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

(11) EP 1 640 442 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.03.2006 Bulletin 2006/13

(51) Int Cl.:
C10M 171/00 *(2006.01)* ***C10M 175/00*** *(2006.01)*

(21) Application number: **04388064.0**

(22) Date of filing: **24.09.2004**

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

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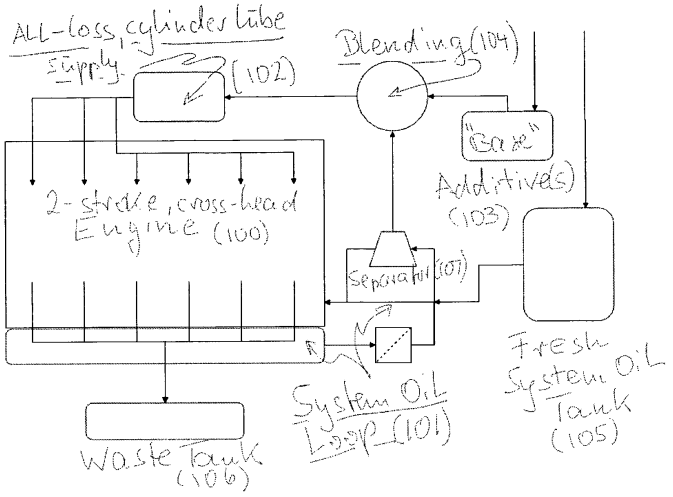
(54) Method and system for modifying a used hydrocarbon fluid to create a cylinder oil

(57) This invention relates to a method (and a corresponding system) of creating a cylinder oil, the method comprising modification of at least one initial fluid (101) by determining the TBN(s) of the at least one initial fluid, determining a desired TBN of a cylinder oil (102) and adjusting the TBN(s) of the at least one initial fluid (101) accordingly by blending the at least one initial fluid (101) with suited additive(s) (103).

In this way, a method (and system) for modifying initial fluid(s) to create a cylinder oil by adjusting TBN is obtained.

This provides significant economical benefits since lubricants that otherwise would have to be disposed of can be re-used as a total-loss cylinder lubricant, Further cylinder oil does not have to be purchased. The oil(s) used to blend the cylinder oil is/are of more consistent quality as it is replenished contrary to the traditional practice which reduces machinery wear, etc. Thus, the replenishment of the initial fluid(s) provides enhanced and consistent performance of the initial fluids resulting in greatly reduced component wear and equipment lifecycle cost. Even further, a more environmentally friendly method/system is provided since waste, in the form of spent oil(s) that is discarded after prolonged use, is reduced as it is converted into a cylinder oil.

Fig. 1:



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Description

FIELD OF THE INVENTION

[0001] The invention relates to a method of creating an all-loss lubricant. Further, the invention relates to a system for creating an all-loss lubricant.

BACKGROUND OF THE INVENTION

[0002] Two-stroke crosshead engines used in marine or stationary applications are equipped with two separate lubricating oil systems. One lubricating system comprises so-called system oil that normally is used for lubrication and cooling of the engine's bearings and e.g. oil-cooled pistons as well as for activation and/or control of various valves or the like. The other lubricating system comprises an all-loss lubricant (cylinder oil) that normally is used for lubrication of the engine's cylinders, piston rings and piston skirt.

[0003] In typical two-stroke crosshead engines, the cylinder oil is spent continuously by each turn of the engine whereas the system oil in principle is not spent (except by smaller unintentional leakages). The lubrication system comprising the cylinder oil is also often referred to as an "all-loss" lubrication system as the oil is spent. The use of and various types of both system oil(s) and cylinder oil(s) is very well known in the art.

[0004] The cylinder oil typically contains certain additives that function to reduce, minimize or neutralise the acid level of the cylinder system.

[0005] Typical cylinder o ils usually have an SAE (Society of Automotive Engineering) viscosity equivalent to about 50 and normally have a total base number (TBN) of about 40 to 70 for the neutralisation of acid products produced during the combustion process. Typical system oils usually have an SAE viscosity of about 30 with a relatively low TBN content, typically below 10. These exemplary values may vary dependent on the actual application and the specific design of the systems that the oils are used in.

[0006] In recent two-stroke cross-head engine designs involving electronic and/or hydraulic control and/or activation of valves, etc., the minimum performance requirements of the system oil has been substantially increased compared to earlier design using traditional mechanical control/activation.

[0007] In four-stroke, trunk piston (diesel) engines, however, typically use only a single oil type for lubrication and cooling. Such engines are used as secondary/auxiliary or propulsion engines on ships, or in stationary power generation or liquid/gas transmission applications. Such used oils typically have a SAE viscosity of about 30 or 40. While the system oil of two-stroke cross-head engines typically remains within its specified performance limits for an extended period of time, trunk piston engine oils are constantly affected by exposure to the combustion process. However, due to the inherent design of two-stroke cross-head engines, spent cylinder lubricants invariably leaks past the piston rod stuffing box contaminating the system oil. Thus, the useful properties of both trunk piston engine and system oil degenerate over time and finally the oils will have to be either replenished or completely changed. Similarly, other lubricants used on-board vessels or at stationary sites, such as hydraulic fluids, gear oils, turbine oils, heavy duty diesel oils, system oils, trunk piston engine oils, compressor oils and the like, do deteriorate over time, due to e.g. contamination, oxidation, hydrolysis etc. and therefore have to be replenished or changed at certain intervals.

[0008] The performance level of lubricants is typically measured periodically and may not go beyond certain limits if the oiled component's condition should not be jeopardized. An important cause of performance loss is caused by particle contamination. These particles include combustion by-products and wear components, which can be partially removed by oil separators. However, in the case of two-stroke cross-head engines, one of the sources of contamination is spent cylinder oil leakage past the stuffing box causing both the viscosity and base number of the system oil to increase over time, a process that cannot be reversed by separators.

[0009] A diesel engine's frictional loss is mainly of a viscose character. An increase in the viscosity of the system oil will therefore result in a diminished efficiency, increased fuel consumption and increased emissions.

[0010] In order to manufacture cylinder oil, prior art methods and systems typically blend suited base oils and suited additives and/or an additive package to obtain a fully formulated cylinder lubricant. This is typically done at a dedicated lubricant blend plant and the resulting cylinder lubricant has to the delivered to a ship or an off-shore plant for use in engines.

[0011] Apart from the mentioned inevitable mixing of cylinder oil and system oil prior art methods and systems do not otherwise mix these types of oils. Further, some prior art methods/systems also suggest a variation in lubricant flow rate or properties in response to actual engine conditions, cf. e.g. US 6,779,505. However, such methods and systems do not address the deterioration of oils due to contamination or other processes and the potential to re-use these used oils as cylinder oil.

OBJECT AND SUMMARY OF THE INVENTION

[0012] It is an object of the present invention to provide a method of creating a cylinder oil (and a corresponding system) that solves the above-mentioned (and other) shortcomings of prior art. A further object is to provide this in a cost-effective and simplified way.

[0013] A further object of the present invention is to enable improved performance of non-total loss lubricants over time and thus a more efficient use of both non-total loss lubricants and cylinder oil.

[0014] These objects, among others, are achieved by a method of (and corresponding system) creating a cyl-

inder oil, the method comprising modification of at least one initial fluid by determining the TBN(s) of the at least one initial fluid, determining a desired TBN of a cylinder oil and adjusting the TBN(s) of the at least one initial fluid accordingly by blending the at least one initial fluid with suited additive(s).

[0015] In this way, a method for modifying an initial fluid to create cylinder oil by adjusting solely TBN is obtained.

[0016] This provides significant economical benefits since lubricants that otherwise would have to be disposed of can be re-used as a total-loss cylinder lubricant. Furthermore, cylinder oil does not have to be purchased. The oil(s) used to blend the cylinder oil is/are of more consistent quality as it is replenished (contrary to the traditional practice) which reduces machinery wear, etc. Thus, the replenishment of the initial fluid(s) provides enhanced and consistent performance of the initial fluids resulting in greatly reduced component wear and equipment lifecycle cost. Even further, a more environmentally friendly method/system is provided since waste, in the form of spent oil(s) that is discarded after prolonged use, is reduced as it is converted into cylinder oil.

[0017] Preferably, at least one of the initial fluids are at least partially used oil(s). Hereby, a fully formulated cylinder lubricant is obtained by modifying TBN of this used initial fluid(s).

[0018] In a preferred embodiment, the suited additive (s) comprise at least one base.

[0019] In a further preferred embodiment, the at least one base comprises

1. basic salts of alkaline or earth alkaline elements, and/or
2. detergents and/or
3. dispersants.

[0020] The alkaline / earth alkaline elements may be e.g. K, Na, Ca, Ba, Mg or the like. The basic salts may belong to the inorganic chemical families of e.g. oxides, hydroxides, carbonates, sulfates or the like. The detergents may belong to the organic chemical families of e.g. sulfonates, salicylates, phenates, sulfophenates, Mannich-bases and the like. The dispersants may belong to the organic chemical families of succinimides or the like.

[0021] In a preferred embodiment, the cylinder oil is used in reciprocating internal combustion engines used in marine or stationary applications.

[0022] In yet another embodiment, the reciprocating internal combustion engines are two-stroke crosshead engines.

[0023] Preferably, the method and embodiments thereof according to the present invention is used offshore, on-site or in a land based plant.

[0024] Preferably, the cylinder oil is created with a TBN in response to fuel oil characteristics and/or actual engine operating requirements.

[0025] In another preferred embodiment, the TBN of the cylinder oil is chosen based upon sulphur-content of the fuel oil.

[0026] Preferably, the initial fluid is a hydrocarbon fluid. In one embodiment, the hydrocarbon fluid is a lubricant.

[0027] In a preferred embodiment, the lubricant is a used lubricant, i.e. a lubricant that has at least been partially used elsewhere.

[0028] Preferably, the used lubricant is selected from a group of lubricants, such as hydraulic fluids, gear oils, system oils, trunk piston engine oils, turbine oils, heavy duty diesel oils, compressor oils and the like.

[0029] In a preferred embodiment, the created cylinder oil is based on two-stroke engine system oil that continuously, near-continuously or intermittently is tapped from an existing system and where the system oil is replenished.

[0030] In an alternative preferred embodiment, the created cylinder oil is based on a mixture of lubricants that continuously, near-continuously or intermittently are tapped from an existing system and where the lubricants are replenished.

[0031] The oils used as initial fluids may e.g. be used or could alternatively be non-used, i.e. straight from any fresh lubricant storage tank or the like.

[0032] In another embodiment, the method further comprises the step of using suited instrumentation in order to control the quality of the finished lubricant.

[0033] The present invention also relates to a system corresponding to and having the same advantages as the method of the present invention. More specifically, the present invention also relates to a system for providing a cylinder oil, the system comprising: an apparatus for modifying at least one initial fluid by determining the TBN(s) of the at least one initial fluid, determining a desired TBN of a cylinder oil and adjusting the TBN(s) of the at least one initial fluid accordingly by blending the at least one initial fluid with suited additive(s).

[0034] Advantageous embodiments of the system according to the present invention are defined in the sub-claims and described in detail in the following. The embodiments of the system correspond to the embodiments of the method and have the same advantages for the same reasons.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] These and other aspects of the invention will be apparent from and elucidated with reference to the illustrative embodiments shown in the drawing, in which:

Figure 1 shows a schematic block diagram of one embodiment according to the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0036] Figure 1 shows a schematic block diagram of one embodiment according to the present invention. Shown are an all-loss cylinder lubricant supply compris-

ing cylinder oil (102), base additive(s) (103) and a system oil loop comprising at least one initial fluid (101). Further shown is a two-stroke crosshead engine (100), a waste tank (106), a fresh system oil tank (105), a separator (107) and a blending apparatus (104) for carrying out the present invention.

[0037] According to the present invention the cylinder oil is created by modification of at least one initial fluid (101) by determining the TBN(s) of the at least one initial fluid, determining a desired TBN of a cylinder oil (102) and adjusting the TBN(s) of the at least one initial fluid (101) accordingly by blending the at least one initial fluid (101) with suited additive(s) (103). This is preferably done by the blending apparatus (104). Preferably, the at least one initial fluid are at least partially used oil(s). Hereby, a fully formulated cylinder lubricant is obtained by modifying TBN of spent oil.

[0038] Adjusting the TBN preferably comprises adjusting at least one additive level or adding one or more additives, where the additives comprise at least one base comprising basic salts of alkaline or earth alkaline elements, and/or detergents and/or dispersants.

[0039] The alkaline / earth alkaline elements may be e.g. K, Na, Ca, Ba, Mg or the like. The basic salts may belong to the inorganic chemical families of e.g. oxides, hydroxides, carbonates, sulfates or the like. The detergents may belong to the organic chemical families of e.g. sulfonates, salicylates, phenates, sulfophenates, Mannich-bases and the like. The dispersants may belong to the organic chemical families of succinimides or the like.

[0040] As mentioned, the cylinder oil may be used in reciprocating internal combustion engines (e.g. two-stroke crosshead engines) used in marine or stationary applications. The creation of a cylinder oil is due to its simplicity and the normal availability of the required initial fluid and the additives very suitable for offshore or on-site applications.

[0041] The creation of the cylinder oil may also take additional aspects into consideration such as actual engine requirements and sulphur content of the fuel.

[0042] The used initial fluid may e.g. be hydraulic fluids, gear oils, system oils, trunk piston engine oils, turbine oils, heavy duty diesel oils, compressor oils and the like.

[0043] Preferably, the initial fluid is system oil and the total-loss lubricant is cylinder oil.

[0044] In one embodiment, the created cylinder oil is based on two-stroke engine system oil that continuously, near-continuously or intermittently is tapped from an existing system and where the system oil is replenished.

[0045] Alternatively, the created cylinder oil is based on a mixture of oils that continuously, near-continuously or intermittently are tapped from an existing system and where the oils are replenished.

[0046] The oils may e.g. be used or could alternatively be non-used, i.e. straight from any fresh lubricant storage tank or the like.

[0047] A significant advantage of the present invention is that the main engine(s) only has to be supplied with fully-formulated, fresh system oil. The system oil is then used for its traditional purpose and some of the system oil is blended with additives adjusting the TBN making it suitable for cylinder oil according to the present invention. This increases the availability of the needed oil geographically and increases competition between supplies of oil since all presently known two-stroke system oils are usable as initial oil for the cylinder oil by using the present invention. Further, since, where applicable, other initial fluids, such as but not limited to used hydraulic, gear, trunk piston engine or compressor oils may be included in the process of creating cylinder oil procurement cost will be considerably reduced .

[0048] Further, since some of initial fluids are now re-used in the manufacture of cylinder oil (as opposed to their traditional use) they will have to be replenished whereby the problem of gradual deterioration is minimised or avoided.

[0049] In a preferred embodiment, a continuous, near-continuous or intermittently tapping of the system oil from a two-stroke main engine and/or any other suited initial fluid is proposed to use these initial fluids as a basis for the creation of cylinder oil according to the present invention.

[0050] The additive(s) or additive package used by the modifier may serve several purposes but will normally always be used for adjusting the oils TBN. The process may also be used to provide flexible TBN levels as required by the actual fuel oil properties and engine operating parameters.

[0051] The creation of cylinder oil/cylinder oil according to the present invention is due to its simplicity very well suited for on-site creation, e.g. aboard a ship / vessel, off-shore equipment, stationary plants, etc.

[0052] In the claims, any reference signs placed between parentheses shall not be constructed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps other than those listed in a claim. The word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements.

Claims

1. A method of creating a cylinder oil, the method comprising modification of at least one initial fluid (101) by determining the TBN(s) of the at least one initial fluid, determining a desired TBN of a cylinder oil (102) and adjusting the TBN(s) of the at least one initial fluid (101) accordingly by blending the at least one initial fluid (101) with suited additive(s) (103).

2. A method according to claim 1, wherein at least one of the initial fluids are at least partially used oil(s).

3. A method according to claims 1 - 2, wherein the suited additive(s) comprise at least one base.

4. A method according to claim 3, wherein the at least one base comprises

   • basic salts of alkaline or earth alkaline elements, and/or
   • detergents and/or
   • dispersants.

5. A method according to claims 1 - 4, wherein the cylinder oil is used in reciprocating internal combustion engines used in marine or stationary applications.

6. A method according to claim 5, wherein said reciprocating internal combustion engines are two-stroke crosshead engines.

7. A method according to claims 1 - 6, wherein the method is used offshore, on-site or in a land based plant.

8. A method according to claims 1 - 7, wherein the cylinder oil is created with a TBN in response to fuel oil characteristics and/or actual engine operating requirements.

9. A method according to claims 1 - 8, wherein the TBN of the cylinder oil is chosen based upon sulphur-content of the fuel oil.

10. A method according to claims 1 - 9, wherein said initial fluid is a hydrocarbon fluid.

11. A method according to claim 10, wherein said hydrocarbon fluid is a lubricant.

12. A method according to claim 11, wherein the lubricant is a used lubricant.

13. A method according to claim 12, wherein the used lubricant is selected from a group of hydraulic fluids, gear oils, system oils, trunk piston engine oils, turbine oils, heavy duty diesel oils, compressor oils and the like.

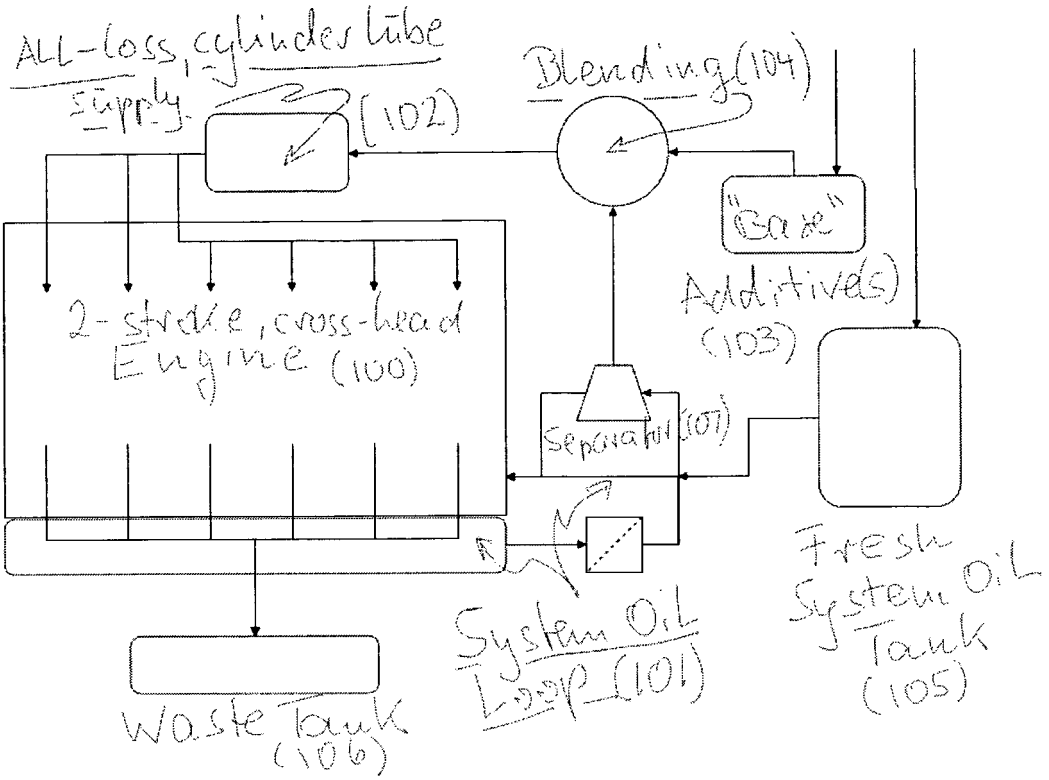
14. A method according to claims 1 - 13, wherein the created cylinder oil is based on two-stroke engine system oil that continuously, near-continuously or intermittently is tapped from an existing system and where the system oil is replenished.

15. A method according to claims 1 - 13, where the created cylinder oil is based on a mixture of lubricants that continuously, near-continuously or intermittently are tapped from an existing system and where the lubricants are replenished.

16. A method according to claims 1 - 15, wherein the method further comprises the step of: using suited instrumentation in order to control the quality of the finished lubricant.

17. A system for providing a cylinder oil, the system comprising: an apparatus (104) for modifying at least one initial fluid (101) by determining the TBN(s) of the at least one initial fluid, determining a desired TBN of a cylinder oil (102) and adjusting the TBN(s) of the at least one initial fluid (101) accordingly by blending the at least one initial fluid (101) with suited additive (s) (103).

Fig. 1:


ALL-loss, cylinder lube supply (102)
Blending (104)
"Base" Additive(s) (103)
2-stroke, cross-head Engine (100)
Separator (107)
Fresh System Oil Tank (105)
System Oil Loop (101)
Waste Tank (106)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 38 8064

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	GB 2 084 667 A (HURNER ERWIN EDWARD) 15 April 1982 (1982-04-15) * abstract * * page 2, line 85 - line 100 * * figure 1 *	1,14,15	TECHNICAL FIELDS SEARCHED (Int.Cl.7) C10M
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 December 2004	Keipert, O

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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& : 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 04 38 8064

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
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09-12-2004

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