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DIESEL ENGINE FUEL

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2 Claims. (Cl. 44—9)

This invention relates to an improved method of lubricating the fuel injectors of internal combustion motors of the injection engine type wherein a liquid fuel is positively injected into the combustion space.

The fuels used in Diesel motors are, in general, non-viscous mixtures of relatively low-molecular weight hydrocarbons of mineral origin, which mixtures have substantially no capacity to form a lubricating film which would resist rupture at even medium pressures per unit area at normal or elevated temperatures. Such fuels include the hydrocarbon mixtures known as "gasoline", "kerosene", "fuel oil", and the like. The expression "fuel oil" is intended to include those fractions of petroleum commonly sold or used as fuel oils and characterized by having insufficient oiliness to prevent wear, e. g., the fraction known as "36–40° Beaumé distillate". The fuel, whatever it may be, is positively forced, with or without combustion-supporting gas, e. g., air, into the combustion space through the agency of an injecting pump.

Such pumps or adjustable injection devices associated with injection engines, normally are so constructed that there is no opportunity for taking up wear or for using stuffing boxes or other packing means: instead, the surfaces intended to have relative movement are very finely ground and nicely fitted to each other by hand, whereby to avoid leakage of fluid fuel. Because of the known wear of such parts, in use, they have been fabricated from hardened steels, nitrided steels, and other wear-resisting alloys; these pumps or injectors represent, in some cases, a large part of the total cost of the power-producing device. In spite of these precautions, wear of the pumps or injectors remains a serious factor as to expense and to continued efficiency of the engine. As they wear, they begin to leak and so to deliver incorrect amounts of fuel to the engine, thus progressively depreciating the efficiency of the engine and its ability to deliver proper power at all times.

It is, therefore, an object of the present invention to provide lubrication to such pumps or injectors.

The liquid fuels commonly used in this type of motor may and frequently do contribute another engineering problem, viz., the "gumming" or impaction of the top rings of the motor pistons. This gumming apparently is occasioned by the existence in such fuels of unsaturated compounds which, upon storage of the fuels, accrue to a material extent. Addition to the liquid fuel of an improper oiliness-conferring material may aggravate "gumming". It is another object of the present invention to provide the liquid fuel with a non-gumming oiliness agent.

It is a fact that "oiliness" in fuels of the hereinbefore described types may be provided by dissolving in the same a material which will bring about segregation of lubricating molecules at the metal surfaces: fat oils (vegetable or animal) appear, in general, to produce some lubricating effect when dissolved in the fuel. However, an oiliness agent to be usable in this relation must possess other characteristics besides a lubricating effect: it must not have a gumming effect; it must not etch metal or otherwise deteriorate metal surfaces; and should, to be commercially usable, be so inexpensive as not materially to increase the cost of the fuel so treated.

It has been found that the above criteria are met, and the above and other objects of invention are realized, by addition to the mixture of normally liquid petroleum hydrocarbons constituting the injection engine fuel, prior to its admission into the fuel pump or injector, of a relatively very small amount of an oiliness agent obtained from the reaction product of the controlled liquid-phase partial oxidation of a mixture of saturated aliphatic hydrocarbons of mineral origin, such as the mixture of hydrocarbons known as "paraffin wax", the mixture known as "crude scale wax", the mixture known as "amorphous wax" or "Sharples' wax", various petroleum distillates (such, for instance, as the "36–40° fuel oil" above described), or a mixture of two or more of the above starting materials. Such oiliness agents per se, and methods whereby they may be obtained from mineral hydrocarbons, are described in Patent No. 1,863,004 to Arthur W. Burwell, wherein patentee disclosed and claimed the concept of dissolving such oiliness agents in lubricating oils whereby to produce improved lubricating oil compositions. Said oiliness agents are oil-soluble compositions consisting essentially of mixtures of a plurality of relatively high molecular weight, saturated, aliphatic, oxygen-containing compounds, which oxygen-containing compounds may or may not contain free acids. Thus, the agent may be

1. The residue obtained by removing unoxidized hydrocarbons from the whole oxidation reaction mixture.

2. The residue 1. above, modified by esterification of the free acids content thereof.

3. The free acids content of 1. above.

4. The residue 1. above modified by removal of the free acids thereof.

5. The ester and lactone contents of 1. above.

6. Esters of 3. above.

7. Mixtures of two or more of the foregoing.

There may be, and usually are, present in the oiliness agent, in admixture, alcohols, ketones, alcohol-ketones, lactones and esters produced as aforesaid by the controlled, liquid phase, partial oxidation of mixtures of saturated aliphatic hydrocarbons of mineral origin. As is set out in the aforesaid Patent No. 1,863,004, said alcohols, ketones, alcohol-ketones, lactones and esters are all of relatively high molecular weight, i. e., consist of aliphatic chains of more than 5 carbon atoms each.

I have found that by the incorporation of relatively very small amounts, e. g., from ½% to 1% or more, by weight, but not in excess of 4% by weight, of these oil-soluble oiliness agents, as such, into gasoline or other light petroleum fuel such as 36–40° fuel oil the resulting fuel composition effectively lubricates the pumps or injectors aforesaid, whereby wear therein is greatly retarded and the efficiency of the device is maintained. In some instances as little as ¼% of the oiliness agent is sufficient. It has been found that the presence of these agents prevents gumming or impaction of the piston rings; that the agents do not etch or otherwise harm the metal surfaces which they lubricate; and that they may be added to the fuel in effective amounts without materially increasing the total cost of the fuel.

The fuel compositions of the present invention are simply prepared by dissolving the predetermined small amount of the agent in the fuel to be moved by the injection engine pump or injector: this may be effected, en masse, by admixing the agent with a body of the fuel prior to use. It may also be effected by adding the agent to the stream of fuel just before or as the latter enters the pump or injector.

Numerous tests, scientifically carried out, have demonstrated that a fuel composition consisting essentially of a liquid fuel having no or only negligible lubricity, e. g., gasoline, kerosene, 36–40° fuel oil, or the like, and a relatively very small amount e. g., from about ½% to 1% or more, of the agent aforesaid, in the absence of any other oiliness agent, has sufficient lubricity in and of itself to reduce to a minimum the wear of moving parts of the pumps or injectors used in positively forcing liquid fuel into the combustion space of the injection engine. This is remarkable in that it heretofore had been believed that to confer lubricity upon a liquid fuel of the nature of gasoline, kerosene, 36–40° fuel oil or the like it was necessary to incorporate in the latter a lubricating oil with or without added oiliness agent. The latter concept is described and claimed in my copending application Serial No. 691,242, filed September 27, 1933, for "Top cylinder lubricants".

I claim:

1. An injection engine fuel consisting essentially of from about 99.5% to about 96.0% by weight of a mixture of normally liquid non-viscous relatively low molecular weight petroleum hydrocarbons of too low lubricity to prevent wear of the injection engine injecting apparatus and from about 0.5% to not more than about 4.0% by weight of an oiliness agent soluble in the petroleum hydrocarbon mixture and consisting essentially of a mixture of non-acidic saturated partially oxidized aliphatic chain hydrocarbons of more than 5 carbon atoms each including alcohols, ketones, alcohol-ketones, lactones and esters.

2. An injection engine fuel consisting essentially of a solution of from about 0.5% to about 1% by weight of an oil-soluble oiliness agent consisting essentially of a mixture of non-acidic saturated partially oxidized aliphatic chain hydrocarbons of more than 5 carbon atoms each, including alcohols, ketones, alcohol-ketones, lactones and esters produced by the liquid phase partial oxidation of a petroleum hydrocarbon mixture, in from about 99.5% to about 99.0% by weight of a liquid fuel of the group consisting of gasoline, kerosene and fuel oil.

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