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CRANKCASE LUBRICATING OIL AND ADDITIVE THEREFOR

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The present invention relates to a crankcase lubricating oil for internal combustion engines which contains a minor proportion of an additive that is effective in reducing the accumulation of undesirable deposits in the combustion chamber of an engine as well as suppressing octane requirement increase normally resulting from operation of such engines, as well as to the additive per se.

It is well known that the operation of an internal combustion engine, initially clean, results in a formation of progressively greater amounts of deposits on the surfaces of the combustion zone, i. e., on the cylinder head, piston top and the intake and exhaust valves, until the amount of deposits reaches a level beyond which no appreciable further increase in amount of deposits are apparent upon continued operation. This increase in deposits is manifested most clearly to the operator of the engine, particularly an automobile engine, by the fact that the presence of the deposits in the engine requires a fuel having a higher octane rating in order not to knock than is required by a new or clean engine. This means, in other words, that the octane value of a fuel required by an engine containing deposits in the combustion zone in order not to knock (referred to hereinafter as "octane requirement") is higher than the octane requirement of a clean engine. For example, a clean engine which requires a gasoline having an octane rating of 60 in order not to knock is said to have an octane requirement of 60. If the same engine, when dirty, i. e., with deposits in the combustion chamber, requires a gasoline having an octane rating of 75 in order not to knock, such an engine is said to have an octane requirement of 75 or an "octane requirement increase" of 15. When upon continued use the octane requirement of the engine increases no further, it is believed that the engine has then reached deposit equilibrium. This is believed to be due to the fact that after a certain amount of deposits have been formed in the combustion zone, additional amounts of deposits either fail to adhere to the deposits already formed or the rate of formation of additional deposits becomes about equal to the rate at which the deposits flake off and are removed through the exhaust of the engine.

The present invention is based on the surprising discovery that combinations of silver naphthenate with copper or nickel naphthenate, when present in minor amounts in a crankcase lubricating oil, are effective in suppressing octane requirement increase and have synergistic effects in inhibiting the formation of combustion chamber deposits as well as in inhibiting the deterioration of the lubricating oil. The additive of the present invention, therefore, essentially comprises a mixture of silver naphthenate with copper or nickel naphthenate and the lubricating oil of the invention is essentially one containing a minor proportion of such an additive.

The relative proportions, in the additive, of the silver naphthenate on the one hand and the copper or nickel naphthenate on the other hand may vary considerably. Relative proportions by weight ranging from about 1:3 to about 3:1 being most desirable and approximately equal proportions, i. e., about 1:1 being preferred. Extremely small concentrations of the additive in the lubricating oil exert some desirable effects in suppressing octane requirement increase and inhibiting the formation of combustion chamber deposits, larger concentrations up to about 2% by weight producing these effects in an increasing degree. Ordinarily, it is desirable, in order to obtain such effects to an appreciable degree to have the additive present in a concentration of at least about 0.2% by weight. Due to economic considerations and the fact that concentrations of additive greater than about 2% by weight do not produce the desired effects in an appreciably greater degree than concentrations below 2%, it is generally not considered practicable that the lubricating oil contain more than about 2% by weight of the additive. Generally, therefore, it is desirable that the concentration of the additive in the oil range between 0.2 and 2% by weight and preferable that the additive be present in a concentration of about 0.5% by weight.

The utility and advantages of the invention will be demonstrated in the following example, it being understood, however, that the example is not to be considered as limitative in scope:

Example

Comparative test runs were conducted with a standard Chevrolet passenger car engine made initially clean after each run by dismantling, removing the combustion chamber deposits and reassembling. In each run the engine was operated on a standard cycle procedure with an 11° spark advance to simulate city driving conditions. Each cycle included one minute at 500 R. P. M. with no load (idling conditions) and an air fuel ratio of 11.2, and 5 minutes at 2000 R. P. M., equivalent to 40 M. P. H. with 11.2 lbs. brake horsepower load, an air/fuel ratio of between 13.5 and 14.5, water outlet temperature of 160° F. and oil sump temperature of 190° F. This six minute cycle was repeated until the octane requirement of the engine had arrived at an equilibrium value. This required an average of about 100 hours operation which is equivalent to approximately 4000 miles of city driving. Octane requirement measurements were made once each day under the following conditions:

Speed, R. P. M.	1000
Load throttle	fuel
Jacket outlet	160° F.
Oil temperature	190° F.
Spark advance	11° B. T. C.
Air/fuel ratio	13.5

All tests were run with a standard gasoline containing 3 cc. per gallon tetraethyl lead and an SAE–30 solvent refined crankcase oil (a blend of SAE–10 and SAE–50 oils) containing about 0.1 to 0.2% by weight sulfur in the form of oil-soluble sulfur compounds.

The results of these tests, in terms of octane requirement increase, piston-top deposit weight (representative

of combustion chamber deposits generally) and used oil properties are tabulated immediately below:

Run No.	Naphthenate Additive	Conc. in Oil, Percent by wt.	Octane Requirement Increase	Piston Top Deposit Weight, grams	Used Oil Properties		
					Vis. Change, SSU, at 100° F.	C_5 Insolubles, percent	Benzene Insoluble, percent
1	None		11	29.7			
2	Ag	0.5	7	26.38	+171	3.36	0.94
3	Cu	0.5	7	22.51	−45	2.48	0.56
4	Ni	0.5	5	22.19	−29	1.09	0.15
5	Ag+Cu	0.25/0.25	5	9.19	−32	3.76	0.13
6	Ag+Ni	0.25/0.25	7	16.50	−124	2.18	0.05
7	Hg	0.5	6	29.99	−41	2.30	0.50
8	Hg+Cu	0.25/0.25	9	27.67	−51	1.11	0.38

Comparison of runs Nos. 1 and 2 shows that while silver naphthenate alone has a beneficial effect in suppressing octane requirement increase by four numbers, it has very little effect in inhibiting the formation of combustion chamber deposits and a somewhat deleterious effect on the used oil properties in that the used oil shows a considerable increase in viscosity and high pentane and benzene insolubles. Comparisons of runs Nos. 3 and 4 with run No. 2 show that copper and nickel naphthenates alone have a comparable effect in supressing octane requirement increase and are slightly more effective in inhibiting the formation of combustion chamber deposits, the used oil properties with copper and nickel naphthenates alone being somewhat superior to those found when silver naphthenate alone was employed. Run No. 5 demonstrates the remarkable synergistic effect obtained by combining silver and copper naphthenates in that the piston-top deposit weight is reduced from mean value of about 24.5 for silver and copper naphthenates alone to only 9.19 grams and in suppressing the octane requirement increase to only five numbers, whereas silver and copper naphthenates alone were effective in suppressing the octane requirement increase to seven numbers. The combination of silver and nickel naphthenates, as shown in the data for run No. 6, is also effective in inhibiting the formation of combustion chamber deposits (16.5 grams as compared with a mean of approximately 24.3 grams for silver and nickel naphthenates alone) but is not quite as effective as the silver-copper naphthenate combination in suppressing octane requirement increase. The used oil properties in runs Nos. 5 and 6, wherein the additive of the invention was employed, are also shown to be significantly better than would be expected in view of the used oil properties resulting from the use of silver naphthenate alone.

Runs Nos. 7 and 8 are included to show the criticality of the combination of silver naphthenate with copper or nickel naphthenate. Run No. 7 shows results obtained by using mercury naphthenate alone and run No. 8 shows the results of using a combination of mercury and copper naphthenates. Where mercury naphthenate alone suppresses the octane requirement increase to six numbers and copper naphthenate alone to seven (run No. 3) it might have been expected that the combination of mercury and copper naphthenates would have suppressed the octane requirement increase to six or seven numbers instead of the nine numbers actually shown in run No. 8. Similarly it appears that, in terms of piston-top deposit weight, the combination of mercury and copper naphthenates shows no synergistic effects comparable to that produced by the combination of silver naphthenate with either copper or nickel naphthenate.

It is to be understood that various modifications will readily occur to those skilled in the art upon reading this description. It is to be understood that all such modifications are intended to be included within the scope of the invention as defined in the accompanying claims.

I claim:

1. A crankcase lubricating oil containing about 0.2 to about 2% by weight of an additive comprising a mixture of silver naphthenate with a naphthenate selected from the group consisting of copper and nickel naphthenates.

2. A crankcase lubricating oil containing about 0.2 to about 2% by weight of an additive comprising a mixture of silver naphthenate with a naphthenate selected from the group consisting of copper and nickel naphthenates, the silver naphthenate comprising from about 25 to about 75% by weight of the additive.

3. A crankcase lubricating oil containing from about 0.2 to about 2% by weight of an additive comprising a mixture of approximately equal parts by weight of silver naphthenate and a metal naphthenate selected from the group consisting of copper and nickel naphthenates.

4. A crankcase lubricating oil containing from about 0.2 to about 2% by weight of an additive comprising a mixture of approximately equal parts by weight of silver and copper naphthenates.

5. A crankcase lubricating oil containing from about 0.2 to about 2% by weight of an additive comprising a mixture of approximately equal parts by weight of silver and nickel naphthenates.

6. An additive for a crankcase lubricating oil comprising a mixture of silver naphthenate with a metal naphthenate selected from the group consisting of copper and nickel naphthenates.

7. An additive for a crankcase lubricating oil comprising a mixture of about 25 to about 75 parts by weight of silver naphthenate with about 25 to about 75 parts by weight of a metal naphthenate selected from the group consisting of copper and nickel naphthenates.

8. An additive for a crankcase lubricating oil comprising a mixture of approximately equal parts by weight of silver naphthenate and of a naphthenate selected from the group consisting of copper and nickel naphthenates.

9. An additive for a crankcase lubricating oil comprising a mixture of approximately equal parts by weight of silver and copper naphthenates.

10. An additive for a crankcase lubricating oil comprising a mixture of approximately equal parts by weight of silver and nickel naphthenates.

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