

(19)



(11)

EP 3 009 657 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
13.03.2019 Bulletin 2019/11

(51) Int Cl.:
F02M 51/06 (2006.01)

(21) Application number: **14189088.9**

(22) Date of filing: **15.10.2014**

(54) **Housing assembly for a fuel injector, fuel injector and method for producing the housing assembly**

Gehäuseanordnung für ein Kraftstoffeinspritzventil, Kraftstoffeinspritzventil und Verfahren zur Herstellung der Gehäuseanordnung

Ensemble boîtier pour un injecteur de carburant, injecteur de carburant et procédé de production de l'ensemble boîtier

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(43) Date of publication of application:
20.04.2016 Bulletin 2016/16

(73) Proprietor: **Continental Automotive GmbH
30165 Hannover (DE)**

(72) Inventors:
• **Polidori, Valerio
57128 Livorno (IT)**

• **Filippi, Stefano
57010 Castel' Anselmo Collesalvetti (IT)**
• **Grandi, Mauro
57128 Livorno (IT)**
• **Lenzi, Francesco
57128 Livorno (IT)**

(56) References cited:
**EP-A1- 1 909 339 EP-A1- 3 009 655
DE-A1- 19 900 405 US-A1- 2002 112 705
US-B1- 6 240 897**

EP 3 009 657 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The invention relates to a housing assembly for a fuel injector, to a fuel injector and to a method for producing the housing assembly.

[0002] Injectors are in widespread use, in particular for combustion engines, where they may be arranged to dose a fluid into an intake manifold of the combustion engine or directly into a combustion chamber of a cylinder of the combustion engine.

[0003] In general a reliable and secure function of an injector inside a combustion engine is required and for this reason it is a task to counteract undesirable effects constantly. For example, regarding a solenoid outward opening injector the force given by a magnetic circuit is one of the most important parameters for a reliable performance of the injector.

[0004] DE 19900405 A1 relates to a method for mounting a valve module of a fuel injector for fuel injection systems of internal combustion engines. The fuel injector comprises an electromagnetic actuating element having a magnet coil, an inner pole and an outer magnetic circuit component, as well as a mobile valve closing body which cooperates with a valve seat assigned to a valve seat body. The valve seat body and the inner pole are arranged in an inner opening of a thin-walled valve sleeve and the magnet coil and outer magnetic circuit component are positioned on the outer circumference of the valve sleeve. First the magnetic circuit component is slid on

[0005] to the valve sleeve and then the valve seat body is pressed into the inner opening of the valve sleeve such that the pushing in of the valve seat body in itself causes the valve sleeve and magnetic circuit component to be firmly joined.

[0006] EP 1909339 A1 discloses an actuator module which has a piezoactuator and casing of elastomer layer. The piezoactuator has a piezoelement arranged between an actuator head and an actuator foot. The sleeve is made from a heat shrinkable tubing which lies sealed within plant ranges on the actuator head or the actuator foot of the piezoactuator. A press ring is located outside on the heat shrinkable tubing which presses the heat shrinkable tubing on the plant ranges. Not previously published document EP 3 009 655 A1 discloses a fuel injection valve for an internal combustion engine which has a two-part separation ring positioned between the armature and the coil casing in order to guide the magnetic flux.

[0007] One object of the invention is to create a housing assembly for a reliable and secure function for a fuel injector for a combustion engine to enable a reliable injector performance.

[0008] The object is 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 of the invention, a housing assembly for a fuel injector is disclosed. According to a second aspect, a fuel injector with the housing assembly is disclosed. The fuel injector preferably has a solenoid actuator comprising a coil and an armature.

The housing assembly comprises at least the following components: a connection tube, a fuel tube, a housing, a separation disc and a sleeve. The components are arrangeable along a longitudinal axis and comprise penetrating openings respectively with respect to the longitudinal axis, in particular to arrange the components at least partially with each other and to enable a streaming fluid pass during an operation of the assembly.

[0010] Specifically, the connection tube, the separation disc, and the fuel tube may be arranged along the longitudinal axis to enable a streaming fluid pass through the penetrating openings during an operation of the assembly. In this way, the connection tube, the fuel tube and the separation disc form a fluid channel. The armature is preferably positioned in the fluid channel, particularly preferably in a region of the connection tube adjacent to the separation disc. In particular, the armature is axially displaceable in the fluid channel relative to the connection tube and the axial displaceability is limited by the separation disc.

[0011] The fuel tube is arranged inside the opening of the housing. In other words, the housing may extend circumferentially around a portion of the fuel tube which portion is in particular positioned inside the opening of the housing. The housing is in particular a coil housing for accommodating the coil. The housing is hydraulically separated from the fluid channel by the connection tube, the separation disc and the fuel tube. Preferably, a magnetic circuit of the solenoid actuator extends from the housing through the separation disc to the armature. The separation disc may be configured to contribute to shaping the magnetic flux of the magnetic circuit.

[0012] In a mounted configuration of the housing assembly, a first end of the connection tube at least partially contacts a first side of the separation disc and a second side of the separation disc at least partially contacts the housing. In particular the first side and the second side are understood to mean a first surface and a second surface of the separation disc which face in opposite axial directions, preferably at opposite axial ends of the separation disc.

[0013] Further, the fuel tube is partially arranged inside the opening of the separation disc. Preferably, it axially extends completely through the separation disc.

[0014] In an expedient embodiment, the housing is axially locked in place by means of a form-fit connection with the second side of the separation disc at one axial end of the housing and by means of a form-fit connection with a step of the fuel tube at the opposite axial end of the housing. In particular, the housing is pressed against the second side of the separation disc by means of mechanical interaction with the step.

[0015] The sleeve is configured to surround the housing and the separation disc and is at least partially connected to an outside surface of the connection tube or of the separation disc and to an outside surface of the fuel tube in a mounted configuration of the assembly to fasten the separation disc to the housing. The sleeve fastens the separation disc to the housing in particular by means of blocking axial displacement of the second side of the separation disc away from the step of the fuel tube. This is preferably achieved by means of the connections of the sleeve to the outside surfaces of the connection tube or of the separation disc, respectively, and of the fuel tube.

[0016] With advantage, the risk for undesirable air gaps, in particular between the separation disc and the coil housing is particularly small in this way. The magnetic circuit of the solenoid actuator may be particularly efficient in this way.

[0017] In an assembled configuration the sleeve is a component to fasten the separation disc to the housing and hence prevents or at least decreases a generation of an undesirable air gap between the mentioned components during an operation of the assembly.

[0018] During production of the housing assembly, the separation disc is welded to the fuel tube. For example due to the effect of welding shrinkage, the separation disc may tend to move axially away from the housing in a conventional housing assembly. This movement may result in an undesirable air gap that causes a lack of magnetic force during an operation of the injector, which may advantageously be avoided by the housing assembly according to the present invention.

[0019] By using the housing assembly with the sleeve as a connecting component, it is not necessary to change other components for example in consideration of a shape or a roughness. In this way, a reliable and secure functioning of the fuel injector can be easily realised.

[0020] In an expedient embodiment, the fuel tube has a circumferential protrusion which forms the step and which is in form-fit engagement with the sleeve to limit displacement of the sleeve in axial direction from the step towards the separation disc. In another expedient embodiment, a form-fit connection and/or a welded connection is established between the first side of the separation disc and the connection tube to block axial movement of the separation disc towards the connection tube. In this way, the sleeve is operable to retain the housing in contact with the separation disc in particularly simple and reliable fashion.

[0021] According to the invention, the connection tube and the sleeve are connected by a welding connection. In this way, the sleeve is particularly securely connected to the connection tube and hence the risk of contact loss between housing and separation disc during an operation of the injector is particularly small. The welding connecting between the sleeve and the connection tube realises a reliable and competitive way to bond these components and because the sleeve is also connected to the fuel tube, the fuel tube and the housing may be pressed to the separation disc due to the effect of welding shrinkage at the welding connection between sleeve and connection tube. This ensures the contact of the housing to the separation disc and hence prevents or at least decreases an undesirable air gap during an operation of the assembly.

[0022] According to a further embodiment of the first aspect the fuel tube and the sleeve are connected by means of a form- and/or force-fit connection. This enables a simple configuration of the assembly to connect the sleeve to the fuel tube and hence to achieve a reliable and secure connection and functioning of the injector.

[0023] In one embodiment, the sleeve may comprise a radially inward extending flange that is in contact with a radial protrusion of the fuel tube to establish the form-fit connection. The flange is in particular positioned at an axial end of the sleeve remote from a contact region of the sleeve with the connection tube or separation disc, respectively.

[0024] According to a further embodiment, the housing assembly comprises at least one coil - i.e. in particular the at least one coil of the solenoid actuator - that is arranged in a recess of the housing.

[0025] In a further embodiment, the fuel injector comprises a valve needle which is at least partially arranged in the opening of the fuel tube and which is configured to prevent a fluid flow through the injector in coaction with a seal seat in a closed position or otherwise to enable it. In one embodiment, the fuel injector is an outward opening injector.

[0026] According to a third aspect of the invention a method for producing a housing assembly for a fuel injector comprises providing a connection tube, a fuel tube, a housing, a separation disc and a sleeve that comprise penetrating openings respectively with respect to a longitudinal axis. The method further comprises assembling the housing onto the fuel tube from a first direction with respect to the longitudinal axis so that the fuel tube is partially arranged inside the opening of the housing. The method further comprises press-fitting the separation disc and the connection tube onto the fuel tube from the first direction with respect to the longitudinal axis until the separation disc contacts the housing. Moreover, the method comprises shifting the sleeve onto the fuel tube from a second direction with respect to the longitudinal axis until the sleeve contacts an outside surface of the fuel tube and an outside surface of the connection tube. The method further comprises connecting the sleeve to the connection tube by a welding connection and connecting the separation disc to the fuel tube by a further welding connection.

[0027] This aspect of the invention describes a method for construction of the assembly for example to create an injector which is enabled to prevent an undesirable air gap and to avoid a lack of force during an operation. This enables a reliable and secure functioning and an improved controlling of the injector.

[0028] The welding connections between the connection tube and the sleeve as well as the separation disc and the

fuel tube enable a simple and competitive possibility for construction of the assembly as described above.

[0029] In an expedient embodiment, press-fitting the sleeve onto the fuel tube comprises press-fitting the sleeve onto the fuel tube from the second direction until the sleeve comes in contact with the outside surface of the connection tube and establishes a form-fit connection with the protrusion of the fuel tube at the outside surface of the fuel tube. In a further embodiment, assembling the housing onto the fuel tube comprises shifting the housing over the fuel tube in the first direction until the housing is in form-fit engagement with the step of the fuel tube which is formed by the protrusion. In this way, an air gap between the housing and the separation disc can be prevented particularly well.

[0030] In one embodiment, welding of the sleeve to the connection tube is done before welding of the separation disc to the fuel tube. Therefore, one function of the sleeve may be to pull down the separation disc to the housing due to the effect of welding shrinkage given by the welding joint between the sleeve and the connection tube. In this way, the second side of the separation disc may be pressed against the housing. A particularly good contact between these two components may be established in this way.

[0031] According to one embodiment, the method comprises connecting the separation disc to the connection tube by a further welding connection.

[0032] This configuration describes a simple and reliable way to connect the mentioned components just by means of welding and hence enables a reliable and competitive way of manufacturing the assembly or the injector as mentioned above.

[0033] For example, the welding connection between the separation disc and the connection tube is already done before the other both mentioned welding connections. In this case, the separation disc is forced in its position and when it is welded to the fuel tube it cannot move away from the housing due to the sleeve that is welded to the connection tube and pulls the connection tube as well as the separation disc in direction to the housing.

[0034] By using the described method for construction of the housing assembly, an injector can be created which enables an improved performance during operation and which in particular makes a contribution to prevent a lack of force and undesirable air gaps or at least decreases it.

[0035] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings and reference numbers. Identical reference numbers designate elements or components with identical functions. The figures show:

Figure 1 a fuel injector for a combustion engine with a housing assembly;

Figure 2 an exemplary embodiment of a housing assembly;

Figures 3a to 3e method steps of a method for producing a housing assembly for a fuel injector according to an exemplary embodiment;

Figures 4a and 4b an exemplary embodiment of a housing assembly in different side views.

[0036] Figure 1 shows a fuel injector 30 which has a longitudinal axis L and comprises a valve needle 31 and a seal seat 33. The valve needle 31 is arranged axially movable with respect to a longitudinal axis L relative to the seal seat 33. In the present embodiment, the injector 30 is an outward opening injector 30.

[0037] The valve needle 31 is biased by a spring element 32 towards the seal seat 33. The valve needle 31 sealingly rests on the seal seat 33 in a closing position due to forces acting on it, amongst others one force being a spring force by the spring element 32.

[0038] Depending on the force balance, the valve needle 31 is axially moved away from its closing position or moved into its closing position and hence a flow of a fluid through the injector 30 is enabled or prevented. One actuating force is exerted by the spring element 32, another actuating force is exerted by an actuator in order to move the valve needle 31 with respect to the longitudinal axis L. Furthermore, a hydraulic force which is exerted by the fluid is a further force acting on the valve needle 31.

[0039] The actuator element may be an electromagnetic actuator, also denoted as solenoid actuator. In this example, the actuator comprises a coil 22 which generates a magnetic force on an armature 40. The armature 40 is mechanically coupled to the valve needle 31. It is movable in reciprocating fashion along the longitudinal axis L and is axially displaced towards the coil 22 to move the valve needle 31 away from the closing position. The coil 22 is arranged in a recess 24 of a housing 7.

[0040] The injector 30 comprises a housing assembly 1, which comprises a connection tube 3, a fuel tube 5, the housing 7, a separation disc 9 and a sleeve 10. These mentioned components comprise several openings 11, 13, 15, 17, 19 to arrange the components at least partially with each other and to enable the streaming fluid pass the assembly 1 and the injector 30. Thereby, the connection tube 3 comprises the opening 11, the fuel tube 5 comprises the opening 13, the housing 7 comprises the opening 15, the separation disc 9 comprises the opening 17 and the sleeve 10 comprises

the opening 19. Further details of the assembly 1 are illustrated below in the following figures 2 to 4. The connection tube 3, the fuel tube 5 and the separation disc 9 form a fluid channel. The connection tube 3, the fuel tube 5 and the separation disc 9 hydraulically separate the housing 7 from the fluid channel. The sleeve 10 circumferentially surrounds the housing 7, the separation disc 9, a portion of the connection tube 3 and a portion of the fuel tube 5.

[0041] Figure 2 shows an enlarged view of the housing assembly 1. In this exemplary embodiment, the separation disc 9 is connected to the connection tube 3 by a welding connection 36 and forms a bottom of the connection tube 3. The separation disc 9 is one fluid leading component and forms one part of an exterior wall of the fluid channel. Moreover, the separation disc 9 has a magnetic function to enable a magnetic coupling between the coil 22 and corresponding movable injector components like the armature 40.

[0042] The separation disc 9 comprises a first side 23, i.e. a first surface, which forms a bottom area of the connection tube 3 and a second side 25, i.e. a second surface, which faces and contacts the housing 7 in an assembled configuration. The housing 7 is axially locked in place by means of a form-fit connection with the second side 25 of the separation disc 9 at one axial end of the housing 7 and by means of a form-fit connection with a step 140 of the fuel tube 5, i.e. in particular a step 140 of the outside surface 29 of the fuel tube 5, at the opposite axial end of the housing 7.

[0043] At a first end 21 of the connection tube 3, adjacent to the separation disc 9, the sleeve 10 is connected to an outside surface 27 of the connection tube 3. For example, the sleeve 10 is connected to the connection tube 3 by means of a welding connection.

[0044] The sleeve 10 is further connected to an outside surface 29 of the fuel tube 5. For example, the sleeve 10 is connected to the fuel tube 5 due to form fit and/or force fit. In the present exemplary embodiment, the sleeve 10 comprises a radially inward extending flange 12 which is in form-fit engagement with a radially extending circumferential protrusion 14 of the fuel tube 5.

[0045] By means of these connections, the connection tube 3, the separation disc 9 and the fuel tube 5 are coupled by the sleeve 10 in such fashion that axial displacement of the second side 25 of the separation disc 9 away from the step 140 of the fuel tube 5 is blocked. This allows to keep the contact of the separation disc 9 to the housing 7. In this way, magnetic losses due to contact loss between the housing 7 and the separation disc 9 during an operation of the assembly 1 or the injector 30 are avoidable.

[0046] Figures 3a to 3e illustrate method steps of an exemplary method for producing the housing assembly 1.

[0047] In a first method step, the housing 7 is assembled onto the fuel tube 5 from a first direction D1 with respect to the longitudinal axis L. The fuel tube 5 is shifted into the opening 13 of the housing 7 until a bottom side of the housing 7 contacts a step 140 in the outside surface 29 of the fuel tube 5 and establishes a form-fit engagement with the step 140.

[0048] A subsequent second method step is illustrated in figure 3b. In this method step, the separation disc 9 and the connection tube 3 are press-fitted onto the fuel tube 5 from the first direction D1 until the second side 25 of the separation disc 9 contacts an upper side of the housing 7 with respect to the longitudinal axis L. The term press-fit is illustrated in this figure 3b by two bold arrows to indicate a force that presses the separation disc 9 to the housing 7.

[0049] A subsequent third method step is shown in Figure 3c. In this method step, the sleeve 10 is shifted onto the fuel tube 5 from a second direction D2 with respect to the longitudinal axis L until the sleeve 10 comes in contact with the outside surface 27 of the connection tube 3 at one axial end of the sleeve 10 and establishes a form-fit connection by means of its flange 12 with a protrusion 14 of the fuel tube 5 at the outside surface 29 of the fuel tube 5. The sleeve 10 then contacts the outside surface 27 of the connection tube 3 in the region of the separation disc 9 at the first end 21 of the connection tube 3 and it contacts the protrusion 14 of the fuel tube 5 with its radially inward extending flange 12. The protrusion 14 forms the above mentioned step 140 of the outside surface 29 of the fuel tube 5. The form-fit connection with the protrusion 14 blocks further displacement of the sleeve 10 in the second direction D2 relative to the fuel tube 5.

[0050] A subsequent fourth method step is illustrated in Figure 3d. In this method step, a reliable and secure connection between the sleeve 10 and the connection tube 3 is made by a welding connection 26 to fasten the sleeve 10 to the connection tube 3. Because of the effect of welding shrinkage at the welding connection 26 and the form-fit connection of the sleeve 10 with the protrusion 14 of the fuel tube 5, the connection tube 3, the separation disc 9 and the fuel tube 5 are pressed together in direction of the longitudinal axis L by the sleeve 10 so that axial displacement of the second side 25 of the separation disc 9 away from the step 140 is blocked and the housing 7 is axially compressed between the second side 25 and the step 140 to avoid an air gap between the separation disc 9 and the housing 7. This enables a simple construction of the assembly 1 and hence a reliable and secure functioning of the injector 30 wherein a lack of force and an undesirable air gap between the separation disc 9 and the housing 7 is prevented or at least decreased.

[0051] In Figure 3e, a subsequent fifth method step is shown. In this method step, a welding connection 28 is produced between the separation disc 9 and the fuel tube 5, for example by laser welding. Producing of this welding connection 28 in principle tends to separate the separation disc 9 from the housing 7 due to welding shrinkage. However, since the sleeve 10 blocks displacement of the separation disc 9 in axial direction away from the step 140, such separation is advantageously avoided. Therefore, an improved magnetic performance of the injector 30 is achieved while at the same time the mechanical stability and the fluid-tightness of the assembly 1 is further enhanced.

[0052] In reference to the exemplary method steps the sleeve 10 is assembled and welded to the connection tube 3 before the separation disc 9 is welded to the fuel tube 5. This means, that the separation disc 9 is forced in its position and when it is welded to the fuel tube 5 it cannot move away from the housing 7 since the sleeve 10 that is already welded to the connection tube 3 and pulls the connection tube 3 as well as the separation disc 9 down to the housing 7 in the first direction D1 with respect to the longitudinal axis L.

[0053] In the figures 4a and 4b, the housing assembly 1 is shown in a mounted configuration in different side views corresponding to a side view and a top view of an electrical connector inlet of the housing 7. In these figures it is apparent that the sleeve 10 surrounds the housing 7 and the separation disc 9 and is connected to the connection tube 3 by the welding connection 26 and to the fuel tube 5 due form-fit by the radially inward extending flange 12 and the corresponding protrusion 14 which is not visible in these figures.

[0054] In this exemplary embodiment, the sleeve 10 further comprises a recess 35 for reasons of electrical connections for example which is represented by an electrical connector 38. Such a recess 35 may be useful to expose the electrical connector inlet of the housing 7. In such a case, the sleeve 10 only partly circumferentially surrounds the housing 7 and the separation disc 9.

[0055] By manufacturing and assembling - i.e. producing - the housing assembly 1 for the injector 30 with the sleeve 10 as a connecting component, it is not necessary to change existing components for example in consideration of a shape or a roughness. In this way, a reliable and secure functioning of the injector 30 can be easily realised without expensive adaptations like interferences between components, weldings or others.

Claims

1. Housing Assembly (1) for a fuel injector comprising following components:

- a connection tube (3),
- a fuel tube (5),
- a housing (7),
- a separation disc (9) and
- a sleeve (10),

wherein

- the connection tube (3), the separation disc (9) and the fuel tube (5) each comprise a penetrating opening (11, 13, 17) with respect to a longitudinal axis (L) and are arranged along the longitudinal axis (L) to enable a streaming fluid pass through the penetrating openings (11, 13, 17) during an operation of the assembly (1),
- the fuel tube (5) is partially arranged inside the opening (17) of the separation disc (9),
- the housing (7) comprises a penetrating opening (15) with respect to the longitudinal axis (L) and extends circumferentially around a portion of the fuel tube (5) which is positioned inside the opening (15) of the housing (7),
- a first end (21) of the connection tube (3) at least partially contacts a first side (23) of the separation disc (9) and a second side (25) of the separation disc (9) at least partially contacts the housing (7), and
- the sleeve (10) is configured to surround the housing (7) and the separation disc (9) and is at least partially connected to an outside surface (27) of the connection tube (3) or of the separation disc (9) and to an outside surface (29) of the fuel tube (5) to fasten the separation disc (9) to the housing (7), wherein the connection tube (3) and the sleeve (10) are connected by a welding connection (26) and the connection tube (3) and the separation disc (9) are connected by a welding connection (36) .

2. Housing assembly (1) in accordance with the preceding claim, wherein

- the housing (7) is axially locked in place by means of a form-fit connection with the second side (25) of the separation disc (9) at one axial end of the housing (7) and by means of a form-fit connection with a step (140) of the fuel tube (5) at the opposite axial end of the housing (7) and
- axial displacement of the second side (25) of the separation disc (9) away from the step of the fuel tube (5) is blocked by means of the connections of the sleeve (10) to the outside surfaces (27, 29) of the connection tube (3) or of the separation disc (9), respectively, and of the fuel tube (5).

3. Housing assembly (1) in accordance with the preceding claim, wherein the fuel tube (5) has a circumferential protrusion (14) which forms the step (140) and which is form-fit engagement with the sleeve (10) to limit displacement of the sleeve (10) in axial direction from the step (140) towards the separation disc (9).

4. Housing assembly (1) in accordance with one of the preceding claims, wherein the fuel tube (5) and the sleeve (10) are connected by means of a form- and/or force-fit connection.

5. Housing assembly (1) in accordance with one of the preceding claims, comprising at least one coil (22) that is arranged in a recess (24) of the housing (7).

6. Injector (30) for a combustion engine comprising

- a housing assembly (1) in accordance with one of the preceding claims, and
- a valve needle (31) which is at least partially arranged in the opening (13) of the fuel tube (5) and which is configured to prevent a fluid flow through the injector (30) in coaction with a seal seat (33) in a closed position or otherwise to enable it.

7. Method for producing a housing assembly (1) for a fuel injector, comprising

- providing a connection tube (3), a fuel tube (5), a housing (7), a separation disc (9) and a sleeve (10) that comprise penetrating openings (11, 13, 15, 17, 19) respectively with respect to a longitudinal axis (L),
- assembling the housing (7) onto the fuel tube (5) from a first direction (D1) with respect to the longitudinal axis (L) so that the fuel tube (5) is partially arranged inside the opening (15) of the housing (7),
- press-fitting the separation disc (9) and the connection tube (3) onto the fuel tube (5) from the first direction (D1) with respect to the longitudinal axis (L) until the separation disc (9) contacts the housing (7),
- shifting the sleeve (10) onto the fuel tube (5) from a second direction (D2) with respect to the longitudinal axis (L) until the sleeve (10) comes in contact with an outside surface (27) of the connection tube (3) and establishes a form- and/or a force-fit connection with a protrusion (14) of the fuel tube (5) at an outside surface (29) of the fuel tube (5),
- connecting the sleeve (10) to the connection tube (3) by a welding connection (26), and
- connecting the separation disc (9) to the fuel tube (5) by a welding connection (28).

8. Method in accordance with claim 7, wherein assembling the housing (7) onto the fuel tube (5) comprises shifting the housing (7) over the fuel tube (5) in the first direction (D1) until the housing (7) is in form-fit engagement with a step (140) of the fuel tube (5) which is formed by the protrusion (14).

9. Method in accordance with claim 7 or 8, wherein the welding connection (26) between the sleeve (10) and the connection tube (3) is made before the welding connection (28) between the separation disc (9) and the fuel tube (5).

10. Method in accordance with one of claims 7 to 9, comprising connecting the separation disc (9) to the connection tube (3) by a welding connection (36).

11. Method in accordance with claim 10, wherein the welding connection (36) between the separation disc (9) and the connection tube (3) is made before the welding connection (26) between the sleeve (10) and the connection tube (3) and the welding connection (28) between the separation disc (9) and the fuel tube (5).

Patentansprüche

1. Gehäuseanordnung (1) für ein Kraftstoffeinspritzventil, die folgende Komponenten aufweist:

- ein Verbindungsrohr (3),
- ein Kraftstoffrohr (5),
- ein Gehäuse (7),
- eine Trennscheibe (9) und
- eine Hülse (10),

wobei

- das Verbindungsrohr (3), die Trennscheibe (9) und das Kraftstoffrohr (5) jeweils eine Durchgangsöffnung (11, 13, 17) in Bezug auf eine Längsachse (L) aufweisen und entlang der Längsachse (L) angeordnet sind, um einem strömenden Fluid zu ermöglichen, während eines Betriebs der Anordnung (1) durch die Durchgangsöff-

nungen (11, 13, 17) zu passieren,

- das Kraftstoffrohr (5) teilweise in der Öffnung (17) der Trennscheibe (9) angeordnet ist,
- das Gehäuse (7) eine Durchgangsöffnung (15) in Bezug auf die Längsachse (L) aufweist und sich umlaufend um einen Teil des Kraftstoffrohrs (5) erstreckt, das in der Öffnung (15) des Gehäuses (7) positioniert ist,
- ein erstes Ende (21) des Verbindungsrohrs (3) zumindest teilweise mit einer ersten Seite (23) der Trennscheibe (9) in Kontakt ist und eine zweite Seite (25) der Trennscheibe (9) zumindest teilweise mit dem Gehäuse (7) in Kontakt ist, und
- die Hülse (10) ausgebildet ist, das Gehäuse (7) und die Trennscheibe (9) zu umgeben und zumindest teilweise mit einer Außenfläche (27) des Verbindungsrohrs (3) oder der Trennscheibe (9) und mit einer Außenfläche (29) des Kraftstoffrohrs (5) verbunden ist, um die Trennscheibe (9) an dem Gehäuse (7) zu befestigen, wobei das Verbindungsrohr (3) und die Hülse (10) durch eine Schweißverbindung (26) verbunden sind und das Verbindungsrohr (3) und die Trennscheibe (9) durch eine Schweißverbindung (36) verbunden sind.

2. Gehäuseanordnung (1) nach einem der vorhergehenden Ansprüche, wobei

- das Gehäuse (7) mittels einer formschlüssigen Verbindung mit der zweiten Seite (25) der Trennscheibe (9) an einem axialen Ende des Gehäuses (7) und mittels einer formschlüssigen Verbindung mit einem Absatz (140) des Kraftstoffrohrs (5) an dem gegenüberliegenden axialen Ende des Gehäuses (7) axial eingerastet ist und
- ein axialer Versatz der zweiten Seite (25) der Trennscheibe (9) weg von dem Absatz des Kraftstoffrohrs (5) mittels der Verbindungen der Hülse (10) mit den Außenflächen (27, 29) des Verbindungsrohrs (3) bzw. der Trennscheibe (9) und des Kraftstoffrohrs (5) blockiert ist.

3. Gehäuseanordnung (1) nach einem der vorhergehenden Ansprüche, wobei das Kraftstoffrohr (5) einen umlaufenden Vorsprung (14) aufweist, der den Absatz (140) ausbildet und der in formschlüssigem Eingriff mit der Hülse (10) ist, um einen Versatz der Hülse (10) in axialer Richtung von dem Absatz (140) in Richtung der Trennscheibe (9) zu begrenzen.

4. Gehäuseanordnung (1) nach einem der vorhergehenden Ansprüche, wobei das Kraftstoffrohr (5) und die Hülse (10) mithilfe einer form- und /oder kraftschlüssigen Verbindung verbunden sind.

5. Gehäuseanordnung (1) nach einem der vorhergehenden Ansprüche, die mindestens eine Spule (22) aufweist, die in einer Vertiefung (24) des Gehäuses (7) angeordnet ist.

6. Einspritzventil (30) für einen Verbrennungsmotor, das aufweist

- eine Gehäuseanordnung (1) nach einem der vorhergehenden Ansprüche, und
- eine Ventalnadel (31) die zumindest teilweise in der Öffnung (13) des Kraftstoffrohrs (5) angeordnet ist und die ausgebildet ist, eine Fluidströmung durch das Einspritzventil (30) unter Zusammenwirken mit einem Dichtungssitz (33) in einer geschlossenen Position zu verhindern oder sie andernfalls zu ermöglichen.

7. Verfahren zum Herstellen einer Gehäuseanordnung (1) für ein Kraftstoffeinspritzventil, das aufweist

- Bereitstellen eines Verbindungsrohrs (3), eines Kraftstoffrohrs (5), eines Gehäuses (7), einer Trennscheibe (9) und einer Hülse (10), die jeweils Durchgangsöffnungen (11, 13, 15, 17, 19) in Bezug auf eine Längsachse (L) aufweisen,
- Zusammenbauen des Gehäuses (7) auf dem Kraftstoffrohr (5) aus einer ersten Richtung (D1) in Bezug auf die Längsachse (L), sodass das Kraftstoffrohr (5) teilweise in der Öffnung (15) des Gehäuses (7) angeordnet ist,
- Einpressen der Trennscheibe (9) und des Verbindungsrohrs (3) auf das Kraftstoffrohr (5) aus der ersten Richtung (D1) in Bezug auf die Längsachse (L), bis die Trennscheibe (9) mit dem Gehäuse (7) in Kontakt ist,
- Verschieben der Hülse (10) auf das Kraftstoffrohr (5) aus einer zweiten Richtung (D2) in Bezug auf die Längsachse (L), bis die Hülse (10) in Kontakt mit einer Außenfläche (27) des Verbindungsrohrs (3) kommt und eine form- und/oder eine kraftschlüssige Verbindung mit einem Vorsprung (14) des Kraftstoffrohrs (5) an einer Außenfläche (29) des Kraftstoffrohrs (5) herstellt,
- Verbinden der Hülse (10) mit dem Verbindungsrohr (3) durch eine Schweißverbindung (26), und
- Verbinden der Trennscheibe (9) mit dem Kraftstoffrohr (5) durch eine Schweißverbindung (28).

8. Verfahren nach Anspruch 7, wobei das Zusammenbauen des Gehäuses (7) auf dem Kraftstoffrohr (5) Verschieben des Gehäuses (7) über das Kraftstoffrohr (5) in der ersten Richtung (D1) aufweist, bis das Gehäuse (7) in form-

schlüssigem Eingriff mit einem Absatz (140) des Kraftstoffrohrs (5) ist, der durch den Vorsprung (14) ausgebildet ist.

9. Verfahren nach Anspruch 7 oder 8, wobei die Schweißverbindung (26) zwischen der Hülse (10) und dem Verbindungsrohr (3) vor der Schweißverbindung (28) zwischen der Trennscheibe (9) und dem Kraftstoffrohr (5) hergestellt wird.

10. Verfahren nach einem der Ansprüche 7 bis 9, das Verbinden der Trennscheibe (9) mit dem Verbindungsrohr (3) durch eine Schweißverbindung (36) aufweist.

11. Verfahren nach Anspruch 10, wobei die Schweißverbindung (36) zwischen der Trennscheibe (9) und dem Verbindungsrohr (3) vor der Schweißverbindung (26) zwischen der Hülse (10) und dem Verbindungsrohr (3) und der Schweißverbindung (28) zwischen der Trennscheibe (9) und dem Kraftstoffrohr (5) hergestellt wird.

Revendications

1. Ensemble boîtier (1) pour un injecteur de carburant comprenant les composants suivants :

- un tube de connexion (3),
- un tube de carburant (5),
- un boîtier (7),
- un disque de séparation (9) et
- un manchon (10),

dans lequel

- le tube de connexion (3), le disque de séparation (9) et le tube de carburant (5) comprennent chacun une ouverture de pénétration (11, 13, 17) par rapport à un axe longitudinal (L) et sont disposés le long de l'axe longitudinal (L) de manière à permettre à un fluide en écoulement de passer à travers les ouvertures de pénétration (11, 13, 17) au cours d'un fonctionnement de l'ensemble (1),
- le tube de carburant (5) est disposé en partie à l'intérieur de l'ouverture (17) du disque de séparation (9),
- le boîtier (7) comprend une ouverture de pénétration (15) par rapport à l'axe longitudinal (L) et s'étend circonférentiellement autour d'une partie du tube de carburant (5), qui est positionnée à l'intérieur de l'ouverture (15) du boîtier (7),
- une première extrémité (21) du tube de connexion (3) vient au moins en partie en contact avec un premier côté (23) du disque de séparation (9) et un deuxième côté (25) du disque de séparation (9) vient au moins en partie en contact avec le boîtier (7), et
- le manchon (10) est configuré pour entourer le boîtier (7) et le disque de séparation (9) et est au moins en partie connecté à une surface extérieure (27) du tube de connexion (3) ou du disque de séparation (9) et à une surface extérieure (29) du tube de carburant (5), pour attacher le disque de séparation (9) au boîtier (7),

le tube de connexion (3) et le manchon (10) étant connectés par une connexion soudée (26) et le tube de connexion (3) et le disque de séparation (9) étant connectés par une connexion soudée (36).

2. Ensemble boîtier (1) selon la revendication précédente, dans lequel

- le boîtier (7) est verrouillé en position axialement au moyen d'une connexion par engagement par correspondance de formes avec le deuxième côté (25) du disque de séparation (9) au niveau d'une extrémité axiale du boîtier (7) et au moyen d'une connexion par engagement par correspondance de formes avec un gradin (140) du tube de carburant (5) au niveau de l'extrémité axiale opposée du boîtier (7) et
- un déplacement axial du deuxième côté (25) du disque de séparation (9) à l'écart du gradin du tube de carburant (5) est bloqué au moyen des connexions du manchon (10) aux surfaces extérieures (27, 29) du tube de connexion (3) ou du disque de séparation (9), respectivement, et du tube de carburant (5).

3. Ensemble boîtier (1) selon la revendication précédente, dans lequel le tube de carburant (5) présente une saillie circonférentielle (14) qui forme le gradin (140) et qui est engagée par correspondance de formes avec le manchon (10) pour limiter le déplacement du manchon (10) dans la direction axiale depuis le gradin (140) vers le disque de séparation (9).

4. Ensemble boîtier (1) selon l'une des revendications précédentes, dans lequel le tube de carburant (5) et le manchon (10) sont connectés au moyen d'une connexion par engagement par correspondance de formes et/ou par force.

5. Ensemble boîtier (1) selon l'une des revendications précédentes, comprenant au moins une bobine (22) qui est disposée dans un renforcement (24) du boîtier (7).

6. Injecteur (30) pour un moteur à combustion interne, comprenant :

- un ensemble boîtier (1) selon l'une des revendications précédentes, et
- une aiguille de soupape (31) qui est au moins en partie disposée dans l'ouverture (13) du tube de carburant (5) et qui est configurée pour empêcher un écoulement de fluide à travers l'injecteur (30) en coopération avec un siège d'étanchéité (33) dans une position fermée ou sinon, pour permettre cet écoulement.

7. Procédé de production d'un ensemble boîtier (1) pour un injecteur de carburant, comprenant :

- fournir un tube de connexion (3), un tube de carburant (5), un boîtier (7), un disque de séparation (9) et un manchon (10) qui comprennent, respectivement, des ouvertures de pénétration (11, 13, 15, 17, 19) par rapport à un axe longitudinal (L),
- assembler le boîtier (7) sur le tube de carburant (5) depuis une première direction (D1) par rapport à l'axe longitudinal (L) de telle sorte que le tube de carburant (5) soit disposé en partie à l'intérieur de l'ouverture (15) du boîtier (7),
- ajuster par pressage le disque de séparation (9) et le tube de connexion (3) sur le tube de carburant (5) depuis la première direction (D1) par rapport à l'axe longitudinal (L) jusqu'à ce que le disque de séparation (9) vienne en contact avec le boîtier (7),
- déplacer le manchon (10) sur le tube de carburant (5) depuis une deuxième direction (D2) par rapport à l'axe longitudinal (L) jusqu'à ce que le manchon (10) vienne en contact avec une surface extérieure (27) du tube de connexion (3) et établisse une connexion par engagement par correspondance de formes et/ou par force avec une saillie (14) du tube de carburant (5) au niveau d'une surface extérieure (29) du tube de carburant (5),
- connecter le manchon (10) au tube de connexion (3) par une connexion soudée (26), et
- connecter le disque de séparation (9) au tube de carburant (5) par une connexion soudée (28).

8. Procédé selon la revendication 7, dans lequel l'assemblage du boîtier (7) sur le tube de carburant (5) comprend le déplacement du boîtier (7) par-dessus le tube de carburant (5) dans la première direction (D1) jusqu'à ce que le boîtier (7) soit engagé par correspondance de formes avec un gradin (140) du tube de carburant (5) qui est formé par la saillie (14).

9. Procédé selon la revendication 7 ou 8, dans lequel la connexion soudée (26) entre le manchon (10) et le tube de connexion (3) est réalisée avant la connexion soudée (28) entre le disque de séparation (9) et le tube de carburant (5) .

10. Procédé selon l'une des revendications 7 à 9, comprenant la connexion du disque de séparation (9) au tube de connexion (3) par une connexion soudée (36).

11. Procédé selon la revendication 10, dans lequel la connexion soudée (36) entre le disque de séparation (9) et le tube de connexion (3) est effectuée avant la connexion soudée (26) entre le manchon (10) et le tube de connexion (3) et la connexion soudée (28) entre le disque de séparation (9) et le tube de carburant (5).

FIG 1

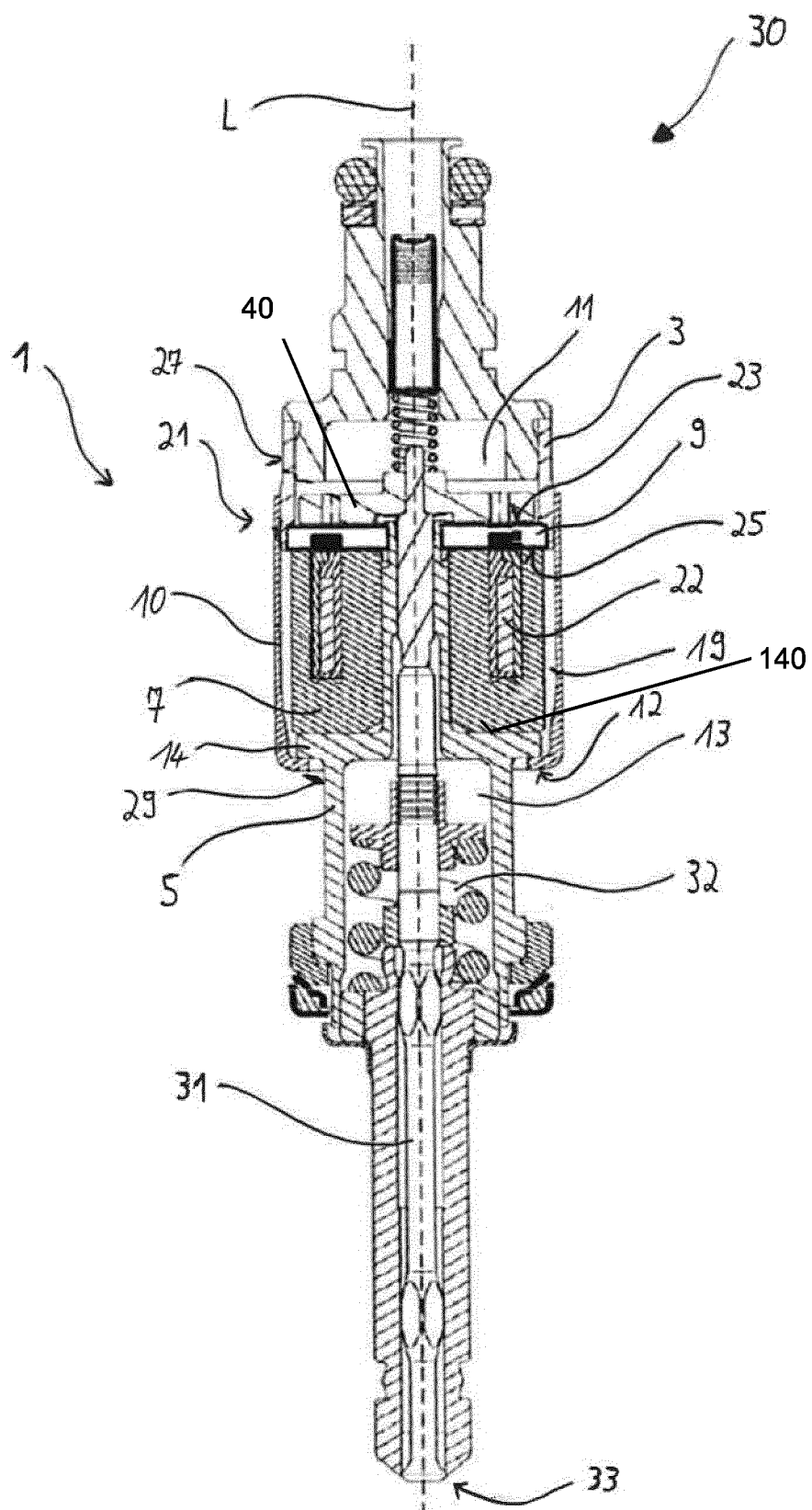


FIG 2

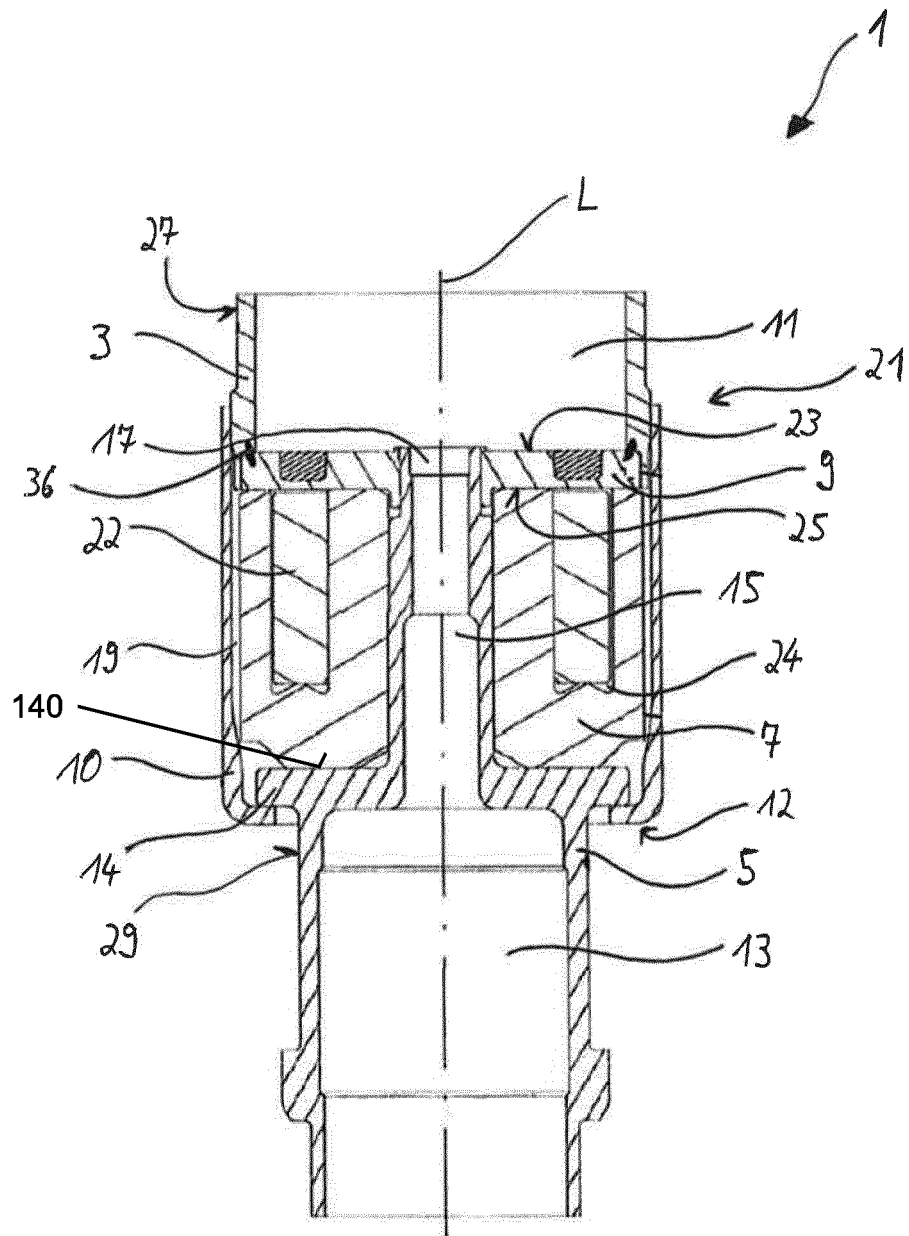


FIG 3 a

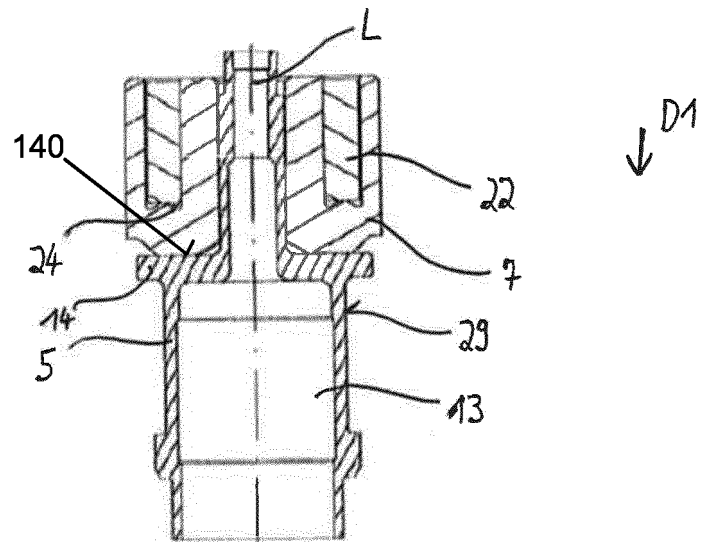


FIG 3 b

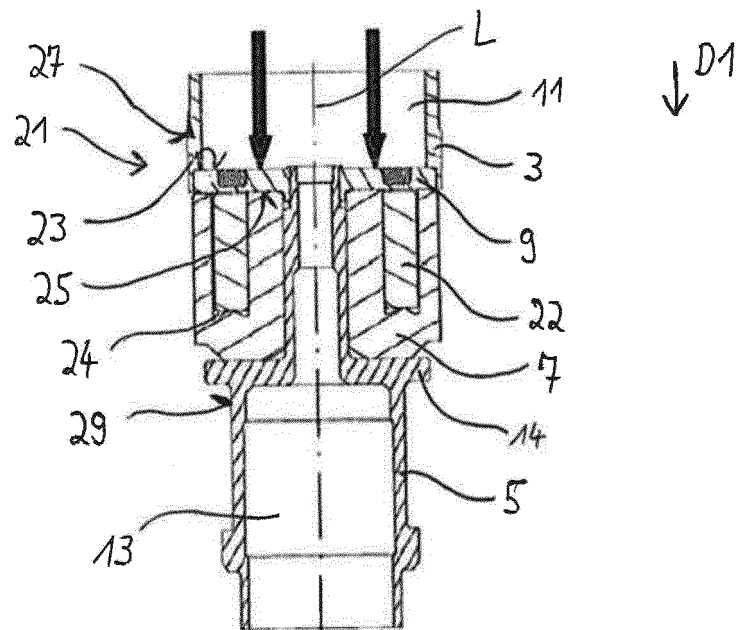


FIG 3 c

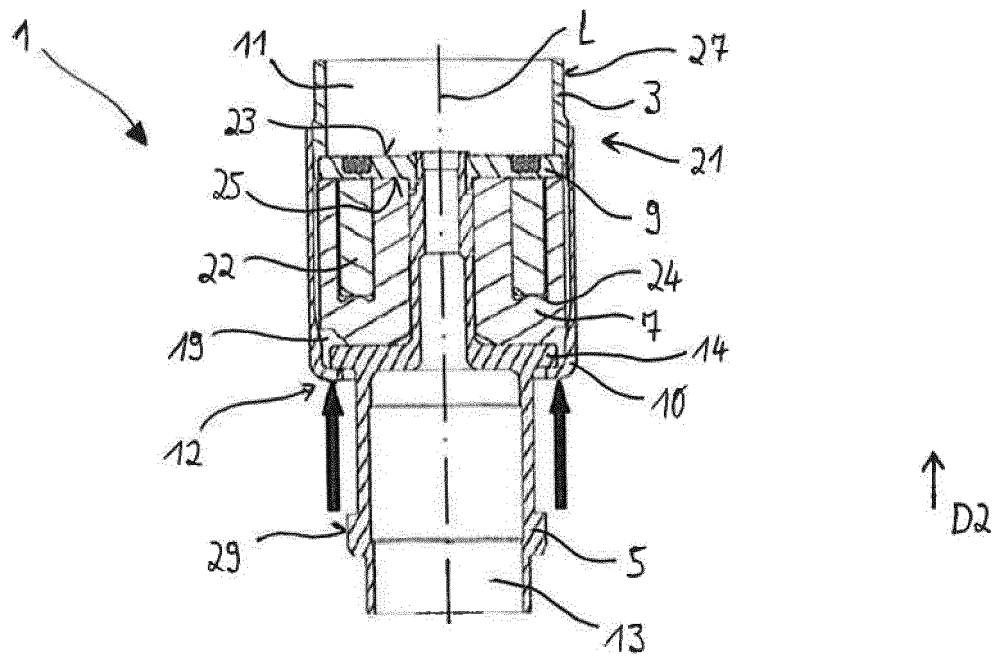


FIG 3 d

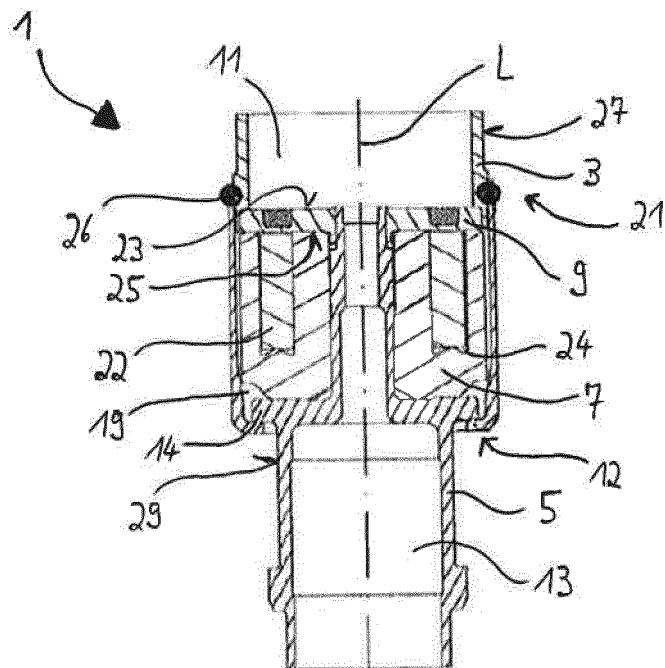


FIG 3 e

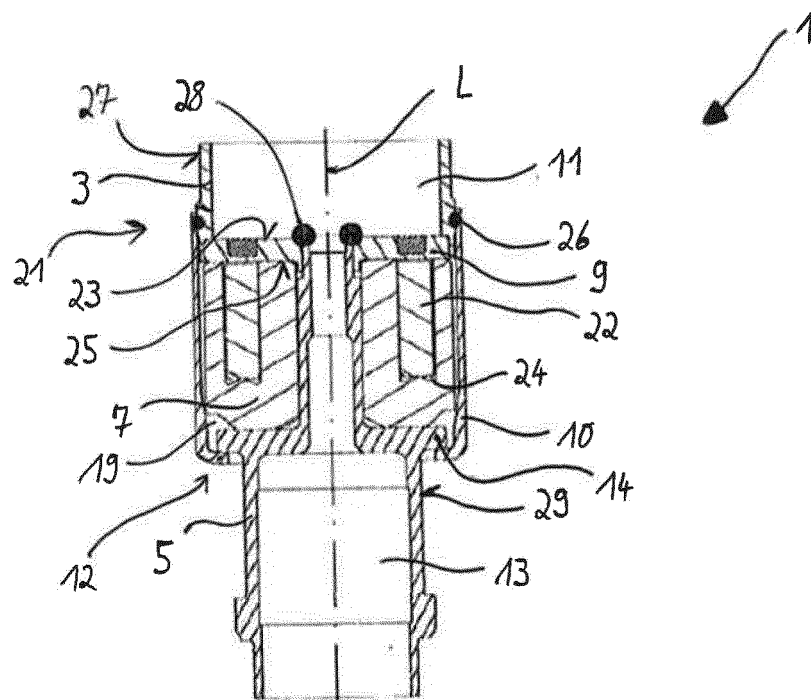


FIG 4 a

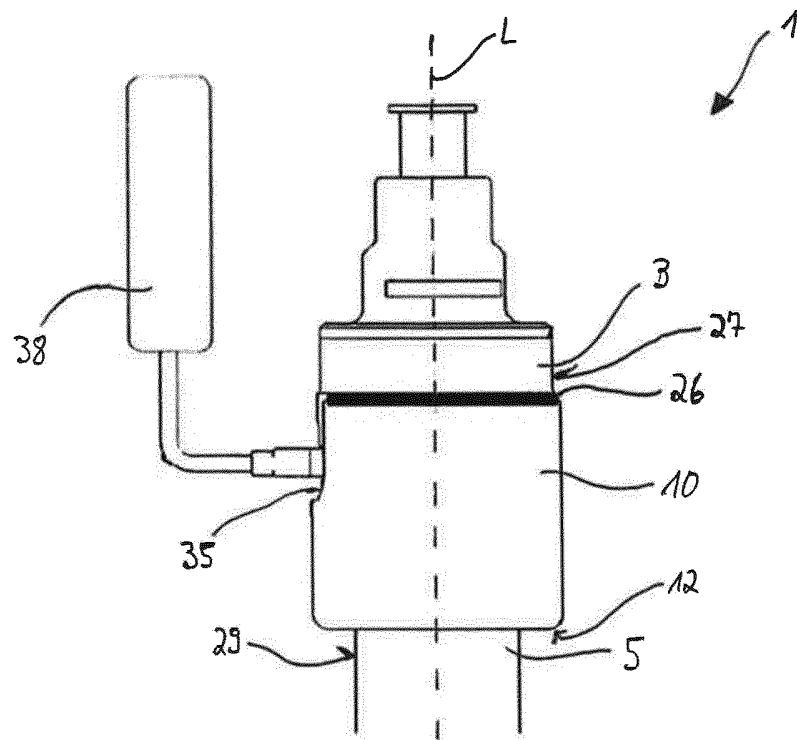
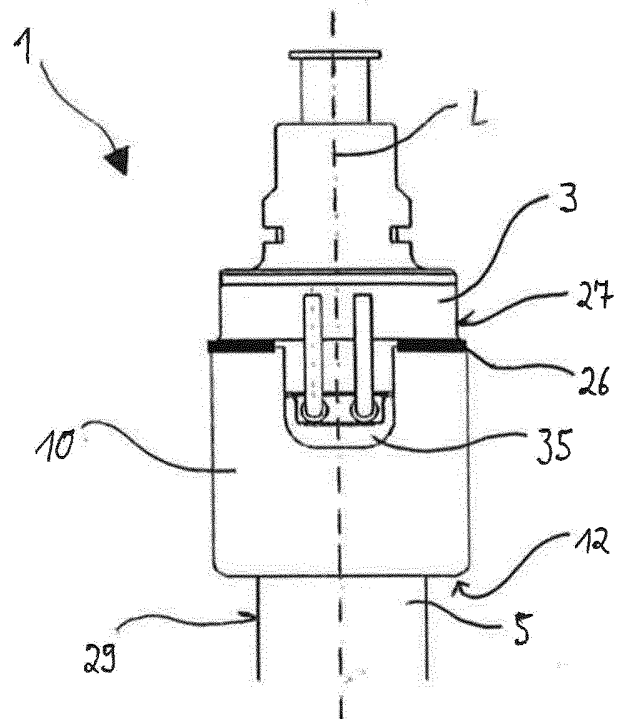


FIG 4 b



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 19900405 A1 [0004]
- EP 1909339 A1 [0006]
- EP 3009655 A1 [0006]