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(54) **Lubricants, particularly lubricating grease compositions for constant velocity universaljoints.**

(57) High performance lubricant compositions, particularly high performance lubricating grease for lubricating and reducing or eliminating shuddering in inboard constant velocity universal joints under high torque and high angle of articulation comprise a base oil, a thickener and in intimate admixture therewith at least one organic molybdenum compound from the group consisting of molybdenum dithiophosphates and molybdenum dithiocarbamates and at least one ashless additive from the group consisting of ashless dithiophosphates and ashless dithiocarbamates.

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BACKGROUND AND DESCRIPTION OF THE INVENTION

This invention relates generally to lubricants and, more particularly, to lubricating greases which are particularly useful for lubricating and reducing or eliminating shuddering in constant velocity universal joints operating under high torque and high angle of articulation.

While the invention relates primarily to lubricating grease compositions, it also has utility in other lubricants such as lubricating oil.

Under high torque and high angle of articulation, inboard constant velocity universal joints give uneven torque to the wheels in automotive drives, causing a shuddering sensation. The object of the invention, generally stated, is the provision of lubricants for such constant velocity universal joints which will reduce or eliminate such shuddering. Such lubricants or lubricating greases will have other applications wherein high performance low friction lubricants are required.

The procedures and equipment for producing lubricants, and particularly lubricating greases, are well known. Likewise, it is well known that a lubricating grease will comprise an oil and a thickening agent therefor as the base components and into which various low friction additives are intimately incorporated so as to result in a uniform intimate admixture of all components. The present invention relates particularly to the combination of additives utilized, sometimes referred to as the "additive package". A lubricating grease formulated in accordance with the present invention will have the following general formula:

GENERAL FORMULA

Base Oil
Thickening Agent (if the composition is to be a grease) Molybdenum Dithiocarbamate and/or Dithiophosphate
Ashless Dithiophosphate and/or Dithiocarbamate

Any suitable base oil may be utilized such as a mineral oil or a synthetic hydrocarbon oil having a viscosity of a lubricant. Various known thickening agents may be used the preferred ones being a urea type (monourea, diurea, triurea, tetraurea, and polyurea).

The additives are commercially available from various sources under proprietary designations as follows:

Molybdenum dialkyl dithiocarbamate (MoDTC) and molybdenum dialkyl dithiophosphate (MoDTP) available from R.T. Vanderbilt Company, Inc. of Norwalk, Connecticut under the trademarks MOLYVAN A and MOLYVAN L, respectively. Molybdenum diaryl dithiophosphate available from ASAHI DENKA KOGYO K.K. SAKURA Lube 300. Ashless dithiophosphate and ashless dithiocarbamate available from R.T. Vanderbilt Company, Inc. under the trademarks VANLUBE 7611 and VANLUBE 732, respectively.

The following is a specific and preferred example of a lubricating grease embodying the invention.

PREFERRED EXAMPLE

(Grease A)

	% By Weight
600 SUS* Solvent Refined Paraffinic Oil	84.5%
Polyurea Thickener	13.0%
MolyVan L	1.0%
Vanlube 7611	1.5%

*600 Saybolt Universal Seconds Viscosity at 100°F.

The grease of the above preferred example was prepared in the following conventional manner.

Polyurea thickener was prepared in a kettle by adding: (a) about 300 by weight of a solvent extracted neutral base oil with a viscosity of 600 SUS at 100°F and (b) about 7.450 by weight of primary oleyl amine. The primary amine base oil was then mixed for 30-60 minutes at a maximum temperature of 120°F with about 5.4% by weight of an isocyanate, such as 143 L-MDI manufactured by Dow. About 3% by weight water was then added and stirred for about 20 to 30 minutes before adding 40% base oil and heating to 320°F. The grease is then cooled to 180°F. At this time, 1% MolyVan L and 1.5% Vanlube 7611 are then added along with the remaining base oil. The resulting grease is then milled through a colloid type mill.

The grease of the above preferred example (Grease A) was subjected to the following standard physical tests with the results being tabulated as follows in comparison with:

(Grease B) Polyurea Base Grease
(Grease C) 3% Moly Lithium
(Grease D) Lithium Base Grease
(Grease E) Lithium Base Grease w/Low Friction Additive Package
(Grease F) Polyurea Base Grease w/30 Molybdenum disulfide

TABLE 1

Grease	60X*	4 Ball Wear**	Dropping Point
(A)	312	0.33 mm	412°F
(B)	298	0.67 mm	412°F
(C)	292	0.68 mm	401°F
(D)	285	0.72 mm	408°F
(E)	285	0.35 mm	417°F
(F)	330	0.64 mm	423°F

* 60 Strokes in a standard grease worked as described in ASTM Method D-217.

** ASTM Method D-2596-87.

The grease composition of the above-preferred example (Grease A) was subjected to Line Contact SRV friction and load carrying test using the Optimol SRV Tester of Optimol Lubricants, Cartaret, New Jersey to demonstrate its ability to minimize or eliminate shuddering in a constant velocity universal joint. For purpose of comparison, the grease compositions of B-F above were also subjected to the same test. The comparative test results are tabulated as follows (Table 2).

TABLE 2

GREASE	LOAD IN NEWTONS (N) 50	100	200	300	400	500	600	700	800	900	1000	1100	1200
	COEFFICIENTS OF FRICTION												
A@ 80°C	0.13	0.08	0.06	0.055	0.045	0.04	0.04	0.04	0.05	0.06	FAIL	0.098	0.1
A@ 150°C	0.13	0.075	0.05	0.045	0.04	0.039	0.039	0.06	0.09	0.095	0.094		
B@ 80°C	0.18	0.20	0.185	0.17	FAIL								
B@ 150°C	0.18	0.16	0.135	0.13	FAIL								
C@ 80°C	0.14	0.11	0.08	0.07	0.11	0.12	0.12	FAIL					
C@ 150°C	0.085	0.06	0.05	0.049	0.43	FAIL							
D@ 80°C	0.15	0.135	0.13	0.14	0.14	0.14	FAIL	0.126	0.125	FAIL			
D@ 150°C	0.12	0.11	0.115	0.115	0.12	0.18	0.19						
E@ 80°C	0.16	0.115	0.078	0.069	0.07	0.068	0.07	0.07	0.07	0.065	0.06	0.455	FAIL
E@ 150°C	0.09	0.07	0.07	0.06	0.05	FAIL							
F@ 80°C	0.15	0.13	0.12	0.15	0.145	0.14	0.149	FAIL					
F@ 80°C	0.125	0.14	0.129	0.129	0.13	0.135	0.135	0.139	FAIL				

The following examples are given to illustrate other uses in which the invention may be practiced:

Antifriction Bearings (Ball & Roller)

Reciprocating Pivots

Automotive Steering Linkage
Automotive Ball Joints

From the foregoing preferred example, it will be apparent that the various components may be utilized in various ranges. In general, the useful range for the combined base, fillers, oils and thickeners is from 80 to 99.9 percent by weight of the grease compositions and the useful range for the additive package is from 0.1 to 20 percent by weight.

Claims

1. A lubricant composition comprising a base oil and in intimate admixture therewith additives comprising at least one organic molybdenum compound selected from the group consisting of molybdenum dithiocarbamates and molybdenum dithiophosphates and at least one ashless additive selected from the group consisting of ashless dithiophosphates and ashless dithiocarbamates.

2. A lubricant composition according to claim 1 additionally including thickening agent for the base oil.

3. A lubricant composition according to claim 1 or claim 2 wherein said thickening agent is at least a mono urea compound.

4. A lubricant composition according to any one of the preceding claims wherein the at least one molybdenum compound is selected from the group consisting of molybdenum dialkyl dithiophosphate, molybdenum dialkyl dithiocarbamate and molybdenum diaryl dithiophosphate.

5. A lubricating grease comprising a base oil and a polyurea thickening agent therefor and in intimate admixture therewith approximately 1.0% by weight of molybdenum dialkyl dithiophosphate and approximately 1.5% by weight of ashless dithiophosphate.

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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 2790

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X A	EP-A-0 117 454 (OPTIMOL-ÖLWERKE) * page 12, line 1 - line 3 * * page 6, line 26 - line 28 * * claims 1,10,16 *	1,2,4 5	C10M135/18 C10M137/10 C10M141/10 C10M169/06 //(C10M135/18,
X	DE-A-1 954 452 (OPTIMOL-ÖLWERKE) * page 3, line 1 - line 8 * * page 3, line 11 * * page 3, line 31 - page 4, line 7 *	1,4	135:18) (C10M137/10, 137:10) (C10M141/10, 135:18,137:10)
P,X	FR-A-2 676 065 (NTN CORPORATION) * claims 1,2 *	1,2,4	(C10M169/06, 115:08,119:24, 135:18,135:18,
X	EP-A-0 041 597 (R.T. VANDERBILT COMPANY) * page 8; example III * * claims 6,9 *	1,2,4	137:10,137:10) (C10N10:12) (C10N40:00) (C10N50:10)
X	US-A-4 501 678 (TAKAO KATAYAMA) * column 9; example 5; table 1 *	1,4	
X A	GB-A-1 373 588 (OPTIMOL-ÖLWERKE) * page 2, line 94 - line 99 * * page 3; example 1 * * claim 1 *	1,4 5	TECHNICAL FIELDS SEARCHED (Int. Cl.5) C10M
A	FR-A-2 592 891 (NTN TOYO BEARING) * page 5, line 22 - line 26 *	1-4	
A	EP-A-0 435 745 (NISSAN MOTOR COMPANY LIMITED) * claims 1-3 *	1,2,4	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 JUNE 1993	HILGENGA K.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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