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(54) **Valve assembly for an injection valve and injection valve**

Düsenanordnung für eine Einspritzdüse und Einspritzdüse

Assemblage de soupape d'injection et soupape d'injection

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- **PATENT ABSTRACTS OF JAPAN vol. 1997, no. 01, 31 January 1997 (1997-01-31) & JP 08 246981 A (NIPPONDENSO CO LTD), 24 September 1996 (1996-09-24)**

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Description

[0001] The invention relates to a valve assembly for an injection valve and an injection valve.

[0002] Injection valves are in widespread 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] Injection valves are manufactured in various forms in order to satisfy the various needs for the various combustion engines. Therefore, for example, their length, their diameter, and all the various elements of the injection valve being responsible for the way the fluid is dosed may vary in a wide range. In addition to that, injection valves may accommodate an actuator for actuating a needle of the injection valve, which may, for example, be an electromagnetic actuator or a piezoelectric actuator.

[0004] In order to enhance the combustion process in view of the creation of unwanted emissions, the respective injection valve may be suited to dose fluids under high pressures.

[0005] The pressures may be in case of a gasoline engine, for example, in the range of up to 200 bar.

[0006] US 5,002,231 discloses an injection valve having a movable valve element and a valve seat face located in a nozzle body, a cup-shaped injection port insert is provided downstream of the valve seat face. To increase the rigidity of the injection port insert, the bottom of the injection port insert has a dishlike indentation, which is remote from the movable valve element, so that a collecting chamber is formed between the movable valve element and the bottom. The injection valve is particularly suitable for fuel injection systems in internal combustion engines.

[0007] US 5,881,957 discloses a fuel injector for an internal combustion engine which includes a valve body, a needle valve, and a hollow nozzle body with a bottom having formed therein spray holes. The needle valve is controlled to be selectively brought into and out of engagement with a valve seat in the valve body to close and open a fuel outlet formed in an end surface of the valve body. The hollow nozzle body is welded to the valve body with the bottom urged into constant engagement with the end surface of the valve body at a given level of pressure which is greater than a maximum fuel injection pressure. This makes it possible to establish the constant engagement of the bottom of the hollow nozzle body with the end surface of the valve body without any clearances even when the maximum fuel injection pressure acts on a portion of the bottom of the hollow nozzle body around the spray holes.

[0008] The object of the invention is to create a valve assembly for an injection valve and an injection valve which is simple to be manufactured and which facilitates a reliable and precise function.

[0009] This object is achieved by the features of the independent claim. Advantageous embodiments of the invention are given in the dependent claims.

[0010] According to the first aspect, the invention is distinguished by a valve assembly of an injection valve, the valve assembly comprising a valve body with a seat body, cavity and an orifice disc being arranged away from the cavity relative to the seat body, and a valve needle axially movable in the cavity. The seat body comprises a needle seat for the valve needle and a projection extending away from the cavity relative to the seat body. The orifice disc comprises a nozzle and a protrusion extending away from the cavity relative to the seat body, and the protrusion abutting the projection of the seat body being rigidly coupled to the projection of the seat body. The orifice disc comprises a plurality of protrusions distributed over the circumference of the orifice disc.

[0011] This has the advantage that a good alignment of the orifice disc relative to the seat body can be obtained. Consequently, a good injection performance of the nozzle is possible. By the plurality of protrusions distributed over the circumference of the orifice disc a very exact positioning of the orifice disc relative to the seat part is possible.

[0012] In an advantageous embodiment of the invention, the coupling between the protrusion of the orifice disc and the projection of the seat body is laser-welded. This allows a reliable coupling between the seat body and the orifice disc.

[0013] In a further advantageous embodiment of the invention, the orifice disc comprises two protrusions which are arranged on opposing sides of the orifice disc. This enables a simple construction of the orifice disc of the protrusions. Consequently, a low-cost solution for the production of the orifice disc may be obtained.

[0014] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings. These are as follows:

Figure 1, an injection valve with a valve assembly in a longitudinal section view,

Figure 2, a part of the valve assembly of the injection valve in a longitudinal section view, and

Figure 3, the part of the valve assembly of the injection valve in a plan view along line III-III of figure 2.

[0015] Elements of the same design and function that appear in different illustrations are identified by the same reference characters.

[0016] An injection valve 12 that can be used as a fuel injector for an internal combustion engine comprises a valve assembly 10, an actuator unit 11, a fuel connector 13 and a housing 14 (figure 1). The fuel connector 13 is designed to be connected to a (not shown) fuel chamber of the internal combustion engine. The fuel can be stored under a pressure of about 200 bar, for example.

[0017] The housing 14 is preferably formed in a way that there is a space to lead the fuel from the fuel connector 13 to a fuel inlet of a valve body 20.

[0018] The actuator unit 11 is preferably arranged in the housing 14. The actuator unit 11 may be of a type known to a person skilled in the art that is suitable for the purpose. It may, for example, contain a piezoelectric actuator. However, the actuator unit 11 may alternatively contain an electromagnetic actuator that comprises an armature 31, a solenoid 32, and a pole element 33. A return spring 25 is arranged and preloaded in such a way that it pushes away the armature 31 from the pole element 33 unless an electromagnetic force created by the solenoid 32 is larger than the preloading force of the return spring 25.

[0019] The valve body 20 comprises a cartridge 16, which is fixed to the housing 14 at one of its free ends, preferably by welding, especially by laser-welding. The cartridge 16 comprises a cavity 18, which takes in a valve needle 22 and also serves as a fluid duct. The cavity 18 of the cartridge 16 takes in on one of its ends a seat body 27. The seat body 27 comprises in a conically shaped area a needle seat 29 for the inward-opening valve needle 22. The valve needle 22 comprises a seat part 24 with a sealing area 30 that is designed to rest on the needle seat 29, if the seat part 24 is pushed against the needle seat 29. The valve needle 22 is mechanically coupled to the armature 31.

[0020] The seat body 27 may be made in one part with the cartridge 16 or as a separate part from the cartridge 16. In addition to that a guide disc 35 for guiding the valve needle 22 is provided (figure 2).

[0021] The seat part 24 of the valve needle 22 may be shaped spherically which improves the sealing quality between the sealing area 30 of the seat part 24 and the needle seat 29. The spherical shape can be easily obtained by forming the seat part 24 out of a ball with a hole where the valve needle 22 is taken in. The ball is preferably fixed to the valve needle 22 by welding.

[0022] If the valve needle 22 rests with the sealing area 30 of its seat part 24 in the needle seat 29 of the seat body 27, fluid is prevented from flowing through one nozzle 41 or a plurality of nozzles 41. If the sealing area 30 of the seat part 24 of the valve needle 22 is distanced from the needle seat 29 of the seat body 27 the fluid can flow through the nozzles 41 out of the valve body 20. The nozzles 41 are arranged in an orifice disc 37 which is arranged away from the cavity 18 relative to the seat body 27. The orifice disc 37 is preferably laser-welded to the seat body 27. It may be also fixed in a different manner.

[0023] The seat body 27 comprises a projection 28 which extends away from the cavity 18 relative to the seat body 27. As can be seen in figure 2 the orifice disc 37 comprises a protrusion 39 which abuts the projection 28 of the seat body 27 and is coupled to the projection 28 of the seat body 27 by welding, preferably by laser-welding. This allows a reliable coupling between the seat body 27 and the orifice disc 37.

[0024] Figure 3 shows the valve assembly 10 with the orifice disc 37 comprising a plurality of protrusions 39 which are distributed over the circumference of the orifice disc 37. The protrusions 39 are forming spring elements and allow a very exact positioning of the orifice disc 37 relative to the seat body 27. Preferably each two protrusions 39 are arranged on opposing sides of the orifice disc 37. This enables a simple construction of the orifice disc 37 of the protrusions 39 and, consequently, a low-cost solution is possible.

[0025] Alternatively, the protrusion 39 is a one-piece element which extends over the whole circumference of the orifice disc 37. This means that the protrusion 39 forms a collar of the orifice disc 37 abutting the projection 38 of the seat body 27. The protrusion 39 works as a spring element and allows a precise fitting of the orifice disc 37 relative to the seat body 27.

[0026] In the following, the function of the injection valve 12 is described in detail:

[0027] The fluid is led from the fuel connector 13 to the cavity 18.

[0028] The spring 25 forces the valve needle 22 towards the actuator unit 11. In the case when the actuator unit 11 is deenergized the spring 25 can force the valve needle 22 to move in axial direction in its closing position. The axial position of the valve needle 22 which determines whether the cavity 18 is opened or closed for a fluid flow is depending on the force balance between the force on the valve needle 12 caused by the actuator unit 11 with the solenoid 32 and the force on the valve needle 22 caused by the spring 25.

[0029] In the closing position of the valve needle 22 the seat part 24 of the valve needle 22 sealingly rests on the needle seat 29 of the seat body 27 and consequently prevents a fluid flow through the nozzles 41.

[0030] In the case that the actuator unit 11 gets energized, the actuator unit 11 may effect a force on the valve needle 22. The valve needle 22 is able to move in axial direction out of the closing position. Outside of the closing position of the valve needle 22, there is a gap in an area between the needle seat 29 of the seat body 27 and the sealing area 30 of the valve needle 22. This enables a fluid flow through the nozzles 41 which can be directed very precise due to the exact positioning of the orifice disc 37 with the protrusions 39 relative to the seat body 27.

Claims

1. Valve assembly (10) of an injection valve (12), the valve assembly (10) comprising

- a valve body (20) with a seat body (27), a cavity (18) and an orifice disc (37) being arranged away from the cavity (18) relative to the seat body (27), and

- a valve needle (22) axially movable in the cavity (18), the seat body (27) comprising a needle seat (29) for the valve needle (22) and a projection (28) extending away from the cavity (18) relative to the seat body (27),

characterized in that the orifice disc (37) comprises a nozzle (41) and a plurality of protrusions (39) distributed over the circumference of the orifice disc (37), said protrusions (39) extending away from the cavity (18) relative to the seat body (27), and said protrusions (39) abutting the projection (28) of the seat body (27) and being rigidly coupled to the projection (28) of the seat body (27).

2. Valve assembly (10) in accordance with claim 1 with the coupling between the protrusions (39) of the orifice disc (37) and the projection (28) of the seat body (27) being laser-welded.

3. Valve assembly (10) in accordance with one of the preceding claims with the orifice disc (37) comprising two protrusions (39) being arranged on opposing sides of the orifice disc (37).

4. Injection valve (12) with a housing (14), an actuator unit (11) and a valve assembly (10) according to one of the preceding claims.

Patentansprüche

1. Ventilanordnung (10) eines Einspritzventils (12), während die Ventilanordnung (10) umfasst:

einen Ventilkörper (20) mit einem Sitzkörper (27), einem Hohlraum (18) und einer Öffnungsscheibe (37), die in Bezug auf den Sitzkörper (27) abgewandt von dem Hohlraum (18) angeordnet ist, und
eine axial in dem Hohlraum (18) bewegbare Ventilnadel (22), während der Sitzkörper (27) einen Nadelsitz (29) für die Ventilnadel (22) sowie einen Vorsprung (28) umfasst, der sich in Bezug auf den Sitzkörper (27) von dem Hohlraum (18) weg erstreckt, **dadurch gekennzeichnet, dass** die Öffnungsscheibe (37) eine Düse (41) sowie eine Mehrzahl an Vorsprüngen (39) aufweist, die über den Umfang der Öffnungsscheibe (37) verteilt sind, wobei sich die Vorsprünge (39) in Bezug auf den Sitzkörper (27) von dem Hohlraum (18) weg erstrecken und an dem Vorsprung (28) des Sitzkörpers (27) anliegen sowie starr an den Vorsprung (28) des Sitzkörpers (27) gekoppelt sind.

2. Ventilanordnung (10) gemäß Anspruch 1, in der die Kopplung zwischen den Vorsprüngen (39) der Öffnungsscheibe (37) und dem Vorsprung (28) des Sitzkörpers (27) lasergeschweißt ist.

3. Ventilanordnung (10) gemäß einem der vorhergehenden Ansprüche, in der die Öffnungsscheibe (37) zwei Vorsprünge (39) aufweist, die an entgegengesetzten Seiten der Öffnungsscheibe (37) angeordnet sind.

4. Einspritzventil (12) mit einem Gehäuse (14), einer Stellgliedeinheit (11) und einer Ventilanordnung (10) gemäß einem der vorhergehenden Ansprüche.

Revendications

1. Assemblage de soupape (10) pour une soupape d'injection (12), lequel assemblage de soupape (10) comprend :

- un corps de soupape (20) avec un corps de siège (27), une cavité (18) et un disque d'orifice (37) disposé à l'écart de la cavité (18) par rapport au corps de siège (27) ; et
- une aiguille de soupape (22) mobile axialement dans la cavité (18), le corps de siège (27) comprenant un siège d'aiguille (29) pour l'aiguille de soupape (22) et une protubérance (28) qui s'étend en s'écartant de la cavité (18) par rapport au corps de siège (27) ;

caractérisé en ce que le disque d'orifice (37) comprend une buse (41) et plusieurs protubérances (39) réparties sur la circonférence du disque d'orifice (37), lesdites protubérances (39) s'écartant de la cavité (18) par rapport au corps de siège (27), et lesdites protubérances (39) entrant en butée contre la protubérance (28) du corps de siège (27) et étant rigidement couplées à la protubérance (28) du corps de siège (27).

2. Assemblage de soupape (10) selon la revendication 1, dans lequel le couplage entre les protubérances (39) du disque d'orifice (37) et la protubérance (28) du corps de siège (27) est soudé au laser.

3. Assemblage de soupape (10) selon l'une quelconque des revendications précédentes, dans lequel le disque d'orifice (37) comprend deux protubérances (39) disposées sur les côtés opposés du disque d'orifice (37).

4. Soupape d'injection (12) comprenant un boîtier (14), une unité d'actionnement (11) et un assemblage de soupape (10) selon l'une quelconque des revendications précédentes.

FIG 1

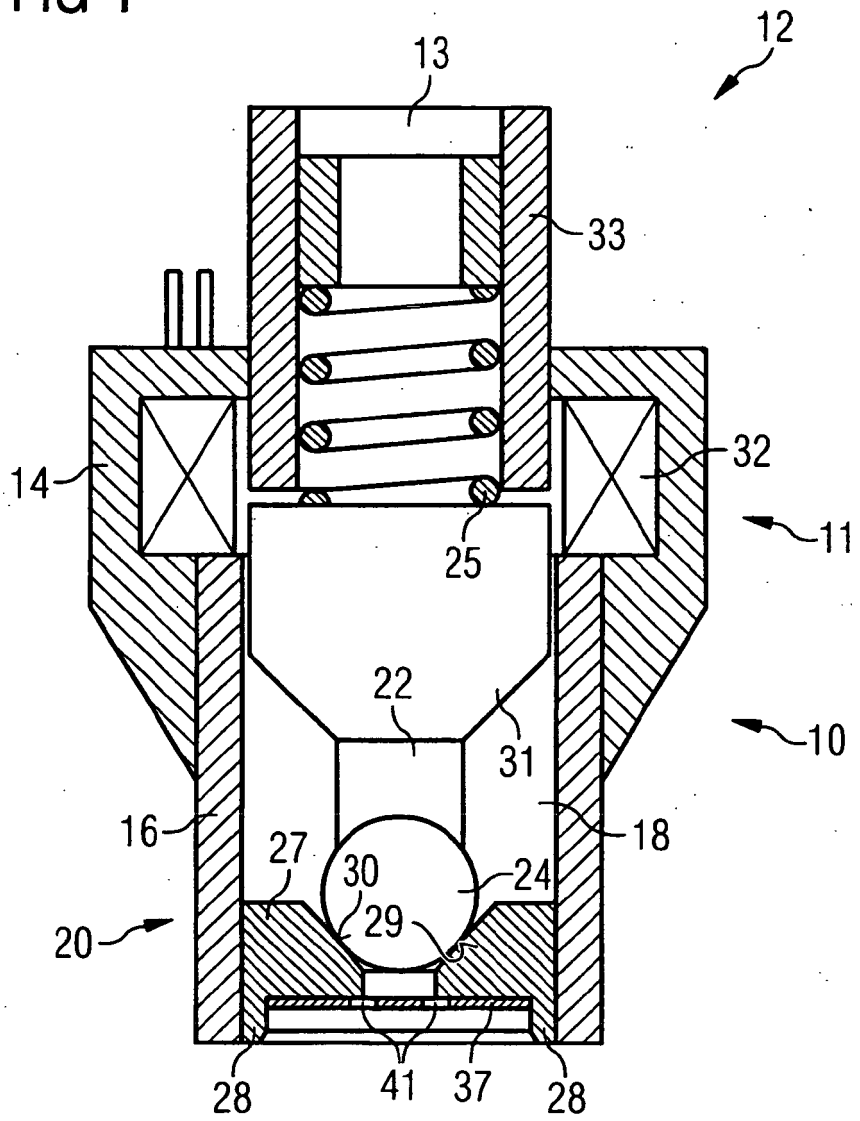

FIG 2

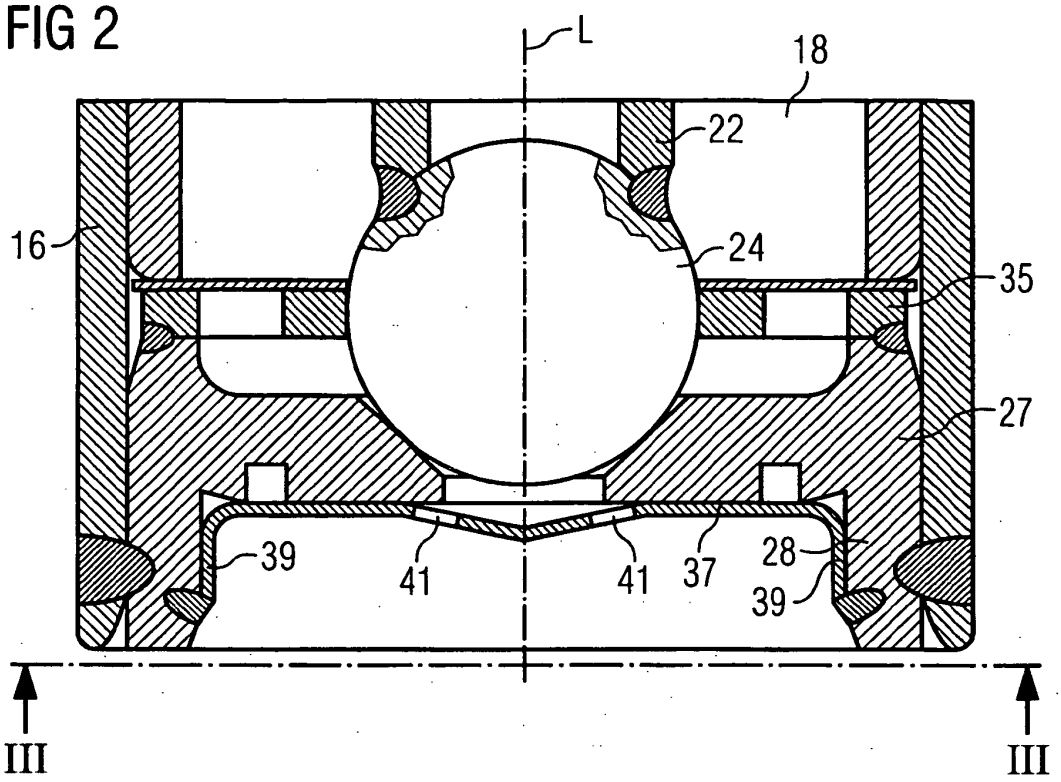
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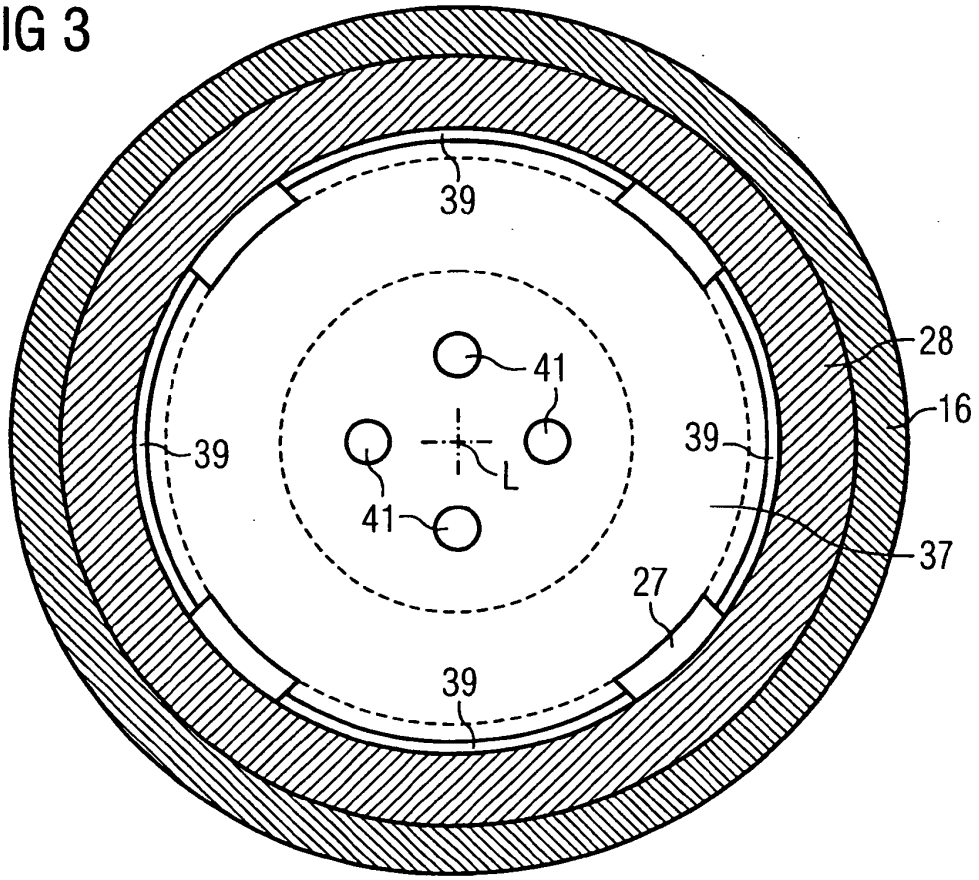
FIG 3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REFERENCES CITED IN THE DESCRIPTION

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