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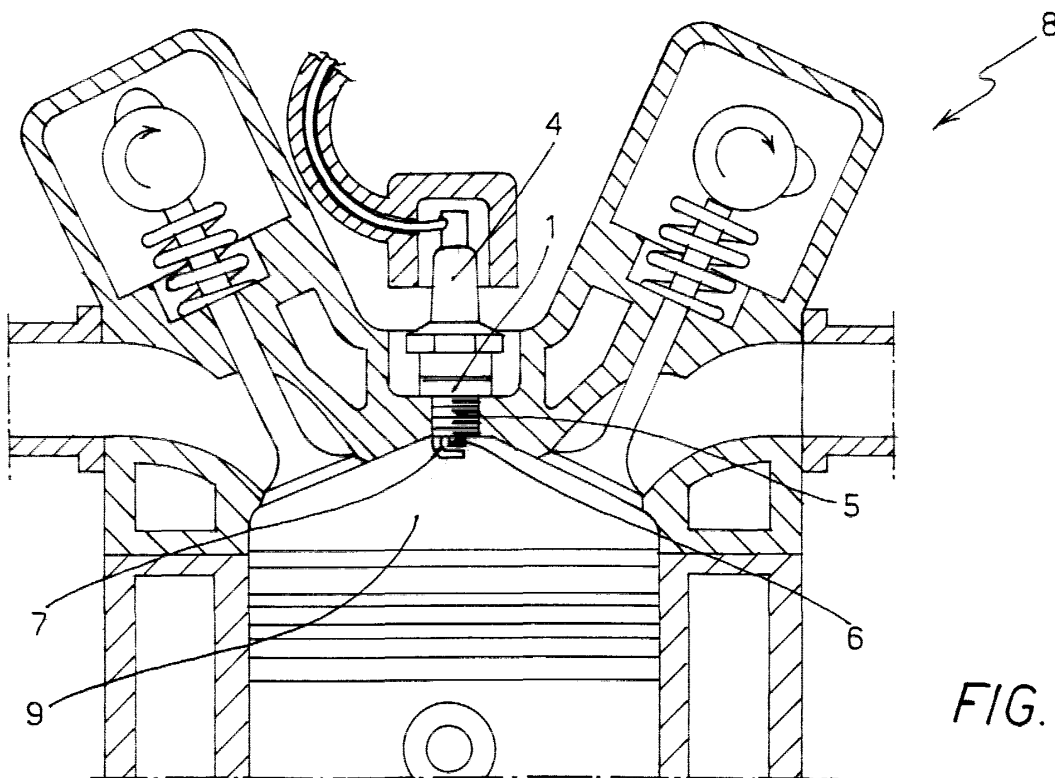
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(54) **Spark plug spacer**

(57) A spacer for spark plugs of internal combustion engines operating according to "Otto" cycle, comprising a cylindrical body provided with an axial bore (2) the inner surface of which has a thread (3) for screwing the spacer (1) onto the thread (5) of a spark plug (4), which

is then mounted on an engine (8), in order to reduce the insertion length of said spark plug (4) into the combustion chamber (9) of said engine (8), thereby reducing the compression ratio of the engine to allow changing the engine supply from premium (leaded) petrol to green (unleaded) petrol supply.



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Description

[0001] The invention concerns a spacer for spark plugs of internal combustion engines, and more particularly a spacer that can be applied to spark plugs to allow supplying with "green" (unleaded) petrol "Otto" cycle internal combustion engines designed for being supplied with "premium" (lead) petrol.

[0002] It is known that ignition of air-petrol or air-petrol-oil mixture in four- or two-stroke internal combustion engines is caused by the spark generated when the potential difference between the two mutually insulated electrodes of a spark plug is increased, at the proper instant, up to the value required to win the resistance of the intervening dielectric, consisting of the compressed mixture.

[0003] The mixture fed to the cylinder is pushed by the piston that compresses it in the cylinder head.

[0004] Of course, the higher the engine compression ratio, defined as the ratio between the overall volume of the cylinder (including the combustion chamber) and the volume of the only combustion chamber, the more compressed the mixture.

[0005] The present so-called "ecological" engines are designed with lower compression ratios if compared with old engines. Actually, present engines have a combustion chamber of greater volume than old engines, and consequently the compression ratio is lower.

[0006] It is known that combustion process in an internal combustion engine starts when the spark generated between the spark plug electrodes triggers the combustion reaction, giving rise to a flame front that propagates through the combustion chamber and encounters the fresh mixture portions at a propagation speed of some ten meters per second.

[0007] Heat generated by combustion causes a temperature and pressure increase that is communicated to the mixture portion not yet burnt.

[0008] If pressure and temperature values exceed the self-ignition values of the mixture not yet burnt, the latter is immediately ignited resulting in detonation phenomenon with consequent propagation of the flame front at a speed of the order of thousands of meters per second.

[0009] The piston, instead of receiving a gradual push, is submitted to a strong shock while the energy developed in detonation gives rise to a series of pressure waves that propagate through the combustion chamber originating the characteristic sound effect known as "knocking".

[0010] Detonation causes several inconveniences: in particular it reduces the engine power and can cause serious damages in the engine members both by a mechanical effect, due to the pressure peaks, and because of the abnormal temperatures reached.

[0011] Resistance to detonation is measured, in petrol, by the "octane number": the higher the octane number, the higher the resistance to detonation.

[0012] The octane number sensibly affects the characteristics of an engine, since power and consumption of same are strictly related with the compression ratio.

acteristics of an engine, since power and consumption of same are strictly related with the compression ratio.

[0013] The compounds used in the practice as knock suppressing additives in premium petrol are tetraethyl lead and tetramethyl lead mixed with ethylene bromide, with the addition of colouring agents for identification purposes.

[0014] During combustion, such substances form volatile compounds that, when exhausted together with the exhaust gases, are highly harmful for both the health and the environment: thus, they are absent in ecological petrol, the so-called "green" petrol.

[0015] Consequently, green (i.e. unleaded) petrol has a lower octane number and therefore it is not suitable for supplying engines originally designed for being supplied with premium petrol.

[0016] Therefore, it is an object of the present invention to solve the problem of allowing use of green petrol also for supplying engines designed for being supplied with premium petrol, without encountering the aforementioned inconveniences.

[0017] The spacer according to the present invention is suitable for use in all engines operating according to "Otto" cycle, i. e. four-stroke and two-stroke engines using spark plugs and supplied with petrol and/or petrol-oil mixture.

[0018] Another problem the invention aims to solve is to provide a spacer which is easy and cheap to manufacture and which can be mounted on all kinds of commercially available spark plugs for Otto cycle internal combustion engines.

[0019] The above and other aims of the invention are obtained with the spacer for spark plugs of internal combustion engines as claimed in the appended claims.

[0020] The present invention consists in a spacer to be applied to spark plugs of an Otto cycle internal combustion engine designed for being supplied with premium petrol, so as to decrease its compression ratio by a sufficient amount to avoid detonation when the engine is supplied with green petrol.

[0021] The spacer according to the invention has a number of advantages, among which the following ones are mentioned:

- improvement in the cold start, which is made easier by a better exploitation of the mixture volatility, with consequent reduction of deposits on spark plugs, valves and piston rings;
- reduction of lubricant dilution by unburned fuel;
- reduced consumption of lubricating oil;
- reduced operation noise;
- possibility of using the spacer in all Otto cycle engines for motor vehicles, in nautical engines, engines for agricultural use, industrial engines, etc;
- elimination of flooding phenomena, of particular effectiveness for hot start of nautical engines and jerk start engines in general.

[0022] The aforementioned aims and advantages will become more apparent from the detailed description of an embodiment of the invention, with particular reference to the accompanying drawings, in which:

- Fig. 1 is a plan view of the spark plug spacer according to the invention;
- Fig. 2 is a cross sectional view of the spacer, taken along line II-II of Fig. 1;
- Fig. 3 is a side view of the spacer according to the invention, to be screwed onto a spark plug;
- Fig. 4 is a side view of the spacer according to the invention, screwed onto a spark plug;
- Fig. 5 is a schematic view, in lateral cross-section, of an engine on which a spark plug equipped with the spacer according to the invention is mounted.

[0023] With reference to Figs. 1 to 4, spacer 1 according to the invention for spark plugs 4 of internal combustion engines operating according to Otto cycle consists in a ring nut made of steel for high speed working, of the same kind as that used for the metal body of spark plugs.

[0024] Spacer 1 is obtained by turning the external diameter, drilling in order to obtain an internal hole 2, then boring hole 2 to predispose its inner surface to the subsequent provision of a thread.

[0025] Spacer 1 is screwed onto threaded portion 5 of spark plug 4 so as to leave free an important portion of thread 5 together with central electrode 6 and mass electrode 7 of spark plug 4.

[0026] Height h of spacer 1 is defined depending on the kind of engine, since that height is the parameter defining the reduction of the insertion length of the spark plug into the combustion chamber of the engine.

[0027] Therefore, the increase in the volume of the combustion chamber, i. e. the decrease in the compression ratio of the engine, depends on height h of spacer 1.

[0028] It has been determined that height h must be in the range 2 to 8 mm, preferably 5.5 mm.

[0029] Fig. 5 shows merely by way of example a single cylinder engine 8 with combustion chamber 9.

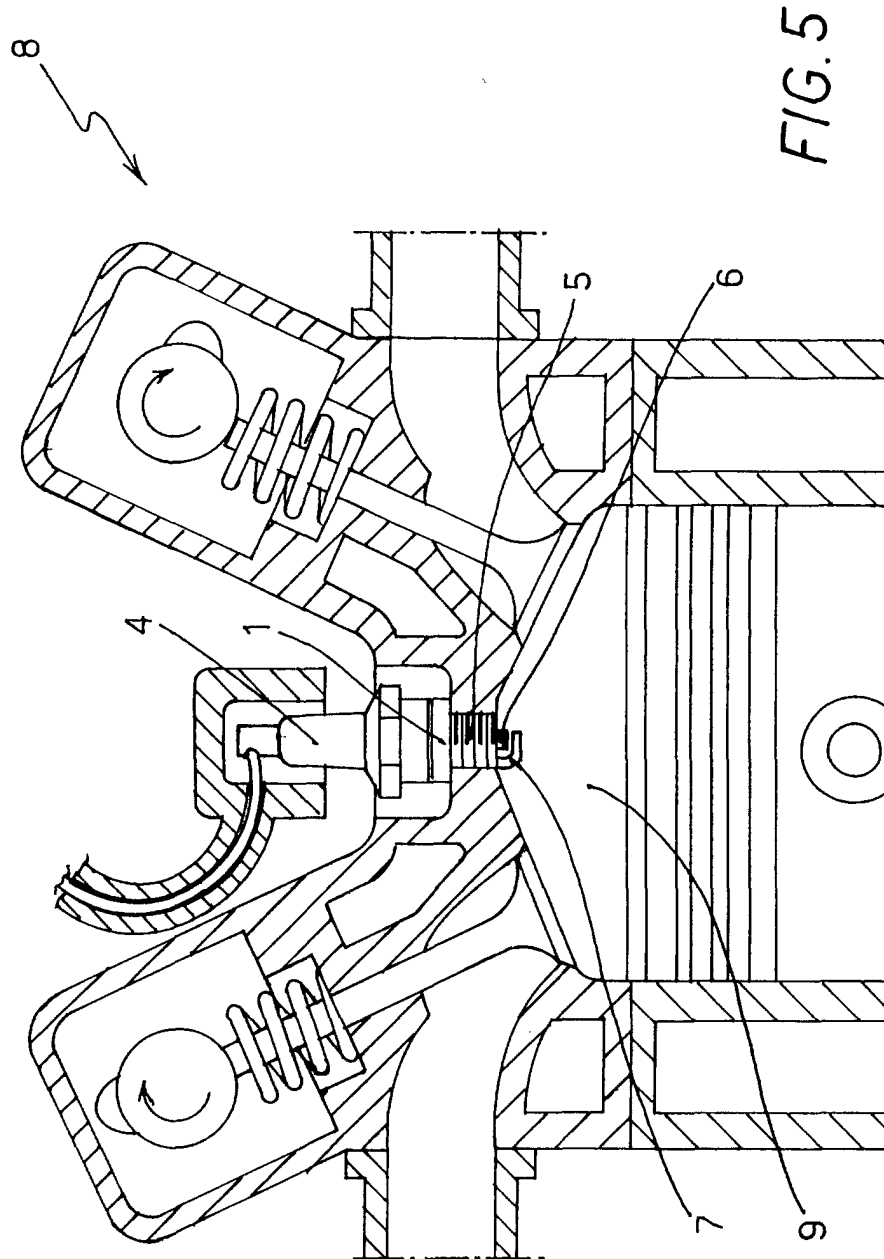
[0030] Spacer 1 is screwed onto spark plug 4, and subsequently spark plug 4 is mounted on engine 8, thereby providing for an increase of the volume of combustion chamber 9 of engine 8.

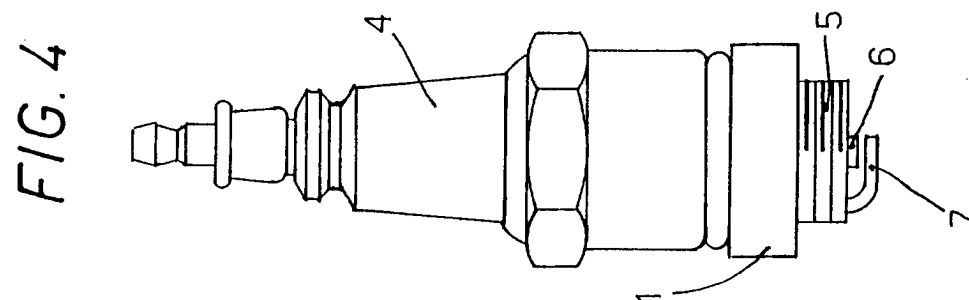
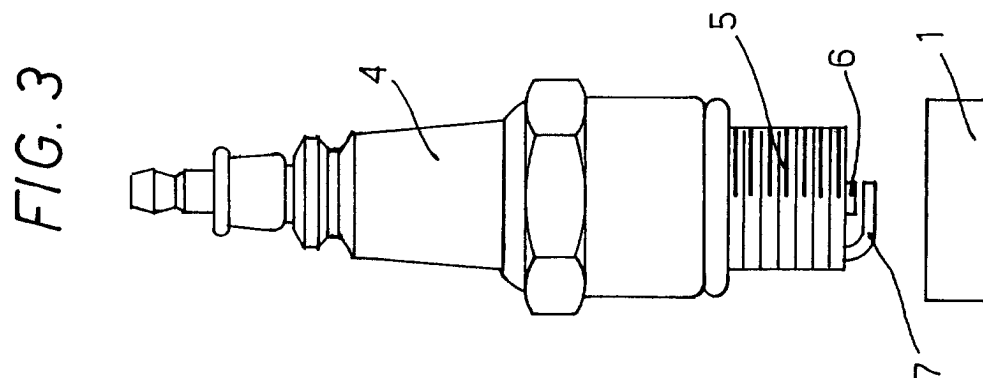
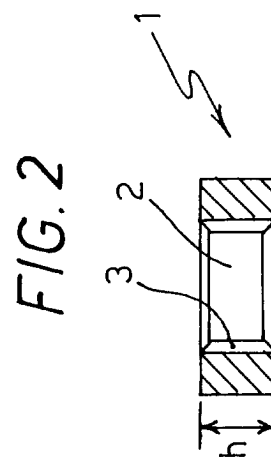
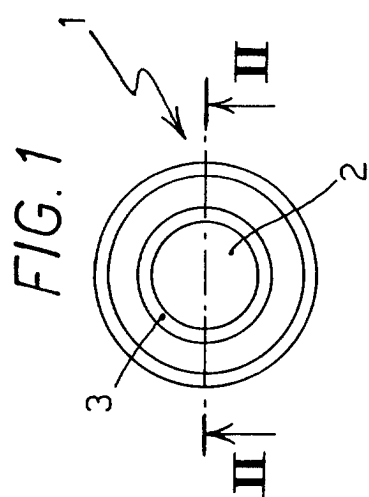
compression ratio of the engine to allow changing the engine supply from premium (leaded) petrol to green (unleaded) petrol supply.

2. A spark plug spacer according to claim 1, **characterised in that** said spacer (1) has a height (h) in the range 2 to 8 mm, preferably a height of 5.5 mm.
3. A spark plug spacer according to claim 1, **characterised in that** said spacer (1) is made of steel for high speed working, of the same type as that used for the metal body of spark plugs.
4. A spark plug for internal combustion engines operating according to "Otto" cycle, **characterised in that** it comprises a spacer (1) screwed on the thread (5) of said spark plug (4) in order to reduce the insertion length of said spark plug into the combustion chamber (9) of said engine (8) and consequently to reduce the compression ratio of the engine.

Claims

1. A spark plug spacer for spark plugs of internal combustion engines operating according to "Otto" cycle, the spacer comprising a cylindrical body provided with an axial bore (2) of which the inner surface has a thread (3) for screwing the spacer (1) onto the thread (5) of a spark plug (4), which is then mounted on an engine (8) in order to reduce the insertion length of said spark plug (4) into the combustion chamber (9) of said engine (8), thereby reducing the







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EUROPEAN SEARCH REPORT

Application Number
EP 00 83 0260

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)
X	GB 339 849 A (IMPERIAL AIRWAYS LTD) 8 January 1931 (1931-01-08) * page 2, line 25 - line 58; figures 2,3 * -----	1-4	H01T13/08
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01T
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 August 2000	Examiner Bijn, E
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 83 0260

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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09-08-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 339849	A	NONE	

EPO FORM P0459

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