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LOW TEMPERATURE GREASES

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This invention relates to low temperature greases. More specifically the invention relates to those greases which have a comparatively uniform viscosity throughout the temperature range in which the grease is to be used.

I have discovered that many synthetic alkyl esters of organic acids are good lubricants and are well adapted for the manufacture of low temperature greases. Examples of such alkyl esters are—alkyl ricinoleates, alkyl lactates, alkyl benzoates and dialkyl oxalates. These esters have very good viscosities which adapt them for making low temperature greases but these esters are quite expensive compared to the cost of mineral oil lubricants.

I have also found that greases made from synthetic esters are compatible with greases made from mineral oil lubricants and when these two greases are blended a comparatively small amount of alkyl ester grease will greatly improve the low temperature viscosity characteristics of the mineral oil grease. Accordingly an effective low temperature grease may be made by using a small amount of a more expensive synthetic ester grease blended with a mineral oil lubricant grease.

The primary object of the present invention is to provide an improved low temperature grease by utilizing a blend of a mineral oil and a synthetic alkyl ester grease.

Experimental work has shown that the synthetic esters do not form stable emulsions with all of the alkali and alkaline earth metal soaps of fatty acids. Further the technic of making greases with synthetic esters is different from the technic of making greases with mineral oils. I have discovered, however, that up to 30% of stable greases made from synthetic esters may be blended with greases made from mineral oils and still stay in stable suspensions.

Accordingly another object of the invention is to provide a method of making a stable grease when using a substantial proportion of alkyl organic ester lubricants in combination with a mineral oil lubricant base.

In my work on lubricants I have found that alkyl esters of monobasic acids, such as ricinoleic and lactic acids, and the aliphatic esters of dibasic acids, such as oxalic acids have the proper boiling point, melting point, and viscosity characteristics, which adapt them for lubricants. I have also found that the alkyl esters of aromatic carboxylic acids, such as the benzoates, have the proper physical properties to adapt them for lubricants.

Tests have shown that the methyl, ethyl, butyl, and propyl acetyl ricinoleates all have lubricating properties and desirable viscosity characteristics. For example, butyl acetyl ricinoleate has the following kinematic viscosities:

Temperature, ° F.	Viscosity centistokes
−40	(1)
0	423
100	17.9
200	5

[1] Very viscous.

The alkyl lactates have boiling points and melting points which well adapt them as lubricants. For example, ethyl lactate boils at 311° F., butyl lactate at 370° F., and isobutyl lactate at 350 to 390° F. These alkyl lactates have the following viscosity characteristics:

	Temperature, ° F.	Viscosity centistokes
Ethyl lactate	−40	69.5
	0	12.9
	100	1.72
	200	.75
Butyl lactate	−40	135
	0	22.3
	100	2.44
	200	.93
Isobutyl lactate	−40	231
	0	29.1
	100	2.49
	200	.93

The dialkyl oxalates have very desirable boiling and melting points which adapt them for low temperature greases. Viscosity characteristics of diethyl and dibutyl oxalates are as follows:

	Temperture, ° F.	Viscosity centistokes
Diethyl oxalate	−40	14.2
	0	5.3
	100	1.37
	200	.72
Dibutyl oxalate	−40	22.00
	0	11.4
	100	2.25
	200	1.05

The physical properties of the alkyl benzoic acid esters are well adapted for the manufacture grease in that the boiling point of these esters is high, the products are practically all colorless liquids and the melting points are very low. The viscosities of some of these esters have been determined as follows:

Ester	Temperature, degrees F.			
	−40 viscosity centistokes	0 viscosity centistokes	100 viscosity centistokes	200 viscosity centistokes
Methyl benzoate	(1)	6.1	1.39	0.73
Ethyl benzoate	20.4	6.5	1.52	0.79
Propyl benzoate	47.5	11.3	2.09	0.91
Butyl benzoate	72.8	14.1	2.27	1.03
Isoamyl benzoate	79.1	17.7	2.56	1.11
Benzyl benzoate	(1)	93.8	5.06	1.73

[1] Viscous.

A lithium base grease can be made from a mineral oil lubricant preferably, a lubricant of a naphthenic base crude oil, by blending from 4 to 12% lithium stearate with 86 to 96% naphthenic base oil and from .5 to 3% aluminum stearate. Preferably 1% of an antioxidant, such as tributyl phosphite and sulfurized tricresyl phosphite may be added to the mineral oil prior to the blending of mineral oil with the lithium soap. Other soaps may be used for blending with the mineral oil lubricant, such as sodium and potassium stearates, or sodium, potassium and lithium soaps of other fatty acids. It is preferred, however, to use the lithium soap because such soaps are found to have better low temperature viscosity characteristics.

A stable grease may be made using an alkyl acetyl ricinoleate as a lubricating base. For example, a grease has been produced utilizing butyl acetyl ricinoleate 93%, lithium stearate 6%, and aluminum stearate 1%. To this ricinoleate is preferably added 1% of an extreme pressure lubricant, such as Polane or tricresyl phosphite. Up to 30% of this ricinoleate grease may be blended with the lithium base grease of mineral oil described above to provide a satisfactory blended mixture which is well adapted for low temperature lubrication. A suitable low temperature blended grease may comprise from 5% to 30% of an alkyl acetyl ricinoleate, from 63% to 88% of a mineral lubricating oil, 6% of lithium stearate, and 1% of aluminum stearate.

Greases may be produced from the alkyl lactates when using sodium or calcium base grease, for example sodium or calcium stearates, oleates or palmitates. A stable grease that will not bleed has been made using 93% ethyl lactate, 6% sodium stearate and 1% of an extreme pressure additive, such as Polane or tricresyl phosphite. Up to 30% of the ethyl lactate sodium grease may be blended with a lithium soap mineral oil base grease, such as described above, to provide a satisfactory low temperature grease.

A low temperature grease can be produced by dissolving 6% of lithium stearate in 93% butyl oxalate and 1% of an extreme pressure additive, such as Polane. Other dialkyl oxalates, such as the diethyl, diisobutyl, and diisoamyl, may be substituted for the dibutyl in making a satisfactory grease. Up to 30% of the dialkyl oxalate greases may be blended with a lithium soap mineral oil base grease, such as described above, to make a satisfactory low temperature grease. A suitable low temperature blended grease may comprise from 5% to 30% of dibutyl oxalate, from 63% to 88% of a mineral lubricating oil, and 6% of lithium stearate.

The methyl, ethyl, propyl, butyl, isoamyl and benzyl benzoates may act to dissolve soaps, such as lithium stearate, oleate or palmitate, and sodium stearate to produce satisfactory low temperature greases. When making the sodium base grease it is desirable to use approximately 1% of aluminum stearate to produce a non-bleeding grease. Up to 30% of these alkyl benzoate greases may be blended with a lithium soap mineral oil base grease of the type described above, in producing a satisfactory low temperature grease. A suitable low temperature blended grease may comprise from 5% to 30% of butyl benzoate, from 3% to 15% of lithium stearate, and from 60% to 88% of a mineral lubricating oil.

When 90% of the mineral oil lithium grease is blended with 10% of the greases produced from the synthetic alkyl esters described above, the average reduction in viscosity of the mixture compared with the viscosity of the straight mineral oil base grease at −60° F. has been approximately 40%. When 80% of the mineral oil base grease is blended with 20% of the grease produced from the synthetic alkyl organic esters as described above the viscosity of the mixture at −60° F. has been found to be approximately 75% less than the viscosity of the straight mineral oil base grease. It will be seen, therefore, that by varying the percentage blend of straight mineral oil base grease with the grease produced from the synthetic alkyl organic esters that a grease of a predetermined and desired viscosity may be produced. Furthermore the blending of the alkyl ester base greases with the mineral oil base greases has a very substantial effect in changing the viscosity of the grease for low temperature operation and thus a relatively small amount of the relatively more expensive synthetic alkyl ester base grease, may be used in obtaining a grease of desirable viscosity. A low temperature blended grease made in accordance with the present invention may comprise from 60% to 88% of a mineral lubricating oil, from 3% to 15% of an alkali metal soap, and from 5% to 30% of an alkyl ester selected from the alkyl acetyl ricinolates, alkyl lactates, alkyl benzoates, and dialkyl oxalates.

The synthetic alkyl esters used in the production of greases, as described above, all have good lubricating properties but it is found that by blending with them from .1 to 1% of an extreme pressure additive, the load-carrying capacity of the ester lubricants is greatly increased. The additives above referred to are commercial products now on the market. The extreme pressure agent "Polane" mentioned above is chlormethyl stearate. The extreme pressure agents disclosed in Engelke Patent No. 2,260,303, sulfurized tricresyl phosphites may be used. These additives are preferably dissolved in the lubricants prior to the time that the lubricants are blended with soaps for the manufacture of grease.

It has been found that it is quite important in obtaining a grease which is a blended mixture of a mineral oil base grease with an alkyl ester grease, that the two different forms of greases should be separately made before they are blended in order to maintain a stable emulsion and to prevent the resulting grease from bleeding. However, the esters may be blended directly with the mineral oil and the desired quantities of soap added, and the mixture heated to a temperature of about 380° F., then quickly cooled in thin layers to room temperature, and a very satisfactory grease obtained.

A naphthenic base mineral oil is preferably used in making the lithium grease as described above. The naphthenic oil which is used in making low temperature greases preferably has a viscosity of approximately 100 at 100° F. A

naphthenic base mineral oil grease made with a lithium soap will dissolve in or be compatible with up to 30% of any of the greases made from synthetic alkyl organic esters as described above.

The preferred form of the invention having been thus described what is claimed as new is:

1. A low temperature grease comprising from 63% to 88% of a mineral lubricating oil, from 5% to 30% of an alkyl acetyl ricinoleate, approximately 6% of lithium stearate and approximately 1% of aluminum stearate.

2. A low temperature grease comprising butyl benzoate 5 to 30%, lithium stearate 3 to 15%, aluminum stearate 0.5 to 1%, mineral lubricating oil 60 to 88%, and an extreme pressure additive 0.1 to 1.0%.

3. A low temperature blended grease comprising a blend of about 90% of a mineral oil grease containing from about 86% to about 96% of a mineral lubricating oil, from 4% to about 12% of a lithium soap and from 0.5% to 3% of an aluminum soap, with approximately 10% of an ester grease containing approximately 93% of an alkyl ester selected from the group consisting of alkyl acetyl ricinoleates, alkyl lactates, alkyl benzoates and dialkyl oxalates, about 6% of a lithium soap and about 1% of an aluminum soap.

4. A low temperature blended grease comprising a blend of about 80% of a mineral oil grease containing from about 86% to about 96% of a mineral lubricating oil, from 4% to about 12% of a lithium soap and from 0.5% to 3% of an aluminum soap, with approximately 20% of an ester grease containing approximately 93% of an alkyl ester selected from the group consisting of alkyl acetyl ricinoleates, alkyl lactates, alkyl benzoates and dialkyl oxalates, about 6% of a lithium soap and about 1% of an aluminum soap.

5. A low temperature blended grease comprising a blend of about 70% to 90% of a mineral oil grease containing from about 86% to about 96% of a mineral lubricating oil, from 4% to about 12% of a lithium soap and from 0.5% to 3% of an aluminum soap, with approximately 30% to 10% of an ester grease containing approximately 93% of an alkyl ester selected from the group consisting of alkyl acetyl ricinoleates, alkyl lactates, alkyl benzoates, and dialkyl oxalates, about 6% of a lithium soap and about 1% of an aluminum soap.

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