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(54) Lubricating grease composition

(57) The invention relates to a lubricating grease composition and to an advantageous use of such a lubricating grease composition. The lubricating grease according to the invention comprises at least one polyolefin component, at least one base or component and, in addition, at least one rubber component. The properties of the lubricating grease composition according to the invention, for example with regard to oil bleeding, adhesion properties, working life, noise properties and/or mechanical stability, can be regulated by its composition and the rubber component or components. The lubricating grease composition according to the invention can be used for several different applications in which lubricating grease is normally used, such as for different types of bearing and other mechanical components such as couplings, toothed transmission gears and the like. The lubricating grease composition according to the invention can also be used, for example, for lubricating chutes and instruments.

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Description

TECHNICAL FIELD:

5 [0001] The present invention relates to a lubricating grease composition and an advantageous use of such a lubricating grease composition.

[0002] The lubricating grease composition in accordance with the invention comprises at least one polyolefin component, at least one base oil component, and, in addition to that, at least one rubber component.

10 [0003] The present invention makes it possible to direct and control the properties of a lubricating grease composition such as oil bleeding, adhesion and cohesion. Working life, noise properties and/or mechanical stability can also be improved.

[0004] The lubricating grease composition in accordance with the invention can be employed for several different applications in which lubricating grease is normally employed, for example for lubricating different types of bearing and other mechanical components, such as couplings, toothed transmission gears and the like. The lubricating grease composition in accordance with the invention can also be used, for example, for lubricating chutes and instruments.

TECHNICAL BACKGROUND:

20 [0005] A large number of different lubricating grease compositions for use in connection with lubricating bearings and the like have been known for a long time, and different polymeric thickeners or consistency-imparters are also previously known.

[0006] Thus, the Patent Specification US-A-3,850,828, for example, describes a lubricating grease composition which is thickened with a polymeric mixture which comprises a polyethylene and an atactic polypropylene.

25 [0007] Patent Specification US-2,917,458 describes a grease composition which comprises an oil-soluble amorphous polypropylene base to which is added from 2 to 5% by weight of an isotactic polypropylene and from 5 to 35% by weight of a soap-salt thickener.

[0008] In addition, Patent Specification US-3,290,244 describes a grease composition which comprises a mineral lubricating oil, a thickening agent and an oil-soluble atactic homopolymer of polypropylene or an oil-soluble atactic copolymer of ethylene and propylene.

30 [0009] None of the abovementioned patent specifications, i.e. US-A-3,850,828, US-2,917,458 or US-3,290,244, appears to mention anything about the properties which can be obtained using the lubricating grease compositions they describe, for example with regard to oil bleeding.

[0010] In this present document, oil bleeding is understood as being the separation of the different components present in a lubricating grease which can occur during use. Such a separation can, for example, consist of base oil, which separates from the remaining lubricating grease structure. In many applications, it is desirable to control the degree of oil bleeding, i.e. the different components of a lubricating grease should remain in a stable mixture in order to ensure that the working lives of the lubricating grease and of the mobile component which is lubricated are as long as possible.

40 [0011] Certain applications exist in which a relatively high degree of oil bleeding is desirable, for example in relation to lubricating grease compositions which are to be used in very cold climates. In such cases, it can be desirable for lubricating oil of relatively low viscosity to separate from the lubricating grease in order to ensure that lubrication is obtained even under conditions of severe cold.

45 [0012] Patent Specification US 3,392,119 describes a grease which comprises a white mineral oil which has been thickened by using a copolymer of ethylene and a homopolymer of polypropylene. This patent specification mentions that the use of white mineral oil together with a polymer of ethylene and a polymer of polypropylene results in lubricating greases which exhibit less oil bleeding.

[0013] Patent Specification US 4 448 700 describes a lubricating composition which possesses built-in oil-releasing properties and which comprises polypropylene having a low melt-flow index and a synthetic lubricating oil which is based on one or more neopentylpolyol esters whose acid residues have, on average, relatively short chains. It is stated that the described composition can be shaped into, and function as, a mechanical component.

50 [0014] EP 0 700 986 A2 describes a polymeric thickener for lubricating grease compositions in which the thickener comprises a mixture of copolymers or homopolymers of polypropylene having a high molecular weight and a copolymer or homopolymer of propylene having a low molecular weight. In addition, EP 0 700 986 A2 describes a lubricating grease composition which comprises a lubricating oil and the abovementioned polymeric thickener, and also a process for producing such a lubricating grease composition. EP 0 700 986 A2 furthermore describes a use of a polymeric thickener of the previously mentioned type in association with producing lubricating grease compositions. In this context, the lubricating grease compositions which are described in EP 0 700 986 A2 are stated to give rise to improved oil bleeding properties at low temperature, increased working life, improved mechanical stability and improved noise properties.

[0015] WO 94/08710 describes another type of lubricating composition which consists of an oil gel which is produced for use as a filler inside optical cables. In this context, the cable filler material principally comprises an aluminium soap complex, a base oil and a rubber component. Very special demands are made on fillers for the purpose described. Thus, the filler should be able to act as a lubricating and buffering medium between the individual components contained in the cable. In addition, there is a limit to the choice of the components which can be included in the filler since these components should not, for example, include mineral oils or other materials which can interact with the cable material itself. A cable is furthermore expected to have a very long working life and may be buried in the ground for almost 40 years. It is therefore important that the tiller also has a working life which is of this order of size. Consequently, it is of great importance that the tendency of the filler material to separate be as low as possible. On the other hand, the lubricating power of the filler material does not need to be particularly great since the forces which can arise between the individual components in the cable are relatively small. Consequently, a composition in accordance with WO 94/08710 does not function particularly well for lubricating purposes which require lubrication in bearings and/or between metallic surfaces.

[0016] The previously known lubricating grease compositions can be found to have certain drawbacks. In this connection, it has emerged that there is a particular demand for improvements with regard to oil-bleeding properties, working life and mechanical stability. Thus, previously known lubricating grease compositions can be found to be mechanically unstable in certain applications. Furthermore, it has in general previously been difficult to regulate the oil-bleeding and separation properties of a lubricating grease composition in the manner required by a particular lubrication application without at the same time altering other properties of the lubricating grease composition, for example its adhesion properties, working life, noise properties or mechanical stability, in an undesirable direction.

ACCOUNT OF THE INVENTION:

[0017] Consequently, the primary object of the present invention is that of providing a lubricating grease composition which solves the abovementioned problem of insufficient mechanical stability and which, in addition, makes it possible to regulate and control oil-bleeding properties, adhesion properties and cohesion, and to achieve increased working life and improved mechanical stability and noise properties.

[0018] This object of the present invention is achieved, in accordance with the subsequent Patent Claim 1, by the lubricating grease composition according to the invention comprising at least one polyolefin component and at least one base oil component and by the lubricating grease composition, in addition to that, comprising at least one rubber component.

[0019] A further object of the present invention is to indicate advantageous areas of application for the lubricating grease composition according to the invention.

[0020] This object of the present invention is achieved, in accordance with the subsequent Patent Claim 9, by using a lubricating grease composition according to the invention for lubricating bearings, couplings, toothed transmission gears, chutes or instruments, with the lubricating grease composition being chosen, in association with the use, on the basis of properties selected from the group oil-bleeding properties, adhesion properties, working life, mechanical stability and noise properties.

[0021] A very important property of a lubricating grease is, of course, its working life. A lubricating grease which has a long working life gives rise to fewer shut-downs and requires less maintenance work. It is consequently very advantageous to be able to offer a lubricating grease which has an improved working life.

[0022] The oil-bleeding properties are also important. A lubricating grease composition according to the invention can be tailor-made for the intended use. The oil-bleeding can be regulated and controlled by selecting, inter alia, the quantity and type of rubber component, signifying that it is possible to produce a lubricating grease composition which releases a predetermined quantity of oil component over a relatively long period of time. As a result of this, it is also possible to obtain satisfactory lubrication over a long period using a substantially lower quantity of lubricating grease than was previously possible.

[0023] The fact that a lubricating grease composition in accordance with the invention affords a non-ionic environment results in a better additive response being obtained than that which is possible, for example, in soap-based compositions.

DESCRIPTION OF THE FIGURES:

[0024] The attached drawings illustrate, by means of diagrams, some of the properties which can be controlled or improved in lubricating grease compositions according to the invention, with

Fig. 1 illustrating the time and temperature dependence of the oil separation in the case of two different lubricating grease compositions, A and B, according to the invention, with the oil separation being measured by the

(modified) FTM 791/391.2 method of measurement, and
 Fig. 2 illustrating the time and temperature dependence of the oil separation in the case of the previously mentioned lubricating grease composition A according to the invention, with the oil separation being measured by the (modified) DIN 51817 method of measurement.

PREFERRED EMBODIMENTS:

[0025] Lubricating grease compositions according to the invention consist of at least three different types of component having different functions, namely one or more components of the polyolefin type, one or more components of the base oil type and one or more rubber components.

[0026] In this context, the main task of the polyolefin component or components is to supply a base chemical structure in the form of a polymeric lattice. The polyolefin component can, for example, comprise polyethylene or polypropylene or mixtures of these substances. The content of polyolefin component in lubricating grease compositions according to the invention is advantageously between 5 and 30% by weight, and preferably between 9 and 15% by weight.

[0027] The task of the base oil component or components is to supply lubricating or friction-reducing properties and also to impart a certain viscosity to the lubricating grease composition and supply the desired polarity and solubility for additive components which are included. The base oil can be selected at will from available lubricating oils, for example from natural oils such as mineral oil and different types of vegetable oil, or from synthetic oils such as polyalphaolefins, esters or polyethers. The content of base oil in the lubricating grease composition according to the invention is advantageously between 60 and 90% by weight, and preferably between 75 and 88% by weight.

[0028] The main tasks of the rubber component or components in the lubricating grease composition according to the invention are to stabilize the lattice which is formed by the abovementioned polyolefin component, to supply a certain elasticity to the lubricating grease structure, to impart suitable relaxation properties and to increase adhesion to the surfaces which are to be lubricated.

[0029] In addition, the rubber component or components make(s) it possible to regulate the oil-bleeding and separation properties of the lubricating grease composition according to the invention in the desired manner by means of the admixing ratio and choice of rubber type. It has also been found that the cohesion properties of the finished lubricating grease composition are improved if the rubber component is added to the composition from the start. On the other hand, adding the rubber component at a later stage in the production process results in increased adhesion properties.

[0030] Adding the rubber component also makes it possible to improve or control the mechanical stability, cohesion, adhesion properties, working life and noise properties of the lubricating grease composition.

[0031] The term "rubber component" which is used in this present document is intended to encompass a number of natural or synthetic, rubber-like organic polymers which exhibit a high degree of elastic extensibility at the normal temperature at which the lubricating grease composition according to the invention is used.

[0032] A rubber component for use in the lubricating grease composition according to the invention can advantageously comprise natural rubber (NR), polyisoprene (IR), polyisobutadiene (BR), styrenebutadiene (SBR), ethylenepropylenediene (EPDM), ethylenepropylene rubber (EPR), polyurethane (PUR), polymethacrylate (PMA), polyisobutylene (PIB), polyisobutylene-succinic acid (PIBSA) or polyisobutylene-succinic acid-polyacrylamide (PIBSA-PAM), or mixtures of these substances. It is also possible to conceive of using other similar organic polymers as a rubber component in the lubricating grease composition according to the invention. The content of rubber component in the lubricating grease composition according to the invention is advantageously between 0.05 and 4.5% by weight, and preferably between 0.5 and 3.0% by weight.

[0033] The lubricating grease composition according to the invention can also advantageously comprise one or more additive components of a type which is previously known per se. The additive component or components can consist of one or more different functional chemical additives which reinforce, improve or complement the basic properties of the lubricating grease composition. Examples of such additives are antioxidants, corrosion inhibitors, anti-abrasion agents and pressure tolerance-increasing additives of the type and chemical composition which is well known to the skilled person. Where appropriate, the total content of additive component(s) in the lubricating grease composition according to the invention is advantageously between 0.2 and 15% by weight, and preferably between 1 and 8% by weight.

[0034] Lubricating grease compositions according to the invention can be produced by means of manufacturing processes which are known per se and which will not, therefore, be described in detail in this present document. A typical process for manufacturing lubricating grease compositions is described, for example, in the previously mentioned patent specification EP 0 700 986 A2.

[0035] A typical manufacturing process for producing lubricating grease can, for example, but not necessarily, comprise the following main steps:

- mixing polymer components while heating and/or with the use of suitable solvents,

- mixing the polyolefin component with the base oil component and any additive components,
- using a protective atmosphere in order to avoid oil oxidation,
- heating to a temperature which is higher than the melting point of the polyolefin component,
- cooling down rapidly to room temperature or lower (quenching).

[0036] In this context, the rubber component can be added, together with other components, during the first step of the process. Alternatively, the rubber component can be added after the last step of the process, in connection with the mixture being homogenized. As has previously been mentioned, early addition of the rubber component gives rise to a final product having high cohesion whereas late addition of the rubber component gives rise to increased adhesion properties.

EXAMPLE 1:

[0037] TABLE 1 below shows the composition of a first preferred embodiment (A) of a lubricating grease composition according to the invention which is composed to give low oil bleeding.

TABLE 1

Lubricating grease composition A		
COMPONENT	TYPE	% BY WEIGHT
Polyolefin	polypropylene (Mw: $\approx 90,000$)	10.0
Rubber	EPDM	2.5
Base oil	mineral oil (kinematic visc. (100°C): 85 mm ² /s)	81.5
Additive	conventional additives which are well known to the skilled person	6.0
- antioxidant		
- anti-abrasion		
- corr. inhibitor		

[0038] TABLE 2 below shows the composition of a second preferred embodiment of a lubricating grease composition according to the invention. In this case, the lubricating grease composition B has been composed in order to give a relatively high oil bleeding.

TABLE 2

Lubricating grease composition B		
COMPONENT	TYPE	% BY WEIGHT
Polyolefin	polypropylene (Mw: $\approx 90,000$)	10.0
Rubber	BR	2.5
Base oil	mineral oil (kinematic visc. (100°C): 85 mm ² /s)	81.5
Additive	conventional additives which are well known to the skilled person	6.0
- antioxidant		
- anti-wear		
- corr. Inhibitor		

[0039] While the types of additive component which may possibly be used are not critical when implementing the present invention, they must be selected on the basis of what the particular application requires. Selecting suitable additive components for a specific application should not present the skilled person with any difficulty.

[0040] The additive components which are used in the lubricating grease compositions A and B are chemical com-

pounds of a type which is well known to the skilled person.

[0041] The results from a laboratory evaluation, carried out using test methods which are recognized for the purpose, of lubricating these compositions A and B, which were produced in a pilot plant, are recorded in TABLE 3 below.

[0042] As has been previously mentioned, the attached Figure 1 shows the results from measurements of oral separation carried out on the said lubricating grease compositions A and B while the attached Figure 2 shows the results from additional measurements of oil separation made on lubricating grease composition A.

[0043] If the skilled person should wish to make a comparison between the measurement results for lubricating grease compositions A and B according to the invention, as shown in TABLE 3 or in Figures 1 and 2, and results obtained with previously known lubricating grease compositions, he should be able to make use of some of the results which are given in the patent specifications which are mentioned in this present document in connection with describing the prior art.

TABLE 3

TEST	METHOD	LUBRICATING GREASE COMPOSITION (according to the invention)	
		A	B
Penetration, 60 strokes	DIN ISO 2137	290	300
Penetration, 5000 strokes	DIN ISO 2137	310	320
Penetration, 100,000 strokes	DIN ISO 2137	325	330
Penetration after *) SRS at 50 h/80°C	ASTM D 1831	330	330
R2F A at 90°C	DIN 51806	approved	approved
Oil separation at 40°C	DIN 51817	2.4%	8.3%
Kin. Viscosity at 40°C	ASTM D 446	85 mm ² /s	85 mm ² /s
Drop point	DIN ISO 2176	147°C	147°C

*) SRS: Shell Roll Stability

[0044] Incidentally, some of the test methods used in this present document are described in the previously mentioned patent specification EP 0 700 986 A2.

[0045] The measurement results shown in the attached Figure 1 derive from a modified measurement carried out on lubricating grease compositions A and B using the FTM 791/391.2 method of measurement, with the measurement continuing for a good 2 weeks instead of the customary 1 week.

[0046] The measurement results which are shown in the attached Figure 2 derive from measurements carried out in accordance with DIN 51817, at two different temperatures, i.e. 25°C and 40°C, on lubricating grease composition A.

[0047] The test methods which were used in the laboratory evaluation of lubricating grease compositions A and B according to the invention should otherwise be evident from the standard methods given in TABLE 3.

[0048] As is evident from TABLE 3 and the attached Figure 1, the degree of oil bleeding in the case of lubricating grease composition A according to the invention is substantially lower than that in the case of lubricating grease composition B according to the invention, i.e. the degree of oil bleeding can be regulated by the choice of the type of rubber.

[0049] It can also be seen from TABLE 3 that the lubricating grease compositions A and B according to the invention both exhibit good mechanical stability despite the fact that they behave differently with regard to oral separation.

[0050] The two lubricating grease compositions A and B according to the invention also exhibit good lubricating properties as measured in accordance with R2F A.

EXAMPLE 2:

[0051] In a second experimental series, a lubricating grease composition C according to the invention was prepared with the composition shown in TABLE 4 below.

TABLE 4

Lubricating grease composition C		
COMPONENT	TYPE	% BY WEIGHT
Polyolefin	Polypropylene (Mw: $\approx 90,000$)	13.5
Rubber	EPDM	1.5
Base oil 1	Mineral oil (kinematic visc. (40°C): 30 mm ² /s)	65.0
Base oil 2	Ester (kinematic visc. (40°C) : 30 mm ² /s)	15.0
Additive - antioxidant - anti-wear - corr. Inhibitor	Conventional additives which are well known to the skilled person	5.0

[0052] As can be seen from TABLE 4 above, lubricating grease composition C contains two different base oil components. Furthermore, the contents of the different components differ from those of the previously described lubricating grease compositions A and B.

[0053] The test results which were obtained when testing lubricating grease composition C are shown in TABLE 5 below.

[0054] As can be seen from the results recorded in TABLE 5, lubricating grease composition C exhibits very good properties with regard, for example, to lubricating ability (R2F), working life (R0f), noise level (SKF-BEQUIET), pumpability and stability (system 24, automatic lubrication).

TABLE 5

TEST	METHOD	LUBRICATING GREASE COMP. C (according to the invention)
Penetration, after 60 strokes	DIN ISO 2137	280
Penetration, after 10 ⁵ strokes	DIN ISO 2137	315
Penetration after SRS*)	ASTM D1831	325
R2F (110°C)	DIN 51806	Approved
R0F (10,000 rpm, 120°C)	SKF test method	L50 approx. 4000 h
Noise level (max. peaks)	SKF-BEQUIET	< 5 μ m/s
Oil separation, room temperature	DIN 51817	1.9%
Drop point	DIN ISO 2176	147°C
Pumpability	Lincoln-Helios	<-20°C
System 24 automatic lubr.	SKF test method	Excellent

*) Shell roll stability at 50 h/80°C

[0055] The present invention consequently makes it possible to regulate the properties of a lubricating grease composition, especially with regard to oral bleeding, by means of the choice of base oil or, especially, by means of varying the ratio between the rubber component and the polyolefin component. As has previously been mentioned, it is also possible to alter the properties of a lubricating grease composition by choosing when to add the rubber component during the manufacturing process.

[0056] In this connection, the polyolefin component or components can be said to supply crystalline parts of the finished lubricating grease composition according to the invention while the rubber component or components sup-

ply(supplies) amorphous parts.

[0057] Taken together, the polyolefin component and the rubber component gave rise to a structure which imparts a high degree of mechanical stability to the lubricating grease composition according to the invention. The proportion of amorphous and crystalline parts regulates the mechanical properties of the lubricating grease composition such as elasticity and film thickness and, in addition, with regard to the base or lubricating oil, its absorption ability and holding ability.

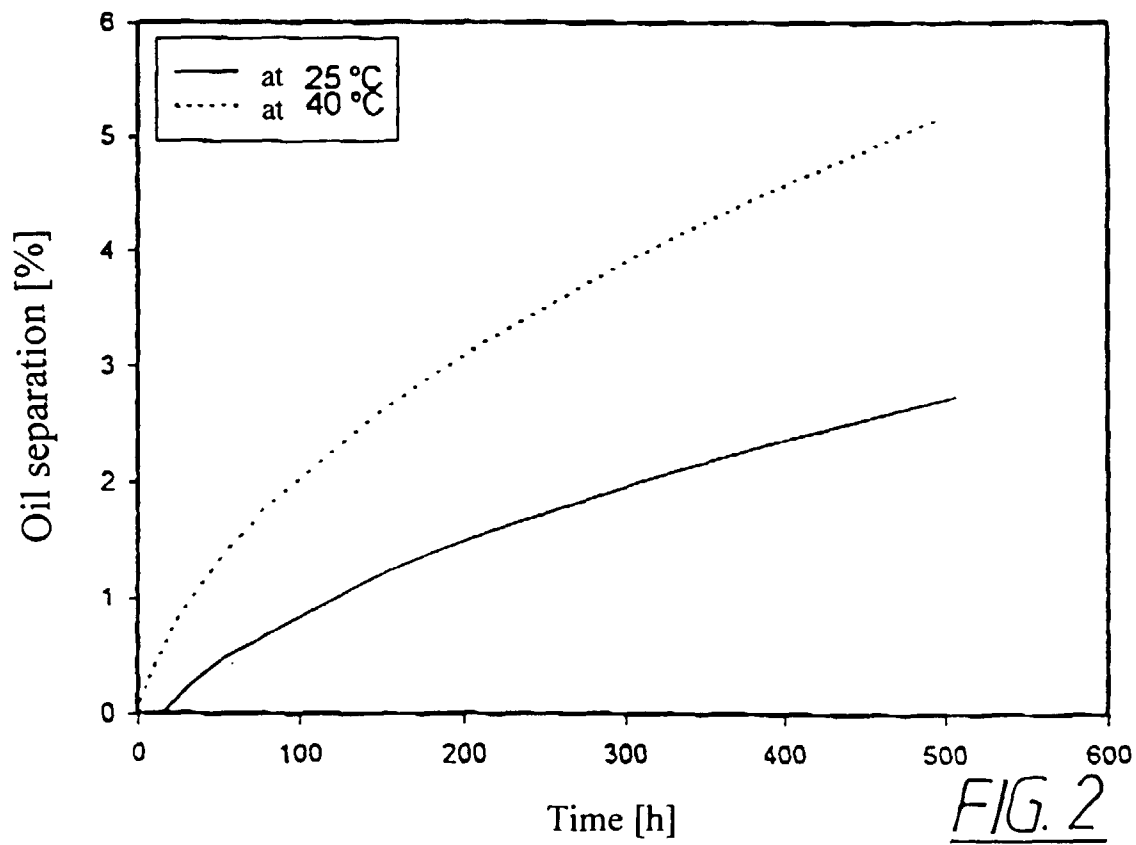
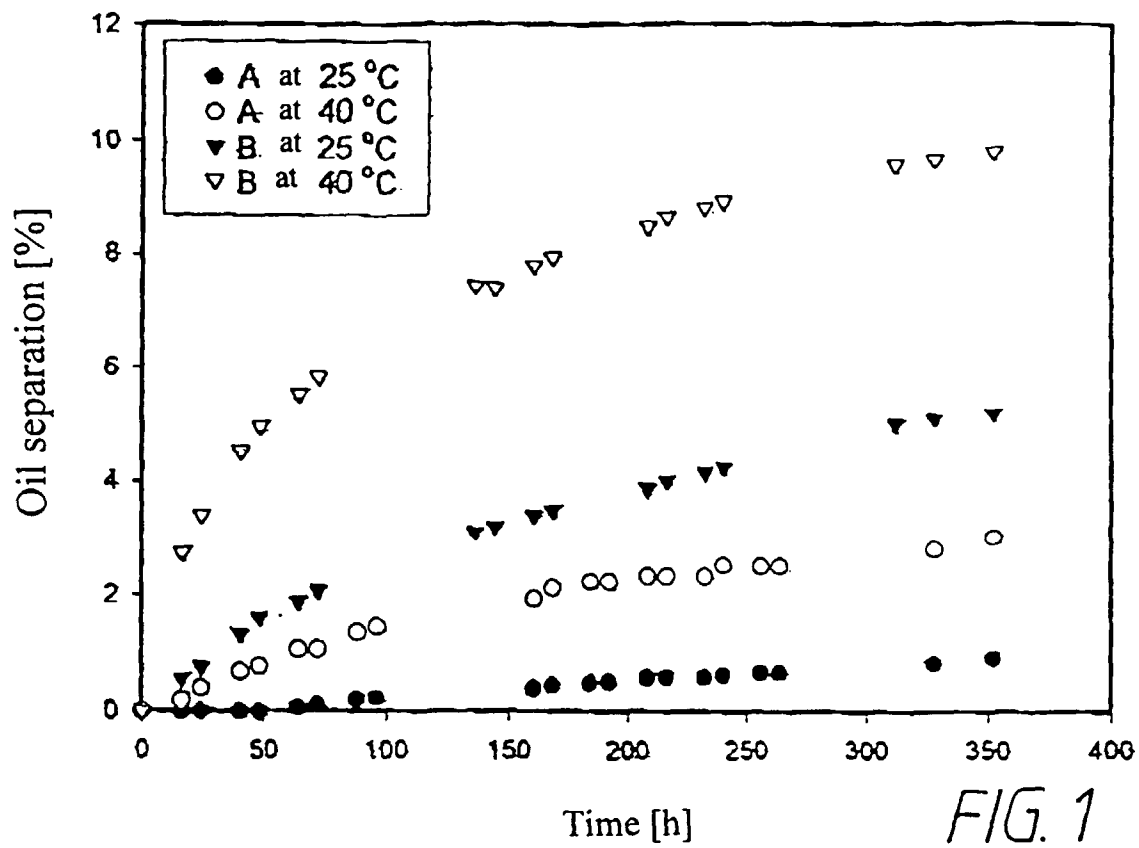
[0058] In addition, the noise properties of the lubricating grease composition according to the invention can be improved by the choice of type and content of rubber component. Other properties, such as working life, can also be improved greatly by adjusting the composition of the lubricating grease composition according to the invention.

[0059] The lubricating grease composition according to the invention provides the possibility of specially designing compositions for different lubricant classes, so-called NLGI classes.

[0060] It should be understood that the present invention is in no way limited to what has emerged in connection with the description of the preferred exemplary embodiment and that the scope of the invention is defined by the subsequent Patent Claims.

Claims

1. Lubricating grease composition, comprising at least one polyolefin component and at least one base or component, characterized in that the lubricating grease composition additionally comprises at least one rubber component.
2. Lubricating grease composition according to Patent Claim 1, characterized in that the rubber component or the rubber components comprise(s) an amorphous structure.
3. Lubricating grease composition according to Patent Claim 1 or 2, characterized in that the rubber component or the rubber components is/are selected from the group natural rubber, polyisoprene, polyisobutadiene, styrenebutadiene, ethylenepropylenediene, polyurethane, polymethacrylate, polyisobutylene, polyisobutylene-succinic acid or polyisobutylene-succinic acid-polyacrylamide.
4. Lubricating grease composition according to any one of Patent Claims 1 to 3, characterized in that the content of rubber component is between 0.05 and 4.5% by weight, and preferably between 0.5 and 3.0% by weight.
5. Lubricating grease composition according to any one of Patent Claims 1 to 4, characterized in that the content of polyolefin component is between 5 and 30% by weight, and preferably between 9 and 15% by weight.
6. Lubricating grease composition according to Claim 1 of Patent Claim 1 to 5, characterized in that the content of base oil component is between 60 and 90% by weight, and preferably between 75 and 88% by weight.
7. Lubricating grease composition according to any one of Patent Claims 1 to 6, characterized in that the lubricating grease composition additionally comprises at least one additive component which is selected from the group antioxidants, corrosion inhibitors, anti-wear agents or pressure tolerance-increasing additives, and in that the content of additive component in this context is between 0.2 and 15% by weight, and preferably between 1 and 8% by weight.
8. Lubricating grease composition according to any one of Patent Claims 1 to 7, in which the polyolefin component provides a mainly crystalline structure, characterized in that the ratio between the amorphous structure and the crystalline structure has been adjusted in order to regulate the mechanical properties of the lubricating grease composition and, with regard to the base oil component, its absorption ability and holding ability.
9. Use of a lubricating grease composition according to any one of Patent Claims 1 to 8 for lubricating bearings, couplings, toothed transmission gears, chutes or instruments, with the lubricating grease composition being chosen, in association with the use, on the basis of its properties selected from the group oil-bleeding properties, adhesion properties, working life, mechanical stability and noise properties.





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EUROPEAN SEARCH REPORT

Application Number
EP 98 85 0198.7

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.6)
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			TECHNICAL FIELDS SEARCHED (Int. Cl.6)
			C10M
The present search report has been drawn up for all claims			
Place of search STOCKHOLM		Date of completion of the search 24 June 1999	Examiner DAGMAR JÄRVMAN/EÖ
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO. EP 98 85 0198.7**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on 01/06/99
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