Patented Jan. 30, 1951

2,539,422

UNITED STATES PATENT OFFICE

2,539,422

LUBRICATING OIL

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No Drawing. Application July 23, 1947, Serial No. 763,152

7 Claims. (Cl. 252—33)

1

Our present invention relates to a lubricating oil, particularly to a crank case oil and to a break-in oil for internal combustion engines and to a method and agent for inhibiting the formation of water emulsion sludge in said oils.

During use the crank case oil of automobile engines becomes contaminated with sludge which comprises water, gasoline, carbon, varnish or lacquer-like material, gums, acids and metal particles from the bearings, piston rings, cylinder walls and other motor parts.

This contamination occurs particularly in cold or winter weather and most markedly when the automobile is operated intermittently or for short runs. Under such conditions the moisture formed by the combustion of the motor fuel condenses on the cylinder walls while the engine is cold and finds its way into the crank case. Here it is emulsified with the oil by the churning action of the crank shaft and by being forced through the narrow passages of the engine lubricating system. The resulting emulsion is of a thick sticky nature being of the consistency of mayonnaise. It tends to disperse and hold in suspension the other contaminants, particularly carbon, fine metal particles, gums and varnish or lacquer formed or set free in the oil during the operation of the engine.

While this emulsion may be broken and the water vaporized when the crank case reaches a sufficient temperature as, for example, on a long run or in warm weather, a sufficient amount remains to clog the oil filter and thus cause the contaminated oil to be by-passed into the bearings and working parts of the engine. Contamination of this type leads to a rapid clogging of the oil filter and to increased wear on moving parts of the motor.

In some cases the amount of water emulsion sludge carried by the oil may equal 10% or more of the total amount of oil in the crank case and may be formed of approximately equal parts of oil, water and materials insoluble in petroleum, such as carbon, metallic soaps, metals, varnish and gums, acidic materials and other oxidation products.

The formation of the water emulsion aids very materially in suspension of the solid and gummy and acidic impurities which greatly impair the lubricating quality of the oil, hastening corrosion and wear, and reduces the efficiency of the oil filters or screens and of the lubricating end of the lubricating ports or passages.

2

The clogging of the oil filter is particularly objectionable as it renders the filter useless and by-passes all of the impurities through the oil or lubricating passage.

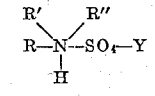
In our present invention we provide in the lubricating oil an agent which inhibits the formation or maintenance of an oil and water emulsion, thereby freeing the oil of the above contaminants.

A special type of crank case oil to which our present invention is applied is a break-in oil. Break-in oils are used in the crank cases of new and reconditioned automotive engines in which there are small clearances between the new or freshly exposed metal surfaces which are "dry," that is, substantially free from oil film. These engines are run at reduced speeds, with the break-in oil in the crank case, for a minimum mileage, usually from 500 to 1000 miles, until the engine is "broken in."

In order to ensure penetration of the break-in oil in the small clearances between the moving parts of the engine, the oil is thinner or lighter than the usual crank case oil. A thinner break-in oil may be one of lower viscosity or one having a volatile solvent.

In our present invention the break-in oil has the added advantage of increasing the adhesiveness between the oil and metal parts of the engine and providing a greater film strength, ensuring that the oil or lubricant will cover all parts of the surface to be lubricated, excluding water or moisture from contact therewith, and will penetrate promptly into the narrow spaces between the closely fitting metal parts of the engine.

In our present invention we add as an inhibiting agent a member of the class of compounds having the general formula:



wherein R is a cyclohexyl radical, R′ and R″ are alkyl groups containing not more than 3-carbon atoms and Y is a normal primary aliphatic hydrocarbon radical having from 8 to 20 carbon atoms.

An example of such a compound is one in which R′ and R″ may be either ethyl or methyl radicals, or in which one may be ethyl and the other methyl and, for example, in which Y may be a lauryl radical or may be an oleyl or a stearyl radical. This class of agents and its method of manufacture have been described in

a patent to Lenher and Arnold, No. 2,139,277, granted December 6, 1938.

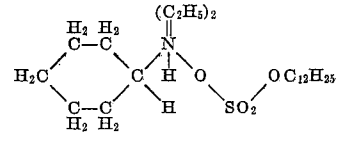
The above agents have been known as surface active or wetting agents and have been used to render oils dispersible in water or aqueous mediums.

In our present invention, however, we use the agent with a lubricating oil of the crank case or break-in type to prevent the emulsification of water in the oil, particularly at low temperatures. For this purpose a very small quantity of the agent is used in the lubricant, this amount being less than 1% or between .05% and 1%, but preferably between 0.2% and 1% of the weight of the oil.

At concentrations substantially above 1% in the crank case or break-in oil the effectiveness of the agent as a de-emulsifying agent decreases and at 2% or more the action is reversed and the agent tends to aid or stabilize emulsification.

However, in incorporating the inhibiting agent in the crank case oil or break-in oil it may be first dissolved in a suitable oil solvent in much greater concentration and up to the limit of solubility of the agent in the respective oil and then mixed with the crank case oil either before or after the latter is introduced into the crank case or lubricating system so as to obtain the concentration within the above limits. Preferably, however, the agent is introduced into the crank case oil before the latter is placed into the crank case to obtain a uniform distribution at the start of the operation.

An example of a crank case oil is one having a viscosity in the usual range of from about 20 S. A. E. and upwards and containing 0.2% by weight of diethyl cyclohexylamine lauryl sulphate:



To speed up the solution of the agent in the oil a small amount of an alcohol having from 12 to 18-carbon atoms, such as lauryl, oleyl or stearyl alcohol may be used.

An example of the addition of the agent in a solvent would be to add 1 part of a 10% solution of the agent in petroleum benzine to 50 parts by volume of a crank case oil to produce a resulting concentration of 0.2%. When the crank case oil into which the solution of inhibitor is mixed contains a water emulsion sludge the emulsion is broken, the water settling to the bottom of the crank case.

If a contaminated crank case oil is treated with the inhibitor and centrifuged at, for example, 2000 R. P. M. from 7 to 10 minutes and a control of the same oil without the inhibitor be similarly centrifuged, free water will be thrown out in the case of the treated sample, but no free water is thrown out of the untreated sample even with continued centrifuging.

If an oil is contaminated with 2.5% by volume of solid contaminants and steam is passed through the oil treated with the above agent, the resultant condensate readily separates from the oil, whereas in a similar oil without the inhibitor agent water entrained by the steam does not separate even with centrifuging.

If the steamed samples are allowed to stand at room temperature and then poured onto a filter consisting of several layers of cheese cloth, the crank case oil containing the inhibitor agent passes through the filter in less than one minute, whereas the control sample without the inhibitor fails to pass through the filter even after several days' standing.

As a result of the inhibiting action of the agent, therefore, the crank case oil remains much cleaner, does not form sticky clogging emulsions or suspension and thereby maintains a much cleaner condition in the motor.

Comparative tests were made on motors using crank case oils with and without the inhibitor. For example in a test conducted from June to February in two successive years on two fleets of eight cars the test being first run in one year with oil minus the inhibitor and in the same engines in the next year with the inhibitor and under similar conditions, the amount of petroleum insolubles removed per month from the oil without the inhibitor averaged 2.5%, and from the oil with the inhibitor 1.2%. The average number of miles the cars were driven between the draining or changing of oil was 1013 for the untreated oil and 1686 for the treated oil. No water emulsion sludge was found in the treated oil, whereas it did occur in the untreated oil.

In a similar test of a fleet of 14 cars during a similar period in two successive years, the average per cent of solids removed per month from the untreated oil was 2.1% and from the treated oil 1.1%. The number of miles driven between renewal or draining was 1125 for the untreated oil and over 2300 miles for the treated oil. There was no water emulsion sludge in the treated oil. Other tests on individual motors gave results similar to the above.

In the case of a break-in oil a slightly greater amount of the above agent may be added. The break-in oil may be a crank case oil of very low viscosity as, for example, a mineral oil having a viscosity of 125 seconds Saybolt at 130° F., or a mixture of a low viscosity petroleum oil with other selective oils such, for example, as prime lard oil. Or it may be a crank case oil to which is added a quantity of a volatile hydrocarbon oil or a volatile organic compound, such as secondary butyl alcohol, which is freely soluble and miscible in mineral oils, or a mixture of such volatile compounds.

A volatile compound, such as that known as Stoddard solvent and which is substantially a mineral oil distillate having a minimum flash point of 100° F. and of which at least 50% distils up to or at 350° F., is an example of a volatile solvent that may be employed in the break-in oil.

Examples of break-in oils within the scope of the invention are as follows:

Example 1

1.2 oz. avoirdupois of di-ethyl (or di-methyl) cyclohexylamine lauryl sulphate is dissolved in 1 qt. of Stoddard solvent and made up to a volume of 2 qts. with a commercial grade of S. A. E. 10 motor oil. This provides a concentration of 1.8% (1.8 grams per 100 milliliters) of the inhibiting agent.

Example 2

1.2 oz. avoirdupois of the above agent is dissolved in a mixture of 1 pt. of Stoddard solvent and 1 pt. of secondary butyl alcohol and made up to 2 qts. with S. A. E. 10 oil.

Example 3

1.2 oz. avoirdupois of the above agent is dis-

solved in 0.25 pt. of lard oil and 1.75 pt. Stoddard solvent and made up to 2 qts. of S. A. E. 10 oil.

The preferred method of use of the break-in oils such as those of the above examples is to add two quarts of a break-in oil after the regular oil in the crank case has been brought to the normal "full" level on the oil level indicator. The purpose of the extra oil is to compensate for the loss of volatile solvent, which is expelled, after 150 to 200 miles of operation and to ensure a liberal supply of lubricating oil.

Crank case capacities vary in different types of motors but the range of effectiveness of the surface-active agents is considerable and excellent results have been obtained under actual operating conditions with crank case capacities ranging from 3½ to 7 quarts. Furthermore, the proportion of break-in oil to the other oil in the crank case can be readily adjusted under special conditions, retaining the desirable features of the invention.

Break-in oils containing the above agent may also be prepared with low viscosity oils and varying amounts of the volatile solvent or the volatile portion may be left out entirely. In the latter instance, since it is not necessary to compensate for the loss of volatile material, the total volume of break-in oil plus regular oil in the motor need not exceed the "full" level on the oil level indicator.

It is also obvious that a complete oil with or without volatile solvent may also be prepared and the concentration of the above agent adjusted to the desirable concentration. Such an oil would have preferably $\frac{4}{16}$% of the above agent in a light or low viscosity oil. When a volatile solvent is present, additional oil is introduced into the crank case to compensate for loss by volatilization.

Also the above agent can be dissolved in a volatile solvent and introduced into the break-in oil by admixing therewith in the crank case.

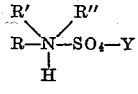
The typical viscosities of a mixture of break-in oil of 30 seconds Saybolt at 130° F. with a #30 S. A. E. crank case oil are as follows:

Quarts Break-in oil	Quarts SAE 30 motor oil	Seconds
2	4	89
2	6	106
2	8	123

This compares with #10 S. A. E. oil having a viscosity of 90—120 seconds at 130° F.

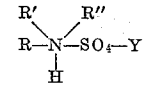
What we claim is:

1. An emulsion resistant crank case oil consisting of crank case oil and from 0.05% to about 1% of the compound having the following formula:



wherein R is a cyclohexyl radical, R' and R'' are alkyl groups containing not more than 3 carbon atoms and Y is a normal primary aliphatic hydrocarbon radical having from 8 to 20 carbon atoms to inhibit formation of emulsion.

2. An emulsion resistant crank case oil consisting of crank case oil and about 0.2% of the compound having the following general formula:

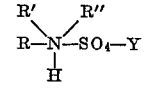


wherein R is a cyclohexyl radical, R' and R'' are alkyl groups containing not more than 3 carbon atoms and Y is a normal primary aliphatic hydrocarbon radical having from 8 to 20 carbon atoms to inhibit formation of emulsion.

3. The crank case oil of claim 1 having a viscosity of from 89 seconds to 123 seconds Saybolt at 130° F.

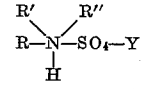
4. The crank case oil of claim 1 having a viscosity of from 89 seconds to 123 seconds Saybolt at 130° F. and containing a volatile hydrocarbon oil.

5. The method of inhibiting emulsion formation in crank case oils which comprises adding to said crank case oil the compound having the general formula:



wherein R is a cyclohexyl radical, R' and R'' are alkyl groups containing not more than 3 carbon atoms and Y is a normal primary aliphatic hydrocarbon radical having from 8 to 20 carbon atoms in an amount between 0.05% and 1%.

6. The method of inhibiting emulsion formation in crank case oils which comprises adding to said crank case oil a solution of a compound having the general formula:



wherein R is a cyclohexyl radical, R' and R'' are alkyl groups containing not more than 3 carbon atoms and Y is a normal primary aliphatic hydrocarbon radical having from 8 to 20 carbon atoms in a solvent miscible with said crank case oil in an amount to provide between 0.05% and 1% in said crank case oil.

7. The method of claim 6 in which said solvent is relatively more volatile than said crank case oil.

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