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WATER RESISTANT LUBRICANTS THICKENED WITH INORGANIC GELLING AGENTS

William A. Marshall, Chicago, Ill., and Charles F. Steininger, Havertown, Pa., assignors to The Pure Oil Company, Chicago, Ill., a corporation of Ohio

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This invention relates to multi-purpose lubricating compositions employing inorganic gelling agents as thickeners for an oleaginous medium.

Because of limitations on the use of petroleum greases, substitute products have been developed for lubrication applications in which petroleum greases will not satisfactorily function. It has been found that grease-like structures can be prepared by thickening oleaginous media to the proper consistency with various non-soap gelling agents. Suitable soap substitutes include gels prepared from polyvalent oxides and hydroxides, various dye stuffs such as phthalocyanine and indigo, modified bentonite clays, alkyl substituted ureas, etc. In the formulation of grease compositions it is desirable to prepare a single composition which will effectively function as a lubricant in a plurality of services. This desideratum may be obtained through the use of lubricating compositions which have been thickened with inorganic gelling agents prepared from the oxides and hydroxides of such polyvalent metals as calcium, chromium, cobalt, iron, lead molybdenum, nickel and the like. These substances are preferably employed in the aerogel form as prepared by following the teachings of Kistler in U. S. Patent 2,260,625. Although gels prepared from compounds of the above-mentioned metals may be employed with varying degrees of success, silica gels have been extensively and preferably employed in the formulation of lubricating compositions of this nature because of a number of economic and processing factors which make their use desirable. The aforementioned inorganic gelling agents may be effectively employed in the formulation of multi-purpose lubricating compositions inasmuch as they produce a grease-like structure which inherently possesses a number of the fundamental characteristics of multi-purpose greases such as high temperature consistency stability, mechanical stability, and ease and reproduceability of preparation. They also can readily be stabilized to overcome certain deficiencies. While the oxidation stability of these lubricating compositions is acceptable, preferred formulations contain proprietary compounds which have been added to enhance the oxidation resistance of these materials. However, all of the inherent properties of lubricating compositions which have been prepared by admixing an aerogel with an oleaginous medium are not advantageous. A very serious deficiency which exists in unmodified greases is their lack of water resistance characteristics. It has been found that additives must be employed to stabilize these lubricating compositions against destruction of the grease structure when in contact with water. A number of additives which are effective for this purpose are suggested in the prior art. Various hydroxy aliphatic organic compounds such as the polyoxyalkylene glycols and their derivatives, hydroxy fatty acids and esters prepared from these acids as well as various amine compounds and metallic soaps have been found effective for overcoming the water resistance deficiency exhibited by these lubricating compounds. Although the prior art discusses the general application of amino compounds, it

has been found that there are a number of inoperative compounds within at least one of these generic classes which will not function to prevent the deleterious effect of water on unstabilized lubricating compositions which have been thickened with the above-mentioned aerogels. It is disclosed by Stross in U. S. Patent 2,554,222 that water resistance may be imparted to lubricating compositions which have been thickened with inorganic aerogels such as silica aerogels by the addition of cyclic amines such as imidazoline. However, Hughes et al., U. S. Patent 2,655,476, disclose a number of imidazolines which are ineffective additives for this purpose thus demonstrating that at least with regard to the cyclic amines the water proofing mechanism is of an empirical nature and the expected action of other species within this class cannot be foretold.

It is therefore an object of this invention to impart water resistance to grease compositions which employ inorganic gelling agents by the addition of a cyclic amine stabilizer which is effective for this purpose. This and other objects will become apparent from the following discussion of this invention.

In accordance with the present invention, water resistance may be imparted to lubricating compositions which have been thickened with inorganic aerosols such as silica gel by the addition of a heterocyclic polycyclic unsaturated amine of an aromatic nature, namely, quinoline, and its lower alkyl homologs having not more than about eight carbon atoms in an alkyl substituent, isomers and mixtures thereof. The quinolines of this invention may also be utilized in the form of their acid salts such as quinoline hydrochloride. To facilitate the application of the quinoline water proofing agents, it is preferred that those quinoline compounds which are normally in the liquid state, such as quinoline and mono- and di-methyl substituted quinolines be employed. This state permits the waterproofing agent to be incorporated into the lubricating composition by simple admixture. In the event that a quinoline compound which normally is in the crystalline state is employed, it is necessary to dissolve the material in a suitable solvent such as ether, benzene, etc. The inorganic gelling agent is impregnated with the solution and subsequently treated to remove the solvent leaving the quinoline compound on the gelling agent surfaces to produce a hydrophobic gelling agent. It is postulated that the effectiveness of the quinolines for imparting water resistance to the aerogel compositions results from its being absorbed by the gelling agent to produce a gelling agent which is oleophilic and hydrophobic. In this condition the gelling agent becomes resistant to the disintegrating effect of water. The quinoline compounds employed in this invention may be either prepared synthetically by any of the various syntheses which are of general application or recovered from coal tar. The amount of quinoline compound which is employed for improving the water resistance of grease compositions will vary depending upon a number of factors, such as particle size and surface area of the gelling agent. Generally, however, 1 to about 35% by weight, based on the amount of gelling agent, may be employed. It is preferred, however, to employ amounts between about 10 and 25 weight percent in order to bring about water resistance although amounts outside these ranges may be employed in certain instances.

While petroleum lubricating oil fractions are preferred as the oleaginous vehicle other unctuous materials such as polymerized olefins, silicones, diesters of carboxylic acids, polyoxyalkylene glycols, their derivatives and mixtures thereof may be employed for certain applications where petroleum lubricating oil fractions are undesirable. The gelling agents employed in this invention are gels prepared from polyvalent metal oxides and hydroxides

which have been processed to produce a so-called aerogel structure. The preparation of these gelling agents which is described by Kistler in U. S. Patent 2,260,625 has become a conventional technique in the preparation of inorganic gelling agents of this nature. Gels prepared in accordance with Kistler's teachings or by similar techniques are of a microscopic size and in this finely divided state are non-abrasive. There are a number of materials which are commercially available such as the Santocel compositions marketed by Monsanto Chemical Company. The instant invention is not concerned with inorganic gelling agents per se but rather with imparting water resistance to the substances by a suitable treatment thereof. Accordingly any of the conventional water-susceptible, inorganic amorphous gelling agents which have known application as gelling agents in the preparation of lubricants of grease-like consistency are considered within the scope of this invention.

As it has been pointed out, one of the advantages of lubricating compositions which have been thickened with an inorganic gelling agent such as silica aerogel is their ease of preparation. If the gelling agent has a sufficiently small particle size, it has been found that simply by incorporating a sufficient amount of the gelling agent in the oleaginous vehicle a grease-like structure can be obtained without further processing. In some instances it has been necessary to mill the gel-oil mixture in conventional grease-making equipment in order to produce a grease-like structure. The gelling agents are generally employed in amounts from about 2 to 20% by weight of the total composition. However, in employing amounts between about 5 to 14% by weight, a thickened oil of suitable consistency is produced.

For further information on the preparation and properties of oils thickened with amorphous inorganic gelling agents reference is made to the Institute Spokesman, XVI (10), at page 18 et. seq. where silica aerogel-thickened greases are comprehensively considered.

The quinoline compounds employed as water resistance additives in the instant invention may be introduced subsequent to the formation of the thickened composition. This is the preferred method. However, they may be dissolved in the liquid vehicle prior to the grease formation.

In the event that the uncompounded base grease must conform with specialized requirements, various types of additives may be employed. As it has been already pointed out, the oxidation resistance of the lubricating compositions of this invention may be further increased by the addition of such materials as dialkyl selenides, trialkyl phenols, tetramethyldiaminodiphenylmethane, etc. It may also be necessary to employ rust preventatives, extreme pressure agents or other functional additives in order to enhance the characteristics of the base grease.

In accordance with the subject invention, a water resistant grease is prepared by dispersing 10 parts by weight of a silica aerogel (Santocel ARD) in 88 parts by weight

of a mixture of 30 parts by weight of a 100 V. I. 85 viscosity neutral lubricating oil fraction and 70 parts by weight of a 85 V. I., 160 viscosity bright stock lubricating oil fraction obtained from Van Zandt crude oil. This composition also contains one part by weight of quinoline which materially improves the water resistant characteristic of the base grease.

What is claimed as this invention is:

1. A gelatinous lubricating composition comprising a major portion of an oleaginous lubricating liquid having incorporated therein an inorganic gel as a gelling agent in an amount sufficient to produce a gelatinous composition of grease-like consistency and a sufficient amount of water proofing agent for said gelling agent selected from the group consisting of quinoline, and lower alkyl substituted quinoline having not more than about eight carbon atoms in a substituent group to impart water resistance to said composition.

2. A gelatinous lubricating composition comprising a major portion of an oleaginous lubricating liquid having incorporated therein a silica gelling agent in an amount sufficient to produce a gelatinous composition of grease-like consistency and a sufficient amount of water proofing agent for said gelling agent selected from the group consisting of quinoline, and lower alkyl substituted quinoline having not more than about eight carbon atoms in a substituent group to impart water resistance to said composition.

3. A composition in accordance with claim 2 in which the water proofing agent employed is quinoline.

4. A lubricating composition comprising a major portion of an oleaginous lubricating liquid having incorporated therein a silica aerogel in an amount sufficient to produce a gelatinous composition of grease-like consistency, 5 to 35% by weight, based on the aerogel, of water proofing agent for said aerogel selected from the group consisting of quinoline, and the lower alkyl substituted quinoline having not more than about eight carbon atoms in a substituent group, to impart water resistance to said composition.

5. A lubricating composition comprising a major portion of a petroleum oil lubricating fraction having incorporated therein 2 to 20% by weight based on the total composition of a silica aerogel to produce a gelatinous composition and 10 to 25% by weight based on the aerogel of water proofing agent for said aerogel selected from the group consisting of quinoline, and the lower alkyl substituted quinoline having not more than about eight carbon atoms in a substituent group to impart water resistance to said composition.

6. A composition in accordance with claim 7 in which the water proofing agent is quinoline.

7. A composition in accordance with claim 5 in which a liquid water proofing agent selected from the group consisting of quinoline, mono-methyl substituted quinoline, and di-methyl substituted quinoline is employed.

No references cited.