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LUBRICATING OILS

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This invention relates to lubricating oils and it comprises an improved lubricating oil to which has been added a small amount, of the order of 0.1 to 1 percent, of an aliphatic nitrile or the products obtained by cracking aliphatic nitriles.

Within recent years efforts have been made to improve mineral lubricating oils by adding various ingredients thereto. In many cases such additions have been made for the purpose of improving that characteristic of the oil commonly referred to as oiliness. These added substances have mostly been fatty acids such as oleic acid, various glycerides, lard, etc. The property of oiliness has not been clearly defined, but the term has a rather definite meaning to those skilled in the art. Some have defined it as that property which an oil must possess to a sufficient degree to enable the oil to lubricate adequately under all conditions of use. In more practical terms, an oily oil is one which will form a film between bearing surfaces of such strength that the film will withstand rupture under extreme conditions of pressure or temperature. To put it another way, an oily oil is one which has high film strength and as a result will give better engine performance under all conditions of use. At the same time, however, such oils should have low internal friction and should also have the property of clinging to metal surfaces. It used to be considered that viscosity was a good criterion of the oiliness in oil on the theory that the higher the viscosity the stronger would be the oil film. However, it has now been pretty well acknowledged that viscosity alone does not explain oiliness in an oil.

As stated, the prior art has hitherto added small quantities of vegetable oils such as oleic acid to hydrocarbon lubricating oils. Undoubtedly such additions have proved beneficial, in part because of the high "polar" characteristics of the higher fatty acids. That is to say the carboxylic acid group of the fatty acid tends to cling to the metal surfaces of a bearing and thus aids in the development of a persistent film. However, in many instances the internal friction of the compounded oil has been increased and this is a distinct disadvantage. Many of the added substances hitherto used increases the viscosity of the oil and hence such oils necessarily cause increased power loses in engines lubricated with them. This is because of the internal friction in the oil itself.

Another serious objection to the addition of substances like oleic acid and fats is that these added substances do not have very much resistance to high temperatures. In a gasoline engine the crank-case temperature may on the average be about 210° F. and bearing temperatures may run as high as 400° F. Bearing pressures may occasionally be as high as 600 pounds per square inch which means that a satisfactory oil must have high film strength and heat resistance if it is to function continuously under these conditions.

Substances like oleic acid are not sufficiently heat resistant to operate satisfactory over long periods of time at the relatively high temperatures in a rapidly rotating bearing. These substances, although they initially contribute oiliness to an oil, tend to break down and decompose at high temperatures. This action may be oxidizing, or it may in part be instituted by the presence of traces of moisture. Fatty esters are readily hydrolized at the high operating temperatures in the presence of moisture and free fatty acids thus liberated tend to decompose. All of which means that such substances, although they may initially improve a mineral lubricant very soon lose their effectiveness and actually prove detrimental.

We have now discovered that aliphatic nitriles impart the characteristic of oiliness to lubricating oils and greases, and we have further discovered that the addition of such compounds does not impart any tendency for increased oxidation or increased sludge formation in the oil so treated. This result is unexpected and cannot be predicted from the prior art since it has formerly been assumed that substances imparting oiliness to oils must contain oxygen or sulfur.

In the practice of our invention we can use a large number of aliphatic nitriles. We do, however, find it best to use those nitriles having at least six carbon atoms. All of the nitriles which we use can be prepared from the corresponding fatty acids by reacting the acid with ammonia in the presence of a dehydrating catalyst. Stearonitrile and palmitonitrile are nitriles corresponding to stearic and palmitic acids. Nitriles corresponding to other fatty acids containing six or more carbon atoms can be prepared in like manner and used in our invention. For example, we can use nitriles prepared from capric, caprylic, lauric, myristic, and the unsaturated fatty acids such as oleic and linoleic.

We can also use products obtained by pyrolytically cracking higher fatty acid nitriles such as stearo and palmito nitriles. These cracked products are mostly lower molecular weight fatty acid nitriles both saturated and unsaturated and which boil from 40° C. to as high as 360° C. In many instances the cracked nitriles are associated with quantities of hydrocarbons which are also products of the cracking reaction. Methods of preparing these cracked nitriles are described in the copending applications Serial Number 9,660 and 11,348 filed by us. These methods involve heating nitriles such as stearonitriles, lard fatty acid nitriles, etc., at a temperature of about 500° C. with or without a catalyst and either at ordinary or elevated pressures.

As stated above, in broad aspects our invention comprises the addition of a small amount, of the order of 0.5 to 1 percent, of an aliphatic nitrile, having at least six carbon atoms, to lubricating oils to increase the oiliness of the oil.

Recently, methods have been devised for determining the oiliness of an oil, and for comparing oils with each other as regards oiliness. Many of these methods depend upon the fact that as the temperature of an oil increases its power of lubrication decreases. To put it another way, as the temperature increases, the oil film begins to break down. Devices used for testing oils hence include a bearing lubricated by the oil under test, means to heat the oil gradually, and means to indicate when the lubricating effect of the oil begins to stop, and when it finally ceases. The temperature at which lubrication initially begins to break down, and the temperature at which lubrication substantially ceases are noted. An "oily" oil will have a higher temperature at the so-called initial "break" and a higher temperature at the final "break" than an oil which is less oily. This means that the oily oil has better film strength at elevated temperatures than an oil which is less oily.

One device for testing oiliness consists of a metal cup in which a flat plate is fixed, another plate which can be rotated contacts with the first and both are forced together by a spring under a fixed tension. The rotatable plate is fixed to a shaft which in turn is linked to an indication needle. The cup has means to heat oil therein, usually electric.

When the oil under test is placed in the cup and the shaft rotated, the indicator needle records a straight line on a dial as long as lubrication between the two plates is complete. In other words there is no drag other than internal friction in the oil. As the oil is heated up, the oil film between the plate is affected. At a certain temperature, depending upon the oiliness of the oil, the indicating needle will begin to depart from a straight line, thus indicating the initial "break" in the lubrication. As the temperature rises still higher, a temperature will be reached at which the needle oscillates violently. This is the so-called "final" break and indicates substantially complete break-down of the oil film. These two temperatures are an indication of the oiliness of the oil.

We shall now give examples of our invention. One Mid-Continent oil without the addition of the nitriles of the present invention, shows an initial break at 142° F. and a final break at 164° F. When 0.25 percent of commercial stearonitrile is dissolved therein, the initial break was raised to 160° F. and the final break to 206° F.

In another example we add about 0.25 percent of a 50–50 mixture of stearo- and palmitonitrile to the above Mid-Continent oil. The improved oil shows an initial break at 159° F. and a final at 202° F.

As a further example, we add from 0.25 to 1 percent of a mixture of nitriles from lard fatty acids having a boiling point range of 320°–355° C. In this case the initial break is 160° F. and the final 200° F.

Instead of using these higher fatty acid nitriles which contain, on the average sixteen carbon atoms, we can add lower molecular weight nitriles such as those obtained by cracking the higher nitriles. In such cases we add from 0.5 to 1 percent of cracked nitriles containing from 7 to 12 carbon atoms to the above oil and obtain an initial break at 158° F. and the final at 199° F.

Any mineral lubricating oil can be improved as regards oiliness by the addition thereto of higher fatty acid nitriles. The viscosity of the original oil will of course vary with the conditions of lubrication it has to meet. The quantity of nitrile present in the oil can vary over rather wide limits but we do not generally add more than about one percent to the oil since this is sufficient. The proportions usually range from about 0.25 to 1 percent.

We can also, of course, include other oiliness imparting constituents in the oil in addition to our nitriles.

Having thus described our invention, what we claim is:

1. A lubricating oil comprising a mineral lubricating oil and a small amount, of the order of 0.25 to 1 per cent, of an aliphatic nitrile having at least six carbon atoms to increase the oiliness of said mineral oil.

2. A lubricating oil comprising a mineral lubricating oil and a small amount of the order of 0.25 to 1 percent, of an aliphatic nitrile having sixteen carbon atoms to increase the oiliness of said mineral oil.

3. A lubricating oil comprising a mineral lubricating oil and a small amount, of the order of 0.25 to 1 percent, of an aliphatic nitrile having eighteen carbon atoms to increase the oiliness of said mineral oil.

4. A lubricating oil comprising a mineral lubricating oil and a small amount, of the order of 0.25 to 1 percent, of a mixture of stearo- and palmitonitrile to increase the oiliness of said mineral oil.

5. A lubricating oil comprising a mineral lubricating oil and a small amount, of the order of 0.25 to 1 percent, of a mixture of nitriles obtained by cracking nitriles containing at least sixteen carbon atoms to increase the oiliness of said mineral oil.

6. A lubricating oil comprising a mineral lubricating oil and a small amount, of the order of 0.25 to 1 percent, of cracked nitriles to increase the oiliness of said mineral oil.

7. A lubricating oil comprising a mineral lubricating oil and a small amount, of the order of 0.25 to 1 percent of lard fatty acid nitriles to increase the oiliness of said mineral oil.

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