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(54) **MODIFIED OTTO ENGINE WITH ONE CYLINDER**

MODIFIZIERTER OTTOMOTOR MIT EINEM ZYLINDER

MOTEUR OTTO MODIFIE A UN CYLINDRE

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(56) References cited:
WO-A1-82/02576 **US-A- 5 063 883**

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Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a method for modifying a petrol-driven, single-cylinder Otto engine, which engine comprises an engine block with a cylinder, a cylinder head, a piston disposed movably inside the cylinder, a valve arranged by the cylinder, a carburettor with a fuel nozzle and an air filter arrangement.

BACKGROUND

10 **[0002]** It is generally known that single-cylinder, petrol-driven Otto engines are major environmental culprits. Lawnmowers equipped with such engines come chiefly to mind here. Many different measures have been taken to try to reduce/eliminate the environmental pollution above all from lawnmowers. Amongst other things, lawnmowers have been developed that are operated electrically, either using a flex or rechargeable batteries. Battery-driven lawnmowers have
15 a limitation on their operating time, however, that frequently provides insufficient capacity, and they are also still relatively expensive. Although flex-operated lawnmowers indeed do not have these disadvantages, the flex signifies a practical problem and also a safety risk. It can be stated that this trend in development with regard to lawnmowers has not solved the environmental problems, since the majority of users still want to use fuel-powered lawnmowers.

[0003] To compensate for the environmental problem of fuel-driven lawnmowers to a certain extent, many large-scale users, e.g. local authorities, have gone over to using so-called environmental petrol, which is very expensive (approx. 2 euro/l). It is perceived that this extreme additional cost deters many potential users from buying this propellant.

[0004] An alternative fuel that could solve both the environmental and cost problems is ethanol, which is a bio-fuel with combustion products that are on the whole environmentally friendly and which is priced at roughly the level of normal petrol. However, major manufacturers of single-cylinder Otto engines that are used in lawnmowers state that it is not
25 possible to modify their single-cylinder Otto engines for ethanol operation, in spite of the fact that it has been known for over 100 years that Otto engines can de facto be powered by means of ethanol by using a relatively high compression ratio. Difficulties in cold starting are a general problem with ethanol as a fuel, however. It appears that this problem has contributed to the fact that development with regard to ethanol operation has led to increasingly sophisticated and thus expensive solutions. A sophisticated solution of this kind is previously known for example from US 4,522,173, in which
30 direct injection is used and the piston in the engine is formed in a special manner with the aim of optimizing combustion. US 5,063,883 shows another sophisticated solution, a compensating piston mechanism being provided in connection with the combustion space, which compensating piston mechanism provides the possibility of varying the compression ratio, with the aim of being able to use a fuel like ethanol. Furthermore, reference can be made to WO 82/02576, which shows that a microprocessor is used with a similar aim. It is perceived that such expensive solutions cannot give a
35 satisfactory solution to the problem.

BRIEF DESCRIPTION OF THE INVENTION

[0005] It has proved somewhat surprisingly to be the case that, contrary to the perception of current manufacturers,
40 it is possible to convert a petrol-driven, single-cylinder Otto engine cost-effectively to satisfactorily functioning ethanol operation, which method is characterized by the following stages:

- a) measurement of the existing minimum play (S1) between the end (5A) of the valve in its extreme position in the open state and the surface (4A; 3A) facing said end (5A) of the valve,
- 45 b) removal of the cylinder head (3),
- c) machining of the cylinder head (3), its surface (3B) facing the engine block (1) being cut and levelled by 40-100% of the existing minimum play (S1) to obtain a considerably smaller modified play (S2) between said valve end (5A) and said opposing surface (4A; 3A),
- d) checking that said modified play (S2) does not fall below a certain set value (SB),
- 50 e) fitting of the cylinder head (3),
- f) adjustment of the fuel/air admixture so that an increase in the fuel flow in relation to the air flow is achieved,

following which the engine has been modified for operation by means of a fuel containing mainly ethanol.

[0006] Thanks to the method described above, a modified single-cylinder Otto engine is obtained with which it is
55 possible to use an environmentally friendly propellant A propellant known by the designation E85, which contains 85% ethanol and 15% petrol, is particularly suitable. Tests have shown that a drastic reduction in the CO emission can be obtained. Measurements have confirmed that it is possible to obtain a CO emission as low as 0.1 % in operation under load. In addition to the environmental advantage, the cost reduction is very large compared with using so-called envi-

ronmental petrol, since the price of E85 is approx. 1/3 that of environmental petrol. Moreover, it has proved to be the case that the modified engine achieves higher efficiency, resulting in a further reduction in the fuel cost.

BRIEF DESCRIPTION OF FIGURES

[0007]

Fig. 1 shows a preferred modified single-cylinder Otto engine according to the invention in cross-section,
 Fig. 2 shows an engine according to Fig. 1 in cross-section before modification,
 Fig. 3 shows a carburettor for the engine according to Fig. 1 in cross-section,
 Fig. 3A shows a nozzle forming part of a carburettor according to Fig. 3,
 Fig. 4 shows an alternative modified single-cylinder Otto engine according to the invention in cross-section, and
 Fig. 5 shows a preferred air filter forming part of an engine according to Fig. 4.

DETAILED DESCRIPTION

[0008] Fig. 1 shows a single-cylinder Otto engine with an overhead valve according to the invention in cross-section. An engine of this kind occurs extremely commonly mainly in manual lawnmowers, the engine power normally being approx. 3 - 5.5 hp (DIN). They are also common in so-called ride-on lawnmowers¹, but the power is somewhat greater there, approx. 8-9 hp (DIN). The engine comprises an engine block 1 with a cylinder 2. Located on top of the engine block 1 is a cylinder head 3. The cylinder head 3 is provided with cooling fins 3C and an opening 3E for a spark plug. Furthermore, the cylinder head 3 is provided with through holes 3D to screw the cylinder head 3 with its downward facing surface 3B to the cylinder head 1. In the cylinder head 3 are two valve ducts 3F, located inside which are valves 5, 5'. The valves 5, 5' are provided with a valve cone 5B that is intended to interact with a valve seat 5C in the cylinder head 3. Each valve 5 is provided with a flat surface 5A at its end. Situated between the cylinder head 3 and the engine block 1 is a gasket 10. A movable piston 4, which is provided at the top with an essentially flat surface 4A, is located inside the cylinder space 2. The engine also has a cup-type carburettor 6, with a fuel nozzle 7 and a pump mechanism 9. In addition, the engine is provided with an air filter 8. One important aspect of an engine according to the invention is that the play S2 between the valve end 5A and the upper surface 4A of the piston in its upper position is extremely small, preferably approx. 0.4 - 0.6 mm. Another important aspect is that the opening 7A of the nozzle is sufficiently great to permit an adequate fuel inflow. Finally, it is a great advantage that the engine is equipped with a pump mechanism 9 to be able to force fuel into the carburettor on start-up.

[0009] In connection with the modification of a single-cylinder Otto engine provided with an overhead valve according to the invention (see Fig. 2), one starts by laying the engine bare of necessary components such as the plastic cap and tank. The spark plug is then removed so that the spark plug opening (3E) is exposed. Then the engine is turned so that the valves are placed in their most extreme position, i.e. so that both valves (5, 5') are in their most open position a set distance (A) from the cylinder wall in the cylinder head (3). At the same time, it is ensured that the piston (4) is located in its upper extreme position, which according to the example shown here means that the piston top (4A) is on a level with the upper surface (1B) of the engine block (1). In this position the distance (S1) is measured between the valve end (5A) and the piston top (4A). This distance (S1) is also equal to the depth (B) in the cylinder head (3) minus the distance (A) that the valve end (5A) projects from the cylinder wall.

[0010] The minimum distance S1 between the end 5A of the valve and the lower surface 3B of the cylinder head is normally approx. 2-3 mm, i.e. $B - A = S1$, which is approx. 2-3 mm. With the aim of obtaining the optimum compression ratio to be able to use ethanol as a propellant, a part of the material in the cylinder head 3 must now be cut so that the play S1 between the piston top 4A and the lower end 5A of the valve is reduced to a modified play S2 of between 0.4 - 1 mm (see Fig. 1). Thus the cylinder head 3 is machined by means of suitable cutting machining (e.g. milling or grinding) so that a greater part of the distance S1 is cut. More often than not, cutting of approx. 2-3 mm is required to have a remaining gap S2 between the valve ends 5A, 5A' and the piston top 4A. When the cylinder head 3 has been machined down and levelled, it is held against the engine block 1 and the engine is turned round to check that no valve end 5A, 5A' strikes against the piston top 4A. If this check turns out well, i.e. the play lies within the preferred range, the cylinder head is fitted to the engine block 1 with a new gasket 10.

[0011] Fig. 3 shows a detailed view of a carburettor according to the invention. The carburettor 6 is provided with a removable (via screw threads) fuel nozzle 7 in a known manner. The carburettor 6 is also provided with a pump mechanism 9, a so-called "primer system" 9. Fig. 3A shows a detailed view of a fuel nozzle 7 for the carburettor 6. It is shown here that the diameter d, opening 7A in the fuel nozzle has been enlarged from approx. 0.6 mm - approx. 0.7 mm, i.e. an increase in the sectional area of more than 30%, for an engine with a power of approx. 4-5 hp. In engines of a somewhat higher power, e.g. 8-9 hp, the diameter d is normally approx. 0.75 mm. The diameter of the existing opening 7A is enlarged by approx. 5-20%, more preferably approx. 10-15%, which is applicable in principle regardless of the engine's

power within the above-mentioned ranges. To ascertain the optimum enlargement, the engine is tested in operation using a number of different fuel nozzles that are provided with different-sized openings. Thus when modifying the engine it is necessary to be equipped with a set consisting of a number of fuel nozzles with openings of different sizes. When the optimum fuel nozzle opening has thus been checked, a corresponding drill is used to enlarge the existing opening 7A to the desired size.

[0012] Fig. 4 shows a so-called side valve engine, in an engine of this kind the valves 5, 5' are arranged in ducts 1A, 1'A in the engine block 1 adjacent to the piston 4. The principles of modification are the same as described above. In this case, however, the valve end 5'A does not move towards the upper surface 4A of the piston but towards a surface 3A inside the cylinder head 3. In the same way, however, it is important to optimize modification of the cylinder head 3 so that the remaining play S2 between the valve top 5'A and the opposing surface 3A remains approx. 0.5 mm. In connection with modification of a single-cylinder Otto engine provided with a supporting valve according to the invention, one starts out however by removing the cylinder head 3. Following removal of the cylinder head 3, the cylinder head 3 and engine block 1 are cleaned of residues of the old gasket 10. The valves are then positioned in their most extreme position, i.e. so that the valve 5' is in its most open position a set distance A from the cylinder wall in the cylinder head 3. In this position, it is measured (for example using a sliding calliper or dial test indicator) how great distance A is. The depth B in the top is then measured. Cutting, levelling and checking then takes place in the same way as above.

[0013] Fig. 5 shows an air filter 8 intended to be used in a carburettor 6 that is provided with a non-removable fuel nozzle. To be able to optimize the fuel/air mixture, the air filter 8 is provided with a choke element 8B that is provided with choke openings 8A. The choke openings are eight in number according to the practical example shown and consist of circular holes with a diameter of 4 mm. The total opening area through these holes is thus approx. 100 mm². This means a drastic reduction in the inlet area for feed air, since according to the original design (for petrol operation) the entire intake channel is open in principle for the flow of air, i.e. in the present case where the diameter is 34 mm an open area of between 800-900 mm². The area for the fastening screw that penetrates the centre hole (8C) in the choke element (8B) must be deducted here. It is also clear from the figure that the choke element (8B) is cup-shaped, with outer wall parts that are converging, so that the shape of a truncated cone is formed. This shape facilitates a simple, secure and tight fitting of the choke element (8B). It should be made clear that this form of modification is only a necessary alternative when the carburettor 6 is provided with a fixed non-modifiable fuel nozzle.

[0014] In comparative tests that have been carried out, surprisingly good results have been able to be demonstrated with the invention with regard to environmental effects. The results of three different tests carried out are shown below. Test 1 was carried out using Aspen environmental petrol in a new lawnmower. Tests 2 and 3 were carried out on a used lawnmower modified according to the invention. The propellant used in tests 2 and 3 is so-called E85, containing 85% ethanol and 15% petrol.

Test 1

Type of fuel		Emission				
Aspen environmental petrol			Carbon monoxide (CO percent by vol.)	Hydrocarbon (HC ppm)	Carbon dioxide (CO ₂ percent by vol.)	Oxygen (O ₂ percent by vol.)
	Idling speed		0.5	800	7.0	10.1
	Working speed	No-load engine	3.0	248	8.3	6.4
	Working speed	Engine under load	3.4	138	8.4	6.2

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Test 2

Type of fuel	Emission					
Ethanol 85% Adjustable nozzle, adjusted to low running			Carbon monoxide (CO percent by vol.)	Hydrocarbon (HC ppm)	Carbon dioxide (CO ₂ percent by vol.)	Oxygen (O ₂ percent by vol.)
	Idling speed					
	Working speed	No-load engine	0.1	787	6.0	122
	Working speed	Engine under load	0.1	603	9.0	8.2

Test 3

Type of fuel	Emission					
Ethanol 85% Adjustable nozzle, adjusted to steady running			Carbon monoxide (CO percent by vol.)	Hydrocarbon (HC ppm)	Carbon dioxide (CO ₂ percent by vol.)	Oxygen (O ₂ percent by vol.)
	Idling speed		1.8	183	8.4	7.6
	Working speed	No-load engine	2.3	168	9.0	5.9
	Working speed	Engine under load	0.1	140	9.0	8.0

[0015] The results show that a modified engine according to the invention under load, using E85 as a propellant, has exceptionally a much lower CO emission than test 1. The CO emission for an engine under load was only 0.1 % CO, while a lawnmower operated using Aspen environmental petrol emitted 3.4 % CO when under load. The other values regarding emissions are roughly comparable. The test thus shows that an engine modified according to the invention facilitates a drastic reduction in the environmentally harmful CO emission. We have chosen to focus on the emission levels for an engine under load, since a lawnmower operates de facto under load during the greater period of its operation. However, it can be noted that the CO emission is otherwise also good with regard to an engine modified according to an embodiment of the invention.

[0016] It has also proved to be the case that an engine converted in accordance with the invention can meet the high requirements that apply to obtain environmental labelling according to the Swan standard, ISO 14024. In a test carried out according to test cycle G1 in ISO 8178, by the certified testing institute MTC, the following very good exhaust values were measured for a Briggs & Stratton Intek Edge 55 OHV (without catalyzer) that had been modified according to an embodiment of the invention.

Briggs & Stratton Intek Edge 55 OHV (without catalyzer)					
	CO	HC	CO ₂	NOX	BF
	(g/kWh)	(g/kWh)	(g/kWh)	(g/kWh)	(g/kWh)
Test 1	10.42	2.28	891	7.73	437.5
Test 2	10.27	1.98	906	7.90	443.9
Mean	10.34	2.13	898	7.82	440.7

[0017] The invention is not restricted to what has been described above, but can be varied within the scope of the following claims. Thus it is perceived inter alia that the invention can also be applied in application areas other than lawnmowers, for example other garden machinery and/or agricultural machinery. Furthermore, it is perceived that the existing play S1 between critical points in the engine can be measured in ways other than those described above, for example by means of laser meters or other existing measuring devices. In certain extreme cases it is also conceivable for the cylinder head to be cut by more than 100% of S1 and to use a thicker cylinder head gasket instead as compensation.

Claims

1. Method for modifying a petrol-driven, single-cylinder Otto engine, which engine comprises an engine block (1) with a cylinder (2), a cylinder head (3), a piston (4) disposed movably inside the cylinder, two valves (5, 5') arranged by the cylinder, a carburettor (6) with a fuel nozzle (7) and an air filter arrangement (8), **characterized in that** the method comprises the following stages:

- a) measurement of the existing minimum play (S1) between the end (5A) of the valve in its extreme position in the open state and the surface (4A; 3A) facing said end (5A) of the valve,
- b) removal of the cylinder head (3),
- c) machining of the cylinder head (3), its surface (3B) facing the engine block (1) being cut and levelled by 40-100% of the existing minimum play (S1) to obtain a considerably smaller modified play (S2) between said valve end (5A) and said opposing surface (4A; 3A),
- d) checking that said modified play (S2) does not fall below a certain set value (SB),
- e) fitting of the cylinder head (3),
- f) adjustment of the fuel/air admixture so that an increase in the fuel flow in relation to the air flow is achieved,

following which the engine has been modified for operation by means of a fuel mainly containing ethanol.

2. Method according to claim 1, **characterized in that** it is ensured that said carburettor (6) is provided with a pump mechanism (9) to be able to force fuel into said carburettor (6).

3. Method according to claim 1, **characterized in that** the checking according to stage d) is carried out by placing the cylinder head on top of the engine block without a gasket to ensure that none of said valve ends (5A, 5A') strike said opposing surface (4A; 3A), following which the cylinder head (3) is fitted with a cylinder head gasket (10).

4. Method according to claim 1, **characterized in that** said carburettor (6) is provided with a removable fuel nozzle and stage f) comprises the following steps:

- 1) removal of the fuel nozzle (7),
- 2) enlargement of the opening (6A) in the fuel nozzle (7) by 5-20%, preferably 8-15%, more preferred approx. 10%,
- 3) fitting of the enlarged fuel nozzle (7).

5. Method according to claim 4, **characterized in that** between stages 1) and 2) a set of prefabricated fuel nozzles with different-sized openings is used to check the optimum opening size for the current engine before the opening (7A) in the engine's own fuel nozzle (7) is finally enlarged.

6. Method according to claim 1, **characterized in that** the carburettor is provided with a fixed non-modifiable fuel nozzle, stage f) being achieved by said air filter (8) being provided with a choke element (8A, 8B) that reduces the

existing inlet area for feed air by 70-95%, preferably 80-95%, more preferredly approx. 85-90%.

Patentansprüche

1. Verfahren zum Modifizieren eines mit Benzin betriebenen Einzylinder-Ottomotors, der einen Motorblock (1) mit einem Zylinder (2), einen Zylinderkopf (3), einen beweglich im Zylinder angeordneten Kolben (4), zwei am Zylinder angeordnete Ventile (5,5'), einen Vergaser (6) mit einer Brennstoffdüse (7) und eine Luftfilteranordnung (8) aufweist, **dadurch gekennzeichnet, dass** das Verfahren folgende Schritte aufweist:

- a) Messung des vorhandenen minimalen Spiels (S1) zwischen dem Ende (5A) des Ventils in seiner äußersten Stellung im offenen Zustand und der Oberfläche (4A;3A), die diesem Ende (5A) des Ventils gegenüberliegt,
- b) Abnehmen des Zylinderkopfes (3),
- c) Bearbeiten des Zylinderkopfes (3), wobei seine Oberfläche (3B), die dem Motorblock (1) zugewandt ist, beschnitten und um 40-100% des vorhandenen minimalen Spiels (S1) nivelliert wird, um ein merklich kleineres modifiziertes Spiel (S2) zwischen dem Ventil-Ende (5A) und der gegenüber liegenden Oberfläche (4A;3A) zu bekommen,
- d) Überprüfen, dass das modifizierte Spiel (S2) nicht unter einen bestimmten gesetzten Wert (SB) fällt,
- e) Montieren des Zylinderkopfes (3),
- f) Einstellen der Brennstoff/Luft-Beimischung derart, dass ein Anstieg des Brennstoffflusses relativ zum Luftstrom erhalten wird,

wonach der Motor für den Betrieb mittels eines hauptsächlich Äthanol enthaltenden Brennstoffes modifiziert worden ist.

2. Verfahren nach Patentanspruch 1, **dadurch gekennzeichnet, dass** sichergestellt wird, dass der Vergaser (6) mit einem Pumpen-Mechanismus (9) ausgestattet wird, der imstande ist, Brennstoff in den Vergaser (6) zu fördern.

3. Verfahren nach Patentanspruch 1, **dadurch gekennzeichnet, dass** das Überprüfen gemäß Schritt (d) so ausgeführt wird, dass der Zylinderkopf auf den Motorblock ohne eine Dichtung aufgesetzt wird, um sicherzustellen, dass keines der Ventil-Enden (5A,5A') an die gegenüber liegende Oberfläche (4A;3A) stößt, wonach der Zylinderkopf (3) mit einer Zylinderkopfdichtung (10) montiert wird.

4. Verfahren nach Patentanspruch 1, **dadurch gekennzeichnet, dass** der Vergaser (6) mit einer abnehmbaren Brennstoffdüse ausgestattet wird, und dass Schritt f) folgende Schritte umfasst:

- 1 Abnehmen der Brennstoffdüse (7),
- 2 Vergrößern der Öffnung (6A) in der Brennstoffdüse (7) um 5-20%,) vorzugsweise 8-15%, noch bevorzugter um etwa 10%,
- 3 Befestigen der vergrößerten Brennstoffdüse (7).

5. Verfahren nach Patentanspruch 4, **dadurch gekennzeichnet, dass** zwischen den Schritt 1) und 2) ein Satz vorgefertigter Brennstoffdüsen mit Öffnungen verschiedener Größe zum Überprüfen der optimalen Öffnungsgröße für den vorhandenen Motor verwendet werden, bevor die Öffnung (7A) der Motoreigenen Brennstoffdüse (7) schließlich vergrößert wird.

6. Verfahren nach Patentanspruch 1, **dadurch gekennzeichnet, dass** der Vergaser mit einer festen nicht modifizierbaren Brennstoffdüse ausgerüstet wird, wobei Schritt f) **dadurch** erreicht wird, dass das Luftfilter (8) mit einem Drosselement (8A,8B) vorgesehen wird, das die vorhandene Einlassfläche für Luftzufuhr um 70-95%, vorzugsweise 80-95%, noch bevorzugter etwa 85-90% verkleinert.

Revendications

1. Procédé pour modifier un moteur Otto à combustion interne, à cylindre unique, lequel moteur comprend un bloc moteur (1) avec un cylindre (2), une culasse (3), un piston (4) disposé de manière à être mobile à l'intérieur du cylindre, deux soupapes (5, 5') ordonnées par le cylindre, un carburateur (6) avec un gicleur de carburant (7) et un agencement de filtre à air (8), **caractérisé en ce que** le procédé comprend les étapes suivantes :

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- a) mesure du jeu minimum (S1) existant entre l'extrémité (5A) de la soupape dans sa position extrême à l'état ouvert et la surface (4A ; 3A) se trouvant en regard de ladite extrémité (5A) de la soupape,
b) démontage de la culasse (3),
c) usinage de la culasse (3), sa surface (3B) se trouvant en regard du bloc moteur (1) étant coupée et nivelée sur 40 à 100% du jeu minimum existant (S1) pour obtenir un jeu modifié (S2) considérablement plus petit entre ladite extrémité (5A) de soupape et ladite surface en regard (4A ; 3A.),
d) vérification que ledit jeu modifié (S2) ne tombe pas au-dessous d'une certaine valeur déterminée (SB),
e) mise en place de la culasse (3),
f) ajustement du mélange carburant/air de sorte qu'une augmentation du flux de carburant par rapport au flux de l'air soit obtenue,

ce dont il résulte que le moteur a été modifié pour fonctionner au moyen d'un carburant contenant principalement de l'éthanol.

2. Procédé selon la revendication 1, **caractérisé en ce qu'il** est assuré que ledit carburateur (6) est équipé d'un mécanisme de pompe (9) pour pouvoir forcer le carburant à pénétrer dans ledit carburateur (6).
3. Procédé selon la revendication 1, **caractérisé en ce que** la vérification selon l'étape d) est effectuée en plaçant la culasse sur le dessus du bloc moteur sans joint d'étanchéité pour s'assurer qu'aucune desdites extrémités (5A, 5A') de soupape ne rencontre ladite surface en regard (4A ; 3A), après quoi la culasse (3) est montée avec un joint de culasse (10).
4. Procédé selon la revendication 1, **caractérisé en ce que** ledit carburateur (6) est équipé d'un gicleur de carburant démontable et **en ce que** l'étape f) comprend les opérations suivantes :
- 1) démontage du gicleur de carburant (7),
 - 2) agrandissement de l'ouverture (6A) dans le gicleur de carburant (7) de 5 à 20%, de préférence de 8 à 15%, de manière encore plus préférée d'approximativement 10%,
 - 3) montage du gicleur de carburant agrandi (7).
5. Procédé selon la revendication 4, **caractérisé en ce qu'entre** les étapes 1) et 2), un ensemble de gicleurs de carburant préfabriqués avec des ouvertures de différentes tailles est utilisé pour vérifier la taille d'ouverture optimale pour le moteur concerné avant que l'ouverture (7A) soit définitivement agrandie dans le propre gicleur de carburant (7) du moteur.
6. Procédé selon la revendication 1, **caractérisé en ce que** le carburateur est équipé d'un gicleur de carburant fixe non modifiable, l'étape f) étant mise en oeuvre en équipant ledit filtre à air (8) d'un élément d'étranglement (8A, 8B) qui réduit la surface d'admission existante pour l'alimentation en air de 70 à 95%, de préférence de 80 à 95%, de manière encore plus préférée de 85 à 90%.

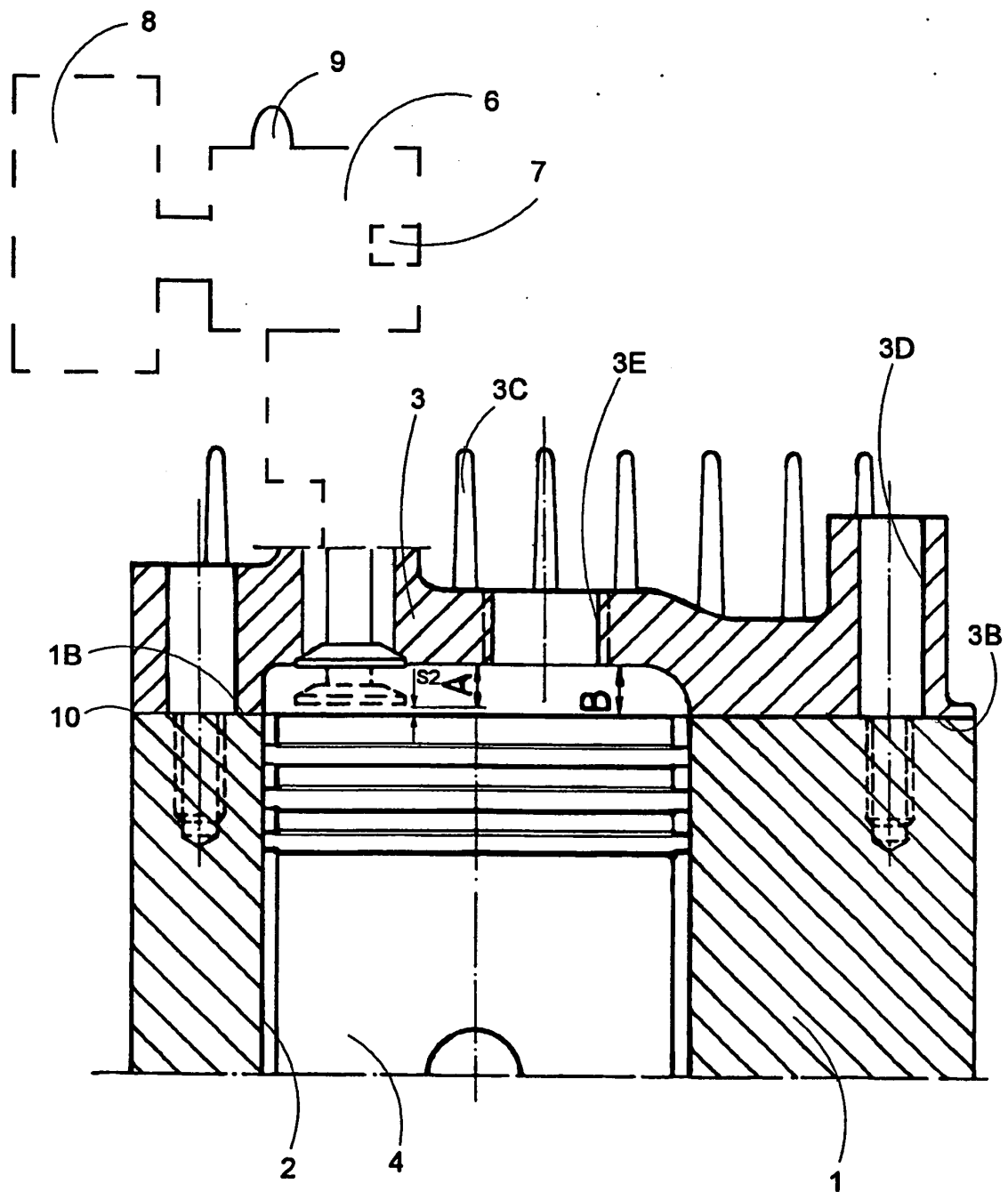


Fig. 1

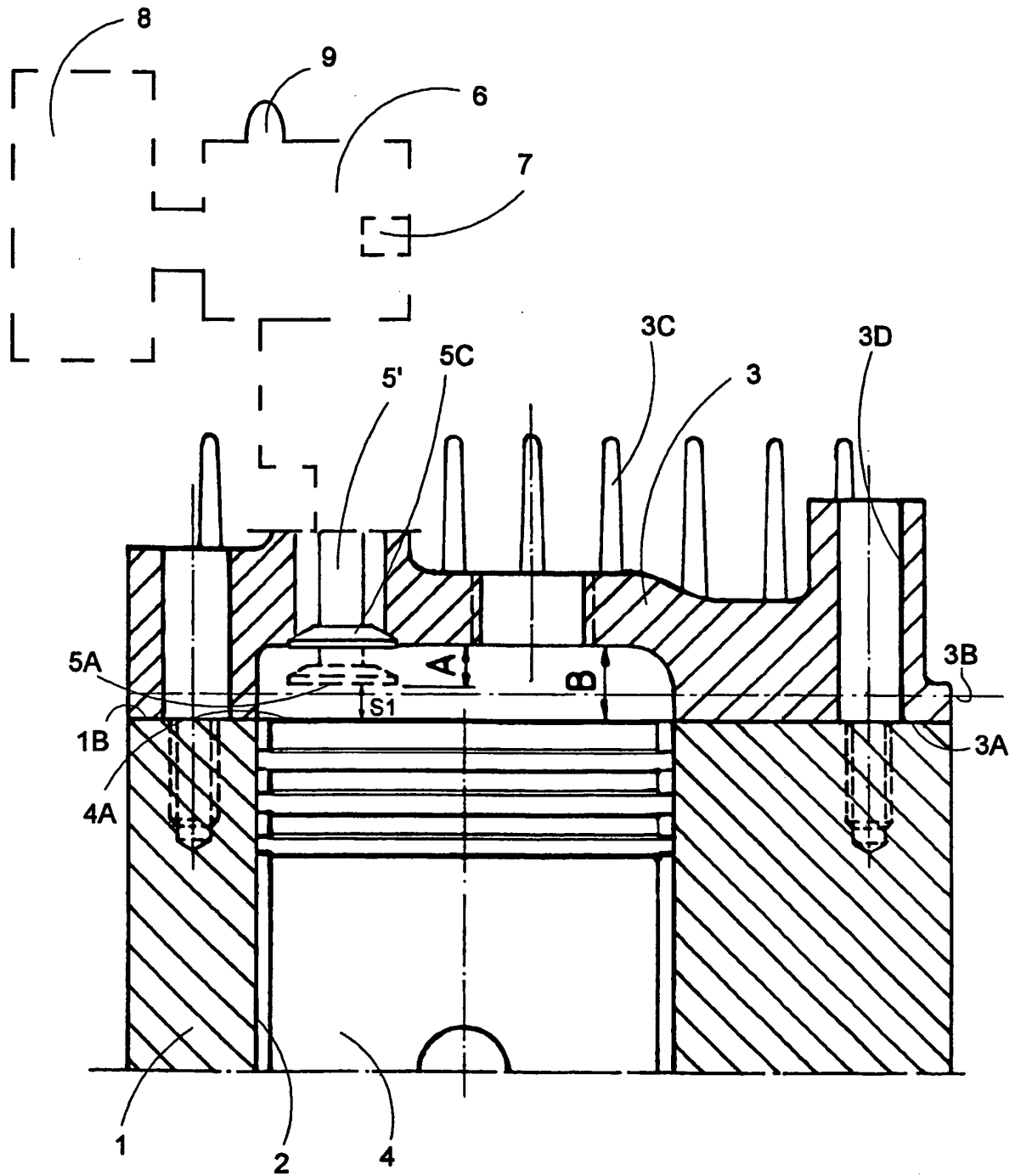


Fig. 2

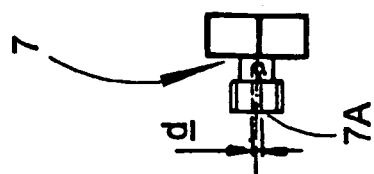
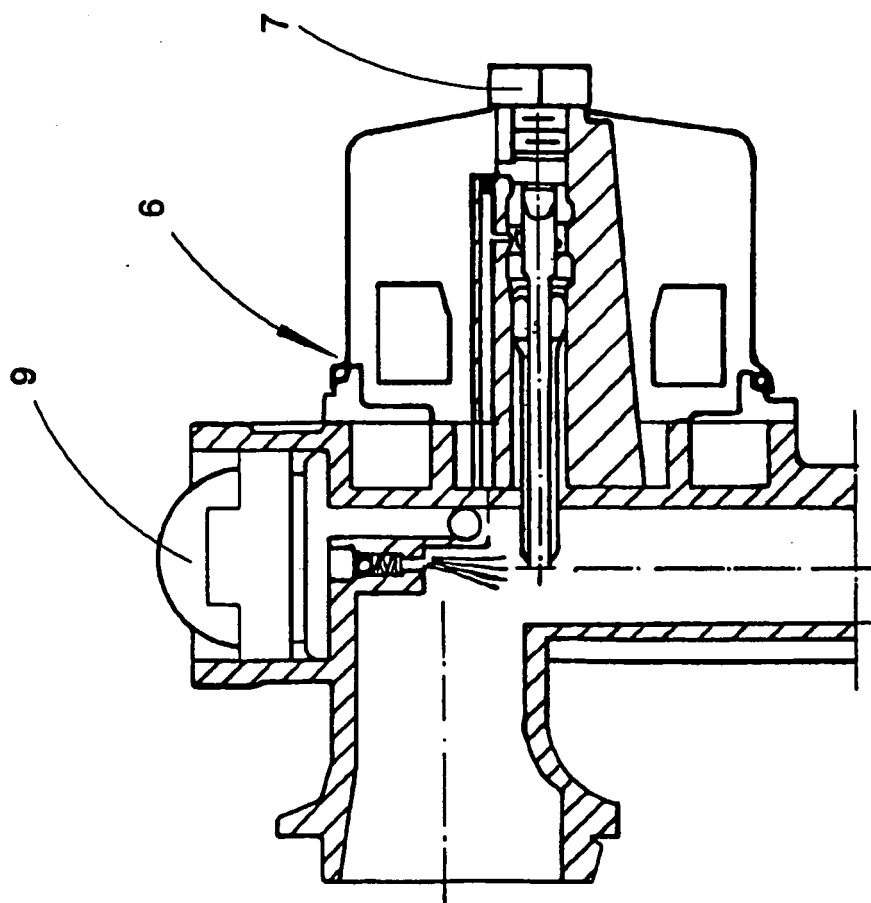


Fig. 3A

Fig. 3

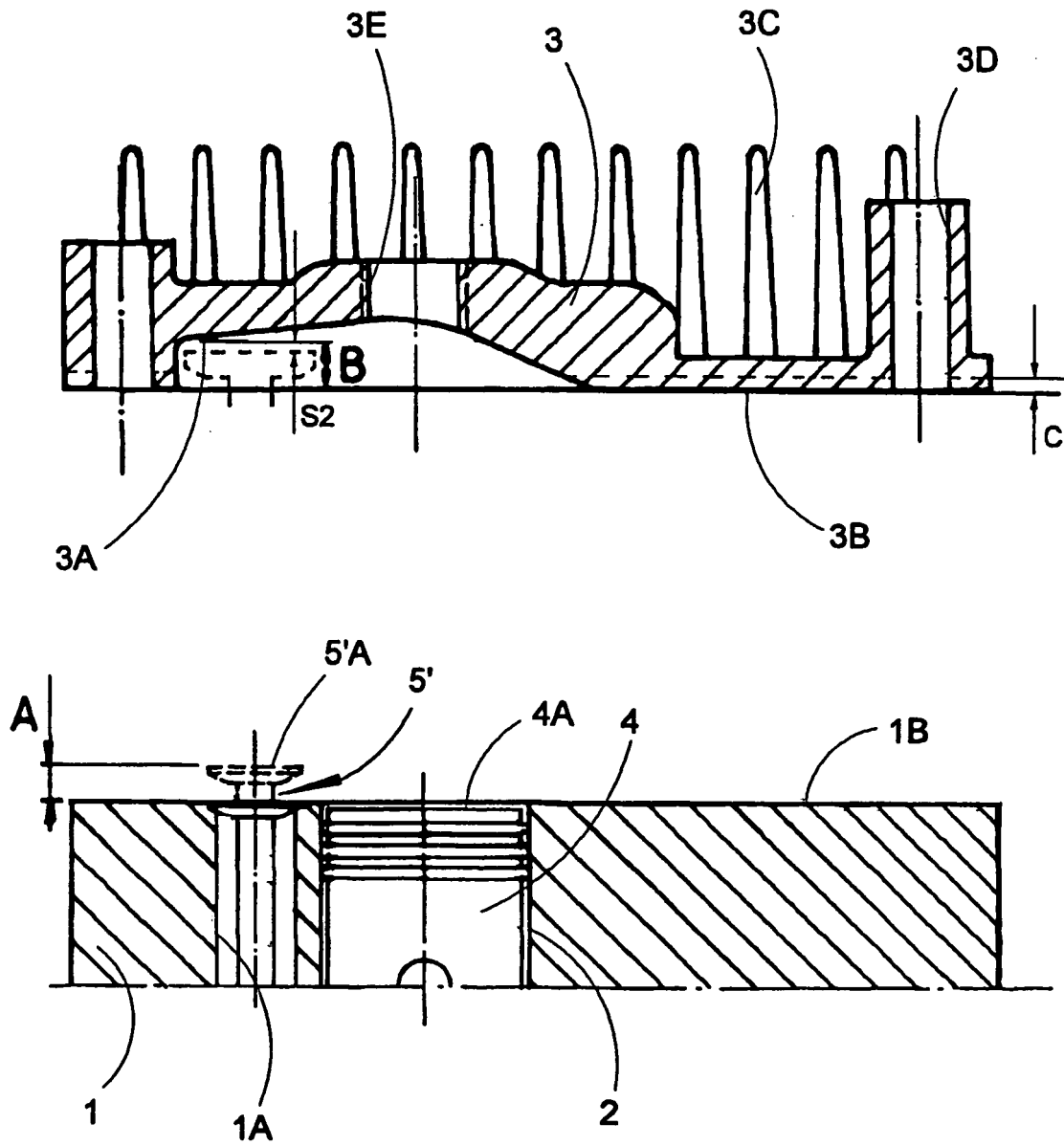


Fig. 4

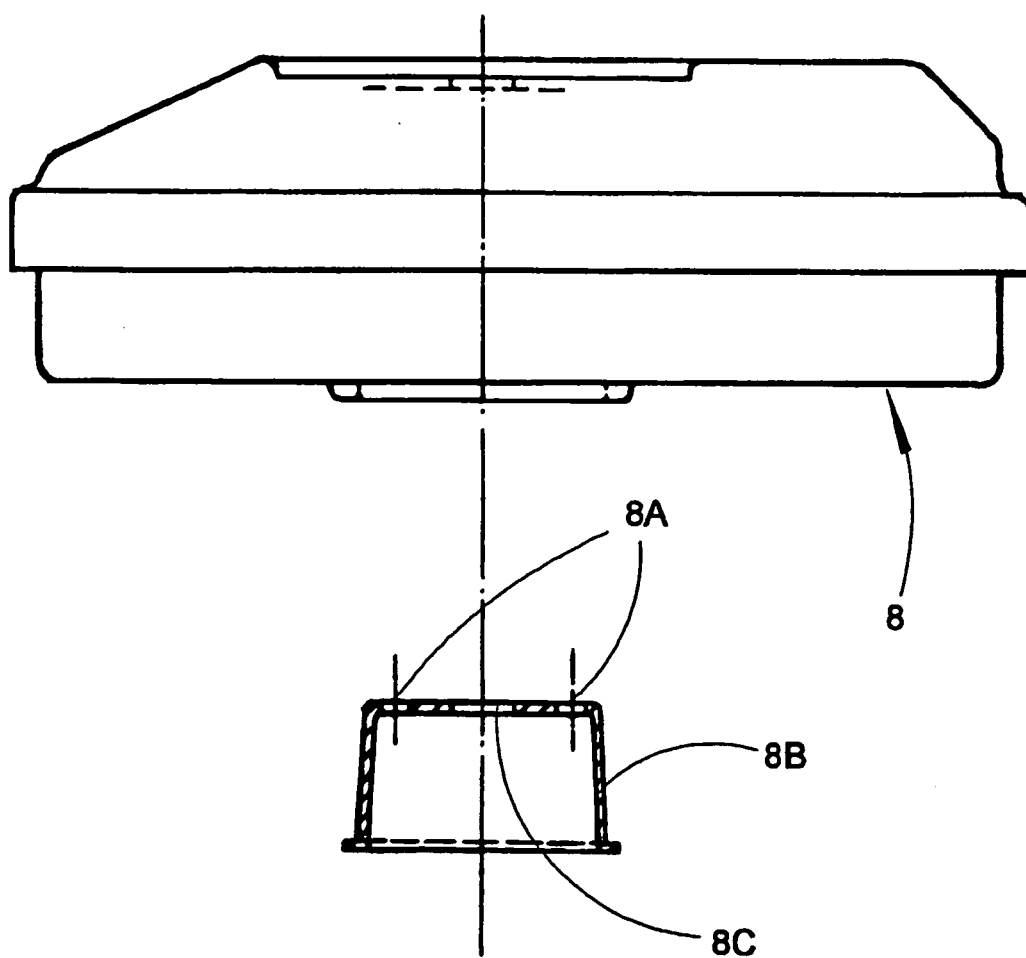


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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