US 20140018270A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2014/0018270 A1**

(43) **Pub. Date: Jan. 16, 2014**

KIM et al.

(54) **LUBRICATING OIL COMPOSITION FOR FLUID DYNAMIC BEARING AND MOTOR FOR HDD FABRICATED USING THE SAME**

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(21) Appl. No.: **13/893,785**

(22) Filed: **May 14, 2013**

(30) **Foreign Application Priority Data**

Jul. 12, 2012 (KR) 10-2012-0076020

Publication Classification

(51) **Int. Cl.**

C10M 141/10 (2006.01)

C10M 105/34 (2006.01)

(52) **U.S. Cl.**

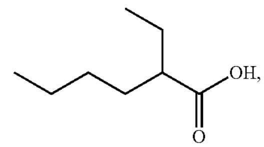
CPC ***C10M 141/10*** (2013.01); ***C10M 105/34*** (2013.01)

USPC **508/409**; 508/463; 508/442; 560/265

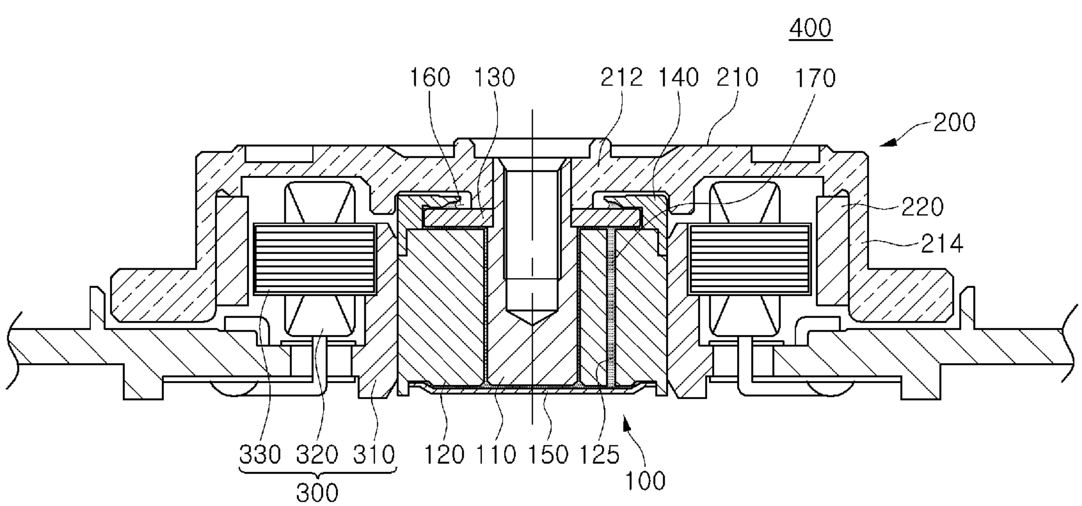
(57) **ABSTRACT**

There are provided a lubricating oil composition for a fluid dynamic bearing and a motor for a hard disk drive (HDD), the lubricating oil composition including, as a base oil, an aliphatic monocarboxylic acid ester having a total of between 16 to 46 carbon atoms, obtained by an esterification reaction of carboxylic acid represented by Chemical Formula 1 below and a primary or a secondary alcohol having between 8 to 38 carbon atoms,

[Chemical Formula 1]



and thus, the motor for an HDD is fabricated using the lubricating oil composition for a fluid dynamic bearing having low viscosity, low evaporation loss, and improved oxidation stability at a practicable temperature, thereby preventing a deterioration in product reliability due to long-time use of the motor.



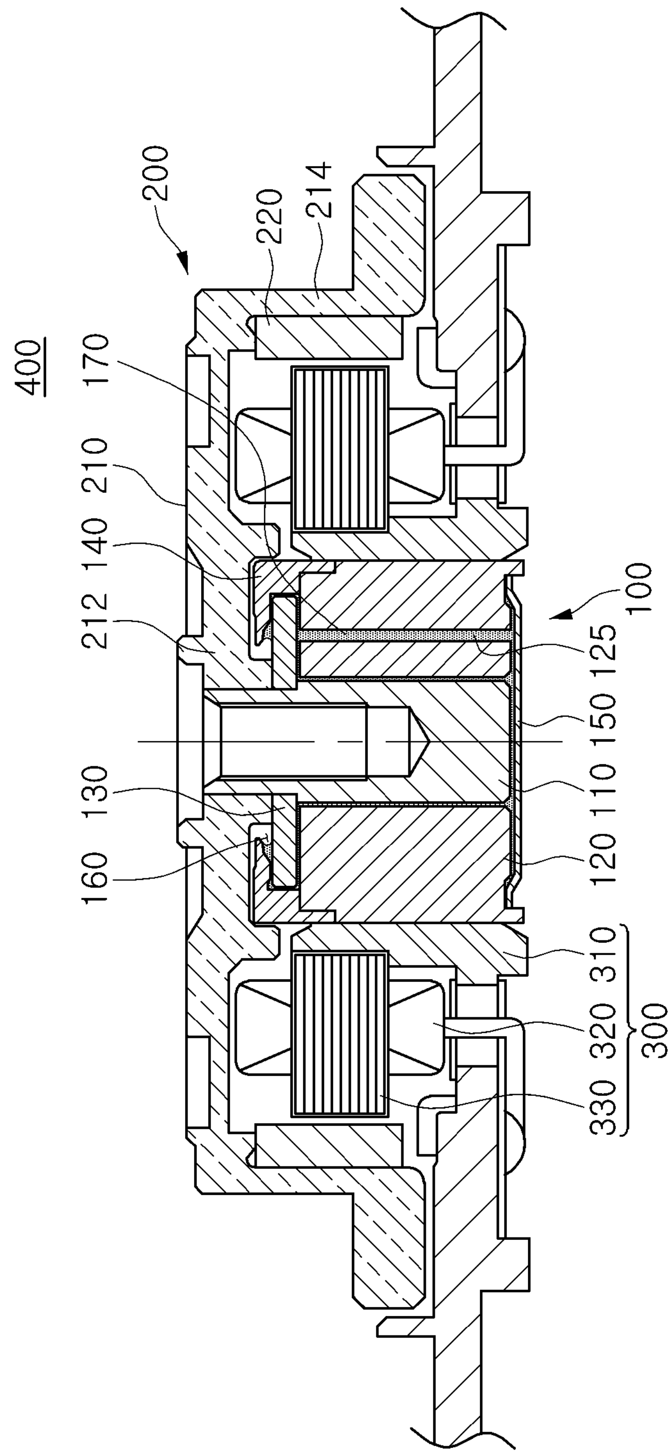

400
200
220
214
170
210
140
212
130
160
100
125
150
110
120
310
320
330
300

FIG. 1

LUBRICATING OIL COMPOSITION FOR FLUID DYNAMIC BEARING AND MOTOR FOR HDD FABRICATED USING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority of Korean Patent Application No. 10-2012-0076020 filed on Jul. 12, 2012, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a lubricating oil composition for a fluid dynamic bearing having low viscosity, low evaporation loss, and improved oxidation stability, and a motor for a hard disk drive (HDD) fabricated using the same.

[0004] 2. Description of the Related Art

[0005] A hard disk drive (HDD), an information storage device, reads data stored on a disk or writes data to a disk using a read/write head.

[0006] A HDD requires a disk driving device capable of driving a disk, and the disk driving device employs a small-sized spindle motor.

[0007] In this small-sized spindle motor, a fluid dynamic bearing assembly is used. A lubricating fluid is interposed between a shaft and a sleeve of the fluid dynamic bearing assembly so that the shaft is supported by fluid pressure generated in the lubricating fluid.

[0008] In the case in which the viscosity of the lubricating fluid is high at a low temperature during rotation of the spindle motor, there is increased viscous resistance to a dynamic power generating groove in the lubricating fluid, generated during rotation of the motor, resulting in increased power loss in the motor.

[0009] On the other hand, in the case in which the lubricating fluid is thermally expanded and the viscosity thereof is decreased in a high temperature region during rotation of the motor, the lubricating fluid may not sufficiently perform a supporting role.

[0010] Due to this reason, the lubricating fluid is required to have conflicting viscosity behavior characteristics in which low viscosity is maintained in a low temperature region and viscosity is not decreased in a high temperature region.

[0011] In order to satisfy these viscosity characteristics, technologies, such as adding a material such as an anti-oxidant or an extreme-pressure additive to a base oil containing a specific ester compound as a main component, have been developed.

[0012] A lubricating fluid containing the above-mentioned additives exhibits a desired effect at the start of a motor lifespan, but when the lubricating fluid is used over an extended period of time, a lubricating agent may be evaporated and viscosity characteristics thereof may be changed, and thus, it may be difficult to continuously maintain the desired effect.

[0013] In addition, with the trend for miniaturization, high precision, high speed rotation, and low power consumption in disk driving device motors, the lubricating fluid is required to have characteristics such as heat resistance, oxidation stability, low evaporation, and abrasion prevention.

[0014] Meanwhile, in the case in which the viscosity of the base oil is reduced, the evaporation loss thereof tends to increase. Therefore, a base oil having a low viscosity at a practical temperature but suppressing evaporation loss is required.

[0015] The following related art document discloses a grease composition containing 2-ethylhexanoic acid. However, while the grease composition has low viscosity at a practical temperature, the evaporation loss thereof is not significantly suppressed.

RELATED ART DOCUMENT

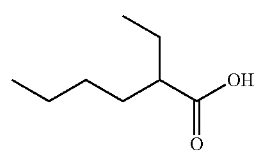
[0016] (Patent Document 1) Japanese Patent Laid-Open Publication No. 2007-154032

SUMMARY OF THE INVENTION

[0017] An aspect of the present invention provides a lubricating oil composition for a fluid dynamic bearing having low viscosity, low evaporation loss, and improved oxidation stability, and a motor for a hard disk drive (HDD) fabricated using the same.

[0018] According to an aspect of the present invention, there is provided a lubricating oil composition for a fluid dynamic bearing, the lubricating oil composition including, as a base oil, an aliphatic monocarboxylic acid ester having a total of between 16 to 46 carbon atoms, obtained by an esterification reaction of carboxylic acid represented by Chemical Formula 1 below and a primary or a secondary alcohol having between 8 to 38 carbon atoms.

[Chemical Formula 1]



[0019] The aliphatic monocarboxylic acid ester may be palmityl ethylhexanoate or cetyl ethylhexanoate.

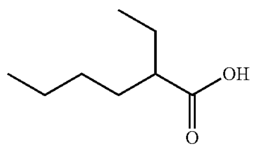
[0020] The lubricating oil composition may further include 0.01 to 2 parts by weight of an oil antioxidant, and the oil antioxidant may be 2,2'-methylene-bis(4-methyl-6-tert-butylphenol).

[0021] The lubricating oil composition may further include 0.01 to 2 parts by weight of a metal antioxidant, and the metal antioxidant may be barium diphenylamine-4-sulfonate.

[0022] The lubricating oil composition may further include 0.01 to 2 parts by weight of an internal pressure inhibitor, and the internal pressure inhibitor may be tricresyl phosphate.

[0023] According to another aspect of the present invention, there is provided a motor for a hard disk drive (HDD), the motor including a lubricating oil composition for a fluid dynamic bearing, including, as a base oil, an aliphatic monocarboxylic acid ester having a total of between 16 to 46 carbon atoms, obtained by an esterification reaction of carboxylic acid represented by Chemical Formula 1 below and a primary or a secondary alcohol having between 8 to 38 carbon atoms.

[Chemical Formula 1]



[0024] The aliphatic monocarboxylic acid ester may be hexadecan-7-yl-ethylhexanoate.

[0025] The lubricating oil composition for a fluid dynamic bearing may further include 0.01 to 2 parts by weight of an oil antioxidant, and the oil antioxidant may be 2,2'-methylene-bis(4-methyl-6-tert-butylphenol).

[0026] The lubricating oil composition for a fluid dynamic bearing may further include 0.01 to 2 parts by weight of a metal antioxidant, and the metal antioxidant may be barium diphenylamine-4-sulfonate.

[0027] The lubricating oil composition for a fluid dynamic bearing may further include 0.01 to 2 parts by weight of an internal pressure inhibitor, and the internal pressure inhibitor may be tricresyl phosphate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The above and other aspects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

[0029] FIG. **1** is a schematic cross sectional view showing a motor for a hard disk drive (HDD), including a fluid dynamic bearing assembly according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

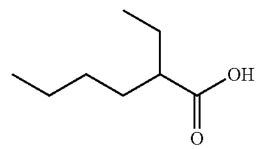
[0030] Hereinafter, embodiments of the present invention will be described in detail with reference to the accompanying drawings. The invention may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

[0031] In the drawings, the shapes and dimensions of elements maybe exaggerated for clarity, and the same reference numerals will be used throughout to designate the same or like elements.

[0032] FIG. **1** is a schematic cross sectional view showing a motor for a hard disk drive (HDD), including a fluid dynamic bearing assembly according to an embodiment of the present invention.

[0033] Referring to FIG. **1**, a lubricating oil composition **170** for a fluid dynamic bearing according to an embodiment of the present invention may include, as a base oil, an aliphatic monocarboxylic acid ester having a total of between 16 to 46 carbon atoms, obtained by an esterification reaction of carboxylic acid represented by Chemical Formula 1 below and a primary or a secondary alcohol having between 8 to 38 carbon atoms.

[Chemical Formula 1]



[0034] Hereinafter, the above constitution will be described in detail.

[0035] The carboxylic acid represented by Chemical Formula 1 may be 2-ethyl hexanoic acid.

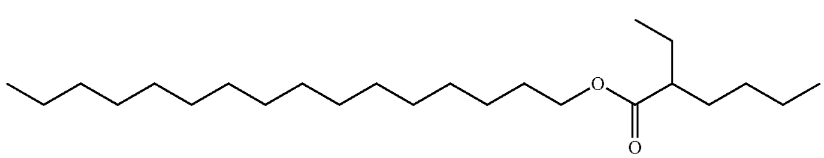
[0036] Meanwhile, according to the embodiment of the present invention, the alcohol may be a primary or a secondary alcohol having between 8 to 38 carbon atoms in order to perform an esterification reaction with the carboxylic acid represented by Chemical Formula 1, but is not limited thereto.

[0037] The lubricating oil composition **170** for a fluid dynamic bearing according to an embodiment of the present invention may include, as a base oil, an aliphatic monocarboxylic acid ester obtained by an esterification reaction of the carboxylic acid represented by Chemical Formula 1 below and the primary or the secondary alcohol having between 8 to 38 carbon atoms.

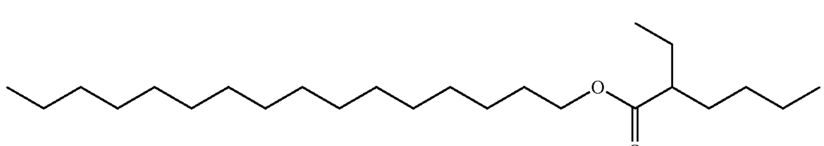
[0038] The aliphatic monocarboxylic acid ester may have, but is not limited to, for example, a total of between 16 to 46 carbon atoms.

[0039] The aliphatic monocarboxylic acid ester may be, but is not limited to, for example, palmityl ethylhexanoate or cetyl ethylhexanoate, represented by Chemical Formula 2 or Chemical Formula 3 below.

[Chemical Formula 2]



[Chemical Formula 3]



[0040] Specifically, Chemical Formula 2 represents palmityl ethylhexanoate, and Chemical Formula 3 represents cetyl ethylhexanoate.

[0041] The lubricating oil composition **170** for a fluid dynamic bearing according to the embodiment of the present invention may have low viscosity, low evaporation loss, and excellent oxidation stability, by including, as the base oil, the aliphatic monocarboxylic acid ester obtained by the esterification reaction of the 2-ethyl hexanoic acid and the primary or the secondary alcohol having between 8 to 38 carbon atoms.

[0042] The kinematic viscosity of the aliphatic monocarboxylic acid ester according to the embodiment of the present invention may be measured together with viscosities at temperatures of −20° C., 25° C., and 85° C.

[0043] Viscosity may be measured by using the Brookfield DB-III Rheometer Viscometer, and may be measured for respective components at three temperature regions (−20° C., 25° C., and 85° C.) in order to check the viscosity tendency thereof with regard to temperature.

[0044] In a general test of motor reliability, among the three temperatures, −20° C. corresponds to a low-temperature motor storage temperature, 25° C. corresponds to a room-temperature motor operating temperature, and 85° C. corresponds to a high-temperature motor operating temperature.

[0045] According to the embodiment of the present invention, the aliphatic monocarboxylic acid ester may have lower viscosity and a lower evaporation rate at high temperatures as compared to a generally used aliphatic monocarboxylic acid ester such as dioctyl adipate (DOA), dioctyl sebacate (DOS), or dioctyl azelate (DOZ).

[0046] Therefore, the use of the aliphatic monocarboxylic acid ester as a base oil can more effectively reduce friction loss in an apparatus while inducing low viscosity, and improve stability at high temperatures due to low evaporation thereof.

[0047] The lubricating oil composition including, as the base oil, the aliphatic monocarboxylic acid ester, may be suitable to be used for, but is not limited thereto, for example, a fluid dynamic bearing of a motor for a hard disc drive (HDD).

[0048] As for a small-sized HDD, power consumption thereof needs to be low, and stability at high temperatures may be a very important factor due to high speed rotation of the motor.

[0049] The lubricating oil composition according to the embodiment of the present invention has low friction loss and superior stability at high temperatures, and thus, can satisfy the above conditions of the small-sized HDD.

[0050] The lubricating oil composition for a fluid dynamic bearing may further 0.01 to 2 parts by weight of an oil antioxidant, and the oil antioxidant may be, but is not limited to, 2,2'-methylene-bis(4-methyl-6-tert-butylphenol).

[0051] The oil antioxidant may be included in a content of 0.01 to 2 parts by weight within such a range that performance of the lubricating oil composition is not deteriorated. If the content of the oil antioxidant is below 0.01 parts by weight, the addition of the oil antioxidant is less effective, and if the content of the oil antioxidant is above 2 parts by weight, the performance of the lubricating oil composition may be deteriorated.

[0052] In addition, the lubricating oil composition for a fluid dynamic bearing may further include 0.01 to 2 parts by weight of a metal antioxidant, and the metal antioxidant may be, but is not limited to, for example, barium diphenylamine-4-sulfonate.

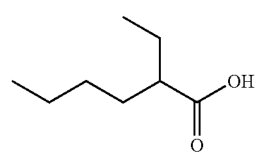
[0053] If the addition amount of the metal antioxidant is below 0.01 parts by weight, the oxidation stability effect is less effective, but if the addition amount of the metal antioxidant is above 2 parts by weight, the performance of the lubricating oil composition may be deteriorated.

[0054] The lubricating oil composition for a fluid dynamic bearing may further include 0.01 to 2 parts by weight of an internal pressure inhibitor, and the internal pressure inhibitor may be, but is not limited to, for example, tricresyl phosphate.

[0055] If the addition amount of the internal pressure inhibitor is below 0.01 parts by weight, the internal pressure inhibition effect is less effective, but if the addition amount of the internal pressure inhibitor is above 2 parts by weight, the performance of the lubricating oil composition may be deteriorated. Therefore, the addition amount of the internal pressure inhibitor may be within the range of 0.01 to 2 parts by weight.

[0056] A motor for an HDD according to another embodiment of the present invention may include a lubricating oil composition for a fluid dynamic bearing containing, as a base oil, an aliphatic monocarboxylic acid ester having a total of between 16 to 46 carbon atoms, obtained by an esterification reaction of carboxylic acid represented by Chemical Formula 1 below and a primary or a secondary alcohol having between 8 to 38 carbon atoms.

[Chemical Formula 1]



[0057] Hereinafter, a motor for an HDD according to another embodiment of the present invention will be described in detail, and descriptions overlapping with those of the above-described embodiment of the present invention will be omitted.

[0058] As for a motor **400** for an HDD, an oil sealing portion **160** may be formed between stationary members **120** and **140** and rotator members **110**, **130**, and **212**, and particularly, may be formed among a sleeve **120**, a thrust plate **130**, and a cap **140**.

[0059] The cap **140** is a member that is press-fitted from above the thrust plate **130** so that a lubricating fluid is sealed between the cap **140** and the thrust plate **130**. A circumferential groove may be formed in an outer diameter direction thereof so that the cap **140** is press-fitted on the thrust plate **130** and the sleeve **120**.

[0060] The cap **140** may have a protrusion formed on a bottom surface thereof in order to seal the lubricating oil, which uses a capillary phenomenon and surface tension of the lubricating fluid in order to prevent the lubricating fluid from being leaked to the outside at the time of motor driving.

[0061] Meanwhile, the motor **400** for an HDD according to another embodiment of the present invention may include a shaft **110**, a sleeve **120**, a thrust plate **130**, a cap member **140**, and an oil sealing portion **160**.

[0062] The sleeve **120** may support the shaft **110** such that an upper end of the shaft **110** protrudes upwardly in an axial direction, and may be formed by forging Cu or Al or sintering a Cu—Fe-based alloy powder or an SUS-based power.

[0063] Here, the shaft **110** is inserted into a shaft hole of the sleeve **120** such that there is a micro gap therebetween. The micro gap is filled with the lubricating fluid and the rotation of the rotor **200** may be more smoothly supported by a radial dynamic pressure groove formed in at least one of an outer diameter of the shaft **110** and an inner diameter of the sleeve **120**.

[0064] The radial dynamic pressure groove may be formed in an inside surface of the sleeve **120**, an inside of the shaft hole of the sleeve **120**, and generate pressure to be biased to one side during rotation of the shaft **110**.

[0065] However, it is to be noted that the radial dynamic pressure groove is not limited to being provided in the inside surface of the sleeve **120**, as described above, but for example, may be provided in an outer diameter portion of the shaft **110** and the number of radial dynamic pressure grooves is not restricted.

[0066] The sleeve **120** may have a bypass channel **125** communicating an upper portion and a lower portion of the sleeve **120** with each other to thereby distribute and balance the pressure of the lubricating fluid in the fluid dynamic bearing assembly **100** and move and exhaust bubbles or the like present in the fluid dynamic bearing assembly **100** by circulation.

[0067] Here, a cover plate **150** may be coupled with a lower portion of the sleeve **120** such that a gap between the sleeve **120** and the cover plate **150** is maintained, and the lubricating oil is contained in the gap.

[0068] The cover plate **150** may serve as a bearing supporting a lower surface of the shaft **110** since the lubricating oil is contained in the gap between the cover plate **150** and the sleeve **120**.

[0069] The thrust plate **130** is disposed upwardly of the sleeve **120** in the axial direction and includes a hole corresponding to a cross section of the shaft **110** at the center thereof. The shaft **110** may be inserted into the hole.

[0070] Here, the thrust plate **130** may be separately manufactured, and then coupled to the shaft **110**, but may also be formed integrally with the shaft **110**. The thrust plate **130** may be rotated following the shaft **110** during rotation of the shaft **110**.

[0071] In addition, a thrust dynamic pressure groove may be formed in an upper surface of the thrust plate **130** to provide thrust dynamic pressure to the shaft **110**.

[0072] The thrust dynamic pressure groove is not limited to being formed in the upper surface of the thrust plate **130** as described above, but may be formed in the upper surface of the sleeve **120** corresponding to a lower surface of the thrust plate **130**.

[0073] A stator **300** may include a coil **320**, a core **330**, and a base member **310**.

[0074] In other words, the stator **300** may be a fixed structure that includes the coil **320** generating electromagnetic force having a predetermined magnitude at the time of the application of power and a plurality of cores **330** wound by the coil **320**.

[0075] The core **330** may be fixed to an upper portion of a base member **310** including a printed circuit board (not shown) having circuit patterns printed thereon. A plurality of coil holes having a predetermined size penetrate the upper surface of the base member **310** corresponding to the winding coil **320** so that the winding coil **320** is downwardly exposed. The winding coil **320** may be electrically connected to the printed circuit board (not shown) to supply external power thereto.

[0076] The base member **310** is press-fitted and fixed to an outer circumferential surface of the sleeve **120** and the core **330** wound by the coil **320** may be inserted thereinto.

[0077] In addition, the base member **310** and the sleeve **120** may be coupled to each other by applying an adhesive to an inner surface of the base member **310** and an outer surface of the sleeve **120**.

[0078] The rotor **200**, a rotational structure provided to be rotatable with respect to the stator **300**, may include a rotor case **210** having a ring-shaped magnet **220** formed on an outer circumferential surface thereof, the magnet facing the core **330** at a predetermined distance.

[0079] In addition, the magnet **220** may be a permanent magnet of which an N pole and an S pole are alternately magnetized in a circumferential direction to thereby generate magnetic force having a predetermined magnitude.

[0080] Here, the rotor case **210** may be composed of a hub base **212** press-fitted and fixed to the upper end of the shaft **110** and a magnet support part **212** extending from the hub base **214** in the outer diameter direction and bent downwardly in the axial direction to support the magnet **220**.

[0081] The motor for an HDD according to another embodiment of the present invention includes the lubricating oil composition for a fluid dynamic bearing, thereby more effectively reducing friction loss in the apparatus while having low viscosity and achieving excellent stability at high temperatures due to low evaporation.

[0082] In addition, the motor for an HDD is fabricated with a lubricating oil composition for a fluid dynamic bearing having low viscosity at a practicable temperature, low evaporation loss, and improved oxidation stability, thereby preventing a deterioration in product reliability due to long-time use of the motor.

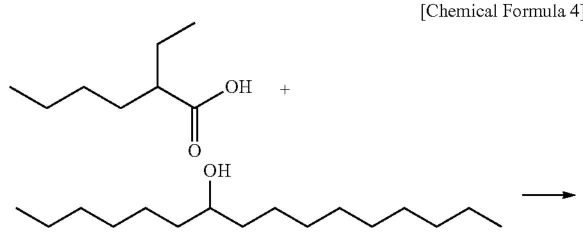
[0083] A method of manufacturing the motor **400** for an HDD may be the same as a general manufacturing method, except for the inclusion of the lubricating oil composition **170** for a fluid dynamic bearing.

[0084] Hereafter, the present invention will be described in detail with reference to embodiments, but is not limited thereto.

INVENTIVE EXAMPLE 1

[0085] In Inventive Example 1, 2-ethyl hexanoic acid and hexadecan-7-ol, commercially available from vendors such as Aldrich, Merck, TCI or the like, were reacted with each other to synthesize hexadecan-7-yl-ethylhexanoate of Chemical Formula 4 below.

[Chemical Formula 4]



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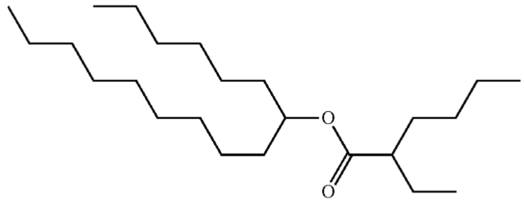


[0086] The above alcohol and acid were put in a reactor, and the reaction was performed at a temperature of 200° C. for 24 hours. After the reaction, a purification process was performed.

[0087] The hexadecan-7-yl-ethylhexanoate accounted for about 95 wt % of a total weight, and additives for improving other characteristics accounted for the other 5 wt %.

[0088] Specifically, 2 wt % of 2,2'-methylene-bis(4-methyl-6-tert-butylphenol) was added for antioxidation of oil, and 2 wt % of tricresyl phosphate was added as an internal pressure inhibitor.

[0089] In addition, 1 wt % of barium diphenylamine-4-sulfonate was added for antioxidation of a metal surface contacted with oil.

COMPARATIVE EXAMPLES 1 AND 2

[0090] In Comparative Example 1, a lubricating oil composition was prepared by adding 5 wt % of additives to a mixture of 65 wt % of dioctyl sebacate (DOS) and 30 wt % of ethylhexyloleate (EHO), as in Inventive Example 1. In Comparative Example 2, a lubricating oil composition was prepared by the same method as Inventive Example 1 except that dioctyl adipate (DOA) was used in an amount of about 95 wt %, based on total weight.

[0091] Esters of Comparative Examples 1 and 2 may be represented by Chemical Formulas 5 and 6 below:

[0092] Table 1 below shows that viscosity for comparing performance of the lubricating oil composition and a level of evaporation were measured to compare reliability between the Inventive Example and the Comparative Examples.

[0093] The viscosity was measured using the Brookfield DB-III Rheometer viscometer, and was measured for respective components at three temperature regions (−20° C., 25° C., and 85° C.) in order to check the viscosity tendency thereof according to temperature.

[0094] The evaporation amount was measured by an experiment where 5 g of a lubricating oil composition for a fluid dynamic bearing containing respective components was placed on a SUS-based evaporation dish made of an SUS material, which was then introduced into a thermostat at 100° C.

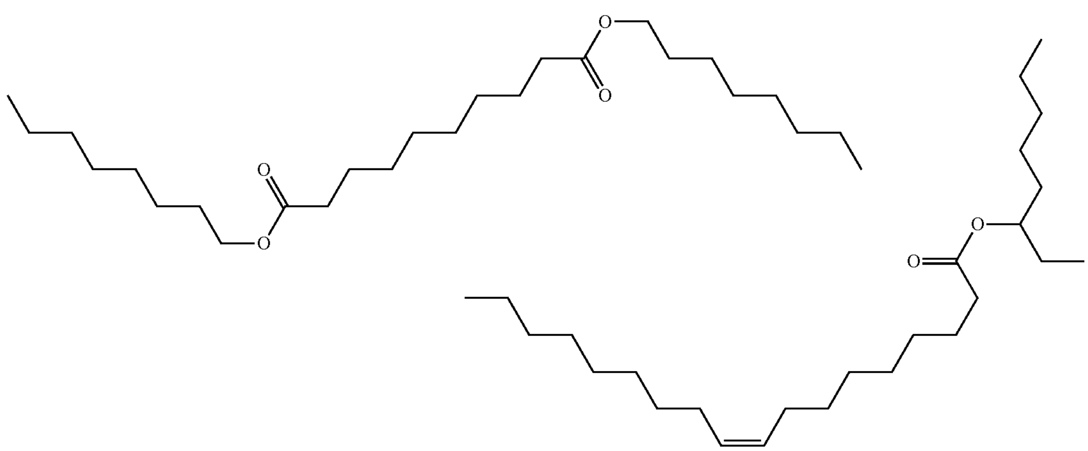
[0095] The experiment was performed for 144 hours (six days), and the comparison of an amount of evaporation was carried out by measuring an initial weight of the lubricating oil composition placed on the evaporation dish and a weight of the lubricating oil composition after 144 hours at 100° C.

TABLE 1

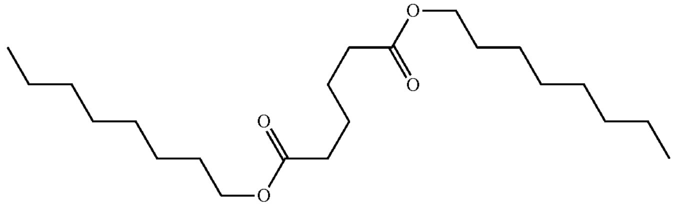
	Viscosity (cP)				Evaporation Amount (wt %)
Classification	0° C.	20° C.	40° C.	100° C.	(100° C., 144 h)
Inventive Example 1	35.4	13.7	6.8	1.9	0.7
Comparative Example 1	42.1	17.7	9.2	2.7	3.41
Comparative Example 2	41.6	17.4	9.0	2.6	7.12

[0096] It can be appreciated from Table 1 above that the lubricating oil composition according to the present invention

[Chemical Formula 5]



[Chemical Formula 6]



(Inventive Example 1) had lower viscosity and a lower evaporation amount than the lubricating oil composition using the mixture of 65 wt % of dioctyl sebacate (DOS) and 30 wt % of 2-ethylhexyloleate (EHO) (Comparative Example 1) and the lubricating oil composition using dioctyl adipate (DOA) (Comparative Example 2).

[0097] Hence, according to the present invention, the HDD motor is fabricated by including the lubricating oil composition for a fluid dynamic bearing having low viscosity, low evaporation loss, and improved oxidation stability, at a practicable temperature, thereby improving the reliability of the motor according to the long-time use of the motor.

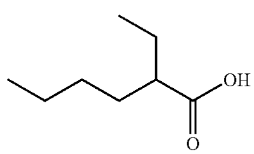
[0098] As set forth above, according to embodiments of the present invention, a motor for an HDD is fabricated using a lubricating oil composition for a fluid dynamic bearing having low viscosity, low evaporation loss, and improved oxidation stability at a practicable temperature, thereby preventing a deterioration in product reliability due to long-time use of the motor.

[0099] While the present invention has been shown and described in connection with the embodiments, it will be apparent to those skilled in the art that modifications and variations can be made without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A lubricating oil composition for a fluid dynamic bearing, the lubricating oil composition comprising, as a base oil, an aliphatic monocarboxylic acid ester having a total of between 16 to 46 carbon atoms, obtained by an esterification reaction of carboxylic acid represented by Chemical Formula 1 below and a primary or a secondary alcohol having between 8 to 38 carbon atoms.

[Chemical Formula 1]



2. The lubricating oil composition of claim **1**, wherein the aliphatic monocarboxylic acid ester is palmityl ethylhexanoate or cetyl ethylhexanoate.

3. The lubricating oil composition of claim **1**, further comprising 0.01 to 2 parts by weight of an oil antioxidant.

4. The lubricating oil composition of claim **3**, wherein the oil antioxidant is 2,2'-methylene-bis(4-methyl-6-tert-butylphenol).

5. The lubricating oil composition of claim **1**, further comprising 0.01 to 2 parts by weight of a metal antioxidant.

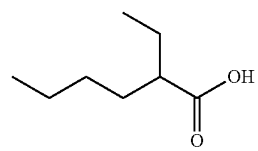
6. The lubricating oil composition of claim **5**, wherein the metal antioxidant is barium diphenylamine-4-sulfonate.

7. The lubricating oil composition of claim **1**, further comprising 0.01 to 2 parts by weight of an internal pressure inhibitor.

8. The lubricating oil composition of claim **7**, wherein the internal pressure inhibitor is tricresyl phosphate.

9. A motor for a hard disk drive (HDD), the motor comprising a lubricating oil composition for a fluid dynamic bearing, including, as a base oil, an aliphatic monocarboxylic acid ester having a total of between 16 to 46 carbon atoms, obtained by an esterification reaction of carboxylic acid represented by Chemical Formula 1 below and a primary or a secondary alcohol having between 8 to 38 carbon atoms.

[Chemical Formula 1]



10. The motor of claim **9**, wherein the aliphatic monocarboxylic acid ester is hexadecan-7-yl-ethylhexanoate.

11. The motor of claim **9**, wherein the lubricating oil composition for a fluid dynamic bearing further includes 0.01 to 2 parts by weight of an oil antioxidant.

12. The motor of claim **11**, wherein the oil antioxidant is 2,2'-methylene-bis(4-methyl-6-tert-butylphenol).

13. The motor of claim **9**, wherein the lubricating oil composition for a fluid dynamic bearing further includes 0.01 to 2 parts by weight of a metal antioxidant.

14. The motor of claim **13**, wherein the metal antioxidant is barium diphenylamine-4-sulfonate.

15. The motor of claim **9**, wherein the lubricating oil composition for a fluid dynamic bearing further includes 0.01 to 2 parts by weight of an internal pressure inhibitor.

16. The motor of claim **15**, wherein the internal pressure inhibitor is tricresyl phosphate.

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