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(54) **LUBRICANT BASE OIL**

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(57) **ABSTRACT**

A lubricant base oil may contain at least one ester compound (A) selected from a diester (A1) having 24 or more carbon atoms and a triester (A2) having 24 or more carbon atoms and at least one base oil (B) selected from a mineral oil (B1) and a synthetic oil (B2) other than an ester synthetic oil. A lubricating oil composition may contain such a lubricant base oil.

LUBRICANT BASE OIL

TECHNICAL FIELD

[0001] The present invention relates to a lubricant base oil, and a lubricating oil composition containing the lubricant base oil.

BACKGROUND ART

[0002] Various devices such as engines, transmissions, decelerators, compressors, and hydraulic systems have mechanisms such as torque converters, wet clutches, gear bearing mechanisms, oil pumps, and hydraulic control mechanisms. Lubricating oil compositions are used in these mechanisms, and lubricating oil compositions that can meet various demands have been developed.

[0003] For example, Patent Literature 1 discloses a transmission oil composition for automobiles that is suitably used for vehicles with electric motors, comprising a base oil and a predetermined amount of a phosphorus compound selected from the group consisting of a hydrocarbon group-containing zinc dithiophosphate, triaryl phosphate, triaryl thiophosphate, and a mixture thereof, wherein the volume resistivity at 80° C. is adjusted to $1\times10^7\Omega\cdot m$ or more.

CITATION LIST

Patent Literature

[0004] Patent Literature 1: WO 2002/097017

SUMMARY OF INVENTION

Technical Problem

[0005] Meanwhile, lubricating oil compositions used, for example, in various devices such as electric motors may be required to have properties such as friction reducing effect and rubber swelling resistance, in addition to insulation properties, depending on the aspect of the device. That is, there is a need for a new lubricating oil composition that has properties suitable for lubrication of various mechanisms incorporated in devices (such as insulation properties, friction reducing effect, and rubber swelling resistance).

Solution to Problem

[0006] The present invention provides a lubricant base oil comprising at least one ester compound selected from a diester and a triester each having a predetermined number of carbon atoms, and at least one base oil (B) selected from a mineral oil and a synthetic oil other than an ester synthetic oil, and a lubricating oil composition comprising the lubricant base oil.

[0007] Specifically, the present invention provides [1] to [12] below.

[0008] [1] A lubricant base oil comprising: at least one ester compound (A) selected from a diester (A1) having 24 or more carbon atoms and a triester (A2) having 24 or more carbon atoms; and at least one base oil (B) selected from a mineral oil (B1) and a synthetic oil (B2) other than an ester synthetic oil.

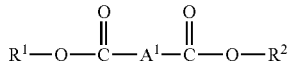
[0009] [2] The lubricant base oil according to [1] above, wherein the lubricant base oil has a density at 15° C. of less than 0.850 g/cm^3.

[0010] [3] The lubricant base oil according to [1] or [2] above, wherein the content of the component (A) is 1 to 90 mass % based on the total amount of the lubricant base oil.

[0011] [4] The lubricant base oil according to any one of [1] to [3] above, wherein the component (A1) has 26 or more carbon atoms.

[0012] [5] The lubricant base oil according to any one of [1] to [4] above, wherein the component (A1) comprises a compound (A11) represented by the general formula (a1-1) below:

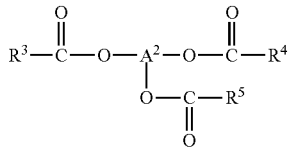
(a1-1)



[0013] wherein R^1 and R^2 are each independently a monovalent chain hydrocarbon group, and A^1 is a divalent hydrocarbon group having 5 or more carbon atoms.

[0014] [6] The lubricant base oil according to any one of [1] to [5] above, wherein the component (A2) comprises a compound (A21) represented by the general formula (a2-1) below:

(a2-1)



[0015] wherein R^3, R^4, and R^5 are each independently a monovalent chain hydrocarbon group, and A2 is a trivalent hydrocarbon group having 5 or more carbon atoms.

[0016] [7] The lubricant base oil according to any one of [1] to [6] above, wherein the component (A) comprises at least the component (A1).

[0017] [8] The lubricant base oil according to any one of [1] to [6] above, wherein the component (A) comprises at least the component (A2).

[0018] [9] A lubricating oil composition comprising the lubricant base oil according to any one of [1] to [8] above.

[0019] [10] The lubricating oil composition according to [9] above, further comprising one or more additives for lubricating oil selected from a pour point depressant, a viscosity index improver, an antioxidant, an extreme pressure agent, a metallic detergent, an ashless dispersant, a metal deactivator, a corrosion inhibitor, a rust inhibitor, and a defoamer.

[0020] [11] The lubricating oil composition according to [9] or [10] above, wherein the content of fatty acid amide is less than 1.0 mass % based on the total amount (100 mass %) of the lubricating oil composition.

[0021] [12] The lubricating oil composition according to any one of [9] to [11] above, wherein the volume change rate of a nitrile rubber for test, as measured by immersing the nitrile rubber for test in the lubricating oil composition under conditions at 100° C. for 144 hours by a rubber immersion test method in accordance with JIS K6258, is less than 10%.

Advantageous Effects of Invention

[0022] The lubricant base oil according to a preferable aspect of the present invention allows a lubricating oil composition having properties suitable for various mechanisms incorporated in devices to be prepared, and the lubricant base oil according to a more preferable aspect allows a lubricating oil composition with well-balanced and improved properties such as insulation properties, friction reducing effect, and rubber swelling resistance to be prepared.

DESCRIPTION OF EMBODIMENTS

[0023] For the numerical ranges described herein, any upper limit and lower limit can be combined. For example, in the case where "preferably 30 to 100, more preferably 40 to 80" is described as numerical ranges, the range of "30 to 80" and the range of "40 to 100" are also included in the numerical ranges disclosed in this description.

[0024] Further, for example, in the case where "preferably 30 or more, more preferably 40 or more, further preferably 100 or less, more preferably 80 or less" is described as numerical ranges, the range of "30 to 80" and the range of "40 to 100" are also included in the numerical ranges disclosed in this description.

[0025] In addition, the description "60 to 100" as a numerical range disclosed in this description, for example, means the range of "60 or more and 100 or less".

[0026] As used herein, kinematic viscosity and viscosity index mean values measured or calculated in accordance with JIS K2283:2000.

[Configuration of Lubricant Base Oil]

[0027] The lubricant base oil according to an aspect of the present invention comprises: at least one ester compound (A) selected from a diester (A1) having 24 or more carbon atoms and a triester (A2) having 24 or more carbon atoms; and at least one base oil (B) selected from a mineral oil (B1) and a synthetic oil (B2) other than an ester synthetic oil.

[0028] In recent years, electric vehicles and hybrid vehicles are required to be smaller and lighter by integrating a transmission and an electric motor. Lubricating oil compositions used in devices that integrate a transmission and an electric motor are required to have insulation properties as an electric motor oil, friction reducing effect as a transmission, and rubber swelling resistance.

[0029] Meanwhile, general transmission oils have a problem of poor insulation properties.

[0030] Further, lubricating oil compositions containing ester synthetic oils as base oils may have good insulation properties but generally have a problem of poor rubber swelling resistance. Furthermore, the friction reducing effect is often insufficient.

[0031] For such problems, the lubricant base oil according to an aspect of the present invention comprises the ester compound (A) and the base oil (B), thereby achieving a lubricant base oil that allows a lubricating oil composition with a well-balanced improvement in properties such as insulation properties, friction reducing effect, and rubber swelling resistance to be prepared.

[0032] The lubricant base oil according to an aspect of the present invention may contain a further base oil other than the components (A) and (B), as long as the effects of the present invention are not impaired.

[0033] Examples of the further base oil include ester synthetic oils that do not fall under the component (A), specifically, monoesters, diesters having 23 or less carbon atoms, triesters having 23 or less carbon atoms, and polyesters having 4 or more ester bonds.

[0034] In the lubricant base oil according to an aspect of the present invention, the total content of the components (A) and (B) is preferably 92 to 100 mass %, more preferably 95 to 100 mass %, further preferably 97 to 100 mass %, furthermore preferably 99 to 100 mass %, particularly preferably 100 mass %, based on the total amount (100 mass %) of the lubricant base oil, for achieving a lubricant base oil that allows a lubricating oil composition with a well-balanced improvement in properties such as insulation properties, friction reducing effect, and rubber swelling resistance to be prepared.

[0035] Hereinafter, the components (A) and (B) contained in the lubricant base oil according to an aspect of the present invention will be described in detail.

<Component (A): Ester Compound>

[0036] The lubricant base oil according to an aspect of the present invention comprises at least one ester compound (A) selected from a diester (A1) having 24 or more carbon atoms and a triester (A2) having 24 or more carbon atoms.

[0037] A lubricant base oil that allows a lubricating oil composition having excellent friction reducing effect to be prepared can be achieved by containing a diester (A1) or triester (A2) with such a specific number of carbon atoms as the component (A) even without containing a friction modifier that can cause a decrease in insulation properties. Further, a lubricating oil composition having excellent insulation properties can be prepared by using a lubricant base oil that also contains the component (A) in the presence of the later-described component (B).

[0038] In the lubricant base oil according to an aspect of the present invention, the content of the component (A) is preferably 1 mass % or more, more preferably 3 mass % or more, more preferably 5 mass % or more, more preferably 7 mass % or more, further preferably 10 mass % or more, further preferably 12 mass % or more, further preferably 15 mass % or more, furthermore preferably 17 mass % or more, particularly preferably 20 mass % or more, based on the total amount (100 mass %) of the lubricant base oil, for achieving a lubricant base oil with improved insulation properties and friction reducing effect that allows a lubricating oil composition to be prepared, and is preferably 90 mass % or less, more preferably 80 mass % or less, more preferably 70 mass % or less, more preferably 60 mass % or less, further preferably 55 mass % or less, further preferably 50 mass % or less, further preferably 45 mass % or less, furthermore preferably 40 mass % or less, particularly preferably 35 mass % or less, for ensuring the content of the component (B) and achieving a lubricant base oil that allows a lubricating oil composition with excellent insulation properties and rubber swelling resistance to be prepared.

[0039] The component (A) to be used in an aspect of the present invention may have a configuration containing at least one component (A1), may have a configuration containing at least one component (A2), or may have a configuration containing at least one component (A1) and at least one component (A2) in combination.

[0040] In the case where the component (A) to be used in an aspect of the present invention contains the component

(A1) and the component (A2) in combination, the content ratio of the component (A1) to the component (A2) [(A1)/(A2)] may be 1/99 or more, 5/95 or more, 10/90 or more, 15/85 or more, 20/80 or more, 25/75 or more, 30/70 or more, 35/65 or more, 40/60 or more, or 45/55 or more, and 99/1 or less, 95/5 or less, 90/10 or less, 85/15 or less, 80/20 or less, 75/25 or less, 70/30 or less, 65/35 or less, or 60/40 or less, in mass ratio.

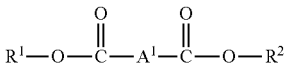
[0041] The number of carbon atoms in the component (A1) is 24 or more but may be preferably 26 or more, more preferably 27 or more, further preferably 28 or more, and 80 or less, 75 or less, 70 or less, 65 or less, 60 or less, 55 or less, 50 or less, 45 or less, 40 or less, 37 or less, or 35 or less, for achieving a lubricant base oil that allows a lubricating oil composition in which the insulation properties and friction reducing effect are improved and the reduction of rubber swelling resistance is suppressed to be prepared.

[0042] The number of carbon atoms in the component (A2) is 24 or more but may be preferably 30 or more, more preferably 38 or more, more preferably 40 or more, more preferably 44 or more, further preferably 48 or more, further preferably 50 or more, further preferably 54 or more, furthermore preferably 58 or more, particularly preferably 60 or more, and 100 or less, 95 or less, 90 or less, 85 or less, 80 or less, 75 or less, or 70 or less, for achieving a lubricant base oil that allows a lubricating oil composition in which the insulation properties and friction reducing effect are improved and the reduction of rubber swelling resistance is suppressed to be prepared.

[Specific Configuration of Component (A1)]

[0043] The component (A1) to be used in an aspect of the present invention preferably comprises a compound (A11) represented by the general formula (a1-1) below.

(a1-1)



[0044] In the general formula (a1-1) above, R^1 and R^2 are each independently a monovalent chain hydrocarbon group, and A^1 is a divalent hydrocarbon group having 5 or more carbon atoms.

[0045] The monovalent chain hydrocarbon groups that can be selected as R^1 and R^2 are each preferably an alkyl group or alkenyl group.

[0046] Examples of the alkyl group include a linear alkyl group or a branched alkyl group such as a methyl group, an ethyl group, a propyl group (a n-propyl group and an isopropyl group), a butyl group (a n-butyl group, a s-butyl group, a t-butyl group, and an isobutyl group), a pentyl group, a hexyl group, a heptyl group, an octyl group, a 2-ethylhexyl group, a 1-methylheptyl group, nonyl group, a 1-methyloctyl group, a 1,1-dimethylheptyl group, a decyl group, a 1-methylheptyl group, an undecyl group, a 1-methyldecyl group, a dodecyl group, a 1-methylundecyl group, a tridecyl group, a 1-methyldodecyl group, a tetradecyl group, a 1-methyltridecyl group, a pentadecyl group, a 1-methyltetradecyl group, a hexadecyl group, a 1-methylpentadecyl group, a heptadecyl group, a 1-methylhexadecyl group, an octadecyl group, a 1-methylheptadecyl group, a nonadecyl group, and a 1-methyloctadecyl group.

[0047] Examples of the alkenyl group include linear alkenyl groups or branched alkenyl groups such as an ethenyl group, a propenyl group, a butenyl group, a pentenyl group, a hexenyl group, a heptenyl group, an octenyl group, a methylheptenyl group, a nonyl group, a methyloctenyl group, a decenyl group, a methylnonyl group, an undecenyl group, a methyldecenyl group, a dodecenyl group, a methylundecenyl group, a tridecenyl group, a methyldodecenyl group, a tetradecenyl group, a methyltridecenyl group, a pentadecenyl group, a methyltetradecenyl group, a hexadecenyl group, a methylpentadecenyl group, a heptadecenyl group, a methylhexadecenyl group, an octadecenyl group, a methylheptadecenyl group, a nonadecenyl group, and a methyloctadecenyl group, and may be a group represented by $—(CH_2)_{m1}—CH═CH—(CH_2)_{m2}—CH_3$ (provided that, m1 and m2 are each independently an integer of 0 or more, and m1+m2 is an integer of 1 or more).

[0048] The number of carbon atoms in the monovalent chain hydrocarbon group that can be selected as each of R^1 and R^2 is preferably 3 or more, more preferably 4 or more, further preferably 5 or more, furthermore preferably 6 or more, particularly preferably 7 or more, and preferably 30 or less, more preferably 25 or less, further preferably 20 or less, furthermore preferably 16 or less, particularly preferably 12 or less, for achieving a lubricant base oil that allows a lubricating oil composition in which the insulation properties and friction reducing effect are improved and the reduction of rubber swelling resistance is suppressed to be prepared.

[0049] Examples of the divalent hydrocarbon group that can be selected as A^1 include an alkylene group, an alkenylene group, a cycloalkylene group, a cycloalkenylene group, an arylene group, and a divalent group combining these groups. The divalent group may have a total number of carbon atoms of 5 or more after combining the aforementioned groups having 1 or more carbon atoms.

[0050] The alkylene group may be a linear alkylene group or may be a branched alkylene group. Specifically, examples thereof include the following groups (i) to (iii).

[0051] (i): A group represented by $—(CH_2)_n—$ (provided that, n is an integer of 1 or more).

[0052] (ii): A group represented by $—(CH_2)_{p1}—CH(CH_3)—(CH_2)_{q1}—$ (provided that, p1 and q1 are each independently an integer of 0 or more).

[0053] (iii): A group represented by $—(CH_2)_{p2}—C(CH_3)_2—(CH_2)_{q2}—$ (provided that, p2 and q2 are each independently an integer of 0 or more).

[0054] The alkenylene group may be a linear alkenylene group or a branched alkenylene group, and specifically, examples thereof include a vinylene group, a methylvinylene group, a n-propenylene group, an isopropenylene group, a n-butenylene group, an isobutenylene group, a methylbutenylene group, an ethylbutenylene group, a n-pentenylene group, an isopentylene group, a methylpentenylene group, an ethylpentenylene group, a n-hexenylene group, an isohexenylene group, a methylhexenylene group, an ethylhexenylene group, a n-heptenylene group, an isoheptenylene group, a methylheptenylene group, an ethylheptenylene group, a n-octenylene group, an isooctenylene group, a methyloctenylene group, and an ethyloctenylene group.

[0055] Examples of the cycloalkylene group include a cyclopentylene group, a cyclohexylene group, a cyclopentylene group, and a cyclooctylene group.

[0056] Examples of the cycloalkenylene group include a cyclopentenylene group, a cyclohexenylene group, a cyclopentenylene group, and a cyclooctenylene group.

[0057] Examples of an arylene group include a phenylene group, a naphthylene group, and an anthracenylene group.

[0058] Among these, the divalent hydrocarbon group that can be selected as A^1 is preferably an alkylene group or alkenylene group, more preferably an alkylene group, for achieving a lubricant base oil that allows a lubricating oil composition in which the insulation properties and friction reducing effect are improved and the reduction of rubber swelling resistance is suppressed to be prepared. In particular, a group represented by $—(CH_2)_n—$ (provided that, n is an integer of 5 or more (preferably 6 or more, more preferably 7 or more, further preferably 8 or more, furthermore preferably 9 or more, particularly preferably 10 or more)) is further preferable, for achieving a lubricant base oil that allows a lubricating oil composition in which the reduction of rubber swelling resistance is further suppressed to be prepared.

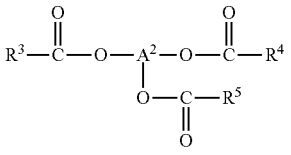
[0059] The number of carbon atoms in the divalent hydrocarbon group that can be selected as A^1 is 5 or more but is preferably 6 or more, more preferably 7 or more, further preferably 8 or more, furthermore preferably 9 or more, particularly preferably 10 or more, and preferably 30 or less, more preferably 24 or less, further preferably 20 or less, furthermore preferably 16 or more, particularly preferably 14 or less, for achieving a lubricant base oil that allows a lubricating oil composition in which the insulation properties and friction reducing effect are improved and the reduction of rubber swelling resistance is suppressed to be prepared.

[0060] In the lubricant base oil according to an aspect of the present invention, the content ratio of the compound (A11) in the component (A1) is preferably 70 to 100 mass %, more preferably 80 to 100 mass %, further preferably 90 to 100 mass %, furthermore preferably 95 to 100 mass %, particularly preferably 98 to 100 mass %, based on the total amount (100 mass %) of the component (A1) contained in the lubricant base oil.

[Specific Configuration of Component (A2)]

[0061] The component (A2) to be used in an aspect of the present invention preferably comprises a compound (A21) represented by the general formula (a2-1) below.

(a2-1)



[0062] In the general formula (a2-1) above, R^3, R^4 and R^5 are each independently a monovalent chain hydrocarbon group, and A^2 is a trivalent hydrocarbon group having 5 or more carbon atoms.

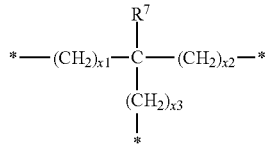
[0063] The monovalent chain hydrocarbon group that can be selected as R^3, R^4, and R^5 is preferably an alkyl group or alkenyl group, and examples thereof include the same alkyl group or alkenyl group as those that can be selected as R^1 and R^2 in the general formula (a1-1) above.

[0064] The number of carbon atoms in the monovalent chain hydrocarbon group that can be selected as each of R^3, R^4, and R^5 is preferably 3 or more, more preferably 5 or more, more preferably 7 or more, further preferably 9 or more, furthermore preferably 11 or more, particularly preferably 13 or more, and preferably 40 or less, more preferably 35 or less, further preferably 30 or less, furthermore preferably 25 or less, particularly preferably 22 or less, for achieving a lubricant base oil that allows a lubricating oil composition in which the insulation properties and friction reducing effect are improved and the reduction of rubber swelling resistance is suppressed to be prepared.

[0065] Examples of the trivalent hydrocarbon group that can be selected as A^2 include a trivalent group obtained by further removing one hydrogen atom from the divalent hydrocarbon group that can be selected as A^1 in the general formula (a1-1) above.

[0066] Among these, it is preferably a group represented by the general formula (a2-1-1) below.

(a2-1-1)



[0067] In the general formula (a2-1-1) above, the symbol * indicates a binding position.

[0068] x1, x2, and x3 are each independently an integer of 0 or more, preferably an integer of 0 to 15, more preferably an integer of 0 to 10, more preferably an integer of 0 to 8, further preferably an integer of 1 to 6, further preferably an integer of 1 to 4, furthermore preferably an integer of 1 to 3, particularly preferably an integer of 1 to 2.

[0069] R^7 is an alkyl group, and examples thereof include the same alkyl group as those that can be selected as R^1 and R^2 in the general formula (a1-1) above.

[0070] The number of carbon atoms in the alkyl group that can be selected as R^7 is preferably 1 to 15, more preferably 1 to 10, more preferably 1 to 8, further preferably 1 to 6, furthermore preferably 1 to 4, particularly preferably 2 to 3.

[0071] In the lubricant base oil according to an aspect of the present invention, the content ratio of the compound (A21) in the component (A2) is preferably 70 to 100 mass %, more preferably 80 to 100 mass %, further preferably 90 to 100 mass %, furthermore preferably 95 to 100 mass %, particularly preferably 98 to 100 mass %, based on the total amount (100 mass %) of the component (A2) contained in the lubricant base oil.

<Component (B): Base Oil>

[0072] The lubricant base oil according to an aspect of the present invention comprises at least one base oil (B) selected from a mineral oil (B1) and a synthetic oil (B2) other than an ester synthetic oil.

[0073] It is possible to achieve a lubricant base oil that allows a lubricating oil composition in which the insulation properties are improved by using the components (A) and (B) in combination, and further the reduction of rubber swelling resistance caused by the component (A) is suppressed to be prepared, while keeping the friction reducing

effect by the component (A) by comprising the component (B) together with the component (A) that causes the reduction of rubber swelling resistance.

[0074] In the lubricant base oil according to an aspect of the present invention, the content of the component (B) is preferably 10 mass % or more, more preferably 20 mass % or more, more preferably 30 mass % or more, more preferably 40 mass % or more, further preferably 45 mass % or more, further preferably 50 mass % or more, further preferably 55 mass % or more, furthermore preferably 60 mass % or more, particularly preferably 65 mass % or more, based on the total amount (100 mass %) of the lubricant base oil, for achieving a lubricant base oil that allows a lubricating oil composition with excellent insulation properties and rubber swelling resistance to be prepared, and is preferably 99 mass % or less, more preferably 97 mass % or less, more preferably 95 mass % or less, more preferably 93 mass % or less, further preferably 90 mass % or less, further preferably 88 mass % or less, further preferably 85 mass % or less, furthermore preferably 83 mass % or less, particularly preferably 80 mass % or less, for ensuring the content of the component (A) and achieving a lubricant base oil that allows a lubricating oil composition with improved friction reducing effect to be prepared.

[0075] Examples of the mineral oil (B1) to be used in an aspect of the present invention include atmospheric residual oils obtained by atmospheric distillation of crude oils such as paraffinic crude oil, intermediate base crude oil, and naphthenic crude oil; distillate oils obtained by vacuum distillation of these atmospheric residual oils; and refined oils obtained by subjecting the distillate oils to one or more refining treatments such as Solvent De-Asphalting, solvent extraction, hydrocracking, solvent dewaxing, catalytic dewaxing, and hydrorefining (hydrocracking).

[0076] Examples of the synthetic oils (B2) other than ester synthetic oils to be used in an aspect of the present invention include poly α-olefins such as α-olefin homopolymers or α-olefin copolymers (α-olefin copolymers having 8 to 14 carbon atoms such as ethylene-α-olefin copolymer); isoparaffin; polyalkyleneglycol; ether oils such as polyphenyl ether; alkylbenzene; alkylnaphthalene; and synthetic oils (GTL) obtained by isomerizing waxes (GTL waxes (Gas To Liquids WAXES)) produced from natural gas by the Fischer-Tropsch process or the like.

[0077] The component (B) to be used in an aspect of the present invention preferably contains at least one selected from a mineral oil and a synthetic oil classified into Group 2 or Group 3 of the API (American Petroleum Institute) base oil category.

[Properties of Lubricant Base Oil]

[0078] The kinematic viscosity at 100° C. of the lubricant base oil according to an aspect of the present invention may be 1.0 mm^2/s or more, 1.2 mm^2/s or more, 1.5 mm^2/s or more, 1.7 mm^2/s or more, 2.0 mm^2/s or more, 2.2 mm^2/s or more, or 2.5 mm^2/s or more, and 10 mm^2/s or less, 9.0 mm^2/s or less, 8.0 mm^2/s or less, 7.0 mm^2/s or less, 6.0 mm^2/s or less, 5.0 mm^2/s or less, 4.5 mm^2/s or less, 4.2 mm^2/s or less, 4.0 mm^2/s or less, 3.8 mm^2/s or less, or 3.5 mm^2/s or less.

[0079] The viscosity index of the lubricant base oil according to an aspect of the present invention may be 70 or more, 80 or more, 85 or more, 90 or more, 95 or more, 100 or more, 105 or more, 110 or more, or 115 or more.

[0080] The density at 15° C. of the lubricant base oil according to an aspect of the present invention may be preferably less than 0.850 g/cm^3, more preferably 0.848 g/cm^3 or less, further preferably 0.847 g/cm^3 or less, furthermore preferably 0.846 g/cm^3 or less, and 0.845 g/cm^3 or less, 0.844 g/cm^3 or less, 0.843 g/cm^3 or less, 0.842 g/cm^3 or less, or 0.841 g/cm^3 or less, and 0.600 g/cm^3 or more, 0.650 g/cm^3 or more, 0.700 g/cm^3 or more, 0.750 g/cm^3 or more, 0.800 g/cm^3 or more, 0.810 g/cm^3 or more, 0.820 g/cm^3 or more, or 0.825 g/cm^3 or more.

[Configuration of Lubricating Oil Composition]

[0081] The lubricating oil composition according to an aspect of the present invention comprises the lubricant base oil according to an aspect of the present invention.

[0082] The lubricating oil composition according to an aspect of the present invention may further contain additives for lubricating oil. Specifically, it may contain one or more additives for lubricating oil selected from a pour point depressant, a viscosity index improver, an antioxidant, an extreme pressure agent, a metallic detergent, an ashless dispersant, a metal deactivator, a corrosion inhibitor, a rust inhibitor, and a defoamer.

[0083] One of these additives for lubricating oil may be used alone, or two or more of them may be used in combination.

[0084] The content of such an additive for lubricating oil can be appropriately adjusted, as long as the effects of the present invention are not impaired, but is generally 0.001 to 15 mass %, preferably 0.005 to 10 mass %, more preferably 0.01 to 5 mass %, independently for each additive, based on the total amount (100 mass %) of the lubricating oil composition.

[0085] In the lubricating oil composition according to an aspect of the present invention, the content of the lubricant base oil according to an aspect of the present invention is preferably 50 mass % or more, more preferably 60 mass % or more, further preferably 70 mass % or more, furthermore preferably 80 mass % or more, particularly preferably 90 mass % or more, based on the total amount (100 mass %) of the lubricating oil composition.

<Pour Point Depressant>

[0086] Examples of the pour point depressant to be used in an aspect of the present invention include ethylene-vinyl acetate copolymer, a condensate of chlorinated paraffin and naphthalene, a condensate of chlorinated paraffin and phenol, polymethacrylate, and polyalkylstyrene.

[0087] One of these pour point depressants may be used alone, or two or more of them may be used in combination.

<Viscosity Index Improver>

[0088] Examples of the viscosity index improver to be used in an aspect of the present invention include polymers such as non-dispersed polymethacrylates, dispersed polymethacrylates, olefin copolymers (e.g., ethylene-propylene copolymer), dispersed olefin copolymers, styrene copolymers (e.g., styrene-diene copolymer and styrene-isoprene copolymer).

[0089] One of these viscosity index improvers may be used alone, or two or more of them may be used in combination.

[0090] Further, the weight-average molecular weight (Mw) of the viscosity index improver to be used in an aspect of the present invention may be 5,000 or more, 7,000 or more, 10,000 or more, 15,000 or more, or 20,000 or more, and 1,000,000 or less, 700,000 or less, 500,000 or less, 300,000 or less, 200,000 or less, 100,000 or less, or 50,000 or less.

<Antioxidant>

[0091] Examples of the antioxidant to be used in an aspect of the present invention include amine antioxidants such as alkylated diphenylamine, phenylnaphthylamine, and alkylated phenylnaphthylamine; phenolic antioxidants such as 2,6-di-t-butylphenol, 4,4'-methylenebis(2,6-di-t-butylphenol), isooctyl-3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate, and n-octadecyl-3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate.

[0092] One of these antioxidants may be used alone, or two or more of them may be used in combination.

[0093] In the lubricating oil composition according to an aspect of the present invention, an amine antioxidant and a phenolic antioxidant are preferably used as antioxidants in combination.

<Extreme Pressure Agent (Antiwear Agent)>

[0094] Examples of the extreme pressure agent (antiwear agent) to be used in an aspect of the present invention include such as sulfur-containing compounds such as zinc dithiophosphate; phosphorus-containing compounds such as phosphorous acid esters, phosphoric acid esters, phosphonic acid esters, and amine salts or metal salts thereof; and sulfur- and phosphorus-containing compounds such as thiophosphorous acid esters, thiophosphoric acid esters, thiophosphonic acid esters, and amine salts or metal salts thereof.

[0095] One of these extreme pressure agents may be used alone, or two or more of them may be used in combination.

<Metallic Detergent>

[0096] Examples of the metallic detergent to be used in an aspect of the present invention include metal salts such as metal sulfonates, metal salicylates, and metal phenates. Further, the metal atom constituting such a metal salt is preferably a metal atom selected from alkali metals and alkaline earth metals, more preferably sodium, calcium, magnesium, or barium, further preferably calcium.

[0097] One of these metallic detergents may be used alone, or two or more of them may be used in combination.

[0098] In the lubricating oil composition according to an aspect of the present invention, the metallic detergent preferably contains one or more selected from calcium sulfonate, calcium salicylate, and calcium phenate, more preferably calcium sulfonate.

[0099] The content ratio of calcium sulfonate is preferably 50 to 100 mass %, more preferably 60 to 100 mass %, further preferably 70 to 100 mass %, furthermore preferably 80 to 100 mass %, based on the total amount (100 mass %) of the metallic detergent contained in the lubricating oil composition.

[0100] The base number of the metallic detergent is preferably 0 to 600 mgKOH/g.

[0101] However, in the lubricating oil composition according to an aspect of the present invention, the metallic detergent is preferably an overbased metallic detergent having a base number of 100 mgKOH/g or more.

[0102] The base number of the overbased metallic detergent is 100 mgKOH/g or more, preferably 150 to 500 mgKOH/g, more preferably 200 to 450 mgKOH/g.

[0103] As used herein, the "base number" means the base number measured by the perchloric acid method according to chapter 7 of "Petroleum products and lubricating oils-Neutralization value test method" of JIS K2501:2003.

<Ashless Dispersant>

[0104] Examples of the ashless dispersant to be used in an aspect of the present invention include boron-free succinimides such as boron-free alkenylsuccinimide, boron-containing succinimides such as boron-containing alkenylsuccinimide, benzylamines, boron-containing benzylamines, succinic acid esters, and monovalent or divalent carboxylic acid amides typified by fatty acids or succinic acid.

[0105] One of these ashless dispersants may be used alone, or two or more of them may be used in combination.

<Metal Deactivator>

[0106] Examples of the metal deactivator to be used in an aspect of the present invention include benzotriazole compounds, tolyltriazole compounds, imidazole compounds, thiadiazole compounds, and pyrimidine compounds.

[0107] One of these metal deactivators may be used alone, or two or more of them may be used in combination.

<Corrosion Inhibitor>

[0108] Examples of the corrosion inhibitor to be used in an aspect of the present invention include amine compounds, alkanolamine compounds, amide compounds, and carboxylic acid compounds.

[0109] One of these corrosion inhibitors may be used alone, or two or more of them may be used in combination.

<Rust Inhibitor>

[0110] Examples of the rust inhibitor to be used in an aspect of the present invention include fatty acids, alkenyl succinic acid half esters, fatty acid soaps, alkyl sulfonates, polyhydric alcohols fatty acid esters, fatty acid amines, oxidized paraffins, and alkyl polyoxyethylene ethers.

[0111] One of these rust inhibitors may be used alone, or two or more of them may be used in combination.

<Defoamer>

[0112] Examples of the defoamer to be used in an aspect of the present invention include silicone oils, fluorosilicone oils, and fluoroalkyl ethers.

[0113] One of these defoamers may be used alone, or two or more of them may be used in combination.

<Fatty Acid Amide>

[0114] Since the lubricating oil composition according to an aspect of the present invention uses a lubricant base oil containing the components (A) and (B) and thus has excellent friction reducing effect, there is no need to contain an aliphatic amide.

[0115] Further, since the aliphatic amide causes a reduction in insulation properties of the lubricating oil composi-

tion, the content thereof is preferably as low as possible, and it is more preferable that it is substantially not contained.

[0116] In the lubricating oil composition according to an aspect of the present invention, the content of the aliphatic amide is preferably less than 1.0 mass %, more preferably less than 0.5 mass %, further preferably less than 0.1 mass %, based on the total amount (100 mass %) of the lubricating oil composition.

[0117] In this description, "the aliphatic amide is substantially not contained" is a provision that excludes aspects of containing aliphatic amides based on a specific purpose, includes aspects in which aliphatic amides are unavoidably contained as impurities, and does not exclude aspects in which aliphatic amides are unintentionally contained.

[0118] In consideration of the aspect in which "the aliphatic amide is substantially not contained", the content of the aliphatic amide is more preferably less than 0.01 mass %, further preferably less than 0.001 mass %, furthermore preferably less than 0.0001 mass %, particularly preferably less than 0.00001 mass %, based on the total amount (100 mass %) of the lubricating oil composition.

[0119] Examples of the aliphatic amide include reaction products of aliphatic carboxylic acids and aliphatic amines.

[0120] Examples of the aliphatic carboxylic acids include palmitic acid, isopalmitic acid, stearic acid, isostearic acid, behenic acid, lignoceric acid, cetylonic acid, heptacanoic acid, montanic acid, melissic acid, lacceric acid, setoleic acid, and erucic acid.

[0121] Further, examples of the aliphatic amines include ammonia, ethylenediamine, diethylenetriamine, triethylenetetramine, tetraethylenepentamine, and pentaethylenehexamine.

[Properties and Characteristics of Lubricating Oil Composition]

[0122] The kinematic viscosity at 100° C. of the lubricating oil composition according to an aspect of the present invention is appropriately adjusted according to the application and may be 1.0 mm^2/s or more, 1.5 mm^2/s or more, 2.0 mm^2/s or more, 2.2 mm^2/s or more, 2.5 mm^2/s or more, 2.7 mm^2/s or more, or 3.0 mm^2/s or more, and 10 mm^2/s or less, 9.0 mm^2/s or less, 8.0 mm^2/s or less, 7.0 mm^2/s or less, 6.0 mm^2/s or less, 5.0 mm^2/s or less, 4.5 mm^2/s or less, 4.2 mm^2/s or less, 4.0 mm^2/s or less, 3.8 mm^2/s or less, or 3.5 mm^2/s or less.

[0123] The viscosity index of the lubricating oil composition according to an aspect of the present invention may be 70 or more, 80 or more, 85 or more, 90 or more, 95 or more, 100 or more, 105 or more, 110 or more, 115 or more, 120 or more, 125 or more, or 130 or more.

[0124] The volume resistivity of the lubricating oil composition according to an aspect of the present invention, as measured under conditions at a measurement temperature of 80° C. and an applied voltage of 250 V for a measurement time of 1 minute in accordance with JIS C2101, is preferably over $1.4\times10^7\Omega\cdot m$, more preferably $1.5\times10^7\Omega\cdot m$ or more, further preferably $1.6\times10^7\Omega\cdot m$ or more, furthermore preferably $1.7\times10^7\Omega\cdot m$ or more.

[0125] The value of volume resistivity means a value measured by the method described in Examples below.

[0126] The coefficient of friction between metals of the lubricating oil composition according to an aspect of the present invention, as measured by the method described in Examples below, is preferably less than 0.160, more preferably 0.158 or less, further preferably 0.157 or less, furthermore preferably 0.155 or less, particularly preferably 0.153 or less.

[0127] The volume change rate of a nitrile rubber for test, as measured by immersing the nitrile rubber for test in the lubricating oil composition according to an aspect of the present invention under conditions at 100° C. for 144 hours by the rubber immersion test method in accordance with JIS K6258, is preferably 10% or less, more preferably 8% or less, further preferably 7% or less, furthermore preferably 5% or less, particularly preferably 4% or less.

[0128] The volume change rate of a nitrile rubber for test means a value measured by the method described in Examples below.

[Applications of Lubricating Oil Composition]

[0129] The lubricating oil composition according to a preferable aspect of the present invention has properties suitable for various mechanisms incorporated in devices and is excellent in insulation properties, friction reducing effect, and rubber swelling resistance.

[0130] In consideration of such properties, the lubricating oil composition according to an aspect of the present invention can be preferably used, for example, for lubrication in electric drive units, engines, transmissions, decelerators, compressors, and mechanisms such as torque converters, wet clutches, gear bearing mechanisms, oil pumps, and hydraulic control mechanisms that are incorporated in various hydraulic systems. Further, due to excellent cooling and insulation properties, it can be suitably used for cooling and insulation of motors or batteries.

[0131] Further, due to excellent rubber swelling resistance, the lubricating oil composition according to a preferable aspect of the present invention can be also suitably used for portions in contact with O-rings or gaskets.

EXAMPLES

[0132] Next, the present invention will be described in more detail with reference to Examples; however, the present invention is not limited in any way by these Examples. The methods for measuring or calculating various properties are as follows.

(1) Kinematic Viscosity and Viscosity Index

[0133] They were measured and calculated in accordance with JIS K2283:2000.

(2) Density

[0134] It was measured in accordance with JIS K2249.

Examples 1 to 7 and Comparative Examples 1 to 4

[0135] Lubricant base oils were prepared by mixing base oils of the types and amounts shown in Table 1. For the base oils prepared, the kinematic viscosity at 100° C., the viscosity index, and the density at 15° C. were measured or calculated, as a result of which the values shown in Table 1 were obtained.

[0136] Then, lubricating oil compositions were prepared by adding additives for lubricating oil of the types and amounts shown in Table 1.

[0137] The base oil components and additives for lubricating oil used for preparing the lubricant base oils and lubricating oil compositions were as follows.

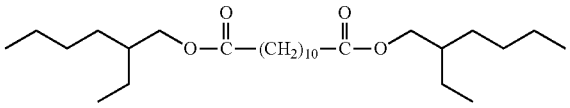
<Ester Synthetic Oils>

[0138] "C28 diester": Bis(2-ethylhexyl) dodecanedioate, a diester having 28 carbon atoms represented by the general formula (a1-i) below.

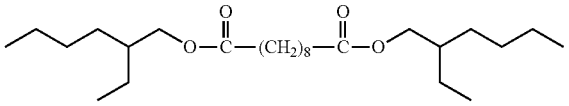
[0139] "C26 diester": Bis(2-ethylhexyl) sebacate, a diester having 26 carbon atoms represented by the general formula (a1-ii) below.

[0140] "C22 diester": Bis(2-ethylhexyl) adipate, a diester having 22 carbon atoms represented by the general formula (a1-iii) below.

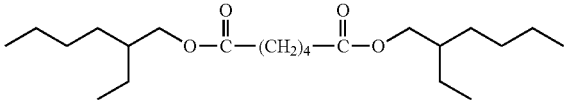
(a1-i)



(a1-ii)



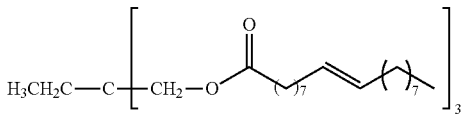
(a1-iii)



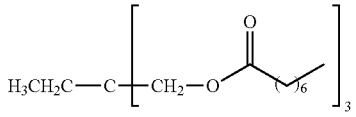
[0141] "C60 triester": trimethylolpropane (oleic acid) triester, a triester having 60 carbon atoms represented by the general formula (a2-i) above.

[0142] "C30/C36 triester": trimethylolpropane (caprylic acid/capric acid) triester, a mixture of a triester having 30 carbon atoms represented by the general formula (a2-iia) above and a triester having 36 carbon atoms represented by the general formula (a2-iib) above.

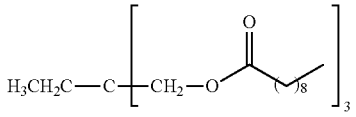
(a2-i)



(a2-iia)



(a2-iib)



<Base Oils Other than Ester Synthetic Oils>

[0143] "60 N mineral oil": Paraffin mineral oil belonging to group II of the API base oil category with a kinematic viscosity at 100° C.=2.3 mm^2/s and a viscosity index=106.

[0144] "100 N mineral oil": Paraffin mineral oil belonging to group III of the API base oil category with a kinematic viscosity at 100° C.=4.2 mm^2/s and a viscosity index=125.

[0145] "PAO (1)": Poly α-olefin synthetic oil with a kinematic viscosity at 100° C.=1.8 mm^2/s.

[0146] "PAO (2)": Poly α-olefin synthetic oil with a kinematic viscosity at 100° C.=3.9 mm^2/s and a viscosity index=120.

<Additives for Lubricating Oil>

[0147] "Pour point depressant": Polymethacrylate (PMA) pour point depressant.

[0148] "Additive mixture": An additive mixture composed of phosphite ester, a phenolic antioxidant, an amine antioxidant, thiadiazole, calcium sulfonate, boron-modified polybutenyl succinimide, a corrosion inhibitor, and a silicone defoamer.

[0149] "Fatty acid amide": A reaction product of tetraethylenepentamine and isostearic acid.

[0150] For the lubricating oil compositions prepared, the kinematic viscosity at 100° C. and the viscosity index were measured or calculated, and various tests (1) to (3) below were performed thereon. Table 1 shows these results.

(1) Insulation Test

[0151] The volume resistivity of each sample oil was measured under the test conditions at a measurement temperature of 80° C. and an applied voltage of 250 V for a measurement time of 1 minute in accordance with JIS C2101. It can be said that the larger the volume resistivity, the more excellent the insulation properties of the lubricating oil composition. In this example, lubricating oil compositions with a volume resistivity over $1.4\times10^7\Omega\cdot m$ were determined to be lubricating compositions having good insulation properties.

(2) Friction Reducing Effect Test

[0152] Using a reciprocating friction tester (SRV reciprocating friction tester, available from Optimol Instruments Pruftechnik GmbH), the coefficient of friction was measured by the following procedure.

[0153] A disk (material: SUJ-2 with a diameter of 24 mm and a thickness of 7.9 mm) was used as a test piece, several drops of a lubricating oil composition as a measurement target were dropped on the disk, and a ball (ball material: SUJ-2 with a diameter of 10 mm) was set on the disk.

[0154] In this state, the coefficient of friction was determined under conditions at 100° C., a load of 75 N (1.7 GPa), a speed of 0.16 m/s, an amplitude of 1 mm, and a frequency of 50 Hz° C.

[0155] It can be said that the smaller the value of the friction coefficient, the more excellent the friction reducing effect of the lubricating oil composition. In this example, lubricating oil compositions with a friction coefficient of less

than 0.160 were determined to be lubricating compositions with good friction reduction effect.

(3) Rubber Swelling Resistance Test

[0156] A rubber immersion test in accordance with JIS K6258 was conducted. Specifically, a nitrile rubber for test (product name: "A727", available from NOK CORPORATION) was immersed in each lubricant base oil as a measurement target under conditions at an immersion temperature of 100° C. for an immersion time of 144 hours and measured. Then, the volume of the test piece was measured before and after the test, and the volume change rate was calculated from the following formula.

[Volume change rate (%)]=([Volume of test piece after test]−[Volume of test piece before test])/[Volume of test piece before test]×100

[0157] It can be said that the higher the value of the volume resistivity, the more excellent the rubber swelling resistance of the lubricating oil composition.

[0158] In this example, lubricating oil compositions with a volume change rate of 10% or less were determined to be lubricating compositions with good rubber swelling resistance.

TABLE 1

				Example 1	Example 2	Example 3	Example 4	Example 5	Example 6
Composition of lubricating oil composition	Ester compounds	C28 diester	mass %	20.00	—	—	31.92	—	—
		C26 diester	mass %	—	—	—	—	—	31.92
		C22 diester	mass %	—	—	—	—	—	—
		C60 triester	mass %	—	13.59	10.00	—	13.59	—
		C30/C36 triester	mass %	—	—	—	—	—	—
	Base oil other than ester compounds	60 N mineral oil	mass %	64.34	80.86	77.32	—	—	—
		100 N mineral oil	mass %	10.11	—	7.13	—	—	—
		PAO (1)	mass %	—	—	—	34.53	48.00	31.53
		PAO (2)	mass %	—	—	—	28.00	32.86	31.00
	Additives for lubricating oil	Pour point depressant	mass %	0.20	0.20	0.20	0.20	0.20	0.20
		Additive mixture	mass %	5.35	5.35	5.35	5.35	5.35	5.35
		Fatty acid amide	mass %	—	—	—	—	—	—
	Total		mass %	100.00	100.00	100.00	100.00	100.00	100.00
Properties of lubricant base oil	Content of ester compounds based on the total amount (100 mass %) of lubricant base oil		mass %	21.18	14.39	10.59	33.80	14.39	33.80
	Content of base oils other than ester compounds based on the total amount (100 mass %) of lubricant base oil		mass %	78.82	85.61	89.41	66.20	85.61	66.20
	Kinematic viscosity at 100° C. of lubricant base oil		mm^2/s	2.7	2.7	2.7	2.7	2.7	2.7
	Viscosity index of lubricant base oil		—	118	124	120	128	126	124
	Density at 15° C. of lubricant base oil		g/cm^3	0.846	0.841	0.839	0.840	0.821	0.842
Properties of lubricating oil composition/ Various tests	Kinematic viscosity at 100° C. of lubricating oil composition		mm^2/s	3.0	3.0	3.0	3.0	3.0	3.0
	Viscosity index of lubricating oil composition		—	130	136	132	140	138	136
	(1) Insulation test, Volume resistivity		Ω · m	1.7×10^7	2.8×10^7	2.9×10^7	1.6×10^7	2.8×10^7	1.5×10^7
	(2) Friction reducing effect test, Coefficient of friction between metals (SRV)		—	0.153	0.145	0.147	0.154	0.146	0.157
	(3) Rubber swelling resistance test, Volume change rate		%	4	2	2	5	2	7

				Example 7	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Composition of lubricating oil composition	Ester compounds	C28 diester	mass %	—	—	—	—	94.45
		C26 diester	mass %		—	—	—	—
		C22 diester	mass %	—	31.92	—	—	—
		C60 triester	mass %	—	—	—	—	—
		C30/C36 triester	mass %	31.92	—	—	—	—

TABLE 1-continued

				Example 1	Example 2	Example 3	Example 4	Example 5	Example 6
	Base oil other than ester compounds	60 N mineral oil	mass %	—	34.53	67.45	66.45	—
		100 N mineral oil	mass %	—	28.00	27.00	27.00	—
		PAO (1)	mass %	40.53	—	—	—	—
		PAO (2)	mass %	22.00	—	—	—	—
	Additives for lubricating oil	Pour point depressant	mass %	0.20	0.20	0.20	0.20	0.20
		Additive mixture	mass %	5.35	5.35	5.35	5.35	5.35
		Fatty acid amide	mass %	—	—	—	1.00	—
	Total		mass %	100.00	100.00	100.00	100.00	100.00
Properties of lubricant base oil	Content of ester compounds based on the total amount (100 mass %) of lubricant base oil		mass %	33.80	33.80	0.00	0.00	100.00
	Content of base oils other than ester compounds based on the total amount (100 mass %) of lubricant base oil		mass %	66.20	66.20	100.00	100.00	0.00
	Kinematic viscosity at 100° C. of lubricant base oil		mm^2/s	2.7	2.7	2.7	2.7	3.2
	Viscosity index of lubricant base oil		—	116	113	111	111	153
	Density at 15° C. of lubricant base oil		g/cm^3	0.842	0.863	0.831	0.831	0.918
Properties of lubricating oil composition/ Various tests	Kinematic viscosity at 100° C. of lubricating oil composition		mm^2/s	3.0	3.0	3.0	3.0	3.5
	Viscosity index of lubricating oil composition		—	128	125	123	123	166
	(1) Insulation test, Volume resistivity		$\Omega \cdot m$	1.6×10^7	1.4×10^7	2.1×10^7	9.8×10^6	5.5×10^6
	(2) Friction reducing effect test, Coefficient of friction between metals (SRV)		—	0.155	0.150	0.161	0.153	0.101
	(3) Rubber swelling resistance test, Volume change rate		%	7	11	2	2	25

[0159] From Table 1, all the lubricating oil compositions of Examples 1 to 7 had well-balanced and excellent properties of insulation properties, friction reducing effect, and rubber swelling resistance.

[0160] Meanwhile, the lubricating oil compositions of Comparative Examples 1 to 4 were inferior in at least one property of insulation properties, friction reducing effect, and rubber swelling resistance.

1. A lubricant base oil, comprising:

an ester compound (A) comprising a diester (A1) having 24 or more carbon atoms and/or a triester (A2) having 24 or more carbon atoms; and

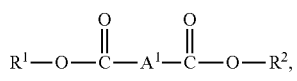
a base oil (B) comprising a mineral oil (B1) and/or a synthetic oil (B2) other than an ester synthetic oil.

2. The lubricant base oil of claim **1**, wherein having a density at 15° C. of less than 0.850 g/cm^3.

3. The lubricant base oil of claim **1**, wherein the ester compound (A) is present in a range of from 1 to 90 mass %, based on a total lubricant base oil mass.

4. The lubricant base oil of claim **1**, wherein the diester (A1) is present and has 26 or more carbon atoms.

5. The lubricant base oil of claim **1**, wherein the diester (A1) is present and comprises a compound (A11) of formula (a1-1):


(a1-1)

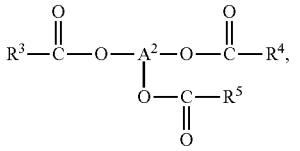
wherein

R^1 and R^2 are each independently a monovalent chain hydrocarbon group, and

A^1 is a divalent hydrocarbon group having 5 or more carbon atoms.

6. The lubricant base oil of claim **1**, wherein the triester (A2) comprises a compound (A21) of formula (a2-1):

(a2-1)



wherein

R^3, R^4, and R^5 are each independently a monovalent chain hydrocarbon group, and

A^2 is a trivalent hydrocarbon group having 5 or more carbon atoms.

7. The lubricant base oil of claim **1**, wherein the ester compound (A) comprises the diester (A1).

8. The lubricant base oil of claim **1**, wherein the ester compound (A) comprises the synthetic oil (A2).

9. A lubricating oil composition, comprising:

the lubricant base oil of claim **1**.

10. The composition of claim **9**, further comprising:

a pour point depressant;

a viscosity index improver;

an antioxidant;

an extreme pressure agent;

a metallic detergent;

an ashless dispersant;

a metal deactivator;

a corrosion inhibitor;

a rust inhibitor; and

a defoamer.

11. The composition of claim **9**, further comprising:

a fatty acid amide in less than 1.0 mass %, based on a total lubricating oil composition mass.

12. The composition of claim **9**, wherein a volume change rate of a nitrile rubber for test, as measured by immersing the nitrile rubber for test in the lubricating oil composition under conditions at 100° C. for 144 hours by a rubber immersion test method in accordance with JIS K6258, is less than 10%.

13. The lubricant base oil of claim **1**, wherein the ester compound (A) comprises the diester (A1) and the synthetic oil (A2).

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