of anhydrous aluminum chloride at a temperature of from 150° to 300° F., removing aluminum chloride from the reaction product, and reacting said product and from 10 to 75 per cent by weight of an alkyl phosphate having at least 5 carbon atoms in the alkyl group with from 2 to 20 per cent by weight of phosphorus pentasulfide at a temperature of from 450° F. to a maximum temperature below the minimum cracking temperature of said product to incorporate phosphorus and sulfur therein.

4. The process of claim 3, wherein the product is dissolved in a mineral lubricating oil.

5. The process of claim 3, wherein the alkyl phosphate contains from 8 to 18 carbon atoms in an alkyl group.

6. The process of claim 5, wherein the alkyl ester of phosphoric acid is tri-sec octyl phosphate.

7. The process of preparing an improvement agent for mineral oil lubricants which comprises heating an essentially paraffinic base lubricating oil, phosphorus pentasulfide and from 10 to 75 per cent by weight of an alkyl orthophosphate having from 8 to 18 carbon atoms in an alkyl group, in the presence of a surface active silica-containing solid catalyst and at a temperature of from 300° F. to a maximum temperature below the minimum cracking temperature of said lubricating oil to incorporate phosphorus and sulfur therein.

8. The process of preparing an improvement agent for mineral oil lubricants which comprises heating an essentially paraffinic base lubricating oil, from 2 to 20 per cent by weight of phosphorus pentasulfide, and from 10 to 50 per cent by weight of an alkyl orthophosphate having from 8 to 18 carbon atoms in an alkyl group, in the presence of from 2 to 25 per cent by weight of a surface active silica-containing solid catalyst and at a temperature of from 300° F. to a maximum temperature below the minimum cracking temperature of said oil to incorporate phosphorus and sulfur therein.

9. The process of claim 8 wherein the alkyl orthophosphate is tri-sec octyl phosphate.

10. The process of preparing an improvement agent for mineral oil lubricants which comprises heating an essentially paraffinic base lubricating oil with from 1 to 20 per cent by weight of anhydrous aluminum chloride at a temperature of from 150° to 300° F., removing aluminum chloride from the reaction product, heating said product with from 2 to 20 per cent by weight of phosphorus pentasulfide in the presence of a surface active silica-contained solid catalyst and from 10 to 75 per cent by weight of an alkyl orthophosphate having from 8 to 18 carbon atoms in an alkyl group at a temperature of from 300° F. to a maximum temperature below the minimum cracking temperature of the aluminum chloride treated oil to incorporate phosphorus and sulfur therein.

11. The product obtainable by the process of claim 1.

12. The product obtainable by the process of claim 4.

13. The product obtainable by the process of claim 5.

14. The product obtainable by the process of claim 7.

15. The product obtainable by the process of claim 10.

16. A lubricant composition comprising a major amount of a mineral lubricating oil and a minor amount, sufficient to confer improved antioxidant and corrosion-inhibiting properties on the composition, of the product obtainable by the process of claim 1.

17. A lubricant composition comprising a major amount of a mineral lubricating oil and a minor amount, sufficient to confer improved antioxidant and corrosion-inhibiting properties on the composition, of the product obtainable by the process of claim 3.

18. A lubricant composition comprising a major amount of a mineral lubricating oil and a minor amount, sufficient to confer improved antioxidant and corrosion-inhibiting properties on the composition, of the product obtainable by the process of claim 7.

19. A lubricant composition comprising a major amount of a mineral lubricating oil and a minor amount, sufficient to confer improved antioxidant and corrosion-inhibiting properties on the composition, of the product obtainable by the process of claim 10.

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