United States Patent Office 2,785,662 Patented Mar. 19, 1957

2,785,662

COMPOSITIONS AND METHODS FOR REMOVING DEPOSITS

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No Drawing. Application April 6, 1953, Serial No. 347,180

3 Claims. (Cl. 123—1)

This invention relates to compositions for removing engine deposits, and more particularly to compositions for removing deposits from the combustion chambers of internal-combustion engines.

Briefly, the invention relates to a composition of matter comprising a hydrocarbon fuel and a cetane improver for diesel fuels, said cetane improver being present in an amount of not more than approximately 80% by volume. The invention also includes the method of removing deposits from the combustion chambers of internal-combustion engines through the use of such a composition.

Among the objects of the invention may be noted the provision of compositions which are effective in removing deposits from the combustion chambers of internal-combustion engines; the provision of such compositions which are effective in removing deposits formed through the use of fuels treated with tetraethyl lead; the provision of compositions of the type described which are inexpensive and convenient to employ in the removal of engine deposits; and the provision of methods for using such compositions. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the products and methods hereinafter described, the scope of the invention being indicated in the following claims.

In the operation of internal-combination engines, deposits, composed chiefly of carbon, form on the cylinder walls, cylinder heads, pistons and valves. The carbon in these deposits may come from either the fuel or lubricating oil being employed, and, inasmuch as the deposits result in a loss of power, they are extremely objectionable. With the advent of internal-combustion engines, particularly automotive engines, having high compression ratios, it has become more imperative than ever to reduce carbon deposits to a minimum in order to maintain high output performance in such engines. Even the use of currently marketed high octane fuels does not permit knock-free operation of engines without the formation of substantial amounts of deposits in the combustion chambers.

These deposits cause loss of power and performance through knocking, missing of explosion or burned valves. For example, carbon deposits may result in an increase in combustion chamber temperature, thereby causing preignition which fires the fuel charge prior to the occurrence of a spark. Such a premature ignition has the same general effect, i. e., loss of power, as advancing the spark materially ahead of the optimum setting.

Heretofore, many attempts have been made to remove deposits by the use of chemical solvents, oxygen decarbonizing and mechanical means. The oxygen decarbonizing methods and mechanical means employed in the past, however, are laborious, time-consuming and generally require removal of the engine head. On the other hand, while some chemical solvents will remove ordinary carbon deposits, they have little or no effect on deposits caused by the use of fuels treated with tetra-

ethyl lead. Deposits from the use of such fuels contain a lead residue and form local hot spots in the combustion chamber, which continue to initiate pre-ignition and severe knocking as in the case of carbon deposits. Moreover, these deposits accumulate during normal engine operation at the usual operating temperatures of the water jacket, thus occasioning an increased power loss.

In accordance with the present invention, it has now been found that carbon deposits of all types are effectively removed from the combustion chambers of internal-combustion engines through the use of compositions containing a hydrocarbon fuel and a compound which is a cetane improver for diesel fuels. These compositions when ignited in the engine combustion chambers produce explosions of a high order of brisance. The sharp, vibrating type of detonation produced effectively breaks the deposits loose into small particles (even where the deposits are firmly bonded to metal), which are then blown out through the exhaust. The breaking up of the deposits into particles is aided by the increased water jacket temperature brought about by the heat generated from the explosion. This increased water jacket temperature effects an expansion in the metal, thereby causing the deposits to crack or crumble into particles since they are relatively nonelastic and do not expand at the same rate as the metal.

The high brisance explosions and deposit removal are conveniently effected by adding a charge of one of the compositions of the invention to the engine carburetor, starting the engine, partially opening the throttle from normal idle, accelerating the engine to a limited speed and closing the throttle when detonation is heard. Care must be taken not to open the throttle too wide, for the explosions produced by the compositions of the invention are of such high brisance that serious damage is likely to result if the throttle is opened too far. Further, the invention should not be practiced on engines operating under load as the violent knocking which occurs in such engines is likely to injure piston heads.

As previously mentioned, the compositions which I have found effective in removing engine deposits contain a hydrocarbon fuel and a compound which is a cetane improver for diesel fuels. While any hydrocarbon fuel is suitable, I prefer to use fuels having relatively low octane numbers, since fuels of higher octane numbers are composed chiefly of highly branched hydrocarbons, such as, for example, 2,2,4-trimethylpentane, which possess strong antiknocking properties. I have found n-heptane to be especially suitable for use as a hydrocarbon fuel in the practice of the invention. It will be understood that mixtures of hydrocarbon fuels are also useful in the compositions of the invention.

Any compound which improves the cetane rating or cetane number of diesel oils or fuels is useful in the compositions of the invention. As is recognized by the art, n-cetane is considered the best diesel fuel, and the cetane number is the percentage of cetane in a mixture of α-methyl naphthalene and cetane which gives the same ignition performance as the fuel tested when measured in direct ignition lag. Exemplary cetane improvers for diesel fuels which I have found effective include ethyl nitrate, n-butyl nitrate, amyl nitrate, tertiary butyl hydro-peroxide, di-tertiary butyl hydro-peroxide, cumene hydro-peroxide, 2,2-dinitro propane and carbon tetrachloride. It will be understood that other cetane improvers or mixtures of cetane improvers are also suitable for use.

Where the cetane improver possesses a limited solubility in hydrocarbon fuels, a cosolvent such as, for example, methanol, may be included in the composition without altering its effectiveness in removing engine deposits.

In general, the compositions of the invention contain from approximately 0.05% to approximately 75%, and

not more than 80%, by volume of the cetane improver and from approximately 20% to approximately 99.95% by volume of the hydrocarbon fuel. When n-heptane which has an octane number of zero is employed, for example, as the hydrocarbon fuel, compositions containing from approximately 95% to approximately 99.95% by volume of n-heptane and from approximately 0.05% to approximately 5% by volume of a cetane improver are preferred. Approximately 15 ounces of a composition of the invention will generally be sufficient to effectively remove approximately 95% of engine carbon deposits. This quantity may be varied, depending upon the composition employed and the amount of deposits to be removed.

The following examples illustrate the invention:

Example 1

A 15-ounce charge of a composition containing 15% by volume of amyl nitrate and 85% by volume of 84-octane gasoline was added to the carburetor of an automotive engine having deposits in the combustion chambers. The engine had a compression ratio of 6.58. After the addition of the composition, the engine was started, and the throttle partially opened from normal idle. The engine was then accelerated to a limited speed and when detonation in the combustion chambers was heard, the throttle was closed. Subsequent inspection of the combustion chambers showed that the deposits had been substantially removed.

Example 2

The procedure of Example 1 was repeated except that a composition containing 99.95% by volume of n-heptane and 0.05% by volume of ethyl nitrate was employed. Results comparable to those of Example 1 were obtained.

Example 3

The procedure of Example 1 was repeated except that a composition containing 99.95% by volume of n-heptane and 0.05% by volume of n-butyl nitrate was employed. Results comparable to those of Example 1 were obtained.

Example 4

The procedure of Example 1 was repeated except that a composition containing 99.95% by volume of n-heptane and 0.05% by volume of tertiary butyl hydro-peroxide was employed. Results comparable to those of Example 1 were obtained.

Example 5

The procedure of Example 1 was repeated except that a composition containing 99.95% by volume of n-heptane and 0.05% by volume of di-tertiary butyl hydro-peroxide was employed. Results comparable to those of Example 1 were obtained.

Example 6

The procedure of Example 1 was repeated except that a composition containing 99.95% by volume of n-heptane and 0.05% by volume of cumene hydro-peroxide was employed. Results comparable to those of Example 1 were obtained.

Example 7

The procedure of Example 1 was repeated except that a composition containing 99.95% by volume of n-heptane and 0.05% by volume of 2,2-dinitro propane was employed. Results comparable to those of Example 1 were obtained.

Example 8

The procedure of Example 1 was repeated except that a composition containing 90% by volume of n-heptane and 10% by volume of carbon tetrachloride was used. Results comparable to those of Example 1 were obtained.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above methods and products without departing from the scope of the invention, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. The method of removing deposits from the combustion chambers of internal combustion engines which comprises heating the engine above normal; introducing into the carburetor a composition containing a hydrocarbon fuel having a relatively low octane number and a sufficient amount of a cetane improver for diesel fuels to render the hydrocarbon fuel unfit for the normal power operation of an internal combustion spark ignition engine, starting the engine, partially opening the throttle, accelerating the engine and closing the throttle upon the occurrence of high brisance explosions in said combustion chambers, the above steps being performed with the engine free of load.

2. The method according to claim 1 wherein said hydrocarbon fuel is n-heptane and said cetane improver is amyl nitrate in an amount between .1% and 25% by volume.

3. The method according to claim 1 wherein said hydrocarbon fuel is n-heptane and said cetane improver is a compound selected from the group consisting of ethyl nitrate, n-butyl nitrate, amyl nitrate and 2,2-dinitro propane and is present in an amount between .1% and 25% by volume.

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