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

(11) **EP 1 884 657 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
15.07.2009 Bulletin 2009/29

(51) Int Cl.:
F02M 61/14 *(2006.01)*

(21) Application number: **06016348.2**

(22) Date of filing: **04.08.2006**

(54) **Fixing device for fixing a fuel injector in a cylinder head of a combustion engine**

Befestigungsvorrichtung zur Befestigung eines Brennstoffeinspritzventils an einem Zylinderkopf einer Brennkraftmaschine

Dispositif de fixation d'un injecteur de carburant sur une culasse de moteur à combustion interne

(84) Designated Contracting States:
DE FR IT

(43) Date of publication of application:
06.02.2008 Bulletin 2008/06

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EP 1 884 657 B1

Description

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

[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 device. 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 103 56 856 A1 uncovers an injector comprising a clamping device to be mounted in a cylinder head. The clamping device comprises a clamping claw which engages on the top part of the injector and presses the bottom portion of the injector against a sealing surface of the cylinder head. An injector sleeve is slid onto the injector housing. The clamping claw rests against the upper end of the injector sleeve such that the lines of force are deflected from the clamping claw to a nozzle clamping nut located at the bottom via the injector sleeve.

[0005] The object of the invention is to create a fixing device 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] Additionally, the object of the invention is to create a force introduction arrangement to ensure the precise fixing of the fuel injector in the cylinder head of the combustion engine.

[0008] The objects are achieved by the features of the independent claims. Advantageous embodiments of the invention are given in the dependent claims.

[0009] According to a first aspect the invention is distinguished by a fixing device for fixing a fuel injector in a cylinder head of a combustion engine, comprising a tubular portion including a central longitudinal axis, the tubular portion being designed to engage the fuel injector and to be rigidly coupled to the fuel injector, and projections being formed in one piece with the tubular portion and being bent away to extend from tubular portion outwards in radial direction. The projections comprise at least two force receiving areas and are arranged and designed to receive a retaining force in the force receiving areas. The retaining force is acting in the direction of the central longitudinal axis to retain the fuel injector in the cylinder head, two of the force receiving areas are substantially opposing each other radially relative to the central longitudinal axis, and the projections are formed to follow directly the tubular portion in the direction of the retaining force. Recesses in the tubular portion are formed by bending the projections away from the tubular portion.

[0010] This has the advantage that the fixing device has a high robustness against mechanical stress, in particular the projections have a high robustness against permanent retaining forces. Furthermore, the fixing device is highly flexible in particular in radial direction due to the recesses in the tubular portion caused by bending the projections away from the tubular portion. As the projections are formed to follow directly the tubular portion in the direction of the retaining force the force introduction via the force receiving areas into the projections causes only a small mechanical stress to the projections.

[0011] In an advantageous embodiment of the invention the tubular portion comprises a first axial end and a second axial end which are designed to be completely attachable to the fuel injector. This has the advantage that it is possible to use the complete first axial end and the complete second axial end for coupling the fixing device with the injector. In particular it is possible to weld the fixing device at the axial ends to the injector. By this it is possible to obtain a firm coupling of the fixing device to the fuel injector.

[0012] In a further advantageous embodiment of the invention at least one of the first axial end and the second axial end is circumferentially closed. By this it is possible to obtain a very good coupling of the fixing device to the fuel injector over the whole circumference of the fuel injector via the axial ends of the fixing device. In particular it is possible to couple the fixing device to the fuel injector welding the axial ends of the fixing device to the fuel injector.

[0013] According to a second aspect the invention is distinguished by a fuel injector comprising a fixing device.

[0014] According to a further aspect the invention is distinguished by a force introduction arrangement comprising a fuel injector and a force exerting device which is arranged and designed to exert the retaining force to the force receiving areas.

[0015] In this respect it is advantageous if the force exerting device is a spring. By this it is possible to exert the retaining force to the force receiving areas by a simple structured element.

[0016] 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 in a perspective view,

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

Figure 4 the fixing arrangement in a first embodiment in a perspective view,

Figure 5 the fixing arrangement in a second embodiment in a perspective view, and

Figure 6 a part of the fuel injector and the fixing arrangement with a force exerting device in a perspective view.

[0017] Elements of the same design and function that occur in different illustrations are identified by the same reference character.

[0018] 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.

[0019] The cylinder head 14 comprises a fuel injector 18 and a sparking plug 19. A fixing device 30 enables the fixing of the fuel injector 18 to the cylinder head 14 of the combustion engine 22.

[0020] The fuel injector 18 (figures 2 and 3) 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.

[0021] 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.

[0022] 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.

[0023] As can be best seen in the figures 4 and 5 the fixing device 30 comprises a tubular portion 32 extending in the direction of the central longitudinal axis L. The tubular portion 32 of the fixing device 30 has an inner surface 40 in which the fuel injector 18 with an outer surface 42 is arranged. The tubular portion 32 of the fixing device 30 engages the fuel injector 18 and is rigidly coupled to the fuel injector 18.

[0024] The coupling between the fuel injector 18 and the fixing device 30 can be realized by welding, but it may also be carried out by another adequate coupling method.

[0025] The fixing device 30 further comprises projections 36 which are in one piece with the tubular portion 32. The projections 36 are bent away from the tubular portion 32 and extend outwards in radial direction from the tubular portion 32. The projections 36 have force receiving areas 38. A retaining force F can be applied to the force receiving areas 38 of the projections 36 to fix the fuel injector 18 in a recess 15 of the cylinder head 14 (figure 3). The projections 36 follow the tubular portion 32 directly in the direction of the retaining force F.

[0026] Additionally, the fixing device 30 comprises a protrusion 48 being in one piece with the tubular portion 32. The protrusion 48 extends outwards in radial direction from the tubular portion 32. It is designed to serve as an orientation element to define the relative angular position of the fuel injector 18 relative to the cylinder head 14 during the assembly of the fuel injector 18 and the fixing device 30 with the cylinder head 14.

[0027] Figure 4 shows a first embodiment of the fixing device 30 with a first axial end 44 and a second axial end 46. Furthermore, the fixing device 30 has two circumferential ends 56 extending between the first axial end 44 and the second axial end 46. As the fixing device 30 has a gap 60 between the two circumferential ends 56 the axial ends 44, 46 of the fixing device 30 are open in circumferential direction. As they are formed continuously over a large extension in circumferential direction it is possible to attach the first axial end 44 as well as the second axial end 46 in one piece to the fuel injector 18. Therefore, a good coupling of the tubular portion 32 to the fuel injector 18 may be obtained, for preferably by applying a single weld seam between the outer surface 42 of the fuel injector 18 and each of the axial ends 44, 46 of the fixing device 30.

[0028] The tubular portion 32 further comprises recesses 50 by bending the projections 36 relative to the tubular portion 32. The recesses 50 enable a high flexibility of the fixing device 30 in particular in the radial direction. This high flexibility is preferred in order to obtain a good coupling of the fixing device 30 to the fuel injector 18.

[0029] In the second embodiment of the fixing device 30 shown in figure 5 the first axial end 44 and the second axial end 46 of the fixing device 30 are circumferentially closed. With this it is possible to rigidly fix the fixing device 32 to the fuel injector 18 over the whole circumference of the fuel injector 18 via the axial ends 44, 46. This enables a very strong coupling between the fuel injector 18 and the fixing device 30. The tubular portion 42 of figure 5 comprises joint elements 58 so that the first axial end 44 and the second axial end 46 are circumferentially closed. By this it is possible to obtain a good rigid coupling between the circumferential ends 56 of the tubular portion 32 by simple means.

[0030] Figure 6 shows a force introduction arrangement 52 with a section of the fuel injector 18 and a force exerting device 54. For a permanent fixing of the fuel injector 18 in the cylinder head 14 the force exerting device 54 is arranged to exert the retaining force F to the force receiving areas 38 of the fixing device 30. Prefer-

ably the force exerting device 54 is a fork spring with two arms 70. The force exerting device 54 is firmly coupled to the cylinder head 14 by a screw 72 thereby enabling an exertion of the retaining force F from the two arms 70 of the force exerting device 54 to the force receiving areas 38 of the fixing device 30.

[0031] In the following, the assembly of the fuel injector 18 and the fixing device 30 and the fixing of the fuel injector 18 in the cylinder head 14 of the combustion engine 22 will be described:

[0032] For assembling the fuel injector 18 the fuel injector 18 is inserted into the fixing device 30. The fixing device 30 is clamped together. By this the first axial end 44 and the second axial end 46 of the tubular portion 32 are in contact with the outer surface 42 of the fuel injector 18 thereby enabling a fixed coupling of the fixing device 30 to the fuel injector 18 preferably by welding.

[0033] The fuel injector 18 with the fixing device 30 is inserted into the recess 15 of the cylinder head 14 with the support of the protrusion 48 which allows orienting the fuel injector 18 relative to the cylinder head 14. Additionally, the force exerting device 54 is arranged in a way that the two arms 70 of the force exerting device 54 are in contact with the projections 36. Consequently, the retaining force F from the two arms 70 of the force exerting device 54 is transmitted to the force receiving areas 38 of the fixing device 30. By this the fuel injector 18 can be fixed in a secure manner in the recess 15 of the cylinder head 14 even if large forces exert on the fuel injector 18 in opposite direction to the retaining force F.

[0034] As the projections 36 directly follow the tubular portion 32 in the direction of the retaining force F the fixing device 30 is very robust against mechanical stress in particular in the area between the bent projections 36 and the tubular portion 32. By this a high lifetime of the fixing device 30 can be obtained.

Claims

1. Fixing device (30) for fixing a fuel injector (18) in a cylinder head (14) of a combustion engine (22), comprising

   - a tubular portion (32) including a central longitudinal axis (L), the tubular portion (32) being designed to engage the fuel injector (18) and to be rigidly coupled to the fuel injector (18), and
   - projections (36) being formed in one piece with the tubular portion (32) and being bent away to extend from the tubular portion (32) outwards in radial direction, the projections (36) comprising at least two force receiving areas (38) and being arranged and designed to receive a retaining force (F) in the force receiving areas (38), the retaining force (F) acting in the direction of the central longitudinal axis (L) to retain the fuel injector (18) in the cylinder head (14), two of the force receiving areas (38) substantially opposing each other radially relative to the central longitudinal axis (L), and the projections (36) being formed to directly follow the tubular portion (32) in the direction of the retaining force (F),

   characterized in recesses (50) in the tubular portion (32) being formed by bending the projections (36) away from the tubular portion (32).

2. Fixing device (30) in accordance with claim 1, with the tubular portion (32) comprising a first axial end (44) and a second axial end (46) being designed to be completely attachable to the fuel injector (18).

3. Fixing device (30) in accordance with claim 2, with at least one of the first axial end (44) and the second axial end (46) being circumferentially closed.

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

5. Force introduction arrangement (52) comprising a fuel injector (18) according to claim 4 and a force exerting device (54) being arranged and designed to exert the retaining force (F) to the force receiving areas (38).

6. Force introduction arrangement (52) according to claim 5, with the force exerting device (54) being a spring.

Patentansprüche

1. Befestigungsvorrichtung (30) zum Befestigen eines Kraftstoffinjektors (18) in einem Zylinderkopf (14) einer Brennkraftmaschine (22), umfassend
   einen eine mittlere Längsachse (L) aufweisenden rohrförmigen Bereich (32), der gestaltet ist, um mit dem Kraftstoffinjektor (18) in Eingriff zu gelangen und fest mit dem Kraftstoffinjektor (18) verbunden zu sein, und
   in einem Stück mit dem rohrförmigen Bereich (32) ausgebildete Vorsprünge (36), die weggebogen sind, um sich auswärts in radialer Richtung von dem rohrförmigen Bereich (32) zu erstrecken, während die Vorsprünge (36) mindestens zwei kraftaufnehmende Bereiche (38) umfassen und angeordnet sowie gestaltet sind, um eine Haltekraft (F) in den kraftaufnehmenden Bereichen (38) aufzunehmen, wobei die Haltekraft (F) in Richtung der mittleren Längsachse (L) wirkt, um den Kraftstoffinjektor (18) in dem Zylinderkopf (14) zu halten, während zwei der kraftaufnehmenden Bereiche (38) sich radial in Bezug auf die mittlere Längsachse (L) im Wesentlichen gegenüberliegen, und die Vorsprünge (36) ausgebildet sind, um direkt dem rohrförmigen Bereich (32) in

Richtung der Haltekraft (F) zu folgen,
gekennzeichnet durch Ausnehmungen (50) in dem rohrförmigen Bereich (32), die **durch** Biegen der Vorsprünge (36) weg von dem rohrförmigen Bereich (32) ausgebildet sind.

2. Befestigungsvorrichtung (30) gemäß Anspruch 1, während der rohrförmige Bereich (32) ein erstes axiales Ende (44) und ein zweites axiales Ende (46) umfasst, die gestaltet sind, um vollständig an dem Kraftstoffinjektor (18) befestigt zu werden.

3. Befestigungsvorrichtung (30) gemäß Anspruch 2, in der mindestens das erste axiale Ende (44) und das zweite axiale Ende (46) umfänglich geschlossen sind.

4. Kraftstoffinjektor (18), umfassend eine Befestigungsvorrichtung (30) gemäß einem der vorhergehenden Ansprüche.

5. Krafteinführungsanordnung (52), umfassend einen Kraftstoffinjektor (18) gemäß Anspruch 4 sowie eine Kraftanwendungsvorrichtung (54), die angeordnet und gestaltet ist, um die Haltekraft (F) auf die kraftaufnehmenden Flächen (38) auszuüben.

6. Krafteinführungsanordnung (52) gemäß Anspruch 5, in der die Kraftanwendungsvorrichtung (54) eine Feder ist.

Revendications

1. Dispositif de fixation (30) destiné à fixer un injecteur de carburant (18) dans une culasse (14) d'un moteur à combustion (22), comprenant

- une portion tubulaire (32) qui présente un axe longitudinal central (L), la portion tubulaire (32) étant construite pour être en prise avec l'injecteur de carburant (18) et pour être accouplée rigidement à l'injecteur de carburant (18), et
- des saillies (36) étant formées en une seule pièce avec la portion tubulaire (32) et étant repliées pour s'étendre vers l'extérieur dans une direction radiale en partant de la portion tubulaire (32), les saillies (36) comprenant au moins deux zones de réception de force (38) et étant disposées et construites pour recevoir une force de retenue (F) dans lesdites zones de réception de force (38), la force de retenue (F) agissant dans la direction de l'axe longitudinal central (L) pour retenir l'injecteur de carburant (18) dans la culasse (14), deux des zones de réception de force (38) étant sensiblement à l'opposé l'une de l'autre dans la direction radiale par rapport à l'axe longitudinale central (L), et les saillies (36) étant formées pour suivre directement la portion tubulaire (32) dans la direction de la force de retenue (F),

caractérisé en ce que des cavités (50) ménagées dans la portion tubulaire (32) sont formées en repliant les saillies (36) dans le sens qui s'éloigne de la portion tubulaire (32).

2. Dispositif de fixation (30) selon la revendication 1, dans lequel la portion tubulaire (32) comprend une première extrémité axiale (44) et une seconde extrémité axiale (46) qui sont construites pour pouvoir être entièrement attachées à l'injecteur de carburant (18).

3. Dispositif de fixation (30) selon la revendication 2, dans lequel au moins l'une, de la première extrémité axiale (44) et de la seconde extrémité axiale (46), est fermée circonférentiellement.

4. Injecteur de carburant (18) comprenant un dispositif de fixation (30) selon une des revendications précédentes.

5. Agencement d'introduction de force (52) comprenant un injecteur de carburant (18) selon la revendication 4 et un dispositif exerçant une force (54) qui est disposé et construit pour exercer la force de retenue (F) sur les zones de réception de force (38).

6. Agencement d'introduction de force (52) selon la revendication 5, dans lequel le dispositif exerçant une force (54) est un ressort.

FIG 1

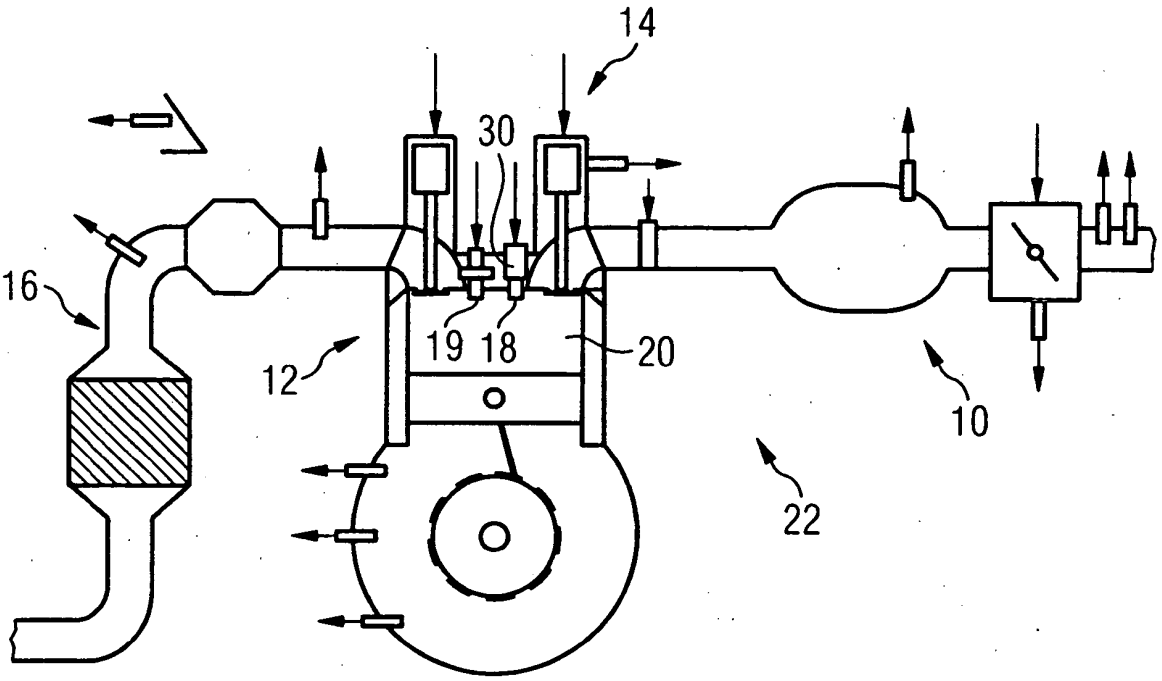

FIG 2

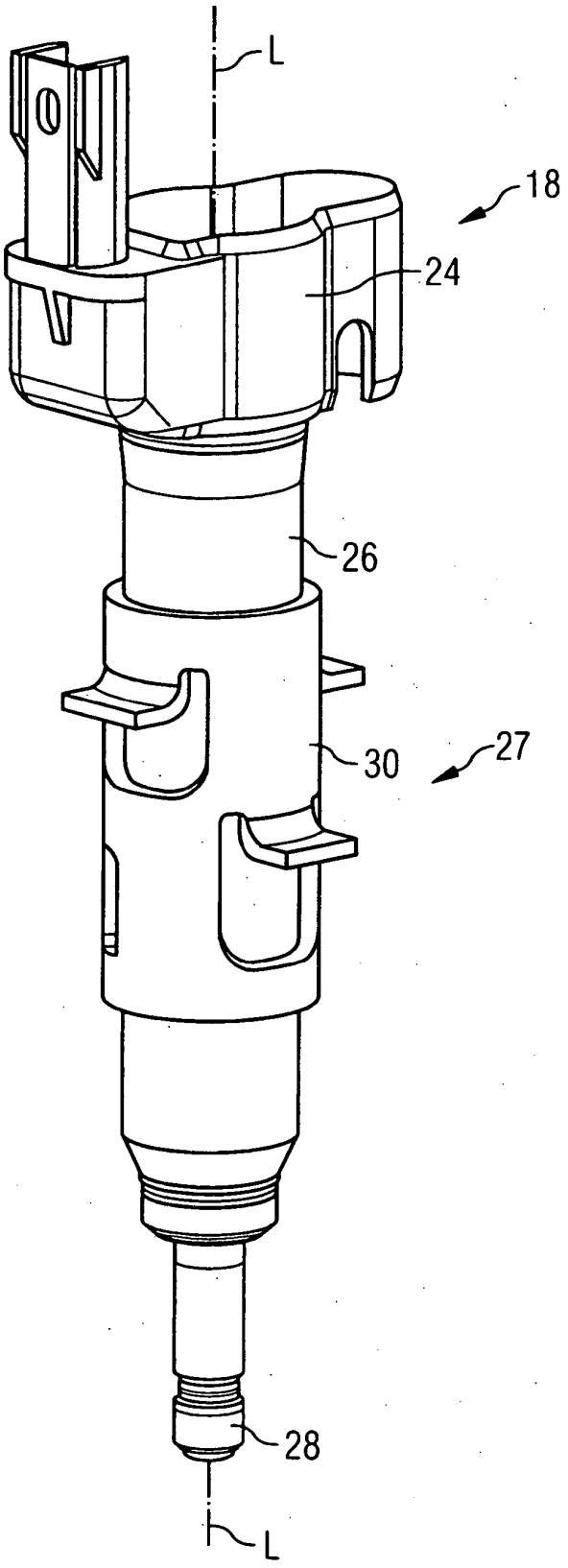

FIG 3

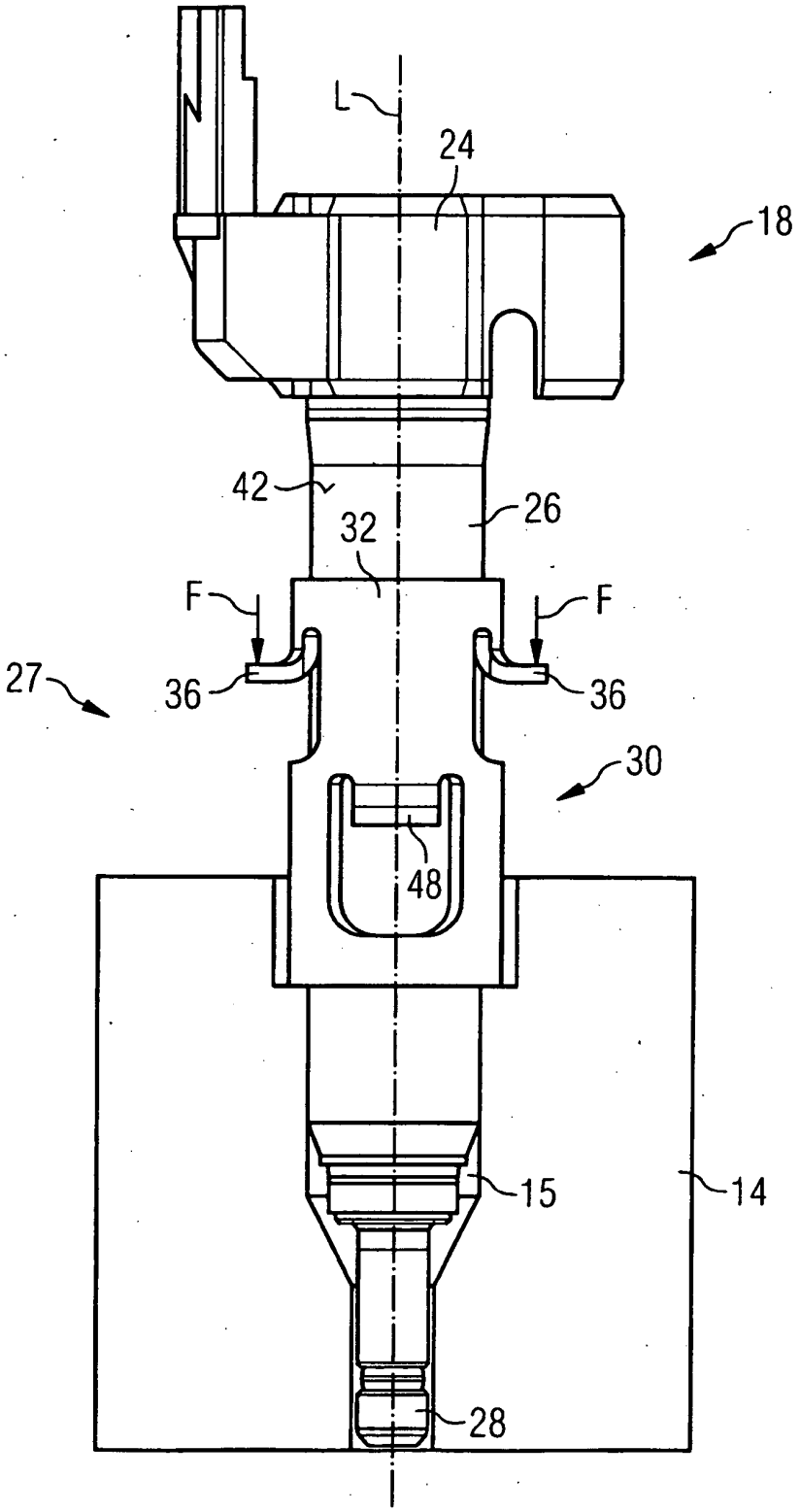

FIG 4

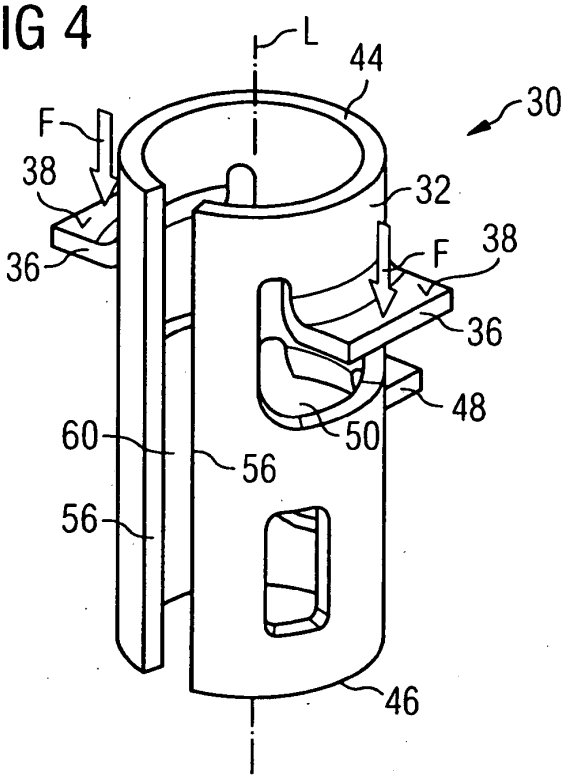
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FIG 5

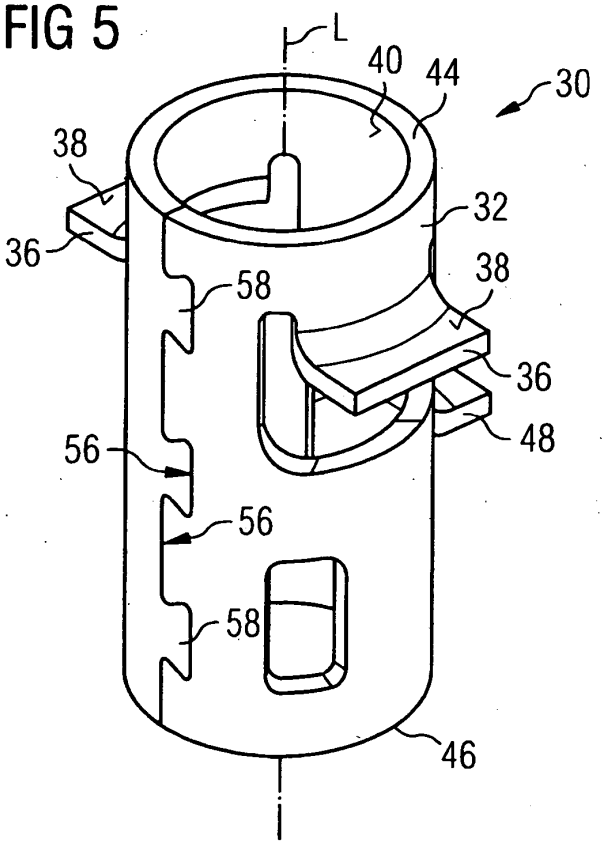
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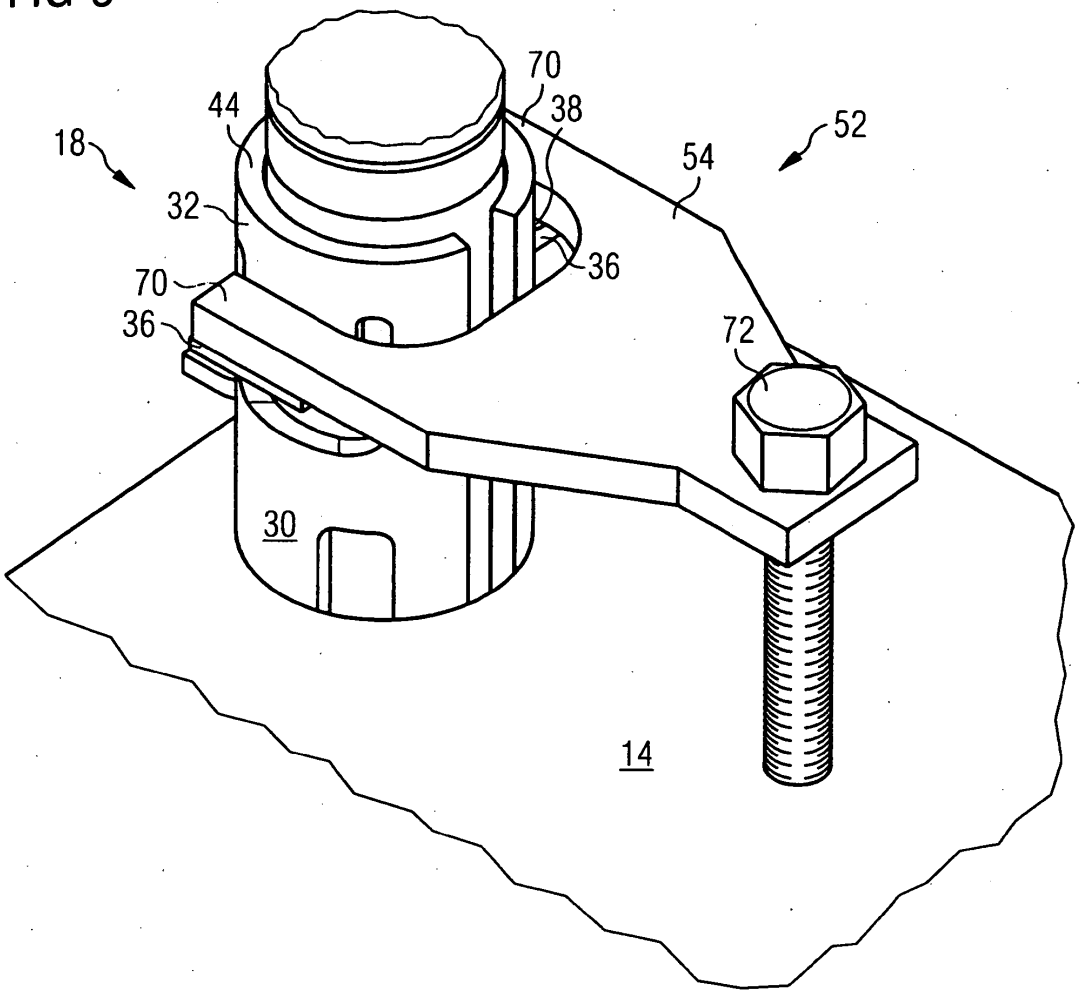
FIG 6



REFERENCES CITED IN THE DESCRIPTION

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