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DIESEL FUEL

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This invention relates to improved Diesel engine fuels and to a method for improving the performance of Diesel engines.

It is well known in the art to use organic peroxides as Diesel fuel additives in order to improve the cetane number of the fuel. Among organic peroxides which are known to improve cetane number of Diesel fuels are acetyl peroxide, tetralin peroxide, acetone peroxide and propionyl peroxide. Of these peroxides acetyl peroxide is perhaps the most effective in increasing the cetane number of Diesel fuels.

I have discovered that peresters of organic acids and alcohols, and particularly peresters of aliphatic alcohols and aromatic organic acids, are superior to the peroxides as Diesel fuel additives. Peresters of aliphatic alcohols having from 1 to 8 carbon atoms in the molecule and of mononuclear aromatic acids, are preferred. Not only do the peresters increase the cetane number of Diesel fuels to a greater extent than do the peroxides, but they are more stable than the peroxides and less soluble in water. Furthermore, whereas it is necessary to use peroxides in a diluted state because of their instability, peresters can be used in a pure form and thereby avoid contamination of the fuel with diluents.

As examples of peresters which may be used are mentioned tertiary-amyl perbenzoate and tertiary-butyl perbenzoate. The peresters are effective in amounts as low as 0.1% by weight of the fuel, and may be used in amounts up to approximately 1% by weight of the fuel.

In order to demonstrate the effectiveness of peresters in increasing cetane number of Diesel fuels, a Diesel fuel of mineral oil composition boiling between 372° and 640° F. having an A. P. I. gravity of 38.6, and produced in a thermal cracking operation, was blended with small amounts of acetyl peroxide and tertiary-amyl perbenzoate and tertiary-butyl perbenzoate, and cetane numbers determined on the blends, as well as on the fuel without additive. The results obtained are given in the following table:

Table I

Additive, Per Cent by Wt.	Cetane Number	Cetane Number Increase
No additive	51.2	
0.15% acetyl peroxide	54.2	3.0
0.5% acetyl peroxide	62.6	11.4
0.225% t-amyl perbenzoate	60.0	8.8
0.5% t-amyl perbenzoate	64.3	13.1
0.5% t-butyl perbenzoate	64.5	13.3

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A further series of tests was made on straight run kerosene and the results obtained are given in the following table:

Table II

Additive, Per Cent by Wt.	Cetane Number	Cetane Number Increase
No additive	48.8	
0.15% acetyl peroxide	54.8	6.0
0.5% acetyl peroxide	62.8	14.0
0.225% t-amyl perbenzoate	58.6	9.8
0.5% t-amyl perbenzoate	64.7	15.9
0.5% t-butyl perbenzoate	63.8	15.0

From the foregoing tables it will be seen that both tertiary-amyl perbenzoate and tertiary-butyl perbenzoate were more effective in increasing cetane number of both cracked Diesel fuel and a straight run Diesel fuel than is acetyl peroxide.

A 25-hour test run was made on a Fairbanks-Morse Diesel engine using straight run kerosene as fuel in one test, and straight run kerosene containing ½% by volume of tertiary-butyl perbenzoate. Cetane number of the kerosene was 51.7 without additive and 63.1 with additive. It was observed during the test that the engine performed better and ran smoother with the fuel containing the additive. The injector nozzle was examined at the end of each test, and in the run in which kerosene with no additive was used there was a slight build-up of carbon on the nozzle pintle. In the run in which kerosene containing ½% by volume of tertiary-butyl perbenzoate was used, there was no carbon flute on the nozzle. The carbon deposit on the top and side walls of the piston in the run using additive was also less than the carbon deposit on the top and side walls of the piston in which no additive was used.

It will be seen, therefore, that I have discovered a group of compounds, namely peresters, which when used in small amounts in conjunction with conventional Diesel fuels of the mineral oil type improve the performance of such fuels, and the performance of engines in which the fuels are used.

Although we prefer to add the perester to the fuel before injection into the engine, the additive may be injected separately into the engine either in pure form or in the form of a concentrated solution in a fraction of the fuel, or other suitable solvent.

It should be understood that the peresters are useful in conjunction with all non-viscous liquid hydrocarbons which are commonly used as Diesel

fuels. The preparation and properties of peresters is set forth in some detail in the Journal of the American Chemical Society, 68, 642–644 (1946).

It is claimed:

1. A fuel for compression ignition engines of the Diesel type consisting essentially of a hydrocarbon fuel which contains a small amount of a perester selected from the group consisting of tertiary butyl perbenzoate and tertiary amyl perbenzoate for increasing the cetane number of Diesel fuel.

2. A fuel for compression ignition engines of the Diesel type consisting essentially of a hydrocarbon fuel which contains a small amount of tertiary butyl perbenzoate for increasing the cetane number of the Diesel fuel.

3. A fuel for compression ignition engines of the Diesel type consisting of a hydrocarbon fuel which contains a small amount of tertiary amyl perbenzoate for increasing the cetane number of the Diesel fuel.

4. A non-viscous normally liquid hydrocarbon Diesel fuel containing about 0.1 to 1 per cent by weight of a perester selected from the group consisting of tertiary butyl perbenzoate and tertiary amyl perbenzoate.

5. A non-viscous normally liquid hydrocarbon Diesel fuel containing about 0.1 to 1 per cent by weight of tertiary butyl perbenzoate.

6. A non-viscous normally liquid hydrocarbon Diesel fuel containing about 0.1 to 1 per cent by weight of tertiary amyl perbenzoate.

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