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LOW TEMPERATURE GREASE

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This invention relates to novel compositions, particularly lubricating greases, and particularly such as are suitable for lubricating machinery at very low temperatures, and to methods of preparing and using such lubricants.

Most commercial greases are unsatisfactory for use at low temperatures where hydrocarbons are handled, since such greases dissolve in the hydrocarbon. Low temperature lubricants consisting essentially of hydrocarbon materials tend to dissolve in the hydrocarbons being treated. Also some greases which contain alcohols are unsuitable for handling certain types of materials such as boron fluoride, aluminum chloride or other Friedel-Crafts catalysts, such as are used for low temperature polymerization reactions.

One object of the present invention is to make a grease which will remain soft at very low temperatures, such as —100° F. or —140° F., and which will satisfactorily lubricate bearings, stuffing boxes, etc., in machinery operating at such low temperatures, and particularly for processes involving light hydrocarbons, such as propane, ethane, ethylene and methane, with or without the presence of Friedel-Crafts catalysts, such as mentioned above. Another object of the invention is to prepare such low temperature lubricants from ingredients which will still satisfactorily lubricate such low temperature machinery even if a substantial proportion of hydrocarbon constituents of the grease are removed. These and other objects and advantages of the invention will appear from the following description.

Broadly, the invention comprises incorporating a hydrocarbon insoluble grease-forming metal soap into a low freezing point liquid vehicle such as petroleum hydrocarbons boiling below the kerosene boiling range, such as the various naphthas and gasolines. Such hydrocarbon liquids should generally consist of hydrocarbons having about 4–10 carbon atoms, and preferably 5–8 carbon atoms. Such liquids are produced commercially in various modifications.

The boiling range and A. S. T. M. pour point of a number of such commercially available light hydrocarbon liquids are given in the following table:

Hydrocarbon liquid	Boiling range, °F.	Pour point, °F.
Solvent naphtha #3	140–210	Below —90
Solvent naphtha #4	165–235	Below —90
Solvent naphtha #6	190–280	Below —90
V. M. & P.[1] naphtha	230–310	Below —90
Solvesso[2] #1	200–275	Below —90
Solvesso[2] #2	275–350	Below —90
Varsol (a varnolene)[3]	305–390	Below —90
Esso (a commercial gasoline) for motor fuel	100–400	Below —90

[1] Varnish makers and painters.
[2] A refined aromatic extract of petroleum naphtha fraction.
[3] Varsol (varnolene) is a mineral spirit type of naphtha boiling within the boiling range of mineral spirits as defined in standard specification A. S. T. M. No. D235–39.

These liquids are all suitable for the purposes of this invention. Alcohol, which has a freezing point of about —152 to —155, can also be used.

The metal soap, which is the other main constituent of the low temperature lubricants of this invention, should be one which will serve as a satisfactory lubricant even if the major proportion, or even practically all, of the hydrocarbon constituent of the lubricant may be removed due to contact with the hydrocarbons being treated in the equipment being lubricated. Although it has been found that zinc stearate is a very satisfactory soap for the purposes of this invention, magnesium stearate is also suitable, and calcium stearate is fairly satisfactory. It is preferred to use soaps of metals of group II of the Mendeleeff Periodic Table. For instance, barium stearate may also be used. The acid radical of the soap is preferably a fatty acid and preferably a saturated fatty acid which will not react chemically with unsaturated hydrocarbons being treated in the equipment being lubricated nor be subject to polymerization or condensation due to the presence of Friedel-Crafts catalysts, such as mentioned above. Instead of preparing the soap from stearic acid, it may be made from synthetic acid made by the oxidation of paraffin wax or from acids derived from the non-drying vegetable or other fatty oils, or from fats.

The proportions in which the two above-described primary ingredients of the lubricant of this invention should be mixed will depend to some extent on the type of specific constituents being used and on the purpose for which the lubricant will be used. For instance, when using a varnolene as the liquid vehicle and zinc stearate as the soap, the amount of zinc stearate should be about 30–50% by weight and the varnolene about 70–50% but preferably the zinc stearate should be about 30–35% if the lubricating grease is to be used in a grease gun, and about 45–50% by weight if the grease is to be used in a grease cup. Generally the amount of metal soaps should be between the broader limits of about 20–60% by weight and the hydrocarbon liquid about 80–40% by weight. Also mixtures of various metal soaps may be used.

In carrying out this invention the soap, such as zinc stearate, may be mixed directly into the naphtha or other liquid hydrocarbon to be used, or if desired, the reverse procedure may be used, namely, by gradually mixing or milling the naphtha into the zinc stearate. Although heating is normally not necessary, the mixture may be heated, if desired, to a suitable temperature, such as up to about 100° F. or 150° F. or so, with or without refluxing under slight superatmospheric pressure to prevent undue volatilization of the hydrocarbon liquid in order to facilitate solution or dispersion of the soap in the hydrocarbon liquid.

In addition to the above two primary constituents, other addition agents may be used in minor amounts, such as dyes, anti-oxidants, pour depressors, etc.

The low temperature lubricants of this invention remain soft at temperatures of −100° F. and preferably even at substantially lower temperatures, such as −140° F. or lower. These lubricating greases preferably should have a penetration of at least 50 (using the standard A. S. T. M. procedure at 77° F.), and should have a consistency of less than 1500 on the consistometer at 77° F. or a Saybolt viscosity of at least about 500 sec. at 77° F. In non-technical terms, the consistency should be approximately between that of a library paste and that of milk of magnesia, or very slightly thinner. The consistency or fluidity varies directly with the proportion of liquid vehicle present in the mixture, and ordinarily if much more than 70% of a liquid, such as naphtha, is used, the mixture will be so thin that the zinc stearate will tend to settle out, as in the case of a mixture containing 20% of zinc stearate and 80% varnolene (heavy naphtha). Obviously such compositions which tend to settle out, especially at relatively warm temperatures, would only be suitable under circumstances in which they can be mixed thoroughly just before use. On the other hand, compositions containing more than 50% zinc stearate, for example, one containing 60% zinc stearate in a varnolene, are somewhat difficult to get properly mixed and also they are too stiff for most lubrication purposes; however, they may be used for particular applications where, for instance, a block grease might be used. The following table shows some of the physical properties, i. e., the pour point, consistency or penetration, and viscosity, of mixtures of zinc stearate in Varsol, which is a commercial varnolene (heavy naphtha) on the market, with various proportions of zinc stearate ranging from 10% to 60%.

	A. S. T. M. pour point, °F.	Consistency or penetration at 77° F.	Vis. at 77° F.
10% zinc stearate in Varsol (tends to settle out).	Below −90	[1] 2296	35.2
20% zinc stearate in Varsol (tends to settle out).	Below −70	[1] 2137	73.2
30% zinc stearate in Varsol.	Below −70	[1] 1119	1,506.7
40% zinc stearate in Varsol.	Below −60 (Soft at −70)	[1] 459	
50% zinc stearate in Varsol.		[2] 285	
60% zinc stearate in Varsol (difficult to get in solution).		[2] 15	

[1] A. S. T. M. consistency number (Test D-217-38T).
[2] Penetration, A. S. T. M. at 77° F.

The low temperature lubricants of this invention are especially suitable for the lubrication of bearings, stuffing boxes, cocks or valves, packing glands, etc., in equipment operating at low temperatures. They have been found especially useful for lubricating equipment used in the manufacture of butyl rubber, for which some of the equipment may be operated at temperatures as low as −140° F. For such lubrication of butyl rubber machinery, it is desirable to make the lubricating grease of a highly refined naphtha, such as a varnolene, which is substantially free from olefins. For some purposes, the grease may be applied in the form of a braided cotton or asbestos or other fibrous packing material impregnated with the grease.

The following examples will illustrate the invention:

Example 1

About 30% by weight of zinc stearate is mixed into about 70% by weight of a varnolene having a boiling range of about 400°–300° F. and being substantially free from olefins, and the resulting composition a consistency of a paste is used as a grease for lubricating equipment used in the manufacture of butyl rubber at low temperatures, as low as −140° F. This grease did not become hard at −140° F. Although during such use a large proportion of the varnolene liquid was removed from the grease, the residual wax stearate, still containing a small amount of hydrocarbon liquid, gave satisfactory lubrication.

Example 2

About 45–50% by weight of wax stearate was mixed with a varnolene similar to that used in Example 1, and the resulting grease was used to fill grease cups in machinery being used for the manufacture of butyl rubber. This grease gave very satisfactory service.

Example 3

About 30–35% by weight of magnesium stearate was incorporated in a varnolene and produced a satisfactory low temperature lubricating grease.

Example 4

Example 3 was repeated, except calcium stearate was substituted in place of the magnesium stearate. Although the product was not quite as good as the product of Example 3, it gave fairly satisfactory results.

It is not intended that this invention be limited to the specific materials which are recited merely for the sake of illustration, but only by the appended claims in which it is intended to claim all novelty inherent in the invention as well as all modifications coming within the scope and spirit of the invention.

We claim:

1. A low temperature lubricant comprising essentially from 50–70% of a hydrocarbon liquid having a pour point at least as low as −90° F. and about 30–50% by weight of a fatty acid soap of a metal of group II of the periodic table.

2. A low temperature lubricant comprising about 50–70% of a petroleum naphtha and about 30–50% of zinc stearate.

3. A low temperature lubricating grease which is soft at −100° F. and has a suitable consistency for use in a grease gun comprising essentially about 65–70% of a petroleum naphtha and about 30–35% by weight of zinc stearate.

4. A low temperature lubricating grease which is soft at −100° F. and having a cup grease consistency, comprising essentially about 50–55% of petroleum naphtha and containing 45–50% by weight of zinc stearate.

5. A low temperature grease which is soft at −100° F. and adapted for the lubrication of machinery for manufacturing butyl rubber at temperatures as low as about −100° F., comprising essentially about 50–70% of a solvent extracted petroleum naphtha, and about 30–50% by weight of zinc stearate.

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