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LUBRICATING COMPOSITIONS

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This invention relates to lubricating compositions, which are especially suitable for use in heavy duty engines. More particularly, this invention pertains to lubricating compositions containing a combination of oil additives which produce improved heavy duty lubricants, particularly suitable for automobile, truck, bus and tractor engines, as well as all types of diesel engines, and the like.

Hydrocarbon oils such as mineral lubricating oils and the like, as well as synthetic oils, are generally unsuited for heavy duty lubrication due to the extreme pressures, heavy loads and high temperatures developed in above engines under operating conditions. Oils, when subjected to such conditions, rapidly deteriorate and break down, forming sludges, varnish and lacquer coatings, corrosive acidic materials which attack and damage alloyed metals, and other contaminants which cause wear, scratching, scuffing and scoring of engine parts as well as ring sticking and seizure.

Other conditions which accentuate and accelerate deterioration of base lubricants and which account at least in part for their rapid oxidation, include the presence of small amounts of moisture formed or present in the lubricant, or blow-by vapors from fuels which enter the lubricating system and form harmful deterioration products and the like. Also the close tolerances to which engine parts are machined as well as the restricted clearances between various engine parts aggravate this situation and aid in breaking down the lubricant. This is due to the fact that varnish and/or lacquer coatings on various engine parts such as rings, valves, pistons and cylinder walls, caused by deterioration, diminish side clearances and act as heat insulators, both conditions causing an increase in oil temperature and resulting in further breakdown. Lacquer formations are attributed to oxidation of oils and are hard resinous materials having a tendency to adhere to metal surfaces and form thereon a hard deposit which blisters and chips, thereby acting as an abrasive capable of scratching surfaces and blocking oil passages.

Ring and piston sticking, clogging and fouling of an engine are also caused by sludge resulting from oxidation of oils at high loads and

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elevated temperatures. Sludges are extremely harmful for in addition to causing wear and corrosion they coat and clog up the circulating systems of engines thereby decreasing their efficiency.

Oil oxidation and decomposition products are highly corrosive especially to alloys such as copper-lead, cadmium-silver and lead-bronze-steel bearings, and the like. Other factors can account for corrosion and they are complex in nature and varied in origin. For example, acids found or formed in oil or fuel may attack alloy bearings. Again, the effect on modern bearings at high temperatures of sulfur derived from certain of its compounds or even found free in the oil or fuel, may be very serious. Thus, the presence of certain sulfur compounds may induce pitting of bearing surfaces such as exhaust valve stem guides, etc. These conditions which are generally encountered in heavy duty lubrication of engines not only result in damage to an engine but frequently in its complete failure.

Heavy duty lubricants often must have so-called extreme pressure properties so as to withstand wear and protect bearing surfaces under stringent conditions. It has been found, however, that such additives generally increase engine deposits and are highly corrosive. The problem of compounding a lubricant for heavy duty purposes, having satisfactory anti-oxidant, detergent, anti-wear, anti-corrosion and extreme pressure properties has not been solved up to the present time to the best knowledge of applicant.

It is known that the addition of certain types of organic and organo-metallic compounds to lubricating oils improves various properties of the oils including the ability to maintain a clean engine during operation. Among these additives certain types of organo-metallic compounds have found wide application in the production of lubricating oils which are capable of maintaining clean engine conditions. The organo-metallic compounds frequently tend to cause corrosion of metal alloy bearings and other parts used in automotive engines, and in addition they tend to give rise to depositis on piston crowns, on the combustion chamber walls and on valve parts which come into contact with engine combustion products. Furthermore, metal-contain-

ing additives may give rise to oil insoluble degradation products or they may be removed from the lubricating oil when an oil circulatory system comprising certain types of filter is employed. This has resulted in a demand for lubricants free from metal-containing additives, especially for engines operating at high speeds and high temperatures in which some or all of the foregoing defects of metal containing additives are accentuated.

It is therefore an object of the present invention to provide improved mineral lubricating oils which, while free from metal-containing additives, have the ability to maintain clean engine conditions with a substantial reduction or elimination of the lacquer and sludge deposits, of the tendency of piston rings to stick and of the choking of oil holes generally encountered with mineral oil lubricants consisting solely of refined petroleum products. It is a further object of the invention to provide such improved lubricating oils which are in addition free from any tendency to corrode metal alloys which may be present in the engine. It is also an object of this invention to provide a heavy duty lubricating composition suitable for use in engines operating at extremely high temperatures and under heavy loads. It is another object of this invention to provide a non-corrosive lubricating composition suitable for heavy duty lubrication. These and other objects of this invention will be apparent from the following description and the appended claims.

Broadly stated this invention comprises a lubricant containing minor amounts of two particular types of additives, the combination of which produces a synergistic action in determining the properties of the resulting composition, resulting in a composition of outstanding stability and lubricity.

Specifically, it has been found that certain sulfurized (which includes in addition to sulfur and sulfur compounds the seleno and telluro analogs) unsaturated hydrocarbons such as olefins and the like when in the presence of certain types of phenolic compounds are remarkably effective additives for the production of lubricating compositions and are particularly valuable as crank case lubricants in engines operating at high speeds and high temperatures. Compounded lubricants of this invention can be used in various engines over long periods without giving rise to any lacquer or sludge deposits or to the sticking of piston rings, the choking of oil holes or lines or to general engine fouling.

The unsaturated material or materials which are treated with a sulfurizing agent should contain at least 10 carbon atoms in the molecule. The unsaturated materials are preferably unsaturated aliphatic hydrocarbons and may be pure or substantially pure monoalkylenes such as decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, cetene, cerotene, melene and the like. Mixtures of said unsaturated compounds may also be used as well as unsaturated hydrocarbons containing more than one double bond such as di-isoprene, tributadiene and the like, or acetylenic compounds such as dodecyne, decyne, and the higher alkynes.

Instead of using pure compounds of the above type, unsaturated aliphatic hydrocarbons may be obtained from petroleum hydrocarbon stock. Thus monoalkenes boiling above about 300° F. such as obtained by cracking paraffin wax or by dehalogenation and/or dehydrohalogenation of halogenated paraffins and alkyl halides. Olefins may also be obtained by dehydration of long chain fatty alcohols containing at least 10 or more carbon atoms such as lauryl or stearyl alcohols, or by decarbonylation of oleyl alcohol or such unsaturated alcohols as are obtained by carboxyl reduction of sperm oil, etc. Of this class of alkenes, the mixture of monoalkenes containing 10 to 25, preferably 10 to 18 carbon atoms in the molecule derived from paraffin waxes by cracking is a particularly preferred material for sulfurizing.

The sulfurizing agents and analogous materials which are used may be the following materials and their mixtures: sulfur, sulfur mono- and dichloride, sodium polysulfides, e. g. sodium tetra- and pentasulfide, ammonium polysulfides, sulfur dioxide, hydrogen sulfide, hydrogen selenide, hydrogen telluride, ammonium hydrosulfide-H_2S mixture, P_2S_5, P_4S_3, P_4S_7, P_2Se_5, P_2Te_5, etc., and mixtures thereof.

In carrying out the reaction, conditions are so controlled that only the sulfur, selenium and/or tellurium atoms remain tightly bonded to the unsaturated compound. Thus, in cases where, for example, P_2S_5 is used, as the sulfurizing agent, the reaction is carried out at an elevated temperature of above 160° C. so that any phosphorus entering the reaction finally splits out as sludge and is substantially removed. Any phosphorus remaining as a component of the sulfurized material is present as entrained matter in amounts not exceeding 0.2%. The simplest of the methods available for effecting such sulfurization, and the one preferred, comprises heating the unsaturated hydrocarbon with sulfur so that a complex reaction sets in, the mechanism of which is not yet elucidated. At temperatures above the melting point of sulfur it is believed that the sulfur may attach itself at the points of unsaturation in, for example, one of the following manners:

$$RCH{=}CHR' + 2S \longrightarrow RCH(-S-S-)CHR'$$

$$RCH{=}CHR' + S \longrightarrow RCH\underset{S}{<}CHR'$$

wherein R and R' are alkyl groups. Products of this invention are not limited to the foregoing types alone, or to any specific set of types since knowledge of the mechanism of the sulfurization treatment is by no means sufficient to permit such precision on the matter of chemical configuration. Under certain conditions, it is believed that polymeric forms of the above adducts of sulfur with unsaturated hydrocarbons may be obtained. In addition products containing sulfur bridges linking two or more hydrocarbon residues may be obtained by the foregoing procedure. However, other methods of sulfurization may be employed to give compounds of equal effectiveness for use in this invention.

The following examples describe specific conditions for preparing the sulfurized products of this invention.

Example I

About 1 mole of Stanlow cracked wax olefin of C_{10}–C_{18} (average molecular weight of about 185 containing substantially only terminal double bonds and having an average of about 0.9 double bond per molecule) was reacted with about 1 mol of sulfur at about 160° C.–175° C. for 6 hours. The sulfurized olefin was isolated by extraction with a light petroleum hydrocarbon solvent boiling between 164° F. and 233° F., and the solvent

thereafter removed by suitable means such as evaporation. The final reaction product contained 13.9% by weight of sulfur.

Example II

Following the above procedure the two materials as indicated above and in the same proportions were reacted for 24 hours and on analysis the final product contained 13.7% sulfur by weight.

Example III

Following the procedure described in Example I about one mol of Stanlow cracked wax olefin of C_{10}–C_{18} was reacted with about one-half mol of sulfur for 6 hours and on analysis the final product contained 9.1% sulfur by weight.

Example IV

Following the procedure described in Example I about one mol of Stanlow cracked wax olefin of C_{10}–C_{18} was reacted with about one-half mol of sulfur for about 24 hours and on analysis the the final product contained about 8.9% sulfur by weight.

Example V

About one mol of cracked wax olefin from Balik Papan (averaging approximately C_{16} with an average molecular weight of about 220, and containing substantially only terminal double bonds and an average of about 0.75 double bonds per molecule) was reacted with about one mol of sulfur for about 24 hours in the manner described above and on analysis the recovered product contained 9.9% sulfur by weight.

It might be of interest to point out that from the above examples it can be seen that the degree of sulfurization varies directly with the amount of sulfur employed, at least up to one atom of sulfur per double bond, and it is relatively independent of the time of reaction.

These sulfurized additives or mixtures thereof may be used in amounts varying from 0.01% to 20% and preferably are used in amounts varying from 1% to about 5% by weight.

The second additive used in lubricating compositions of this invention may be a polar substituted aromatic compound represented by the general formula:

$$(R'')_y\text{—Ar—}(YH)_x$$

wherein Ar is a mono or poly nuclear aromatic ring compound, R'' represents alkyl and/or alkoxy radicals, one of which should contain at least 8 carbon atoms, Y is an element from the group consisting of O, S, Se and Te, and the radicals (YH) are attached directly to the aromatic ring, x is an integer of 1 to 2 and y is a small integer of at least 1, preferably from 1 to 4, and selected so that x plus y is not greater than 6 when Ar is a mono nuclear ring. If x is greater than one, then the radicals YH may be the same or different.

The alkyl phenols should preferably contain no additional water-solubilizing groups. The alkyl phenols can be made by alkylation of a phenol by any known suitable means. Alkenes and their mixtures containing from 10 to 18 carbon atoms in the molecule can be used as the alkylating material. Here again mixtures of alkenes derived from paraffin waxes by cracking or from higher fatty alcohols by dehydration are valuable and easily accessible starting materials. Thus, a mixture of alkyl phenols made by the alkylation of phenol or lower alkyl phenols such as the cresols and xylenols, or alpha or beta-naphthol with a mixture of alkenes containing from 10 to 18 carbon atoms in the molecule and obtained by the above-mentioned procedures can be employed. More than one alkyl group may be present in the phenol as in the case of compounds made by the di- or tri-alkylation of phenols with alkenes or alkyl halides or alcohols or ethers or of compounds made by the monoalkylation of, for example, a cresol, xylenol, or carvacrol. Other nuclear substituents may be present provided they do not increase substantially the water solubility of the product. Thus, halogen, alkoxy, alkyl mercapto, and alkyl amino groups may be present in the phenol. Moreover di- or polyhydric phenols such as catechol, resorcinol, pyrogallol, and the dihydroxy naphthalenes may be alkylated to produce water-insoluble and oil-soluble phenols useful for the purposes of this invention.

Specific compounds which are represented by the above general formula and which can be used in compositions of this invention are:

2,4-dimethyl-6-tertiary octyl phenol.
2,4-dibutyl-6-tertiary octyl phenol.
2,4-dioctyl-6-methyl phenol.
2-ethyl-4-octyl phenol.
1,4-dihydroxy-2(2-octyl) benzene.
2,4-dimethyl-6-tertiary octyl alpha naphthol.
2,4-dioctyl-6-butyl alpha naphthol.
2,4-dioctyl alpha naphthol.
2,4-dimethyl-6-tert.-octyl thiophenol.
2,4-dimethyl-6-tert.-octyl seleno-phenol.
1,4-dimercapto-2(2-octyl) benzene.
1-mercapto-4-hydroxy-2-octyl benzene.
2-ethyl-4-octyl thiophenol.
2,4-dioctyl-6-methyl alpha thionaphthol.
2,4-dimethyl-6-octyl alpha thionaphthol.
2,4-dimethyl-6-tert.-octyl telluro phenol.
C_{14}-alkylated cardanol.
C_{14}-alkylated thiocardanol.
Paratertiary octyl phenol.
Paratertiary nonyl phenol.
Ortho dodecyl phenol.
Para dodecyl phenol.

The alkyl phenols and mixtures thereof can be used in amounts varying from 0.01 to about 20% and preferably to about 5% by weight.

The base lubricant can be selected from a wide variety of natural and synthetic lubricants. Mineral oils and their mixtures varying in viscosity from 100 to 200 SUS at 100° C. can be used, said mineral oils being obtained from various petroleum crudes, such as paraffinic or asphaltic and if desired may be refined by any of the well known processes, such as treatment with sulfuric acid, solvent extraction, or solvent dewaxing. Mixtures of mineral oils and fixed oils such as castor oil, lard oil, and the like can be used as well as synthetic oils and mixtures of synthetic oils with mineral and/or fixed oils and their derivatives.

Synthetic lubricants which can be used in compositions of this invention are:

I. Synthetic lubricants produced by the Fischer-Tropsch, Synthol, Synthine and related processes, e. g.
   A. Polymerization of olefins such as ethylene, butylene, and the like, and their mixtures in the presence of a Friedel-Crafts or other type catalyst at elevated temperatures and pressures.

B. Polymerization of unsaturated hydrocarbons in presence of a catalyst and then condensing said polymerized product with an aromatic hydrocarbon such as xylol, benzol, naphthalene, etc.

C. Oxidation of polymerized olefins of lubricating range as noted under A and B.

D. Process of converting natural gas to carbon monoxide and hydrogen, followed by catalytic reaction under elevated temperature and pressure to produce hydrocarbons of lubricating range (Synthol Process).

II. Bergius Process for producing synthetic lubricants, e. g.

A. Hydrogenation of coal, peat, and related carbonaceous materials under pressure and at elevated temperature in presence of a catalyst.

B. Hydrogenation of asphalts, petroleum residues and the like.

III. Voltolization Process for producing syntheic lubricants, e. g.

A. Voltolization of fatty materials such as fatty oils.

B. Voltolization of mixtures of fatty oils and petroleum hydrocarbons.

C. Voltolization of unsaturated hydrocarbons, their mixtures, and the like.

IV. Organic Synthetic lubricants

A. Alkyl esters of organic acids, e. g.
Alkyl lactates
Alkyl oxalates
Alkyl sebacates (2-ethylhexyl sebacate)
Alkyl adipates
Alkyl phthalates (dioctyl phthalates)
Alkyl ricinoleates (ethyl ricinoleate)
Alkyl benzoates

B. Alkyl, alkylaryl esters of inorganic acids, e. g.
Trixylenyl phosphate
Tributyl phosphate
Triethyl phosphate

V. Synthetic lubricants made by polymerization of alkylene oxides and glycols at elevated temperatures in the presence of catalysts such as iodine, hydriodic acid, etc.

A. Polymers of alkylene glycols:
Trimethyl glycol
Propylene glycol
Tetramethylene glycol
Hexamethylene glycol
Pentamethylene glycol

B. Copolymer of
Trimethylene glycol and triethylene glycol
Trimethylene glycol and hexamethylene glycol
Trimethylene glycol and B-methyltrimethylene glycol
Trimethylene glycol and diethylene glycol

C. Copolymers prepared from certain peroxides at elevated temperatures and in presence of KOH or BF_3-ether catalyst, e. g.
Ethylene oxide and propylene oxide
Isobutylene oxide and propylene oxide
Epichlorohydrin and propylene oxide

D. Sulfur containing polymers obtained by treating allyl alcohol, divinyl ether, diallyl ether, diallyl sulfide, dimethylallyl ether, glycols, with H_2S in presence of a catalyst such as toluene sulfonic acid, peroxides, ultraviolet light, e. g.
Dihydroxy dipropyl sulfide
Trimethylene glycol and dihydroxyl dipropyl sulfide
Trimethylene glycol and dihydroxy diethyl sulfide

VI. Polymers obtained from oxygen-containing heterocyclic compounds, e. g.
Polymerization of tetrahydrofuran in the presence of a catalyst.

VII. Silicon polymers, e. g.
Polyalkyl siloxane and silicate polymers
Alkylaryl siloxane and silicate polymers
Dimethyl siloxane and silicate polymers, etc.

In addition to the two essential additives described hereinabove which constitute components of lubricating compositions of this invention, other additives such as oxidation and corrosion inhibitors, sludge dispersers, oiliness agents, extreme pressure agents, antiwear agents and the like may be used and will be hereinafter fully discussed.

Compositions of the invention may be formulated as follows:

	Broad range	Preferred range
Sulfurized unsaturated aliphatic hydrocarbon having at least 10 carbon atoms in the molecule (e. g. Sulfurized wax olefins of C_{10}–C_{25})	*Percent* 0.01–20	*Percent* 1–5
Alkyl phenol containing at least one alkyl group of at least 8 carbon atoms e. g. alkylated C_{10}–C_{18} phenol	0.01–20	1–5
Base lubricant (natural and/or synthetic oil)	Balance	Balance

A specific composition of this invention may be illustrated by the following example:

	Percent
C_{10}–C_{18} alkyl phenol	1.0
Sulfurized mixture of alkenes containing 19 to 25 carbon atoms in the molecule.	1.2
High VI paraffinic solvent refined oil	balance

The following table further illustrates lubricating compositions of this invention.

		1	2	3	4	5	6	7
I	Sulfurized cracked paraffin wax	x						x
	Sulfurized higher alkynes containing C_{10}–C_{25}					x		
	Sulfurized diisoprene		x					
	Sulfurized cetene			x	x			
	Sulfurized polymeric diisobutylene						x	
II	Paratertiary octyl phenol							x
	Paradodecyl phenol						x	
	Paratertiary octyl resorcinol					x		
	Paranonyl thiophenol	x						
	2,4-ditertiary butyl-6-phenol		x					
	Octyl naphthol			x				
III	Mineral lubricating oil	x	x	x		x	x	
	Dioctyl sebacate				x			x

To illustrate the pronounced improvement obtained with compositions of this invention, a series of engine tests were made by running a Petter engine for over 50 hours with the following lubricating compositions and thereafter observing the cleanliness conditions of the engine.

Composition			Condition of the engine after test run
Base lubricant	Sulfurized additive	Phenolic additive	
Undoped high VI paraffinic solvent refined oil.			Poor.
Do	+1.2% by weight of a sulfur treated mixture of alkenes containing C_{10}-C_{25} molecules.		Do.
Do		+1% C_{10}-C_{18} alkylated phenol.	Poor (worse than undoped oil).
Do	+1.2% by weight of a sulfur treated mixture of alkenes containing C_{10}-C_{25} molecules.	do	Very good (engine clean).
Do	+Sulfurized ethylene		Poor.
Do		+ Butyl phenol	Do.
Do	+Sulfurized ethylene	do	Do.

The present additives may be incorporated advantageously in extreme pressure lubricants, cutting oils, rolling oils, wire drawing lubricants, greases, hypoid gear lubricants, and especially these polymers, may be employed in lubricants for bearings, in particular modern alloy bearings such as cadmium-silver, cadmium-nickel, copper-lead, "high lead" alloys as well as Babbitt metal. and the like. They may also be used to impart antiwear and/or antioxidant properties to lubricants not necessarily subject to high pressure. The above additive mixtures may be incorporated advantageously in organic substances not intended for use as lubricants at all, such as gasoline, kerosene, spray oil, medicinal oil, transformer or electrical insulating oil, cleaning fluid, synthetic or natural rubber, resins, waxes, diesel fuel.

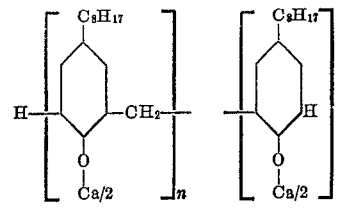
The present additives may also be advantageously used in connection with other additives in lubricating media, for example, detergents formed from the oil-soluble salts of various bases with detergent forming acids. Such bases include metallic as well as organic bases. Metallic bases include those of the alkali metal, as well as Cu, Mg, Ca, Sr, Ba, Zn, Cd, Al, Sn, Pb, Cr, Mn, Fe, Ni, Co, etc. Organic bases include various nitrogen bases as primary secondary, tertiary and quaternary amines, including heterocyclic nitrogenous basic substances such as pyridine and pyrrolidine.

Examples of detergent-forming acids are the various fatty acids of, say, 10 to 30 carbon atoms, wool fat acids, paraffin wax acids (produced by oxidation of paraffin wax), chlorinated fatty acids, aromatic carboxylic acids including aryl fatty acids, aryl hydroxy fatty acids, paraffin wax benzoic acids, various alkyl salicylic acids, phthalic acid monoesters, aromatic keto acids, aromatic ether acids; diphenols as di(alkyl phenol) sulfides and disulfides, methylene bis alkyl phenols; sulfonic acids such as may be produced by treatment of alkyl aromatic hydrocarbons or high boiling petroleum oils with sulfuric acid; sulfuric acid mono esters; phosphoric acid mono and di-esters, including the corresponding thiophosphoric acids; phosphonic and arsonic acids, etc.

Non-metallic detergents include compounds such as the phosphatides (e. g. lecithin), certain fatty oils as rapeseed oils, voltolized fatty or mineral oils.

Other detergents are the alkaline earth phosphate di-esters, including the thiophosphate di-esters; the alkaline earth diphenolates, specifically the calcium and barium salts of diphenol mono and poly sulfides, etc.

Particularly effective detergents are the polyvalent metal salts of the resinous condensation products of low molecular weight aldehydes (such as HCHO, CH_3CHO, etc.) with alkylated aryl hydroxy products (such as alkyl phenol, alkyl naphthol, etc.). They may be typified by calcium salts of reaction products of formaldehyde and octyl phenol which may be represented by the general formula



wherein n is a small integer such as 1, 2, 3, 4 or 5 or the product is a mixture of such polymers.

Other agents such as corrosion inhibitors may also be present such as dicarboxylic acids of 16 and more carbon atoms, alkali metal and alkaline earth salts of sulfonic acids and fatty acids, monocarboxylic acids containing a minimum of about 12 carbon atoms and having a nitro, nitroso, nitrile, mercapto, or aryl sulfonyl group attached to the alpha or beta carbon atom etc.

Likewise, other additives may be present in a lubricating oil composition of this invention such as blooming agents, anti-foaming agents, other viscosity index improvers, pour point depressants, etc. The auxiliary additives are generally used in amounts ranging from 0.1% to 2% by weight.

I claim as my invention:

1. A mineral lubricating oil composition having incorporated therein from 0.01% to 5% by weight of an alkyl phenol having the formula ROH wherein R is an alkaryl hydrocarbon radical containing an alkyl group having from 8 to 18 carbon atoms and as the only sulfur containing compound wherein sulfur is present as a sulfide about 0.01% to 5% by weight of a sulfurized cracked wax olefin, said cracked wax olefin having an average molecular weight of about 185, containing from 10 to 18 carbon atoms per molecule, containing substantially only terminal double bonds and having an average of about 0.9 double bond per molecule.

2. A mineral lubricating oil composition having incorporated therein from 0.01% to 5% by weight of an alkyl phenol having the formula ROH wherein R is an alkaryl hydrocarbon radical containing an alkyl group having from 8 to 18 carbon atoms and as the only sulfur containing compound wherein sulfur is present as a sulfide about 0.01% to 5% by weight of a sulfurized cracked wax olefin, said cracked wax olefin having an average molecular weight of about 220, consisting

substantially of molecules containing 16 carbon atoms, containing substantially only terminal double bonds and having an average of about 0.75 double bond per molecule.

3. A mineral lubricating oil composition having incorporated therein from 0.01% to 5% by weight of C_{10-18} alkyl phenol and as the only sulfur containing compound wherein sulfur is present as a sulfide from 0.01% to 5% of a sulfurized cracked wax olefin, said cracked wax olefin consisting substantially of a mixture of monoalkenes containing from 19 to 25 carbon atoms per molecule and containing substantially only terminal double bonds.

4. A mineral lubricating oil composition having incorporated therein about 1% by weight of C_{10-18} alkylphenol and as the only sulfur containing compound wherein sulfur is present as a sulfide about 1.2% by weight of a sulfurized cracked wax olefin, said cracked wax olefin consisting substantially of a mixture of monoalkenes containing from 19 to 25 carbon atoms per molecule and containing substantially only terminal double bonds.

5. A mineral lubricating oil composition having incorporated therein from 0.01% to 5% by weight of C_{10-18} alkyl phenol and as the only sulfur containing compound wherein sulfur is present as a sulfide from 0.01% to 5% of a sulfurized cracked wax olefin, said cracked wax olefin consisting substantially of a mixture of monoalkenes containing from 10 to 25 carbon atoms per molecule and containing substantially only terminal double bonds.

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