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(54) **Fixing arrangement**

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Description

[0001] The invention relates to a fixing arrangement for fixing a fuel injector in a cylinder head of a combustion engine and a fuel injector.

[0002] Fuel injectors are in wide spread use, in particular for internal combustion engines where they may be arranged in order to dose fuel into an intake manifold of the internal combustion engine or directly into the combustion chamber of a cylinder of the internal combustion engine. Fuel can be supplied to the internal combustion engine by the fuel injector that comprises the fixing arrangement. The fuel injectors can be coupled to the cylinder head of the internal combustion engine in different manners.

[0003] The coupling of the fuel injectors to the cylinder heads needs to be very precise to get a correct injection angle.

[0004] DE 195 08 305 A1 discloses an injector nozzle holder in a cylinder head. The nozzle passes through a hollow screw securing it to the head or another component of the machine. The screw acts via an elastic component against a shoulder in the head, movement being limited by a stop. The elastic component can be permanently secured to a thrust ring, bearing against the nozzle shoulder, and it can consist of a sleeve-shaped compression spring, which can be integral with the ring or screw.

[0005] The object of the invention is to create a fixing arrangement for fixing a fuel injector in a cylinder head of a combustion engine which is simply to be manufactured and which facilitates a reliable and precise coupling between the fuel injector and the cylinder head of the combustion engine.

[0006] It is furthermore the object of the invention to create a fuel injector that ensures a precise dosing of fuel.

[0007] The objects are achieved by the features of the independent claim. Advantageous embodiments of the invention are given in the sub-claims.

[0008] According to a first aspect the invention is distinguished by a fixing arrangement for fixing a fuel injector being inserted into a cylinder head of a combustion engine in an inserting direction, wherein the fixing arrangement is formed as a snap-in arrangement. The fixing arrangement comprises a first tubular portion including a central longitudinal axis, comprising a snap-in recess and being designed to be rigidly coupled to the cylinder head, and a second tubular portion being designed to engage the fuel injector and to be rigidly coupled to the fuel injector. The second tubular portion comprises a snap-in projection extending away from the second tubular portion outwards in radial direction and is designed to be received by the snap-in recess of the first tubular portion to retain the second tubular portion in the first tubular portion in direction of the central longitudinal axis. This has the advantage that a fast coupling of the fuel injector in the cylinder head is possible. Furthermore, a low cost solution for the fixing arrangement is obtainable. Additionally, a simple construction of the fixing arrangement is possible which allows carrying out a fast coupling of the second tubular portion in the first tubular portion.

[0009] In an advantageous embodiment the fixing arrangement has a spring element being arranged and designed to exert a force against the inserting direction of the fuel injector. By this it is possible to obtain a defined position of the fuel injector relative to the cylinder head in axial direction which is necessary to obtain a precise injection of fuel into the combustion chamber of the internal combustion engine.

[0010] In a further advantageous embodiment one of the tubular portions comprises the spring element being arranged and designed to exert the axial force on the second tubular portion to fix the second tubular portion relative to the first tubular portion in axial direction. By this a simple construction of the spring element is obtainable which allows fixing the second tubular portion relative to the first tubular portion in axial direction.

[0011] In a further advantageous embodiment the spring element is arranged at an axial end of the second tubular portion, the axial end of the second tubular portion being arranged to face the cylinder head. This allows arranging and fixing the spring element between the second tubular portion and the cylinder head.

[0012] In a further advantageous embodiment the spring element is a leaf spring extending in axial direction. This has the advantage that the spring element can be simple realized.

[0013] In a further advantageous embodiment the spring element is designed to be supported on the cylinder head. This has the advantage that it is possible that only one further support for the spring element on the fixing arrangement is needed.

[0014] In a further advantageous embodiment the spring element is formed in one part with the second tubular portion. This has the advantage that no further elements for coupling the spring element to the second tubular portion are necessary.

[0015] In a further advantageous embodiment the second tubular portion has a plurality of spring elements distributed circumferentially over the second tubular portion. By this a homogenous distribution of the force for fixing the second tubular portion in axial direction relative to the second tubular portion is possible.

[0016] In a further advantageous embodiment the spring elements are distributed axial symmetrically over the second tubular portion relative to the central longitudinal axis. By this a very homogenous distribution of the force for fixing the second tubular portion in axial direction relative to the second tubular portion is possible.

[0017] In a further advantageous embodiment the second tubular portion has a plurality of snap-in projections distributed circumferentially over the second tubular portion. This has the advantage that a homogenous distribution of the force for retaining the second tubular portion in the first tubular portion is possible.

[0018] In a further advantageous embodiment the snap-in projections are distributed axial symmetrically

over the second tubular portion relative to the central longitudinal axis. This has the advantage that a very homogenous distribution of the force for retaining the second tubular portion in the first tubular portion is possible.

[0019] In a further advantageous embodiment the snap-in recess of the first tubular portion is designed as a through-hole. By this the fuel can be easily removed from the cylinder head by a simple tool, which can engage the fixing arrangement from outside thereby disengaging the projections from the snap-in recesses of the first tubular portion.

[0020] According to a second aspect the invention is distinguished by a fuel injector comprising a fixing arrangement.

[0021] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings. These are as follows:

Figure 1 an internal combustion engine in a schematic view,

Figure 2 a fuel injector with a fixing arrangement and a cylinder head in a longitudinal section view,

Figure 3 the fuel injector with the fixing arrangement and the cylinder head in a top view,

Figure 4 the fuel injector with the fixing arrangement and the cylinder head in a longitudinal section view along line IV-IV' of figure 3,

Figure 5 the fuel injector with the fixing arrangement and the cylinder head in a longitudinal section view along line V-V' of figure 3, and

Figure 6 the fuel injector with the fixing arrangement and a cylinder head in a cross sectional view along line VI-VI' of figure 5.

[0022] Elements of the same design and function that occur in different illustrations are identified by the same reference character.

[0023] Figure 1 shows an internal combustion engine 22, with an intake air tract 10, a motor block 12, a cylinder head 14 and an exhaust gas tract 16. In the motor block 12 a combustion chamber 20 is arranged.

[0024] The cylinder head 14 comprises a fuel injector 18 and a sparking plug 19. A fixing arrangement 30 enables the fixing of the fuel injector 18 to the cylinder head 14 of the combustion engine 22.

[0025] The fuel injector 18 (figures 2) comprises an injector coupling portion 24 and a valve assembly 27. The injector coupling portion 24 is designed to be coupled to a highpressure fuel chamber of the internal combustion engine 22, the fuel is stored under high pressure, for example, under the pressure of about 200 bar in the case of a gasoline engine or of about 2,000 bar in the case of a diesel engine.

[0026] Furthermore, the injector coupling portion 24 is designed to be coupled to an electrical supply to actuate a not shown actuator unit of the fuel injector 18.

[0027] The valve assembly 27 comprises a valve body 26 with a central longitudinal axis L and a not shown cavity which is axially led through the valve body 26. The valve assembly 27 further comprises a not shown valve needle taken in the cavity of the valve body 26. On a free end of the valve assembly 27 an injection nozzle 28 is formed which is closed or opened by an axial movement of the valve needle. In a closing position a fuel flow through the injection nozzle 28 is prevented. In an opening position fuel can flow through the injection nozzle 28 into the combustion chamber 20 of the internal combustion engine 22.

[0028] As can be best seen in figure 2 the fixing arrangement 30 comprises a first tubular portion 32 and a second tubular portion 34 extending in the direction of the central longitudinal axis L.

[0029] The first tubular portion 32 has a snap-in recess 50 which is carried out as a through-hole.

[0030] At an axial end 54 of the first tubular portion 32, facing away from the cylinder head 14, a chamfer 52 is arranged. The chamfer 52 is designed to be arranged circumferentially over the first tubular portion 32.

[0031] The first tubular portion 32 has an outer surface 56 by which the first tubular portion 32 is coupled to the cylinder head 14. The cylinder head 14 has a recess 15, which engages the first tubular portion 32 partially. This enables a rigid coupling of the first tubular portion 32 to the cylinder head 14. The coupling between the cylinder head 14 and the first tubular portion 32 can be carried out by brazing, but it may also be done by another adequate coupling method as press-fitting or welding.

[0032] The second tubular portion 34 of the fixing arrangement 30 has an inner surface 40 in which the fuel injector 18 with an outer surface 42 is arranged. The second tubular portion 34 of the fixing arrangement 30 engages the fuel injector 18 and is rigidly coupled to the fuel injector 18. The coupling between the fuel injector 18 and the fixing arrangement 30 is preferably carried out by welding.

[0033] The fixing arrangement 30 further comprises snap-in projections 36 which are in one piece with the second tubular portion 34. The snap-in projections 36 are bent away from the second tubular portion 34 and extend outwards in radial direction from the tubular portion 32.

[0034] The second tubular portion 34 comprises a first axial end 44 which faces away from the cylinder head 14, and a second axial end 46, which is facing the cylinder head 14.

[0035] At the second axial end 46 of the second tubular portion 44, a spring element 38 is arranged. The spring element 38 is designed as a leaf spring which extends in axial direction. The spring element 38 is supported on the cylinder head 14 and is designed to exert an axial force F on the second tubular portion 34 to fix the second

tubular portion 34 relative to the first tubular portion 32 in axial direction. The spring element 38 is formed in one part with the second tubular portion 34. By this, it is possible to form the second tubular portion 34 and the spring element 38 in a way that no further coupling elements between the spring element 38 and the second tubular portion 34 are necessary.

[0036] As can be seen in figure 3, the second tubular portion 34 of the shown embodiment of the fixing arrangement 30 has three snap-in projections 36 and two spring elements 38.

[0037] The three snap-in projections 36 are arranged in an angular distance of 120° to each other, thereby being distributed axial-symmetrically over the second tubular portion 34 relative to the central longitudinal axis L. The number of the snap-in projections 36 may vary but it is preferred that the snap-in projections 36 are distributed axial-symmetrically over the circumference of the second tubular portion 34 to get a very homogenous distribution of the retaining force between the first tubular portion 32 and the second tubular portion 34.

[0038] The two spring elements 38 of the second tubular portion 34 are opposing each other relative to the central longitudinal axis L. The number of spring elements 38 may differ from three but it is preferred that the spring elements 38 are distributed axial-symmetrically over the circumference of the second tubular portion 34 relative to the central longitudinal axis L as to obtain a very homogenous distribution of the axial forces F on the second tubular portion 34 to fix the second tubular portion 34 relative to the first tubular portion 32 in axial direction.

[0039] In the following, the assembly and disassembly of the fuel injector 18, the fixing arrangement 30 and the cylinder head 14 of the combustion engine 22 will be described in detail:

[0040] For assembling the cylinder head 14 with the first tubular portion 32, the first tubular portion 32 is inserted into the recess 15 of the cylinder head 14. As the outer surface 56 of the first tubular portion 32 is in contact with the cylinder head 14, a fixed coupling of the cylinder head 14 to the first tubular portion 32 is enabled, preferably by brazing, press-fitting or welding.

[0041] The fuel injector is inserted into the second tubular portion 34. By this, the outer surface 42 of the fuel injector 18 is in contact with the inner surface 40 of the second tubular portion 34, thereby enabling a fixed coupling of the second tubular portion 34 to the fuel injector 18, preferably by welding.

[0042] The fuel injector 18 with the second tubular portion 34 is inserted in an inserting direction D into the first tubular portion 32 with the assistance of the chamfer 52, which engages the snap-in projections 36 of the second tubular portion 34. The snap-in projections 36 are moving in direction of the inserting direction D until the snap-in projections 36 come into engagement with the snap-in recesses 50 of the first tubular portion 32. During the axial movement of the second tubular portion 34 in the inserting direction D relative to the first tubular portion 32, the spring element 38 is compressed as it is in contact with the cylinder head 14. When the snap-in projections 36 come into engagement with the snap-in recesses 50, the spring elements 38 are compressed and exert the axial force F on the second tubular portion 34. Thereby, the second tubular portion 34 is fixed relative to the first tubular portion 32 in axial direction.

[0043] If the fuel injector 18 shall be removed from the cylinder head 14, a tool can be inserted into the snap-in recesses 50 which are formed as through-holes and the snap-in projections 36 can be moved into radial direction towards the central longitudinal axis L until the snap-in projections 36 disengage with the snap-in recesses 50 in the first tubular portion 32. Subsequently, the second tubular portion 34 with the injector 18 can be pulled out from the first tubular portion 32 in the cylinder head 14.

[0044] As has been shown, the construction of the fixing arrangement 30 as a snap-in arrangement allows a fast and simple assembly and disassembly of the fuel injector 18 and the cylinder head 14.

Claims

1. Fixing arrangement (30) for fixing a fuel injector (18) being inserted into a cylinder head (14) of a combustion engine (22) in an inserting direction (D), wherein the fixing arrangement (30) is formed as a snap-in arrangement and comprises

- a first tubular portion (32) including a central longitudinal axis (L), comprising a snap-in recess (50) and being designed to be rigidly coupled to the cylinder head (14), and
- a second tubular portion (34) being designed to engage the fuel injector (18),

characterized in that

the second tubular portion (34) is rigidly coupled to the fuel injector (18) and comprises a snap-in projection (36) extending away from the second tubular portion (34) outwards in radial direction and being designed to be received by the snap-in recess (50) of the first tubular portion (32) to retain the second tubular portion (34) in the first tubular portion (32) in direction of the central longitudinal axis (L).

2. Fixing arrangement (30) in accordance with claim 1, with a spring element (38) being arranged and designed to exert a force (F) against the inserting direction (D) of the fuel injector (18).

3. Fixing arrangement (30) in accordance with claim 1 or 2, with one of the tubular portions (32, 34) comprising the spring element (38) being arranged and designed to exert the axial force (F) on the second tubular portion (34) to fix the second tubular portion (34) relative to the first tubular portion (32) in axial

direction.

4. Fixing arrangement (30) in accordance with one of the preceding claims, with the spring element (38) being arranged at an axial end (46) of the second tubular portion (34), the axial end (46) of the second tubular portion (34) being arranged to face the cylinder head (14).

5. Fixing arrangement (30) in accordance with one of the preceding claims, with the spring element (38) being a leaf spring extending in axial direction.

6. Fixing arrangement (30) in accordance with one of the preceding claims, with the spring element (38) being designed to be supported on the cylinder head (14).

7. Fixing arrangement (30) in accordance with one of the preceding claims, with the spring element (38) being formed in one part with the second tubular portion (34).

8. Fixing arrangement (30) in accordance with one of the preceding claims, the second tubular portion (34) having a plurality of spring elements (38) distributed circumferentially over the second tubular portion (34).

9. Fixing arrangement (30) in accordance with claim 8, the spring elements (38) being distributed axial symmetrically over the second tubular portion (34) relative to the central longitudinal axis (L).

10. Fixing arrangement (30) in accordance with one of the preceding claims, the second tubular portion (34) having a plurality of snap-in projections (36) distributed circumferentially over the second tubular portion (34).

11. Fixing arrangement (30) in accordance with claim 10, the snap-in projections (36) being distributed axial symmetrically over the second tubular portion (34) relative to the central longitudinal axis (L).

12. Fixing arrangement (30) in accordance with one of the preceding claims, the snap-in recess (50) of the first tubular portion (32) is designed as a throughhole.

13. Fuel injector (18) comprising a fixing arrangement (30) according to one of the preceding claims.

Patentansprüche

1. Befestigungsanordnung (30) zum Befestigen eines Kraftstoffinjektors (18), der in einen Zylinderkopf (14) einer Brennkraftmaschine (22) in einer Einsetzrichtung (D) eingesetzt wird, während die Befestigungsanordnung (30) ausgebildet ist als eine Einschnappanordnung und umfasst:

einen ersten rohrförmigen Bereich (32), der eine zentrale Längsachse (L) aufweist, eine Einschnappaussparung (50) umfasst und gestaltet ist, um starr an den Zylinderkopf (14) gekoppelt zu werden, und
einen zweiten rohrförmigen Bereich (34), der gestaltet ist, um mit dem Kraftstoffinjektor (18) in Eingriff zu stehen,

dadurch gekennzeichnet, dass
der zweite rohrförmige Bereich (34) starr an den Kraftstoffinjektor (18) gekoppelt ist und einen Einschnappvorsprung (36) aufweist, der sich von dem zweiten rohrförmigen Bereich (34) auswärts in radialer Richtung weg erstreckt und der gestaltet ist, um in der Einschnappaussparung (50) des ersten rohrförmigen Bereichs (32) aufgenommen zu werden, um den zweiten rohrförmigen Bereich (34) in dem ersten rohrförmigen Bereich (32) in Richtung der zentralen Längsachse (L) zu halten.

2. Befestigungsanordnung (30) gemäß Anspruch 1, mit einem Federelement (38), das angeordnet und gestaltet ist, um eine Kraft (F) entgegen der Einsetzrichtung (D) des Kraftstoffinjektors (18) auszuüben.

3. Befestigungsanordnung (30) gemäß Anspruch 1 oder 2, während einer der rohrförmigen Bereiche (32, 34) das Federelement (38) umfasst, das angeordnet und gestaltet ist, um die axiale Kraft (F) auf den zweiten rohrförmigen Bereich (34) auszuüben, um den zweiten rohrförmigen Bereich (34) im Bezug auf den ersten rohrförmigen Bereich (32) in axialer Richtung zu befestigen.

4. Befestigungsanordnung (30) gemäß einem der vorhergehenden Ansprüche, während das Federelement (38) an einem axialen Ende (46) des zweiten rohrförmigen Bereichs (34) angeordnet ist, wobei das axiale Ende (46) des zweiten rohrförmigen Bereichs angeordnet ist, um dem Zylinderkopf (14) gegenüberzustehen.

5. Befestigungsanordnung (30) gemäß einem der vorhergehenden Ansprüche, während das Federelement (38) eine Blattfeder ist, die sich in axialer Richtung erstreckt.

6. Befestigungsanordnung (30) gemäß einem der vorhergehenden Ansprüche, während das Federelement (38) gestaltet ist, um auf dem Zylinderkopf (14) unterstützt zu werden.

7. Befestigungsanordnung (30) gemäß einem der vorhergehenden Ansprüche, während das Federelement (38) einteilig mit dem zweiten rohrförmigen Bereich (34) ausgebildet ist.

8. Befestigungsanordnung (30) gemäß einem der vorhergehenden Ansprüche, während der zweiten rohrförmige Bereich (34) eine Mehrzahl an Federelementen (38) aufweist, die umfänglich über den zweiten rohrförmigen Bereich (34) verteilt sind.

9. Befestigungsanordnung (30) gemäß Anspruch 8, während die Federelemente (38) axial symmetrisch über den zweiten rohrförmigen Bereich (34) relativ zu der zentralen Längsachse (L) verteilt sind.

10. Befestigungsanordnung (30) gemäß einem der vorhergehenden Ansprüche, während der zweite rohrförmige Bereich (34) eine Mehrzahl an Einschnappvorsprüngen (36) aufweist, die umfänglich über den zweiten rohrförmigen Bereich (34) verteilt sind.

11. Befestigungsanordnung (30) gemäß Anspruch 10, während die Einschnappvorsprünge (36) axial symmetrisch über den zweiten rohrförmigen Bereich (34) relativ zu der zentralen Längsachse (L) verteilt sind.

12. Befestigungsanordnung (30) gemäß einem der vorhergehenden Ansprüche, während die Einschnappaussparung (50) des ersten rohrförmigen Bereichs (32) als eine Durchgangsbohrung gestaltet ist.

13. Kraftstoffinjektor (18) umfassend eine Befestigungsanordnung (30) gemäß einem der vorhergehenden Ansprüche.

Revendications

1. dispositif de fixation (30) destiné à fixer un injecteur de carburant (18) devant être inséré dans une tête de cylindre (14) d'un moteur à combustion (22) dans une direction d'insertion (D), dans lequel le dispositif de fixation (30) a la forme d'un dispositif encliquetable et comprend

- une première portion tubulaire (32) comportant un axe central longitudinal (L) comprenant un évidement encliquetable (50) et conçue pour être couplée de façon rigide à la tête de cylindre (14), et
- une seconde portion tubulaire (34) conçue pour venir en prise avec l'injecteur de carburant (18),

caractérisé en ce que
la seconde portion tubulaire (34) est couplée de façon rigide à l'injecteur de carburant (18) et comprend une protubérance encliquetable (36) s'éloignant de la seconde portion tubulaire (34) vers l'extérieur dans la direction radiale et conçue pour être insérée dans l'évidement encliquetable (50) de la première portion tubulaire (32), afin de maintenir la seconde portion tubulaire (34) dans la première portion tubulaire (32) dans la direction de l'axe central longitudinal (L).

2. Dispositif de fixation (30) selon la revendication 1, comportant un élément de type ressort (38) disposé et conçu pour exercer une force (F) à l'encontre de la direction d'insertion (D) de l'injecteur de carburant (18).

3. Dispositif de fixation (30) selon la revendication 1 ou la revendication 2, dont l'une des portions tubulaires (32, 34) comprenant l'élément de type ressort (38) est disposée et conçue pour exercer la force axiale (F) sur la seconde portion tubulaire (34), afin de fixer dans la direction axiale la seconde portion tubulaire (34) par rapport à la première portion tubulaire (32).

4. Dispositif de fixation (30) selon l'une quelconque des revendications précédentes, dans lequel l'élément de type ressort (38) est disposé au niveau d'une extrémité axiale (46) de la seconde portion tubulaire (34), l'extrémité axiale (46) de la seconde portion tubulaire (34) étant disposée de manière à faire face à la tête de cylindre (14).

5. Dispositif de fixation (30) selon l'une quelconque des revendications précédentes, dans lequel l'élément de type ressort (38) est un ressort à lames s'étendant dans la direction axiale.

6. Dispositif de fixation (30) selon l'une quelconque des revendications précédentes, dans lequel l'élément de type ressort (38) est conçu pour reposer sur la tête de cylindre (14).

7. Dispositif de fixation (30) selon l'une quelconque des revendications précédentes, dans lequel l'élément de type ressort (38) est formé d'un seul tenant avec la seconde portion tubulaire (34).

8. Dispositif de fixation (30) selon l'une quelconque des revendications précédentes, dans lequel la seconde portion tubulaire (34) comporte une pluralité d'éléments de type ressorts (38) répartis sur la circonférence de la seconde portion tubulaire (34).

9. Dispositif de fixation (30) selon la revendication 8, dans lequel les éléments de type ressort (38) sont répartis sur la seconde portion tubulaire (34) selon une symétrie axiale par rapport à l'axe central longitudinal (L).

10. Dispositif de fixation (30) selon l'une quelconque des

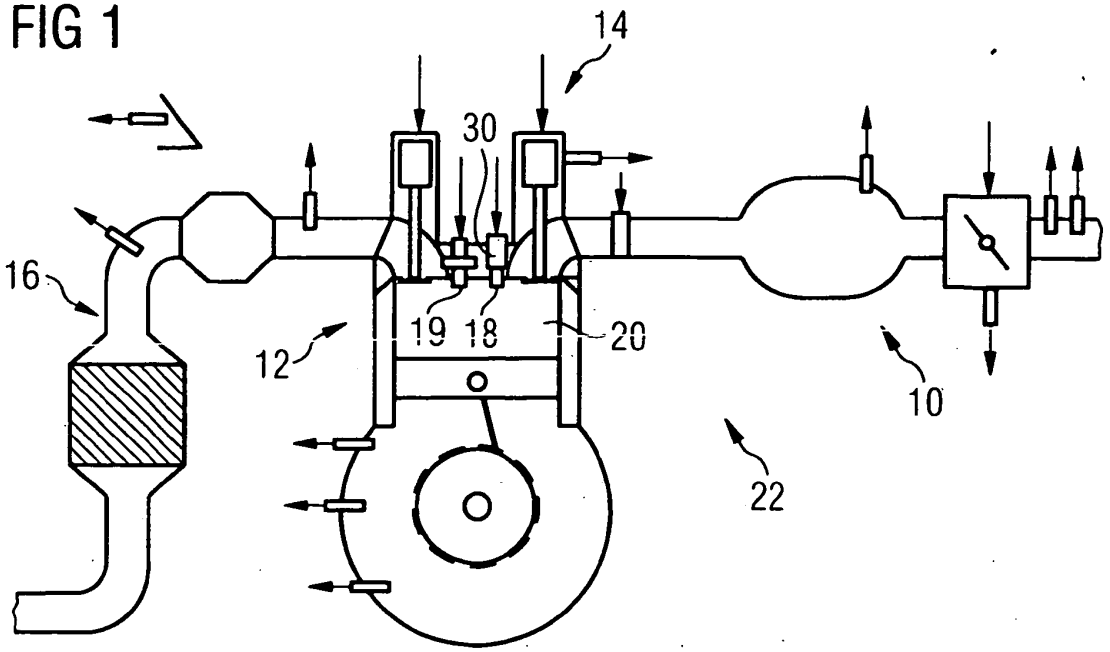
revendications précédentes, dans lequel la seconde portion tubulaire (34) comporte une pluralité de protubérances encliquetables (36) réparties sur la circonférence de la seconde portion tubulaire (34).

11. Dispositif de fixation (30) selon la revendication 10, dans lequel les projections encliquetables (36) sont réparties sur la seconde portion tubulaire (34) selon une symétrie axiale par rapport à l'axe central longitudinal (L).

12. Dispositif de fixation (30) selon l'une quelconque des revendications précédentes, dans lequel l'évidement encliquetable (50) de la première portion tubulaire (32) est conçu sous la forme d'un trou traversant.

13. Injecteur de carburant (18) comprenant un dispositif de fixation (30) selon l'une quelconque des revendications précédentes.

FIG 1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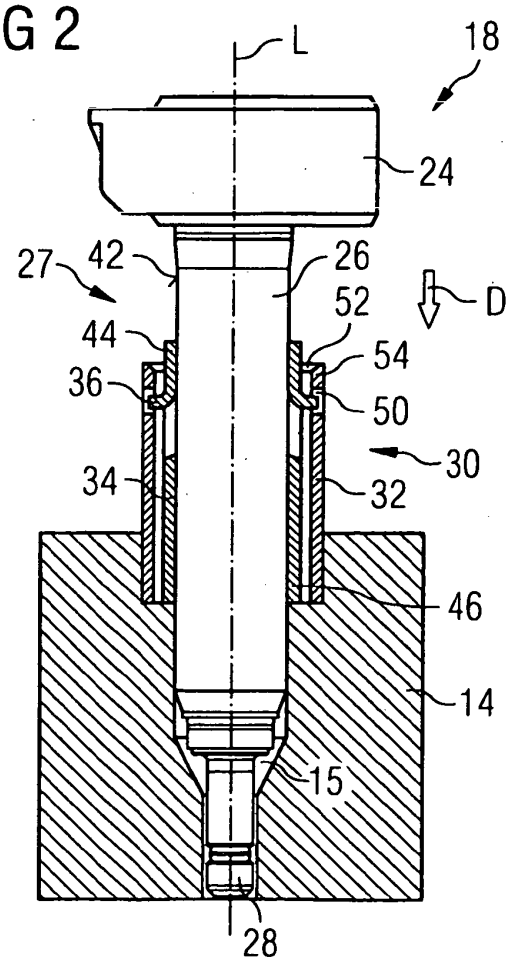
22

FIG 2


L
18
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D
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36
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32
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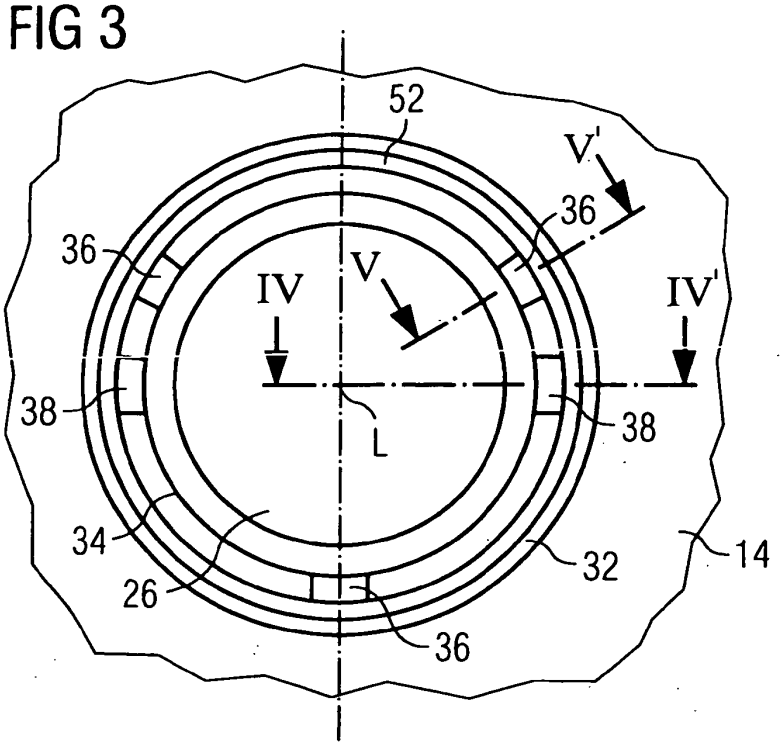
14
15
28

FIG 3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IV
V
IV'
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34
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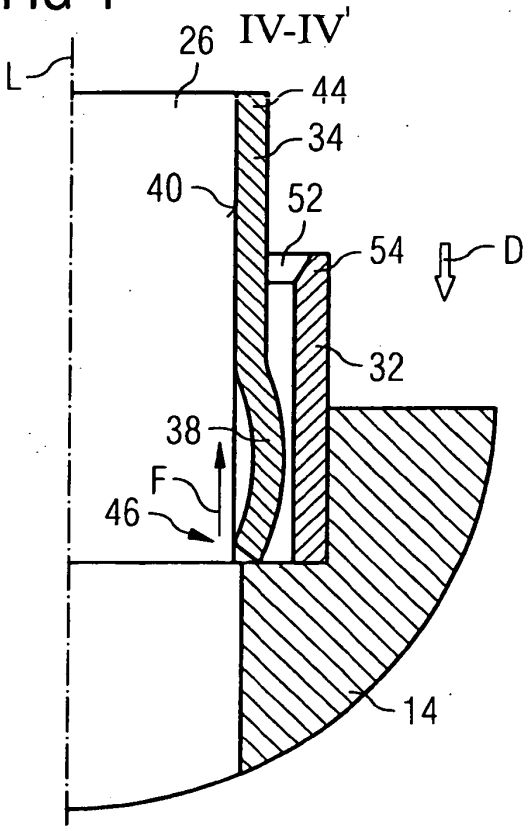
14
26
36

FIG 4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IV-IV'
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52
54
D
32
38
F
46
14

FIG 5

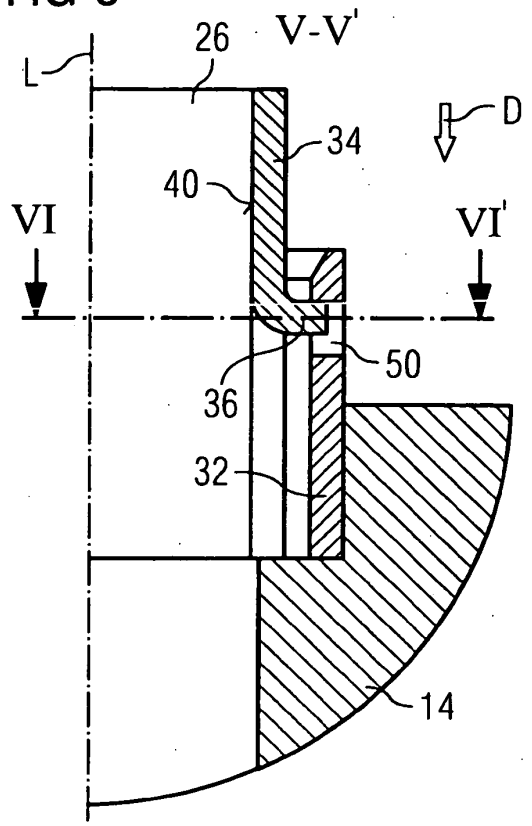
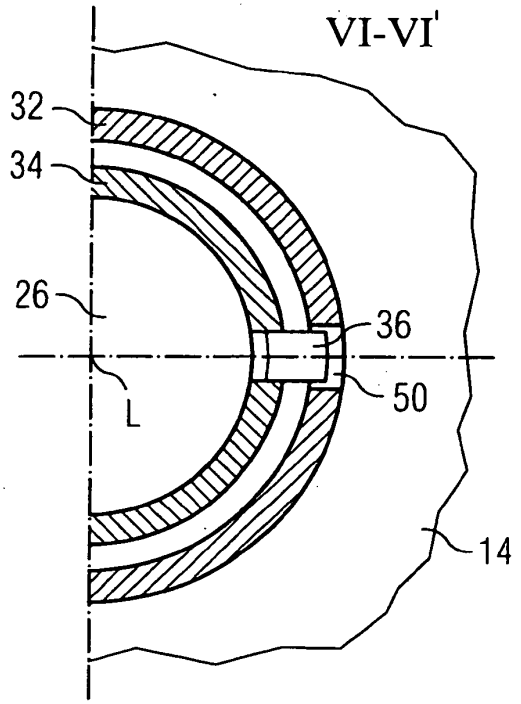


FIG 6



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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