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LUBRICATING COMPOSITIONS

Paul R. McCarthy, Allison Park, Pa., assignor to Gulf Research & Development Company, Pittsburgh, Pa., a corporation of Delaware

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This invention relates to improved lubricating compositions and to the process of preparing them and, more particularly, to the class of lubricants existing as plastic solids or jellies.

Compositions having good mechanical and lubricating properties over a wide temperature range can be prepared by dispersing compounds of bentonite with organic bases in an oil.

I have discovered that a considerable saving in the bentonite-organic base compound can be effected when producing a composition of a selected consistency from an organic bentonite compound and an oil if a small amount of water is dispersed together with said bentonite compound in said oil. I have discovered further that a dispersion of a small amount of water and a selected amount of a compound of a bentonite and an organic base in an oil produces a lubricant having a consistency greater than the consistency of a lubricant comprising a dispersion only of said selected amount of said bentonite compound in said oil. Therefore, in accordance with my invention a lubricant having a consistency equal to the consistency of a dispersion of a selected amount of a compound of a bentonite and an organic base in an oil can be produced by dispersing in said oil less than said selected amount of the bentonite compound, provided that a small amount of water is also dispersed in said oil. For instance, I have found that when as little as 0.5 per cent by weight of water is dispersed in an oil the compound of bentonite required to produce a composition of a selected consistency may be reduced by as much as 33 per cent over the amount of the bentonite compound required when no water is present. The amount of water dispersed in the compositions of my invention may be between about 0.1 and 1.0 per cent by weight based on the weight of the total composition. It should be understood, however, that the optimum amount of water may vary depending upon the particular bentonite compound employed as well as upon the amount of said bentonite compound dispersed in the oil.

In compounding the compositions of the present invention, various compounding and blending procedures may be used. In accordance with a preferred embodiment, however, the compound of bentonite with an organic base is intimately dispersed in an oil by introducing the oil and the compound in the desired proportions into a mixing device such as a paint mill or a colloid mill, and repeatedly passing the mixture in plastic form through the mixing device to subject the mixture to mechanical shearing action until the

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desired degree of dispersion of the compound in the oil is obtained. Water is ordinarily added to the mixture prior to the milling operation. If an oxidation inhibitor is employed, it is advantageously added to the oil before the water and the organic bentonite compound are dispersed in the oil. It should be understood, however, that the order in which the separate constituents are added may be varied without deviating from the scope of the present invention.

The mineral oil ingredient in the compositions provided by this invention may be any of the hydrocarbon oils of lubricating grade, such as customarily used in compounding greases. The oil may be a refined or semi-refined paraffinic-, naphthenic-, or asphaltic-base oil having a viscosity of about 50 to 4000 SUS at 100° F. If desired, a blend of oils of suitable viscosity may be employed instead of a single oil, by means of which any desired viscosity within the range of 50 to 4000 SUS at 100° F. may be secured. The viscosity of the oil has little effect on the dropping point of the compositions, but more viscous oils produce compositions having greater stickiness and adhesive properties than do the lighter oils. The oil content of the compositions prepared according to this invention may comprise about 65 to about 97 per cent by weight of the total composition. The particular oil, as well as the exact amount of oil employed, depends upon the characteristics desired in the final composition.

The bentonite compounds employed in accordance with the invention are compounds composed of a montmorillonite mineral in which at least a part of the cation content of the mineral has been replaced by an organic base. Clays that swell at least to some extent on being contacted with water and contain as a primary constituent a mineral of the group known as montmorillonites are generally referred to as bentonites. Such clays, which contain exchangeable alkali metal atoms either naturally or after treatment, constitute the raw materials employed in making the bentonite-organic base compounds used in the compositions of this invention. So far as known, all naturally occurring montmorillonites contain some magnesium and certain of them, as exemplified by Hector clay, contain such a high percentage of magnesium that they largely have magnesium in place of the aluminum content characteristic of the more typical montmorillonites.

The bentonite-organic base compounds are preferably prepared as described in U. S. Patent

No. 2,033,856, issued March 10, 1936, by bringing together the bentonite and the organic base in the presence of aqueous mineral acid to effect base exchange. The organic bases should preferably be titratable with mineral acids. Among these reactive bases are many alkaloids, and cyclic, aliphatic, and heterocyclic amines. The bentonite-organic base compounds used in preparing the lubricating compositions of this invention are preferably those prepared by bringing together a bentonite clay and such organic bases as aliphatic amines, their salts, and quaternary ammonium salts. Examples of such amines and salts are: decylamine, dodecylamine, tetradecylamine, hexadecylamine, octadecylamine, hexadecyl ammonium acetate, octadecyl ammonium acetate, dimethyldioctyl ammonium acetate, dimethyldidodecyl ammonium acetate, dimethyldodecylhexadecyl ammonium acetate, dimethyldicetyl ammonium acetate, dimethylhexadecycloctadecyl ammonium acetate, dimethyldioctadecyl ammonium acetate, and the corresponding chlorides and quaternary ammonium chlorides. The organic bases employed should be such as to impart substantial organophilic properties to the resulting compounds. The preferred bentonite compounds are prepared from quaternary ammonium compounds in which the N-substituents are aliphatic groups containing at least one alkyl group with a total of at least 10 to 12 carbon atoms. When aliphatic amines are used they preferably contain at least one alkyl group containing at least 10 to 12 carbon atoms.

The amount of bentonite compound used may vary over wide limits depending upon the particular oil with which the bentonite compound is to be blended and upon the properties desired in the final lubricating composition. While as much as 30 per cent by weight of the total composition may comprise the bentonite compound, I prefer to use smaller amounts, that is, in the order of about 3 to about 10 per cent. When a bentonite compound is mentioned, it is understood, of course, that one or more of such compounds is intended.

In some instances, as when using short or single chain aliphatic amine bentonite compounds for example, dispersion of the organic bentonite compound in the oil can be facilitated by the use of one or more solvating agents. Suitable solvating agents are polar organic compounds such as organic acids, esters, alcohols, ethers, ketones, and aldehydes, especially low molecular weight compounds of these classes. Examples of suitable solvating agents are: ethyl acetate, acetic acid, acetone, methyl alcohol, ethyl alcohol, benzoyl chloride, butyl stearate, cocoanut oil, cyclohexanone, ethylene dichloride, ethyl ether, furfural, isoamyl acetate, methyl ethyl ketone, and nitrobenzene. In cases where the use of a solvating agent is desirable for effecting more rapid and more complete dispersion of the organic bentonite compound in the oil, ordinarily only a relatively small amount of such agent may be necessary. However, as much as about 50 per cent by weight based on the amount of the bentonite compound can be used.

When it is desired to produce compositions having improved oxygen stability, I advantageously employ a small amount of a diaryl amine. As examples of some of the diaryl amines which may be used in the compositions of this invention may be mentioned diphenylamine, phenyl alpha naphthylamine, phenyl beta naphthylamine, alpha alpha, alpha beta, beta beta dinaphthylamines, and the like. Other diaryl amines as well as their derivatives wherein one or more hydrogen atoms on one or both of the aromatic nuclei are replaced by a substituent group may be used. The substituting group may, for example, be one selected from the class of aryl, alkyl, amino, aryloxy and alkyloxy radicals, so long as the presence of the substituent does not render the diaryl amine insoluble in oil, or soluble in water or otherwise adversely affect the effectiveness of the diaryl amine. The amount of the diaryl amine employed will depend to a large extent upon the severity of the conditions to which the composition is subjected, as well as the particular diaryl amine used. For instance when the composition is subjected to prolonged use under oxidizing conditions, such as under extreme temperature and pressure, the diaryl amine requirement will be much greater than when relatively mild operating conditions are encountered. Generally, however, the amount of the diaryl amine employed is between about 0.1 and 1.5 per cent by weight based upon the weight of the total composition. In any case, an amount sufficient to substantially inhibit oxidational deterioration is employed.

In order to illustrate the effect of dispersing a small amount of water in an organic bentonite-thickened lubricant, a standard test lubricant was prepared by dispersing 6 parts by weight of octadecyl amine bentonite and 3 parts by weight of dimethyldicetyl ammonium bentonite in 88.7 parts by weight of a mineral lubricating oil having a viscosity of 500 SUS at 100° F. 2.3 parts by weight of methanol were used to aid in dispersing the octadecyl amine bentonite in the oil. To separate portions of the standard lubricant thus prepared were dispersed 0.16 and 0.32 per cent by weight of water. The consistencies of the compositions were as follows:

Composition	Consistency (ASTM D217-44T)	
	Unworked	Worked
Standard test lubricant	259	300
Standard test lubricant plus 0.16 percent water	239	250
Standard test lubricant plus 0.32 percent water	225	220

As shown above, a dispersion of a small amount of water and a selected amount of a compound of a bentonite and an organic base in an oil produces a lubricant having a consistency greater than the consistency of a lubricant comprising a dispersion of said selected amount of said bentonite compound in said oil.

In order to illustrate the preparation of a lubricant having a consistency equal to the consistency of a dispersion of a selected amount of a compound of a bentonite and an organic base in an oil by dispersing in said oil less than said selected amount of the bentonite compound, a composition was prepared by dispersing 4 parts by weight of octadecyl amine bentonite, 2 parts by weight of dimethyldicetyl ammonium bentonite, and 0.5 part by weight of water in 94 parts by weight of the lubricating oil used in preparing the standard test lubricant. 2.3 parts by weight of methanol were used to aid in dispersing the octadecyl amine bentonite. The composition thus obtained had a worked consistency of 300. The standard test lubricant also had a worked consistency of 300, but the standard test lubricant contained 50 per cent

more organic bentonite compound. Therefore, in accordance with my invention a considerable saving in the bentonite-organic base compound is effected.

While this invention has been described with reference to specific details and examples of the production and properties of the compositions of my invention, it is to be understood that the invention is not intended to be limited to such details and examples, except as recited hereinafter in the appended claims.

I claim:

1. A lubricant consisting essentially of a dispersion of a minor amount of water and a compound of a bentonite and an organic-nitrogen base in a major amount of a mineral oil, wherein the amount of said bentonite compound in said lubricant is sufficient to produce a composition having the consistency of a grease and wherein said water is present in an amount sufficient to increase the consistency of the lubricant.

2. An improved lubricant consisting essentially of a dispersion of water and a compound of a bentonite and an organic nitrogen base in a major amount of a mineral oil, wherein said bentonite compound is present in said lubricant in an amount corresponding to about 3 to about 30 per cent by weight of the lubricant and wherein said water is present in said lubricant in an amount corresponding to about 0.1 to 1.0 per cent by weight of the lubricant.

3. An improved lubricant consisting essentially of a dispersion of water and dimethyldicetyl ammonium bentonite in a major amount of a mineral oil, wherein said bentonite compound is present in said lubricant in an amount corresponding to about 3 to about 30 per cent by weight of the lubricant and wherein said water is present in said lubricant in an amount corresponding to about 0.1 to 1.0 per cent by weight of the lubricant.

4. An improved lubricant consisting essentially of a dispersion of water and dimethyldicetyl ammonium bentonite in a major amount of a mineral oil, wherein said bentonite compound is present in said lubricant in an amount corresponding to about 3 to about 10 per cent by weight of the lubricant and wherein said water is present in said lubricant in an amount corresponding to about 0.1 to 1.0 per cent by weight of the lubricant.

5. An improved lubricant consisting essentially of a dispersion of water and dimethyldicetyl ammonium bentonite in a major amount of a

mineral oil, wherein said bentonite compound is present in said lubricant in an amount corresponding to about 3 to about 10 per cent by weight of the lubricant and wherein said water is present in said lubricant in an amount corresponding to about 0.5 per cent by weight of the lubricant.

6. An improved lubricant consisting of a uniform mixture of about 88 to about 97 per cent by weight of a mineral lubricating oil, about 3 to about 10 per cent by weight of dimethyldicetyl ammonium bentonite, about 0.1 to about 1.5 per cent by weight of a diaryl amine, and about 0.1 to about 1.0 per cent by weight of water.

7. An improved lubricant consisting of a uniform mixture of about 88 to about 94 per cent by weight of a mineral lubricating oil, about 4 to about 6 per cent by weight of octadecyl amine bentonite, about 2 to about 4 per cent by weight of dimethyldicetyl ammonium bentonite, and about 0.1 to 1.0 per cent by weight of water.

8. In the production of a lubricant from a major amount of a mineral oil and a compound of a bentonite and an organic nitrogen base wherein said bentonite compound is present in said lubricant in an amount sufficient to produce a composition having the consistency of a grease, the improvement which consists essentially of dispersing in said oil a small amount of water, sufficient to increase the consistency of said lubricant, together with said bentonite compound.

9. In the production of a lubricant from a major amount of a mineral oil and a compound of a bentonite and an organic nitrogen base wherein said bentonite compound is present in said lubricant in an amount corresponding to about 3 to about 30 per cent by weight of the lubricant, the improvement which consists essentially of dispersing in said oil between about 0.1 and 1.0 per cent by weight of water together with said bentonite compound.

PAUL R. McCARTHY.

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