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(54) **Electrical connector for an injector, actuator unit for an injector, injector and method for coupling a first connector element to a second connector element of an electrical connector for an injector**

Elektrischer Verbinder für einen Injektor, Aktuatereinheit für einen Injektor, Injektor und Verfahren zur Kopplung eines ersten Verbinderelements mit einem zweiten Verbinderelement eines elektrischen Verbinders für einen Injektor

Connecteur électrique pour injecteur, unité d'actionneur pour actionneur, injecteur et procédé de couplage d'un premier élément connecteur vers un second élément connecteur d'un connecteur électrique pour injecteur

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(56) References cited:
DE-A1- 10 317 148 DE-A1-102004 063 292
DE-A1-102005 024 196

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Description

[0001] The invention relates to an electrical connector for an injector, an actuator unit for an injector, an injector and a method for coupling a first connector element to a second connector element of an electrical connector for an injector.

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

[0003] In order to enhance the combustion process in view of the creation of unwanted emissions, the respective injector may be suited to dose fluids under very high pressures. The pressures may be in case of a gasoline engine, for example the range of up to 200 bar or in the case of diesel engines in the range of up to 2,000 bar. The injection of fluids under such high pressures has to be carried out very precisely.

[0004] Injectors for an internal combustion engine comprise actuator units. In order to inject fuel, the actuator unit is energized so that a fluid flow through the fluid outlet portion of the injector is enabled.

[0005] An electrical connector for an injector according the preamble of claim 1 is disclosed in DE 10 2005 024 196 A1.

[0006] DE 10 2005 024 196 A1 discloses a fuel injector, for an internal combustion motor, with a piezo actuator to operate the injection valve. A circuit with contact pins is arranged between the group of contacts and the actuator as a connection component group with two sections. The actuator contact pins are each held at the clamp contacts of the sections.

[0007] The object of the invention is to create an electrical connector for an injector, an actuator unit and an injector which are simply to be manufactured and which facilitate a reliable and precise function of the injector. Furthermore, the object of the invention is to create a method for coupling a first connector element to a second connector element of an electrical connector for an injector that is simply to realize and which facilitates a reliable and precise function of the injector.

[0008] These objects are achieved by features of the independent claims. Advantageous embodiments of the invention are given in the sub-claims.

[0009] According to a first aspect the invention is distinguished by an electrical connector for an injector comprising a first connector element and a second connector element, the first connector element comprising a connector body, and an electric conductor being mechanically coupled to the connector body, being designed for an electrical coupling to a power supply and having an external electric conductor section outside the connector body, the external electric conductor section extending in a longitudinal direction, the second connector element comprising a supporting element being designed as a

cylinder with a longitudinal axis, a first electric pin being rigidly coupled to the supporting element and being designed for an electrical coupling to an actuator unit of the injector, and a second electric pin being rigidly coupled to the supporting element and electrically coupled to the first electric pin, the second electric pin being electrically coupled to the external electric conductor section of the first connector element in a mechanically tension-free manner and extending in a plane being parallel to the longitudinal direction of the external electric conductor section.

[0010] This means, that the smallest angle between the plane and the longitudinal axis is equal to the angle between the longitudinal direction of the external electric conductor section and the longitudinal axis.

[0011] This has the advantage that there is no mechanical preload to the coupling area of the electric conductor of the first connector element with the second electric pin of the second connector element in the longitudinal direction of the electric conductor. Furthermore, the coupling between the electric conductor and the second electric pin can be carried out in a mechanical robust manner.

[0012] The second electric pin is extending in the longitudinal direction of the external electric conductor section. This has the advantage that a coupling of the electrical connector in a mechanically preload-free manner is possible.

[0013] The longitudinal direction of the second electric pin is perpendicular to the longitudinal axis of the supporting element. This has the advantage that a simple construction of the electrical connector is possible.

[0014] In an advantageous embodiment of the invention the coupling between the second electric pin and the external electric conductor section is a laser-welded coupling. This has the advantage that laser-welding is a simple and secure coupling method. Additionally, a high repeatability and stability of the coupling is obtainable. Furthermore, little need for the inspection of the coupling area is necessary.

[0015] According to a second aspect the invention is distinguished by an actuator unit with an electrical connector according to the first aspect of the invention and a piezo actuator, wherein the piezo actuator is mechanically coupled to the second connector element of the electrical connector and is designed as a cylinder with a axis extending in direction of the longitudinal axis of the supporting element of the second connector element. This has the advantage that mechanical stress of the coupling area of the electric conductor of the first connector element and the second electric pin of the second connector element due to vibrations of the piezo actuator can be prevented. Furthermore, the coupling between the electric conductor and the second electric pin can be carried out in a mechanical robust manner.

[0016] According to a third aspect the invention is distinguished by an injector comprising the actuator unit of the second aspect of the invention, with the actuator unit being designed for acting on the valve assembly.

[0017] According to a fourth aspect the invention is distinguished by a method for coupling a first connector element of an electrical connector for an injector to a second connector element, the first connector element comprising a connector body, and an electric conductor being mechanically coupled to the connector body, being designed for an electrical coupling to a power supply and having an external electric conductor section outside the connector body, the external electric conductor section extending in a longitudinal direction, the second connector element comprising a supporting element being designed as a cylinder with a longitudinal axis, a first electric pin being rigidly coupled to the supporting element and being designed for an electrical coupling to the actuator unit of the injector, and a second electric pin being rigidly coupled to the supporting element and electrically coupled to the first electric pin, the method comprising the following steps: providing the first connector element and the second connector element, aligning the external electric conductor section of the first connector element relative to the second electric pin of the second connector element to obtain a defined position of the first connector element relative to the second connector element, so that the external electric conductor section of the first connector element and the second electric pin of the second connector element are mechanically coupled in a tension-free manner, rigidly coupling the external electric conductor section of the first connector element to the second electric pin of the second connector element to provide an electric coupling between the first connector element and the second connector element.

[0018] Exemplary embodiments of the invention are explained in the following with the help of schematic drawings. These are as follows:

Figure 1, an injector in a longitudinal section view,

Figure 2, parts of an electrical connector and parts of an actuator unit for the injector according to figure 1 in a longitudinal section view, and

Figure 3, the electrical connector for the injector according to figure 1 in a schematic perspective view.

[0019] Elements of the same design and function that appear in different illustrations are identified by the same reference characters.

[0020] An injector 10 (figure 1) that is used as a fuel injector for an internal combustion engine, comprises an actuator unit 14 and a valve assembly 60.

[0021] The injector 10 has a housing 12 with a tubular shape and a central longitudinal axis A and a cavity 24 which is axially led through the housing 12. The actuator unit 14 is inserted into the cavity 24 of the housing 12 and comprises a piezo actuator 16, which changes its axial length depending on a control signal applied to it. A piezo actuator housing 17 encloses the piezo actuator

16 so that the piezo actuator 16 is stored in a mechanical robust manner.

[0022] The injector 10 has an electrical connector 50 (figure 2) which is electrically and mechanically coupled to the piezo actuator 16 to supply the piezo actuator 16 with electric energy.

[0023] The valve assembly 60 comprises a valve body 20 and a part of the cavity 24 which is axially led through the valve body 20. The cavity 24 of the housing 12 comprises a fluid inlet portion 26. The fluid inlet portion 26 is designed to be connected to a high pressure fuel chamber of an internal combustion engine, the fuel is stored under high pressure, for example, under the pressure of above 200 bar. On one of the free ends of the cavity 24, a fluid outlet portion 28 is formed which is closed or open depending on the axial position of a valve needle 22.

[0024] The valve body 20 has a valve body spring rest 32 and the valve needle 22 comprises a valve needle spring rest 34, both spring rests 32, 34 supporting a spring 30 arranged between the valve body 20 and the valve needle 22.

[0025] The injector 10 is of an outward opening type. In an alternative embodiment of the injector 10 it may be of an inward opening type. Between the valve needle 22 and the valve body 20 a bellow 36 is arranged which is sealingly coupling the valve body 20 with the valve needle 22. By this a fluid flow between the cavity 24 and a chamber 38 is prevented. Furthermore, the bellow 36 is formed and arranged in a way that the valve needle 22 is actuable by the actuator unit 14.

[0026] Figure 2 shows a detailed view of the electrical connector 50. The piezo actuator housing 17 enclosing the piezo actuator 16 comprises a top cap 42. The top cap 42 of the piezo actuator housing 17 is arranged at an end of the piezo actuator 16 facing away from the valve assembly 60. The actuator unit 14 further comprises a piston 46. A thermal compensator unit 40 is arranged in the cavity 24 of the housing 12 and is mechanically coupled to the piston 46 of the piezo actuator 16. The thermal compensation unit 40 enables to set an axial preload force on the actuator unit 14 via the piston 46 to compensate changes of the fluid flow through the fluid outlet portion 28 in the case of temperature changes of the injector 10.

[0027] The piezo actuator 16 further comprises electric pins 41 to supply the piezo actuator 16 with electric energy. The piezo actuator 16 changes its length in axial direction depending on electric energy supplied to it. By changing its length the piezo actuator 16 can exert a force to the valve needle 22. The force from the piezo actuator 16 being exerted to the valve needle 22 in an axial direction allows or prevents a fluid flow through the fluid outlet portion 28.

[0028] The electrical connector 50 of the injector 10 further comprises a first connector element 43 with a non-conductive connector body 44 in which an electric conductor 45 is arranged. Outside the connector body 44 the electric conductor 45 has an external electric conductor

section 45a extending in a longitudinal direction D. Electric energy can be supplied to the electric conductor 45 of the first connector element 43 by a not shown power supply.

[0029] The electrical connector 50 of the injector 10 further comprises a second connector element 47 consisting of a supporting element 48 and first electric pins 49a and second electric pins 49b which are rigidly coupled to the supporting element 48. Preferably, the supporting element 48 consists of plastic or another non-conductive material. The extern electric conductor section 45a of the first connector element 43 is electrically coupled to one of the second electric pins 49b of the second connector element 47 which is electrically coupled to one of the first electric pins 49a which on its part is electrically coupled to one of the electric pin 41 of the piezo actuator 16. Consequently, electric energy can be supplied to the piezo actuator 16 via the first connector element 43 and the second connector element 47 in a simple manner.

[0030] Figure 3 shows the electrical connector 50 with the first connector element 43 and the second connector element 47 in a schematic perspective view. A plane P is extending parallel to the longitudinal direction D of the extern electric conductor section 45a. The plane P is the plane in which the second electric pin 49b of the second connector element 47 is arranged. A smallest angle between the plane P and the longitudinal axis A of the supporting element 48 of the second connector element 47 is equal to an angle ALPHA between the longitudinal direction D of the extern electric conductor section 45a and the longitudinal axis A. Figure 3 shows two possible positions I and II of the second electric pin 49b. For a good overview the first connector element 43 is shown in a distance from the second connector element 47 although in a more realistic representation the first connector element 43 would be very near to the second connector element 47 similar to figure 2.

[0031] As the smallest angle between the plane P and the longitudinal axis A of the supporting element 48 of the second connector element 47 is equal to the angle ALPHA between the longitudinal direction D of the extern electric conductor section 45a and the longitudinal axis A and the second electric pin 49b is arranged in the plane P a mechanical preload to a coupling area 52 of the electric conductor 45 of the first connector element 43 with the second electric pin 49b of the second connector element 47 in the longitudinal direction D of the extern electric conductor section 45a can be prevented. The coupling between the electric conductor 45 and the second electric pin 49b can be carried out in a mechanical robust manner.

[0032] In figure 2 a particular constellation of the angle ALPHA between the longitudinal direction D of the extern electric conductor section 45a and the longitudinal axis A is shown with the Angle ALPHA being equal 90°, and the second electric pin 49b extending in the longitudinal direction D of the extern electric conductor section 45a.

By this, it is possible to obtain several coupling points between the extern electric conductor section 45a of the first connector element 43 and the second electric pins 49b of the second connector element 47.

[0033] In the following a method for coupling the extern electric conductor section 45a to the second electric pin 49b of the injector 10 will be described:

[0034] The first connector element 43 and the second connector element 47 of the injector 10 are provided. The extern electric conductor section 45a of the first connector element 43 is aligned relative to the second electric pin 49b of the second connector element 47. By this a defined position of the first connector element 43 relative to the second connector element 47 can be obtained, so that the extern electric conductor section 45a of the first connector element 43 and the second electric pin 49b of the second connector element 47 can be mechanically coupled in a manner free of mechanical tensions. Finally, the extern electric conductor section 45a of the first connector element 43 is coupled to the second electric pin 49b of the second connector element 47 to provide an electric coupling between the first connector element 43 and the second connector element 47. Preferably, the coupling between the second electric pin 49b and the extern electric conductor section 45a is carried out by laser-welding. This is very advantageous as laser-welding is a simple and very secure coupling method and the coupling can be carried out with a high repeatability and a good stability.

[0035] In the following, the function of the injector 10 will be described:

[0036] The fluid is led from the fluid inlet portion 26 through the housing 12 to the fluid outlet portion 28.

[0037] The valve needle 22 prevents a fluid flow through the fluid outlet portion 28 in the valve body 20 in a closing position of the valve needle 22. Outside of the closing position of the valve needle 22, the valve needle 22 enables the fluid flow through the fluid outlet portion 28.

[0038] The piezo actuator 16 may change its axial length if it is energized. By changing its length the piezo actuator 16 may exert a force on the valve needle 22. The valve needle 22 is able to move in axial direction out of the closing position. Outside the closing position of the valve needle 22 there is a gap between the valve body 20 and the valve needle 22 at an axial end of the injector 10 facing away from the piezo actuator 16. The spring 30 can force the valve needle 22 via the valve needle spring rest 34 towards the piezo actuator 16. In the case the piezo actuator 17 is de-energized the piezo actuator 16 shortens its length. The spring 30 can force the valve needle 22 to move in axial direction in its closing position. It is depending on the force balance between the force on the valve needle 22 caused by the piezo actuator 16 and the force on the valve needle 22 caused by the spring 30 whether the valve needle 22 is in its closing position or not.

Claims

1. Electrical connector (50) for an injector (10) comprising a first connector element (43) and a second connector element (47),
the first connector element (43) comprising

- a connector body (44), and
- an electric conductor (45) being mechanically coupled to the connector body (44), being designed for an electrical coupling to a power supply and having an external electric conductor section (45a) extending in a longitudinal direction (D),

the second connector element (47) comprising

- a supporting element (48) being designed as a cylinder with a longitudinal axis (A),
- a first electric pin (49a) being rigidly coupled to the supporting element (48) and being designed for an electrical coupling to an actuator unit (14) of the injector (10), and
- a second electric pin (49b) being rigidly coupled to the supporting element (48) and electrically coupled to the first electric pin (49a), **characterized in that**

the second electric pin (49b) being electrically coupled to the external electric conductor section (45a) of the first connector element (43) in a mechanically tension-free manner and extending in a plane (P) being parallel to the longitudinal direction (D) of the external electric conductor section (45a), wherein the second electric pin (49b) is extending in the longitudinal direction (D) of the external electric conductor section (45a), whereby the external electric conductor section (45a) is arranged outside the connector body (44), and **in that** the longitudinal direction (D) of the second electric pin (49b) is perpendicular to the longitudinal axis (A) of the supporting element (48).

2. Electrical connector (50) according to claim 1, wherein the coupling between the second electric pin (49b) and the external electric conductor section (45a) is a laser-welded coupling.
3. Actuator unit (14) with an electrical connector (50) according to one of the preceding claims and a piezo actuator (16), wherein the piezo actuator (16) is mechanically coupled to the second connector element (47) of the electrical connector (50) and is designed as a cylinder with a axis extending in direction of the longitudinal axis (A) of the supporting element (48) of the second connector element (47).

4. Injector (10) with a valve assembly (60) and an ac-

tuator unit (14) according to claim 3, with the actuator unit (14) being designed for acting on the valve assembly (60).

5. Method for coupling a first connector element (43) to an second connector element (47) of an electrical connector (50) for an injector (10),
the first connector element (43) comprising

- a connector body (44), and
- an electric conductor (45) being mechanically coupled to the connector body (44), being designed for an electrical coupling to a power supply and having an external electric conductor section (45a) outside the connector body (44), the external electric conductor section (45a) extending in a longitudinal direction (D),

the second connector element (47) comprising

- a supporting element (48) being designed as a cylinder with a longitudinal axis (A),
- a first electric pin (49a) being rigidly coupled to the supporting element (48) and being designed for an electrical coupling to the actuator unit (14) of the injector (10), and
- a second electric pin (49b) being rigidly coupled to the supporting element (48) and electrically coupled to the first electric pin (49a), whereby the longitudinal direction (D) of the second electric pin (49b) is perpendicular to the longitudinal axis (A) of the supporting element (48),

the method comprising the following steps:

- providing the first connector element (43) and the second connector element (47),
- aligning the external electric conductor section (45a) of the first connector element (43) relative to the second electric pin (49b) of the second connector element (47) to obtain a defined position of the first connector element (43) relative to the second connector element (47), so that the external electric conductor section (45a) of the first connector element (43) and the second electric pin (49b) of the second connector element (47) are mechanically coupled in a tension-free manner,
- rigidly coupling the external electric conductor section (45a) of the first connector element (43) to the second electric pin (49b) of the second connector element (47) to provide an electric coupling between the first connector element (43) and the second connector element (47).

Patentansprüche

1. Elektrischer Verbinder (50) für einen Injektor (10), umfassend ein erstes Verbindererelement (43) und ein zweites Verbindererelement (47), während das erste Verbindererelement (43) umfasst:

einen Verbinderkörper (44) und einen elektrischen Leiter (45), der mechanisch an den Verbinderkörper (44) gekoppelt ist, für ein elektrisches Koppeln an eine Stromversorgung gestaltet ist und einen äußeren elektrischen Leiterabschnitt (45a) aufweist, der sich in einer Längsrichtung (D) erstreckt, während das zweite Verbindererelement (47) umfasst:

ein Unterstützungselement (48), das als ein Zylinder mit einer Längsachse (A) gestaltet ist,

einen ersten elektrischen Stift (49a), der starr an das Unterstützungselement (48) gekoppelt ist und für ein elektrisches Koppeln an eine Aktuatoreinheit (14) des Injektors (10) gestaltet ist, und

einen zweiten elektrischen Stift (49b), der starr an das Unterstützungselement (48) gekoppelt ist und elektrisch an den ersten elektrischen Stift (49a) gekoppelt ist, **dadurch gekennzeichnet, dass**

der zweite elektrische Stift (49b) elektrisch an den äußeren elektrischen Leiterabschnitt (45a) des ersten Verbindungselements (43) in einer mechanisch spannungsfreien Weise gekoppelt ist und sich in einer Ebene (P) erstreckt, die parallel zu der Längsrichtung (D) des äußeren elektrischen Leiterabschnitts (45a) ist, während der zweite elektrische Stift (49b) sich in der Längsrichtung (D) des äußeren elektrischen Leiterabschnitts (45a) erstreckt, wodurch der äußere elektrische Leiterabschnitt (45a) außerhalb des Verbinderkörpers (44) angeordnet ist, sowie dadurch, dass die Längsrichtung (D) des zweiten elektrischen Stifts (49b) rechtwinklig zu der Längsachse (A) des Unterstützungselements (48) ist.

2. Elektrischer Verbinder (50) gemäß Anspruch 1, während das Koppeln zwischen dem zweiten elektrischen Stift (49b) und dem äußeren elektrischen Leiterabschnitt (45a) ein lasergeschweißtes Koppeln ist.
3. Aktuatoreinheit (14) mit einem elektrischen Verbinder (50) gemäß einem der vorhergehenden Ansprüche sowie einem Piezoaktuator (16), während der Piezoaktuator (16) mechanisch an das zweite Ver-

bindererelement (47) des elektrischen Verbinders (50) gekoppelt ist und als ein Zylinder mit einer Achse gestaltet ist, die sich in Richtung der Längsachse (A) des Unterstützungselements (48) des zweiten Verbindererelements (47) erstreckt.

4. Injektor (10) mit einer Ventilanordnung (60) und einer Aktuatoreinheit (14) gemäß Anspruch 3, während die Aktuatoreinheit (14) zum Wirken auf die Ventilanordnung (60) gestaltet ist.

5. Verfahren zum Koppeln eines ersten Verbindererelements (43) an ein zweites Verbindererelement (47) eines elektrischen Verbinders (50) für einen Injektor (10), während das erste Verbindererelement (43) umfasst:

einen Verbinderkörper (44) und einen elektrischen Leiter (45), der mechanisch an den Verbinderkörper (44) gekoppelt ist, für ein elektrisches Koppeln an eine Stromversorgung gestaltet ist und einen äußeren elektrischen Leiterabschnitt (45a) außerhalb des Verbinderkörpers (44) aufweist, wobei sich der äußere elektrische Leiterabschnitt (45a) in einer Längsrichtung (D) erstreckt, während das zweite Verbindererelement (47) umfasst:

ein Unterstützungselement (48), das als ein Zylinder mit einer Längsachse (A) gestaltet ist,

einen ersten elektrischen Stift (49a), der starr an das Unterstützungselement (48) gekoppelt ist und für ein elektrisches Koppeln an die Aktuatoreinheit (14) des Injektors (10) gestaltet ist, und

einen zweiten elektrischen Stift (49b), der starr an das Unterstützungselement (48) gekoppelt ist und elektrisch an den ersten elektrischen Stift (49a) gekoppelt ist, während die Längsrichtung (D) des zweiten elektrischen Stifts (49b) rechtwinklig zu der Längsachse (A) des Unterstützungselements (48) ist, wobei

das Verfahren die folgenden Schritte umfasst:

Bereitstellen des ersten Verbindererelements (43) sowie des zweiten Verbindererelements (47),

Ausrichten des äußeren elektrischen Leiterabschnitts (45a) des ersten Verbindererelements (43) in Bezug auf den zweiten elektrischen Stift (49b) des zweiten Verbindererelements (47), um eine definierte Position des ersten Verbindererelements (43) in Bezug auf das zweite Verbindererelement (47) zu erhalten, so dass der äußere elek-

trische Leiterabschnitt (45a) des ersten Verbinderelements (43) und der zweite elektrische Stift (49b) des zweiten Verbinderelements (47) mechanisch in einer spannungsfreien Weise gekoppelt sind, und starres Koppeln des äußeren elektrischen Leiterabschnitts (45a) des ersten Verbinderelements (43) an den zweiten elektrischen Stift (49b) des zweiten Verbinderelements (47), um ein elektrisches Koppeln zwischen dem ersten Verbinderelement (43) und dem zweiten Verbinderelement (47) bereitzustellen.

Revendications

1. Connecteur électrique (50) pour un injecteur (10) comprenant un premier élément connecteur (43) et un second élément connecteur (47), le premier élément connecteur (43) comprenant

- un corps de connecteur (44), et
- un conducteur électrique (45) étant couplé mécaniquement au corps de connecteur (44), étant conçu pour un couplage électrique à une source d'alimentation et ayant une section de conducteur électrique externe (45a) s'étendant dans une direction longitudinale (D),

le second élément connecteur (47) comprenant

- un élément de support (48) ayant la forme d'un cylindre avec un axe longitudinal (A),
- une première broche électrique (49a) étant couplée de façon rigide à l'élément de support (48) et étant conçue pour un couplage électrique à une unité d'actionneur (14) de l'injecteur (10), et
- une seconde broche électrique (49b) étant couplée de façon rigide à l'élément de support (48) et couplée électriquement à la première broche électrique (49a),

caractérisé en ce que

la seconde broche électrique (49b) est couplée électriquement à la section de conducteur électrique externe (45a) du premier élément connecteur (43) de manière mécanique sans tension et s'étend dans un plan (P) parallèle à la direction longitudinale (D) de la section de conducteur électrique externe (45a), la seconde broche électrique (49b) s'étendant dans la direction longitudinale (D) de la section de conducteur électrique externe (45a), moyennant quoi la section de conducteur électrique externe (45a) est agencée à l'extérieur du corps de connecteur (44), et en ce que la direction longitudinale (D) de la seconde broche électrique (49b) est perpendiculaire à l'axe

longitudinal (A) de l'élément de support (48).

2. Connecteur électrique (50) selon la revendication 1, dans lequel le couplage entre la seconde broche électrique (49b) et la section de conducteur électrique externe (45a) est un couplage soudé au laser.
3. Unité d'actionneur (14) comprenant un connecteur électrique (50) selon l'une des revendications précédentes et un actionneur piézoélectrique (16), dans laquelle l'actionneur piézoélectrique (16) est couplé mécaniquement au second élément connecteur (47) du connecteur électrique (50) et se présente sous la forme d'un cylindre avec un axe s'étendant en direction de l'axe longitudinal (A) de l'élément de support (48) du second élément connecteur (47).
4. Injecteur (10) comprenant un ensemble de soupape (60) et une unité d'actionneur (14) selon la revendication 3, l'unité d'actionneur (14) étant conçue pour agir sur l'ensemble de soupape (60).

5. Procédé de couplage d'un premier élément connecteur (43) à un second élément connecteur (47) d'un connecteur électrique (50) pour un injecteur (10), le premier élément connecteur (43) comprenant

- un corps de connecteur (44) et
- un conducteur électrique (45) étant couplé mécaniquement au corps de connecteur (44), étant conçu pour un couplage électrique à une source d'alimentation et ayant une section de conducteur électrique externe (45a) à l'extérieur du corps de connecteur (44), la section de conducteur électrique externe (45a) s'étendant dans une direction longitudinale (D),

le second élément connecteur (47) comprenant

- un élément de support (48) se présentant sous la forme d'un cylindre avec un axe longitudinal (A),
- une première broche électrique (49a) étant couplée de façon rigide à l'élément de support (48) et étant conçue pour un couplage électrique à l'unité d'actionneur (14) de l'injecteur (10), et
- une seconde broche électrique (49b) étant couplée de façon rigide à l'élément de support (48) et couplée électriquement à la première broche électrique (49a), moyennant quoi la direction longitudinale (D) de la seconde broche électrique (49b) est perpendiculaire à l'axe longitudinal (A) de l'élément de support (48),

le procédé comprenant les étapes consistant à :

- prévoir le premier élément connecteur (43) et le second élément connecteur (47),

- aligner la section de conducteur électrique externe (45a) du premier élément connecteur (43) par rapport à la seconde broche électrique (49b) du second élément connecteur (47) pour obtenir une position définie du premier élément connecteur (43) par rapport au second élément connecteur (47), de telle sorte que la section de conducteur électrique externe (45a) du premier élément connecteur (43) et la seconde broche électrique (49b) du second élément connecteur (47) soient couplées mécaniquement sans tension,

- coupler de manière rigide la section de conducteur électrique externe (45a) du premier élément connecteur (43) à la seconde broche électrique (49b) du second élément connecteur (47) pour permettre un couplage électrique entre le premier élément connecteur (43) et le second élément connecteur (47).

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FIG 1

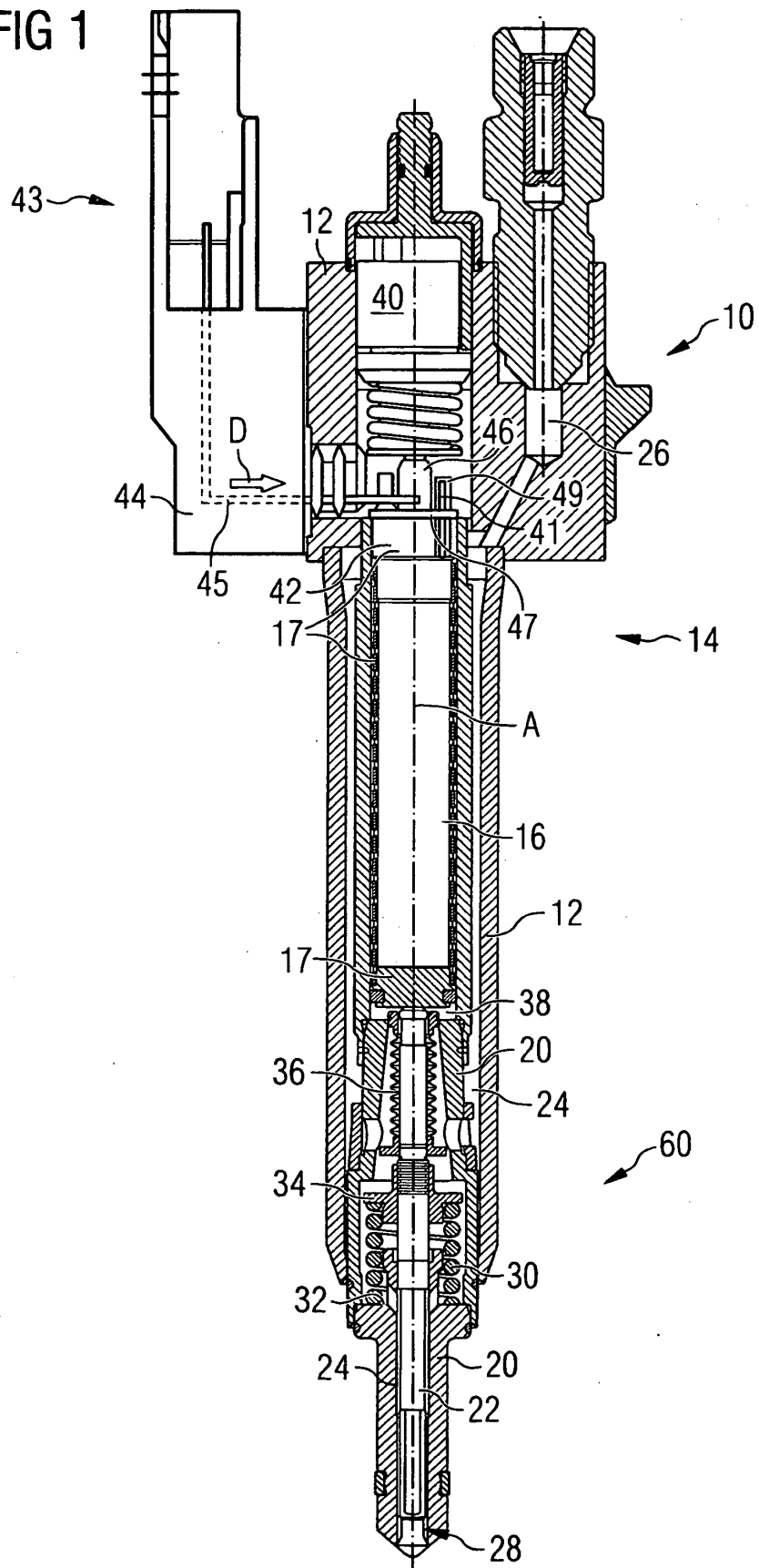


FIG 2

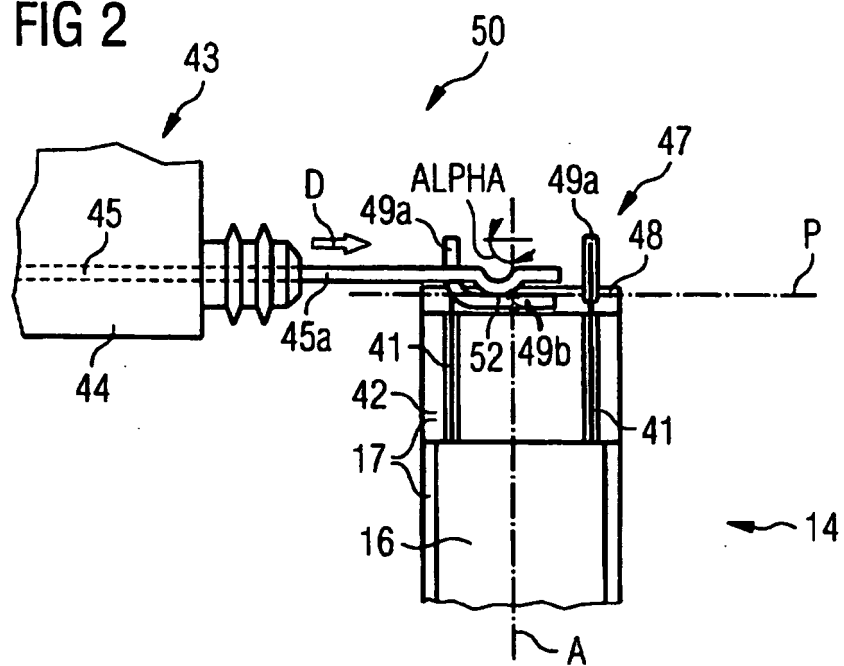
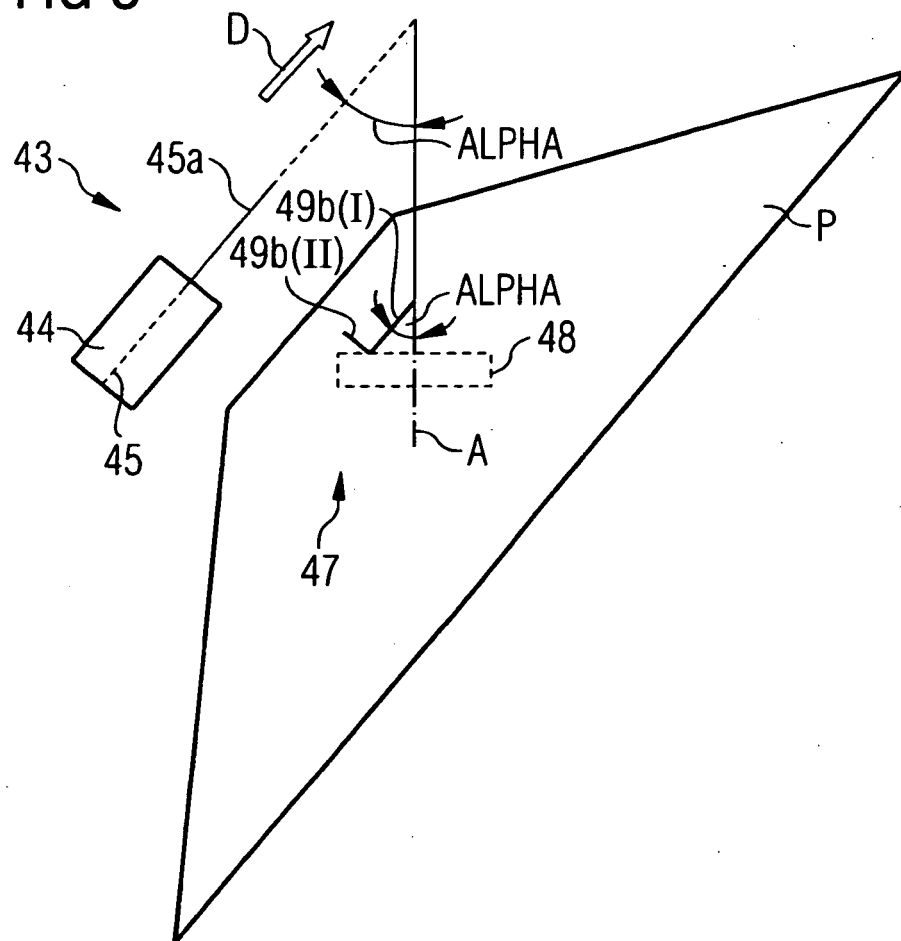


FIG 3



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 102005024196 A1 [0005] [0006]