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LUBRICANT

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The present invention relates to improvements in lubricating oils and to a method for increasing their lubricity or "oiliness", and for improving the viscosity-temperature relationship or viscosity index of lubricating oils, particularly those derived from petroleum.

It has generally been known that the quality of a lubricating oil depends on some properties other than the viscosity of the hydrocarbon oil. This has been found to be particularly true when the lubricant is used under conditions of thin film or boundary lubrication in which the layer of lubricating oil between the rubbing surfaces is very thin. It has been found that some oils act as better lubricants than others under conditions of boundary lubrication even though their viscosities at the temperature of use are substantially the same. The property of one oil which makes it a better lubricant than another under these conditions, particularly in lowering friction and/or wear, has been designated as "oiliness".

In the production of high grade lubricating oils, it is well known that a relatively small change in the viscosity of the oil between temperatures of, for example, 100° F. and 210° F., is desirable. In other words, it is advantageous for the oil to have a relatively flat viscosity-temperature curve, which means that the oil has a high viscosity index as defined by Dean and Davis in their article in Chemical and Metallurgical Engineering, vol. 36, p. 618.

It is therefore an object of this invention to increase the "oiliness" and/or the viscosity index of paraffin base, mixed base and naphthene base lubricating oils by the addition thereto of a relatively small proportion of a material which is active to improve these properties without objectionably affecting other desirable properties thereof. More particularly, the present invention relates to the production of an improved lubricating oil of this type having increased "oiliness" and viscosity index, by the addition thereto of a carboxylic acid ester of a hydroxy-ether.

In accordance with my invention, a carboxylic acid ester of a hydroxy-ether or a mixture of such esters is admixed with a lubricating oil in quantities of the order of 1%, 3%, 5%, or 10% or more, depending upon the degree of improvement desired. Among the esters which may be suitably employed are the oleates, stearates and the naphthenates of the hydroxy-ethers derived from the polyhydric alcohols, such as monomethyl ether of ethylene glycol; mono-ethyl ether of ethylene glycol; mono-ethyl ether of diethylene glycol; mono-butyl ether of diethylene glycol and the like. Likewise there may be employed the oleate, stearate and naphthenate esters of the hydroxy-ethers derived from other polyhydric alcohols such as propylene glycol, butylene glycol, amylene glycol and glycerol.

In the preparation of the esters, naphthenic acids produced synthetically or derived from petroleum or other sources may be utilized. Since the naphthenic acids from petroleum may be produced at less expense than naphthenic acids synthesized by various methods, I prefer to employ the petroleum acids in the manufacture of the esters. Such acids preferably have an acid number between about 150 and 300 mg. KOH/gm., and molecular weights varying from about 185 to about 375. Other carboxylic acids which may suitably be employed include the higher aliphatic acids such as lauric, stearic, oleic and the like.

My invention may be further illustrated by the following example:

400 parts by weight of substantially oil-free petroleum naphthenic acids having an acid number of 242 mg. KOH/gm. was admixed with 282 parts by weight of mono-butyl ether of diethylene glycol, and the mixture was refluxed at a temperature of about 350° F. until the esterification was substantially complete and no further water from the reaction was evolved. The mixture of esters and excess naphthenic acid was then washed with sodium hydroxide solution to remove the unconverted naphthenic acids, and the esters were thereafter dried and subjected to distillation under reduced pressure (3 m/m. absolute) to separate and recover an ester fraction boiling between about 340° F. and 490° F. The naphthenic acid ester of mono-butyl ether of diethylene glycol so produced had a Saybolt Universal viscosity of 56 seconds at 100° F. and 36 seconds at 210° F., with a corresponding viscosity index of 201.

In order to determine the effectiveness of the ester as an addition agent for improving the viscosity index and/or "oiliness" of lubricating oil, 2% and 10% by volume of the above ester fraction was added to a hydrocarbon oil having a Saybolt Universal viscosity of 376 seconds at 100° F., an A. P. I. gravity of 21.9°, and containing 3% by volume of tricresyl phosphate. The latter material has little or no effect upon either the viscosity index or "oiliness" but functions to increase the film strength of the oil and permit "oiliness" tests to be carried on under heavier loads than the hydrocarbon lubricating oil, per

se, is able to withstand. The determination of the "oiliness" or lowering of the coefficient of friction was made in an Almen extreme pressure lubricant testing machine at 200 R. P. M., the load being expressed in lbs/sq. in. projected bearing area and the "oiliness" as a measure of the friction expressed in pound-feet torque.

Lubricant	Load (lbs./sq. in.)		
	10,000	15,000	20,000
	Lb.-ft.	*Lb.-ft.*	*Lb.-ft.*
Oil+3% tricresyl phosphate	35	48	58
Oil+3% tricresyl phosphate +2% naphthenate ester	32	44	52
Oil+3% tricresyl phosphate +10% naphthenate ester	27	37	48

The improvement in viscosity index of the lubricating oil is indicated in the following table.

Lubricant	S. U. vis./ 100° F.	S. U. vis./ 210° F.	Viscosity index
	Seconds	*Seconds*	
Oil+3% tricresyl phosphate	336	53	82
Oil+3% tricresyl phosphate +2% naphthenate ester	317	53	91
Oil+3% tricresyl phosphate +10% naphthenate ester	242	49	102

From the above tables it will be seen that the addition of a carboxylic acid ester of a hydroxy ether, such as the naphthenate of mono-butyl ether of diethylene glycol, to a lubricating oil improves both the "oiliness" and viscosity index thereof. It is not necessary that the lubricant contain a film strength addition agent such as tricresyl phosphate, since an unblended hydrocarbon lubricating oil will exhibit a marked improvement in "oiliness" and/or viscosity index simply upon the addition of the hydroxy ether esters hereinbefore mentioned. In the event that increased film strength is likewise desired, there may be added to the oil-ester blend, a quantity of film strength agent such as aliphatic or aromatic phosphates, phosphites or thiophosphates, chlorinated esters or chlorinated hydrocarbons, or other known agents for improving film strength.

What I claim is:

1. A lubricant comprising a hydrocarbon oil and a minor amount of a carboxylic acid ester of a hydroxy ether.

2. A lubricant comprising a hydrocarbon oil and less than substantially 10% by volume of a carboxylic acid ester of a hydroxy ether.

3. A lubricant comprising a hydrocarbon oil and less than substantially 5% by volume of a carboxylic acid ester of a hydroxy ether.

4. A lubricant comprising a hydrocarbon oil and less than substantially 3% by volume of a carboxylic acid ester of a hydroxy ether.

5. A lubricant comprising a hydrocarbon oil and a minor amount of a naphthenic acid ester of a hydroxy ether.

6. A lubricant comprising a hydrocarbon oil and a minor amount of a naphthenic acid ester of a hydroxy ether derived from an aliphatic polyhydric alcohol.

7. A lubricant comprising a hydrocarbon oil and a minor amount of a naphthenic acid ester of diethylene glycol mono-butyl ether.

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