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LUBRICANT

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This invention is for improvements in or relating to lubricants and has for its object to provide improved lubricating compositions that possess high film rupture strength (hereinafter referred to as "F. R. S.") and/or good wear-reducing properties and as such are particularly useful under conditions of extreme pressure and high load characteristics.

It is well-known that the film rupture strength and also the wear-reducing properties of a lubricating oil may be improved by the addition thereto of various organic substances. It has now been found that particularly beneficial properties as lubricating oil addition agents are possessed by quinones and quinone derivatives.

According to the present invention, therefore, a lubricating composition, especially a lubricating composition intended for use under conditions of extreme pressure, comprises a lubricating oil and a minor proportion of a quinone or of a quinone derivative.

According to a preferred feature of this invention, the quinone or quinone derivative contains one or more groups known to convey or to enhance extreme pressure properties in a lubricating oil. For example, there may be present as substituents, halogen atoms, (for example, chlorine atoms), sulphur, nitrogen-containing groups, hydroxyl, and ester groups. Examples of suitable quinone derivatives for the purpose of the present invention are halogen-substituted quinones and N-substituted quinone derivatives (e. g. N-chloroimines), and the expression quinone derivative is intended to include such N-substituted compounds.

The organic compounds employed as additions to a lubricating oil in accordance with the present invention, are preferably incorporated in a proportion which is but a minor fraction of the total weight of the composition. In general, amounts of said organic compounds up to about 10% by weight of the lubricating oil (and preferably substantially below this amount) are employed. It will be understood that in any particular case, the proportion to be employed depends upon the stability of the composition when the organic compound has been incorporated and the relative considerations of economy in cost and of the improvement desired. However, in most cases, it can be said that the optimum proportion lies below 2% by weight of the lubricating oil employed.

In selecting any particular compound from the class of organic addition agents above referred to, regard must be had not only to the nature of the lubricating oil with which the addition agent is to be incorporated but also to the physical characteristics of the compound. Thus, since the present invention is particularly concerned with extreme pressure lubricants, it is preferred that the quinone or quinone derivative employed shall possess a relatively high boiling point and decomposition temperature so that it is stable under service conditions; compounds which do not decompose below 130° C. are particularly useful in this respect.

Furthermore, it is to be understood that the addition agents shall be substantially oil-soluble or of such a nature that they may be included in the lubricating composition in the form of a stable suspension. Certain of the addition agents contemplated by this invention do not dissolve readily in the lubricating oil and, in these cases, the compound is incorporated in the form of a dispersion (a suitable stabilising agent being added if necessary) or in the form of a solution in a suitable solvent such as cyclohexanol.

The following examples illustrate the present invention.

EXAMPLE I

To a mineral lubricating oil there was added 0.5% by weight of quinone chloroimine. The quinone chlorimide dissolved to form a lubricating composition exhibiting a particularly high film rupture strength and also good wear-reducing properties. Comparative tests conducted with the untreated oil and with the said composition, in known types of machines for film rupture strength and wear characteristics gave the following results:

		F. R. S.	Wear impression
1	Untreated oil	4,000	0.415
2	Treated oil	More than 15,000	0.200

EXAMPLE II

0.5% by weight of 2.6-dichloroquinone was dissolved in a mineral lubricating oil and, as in the case of Example I, comparative tests on the untreated and treated oils were carried out. The following results were obtained:

		F. R. S.	Wear impression
1	Untreated oil	4,000	0.415
2	Treated oil	8,000	0.250

It will be observed that both the film rupture strength and also the wear-reducing properties of the treated oil of either of the above examples are considerably superior to those of the untreated oil. In addition to the compounds specified, there may also be mentioned tetrachloroquinone.

The organic addition agents of this invention are particularly useful in improving the properties of a mineral lubricating oil, particularly an oil of a paraffinic nature, but they may be incorporated in other lubricating oils with advantageous results.

In determining the suitability of particular quinones or quinone derivatives for use as additions to lubricating oils and particularly to mineral lubricating oil the device used for testing F. R. S. was the well-known Almen oil testing machine in which a bearing or bush immersed in the oil to be tested supports a rotating journal or pin to which weights are gradually applied at regular time intervals until some irregularity is noticed, the recorded figure being measured in pounds per square inch at the limit. The particular Almen machine used did not record above 15,000 lbs./in^2. In the same way the device used for testing wear-reducing properties was the well-known "Avery-Brownsdon" wear and lubricant tester in which a hard steel wheel rapidly revolved in contact with a smooth steel plate coated with the lubricant makes a mark of measurable length. The wear impression is measured in inches. In the tests referred to below (unless otherwise stated) the oil used was a mineral lubricating oil of a paraffinic character and the table which follows shows the results of typical tests.

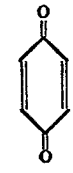
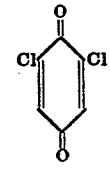
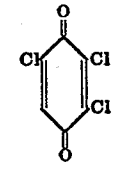
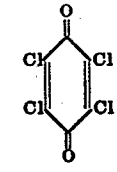
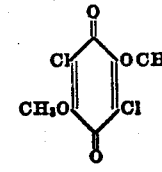
In a blank test using the paraffinic oil alone the wear impression was 0.415" and the F. R. S. was 4,000. As cyclohexanol was used as a solvent in certain cases a blank test was made by adding 10% of cyclohexanol alone to the paraffinic oil and on test the wear impression was 0.410" and and the F. R. S. 6,000.

It is found in certain cases that a lubricating composition of improved quality can be obtained by incorporating with the lubricating oil not only a quinone or quinone derivative but also a sulphur-containing compound, for example, an organic mercaptan, an organic disulphide, a thiocyanate or a thioether.

The results obtained may be divided into two classes (1) those obtained by adding to the oil single substances of the quinone class, and (2) those obtained by adding to the oil mixtures of quinones especially halogenated quinones with sulphur compounds.

TABLE I

Adding to the oil single substances

Compound	Formula	Percentage on the oil	F. R. S.	Wear impression
			Lbs. per sq. in.	*Inches*
Quinone (with 10% cyclohexanol)		0.5	7,000	0.315
2:6 dichloroquinone		0.5 1.0	8,000 10,000	0.250 0.185
Trichloroquinone		0.5 1.0	8,000 15,000	0.225 0.165
Chloranil (tetrachloroquinone)		0.5 1.0	9,000 >15,000	0.225 0.155
2:5 dimethoxy, 3:6 dichloroquinone		0.5	----------	0.295

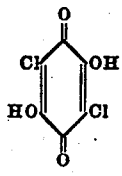
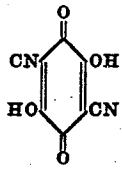
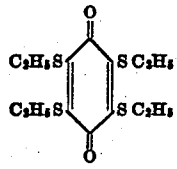
Compound	Formula	Percentage on the oil	F. R. S.	Wear impression
			Lbs. per sq. in.	*Inches*
Chloranilic acid (with 10% cyclohexanol)		0.5	>15,000	0.220
3:6 dicyan-2:5-dihydroxyquinone (with 10% cyclohexanol).		0.5		0.295
Tetrakis ethyl-thioquinone		0.25	10,000	----------
Quinone chloroimine		0.5	>15,000	0.200
Quinone dichloro-di-imine		0.5	>15,000	0.25

TABLE II

Mixtures

Sulphur compound	Other components	F. R. S.
		Lbs. per sq. in.
Dibenzyl, disulphide 0.5%	Chloranil 0.5%	>15,000
Lorol thiocyanate 0.5%	2:6 dichloroquinone 0.5%	13,000

Lorol thiocyanate is a mixture of thio-cyanates derived from straight chain fatty alcohols of 8 and 10 carbon atoms.

Thioether 1% 2:6 dichloroquinone 1%>15,000.

The thioether used was di(3:carbomethoxy-4:hydroxyphenyl) thioether.

The results of the tests have shown that the chloroquinones and the quinone chloroimine are particularly useful. It has also been noticed that useful properties are conferred by the presence in the quinone molecule of halogens and further substituents such as hydroxyl groups.

In the above description, the only mixtures specified (for addition to lubricating oil) are mixtures of quinones or quinone derivatives with sulphur-containing compounds but it will be understood that the lubricating compositions prepared according to this invention may also include other oil improvers including metallic compounds, oxidation inhibitors such as tertiary butyl cresol or corrosion inhibitors such as mercaptobenzthiazole.

In the examples the oil used is of a paraffinic nature, but it will be understood that mineral oils of an asphaltic or naphthenic character may also be used.

Some lubricating oils contain a proportion of fatty oil or vegetable oil such as rape oil and such oils may be used in the preparation of lubricating compositions according to this invention.

I claim:

1. A lubricating composition suitable for use under conditions of extreme pressure comprising a lubricating oil and a sufficient amount of a quinone chloro-imine to impart extreme pressure properties to the composition.

2. A lubricating composition suitable for use under conditions of extreme pressure comprising a lubricating oil and a minor proportion of a quinone compound having a nitrogen-containing group and at least one halogen atom, said compound being in sufficient amount to impart extreme pressure properties to the composition.

3. A lubricating composition suitable for use under conditions of extreme pressure comprising a lubricating oil and a minor proportion of a quinone compound having at least one substituent group containing nitrogen and a halogen, said compound being in sufficient amount to impart extreme pressure properties to the composition.

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