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NO DRAWINGS.

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COMPLETE SPECIFICATION.

## Fuel Additive for Internal Combustion Machines.

We, AUTOL A.G., a Swiss Corporation, of Allschwil, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

In the operation of combustion engines disadvantages occur in many operative conditions as a result of incomplete combustion, for example corrosion and wear due to acid combustion products, residues in the combustion chamber at the outlet valves or slits and in the outlet paths, in the case of diesel engines also at the nozzle apertures and, as a consequence thereof, decrease in performance and increased wear. These unavoidable effects are particularly serious in the case of engines which are running cold, such as is the case in short distance running.

A great number of proposals have already been made known for preventing these damaging results of incomplete combustion such as, for examplie, by way of the engine oil by the use of the well known HP-engine oils; since these cannot be used in the fuel, however, additives are advised for this field, for which numerous combinations of substances with anti-corrosive and cleaning effect have been proposed. It is a question here principally of combinations of corrosion protection agents or selected detergents with solvents such as terpentine oils, camphor oils, alcohols, ketones, esters and hydrohalides. In the recent past, an additive has been proposed as particularly active consisting of polyalcohol fatty acid esters or free fatty acids with at least 12 carbon atoms, aliphatic fatty acid esters, and calcium phenyl stearate. Moreover, it has been proposed to use in these additives, instead of aliphatic fatty acid esters, esters of phenol and its homologues or fatty acid esters with a hydroxyl or alkyoxy group in the fatty acid component or in the alcohol component, or in both, as well as mixtures of these esters.

It has now been found that both the corrosion protection and the dissolving action on combustion residues in internal combustion machines can be substantially improved if a fuel additive is used which contains

(a) 1—50% of a condensation product of 1 mole of a polyethanolamine with 1 to 2 moles of a fatty acid having at least 10 carbon atoms or of a mixture of several of such fatty acids,

(b) 1—50% of a high boiling ester of fatty acids, aromatic acids, hydroaromatic acids or naphthenic acids or of a mixture of such esters, and

(c) 10—90% of a refined mineral oil having a viscosity of at least 1.6°E/20°C. and at most 15.0°E/50°C.

To produce the above said condensation product one can heat to temperatures exceeding 130°C for 1—3 hours in conventional manner e.g. 1 mole by weight of triethanolamine with 1 mole by weight of a fatty acid having at least 12 carbon atoms, for example, oleic acid. In order to obtain light condensation products, it is advantageous to perform the reaction in containers of glass, porcelain or anti-corrosive steels; it may also be helpful to carry out the reaction in vacuo with the addition of metal reactivators such as, for example, a Schiff base of salicylic aldehyde. After distilling off the water entirely and cooling one obtains, when oleic acid is used, a light yellow to light brownish liquid condensation product which consists principally of the mono-oleic acid ester of triethanolamine. If 2 moles of oleic acid are used instead of 1 mole, the triethanolamine dioleic acid ester principally forms. Both said condensation products are


[*Price 4s. 6d.*]

readily soluble in most solvents and in the refined mineral oils to be used.

In the fuel additive according to the invention, one can use, instead of the condensation product of triethanolamine and a fatty acid having at least 10 carbon atoms, a product which is obtained by analageous condensation of 1 mole of diethanolamine with 1 mole of a fatty acid having at least 10 carbon atoms, or with a mixture of such fatty acids. If technical oleic acid is used as the fatty acid, the mono-oleic acid ester of diethanolamine is obtained substantially as reaction product.

All high boiling fatty acid esters or mixtures of fatty acid esters which are soluble in hydrocarbons are suitable as ester component (b) for the purposes of the invention, but preferably those having a boiling point exceeding 150°C. such as, for example, lauric acid ethyl ester, butyric acid isooctyl ester, acetic acid oleyl ester, benzoic acid ethyl ester, naphthenic acid isopropyl ester and cyclohexane carboxylic acid methyl ester.

However, esters of carboxylic acids and phenol and its homologues, and fatty acid esters in which either the alcohol component or the fatty acid component or both bear a hydroxy or alkoxy group, or mixtures of these esters, have proven especially active as ester component (b). As esters of carboxylic acids and phenol and its homologues, the following may be used by way of example: cresyl acetate, xylenyl acetate, phenol esters of naphthenic acids, cresyl naphthenate or the cresyl ester of cyclohexane carboxylic acid. Fatty acid esters which bear a hydroxy or alkoxy group are, for example, methoxybutyl acetate, methoxy acetic acid ethyl ester, methoxy butyl ester of methoxy acetic acid, lactic acid acetyl ester, lauric acid monoester of methoxy ethanol, glycol monooleate, or mixtures thereof.

The new fuel additive is produced according to the invention by dissolving the condensation product (a) and the ester mixture (b) in any desired sequence in a refined mineral oil (c) which has a viscosity of at least 1.6°E/20°C. and at most 15°E/50°C. The refined mineral oil (c) can be partially replaced by synthetic hydrocarbons prepared for example by the Fischer-Tropsch synthesis, or also by synthetic or natural aromatic hydrocarbons such as alkyl benzenes.

In engine tests it has proven that very small amounts of the individual components of the additive have an optimal action on a conventional fuel. As a rule, 0.005 to 1% by volume, preferably 0.02 to 0.5% by volume, based on the engine fuel, are sufficient.

The amount of the individual components contained in the fuel additive of the invention will depend essentially upon the desired concentration of the individual components in the engine fuel and upon the amount of fuel additive which should be added to the fuel.

In the following Examples some fuel additives are described which have proven to be especially effective.

*Example 1*

6—12% of the condensation product of 1 mole of triethanolamine and 2 moles of technical oleic acid,
2— 6% of cresyl naphthenate,
8—16% of glycol monooleate or methoxy butyl butyrate, and
20—25% of neutral oil (3.7°E/50°C.), brought to 100% with synthetic hydrocarbons.

When 2% of this additive are added to conventional diesel fuel, the amount of the active components in the diesel fuel is:

| | |
|---|---|
| Condensation product ... | 0.12 to 0.40% |
| Cresyl naphthenate ... | 0.04 to 0.12% |
| Glycol monooleate or Methoxy butyl butyrate ... | 0.16 to 0.32% |
| Neutral oil ... ... ... | 0.40 to 0.50% |

If diesel engines which already have heavy residues are driven with diesel fuel containing 2% of the above additive, the residues are removed within a few running hours. Simultaneously, the corrosion protection in the fuel system is also substantially improved.

*Example 2*

5—15% of the condensation product of 1 mole of diethanolamine and 1 mole of oleic acid
5—20% of cresyl acetate,
5—15% of methoxy butyl acetate,
5—20% of refined spindle oil (2.5°E/20°C.) and
80—30% of synth. alkyl benzene mixture (boiling range 140—240°C.).

If 0.2% of this additive are added to conventional gasoline (fuel), the active concentration in the fuel amounts to:

| | |
|---|---|
| Condensation product ... | 0.01 to 0.03% |
| Cresyl acetate ... ... | 0.01 to 0.04% |
| Methoxy butyl acetate ... | 0.01 to 0.03% |
| Refined spindle oil ... | 0.01 to 0.04% |
| Alkyl benzene mixture ... | 0.16 to 0.06% |

The formation of corrosion and residues in two and four stroke carburetor engines is substantially prevented by the addition of this fuel additive to commercial fuel. Residues already present in carburetor engines are removed within a few running hours.

*Example 3*

Instead of the additive cited in Example 2, the following two stroke engine oil may also be used in two stroke engines:

0.5—1.5% of the condensation product of 1 mole of triethanolamine and 2 moles of technical oleic acid.
0.5—2.0% of cresyl acetate,
0.5—1.5% of methoxy butyl acetate,
8.5—5.0% of refined light oil and
90.0% of engine oil SAE 40.

The usual addition of 3 to 5% of engine oil to commercial gasoline (fuel), gives approximately the same concentrations of the individual components, based on the gasoline-oil mixture, as in Example 2.

The compositions cited in the foregoing Examples may vary considerably according to the amount of additive which should be added to the fuel. It is solely of importance that the amount of additive in the fuel is within the above said limits.

Further substances such as, for example, corrosion inhibitors, ignition accelerators, octane number improvers, antioxidants, high pressure additives, and combustion promotors, which are usually added to fuels, may be added to the additives of the invention.

An improved engine fuel comprising a fuel additive in accordance with the present invention is claimed and described in the Specification of our co-pending Application No. 28288/64 (Serial No. 1,062,606).

WHAT WE CLAIM IS:—

(1) Fuel additive for internal combustion engines, characterized by containing

(a) 1—50% of a condensation product of 1 mole of a polyethanolamine with 1 to 2 moles of a fatty acid having at least 10 carbon atoms or a mixture of several of such fatty acids,

(b) 1—50% of a high boiling point ester of fatty acids, aromatic acids, hydroaromatic acids or naphthenic acids or of a mixture of such esters and

(c) 10—90% of a refined mineral oil having a viscosity of at least 1.6°E/20°C. and at most 15°E/50°C.

(2) Fuel additive according to Claim 1, characterized by containing as condensation product a product which is obtained by condensation of 1 mole of diethanolamine with 1 mole of a fatty acid having at least 10 carbon atoms or, respectively, of a mixture of such fatty acids.

(3) Fuel additive according to Claim 1, characterized by containing as condensation product a product which is obtained by condensation of 1 mole of triethanolamine and 2 moles of a fatty acid having at least 10 carbon atoms or, respectively, of a mixture of such fatty acids.

(4) Fuel additive according to any one of Claims 1 to 3, characterized by using as high boiling ester at least one ester of a carboxylic acid and phenol or one of its homologues, or at least one fatty acid ester in which either the alcohol component or the fatty acid component or both the alcohol component and the fatty acid component bear a hydroxy or alkoxy group, or a mixture thereof.

(5) Additive according to any one of Claims 1 to 4, characterized in that the refined mineral oil is partially replaced by synthetic hydrocarbons such as are prepared by the Fischer-Tropsch synthesis.

(6) Additive according to any one of Claims 1 to 4, characterized in that the refined mineral oil is partially replaced by synthetic or natural aromatic hydrocarbons such as alkyl benzenes.

(7) Additive according to any one of Claims 1 to 6, characterized in that the individual components are present in such amounts that the concentration of the individual components in the case of addition of the additive to engine fuels amounts to 0.005 to 1% by volume, preferably 0.02 to 0.5% by volume, based on the engine field.

(8) Additive according to any one of Claims 1 to 7 for two stroke engines, characterised in that the refined mineral oil is engine oil.

(9) Fuel additive for internal combustion engines substantially as hereinbefore described with reference to the foregoing Examples.

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