Patented Dec. 8, 1936 2,063,880

UNITED STATES PATENT OFFICE

2,063,880

LUBRICATING OIL

Bert H. Lincoln, Ponca City, and Alfred Henriksen, deceased, late of Ponca City, Okla., by Ellen M. Henriksen, administratrix, Ponca City, Okla., assignors, by mesne assignments, to The Lubri-Zol Development Corporation, Cleveland, Ohio, a corporation of Delaware

No Drawing. Application January 22, 1934, Serial No. 707,783

5 Claims. (Cl. 87—9)

Our invention relates to high quality lubricating oils and specifically comprises such products as new compositions of matter.

The present design of mechanical devices calls for higher pressures on rubbing surfaces. The designers are, however, limited to pressures at the rubbing surfaces which are below the pressures at which high quality lubricating oils will break down in use and allow metal-to-metal contacts which result in seizure. The lubricant between the two rubbing surfaces is spread out in a relatively thin film and if the lubricant does not have high film strength, it will break down with subsequent damage to the machine or rubbing surfaces. Conventional hydrocarbon lubricants vary in their film strength; the very highest quality lubricants, however, do not have sufficiently high film strength properties for the designers of mechanical devices, to take advantage of the improvements which might be achieved with higher rubbing surface pressures.

The primary object of our invention is to provide a lubricant of greatly increased film strength in an economical manner. In general, our invention comprises the addition of halogenated hydroaromatic substances with single nucleus to hydrocarbon lubricants. By hydroaromatic substances with single nucleus we mean the saturated single nucleus hydrocarbons of which hexahydro benzol is the parent hydrocarbon. Hexahydro benzol is sometimes called "hexanaphthene" and its homologues are called heptanaphthene, octonaphthene, nononaphthene, et cetera. Other hydroaromatic substances within the scope of this invention are the homologues with side chains, either of short or long character. For example, methyl cyclohexane, 1,1-dimethyl cyclohexane, 1,2-methyl-ethyl cyclohexane, 1,3,5-trimethyl-cyclohexane, and the like. These substances may be halogenated either in the ring or on the side chain and be within the scope of this invention.

The hydroaromatic selected for use in our invention is halogenated by any of the well-known methods. Since these compounds are saturated as a rule, it is necessary to add the halogen by substitution of hydrogen. It is not the intent of this invention to cover any specific method of halogenation of hydroaromatic compounds, since the method giving the best results with the substance being halogenated may be employed. The tetra and dihydro benzols may be used in our invention and will readily absorb halogens at their double bonds to form the saturated compound with this type of starting material, it is not necessary to halogenate by substitution. The halogen substitution product of the hexahydro benzols may be formed by four well developed procedures: (1) from the hexahydro benzols by the introduction of halogen; (2) by the addition of halogen and halogen hydrides to di and tetra hydro benzols; (3) by the addition of halogens to benzols and halogen benzols; and (4) from cyclohexanols through the exchange of hydroxyl groups for halogens, by means of hydrogen haloids, or phosphorous haloids.

It is well known that isomeric halogenated hydroaromatics are obtained on halogenation. This invention does not make any distinction, but includes all isomeric compounds. For example, chlorocyclohexane boiling point 143° C., bromocyclohexane boiling point 163° C., iodocyclohexane boiling point 69° C. (10 millimeters), 1,1-methylchlorocyclohexane, and the 1,2-methylchlorocyclohexane, also the 1,3 and 1,4-methylchlorocyclohexanes, ranging in boiling points from 54° C. at 40 millimeters pressure to 158° C., hexahydrobenzylchloride boiling point 98° C. at 100 millimeters pressure, and hexahydrobenzyliodide boiling point 103° C. at 28 millimeters pressure, and similar type compounds are within the scope of this invention.

Various di, tri, and tetra halogen derivatives of the hydroaromatics may be prepared and are within the scope of this invention. The above and other ortho-, meta-, para-, and mixed halogenated hydroaromatics are satisfactory for use in our invention. The numerous halogenated and alkylated hydroaromatics up to and including the per halogenated products are within the scope of our invention.

Commercially available hydroaromatics are satisfactory for use within our invention, since a great degree of purity is not required and mixtures of the various hydroaromatic compounds are perfectly satisfactory. One commercial source of hydroaromatic compounds is from certain petroleum oils, such as Caucasian crudes and probably from other crudes. The type of crudes which are rich in hydroaromatic compounds are usually referred to as naphthene type crudes. It is only necessary to segregate a relatively pure fraction by fractionation of hydroaromatics from such types of crudes to obtain a satisfactory starting material for our invention. Another commercial source of hydroaromatic hydrocarbons is in the tar from bituminous coal and from certain shales. It is not necessary to separate the individual hydroaromatics from the bituminous coal residue or from the shale oil, as the

mixture rich in hydroaromatics is satisfactory. Still another source of commercial supply is in the resin oils obtained from the distillation of colophonium. Other sources of supply of hydroaromatic compounds are known, but the previously mentioned sources give products of satisfactory purity. However, synthetically pure compounds are satisfactory.

Upon the addition of halogenated hydroaromatic compounds to good quality hydrocarbon lubricants the film strength of the original hydrocarbon lubricant is improved. There is considerable variation in the degree of improvement obtained when the quantity of halogenated hydroaromatic hydrocarbons added to the hydrocarbon lubricant is varied, and also with the type of halogenated hydroaromatic hydrocarbons added. The improvement obtained by our invention can be proved by testing the film strength on a testing machine such as the Timken testing machine, which has been developed and described by the Timken Roller Bearing Company. The film strength of the original hydrocarbon lubricant may be determined and compared with the film strength of another sample of the same hydrocarbon lubricant to which one or more of the halogenated hydroaromatic compounds has been added. The greater the stability of the halogenated hydroaromatic and the lower the halogen content, the less the film strength improvement. It is of course understood that the film strength improvement can be varied due to the character of the original hydrocarbon lubricant and with the amount of halogenated hydroaromatic hydrocarbons added to the lubricant.

The percentage of halogenated hydroaromatic hydrocarbon to be added to the original hydrocarbon lubricant is as a rule relatively small and between .1% and 5.0%. Smaller quantities than .1% may be used in some oils for some limited service, and quantities greater than 5% may be required in other lubricating oils for other duties. This variation in percentage to be added is of course greatly influenced by the nature of the halogenated hydroaromatic being used and the halogen content of the hydroaromatic compound.

We prefer to use chlorine as representative of the halogen family, but it is to be understood that the other halogens are contemplated within the scope of this invention. Fluorine while operative, is difficult to handle commercially and iodine and bromine may be employed, but would be more expensive than the chlorine compound. This will be understood by those skilled in the art, inasmuch as the halogen family is similar in their properties.

Prior to adding the halogenated hydroaromatic compound to the mineral hydrocarbon lubricant, it may be subjected to one or more of the usual methods used to purify such products. For example, the mixture may be dissolved in one of the organic solvents and the solution well washed with a dilute alkali or water. Other means of purification may comprise distillation, filtration through alkalis, contacting or filtering through fuller's earth or carbon, by low temperature vacuum distillation, or by a combination of two or more of these methods, or other methods well known to those skilled in the art. If a solvent is used in combination with any of the methods, or alone, it must be removed from the halogenated hydroaromatic prior to the addition of the compound to the mineral lubricant.

It is to be understood that our invention is applicable to all hydrocarbon lubricants irrespective of classification, including hydrogenated and synthetic hydrocarbon lubricants.

It is not necessary to add sufficient halogen to the hydroaromatic for it to have a halogen content equivalent to the monohalogen product, since 1% chlorine content product may be used with partial success and as much as 65% or more of halogen in the halogenated hydroaromatic may be employed.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of our claims. It is further obvious that various changes may be made in details within the scope of our claims without departing from the intent of our invention. It is therefore to be understood that our invention is not to be limited to the specific details shown and described.

Having thus described our invention, what we claim is:

1. A lubricating oil comprising in combination a hydrocarbon oil and a small amount of a halogenated hydroaromatic compound.

2. A lubricating oil comprising in combination a hydrocarbon oil and a small amount of a chlorinated hydroaromatic compound.

3. A lubricating oil comprising in combination a hydrocarbon oil and a small amount of a halogenated hydroaromatic compound selected from the following group: cyclo-olefins, cycloparaffins, hydronaphthalenes.

4. A lubricating oil comprising in combination a hydrocarbon oil and a small quantity of a halogenated organic compound containing a partially or completely reduced benzene nucleus.

5. A lubricating oil comprising in combination a hydrocarbon oil and a small amount of a halogenated naphthene containing at least six carbon atoms in the nucleus.

BERT H. LINCOLN.
ELLEN M. HENRIKSEN,
Administratrix for the Estate of Alfred Henriksen, Deceased.