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(54) **Synthetic lubricant composition.**

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Description

The present invention relates to synthetic lubricant compositions for use in high temperature rotary engines using internally lubricated fuel, wherein the lubricant is consumed and combusted during operation.

A wide variety of synthetic lubricants have been described in the patent and scientific literature.

Alkyl trimellitate compositions suitable for use in lubricants and hydraulic fluids are described in Ger. Offen. 2,14O,683, abstracted in Chemical Abstracts, Vol 76, 115812c (1972). Of similar teaching is U.S.S.R. Patent No. 525,663, abstracted in Chemical Abstracts, Vol. 86, 92985b (1977). Blends of penta-erythritol and trimellitate esters as a synthetic lubricating oil base stock for jet engines is described in British Patent No. 1,481,27O.

U.S. Patent No. 3,637,5O1 describes complex esters made by reaction of a mixture of neopentyl-type polyol, an aromatic polycarboxylic acid, and an aliphatic monocarboxylic acid. It is suitable for lubricating gas turbine engines.

Certain dialkyl diesters of mixtures of isophthalic acid and terephthalic acid are characterized as excellent synthetic oils in U.S. Patent No. 2,936,32O.

U.S. Patent No. 3,O21,357 describes novel dialkyl esters of 5-t-alkylisophthalic acid which are suitable as synthetic liquid lubricants and plasticizers for synthetic polymeric resins. A gas turbine lubricant employing, as a base stock, a blend of a carboxylate ester (e.g., an ester of phthalic and/or isophthalic acid) and a low viscosity mineral oil is described in U.S. Patent No. 3,912,64O.

One example of a synthetic lubricant which was tried in gas-fired rotary engines, for example, was a product sold under the trademark STAUFFER SDL-1. It comprised about 88% of a blend of certain reaction products of trimethylolpropane with various C7-C18 carboxylic acids. It, however, produced wear and deposit problems in such engines.

British Patent No. 1,44O,129 describes lubricants containing 85-96% triisodecyl trimellitate as a base fluid. Tricresyl phosphate is used in the lubricant of Example 2. In its two exemplified lubricants, inorganic, metal-containing additives are also used. The use of such metal-containing additives would give rise to an undesired ash residue when used under high temperature conditions, e.g., those existing in gas-fired rotary engines, above the decomposition temperature of the lubricant. Such residues lead to wear, deposits, and other problems. Also, the lubricant shown in Example 2 of British Patent No. 1,44O,129, although containing triisodecyl trimellitate (85%) and tricresyl phosphate (1.5%), additionally contains an alkyl methacrylate copolymer as a viscosity improver. Use of such a copolymer in a lubricant which is consumed during the ignition cycles of the engine with the fuel will also lead to undesired carbon deposits. Thus, the lubricant compositions shown in British Patent No. 1,44O,129, if used in gas-fired rotary engines where the lubricant is sprayed into the combustion chamber for eventual consumption along with the fuel, will lead to residue problems (e.g., ash deposition or ash and carbon deposition).

The present lubricant composition is an improved lubricant for such engines, for example, which is consumed with the fuel and leaves essentially no residue in the combustion chamber. It comprises nonmetal containing constituents and is therefore an ashless product when subjected to high temperature conditions above the decomposition temperature of the lubricant. It does not contain polymeric additives in its additives package which, when incinerated, would also give rise to carbon deposits.

The present engine lubricant is a blend of a major amount of at least one aromatic tricarboxylic ester, a minor amount of antiwear agents comprising a phosphate ester, and a minor amount of an organic additives package, which is substantially free of metallic moieties or components and polymeric components as a result of which said organic additives package leaves no residue in the engine when the lubricant is incinerated during operation of the engine.

The first component for the lubricant of the present invention, which is present in major or predominate amount and functions as the base lubricating fluid is at least one aromatic tricarboxylic ester. A preferred triester component is a trimellitate ester component. These esters are aromatic or benzene tricarboxylic acid triesters having the formula Ar[C(O)OR]3, where Ar is a phenyl ring and R is an aryl or an alkyl group, e.g., one having less than about 18 carbon atoms. Preferred alkyl groups in such esters range from about 4 to about 18 carbon atoms in length. This component is present at from about 75 to about 99 percent by weight of the lubricant of the present invention.

The Table listed below gives a representative listing of potential "R" groups (i.e., R′, R″ and R‴) for preferred trimellitate esters which can be used.

R'	R''	R'''
n-butyl	n-butyl	n-butyl
i-octyl	i-octyl	i-octyl
2-ethylhexyl	2-ethylhexyl	2-ethylhexyl
i-decyl	i-decyl	i-decyl
methyl	methyl	methyl
ethyl	ethyl	ethyl
n-butyl	n-butyl	n-butyl
phenyl	n-butyl	n-butyl
n-hexyl	n-hexyl	n-hexyl
n-heptyl	n-heptyl	n-heptyl
nonyl	nonyl	nonyl

Preferred triesters are triisodecyl trimellitate and tris-(2-ethylhexyl)trimellitate or their mixtures at ratios providing a desired viscosity.

An optional, component of the present invention, which can also be present in minor amount, e.g., up to about 15 percent by weight of the lubricant, is at least one thermally and oxidatively stable phthalate ester component. This component is used to adjust the viscosity of the lubricant since the tri-carboxylic triesters tend to be viscous and might not have the desired viscosity characteristics if used without this optional phthalate ester also being present. Such a component is a benzene carboxylic acid diester of the formula Ar(C(O)OR)2, where Ar is a phenyl ring and R is as defined above and is an alkyl group of less than about 18 carbon atoms, e.g., from about 4 to about 10 carbon atoms. The esters that form this component can be derivatives of such benzene dicarboxylic acids as phthalic acid, isophthalic acid and terephthalic acid. Phthalate ester, where the substituents are in the ortho-position is not thermally and oxidatively stable within the purview of the present invention.

Both of the above-mentioned types of tricarboxylic triesters and phthalate esters should be substantially fully esterified so there is no appreciable unreacted acid functionality in the ester component. Preferably, both are branch-chain aliphatic esters of the benzene carboxylic type with suitable branch chain groups including 2-ethylhexyl, 2-ethylbutyl, isooctyl, iso-propyl, and isodecyl. Branch chain groups derived from "Oxo" alcohols are also useful, as described in U.S. Patent No. 2,760,934.

The second component of the present invention is a phosphate ester component at from about 0.5% to about 10% by weight. This component is present as an antiwear and extreme pressure additive. Preferably, the phosphate ester is one containing three aryl groups in the form of aryl and/or alkaryl groups. Examples of useful phosphate esters are tertiary butylphenyl/ phenylphosphate, secondary butylphenyl/phenylphosphate, and isopropylphenyl/phenylphosphate. These phosphate esters may be prepared in accordance with known alkylation and phosphorylation procedures as described, for example, in U.S. Reissue Patent No. 29,540. Mixed tertiary butyl/phenyl phosphates (primarily di-(tert-butylphenyl) monophenylphosphate and mono-(tert-butyl)phenyldiphenylphosphate) are highly preferred because of their availability and thermostability.

The second antiwear component of the present lubricant compositions preferable also comprises supplemental extreme pressure antiwear agents. Suitable extreme pressure antiwear agents include oil-soluble organosulfur compounds, in particular, sulfurized hydrocarbons of desired molecular weight. These sulfur compounds may contain other groups which are beneficial and include phosphoros atoms. A preferred class of organosulfur compounds is constituted by sulfurized olefins prepared by the reaction of a C3-C6 olefin or a polyolefin derived therefrom, with a sulfur-containing compound, such as sulfur, sulfur monochloride and phosphorpentasulfide. Such extreme pressure additives are commercially available, frequently contained in additive packages designed for gear lubricants. Such commercial additives may directly be used in the present invention provided that no metal-containing components are present. Sulfurized and phosphorized extreme pressure agents are preferred.

The third essential component of the present invention is a substantially residue-free additives package which can comprise the following types of components:

Load Carrying Additive	up to 2.0, pref. 0.1 to 1.0 wt.%
Corrosion Inhibitor	0.015 to 2.0, pref. 0.10 to 0.3 wt.%
Antioxidant	0.05 to 2.0, pref. 0.25 to 1.0 wt.%
Metal Passivator	0.002 to 0.50, pref. 0.01 to 0.04 wt.%
Wetting Agent	up to 0.20, pref. up to 0.1 wt.%

In order to be substantially residue-free, in accordance with the present invention when the lubricant is combusted, the components used in the additives package need to be substantially free of metallic moieties or components if ash residues are to be avoided. In other words, they are organic, rather than either metalloorganic or inorganic, in nature. Also, the organic additives chosen should not be polymers which, upon incineration, give rise to carbon deposits. With these provisos in mind, representative additives can be selected to the non-metal-containing and non-polymeric organic materials listed as additives in British Patent No. 1,440,129 at page 3, line 35 and following, in accordance with the description provided herein.

The additives package used in the instant lubricant is intended to provide oxidation stability, to enhance load carrying properties, and to prevent corrosion by chemical attack on ferrous surfaces as well as to passivate non-ferrous metals such as copper-containing alloys.

The useful load carrying additives include the amine salt of phosphoric and phosphonic acid derivatives. Moreover, certain phosphorus-amine compounds will also function as ashless antiwear additives in the synthetic base stocks of the instant invention. Such phosphorus-amine products will also give anti rust protection. Lubricant compositions containing the optional extreme pressure antiwear agent do not require the addition of a load carrying additive.

There will essentially be no need for using detergent and dispersant-type additives in the instant lubricant compositions when used in its preferred embodiment in a natural gas-fired rotary engine. This is because the lubricant in this type of rotary engine in not cycled and the lubricant is consumed with the fuel. Likewise, there is no need to add a viscosity index improver to these lubricants. In particular, the type of polymeric viscosity improvers used in British Patent No. 1,440,129 should be avoided.

Aromatic amines have been used for many years to improve the oxidation stability of various synthetic lubricant base stocks. Polyol esters of the type used in aircraft gas turbine engines have a long history of using aromatic amines, such as octylphenylnaphthylamine, phenothiazene, and phenyl-alpha-naphthylamine to enhance the oxidation stability of such fluids.

Triarylphosphate esters are good antiwear additives under normal loading conditions in both mineral oil-based and synthetic lubricants. For example, tert-butylphenyl/diphenyl phosphate has the added ability to also give extreme pressure protection under more severe loading conditions.

The following Examples illustrate certain preferred embodiments of the present invention.

Example 1

A lubricant composition in accordance with this invention is formed by admixture of the following ingredients:

Ingredient	Weight %
Mixed trialkyl trimellitate lubricant[1] (HATCOL 2920 brand)	43.79
Mixed trialkyl trimellitate lubricant[2] (HATCOL 2932 brand)	43.79
Di(2-ethylhexyl)isophthalate plasticizer (FLEXOL 380 brand)[3]	9.73
Tertiary butylphenyl/diphenylphosphate (SYN-O-AD 8478 brand)[4]	1.0
Phosphorus-sulfur extreme pressure antiwear composition (HITEC E-320 brand)	1.0
Alkyl thiodiazole as corrosion inhibitor (AMOCO 153 brand)	0.15
Phenyl-alpha-naphthylamine as antioxidant	0.50
Benzotriazole as metal passivator	0.02

[1] This product has a viscosity of 456 SUS (Saybolt Universal Seconds) (98 mm2/s) at 100oF (37.8°C)

[2] This product has a viscosity of 690 SUS (149 mm2/s) at 100°F (37.8°C).

[3] Alternative products for use include Stauffer Base Stock 610 or Morflex 1121.

[4] This product is a 150 SUS (32 mm2/s) at 100°F (37.8°C) antiwear agent.

The resulting composition was an amber colored liquid, having an "oily" odor, with an acid number of O.68 mg KOH/g. It had a boiling point of over 6OO°F (315°C), a specific gravity of O.98 at 6O°F (15.6°C), a flash point of over 46O°F (24O°C) and a vapor pressure of under 1.O mm Hg at 25°C. All of the ingredients mentioned above are non-metal containing thereby rendering the entire composition an ashless, high-temperature lubricant.

Example 2

Ingredient	Weight %
Trialkyl trimellitate lubricant[5]	87.58
Di-octylterephthalate plasticizer	9.73
Tertiary butylphenyl/diphenylphosphate (SYN-O-AD 8478 brand)	1.0
Phosphorus-sulfur extreme pressure antiwear composition (HITEC E-320 brand)	1.0
Alkyl thiodiazole corrosion inhibitor (AMOCO 153 brand)	0.15
Phenyl-alpha-naphthylamine antioxidant	0.50
Benzotriazole metal passivator	0.02

[5] Viscosity = 780 SUS, 170 mm^2/s, at 100°F (37.8°C)

Example 3

Ingredient	Weight %
Mixed trialkyl trimellitate lubricant [6]	64.82
Trialkyl trimellitate lubricant [7]	22.27

Di-(2-ethylhexyl) isophthalate plasticizer (FLEXOL 380 brand)	9.73
Tertiary butylphenyl/diphenylphosphate (SYN-O-AD 8478 brand)	1.0
Phosphorus-sulfur extreme pressure antiwear composition (HITEC E-320 brand)	1.0
Alkyl thiodiazole corrosion inhibitor (AMOCO 153 brand)	0.15
Phenyl-alpha-naphthylamine antioxidant	0.50
Benzotriazole metal passivator	0.02

[6] Viscosity = 456 SUS, 98 mm²/s, at 100°F (37.8°C)

[7] Viscosity = 1,122 SUS, 242 mm²/s, at 100°F (37.8°C)

Example 4

Ingredient	Weight %
Mixed trialkyl trimellitate lubricant [8]	98.33
Tert-butylphenyl diphenylphosphate (SYN-O-AD 8478 brand)	1.00
Phosphorus-amine load carrying additive (VANLUBE 672)	0.15
Phenyl-alpha-naphthylamine	0.50
Benzotriazole	0.02

[8] This product had a viscosity of 690 SUS (149 mm²/s) at 100°F (37.8°C).

Example 5

Ingredient	Weight %
Mixed trialkyl trimellitate lubricant [9]	44.16
Mixed trialkyl trimellitate lubricant [10]	44.16
Di-(2-ethylhexyl)isophthalate (FLEXOL 380 brand)	9.81
Tert-butylphenyl diphenylphosphate (SYN-O-AD 8478 brand)	1.00
Phosphorus-amine load carrying additive (VANLUBE 672 brand)	0.20
Alkyl thiodiazole corrosion inhibitor (AMOCO 153 brand)	0.15
Phenyl-alpha-naphthylamine antioxidant	0.50
Benzotriazole metal passivator	0.02

[9] This product had a viscosity of 456 SUS (98 mm^2/s) at 100°F (37.8°C).

[10] This product had a viscosity of 1,122 SUS (242 mm^2/s) at 100°F (37.8°C).

Example 6

Ingredient	Weight %
Mixed trialkyl trimellitate lubricant [11]	97.23
Tert-butylphenyl diphenylphosphate antiwear (SYN-O-AD 8478 brand)	1.00
Phosphorus-amine load-carrying additive	0.10
Phosphorus-sulfur extreme pressure antiwear additive(HITEC E-320 brand)	1.00
Alkyl thiodiazole corrosion inhibitor (AMOCO 153 brand)	0.15
Phenyl-alpha-naphthylamine antioxidant	0.50
Benzotriazole metal passivator	0.04

[11] This product had a viscosity of 688 SUS (148.6 mm^2/s) at 100°F (37.8°C).

Example 7

Ingredient	Weight %
Mixed trialkyl trimellitate lubricant	88.00
Di(2-ethylhexyl)isophthalate (FLEXOL 380 brand)	3.78
Tert-butylphenyl diphenylphosphate (SYN-O-AD 8479 brand)	6.00

Phosphorus-sulfur extreme pressure antiwear compound (ROSCAN 480 brand)	0.15
Alkyl thiodiazole corrosion inhibitor (AMOCO 153 brand)	0.50
Benzotriazole	0.02

Table I

The viscometric properties for the various trimellitate-containing lubricants shown in certain of the foregoing Examples are summarized in the following Table:

Fluid from	Viscosity, SUS (mm^2/s) at 100°F (37.8°C)	210°F (98.9°C)	Viscosity Index
Example No. 1	596 (128.7)	64 (11.45)	88
Example No. 2	581 (125.4)	63.5 (11.32)	81
Example No. 3	486 (104.8)	59.4 (10.0)	83
Example No. 4	648 (139.7)	68.4 (12.5)	87
Example No. 5	592 (127.8)	64.0 (11.33)	79
Example No. 6	675 (145.7)	68.1 (12.55)	82
Example No. 7	607 (131.0)	63.7 (11.37)	75

Table II

Lubricity of trialkyl trimellitate-based synthetic lubricants as measured in Four Ball Wear tests:

Test Conditions:		
	Load, kg	40
	Speed, rpm	1200
	Temperature, °C	60
	Time, hr	1.0

Fluid Tested	Wear Scar (mm)
Trialkyl trimellitate	0.83
Example No. 1	0.35
Example No. 2	0.34
Example No. 3	0.35
Example No. 4	0.36
Trialkyl trimellitate (90 wt %) plus FLEXOL 380 brand (10 wt %)	0.87
Example No. 5	0.36
Example No. 6	0.33
Example No. 7	0.39
STAUFFER SDL-1 lubricant	0.38

The foregoing Examples illustrate certain preferred embodiments of the present invention, but should not be construed in a limiting sense. The scope of the protection that is sought set forth in the claims which follow.

Claims

1. An engine lubricant composition which comprises a predominate amount of at least one aromatic tricar-

boxylic ester, a minor amount of an antiwear agent comprising a phosphate ester, and a minor amount of an organic additives package which is substantially free of metallic moieties or components and polymeric components as a result of which said organic additives package leaves no residue in the engine when the lubricant is incinerated during operation of the engine.

2. A composition as claimed in Claim 1, wherein the tricarboxylic ester is present at from 75 to 99%, by weight of the lubricant.

3. A composition as claimed in Claim 1 or 2, wherein the tricarboxylic ester is a trimellitate ester having alkyl groups of from 4 to 18 carbon atoms in length.

4. A composition as claimed in any or more of Claims 1-3, wherein the antiwear agent is present at from O.5% to 1O%, by weight of the lubricant.

5. A composition as claimed in any or more of Claims 1-4, wherein the phosphate ester contains three aryl groups.

6. A composition as claimed in any or more of Claims 1-5, wherein the antiwear agent further comprises a supplemental extreme pressure antiwear agent.

7. A composition as claimed in any or more of Claims 1-6, wherein the extreme pressure antiwear agent is present at from O.25 to 5.0%, by weight of the lubricant.

8. A composition as claimed in Claims 6 or 7, wherein the extreme pressure antiwear agent is a sulfurized synthetic product.

9. A composition as claimed in any or more of Claims 1-8 wherein the organic additives package is present at from O.1 to 5% by weight of the lubricant.

1O. A composition as claimed in any or more of Claims 1-9 wherein the organic additives package comprises up to 2.O% of a load carrying additive, O.O15 to 2.O% of a corrosion inhibitor, O.O5 to 2O% of an antioxidant, O.OO2 to O.5O% of a metal passivator, and up to O.2O% of a wetting agent, by weight of the lubricant.

11. A composition as claimed in any or more of Claims 1-1O which further comprises a minor amount of a thermally and oxidatively stable phthalate ester.

12. A composition as claimed in Claim 11, wherein the phthalate ester is present at up to 15%, by weight of the lubricant.

13. A composition as claimed in Claim 11 or 12, wherein phthalate ester is selected from the group consisting of esters of isophthalic acid and esters of terephthalic acid.

14. Use of an engine lubricant composition as claimed in any of the Claims 1-13 for lubricating high temperature rotary engines by feeding the engine lubricant to the combustion chamber of the engine together with fuel and consuming the lubricant during operation of the engine.

Patentansprüche

1. Maschinenschmiermittel, das einen überwiegenden Anteil an mindestens einem aromatischen Tricarbonsäureester, einen geringeren Anteil eines Phosphatester enthaltenden Antiabnützungsmittels sowie einen geringeren Anteil eines organischen Additivpakets enthält, welches im wesentlichen frei von metallischen Anteilen oder Komponenten sowie von polymeren Komponenten ist, derart, dass das organische Additivpaket bei Verbrennung des Schmiermittels in der laufenden Maschine keine Rückstände hinterlässt.

2. Mittel nach Anspruch 1, bei welchem der Tricarbonsäureester in einem Anteil von 75 bis 99% des Gewichts des Schmiermittels vorhanden ist.

3. Mittel nach Anspruch 1 oder 2, bei dem der Tricarbonsäureester ein Trimellithsäurester mit Alkylgruppen ist, die eine Länge von 4 bis 18 Kohlenstoffatomen haben.

4. Mittel nach einem oder mehreren der Ansprüche 1 bis 3, in welchem das Antiabnützungsmittel in einem Anteil entsprechend 0.5 bis 10% des Gewichts des Schmiermittels vorhanden ist.

5. Mittel nach einem oder mehreren der Ansprüche 1 bis 4, in welchem der Phosphatester drei Arylgruppen enthält.

6. Mittel nach einem oder mehreren der Ansprüche 1 bis 5, in welchem das Antiabnützungsmittel ausserdem ein zusätzliches Extremdruck-Antiabnützungsmittel enthält.

7. Mittel nach einem oder mehreren der Ansprüche 1 bis 6, in welchem das Extremdruck-Antiabnützungsmittel 0.25 bis 5.0% des Gewichtes des Schmiermittels ausmacht.

8. Mittel nach einem der Ansprüche 6 oder 7, in welchem das Extremdruck-Antiabnützungsmittel ein sulfuriertes Syntheseprodukt ist.

9. Mittel nach einem oder mehreren der Ansprüche 1 - 8, in welchem das organische Additivpaket in einem Anteil entsprechend 0.1 bis 5 % des Gewichts des Schmiermittels vorhanden ist.

10. Mittel nach einem oder mehreren der Ansprüche 1-9, in welchem das organische Additivpaket bis 2.0% eines belastbaren Additivs, 0.015 bis 2.0% eines Korrosionsinhibitors, 0.05 bis 20% eines Antioxydationsmittels, 0.002 bis 0.50% eines Metallpassivierungsmittels und bis zu 0.20% eines Netzmittels, bezogen auf das Gewicht des Schmiermittels, enthält.

11. Mittel nach einem oder mehreren der Ansprüche 1-10, das ausserdem einen geringen Anteil eines thermisch und oxydativ stabilen Phthalatesters enthält.

12. Mittel nach Anspruch 11, in welchem der Phthalatester in einem Anteil von bis zu 15%, bezogen auf das Gewicht des Schmiermittels, vorhanden ist.

13. Mittel nach Anspruch 11 oder 12, in welchem der Phthalatester aus der Gruppe der Isophthalsäureester und Terephtalsäureester gewählt ist.

14. Verwendung eines Maschinenschmiermittels gemäss einem der Ansprüche 1 - 13 zum Schmieren von Hochtemperatur-Rotationsmaschinen durch Einspeisen des Maschinenschmiermittels zusammen mit dem Brennstoff in die Verbrennungskammer der Maschine und Verbrauch des Schmiermittels während des Betriebs der Maschine.

Revendications

1.- Une composition lubrifiante pour moteur qui comprend une quantité majeure d'au moins un ester tricarboxylique aromatique, une quantité mineure d'un agent anti-usure comprenant un ester phosphaté, et une quantité mineure d'un ensemble d'additifs organiques qui est sensiblement exempt de parties ou composants métalliques et de composants polymères, de sorte que ledit ensemble d'additifs organiques ne laisse aucun résidu dans le moteur lorsque le lubrifiant est brûlé au cours du fonctionnement du moteur.

2.- Une composition telle que revendiquée dans la revendication 1, dans laquelle l'ester tricarboxylique est présent en une proportion comprise entre 75 et 99%, en poids du poids de lubrifiant.

3.- Une composition telle que revendiquée dans la revendication 1 ou dans la revendication 2, dans laquelle l'ester tricarboxylique est un ester d'acide trimellitique présentant des groupes alkyles comprenant de 4 à 18 atomes de carbone sur leur longueur.

4.- Une composition telle que revendiquée dans l'une quelconque ou plusieurs des revendications 1 à 3, dans laquelle l'agent anti-usure est présent en quantité comprise entre 0,5 et 10% en poids du poids de lubrifiant.

5.- Une composition telle que revendiquée dans l'une quelconque ou plusieurs des revendications 1 à 4, dans laquelle l'ester phosphaté contient trois groupes aryles.

6.- Une composition telle que revendiquée dans l'une quelconque ou plusieurs des revendications 1 à 5, dans laquelle l'agent anti-usure comprend de plus un agent anti-usure de pression extrême supplémentaire.

7.- Une composition telle que revendiquée dans l'une quelconque ou plusieurs des revendications 1 à 6, dans laquelle l'agent anti-usure sous pression extrême est présent en une quantité de l'ordre de 0,25 à 5% du poids de lubrifiant.

8.- Une composition telle que revendiquée dans les revendications 6 ou 7, dans laquelle l'agent anti-usure de pression extrême est un produit synthétique soufré.

9.- Une composition telle que revendiquée dans l'une quelconque ou plusieurs des revendications 1 à 8, dans laquelle l'ensemble d'additifs organiques est présent en une quantité de l'ordre de 0,1 à 5% du poids de lubrifiant.

10.- Une composition telle que revendiquée dans l'une quelconque ou plusieurs des revendications 1 à 9, dans laquelle l'ensemble d'additifs organiques comprend jusqu'à 2,0% d'un additif porteur de charge, de 0,015 à 2,0% d'un inhibiteur de corrosion, de 0,05 à 20% d'un anti-oxydant, de 0,002 à 0,50% d'un agent passivateur de métal, et jusqu'à 0,20% d'un agent mouillant en poids du poids de lubrifiant.

11.- Une composition telle que revendiquée dans l'une quelconque ou plusieurs des revendications 1 à 10, qui comprend de plus une quantité mineure d'un ester d'acide phtalique stable du point de vue de l'oxydation

et du point de vue thermique.

12.- Une composition telle que revendiquée dans la revendication 11, dans laquelle l'ester d'acide phtalique est présent en une quantité pouvant atteindre 15% en poids du poids de lubrifiant.

13.- Une composition telle que revendiquée dans la revendication 11 ou la revendication 12, dans laquelle l'ester d'acide phtalique est choisi parmi le groupe consistant en ester d'acide isophtalique et ester d'acide terephtalique.

14.- Utilisation d'une composition lubrifiante pour moteur telle que revendiquée dans l'une quelconque des revendications 1 à 13, pour la lubrification de moteurs rotatifs à haute température par injection du lubrifiant pour moteur dans la chambre de combustion du moteur en même temps que le carburant et consommation du lubrifiant pendant le fonctionnement du moteur.