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HYDROCARBON ADDITIVE OILS

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Our present invention relates to an agent for inhibiting or preventing the formation of water emulsions and the formation of gummy substances in hydrocarbon oils, particularly in oils and fuels for internal combustion engines, and for inhibiting corrosion of metal parts by said hydrocarbons, also to improving the penetrating power and film strength of the oils, and also to lubricating oils and motor fuels containing an additive agent.

During the use of lubricating oils, such as crank case oil, in the operation of internal combustion engines, gummy or varnish-like substances tend to form by the break down and recombination of the lubricant. Also, water formed by the combustion of the motor fuel tends to become emulsified in the oil, particularly during operation at low temperatures.

The formation of emulsion and of the gummy substances tend to keep suspended in the oil fine particles of metal, carbon or grit, which are formed during the combustion of the motor fuel or by wearing of metal parts etc. The sludge thus formed may clog the passages, particularly those of narrow clearance through which the oil is forced by the fuel pump of the engine, and also tend to clog the filter, causing the oil to bypass it and carry the fine suspended particles, the gummy substances and emulsion into the narrow ducts and passages. Because of these actions the oil may fail to penetrate into the spaces between moving parts, particularly if the oil has a low penetrating action, and excessive wear may thereby be occasioned. To guard against such excessive wear a frequent renewal of the oil has been required.

Also in the motor fuels used for internal combustion engines there is a tendency toward the formation of gummy substances which accumulate in the fuel lines and in the passages of the carbureter which interferes with the proper feed of the fuel and the functioning of the engine.

In our present invention we provide an additive agent which inhibits or prevents the formation of water emulsions and of gummy or varnish-like materials in lubricating oils and motor fuels and which also improves the penetrating power and the strength of film of the lubricant.

Our improved agent also has a detergent action which tends to keep the crank case clean and to improve the filtering of the oil in the oil filter. It also prevents corrosion of the oil ducts and of the bearings or other moving parts and avoids

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excessive wear of those parts by the formation of suspended particles in the oil or lubricant.

The addition agent of our invention comprises the reaction product of an anionic surface active organic phosphorus compound of the general formula $Na_5R_5(P_3O_{10})_2$, in which R stands for a hydrocarbon chain having from 6 to 10 hydrocarbons and with or without side chains, with an organic sulphonate or sulphate of a long chain hydrocarbon or alkyl compound. Any suitable salt of the sulphate or sulphonate may be employed, such as sodium salt. During the reaction some insoluble material separates from the reaction product and the sulphate or sulphonate combines with the complex phosphate compound.

An example of an organic sulphonate is the sodium salt of a sulphonated dioctyl succinic ester or other double ester of a sulphonated succinic acid or dibasic acid.

Examples of a hydrocarbon sulphate are:

(1) 7 ethyl-2 methyl-4 undecanol sodium sulphate.

$$C_4H_9CH(C_2H_5)C_2H_4\underset{\displaystyle SO_4Na}{\underset{|}{C}}HCH_2CH(CH_3)_2$$

(2) 3-9 diethyl-6 tridecanol sodium sulphate.

$$C_4H_9CH(C_2H_5)C_2H_4\underset{\displaystyle SO_4Na}{\underset{|}{C}}HC_2H_4CH(C_2H_5)_2$$

(3) 2-8 diethyl duodecanol sodium sulphate.

$$C_3H_7CH(C_2H_5)C_2H_4\underset{\displaystyle SO_4Na}{\underset{|}{C}}HC_2H_4CH(C_2H_5)_2$$

The sodium alkyl phosphate of the above type is water soluble but insoluble in oil, whereas the hydrocarbon sulphates and sulphonates are oil miscible and to some extent water soluble.

When sodium alkyl phosphate is heated and reacted with an alkyl sulphate or sulphonate of the above group it becomes oil soluble and may be dissolved in hydrocarbon oil.

Examples of the reaction of the phosphate and sulphate compounds are as follows:

6 parts of sodium salt of the dioctyl ester of sulphonated succinic acid and 4 parts of a phosphate which has a chain of 6-carbon atoms having an ethyl side chain, the compound having the formula:

$$(H_2C\!-\!\underset{\displaystyle C_2H_5}{\underset{|}{C}}\!-\!\overset{H}{C}\!-\!\overset{H_2}{C}\!-\!\overset{H_2}{C}\!-\!\overset{H_2}{C}\!-\!CH_3)_5$$

$$(P_3O_{10})_2Na_5$$

are mixed with 10 parts of water by weight and heated until the mixture thickens and most of the water is evaporated. 20 parts of a light oil

such as kerosene or Stoddard solvent are then added and the mixture heated until all of the water is evaporated and the temperature is raised to about 130° C. While hot 20 parts of SAE 10 oil are added to the temperature raised to about 150° C. At this stage most of the foaming stops. The mixture is then permitted to cool and filtered or centrifuged to separate and remove any inorganic salts that may be formed and to get a clear solution.

Example 2

Similarly, 4 parts of the above phosphate compound and 5 parts of one of the alkyl secondary sulphates mentioned above are heated with 10 parts of water and then heated as above with hydrocarbon oils to a final temperature of 150° C. (300° F.), and filtered or centrifuged. It is not necessary to hold the temperature to 150° C. during or after the reaction as the reaction products are stable at temperature considerably above this temperature.

An excess of the sulphates or sulponates may be used over and above the above proportions and will remain merely as an excess. If an excess of the phosphate be used a gummy product will be formed. Any alkyl sulphate or sulphonate may be combined with a phosphorus compound providing the length of the alkyl chain is sufficient to make the resulting compound oil soluble. A chain of from 11 to 18 carbon atoms may be used, but preferably one having from 11 to 13 carbon atoms.

This solution containing about 20% of the reaction products in oil is used in the ratio of ½ ounce per quart of oil to provide the oil with about 0.3% by weight of the combined additive. The amount used to inhibit formation of gum in gasoline is about 0.05% on the basis of combined additive or 0.25% of the solution of additive in oil.

It will be understood that the amount of additive may vary somewhat from the percentages given above, which are given by way of example to indicate the small quantities of the additive required to inhibit gum formation and to prevent emulsification of oil and water and to inhibit corrosion of the metal parts being lubricated.

An example of the effect of the additive on gum formation as shown by the copper dish method, is indicated by the following table of tests on a number of representative gasolines. The amount of additive used was 0.05% of the pure additive or ½ gram per liter:

Gasoline Samples	Gum Without Additive	Gum With Additive
1	5.0 mg. per 100 cc.	2.0 mg. per 100 cc.
2	23.0 mg.	2.0 mg.
3	5.6 mg.	2.9 mg.
4	42.0 mg.	1.4 mg.
5	141.8 mg.	6.3 mg.
6	2.2 mg.	2.6 mg.
7	106.6 mg.	9.8 mg.

Through the above invention we have provided a new additive compound and a new hydrocarbon composition whereby the formation of gums and emulsions in lubricants and motor fuels and the corrosion of the metal parts by the lubricant or oil or fuel are inhibited.

The additive compound acts as a detergent keeping the crank case, oil ducts and fuel lines clean and free from deposits. The oil containing the additive filters more freely and has an

increased capacity to penetrate the narrow passages of the motor and to remain therein.

What we claim is:

1. The reaction product formed by heating above about 130° C. until the product is oil soluble, four parts by weight of sodium penta alkyl tripoly phosphate in which the alkyl radical has a chain of from 6 to 10 carbon atoms and at least five parts by weight of a member of the class consisting of the sodium sulphonates of dibasic saturated alkyl acid esters and of secondary alkyl sulphates having a carbon chain of from 11 to 18 carbon atoms.

2. The reaction product formed by heating above about 130° C. until the product is oil soluble, four parts by weight of sodium penta ethyl hexyl tripoly phosphate and at least five parts by weight of a member of the class consisting of the sodium sulphonates of saturated alkyl dibasic acid esters and of secondary alkyl sulphates having a carbon chain of from 11 to 18 carbon atoms.

3. The reaction product formed by heating above about 130° C. until the product is oil soluble, four parts by weight of sodium penta octyl tripoly phosphate and at least five parts by weight of a member of the class consisting of the sodium sulphonates of saturated alkyl dibasic acid esters and of secondary alkyl sodium sulphates having a carbon chain of from 11 to 18 carbon atoms.

4. The reaction product formed by heating above about 130° C. until the product is oil soluble, four parts by weight of sodium penta alkyl tripoly phosphate in which the alkyl radical has a chain of from 6 to 10 carbon atoms and at least five parts by weight of the sodium salt of sulphonated dialkyl succinic ester.

5. The reaction product formed by heating above about 130° C. until the product is oil soluble, four parts by weight of sodium penta alkyl tripoly phosphate in which the alkyl radical has a chain of from 6 to 10 carbon atoms and at least five parts by weight of the sodium salt of sulphonated dioctyl succinic ester.

6. The reaction product formed by heating above about 130° C. until the product is oil soluble, four parts by weight of sodium penta octyl tripoly phosphate and at least five parts by weight of dioctyl succinic ester sodium sulphonate.

7. A hydrocarbon oil containing between 0.05% and 1.0% of the reaction product formed by heating above about 130° C. until oil soluble four parts by weight of sodium penta alkyl tripoly phosphate in which the alkyl radical has a chain of from 6 to 10 carbon atoms and at least five parts by weight of a member of the class consisting of the sodium sulphonates of saturated alkyl dibasic acid esters and of secondary alkyl sodium sulphates having a carbon chain of from 11 to 18 carbon atoms.

8. A hydrocarbon oil containing from 0.05% to 1.0% of a reaction product formed by heating above about 130° C. until oil soluble four parts by weight of a sodium penta alkyl tripoly phosphate in which the alkyl radical has a chain of from 6 to 10 carbon atoms and at least five parts by weight of sodium sulphonate of dioctyl succinic ester.

9. A hydrocarbon oil containing from 0.05% to 1.0% of the reaction product formed by heating above about 130° C. until oil soluble, four parts by weight of a sodium penta octyl tripoly phos-

phate and at least five parts by weight of a sodium sulphonate of dioctyl succinic ester.

10. A process of making a corrosion and emulsion inhibiting additive for hydrocarbon oils which comprises heating to at least 130° C. until oil soluble, four parts by weight of sodium penta alkyl tripoly phosphate in which the alkyl radical has a chain of from 6 to 10 carbon atoms with at least five parts by weight of a member of the class consisting of the sodium sulphonates of saturated alkyl dibasic acid esters and of secondary alkyl sodium sulphates having a carbon chain of from 11 to 18 carbon atoms.

11. A process of making a corrosion and emulsion inhibiting additive for hydrocarbon oils which comprises heating to at least 130° C. until oil soluble a solution of four parts by weight of a penta alkyl tripoly sodium phosphate in which the alkyl radical has a chain of from 6 to 10 carbon atoms, and at least five parts by weight of a member of the class consisting of the secondary alkyl sodium sulphates having a chain of from 11 to 18 carbon atoms in ten parts by weight of water until the solution thickens, adding twenty parts by weight of a light hydrocarbon oil and heating until the water is evaporated.

12. The process of making a corrosion and emulsion inhibiting additive for hydrocarbon oils which comprises heating to above about 130° C. until oil soluble a solution of four parts by weight of sodium penta octyl tripoly phosphate and at least five parts by weight of a sodium sulphonate of dioctyl succinic ester in ten parts by weight of water until the solution thickens, adding twenty parts by weight of a light hydrocarbon oil, heating until the water is evaporated, thereafter adding about twenty parts by weight of a solvent hydrocarbon oil and heating said mixture to a temperature of at least about 150° C.

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