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METHOD OF CLEANING INTERNAL-COMBUSTION ENGINES

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1

The present invention relates to an internal engine cleaning composition. It is a liquid mixture in the form of a clear, transparent, colloidal suspension comprising a phenol, soap and hydrocarbon oil as its essential components. The invention also relates to a method of cleaning internal combustion engines and engine parts with the new composition.

One object of the invention is to provide a cleaning composition that is easy and safe to handle and has the ability to thoroughly cleanse the interior of an engine by removing varnish, sludge and other foreign materials that may be deposited, caked or otherwise affixed in or to the parts or small spaces thereof without requiring the engine to be taken apart.

It has been found that a composition obtained by combining one or more phenols, soap and a hydrocarbon oil has surprisingly excellent cleansing qualities and that when used in accordance with the method of this invention, this composition is capable of restoring the interior of an internal combustion engine to a factory clean condition without harmful effects to the engine.

The soap component is one or more alkali metal salts of the higher unsaturated fatty acids preferably having saponification values not greater than about 205 and iodine values not less than about 75. The soap component may be added to the mixture as such or be formed in situ by saponifying, with an alkali metal hydroxide such as potassium hydroxide, sodium hydroxide or a mixture thereof, vegetable or animal oils, such as cottonseed, corn, soybean, tung, linseed, olive, castor, peanut, seal or whale blubber oil.

The phenol component may be unsubstituted phenol, an alkyl substituted phenol such as a cresol, ethyl phenol, xylenol or mesitol, or a combination thereof. For the purposes of this invention, cresols consisting predominantly or solely of ortho-cresol are preferred for the reason that cleaning compositions containing such a cresol have been found to be up to three times as effective as compositions containing a mixture of ortho-, meta- and para-cresol, such as is ordinarily used from coal tar.

The hydrocarbon oil component may be kerosene, straw paraffin oil (75 SUS at 100° F.) or any other hydrocarbon oil ranging in viscosity up to SAE 30, the viscosity depending upon the particular conditions involved in the cleansing operation for which the composition is designed.

The composition of this invention may be prepared in any one of a number of different ways.

One method is to mix the soap with the phenol

2

to form a solution of phenol and soap and then to add the hydrocarbon oil.

Another method, when the soap is not available as such, is to dissolve one or more vegetable or animal oils having a saponification value not greater than about 205 and iodine value not less than about 75 in a solvent, such as alcohol, saponifying the oil with a stoichiometric amount of an aqueous solution of alkali metal hydroxide, then adding the phenol to form a phenol-soap solution and finally adding the said solution to the hydrocarbon oil.

Still another method is to mix the phenol with one or more of the vegetable or animal oils, saponifying the oil or oils in situ by adding the aqueous solution of an alkali metal hydroxide and heating the mixture while stirring and, when the saponification is completed, adding the hydrocarbon oil to form the final composition.

In either of the later two methods, the completion of the saponification of the oil will be indicated by the fact that a small portion thereof will form a clear solution with hot distilled water.

The ratio of phenol to soap may vary widely and is determined largely by the miscibility of the phenol-soap solution with the hydrocarbon oil. Ordinarily, the proportion of phenol should be at least sufficient to make the phenol-soap solution miscible with oil. If the proportion of phenol is appreciably less than about equal to the amount of soap, the solution will become immiscible with the oil. There is no critical upper limit to the amount of phenol in the soap solution. The relative proportions of phenol to soap may be as high as 2 or 3 to 1.

It is preferred that the amount of the alkali metal hydroxide be not substantially more than that needed to form the soap, but since the amount is not critical, small amounts of the alkali metal cresolate may be formed and do not interfere with the utility of the composition.

The amount of phenol-soap solution in the cleaning composition may likewise vary within a wide range. Since the composition is preferably used in an engine while the engine is running, it is essential that at least some oil be present to lubricate the parts thereof. Tests have shown that very satisfactory results are obtained when the phenol-soap component is present to the extent of as little as 25% and as high as 90%. The cleansing effect increases with an increase in the proportion of phenol-soap component and superior results are obtainable when the phenol-soap component is present in proportions as high as 90%. For practicable purposes, the range of

concentration of the phenol-soap component in the composition may, therefore, vary between about 25% and 90%. For reasons of economy, however, it is preferable to keep the concentration of the phenol-soap component in the vicinity of 25% to 50%.

The preferred cleaning composition therefore is one wherein the proportions of phenol, soap and hydrocarbon oil are about 12.5:12.5:75 to 25:25:50. One such composition is readily obtained by adding 25 parts of liquor cresolis saponatus, wherein the phenol is orthocresol and the saponified oil is linseed oil, to 25 to 75 parts of hydrocarbon oil.

In accordance with the method of this invention, the crankcase oil of a dirty engine is drained and replaced by an equal or greater volume of the cleansing composition. The engine is then idled for a period of up to about one-half hour to an hour or more, the time depending upon the condition of the engine. The crankcase is then drained and the engine is preferably given a final flushing to remove residual cleaning composition and any insoluble material loosened by the cleaning composition but not carried completely out of the crankcase.

The following examples are included to further illustrate the present invention.

EXAMPLE 1

A conventional Chevrolet engine having a piston displacement of 216.5 cu. in. and a compression ratio of 6.1:1 and containing in the crankcase an S. A. E. 30 grade lubricating oil, having added thereto iron naphthenate as an oxidation catalyst, was run for 24 hours at 3150 R. P. M. with a load of 30 B. H. P. The temperature of the cooling water at the jacket outlet was 200° F. and the oil temperature was maintained at 280° F. At the end of this run, the engine was completely sludged and varnished. The sludge content of the oil had reached up to 8%, the piston demerit rating was 9.0 to 10.0 and the engine pans and interior were covered with a heavy varnish and sludge coating. The cam followers were so badly varnished that they seized in the block, bending the push rods. Severe pounding with a heavy hammer and punch was necessary to free these followers in their guides. Thus, it is obvious that the engine was in a maximum sludged condition.

The oil was drained from the dirty engine and five quarts of the preferred cleaning composition of this invention were poured into the crankcase. This composition consisted of 75% straw paraffin oil having a viscosity of 75 SUS at 100° F. and 25% of a cresol-soap solution made by dissolving 35 parts by volume of linseed oil in 5.5 parts ethanol and adding thereto a hot solution of 7.26 parts by weight of potassium hydroxide dissolved in 10 parts water while vigorously stirring the mixture. When saponification was completed, a soap solution having a pH of 8.5 to 9.0 was formed. To this solution there were added 50 parts by volume of ortho-cresol.

The engine was then idled for 30 minutes at 2800 R. P. M., the crankcase temperature being maintained between 150° and 160° F. At the end of that time, the crankcase was drained, another five quarts of the same cleaning composition were added and the engine was run for an additional 30 minutes under the same conditions.

The crankcase was then drained again. Five quarts of lubricating oil were added and the engine run for another 15 minutes. The oil was then drained and the engine was dismantled.

The dismantled engine was rated by visual inspection of the various parts for sludge and varnish deposits in accordance with an arbitrary system of demerits. In accordance with this system, a rating of 0.0 is perfect, while 10.0 is the lowest rating obtainable. In Table 1 below there are tabulated the ratings of the engine before and after cleaning in accordance with this example.

Table 1

	Before Cleaning	After Cleaning
Rocker Arms	8.0	2.5
Side Pan	8.0	5.0
Valve Cover	3.0	2.0
Oil Pan:		
Sludge	5.0	0.0
Varnish	8.0	0.0
Piston Skirt Varnish	9.0–10.0	0.0
Rings and Grooves	2.0	0.25

The cleaning of the rocker arms and side pan is of necessity less effective than that of the crankcase parts because the flow is more restricted in those areas. The cleaning procedure removed all traces of sludge and varnish from the crankshaft and crankcase surfaces, leaving these important parts in a factory clean condition. Furthermore, all varnish was removed from the piston skirts and piston interiors, as well as from the cam followers.

EXAMPLE 2

A cleaning composition, prepared by combining 100 parts of liquor cresolis saponatus, containing as its essential components cresol and saponified linseed oil, the cresol being present to the extent of 50 parts, with 300 parts of straw paraffin oil having a viscosity of 75 SUS at 100° F. was used to clean the engine of a Chevrolet station wagon which had become sludged during duty on the road. Prior to the cleansing operation, the oil filter cartridge was removed with considerable effort and the oil filter well was found, upon inspection, to have accumulated sludge to a depth of about two inches. This is indicative of the completely sludged and extremely poor condition of the engine.

The engine was cleaned by draining the crankcase, pouring in two gallons of the cleaning composition described in this example and idled the engine for 40 minutes. The crankcase was then drained and the engine dismantled for inspection of parts. It was found that the sludge had been removed from the parts it had covered before cleaning and that the crankcase was free from sludge and varnish.

EXAMPLE 3

The dirty engine of a General Motors truck was cleaned with the same composition and under the conditions as described in Example 2, the idling time with the cleaning composition in the crankcase again being 40 minutes. After the crankcase was drained, a hydrocarbon oil consisting of 3 parts by volume of No. 10 weight oil and 1 part by volume of kerosene was poured into the crankcase and the engine was fast idled for about 4 minutes, to remove the residual cleaning composition from the engine and to carry out of the crankcase insoluble material which has been loosened during the cleaning procedure.

The compression in pounds per square inch of the individual cylinders was measured before the

cleaning operation and after the final flushing by removing the spark plugs, putting pressure gauges in the spark plug sockets and turning the engine over with the starter. The ratings obtained are tabulated in Table 2 below:

Table 2

Cylinder No.	Before	After	Change
1	70	100	+30
2	90	95	+5
3	55	100	+45
4	70	100	+30
5	85	90	+5
6	72.5	100	+27.5

It is believed that the beneficial results obtained in this test were due primarily to the freeing of the piston rings and valves and to the cleaning of the valve seats. Inasmuch as the distribution of work among the cylinders is roughly proportional to the compression levels, it is manifest that the equalization of the compression levels resulting from the cleaning operation herein described resulted in a much smoother and more efficient operation of the engine.

After the compression tests were completed, the engine was dismantled, the interior was found to be perfectly clean, the crankcase was free of varnish and the sludge and the oil screen was open and clean.

It is to be understood, of course, that the composition and method of this invention are susceptible to innumerable modifications that will readily become apparent to those skilled in the art upon reading this description. Thus, while the invention has been described particularly with reference to compositions containing one or more phenols, related compounds such as naphthols and anthrols, e. g., anthranol, may be used in place of or in addition to a phenol Furthermore, there may be added to the cleaning composition such materials as wetting agents or other detergents. If desired, the temperature during the cleaning operation may be maintained between about 150° F. and a temperature slightly below the boiling point of the cleaning composition. All such modifications are intended to be included within the scope of this invention as defined in the appended claims.

I claim:

1. A method of cleaning an engine internally which comprises introducing into the crankcase of the engine an amount of a cleaning composition at least equal to the lubricating oil capacity of the engine, said cleaning composition consisting essentially of about 50 to about 75 parts by volume of a hydrocarbon lubricating oil having a viscosity ranging from about 75 SUS at 100° F. up to SAE 30 to 50 to 25 parts by volume of a cresol-soap solution, said solution comprising about equal parts by volume of ortho-cresol and of a potassium linseed oil soap solution, said soap solution having a pH between about 8.5 and 9.0, idling the engine for a period up to about one hour and thereafter draining the engine.

2. A method of cleaning an engine internally which comprises introducing into the crankcase of the engine an amount of a cleaning composition at least equal to the lubricating oil capacity of the engine, said cleaning composition consisting essentially of about 50 to about 75 parts by volume of a hydrocarbon lubricating oil having a viscosity ranging from about 75 SUS at 100° F. up to SAE 30 to 50 to 25 parts by volume of a cresol-soap solution, said solution comprising about equal parts by volume of ortho-cresol and of a soap solution, said soap solution having a pH between about 8.5 and 9.0 and the soap in said soap solution being a soap selected from the group consisting of the potassium and sodium soaps of an oil selected from the group consisting of linseed, soy bean and corn oil, idling the engine for a period up to about one hour and thereafter draining the engine.

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