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(54) **Grease composition for constant velocity joints**

Schmierfettzusammensetzung für homokinetische Gelenke

Composition de graisse pour joints homocinétiques

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EP-A- 0 773 280 **US-A- 5 059 336**
US-A- 5 160 645 **US-A- 5 207 936**
US-A- 5 449 471 **US-A- 5 498 357**
US-A- 5 516 439

Remarks:

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

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Description**BACKGROUND OF THE INVENTION**

5 **[0001]** The present invention relates to a grease composition for use in constant velocity joints, in particular, for ball type fixed and plunging constant velocity joints. A very high contact pressure is developed between the parts of the constant velocity joints to be lubricated and the joint parts undergo complicated rolling and sliding motions. This often results in abnormal wear and metal fatigue and, in turn, leads to a spalling phenomenon, i.e., pitting of the joint parts. More specifically, the present invention relates to a grease composition for constant velocity joints which can effectively lubricate such constant velocity joints to effectively reduce the wear of joints and to effectively reduce the occurrence of any pitting of the parts.

10 **[0002]** Examples of lubricating greases conventionally used in such constant velocity joints include a lithium soap thickened extreme pressure grease containing molybdenum disulfide and a lithium soap thickened extreme pressure grease containing molybdenum disulfide and extreme pressure agents, e.g., sulfur-phosphorus or a lead naphthenate. However, these greases for constant velocity joints have not always been satisfactory in the severe working conditions which occur in the present high-performance motorcars.

15 **[0003]** Recently, the number of four-wheel drive (FF-type) motorcars have rapidly increased. For use in these vehicles constant velocity joints need to be as making light and small as possible. The double offset type constant velocity joints and cross groove type constant velocity joints used as the plunging joints as well as Birfield joints used as the fixed joints have a structure in which torques are transmitted through 6 balls. These joints cause complicated reciprocating motions such as complicated rolling and sliding motions during rotation under a high contact pressure, stresses are repeatedly applied to the balls and the metal surfaces which come in contact with the balls and accordingly, the pitting phenomenon is apt to occur at such portions due to metal fatigue. The recent improvement in the power of engines is accompanied by an increase in the contact pressure as compared with conventional engines. Motorcars are being made lighter to improve fuel consumption and the size of joints has correspondingly been down-sized. This leads to a relative increase in the contact pressure and thus the conventional greases are ineffective in that they cannot sufficiently reduce the pitting phenomenon. In addition, the greases must also be improved in their heat resistance.

BACKGROUND ART

30 **[0004]** EP-A-0 773 280 has priority dates earlier than that of the present application but was published after the present application was filed. It describes and claims a grease having a base oil, a urea thickener, molybdenum disulfide, a metal salt or overbasic metal salt of a selected group of metals (Ca, Mg, Ba, Na, K, Pb, Zn, Al) and either an extreme pressure agent selected from a metal-free sulfur-phosphorus extreme pressure agent and molybdenum dithiophosphate or molybdenum dithiocarbamate. The patent also discloses compositions consisting of all the above constituents but the metal salt is selected from the salts of magnesium, barium, sodium, potassium, lead, zinc and aluminium.

35 **[0005]** US-A-5 207 936 discloses a grease having a urea thickener which includes molybdenum disulfide and molybdenum dithiocarbamate. In addition it includes zinc dithiophosphate and a vegetable oil.

40 **[0006]** US-A-5 516 439 discloses a grease having a lithium thickener and a metal salt of various types, including a calcium salt, and molybdenum dithiocarbamate or molybdenum dithiophosphate. In addition the grease includes zinc dithiophosphate.

45 **[0007]** US-A-5 160 645 discloses a urea thickened grease which includes a metal-free sulfur-phosphorus extreme pressure agent and molybdenum dithiocarbamate. In addition the grease contains zinc dithiophosphate and lead dithiocarbamate.

SUMMARY OF THE INVENTION

50 **[0008]** Accordingly, an object of the present invention is to provide a novel grease composition for constant velocity joints which has an excellent pitting-inhibitory effect and heat resistance.

[0009] The inventors of this invention have conducted various studies to develop a grease composition capable of optimizing the frictional wear of the constant velocity joints and of eliminating the problem of pitting of joints due to abnormal wear and metal fatigue and having improved heat resistance. The inventors have carried out a quality evaluation of greases used under lubricating conditions which are accompanied by complicated reciprocating motions such as complicated rolling and sliding motions under a high contact pressure as has been discussed above using an SRV (Schwingung Reibung und Verschleiss) tester known as an oscillating friction and wear tester, to determine lubricating characteristics (such as friction coefficient and wear) of various kinds of extreme pressure agents, solid lubricants or combinations of additives. As a result, the inventors have found that a grease comprising a specific combination of a

base oil, an urea thickener, molybdenum disulfide, a calcium salt or an overbasic calcium salt of a specific compound, a metal-free sulfur-phosphorus extreme pressure agent and molybdenum dithiocarbamate exhibits desired lubricating characteristics such as a good friction coefficient and low wear and have confirmed, by a durability test performed using a practical constant velocity joint, that the grease can prevent the occurrence of any pitting phenomena, unlike the conventional greases for constant velocity joints and thus have completed the present invention.

[0010] The foregoing object of the present invention can effectively be accomplished by providing a grease composition for constant velocity joints which consists essentially of:

- (a) a base oil;
- (b) an urea thickener;
- (c) molybdenum disulfide;
- (d) a calcium salt or an overbasic calcium salt selected from the group consisting of calcium salts of oxidized waxes, calcium salts of petroleum sulfonates, calcium salts of alkyl aryl sulfonates, calcium salts of salicylate, calcium salts of phenates, overbasic calcium salts of oxidized waxes, overbasic calcium salts of petroleum sulfonates, overbasic calcium salts of alkyl aryl sulfonates, overbasic calcium salts of salicylate, and overbasic calcium salts of phenates;
- (e) a metal-free sulfur-phosphorus extreme pressure agent; and
- (f) molybdenum dithiocarbamate.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] The present invention will hereunder be explained in more detail.

[0012] The base oil as Component (a) is not restricted to specific ones and may be, for instance, lubricating oils currently used such as mineral oils, ester type synthetic oils, ether type synthetic oils, hydrocarbon type synthetic oils or mixture thereof.

[0013] The urea thickener as Component (b) is not restricted to specific ones and may be, for instance, diurea compounds and polyurea compounds.

[0014] Examples of the diurea compounds include those obtained through a reaction of a monoamine with a diisocyanate compound. Examples of the diisocyanates include phenylene diisocyanate, diphenyl diisocyanate, phenyl diisocyanate, diphenylmethane diisocyanate, octadecane diisocyanate, decane diisocyanate, and hexane diisocyanate. Examples of the monoamines include octylamine, dodecylamine, hexadecylamine, octadecylamine, oleylamine, aniline, p-toluidine, and cyclohexylamine.

[0015] Examples of the polyurea compounds include those obtained through a reaction of a diamine with a diisocyanate compound. Examples of the diisocyanates include those used for the formation of the diurea compounds as mentioned above. Examples of the diamines include ethylenediamine, propanediamine, butanediamine, hexanediamine, octanediamine, phenylenediamine, tolylenediamine, and xylenediamine.

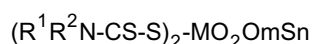
[0016] Preferred examples of urea thickeners include those obtained through a reaction of aryl amine such as aniline or p-toluidine, cyclohexyl amine or a mixture thereof with a diisocyanate. The aryl group in the diurea compounds is preferably those having 6 or 7 carbon atoms and the rate of the aryl group in the diurea compound ranges from 100 to 0 mole% based on the total moles of the aryl and the cyclohexyl groups in the diurea compounds.

[0017] The molybdenum disulfide as Component (c) has widely been used as an extreme pressure agent. With regard to the lubricating mechanism thereof, the molybdenum disulfide is easily sheared under the sliding motions through the formation of a thin layer since it has a layer lattice structure and it shows effects of reducing the frictional force and of preventing seizure of joints. There have been known molybdenum disulfide products having various particle sizes, but it is preferable, in the present invention, to use those having a particle size ranging from 0.25 to 10 μ m expressed in terms of an average particle size as determined by the method called Fisher method (by the use of a Fisher Sub-Sieve sizer), in particular, those having an average particle size of 0.55 to 0.85 μ m.

[0018] The calcium salts or overbasic calcium salts as Component (d) are selected from those known as metal cleaning dispersants or rust-inhibitors which are used in lubricants such as engine oils, such as calcium salts of oxidized waxes, calcium salts of petroleum sulfonates which are obtained by the sulfonation of aromatic hydrocarbon in lubricating oil fraction, calcium salts of synthetic sulfonates such as dinonylnaphthalene sulfonic acid and alkylbenzene sulfonic acid, calcium salts of salicylate, calcium salts of phenates, overbasic calcium salts of oxidized waxes, overbasic calcium salts of petroleum sulfonates, overbasic calcium salts of alkyl aryl sulfonates, overbasic calcium salts of salicylate, and overbasic calcium salts of phenates.

[0019] Preferred metal-free sulfur-phosphorus extreme pressure agents as Component (e) have a sulfur content ranging from 15 to 35% by weight and a phosphorus content ranging from 0.5 to 3% by weight and exhibit excellent effects of inhibiting wear and of preventing seizure of the joints through the well-established balance between the sulfur and phosphorus contents.

[0020] The molybdenum dithiocarbamate as Component (f) is preferably represented by the following formula:



wherein R^1 and R^2 independently represent an alkyl group having 1 to 24 carbon atoms, preferably 3 to 18 carbon atoms, m is 0 to 3, n is 4 to 1 and $m + n = 4$.

[0021] The grease composition for constant velocity joints according to the present invention may further comprise antioxidants, corrosion inhibitors, rust inhibitors in addition to the foregoing essential components.

[0022] The grease composition for constant velocity joints according to the present invention preferably comprises, on the basis of the total weight of the grease composition, 52.0 to 97.8% by weight of the base oil (a); 1 to 25% by weight of the urea thickener (b); 0.5 to 5% by weight of the molybdenum disulfide (c); 0.5 to 15% by weight of the calcium salt or overbasic calcium salt (d); 0.1 to 3% by weight of the metal-free sulfur-phosphorus extreme pressure agent (e); and 0.1 to 5% by weight of the molybdenum dithiocarbamate (f).

[0023] The present invention will hereunder be described in more detail with reference to the following non-limitative working Examples and Comparative Examples.

Examples 1 to 9 and Comparative Examples 1 to 3

[0024] There were added, to a container, 4100 g of a base oil and 1012 g of diphenylmethane-4,4'-diisocyanate and the mixture was heated to a temperature between 70 and 80°C. To another container, there were added 4100 g of a base oil, 563 g of cyclohexylamine and 225 g of aniline followed by heating at a temperature between 70 and 80 °C and addition thereof to the foregoing container. The mixture was then reacted for 30 minutes with sufficient stirring, the temperature of the reaction system was raised up to 160 °C with stirring and the reaction system was allowed to cool to give a base urea grease. To the base grease, there were added the following additives listed in Table 1 in amounts likewise listed in Table 1 and an optional and additional amount of the base oil and the penetration of the resulting mixture was adjusted to the No. 1 grade by a three-stage roll mill.

Example 10

[0025] There were added, to a container, 440 g of a base oil and 58.9 g of diphenylmethane-4,4'-diisocyanate and the mixture was heated to a temperature between 70 and 80 °C. To another container, there were added 440 g of a base oil and 61.1 g of octylamine followed by heating at a temperature between 70 and 80°C and addition thereof to the forementioned container. The mixture was then reacted for 30 minutes with sufficient stirring, the temperature of the reaction system was raised up to 160 °C with stirring and the reaction system was allowed to cool to give a base aliphatic amine urea grease. To the base grease, there were added the following additives listed in Table 1 in amounts likewise listed in Table 1 and an optional and additional amount of the base oil and the penetration of the resulting mixture was adjusted to the No. 1 grade by a three-stage roll mill.

[0026] In all of the abovementioned Examples and Comparative Examples, a mineral oil having the following properties was used as the base oil.

Viscosity	at 40°C	157 mm ² /s
	at 100°C	14 mm ² /s
Viscosity Index	88	

[0027] Moreover, a commercially available lithium grease containing molybdenum disulfide, a sulfur-phosphorus extreme pressure agent and a lead naphthenate was used as the grease of Comparative Example 4.

[0028] Physical properties of these greases were evaluated according to the methods detailed below. The results thus obtained are also summarized in Table 1.

[Penetration]	According to ISO 2137.	
[Dropping point]	According to ISO 2176.	
[SRV Test]		
Test Piece: ball	diameter 10 mm	(SUJ-2)
cylindrical plate:	diameter 24 mm × 7.85 mm	(SUJ-2)

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Conditions for Evaluation:	
Load	500 N
Frequency	15 Hz
Amplitude	3000 μm
Time	10 min
Test Temperature	25°C
Items evaluated	Maximum coefficient of friction Averaged diameter of wear scar observed on balls (mm) Maximum depth of wear observed on plates (μm)

[Durability Test on Bench Using Real Joints]

[0029] The greases were inspected, under the following conditions, for the occurrence of pitting by a durability test on a bench using real joints.

Test Conditions:	
Number of Revolutions	1000 rpm
Torque	392 N • m
Angle of Joint	8 °
Operation Time	100 hours
Type of Joint Used	Birfield Joint Cross Groove Joint

Item evaluated: Occurrence of pitting at each part after operation.

Table 1

<u>Components</u>	<u>Example</u>				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
1) Diurea Grease ①	94.0	94.0	93.5	93.5	94.0
2) Diurea Grease ②	-	-	-	-	-
3) Molybdenum Disulfide	3.0	3.0	3.0	3.0	3.0
4) Ca salt of oxidized wax	2.0	-	-	-	-
5) Calcium petroleum sulfonate	-	2.0	-	-	-
6) Calcium naphthalene sulfonate	-	-	2.0	-	-
7) Calcium salicylate	-	-	-	2.0	-
8) Calcium phenate	-	-	-	-	2.0
9) Calcium sulfonate ①	-	-	-	-	-
10) Calcium sulfonate ②	-	-	-	-	-
11) S-P Extreme pressure agent	0.5	0.5	0.5	0.5	0.5
12) Mo dithiocarbamate ①	0.5	0.5	-	-	0.5
13) Mo dithiocarbamate ②	-	-	1.0	1.0	-
<u>Evaluation Test</u>					
14) Penetration (60 W)	321	327	335	326	329
15) Dropping Point (°C)	260<	260<	260<	260<	260<
16) SRV Test Max. Coeff. of Friction	0.06	0.06	0.06	0.06	0.06
17) Wear Scar Diameter (mm)	0.62	0.63	0.59	0.61	0.61
18) Wear Depth (μm)	0.4	0.4	0.4	0.4	0.4
<u>Durability Test</u>					
19) Birfield Joint	○	○	○	○	○
20) Cross Groove Joint	○	○	○	○	○

Table 1 (continued)

<u>Components</u>	<u>Example</u>				
	6	7	8	9	10
1) Diurea Grease ①	94.0	93.5	94.0	92.5	-
2) Diurea Grease ②	-	-	-	-	93.5
3) Molybdenum Disulfide	3.0	3.0	3.0	3.0	3.0
4) Ca salt of oxidized wax	-	-	-	-	-
5) Calcium petroleum sulfonate	-	-	-	-	-
6) Calcium naphthalene sulfonate	-	-	2.0	2.0	2.0
7) Calcium salicylate	-	-	-	-	-
8) Calcium phenate	-	-	-	-	-
9) Calcium sulfonate ①	2.0	-	-	-	-
10) Calcium sulfonate ②	-	2.0	-	-	-
11) S-P Extreme pressure agent	0.5	0.5	0.5	0.5	0.5
12) Mo dithiocarbamate ①	0.5	-	-	-	-
13) Mo dithiocarbamate ②	-	1.0	0.5	2.0	1.0
<u>Evaluation Test</u>					
14) Penetration (60 W)	332	325	328	324	317
15) Dropping Point (°C)	260<	260<	260<	260<	260<
16) SRV Test Max. Coeff. of Friction	0.06	0.06	0.06	0.06	0.06
17) Wear Scar Diameter (mm)	0.60	0.60	0.61	0.61	0.62
18) Wear Depth (μm)	0.4	0.4	0.4	0.4	0.4
<u>Durability Test</u>					
19) Birfield Joint	○	○	○	○	○
20) Cross Groove Joint	○	○	○	○	○

Table 1 (continued)

<u>Components</u>	<u>Comparative Example</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
1) Diurea Grease ①	97.0	98.0	98.0	
2) Diurea Grease ②	-	-	-	
3) Molybdenum Disulfide	3.0	-	-	
4) Ca salt of oxidized wax	-	-	-	
5) Calcium petroleum sulfonate	-	-	-	
6) Calcium naphthalene sulfonate	-	2.0	-	
7) Calcium salicylate	-	-	-	
8) Calcium phenate	-	-	-	
9) Calcium sulfonate ①	-	-	2.0	
10) Calcium sulfonate ②	-	-	-	
11) S-P Extreme pressure agent	-	-	-	
12) Mo dithiocarbamate ①	-	-	-	
13) Mo dithiocarbamate ②	-	-	-	
<u>Evaluation Test</u>				
14) Penetration (60 W)	324	321	321	280
15) Dropping Point (°C)	260<	260<	260<	190
16) SRV Test Max. Coeff. of Friction	0.15<	0.09	0.15<	0.15<
17) Wear Scar Diameter (mm)	I.M.*	0.63	I.M.	I.M.
18) Wear Depth (μm)	I.M.	0.6	I.M.	I.M.
<u>Durability Test</u>				
19) Birfield Joint	×	×	×	×
20) Cross Groove Joint	×	×	×	×

*: I.M. = Incapable of measuring

- 1) Diurea grease using a diurea compound wherein cyclohexyl amine and aniline are used as a monoamine
- 2) Diurea grease using a diurea compound wherein octyl amine is used as a monoamine
- 3) Molybdenum disulfide available from Climax Molybdenum Company under the trade name of Molysulfide; average particle size: $0.7 \mu m$
- 4) Calcium salt of oxidized wax available from Alox Corporation under the trade name of Alox 165
- 5) Calcium salt of petroleum sulfonate available from Matsumura Petroleum Laboratory Co., Ltd. under the trade name of Sulfol Ca-45
- 6) Calcium salt of dinonylnaphthalene sulfonate available from King Industries Co., Ltd. under the trade name of NA-SUL 729
- 7) Calcium salicylate available from Osca Chemical Co., Ltd. under the trade name of OSCA423
- 8) Calcium phenate available from Oronite Japan Co., Ltd. under the trade name of OLOA 218A
- 9) Overbasic calcium sulfonate ① available from Lubrizol Japan under the trade name of Lubrizol 5283
- 10) Overbasic calcium sulfonate ② available from Witco Corporation under the trade name of Bryton C-400C
- 11) Sulfur-phosphorus extreme pressure agent available from Lubrizol Japan under the trade name of Anglamol 99
- 12) Molybdenum dithiocarbamate ① available from R.T.Vanderbilt under the trade name of Molyvan A
- 13) Molybdenum dithiocarbamate ② available from R.T.Vanderbilt under the trade name of Molyvan 822

- 14) Penetration according to ISO 2137
- 15) Dropping point according to ISO 2176 (°C)
- 16) Maximum coefficient of friction
- 17) Averaged diameter of wear scar observed on balls (mm)
- 18) Maximum depth of wear observed on plates (μ m)
- 19) Durability test on bench using real joints

Birfield Joint

- 20) Durability test on bench using real joints

Cross Groove Joint

In the durability test, these greases were evaluated according to the following criteria:

○ : No pitting was observed;

× : Pitting was observed.

[0030] As has been discussed above in detail, the grease composition for constant velocity joints according to the present invention consists essentially of (a) a base oil; (b) an urea thickener; (c) molybdenum disulfide; (d) a specific calcium salt or a specific overbasic calcium salt; (e) a metal-free sulfur-phosphorus extreme pressure agent; and (f) molybdenum dithiocarbamate and thus exhibits excellent wear-resistant effect and an excellent pitting-inhibitory effect as is also apparent from the comparison of the results of Examples with those of Comparative Examples.

Claims

1. A grease composition for constant velocity joints consisting essentially of:

- (a) a base oil;
- (b) an urea thickener;
- (c) molybdenum disulfide;
- (d) a calcium salt or an overbasic calcium salt selected from the group consisting of calcium salts of oxidized waxes, calcium salts of petroleum sulfonates, calcium salts of alkyl aryl sulfonates, calcium salts of salicylate, calcium salts of phenates, overbasic calcium salts of oxidized waxes, overbasic calcium salts of petroleum sulfonates, overbasic calcium salts of alkyl aryl sulfonates, overbasic calcium salts of salicylate, and overbasic calcium salts of phenates;
- (e) a metal-free sulfur-phosphorus extreme pressure agent; and
- (f) molybdenum dithiocarbamate.

2. The grease composition for constant velocity joints of claim 1 wherein the grease composition consists essentially of, on the basis of the total weight of the composition, 52.0 to 97.8% by weight of the base oil (a); 1 to 25% by weight of the urea thickener (b); 0.5 to 5.0% by weight of the molybdenum disulfide (c); 0.5 to 15% by weight of the calcium or overbasic calcium salt (d); 0.1 to 3% by weight of the metal-free sulfur-phosphorus extreme pressure agent (e); and the molybdenum dithiocarbamate (f).

3. The grease composition for constant velocity joints of claim 1 or 2 wherein the metal-free sulfur-phosphorus ex-

treme pressure agent (e) has a sulfur content ranging from 15 to 35% by weight and a phosphorus content ranging from 0.5 to 3% by weight.

4. The grease composition for constant velocity joints of claim 1 or 2 wherein said constant velocity joints are constant velocity plunging ball joints.

5. The grease composition for constant velocity joints of claim 1 or 2 wherein said constant velocity joints are constant velocity fixed ball joints.

Patentansprüche

1. Schmierfettzusammensetzungen für Gleichlaufgelenke, im Wesentlichen bestehend aus:

- (a) einem Basisöl;
- (b) einem Harnstoff-Verdickungsmittel;
- (c) Molybdändisulfid;
- (d) einem Calciumsalz oder einem überbasischen Calciumsalz, ausgewählt aus Calciumsalzen oxidierter Wachse, Calciumsalzen von Petroleumsulfonaten, Calciumsalzen von Alkylarylsulfonaten, Calciumsalzen von Salicylat, Calciumsalzen von Phenaten, überbasischen Calciumsalzen oxidierter Wachse, überbasischen Calciumsalzen von Petroleumsulfonaten, überbasischen Calciumsalzen von Alkylarylsulfonaten, überbasischen Calciumsalzen von Salicylat und überbasischen Calciumsalzen von Phenaten;
- (e) einem metallfreien Schwefel-Phosphor-Extremdruckmittel; und
- (f) Molybdändithiocarbamat.

2. Schmierfettzusammensetzung für Gleichlaufgelenke nach Anspruch 1, wobei die Schmierfettzusammensetzung auf der Basis des Gesamtgewichts der Zusammensetzung im Wesentlichen aus 52,0 bis 97,8 Gewichts-% des Basisöls (a); 1 bis 25 Gewichts-% des Harnstoff-Verdickungsmittels (b); 0,5 bis 5 Gewichts-% des Molybdändisulfids (c); 0,5 bis 15 Gewichts-% des Calciumsalzes oder des überbasischen Calciumsalzes (d); 0,1 bis 3 Gewichts-% des metallfreien Schwefel-Phosphor-Extremdruckmittels (e); und des Molybdändithiocarbamats (f) besteht.

3. Schmierfettzusammensetzung für Gleichlaufgelenke nach Anspruch 1 oder 2, wobei das metallfreie Schwefel-Phosphor-Extremdruckmittel (e) einen Schwefelgehalt im Bereich von 15 bis 35 Gewichts-% und einen Phosphorgehalt im Bereich von 0,5 bis 3 Gewichts-% hat.

4. Schmierfettzusammensetzung für Gleichlaufgelenke nach Anspruch 1 oder 2, wobei die Gleichlaufgelenke Gleichlaufgelenke mit Eintauchkugel sind.

5. Schmierfettzusammensetzung für Gleichlaufgelenke nach Anspruch 1 oder 2, wobei die Gleichlaufgelenke Gleichlaufgelenke mit fixierter Kugel sind.

Revendications

1. Composition de graisse pour joints homocinétiques, essentiellement constituée par :

- (a) une huile de base ;
- (b) un épaississant à base d'urée ;
- (c) du disulfure de molybdène ;
- (d) un sel de calcium ou un sel de calcium superbasique, choisi dans le groupe constitué par les sels de calcium de cires oxydées, les sels de calcium de sulfonates de pétrole, les sels de calcium d'alkyl aryl sulfonates, les sels de calcium de salicylate, les sels de calcium de phénates, les sels de calcium superbasiques de cires oxydées, les sels de calcium superbasiques de sulfonates de pétrole, les sels de calcium superbasiques d'alkylarylsulfonates, les sels de calcium superbasiques de salicylate et les sels de calcium superbasiques de phénates;
- (e) un agent pour pression extrême à base de soufre et de phosphore, exempt de métal ; et
- (f) du dithiocarbamate de molybdène.

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2. Composition de graisse pour joints homocinétiques selon la revendication 1, dans laquelle la composition de graisse est essentiellement constituée, par rapport au poids total de la composition, de 52,0 à 97,8 % en poids de l'huile de base (a) ; de 1 à 25 % en poids de l'épaississant à base d'urée (b) ; de 0,5 à 5,0 % en poids de disulfure de molybdène (c) ; de 0,5 à 15 % en poids du sel de calcium ou du sel de calcium superbasique (d) ; de 0,1 à 3 % en poids de l'agent pour pression extrême à base de soufre et de phosphore, exempt de métal (e) ; et du dithiocarbamate de molybdène (f).
3. Composition de graisse pour joints homocinétiques selon la revendication 1 ou 2, dans laquelle l'agent pour pression extrême à base de soufre et de phosphore, exempt de métal (e) présente une teneur en soufre de 15 à 35 % en poids et une teneur en phosphore de 0,5 à 3 % en poids.
4. Composition de graisse pour joints homocinétiques selon la revendication 1 ou 2, dans laquelle les joints homocinétiques sont des joints à rotules plongeurs homocinétiques.
5. Composition de graisse pour joints homocinétiques selon la revendication 1 ou 2, dans laquelle les joints homocinétiques sont des joints fixes homocinétiques.