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FUEL OIL ADDITIVE FOR PREVENTING WEAR IN DIESEL ENGINES AND GAS TURBINES

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This invention relates to fuel oil additives.

All diesel fuels contain some percentage of sulphur, and most residual type fuels, such as those intended primarily for under-boiler use, contain relatively high percentages of sulphur, up to three and one-half percent or higher. When such fuels are burned in a diesel engine, the sulphur combines with oxygen to form sulphur dioxide and sulphur trioxide which in the presence of water form sulphurous and sulphuric acids, both of which are corrosive and cause relatively high rates of wear to the cylinders and piston rings. Furthermore, most residual type fuels contain some percentage of vanadium and sodium which, in the form of vanadium pentoxide and sodium sulphate, respectively, in the fuel ash, react with ferrous metals and alloys to produce surface and depth corrosion to the ferrous metal or alloy parts, such as cylinders, piston rings and valves in a diesel engine; to the nozzles and the rotor buckets in a gas turbine; and the fire side of boiler tubes and superheater tubes in a high pressure steam boiler.

It is accordingly a principal object of the present invention to provide a fuel oil additive which, when introduced into the fuel oil, will limit the corrosive effects attributed to the aforementioned sulphur, vanadium and sodium compounds present in these fuels.

It is another object of the present invention to provide a fuel oil additive which will improve the operation of diesel engines and gas turbines and particularly the operation of those diesel engines and gas turbines burning heavy residual type fuel oils or blends of these heavy fuels with distillate fuels.

It is still another object of the present invention to provide a fuel oil additive of the above type, the application of which is not limited to heavy fuels but wherein improved operation will be obtained when used with well refined distillate fuels, although to a lesser extent.

It is still another object of the present invention to provide a fuel oil additive which will reduce the pitting and corrosion of the fire side of boiler tubes and superheater tubes in high pressure steam boilers such as those generating steam for steam turbines, where heavy under-boiler or bunker C type fuels are used.

Another problem of serious concern to the operators and builders of diesel engines, when burning high sulphur fuels, is the rapid rise in acid number of the crank case lubricating oil due to the acidic by-products of combustion and other fuel contamination which gets into the crank case and piston cooling oil.

It is accordingly another object of the present invention to provide an alkaline fuel oil additive which minimizes the acidic by-products of combustion and contaminants which get into the crank case and circulating lubricating oil.

It is still another object of the present invention to provide a fuel oil additive which, due to the detergent dispersant nature thereof, will, when used with fuel oils, tend to disperse the carbon particles and ash-forming particles and thereby promoting better injection characteristics, minimizing injector fouling and preventing sticking in the diesel engine. Also, as a result of this better dispersion characteristic imparted to the fuel by the additive, an improved and more complete combustion will be provided in the combustion chamber of the diesel engine.

The most efficient centrifuge and purification equipment available for installation at the diesel engine operator's plant is unable to remove all of the water and dissolved harmful particles present in residual type fuel oils. After the fuel oil is centrifuged and purified at the location of the diesel engine operator's plant, there still remains in the fuel oil from one hundred to five hundred parts per million of water.

It is still another object of the present invention to provide a fuel oil additive which will take these water particles and put them into solution with the fuel oil, rendering them less harmful when injected into the combustion chamber, and which will prevent corrosion from taking place on the close fitting parts of the fuel injection system.

It is still another object of the present invention to provide a fuel oil additive which during times of national emergency will conserve critical alloy metals that might be affected and which would otherwise wear and corrode.

It is still another object of the present invention to provide a fuel oil additive which during times of national emergency would permit residual type fuels and lower quality fuels to be used more satisfactorily than heretofore in diesel engines and gas turbines, thereby releasing more distillate fuels for jet aircraft and other prime movers specifically requiring highly refined fuels.

Other objects and the advantages and nature of my improved fuel additive will be apparent from the following description of the ingredients making up the same, the proportions thereof, the method of preparation, and the manner in which the aforesaid fuel additive is to be used.

I have discovered that alkaline metallic water soluble salts, such as calcium acetate, calcium formiate, barium acetate, magnesium acetate, magnesium sulphate, when dissolved in an aqueous solution of approximately twenty-five percent concentration will emulsify with calcium sulfonate (preferably basic calcium sulfonate, rather than neutral) and when reduced in viscosity with a light naphthenic type pale neutral oil of S.S.U. viscosity of 60 to 250 seconds at 100 degrees F. may be added to fuel oils to promote the foregoing objects. In view of the relative costs and availability of the water soluble salts referred to above, the invention incorporates calcium acetate into the formulation, although comparable results can be obtained with the other salts disclosed, the presence of these low molecular weight salts imparting an anti-wear property when in the presence of metallic sulfonates.

The following example is further illustrative of the invention, and it will be understood that the invention is not limited thereto:

Example

An aqueous solution of purified calcium acetate was prepared to a concentration of twenty-five percent by weight. This aqueous base solution was slowly added to basic calcium sulfonate, using a mixer or paddle, in the ratio of 3 parts by volume of the aqueous solution of calcium acetate to one part of the basic calcium sulfonate until a coarse emulsion was prepared. To this coarse emulsion a light naphthenic type neutral oil of approximately 100 S.S.U. viscosity at 100 degrees F. was added in the ratio of 60 percent oil to 40 percent emulsion, stirring with addition, and homogenizing by means of a gear pump.

The resulting emulsion was about the viscosity of an S.A.E. 20 motor oil and was stable on storage at temperatures from —40 degrees F. to 200 degrees F. without any water or oil separation. The additive when blended to the above formulation had a sulfated residue of approximately 8.5 percent.

When the above additive was introduced into residual type fuel oil in the ratio of one gallon of additive to 1,000 gallons of fuel oil, it imparted to the fuel oil ap-

proximately 85 parts per million of basic calcium particles. These calcium particles imparted to the fuel oil an anti-wear benefit to the cylinders, piston rings and valves of a diesel engine; reducing the harmful corrosive effects of the sulphur, vanadium and sodium compounds on the nozzles and rotor buckets in gas turbines; and reducing similar corrosive effects by these compounds on boiler tubes and superheater tubes in a high pressure steam generating boiler.

Depending on the nature and quantity of harmful compounds in the fuel oil, the ratio of additive to fuel oil, as mentioned above, may be increased or decreased from the ratio of 1 to 1,000.

The fuel oil additive formulated above by virtue of its containing metallic sulfonates dissolves the remaining particles of water in the fuel, permitting the sulfonates to preferentially wet with oil the close fitting parts in the injection system of the diesel engine or gas turbine, thus preventing corrosion or rust formation on these parts.

While the invention has been described with reference to a particular example and embodiment, it will be apparent to those skilled in the art, that various modifications may be made, and equivalents substituted therefor, without departing from the principles and true nature of the present invention.

Having thus set forth and disclosed the nature of my invention, what is claimed is:

1. A fuel-oil additive consisting essentially of a water-in-oil emulsion, including a basic calcium sulfonate as an emulsifying agent, the water phase of the emulsion being about a 25% aqueous solution of a water-soluble salt of a metal selected from the class consisting of calcium, barium, and magnesium; the oil phase being a light naphthenic neutral oil present in the amount of about 60% by volume of the total emulsion and the water phase being present in the amount of about 40% of the total emulsion.

2. The additive emulsion of claim 1 in which the calcium sulfonate is present in the amount of one part to each three parts by volume of the aqueous solution and the said water-soluble salt is calcium acetate.

References Cited in the file of this patent

UNITED STATES PATENTS

2,528,605	Partridge	Nov. 7, 1950
2,626,207	Wies	Jan. 20, 1953
2,671,758	Vinograd	Mar. 9, 1954

FOREIGN PATENTS

689,579	Great Britain	Apr. 1, 1953
705,176	Great Britain	Mar. 10, 1954

OTHER REFERENCES

"Emulsions and Foams," by Berkman et al., Reinhold Pub. Co., 1941, page 439.