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Description

This invention relates to fluid compositions suitable for use in traction drives.

Traction drive devices such as of ball-cone, cone-ring, wheel-disc, chain-sieve, toroidal and planetary roll types are designed to operate with power transmission that takes advantage of the rolling friction which develops as a result of a film of oil being hardened at the contacting surfaces. In general, lubricating oils for use in those traction drives should meet the following requirements.

1. High coefficient of traction.
2. Enhanced oxidation stability, hence freedom from sludge formation and high shear stability.
3. Rust-proofness to prevent pitching and flaking at the contacting surfaces of the traction wheel.
4. High wear resistance to permit sufficient lubrication of bearings, wheels and actuators.

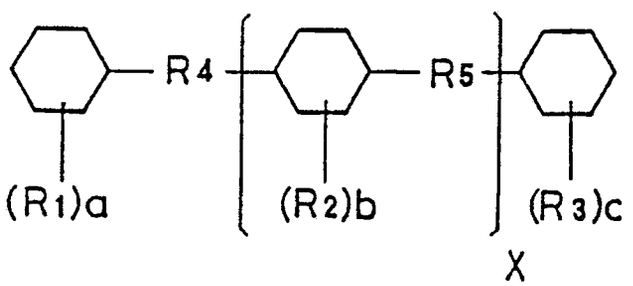
EP-A-0135871 discloses the use of cyclohexyl-substituted alkylene derivatives as traction drive fluids. Similar substances are disclosed for this purpose by EP-A-0113045, with the addition of zinc dialkyldithiophosphates and other S-P compounds as antioxidants, together with rust preventers, viscosity improvers and antifoam agents. In DE-A-3127970 similar cyclohexyl alkylene base oils are proposed also in combination with zinc dithiophosphate together with other additives including alkenyl succinic acid imides or their boron derivatives.

Known traction fluids are satisfactory in part, not in whole of the above requirements. Various additives have been proposed to compensate for the missing qualities. However, the use of such additives has in many instances resulted in reduced fatigue life of traction wheels, bearings and gears and also reduced traction coefficient.

It has now been found that fluid compositons of superior characteristics can be obtained for use in traction drives which incorporate a selected class of hydrocarbon compounds combined with certain dialkyldithio- zinc phosphates, alkenyl succinimides or their boron derivatives, and carboxylates of polyalcohols.

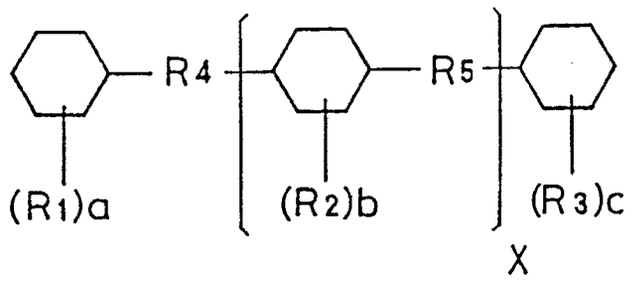
It is therefore the primary object of the present invention to provide improved tractive fluid compositions which are capable of providing traction drive apparatus with prolonged fatigue life, high wear resistance, high traction coefficient, high oxidation and shear stability, rust-proofness and other characteristics desired to attain best traction performance.

According to a first aspect of the invention, there is provided a lubricant composition for use in traction drives comprising: a base oil represented by the formula



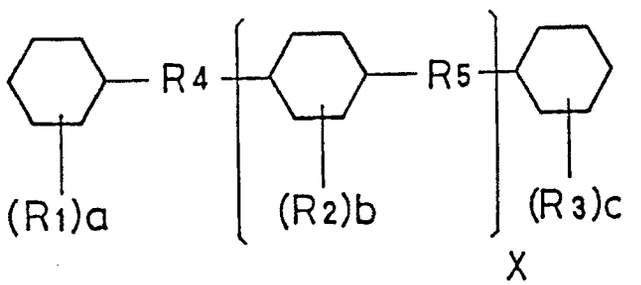
where R_1, R_2 and R_3 are alkyl groups of 1 - 4 carbon atoms, R_4 and R_5 are methylene, ethylene or trimethylene groups which may be substituted at the hydrogen atoms with an alkyl group of 1 - 4 carbon atoms, a, b and c are integers of 0 - 2, and x is an integer of 0 or 1; [I] a zinc dialkyldithio phosphate in an amount of 0.1 - 5 wt. %; [II] an alkenyl succinimide or its boron derivative in an amount of 0.1 - 5 wt. %; and [III] a carboxylic acid partial ester of a polyalcohol of 3 - 6 carbon atoms in an amount of 0.01 - 5 wt. %, each of the amounts being based on the total composition.

According to a second aspect of the invention, there is provided a lubricant composition for use in traction drives comprising: a base oil represented by the formula



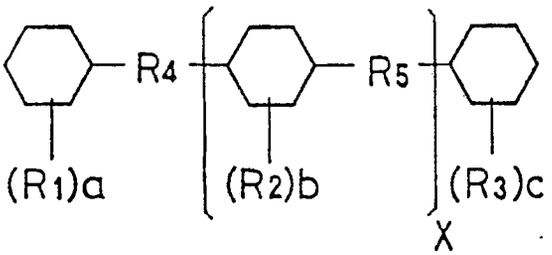
where R_1, R_2 and R_3 are alkyl groups of 1 - 4 carbon atoms, R_4 and R_5 are methylene, ethylene or trimethylene groups which may be substituted at the hydrogen atoms with an alkyl group of 1 - 4 carbon atoms, a, b and c are integers of 0 - 2, and x is an integer of 0 or 1; [I] a zinc dialkyldithio phosphate in an amount of 0.1 - 5 wt. %; [II] an alkenyl succinimide or its boron derivative in an amount of 0.1 - 5 wt. %; [III] a carboxylic acid partial ester of a polyalcohol of 3 - 6 carbon atoms in an amount of 0.01 - 5 wt. %; and [IV] a polyolefin in an amount of 0.1 -20 wt. %, the polyolefin resulting from the homo- or co-polymerization of olefins of 2 - 8 carbon atoms and having an average molecular weight of 200 - 10,000, each of the amounts being based on the total composition.

According to a third aspect of the invention, there is provided a lubricant composition for use in traction drives comprising: a base oil represented by the formula



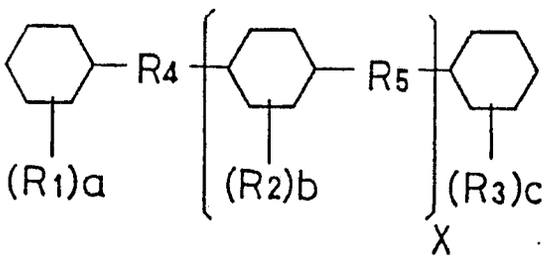
where R_1, R_2 and R_3 are alkyl groups of 1 - 4 carbon atoms, R_4 and R_5 are methylene, ethylene or trimethylene groups which may be substituted at the hydrogen atoms with an alkyl group of 1 - 4 carbon atoms, a, b and c are integers of 0 - 2, and x is an integer of 0 or 1; [I] a zinc dialkyldithio phosphate in an amount of 0.1 - 5 wt. %; [II] an alkenyl succinimide or its boron derivative in an amount of 0.1 - 5 wt. %; [III] a carboxylic acid partial ester of a polyalcohol of 3 - 6 carbon atoms in an amount of 0.01 - 5 wt. %; and [V] at least one of molybdenum dithiophosphates and molybdenum dithiocarbamates in an amount of 0.1 - 10 wt. %, each of the amounts being based on the total composition.

According to a fourth aspect of the invention, there is provided a lubricant composition for use in traction drives comprising: a base oil represented by the formula



where R_1, R_2 and R_3 are alkyl groups of 1 - 4 carbon atoms, R_4 and R_5 are methylene, ethylene or trimethylene groups which may be substituted at the hydrogen atoms with an alkyl group of 1 - 4 carbon atoms, a, b and c are integers of 0 - 2, and x is an integer of 0 or 1; [I] a zinc dialkyldithio phosphate is an amount of 0.1 - 5 wt. %; [II] an alkenyl succinimide or its boron derivative in an amount of 0.1 - 5 wt. %;[III] a carboxylic acid partial ester of a polyalcohol of 3 - 6 carbon atoms in an amount of 0.01 - 5 wt. %; and [IV] a polyolefin in an amount of 0.1 -20 wt. %, the polyolefin resulting from the homo- or co-polymerization of olefins of 2 - 8 carbon atoms and having an average molecular weight of 200 - 10,000; and [V] at least one of molybdenum dithiophosphates and molybdenum dithiocarbamates in an amount of 0.1 - 10 wt. %, each of the amounts being based on the total composition.

Base oils suitable for the purpose of the present invention are hydrocarbon compounds represented by the formula



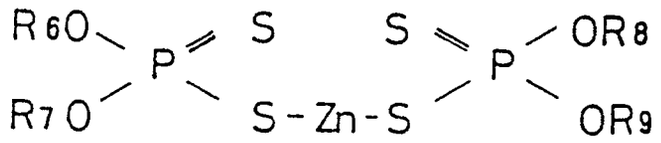
where R_1, R_2 and R_3 are alkyl groups of 1 - 4 carbon atoms, R_4 and R_5 are methylene, ethylene or trimethylene groups which may be substituted at the hydrogen atoms with an alkyl group of 1 - 4 carbon atoms, a, b and c are integers of 0 - 2, and x is an integer of 0 or 1.

Eligible substituting groups for R_1, R_2 and R_3 are methyl, ethyl, propyl and butyl, amongst which methyl and ethyl are particularly preferred. Eligible R_4 and R_5 groups are methylene, methylmethylene (ethylidene), dimethylmethylene, ethylene, methylethylene, 1,1-dimethylethylene, 1,2-dimethylethylene, 1,1,2-trimethylethylene, tetramethylethylene, trimethylene, 1-methyltrimethylene, 2-methyltrimethylene, 1,1-dimethyltrimethylene, 1,2-dimethyltrimethylene, 1,3-dimethyltrimethylene, 2,2-dimethyltrimethylene, 1,1,2-trimethyltrimethylene, 1,1,3-trimethyltrimethylene, 1,2,2-trimethyltrimethylene, 1,2,3-trimethyltrimethylene, 1,1,2,2-tetramethyltrimethylene, 1,1,2,3-tetramethyltrimethylene, 1,1,3,3-tetramethyltrimethylene and 1,2,2,3-tetramethyltrimethylene.

Specific examples of the base oils include dicyclohexylmethane, 1,1-dicyclohexylethane, 1,2-dicyclohexylethane, 1,2-dicyclohexylpropane, 1,3-dicyclohexylpropane, 2,2-dicyclohexylpropane, 1,2-dicyclohexyl-2methylpropane, 1,3-dicyclohexylbutane, 1,3-dicyclohexyl-3-methylbutane, 1,3-dicyclohexyl-2,3-dimethylbutane, 2,3-dicyclohexyl-2,3-dimethylbutane, 2,4-dicyclohexylpentane, 2,4-dicyclohexyl-2-methylpentane, bis(cyclohexylmethyl)cyclohexane, bis(1-cyclohexylethyl)cyclohexane and bis(1-methyl-2-cyclohexylethyl)cyclohexane, substituted compounds thereof in which one or two methyl or ethyl groups are bonded to the hydrogen atoms of the cyclohexyl ring, and combinations thereof. Particularly preferred among those base oils are 1-cyclohexyl-1-methylcyclohexylethane, 1-cyclohexyl-1-ethylcyclohexylethane, 1-cyclohexyl-1-dimethylcyclohe xylethane, bis(1-cyclohexylethy)methylcyclohexane, bis(1-cyclohexylethyl)-

ethylcyclohexane, bis(1-cyclohexylethyl)dimethylcyclohexane and 2,4-dicyclohexyl-2-methylpentane, and combinations thereof.

Zinc dialkyldithio phosphates useful as component [I] hereunder are compounds represented by the formula



where R_6, R_7, R_8 and R_9 are alkyl or alkylaryl groups having a carbon number of 3 - 22, preferably 3 - 15, and may be the same or different. Particularly preferred alkyl and alkylaryl groups are isopropyl, sec-butyl, isobutyl, n-amyl, isoamyl, 4-methylpentyl, 2-ethylhexyl, decyl, isodecyl, nonylphenyl and dodecylphenyl.

The amount of component [I] to be added should be in the range of 0.1 - 5 wt. %, preferably 0.5 - 3 wt. %, based on the total composition. Smaller amounts than 0.1 wt. % would fail to give sufficient wear resistance and oxidation stability. Greater amounts than 5 wt. % would result in reduced rolling fatigue life and traction coefficient.

Alkenyl succinimides and their boron derivatives are useful as component [II[in the invention. The alkenyl succinimides may be obtained by reaction of polyolefins with maleic anhydride and by subsequent conversion of the resulting intermediates into the form of imides by reaction with amines. Examples of the polyolefins are those resulting from the homo- and co-polymerization of olefins of 2 - 30 carbon atoms such as ethylene, propylene, butene, pentene, hexene, heptene, octene, nonene, decene and dodecene, and also from the co-polymerization of those olefins with aromatic olefins such as styrene. The molecular weight of the polyolefins is between 300 and 5,000. Examples of the amines to be here used include monoamines such as methylamine, ethylamine, propylamine, butylamine, pentylamine, hexylamine, heptylamine and octylamine, polyamines such as ethylenediamine, propylenediamine, N,N'-dimethylpropylenediamine, trimethylenediamine, N,N-dihexyltrimethylenediamine, decamethylenediamine, di(trimethylene)triamine, di-(heptamethylene)triamine, triethylenetetraamine, tripropylenetetraamine, tetraethylenepentaamine, pentaethylenehexaamine, imidazoline, methylimidazoline, bis(aminoethyl)imidazoline, pyrimidine, aminopropylpiperazine and bis(aminoethyl)piperazine, and hydroxy-substituted amines such as N-mono(hydroxyethyl)-ethylenediamine, N,N'-bis(hydroxyethyl)ethylenediamine, N-mono(hydroxypropyl)diethylenetriamine and N,N'-bis(hydroxypropyl)-tetraethylenepentaamine.

The borides or boron derivatives of the above alkenyl succinimides are obtainable by reaction of such succinimides with boron compounds selected for example from boron oxide, boron oxide hydrates, boron trifluoride, boron trichloride, boron tribromide, alkyl or aryl borons, boric acid, metaboric acid and tetraboric acid, esters of these boric acids with alcohols and phenols and ammonium salts thereof. The boron derivatives may be synthesized by numerous methods disclosed for example in U. S. Patent Nos. 3,281,428, 3,282,955, 3,284,410, 3,284,409, 3,344,069 and 3,533,945, Japanese Patent Publication Nos. 42-8013, 42-8014, 47-45161 and 47-45162, and Japanese Patent Application (Kokai) Nos. 51-52381, 51-130408 and 54-87705.

The amount of component [II] to be added should be in the range of 0.1 - 5 wt. %, preferably 0.5 - 3 wt. %, based on the total composition. Smaller amounts than 0.1 wt. % would invite insufficient oxidation stability. Greater amounts than 5 wt. % would result in reduced rolling fatigue life, traction coefficient and wear resistance.

Carboxylic acid partial esters of polyalcohols of 3 - 6 carbon atoms are useful as component [III] in the invention. Examples of the polyalcohols include glycerine [$C_3H_5(OH)_3$], pentaerythritol [$C_4H_8(OH)_4$], sorbitol [$C_6H_8(OH)_6$] and sorbitan [$C_6H_8O(OH)_4$]. Examples of the carboxylic acids are those having a carbon number of 8 - 22, preferably 12 - 18, and in cluding decanoic acid (capric acid), undecanoic acid, dodecanoic acid (lauric acid), tridecanoic acid, tetradecanoic acid (myristic acid), pentadecanoic acid, hexadecanoic acid (palmitic acid), heptadecanoic acid (margaric acid), octadecanoic acid (stearic acid), nonadecanoic acid, eicosanoic acid (arachidic acid), heneicosanoic acid, decosanoic acid (behenic acid), dodecenoic acid, tetradecenoic acid, hexadecenoic acid, octadecenoic acid (oleic acid), dodecadienoic acid, tetradecadienoic acid, hexadecadienoic acid and octadecadienoic acid (linoleic acid).

Specific examples of component [III] include glycerine dodecanoic acid monoester (monoglyceride laurate), glycerine hexadecanoic acid monoester (monoglyceride palmitate), glycerine octadecanoic acid monoester (monoglyceride stearate), glycerine octadecenoic acid monoester (monoglyceride oleate), pentaerythritol dodecanoic acid monoester (pentaerythritol monolaurate), pentaerythritol hexadecanoic acid monoester (pentaerythritol monopalmitate), pentaerythritol octadecanoic acid monoester (pentaerythritol monostearate), pentaerythritol octadecenoic acid monoester (pentaerythritol monooleate), sorbitol dodecanoic acid monoester (sorbitol monolaurate), sorbitol hexadecanoic acid monoester (sorbitol monopalmitate), sorbitol octadecanoic acid monoester (sorbitol monostearate), sorbitol octadecenoic acid monoester (sorbitol monooleate), sorbitan dodecanoic acid monoester (sorbitan monolaurate), sorbitan hexadecanoic acid monoester (sorbitan monopalmitate), sorbitan octadecanoic acid monoester (sorbitan monostearate), sorbitan octadecenoic acid monoester (sorbitan monooleate), sorbitan octadecanoic acid triester (sorbitan tristearate) and sorbitan octadecenoic acid triester (sorbitan trioleate), and combinations thereof.

The amount of component [III] to be added should be in the range of 0.01 - 5 wt. %, preferably 0.1 - 3 wt. %, based on the total composition. Smaller amounts than 0.01 wt. % would be insufficient for rust-proofness. Greater amounts than 5 wt. % would induce reduced rolling fatigue life and traction coefficient.

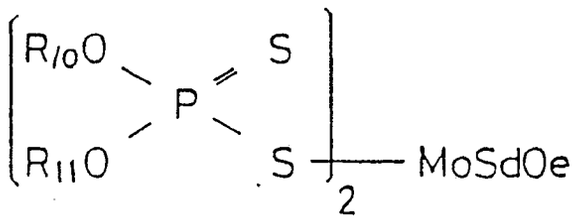
A first embodiment of the invention provides lubircant compositions in which components [I] to [III] are combined with base oils. According to a second embodiment of the invention, selected polyolefins are further incorporated to build dynamic viscosity and shear stability.

Polyolefins eligible as component [IV] hereunder are those having an average molecular weight of 200 -10,000, preferably 1,000 - 4,000, and obtained by the homo- and co-polymerization of olefins selected for example from ethylene, propylene, 1-butene and isobutylene with use of a Friedel-Crafts catalyst such as aluminum chloride, magnesium chloride, boron fluoride or titanium tetrachloride, or a complex compound thereof, if necessary in combination with a co-catalyst such as an organic halide or hydrochloric acid. Polybutene, polyisobutylene, ethylene-propylene copolymer, ethylene-1-butene copolymer and ethylene-propylene-1-butene copolymer are particularly preferred.

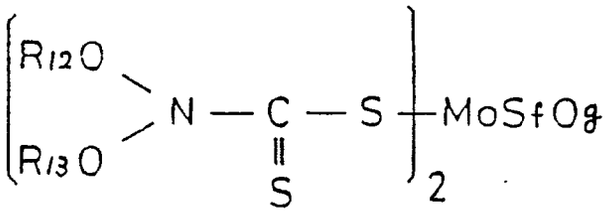
The amount of component [IV] to be added should be in the range of 0.1 - 20 wt. %, preferably 1 - 10 wt. %, based on the total composition. Smaller amounts than 0.1 wt. % would be ineffective for viscosity buildup. Greater amounts than 20 wt. % would lead to reduced traction coefficient.

Third and fourth embodiments of the invention are intended to make the resulting compositions more highly resistant to wear and longer in rolling fatigue life by further addition of selected molybdenum compounds.

Molybdenum compounds suitable as component [V] in the invention are one or more of molybdenum dithiophosphates and molybdenum dithiocarbamates represented respectively by the formulae



where R_{10} and R_{11} are alkyl, cycloalkyl, alkylcycloalkyl, aryl, alkylaryl or arylalkyl groups of 1 - 24 carbon atoms, d is $0 < d \leqq \alpha\mu\rho^{\cdot\cdot} 4$, and e is $0 \leqq \alpha\mu\rho^{\cdot\cdot}$ hich d + e = 4, and



where R_{12} and R_{13} are as defined above, f is $0 < f \leqq \alpha\mu_p$ 4, and g is $0 \leqq \alpha\mu_p$ g < 4 in which f + g = 4.

Eligible R_{10} to R_{13} groups are methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, dodecyl, tetradecyl, hexadecyl, octadecyl, eicosyl, docosyl, tetracosyl, cyclopentyl, cyclohexyl, methylcyclohexyl, ethylcyclohexyl, dimethylcyclohexyl, cycloheptyl, phenyl, tolyl, xylyl, ethylphenyl, propylphenyl, butylphenyl, pentylphenyl, hexylphenyl, heptylphenyl, octylphenyl, nonylphenyl, decylphenyl, dodecylphenyl, tetradecylphenyl, hexadecylphenyl, octadecylphenyl, benzyl and phenethyl.

Specific examples of component [V] include molybdenum diethyldithiophosphate sulfide, molybdenum dipropyldithiophosphate sulfide, molybdenum dipropyldithiophosphate sulfide, molybdenum dibutyldithiophosphate sulfide, molybdenum dipentyldithiophosphate sulfide, molybdenum dihexyldithiophosphate sulfide, molybdenum dioctyldithiophosphate sulfide, molybdenum didecyldithiophosphate sulfide, molybdenum didecyldithiophosphate sulfide, molybdenum di(butylphenyl)dithiophosphate sulfide, molybdenum-(nonylphenyl)dithiophosphate sulfide, oxymolybdenum diethyldithiophosphate sulfide, oxymolybdenum dipropyldithiophosphate sulfide, oxymolybdenum dibutyldithiophosphate sulfide, oxymolybdenum dipentyldithiophosphate sulfide, oxymolybdenum dihexyldithiophosphate sulfide, oxymolybdenum dioctyldithiophosphate sulfide, oxymolybdenum didecyldithiophosphate sulfide, oxymolybdenum didodecyldithiophosphate sulfide, oxymolybdenum di(butylphenyl)dithiophosphate sulfide, oxymolybdenum di-(nonylphenyl)dithiophosphate sulfide, molydbenum diethyldithiocarbamate sulfide, molybdenum dipropyldithiocaramate sulfide, molybdenum dibutyldithiocarbamate sulfide, molybdenum dihexyldithiocarbamate sulfide, molybdenum dioctyldithiocarbamate sulfide, molybdenum didecyldithiocarbamate sulfide, molybdenum didodecyldithiocarbamate sulfide, molybdenum di(butylphenyl)dithiocarbamate sulfide, molybdenum di(nonylphenyl)dithiocarbamate sulfide, oxymolybdenum diethyldithiocarbamate sulfide, oxymolybdenum dipropyldithiocarbamate sulfide, oxymolybdenum dibutyldithiocarbamate sulfide, oxymolybdenum dipentyldithiocarbamate sulfide, oxymolybdenum dihexyldithiocarbamate sulfide, oxymolybdenum dioctyldithiocarbamate sulfide, oxymolybdenum dioctyldithiocarbamate sulfide, oxymolybdenum didecyldithiocarbamate sulfide, oxymolybdenum didodecyldithiocarbamate sulfide, oxymolybdenum di(butylphenyl)dithiocarbamate sulfide and oxymolybdenum di(nonylphenyl)dithiocarbamate sulphide, and combinations thereof. Particularly preferred are combinations of phosphates, molybdenum dithiophosphates and molybdenum dithiocarbamates.

The amount of component [V] to be added should be in the range of 0.1 - 10 wt. %, preferably 0.3 - 5 wt. %, based on the total composition. Smaller amounts than 0.1 wt. % would fail to produce sufficient wear resistance and rolling fatigue life. Greater amounts than 10 wt. % would result in reduced traction coefficient and rolling fatigue life.

There may be used additives such as metallic cleaning agents including alkali metal sulfonates and alkaline earth metal sulfonates, anticorrosive agents, extreme pressure agents, viscosity index improvers, rust preventives and the like.

The invention will be further described by way of the following examples.

Inventive Examples 1 - 8

Numerous tractive fluid compositions according to the invention were formulated and prepared as per Table 1.

Comparative Examples 1 - 2

Two controls were prepared, one control using only a base oil of the invention, and the other being commercially available.

Performance test was made with the results shown in Table 2.

Dynamic Viscosity

Measurement was made in accordance with ASTM D 445 (Standard Test Method for Kinematic Visco arent and Opaque Liquids).

Traction Coefficient

Four-cylinder rolling friction tester was used with rolling speed 310 cm/second, load 90 kg/mm^2 and slip rate 2 %.

Oxidation Stability

JIS K 2514 (Testing Method for Oxidation Stability of Lubricants for Internal Combustion Engine Oils) was followed with temperature 165.5 ° C and time 72 hours. Viscosity ratio at 40 ° C was determined.

Shear Stability

Test was made in accordance with ASTM D 2603 (Standard Test Method for Sonic Shear Stability of Polymer-Containing Oils) with sonic radiation 10 KH_2, temperature 40 ° C and time 30 minutes. Viscosity reduction at 40 ° C was determined.

Wear Resistance

ASTM D 2266 was followed with speed 1,500 ppm, load 40 kgf and time 2 hours, using four balls. Wear scar diameter was measured.

Fatigue Life

IP 305 (Testing Method for Uni-Steel Rolling Fatigue) was followed. Length of time required for L_{10}:90 % life was measured.

Rust Prevention

This test was made in accordance with ASTM D 665 (Standard Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water).

It is to be noted that the compositions representing Inventive Examples 1 - 8 are highly satisfactory in respect of all the performance characteristics tested. The controls of Comparative Examples 1 - 2 were inadequate in wear resistance, fatigue life, shear stability and rust-proofness.

Table 1

Example	Formulation (wt. %)					
	base oil	component [I]	component [II]	component [III]	component [IV]	component [V]
Inventive Example 1	2,4-dicyclohexyl-2-methylpentane	zinc di-2-ethylhexyldithio phosphate (1.0)	alkenyl succinimide * (2.0)	sorbitan monolaurate (0.1)	--	--
Inventive Example 2	2,4-dicyclohexyl-2-methylpentane	zinc dinonylphenyldithiophosphate (2.0)	alkenyl succinimide boride (1.0)	sorbitan monooleate (0.1)	--	--
Inventive Example 3	bis(1-cyclohexylethyl)-dimethylcyclohexane	zinc diisopropyldithiophosphate (1.0)	alkenyl succinimide boride (1.0)	pentaerythritol monooleate (0.1)	--	--
Inventive Example 4	2,4-dicyclohexyl-2-methylpentane	zinc di-2-ethylhexyldithiophosphate (1.0)	alkenyl succinimide (1.0)	pentaerythritol monoisostearate (0.2)	polybutene A (4.0)	--
Inventive Example 5	2,4-dicyclohexyl-2-methylpentane	zinc didecyldithiophsphate (2.0)	alkenyl succinimide boride (1.0)	sorbitan monoisostearate (0.1)	ethylene-propylene copylymer (4.0)	--
Inventive Example 6	bis(1-cyclohexylethyl)-dimethylcyclohexane	zinc diisobutyldithiophosphate (1.0)	alkenyl succinimide (2.0)	pentaerythritol monolaurate (0.2)	polybutene B (8.0)	--

Table 1 (cont'd)

Example	Formulation (wt. %)					
	base oil	component [I]	component [II]	component [III]	component [IV]	component [V]
Inventive Example 7	2,4-dicyclohexyl-2-methylpentane	zinc diisopropyldithiophosphate (1.0)	alkenyl succinimide boride (1.0)	sorbitan monolaurate (0.1)	--	oxymolybdenum di(2-ethylhexyl)dithiophosphate (0.3) sulfide
Inventive Example 8	2,4-dicyclohexyl-2-methylpentane	zinc dinonylphenyldithiophosphate (2.0)	alkenyl succinimide boride (1.0)	pentaerythritol monoisostearate (0.2)	polybutene A (4.0)	oxymolybdenum dibutyldithiocarbamate (0.5) sulfide
Comparative Example 1	2,4-dicyclohexyl-2-methylpentane	--	--	--	--	--
Comparative Example 2	commercial product					

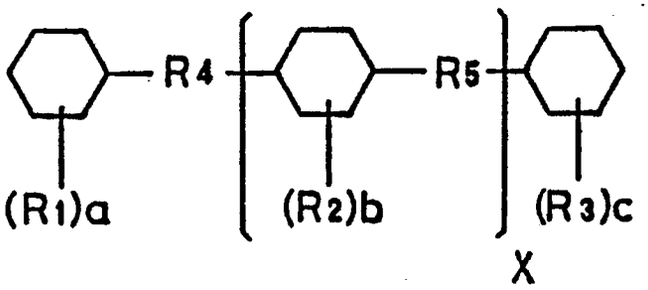
* alkenyl succinimide: compound derived by reaction of polyisobutylene (molecular weight 1,000) substituted succinic anhydride with N-octadecyltrimethylenediamine
* alkenyl succinimide boride: compound derived by reaction of polyisobutylene (molecular weight 1,000) substituted succinic anhydride with N-octadecyltrimethylenediamine and boric acid
* polybutene A: average molecular weight 2,700
* polybutene B: average molecular weight 1,350
* ethylene-propylene copolymer: average molecular weight 3,700

Table 2

Example	Performance						
	dynamic viscosity (cSt, @40°C) $\nu \times 10^{-6}$ m²/s	traction coefficient	oxidation stability (viscosity ratio, @40°C)	shear stability (viscosity reduction, @40°C)	wear resistance (wear scar diameter, mm)	fatigue life (L_{10}, hr)	rust-proofness
Inventive Example 1	21.0	0.087	1.0	0.0	0.53	7.2	rustless
Inventive Example 2	20.9	0.088	1.0	0.0	0.57	7.0	"
Inventive Example 3	20.9	0.087	1.0	0.0	0.55	7.3	"
Inventive Example 4	30.2	0.088	1.0	0.1	0.41	8.3	"
Inventive Example 5	32.5	0.087	1.0	0.1	0.60	8.2	"
Inventive Example 6	31.6	0.087	1.0	0.1	0.46	8.4	"
Inventive Example 7	21.0	0.087	1.2	0.0	0.51	9.1	"
Inventive Example 8	30.1	0.087	1.0	0.1	0.40	9.0	"
Comparative Example 1	20.6	0.086	1.2	0.0	0.76	6.5	extremely rusted
Comparative Example 2	29.7	0.086	1.2	14.2	1.45	7.3	"

Claims

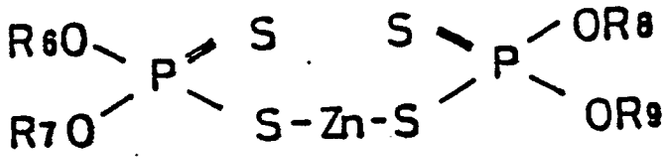
1. A lubricant composition for use in traction drives comprising: a base oil represented by the formula



where R_1, R_2 and R_3 are alkyl groups of 1 - 4 carbon atoms, R_4 and R_5 are methylene, ethylene or trimethylene groups which may be substituted at the carbon atoms with an alkyl group of 1 - 4 carbon atoms, a, b and c are integers of 0 - 2, and x is an integer of 0 or 1; [I] a zinc dialkyldithio phosphate in an amount of 0.1 - 5 wt.%; [II] an alkenyl succinimide or its boron derivatives in an amount of 0.1 - 5 wt.%; and [III] a carboxylic acid partial ester of a polyalcohol of 3 - 6 carbon atoms in on amount of 0.01 - 5 wt.%, each said amount being based on the total compositon.

2. The lubricant composition according to claim 1 wherein said base oil is selected from the group consisting of dicyclohexylmethane 1,1-dicyclohexylethane, 1,2-dicyclohexylethane, 1,2-dicylohexyl-propane, 1,3-dicyclohexylpropane, 2,2-dicyclohexylpropane, 1,2-dicyclohexyl-2-methylpropane, 1,3-dicyclohexylbutane, 1,3-dicyclohexyl-3-methylbutane, 1,3-dicyclohexyl-2,3-dimethylbutane, 2,3-dicyclohexyl2,3-dimethylbutane, 2,4-dicyclohexyl-pentane, 2,4-dicyclohexyl-2-methylpentane, bis-(cyclohexylmethyl)cyclohexane, bis(1-cyclohexylethyl)cyclohexane and bis(1-methyl-2-cyclohexylethyl)-cyclohexane, substituted compounds thereof in which one or two methyl or ethyl groups are bonded to the carbon atoms of the cyclohexyl ring, and combinations thereof.

3. The lubricant compositions according to claim 1 wherein said component [I] is a compound represented by the formula



where R_6, R_7, R_8 and R_9 are alkyl or alkylaryl groups of 3 - 22 carbon atoms, and may be the same or different.

4. The lubricant composition according to claim 1 wherein said component [II] is an alkenyl succinimide resulting from the reaction of a polyolefin of 2 - 30 carbon atoms with maleic anhydride, followed by conversion of the resulting reaction product into an imide form by reaction with an amine.

5. The lubricant composition according to claim 4 wherein said polyolefin is selected from the group consisting of homopolymers and copolymers of ethylene, propylene, butene, petene, hexene, heptene, octene, nonene, decene and dodecene, and copolymers thereof with styrene, and said amine is selected from the group consisting of methylamine, ethylamine, propylamine, butylamine, pentylamine, hexylamine, heptylamine, octylamine, ethylenediamine propylenediamine, N,N'-dimethyl-propylenediamine, trimethylenediamine, N,N'-dihexyltrimethylenediamine, decamethylenediamine, di-(trimethylene)triamine, di(heptamethylene)triamine, triethylenetetraamine, tripropylenetetraamine, tetraethylenepentaamine, pentaethylenehexaamine, imidazoline, methylimidazoline, bis(aminoethyl)-imidazoline, pyrimidine, aminopropylpiperazine, bis(aminoethyl)piperazine, N-mono(hydroxylethyl)-ethylenediamine, N,N'-bis(hydroxylethyl)ethylenediamine, N-mono(hydroxylpropyl)diethylenetriamine and N,N'-bis(hydroxylpropyl)-tetraethylenepentaamine.

6. The lubricant composition according to claim 4 wherein said component [II] is a compound derived by reaction of said alkenyl succinimide with a boron compound selected from the group consisiting of boron oxide, boron oxide hydrates, boron trifluoride, boron trichloride, boron tribromide, alkyl borons, aryl borons, boric acid, metaboric acid and tetraboric acid, and esters of said boric acids with alcohols and phenols and ammonium salts thereof.

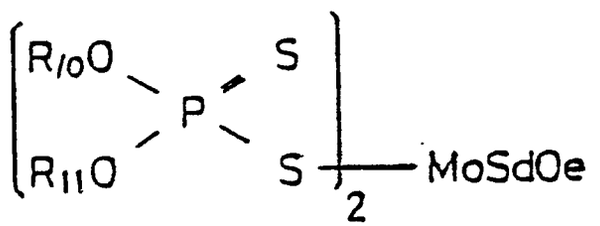
7. The lubricant composition according to claim 1 wherein said component [III] is selected from the group consisting of glycerine dodecanoic acid monoester, glycerine hexadecanoic acid monoester, glycerine octadecanoic acid monoester, glycerine octadecenoic acid monoester, pentaerythritol dodecanoic acid monoester, pentaerythritol hexadecanoic acid monoester, pentaerythritol octadecanoic acid monoester, pentaerythritol octadecenoic acid monoester, sorbitol dodecanoic acid monoester, sorbitol hexadecanoic acid monoester, sorbitol octadecanoic acid monoester, sorbitol octadecenoic acid monoester, sorbitan dodecanoic acid monester, sorbitan hexadecanoic acid monoester, sorbitan octadecanoic acid monoester, sorbitan octadecenoic acid monoester, sorbitan octadecanoic acid triester and sorbitan octadecenoic acid triester and combinations thereof.

8. A lubricant composition according to any of claims 1 to 7 further comprising: [IV] a polyolefin in an amount of 0.1 - 20 wt.%, said polyolefin resulting from the homo- or co-polymerization of olefins of 2 - 8 carbon atoms and having an average molecular weight of 200 - 10,000, each said amount being based on the total composition.

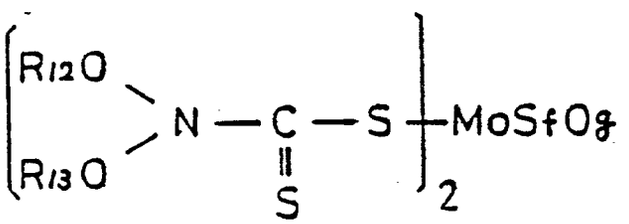
9. The lubricant composition according to claim 8 wherein said component [IV] is selected from the group consisiting of polybutene, polyisobutylene, ethylenepropylene copolymer, ethylene-1-butene copolymer and ethylene-propylene-1-butene copolymer.

10. A lubricant composition according to any of claims 1 to 9 further comprising: [V] at least one of molybdenum dithiophosphates and molybdenum dithiocarbamates in an amount of 0.1 - 10 wt.%, each said amount being based on the total composition.

11. The lubricant composition according to claim 10 wherein said component [V] is a molybdenum dithiophosphate represented by the formula



where R_{10} and R_{11} are alkyl, cycloalkyl, alkylcycloalkyl, aryl, alkylaryl or arylalkyl groups of 1 - 24 carbon atoms, d is $0 < d \leq 4$, and e is $0 \leq e < 4$ in which $d + e = 4$ and/or a molybdenum dithiocarbamate represented by the formula



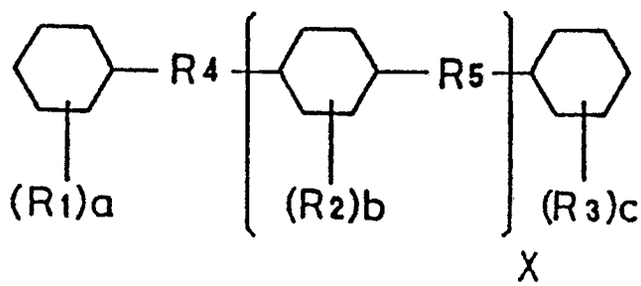
where R_{12} and R_{13} are as defined above, f is $0 < f \leqq 4$, and g is $0 \leqq g < 4$ in whcih $f + g = 4$.

12. The lubricant composition according to claim 11 wherein said component [V] is selected from the group consisting of molybdenum diethyldithiophosphate sulfide, molybdenum dipropyldithiophosphate sulfide, molybdenum dibuthyldithiophosphate sulfide, molybdenum dipentyldithiophosphate sulfide, molybdenum dihexyldithiophosphate sulfide, molybdenum dioctyldithiophosphate sulfide, molybdenum didecyldithiophosphate sulfide, molybdenum didodecyldithiophosphate sulfide, molbdenum di-(butylphenyl)dithiophosphate sulfide, molbdenum (nonylphenyl)dithiophosphate sulfide, oxymolbdenum diethyldithiophosphate sulfide, oxymolbdenum dipropyldithiophosphate sulfide, oxymolbdenum dibutyldithiophosphate sulfide, oxymolybdenum dipentyldithiophosphate sulfide, oxymolybdenum dihexyldithiophosphate sulfide, oxymolybdenum dioctyldithiophosphate sulfide, oxymolybdenum didecyldithiophosphate sulfide, oxymolybdenum didodecyldithiophosphate sulfide, oxymolybdenum di-(butylphenyl)dithiophosphate sulfide, oxymolybdenum di(nonylphenyl)dithiophosphate sulfide, molybdenum diethyldithiocarbamate sulfide, molybdenum dipropyldithiocarbamate sulfide, molybdenum dibutyldithiocarbamate sulfide, molybdenum dihexyldithiocarbamate sulfide, molybdenum dioctyldithiocarbamate sulfide, molybdenum didecyldithiocarbamate sulfide, molybdenum didodecyldithiocarbamate sulfide, molybdenum di(butylphenyl)dithiocabamate sulfide, molybdenum di(nonylphenyl)-dithiocarbamate sulfide, oxymolybdenum diethyldithiocarbamate sulfide, oxymolybdenum dipropyldithiocarbamate sulfide, oxymolybdenum dibutyldithiocarbamate sulfide, oxymolybdenum dipentyldithiocarbamate sulfide, oxymolybdenum dihexyldithiocarbamate sulfide, oxymolybdenum dioctyldithiocarbamate sulfide, oxymolybdenum didecyldithiocarbamate sulfide, oxymolybdenum didodecyldithiocarbamate sulfide, oxymolybdenum di(butylphenyl)dithiocarbamate sulfide and oxymolybdenum di(nonylphenyl)dithiocarbamate sulfide, and combinations thereof.

Revendications

1. Composition lubrifiante pour un usage dans les commandes de traction comprenant:

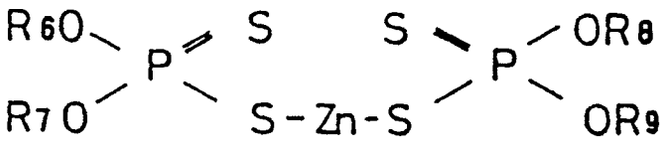
une huile de base représentée par la formule:



où R_1, R_2 et R_3 sont des groupements alkyles de 1 - 4 atomes de carbone, R_4 et R_5 sont des groupements méthylène, éthylène ou triméthylène qui peuvent être substitués aux positions des atomes de carbone par un groupement alkyle de 1 - 4 atomes de carbone a, b et c sont des nombres entiers de 0 - 2, et x est 0 ou 1; [I] un dialkyldithio phosphate de zinc en quantité de 0.1 - 5 % en poids; [II] un alcényl succinimide ou un de ses dérivés de bore en quantité de 0.1 - 5 % en poids et [III] un ester partiel d'acide carboxylique et d'un alcool polyvalent de 3 - 6 atomes de carbone en quantité de 0.01 - 5 % en poids, chacune desdites quantités étant basée sur la composition totale.

2. Composition lubrifiante suivant la revendication 1, dans laquelle ladite huile de base est choisie dans le groupe constitué des dicyclohexylméthane 1,1-dicyclohexyléthane, 1,2-dicyclohexyléthane, 1,2-dicyclohexylpropane, 1,3-dicyclohexylpropane, 2,2-dicyclohexylpropane, 1,2-dicyclohexyl-2-méthylpropane, 1,3-dicyclohexylbutane, 1,3-dicyclohexyl-3-méthylbutane, 1,3-dicyclohexyl-2,3-diméthylbutane, 2,3-dicyclohexyl-2,3-diméthylbutane, 2,4-dicyclohexyl-pentane, 2,4-dicyclohexyl-2-méthylpentane, bis-(cyclohexylméthyl)cyclohexane, bis(1-cyclohexyléthyl)cyclohexane et bis(1-méthyl-2-cyclohexyléthyl)-cyclohexane, leurs composés de substitution dans lesquels un ou deux groupements méthyle ou éthyle sont liés aux atomes de carbone du noyau cyclohexyle et leurs associations.

3. Compositions lubrifiantes suivant la revendication 1, dans lesquelles ledit composant [I] est un composé représenté par la formule:



où R_6, R_7, R_8 et R_9 sont des groupements alkyles ou alkylaryles de 3 - 22 atomes de carbone qui peuvent être identiques ou différents.

4. Composition lubrifiante suivant la revendication 1, dans laquelle ledit composant [II] est un alcényl succinimide résultant de la réaction d'une polyoléfine de 2 - 30 atomes de carbone avec de l'anhydride maléïque suivie de la conversion du produit de réaction résultant en une forme imide par réaction avec une amine.

5. Composition lubrifiante suivant la revendication 4, dans laquelle ladite polyoléfine est choisie dans le groupe constitué des homopolymères et copolymères de éthylène, propylène, butène, pentène, hexène, heptène, octène, nonène, decène et dodecène, et leurs copolymères avec le styrène, et ladite amine est choisie dans le groupe constitué des méthylamine, éthylamine, propylamine, butylamine, pentylamine, hexylamine, heptylamine, octylamine, éthylènediamine propylènediamine, N,N'-diméthyl-propylènediamine, triméthylènediamine, N,N'-dihexyltriméthylènediamine, décaméthylènediamine, di-(triméthylène)triamine, di(heptaméthylène)triamine, triéthylènetetraamine, tripropylènetétraamine, tetraéthylènepentaamine, pentaéthylènehexaamine, imidazoline, méthylimidazoline, bis(aminoéthyl)-imidazoline, pyrimidine, aminopropylpipérazine, bis(aminoéthyl)-pipérazine, N-mono(hydroxyléthyl)-éthylènediamine, N,N'-bis(hydroxyléthyl)éthylènediamine, N-mono(hydroxylpropyl)diéthylènetriamine et N,N'-bis(hydroxylpropyl)-tétraéthylènepentaamine.

6. Composition lubrifiante suivant la revendication 4, dans laquelle ledit composant [II] est un composé produit par la réaction dudit alcényl succinimide avec un composé de bore choisi dans le groupe constitué des oxydes de bore, hydrates d'oxyde de bore trifluorure de bore, trichlorure de bore, tribromure de bore, alkylbore, arylbore, acide borique, acides métaborique et tétraborique et les esters desdits acides boriques avec des alcools et des phénols et leurs sels d'ammonium.

7. Composition lubrifiante suivant la revendication 1, dans laquelle ledit composant [III] est choisi dans le groupe constitué des monoesters de la glycérine et de l'acide dodécanoïque, monoester de la glycérine et de l'acide hexadécanoïque, monoester de la glycérine et de l'acide octadécanoïque, monoester de la glycérine et de l'acide octodécénoïque, monoester du pentaérythritol et de l'acide dodécanoïque, monoester du pentaérythritol et de l'acide hexadécanoïque, monoester du pentaérythritol et de l'acide octadécanoïque , monoester du pentaérythritol et de l'acide octadécénoïque, monoester du sorbitol et de l'acide dodécanoïque, monoester du sorbitol et de l'acide hexadécanoïque, monoester du sorbitol et de l'acide octadécanoïque, monoester du sorbitol et de l'acide octadécénoïque, monoester du sorbitan et de l'acide dodécanoïque, monoester du sorbitan et de l'acide hexadécanoïque, monoester du sorbitan et de l'acide octadécanoïque, monoester du sorbitan et de l'acide octadécénoïque, triester du sorbitan et de l'acide octadécanoïque, triester du sorbitan et de l'acide octadécénoïque et leurs associations.

8. Composition lubrifiante suivant l'une quelconque des revendications 1 - 7 comprenant entre outre:

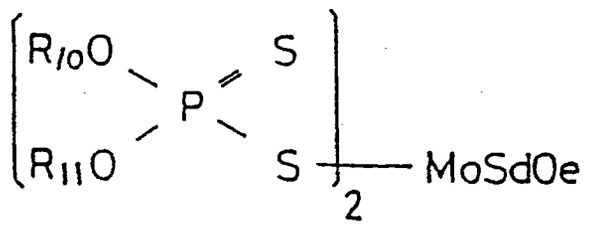
[IV] une polyoléfine en quantité de 0,1 - 20 % en poids, ladite polyoléfine résultant de l'homo- ou co-polymérisation d'oléfines de 2 - 8 atomes de carbone et ayant un poids moléculaire moyen de 200 - 10.000, chacune desdites quantités étant basée sur la composition totale.

9. Composition lubrifiante suivant la revendication 8, dans laquelle ledit composant [IV] et choisi dans le groupe constitué des polybutène, polyisobutylène, copolymère éthylènepropylène, copolymère éthylène-1-butène et copolymère éthylène-propylène-1-butène.

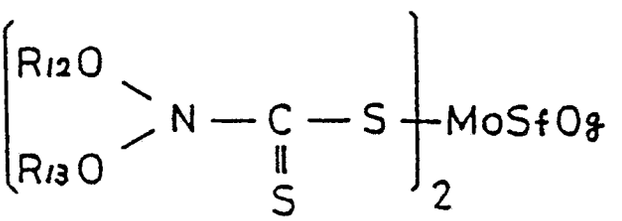
10. Composition lubrifiante suivant l'une quelconque des revendications 1 - 9 comprenant en outre:

[V] au moins un des dithiophosphates de molybdène et dithiocarbamates de molybdène en quantité de 0,1 - 10 % en poids, chacune de ces quantités étant basée sur la composition totale.

11. Composition lubrifiante suivant la revendication 10, dans laquelle ledit composant [V] est un dithiophosphate de molybdène représenté par la formule:



où R_{10} et R_{11} sont des groupements alkyles, cycloalkyles, alkylcycloalkyles, aryles, alkylaryles ou arylalkyles de 1 - 24 atomes de carbone, d est $0 < d \leq 4$, et e est $0 \leq e < 4$ dans lesquels $d + e = 4$ et/ou un dithiocarbamate de molybdène représenté par la formule:



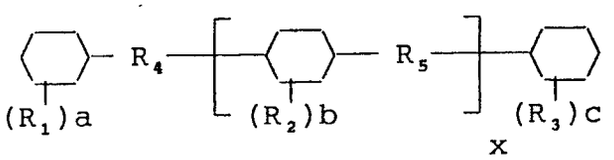
où R_{12} et R_{13} sont tels que définies plus haut, f est $0 < f \leq 4$, et g est $0 \leq g < 4$ où $f + g = 4$.

12. Composition lubrifiante suivant la revendication 11, dans laquelle ledit composant [V] est choisi dans le groupe constitué des sulfure de diéthyldithiophosphate de molybdène, sulfure de dipropyldithiophosphate de molybdène, sulfure de dipropyldithiophosphate de molybdène, sulfure de dibutyl-dithiophosphate de molybdène, sulfure de dipentyldithiophosphate de molybdène, sulfure de dihexyldithiophosphate de molybdène, sulfure de dioctyldithiophosphate de molybdène, sulfure de didécyldithiophosphate de molybdène, sulfure de didodécyldithiophosphate de molybdène, sulfure de di(butylphényl)-dithiophosphate de molybdène, sulfure de (nonylphényl)-dithiophosphate de molybdène, sulfure de diéthyldithiophosphate d'oxymolybdène, sulfure de dipropyldithiophosphate d'oxymolybdène, sulfure de dibutyldithiophosphate d'oxymolybdène, sulfure de dipentyldithiophosphate d'oxymolybdène, sulfure de dihexyldithiophosphate d'oxymolybdène, sulfure de dioctyldithiophosphate d'oxymolybdène, sulfure de didécyldithiophosphate d'oxymolybdène, sulfure de didodécyldithiophosphate d'oxymolybdène, sulfure de di(butylphényl)dithiophosphate d'oxymolybdène, sulfure de di(nonylphényl)dithiophosphate d'oxymolybdène, sulfure de diéthyldithiocarbamate de molybdène, sulfure de dipropyldithiocarbamate de molybdène, sulfure de dibutyldithiocarbamate de molybdène, sulfure de dihexyldithiocarbamate de molybdène, sulfure de dioctyldithiocarbamate de molybdène, sulfure de didécyldithiocarbamate de molybdène, sulfure de didodécyldithiocarbamate de molybdène, sulfure de di(butylphényl)-dithiocarbamate de molybdène, sulfure de di(nonylphényl)dithiocarbamate de molybdène, sulfure de diéthyldithiocarbamate d'oxymolybdène, sulfure de dipropyldithiocarbamate d'oxymolybdène, sulfure de dibutyldithiocarbamate d'oxymolybdène, sulfure de dipentyldithiocarbamate d'oxymolybdène, sulfure

de dihexyldithiocarbamate d'oxymolybdène, sulfure de dioctyldithiocarbamate d'oxymolybdène, sulfure de didécyldithiocarbamate d'oxymolybdène, sulfure de didodécyldithiocarbamate d'oxymolybdène, sulfure de di(butylphényl)dithiocarbamate d'oxymolybdène, et sulfure de di(nonylphényl)-dithiocarbamate d'oxymolybdène et leurs associations.

Patentansprüche

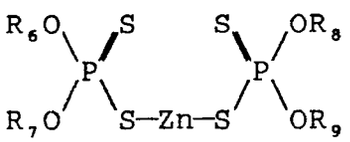
1. Eine Schmiermittelzusammensetzung zum Einsatz in Zugantrieben, bestehend aus: einem Basisöl folgender Formel



Dabei sind R_1, R_2 und R_3 Alkylgruppen von 1 - 4 Kohlenstoffatomen; R_4 und R_5 sind Methylen-, Ethylen- oder Trimethylen-Gruppen, deren Kohlenstoffatome mit einer Alkylgruppe von 1 - 4 Kohlenstoffatomen substituiert werden können; a, b und c sind Ganze von 0 - 2 und x ein Ganzes von 0 oder 1; [I] ein Zinkdialkyldithiophosphat in einer Menge von 0,1 bis 5 Gew.-%; [II] ein Alkenylsuccinimid oder dessen Borderivate in einer Menge von 0.1 bis 5 Gew.-%; und [III] ein partieller Carbonsäureester eines Polyols von 3 - 6 Kohlenstoffatomen in einer Menge von 0,01 bis 5 Gew.-%; dabei sind die angegebenen Einzelmengen jeweils auf die Gesamtzusammensetzung bezogen.

2. Die Schmierstoffzusammensetzung nach Anspruch 1, bei der das betreffende Basisöl aus einer Gruppe ausgewählt wird, die besteht aus Dicyclohexylmethan, 1,1-Dicyclohexylethan, 1,2-Dicyclohexylpropan, 1,3-Dicyclohexylpropan, 2,2-Dicyclohexylpropan, 1,2-Dicyclohexyl-2-methylpropan, 1,3-Dicyclohexylbutan, 1,3-Dicyclohexyl-3-methylbutan, 1,3-Dicyclohexyl-2,3-dimethylbutan, 2,3-Dicyclohexyl-2,3-dimethylbutan, 2,4-Dicyclohexylpentan, 2,4-Dicyclohexyl-2-methylpentan, Bis(cyclohexylmethyl)cyclohexan, Bis-(1-cyclohexylethyl)cyclohexan und Bis(1-methyl-2-cyclohexylethyl)cyclohexan, deren Substitutionsverbindungen, bei denen ein oder zwei Methyloder Ethylgruppen mit den Kohlenstoffatomen des Cyclohexylrings verbunden ist, sowie Kombinationen davon.

3. Die Schmiermittelzusammensetzungen nach Anspruch 1, bei denen die Komponente [I] eine Verbindung entsprechend folgender Formel ist:



Dabei sind R_6, R_7, R_8 und R_9 die gleichen oder unterschiedliche Alkyl- oder Alkylarylgruppen von 3 bis 22 Kohlenstoffatomen.

4. Die Schmiermittelzusammensetzung nach Anspruch 1, bei der die Komponente [II] ein Alkenylsuccinimid aus der Reaktion eines Polyolefins von 2 - 30 Kohlenstoffatomen mit Maleinsäureanhydrid, gefolgt von einer Umwandlung des daraus resultierenden Reaktionsproduktes in eine Imidform durch Reaktion mit einem Amin.

5. Die Schmiermittelzusammensetzung nach Anspruch 4, bei der das Polyolefin aus einer Gruppe ausgewählt wird, die besteht aus Homo- und Copolymeren von Ethylen, Propylen, Buten, Penten, Hexen, Hepten, Octen, Nonen, Decen und Dodecen sowie Copolymeren davon mit Styrol, und bei der das Amin aus einer Gruppe ausgewählt wird, die besteht aus Methylamin, Ethylamin, Propylamin,

Butylamin, Pentylamin, Hexylamin, Heptylamin, Octylamin, Ethylendiamin, Propylendiamin, N,N'-Dimethylpropylendiamin, Trimethylendiamin, N,N'-Dihexyltrimethylendiamin, Decamethylendiamin, Di-(trimethylen)triamin, Di(heptamethylen)triamin, Triethylentetraamin, Tripropylentetraamin, Tetraethylenpentaamin, Pentaethylenhexaamin, Imidazolin, Methylimidazolin, Bis(aminoethyl) imidazolin, Pyrimidin, Aminopropylpiperazin, Bis(aminoethyl)piperazin, N-Mono(hydroxyethyl)ethylendiamin, N,N'-Bis-(hydroxyethyl)ethylendiamin, N-Mono(hydroxypropyl)diethylentriamin und N,N'-bis(hydroxypropyl)-tetraethylenpentaamin.

6. Die Schmiermittelzusammensetzung nach Anspruch 4, bei der die Komponente [II] eine Verbindung ist, die durch Reaktion des Alkenylsuccinimids mit einer Borverbindung abgeleitet wird, die ausgewählt wird aus einer Gruppe bestehend aus Boroxid, Boroxidhydraten, Bortrifluorid, Bortrichlorid, Bortribromid, Alkylboren, Arylboren, Borsäure, Meta- und Tetraborsäure sowie Estern dieser Borsäuren mit Alkoholen und Phenolen und deren Ammoniumsalzen.

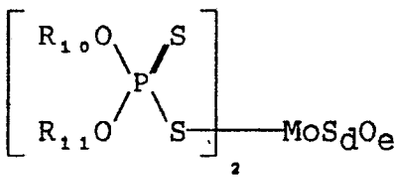
7. Die Schmiermittelzusammensetzung nach Anspruch 1, bei der die Komponente [III] aus einer Gruppe ausgewählt wird, die besteht aus Glycerindodecansäuremonoester, Glycerinhexadecansäuremonoester, Glycerinoctadecansäuremonoester, Pentaerythrithexadecansäuremonoester, Pentaerythritoctadecansäuremonoester, Pentaerythritoctadecensäuremonoester, Sorbitdodecansäuremonoester, Sorbithexadecansäuremonoester, Sorbitoctadecansäuremonoester, Sorbitoctadecensäuremonoester, Sorbitandodecansäuremonoester, Sorbitanhexadecansäuremonoester, Sorbitanoctadecansäuremonoester, Sorbitanoctadecensäuremonoester, Sorbitanoctadecansäuretriester und Sorbitanoctadecensäuretriester sowie Kombinationen daraus.

8. Eine Schmiermittelzusammensetzung nach irgendeinem der Ansprüche 1 bis 7, zusätzlich bestehend aus [IV] einem Polyolefin in einer Menge von 0,1 - 20 Gew.-%, das aus der Homo- oder Copolymerisierung von Olefinen mit 2 bis 8 Kohlenstoffatomen resultiert und ein durchschnittliches Molekulargewicht von 200 - 10.000 aufweist, wobei jede Einzelmenge auf die Gesamtzusammensetzung bezogen ist.

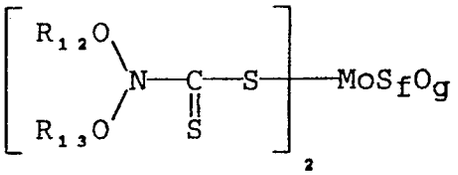
9. Die Schmiermittelzusammensetzung nach Anspruch 8, bei der die Komponente [IV] aus einer Gruppe ausgewählt wird, die besteht aus Polybuten, Polyisobutylen, Ethylenpropylen-Copolymer, Ethylen-1-Buten-Copolymer und Ethylen-Propylen-1-Buten-Copolymer.

10. Eine Schmiermittelzusammensetzung nach irgendeinem der Ansprüche 1 bis 9, zusätzlich bestehend aus [V] mindestens einem der Molybdändithiophosphate und Molybdändithiocarbamate in einer Menge von 0,1 bis 10 Gew.-%, wobei jede Einzelmenge auf die Gesamtzusammensetzung bezogen ist.

11. Die Schmiermittelzusammensetzung nach Anspruch 10, bei der die Komponente [V] ein Molybdändithiophosphat folgender Formel ist:



Dabei sind R_{10} und R_{11} Alkyl-, Cycloalkyl-, Alkylcycloalkyl-, Aryl-, Alkylaryl- oder Arylalkylgruppen von 1 - 24 Kohlenstoffatomen, d ist $0 < d \leq 4$ und e ist $0 \leq e < 4$, wobei $d + e = 4$ und/oder ein Molybdändithiocarbamat folgender Formel sind:



Dabei sind R_{12} und R_{13} wie oben definiert, f ist $0 < f \leq 4$ und g ist $0 \leq g < 4$, wobei $f + g = 4$.

12. Die Schmiermittelzusammensetzung nach Anspruch 11, wobei die Komponente [V] ausgewählt wird aus einer Gruppe, die besteht aus Molybdändiethyldithiophosphatsulfid, Molybdändipropyldithiophosphatsulfid, Molybdändibutyldithiophosphatsulfid, Molybdändipentyldithiophosphatsulfid, Molybdändihexyldithiophosphatsulfid, Molybdändioctyldithiophosphatsulfid, Molybdändidecyldithiophosphatsulfid, Molybdändidodecyldithiophosphatsulfid, Molybdändi(butylphenyl)dithiophosphatsulfid, Molybdändi(nonylphenyl)dithiophosphatsulfid, Molybdänoxid-Diethyldithiophosphatsulfid, Molybdänoxid-Dipropyldithiophosphatsulfid, Molybdänoxid-Dibutyldithiophosphatsulfid, Molybdänoxid-Dipentyldithiophosphatsulfid, Molybdänoxid-Dihexyldithiophosphatsulfid, Molybdänoxid-Dioctyldithiophosphatsulfid, Molybdänoxid-Didecyldithiophosphatsulfid, Molybdänoxid-Didodecyldithiophosphatsulfid, Molybdänoxid-Di(butylphenyl)dithiophosphatsulfid, Molybdänoxid-Di(nonylphenyl)-dithiophosphatsulfid, Molybdändiethyldithiocarbamatsulfid, Molybdändipropyldithiocarbamatsulfid, Molybdändibutyldithiocarbamatsulfid, Molybdändihexyldithiocarbamatsulfid, Molybdändioctyldithiocarbamatsulfid, Molybdändidecyldithiocarbamatsulfid, Molybdändidodecyldithiocarbamatsulfid, Molybdändi(butylphenyl)dithiocarbamatsulfid, Molybdändi(nonylphenyl)dithiocarbamatsulfid, Molybdänoxid-Diethyldithiocarbamatsulfid, Molybdänoxid-Dipropyldithiocarbamatsulfid, Molybdänoxid-Dibutyldithiocarbamatsulfid, Molybdänoxid-Dipentyldithiocarbamatsulfid, Molybdänoxid-Dihexyldithiocarbamatsulfid, Molybdänoxid-Dioctyldithiocarbamatsulfid, Molybdänoxid-Didecyldithiocarbamatsulfid, Molybdänoxid-Didodecyldithiocarbamatsulfid, Molybdänoxid-Di(butylphenyl)dithiocarbamatsulfid und Molybdänoxid-Di(nonylphenyl)dithiocarbamatsulfid sowie Kombinationen davon.