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(54) **Modifier of combustion of liquid and gaseous fuels in combustion engines**

Modifikator für die Verbrennung von flüssigen und gasförmigen Brennstoffen in Verbrennungsmotoren

Modificateur de combustion des combustibles liquides et gazeux dans des moteurs à combustion

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(73) Proprietor: **DAGAS Sp. z o.o.
05-660 Warka (PL)**

(72) Inventor: **Majcher, Marek
05-660 Warka (PL)**

(74) Representative: **Gizinska-Schohe, Malgorzata et al
European Patent Attorney
Helmptstrasse 11a
80687 München (DE)**

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Description

[0001] Object of the invention is a modifier of combustion of liquid and gaseous fuels, such as fuel for marine engines, diesel oil, petrol, light and heavy oil, mazout and other hydrocarbons, in combustion engines, a method of modifying a process of combustion of fuels and a use of the modifier of fuel combustion.

[0002] Processes of combustion of liquid and gaseous fuels in combustion engines are still being improved. In particular, all methods that allow to increase a process yield and limitation of emission of harmful substances to atmosphere are investigated. Additives of various types that modify processes taking place during combustion of fuels are known. In particular, preventing from carbon black and other sludge banks settling in e.g. in exhaust systems of combustion engines, is desirable.

[0003] Ferrocene derivatives belong to a group of metal organic compounds from a group of cyclopentadienyl complexes. Complexes with iron II constitute a sandwich system, in which two ligands are bound with a metal cation located between them. Derivatives of such type are known and are used as catalysts of chemical processes.

[0004] From Japanese patent specification JP2000247990, a use of cyclopentadiene complexes in chemical synthesis, e.g. during preparation of aromatic amines, is known.

[0005] From Swiss patent CH 599464, a use of ferrocene as a catalyst of processes of combustion to be used as an additive to fuels used in engines, e.g. motor car engines, is known.

[0006] RU 2 314 334 C1 and CN 1 114 676 A, both disclose fuel additive compositions improving the combustion of a fuel oil in an engine.

[0007] Object of the invention is a modifier of combustion of liquid and gaseous fuels, such as fuel for marine engines, diesel oil, petrol, light and heavy oil, mazout and other hydrocarbons in combustion engines, **characterised in that** it contains from 10 to 30 wt. % of carrier, preferably water or a hydrocarbon distillate of a fraction of the 180 - 380°C range, from 20 to 80 wt. % of at least one aliphatic alcohol, from 5 to 15 wt. % of carbamide or its derivatives and from 5 to 15 wt. % of monoacetylferrocene.

[0008] The modifier contains from 10 to 30 wt. % of water or a hydrocarbon distillate of a fraction of the 180 - 380°C range, from 20 to 40 wt. % of isopropanol, from 20 to 40 wt. % of n-butanol, from 5 to 15 wt. % of carbamide and from 5 to 15 wt. % of monoacetylferrocene.

[0009] The modifier contains 20 wt. % of water or hydrocarbon distillate of a fraction of the 180 - 380°C range, 30 wt. % of isopropanol, 30 wt. % of n-butanol, 10 wt. % of carbamide and 10 wt. % of monoacetylferrocene.

[0010] Object of the invention is also a method of modifying a process of combustion of liquid and gaseous fuels, such as fuel for marine engines, diesel oil, petrol, light and heavy oil, mazout and other hydrocarbons, in combustion engines, **characterised in that** the modifier of combustion containing from 10 to 30 wt. % of carrier, preferably water or hydrocarbon distillate of a fraction of the 180 - 380°C range, from 20 to 80 wt. % of at least one aliphatic alcohol, from 5 to 15 wt. % of carbamide or its derivatives, and from 5 to 15 wt. % of monoacetylferrocene, is metered as optionally additionally diluted, the diluent preferably being a carrier, either is metered as liquid directly to the fuel or to the aeration system of combustion chamber of the engine, preferably through pumping together with air to fuel mixture fed to the combustion chamber of the engine, the modifier being metered as diluted with a carrier, preferably at the ratio 2.5 - 3.8 mL modifier per 1 L water or the hydrocarbon fraction of the 180 - 380°C range.

[0011] The modifier contains from 10 to 30 wt. %, preferably 20 wt. % of carrier, from 20 to 40 wt. %, preferably 30 wt. % of isopropanol, from 20 to 40 wt.%, preferably 30 wt. % of n-butanol, from 5 to 15 wt. %, preferably 10 wt. % of carbamide and from 5 to 15 wt. %, preferably 10 wt. % of monoacetylferrocene.

[0012] In case of metering the modifier to the aeration system, it is metered by means of spraying.

[0013] From 1.8 to 10 mL of the modifier per 100 L of fuel as diesel oil or from 5 to 47 mL of the modifier per 1000 kg of fuel for marine engines or from 10 to 100 mL of the modifier per 1000 litres of liquid fuels, such as mazout and heavy oil, is metered in the method, and the given amounts refer to the modifier composition prior to the additional dilution.

[0014] Object of the invention is also a use of the modifier of combustion defined above for increasing a yield of combustion of liquid and gaseous fuels, reducing their consumption and as a catalyst in combustion process in engines, and for decreasing emission of undesirable gases, in particular carbon monoxide, to atmosphere and also for after-burning carbon black, exhaust gases and other impurities present in the combustion chamber, for example dusts and coal tar-type substances, as well as for purifying the combustion chamber and exhaust system from sludge banks.

[0015] Object of the invention is also an application of the modifier of combustion of liquid and gaseous fuels, containing a carrier, preferably water or hydrocarbon distillate of a fraction of the 180 - 380°C range, at least one aliphatic alcohol, carbamide or its derivatives and monoacetylferrocene, for increasing a yield of combustion of liquid and gaseous fuels, reducing its consumption and as a catalyst in combustion process in engines, and for decreasing emission of undesirable gases, in particular carbon monoxide, to atmosphere and also for after-burning carbon black, exhaust gases and other impurities present in the combustion chamber, for example dusts and coal tar-type substances, as well as for purifying the combustion chamber and exhaust system from sludge banks.

[0016] The above-mentioned composition of the modifier can be adjusted to a type of fuel used and a type of engine

powered with that fuel. Accordingly, amounts of individual components can be changed. In addition to the ratios mentioned-above, the modifier can also contain 15 to 25 wt. % of carrier, 25 to 35 wt. % of isopropanol, 25 to 35 wt. % of n-butanol, 8 to 12 wt. % of carbamide and 8 to 12 wt. % of monoacetylferrocene.

[0017] The modifier of combustion according to the invention can in particular be used in chambers of self igniting diesel-oil, low-speed and high-speed engines powered with low-octane or high-octane (92, 95, 98) petrol, light and heavy diesel oil, mazout, gas e.g. methane or propane-butane. The modifier can also be used together with fuels of a different type, selection or composition modification of which will be familiar for a skilled in the art. As fuels to which the modifier of the invention can be utilised, suitable hydrocarbon fractions utilised for fuelling combustion engines, e.g. a fraction derived from crude oil distillation within the fraction of the 180 - 360°C range, e.g. diesel oil, can be used. It can also be a fraction of the 220 - 340°C range. Hydrocarbon fractions can also be used as an additional diluent for combustion modifier composition, when it is metered in the liquid state directly to the fuel. When the modifier is metered in a sprayed form to an aeration system of the engine (to a carburettor), it is water which is used as a carrier and a diluent for the modifier composition. A use of a different type of carriers and diluents having similar properties i.e. not interfering into chemical processes during fuel combustion when using a modifier, is also possible.

[0018] Aim of the invention was to develop a universal modifier of combustion of all fuel types in combustion engines having different construction, to act as a catalyst that limits settling carbon black and coal tar type substances, ensures its after-burning and reduces emission of undesirable substances, e.g. carbon monoxide, solids and hydrocarbons to atmosphere and - at the same time - enhances a yield of combustion processes by reducing consumption of the respective fuels.

[0019] Unexpectedly, it has been found that modifier components - as a result of its specific quantitative and qualitative selection - make it possible to carry out the combustion process in engines in a stable and safe way. A use of a specific ferrocene derivative (monoacetylferrocene) in combination with alcohols and carbamide has made it possible to fully control existing processes and ensured a universal character of the modifier, suitable to be used with various fuels. What is more important, general operational parameters of engines used in tests have not been deteriorated. On the other hand, several advantages resulting from a use of the modifier of combustion according to the invention, in particular limitation of emission of harmful exhaust gas components to atmosphere, were observed.

[0020] One of the most prospective directions when utilising the modifier of combustion of the invention is its application for modifying the process of fuel combustion in marine engines, motor-cars of any type, construction equipment, diesel locomotives, in engines that supply electric energy generators, mining machines and aircraft reaction engines. The performed study has demonstrated that the reduction in relative consumption during modified fuel combustion for methane-rich natural gas (GZ-50) is not less than 12 %, for diesel oil - 12 %, and for mazout and fuel for marine engines - 10-15%. A decrease in fuel consumption was also observed for other hydrocarbon fractions used as a liquid and gaseous fuel.

[0021] Experiments concerning practical implementation of the modifier of the invention i.e. a composition of the modifier (for example according to Example 1) have evidenced that in some cases there is a possibility of fuel saving up to 12% and even up to 25%, a direct influence of the modifier on saving of fuel consumption necessary to perform definite work amounting to 8-12 %, while the remaining contribution to saving being an indirect factor, e.g. resulting from purifying the engine and systems of feeding and exhausting. An extra effectiveness of processes was achieved through introducing a slight modification of aeration system of the combustion chamber, not involving any construction changes in the feeding system. A use of the modifier of the invention results in good condition of exhaust system as a result of e.g. its purification without necessity of introducing substantial changes in engine construction.

[0022] It is also crucial that the modifier acts in all engine sections i.e. in the area of fuel feeding to the engine, in the engine itself, and in the exhaust system, where it causes a decrease in contamination of oil with fuel combustion products, and also in oil filtration system, thanks to which advantageous changes occur within the whole mentioned area and then after-burning of exhaust gas, dust and sludge banks takes place.

[0023] The modifier according to the invention can be successfully used in combustion engines and in jet engines of any type, for various fuels such as aircraft fuel, petrol, light and heavy diesel oils, marine engines fuel, mazout, hydrocarbons of various types, and their compositions in a mixture with petroleum-based synthetic fuels, optionally processed or not, and all low-grade fuels. The invention is also applicable for gaseous and liquid fuels such as methane, propane - butane, synthesis gas, as well as for various contaminated mixtures and fuels.

[0024] An application of the modifier according to present invention makes it possible to use low-processed and wet raw materials as fuels.

[0025] The essential component of the modifier according to the invention is a complex being an iron carrier - monoacetylferrocene i.e. cyclopenta-1,3-diene; 1-(1-cyclopenta-2,4- dienyldiene) etanolate of ferrum ion 2+. In processes during combustion, presence of hydroxyl groups in a reaction medium is of crucial importance. The modifier contains also carbamide or its derivatives, selected from alkylurea of $R_1R_2N(CO)NR_1R_2$ type, where R_1 , R_2 , R_3 , R_4 are the same or different and are C_1 - C_6 alkyl groups, e.g. methylene or ethylene groups.

[0026] Aliphatic alcohols used in the modifier according to the invention can have linear or branched chains. The

modifier of the invention should include at least one alcohol (a carrier of OH groups). Preferably, the alcohol is selected from a group of C₂ - C₁₁ alcohols, more preferably C₃-C₈ alcohols, in particular C₃-C₆ alcohols. Examples of alcohols used are: ethanol, propanol, isopropanol, n-butanol, pentanol, heptanol and octanol. By selecting the alcohol, a ratio of hydroxyl groups to a number of carbon atoms in a chain is changed, thereby changing the ratio of hydroxyl groups to a mass of other modifier components. Advantageous effects are obtained when using alcohols of moderate chain length, e.g. isopropanol and n-butanol. Thus, a mixture of the two alcohols in the modifier is preferably used. On the other hand, the modifier can contain only one alcohol of the mentioned group or a mixture of three or four alcohols.

[0027] A mixture of the modifier may also include additives, which do not influence its properties. e.g. dyes, to make a distinction between various types of the modifier.

[0028] One can assume that during combustion processes, complex ligands based on an N-radical having a complexing centre constituted by an iron ion with built-in hydroxyl groups and hydrocarbon chains in a suitable position are formed in the reaction mixture.

[0029] Roughly speaking, one can define these compounds as derivatives of C₅H₅FeC₅H₄COC_mH_n-type, but it is only a pictorial formula and there is no possibility to isolate such compounds from the reaction mixture.

[0030] In the method according to the invention, the modifier composition is optionally diluted with water or a hydrocarbon fraction, and only then it is metered. The modifier is either directly added to the fuel (e.g. to a fuel container) and does not contain water, or it is fed through a metering system to an air suction system i.e. to a carburettor premixing chamber (through a feeding channel), where the modifier is metered by spraying as an aqueous solution.

[0031] In Figures (Figs. 1-4) results of comparison of testing of exhaust gas components for the basic fuel (diesel oil) and for the modifier-added fuel of the composition of Example 1 are shown. The tests were carried out with a use of SULZER 6A20/24 engine. The modifier diluted at the ratio of 2.8 mL modifier : 1 L diluent (carrier) was used. The modifier was metered directly to the fuel or to the engine aeration chamber at the amount from 4.6 mL to 5mL of modifier per 100 L and per 1000 L of diesel oil feeding the engine.

[0032] Fig. 1 presents comparison of values of emission of not-burnt hydrocarbons (THC) in exhaust gas when feeding with the basic fuel and the fuel with the added modifier of the invention, Fig. 2 - comparison of values of emission of carbon monooxide in exhaust gas when feeding with the basic fuel and the fuel with the added modifier of the invention, Fig.3 - comparison of values of emission of carbon black in exhaust gas when feeding with the basic fuel and the fuel with the added modifier of the invention, Fig. 4 - comparison of values of emission of solid particles in exhaust gas when feeding with the basic fuel and the fuel with the added modifier of the invention.

Example 1

[0033] A modifier of the following composition: 20 wt. % of carrier, 30 wt. % of isopropanol, 30 wt. % of n-butanol, 10 wt. % of carbamide and 10 wt. % of monoacetyloferrocene has been prepared. Sample 1a was a modifier, in which water was used as a carrier, sample 1b was a modifier with an added hydrocarbon distillate of a fraction of the 180 - 380°C range as a carrier.

Example 2

[0034] In an analogous way, samples 2a and 2b were prepared. The modifier composition was the following: 30 wt. % of carrier (water or hydrocarbon distillate), 35 wt. % of isopropanol, 25 wt. % of n-butanol, 5 wt. % of carbamide, 5 wt. % of monoacetyloferrocene.

Example 3

[0035] In an analogous way, samples 3a and 3b were prepared; the modifier was of the following composition: 20 wt. % of carrier (water or hydrocarbon distillate), 50 wt. % of isopropanol, 15 wt. % of carbamide and 15 wt. % of monoacetyloferrocene.

Example 4

[0036] The modifier of Example 1 - sample 1a was diluted with water at the ratio of 3 mL catalyst composition per 1 L water. The resulting solution was metered to the aeration chamber of the engine. Sample 1b was diluted with hydrocarbon fraction 180÷360 at the analogous ratio and was metered as liquid to a fuel container. Amounts of the metered modifier amounted to 5 mL per 100 L diesel oil (recalculated to modifier before being diluted). Diluting the modifier carrier only provided uniform metering and more easy handling with liquids. Testing of modifier efficiency was carried out using test engines PERKINS 1104C-44 and SULZER 6A20/24.

[0037] In Table I below comparison of testing of emission of engine SULZER 6A20/24 for the basic fuel with the added

modifier of Example I and for the basic fuel (standard diesel oil) with no additives, is presented. Emission of hydrocarbons (HC) and carbon monoxide (CO) was considerably lower in case of the modifier-added fuel. Results of comparison for engine SULZER are presented also in Fig. 1-4, which show, what advantages as regards emission of exhaust gas were achieved by using the modifier of Example 1.

[0038] In tests carried out for PERKINS 1104C-44-type engine, a presence of the modifier additive in diesel oil (basic fuel) resulted in a decrease in power output of the engine within the whole range of engine speed. The observed power output decrease at 2200 rpm was 7% as compared to the conventionally used diesel oil. At the same time, a decrease in fuel consumption from 4 to 12% depending on a modifier composition was observed. Calculations of general efficiency of engine for the conventional fuel and the fuel with added modifier did not exhibit any significant differences. This results from modifier properties, which cause a slight decrease in engine power output, but at the same time reduce fuel consumption. It was also observed that using the fuel with the added modifier resulted in a reduced emission of carbon monoxide and solid particles, in particular at low engine speeds. A decrease in carbon monoxide emission was within the range of 70 ÷ 90%. A level of hydrocarbons emission decreased about 30%.

[0039] In tests with a use of SULZER 6A20/24 engine, testing of exhaust gas and calibration procedures and analytical equipment control conformed to Norm PN-EN ISO 8178 (01.1999). Testing was carried out on a marine piston diesel engine of SULZER 6A20/24 type. A spectrophotometric analyzer of exhaust gas was used. No influence of the fuel with the added modifier of the invention on change in mechanical or energy performance of engine was observed. At the same time, an advantageous influence of the combustion modifier on levels of emission of harmful exhaust gas components was observed. A level of reduction of emission of solid particles lies within the range of 53 ÷ 73%. Emission of insoluble fraction of organic compounds was reduced by 35 ÷ 62%. Also a decrease in emission of solid particles within the range of 40 ÷ 62% was observed. A decrease in emission of not-burnt hydrocarbons amounted to 19 ÷ 40%. Values of listed parameters depended on the engine load. A decrease in emission of carbon monoxide was very considerable at low engine load and amounted to 38.6% (for the remaining ranges it amounted to 1 ÷ 9%).

[0040] The fuel with the added modifier of the invention in figures (fig. 1-4) was denoted with a trade name "Reduxco".

Table 1

Component		Basic fuel	Modified fuel
NOx unit weighed emission	g/kWh	16.71	17.40
CO unit weighed emission	g/kWh	1.30	1.06
HC unit weighed emission	g/kWh	1.33	0.97
SOx unit weighed emission	g/kWh	0.05	0.05

Claims

1. Modifier of combustion of liquid and gaseous fuels, such as fuel for marine engines, diesel oil, petrol, light and heavy oil, mazout and other hydrocarbons, in combustion engines, **characterised in that** it contains from 10 to 30 wt. % of carrier selected from hydrocarbon distillate of a fraction of the 180 - 380°C range, from 20 to 80 wt. % of at least one aliphatic alcohol, from 5 to 15 wt. % of carbamide or its derivatives selected from alkylurea of $R_1R_2N(CO)NR_1R_2$ type, where R_1, R_2, R_3, R_4 are the same or different and are C_1-C_6 alkyl groups, and from 5 to 15 wt % of monoacetylferrocene.
2. Modifier according to Claim 1, **characterised in that** it contains from 10 to 30 wt. % of a hydrocarbon distillate of a fraction of the 180 - 380°C range, from 20 to 40 wt. % of isopropanol, from 20 to 40 wt. % of n-butanol, from 5 to 15 wt. % of carbamide and from 5 to 15 wt. % of monoacetylferrocene.
3. Modifier according to Claim 1, **characterised in that** it contains 20 wt. % of a hydrocarbon distillate of a fraction of the 180 - 380°C range, 30 wt. % of isopropanol, 30 wt. % of n-butanol, 10 wt. % of carbamide and 10 wt. % of monoacetylferrocene.
4. Method of modifying a process of combustion of liquid and gaseous fuels, such as fuel for marine engines, diesel oil, petrol, light and heavy oil, mazout and other hydrocarbons, in combustion engines, **characterised in that** the modifier of combustion containing from 10 to 30 wt. % of carrier, from 20 to 80 wt. % of at least one aliphatic alcohol, from 5 to 15 wt. % of carbamide or its derivatives selected from alkylurea of $R_1R_2N(CO)NR_1R_2$ type, where R_1, R_2, R_3, R_4 are the same or different and are C_1-C_6 alkyl groups, and from 5 to 15 wt. % of monoacetylferrocene, is

metered as optionally additionally diluted, a diluent preferably being a carrier, either in the liquid state, directly to the fuel or to an aeration system of an engine combustion chamber, the modifier being metered as diluted with the carrier, preferably at the ratio of 2.5 - 3.8 mL modifier per 1 L water or the hydrocarbon fraction of the range 180 - 380°C.

- 5 5. Method according to Claim 4, **characterised in that** the carrier is selected from water or a hydrocarbon distillate of a fraction of the 180 - 380°C range.
6. Method according to Claim 4, **characterised in that** the composition is metered directly to the fuel or to an aeration system of an engine combustion chamber by pumping together with air to a fuel mixture fed to the engine combustion chamber.
7. Method according to Claim 4, **characterised in that** the modifier of combustion contains from 10 to 30 wt. % of carrier, from 20 to 40 wt. % of isopropanol, from 20 to 40 wt. % of n-butanol, from 5 to 15 wt. % of carbamide and from 5 to 15 wt. % of monoacetylferrocene.
8. Method according to Claim 7, **characterised in that** the modifier of combustion contains 20 wt. % of carrier, 30 wt. % of isopropanol, 30 wt. % of n-butanol, 10 wt. % of carbamide, and 10 wt. % of monoacetylferrocene.
9. Method according to Claim 4, **characterised in that** in case of metering of the modifier to the aeration system, it is metered by spraying.
10. Method according to Claim 4, **characterised in that** from 1.8 to 10 mL modifier per 100 L fuel, as diesel oil, or from 5 to 47 mL modifier per 1000 kg fuel for marine engines, or from 10 to 100 mL modifier per 1000 L liquid fuels, such as mazout and heavy oil, is metered, and the given amounts of the modifier refer to its composition prior to the additional dilution.
11. Use of the modifier of combustion defined in Claim 1 for increasing a yield of combustion of liquid and gaseous fuels, for reducing its consumption, as a catalyst in combustion engines, and for reducing emission of undesirable gases, in particular carbon monoxide, to atmosphere, as well as for after-burning carbon black, exhaust gases and other impurities present in the combustion chamber, for example dusts and coal tar-type substances, as well as for purifying the combustion chamber and exhaust system from sludge banks.

Patentansprüche

1. Modifikator für die Verbrennung von flüssigen und gasförmigen Brennstoffen, wie Brennstoffe für Schiffsmotoren, Dieselöl, Benzin, Leicht- und Schweröl, Masut und andere Kohlenwasserstoffe, in Verbrennungsmotoren, **dadurch gekennzeichnet, dass** er von 10 bis 30 Gew.-% Träger, ausgewählt aus Kohlenwasserstoffdestillat einer Fraktion aus dem Bereich 180 - 380°C, von 20 bis 80 Gew.-% zumindest eines aliphatischen Alkohols, von 5 bis 15 Gew.-% Carbamid oder seiner Derivate ausgewählt aus Alkylharnstoff vom Typ $R_1R_2N(CO)NR_1R_2$, wobei R_1 , R_2 , R_3 , R_4 gleich oder unterschiedlich sind und C_1 - C_6 -Alkylgruppen sind, und von 5 bis 15 Gew.-% Monoacetylferrocen enthält.
2. Modifikator nach Anspruch 1, **dadurch gekennzeichnet, dass** er von 10 bis 30 Gew.-% eines Kohlenwasserstoffdestillats einer Fraktion aus dem Bereich 180 - 380°C, von 20 bis 40 Gew.-% Isopropanol, von 20 bis 40 Gew.-% n-Butanol, von 5 bis 15 Gew.-% Carbamid und von 5 bis 15 Gew.-% Monoacetylferrocen enthält.
3. Modifikator nach Anspruch 1, **dadurch gekennzeichnet, dass** er 20 Gew.-% eines Kohlenwasserstoffdestillats einer Fraktion aus dem Bereich 180 - 380°C, 30 Gew.-% Isopropanol, 30 Gew.-% n-Butanol, 10 Gew.-% Carbamid und 10 Gew.-% Monoacetylferrocen enthält.
4. Verfahren zum Modifizieren des Verbrennungsprozesses von flüssigen und gasförmigen Brennstoffen, wie Brennstoffe für Schiffsmotoren, Dieselöl, Benzin, Leicht- und Schweröl, Masut und andere Kohlenwasserstoffe, in Verbrennungsmotoren, **dadurch gekennzeichnet, dass** der Verbrennungsmodifikator, enthaltend von 10 bis 30 Gew.-% Träger, von 20 bis 80 Gew.-% zumindest eines aliphatischen Alkohols, von 5 bis 15 Gew.-% Carbamid oder seiner Derivate ausgewählt aus Alkylharnstoff vom Typ $R_1R_2N(CO)NR_1R_2$, wobei R_1 , R_2 , R_3 , R_4 gleich oder unterschiedlich sind und C_1 - C_6 -Alkylgruppen sind, und von 5 bis 15 Gew.-% Monoacetylferrocen, optional zusätzlich verdünnt, wobei das Verdünnungsmittel vorzugsweise ein Träger ist, entweder im flüssigen Zustand, direkt in den Brennstoff oder ins Belüftungssystem der Motor-Verbrennungskammer dosiert wird, wobei der Modifikator mit dem

Träger verdünnt, vorzugsweise im Verhältnis von 2,5 - 3,8 mL Modifikator pro 1 L Wasser oder Kohlenwasserstofffraktion aus dem Bereich 180 - 380°C, dosiert wird.

5. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** der Träger aus Wasser oder einem Kohlenwasserstoffdestillat einer Fraktion aus dem Bereich 180 - 380°C ausgewählt ist.
6. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** die Zusammensetzung direkt in den Brennstoff oder ins Belüftungssystem der Motor-Verbrennungskammer dosiert wird, indem sie zusammen mit der Luft in die Brennstoffmischung, die in die Motor-Verbrennungskammer eingespeist wird, gepumpt wird.
7. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** der Verbrennungsmodifikator von 10 bis 30 Gew.-% Träger, von 20 bis 40 Gew.-% Isopropanol, von 20 bis 40 Gew.-% n-Butanol, von 5 bis 15 Gew.-% Carbamid und von 5 bis 15 Gew.-% Monoacetylferrocen enthält.
8. Verfahren nach Anspruch 7, **dadurch gekennzeichnet, dass** der Verbrennungsmodifikator 20 Gew.-% Träger, 30 Gew.-% Isopropanol, 30 Gew.-% n-Butanol, 10 Gew.-% Carbamid, und 10 Gew.-% Monoacetylferrocen enthält.
9. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** im Falle der Dosierung des Modifikators ins Belüftungssystem, dieser durch Sprühen dosiert wird.
10. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** von 1,8 bis 10 mL Modifikator pro 100 L Brennstoff, wie Dieselöl, oder von 5 bis 47 mL Modifikator pro 1000 kg Brennstoff für Schiffsmotoren, oder von 10 bis 100 mL Modifikator pro 1000 L flüssiger Brennstoffe, wie Masut und Schweröl, dosiert werden, und sich die angegebenen Mengen an Modifikator auf seine Zusammensetzung vor der zusätzlichen Verdünnung beziehen.
11. Verwendung des im Anspruch 1 definierten Verbrennungsmodifikators zum Steigern des Verbrennungsertrags von flüssigen und gasförmigen Brennstoffen, zum Reduzieren seines Verbrauchs, als Katalysator in Verbrennungsmotoren, und zum Reduzieren von Emissionen von unerwünschten Gasen, insbesondere Kohlenstoffmonoxid, in die Atmosphäre, sowie zum Nachverbrenen von Ruß, Abgasen und anderen in der Verbrennungskammer vorliegenden Verunreinigungen, zum Beispiel Stäuben und Substanzen vom Kohlenteer-Typ, sowie zum Reinigen der Verbrennungskammer und des Abgassystems von Ablagerungen der Rückstände.

Revendications

1. Modificateur de combustion des combustibles liquides et gazeux, tels que combustible pour les moteurs marins, gazole, essence, huile légère et lourde, mazout et autres hydrocarbures, dans des moteurs à combustion, **caractérisé en ce qu'il** contient de 10 à 30% en poids de porteur choisi parmi distillat d'hydrocarbure d'une fraction de la gamme de 180 - 380°C, de 20 à 80% en poids d'au moins un alcool aliphatique, de 5 à 15% en poids de carbamide ou de ses dérivés choisis parmi alkylurée de type $R_1R_2N(CO)NR_1R_2$, où R_1, R_2, R_3, R_4 sont identiques ou différents et sont des groupes alkyles C_1-C_6 , et de 5 à 15% en poids de monoacétylferrocène.
2. Modificateur selon la revendication 1, **caractérisé en ce qu'il** contient de 10 à 30% en poids de distillat d'hydrocarbure d'une fraction de la gamme de 180 - 380°C, de 20 à 40% en poids d'isopropanol, de 20 à 40% en poids de n-butanol, de 5 à 15% en poids de carbamide et de 5 à 15% en poids de monoacétylferrocène.
3. Modificateur selon la revendication 1, **caractérisé en ce qu'il** contient 20% en poids de distillat d'hydrocarbure d'une fraction de la gamme de 180 - 380°C, 30% en poids d'isopropanol, 30% en poids de n-butanol, 10% en poids de carbamide et 10% en poids de monoacétylferrocène.
4. Procédé de modification d'un processus de combustion des combustibles liquides et gazeux, tels que combustible pour les moteurs marins, gazole, essence, huile légère et lourde, mazout et autres hydrocarbures, dans des moteurs à combustion, **caractérisé en ce que** le modificateur de combustion contenant de 10 à 30% en poids de porteur, de 20 à 80% en poids d'au moins un alcool aliphatique, de 5 à 15% en poids de carbamide ou de ses dérivés choisis parmi alkylurée de type $R_1R_2N(CO)NR_1R_2$, où R_1, R_2, R_3, R_4 sont identiques ou différents et sont des groupes alkyles C_1-C_6 , et de 5 à 15% en poids de monoacétylferrocène, est dosé comme en outre éventuellement dilué, le diluant étant de préférence un porteur, soit à l'état liquide, directement au combustible soit à un système d'aération d'une chambre de combustion du moteur, le modificateur étant dosé comme dilué avec le porteur, de préférence

dans un rapport de 2,5 à 3,8 mL de modificateur par 1 L d'eau ou la fraction d'hydrocarbures de la gamme de 180 - 380°C.

5. Procédé selon la revendication 4, **caractérisé en ce que** le porteur est choisi parmi l'eau ou un distillat d'hydrocarbure d'une fraction de la gamme de 180 - 380°C.
6. Procédé selon la revendication 4, **caractérisé en ce que** la composition est dosée directement au combustible ou à un système d'aération d'une chambre de combustion du moteur par pompage avec de l'air à un mélange combustible fourni à la chambre de combustion du moteur.
7. Procédé selon la revendication 4, **caractérisé en ce que** le modificateur de combustion contient de 10 à 30% en poids de porteur, de 20 à 40% en poids d'isopropanol, de 20 à 40% en poids de n-butanol, de 5 à 15% en poids de carbamide et de 5 à 15% en poids de monoacétylferrocène.
8. Procédé selon la revendication 7, **caractérisé en ce que** le modificateur de combustion contient 20% en poids de porteur, 30% en poids d'isopropanol, 30% en poids de n-butanol, 10% en poids de carbamide et 10% en poids de monoacétylferrocène.
9. Procédé selon la revendication 4, **caractérisé en ce qu'**en cas de dosage du modificateur au système d'aération, il est dosé par pulvérisation.
10. Procédé selon la revendication 4, **caractérisé en ce que** de 1,8 à 10 mL de modificateur par 100 L de combustible, comme gazole, ou de 5 à 47 mL de modificateur par 1000 kg de combustible pour les moteurs marins, ou de 10 à 100 mL de modificateur par 1000 L des combustibles liquides, tels que mazout et huile lourde, est dosé, et les quantités données du modificateur se rapportent à la composition avant la dilution supplémentaire.
11. Utilisation du modificateur de combustion défini dans la revendication 1 pour augmenter un rendement de combustion des combustibles liquides et gazeux, pour réduire sa consommation, comme catalyseur dans des moteurs à combustion, et pour réduire l'émission de gaz indésirables, en particulier monoxyde de carbone, dans l'atmosphère, ainsi que pour la post-combustion du noir de carbone, des gaz d'échappement et des autres impuretés présentes dans la chambre de combustion, par exemple des poussières et des substances de type goudron de houille, ainsi que pour purifier la chambre de combustion et le système d'échappement des banques de boue.

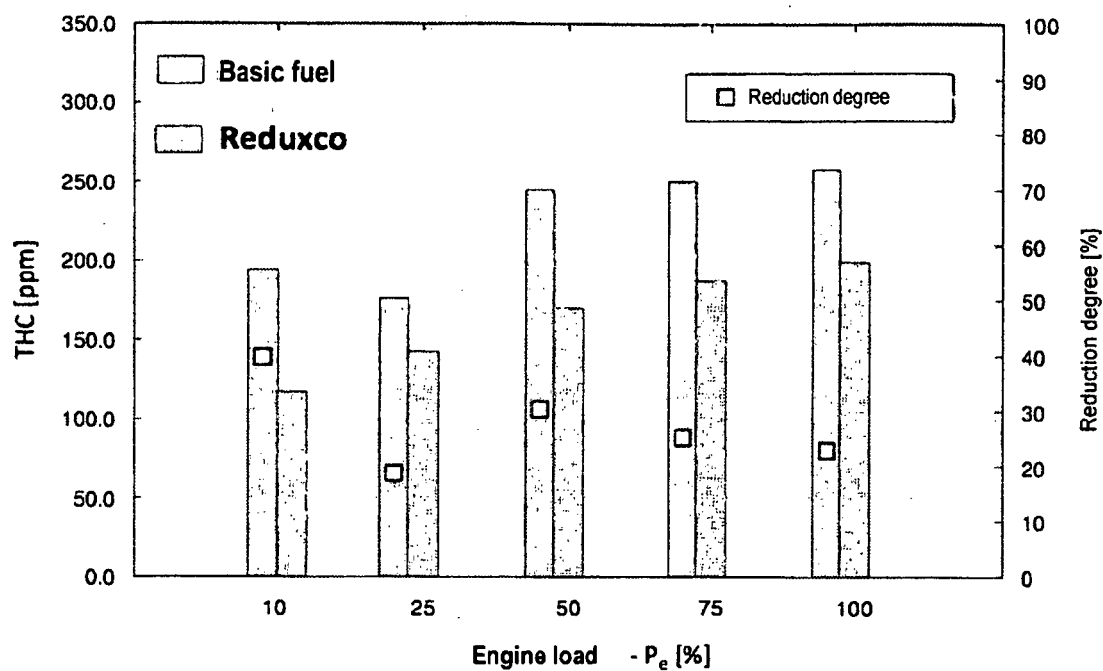


Fig. 1

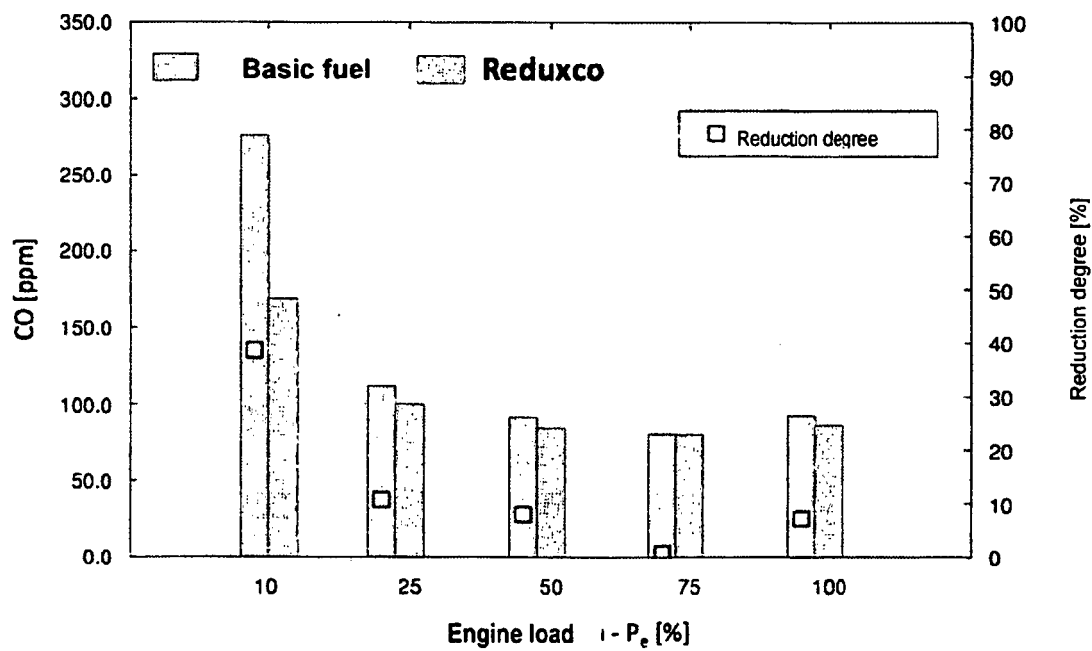


Fig. 2

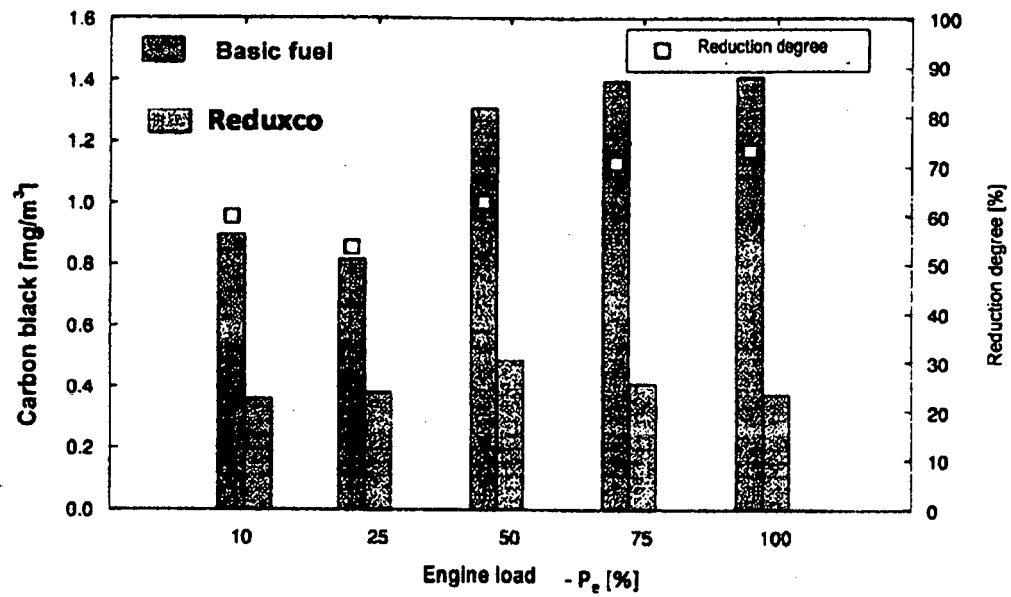


Fig. 3

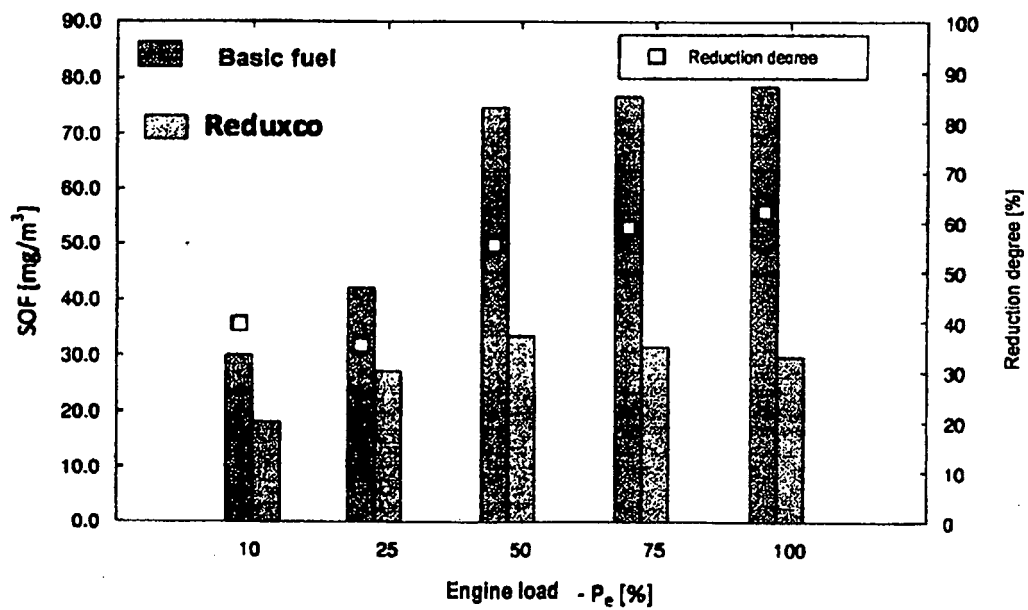


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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