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(54) Lubricating oil composition

Schmiermittelzusammensetzung

Composition lubrifiante

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The file contains technical information submitted after the application was filed and not included in this specification

EP 0 286 996 B2

Description

[0001] The present invention relates to a lubricating oil composition, in particular it relates to a lubricating oil composition having excellent frictional characteristics, decreased in changes with time of the frictional characteristics and an excellent oxidation stability, which therefore is useful as a lubricating oil for use in various parts such as an automatic transmission, a continuously variable transmission, a brake of a tractor and a power steering.

[0002] A lubricating oil to be used in parts including a wet clutch or a wet brake of an automatic transmission, a continuously variable transmission and a tractor is required to have such properties that frictional characteristics, oxidation stability, corrosion resistance and rust resistance are good.and transmission torque is large. An especially important requirement is that the ratio of coefficient of static friction (μ_0) to coefficient of kinematic friction (μ_{1200}) as a measure of frictional characteristics is small and further that the change with time of the above ratio is small.

[0003] A lubricating oil having a high coefficient of static friction and good in transmission torque has heretofore been known. This lubricating oil, however, has disadvantages in that frictional characteristics are not sufficiently satisfactory and shift shock is undesirably big.

[0004] In recent years, with miniaturization of cars and with increased production of FF (front engine front wheel driven) cars, a tendency toward miniaturziation of an automatic transmission and so forth has been increasingly developed. This miniaturization of the automatic transmission makes a driver more sensitive to the shift shock. Thus, in order to reduce the shift shock and to make a car more comfortable to drive, it has become a technical subject to improve frictional characteristics, especially at an initial stage.

[0005] In order to improve frictional characteristics, a lubricating oil containing a friction modifier has been proposed. This friction modifier-containing lubricating oil, however, is not sufficiently improved in frictional characteristics and further has a problem in that the frictional characteristics are reduced by degradation of oil due to its long term use (change with time). Moreover there is a tendency that the corrosion preventing ability drops.

[0006] GB-A-1 199 936 discloses a lubricating oil composition comprising a naphthene + paraffin base oil having an aromatic content (C_A) of less than 0,5 % by weight and a kinematic viscosity of 19.24 x 10^{-6} m^2/s (19,24 cSt). The composition further comprises sulfur-containing compounds, amine salts of phosphoric acid esters and carboxylic acid esters. The exact naphthene content is not specified in this reference.

[0007] FR-A-1 544 802 disclosed a combination of a mineral oil with phosphate additives, the mineral oil having a naphthene content of at least 25 % and a kinematic viscosity at 90°C of from 1,06 x 10^{-6} m^2/s to 2,44 x 10^{-6} m^2/s (1,06 to 2,44 cSt), and the aromatic content of the lubricating oil composition disclosed therein being 9,0 %.

[0008] As described above there has not yet been obtained a lubricating oil which possesses frictional characteristics which are good and are decreased in the change with time, and further which has a high transmission torque.

[0009] The object of the present invention is to overcome the above problems and to provide a lubricating oil composition which is decreased in shift shock, is great in transmission torque, and further has a sufficiently high corrosion-preventing ability. and thus is suitable for use in lubrication of an automatic transmission.

[0010] It has been found that according to the present invention this object can be attained by compounding a specified proportion of a specific friction modifier to a base oil having specified properties.

[0011] The present invention relates to a lubricating oil composition which comprises:

(A) a base oil having a naphthene content of at least 30 %, an aromatic content of not more than 2 %, and a kinematic viscosity at 100 °C of from 1,5 x 10^{-6} to 30 x 10^{-6} m^2/s (1,5 to 30 cSt), a viscosity index of at least 80 and a pour point of not more than -30 ° C; and

(B) 0,01 to 5 % by weight based on the total weight of the composition of a friction modifier, which is at least one compound selected from the group consisting of phosphoric acid esters, phosphorous acid esters, amine salts of phosphoric acid esters, amine salts of phosphorous acid esters, sorbitan fatty acid esters, pentaerythritol fatty acid esters, tetraesters being excluded, glycerine fatty acid esters trimethylolpropane fatty acid esters, triesters being excluded, glycol fatty acid esters, neopentyl glycol fatty acid diesters being excluded, carboxylic acids, carboxylic acid amides. carboxylic acid esters, dicarboxylic acid esters being excluded, metal salts of carboxylic acids, fats and oils. higher alcohols and sulfur-containing compounds.

[0012] According to a preferred embodiment of the present invention the base oil component (A) of the lubricating oil composition of the present invention is a mineral oil, preferably a deep dewaxed oil obtained by subjecting a purified oil to deep dewaxing treatment.

[0013] The base oil as the component (A) of the present composition has a naphthene content (% C_N) of at least 30 %, preferably 32 to 70 %, an aromatic content (% C_A) of not more than 2 %, preferably not more than 1 %, and a kinematic viscosity at 100 ° C of from 1,5 x 10^{-6} to 30 x 10^{-6} m^2/s (1,5 to 30 cSt), preferably 2 x 10^{-6} to 20 x 10^{-6} m^2/s (2 to 20 cSt).

[0014] If the naphthene content is less than 30 %, frictional characteristics are reduced. If the aromatic content is

more than 2 %, oxidation stability is poor and the change with time is undesirably large. Moreover, if the kinematic viscosity at 100° C is less than 1,5 x 10^{-6} m^2/s (1,5 cSt), the evaporation loss is undesirably large while on the other hand if it is more than 30 x 10^{-6} m^2/s (30 cSt), the power loss due to viscosity resistance is undesirably too large.

[0015] It is preferred for the base oil of the component (A) to have such characteristics as required for the usual lubricating oil, for example, (1) proper viscosity characteristics. (2) good stability against oxidation, (3) good detergency and dispersancy, (4) good rust resistance and corrosion resistance and (5) good low temperature fluidity.

[0016] It is more preferred that the base oil has a viscosity of at ieast 80, a pour point of not more than -30 ° C, and a total acid value of 0,1 mg KOH/g.

[0017] As the base oil of the component (A), various mineral oils and synthetic oils can be used as long as they have the above specified properties.

[0018] Representative examples of the mineral oil which can be used as the base oil of the component (A) include a purified oil which is obtained by purifying a distillate oil by the usual method, said distillate oil having been obtained by atmospheric distillation of a paraffin base crude oil or an intermediate base crude oil, or by vacuum distillation of a residual oil resulting from the atmospheric distillation, and a deep dewaxing oil which is obtained by subjecting the above purified oil to deep dewaxing treatment. In this case, the process for purification of the distillate oil is not critical, and various methods can be employed. Usually, the distillate oil is purified by applying such treatments as (a) hydrogenation, (b) dewaxing (solvent dewaxing or hydrogenation dewaxing), (c) solvent extraction, (d) alkali distillation or sulfuric acid treatment, and (e) clay filtration, alone or in combination with one another. It is also effective to apply the same treatment repeatedly at multi-stages.

[0019] For example, (1) a method in which the distillate oil is hydrogenated, or after hydrogenation, it is further subjected to alkali distillation or sulfuric acid treatment, (2) a method in which the distillate oil is hydrogenated and then is subjected to dewaxing treatment, (3) a method in which the distillate oil is subjected to solvent extraction treatment and then to hydrogenation treatment, (4) a method in which the distillate oil is subjected to two- or three-stage hydrogenation treatment, or after the two or three-stage hydrogenation treatment, it is further subjected to alkali distillation or sulfuric acid rinsing treatment, and (5) a method in which after the treatment of the distillate oil by the methods (1) to (4) as described above, it is again subjected to dewaxing treatment to obtain a deep dewaxed oil, can be employed.

[0020] In the practice of the above methods, it suffices that processing conditions be controlled so that the resulting oil has a kinematic viscosity at 100°C, a naphthene content and an aromatic content all falling within the above-specified ranges.

[0021] A mineral oil obtained by deep dewaxing, i.e., deep dewaxed oil is particularly preferred as the base oil of the component (A). This deep dewaxing is carried out for example by solvent dewaxing under severe conditions, and catalytic hydrogenation dewaxing using a Zeolite catalyst.

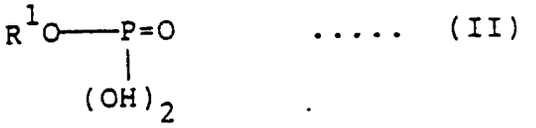
[0022] As well as the aforementioned mineral oil, usual synthetic oils such as alkylbenzene, polybutene and poly(α-olefin), a synthetic oil containing saturated hydrocarbons having fused rings and/or non-fused rings-such as 1-(1-decalyl)-1-cyclohexylethane or mixtures thereof can be used as the base oil of the component (A).

[0023] The friction modifier as the component (B) of the present composition is added to the base oil as the component (A) in a proportion of 0,01 to 5 % by weight, preferably 0,1 to 2 % by weight based on the total weight of the composition. If the proportion of the friction modifier is less than 0,01 % by weight, its addition is not effective. On the other hand, if it is more than 5 % by weight, oxidation stability is undesirably reduced.

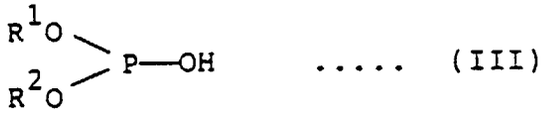
[0024] As the friction modifier which is used as the component (B) of the present composition, at least one compound selected from the group consisting of phosphoric acid esters, phosphorous acid esters, amine salts of phosphoric acid esters, amine salts of phosphorous acid esters. sorbitan fatty acid esters, pentaerythritol fatty acid esters, tetraesters being excluded, glycerine fatty acid esters, trimethylolpropane fatty acid esters, triesters being excluded, glycol fatty acid esters, neopentyl glycol fatty acid diesters being excluded, carboxylic acid esters, dicarboxylic acid esters being excluded, metal salts of carboxylic acids, fats and oils. higher alcohols, and sulfur-containing compounds is used. These compounds can be used alone or in combination with one another.

[0025] Of the above phosphoric acid esters and phosphorous acid esters, those represented by the following general formulae (I), (II) and (III) are preferred.

..... (I)



..... (II)



..... (III)

[0026] In the above formulae (I), (II) and (III), R^1 and R^2 may be the same or different and are each an alkyl group having 4 to 30 carbon atoms, an aryl group, or an alkyl-substituted aryl group.

[0027] Representative examples of the phosphoric acid esters and phosphorous acid esters include butylacid phosphate, 2-ethylhexylacid phosphate, laurylacid phosphate, oleylacid phosphate, stearylacid phosphate, dibutylhydrogen phosphite, dilaurylhydrogen phosphite, dioleylhydrogen phosphite, distearylhydrogen phosphite, and diphenylhydrogen phosphite.

[0028] The amine salts of phosphoric acid esters and phosphorous acid esters include the oleylamine salts, coconut amine salts, beef tallow amine salts of the above phosphoric acid esters and phosphorous acid esters.

[0029] Representative examples of sorbitan fatty acid esters include sorbitan monolaurate, sorbitan monooleate, sorbitan monostearate, sorbitan sesquioleate, sorbitan dioleate and mixtures thereof.

[0030] Representative examples of pentaerythritol fatty acid esters include the monoesters, diesters or triesters of pentaerythritol or dipentaerythritol and fatty acids such as capric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linolic acid and behenic acid, and mixtures thereof.

[0031] Representative examples of glycerine fatty acid esters include oleic monoglyceride, stearic monoglyceride, oleic diglyceride and mixtures thereof.

[0032] Representative examples of trimethylolpropane fatty acid esters include the monoesters or diesters of trimethylpropane and fatty acids such as capric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linolic acid and behenic acid, and mixtures thereof.

[0033] Representative examples of glycol fatty acid esters include the monoesters of propylene glycol, trimethylene glycol, 1,4-butanediol or neopentyl glycol and fatty acids such as capric acid, lauric acid, palmitic acid, myristic acid, stearic acid, oleic acid, linolic acid and behenic acid, and mixtures thereof.

[0034] As carboxylic acids, aliphatic carboxylic acids, divalent carboxylic acids (dibasic acids) and aromatic carboxylic acids can be used. The aliphatic carboxylic acids have 8 to 30 carbon atoms and may be saturated or unsaturated. Representative examples of the aliphatic carboxylic acids include pelargonic acid, lauric acid, tridecanic acid, myristic acid, palmitic acid, stearic acid, eicosanic acid, behenic acid, triacon-tanoic acid, undecylenic acid, oleic acid, linolic acid, linoleic acid, erucic acid, and oils and fats fatty acids (e.g., coconut oil fatty acid, and palm kernel oil fatty acid). Representative examples of the divalent carboxylic acid include octadecylsuccinic acid, octadecenylsuccinic acid, polybutenesuccinic acid, adipic acid, azelaic acid, sebacic acid and dodecane diacid. The aromatic carboxylic acids include salicylic acid.

[0035] As the carboxylic acid amide, various compounds can be used. For example, the reaction products of carboxylic acids as described above and amine compounds (e.g., diethylenetriamine, triethylenetetramine, tetraethylenepentamine, hexaethylenepentamine, heptaethyleneoctamine, tetrapropylenepentamine, hexabutyleneheptamine, and alkanolamines such as monoethanolamine, and diethanolamine) can be used.

[0036] Carboxylic acid esters include aliphatic carboxylic acid esters. As the aliphatic carboxylic acid esters, the alkyl (e.g., methyl, ethyl, propyl, butyl, octyl, lauryl, and oleyl) esters of aliphatic carboxylic acids are described above are usually used.

[0037] As the carboxylic acid metal salts, zinc laurate, zinc oleate, zinc stearate, zinc salt of coconut fatty acid, aluminum stearate and magnesium salicylate can be used.

[0038] As the fats and oils, both animal oils and vegetable oils can be used. Examples of the animal oils include lard, beef tallow and fish oil. Examples of the vegetable oils include soy bean oil, rapeseed oil, rice bran oil, palm oil, palm kernel oil and coconut oil.

[0039] As the higher alcohols, octyl alcohol, lauryl alcohol, myristyl alcohol, oleyl alcohol and stearyl alcohol can be used.

[0040] As the sulfur-containing compounds, sulfurized oil, the reaction product of phosphorous sulfide and pinene

can be used.

[0041] The above compounds can be used as the component (B), friction modifier, of the composition of the present invention. Of these compounds, phosphoric acid esters, phosphorous acid esters or their amine salts, carboxylic acid amides, glycerine fatty acid esters, sorbitan fatty acid esters, carboxylic acid metal salts and mixtures comprising two or more thereof are preferred.

[0042] The composition of the present invention is obtained by adding a friction modifier as the component (B) to a base oil as the component (A). If desired, a viscosity index improver, an antioxidant, a detergent dispersant and so forth can be added to the composition of the present invention.

[0043] The type of the viscosity idex improver is not critical. For example, polymethacrylate, polyisobutene, polyalkylstyrene and an ethylene-propylene copolymer can be used. Of these, polymethacrylate having a molecular weight of not more than 100 000, preferably not more than 50 000, which is excellent in shear stability and is able to prevent changes in viscosity for a long time, is particularly suitable. The amount of the viscosity indes improver added can be determined appropriately; usually, it is 0,5 to 15 % by weight, preferably 2 to 10 % by weight based on the total weight of the composition.

[0044] As the antioxidant, compounds commonly used, such as phenol-based compounds, amine-based compounds, and zinc dithiophosphate can be used. Representative examples are 2,6-di-tert-butyl-4-methylphenol, 2,6-di-tert-butyl-4-ethylphenol, 4,4'-methylenebis(2,6-di-tert-butylphenol), phenyl-α-naphthylamine, dialkyldiphenylamine, zinc di-2-ethylhexyldithiophosphate, zinc diamyldithiocarbamate, and pinene pentasulfide. The amount of the antioxidant added is 0.01 to 2% by weight, preferably 0.05 to 1% by weight based on the total weigh of the composition.

[0045] As the detergent dispersant, e.g. an ashless detergent, and a metal detergent can be used. In addition, a boron-containing ashless detergent can be used. Specifically alkenylsuccinic acid imide, sulfonates, and phenates are preferred. Examples are polybutenylsuccinic acid imide, calcium sulfonate, barium sulfonate, calcium phenate, barium phenate, and calcium salicylate. The amount of the detergent dispersant added is 0.1 to 10% by weight, preferably 0.5 to 5% by weight based on the total weight of the composition.

[0046] In addition, if necessary, suitable amounts of a corrosion preventing agent, a rubber swelling agent, and a defoaming agent can be added to the composition of the present invention.

[0047] In the lubricating oil composition of the present invention, initial frictional characteristics are good, that is, the ratio of coefficient of static friction to coefficient of kinematic friction is small, and the shock due to speed change is small. Changes with time of the frictional characteristics are small. Furthermore, the lubricating oil composition of the present invention is excellent in oxidation stability and corrosion resistance. Thus the lubricating oil composition of the present invention is suitable for miniaturization of a transmission and so forth.

[0048] Accordingly the lubricating oil composition of the present invention is quite useful as a lubricating oil for use in an automatic transmission or a continuously variable transmission, or as a lubricating oil for use in parts including a wet clutch or a wet brake of an agricultural tractor.

[0049] Moreover the lubricating oil composition of the present invention having characteristics as described above is useful as a lubricating oil to be used in a shock absorber, a power steering, an oil suspension and further in various construction machines.

[0050] The present invention is described in greater detail with reference to the following examples.

EXAMPLES 1 to 10, and COMPARATIVE EXAMPLES 1 to 11

(1) Preparation of Lubricating Oil Composition

[0051] Base Oils A to E shown below were used as the base oil. To 89.3% by weight of each of Base Oils A to E were added 4.0% by weight of polymethyl methacrylate (weight average molecular weight 42,000), 0.5% by weight of 2,6-di-tert-butyl-4-methylphenol, 5.0% by weight of polybutenylsuccinic acid imide, 0.1% by weight of an anti-corrosion agent, 1.0% by weight of a rubber swelling agent and 1% by weight of a defoaming agent to prepare Basic Oils A to E.

[0052] To these Basic Oils A to E were added the compounds shown in the table following below in predetermined amounts to obtain lubricating oil compositions.

Base Oil A

(1) Properties

[0053]

Viscosity: $5{,}40.10^{-6}$ m^2/s (5.40 cSt) (100°C)
Viscosity Index: 105

Ring Analysis: $\%C_A$ 0.1, $\%C_N$ 38.0
Pour Point: -45°C

(2) Method of Preparation

[0054] Obtained by subjecting a distillate from an intermediate base oil to two-stage hydrogenation treatment and further to deep dewaxing treatment.

Base Oil B

(1) Properties

[0055]

Viscosity: $5{,}20.10^{-6}$ m^2/s (5.20 cSt) (100°C)
Viscosity Index: 105
Ring Analysis: $\%C_A$ 4.5, $\%C^N$ 27.0

(2) Method of Preparation

[0056] Obtained by subjecting a distillate from an intermediate base oil to solvent extraction treatment and further to hydrogenation treatment.

Base Oil C

(1) Properties

[0057]

Viscosity: $5{,}45.10^{-6}$ m^2/s (5.45 cSt) (100°C)
Viscosity Index: 83
Ring Analysis: $\%C_A$ 1.5, $\%C_N$ 50

(2) Method of Preparation

[0058] Mixture of 40% by weight of Base Oil A, 30% by weight of an oil obtained by subjecting a distillate from an intermediate base oil to hydrogenation treatment, and 30% by weight of 1-(1-decalyl)-1-cyclohexylethane.

Base Oil D

(1) Properties

[0059]

Viscosity: $5{,}6.10^{-6}$ m^2/s (5.6 cSt) (100°C)
Viscosity Index: 120
Ring Analysis: $\%C_A$ 0.1 or less, $\%C_N$ 19

(2) Method of Preparation

[0060] Mixture of 50% by weight of Base Oil A and 50% by weight of poly-α-olefin.

Base Oil E

(1) Properties

[0061]

Viscosity: 5,1.10^{-6} m^2/s (100°C)
Viscosity Index: 60
Ring Analysis: $\%C_A$ 4, $\%C_N$ 40

(2) Method of Preparation

[0062] Obtained by subjecting a distillate from a naphthenic oil to solvent extraction treatment.

(2) Performance Test

[0063] The lubricating oil compositions prepared in (1) above, and after forced degradation of these lubricating oil compositions, were subjected to the following performance test. The results are shown in the table. The forced degradation was performed at 150°C for 24 hours according to Oxidation Stability Test of Lubricating Oil for Intemal Combustion Engine, JIS K 2514.

SAE (Society of Automotive Engineers) No. 2 Friction Test

[0064] Frictional characteristics were evaluated under the conditions shown below by the use of SAE No. 2 tester (manufactured by Greening Association Inc.)

(Test Conditions)

[0065]

Disc: Two paper discs for an automatic transmission made in Japan
Plate: Three steel plates for an automatic transmission in Japan
Number of revolutions of motor: 3,600 rpm
Piston pressure: 0,27 MPa (38 psi)
Oil Temperature: 120 ° C

[0066] A coefficient of kinematic friction (μ_{1200}) at a number of revolutions of 1,200 rpm under the above conditions and a coefficient of static friction (μ_0) at the time of stop were measured, and μ_0/μ_{1200} was calculated.

Oxidation Stability Test

[0067] This test was performed at 150° C for 96 hours according to Oxidation Stability Test of Lubricating Oil for Internal Combustion Engine, JIS K 2514.

Corrosion Test

[0068] The state of corrosion of a copper plate was measured after 3 hours at 100°C according to JIS K 2513.

Table

	Example						Comparative Example					
	1	2	3	4	5	6	1	2	3	4	5	6
Component of the Composition (wt%)												
Basic Oil A	99.0	99.5	99.5	99.9	99.0	99.0	-	-	-	-	-	-
Basic Oil B	-	-	-	-	-	-	99.0	99.5	99.5	99.9	99.0	99.0
Basic Oil C	-	-	-	-	-	-	-	-	-	-	-	-
Basic Oil D	-	-	-	-	-	-	-	-	-	-	-	-
Basic Oil E	-	-	-	-	-	-	-	-	-	-	-	-
Amine Salt of Oleyl-hydrogen Phosphite	1.0	-	-	-	-	-	1.0	-	-	-	-	-
Oleylacid Phosphate	-	0.5	-	-	-	-	-	0.5	-	-	-	-
Laurylhydrogen Phosphite	-	-	0.5	-	-	-	-	-	0.5	-	-	-
Stearic Acid	-	-	-	0.1	-	-	-	-	-	0.1	-	-
Oleyl Alcohol	-	-	-	-	1.0	-	-	-	-	-	1.0	-
Sorbitan Monooleate	-	-	-	-	-	1.0	-	-	-	-	-	1.0
Results												
SAE No. 2 Test (μ_0/μ_{1200})												
Fresh Oil	1.04	1.08	1.00	1.08	1.05	1.05	1.07	1.14	1.02	1.13	1.09	1.08
Degradated Oil	1.04	1.08	1.00	1.10	1.07	1.06	1.10	1.22	1.07	1.19	1.14	1.12
Oxidation Stability Test												
Viscosity Ratio	0.98	0.99	0.98	1.00	1.00	0.99	1.12	1.20	1.09	1.19	1.07	1.09
Increase in Total Acid Value	0.13	0.23	0.15	0.31	0.24	0.10	1.33	1.97	1.42	3.32	1.11	1.43
Lacquer	no	no	no	no	no	no	no	no	no	no	no	no
Corrosion Test	1(1a)	1(1a)	1(1a)	1(1a)	1(1a)	1(1a)	1(1a)	1(1a)	1(1a)	1(1a)	1(1a)	1(1a)

Table (continued)

	Example 7	Comparative Example 7	Comparative Example 8
Component of the Composition (wt%)			
Basic Oil A	-	-	-
Basic Oil B	-	-	-
Basic Oil C	99.0	-	-
Basic Oil D	-	99.0	-
Basic Oil E	-	-	99.0
Amine Salt of Oleyl-hydrogen Phosphite	1.0	1.0	1.0
Oleylacid Phosphate	-	-	-
Laurylhydrogen Phosphite	-	-	-
Stearic Acid	-	-	-
Oleyl Alcohol	-	-	-
Sorbitan Monooleate	-	-	-
Results			
SAE No. 2 Test (μ_0/μ_{1200})			
Fresh Oil	1.02	1.09	1.04
Degradated Oil	1.04	1.10	1.07
Oxidation Stability Test			
Viscosity Ratio	1.02	0.98	1.10
Increase in Total Acid Value	0.51	0.11	1.00
Lacquer	no	no	no
Corrosion Test	1(1a)	1(1a)	1(1a)

	Example 8	Example 9	Example 10	Comparative Example 9	Comparative Example 10	Comparative Example 11
Component of the Composition (wt%)						
Basic Oil A	99.5	99.5	99.5	-	-	-
Basic Oil B	-	-	-	99.5	99.5	99.5
Basic Oil C	-	-	-	-	-	-
Basic Oil D	-	-	-	-	-	-
Basic Oil E	-	-	-	-	-	-
Reaction Product of Tetraethylenepentamine and Oleic Acid	0.5	-	-	0.5	-	-
Octadecenylsuccinic Acid Monopropylester	-	0.5	-	-	0.5	-
Zinc Oleate	-	-	0.5	-	-	0.5
Results						
SAE No. 2 Test (μ_0/μ_{1200})						
Fresh Oil	0.98	0.98	0.99	1.02	1.02	1.04
Degradated Oil	0.98	0.98	0.99	1.05	1.05	1.07
Oxidation Stability Test						
Viscosity Ratio	0.97	0.98	0.98	1.05	1.08	1.10
Increase in Total Acid Value	0.12	0.14	0.15	1.39	1.42	1.43
Lacquer	no	no	no	no	no	no
Corrosion Test (Corrosion-Preventing Ability)	1(1a)	1(1a)	1(1a)	1(1a)	1(1a)	1(1a)

Claims

1. A lubricating oil composition comprising:

(A) a base oil having a naphthene content of at least 30 %, an aromatic content of not more than 2 %, a kinematic viscosity at 100 °C of from $1,5 \cdot 10^{-6}$ to $30 \cdot 10^{-6}$ m^2/s (1,5 to 30 cSt), a viscosity index of at least 80 and a pour point of not more than -30 ° C; and

(B) 0.01 to 5 % by weight based on the total weight of the composition of a friction modifier, which is at least one compound selected from the group consisting of phosphoric acid esters, phosphorous acid esters, amine salts of phosphoric acid esters, amine salts of phosphorous acid esters, sorbitan fatty acid esters, pentaerythritol fatty acid esters, tetraesters being excluded, glycerine fatty acid esters, trimethylolpropane fatty acid esters, triesters being excluded, glycol fatty acid esters, neopentyl glycol fatty acid diesters being excluded, carboxylic acids, carboxylic acid amides, carboxylic acid esters, dicarboxylic acid esters being excluded, metal salts of carboxylic acids, fats and oil; higher alcohols and sulfur-containing compounds.

2. The composition as claimed in Claim 1 wherein the base oil (A) is a mineral oil.

3. The composition as claimed in Claim 2 wherein the mineral oil is a deep dewaxed oil obtained by subjecting a purified oil to deep dewaxing treatment.

Patentansprüche

1. Schmierölzusammensetzung umfassend:

(A) ein Basisöl mit einem Naphthengehalt von wenigstens 30 %, einem aromatischen Gehalt von nicht mehr als 2 %, einer kinematischen Viskosität bei 100° C von 1,5 x 10^{-6} bis 30 x 10^{-6} m^2/s; einem Viskositätsindex von mindestens 80 und einem Fließpunkt von nicht mehr als - 30°C;und

(B) 0,01 bis 5 Gew.-% bezogen auf das Gesamtgewicht der Zusammensetzung eines Reibungsmodifizierungsmittels, das wenigstens eine Verbindung ist, ausgewählt aus der Gruppe bestehend aus Estern der Phosphorsäure, Estern der phosphorigen Säure, Aminsalzen von Estern der Phosphorsäure, Aminsalzen von Estern der phosphorigen Säure, Sorbitanfettsäureestern, Pentaerythritolfettsäureestern, wobei Tetraester ausgeschlossen sind, Glycerinfettsäureestern, Trimethylolpropanfettsäureestern, wobei Triester ausgeschlossen sind, Glykolfettsäureestern, wobei Neopentylglycolfettsäurediester ausgeschlossen sind, Carbonsäuren, Carbonsäureamiden, Carbonsäureestern, wobei Oicarbonsäureester ausgeschlossen sind, Metallsalzen von Carbonsäuren, Fetten und Ölen, höheren Alkoholen und Schwefel-enthaltenden Verbindungen.

2. Zusammensetzung nach Anspruch 1, wobei das Basisöl (A) ein Mineralöl ist.

3. Zusammensetzung nach Anspruch 2, wobei das Mineralöl ein hochgradig entwachstes Öl ist, das dadurch erhalten wird, daß man ein gereinigtes Öl einer Behandlung zum hochgradigen Entwachsen unterzieht.

Revendications

1. Une composition d'huile lubrifiante comportant :

(A) une huile de base présentant une teneur en naphtène d'au moins 30 %, une teneur en composés aromatiques ne dépassant pas 2 % et une viscosité cinématique à 100°C de 1,5 x 10^{-6} à 30 x 10^{-6} m^2/s (1,5 à 30 cSt) ; un indice de viscosité d'au moins 80 et un point d'éculement ne dépassant pas -30° C; et
(B) de 0,01 à 5 % en poids, en se basant sur le poids total de la composition d'un agent modifiant le frottement, qui est au moins un composé choisi dans le groupe constitué par les esters de l'acide phosphorique, les esters de l'acide phosphoreux, les sels aminés des esters de l'acide phosphorique, les sels aminés des esters de l'acide phosphoreux, les esters d'acide gras du sorbitan, les esters d'acide gras du pentaérythritol, les tétraesters étant exclus, les esters d'acide gras de la glycérine, les esters d'acide gras du triméthylolproane, les triesters étant exclus, les esters d'acide gras du glycol, les esters d'acide gras du néopentyl glycol étant exclus, les acides carboxyliques, les amides d'acides carboxyliques, les esters d'acides carboxyliques, les esters d'acides dicarboxyliques étant exclus, les sels métalliques d'acides carboxyliques, les graisses et les huiles; les alcools supérieurs et les composés renfermant du soufre.

2. De la composition telle que revendiquée dans la revendication 1, dans laquelle l'huile de base (A) est une huile minérale.

3. La composition telle que revendiquée dans la revendication, dans laquelle l'huile minérale est une huile extrêmement déparaffinée, obtenue en soumettant une huile purifiée à un traitement de déparaffinage poussé.