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RUDOLPH R. ROSENBAUM, OF CHICAGO, ILLINOIS

MOTOR FUEL AND PRODUCING PROCESS

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My invention relates to motor fuels. It is well known that the fuels commonly used today in internal combustion motors or engines produce a detonation or so-called "knock", and such knocking is a function of the engine compression and begins when the critical compression is reached and increases as the compression increases.

I have found that naphthenic acids, which are present in certain crude oils found in this country, are especially adapted for suppressing detonation when added to the motor fuel.

I have found further that if such naphthenic acids are esterized with alcohols, such as methyl, ethyl, butyl, propyl, iso-propyl, or amyl alcohols, such esters will cause suppression of detonation to a much greater degree.

I have also found that when a naphthenic acid, or a naphthenic acid radical, or a naphthenic acid ester, is bound to a metal, particularly a metal found in group 2 of Mendelejeff's table of periodic arrangement of the elements, detonation suppression is greatly increased. The reason for this I attribute to the fact, as I have found it to be, that such naphthenic acid metal compounds, even when added in only small quantity, will cause the fuel to become of very high electrical conductivity, it being my belief that the comparatively low electrical conductivity of fuels ordinarily used is to a great extent responsible for detonation or knocking at comparatively low compression. The naphthenic acid-metal compounds referred to will change the ordinary motor fuel from a low compression fuel to a high compression fuel. I have found compounds comprising the metal mercury bound to naphthenic acids very efficient, as for example mercury naphthenate; likewise compounds comprising mercury bound to naphthenic acid esters, or a mixture of mercury naphthenate and naphthenic acid esters. Motor fuels treated with such compounds may be used in engines having compression pressures of over 160 pounds without danger of knocking. If a radical is attached to the metal as shown in Group II of Mendelejeff's table, and combined in such manner that the resulting compound is volatile and oil soluble, higher anti-knock values for such metal are obtained.

Mercury compounds are particularly desirable not only for their good electrical conductivity but also because when fuels having such compounds are exploded and mercury may be formed, such mercury will not deposit on the combustion chamber walls but will be volatilized by the high combustion temperature and pass out with the exhaust gases.

The naphthenic acids can be readily obtained from the crude oils which contain them and used to prevent detonation with distillates of crude oils which do not contain such acids. The process of extracting the acids from the acid bearing crude oils is well known. The distillates of such oils, as kerosene and gasoline, contain the acids, and such distillates are treated with sulphuric acid which combines with the naphthenic acids to produce sulphonated naphthenic acids, and the distillate is then washed with alkali solution to cause neutralization of the acids and the production of the alkali salts of such acids, such salts being soluble in water. This alkali wash water is then acidified to liberate the sulphon-naphthenic acids. By breaking up these sulphon-naphthenic acids in any well known manner, the pure naphthenic acid is obtained. Such naphthenic acid may be esterized by treatment with alcohols of the classes hereinbefore referred to.

Exemplfying the reactions and resulting products by formulæ, the naphthenic acid in the distillate combines with sulphuric acid as follows:—

$$C_8H_{15}COOH + H_2SO_4 = C_8H_{14}\begin{matrix}SO_2OH\\COOH\end{matrix} + H_2O.$$

(Nono-naphthenic) (Sulphonic acid)

Washing with alkali solution results thus:

$$C_8H_{14}\begin{matrix}SO_2OH\\COOH\end{matrix} + 3\,NaOH = C_8H_{14}\begin{matrix}OH\\COONa\end{matrix} + Na_2SO_3 + 2H_2O.$$

The resulting oxy-naphthenic acid sodium

salt is then combined with a mercury salt, thus:

$$2C_8H_{14}\begin{matrix}OH\\COONa\end{matrix} + HgCl_2 \rightarrow (C_8H_{15}CO_3)_2Hg + NaCl$$

(Mercury naphthenate)

the mercury becoming bound to the naphthenic acid to form mercury naphthenate which is oil soluble and which I have found to be an excellent anti-knock agent.

If a naphthenic acid, for example, oxynono-naphthenic acid, is combined with an alcohol, for example, butyl alcohol, and subjected to distilling heat in an autoclave or reflux condenser, a butyl ester of the acid will result, the formula being

$$C_8H_{14}\begin{matrix}OH\\COOC_4H_9\end{matrix}.$$

Such ester alone has proven to be an efficient anti-knock agent, and likewise a product comprising a metal such as mercury bound to the ester.

The anti-knock agent, such as the mercury naphthenate, is dissolved in a suitable solvent such as an alcohol to the extent of say about 10%, and this anti-knock solution is added to the fuel, for example, gasoline, to the extent of about 1%.

An ester such as the butyl ester above designated could be used as the solvent for the mercury naphthenate and the solution added in proper proportion to the fuel.

Instead of removing the naphthenic acids from the distillates, such acids may be esterized while still in the distillates. If, after such distillates have been treated with sulphuric acid, and before neutralization with alkali, they are treated with an alcohol under agitation and then redistilled, it is obvious that the naphthenic acids present in the distillates will produce esters, and as such esters are easily soluble in the distillates they will impart qualities to such distillates or fuels which will tend to suppress detonation. Such process forms a very important feature of my invention.

By the term "naphthenic acid" as used in the claims I mean to include those naphthenic acids which are present in crude petroleum.

I claim as follows:—

1. A motor fuel comprising a petroleum distillate and an ester of naphthenic acid.

2. A fuel for internal combustion engines comprising a petroleum distillate and mercury bound to a naphthenic acid.

3. As a new article of manufacture, a motor fuel containing a mercury compound of a naphthenic acid.

4. As a new article of manufacture, a motor fuel containing an anti-knock ingredient consisting of a mercury derivative of a naphthenic acid ester.

5. As a new article of manufacture, a motor fuel containing a mixture of mercury naphthenate and a naphthenic acid ester.

6. A motor fuel comprising a petroleum distillate and a mixture of mercury naphthenate and a naphthenic acid ester.

7. A motor fuel containing as an anti-knock reagent, an oil soluble metallic naphthenic acid ester derivative selected from the non-alkali forming metals of the second group of the periodic system.

In witness whereof, I hereunto subscribe my name this 14th day of July, 1927.

RUDOLPH R. ROSENBAUM.