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LUBRICATING OIL

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Our invention relates to lubricating oils and more particularly to such products as new compositions of matter.

The present design of mechanical devices calls for higher pressures on rubbing surfaces. The designers are, however, limited to pressures at which high quality lubricating oil will break down in use and allow metal to metal contact and seizing. The lubricant between two rubbing surfaces is spread out in a relatively thin film, and if the lubricant does not have high film strength it will break down with consequent damage to the rubbing surfaces. Conventional hydrocarbon lubricants vary in their film strength. The very highest quality ordinary lubricants, however, do not have sufficiently high film strength properties for the designers of mechanical devices to take advantage of the improvements which might be achieved with higher rubbing pressures.

The halogens and sulphur are the elements that when added to a lubricating oil in certain forms impart increased film strength and oiliness to the lubricant. Ordinarily, halogen or sulphur compounds are used alone in a lubricant to give a high film strength product.

We have discovered that combinations of halogen and sulphur compounds in the same lubricant have certain advantages in film strength and oiliness over either when used alone. This advantage is not cumulative, but is due to the combination of the sulphur and halogen compounds. In what manner this combination of halogen and sulphur compounds in the same lubricant attain this advantage is not known. Our invention rests on the improved results obtained by the combination.

We list the groups of halogen and more specifically the chlorine compounds with examples of each group that may be used in combination with sulphur compounds in any suitable lubricating base oil in practicing this invention.

Halogen containing saturated paraffin compounds with a boiling point above 140° C. such as hexa-chloro-ethane, chloro-propanes, chloro-butanes, chloro-pentanes and higher homologues, such as chlorinated petroleum wax of high and low melting point.

Halogen containing unsaturated paraffin compounds with boiling points near 140° C. or higher, such as tetrachloro-ethylene, hexa-chloro-propylene, chloro-butylenes, chloro-pentenes, and higher homologues, such as the unsaturated hydrocarbons resulting from the cracking or partial pyrolitic decomposition of high boiling petroleum hydrocarbons.

Halogen containing oxygen bearing aliphatic compounds, which may be subdivided into the following subgroups:

Halogenated mono-, di-, and tri-hydric alcohols and higher homologues. Examples of halogen containing alcohols are as follows: Ethylene chloro-hydrin, glyceryl mono chloro hydrin and higher homologues.

Halogen containing aliphatic aldehydes, such as chloral and higher homologues as for example chloro-butanal, chloro-pentanal, etc.

Halogen containing saturated aliphatic acids such as chloro-acetic, chloro-propionic acids, and their higher homologues, as for example chloro-lauric, chloro-myristic, chloro-palmitic, chloro-stearic acids, etc.

Halogen containing unsaturated acids such as chloro-crotonic, chloro-acrylic, and higher homologues such as chloro-oleic acid, etc.

Halogen containing esters of saturated and unsaturated fatty acids such as methyl-chloro-propionate, ethyl chloro-laurate, methyl-chloro-stearate, and higher homologues. The equivalent mono and di-glycol esters, the mono, di- and tri-glycerol esters of the above chloro-fatty acids are included within the scope of halogenated compounds suitable for use in our combination.

Halogen containing substituted fatty acids and their esters of mono-, di-, tri-, and higher polyhydric alcohols such as methyl-chloro-ricinoleic acid and its esters, etc.

Halogen containing ketones such as chloro-methyl ethyl-ketone, chloro-di-butyl-ketone, and higher homologues of mixed and straight halogen containing ketones.

Halogen containing ethers such as di-chloro-ethyl ether, chloro-methyl-propyl-ether, and higher homologues of these straight and mixed ethers.

It will be noted that the acids, esters and ketones may be classified as chlorinated aliphatic compounds containing a carbonyl group.

Similarly among the halogen containing compounds of the carbo-cyclic series, we may place in the first group the derivatives of the straight hydrocarbons. These may be divided into several subgroups as follows:

Halogen containing benzenes such as the chloro-benzenes. Halogen containing hydrogenated and hydrocarbon substitution products of benzene such as chloro-toluenes, chloro-xylenes. Also chloro-mono, di-, tri-, phenyl benzenes are included in this group.

Halogen containing derivatives of naphthalene, such as mono-alpha- and beta-chloro-naphtha-

lene and higher chlorine derivatives. Also the hydrogenated and hydrocarbon substitution products of napthalene are included, as for example chloro-tetralin, chloro-decalin, chloro-methyl naphthalenes, chloro-ethyl naphthalenes, etc.

Halogen containing three-membered rings and their hydrocarbon substitution products, as for example chloro anthracene, chloro-phenathrene, etc.

Halogen containing terpenes, such as pinene-hydro-chloride, etc.

As with the halogen containing oxygen bearing aliphatic compounds, we may also similarly have a large group of compounds that may be classified under the heading of halogen containing oxygen bearing ring compounds. This large class may be divided into a number of subgroups as follows:

Halogen containing hydroxy-aromatic compounds, such as chloro-phenols, chloro-cresols, chloro-naphthols, and homologues.

Halogen containing aromatic aldehydes, such as chloro-benzaldehydes, etc.

Halogen containing aromatic acids and their substitution products, such as chloro-benzoic acid, chloro-salicylic acid, etc.

Halogen containing aromatic ketones and their substitution products such as chloro-ethyl phenyl ketone, chloro-benzophenone, etc.

Halogen containing aromatic ethers and their substitution products such as chloro-methyl-phenyl ether, chloro-diphenyl ether, etc.

Halogen containing aromatic esters such as chlor-methyl-benzoate and chlor-phenyl benzoate.

Halogen containing aromatic compounds having oxygen in the ring such as the chloro-diphenylene oxides.

Halogen containing condensation or polymerization products of aromatic compounds and chlorinated aliphatic compounds where any of the conventional condensation or polymerization agents are used to promote the combination. For example, the compound obtained by reacting naphthalene and chloro-paraffin wax in the presence of aluminum chloride, etc. In fact, any stable chlorine compound with a boiling point above 140° C. may be used in this invention in combination with a suitable sulphur containing compound.

For the sulphur compound to be suitable, it must be stable in the lubricating service in which it is employed and have a boiling point of over 140° C. A number of these compounds are listed as follows: Butyl sulfide, butyl disulfide, amyl sulfide, amyl disulfide, amyl sulfone, benzyl sulfide, para-cresyl ethyl thio-ether, dihydroxy ethyl sulfide, diphenyl sulfide, diphenyl sulfone, diphenyl sulfoxide, diphenyl thiocarboxide, diphenyl thio-urea, dithio-diglycol, di-para tolyl disulfide, di-para tolyl sulfide, di-para tolyl sulfone, di-para tolyl sulfoxide, ethyl dithio-oxalate, ethyl thio-cyanate, heptyl sulfide, methyl-heptyl sulfide, o-tolyl thio-urea, thio-cresols, thio-phenol, thio-acids, thio-naphthols, thio-phenyl acetal, thio-acetamides, thio-imido ethers, thio-ketones, thionic acids, thiophene. It will be observed that the foregoing compounds are of the type which are sufficiently stable so as not to substantially react with a copper strip in the conventional copper strip test. This is an essential characteristic when the lubricating composition containing the same is used to lubricate alloy bearings made from sensitive metals such as copper. These compounds are therefore of the "non-corrosive" type. All of the oxygen containing derivatives and the substitution products of thiophenes and sulfones are suitable for use in accordance with our invention. In fact, any oil soluble sulphur compound having a boiling point sufficiently high (140° C. or higher) so that it will not evaporate from the lubricant is suitable for use in our invention. The oxygen-bearing organic sulphur compounds are particularly suited for certain uses and especially when employed in conjunction with a separate organic halogen compound and more especially when such halogen compound is a relatively stable ring compound.

A satisfactorily colloidal suspension of the sulfur compound and halogen compound may be used in this invention in place of the true solution of the compounds. A physical solution of elemental sulfur in the halogenated compound also may be used.

Some sulfur and/or halogen compounds should not be used where they will come into contact with water. These should be used only in lubricants which will not come into contact with excessive moisture during their normal usage.

Any one or more of the above described halogens containing compounds may be blended with any one or more of the described sulphur compounds in a suitable oil base in practicing this invention. In general, the invention comprises the addition of relatively small quantities of the two types of compounds to a lubricating oil base. From 0.02 per cent to 10 per cent of the halogen compound is used with quantities varying from 0.02 per cent to 10 per cent of the sulphur containing compound. The purpose for which the oil is to be used will largely determine the kind and the quantity of addition agents required.

A suitable oil base may be defined as a hydrocarbon lubricant of a comparatively viscous or nonviscous nature, refined or unrefined, natural or synthetic. A vegetable or animal oil base is also suitable for use in this invention.

We are aware of the use of sulphur chloride treated oils for the improvement of lubricants. An example of such an oil is disclosed in the patent granted to Sommer, U. S. P. 461,513. In this patent, however, the chlorine and sulphur are in altogether different relation to each other since they are loosely held in the same molecule. The sulphur and chlorine in our invention is always found in two different molecules.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of our claims. It is further obvious that various changes may be made in details within the scope of our claims without departing from the spirit of our invention. It is therefore, to be understood that our invention is not to be limited to the specific details shown and described.

Having thus described our invention, what we claim is:

1. A lubricating oil comprising in combination, a major proportion of lubricating oil and from .02 of 1 per cent to 10 per cent by weight of a chlorinated aliphatic compound intimately mixed with said oil together with from .02 of 1 per cent to 10 per cent by weight of an organic sulphur compound, said sulphur containing and chlorinated compounds being oil soluble and having a boiling point above 140° C.

2. A lubricating oil comprising in combination, a major proportion of lubricating oil and from .02

of 1 per cent to 10 per cent by weight of a chlorinated oxygen-bearing aliphatic compound intimately mixed with said oil together with from .02 of 1 per cent to 10 per cent by weight of an aliphatic sulphur compound, said sulphur containing and chlorinated compounds being oil soluble and having a boiling point above 140° C.

3. A lubricating oil comprising in combination, a major proportion of lubricating oil and from .02 of 1 per cent to 10 per cent by weight of a chlorinated aliphatic compound containing a carbonyl group intimately mixed with said oil together with from .02 of 1 per cent to 10 per cent by weight of an organic sulphur compound, said sulphur containing and chlorinated compounds being oil soluble and having a boiling point above 140° C.

4. A lubricating oil comprising in combination, a major proportion of lubricating oil and from .02 of 1 per cent to 10 per cent by weight of a chlorinated ester intimately mixed with said oil together with from .02 of 1 per cent to 10 per cent by weight of an organic sulphur compound, said sulphur containing and chlorinated compounds being oil soluble and having a boiling point above 140° C.

5. A lubricating oil comprising in combination, a major proportion of lubricating oil and from .02 of 1 per cent to 10 per cent by weight of methyl-chloro-stearate intimately mixed with said oil together with from .02 of 1 per cent to 10 per cent by weight of an organic sulphur compound, said sulphur containing and chlorinated compounds being oil soluble and having a boiling point above 140° C.

6. A lubricating oil comprising in combination, a major proportion of lubricating oil and from .02 of 1 per cent to 10 per cent by weight of a chlorinated aliphatic ether intimately mixed with said oil together with from .02 of 1 per cent to 10 per cent by weight of an organic sulphur compound, said sulphur containing and chlorinated compounds being oil soluble and having a boiling point above 140° C.

7. A lubricating oil comprising in combination, a major proportion of lubricating oil and from .02 of 1 per cent to 10 per cent by weight of a chlorinated aliphatic hydrocarbon intimately mixed with said oil together with from .02 of 1 per cent to 10 per cent by weight of an organic sulphur compound, said sulphur containing and chlorinated compounds being oil soluble and having a boiling point above 140° C.

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