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LUBRICATING OIL CONTAINING A POLYMER OF TETRADECYL VINYL ETHER

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1 Claim. (Cl. 252-52)

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This invention relates to the improvement of lubricating oils, and more particularly to the reduction of pour points of wax containing mineral oils. More specifically the invention relates to a method of altering the crystallization characteristics of the paraffin wax dissolved in lubricating oils, and avoiding the solidification of the lubricant upon cooling.

Many of the commercially available petroleum stocks contain high molecular weight hydrocarbon waxes, and the lubricating oil fractions, separated by various refining procedures, contain a substantial proportion dissolved therein. Upon cooling these lubricants, the dissolved waxes crystallize in such form that the mass is solidified. It is known that some substances affect the crystallization of the wax and permit the lubricants to retain their fluidity after cooling to temperatures below the normal pour points of the oils.

The purpose of this invention is to provide a convenient and readily available agent for depressing the pour points of lubricating oils. A further purpose of this invention is to enable the selection of an effective pour point depressant for a wide variety of wax containing lubricating oils.

The pour points of lubricating oils are measured by a standard A. S. T. M. procedure, by which a sample of oil is heated and then gradually cooled while observing the fluid characteristics of the sample at every 5° F. interval, the temperature being multiples of 5° F. The pour point is the lowest temperature at which the sample is fluid. The details of the method of determining pour points are set forth in the American Society for Testing Materials Bulletin, on petroleum products and lubricants D-97-39.

It has been discovered that there is a critical relationship between the length of the alkyl group of an alkyl vinyl ether, and the pour point of a wax containing oil in which the polymer is an effective pour point depressant. Polymers of alkyl vinyl ethers having alkyl groups longer or shorter than the critical length may be less effective, or entirely ineffective, in depressing the pour point of the same oil. In accordance with this invention the polymer of tetradecyl vinyl ether is used as a pour depressant for wax containing oils having pour points between 15 and 50° F. Other polymeric alkyl vinyl ethers are not effective pour point depressants for 15 to 50° F. pour oils, and the polymer of tetradecyl vinyl ether is not effective in higher or lower pour oils.

In the practice of this invention, the polymerized tetradecyl vinyl ether is prepared pref-

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erably by the well known low temperature polymerization technique, for example, at temperatures between -10° F. and +20° F. in the presence of catalysts, such as aluminum chloride or boron trifluoride. The effectiveness of the polymer as a pour point depressant is not materially affected by the molecular weight of the polymer; the wide range of molecular weights achieved by conventional polymerization operation all appear to have the same or very similar pour point depression. The polymerized tetradecyl vinyl ether may be used in an amount varying from 0.01 to 5 percent by weight, but preferred operation involves the use of from 0.05 to 2 percent. The polymer is dispersed in the lubricating oil by adding it directly and stirring the mixture until a homogeneous dispersion, or solution, is effected. It is frequently desirable to prepare master batches by dispersing large amounts of the polymerized tetradecyl vinyl ether in a lubricating stock and thereafter mixing the concentrate with a suitable large quantity of the untreated oil, the proportion being chosen so as to achieve a small but effective proportion of the polymerized tetradecyl vinyl ether in the final lubricant.

This invention may be practiced by using a mixture of polymeric alkyl vinyl ethers containing predominantly the polymer of tetradecyl vinyl ethers, and copolymers of mixed alkyl vinyl ethers containing predominantly tetradecyl vinyl ethers and substantial portions of near homologues, for example, hexadecyl vinyl ether and dodecyl vinyl ether. These copolymers are generally derived from the mixed alcohols as obtained from animal and vegetable oils by saponification and reduction.

The pour point depressant may be used in combination with other known depressants and other modifying agents, such as antioxidant and detergents.

The critical characteristics of pour point depression of lubricating oils with polymerized vinyl ethers are demonstrated by the following specific examples.

Example 1

The critical effect of the dependent alkyl chain of various polymerized alkyl vinyl ethers was demonstrated by preparing one percent by weight solutions of polymerized octyl vinyl ether, polymerized decyl vinyl ether, polymerized dodecyl vinyl ether, polymerized tetradecyl vinyl ether, polymerized hexadecyl vinyl ether and polymerized octadecyl vinyl ether in wax containing lubricating oils having a 20° F. pour point in the unmodified condition. The six samples of

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modified oils were tested by means of the standard A. S. T. M. pour point measuring method, and the observed data is set forth in the following table.

| Polymerized agent | Pour Point, °F. | Depression, °F. |
|-----------------------------|-----------------|-----------------|
| Octyl vinyl ether..... | 20 | 0 |
| Decyl vinyl ether..... | 20 | 0 |
| Dodecyl vinyl ether..... | 15 | 5 |
| Tetradecyl vinyl ether..... | 0 | 20 |
| Hexadecyl vinyl ether..... | 20 | 0 |
| Octadecyl vinyl ether..... | 20 | 0 |

This demonstrates that the polymerized alkyl vinyl ether containing alkyl chains of 8, 10, 16 and 18 carbon atoms have absolutely no effect on the pour point of the oils, whereas the polymerized alkyl vinyl ether with an alkyl chain of 12 carbon atoms has only a very slight effect. On the other hand, the polymerized alkyl vinyl ether having 14 carbon atoms in the alkyl chain is an effective pour point depressant. Thus, the critical nature of the polymerized tetradecyl vinyl ether as a pour point depressing agent is established.

Example 2

For the purpose of demonstrating the criticality of the original pour point of the oil upon the degree of pour point depression achieved by means of the polymerized tetradecyl vinyl ether, a series of samples were prepared by dissolving one percent by weight of polymerized tetradecyl vinyl ether in samples of oils having pour points varying from 0° to 60° F. The following table sets forth the original and final pour point as well as the degree of pour point depression achieved.

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| Original Pour, °F. | Final Pour, °F. | Depression, °F. |
|--------------------|-----------------|-----------------|
| 0 | +10 | -10 |
| 20 | 0 | 20 |
| 45 | +5 | 40 |
| 60 | +55 | 5 |

This data clearly demonstrates that tetradecyl vinyl ether is a good pour point depressant for 20° F. pour oil and unusually good depressant for 45° F. pour oil, but that its effect on 60° F. pour oil is almost negligible. On the other hand, in 0° F. pour oil, the polymerized tetradecyl vinyl ether has a deleterious effect in increasing the pour point of the oil.

The invention is defined by the following claim:

A lubricating composition which comprises a wax containing mineral lubricating oil having an A. S. T. M. pour point of from 15 to 50° F., containing intimately dissolved therein from 0.05 to 2 percent by weight of a polymer of tetradecyl vinyl ether.

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