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GREASE COMPOSITION

John H. Wright, Waterford, N.Y., assignor to General Electric Company, a corporation of New York

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9 Claims. (Cl. 252—28)

This application is a continuation-in-part of my copending application, Serial No. 29,186, now abandoned, filed May 16, 1960, and assigned to the same assignee as the present invention.

This invention relates to improved organopolysiloxane grease compositions. More particularly, the present invention is concerned with organopolysiloxane grease composition which provide improved resistance to corrosion of metals with which the greases are in contact.

Organopolysiloxane greases and grease compositions are well known in the art and have been used as lubricants, dielectric compounds, sealing compounds and high vacuum greases. These organopolysiloxane greases have been particularly valuable because of their high degree of heat stability, their water repellency, their low viscosity-temperature characteristics, and dielectric properties. In many of their applications these greases are employed in contact with metal parts. While the greases themselves are not corrosive to metal parts it has been found that where the grease has been employed in contact with metal parts in oxidative atmospheres the grease offers less than the desired degree of protection of metal parts from the corrosive effects of the oxidative atmosphere. This has been particularly true when the metal parts were formed of copper, copper alloys or steel. In an attempt to solve this problem of inadequate protection of metal parts against corrosion it has been suggested in the art to employ additives in the grease composition. While many of these additives have served their purpose so far as corrosion inhibition is concerned these additives have been of a non-silicone nature and have had an adverse effect on the desirable characteristics, particularly the thermal characteristics, of the organopolysiloxane component of the grease compositions.

It is an object of the present invention to provide improved organopolysiloxane grease compositions which retain all the highly beneficial properties of heretofore known organopolysiloxane grease compositions and which contain a specific type of polysiloxane as an additive to provide increased corrosion resistance when the grease composition is applied to metallic surfaces, such as the surfaces of copper and steel.

This and other objects of my invention are accomplished by an improved organopolysiloxane grease composition containing a minor amount of methyl hydrogen polysiloxane units. It has been found that the presence of a minor amount of methyl hydrogen polysiloxane units in an organopolysiloxane grease composition provides markedly improved corrosion resistance to metal parts with which the grease composition is in contact without impairing the other valuable properties of such compositions.

The grease compositions of the present invention comprise (1) a polysiloxane fluid containing silicon-bonded organo groups selected from the class consisting of monovalent hydrocarbon radicals, halogenated monovalent hydrocarbon radicals and cyanoalkyl radicals, and in which fluid a minor portion of the silicon atoms contain a silicon-bonded hydrogen atom and (2) a grease thickening agent.

The fluid organopolysiloxanes employed in the practice of the present invention are well known in the art. These fluid polysiloxanes are of three general types. The first type may be characterized as a conventional organopolysiloxane fluid in which all of the valences of

silicon other than those satisfied by oxygen atoms are satisfied by monovalent organic radicals attached to silicon through a silicon-carbon linkage. These fluids are described generally in Patents 2,469,888 and 2,469,890, Patnode. This type of organopolysiloxane can be characterized as having the average formula:

$$(1) \qquad R_nSiO_{\frac{4-n}{2}}$$

where R represents a member selected from the class consisting of monovalent hydrocarbon radicals, halogenated monovalent hydrocarbon radicals, and cyanoalkyl radicals, and n has a value of from 2.004 to 2.4. Among the specific radicals represented by R in Formula 1 are alkyl radicals, e.g., methyl, ethyl, propyl, octyl, etc. radicals; aryl radicals, e.g., phenyl, naphthyl, tolyl, xylyl, etc. radicals; aralkyl radicals, e.g., benzyl phenylethyl, etc. radicals; alkenyl radicals, e.g., vinyl, allyl, etc. radicals; cycloaliphatic radicals, e.g., cyclohexyl, cycloheptyl, cyclohexenyl, etc. radicals; halogenated aliphatic radicals, e.g., chloromethyl, trifluoromethyl, chlorovinyl, etc. radicals; haloaryl radicals, e.g., chlorophenyl, dichlorophenyl, tetrachlorophenyl, dibromophenyl, chloronaphthyl, etc. radicals; and cyanoalkyl radicals, e.g., cyanomethyl, alpha-cyanoethyl, β-cyanoethyl, gamma-cyanopropyl, etc. radicals.

In the preferred embodiment of my invention the organopolysiloxane fluids within the scope of Formula 1 are those in which at least 50 percent of the organic radicals attached to silicon are methyl radicals. It should be understood that the viscosity of the organopolysiloxane fluid within the scope of Formula 1 will vary with the molecular weight of the fluid and with the nature of the silicon-bonded organic groups in the fluid. Although any organopolysiloxane fluid within the scope of Formula 1 is applicable in the process of the present invention it is preferred that the fluid have a viscosity of from about 10 centistokes to 100,000 centistokes when measured at 25° C.

It should be understood that the organopolysiloxane fluids of Formula 1 can include siloxane units of varied type and formulation, such as triorganosiloxane units and diorganosiloxane units alone or in combination with monoorganosiloxane units. The only requirement is that the ratio of the various siloxane units employed be selected so that the average composition of the copolymeric fluid is within the scope of Formula 1. It should be also understood that these various siloxane units may contain the same or different silicon-bonded organic radicals. For example, the siloxane units employed in preparing the fluid of Formula 1 can contain trimethylsiloxane units, methylphenylsiloxane units, diphenylsiloxane units, triphenylsiloxane units, methyl-β-cyanoethylsiloxane units, methylsiloxane units, phenylsiloxane units, β-cyanoethylsiloxane units, etc.

The second class of organopolysiloxanes employed in the practice of the present invention can be described as methyl hydrogen polysiloxanes and correspond to the formula:

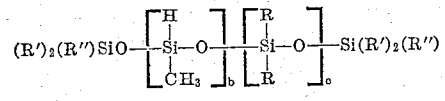
$$(2) \qquad (R')_2(R'')SiO\left[\begin{array}{c} H \\ | \\ Si-O \\ | \\ CH_3 \end{array}\right]_a Si(R')_2(R'')$$

where R′ represents members selected from the class consisting of methyl and phenyl, R″ represents a member selected from the class consisting of methyl, phenyl, and hydrogen, a has a value of at least 10, e.g., from 10 to 500 or more. Preferably, both R′ and R″ represent methyl groups. Many of these methyl hydrogen polysiloxanes and their method of preparation are described in Patent

2,491,843, Wilcock. Other methyl hydrogen polysiloxanes within the scope of Formula 2 are also well known in the art.

The third type of polysiloxane fluid employed in the practice of the present invention is a copolymer which contains both methyl hydrogen siloxane units and silicon atoms in which all of the valences of silicon other than those in the siloxane chain are satisfied by organic radicals attached to silicon through silicon-carbon linkages. These polysiloxane copolymers are also generally well known in the art, and are characterized by the formula:

(3)



where R, R', and R'' are as previously described and where *b* has a value of at least 1, e.g., from 1 to 500 or more; *c* has a value of at least 1, e.g., from 1 to 500 or more; and the sum of *b* plus *c* has a value of at least 10, e.g., from 10 to 500 or more.

One component of the grease compositions of the present invention are the grease thickening agents, which are well known in the art. This invention contemplates the use of any of these well known thickening agents to form a grease composition of the desired consistency. The term "grease" as employed in the present application is intended to refer to grease-like materials which may have consistencies varying from readily flowable materials to materials which exhibit almost no flow. The consistency of the greases of the present invention depend on the amount of thickening agent employed, the type of thickening agent employed and the particular polysiloxane fluids in the grease. Examples of suitable thickening agents include the metallic salts of fatty acids of at least 8 carbon atoms where the metals in such salts include aluminum, lead, zinc, manganese, lithium, sodium, potassium, calcium, barium, strontium copper, mercury, bismuth, chromium, iron, cobalt, nickel etc. The use of many of such metal salts are disclosed in U.S. Patents 2,456,642 and 2,599,984. Metallic salts of shorter chain length fatty acids such as acids containing from 2 to 6 carbon atoms as well as hydroxy-substituted fatty acids and hydroxy-substituted fatty acid glycerides such as are disclosed in Patents 2,551,931 and 2,508,741 may also be employed as thickening agents.

Other specific metallic salts which can be used as thickening agents in the practice of the present invention include lithium-2-ethylhexoate, lithium hydroxy stearate, lithium myristate and lithium caprate. Another suitable thickening agent is phthalocyanine.

In addition to metal salts, the compositions of the present invention may employ as grease thickening agents finely divided inert oxides of metallic and quasi-metallic materials such as silica, alumina, iron oxide, titani, and zinc oxides. Silica, when used as a thickening agent, is preferably employed as an aerogel, but may also be employed as fumed silica, precipitated silica, or natural deposits such as diatomaceous earth.

In addition to the relatively simple thickening agents described above, the invention of the present application contemplates the use of complex metal soaps such as aluminum benzoate stearate as described in Patent 2,599,553, acyl ureas such as octadecanoyl urea as described in Patent 2,698,300 and the phenylenediamides such as N,N-acetylstearoyl-p-phenylenediamides as described in Patent 2,709,157. In addition, a particularly useful group of thickening agents are the aromatic substituted ureas which are commonly referred to as ASU thickeners.

While, as explained above, the amounts of thickening agent employed in the grease compositions of the present

invention are not critical and may vary within wide limits depending on the particular consistency desired in the final product, it has been found that the amount of thickening agent usually varies from about 2 percent to 35 percent, and preferably from about 2 percent to 25 percent by weight, based on the weight of the polysiloxanes in the grease composition. One critical feature, however, of the grease composition of the present invention is the amount of methyl hydrogen polysiloxane units in the polysiloxane fluids. For satisfactory corrosion inhibition it has been found that the methyl hydrogen polysiloxane units must be present in an amount equal to from about 0.1 percent to 2 percent by weight, based on the weight of the polysiloxane fluids in the composition. When less than 0.1 percent by weight of the methyl hydrogen polysiloxane units is present, it is found that the resulting grease composition is ineffective to prevent corrosion when in contact with copper, copper alloy or steel surfaces. When the amount of methyl hydrogen polysiloxane units in the grease composition is in excess of 2 percent by weight, it is found that the methyl hydrogen polysiloxane units themselves actually cause corrosion of copper, copper alloy or steel surfaces with which the grease composition is in contact. For example, when a grease is prepared as suggested in the aforementioned Patent 2,491,843, Wilcock, employing only a methyl hydrogen polysiloxane and a thickening agent such as a metallic soap, it is found that copper surfaces with which the grease composition is in contact acquire a spotty black surface due to some unknown reaction between the copper surface and the methyl hydrogen polysiloxane. Similarly, when, as suggested by the aforementioned Wilcock patent, a composition comprising a major portion of the methyl hydrogen polysiloxane units and a minor portion of an organopolysiloxane within the scope of Formula 1 is prepared and compounded to a grease with a thickening agent, the resulting grease again causes corrosion of copper surfaces with which the grease is in contact. This same spotting or corrosion phenomenon is observed when as little as 3 percent by weight of methyl hydrogen polysiloxane units is employed in a grease formulation which contains a major portion of an organopolysiloxane within the scope of Formula 1. Thus, the critical requirement of the compositions of the present invention is that the composition contain from 0.1 to 2 percent by weight, based on the weight of the total polysiloxane fluids, of methyl hydrogen polysiloxane units.

There are a number of methods of incorporating methyl hydrogen siloxane units into the polysiloxane fluids employed in preparing the grease compositions of the present invention. In the preferred embodiment of my invention the polysiloxane fluid is composed of a mixture of organopolysiloxanes within the scope of Formula 1 and methyl hydrogen polysiloxane fluids within the scope of Formula 2. In this embodiment of my invention the ratio of the organopolysiloxane fluids of Formula 1 to the methyl hydrogen polysiloxane fluids of Formula 2 are selected so that the methyl hydrogen polysiloxane units are present in the aforementioned critical amount of from about 0.1 to 2 percent by weight, based on the weight of the total polysiloxane fluids in the grease composition. In this preferred embodiment of my invention the composition comprises substantially from about 0.1 to 2.0 percent by weight of the methyl hydrogen polysiloxane fluid of Formula 2 and from about 2 to 25 percent by weight of a thickening agent, both based on the weight of the organopolysiloxane fluid of Formula 1.

In one modification of my invention the polysiloxane fluid can be composed of an organopolysiloxane fluid within the scope of Formula 1 together with the copolymer fluid of Formula 3. In this modification the relative proportions of the two polysiloxane fluids in the mixture are again selected so that the resulting mixture contains the critical concentration of from about 0.1 to

2 percent by weight, based on the weight of the polysiloxane fluids, of methyl hydrogen siloxane units.

In still another embodiment of my invention the polysiloxane fluid in the mixture can comprise only the organopolysiloxane copolymer of Formula 3, in which case the ratio of the methyl hydrogen siloxane units in the copolymer fluid of Formula 3 must initially be such that the methyl hydrogen silioxane units comprise from about 0.1 to 2 percent by weight of the total weight of the copolymer fluid.

Other modifications of the polysiloxane fluids employed in the practice of my invention will be obvious to those skilled in the art. For example, the polysiloxane fluids can comprise a mixture of the methyl hydrogen polysiloxane fluids of Formula 2 and the copolymer fluids of Formula 3, or the fluid can comprise a mixture of the organopolysiloxane fluids of Formula 1, the methyl hydrogen polysiloxane fluids of Formula 2, and the copolymer fluids of Formula 3, so long as the resulting polysiloxane fluid contains the aforestated ratio of ingredients so as to provide from about 0.1 to 2 percent by weight of methyl hydrogen siloxane units, based on the total weight of the polysiloxane fluids in the grease composition of the present invention.

The grease compositions of the present invention can be prepared in conventional fashion by merely mixing the polysiloxane fluids and the thickening agent in conventional mixing or milling equipment. Especially satisfactory results have been obtained when the composition has been mixed on a conventional paint mill or on a conventional colloid mill.

Other additives can be present in the compositions of this invention, if desired. For example, the incorporation of pigments and additives for improving the lubricity of stability of greases is within the scope of this invention. The addition of many such materials is described in the art.

The following examples are illustrative of the practice of my invention and are not intended for purposes of limitation. In each case, the grease composition is prepared by adding the polysiloxane fluids and the thickening agent to a paint mill. The mixture is then milled until a uniform product is obtained. The corrosion resistance of each composition was determined by applying a coating of the composition to a freshly cleaned, sanded and polished copper strip which was then immersed in water maintained at a temperature of 70° C. and kept in the water until the corrosion was observed. The corrosion showed itself when the copper strip had noticeably discolored as compared to a fresh copper strip. When a copper strip was placed in the water without any grease composition coating, the copper strip discolored in four hours.

EXAMPLE 1

In this example a number of grease compositions were prepared employing a trimethylsilyl chain-stopped dimethylpolysiloxane having a viscosity of 300 centistokes when measured at 25° C. as the base fluid and with each grease composition containing 10 percent by weight, based on the weight of the aforementioned fluid of a finely divided silica aerogel as a thickening agent. One portion of this grease was retained as a control to which no inhibitor was added and the remaining portion of this composition was modified by the addition thereto of various percentages of a methyl hydrogen polysiloxane fluid having a viscosity of about 20 centistokes when measured at 25° C. and which comprised a trimethylsilyl chain-stopped methyl hydrogen polysiloxane containing an average of about 40 dimethyl hydrogen siloxane units per molecule. In the table below are listed the various percentages of methyl hydrogen polysiloxane fluid based on the weight of the trimethylsilyl chain-stopped dimethylpolysiloxane and the results of the corrosion tests described above.

Table I

Run No.	Weight Percent Methyl Hydrogen	Results
1	None	Discolored in 18 hours.
2	0.05	Discolored in 24 hours.
3	0.1	Clean after 100 hours.
4	0.5	Do.
5	1.0	Do.
6	2.0	Do.
7	3.0	Discolored in 48 hours.
8	50	Discolored in 30 hours.
9	98	Do.

As is shown by the foregoing table, the grease composition which did not contain the methyl hydrogen polysiloxane discolored in 18 hours. The composition containing 0.05 percent by weight of the methyl hydrogen polysiloxane was not significantly better since it discolored in 24 hours. In contrast to this, compositions within the scope of the present invention which contained 0.1 and 0.5 percent by weight of the methyl hydrogen polysiloxane were still satisfactory after 100 hours. When the amount of methyl hydrogen polysiloxane employed is greater than the amount specified within the scope of the present invention, it is seen that the corrosion inhibition falls drastically. When other types of conventional corrosion inhibitors were added to a grease composition in place of applicant's methyl hydrogen polysiloxane, the results were again unsatisfactory. For example, when a nonylphenyl was added to the composition, the copper strip had discolored in 72 hours. With any of the following prior art corrosion inhibitors, the copper test strips discolored in less than 50 hours. This result was observed with ethylene diamine tetraacetic acid and the di, tri, and tetra sodium salts of this acid, 2,6-di-t-butylhydroquinone, anthraquinone, 2-amino anthraquinone, 2,3-dichloro-1,4-napthaquinone, dichlorohydroquinone, 3,5-dimethyl phenol, and zinc naphthenate.

EXAMPLE 2

A methylchlorophenylpolysiloxane fluid within the scope of Formula 1 was prepared which contained an average of 2.22 methyl groups per silicon atom and 0.03 chlorophenyl groups per silicon atom with each phenyl group containing an average of about 4 chlorine atoms. This fluid had a viscosity of about 70 centistokes at 25° C. A number of grease compositions were prepared from this fluid by adding to the fluid 30 percent by weight, based on the weight of the fluid, of lithium-2-ethylhexoate and varying amounts of a methyl hydrogen polysiloxane fluid within the scope of Formula 2 which contained an average of 1,000 methyl hydrogen siloxane units per molecule and which had a viscosity of 1,000 centistokes at 25° C. In the table below are the results obtained from these grease formulations in the copper corrosion test described above.

Table II

Run No.	Weight Percent Methyl Hydrogen	Results
10	None	Discolored in 12 hours.
11	0.05	Discolored in 18 hours.
12	0.1	Clean after 100 hours.
13	1.0	Do.
14	2.0	Do.
15	3.0	Discolored in 24 hours.

When the greases of Runs Nos. 10 and 13 were applied to a low carbon steel panel and given the corrosion test described above, discoloration of the panel coated with the grease of Run No. 10 was observed in 30 hours. The panel coated with the grease of Run No. 13 was clean after 100 hours.

EXAMPLE 3

A methylphenylpolysiloxane fluid was prepared which comprised a trimethylsilyl chain-stopped copolymer containing dimethylsiloxane units and methylphenylsiloxane units. The ratio of dimethylsiloxane units to methylphenylsiloxane units in this copolymer was three to one and the viscosity of the fluid was 500 centistokes at 25° C. A grease was prepared by compounding this fluid with 10 percent by weight of an aromatic-substituted urea (ASU) thickening agent based on the weight of the fluid and varying percentages of the methyl hydrogen polysiloxane described in Example 1. The results of these various greases in the copper corrosion test were comparable to those of Examples 1 and 2 in that no discoloration of the test strips was observed at the end of 100 hours when the methyl hydrogen polysiloxane was present in the range of from 0.1 to 2 percent by weight, while discoloration was observed in less than 50 hours when either less or more than this amount of methyl hydrogen polysiloxane was employed.

EXAMPLE 4

A trimethylsilyl chain-stopped copolymer of 10 mole percent methyl-β-cyanoethylsiloxane units, 80 mole percent dimethylsiloxane units and 10 mole percent diphenylsiloxane units was prepared. This fluid had a viscosity of 25 centistokes when measured at 25° C. When a grease was prepared by adding 15 percent by weight, based on the weight of the fluid, of a silica aerogel to this fluid and varying amounts of the methyl hydrogen polysiloxane of Example 2, it was found that comparable results were obtained in the copper corrosion tests. In addition, it was found that when less than 0.1 percent by weight of the methyl hydrogen polysiloxane was employed in this fluid and a low carbon steel strip was substituted for the copper strip in the corrosion test, discoloration occurred in less than 50 hours. When the amount of methyl hydrogen polysiloxane was within the range of 0.1 to 2 percent by weight, based on the weight of the fluid, no discoloration of the steel was observed at the end of 100 hours.

EXAMPLE 5

A methyl hydrogen siloxane-dimethyl siloxane copolymer fluid which was chain-stopped with trimethylsilyl units was prepared by hydrolyzing and condensing a mixture of methyl hydrogen dichlorosilane, dimethyldichlorosilane and trimethylchlorosilane in a conventional fashion. The proportions of the various chlorosilanes were selected so that the resulting polysiloxane fluid contained 0.5 percent by weight, methyl hydrogen siloxane units, based on the weight of the fluid, and had a viscosity of about 25 centistokes when measured at 25° C. This resulted in a trimethylsilyl chain-stopped material which, on the average, was a copolymer of methyl hydrogen siloxane units and dimethyl siloxane units. A silicone grease was prepared from this fluid by mixing 10 parts by weight of a finely divided silica aerogel as a thickening agent to 100 parts of the fluid. When this grease was given the corrosion test described above, it was found that the copper strip was clean at the end of 100 hours of test.

EXAMPLE 6

Following the procedure of Example 5, trimethylsilyl chain-stopped copolymers of dimethyl siloxane units and methyl hydrogen siloxane units, having a viscosity of about 25 centistokes at 25° C., were prepared to contain 1.0, 5.0, 10.0 and 20.0 percent by weight, methyl hydrogen polysiloxane units. Greases were made with these fluids by adding an amount of each fluid to a 300-centistoke trimethylsilyl chain-stopped dimethyl polysiloxane sufficient to provide 0.5 percent by weight, methyl hydrogen siloxane units based on the weight of the fluid mixture. Each of the greases contained 10 percent by weight, based on the weight of the fluids, of a finely divided silica aerogel as a thickening agent. Each of these greases was subjected to the previously described copper corrosion test and each test piece was found to be clean at the end of 100 hours of test.

While the foregoing examples have illustrated certain of the embodiments of the present invention, it should be understood that my invention is broadly applicable to the grease compositions containing methyl hydrogen polysiloxane units in an amount equal to from 0.1 to 2 percent by weight, based on the weight of the polysiloxane fluid in the grease. Any of the commonly known thickening agents can also be employed in the preparation of these grease compositions with the amount of grease thickener being controlled only by the desired consistency of the resulting grease. In addition to employing the greases of the present invention as corrosion inhibitors, it should also be understood that a number of these greases are also valuable as lubricating materials. This is particularly true of those greases which contain halogenated aryl groups attached to silicon through a silicon-carbon linkage such as the grease formulations described in Example 3 above.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A grease composition consisting essentially of (1) an organopolysiloxane fluid in which the organo groups are selected from the class consisting of monovalent hydrocarbon radicals, halogenated monovalent hydrocarbon radicals and cyanoalkyl radicals, (2) a trimethylsilyl chain-stopped methyl hydrogen polysiloxane fluid in an amount equal to from 0.1 to 2.0 percent by weight, based on the weight of (1), and (3) a thickening agent in an amount equal to from 2 to 25 percent by weight, based on the weight of (1).

2. The grease composition of claim 1 in which the thickening agent is a silica aerogel.

3. A grease composition consisting essentially of (1) a trimethylsilyl chain-stopped dimethylpolysiloxane fluid, (2) from 0.1 to 2.0 percent by weight, based on the weight of (1) of a trimethylsilyl chain-stopped methyl hydrogen polysiloxane, and (3) from 2 to 25 percent by weight, based on the weight of (1), of a thickening agent.

4. A grease composition of improved corrosion resistance consisting essentially of (1) a fluid organopolysiloxane having the formula

$$R_nSiO_{\frac{4-n}{2}}$$

where R represents a member selected from the class consisting of monovalent hydrocarbon radicals, halogenated monovalent hydrocarbon radicals and cyanoalkyl radicals and n has a value of from 2.004 to 2.4, inclusive, (2) from 0.1 to 2.0 percent by weight, based on the weight (1), of a methyl hydrogen polysiloxane fluid having the formula

$$(R')_2(R'')SiO\left[\begin{matrix}H\\|\\Si-O\\|\\CH_3\end{matrix}\right]_a Si(R')_2(R'')$$

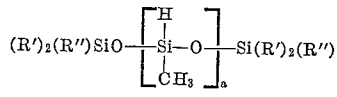
where R' represents members selected from the class consisting of methyl and phenyl, R'' represents a member selected from the class consisting of methyl, phenyl, and hydrogen, a is an integer equal to from 10 to 500, inclusive, and (3) from 2 to 25 percent by weight, based on the weight of (1), of a grease thickening agent.

5. A grease composition of improved corrosion resistance consisting essentially of (1) a fluid organopolysiloxane having the formula

$$R_nSiO_{\frac{4-n}{2}}$$

where R represents a member selected from the class consisting of monovalent hydrocarbon radicals, halogenated monovalent hydrocarbon radicals and cyanoalkyl radicals and n has a value of from 2.004 to 2.4, inclusive,

(2) from 0.1 to 2.0 percent by weight, based on the weight of (1), of a methyl hydrogen polysiloxane fluid having the formula



where R′ represents members selected from the class consisting of methyl and phenyl, R″ represents a member selected from the class consisting of methyl, phenyl and hydrogen, *a* is an integer equal to at least 10, and (3) from 2 to 25 percent by weight, based on the weight of (1), of a grease thickening agent.

6. A grease composition consisting essentially of (1) a polysiloxane fluid containing silicon-bonded organo groups selected from the class consisting of monovalent hydrocarbon radicals, halogenated monovalent hydrocarbon radicals and cyanoalkyl radicals, and in which fluid there is present from 0.1 to 2 percent by weight, based on the weight of said fluid of methyl hydrogen polysiloxane units and (2) from 2 to 35 percent by weight, based on the weight of (1) of a thickening agent.

7. The grease composition of claim 6 in which the thickening agent is a silica aerogel.

8. A grease composition consisting essentially of (1) an organopolysiloxane fluid in which the organo groups are selected from the class consisting of monovalent hydrocarbon radicals, halogenated monovalent hydrocarbon radicals, and cyanoalkyl radicals, (2) a trimethylsilyl chain-stopped copolymer of methyl hydrogen polysiloxane units and dimethyl-siloxane units in an amount sufficient to provide from 0.1 to 2 percent by weight, based on the weight of (1) and (2) of methyl hydrogen siloxane units, and (3) a thickening agent in an amount equal to from 2 to 25 percent by weight, based on the weight of (1) and (2).

9. A grease composition in accordance with claim 8 in which the thickening agent is a silica aerogel.

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