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UNITED STATES PATENT OFFICE

2,161,678

LUBRICATING COMPOSITION

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8 Claims. (Cl. 87—9)

This invention relates to lubricating compositions and particularly to the so-called extreme pressure lubricants.

The standard lubricants for heavy duty service, that is, in internal combustion engines, are mostly hydrocarbon oils. These mineral oils, when properly refined, are very stable under heat, but they are deficient in oiliness and in the strength of the oil film which is formed between metal surfaces in bearings or at other points where lubrication takes place. Both factors of film strength and oiliness are of great importance in the lubrication of heavy duty bearings such as are encountered in modern internal combustion engines or in gear transmissions with high tooth pressures, for example hypoid gears. Insufficient film strength will result in metal to metal contact even when an adequate quantity of lubricant is supplied to the bearing and insufficient oiliness will prevent retention of an oil film in the bearing when for any reason a lubricant supply becomes insufficient. Both deficient oiliness and deficient film strength permit metal to metal contact which results in higher wear and also in the rapid development of heat. Modern high speed internal combustion engines operate at so close to the limit of bearing pressures and rubbing speeds that it has been necessary to change the material used in the bearing, for example to substitute certain high melting bearing metals such as alloys containing silver, cadmium and the like, for the standard Babbitt metals.

Film strength is probably due to molecular forces in the oil film, the molecules of which have the property of wetting or adhering to the metal surface. An oil film is retained tenaciously even when the lubricant supply is interrupted for considerable periods of time.

In the past, the problem was first attacked by the incorporation of small amounts of fatty acids into the oil. These compounds did, in fact, increase the oiliness to some extent, probably due to soap formation of the free acid with the metal of the bearing surface, but they did not produce films of high strength and corrosion and other difficulties rendered their use undesirable. Certain esters such as tricresyl and triphenylphosphate and chlorinated esters of fatty acids with mono or dihydric alcohols have been proposed and have achieved some commercial success, notably in the case of chlorinated stearic acid esters. The presence of the acid radical, even though combined in ester form, was considered to be a necessary characteristic of the compounds.

According to the present invention, I have found that certain halogenated and especially chlorinated polyaryl alkyl compounds which are neither esters, acids or derivatives, possess the property of increasing film strength to a high degree and also improving oiliness. While the property of increasing film strength appears to be general in halogenated polyaryl alkyl compounds where the halogen is attached to the alkyl chain, I have found that the economical compounds are those in which the alkyl chain contains two carbon atoms; that is to say, the halogenated polyarylethanes and ethylenes.

The number of halogen atoms attached to the alkyl or, more specifically, to the two carbon atom alkyl chain, may vary. In general, di- and trihalogenated compounds give good results, particularly diaryl dichlorethylenes and diaryltrichlorethanes. The effect of different aryl groups is comparatively slight, although there appears to be a slight tendency toward increased film strength with higher molecular compounds. Thus, for example, diphenyldichlorethylene does not give as strong a film as diphenyltrichlorethane, but when dixylyldichlorethylene or dinaphthyldichlorethylene is used the film strength is practically the same as with diphenyltrichlorethane. Increase with molecular weight is, however, comparatively small with the trichlorethanes which have such extraordinarily high film strengths and even in the case of the lowest member that the additional cost of higher molecular compounds of this series is not warranted. In the case of dichlorethylenes, however, the increase with molecular weight is very marked.

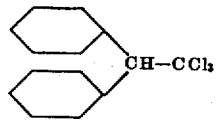
Extreme pressure lubricants of the prior art using esters as the added element have in the past shown an unfortunate tendency of gradually losing film strength after having been kept for long periods of time at an elevated temperature. Of course, in operation, where the lubricant is to be used in the crank case of an internal combustion engine, it normally operates at high temperatures ranging around the boiling point of water or slightly below so that for this type of use an extreme pressure lubricant that loses film strength in use at high temperatures is distinctly disadvantageous. Even in the case of gear lubricants, for example for hypoid gears, it is desirable to have a high temperature stability although in some cases, for example, in the differentials of automobiles, normal use may not involve very high temperatures.

It is an important advantage of the present invention that lubricating compositions containing products of the present invention show extraordinarily high temperature stability. This is an added advantage of the present invention and renders the compounds particularly suitable for use in lubricating oil for internal combustion engines where high temperatures are encountered.

Halogen atoms, particularly chlorine atoms in the aryl nuclei, do not appear to greatly increase film strength although satisfactory lubricating compositions can be prepared using such compounds.

Example I

A standard naphthenic base lubricating oil is compounded with 1% of diphenyltrichlorethane having the following formula



and tested on an Amsler testing machine. The product showed a load carrying capacity of 300 kg. which was the maximum reading for the particular machine. In order to test out the heat stability, a portion of the lubricating composition was placed in an oven maintained at 100° C. and portions removed after 24, 48, 72, 96, 120, 140 and 164 hours. These samples, when tested in the machine, showed no loss in film strength as measured by the machine. The torque reading on the machine which gives some information with regard to the oiliness of the composition, dropped from 65 ft. lbs. for the unheated sample down to a minimum of 43 at 96 hours and then rose to about 90 at 164 hours.

In order to test out the film strength of the composition at very high temperatures, a sample removed from the oven after 48 hours was heated to 205° C. and tested at this temperature. Even at this very high temperature which is not normally encountered in regular service, the film strength was still 150 kg. The untreated oil at low temperature had a film strength of 120 kg.

A solution of ½% of diphenyltrichlorethane in the same hydrocarbon solvent was tested and showed 300 kg. film strength. 5% showed a somewhat lower film strength namely 260 kg.

When measured on the same Amsler machine ditolyl and dixylyltrichlorethane showed the same film strength, i. e. 300 kg. It is probable that these compounds have a slightly higher film strength but as they exceeded the maximum reading of the Amsler machine, the difference could not be determined.

Example II

Dixylyldichlorethylene was mixed with the same hydrocarbon oil as used in Example I in the form of a 1% solution. When tested on the Amsler machine this showed a film strength of 300 kg. and no decrease in film strength was measured by the machine up to 114 hours heating at 100° C. After 165 hours the reading dropped somewhat below 300 kg. The dixylyldichlorethylene therefore shows a high heat stability.

A 2% solution in the same hydrocarbon oil showed the same film strength. The same is true of a 1% solution in a Pennsylvania base lubricating oil.

Diphenyldichlorethylene in a 1% solution in the lubricating oil of Example I showed between 14 and 15% lower film strength than the dixylyldichlorethylene. Ditolyldichlorethylene shows a film strength which is intermediate between diphenyl and dixylyldichlorethylene.

Example III

A 1% solution of dinaphthyldichlorethylene in the hydrocarbon oil of Example I was tested on the Amsler machine and showed a film strength of 290 kg. It also showed good heat stability.

Example IV

1% of tetrachlordiphenyl dichlorethylene is dissolved in the mineral oil described in Example I. When tested on the Amsler machine this composition shows 300 kg. film strength at a torque of 65 and possesses excellent heat stability. This compound shows slightly higher torque but practically equal film strength to the dixylyldichlorethylene. Where maximum film strength is desired and a slightly decreased oiliness is permissible, the tetrachlor diphenyl dichlorethylene may be produced at a somewhat lower cost than the dixylyldichlorethylene.

The chlorinated compounds described in the foregoing examples constitute the preferred products of the present invention as they show very high film strength and can be produced for a reasonable cost. Their film strength is almost double that of 1% solution of tricresylphosphate which shows only 160 kg. on the Amsler machine. The corresponding brominated compounds give film strengths which are practically the same as the chlorinated compounds but their higher cost renders them economically less advantageous.

It is difficult to measure the oiliness directly. Practical tests show an important increase in oiliness when the compounds of the present invention are used and a rough qualitative indication may be noted by considering torques on the Amsler machine. Normally of course high film strength materials using the full 300 kg. pressure show comparatively higher torques than do low film strength materials where the pressure is less. Despite this fact, the torque for diphenyltrichlorethane averages under 65 for a 300 kg. film strength as against 68 for 160 kg. film strength of tricresylphosphate. The dixylyldichlorethylene averages about 50 for a film strength of 300 kg. It will therefore be apparent that the preferred products of the present invention give better lubricating efficiency than do the standard materials of the prior art even at higher bearing loads. While this does not give a quantitative measure of oiliness, it does show that the products of the present invention are superior to tricresylphosphate.

Tests for a considerable period of time in an automobile show that the compositions of the present invention do not decompose to form corrosive or gummy deposits. No increase in gum formation or solution could be noted over the unblended mineral oil except in the case of the dinaphthyl-dichlorethylene which showed some tendency to form sludge.

In the claims, the term "alkyl" is used to cover aliphatic hydrocarbon chains which may be either saturated or unsaturated.

I claim:

1. A lubricating composition comprising a mineral lubricating oil and a small amount of a halogenated polyarylalkyl in which halogen is attached to the alkyl group.

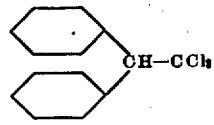
2. A lubricating composition comprising a mineral lubricating oil and a small amount of a chlorinated polyarylalkyl in which halogen is attached to the alkyl group.

3. A lubricating composition comprising a mineral lubricating oil and a small amount of a diarylalkyl having two carbon atoms, the aryl groups being attached to the same carbon atom and the halogen being attached to at least one of the carbon atoms of the alkyl group.

4. A lubricating composition comprising a mineral lubricating oil and a small amount of a diaryl trichlorethane in which the two aryls are attached to the same carbon atom.

5. A lubricating composition comprising a

mineral lubricating oil and a small amount of a diphenyl trichlorethane having the following formula



6. A lubricating composition comprising a mineral lubricating oil and a small amount of a diaryl dichlorethylene.

7. A lubricating composition comprising a mineral lubricating oil and a small amount of a dixylyl dichlorethylene.

8. A lubricating composition comprising a mineral lubricating oil and a small amount of a dinaphthyl dichlorethylene.

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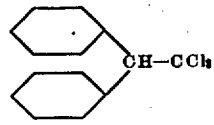
DISCLAIMER

2,161,678.—*Kenneth H. Klipstein*, Short Hills, N. J. LUBRICATING COMPOSITION. Patent dated June 6, 1939. Disclaimer filed June 6, 1942, by the assignee, *American Cyanamid Company*.

Hereby disclaims claims 1, 2, and 3.

[*Official Gazette June 30, 1942.*]

mineral lubricating oil and a small amount of a diphenyl trichlorethane having the following formula



6. A lubricating composition comprising a mineral lubricating oil and a small amount of a diaryl dichlorethylene.

7. A lubricating composition comprising a mineral lubricating oil and a small amount of a dixylyl dichlorethylene.

8. A lubricating composition comprising a mineral lubricating oil and a small amount of a dinaphthyl dichlorethylene.

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