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LUBRICATING OIL AND METHOD OF MANUFACTURING THE SAME

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The present invention relates to improved lubricants and method for producing the same and more particularly to lubricants adapted to extreme pressure and especially for steel bearings.

For many years it has been desirable to increase the load bearing capacity of hydrocarbon lubricants such as oils, greases and the like and attempts have been made to accomplish this by the addition of various substances such as fatty acids, fatty oils, soaps and the like. Among other compounds, those containing sulfur have been of value in this connection, but it is difficult to obtain natural oils with sufficiently high sulfur content to be practically useful. Low boiling sulfur compounds which are readily available are objectionable on account of odor and in some cases are difficult to retain under the conditions of use. While high boiling sulfur compounds rich in sulfur and odorless are available, it is extremely difficult to obtain these sufficiently oil soluble for my purposes and these naturally available are mixed with tarry, darkly colored material which would not be desirable to add.

I have been able to obtain excellent results with synthetic compounds of high boiling point. They may be obtained in good color and are substantially odorless. They are likewise pure in the sense that they are free from tarry or darkly colored impurities. The materials which I prefer have boiling points above 500° F. (normal atmospheric pressure) and in general within the boiling range of commercial lubricating oils. The higher boiling constituents tend to decompose at or near their normal boiling points, so that actual distilling is preferably carried out under vacuum. They have excellent load bearing capacities and on blending with ordinary lubricating oils, the load bearing capacity of the latter may be raised some 4 or 5 fold.

My oils may be used for any of the ordinary purposes for which petroleum lubricating oils are now used although they are of particular value in high pressure bearings of steel to steel. My oils may be used alone or they may be added to ordinary hydrocarbon lubricants to increase their load bearing capacity, for example, motor oils, cutting oils, transmission oils, greases and the like.

The particular excellence of my oils I attribute not only to the desirable form of the sulfur, which is combined as a sulfide, hydrosulfide, and especially poly-sulfide but also to the high purity of these compounds i. e., to the absence of darkly colored gummy or resinous materials of obscure

nature, the presence of which is objectionable in lubricating oils and appear to be present in a substantial extent in all of the naturally available high sulfur content stocks. These materials are extremely difficult to remove from the sulfur compounds and I have found that much better results are obtained by synthetically producing the sulfur compounds which I desire.

In producing poly-sulfides or other sulfur containing materials, hydrocarbons may be used as starting materials, for example, petroleum distillates such as kerosene, gas oils and lubricating oils and particularly the solid hydrocarbons such as paraffine or petrolatum. It is necessary to first produce a suitably reactive group and this may be done by halogenation. Mono-halides are suitable for my process, but I prefer to use diolefines or the higher halides.

After the reactive group is inserted in the manner indicated in the previous paragraph, further reaction is brought about with an inorganic sulfur compound in order to introduce sulfur into the organic compound. This may be accomplished in any convenient manner, for example, by reaction with inorganic poly-sulfides, of which hydrogen poly-sulfide or its sodium, potassium or ammonium salts are the most useful for this purpose and produce organic poly-sulfides. With other inorganic sulfur compounds such as alkali or alkaline earth sulfides, or hydrosulfides, organic sulfides and disulfides or hydrosulfides respectively are produced. Mixture of inorganic sulfides, poly-sulfides or hydrosulfides may be used. Reaction occurs at a relatively low temperature and I have found that refluxing the reactants with a non-aqueous liquid such as absolute alcohol, which dissolves both reactants readily, brings about the reaction. In some cases aqueous media may be used. Other suitable liquids may be used such as ethers, alcohols, ketones and the like. The reaction will be complete within 2-3 hours, but it is not necessary to bring about a complete substitution of sulfur for chlorine or a complete saturation of the double bonds in order to produce desirable products. This is particularly the case when a chlorinated oil or wax is used for by stopping the reaction before the complete substitution of sulfur for chlorine is accomplished, an excellent product can be made which contains substantially equal quantities of sulfur or chlorine, or, if desired, either one or the other may be in excess.

While in general I prefer to use hydrocarbons as the sources of the poly-sulfides or other sul-

fur compounds, I have found that these compounds may be produced from any organic materials containing aliphatic chains and those with chains of more than 10 carbon atoms are particularly to be desired. Among these, the higher alcohols, aldehydes, ketones, acids or esters are desirable and the products obtained therefrom contain the poly-sulfide or other sulfur group. They are soluble at least to a sufficient extent in hydrocarbon oils and in some instances these substances may be preferred to the materials containing only sulfur, carbon and hydrogen.

My poly-sulfide or other sulfur compounds may be incorporated in liquid oils, for example, transmission oils and oils for other purposes and their presence enables the oils or greases to stand greatly increased bearing pressures, for example, in excess of 25,000 lbs. per square inch in the case of poly-sulfides. At the same time, they are stable, of good color and odor and general appearance. As an example of the manner in which my oils are prepared and the properties of the product, the following examples may be considered.

A hard paraffine wax having a melting point of 122° F. was chlorinated to the extent of about 25% chlorine by bubbling through the molten wax a gas rich in chlorine until it had increased in sight of the amount specified above. To 100 parts of this product was then added 72 parts of sodium poly-sulfide and the whole mass was taken up in 1000 parts of 98% isopropyl alcohol. This mixture was refluxed for about 1½ hours, during which time only a small amount of hydrogen sulfide was evolved. The mass was then cooled and solids allowed to settle so that the liquid was decanted and the alcohol distilled from the heavier product. The oil recovered has the following inspection

Viscosity at 100° F.-----	1700 Saybolt seconds
Viscosity at 210° F.-----	161.5 Saybolt seconds
Pour point.-----	80° F.
Percent sulfur-----	13
Percent chlorine-----	15

It was observed in the above experiment that the reaction is not merely a substitution of chlorine for sulfur but that a polymerization has also taken place and that the oil has a higher molecular weight and boiling range than the original wax.

In determining the efficacy of the above material as a high pressure lubricant, it was added to a straight hydrocarbon lubricating oil of good quality in proportion of about 1 part of the sulfur containing stock to 15.6 parts of the oil so that the blend contained 0.8% sulfur. The straight mineral oil and the blend were then tested under exactly comparable conditions in an Almen machine using a steel pin. The test was conducted according to the description contained in the National Petroleum News, November 2, 1932.

Mineral oil failed when 3-4 wts. had been added. The blend carried 15 wts. without failing.

In a similar experiment, the synthetic sulfur compound was produced in substantially the same manner as described in the previous example except that the solvent medium was absolute alcohol and the time of heating was somewhat longer. The oil recovered contained 22.6% of sulfur and no chlorine. This oil when blended with a straight mineral oil so as to produce a product with 1.7% of sulfur showed a bearing

pressure 3 times greater than the unblended oil.

My invention is not to be limited by any theory of the chemical reactions by which these materials are produced or by any particular description of the method or the starting materials from which they are produced, but only by the following claims in which I wish to claim all novelty inherent in the present invention.

I claim:

1. An improved lubricant comprising a hydrocarbon oil and an added organic compound containing both sulfur and halogen prepared by reacting a halogenated compound having an aliphatic chain with an inorganic sulfur salt, so as to replace only a portion of the halogen with sulfur.

2. Product according to claim 1 in which the added compound is produced by reacting the halogenated compound with an inorganic sulfide.

3. Product according to claim 1 in which the added compound is produced by reacting the halogenated compound with an inorganic polysulfide.

4. An improved lubricant comprising a mineral lubricating oil and an added organic compound containing both halogen and sulfur prepared by reaction of a halogenated aliphatic hydrocarbon with a sulfide of the group consisting of alkali and alkaline earths to replace only part of the halogen by sulfur.

5. Product according to claim 4 in which the added compound is produced from a chlorinated waxy hydrocarbon.

6. Product according to claim 4 in which the added compound is made from a chlorinated wax containing on the average more than one chlorine atom per mol.

7. Product according to claim 4 in which the added compound is made from a chlorinated wax containing about 25% chlorine which is reacted with the polysulfide to produce a final product with about equal quantity of sulfur and chlorine.

8. An improved lubricating oil comprising a mineral oil and an added compound containing both halogen and sulfur prepared by reacting a halogenated aliphatic oxygen-containing compound with an inorganic sulfide selected from the group of alkali and alkaline earths, so as to replace only a portion of the halogen with sulfur.

9. Product according to claim 8 in which the added compound is prepared from a chlorinated aliphatic oxygen-containing compound.

10. Product according to claim 8 in which the added compound is prepared by reaction of a chlorinated aliphatic oxygen-containing organic compound and an inorganic polysulfide.

11. An improved lubricant comprising a mineral lubricating oil and an added compound containing both sulfur and chlorine prepared by reaction of a halogenated aliphatic compound selected from the group consisting of organic acids and esters with an inorganic sulfide selected from the group of alkali and alkaline earths.

12. An improved lubricant comprising a mineral lubricating oil and an added compound containing both sulfur and chlorine prepared by reaction of a halogenated aliphatic compound selected from the group consisting of organic acids and esters with an inorganic polysulfide selected from the group of alkali and alkaline earths.

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