United States Patent Office

3,560,387
Patented Feb. 2, 1971

3,560,387

LUBRICATING OILS

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No Drawing. Filed Feb. 19, 1968, Ser. No. 706,633
Claims priority, application Germany, Feb. 23, 1967, D 52,371
Int. Cl. C10m 1/26
U.S. Cl. 252—56 5 Claims

ABSTRACT OF THE DISCLOSURE

Lubricant containing as an essential ingredient imparting lubricating properties, ester of 2,2-dialkylpropanediol-1,3 and monocarboxylic acid, wherein at least one of the alkyl groups contains more than 4 carbon atoms. The lubricants are well suited for use in aircraft and gas turbine engines.

The invention relates to lubricating oils, especially for aircraft engines and gas turbines, on the basis of esters made of 2,2-dialkylpropanediol-1,3 and monocarboxylic acids.

Lubricating oils for aircraft engines and gas turbines must be stable and permit lubrication over a broad range of temperatures. The pour point of such lubricating oils must be lower than −59° C. At the same time, these oils must have low volatility, so that no great evaporation losses will occur at high temperatures. Furthermore, these oils must have a high viscosity index, so as to have a sufficiently high viscosity at operating temperature and a low viscosity at starting temperature.

It is in the prior art to use 2,2-dialkylpropanediol-1,3 compounds as alcohol components for the manufacture of lubricating oils on the basis of esters (German Pat. 958,497, German Green Pat. 1,142,596, U.S. Pats. 2,798,083 and 3,148,147). The two alkyl groups in position 2 on the propanediols contain a maximum of 4 carbon atoms in these prior-art lubricating oils. The ester-base lubricating oils made from propanediols substituted in this manner are not suitable, however, for use in aircraft engines and gas turbines. The reason is that, if short-chain monocarboxylic acids are used for the esterification of these propanediols, the lubricating oils made from them have a low viscosity. This means that they have a high evaporation loss at high temperatures. On the other hand, if these propane diols are esterified with monocarboxylic acids of higher molecular weight, lubricating oils of higher viscosity are obtained, but at the same time the pour point rises so high that these oils are not suitable for the purposes in question, either. The following Table 1 shows the lubricating oil characteristics of a number of prior-art 2,2-dialkylpropanediol-1,3-diesters.

TABLE 1

Ester	Viscosity c St 98.9° C. (210° F.)	Viscosity c St 37.8° C. (100° F.)	V.I.	Pour point, ° C.
2,2-dimethylpropanediol-1,3-dicaprinate	3.60	14.5	150	−54
2,2-dimethylpropanediol-1,3-dipelargonate	2.30	7.8	120	−65
2,2-diethylpropanediol-1,3-dicaprinate	3.75	15.8	146	−50
2,2-diethylpropanediol-1,3-dipelargonate	2.94	11.46	124	−56
2-ethyl-2-butylpropanediol-1,3-dicapronate	2.33	8.92	80	−72
2-ethyl-2-butylpropanediol-1,3-dicaprylate	2.96	11.96	113	−65
2-ethyl-2-butylpropanediol-1,3-dipelargonate	3.40	14.65	121	−52
2-ethyl-2-butylpropanediol-1,3-dicaprinate	3.75	16.70	132	−44

It is apparent from Table 1 that the viscosity and the viscosity index definitely increase as the molecular weight increases, but that the pour point also rises.

On the basis of these facts it is to be expected that a further increase in the molecular weight of the esters will result in a further undesirable rise in the pour point.

Surprisingly, it has now been found that an increase in the number of carbon atoms in the side chains of the 2,2-alkylpropanediol-1,3 compounds does not result in the expected rise in the pour point of the esters made from these alcohols, but that, contrary to this expectation, the esterification of propanediols having hexyl, octyl and decyl radicals as side chains, results in lubricating oils

whose low-temperature characteristics satisfy the MIL specifications. These good characteristics are produced even when higher monocarboxylic acids are used for the esterification.

oils of Table 2. Furthermore the increase in the viscosity and acidity (with reference to the residual oil) is substantially slighter in the new lubricating oils, as is shown in Table 3.

TABLE 3

[Air oxidation test at 200° C., 192 hours, 15 liters of air per hour]

Ester	Percent evaporation loss	Percent viscosity increase, 98.9° C.	Acidity increase, mg. KOH/g.
(I) Prior art:			
2,2-dimethylpropanediol-1,3-dipelargonate	100	----------	----------
2,2-dimethylpropanediol-1,3-dicaprinate	87	380	16.2
2,2-diethylpropanediol-1,3-dipelargonate	100	----------	----------
2,2-diethylpropanediol-1,3-dicaprinate	82	350	15.4
2-ethyl-2-butylpropanediol-1,3-dicapronate	100	----------	----------
2-ethyl-2-butylpropanediol-1,3-dicaprylate	100	----------	----------
2-ethyl-2-butylpropanediol-1,3-dipelargonate	86	370	16.2
2-ethyl-2-butylpropanediol-1,3-dicaprinate	80	320	14.8
(II) This invention:			
2-butyl-2-hexylpropanediol-1,3-dipelargonate	51	280	9.3
2-butyl-2-hexylpropanediol-1,3-dicaprinate	39	270	7.6
2-hexyl-2-octylpropanediol-1,3-dicaprylate	43	300	3.2
2-hexyl-2-octylpropanediol-1,3-dipelargonate	38	270	2.6
2-hexyl-2-octylpropanediol-1,3-dicaprinate	33	250	2.6
2-octyl-2-decylpropanediol-1,3-dicaprylate	32	245	2.3
2-octyl-2-decylpropanediol-1,3-dipelargonate	33	240	1.9

NOTE.—Pour points reported herein were determined in accordance with the stock point test customary in Germany. Viscosity indexes are determined from the viscosities at 100° F. and 200° F. in accordance with ASTM, STP No. 168, June 1955 (American Society for Testing Materials, Special Technical Publication No. 168, Viscosity Index). The viscosities reported are in centistokes.

Accordingly, the subject of the invention is lubricating oils on the basis of diesters formed of 2,2-dialkylpropanediol-1,3 and monocarboxylic acids, which are characterized in that at least one of the two alkyl groups of the propanediol has more than 4 carbon atoms.

Esters in which the side chains of the 2,2-dialkylpropanediol-1,3 compounds contain between 6 and 14 carbon atoms are preferentially suitable as lubricating oils, according to a further improvement of the invention.

The monocarboxylic acid can be the same as those used in the prior art in the known esters of 2,2-dialkylpropanediol-1,3. Monocarboxylic acids having 6 to 20 carbon atoms in the molecule are preferred as acid components of the ester lubricant oils according to the invention.

The ester lubricating oils according to the invention can, for example, compose at least about 80% by weight of the lubricating oil composition. Further, they can be alloyed with lubricating oils on a mineral oil basis and/or mixed with 0.1 to 20%, and preferably 2 to 8%, by weight, of additives such as oxidation inhibitors, corrosion inhibitors and thickeners.

As examples of embodiments of the invention the lubricating oil characteristics of a number of esters are listed in Table 2 below.

TABLE 2

Ester	Viscosity c St 98.9° C. (210° F.)	37.8° C. (100° F.)	−40° C. (−40° F.)	V.I.	Pour point
2-butyl-2-hexylpropanediol-1,3-dipelargonate	4.08	20.45	4,662	112	−69
2-butyl-2-hexylpropanediol-1,3-dicaprinate	4.67	23.50	4,850	133	−59
2-hexyl-2-octylpropanediol-1,3-dicapronate	3.36	13.91	1,890	130	−78
2-hexyl-2-octylpropanediol-1,3-dicaprylate	4.13	18.82	2,850	138	−72
2-hexyl-2-octylpropanediol-1,3-dipelargonate	4.68	23.03	4,060	140	−70
2-hexyl-2-octylpropanediol-1,3-dicaprinate (of impure capric acid)	4.89	23.82	5,210	144	−48
2-octyl-2-decylpropanediol-1,3-dicaprylate	5.16	25.80	4,880	142	−68
2-octyl-2-decylpropanediol-1,3-dipelargonate	5.42	28.02	5,607	140	−60

The esters can be produced by conventional esterification processes.

An important advantage achieved by the invention consists of the fact that the new ester lubricant oils have a significantly lower evaporation loss and better stability to oxidation than the prior-art esters of 2,2-dialkylpropanediol-1,3 compounds. Oxidation experiments in which 15 liters of air per hour were passed through the specimens for 192 hours at a temperature of 200° C. showed evaporation losses which were between 70 and 100% in the case of the prior-art lubricant oils of Table 1, but were only between 20 and 50% in the new lubricating

What s claimed is:

1. Lubricating oil composition containing as an essential ingredient imparting lubrication properties to the oil, diester of 2,2-dialkylpropanediol-1,3 and saturated monocarboxylic acids having 6–20 carbon atoms, and a lubricating oil additive of different composition in an amount effective to improve the lubricating properties of the oil, characterized in that one of the alkyl groups of the propanediol has 4 to 10 carbon atoms and the other of said alkyl groups has 6 to 10 carbon atoms, said diester being at least about 80 wt. percent of said lubricating oil.

2. Lubricating oil according to claim 1, both of said alkyl groups having 6 to 10 carbon atoms.

3. Lubricating oil according to claim 1, the acid groups having 6 to 20 carbon atoms.

4. Lubricating oil according to claim 1, wherein the oil comprises a mineral oil.

5. Lubricating oil according to claim 2, the acid groups having 6 to 20 carbon atoms.

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U.S. Cl. X.R.

260—416.6