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(54) **Valve assembly**

(57) The invention relates to a valve assembly, in particular for use in an injector unit for injecting fuel into a vehicle engine, comprising a valve body (18) with a valve body cavity (20) and a valve orifice (22), in which valve body cavity (20) there is installed a valve needle assembly (14) comprising a valve needle (14) movable along its longitudinal axis between a closed position, in which the valve needle (14) obturates the valve orifice (22), and an open position, in which the valve needle (14) does not obturate the valve orifice (22), the valve needle assembly (14) being guided in an axially centered way by at least two coaxial guiding zones (32; 34) inside the valve body cavity (20) and axially apart from each other, wherein a centring sleeve (36) being fixed inside the valve body cavity (20) comprising the at least two guiding zones (32).

The invention further refers to a method of producing such valve assembly.

FIG 2A

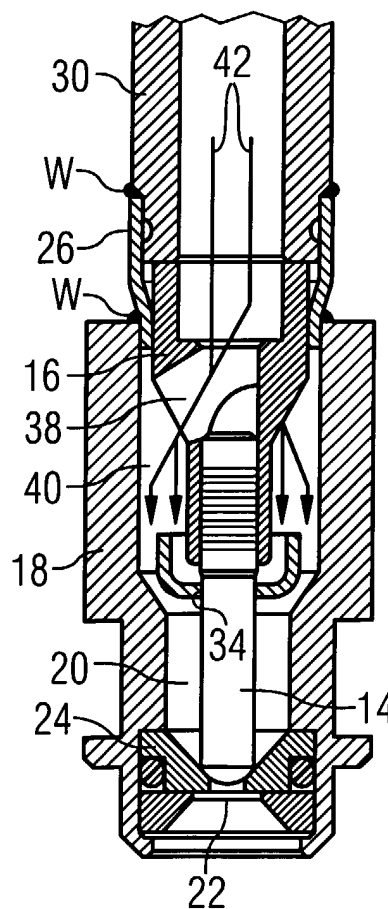
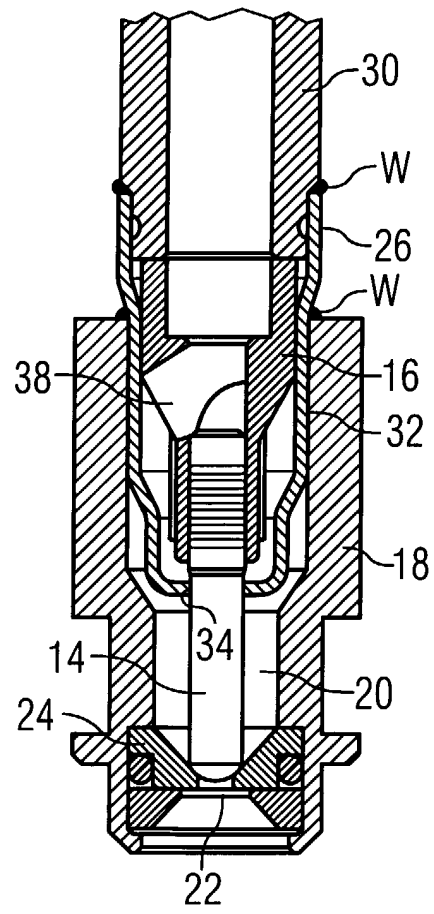


FIG 2B



Description

[0001] The present invention refers to a valve assembly, in particular for use in an injector unit for injecting fuel into a vehicle engine, comprising a valve body with a valve body cavity and a valve orifice, in which valve body cavity there is installed a valve needle assembly comprising a valve needle movable along its longitudinal axis between a closed position, in which the valve needle obturates the valve orifice, and an open position, in which the valve needle does not obturate the valve orifice, the valve needle assembly being guided in an axially centered way by at least two coaxial guiding zones inside the valve body cavity and axially apart from each other.

[0002] The invention further refers to a method for producing a valve assembly, in particular for use in an injector unit for injecting fuel into a vehicle engine, comprising the steps of providing a valve body with a valve body cavity having at least two openings; providing a valve needle assembly comprising a valve needle movable along its longitudinal axis; providing a first guiding element having an inner diameter corresponding substantially to the outer diameter of a first section of the valve needle assembly, and a second guiding element having an inner diameter corresponding substantially to the outer diameter of a second section of the valve needle assembly.

[0003] Injector units for injecting fuel into a modern vehicle engine comprise valve assemblies for metering the fuel with high precision with respect to volume and time of injection. Common valve assemblies, as illustrated e.g. in Fig. 5, mainly consist of a valve body and a valve needle assembly. The valve needle assembly usually comprises the valve needle movable along its longitudinal axis and some actuator unit that can be the armature of an electro-magnetic actuation means. The valve body that may be assembled from several parts provides an outer application surface e.g. for outer holding means and an inner cavity, that can be flooded with fuel. The cavity comprises at least two openings: one, into which the valve needle assembly is inserted and another one providing the valve orifice, which is opened and closed by the valve needle.

[0004] The perfect longitudinal movement of the valve needle is very critical. Any lateral movement or misalignment yields substantial wear of the valve needle and/or the valve seat.

Thus, some guiding of the movement is required.

[0005] Usually; there are provided two guiding zones that shall be referred to as upper and lower guides in the following. The lower guide usually is configured as an aperture situated in the area of the valve seat and valve orifice. The aperture's diameter substantially matches the diameter of the valve needle. The upper guide often is configured as an eyelet around the valve body's rim, where the valve needle assembly is inserted. Thus, the upper guide acts as a centring means when

assembling the valve assembly, while the lower guide acts as a guiding means at every single movement of the valve needle in operation.

[0006] It is obvious that the two guides have to be positioned relative to each other with extreme precision. An additional problem occurs when the parts of the valve assembly are fixed to each other. For permanently fixing the parts to each other they are usually welded. Due to the heat occurring during welding, the upper and lower guides might change their relative position, losing their crucial coaxiality.

[0007] It is an object of the present invention to provide a valve assembly which overcomes the disadvantages of the prior art and in particular to provide a device easier to produce and with a higher degree of precision with respect to the alignment of the upper and lower guides.

[0008] This object is obtained by the features of the independent claim 1.

[0009] Preferred embodiments are defined by the depending claims 2 to 9.

[0010] The valve assembly according to the present invention improves a valve assembly according to the prior art by a centring sleeve being fixed inside the valve body cavity, which centring sleeve comprises the at least two guiding zones.

[0011] That means, the upper and the lower guides are no longer configured as separate parts being installed in different process steps. Rather, the upper and the lower guides are provided by one single element featuring the correct alignment proportions and being inserted into the valve body as a whole.

[0012] In a preferred embodiment of the present invention the valve needle assembly comprises a fluid outlet inside the centring sleeve and the centring sleeve comprises at least one lateral opening in its lateral wall to allow a fluid flow from the fluid outlet into the valve body cavity. In many cases the fuel is filled into the valve body cavity through the valve needle assembly. If now, according to the invention, the valve needle assembly is situated inside the centring sleeve, the openings according to this preferred embodiment act as a channel through which the fuel may stream into the valve body cavity.

[0013] In a further preferred embodiment of the present invention the centring sleeve is shaped with respect to the coaxiality of its at least two guiding zones after having been fixed inside the valve body cavity. Although it is possible to first shape the centring sleeve and then to insert and fix it to the valve body, this procedure may rise the problem of distortion due to the welding heat applied. It may, thus, be better to insert and fix a centring sleeve roughly shaped and to shape it with some special high precision tool after the fixing. This is particularly advantageous, if the wall of the centring sleeve is not too thick. Note that the term "shaping" may, as explained below, include sizing e.g. of diameters.

[0014] Preferably, a first guiding zone - namely the

lower guide - is configured as an opening in an end face of the centring sleeve with a diameter corresponding to the diameter of the valve needle. Such a guiding zone corresponds substantially to the aperture of the prior art without featuring its problems mentioned above. However, the lower guide may also be configured as a cylindrical guiding zone, though this configuration might be disadvantageous in terms of friction between the valve needle and the lower guide.

[0015] Advantageously the centring sleeve is made from a non-magnetic metal, like e.g. a non-magnetic corrosion resistant steel such as SAE 200 series Austenitic. In this configuration the centring sleeve acts additionally as a non-magnetic shell which is required for magnetic insulation, when the valve needle is actuated electro-magnetically.

[0016] Though in most cases the centring sleeve is configured as a single piece, it is possible that the centring sleeve is assembled from at least two parts being permanently fixed to each other. In this case it is possible to adjust the size, e.g. the length of the centring sleeve according to the particular application.

[0017] If, as mentioned above, the fuel stream is led through the valve needle assembly, it is, in a further preferred embodiment of the present invention, advantageous that the centring sleeve comprises a connection port for a fluid tube, which connection port is preferably positioned outside the valve body cavity. These features provide for a particularly easy connection of the valve assembly to a distant fuel reservoir or a pump.

[0018] Though there are many different possibilities to actuate the valve needle, it is preferred, that the valve needle assembly comprises an electro-magnetic armature to move the valve needle upon electrical actuation. This way the valve needle can be moved electro-magnetically, i.e. with high precision with respect to volume and time of injection.

[0019] It is a further object of the present invention to provide a method for producing a valve assembly, that is easy to implement and that yields a better alignment of the upper and the lower guides.

[0020] This object is obtained by the features of the independent claim 10.

[0021] Preferred embodiments are defined by the depending claims 11 to 16.

[0022] The method according to the present invention improves the method according to the prior art by the first and the second guiding elements being configured as coaxial and guiding zones of a single centring sleeve, positioned axially apart from each other, the centring sleeve being inserted into the valve body cavity as a whole.

[0023] This means, that the problem of aligning two different elements in two different steps, as is done with the upper and the lower guide in the method according to the prior art, is solved, because only one single element is positioned as a whole in one single step. Thus, no alignment problems can occur.

[0024] In a preferred embodiment of the invention the method further comprises the steps: inserting and fixing the centring sleeve partially inside the valve body cavity; then shaping the centring sleeve with respect to the coaxiality and/or the diameters of its guiding zones; then inserting the valve needle assembly into the centring sleeve. Although it is possible to first shape the centring sleeve and then to insert and fix it to the valve body, this procedure may rise the problem of distortion due to the welding heat applied. It may, thus, be better to insert and fix a centring sleeve roughly shaped and to shape it with some special high precision tool after fixing. This is particularly advantageous, if the wall of the centring sleeve is not too thick.

[0025] Preferably a first guiding zone - namely the lower guide - is configured as an opening in an end face of the centring sleeve with a diameter corresponding to the diameter of the valve needle. Such a guiding zone corresponds substantially to the aperture of the prior art without featuring its problems mentioned above. However, the lower guide may also be configured as a cylindrical guiding zone, though this configuration might be disadvantageous in terms of friction between the valve needle and the lower guide.

[0026] In a further preferred embodiment of the method according to the invention the method further comprises the steps of providing and fixing a valve seat assembly comprising an orifice and a valve seat to one of the openings of the valve body cavity. Thus, it is not necessary to build the whole valve body with the same high precision, that is required for the valve seat and valve orifice. Rather only the relatively small valve seat assembly has to be machined with high precision, and then fixed into the valve body. The valve body as such may be produced with lower precision, lowering the overall costs.

[0027] In a further preferred embodiment of the method according to the invention the method further comprises the step of checking the coaxiality of the centring sleeve's end face opening and its cylindrical guiding part by a double concentric pin gage. This feature has the advantage, that the alignment of the centring sleeve finally fixed in the valve body can be verified before inserting the valve needle assembly. Using a double concentric pin gage, in particular a Go/No Go-Gage, the upper and the lower guides can be checked together as well as separately, yielding more information about possible errors in the system setup.

[0028] If, as mentioned above, the fuel stream is led through the valve needle assembly, it is, in a further preferred embodiment of the method according to present invention, advantageous that the method further comprises the step of attaching a fluid tube to the centring sleeve. This feature provides for a particularly easy connection of the valve assembly to a distant fuel reservoir or a pump.

[0029] Finally, in a further preferred embodiment of the method according to present invention the axial trav-

el of the valve needle is adjusted by inserting the fuel tube accordingly deep into the centring sleeve in order to provide a first stop for the valve needle, while the valve seat is providing an opposite stop for the valve needle.

[0030] In the following the present invention will be explained in more detail with respect to the drawing, in which

Figure 1 illustrates a centring sleeve according to the present invention in two different views rotated by 90° to each other;

Figure 2 illustrates a complete valve assembly with fuel tube according to the present invention in two different views rotated by 90° to each other;

Figure 3 illustrates eight different steps of a method according to the present invention;

Figure 4 illustrates two versions of a shaping tool used with the method according to the invention;

Figure 5 illustrates a valve assembly according to the prior art.

[0031] Fig. 5 illustrates a valve assembly 10' according to the prior art. A valve needle assembly 12' comprises a valve needle 14', which is movable along its longitudinal axis upon actuation by an actuating unit 16', which is configured as an electro-magnetic armature. The valve needle assembly 12' is positioned in a valve body cavity 20' of a valve body 18'. The valve needle assembly 12' is positioned such, that, upon actuation, the valve needle 14' closes and opens a valve orifice 22' by moving to an from a valve seat 24'.

[0032] In the embodiment shown in Fig. 5 the valve body is assembled from several parts, namely the actual valve body 18', a non-magnetic shell 26' and valve body shell 28'. All three parts are fixed permanently by welds W.

[0033] The non-magnetic shell also acts as a connection port for a fuel tube 30'.

[0034] As explained above, the perfectly linear movement of the valve needle 14' is essential for a long life-time operation of the valve assembly 10'. Thus, two guiding zones are provided inside the valve body cavity, namely an upper guide 32' and a lower guide 34'. The upper guide 32' is configured as a metallic sleeve crimped on the upper rim of the valve body 18'. The inner diameter of the upper guide 32' matches the outer diameter of the actuating unit 16' of the valve needle assembly 12'. The lower guide 34' is configured as an aperture having a diameter, that matches the diameter of the valve needle 14' and which is positioned near the valve seat 24'. It is obvious, that the proper alignment

of the upper guide 32' and the lower guide 34' is crucial. However, as they are configured as two separate elements being inserted and fixed in the valve body cavity 20' in different steps, it is difficult to obtain such proper alignment.

[0035] Fig. 1 illustrates a centring sleeve 36 according to the present invention in two different views rotated by 90° to each other. Fig. 2 illustrates a complete valve assembly with fuel tube according to the present invention in two different views rotated by 90° to each other. Both Figures will be described together in the following. Like reference numerals without prime (') symbolize like or functionally equal elements as in Fig. 5.

[0036] The centring sleeve 36 is inserted and permanently fixed in the valve body 18. In its lower end face it comprises an opening of a diameter matching the diameter of the valve needle 14. This opening acts as a lower guide 34. In its upper part the centring sleeve features a first cylindrical part, acting as an upper guide 32. The outer diameter of the upper guide 32 matches the inner diameter of the valve body, while its inner diameter matches the diameter of the armature 16 of the valve needle assembly 14. In the embodiment of Figs. 1 and 2 the centring sleeve 36 also comprises a second cylindrical part at its upper end, that serves as the non-magnetic shell 26, if the centring sleeve 36 is made from some non-magnetic material as is preferred.

[0037] By using a single element featuring both the upper and the lower guide the crucial alignment of these important zones is substantially facilitated. The term "single element" is to be understood such that the element inserted into the valve body 18 is inserted as one piece. However, the centring sleeve 36 may as well be assembled from several pieces fixed permanently to each other prior to inserting the centring sleeve 36 into the valve body 18. In particular, if the centring sleeve is assembled from two axially movable section, its length can be adapted to the special application before fixing the sections together. The centring sleeve may be produced by any suitable technique and may be a flanged or dished part, an extruded part, a press forging part, a part machined from a solid rod, etc. It may feature different wall thicknesses along its length or not.

[0038] In the embodiment shown, the fuel to be injected is supplied from the fuel tube through the valve needle assembly 14 via a fuel outlet 38. The fuel outlet 38 is situated inside the centring sleeve 36. Thus, the centring sleeve 36 features two lateral openings 40, through which the fuel may stream into the valve body cavity 20, as is indicated by the arrows 42. The particular geometric shape of the lateral openings 40 may be designed according to optimised fuel flow conditions and is not restricted to the shape shown.

[0039] Fig. 3 illustrates eight steps a) to h) of a preferred embodiment of the method according to the present invention. In step a) a centring sleeve 36 according to the invention is inserted into the cavity 20 of a valve body 18. The centring sleeve 36 is configured

as described before, having a lower guide 34, an upper guide 32 and a terminal section 26 serving as a non-magnetic shell. In its lateral walls, the centring sleeve features two openings 40. Though the dimensions of the centring sleeve 36 substantially match the final specifications, this is not crucial, since in the preferred embodiment of Fig. 3 there is provided a special sizing step (see below). It is preferred, that the centring sleeve 36 and the valve body 18 are location fixed to each other. It is possible to provide the centring sleeve 18 with a mechanical stop to obtain a specified insertion depth.

[0040] In step b) the valve body 18 and the centring sleeve 36 are permanently fixed to each other, e.g. by welding, furnace brazing, gluing etc.

[0041] In step c) the upper and lower guides 32, 34 are sized and shaped correctly. This step is very advantageous since the welding heat of step c) might create some distortions of the centring sleeve, corrupting the required coaxiality of the upper and the lower guide 32, 34. The shaping and sizing process is carried out by a particular tool 44. The tool 44 mainly compresses the material inducing plastic deformation and a good, i.e. minimized, surface roughness is obtained yielding reduced friction in the successive insertion process of the valve needle assembly 12.

[0042] Two different versions of the sizing tool 44 are shown in Fig. 4. Fig. 4b illustrates the simpler version, where the sizing tool 44 is configured as one piece with two different sections 46, 48 corresponding to the upper and the lower guides 32, 34. Around each of the sections 46, 48, there are coaxial rims with increasing diameter such that insertion of the tool 44 leads to an increasing compression of the centring sleeve's wall material. It is preferred, that the diameter of the largest rim of each section is slightly larger than the desired corresponding inner diameter of the centring sleeve taking into account material settlement. Fig. 4a illustrates a further embodiment, in which the tool 44 comprises an outer tool body 52 and an inner movable shaft 54. The tool body comprises a first section 46 for sizing the upper guide 32, while the shaft 54 comprises a second section 48 for sizing the lower guide 34. The advantage of this version of the tool 44 is, that the axial distance between upper and lower guides 32, 34 may vary. However, such a tool is more difficult to machine.

[0043] In step d) of Fig. 3 the coaxiality and the inner diameters of the upper and the lower guides are checked by a special gage 56. The gage 56 is preferably configured as a double concentric Go/No Go-gage having an outer gage body 58 and an inner movable gage shaft 60. The gage body 58 has a diameter corresponding to the desired diameter of the upper guide 32, while the gage shaft 60 has a diameter corresponding to the desired diameter of the lower guide 34. The advantage of such double concentric gage is, that the upper and the lower guides 32, 34 may be checked separately as well as simultaneously, which is important for checking their coaxiality.

[0044] In step e) the valve seat assembly is inserted into the valve body 18. The valve seat assembly comprises the valve seat 24 as such as well as the valve orifice 22 and is fixed and sealed hermetically.

[0045] In step f) the valve needle assembly 12 is inserted into the centring sleeve 36 being perfectly guided by the upper and lower guides 32, 34 provided by the centring sleeve 36 according to the invention. The valve needle assembly may be the same in the prior art.

[0046] In step g) the fuel tube 30 is inserted into the terminal section of the centring sleeve 36. It is pushed down to the desired insertion depth. This step can be used to adjust the axial travel of the valve needle 14. The armature 16 is activated by a slave coil. The fuel tube 30 is pushed down towards the valve needle 12 until there is a certain gap between the valve needle assembly impact surface and the fuel tube impact surface. This gap determines the axial travel of the valve needle 14. This adjustment is a step by step process and requires a correct dimensioning and shaping of the lower part of the fuel tube 30.

[0047] In step h) the fuel tube 30 is permanently fixed to the centring sleeve 36 e.g. by welding.

[0048] While the invention has been described in the context of preferred embodiments, it will be apparent to those skilled in the art that the present invention may be modified in numerous ways and may assume many embodiments other than that specifically set out and described above. Accordingly, it is intended by the appended claims to cover all modifications of the invention which fall within the scope of the invention.

Claims

1. A valve assembly, in particular for use in an injector unit for injecting fuel into a vehicle engine, comprising a valve body (18) with a valve body cavity (20) and a valve orifice (22), in which valve body cavity (20) there is installed a valve needle assembly comprising a valve needle (14) movable along its longitudinal axis between a closed position, in which the valve needle (14) obturates the valve orifice (22), and an open position, in which the valve needle (14) does not obturate the valve orifice (22), the valve needle assembly (14) being guided in an axially centered way by at least two coaxial guiding zones (32; 34) inside the valve body cavity (20) and axially apart from each other,
characterized in that
a centring sleeve (36) being fixed inside the valve body cavity (20), which centring sleeve (36) comprising the at least two guiding zones (32; 34).
2. The valve assembly according to claim 1,
characterized in that
the valve needle assembly (14) comprising a fluid outlet (38) inside the centring sleeve (36) and the

centring sleeve (36) comprising at least one lateral opening (40) in its lateral wall to allow a fluid flow from the fluid outlet (38) into the valve body cavity (20).

3. The valve assembly according to one of the preceding claims,

characterized in that

the centring sleeve (36) being shaped with respect to the coaxiality of its at least two guiding zones (32; 34) after having been fixed inside the valve body cavity (20).

4. The valve assembly according to one of the preceding claims,

characterized in that

a first guiding zone (34) being configured as an opening in an end face of the centring sleeve (36) with a diameter corresponding to the diameter of the valve needle (14).

5. The valve assembly according to one of the preceding claims,

characterized in that

the centring sleeve (36) being made from a non-magnetic metal.

6. The valve assembly according to one of the preceding claims,

characterized in that

the centring sleeve (36) being assembled from at least two parts being permanently fixed to each other.

7. The valve assembly according to one of the preceding claims,

characterized in that

the centring sleeve (36) comprising a connection port for a fluid tube (30).

8. The valve assembly according to claim 7,

characterized in that

the connection port being positioned outside the valve body cavity (20).

9. The valve assembly according to one of the preceding claims,

characterized in that

the valve needle assembly comprising an electromagnetic armature (16) to move the valve needle (14) upon electrical actuation.

10. A method for producing a valve assembly, in particular for use in an injector unit for injecting fuel into a vehicle engine, comprising the steps of

- providing a valve body (18) with a valve body cavity (20) having at least two openings;

- providing a valve needle assembly comprising a valve needle (14) movable along its longitudinal axis;

- providing a first guiding element (34) having an inner diameter corresponding substantially to the outer diameter of a first section of the valve needle assembly (12, 12'), and a second guiding element (32) having an inner diameter corresponding substantially to the outer diameter of a second section of the valve needle assembly (12);

characterized in that

the first and the second guiding elements being configured as coaxial and guiding zones (34; 32) of a single centring sleeve (36), positioned axially apart from each other, the centring sleeve (36) being inserted together into the valve body cavity (20) as a whole.

11. The method according to claim 10,

characterized in that

further comprising the following steps:

- inserting and fixing the centring sleeve (36) partially inside the valve body cavity;
- then shaping the centring sleeve (36) with respect to the coaxiality and/or the diameters of the guiding zones (34; 32);
- then inserting the valve needle assembly (12) into the centring sleeve (36).

12. The method according to one of the claims 10 or 11,

characterized in that

the first guiding zone (34) being configured as an opening in an end face of the centring sleeve (36) with a diameter corresponding to the diameter of the valve needle (14).

13. The method according to one of the claims 10 to 12,

characterized in that

further comprising the steps of providing and fixing a valve seat assembly (22, 24) comprising an orifice (22) and a valve seat (24) to one of the openings of the valve body cavity (20);

14. The method according to one of the claims 10 to 13,

characterized in that

further comprising the step of checking the coaxiality of the centring sleeve's (36) guiding zones (34, 32) by a double concentric pin gage (56).

15. The method according to one of the claims 10 to 14,

characterized in that

further comprising the step of attaching a fuel tube

(30) to the centring sleeve (36).

16. The method according to claim 15,

characterized in that

the axial travel of the valve needle (14) is adjusted
by inserting the fuel tube (30) accordingly deep into
the centring sleeve (36) in order to provide a first
stop for the valve needle (14), while the valve seat
(24) is providing an opposite stop for the valve needle (14).

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FIG 1A

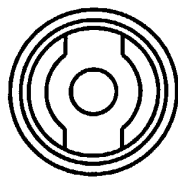


FIG 1B

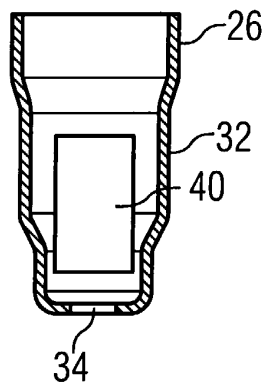
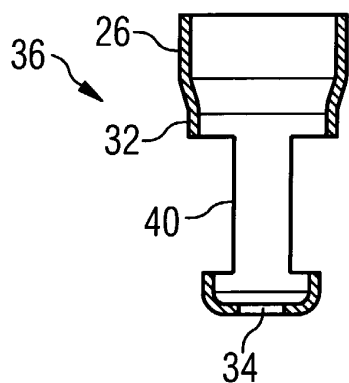
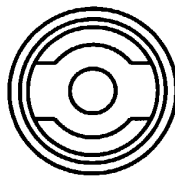


FIG 2A

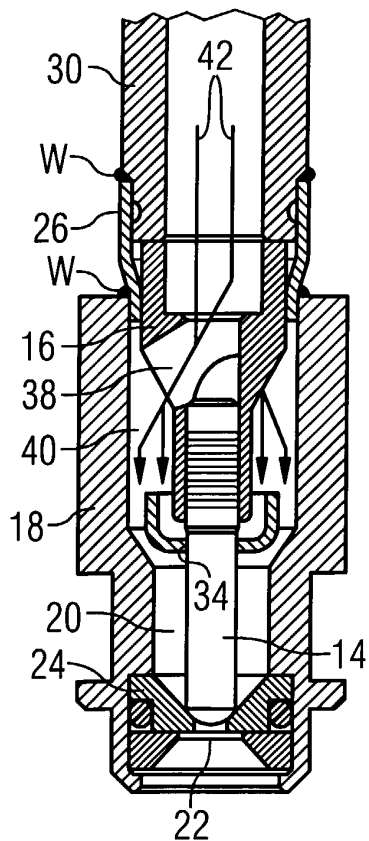
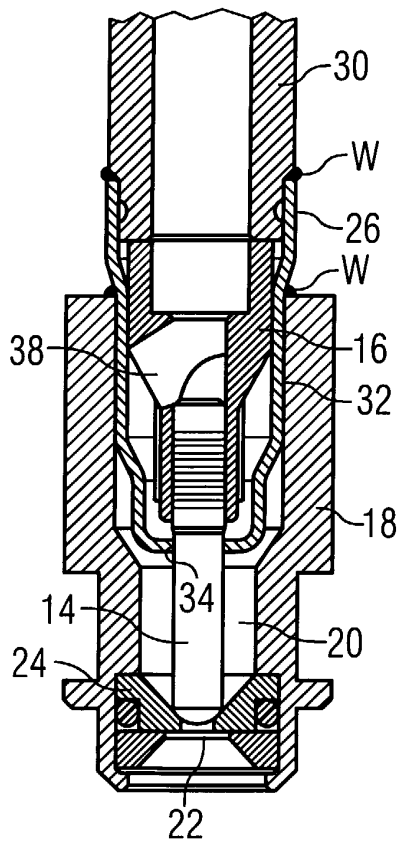
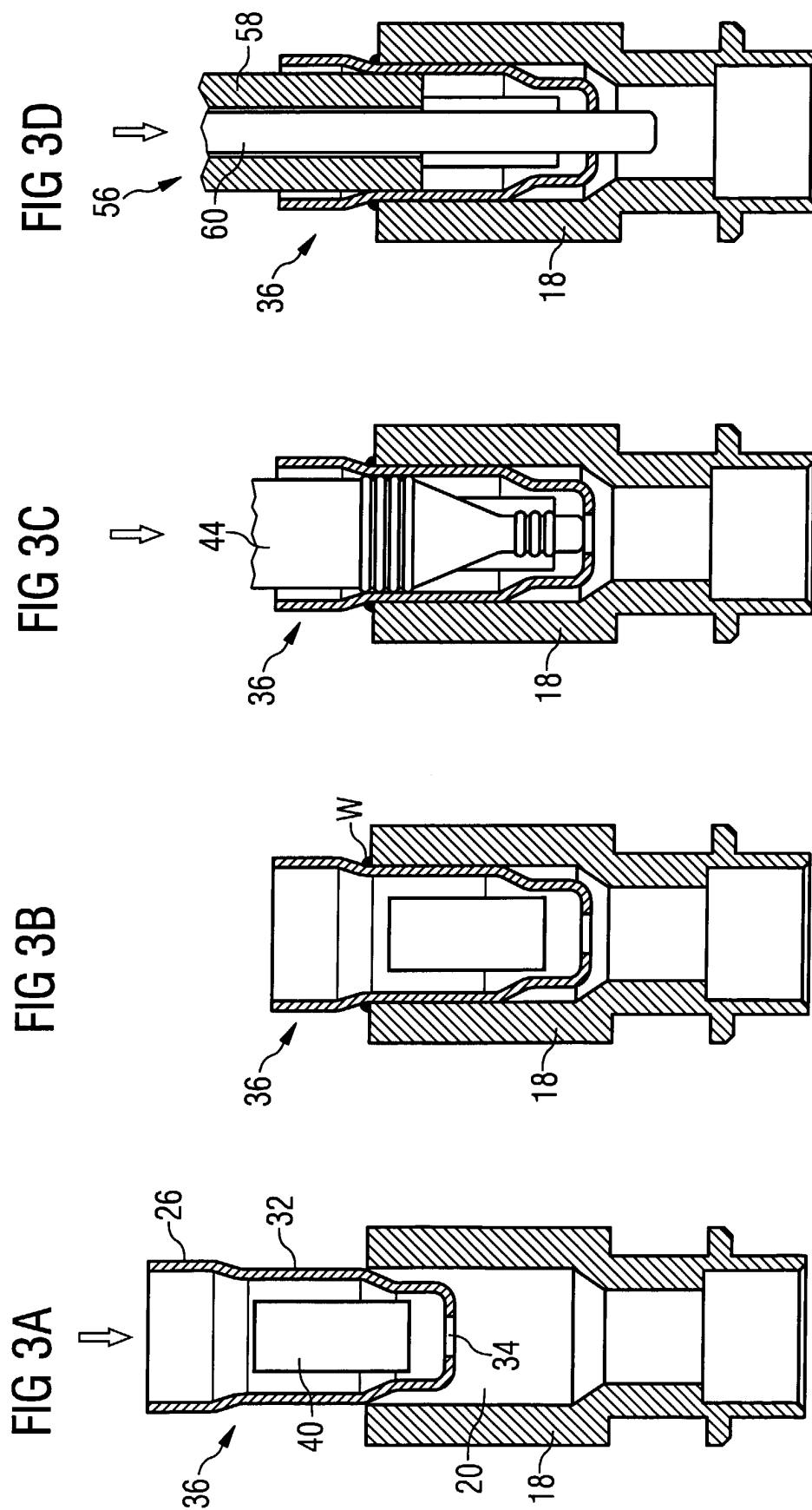
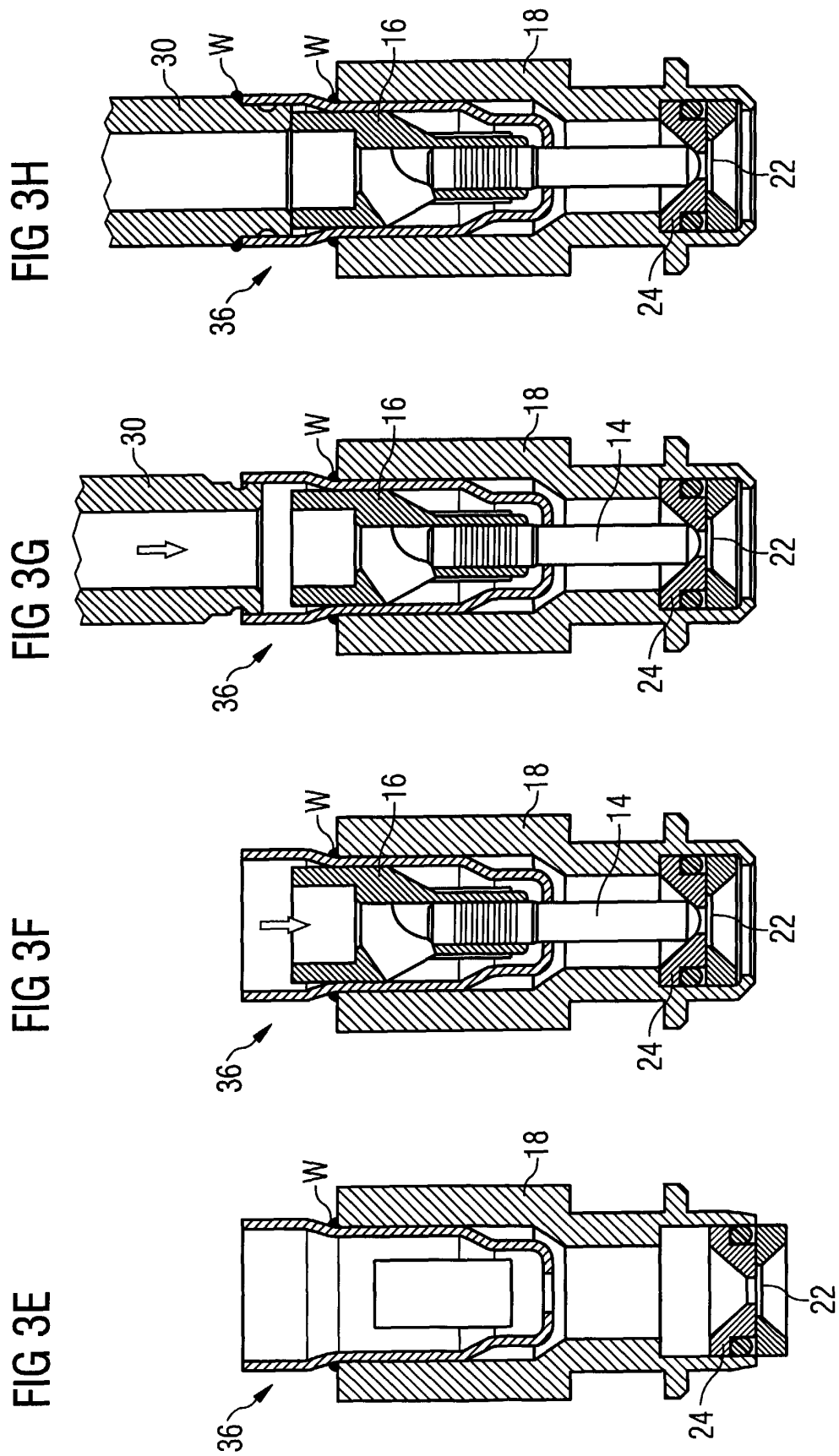
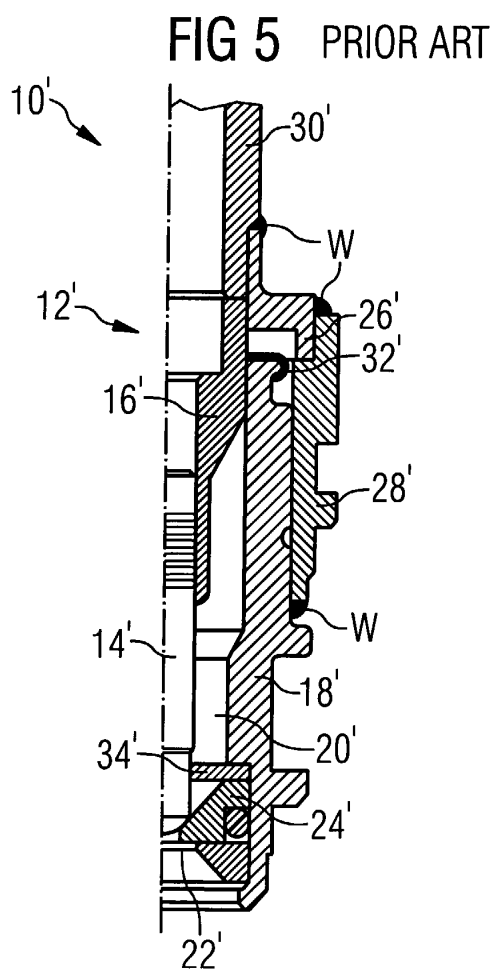
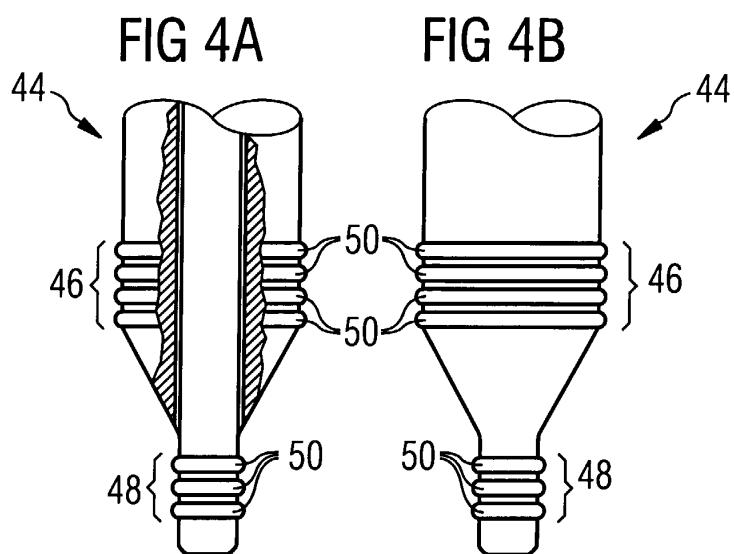


FIG 2B











European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 00 8590

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 04, 31 August 2000 (2000-08-31) & JP 2000 018134 A (ISUZU MOTORS LTD), 18 January 2000 (2000-01-18)	1,3,4,6, 10	F02M61/12 F02M61/16 F02M51/06
Y	* abstract; figures 1-4 *	2,5	
Y	US 4 852 803 A (GASKELL DAVID J) 1 August 1989 (1989-08-01) * column 2, line 1 - column 3, line 19; figures 1,2,4 *	2	
Y	US 4 552 312 A (SEINO TADASHI ET AL) 12 November 1985 (1985-11-12) * column 2, line 60 - column 3, line 65; figure 1 *	5	
X	US 4 903 898 A (KIND WILHELM) 27 February 1990 (1990-02-27) * column 2, line 5 - column 3, line 15; figure 1 *	1,3,7-9	
A	DE 100 31 573 A (BOSCH GMBH ROBERT) 17 January 2002 (2002-01-17) * paragraph [0012] - paragraph [0022]; figures 1,2 *	1,3,4,9	TECHNICAL FIELDS SEARCHED (Int.Cl.7) F02M
A	GB 2 112 455 A (LUCAS IND PLC) 20 July 1983 (1983-07-20) * page 1, line 25 - page 2, line 15; figure 1 *	1,3,4	
A	EP 1 262 654 A (HITACHI LTD ;HITACHI CAR ENG CO LTD (JP)) 4 December 2002 (2002-12-04) * paragraph [0013] - paragraph [0064]; figure 3 *	1,10	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 4 September 2003	Examiner Nobre, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 00 8590

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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