United States Patent

Brenner

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[54] LUBRICANT COMPOSITIONS

[72] Inventor: **Bruce C. Brenner,** Midland, Mich.

[73] Assignee: **Dow Corning Corporation,** Midland, Mich.

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[52] **U.S. Cl.** .....**252/49.6,** 252/56 D, 252/78

[51] **Int. Cl.** **C10m 1/50**

[58] **Field of Search**.....252/49.6, 56 D, 78

[56] **References Cited**

UNITED STATES PATENTS

2,133,734	10/1938	Moser	252/56 D X
2,471,850	5/1949	Wilcock	252/49.6
2,823,218	2/1958	Speier et al.	252/78 X
2,970,150	1/1961	Bailey	252/78 X
3,291,736	12/1966	Buehler et al.	252/49.6

Primary Examiner—Daniel E. Wyman
Assistant Examiner—W. Cannon
Attorney—Robert F. Fleming, Jr., Laurence R. Hobey, Harry D. Dingman and Howard W. Hermann

[57] **ABSTRACT**

The lubrication characteristics of alkylmethylpolysiloxanes in which the alkyl radical contains from six–18 carbon atoms are improved by the addition of from about 0.1 to 3 weight percent dodecenyl succinic acid anhydride.

7 Claims, No Drawings

LUBRICANT COMPOSITIONS

This invention relates to an improved lubricant composition. In one aspect, the invention relates to the use of dodecenyl succinic acid anhydride as a lubricant additive in certain diorganopolysiloxane fluids.

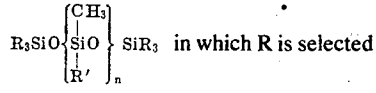
Substituted succinic anhydrides and their derivates have been known for some time and it has been known that these compounds are useful in lubricants. As disclosed in U.S. Pat. No. 2,890,170, this utility has been predicated on the rust-preventing or corrosion-inhibiting properties of this class of compounds. The instant invention resides in the discovery that one member of this class of compounds, dodecenyl succinic acid anhydride, acts as a lubricity additive when combined with alkylmethylpolysiloxanes.

Thus, it is an object of the invention to provide an improved silicone lubricant.

It is another object of the invention to provide an organosiloxane fluid composition suitable for use as a hydraulic fluid.

These and other objects of the invention will be apparent to one skilled in the art upon consideration of the following disclosure.

In accordance with the invention, there is provided a lubricant composition consisting essentially of (a) 97 to 99.9 percent by weight of a fluid organopolysiloxane having a viscosity of from 5 to 500 c.s. (centistokes) as measured at 77° F. and being of the formula



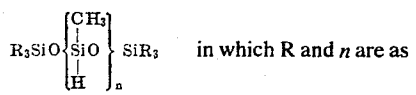
in which R is selected from the group consisting of alkyl radicals of from one to 18 inclusive carbon atoms, the phenyl radical and alkaryl radicals of no more than 10 carbon atoms, at least one R radical being a methyl radical; R′ is an alkyl radical containing from six to 18 inclusive carbon atoms and *n* has a value of from 1 to 20 inclusive and (b) 0.1 to 3 percent by weight of dodecenyl succinic acid anhydride.

As described above, the R substituents can be an alkyl radical, such as methyl, ethyl, hexyl, octyl, dodecyl or octadecyl radical; the phenyl radical, or an alkaryl radical of no more than 10 carbon atoms such as the phenylethyl or 2-phenylpropyl radical. The R substituents form the endblocking groups of the polymeric chain, and it is required that at least one R substituent on each of the terminal silicon atoms be a methyl group. The preferred organosiloxanes are those which are trimethylsilyl-endblocked; i.e., where all of the R radicals are methyl radicals.

The R′ substituents are alkyl radicals including both straight- and branched-chain radicals, such as hexyl, octyl, 2-ethylhexyl, decyl, dodecyl, heptadecyl, octadecyl and the like. The octyl and decyl radicals are preferred for fluid applications requiring relatively low viscosity such as hydraulic fluids.

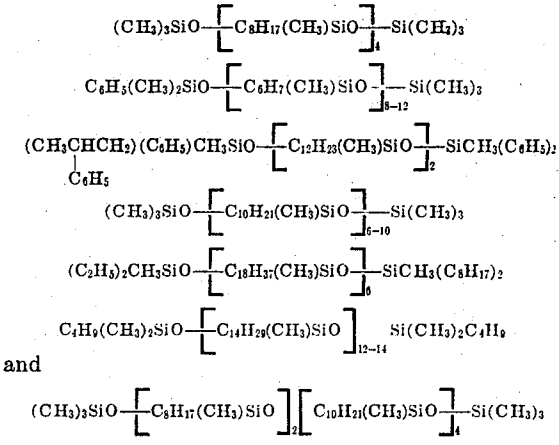
The polymeric chain length, as defined by the value of *n*, also has an effect on the viscosity of the fluid. For low viscosity fluid applications, it is preferred that *n* have a value of from 2 to 10 while in other lubrication applications higher viscosity fluid, such as obtained when *n* has a value from 16 to 18, is preferred. The fluid is required to have a viscosity with a range of from 5 to 500 c.s. in order that the enhancement of lubrication properties be observed.

The above-described organosiloxanes are readily prepared by the reaction of one or more olefinic hydrocarbons with Si-H functional organopolysiloxanes. The olefinic hydrocarbons are specifically alpha-olefins of the formula $CH_2 = CHR''$ in which R″ is an alkyl radical of from four to 16 carbon atoms. The organopolysiloxane reactant can be described as having the formula



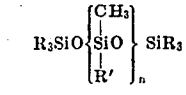
in which R and *n* are as previously defined. These triorganosilyl-terminated methylhydrogenpolysiloxanes are well known in the art. The reaction between the alpha-olefin and the methylhydrogenpolysiloxane can be carried out in the presence of a conventional SiH-olefin addition catalyst such as the chloroplatinic acid catalyst described in U.S. Pat. No. 2,823,218. Mixed olefins and mixed methylhydrogensiloxanes can be used in the reaction. Thus, the fluid may be a homopolymer wherein *n* varies or it can be a copolymer wherein the R′ substituents are different.

Exemplary of the fluids utilized in the practice of the invention are



The lubricant additive, dodecenyl succinic acid anhydride, is mixed with the alkylmethylpolysiloxane in an amount sufficient to provide at least about 0.1 weight percent of the additive in the lubricant composition. Additive amounts greater than 3 weight percent can be utilized in the practice of the invention, but as a practical matter, the compositions containing these higher amounts of additive do not show proportionate increase in lubricity. The dodecenyl succinic acid anhydride is unique in improving the steel on steel lubricity of the defined alkylmethylpolysiloxanes. Closely related compounds, such as ethyldodecenylhydrogensuccinate, do not impart the improved lubricity, nor is the improved lubricity observed in alkylmethylsiloxanes when the alkyl radical (R′) contains more or less than the defined number of carbon atoms.

A preferred embodiment of the invention resides in a lubricant composition consisting essentially of (a) from 97 to 99.9 weight percent of an alkylmethylpolysiloxane having a viscosity of from 5 to 100 c.s. when measured at 77° F. and being of the formula



in which R is selected from the group consisting of the methyl radical, the phenyl radical and the 2-phenylpropyl radical, at least one R being a methyl radical; R′ is an alkyl radical of from six to 10 carbon atoms and *n* has a value of 1 to 10 inclusive and (b) 0.1 to 3 weight percent dodecenyl succinic acid anhydride. This preferred composition has specific utility as hydraulic fluid and is particularly useful as a brake fluid. Thus, it is within the scope of the present invention to provide a method of transmitting power comprising applying pressure to the preferred fluids while the fluids are confined in a hydraulic system.

Reasonable modification and variation, such as the addition of pigments, antioxidants and viscosity improvers to the lubricant compositions, are within the scope of the present invention. The following examples are illustrative and not to be construed as limiting the invention which is claimed.

EXAMPLE 1

A mixture of 236 grams of $(CH_3)_3SiO\text{+}(CH_3)HSiO\text{+}_4Si(CH_3)_3$ (2.35 moles = SiH) and 0.1 cc. of chloroplatinic acid (0.1 mole in isopropanol) was placed in a flask and heated to 100° C. Octene-1 (316.8 grams – 2.83 moles) was added with stirring at a rate sufficient to maintain the reaction at about 150° C. After the dropwise addition of octene-1 was complete, the stirred reaction mixture was heated for 2 hours at 150° C. After cooling the adduct to below 100° C., the excess octene-1 was stripped from the product by heating under vacuum (1 mm Hg) for 1 hour at 170° C. The product,

$(CH_3)_3SiO\text{+}C_8H_{17}(CH_3)SiO\text{+}_4Si(CH_3)_3$ had a viscosity of 15.5 c.s. at 77° F. a flash point of 470° F. and a pour point of less than −75° C.

EXAMPLE 2

Alkylmethylpolysiloxanes were prepared by the method described in Example 1. Fluid A was of the formula $(CH_3)_3SiO\text{+}C_8H_{17}(CH_3)SiO\text{+}_{1-4}Si(CH_3)_3$ and had a viscosity of 16 c.s. as measured at 77° F. Fluid B was of the formula $(CH_3)_3SiO\text{+}C_8H_{17}(CH_3)SiO\text{+}_{3-10}Si(CH_3)_3$ and had a viscosity of 25 c.s. as measured at 77° F. Varying amounts of dodecenyl succinic acid anhydride were added to the fluids. The lubrication properties of the additive-fluid mixtures were determined by the Shell four-Ball method. In this test, a ½-inch-steel ball was rotated against three stationary ½-inch-steel balls at a rate of 600 r.p.m. at a temperature of 167° F. under a load of 40 kilograms for 1 hour. At the end of this time, the length and width of the scar formed on each stationary ball was measured and the average of these six measurements was recorded as the "wear scar diameter". The small the wear scar, the better the lubricant. Results are given below:

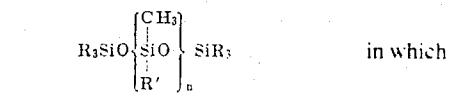
Lubricant Composition		Wear Scar Diameter (mm)
Fluid	Weight % Additive	
A	none	1.65
A	0.5	0.75
A	3.0	0.77
B	none	1.21
B	0.1	0.65
B	0.5	0.57

These data demonstrate the effectiveness of dodecenyl succinic acid anhydride as a lubricity additive for fluid alkylmethylpolysiloxanes.

That which is claimed is:

1. A lubricant composition consisting essentially of

a. 97 to 99.9 percent by weight of a fluid organopolysiloxane having a viscosity of from 5 to 500 c.s. as measured at 77° F. and being of the formula



in which

R is selected from the group consisting of alkyl radicals containing from one to 18 inclusive carbon atoms, the phenyl radical and alkaryl radicals of no more than 10 carbon atoms, at least one R radical being a methyl radical;

R′ is an alkyl radical containing from six to 18 inclusive carbon atoms and

n has a value of from 1 to 20 inclusive; and

b. 0.1 to 3 percent by weight of dodecenyl succinic acid anhydride.

2. The lubricant of claim 1 wherein all of the R substituents are methyl radicals.

3. The lubricant of claim 2 wherein *n* has a value of from 1 to 10.

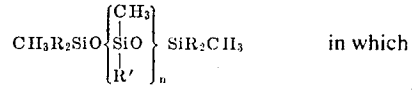
4. The lubricant of claim 3 wherein the R′ substituent is an alkyl radical containing from six to 10 inclusive carbon atoms.

5. The lubricant of claim 4 wherein the fluid organopolysiloxane is of the formula

$(CH_3)_3SiO\text{+}C_8H_{17}(CH_3)SiO\text{+}_nSi(CH_3)_3$.

6. A method of transmitting power comprising applying pressure to a composition consisting essentially of

a. 97 to 99.9 weight percent of an alkylmethylpolysiloxane having a viscosity of from 5 to 100 c.s. as measured at 77° F., said polysiloxane being of the formula



in which

R is selected from the group consisting of methyl, phenyl and 2-phenylpropyl radicals,

R′ is an alkyl radical containing from six to 10 carbon atoms and

n has a value of from 1 to 10; and

b. from 0.1 to 3 weight percent dodecenyl succinic acid anhydride;

said composition being confined in a hydraulic system.

7. The method of claim 6 wherein the siloxane is of the formula

$(CH_3)_3SiO\text{+}C_8H_{17}(CH_3)SiO\text{+}Si(CH_3)_3$.

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