Patented Aug. 22, 1939 2,170,620

UNITED STATES PATENT OFFICE

2,170,620

PROCESS FOR TREATING MINERAL OILS

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No Drawing. Application December 24, 1936, Serial No. 117,537

7 Claims. (Cl. 196—40)

This invention relates to a process of treating mineral oils and refers particularly to a process of producing improved lubricating oils from mineral oil stocks heavier than kerosene.

In the refining of lubricating oils, especially light colored lubricating oils, such as white oils which are used for medicinal purposes, the oils are generally submitted to very drastic treatments. It has been found in the past that the more drastic treatments to which these lubricating stocks are submitted, the more unstable is the finished oil. These oils which have been treated in this manner on standing, especially in sunlight, very quickly deteriorate and form acidic compounds, which are noticeable by the presence of a pronounced odor. On the other hand, if a lubricating oil stock is only subjected to a mild treatment, for example, with a small amount of sulufuric acid, the resulting oil is more stable to oxidation, but upon being used, more readily forms a sludge deposit.

An object of the invention is to provide a process whereby a stable lubricating oil may be prepared. Another object of this invention is to provide an improved method for preparing lubricating oils, especially stable white oils that are used for medicinal purposes and will meet the requirements of the U. S. Pharmacopoeia.

According to this invention, it has been found that by treating a petroleum lubricating oil distillate fraction with oxygen or oxygen-containing gas without the aid of solid absorbents and added steam for 3 or 4 hours, the non-stable hydrocarbon constituents do oxidize and polymerize. The temperatures used for the oxidation are from 400 to 500° F. The lower temperatures of about 400° F. are used when lubricating oil fractions of low viscosity are being treated, that is, those of S. A. E. 10 to 20, and the higher temperature of about 450 to 500° F. being used for oils of higher viscosity such as S. A. E. 30 to 50. The quantity of air or any oxygen-containing gas used is from about 5 to 7 cubic feet per hour for every 300 grams of the oil. Catalysts such as copper naphthenate, manganese stearate, etc., may be used to aid the oxidation.

The oxidized oil is then treated with a small quantity of about 1% to 5% of concentrated sulfuric acid to coagulate the oxidized compounds which are then separated as a sludge. If it is desired to prepare a mineral white oil that will meet the requirements of U. S. Pharmacopoeia, the oxidized oil is treated with approximately 15 to 30% by weight of fuming sulfuric acid after which the oil may be clay filtered, to the desired color.

By this method, smaller amounts of acid are required to prepare a mineral white oil, that is, the amount of fuming sulfuric acid required to produce a white mineral oil suitable for medicinal purposes is reduced from 35 to 80% or more to 15 to 30%. Also, the mineral white oil thereby prepared is more stable and has a lower oxygen absorption rate than that prepared by acid treatment followed by clay filtration to the same color.

Where the oil is to be used only for lubricating purposes, such as in an internal combustion engine, 1 to 5% of concentrated sulfuric acid is generally sufficient to remove any of the oxidized constituents that have been formed. This oil may then be clay treated to improve the color or such. This oil is especially adapted for use as a turbine oil, transformer oil, motor oil, or in any other manner where a lubricating oil is required that will withstand oxidation over long periods of time. It has also been observed that by this treatment the viscosity index is raised, the pour lowered, Sligh number improved, and the finished oil generally improved.

The oil being treated may be subjected to preliminary treatments before being oxidized, that is, the asphaltic constituents may be separated by propane separation, or it may be subjected to an acid treatment to eliminate any unsaturated or aromatic compounds that may be present. It likewise may be subjected to treatments with selective solvents to remove unsaturated and aromatic compounds. A finished oil may be improved and made more stable by being subjected to this treatment. It is not necessary that an oil treated according to this method be treated with clay as the oxidized constituents are readily coagulated by the use of the small quantity of acid, after which the oil may be neutralized and washed. Selective solvents, such as phenol furfural, sulfur dioxide, etc. may also be used to finish up the oil.

The advantages obtained by this process will be more clearly understood on the reading of the following examples:

Example 1

A distillate obtained from a Columbia crude mineral oil, having a medium viscosity of about S. A. E. 30 and a pour point of 0° F. after being oxidized by blowing with 5 to 7 cubic feet of air per hour per 300 grams of the oil for 3 to 4 hours at a temperature of about 450° F., was subjected to the following treatment: 1 to 3% concentrated

sulfuric acid was added to coagulate and separate the oxidized constituents and the separated oil filtered through clay (1 ton of clay per 100 barrels of oil). The pour point of this finished oil was reduced to —20° F. and the viscosity index of the finished oil was increased 3 to 4 points.

Example 2

A lubricating oil distillate stock obtained from a Pennsylvania crude of low viscosity, that is, S. A. E. 10, having a pour point of about 10° F. was treated under the same conditions as described in Example 1, except that 0.1% of copper naphthenate was present. After finishing the oil in the same manner as described in Example 1, the pour point of the finished product was reduced to —10° F.

Example 3

A lubricating oil distillate obtained from a Columbia crude and having a Saybolt viscosity of 700 seconds at 100° F. was blown with 5 to 7 cubic feet of air per hour for every 300 grams of the oil at a temperature of about 400 to 450° F. for 2½ to 4 hours. The oil then was subjected to three treatments each of 5% by volume of fuming sulfuric acid, after which it was neutralized after being separated from the sludge, washed with alcohol and filtered through clay (1 ton of clay per 60 barrels of oil). The oxidation absorption rate of the oil was 15 cc. of oxygen per 15 minutes for every 10 grams of the oil, at a temperature of 175° C., whereas the usual white oils on the market have oxygen absorption rates of over 100, generally in the neighborhood of 140 to 160. The oil also passed the U. S. Pharmacopoeia acid test.

The oxygen absorption rate was determined by circulating a known volume of oxygen through 10 grams of the oil at a temperature of 175° C. for a period of 15 minutes and the amount of oxygen absorbed by the oil is the absorption rate of the said oil.

Example 4

A distillate obtained from a Columbia crude having a Saybolt viscosity of 574 seconds at 100° F. and 59½ seconds at 210° F. and with a viscosity index of 52 upon being oxidized for four hours under the same conditions as described in Example 1, was subjected to 3 fuming sulfuric acid treatments each of 5% by volume of the acid based on the oil. Upon being neutralized, washed with alcohol and filtered through clay, yielded a white oil having the following physical characteristics:

Saybolt viscosity of 432⅗ seconds at 100° F. and 54⅕ seconds at 210° F. and a viscosity index of 63.

This invention is not limited by any theory of the mechanism of the reaction known by any details which may have been given merely for illustrative purposes, but is limited only in and by the following claims in which all the novelty inherent in the invention is claimed.

I claim:

1. The method of treating hydrocarbon oils to produce a stable lubricating oil which comprises treating the lubricating oil distillate with a gas containing free oxygen of about 5 to 7 cubic feet of the said gas for every 300 grams of the oil per our at a temperature of about 400–450 F. for a period of about 3 to 4 hours, treating the said oxidized oil with 1 to 30% sulfuric acid and separating the acid sludge that is formed.

2. The method of treating hydrocarbon oils according to claim 1 in which an oxidizing catalyst is used.

3. The method of treating hydrocarbon oils according to claim 1 in which the separated oil is treated with clay to obtain a light color.

4. The method of treating a hydrocarbon oil to produce a mineral white oil that is suitable for medicinal purposes which comprises contacting at a temperature of about 400–450° F. a lubricating oil fraction for 3 to 4 hours with 5 cubic feet of a gas containing free oxygen for every 300 grams of the said oil, contacting the said oxidized oil with 30% of fuming sulfuric acid by weight, separating the acid sludge that is formed and filtering the separated oil through a body of absorbent clay.

5. The method of treating a hydrocarbon oil to produce a mineral lubricating oil which comprises contacting at a temperature of about 400–450° F. a lubricating oil fraction for 3 to 4 hours with 5 cubic feet of a gas containing free oxygen for every 300 grams of the said oil, contacting the said oxidized oil with 1 to 3% of concentrated sulfuric acid by weight and separating the acid sludge that is formed.

6. The method of treating a hydrocarbon oil to produce a mineral white oil that is suitable for medicinal purposes and passing the U. S. Pharmacopoeia acid test, which comprises contacting at a temperature of about 400–450° F. a lubricating oil distillate for 3 to 4 hours with 5 cubic feet of a gas containing free oxygen for every 300 grams of the said oil, subjecting said oxidized oil to 3 treatments of 5% each of fuming sulfuric acid by weight, separating the acid sludge as it is formed and filtering the separated oil through a body of absorbent clay.

7. The method of treating a hydrocarbon oil to produce a mineral white oil according to claim 6 in which the treated oil, after being separated from the sludge, is neutralized and washed with alcohol before filtering through clay.

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