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DIESEL FUEL OILS

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This invention relates to improved Diesel fuel oils and more particularly to Diesel fuel oils which contain small amounts of addition agents which improve the performance characteristics of Diesel engines that burn said improved Diesel fuel oils.

Diesel engines are generally operated with fuel oils that have a boiling range above that of gasoline and below that of a motor lubricant. They may for instance have initial boiling points of about 400° F. and end boiling points of about 700° F. In the operation of Diesel engines with such petroleum fuel oils various difficulties arise. Often varnish or gum forms on the piston surfaces, cylinder walls, valves, and atomizing apparatus of Diesel engines operating on such fuel oils, and the piston rings stick. Gum formation on the close fitting pintle valve of the fuel injection equipment results in a rapid drop in power and fluctuating combustion pressure due to inconsistent fuel injection. After several days of operation on ordinary Diesel fuel oils power output and engine efficiency decrease and there is a noticeable amount of knocking when the speed of the engine is increased. The engine must frequently be overhauled, cleaned and adjusted to restore its operating efficiency. Diesel fuel oils used in operating marine Diesel engines often become contaminated with water. As little as 0.1 per cent of water in a Diesel fuel oil can cause corrosion of fuel injectors so serious that the injectors must necessarily be replaced. With certain straight-run light Pennsylvania type fuel oils the wear on the injectors and plungers is sufficient to render them inaccurate after a few days operation, thereby causing erratic engine performance. In particular, small and medium size Diesel engines which usually operate on rather light fuel oils operate with lessened efficiency because of insufficient lubrication and of corrosion of parts. Corrosion, wear and gum formation on the high pressure injection pumps, interior cylinder surfaces and piston rings appear to be the major causes for the lessened efficiency with which Diesel engines perform when they are operated on ordinary Diesel fuel oils.

It is an object of this invention to manufacture fuel oils for Diesel engines which will improve the power output and performance characteristics of such engines. A further object is to produce Diesel fuel oils which will deposit very little varnish or gum on the engine parts. A still further object is to provide Diesel fuel oils which will not corrode engine parts if said oils become contaminated with water. Another object is to provide Diesel fuel oils which will tend

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to lessen the wear on the engine parts. Other objects will appear hereinafter.

These objects are accomplished in accordance with the present invention by making improved Diesel fuel oils which contain a small proportion of aliphatic amine salts made from a long chain primary aliphatic amine that has at least 10 carbon atoms and the mixture of fatty acids obtained by hydrolyzing sperm oil and which also contain a small proportion of the mixture of aliphatic alcohols obtained by hydrolyzing sperm oil, said aliphatic amine salts and mixture of aliphatic alcohols being present in sufficient quantities to improve the performance characteristics of Diesel engines burning said Diesel fuel oils.

The aliphatic amine salts used in our improved Diesel fuel oils are made from primary aliphatic amines having at least 10 carbon atoms and the mixture of fatty acids obtained by hydrolyzing sperm oil. The normal straight chain primary aliphatic amines used in preparing the amine salts used in the present invention preferably contain from 10 to 20 carbon atoms. Usually normal straight chain primary alkyl amines, such as decyl amine, undecyl amine, dodecyl amine, tetradecyl amine, cetyl amine, octadecyl amine and eicosyl amine, are employed, but it is also permissible to use unsaturated straight chain primary aliphatic amines, such as undecenyl amine, and 9,10-octadecenyl amine (also called oleyl amine). Mixtures of the straight chain primary alkyl amines, such as cocoamine, are often used because of their relative cheapness. Cocoamine is a commercial mixture of higher alkyl amines prepared from coconut oil fatty acids. It contains a major amount of primary dodecyl amine, and typical samples thereof have been found to have average molecular weights ranging from 200 to 210.

The aliphatic amine salts used in our improved Diesel fuel oils are made by reacting approximately equimolecular proportions of amines, such as those mentioned in the preceding paragraph, with the mixture of fatty acids obtained by hydrolyzing sperm oil. One of the amine salts which has been found to be a very desirable addition agent to Diesel fuel oils is the cocoamine salt of the mixture of fatty acids obtained by hydrolyzing sperm oil. The sperm oil is usually hydrolyzed by saponifying it with an alkali metal hydroxide followed by acidification of the saponification product.

The Diesel fuel addition agent which is preferred for use in the present invention is made

by dissolving 10 parts by weight of a mixture of fatty acids and aliphatic alcohols obtained by hydrolyzing sperm oil in 90 parts by weight of a Texas oil having a viscosity of 1200 S. U. V. at 100° F. and then adding from 3 to 5 parts by weight of cocoamine to this solution to neutralize the fatty acids contained therein. A Diesel fuel addition agent prepared in this manner has the following properties:

Gravity, °API	21.7
Viscosity, SUV:	
100° F	1490
210° F	84.7
Flash, OC, °F	470
Fire, OC, °F	510
Pour, °F	+10

From 0.1 per cent to 1 per cent by volume of this Diesel fuel addition agent may be blended with an ordinary Diesel fuel oil in making the improved Diesel fuel oils comprehended by the present invention. Preferably 0.5 per cent by volume of this Diesel fuel addition agent is blended with an ordinary Diesel fuel oil in making the improved Diesel fuel oils of the present invention. The improved Diesel fuel oils of the present invention may contain as little as 0.01 per cent by weight or as much as 0.25 per cent by weight, and preferably contain at least 0.05 per cent by weight of the aliphatic amine derivatives of hydrolyzed sperm oil described above. If desired we may dispense entirely with the Texas oil of 1200 SUV at 100° F., and add the aliphatic amine derivatives of hydrolyzed sperm oil directly to the Diesel fuel oil in the desired proportions.

The following table gives the comparative properties of a light Diesel fuel oil and an improved light Diesel fuel oil of the present invention which was made therefrom by blending 0.5 per cent by volume of the Diesel fuel addition agent described in the preceding paragraph with 99.5 per cent by volume of the light Diesel fuel oil.

	With Concentrate	Without Concentrate
Gravity, °API	42.5	42.6
Viscosity, SUV, 100° F	31	31
Flash, P-M, ASTM D93-42, °F	146	146
Pour, °F	-50	-45
Sulfur, per cent	0.05	0.05
Carbon Residue, per cent	trace	trace
Carbon Residue on 10% Bottoms, per cent	trace	trace
Corrosion Test No. 1 of Patent No. 2,371,853. Distilled water, 36 Cc., 12 days, Steel Strip:		
Appearance	bright	rust
Area rusted, per cent	nil	100
Neutralization No.	nil	nil
Acid Heat, ASTM D481-39, °F	2	2
Aniline Point, ASTM D611-44T, °F	145	145
Diesel Index No.	61.7	61.7
Cetane No. (CFR Ignition Delay Method)	53	53
Distillation, Gas Oil, ASTM D158-41:		
Over Point, °F	347	347
End Point, °F	526	524
10% at °F	386	386
50% at °F	430	429
90% at °F	490	488

The Diesel fuel oils of the present invention

such, for example, as that described in the preceding table, display many advantages over ordinary Diesel fuel oils. The close fitting pintle valves in the injection equipment of Diesel engines burning our improved fuel oils do not become covered with gum or corroded, and therefore the combustion pressure and power output remain constant even after more than 1000 hours of operation. This is an important advantage especially in connection with the operation of marine Diesel engines such as those used in power barges. Our new Diesel fuel oils substantially prevent corrosion and wear of the high pressure injection pumps, interior cylinder surfaces and piston rings, and reduce the tendency for piston rings to stick. Our Diesel fuels thus improve markedly the performance of Diesel engines, particularly those of small and medium size that usually operate on rather light fuel oils. The Diesel oils of the present invention decrease the tendency toward ring sticking and varnish formation on cylinder walls, valves and atomizing apparatus, thereby improving engine performance, power output and engine efficiency. The speed of Diesel engines burning our improved fuel oils may be increased with less knocking, and such engines will operate for a longer running time without having to be overhauled. If our Diesel fuel oils become contaminated with a little water, no serious corrosion of the injectors will ensue, since the addition agents added to our fuel oils increase water tolerance. The wear on the plungers and injectors decreases considerably when our fuel oils are employed. Our improved Diesel fuel oils successfully counteract many of the factors that decrease the efficiency of Diesel engines operating on ordinary Diesel fuels.

Resort may be had to such modifications and variations as fall within the spirit of the invention and the scope of the appended claims.

What we claim is:

1. An improved Diesel fuel oil which consists of Diesel fuel oil and from about 0.01 per cent to about 0.25 per cent by weight of the product obtained by neutralizing the mixture of fatty acids and alcohols contained in hydrolyzed sperm oil with a long chain primary aliphatic amine that has at least 10 carbon atoms.

2. An improved Diesel fuel oil which consists of Diesel fuel oil and about 0.05 per cent by weight of the product obtained by neutralizing the mixture of fatty acids and alcohols contained in hydrolyzed sperm oil with cocoamine.

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