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LUBRICANT

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This invention has to do in a general way with the art of compounding lubricants and is more particularly related to an improved lubricant which is especially useful in lubricating engines of the compression ignition type.

As is well known to those familiar with the art, the usual type of lubricating oil, under certain conditions of use, such as in internal combustion engines of the Diesel type and those spark ignition engines where piston temperatures are abnormally high, tends to form sticky carbonaceous deposits, which over varying periods of use accumulate in the piston ring grooves, causing the rings to stick and become ineffective. This problem of the piston ring sticking has assumed considerable importance since the advent of high and medium speed Diesel engines. Although little is known as to the actual cause of ring sticking, it is probably both chemical and physical in nature. It is probably chemical in that the oxidation of the oil may produce sticky materials which build up around the ring areas and eventually limit or completely restrict free motion of the rings. The physical action is indicated by the fact that volatility of the oil, as measured by consumption rates, appears to have a definite influence on ring sticking.

Irrespective of any theory as to the cause of this ring sticking action, it has been discovered that such action may be materially reduced by the addition to the oil of certain selective materials. We are aware of the fact, for example, that certain naphthenic materials have been compounded with mineral lubricating oil and have been used with varying degrees of success either to inhibit the formation of, or to maintain in solution or suspension, those materials which lead to the phenomenon of ring sticking. We have discovered that these naphthenic compounds, however, while effective to a degree at least on certain types of oil, such as conventionally refined coastal oils, have little or no effect on other oils, such as solvent refined mid-continent oils.

It therefore becomes the primary object of this invention to provide a lubricant composition which contains an additive ingredient that will prevent the ring sticking action which ordinarily attends the use of the base stock, irrespective of the source of the base stock or the manner in which the same has been refined. It is a further object of this invention to provide a method of inhibiting or preventing the formation of sticky and carbonaceous deposits on metal surfaces, such as piston rings and the like, which are in contact with hydrocarbon lubricant oils under pressure and temperature conditions at which such deposits would normally form. With these objects in mind, we have discovered that certain metal salts of organic ether acids, which are commercially available to the trade under the trade name of "Oilsolates", may be added to mineral lubricants of the type ordinarily used in Diesel engines to provide a lubricant blend which is substantially devoid of those properties that lead to ring sticking.

The "Oilsolates" hereinabove referred to are manufactured and sold for use in the paint industry as siccatives, and their preparation and properties as such are discussed at length in an article by Bruson and Stein in "Industrial and Engineering Chemistry," volume 26, No. 12, pages 1268 to 1271. It will be understood, therefore, that these compositions per se and their method of preparation form no part of the present invention, which is directed to a lubricating composition comprised of a major portion of a hydrocarbon lubricant and a minor proportion of an "Oilsolate" compound and to a method of inhibiting the formation of ring sticking deposits about the piston rings of an internal combustion engine which comprises providing the surface of the piston and said rings with a film of hydrocarbon lubricant oil containing a small amount of an "Oilsolate" compound.

As is stated above, the "Oilsolates," or the compounds contemplated as additive ingredients herein, are metal salts or soaps of a particular class of organic acids, and the particular compounds which we have so far demonstrated as being effective to attain our objectives may be broadly classified as polyvalent metal salts of organic ether acids, such acids being of the general type, $R—O—C_nH_{2n}—COOH$, in which R is a hydrocarbon radical having more than 3 carbon atoms and n is a whole number from 1 to 3. The particular soaps or salts of this general group, which we have employed in compounding Diesel lubricants and which we have used in the method contemplated by this invention, are the cobalt and aluminum salts of ether acids of the general type referred to above, in which R is a hydrocarbon radical derived from a commercial alcohol having more than 5 carbon atoms, and in which n is 1. In other words, these ether acids are those which may be obtained by the condensation of a commercial alcohol or a mixture of commercial alcohols with monochlor acetic acid, according to the procedure outlined in Bruson Patent No. 2,044,968. The alcohol constituent in the synthesis of the acids used in demonstrating the effectiveness of these materials was a mixture of higher monohydric alcohols obtained as a by-product from the synthetic manufacture of methanol by the catalytic treatment of hydrogen and carbon monoxide. It is to be understood, however, that while the cobalt and aluminum salts of these particular ether acids have been used to demonstrate the effectiveness of these "Oilsolate" materials as additive

gredients for lubricants of the type contemated herein, the salts of various other ether ids and of various metals other than cobalt id aluminum which are effective to produce nilar results are also contemplated as being thin the scope of this invention. In this re-rd, reference is made to the Bruson Patent ove referred to and to Bruson Patent No. 920,160 for equivalent ether acids and ether id salts and their methods of preparation.

To demonstrate the effectiveness of the compunds contemplated herein as additive ingredits for Diesel lubricants to inhibit the ring cking action referred to, we have employed series of actual operation tests using a single linder Diesel type engine under accelerated erating conditions, with various lubricating ls and lubricating oil blends to determine the tent to which ring sticking actually occurs th these various lubricants. This engine, inrporated in a dynamometer unit, was in all the tests run at a speed of 1000 R. P. M. and as maintained at a jacket temperature of 375°

The total time of operation was arbitrarily osen as 25 hours, and after operating for this riod, the engine was taken down and the pisn inspected for ring condition. With many bricants it was necessary to stop the run be-re the arbitrary period of 25 hours had exred because of premature failure of the test. ich failure, caused by ring sticking, was best dicated by a drop in the power output and also r the relative amount of blowby in the exaust.

As stated above, the particular additive ingreents employed in these tests were the cobalt id aluminum salts of ether acids or mixed ether ids having the general formula,

$$R—O—CH_2—COOH,$$

which R is a mixture of hydrocarbon radicals erived from commercial alcohol and is preominantly comprised of hydrocarbon groups aving more than 5 carbon atoms. These salts ay be considered as typical of salts from the lass represented by the general formula,

$$(R—O—C_nH_{2n}—COO)_xM,$$

here R and n are as indicated above, M is a olyvalent metal, and x is the valence of the etal.

In these tests the cobalt salts were found referable to the aluminum salts, since it was ecessary to use an excess of organic acid to aintain the aluminum salts in suspension or olution in the oil. Most of these tests, therore, were conducted with the cobalt salts.

The following results are indicative of the improvement that is effected in a Diesel lubricant y the use therein of these ether acid salts, which n the table below are referred to by their trade ame, "Oilsolates."

EXAMPLE I

Oil used

Conventionally refined coastal oil; A. P. I. ravity of 22.3 at 60° F.; A. S. T. M. color of 2; nd Saybolt viscosity of 60 seconds at 210° F.

Operation

The engine with this oil alone operated 13¾ ours. The removal of the piston was difficult. he first three rings were completely stuck, the il ring was half stuck and the fourth ring sticky.

With the same oil containing 1.0% cobalt 'Oilsolate" the engine was operating satisfactorily at the end of 26½ hours, when the run was stopped. The piston removed easily. The first ring was only partially stuck and the remaining rings were free. The oil ring was free and clear.

EXAMPLE II

Oil used

Conventionally refined Mid-Continent oil, A. P. I. gravity 26.6 at 60° F.; A. S. T. M. color of 4.5; and Saybolt viscosity of 66 seconds at 210° F.

Operation

The engine with the oil alone operated 16¾ hours. The piston removed with difficulty. All compression rings were stuck. The oil ring was half stuck and the slots were filled with hard carbon.

With the same oil containing 1% cobalt "Oilsolate" the engine operated the full 25-hour period. All of the rings were free and clean with only a trace of deposit in the oil grooves.

Another satisfactory run was made with this same oil containing 0.5% cobalt "Oilsolate."

A blend of this oil was also made with 1% aluminum "Oilsolate" which gave satisfactory operation over the full 25-hour period. All of the rings were free, but, due perhaps to the lesser stability of the aluminum "Oilsolate," more sludge was formed in the oil ring slots than with the cobalt "Oilsolate."

EXAMPLE III

Oil used

Solvent refined Mid-Continent oil having A. P. I. gravity of 29.3 at 60° F.; A. S. T. M. color of 5; and Saybolt viscosity of 67 seconds at 210° F.

Operation

Using this oil alone the engine operated 6¾ hours. Two rings were completely stuck, and a third ring was half stuck. Part of the slots in the oil ring were closed.

With the same oil plus 1% cobalt "Oilsolate" the engine was operated the full period of 25 hours and all of the rings were free and clean.

It will be apparent from the foregoing results that the ether acid salts contemplated herein may be used in petroleum lubricant stocks from different sources, and variously refined, to materially reduce that property of the oil which tends to bring about ring sticking. The amount of additive ingredient to be used for this purpose may vary with the type of oil used, but for most purposes we consider that a minor proportion, ranging from .1 to 5.0%, will give satisfactory results. Amounts in the neighborhood of 0.5%–2% are preferred. It is to be understood that while we have indicated cobalt salts of ether acids as being preferable to accomplish the objects of our invention, it is not our intention to specifically limit the invention to cobalt salts of particular ether acids, but to include salts of equivalent metals and equivalent acids, of the general type known to the trade as "Oilsolates," which are effective to inhibit the ring sticking action of petroleum lubricants under conditions of use similar to those encountered in engines of the Diesel type.

In compounding a lubricating oil with cobalt "Oilsolate" (a cobalt salt of an ether acid), the preferred compound contemplated by this invention, we have found it preferable to first heat together equal parts of the "Oilsolate" and the oil. The temperature used is preferably in excess of

200° F., and the heating is continued until a solution or colloidal suspension is obtained. The heating is then stopped and oil is added until the concentration of cobalt "Oilsolate" in the oil is reduced to about 20%. This liquid may then be filtered to remove any solid impurities, and in making the final blend from this concentrate the oil to which the concentrate is added is preferably heated to about 150° F. and the concentrate added to the oil at this temperature with stirring.

It will be understood, of course, that while the foregoing is a preferred procedure which may be followed in blending the "Oilsolate" compound with the oil, our invention is not necessarily limited to this particular procedure.

In addition to the item of preventing ring sticking noted above as a primary feature of this invention, we have discovered that lubricant compositions formed by compounding "Oilsolates" with mineral lubricating oil, are much more effective in reducing the wear and abrasive action between relatively moving metal surfaces than the lubricant without the "Oilsolate" added. For example, comparative tests on a Diesel engine under severe operating conditions showed much less wear and abrasive action on the pistons and liners when the engine was lubricated with an oil containing cobalt "Oilsolate," than occurred when the engine was operated with the same lubricant stock alone.

It is to be understood, therefore, that while the prevention of ring sticking is stressed herein as a primary feature of our invention, the invention, in its broader aspect, is an improved lubricant composition and includes within its scope such changes and modifications as fairly come within the spirit of the appended claims.

We claim:

1. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith a small amount of a salt of a polyvalent metal having the general formula,

$$(R—O—C_nH_{2n}COO)_xM,$$

wherein R is a hydrocarbon radical having more than three carbon atoms, n is a whole number from 1 to 3, M is a polyvalent metal, and x is the valence of the metal.

2. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith a small amount of a salt of a polyvalent metal having the general formula,

$$(R—O—C_nH_{2n}COO)_xM,$$

wherein R is a hydrocarbon radical having more than three carbon atoms, n is a whole number from 1 to 3, M is a metal selected from the group consisting of aluminum and cobalt, and x is the valence of said metal.

3. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith a small amount of a cobalt salt of an ether acid having the general formula,

$$R—O—CH_2COOH,$$

in which R is a hydrocarbon radical having more than five carbon atoms.

4. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith from .1 to 5% of a metal salt of an ether acid having the general formula,

$$R—O—C_nH_{2n}—COOH,$$

in which n is a whole number from 1 to 3 and R is a hydrocarbon radical derived from a higher monohydric alcohol having more than 5 carbon atoms, the metal of said salt replacing the hydrogen of the carboxyl group.

5. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith from .1 to 5% of a cobalt salt of an ether acid having the general formula,

$$R—O—C_nH_{2n}—COOH,$$

in which n is a whole number from 1 to 3 and R is a hydrocarbon radical derived from a higher monohydric alcohol having more than 5 carbon atoms.

6. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith a small amount of a metal salt of an ether acid having the general formula,

$$R—O—C_nH_{2n}—COOH,$$

in which n is a whole number from 1 to 3 and in which R is a hydrocarbon radical derived from a higher monohydric alcohol having more than five carbon atoms, the metal of said salt replacing the hydrogen of the carboxyl group.

7. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith a small amount of a metal salt of a mixture of ether acids, said acids having the general formula,

$$R—O—C_nH_{2n}—COOH,$$

in which n is a whole number from 1 to 3 and in which R is derived from a mixture of monohydric alcohols, said mixture of alcohols being predominantly comprised of alcohols having more than five carbon atoms, the metal of said salt replacing the hydrogen of the carboxyl group.

8. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith a small amount of a cobalt salt of a mixture of ether acids, said acids having the general formula,

$$R—O—C_nH_{2n}—COOH,$$

in which n is a whole number from 1 to 3 and in which R is derived from a mixture of monohydric alcohols, said mixture of alcohols being predominantly comprised of alcohols having more than five carbon atoms.

9. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith a small amount of aluminum salt of a mixture of ether acids, said acids having the general formula,

$$R—O—C_nH_{2n}—COOH,$$

in which R is derived from a mixture of monohydric alcohols, said mixture of alcohols being predominantly comprised of alcohols having more than five carbon atoms.

10. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith a small amount of a metal salt of an organic ether acid in which the carboxyl hydrogen of said acid is replaced with its equivalent weight of metal.

11. A lubricating composition comprising a hydrocarbon lubricant oil and in admixture therewith a small amount of a cobalt salt of an organic ether acid.

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