(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 992 677 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.11.2008 Bulletin 2008/47

(51) Int Cl.:
C10M 161/00 *(2006.01)*

(21) Application number: **07251927.5**

(22) Date of filing: **10.05.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(71) Applicant: **CASTROL LIMITED**
Swindon
Wiltshire SN3 1RE (GB)

(72) Inventor: **The designation of the inventor has not yet been filed**

(74) Representative: **Perkins, Nicholas David**
BP International Limited
Global Patents & Technology Law (Central)
Bldg 200, 1st floor
Chertsey Road
Sunbury-on-Thames, Middlesex TW16 7LN (GB)

(54) **Lubricant composition for combustion engine containing dispersant additive and polymer dispersant viscosity index improver**

(57) A multigrade lubricating oil composition with enhanced anti-wear properties for use in an internal combustion engine comprises (a) a base oil comprising at least 90 % by weight of the base oil, of one or more basestocks selected from the group consisting of base stocks derived from Fischer-Tropsch synthesised, waxy, paraffinic hydrocarbon material by processes comprising hydrocracking and/or hydroisomerisation, Group II basestocks, Group III basestocks and mixtures thereof; (b) one or more dispersant viscosity modifiers in a total amount of 0.15 to 0.8 % by weight of the composition; and (c) one or more dispersants in a total amount of active dispersants of 1.5 to 3 % by weight of the composition.

EP 1 992 677 A1

Description

[0001] This invention relates to multigrade lubricating oil compositions for use in internal combustion engines and to the use of additives and base oils to enhance the anti-wear properties of such compositions.

[0002] Lubricating oil compositions for use in internal combustion engines comprise a base oil and one or more additives. Base oils may comprise one or more base stocks.

[0003] Additives present in lubricating oil compositions for internal combustion engines usually comprise one or more dispersants. The purpose of dispersants in lubricating oil compositions is to keep oil-soluble combustion products in suspension to prevent or reduce deposit formation on metals surfaces, oil thickening and sludge deposition in the engine.

[0004] The use of dispersants may increase the viscosity of the lubricating oil composition. Thus, generally, the higher the concentration of dispersant used in a lubricating oil composition, the lower the viscosity of the base oil which must be used to achieve a lubricating oil composition with the required viscosity. Lower viscosity base oils generally have a higher volatility and their use in lubricating oil compositions for internal combustion engines may result in unacceptable wear, for example in the engine bearings and/or valve train of the internal combustion engine. Thus, it is desirable to reduce the amount of dispersant which is required to provide a lubricating oil of the desired performance, so that there can be used a base oil having a viscosity which reduces or at least mitigates these effects.

[0005] US 5719107 relates to a lubricating oil for use in heavy duty diesel engines which comprises an admixture of (A) a major amount of an oil of lubricating viscosity, (B) at least 4 mass % dispersant, (C) at least 0.3 mass % of a metal phenate, (D) less than 0.1 mass % friction modifier, (E) less than 0.3 mass % of sulfurized phenols and (F) less than 0.12% neutral calcium sulfonate. According to this document :

> *"In multi-graded oils that have dispersant viscosity modifiers, the dispersant can be used at a somewhat lower treat rate. In this case the dispersant viscosity modifier serves as an additional dispersant. At least one group of investigators (*U.S. Pat. No. 5,294,354 to Papke et al.*) has reported a formulation with a particular dispersant viscosity modifier where the treat rate of a conventional dispersant is zero. In that case the dispersant viscosity modifier serves as the dispersant."*

[0006] According to US5719107, the dispersant may be present in the range of 4 - 8 mass %.

[0007] US 5958848 seeks to reduce the amount of chlorine containing dispersants in multigrade crankcase lubricants. It relates to the use of multifunction viscosity modifiers to provide dispersancy lost upon decreasing the amount of chlorine-containing dispersant, rather than using non-conventional dispersants. According to US 5958848 :

> *"Viscosity modifiers are materials added to crankcase lubricants to impart high and low temperature operability. Viscosity modifiers that have been post reacted to provide dispersancy are known as multi-functional viscosity modifiers or dispersant viscosity modifiers"*

[0008] According to US 5958848, the amount of viscosity modifier used as active ingredient in the oil is generally from 0.01 to 6 wt %, and more preferably from 0.1 to 2 wt%. The amount of dispersant is said to be in the range 1.5 to 3.0 wt%.

[0009] According to US 5958848, the basestock used in the lubricating oil may be selected from any of synthetic or natural oils used as crankcase lubricating oils for spark-ignited and compression-ignited engines. The lubricating oil base stock is said to have a kinematic viscosity of 2.5 to 12 mm^2/s and preferably 2.5 to 9 mm^2/s at 100 °C. However, US5958848 is silent about the nature of the basestock used in the fully formulated oils in the examples described therein.

[0010] There remains a need for a lubricating oil composition which reduces or at least mitigates at least some of the problems identified above.

[0011] Thus, according to the present invention there is provided a multigrade lubricating oil composition for use in an internal combustion engine which composition comprises :

(a) a base oil comprising at least 90 % by weight of the base oil, of one or more basestocks selected from the group consisting of base stocks derived from Fischer-Tropsch synthesised, waxy, paraffinic hydrocarbon material by processes comprising hydrocracking and/or hydroisomerisation, Group II basestocks, Group III basestocks and mixtures thereof;
(b) one or more dispersant viscosity modifiers in a total amount of 0.15 to 0.8 % by weight of the composition; and
(c) one or more dispersants in a total amount of active dispersants of 1.5 to 3 % by weight of the composition.

[0012] Thus, the present invention solves the technical problem defined above by the use of a combination of the defined base oil, one or more dispersant viscosity modifiers in a total amount of 0.15 to 0.8 % by weight of the composition, and one or more dispersants in a total amount of active dispersants of 1.5 to 3 % by weight of the composition.

[0013] It has been found that a lubricating oil composition which meets the API CH-4 standard or higher may be

formulated by the selection of the defined base oil, the use of one or more dispersant viscosity modifiers in a total amount of 0.15 to 0.8 % by weight of the lubricating oil composition, and the use of one or more dispersants in a total amount of active dispersants of 1.5 to 3 % by weight of the composition. The API standard is defined according to ASTMD 4485.

[0014] It has also been found that the lubricating oil composition of the present invention exhibits good anti-wear properties. In particular, it has been found that the lubricating oil composition unexpectedly reduces valve train wear of an internal combustion engine, which is preferably a diesel engine, more preferably a heavy duty diesel engine.

[0015] Thus, according to another aspect of the present invention there is provided the use in a multigrade lubricating oil composition comprising one or more dispersants in a total amount of active dispersants of 1.5 to 3 % by weight of the composition, of

(i) one or more dispersant viscosity modifiers in an amount of 0.15 to 0.8 % by weight of the composition, in combination with
(ii) a base oil comprising at least at least 90 % by weight of the base oil, of one or more basestocks selected from the group consisting of base stocks derived from Fischer-Tropsch synthesised, waxy, paraffinic hydrocarbon material by processes comprising hydrocracking and/or hydroisomerisation, Group II basestocks, Group III basestocks and mixtures thereof,

to enhance the anti-wear properties of the lubricating oil composition and preferably to enhance the anti-wear properties with respect to valve train wear of an internal combustion engine which is preferably a diesel engine and more preferably, a heavy duty diesel engine.

[0016] Also, according to another aspect of the present invention, there is provided a method of reducing the valve train wear of an internal combustion engine, which is preferably a diesel engine and more preferably a heavy duty diesel engine, which method comprising lubricating the heavy duty diesel engine with a multigrade lubricating oil composition comprising:

(a) a base oil comprising at least 90 % by weight of the base oil, of one or more basestocks selected from the group consisting of base stocks derived from Fischer-Tropsch synthesised, waxy, paraffinic hydrocarbon material by processes comprising hydrocracking and/or hydroisomerisation, Group II basestocks, Group III basestocks and mixtures thereof;
(b) one or more dispersant viscosity modifiers in a total amount of 0.15 to 0.8 % by weight of the lubricating oil composition; and
(c) one or more dispersants in a total amount of active dispersants of 1.5 to 3 % by weight of the composition.

The base oil

[0017] The base oil of the lubricating oil composition of the present invention comprises at least 90 % by weight of the base oil, of one or more basestocks selected from the group consisting of base stocks derived from Fischer-Tropsch synthesised, waxy, paraffinic hydrocarbon material by processes comprising hydrocracking and/or hydroisomerisation, Group II basestocks, Group III basestocks and mixtures thereof.

[0018] Group II base stocks are defined according to API standard 1509, "ENGINE OIL LICENSING AND CERTIFICATION SYSTEM", November 2004 version 15th edition Appendix E, as base stocks having a saturated hydrocarbon content of at least 90 wt %, a sulphur content of no more than 0.03 wt % and a viscosity index of at least 80 and less than 120. Group III base stocks are defined according to the same API standard 1509, as base stocks having a saturated hydrocarbon content of at least 90 wt %, a sulphur content of no more than 0.03 wt % and a viscosity index of at least 120. Group II basestocks include Group II+ basestocks which are Group II basestocks with a viscosity index of 110 to 120.

[0019] Group II and Group III base stocks are derived from mineral oils, by known processes which comprise hydrocracking and/or hydroisomerisation.

[0020] Base stocks derived from Fischer-Tropsch synthesised, waxy, paraffinic hydrocarbon material may be made by processes comprising hydrocracking and/or hydroisomerisation known in the art, for example as described in WO 00/14187, WO 02/064710, WO 2005/066314 and US 6008164.

[0021] Preferably, the base oil has a kinematic viscosity at 100 °C in the range 2.5 to 12 mm^2/s, more preferably in the range 2.5 to 9 mm^2/s, yet more preferably in the range 4 to 8 mm^2/s and most preferably in the range 4.5 to 7.5 mm^2/s. The kinematic viscosity may be measured according to ASTM D445.

[0022] It has been found that the kinematic viscosity of the base oil which may be used to prepare a lubricating oil composition of a defined viscosity according to the present invention, may be higher than that of a base oil which might otherwise be used to prepare a lubricating oil composition with a higher concentration of dispersant than that used in the present invention. For example, a base oil having a kinematic viscosity at 100 °C of 7 to 7.5 mm^2/s, can be used to prepare a multigrade lubricating oil composition according to the present invention of 15W40 grade whereas using

conventional amounts of dispersant, a base oil with a kinematic viscosity at 100°C of 6 to 6.7 mm^2/s would have to be used to prepare a 15W40 multigrade lubricating oil composition. In general, it has been found that multigrade lubricating oil compositions of the present invention may be prepared using base oils having kinematic viscosities which are in the region of 0.5 mm^2/s higher than the kinematic viscosities of base oils which would be used with conventional formulations for multigrade lubricating oil formulations of the same grade.

[0023] An advantage of using base oils with a higher kinematic viscosity is that this tends to reduce oil consumption when the lubricating oil composition is used to lubricate an internal combustion engine and/or to enhance anti-wear properties of the lubricating oil composition.

[0024] The base oil may comprise minor amounts (that is, less than 10 % by weight of the base oil) of other base stocks, for example Group I base stocks.

The dispersant viscosity modifier.

[0025] The one or more dispersant viscosity modifiers are present in the lubricating oil composition in a total amount of 0.15 to 0.8 % by weight of the lubricating oil composition, preferably in a total amount of 0.2 to 0.4 % by weight of the lubricating oil composition, for example in a total amount of 0.25 to 0.3 % by weight of the lubricating oil composition.

[0026] Each dispersant viscosity modifier may comprise more than one oil soluble, polymeric hydrocarbon backbone each having one or more functional groups which are capable of associating with particles to be dispersed. Each functionalised polymeric hydrocarbon backbone may be functionalised with one or more functional groups incorporated into the backbone or with one or more functional groups pendant from the polymer backbone. Typical functional groups may be polar and may contain one or more hetero atoms, for example phosphorus, oxygen, sulphur, nitrogen, halogen or boron. An example of a suitable dispersant viscosity modifier is a co-polymer of ethylene-propylene grafted with an active monomer, for example maleic anhydride and then derivatized with an alcohol or amine. The preparation of such dispersant viscosity modifiers is described for example in US 4089794, US4160739 and US4137185. Other dispersant viscosity modifiers which may be used are copolymers of ethylene or propylene reacted or grafted with nitrogen compounds, for example as described in US 4068056, US4068058, US 4146489 and US 4149984. Other dispersant viscosity modifiers which may be used are graft copolymers, for example as described in WO96/12746 and WO 99/21902.

[0027] A suitable dispersant viscosity modifier is that present in Lubrizol's LZ 7177B, which is an additive concentrate containing about 10 % by weight dispersant viscosity modifier. LZ7177B additive concentrate may suitably be used in an amount of about 2.5 % by weight in the lubricating oil composition to give a dispersant viscosity modifier concentration of about 0.21 % by weight in the lubricating oil composition.

[0028] The one or more dispersant viscosity modifiers may be used with a one or more surfactants. These may stabilise the dispersant.

The dispersants

[0029] The one or more dispersants are present in the lubricating oil composition in a total amount of active dispersants of 1.5 to 3 % by weight of the lubricating oil composition, preferably in a total amount of active dispersants 2 to 2.5 % by weight of the lubricating oil composition.

[0030] Each dispersant comprises one or more, preferably at least two, oil soluble polymeric hydrocarbon backbones, each having one or more functional groups which are capable of associating with particles to be dispersed. The functional groups may be amine, alcohol, amide, or ester groups.

[0031] Suitable dispersants are for example, oil soluble salts, esters, amino-esters, amides, imides and oxazolines of long chain hydrocarbon substituted, mono- and di-carboxylic acids and their anhydrides; thiocarboxylate derivatives of long chain hydrocarbons; long chain aliphatic hydrocarbons having a polyamine attached directly thereto; Mannich condensation products formed by condensing a long chain substituted phenol with formaldehyde and polyalkylene polyamine; Koch reaction products and the like.

[0032] The oil soluble polymeric hydrocarbon backbone is typically an olefin polymer, especially a polymer comprising greater than 50 mole % of a C_2 to C_{18} olefin, typically greater than 50 mole % of a C_2 to C_5 olefin. The oil soluble polymeric hydrocarbon backbone may be a homopolymer or a copolymer of two or more olefins. A preferred class of olefin polymers is polybutenes and more preferably, polyisobutenes. Other preferred classes of olefin polymers are ethylene alpha-olefin copolymers, alpha-olefin homopolymer and alpha-olefin copolymers. The oil soluble polymeric hydrocarbon backbone usually has a number average molecular weight (Mn) in the range of 300 to 20,000, preferably 500 to 10,000, more preferably 700 to 5,000. The molecular weight may be determined by gel permeation chromatography.

[0033] The oil soluble polymeric hydrocarbon backbone may be functionalised with one or more functional groups incorporated into the backbone or with one or more functional groups pendant from the polymer backbone. Typical functional groups may be polar and may contain one or more hereto atoms, for example phosphorus, oxygen, sulphur,

nitrogen, halogen or boron.

[0034] Preferred dispersants are polyisobutenyl succinimide dispersants. Suitable dispersants may be provided in one or more additive concentrates which may be used to provide a total active dispersant concentration of about 2.1 % by weight in the lubricating oil composition.

Other additives.

[0035] The lubricating oil composition will additionally comprise one or more detergents and one or more metal dihydrocarbyl dithiophosphates.

[0036] The lubricating oil composition may also optionally comprise one or more additional additives. Examples of such additives are friction modifiers, supplemental anti-wear agents, anti-oxidants, corrosion inhibitors, pour point depressants, anti-foaming agents, demulsifiers, elastomer compatibility aids, demulsifiers and combinations thereof.

Detergents.

[0037] One or more detergents are present in the lubricating oil composition. Suitable detergents are ashless detergents, metal salt detergents and combinations thereof. Suitable metal salt detergents are neutral and overbased phenates, sulphurised phenates, sulphonates, carboxylates, salicylates and combinations thereof. The metals of the salts may be alkali metals, alkaline earth metals and combinations thereof. Preferably, the metals are calcium, magnesium and combinations thereof. Calcium and magnesium detergent salts may both be present in the lubricating oil composition. Suitable metals detergents are neutral and over-based salts a TBN (total base number as measured by ASTM2896) in the range 20 to 450. Suitable calcium sulfonates may have TBN (total base number) values of 85, 300 and 400. Suitable calcium phenates may have TBN values of 150 and 250. The one or more detergents may be present in the lubricating oil composition in a total amount of 1 to 5 % by weight of the composition. The one or more metal salt detergents may be present in the lubricating oil composition in a total amount of metal salt of 0.5 to 3 % by weight of the composition.

Metal dihydrocarbyl dithiophosphates.

[0038] One or more metal dihydrocarbyl dithiophosphates will be present in the lubricating oil composition. These compounds may be used as anti-wear and/or antioxidant agents. Suitable metals in these compounds are for example, alkali metals, alkaline earth metals, zinc, aluminium, lead, tin, molybdenum, manganese, nickel and copper, most preferably zinc. Primary and/or secondary hydrocarbyl groups may be present in these compounds. Each hydrocarbyl group may have 1 to 18 carbon atoms. The one or more metal dihydrocarbyl dithiophosphates may be present in the lubricating oil composition in a total amount, expressed as phosphorous, of 0.01 to 0.2 % by weight of the composition.

Friction modifiers.

[0039] The one or more surfactants which may optionally be present with the dispersant viscosity modifier in the lubricating oil composition may exhibit friction modifier properties. Additionally, or alternatively, one or more other friction modifiers may be present in the lubricating oil composition. Suitably, such other friction modifiers are for example, mono- and di- amines which may be used as such or in the form of an adduct or reaction product with a boron compound. Other suitable friction modifiers are esters formed by reacting carboxylic acids or anhydrides with alkanols. Suitable friction modifiers are for example, molybdenum dithiocarbamate, oleyl amide and glycerol monooleate and di-oleate. The one or more friction modifiers may be present in the lubricating oil composition in a total amount of less than 1 % by weight of the composition.

Other/supplemental anti-wear agents.

[0040] The one or more dispersant viscosity modifiers and the one or more detergents present in the lubricating oil composition may exhibit anti-wear properties.

[0041] One or more supplemental anti-wear agents may optionally be present in the lubricating oil composition. Suitable supplemental anti-wear agents are for example, boron compounds, salicylates and combinations thereof. The one or more supplemental anti-wear agents may be present in the lubricating oil composition in a total amount of up to 2 % by weight of the composition.

Anti-oxidants.

[0042] One or more anti-oxidants may be present in the lubricating oil composition. Suitable anti-oxidants are for

example, hindered phenols, alkaline earth metals salts of alkylphenolthioesters having preferably C5 to C12 alkyl side chains, calcium nonylphenol sulphide, calcium dodecylphenol sulphide, oil soluble phenates, oils soluble sulphurised phenates, phosphosulphurised hydrocarbons, sulphurised hydrocarbons (for example, sulphurised olefins), phosphorus esters, metal thiocarbamates, oil soluble copper compounds as described in US4867890, molybdenum-containing compounds and the like. The one or more anti-oxidants may be present in the lubricating oil composition in a total amount of up to 5 % by weight of the lubricating oil composition.

Corrosion inhibitors.

[0043] One or more corrosion inhibitors may optionally be present in the lubricating oil composition. Suitable corrosion inhibitors are for example, non-ionic polyoxyalkylene polyols and esters thereof, polyoxyalkylene phenols, triazoles, anionic alkyl sulphonic acids and the like. The one or more corrosion inhibitors may be present in the lubricating oil composition in a total amount of up to 1 % by weight of the lubricating oil composition.

Pour point depressants.

[0044] One or more pour point depressants may optionally be present in the lubricating oil composition. Suitable pour point depressants are for example, methacrylates, alkyl methacrylates, vinyl fumarates, styrene esters and the like. The one or more pour point depressants may be present in the lubricating oil composition in a total amount of up to 1 % by weight of the lubricating oil composition.

Anti-foaming agents.

[0045] One or more antifoaming agents may optionally be present in the lubricating oil composition. Suitable antifoaming agents are for example, siloxanes, dimethyl siloxanes, phenyl methyl siloxanes, acrylates and the like. The one or more anti-foaming agents may be present in the lubricating oil composition in a total amount by weight typically of 10 to 100 ppm of the lubricating oil composition.

Elastomer compatibility aids.

[0046] One or more elastomer compatibility aids may optionally be present in the lubricating oil composition. Suitable elastomer compatibility aids are for example, long chain organic acids and the like. The one or more elastomer compatibility aids may be present in the lubricating oil composition in a total amount of up to 1 % by weight of the lubricating oil composition.

Demulsifiers.

[0047] One or more demulsifiers may optionally be present in the lubricating oil composition. Suitable demulsifiers are for example, ethoxylated compounds and the like. The one or more demulsifiers may be present in the lubricating oil composition in a total amount by weight of up to 1000 pm of the lubricating oil composition.

[0048] A suitable lubricating oil composition according to the present invention may comprise:

one or more dispersant viscosity modifiers in a total active dispersant concentration of 0.15 to 0.8 % by weight of the composition;
one or more dispersants in a total amount of active dispersants of 1.5 to 3 % by weight of the composition;
one or more detergents in a total amount of 1 to 5 % by weight of the composition;
one or more metal dihydrocarbyl dithiophosphates in a total amount expressed as phosphorous of 0.01 to 0.2 % by weight of the composition;
optionally, one or more friction modifiers, which if present, are present in a total amount of less than 1 % by weight of the composition;
optionally one or more supplemental anti-wear agents, which if present, are present in a total amount of up to 2 % by weight of the composition;
optionally one or more anti-oxidants, which if present, are present in a total amount of up to 5 % by weight of the composition;
optionally one or more corrosion inhibitors, which if present, are present in a total amount of up to 1 % by weight of the composition;
optionally one or more pour point depressants, which if present, are present in a total amount of up to 1 % by weight of the composition;

optionally one or more anti-foaming agents, which if present, are present in a total amount by weight of 10 to 100 ppm of the composition;
optionally one or more elastomer compatibility aids, which if present, are present in a total amount of up to 1 % by weight of the composition;
and optionally one or more demulsifiers, which if present, are present in a total amount of up to 1000 ppm of the composition;
the balance of the composition being a base oil comprising at least 90 % by weight of the base oil, of one or more basestocks selected from the group comprising of base stocks derived from Fischer-Tropsch synthesised, waxy, paraffinic hydrocarbon material by processes comprising hydroisomerisation and/or hydrocracking, Group II basestocks, Group III basestocks and mixtures thereof.

[0049] The lubricating oil composition of the present invention may be prepared by blending the base oil with one or more additive concentrates comprising the additives, by methods known in the art.

[0050] An advantage of the present invention is that it enables a base oil with a higher kinematic viscosity to be used than for conventional lubricating oil formulations with higher dispersant concentrations. This can result in a lubricating oil composition with a low Noack volatility. A high base oil kinematic viscosity and a low Noack volatility of the lubricating oil can result in a lubricating oil composition which when used to lubricate and internal combustion engine exhibits improved oil consumption and/or superior valve-train wear performance.

[0051] The lubricating oil composition of the present invention is suitable for use in an internal combustion engine, preferably a diesel engine and more preferably a heavy duty diesel engine.

[0052] The lubricating oil composition may have a Noack volatility value in the range 5 to 13 % by weight. Noack volatility may be measured by the D5800 or IP 421 method or CEC-L-40-A-93 methods.

[0053] The present invention uses a base oil with a kinematic viscosity and a combination of additives which help maintain a lubricant film layer in an internal combustion engine in which is it used. In particular, this may help reduce wear of moving parts in the engine which are subject to metal-to-metal contact and hence which are vulnerable to wear under high load and/or high soot concentrations, for example in a diesel engine and in particular in a heavy duty diesel engine. For example, wear on the injector screws in the valve-train of a diesel engine can lead to incomplete combustion of the fuel and loss of power. Crosshead wear in a diesel engine can lead to valves not opening or closing completely, which in turn can lead to a reduction in performance of the engine. The lubricating oil of the present invention helps mitigate these wear problems. In particular, the lubricating oil of the present invention has been shown to provide excellent valve-train wear protection, roller follower wear protection and ring/liner wear protection according to API industry standard tests. This enables a lubricating oil composition to be formulated to meet the API CH-4 standard or higher, for example CI-4 or CJ-4.

[0054] The lubricating oil composition of the present invention may be a 0W20, 0W30, 0W40, 5W20, 5W30, 5W40, 10W30, 10W40, 10W50, 10W60, 15W30, 15W40, 15W50, 20W40, 20W50, 25W50 or 25W60 lubricating oil composition.

[0055] The invention will now be described by way of example only with reference to the following examples and with reference to Figure 1 which is a graph of wear rates obtained in an engine test using a lubricating oil composition according to the present invention compared to a conventional lubricating oil composition meeting the API CJ-4 standard.

Cummins ISM Engine Test.

[0056] A lubricating oil composition according to the present composition (Example 1) was prepared and a lubricating oil composition (Composition A) was prepared for comparison. Composition A was a commercially available lubricating oil composition meeting API CJ-4 specifications. The composition of the lubricating oil composition used in Example 1 is shown in Table 1.

Table 1.

Components (wt %)	Concentration Example 1 (% by weight)
Dispersant olefin copolymer viscosity modifier, LZ7177B	2.50 (of which 10 % is active)
Low chlorine passenger car oil dispersant and high molecular weight PIB succinimide dispersant	4.20 (corresponding to 2.1 weight % active dispersant in composition)
Mixture of calcium sulphonate and phenate detergents	2.93

(continued)

Components (wt %)	Concentration Example 1 (% by weight)
Primary and secondary zinc dialkyl dithiophosphate antiwear additives	0.91
Other additives : antioxidant, compatibility agent, yellow metal passivators, diluent oil, amide friction modifier, polymer viscosity modifier and pour point depressant.	0.78
Base oil (46 % Jurong 150N and 45 % Jurong 500N Group II basestocks)	88.69

[0057] Each oil was tested in a 2002 Cummins ISM heavy duty diesel engine with electronic controlled unit injectors. In each test the lubricating oil composition was used to lubricate the engine whilst operating for 200 hours with a fuel having a maximum sulphur content of 500 ppm.

[0058] The engines were operated in each test up to a typical maximum soot content in the oil of 6 % by weight and then wear rates were interpolated to determine the wear rate at a soot content in the oil of 4.6 % by weight.

[0059] The results are shown graphically in Figure 1 which shows that although the conventional lubricating oil composition (Comparison A) exceeded the CJ-4 wear criteria, the lubricating oil composition according to the present invention was superior and exhibited lower wear as measured by crosshead weight loss, top ring weight loss and adjusting screw weight loss.

Claims

1. A multigrade lubricating oil composition for use in an internal combustion engine which composition comprises:

(a) a base oil comprising at least 90 % by weight of the base oil, of one or more basestocks selected from the group consisting of base stocks derived from Fischer-Tropsch synthesised, waxy, paraffinic hydrocarbon material by processes comprising hydrocracking and/or hydroisomerisation, Group II basestocks, Group III basestocks and mixtures thereof;
(b) one or more dispersant viscosity modifiers in a total amount of 0.15 to 0.8 % by weight of the composition; and
(c) one or more dispersants in a total amount of active dispersants of 1.5 to 3 % by weight of the composition.

2. Use in a multigrade lubricating oil composition comprising one or more dispersants in a total amount of active dispersants of 1.5 to 3 % by weight of the composition, of

(i) one or more dispersant viscosity modifiers in a total amount of 0.15 to 0.8 % by weight of the composition, in combination with
(ii) a base oil comprising at least 90 % by weight of the base oil, of one or more basestocks selected from the group consisting of base stocks derived from Fischer-Tropsch synthesised, waxy, paraffinic hydrocarbon material by processes comprising hydrocracking and/or hydroisomerisation, Group II basestocks, Group III basestocks and mixtures thereof,

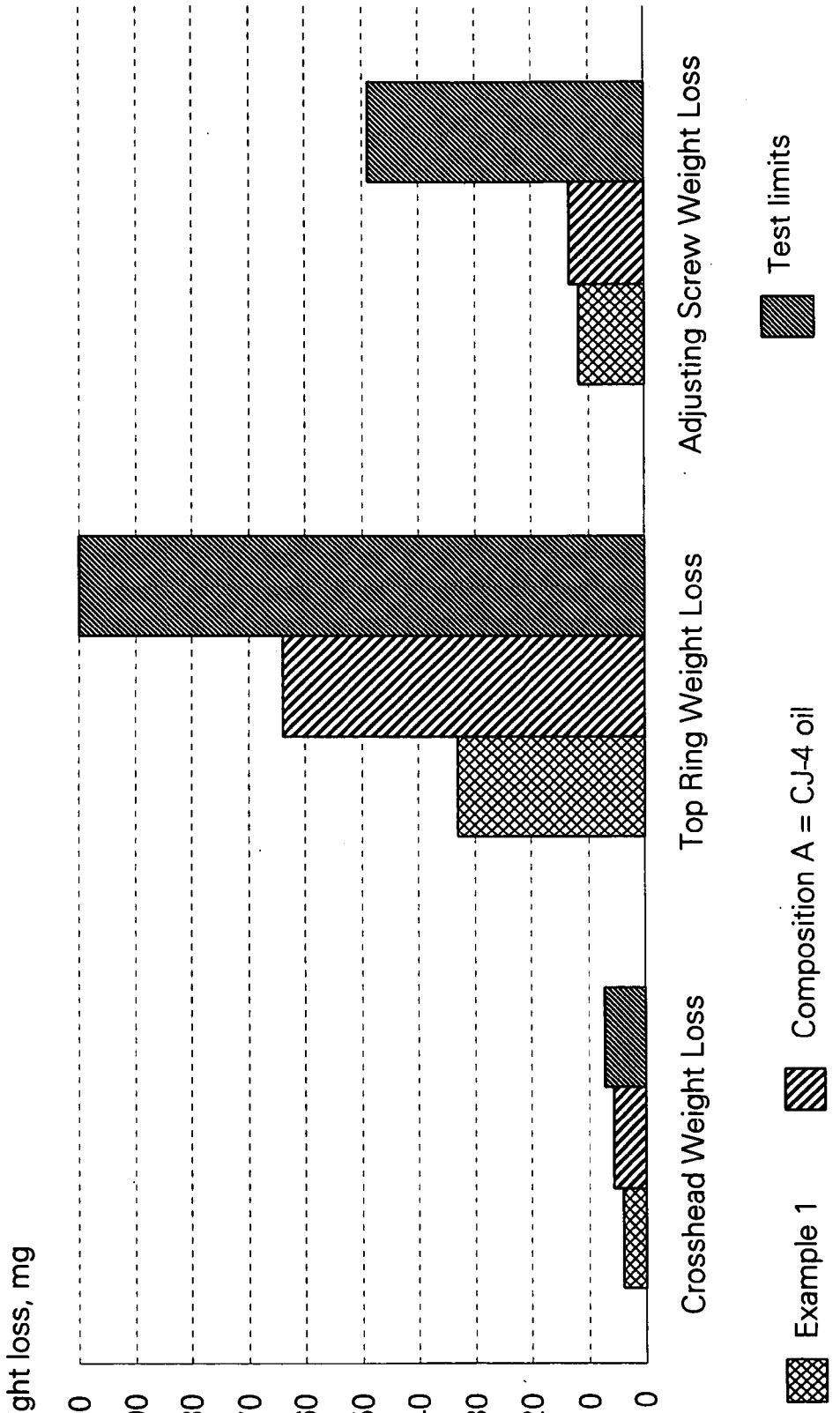
to enhance the anti-wear properties of the lubricating oil composition.

3. Use as claimed in claim 2 in which the use enhances the anti-wear properties with respect to valve train wear of an internal combustion engine which is preferably a diesel engine and more preferably, a heavy duty diesel engine.

4. A method of reducing the valve train wear of an internal combustion engine which method comprising lubricating the engine with a multigrade lubricating oil composition as claimed in claim 1.

5. A method as claimed in claim 4 in which the internal engine is a diesel engine, preferably a heavy duty diesel engine.

FIGURE 1


Weight loss, mg
100
90
80
70
60
50
40
30
20
10
0
Crosshead Weight Loss
Top Ring Weight Loss
Adjusting Screw Weight Loss
Example 1
Composition A = CJ-4 oil
Test limits

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 25 1927

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 925 579 A (STEMKE JEFFREY E [US]) 15 May 1990 (1990-05-15) * claims 1,8,15; examples 1,3; table 1 *	1,4,5	INV. C10M161/00
X	EP 1 191 089 A (INFINEUM INT LTD [GB]) 27 March 2002 (2002-03-27) * paragraphs [0035], [0070] - [0073], [0086], [0091], [0100]; claims 1,2,9,10; figure 1; example 1 *	1-5	
A	US 2002/042349 A1 (BODEN FREDERICK J [US] ET AL) 11 April 2002 (2002-04-11) * paragraphs [0426], [0427]; examples 16,17; table 2 *	1-5	
A	WO 00/34421 A (MOBIL OIL CORP [US]) 15 June 2000 (2000-06-15) * example 6 *	1-5	
A	EP 1 538 193 A (INFINEUM INT LTD [GB]) 8 June 2005 (2005-06-08) * paragraphs [0092], [0096] - [0099]; claims 1-5; table 1 *	1-5	TECHNICAL FIELDS SEARCHED (IPC) C10M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 February 2008	Pöllmann, Klaus

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 25 1927

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-02-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4925579 A	15-05-1990	NONE	
EP 1191089 A	27-03-2002	NONE	
US 2002042349 A1	11-04-2002	NONE	
WO 0034421 A	15-06-2000	AU 763313 B2	17-07-2003
		AU 1931000 A	26-06-2000
		CA 2353463 A1	15-06-2000
		EP 1151063 A1	07-11-2001
		TW 502063 B	11-09-2002
		US 6215033 B1	10-04-2001
EP 1538193 A	08-06-2005	CA 2489035 A1	04-06-2005
		CN 1654612 A	17-08-2005
		JP 2005163048 A	23-06-2005
		SG 112950 A1	28-07-2005
		US 2005124509 A1	09-06-2005

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 5719107 A **[0005] [0006]**
- US 5294354 A, Papke **[0005]**
- US 5958848 A **[0007] [0007] [0008] [0009] [0009]**
- WO 0014187 A **[0020]**
- WO 02064710 A **[0020]**
- WO 2005066314 A **[0020]**
- US 6008164 A **[0020]**
- US 4089794 A **[0026]**
- US 4160739 A **[0026]**
- US 4137185 A **[0026]**
- US 4068056 A **[0026]**
- US 4068058 A **[0026]**
- US 4146489 A **[0026]**
- US 4149984 A **[0026]**
- WO 9612746 A **[0026]**
- WO 9921902 A **[0026]**
- US 4867890 A **[0042]**

Non-patent literature cited in the description

- ENGINE OIL LICENSING AND CERTIFICATION SYSTEM. November 2004 **[0018]**