

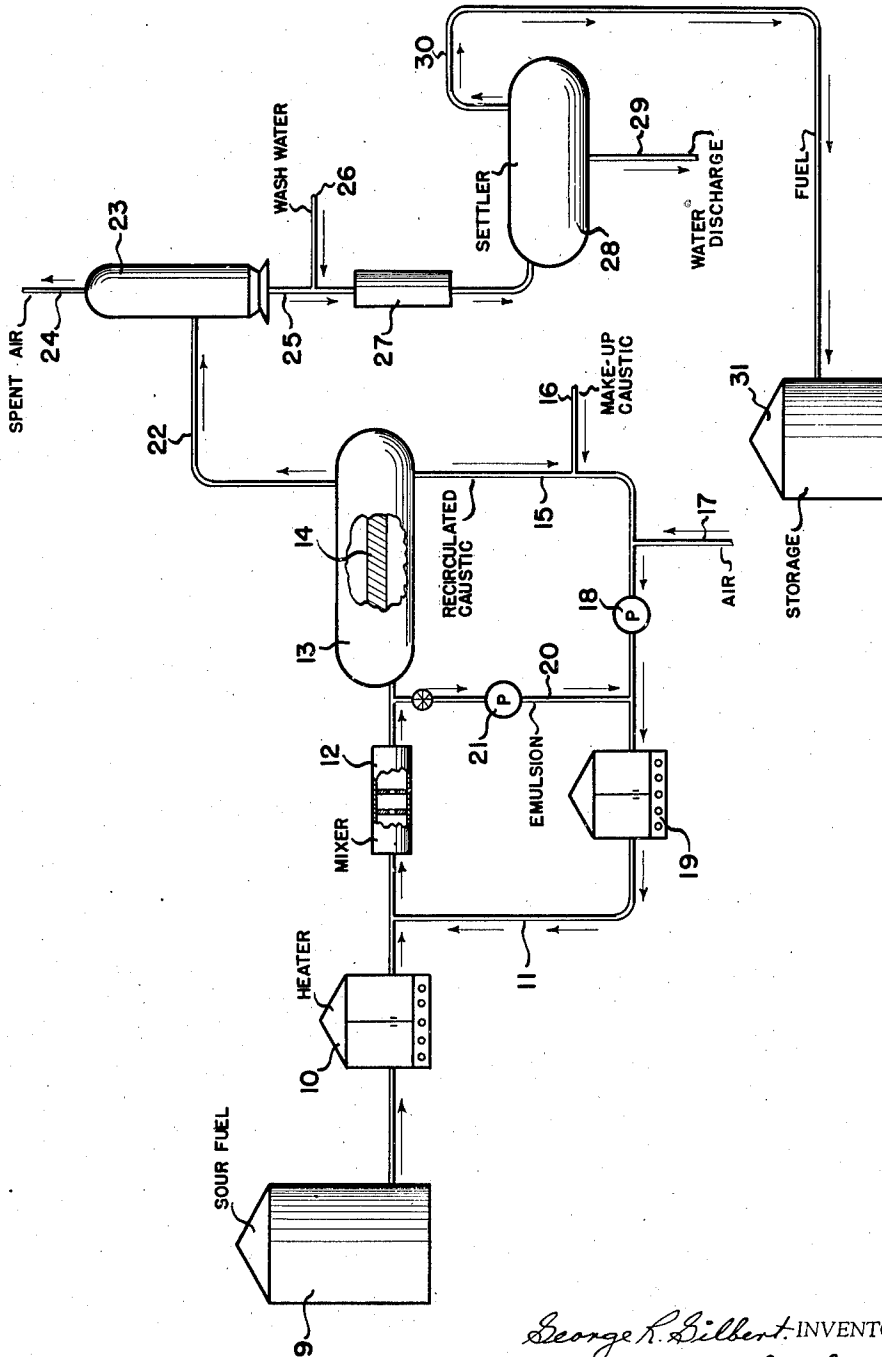
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METHOD OF INCREASING CETANE NUMBER OF FUEL OIL

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METHOD OF INCREASING CETANE NUMBER OF FUEL OIL

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2 Claims. (Cl. 196—29)

The present invention is directed to a method for improving the combustion characteristics of oils suitable for use in Diesel motors.

There has been a rapid increase in the use of Diesel engines and a corresponding demand for premium Diesel fuel oils of high cetane number. Various means for increasing the cetane numbers of Diesel fuels are known to the prior art. These known processes usually involve solvent extraction, or doctor sweetening plus the addition of excess elementary sulfur or the employment of addition agents such as organic nitrates, or sulfur compounds. These known processes suffer the disadvantage that the sulfur content of the fuel is increased or else expensive chemicals are required.

It is an object of the present invention to provide a process for increasing the cetane number of fuel oils. More particularly, sour fuel stocks may be processed in accordance with the present invention to sweeten them and increase the cetane number without increasing the sulfur content of these stocks and by the use of readily available treating materials.

It may be stated broadly that the present invention resides in contacting sour fuel oils in the presence of oxygen with hot caustic solution. Surprisingly enough it has been discovered that recycling the hot caustic results in a greater increase of the cetane number than is obtained when fresh caustic is employed.

The reason for the unexpectedly improved result obtained by employing hot caustic which has been previously contacted with sour fuel oils is not clearly understood. It is known, however, that the presence of disulfides in a fuel oil increases the cetane number of the fuel. It is suggested that the contact of sour fuel with caustic and air converts the mercaptans to disulfides. However, the disulfides are somewhat soluble in caustic, as well as in the hydrocarbon fuel and some of the disulfides are dissolved in the new caustic while a remainder stays in the fuel to increase its cetane number. As the caustic is recirculated to contact succeeding amounts of fuel it dissolves disulfides progressively less and less, since it is approaching saturation. Another theory is that phenols are known to have a low cetane number and are somewhat soluble in caustic. It may, therefore, be assumed that the removal of the phenols by the caustic and air causes the cetane number of the fuel to increase.

It is to be understood that I do not wish to be bound by either of the theories advanced above, and that irrespective of the chemical phenomena

involved the treatment as described herein results in an unexpected improvement in the cetane number of the hydrocarbon fuel treated.

In practicing the present invention, the fuel oil to be treated may be heated to a temperature between 150° and 210° F. and air added thereto either by exposing the mixture while being agitated to air to allow it to become saturated with air or by injecting a small amount of air into the oil in a closed system. The mixture may then be contacted with concentrated caustic solution, such as 50° Bé. sodium hydroxide solution, for a short time. The used sodium hydroxide may be recirculated through the system for a large number of times before it becomes so spent that it must be discarded and as stated above the recirculated caustic gives a product of higher cetane number than does fresh caustic.

As a specific example 15 gallons of gas oil with an original copper number of 160 were heated to a temperature of 185° F. and contacted with one liter of hot 50° Bé. sodium hydroxide with thorough mixing. The mixture was recirculated at the high temperature until it was substantially sweet and the mixture then allowed to settle.

The sodium hydroxide was withdrawn from the first batch and used to treat another 15 gallon charge of the sour gas oil with the mixture being recirculated until the second batch was practically sweet. The spent caustic was withdrawn and used in like manner for treating two more batches of the same original sour stock. The analytical data on the charge and each of the four batches treated by the process are given in the following table:

	Charge	Batch1	Batch2	Batch3	Batch4
Cetane number.....	47.1	49.3	50.0	50.3	51.4
Increase in cetane number.....	0	2.2	2.9	3.2	4.3
Odor.....	Sour	Sweet	Sweet	Sweet	Sweet
Total sulfur content.....	0.82	0.75	0.78	0.77	0.79

While in the above examples the charge stock was treated in batch operation, it will be apparent that the process may be practiced commercially either by using batch operation or in a continuous operation. A continuous method for practicing the invention commercially will now be described in conjunction with the drawing in which the sole figure is a diagrammatical illustration of a preferred embodiment.

Sour fuel oil withdrawn from vessel 9 is heated in heating coil 10 to the desired temperature and mixed with hot recirculated caustic and air from

line 11 in orifice plate mixer 12. The mixture is sent to separating vessel 13 provided with a coagulator bed 14. In vessel 13 caustic settles under the influence of gravity and is withdrawn via pipe line 15. To the recirculated caustic additional fresh caustic is added by line 16 and air by line 17. The stream then flows through pump 18 to heater 19 where it is withdrawn by line 11 and admixed with sour oil as above described. If desired, a line 20 provided with pump 21 may be used to bypass a portion of the emulsion withdrawn from mixture 12 before it is sent to separator 13 to obtain additional admixing of the components.

From the upper portion of separating vessel 13 line 22 removes air and oil. This admixture is sent to separator 23 where it is allowed to settle under the influence of gravity. Spent air is removed from vessel 23 by line 24 and separated oil is removed from the bottom of separating vessel 23 by line 25 and admixed with wash water added thereto by line 26. It will be understood that the separated oil may contain suspended caustic and the water is added to the oil for the purpose of removing this caustic. The admixture of water and oil is sent through mixer 27 to a settling vessel 28 where it settles under the influence of gravity with water discharging via line 29 and the finished fuel oil sent through line 30 to storage tank 31.

It will be evident that in continuous operation a small amount of fresh caustic may be contin-

uously added to the cycle and a small portion of spent caustic continuously withdrawn as shown in the drawing, or alternatively, fresh caustic and charge stock may be flowed concurrently through a system. It will also be apparent that air may be added to the system by injection or, if desired, an admixture of caustic and sour oil may be agitated while exposed to the atmosphere.

Having fully described and illustrated the practice of the present invention, what I desire to claim is:

1. A method of treating sour fuel oil to increase the cetane number thereof comprising the steps of agitating a first batch of sour oil with approximately 50° Baumé caustic solution and in the ratio of approximately 15 parts of oil to 1 part of caustic in the presence of oxygen at a temperature of approximately 190° F. until the batch is sweet, separating under the influence of gravity the oil from the caustic, admixing another batch of sour fuel oil with caustic, removed from said first batch, agitating it in the presence of oxygen at a temperature of approximately 190° F. until the oil is sweet and separating under the influence of gravity the oil from the caustic.

2. A method in accordance with claim 1 in which a plurality of batches of sour oil are serially treated with caustic separated from a preceding batch.

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