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GREASE COMPOSITIONS

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ABSTRACT OF THE DISCLOSURE

Grease compositions are provided comprising an oil of lubricating viscosity, as a vehicle, and a thickening agent comprising boric acid complexes of alkaline earth metal salts of aliphatic monocarboxylic and aliphatic dicarboxylic acids.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to grease compositions and relates more particularly to grease compositions having improved high temperature properties.

2. Description of the Prior Art

The prior art has recognized that the ASTM dropping point of certain greases can be increased by about 70 to 100° F. through the use of hydroxystearate soaps. The prior art has also found that certain low molecular weight materials, such as boric acid, do not materially raise the dropping point of such greases. Furthermore, the prior art has also found that the dropping point of calcium greases can be increased by the addition of polycarboxylic acids as an ingredient of the grease fatty material (soap). Such addition has been found to raise the dropping point of the calcium grease by about 150° F. to a level of about 350° F. Thus, for many applications where a dropping point of the order of about 450° F. to about 500° F. is desired, such greases fail to meet these high temperature requirements.

SUMMARY OF THE INVENTION

In accordance with the present invention there are provided grease compositions having high temperature properties and comprising an oil of lubricating viscosity, as a vehicle, and a thickening agent comprising boric acid complexes of alkaline earth metal salts of monocarboxylic and dicarboxylic acids. These greases, by virture of the combination of the aforementioned boric acid complexes of alkaline earth metal salts of monocarboxylic and dicarboxylic acids, as the thickening agent, have been found to exhibit increased ASTM dropping points of the order of 450–500° F. or higher.

In its more specific aspects, the thickening agent may be employed in any amount sufficient to impart the desired consistency to the oil in forming a grease. In many applications the thickening agent is employed in an amount from about 2 to about 20%, and preferably from about 5 to about 15%, by weight, of the total grease composition. The salts of the monocarboxylic acid are, generally, employed in an amount from about 10 to about 90%, and preferably from about 60 to about 80%, by weight, of the total weight of the thickening agent.

The salts of the dicarboxylic acid are, generally, employed in an amount from about 10 to about 90%, and preferably from about 20 to about 40%, by weight, of the total weight of the thickening agent. Boric acid is, in general, employed in an amount from about 5 to about 25%, by weight, of the total weight of the thickening agent and from about 0.1 to about 5%, by weight, of the total weight of the grease. In this respect, substitution of boric anhydride for boric acid, was found to result in an unsatisfactory grease insofar as high temperature properties are concerned. The vehicle may comprise any oil of lubricating viscosity. Particularly preferred are mineral oils having a viscosity (SUS) of at least 40 seconds at 100° F., and preferably mineral oils having a viscosity within the range from about 60 to about 6,000 seconds at 100° F.

Representative of the monocarboxylic acids that can be employed for forming the corresponding alkaline earth metal salts are stearic acid, 12-hydroxystearic acid, palmitic acid, and lauric acid. Representative of the dicarboxylic acids that can be employed for forming the corresponding alkaline earth metal salts are itaconic acid, adipic acid, azelaic acid and sebacic acid. In forming the alkaline earth metal salt for complexing with boric acid, the monocarboxylic or dicarboxylic acid is reacted with an alkaline earth metal oxide or hydroxide.

DESCRIPTION OF SPECIFIC EMBODIMENTS

The following examples and comparative data will serve to illustrate the marked improvement in properties realized in employing the greases of the present invention, contrasted with greases of the prior art where the essential components of the present greases are not present.

The grease compositions described in the following table were prepared in accordance with the general procedure hereinafter described and represented by the following formulation, which is typical of the improved greases, prepared in accordance with the present invention.

	Percent by weight
Mineral Oil (100 SUS at 100° F.)	84.05
12-Hydroxy Stearic Acid	9.97
Sebacic Acid	3.52
Boric Acid	.26
Calcium Hydroxide	2.20
	100.00

The above grease composition was prepared in the conventional manner in an open grease kettle by saponifying the fatty material in a portion of the mineral oil to a temperature between about 220° F. and about 250° F. to form the corresponding soap. After the grease had bodied-up, the boric acid was added and the temperature was slowly increased to 350° F. to produce a homogeneous complexed product. After cooling the grease to 250° F., the remaining portion of the mineral oil was added and the grease was then homogenized once through a homogenizer at a .004" setting. The resulting grease exhibited an unworked penetration at 77° F. of 225 mm./10. The ASTM D-2265 dropping point was 456° F. Formulations prepared in accordance with the manner described above are set forth in the following table in

which both composition and characteristics are also disclosed.

TABLE

Example	1	2	3	4	5	6	7	8	9	10	11	12
Composition:												
Mineral oil (100 SUS at 100° F.)	85.86	87.43	92.35	80.49	84.70	84.64	84.84	84.64	84.05	86.56	80.86	85.41
Calcium hydroxide	2.14	2.34	4.67	5.31	2.30	2.35	2.35	2.35	2.20	1.82	2.64	3.43
Boric acid		.23		.50					.26	.23	.38	.32
Stearic acid			2.98	8.76								
Hydroxystearic acid	12.00	10.00			9.75	9.75	9.80	9.75	9.97	8.54	11.96	8.16
Dicarboxylic acids:												
Itaconic						3.25						
Adipic								3.25				2.68
Azelaic							3.01		3.52	2.85		
Sebacic				4.94	3.25						4.16	
Bench test results:												
Penetrations at 77° F.:												
Unworked	230	233	249	259	240	304	273	295	225	312	273	295
Worked, 60 times	235	229	[1]	277	235	305	277	300		316	276	294
Dropping point,° F. ASTM D-2265	[2]	[2]	[3]	426	331	323	[4]	335	456	367	465	500

[1] Too soft.
[2] Separated into two phases at about 270–275° F.
[3] Separated into two phases at about 225–230° F.
[4] Separated into two phases at about 312° F.

Referring to the above table it will be noted that Examples 1 and 3 disclose that a grease formulated from calcium stearate or calcium hydroxystearate separates into two phases when heated to temperatures of the order of 225–275° F. Incorporating a dicarboxylic acid, e.g., itaconic, adipic, azelaic or sebacic acid as part of the fatty material, as shown in Examples 5, 6, 7 and 8 will increase their thermal stability as measured by their dropping point. As shown in Example 2, incorporating boric acid into a conventional calcium/hydroxystearate grease does not improve its thermal stability.

In contrast, however, the calcium soaps of a combination of monocarboxylic and dicarboxylic acids and boric acid; as disclosed in Examples 4, 9, 10, 11 and 12, resulted in greases having much greater thermal stability than was previously obtained.

While this invention has been described with reference to preferred compositions and components therefor, it will be understood, by those skilled in the art, that departures from the preferred embodiments can be effectively made and are within the scope of the specification.

I claim:

1. A grease composition comprising an oil of lubricating viscosity, as a vehicle, and a thickening agent comprising a boric acid complex of alkaline earth metal salts of aliphatic long chain monocarboxylic and aliphatic dicarboxylic acids.

2. A grease as defined in Claim **1** wherein said thickening agent is present in an amount from about 2 to about 20%, by weight.

3. A grease as defined in Claim **1** wherein said thickening agent is present in an amount from about 5 to about 15%, by weight.

4. A grease as defined in Claim **1** wherein said salt of the monocarboxylic acid is present in an amount from about 10 to about 90%, by weight, of said thickening agent.

5. A grease as defined in Claim **1** wherein said salt of the monocarboxylic acid is present in an amount from about 60 to about 80%, by weight, of said thickening agent.

6. A grease as defined in Claim **1** wherein said salt of the dicarboxylic acid is present in an amount from about 10 to about 90%, by weight, of said thickening agent.

7. A grease as defined in Claim **1** wherein said salt of the dicarboxylic acid is present in an amount from about 20 to about 40%, by weight, of said thickening agent.

8. A grease as defined in Claim **1** wherein boric acid is present in an amount from about 5 to about 25%, by weight, of said thickening agent.

9. A grease as defined in Claim **1** wherein boric acid is present in an amount from about 0.1 to about 5%, by weight, of the total weight of the grease.

10. A grease as defined in Claim **1** wherein the vehicle comprises a mineral oil.

11. A grease as defined in Claim **1** wherein the vehicle comprises a mineral oil having a viscosity (SUS) of at least 40 seconds at 100° F.

12. A grease as defined in Claim **1** wherein the vehicle is a mineral oil having a viscosity (SUS) within the range from about 60 to about 6,000 seconds at 100° F.

13. A grease as defined in Claim **1** wherein the monocarboxylic acid is stearic acid.

14. A grease as defined in Claim **1** wherein the monocarboxylic acid is 12-hydroxystearic acid.

15. A grease as defined in Claim **1** wherein the monocarboxylic acid is palmitic acid.

16. A grease as defined in Claim **1** wherein the monocarboxylic acid is lauric acid.

17. A grease as defined in Claim **1** wherein the dicarboxylic acid is itaconic acid.

18. A grease as defined in Claim **1** wherein the dicarboxylic acid is adipic acid.

19. A grease as defined in Claim **1** wherein the dicarboxylic acid is azelaic acid.

20. A grease as defined in Claim **1** wherein the dicarboxylic acid is sebacic acid.

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