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LUBRICATING COMPOSITION

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This invention relates, as indicated, to lubricating compositions and more particularly, to compositions for use in connection with the lubrication of the working parts of internal combustion engines, motor vehicles, etc. and it is among the objects of the invention to provide compositions obviating the disadvantages of the usual petroleum oils.

It has been explained by specialists in this particular field of the art that a lubricant employed for the purpose of reducing friction between relatively movable metallic parts functions in two ways commonly referred to as "thick-film" lubrication and "thin-film" lubrication.

In "thick-film" lubrication the bearing surfaces are completely separated by a relatively thick continuous film of the lubricating composition employed. When friction between the moving parts is measured in this case, the results obtained are independent of all factors except pressure, speed and the viscosity of the lubricating composition. A single curve representing all data may be found by plotting the coefficient of friction against a particular function consisting of the product of the viscosity of the lubricating composition and the speed of relative movement of the parts divided by the pressure per unit area of the bearing surface, as long as the value of such function is greater than a definite amount. At this minimum point, reduction of viscosity or speed or an increase in the pressure results in a breaking down of the film of lubricant. Although the value of the coefficient of friction is lowest at the point at which the film is about to break down, the increase in the coefficient for higher viscosity and speed or lower pressure is relatively slight. The conditions resulting in "thick-film" lubrication are, therefore, those which result in low friction.

For pressures sufficiently great or for correspondingly low values of viscosity or speed, the film of lubricant, as above indicated, is broken down and if it is not entirely destroyed, the metallic bearing surfaces are still affected to some extent, at least by the presence of the lubricating composition. This condition is commonly referred to as "thin-film" lubrication.

When one of the bearing surfaces is a metal such as bronze or babbitt, seizure does not take place at once but the coefficient of friction increases rapidly to abnormally high values with each slight further increase in pressure or decrease in viscosity or speed. For a given set of bearings the data obtained for "thin-film" lubrication may be approximately coordinated into a single curve but only on plotting coefficient of friction against the product of viscosity and speed divided by the square root of the pressure.

If both bearing surfaces are of steel, seizure or scoring will result almost immediately upon failure of "thick-film" lubrication when a pure mineral oil is the sole lubricating composition employed.

It is among the objects of our invention to provide a lubricating composition which may be employed to reduce the friction between relatively movable metallic surfaces under pressures and other factors which result in what has been above explained as "thick-film" lubrication and a composition which may be employed for such "thin-film" lubrication and without a material increase in the coefficient of friction between the parts over that found during "thick-film" lubrication.

Other objects of our invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention, then consists of the means hereinafter fully described and particularly pointed out in the claims.

The following description sets forth in detail one approved combination of ingredients embodying our invention, such disclosed means constituting, however, but one of various forms in which the principle of the invention may be used.

Broadly stated, this invention comprises incorporating certain forms of halogenated carbon compounds with certain types of oil bases. More specifically, the invention comprises incorporating a halogenated carbon compound with a sulphur-treated oil base and incorporating an oxygen-bearing halogenated carbon compound with any suitable oil base.

By the term "sulphur treated oil" as employed in this description, is meant any suitable oil base which has been treated with sulphur, for example, the composition produced by heating sulphur with a fixed oil, such as lard, oil, or fish oil; or to which sulphur has been added, so that a certain amount of sulphur is present in active or loosely combined form. It has been found that a suitable oil base containing from 0.50% to 2.50% of sulphur in active or loosely combined form is best suited for use in a composition according to the present invention. These percentages are not to be construed, however, as limitations but merely an indication of the range of sulphur in the form defined for optimum results.

We have found that certain oxygen containing carbon ring compounds which have been chlorinated and added to a lubricating oil are capable of

improving the properties of such oil, particularly when employed for "thin-film" lubricating purposes. The addition of these certain oxygen containing carbon ring compounds which have been chlorinated and added to the lubricating oil have been found to improve the properties thereof to an even greater extent than certain similar chlorinated hydro-carbons, notably when added in very small amounts.

The halogenated oxygen-containing carbon ring compounds added to a suitable oil base are, as above indicated, preferably of the chlorinated species and particularly the following compounds have been found to produce very satisfactory results, viz: halogenated or more specifically, chlorinated oxygen-containing substituted benzene compounds such as:

Chlorinated phenols
Chlorinated cresols
Chlorinated diphenylether
Chlorinated methyl salicylate;

halogenated substituted di-phenyl such as:

Chlorinated p-phenyl phenol
Chlorinated di-xenyl ether;

chlorinated substituted naphthalenes such as:

Chlorinated naphthols;

as well as the aromatic ethers, phenols, acids, the esters and the aldehydes.

It will be noted that the above enumerated specific examples of oxygen-bearing organic ring compounds which are preferably employed (that is, phenols, cresols, diphenyl ether, methyl salicylate, p-phenyl-phenol, di-xenyl ether and naphthols) are compounds of the aryl type, that is compounds containing benzoid ring structures.

It will be further noted that halogenation of these specific oxygen-bearing ring compounds generally produces compounds of the type in which the halogen is directly attached to an atom which is a part of such ring structure.

It will be noted that the example of a halogenated aromatic ester given above (chlorinated methyl salicylate) is a halogenated alkyl ester of a hydroxy-aromatic acid (i. e. an ester of a hydroxy-aryl carboxylic acid); more specifically a halogenated ester of hydroxy-benzoic acid.

Other examples listed above which may be inclusively described as halogenated hydroxy-aromatic compounds are the chlorinated phenols and cresols, and chlorinated p-phenyl phenol. The last-named compound may also be described as a halogenated hydroxy diphenyl.

As a matter of convenience the halogenated oxygen-containing substituted diphenyls, as well as the halogenated oxygen-containing substituted benzenes where two or more phenyl groups are directly linked, may be inclusively referred to as halogenated oxygen-containing substituted polyphenyls.

Since generally the addition of compounds of the class including the above enumerated reduce the viscosity of the oil base to which the same are added, if a large percentage of such compounds are added, there will be a tendency to destroy "thick-film" lubrication because of such reduction in viscosity. If an excessive quantity of such compounds are added, all of the lubrication will then be of the "thin-film" type and therefore, produce a decided increase in the amount of friction developed.

Optimum results are obtained by using minimum quantities of these halogenated compounds so that their beneficial effect in the region of "thin-film" lubrication will not be overshadowed by their detrimental effect in the region of "thick-film" lubrication.

Our invention contemplates incorporating with a suitable oil base a total of less than 20% of at least one halogenated oxygen containing carbon ring compound of the enumerated class.

The optimum amount of the halogenated compound to be employed will depend largely upon the halogen content of the particular compound, its physical characteristics and especially its effect on the viscosity of the oil to which it is added. The particular use for which the lubricant is intended is also a governing factor in determining the amount of the compound to be added.

For the purpose of lubricating and reducing the friction between the relatively movable parts of an internal combustion engine such as crank case bearings, piston and cylinder surfaces, as well as piston rings and valves, a composition according to our invention comprises a large proportion of a suitable oil base such as mineral oil and concentrations of from one-half to two per cent. of halogenated compounds of the above class containing from 50% to 25% of chlorine. If the valve structure of the engine is to be lubricated separately from the remainder of the mechanism or by means acting in an auxiliary fashion, the composition for such purposes will preferably contain a larger amount of such halogenated compounds, i. e., from 2 to 10%.

The limit of the amount of the halogenated compounds which may be added to an oily base and which will produce improved results depends, as above indicated, upon the reduction in viscosity of the composition caused by the addition of such compounds. Certain of the more viscous compounds, for example, chlorinated di-phenyl oxide containing about 50% chlorine, may be added in amounts exceeding 10% without causing too great a reduction of viscosity. In any event, the resultant composition will have inferior lubricating properties if the loss of viscosity is too great as will result from the use of more than 20% of halogenated compounds of any type.

It has been found that for optimum results a certain relationship should be maintained between the amount of chlorine and the amount of sulphur, when the halogenated compounds of the above class are added to a sulphur treated oil. It has been found that to an oil base having a low content of sulphur in active or loosely combined form, halogenated compounds should be added in correspondingly low concentrations for best results.

When the halogenated compounds of the above class added to the oil base, are of the closed ring type in contradistinction to the open chain type, certain advantages are obtained which may be briefly explained as follows:

In case of oil in actual use in machinery of any kind and particularly in the crank case of internal combustion engines, moisture is always present to some extent and due to condensation may even accumulate to form a separate layer. There is always sufficient water present, therefore, for hydrolysis to take place, particularly when the addition of a chlorinated compound is made to the extent of only a few per cent.

Experiments have shown that when compounds which readily hydrolize, such as chlorinated open chain compounds, are added to the oily base, hydrolysis will take place to such an extent that the metal parts of any machine being lubricated will be seriously attacked and corroded by the

acid generated. On the other hand, the addition of chlorinated carbon ring compounds of the above enumerated class does not cause corrosion.

The composition comprising our invention has certain advantages when used as a lubricant of which the following may be mentioned:

First: By the use of this composition it is possible to extend the pressure range between the bearing surfaces because of the reduced tendency for bearing surfaces so lubricated to become scored or to seize at higher pressures than are allowable with ordinary lubricants.

Second: The friction between the bearing surfaces is reduced, especially in the higher pressure range below that obtained with ordinary lubricants.

With regard to the use of sulphur-treated oil in combination with halogenated compounds, it should be noted that for sufficiently desirable results, the major proportion of the ultimate composition need not consist entirely of sulphur-treated oil, but a suitable oil base such as mineral oil may have added thereto minor quantities or proportions of a sulphur-treated oil and a halogenated compound.

Certain subject matter disclosed but not claimed herein is disclosed and claimed in our co-pending applications Serial No. 31,720, Serial No. 136,860 and Serial No. 182,300, now respectively Patent No. 2,137,782, Patent No. 2,137,783 and Patent No. 2,137,784.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the materials employed in carrying out the process, provided the ingredient or ingredients stated in any of the following claims or the equivalent of such stated ingredient or ingredients be employed.

We therefore particularly point out and distinctly claim as our invention:

1. A lubricant comprising in combination a major proportion of a hydrocarbon oil and a minor proportion of a halogenated aromatic hydroxy compound.

2. A lubricating composition including a major proportion of a hydrocarbon oil and a minor proportion of chlorinated phenol.

3. A lubricating composition including a major proportion of a hydrocarbon oil and a minor proportion of chlorinated cresol.

4. A composition of matter which includes a lubricating composition having as a primary lubricating constituent the combination of a major proportion of a suitable oil and a minor proportion of a halogenated phenol.

5. A lubricating composition comprising in combination, a major proportion of a suitable oil base and a minor proportion of a halogenated naphthol.

6. A lubricating composition comprising the combination of a major proportion of a suitable oil base and a minor proportion of a halogen bearing aromatic hydroxy compound selected from the class consisting of the halogenated phenols.

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