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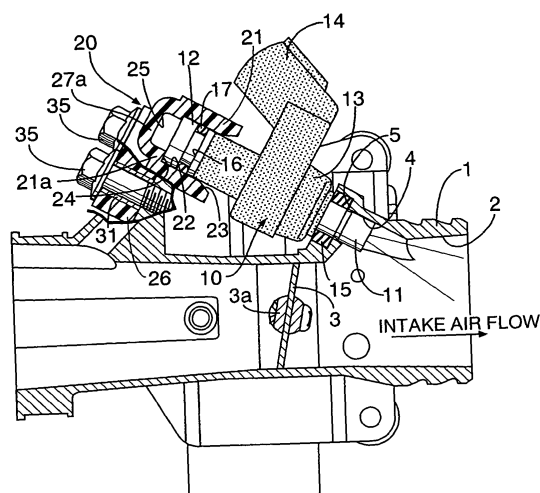
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(54) **HOLDING MEMBER FOR FUEL INJECTION VALVE**

(57) In a retaining member for fuel injection valve which retains in a throttle body (1) a fuel injection valve (10) having a fuel injection portion (11) at one end thereof inserted in a mounting hole (4) provided in a throttle body (1), and is formed by integrally molding a cap portion (21), a fuel joint portion (27) and a mounting boss portion (26) of a synthetic resin so that the fuel joint portion (27) to which a fuel supply pipe (33) is connected, and the mounting boss portion (26) which is connected to the throttle body (1) are integrally connected to the cap portion (21) which is liquid-tightly fitted on an outer periphery of a fuel inlet portion (12) at the other end of the fuel injection valve (10), the mounting boss portion (26) is connected to the cap portion (21) at a region which is away in an axial direction from a fitting surface (22) to the fuel inlet portion (12), on an inner periphery of the cap portion (21). Thus, during molding of a retaining member for a fuel injection valve, thermal shrinkage of the mounting boss portion does not influence the inner peripheral surface of the cap portion, and liquid tightness of a fitting portion of the fuel inlet portion of the fuel injection valve and the cap portion can be secured.

FIG.2



Description

TECHNICAL FIELD

[0001] The present invention relates to an improvement of a retaining member for a fuel injection valve which retains in an intake passage member a fuel injection valve having a fuel injection portion at one end thereof inserted in a mounting hole provided in the intake passage member, and comprises a cap portion, a fuel joint portion and a mounting boss portion which are integrally formed of a synthetic resin by molding so as to integrally connect the fuel joint portion and the mounting boss portion to the cap portion which is liquid-tightly fitted on an outer periphery of a fuel inlet portion at the other end of the fuel injection valve, the mounting boss portion being connected to the intake passage member, the fuel joint portion having an interior communicating with an inside of the cap portion.

BACKGROUND ART

[0002] Such a fuel injection valve retaining member is already known as disclosed in the following Patent Publication 1. Patent Publication 1:

Japanese Patent Application Laid-open No. 2000-54937

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0003] Since in such a conventional retaining member for a fuel injection valve, a mounting boss is provided to protrude on an outer peripheral surface corresponding to a fitting surface of a cap portion, there is the possibility of occurrence of strain on the fitting surface of the cap portion due to the influence of thermal shrinkage of the mounting boss portion during its molding, and depending on the occurrence of the strain, reliability of liquid tightness of a fitting portion of a fuel inlet portion of a fuel injection valve and the cap portion is lost.

[0004] The present invention is made in view of the above circumstances, and has an object to provide a retaining member for a fuel injection valve capable of securing liquid tightness of a fitting portion of a fuel inlet portion of the fuel injection valve and the cap portion by preventing thermal shrinkage of a mounting boss portion from influencing an inner peripheral surface of a cap portion during molding.

MEANS FOR SOLVING THE PROBLEMS

[0005] In order to attain the above object, according to a first feature of the present invention, there is provided a retaining member for a fuel injection valve which retains in an intake passage member a fuel injection valve having

a fuel injection portion at one end thereof inserted in a mounting hole provided in the intake passage member, and comprises a cap portion, a fuel joint portion and a mounting boss portion which are integrally formed of a synthetic resin by molding so as to integrally connect the fuel joint portion and the mounting boss portion to the cap portion which is liquid-tightly fitted on an outer periphery of a fuel inlet portion at the other end of the fuel injection valve, the mounting boss portion being connected to the intake passage member, the fuel joint portion having an interior communicating with an inside of the cap portion, characterized in that the mounting boss portion is connected to the cap portion at a region of an inner periphery of the cap portion, which is away in an axial direction from a fitting surface to the fuel inlet portion.

[0006] It should be noted here that the intake passage member corresponds to a throttle body 1 in embodiments of the present invention which will be described below.

[0007] According to a second feature of the present invention, in addition to the first feature, a pair of mounting boss portions and one fuel joint portion are disposed in a dispersed manner around the cap portion.

[0008] According to a third feature of the present invention, in addition to the first feature, rigidity of a connecting part between the cap portion and the mounting boss portion is made lower than rigidity of the cap portion.

[0009] According to a fourth feature of the present invention, in addition to the second feature, the pair of mounting boss portions are disposed so that axes of both the mounting boss portions are on two vertexes of a virtual triangle with an axis of the cap portion as the remaining one vertex of the virtual triangle in the plane view of the retaining member, and the fuel joint portion is disposed in a range of a vertically opposite angle with respect to a vertical angle of the triangle on the axis side of the cap portion.

[0010] According to a fifth feature of the present invention, in addition to the fourth feature, a power receiving coupler which is provided to protrude at an outer peripheral portion of the fuel injection valve is disposed in the range of the vertically opposite angle.

[0011] According to a sixth feature of the present invention, in addition to the fourth feature, the vertical angle is set to be an obtuse angle.

[0012] According to a seventh feature of the present invention, in addition to the fourth feature, distances to the respective mounting boss portions from the axis of the cap portion are set to be substantially equal.

[0013] According to an eighth feature of the present invention, in addition to the fifth feature, an angle which is formed by a center line of the fuel joint portion and a center line of the power receiving coupler is set at 50° or more.

EFFECT OF THE INVENTION

[0014] According to the first feature of the present invention, the mounting boss portion is connected to the

cap portion at the region which is away in an axial direction from the fitting surface to the fuel inlet portion, on the inner periphery of the cap portion, and therefore, even if thermal shrinkage occurs to the mounting boss portion during molding of the retaining member, its influence is not exerted on the fitting surface. Therefore, the favorable fitting surface without strain can be always secured, and therefore, the fitting surface and the fuel inlet portion which is fitted on the fitting surface via the seal ring are always kept in the favorably sealed state, and leak of the high-pressure fuel can be reliably prevented.

[0015] According to the second feature of the present invention, a pair of mounting boss portions and one fuel joint portion are disposed in a dispersed manner around the cap portion, and therefore, when a fuel supply pipe is attached to and detached from the fuel joint portion in the state in which the retaining member is mounted to the throttle body during maintenance, the load exerted on the fuel joint portion can be dispersed to both the mounting boss portions via the cap portion with good balance, whereby both the mounting boss portions, and thus the retaining member can be made compact and light.

[0016] According to the third feature of the present invention, rigidity of a connecting part between the cap portion and the mounting boss portion is made lower than rigidity of the cap portion, and therefore, when attaching and detaching of the fuel supply pipe to and from the fuel joint portion, and attaching and detaching of the power supplying coupler to and from the power receiving coupler are performed during maintenance, if a large load is applied to the cap portion, the thin connecting portion moderately bends, whereby an excessive load can be prevented from being applied to the fitting portion of the fuel inlet portion of the fuel injection valve 10 and the cap portion, and therefore, strain of the fitting portion is avoided to make it possible to prevent leakage of the fuel.

[0017] According to the fourth feature of the present invention, the pair of mounting boss portions and one fuel joint portion are disposed in a dispersed manner around the cap portion 21, and when the fuel supply pipe is attached to and detached from the fuel joint portion in the state in which the retaining member is mounted to the intake passage member during maintenance, the attachment and detachment can be easily performed without interference of the other components, in addition to which, the load exerted on the fuel joint portion can be dispersed to and supported by both the mounting boss portions via the cap portion with good balance. Therefore, this can contribute to downsizing and reduction in weight of both the mounting boss portions and thus the retaining member.

[0018] According to the fifth feature of the present invention, the power receiving coupler of the fuel injection valve is also disposed in the range of the vertically opposite angle, and therefore, when the power supplying coupler is attached to and detached from the power receiving coupler in the state in which the fuel injection

valve is retained in the intake passage member with the retaining member during maintenance, the load exerted on the fuel injection valve can be dispersed to and supported by both the mounting boss portions via the cap portion with good balance, which also contributes to downsizing and reduction in weight of both the mounting boss portions and thus the retaining member.

[0019] According to the sixth feature of the present invention, when the fuel supply pipe is attached to and detached from the fuel joint portion, the load exerted on the fuel joint portion can be dispersed to and supported by both the mounting boss portions via the cap portion with better balance, and when the power supplying coupler is attached to and detached from the power receiving coupler, the load exerted on the fuel injection valve can be dispersed to and supported by both the mounting boss portions via the cap portion with better balance.

[0020] According to the seventh feature of the present invention, the respective mounting boss portions support the cap portion stably under substantially the same conditions, which can contribute to downsizing and reduction in weight of the retaining member.

[0021] According to the eighth feature of the present invention, attaching and detaching of the fuel supply pipe to and from the fuel joint portion, and attaching and detaching of the power supplying coupler to and from the power receiving coupler can be facilitated without interference with one another during maintenance, which can contribute to enhancement of assemblability.

[0022] The above and other objects, features and advantages of the invention will become apparent from the following description of the preferred embodiment taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

[FIG. 1] FIG. 1 is a plane view showing a state in which a fuel injection valve is mounted to a throttle body of an engine by using a retaining member according to a first embodiment of the present invention (first embodiment).

[FIG. 2] FIG. 2 is a sectional view taken on line 2-2 in FIG. 1 (first embodiment).

[FIG. 3] FIG. 3 is a view seen along the arrow 3 in FIG. 1 (first embodiment).

[FIG. 4] FIG. 4 is a bottom view of the retaining member (first embodiment).

[FIG. 5] FIG. 5 is a sectional view taken on line 5-5 in FIG. 4 (first embodiment).

[FIG. 6] FIG. 6 is a view seen along the arrow 6 in FIG. 4 (first embodiment).

[FIG. 7] FIG. 7 is a sectional view showing a second embodiment of the present invention (second embodiment).

EXPLANATION OF REFERENCE NUMERALS AND SYMBOLS

[0024]

1	intake passage member (throttle body)
4	mounting hole
10	fuel injection valve
11	fuel injection portion
12	fuel inlet portion
14	power receiving coupler
20	retaining member
21	cap portion
22	fitting surface
26	mounting boss portion
27	fuel joint portion
28'	thin connecting portion
30	virtual triangle
33	fuel supply pipe
34	power supplying coupler
A	axis of the mounting boss portion
B	axis of the cap portion
C	center line of the fuel joint portion
D	center line of the power receiving coupler
α	vertical angle of the triangle 30 on the axis side of the cap portion
β	vertically opposite angle
θ	angle formed by the center lines C and D

BEST MODE FOR CARRYING OUT THE INVENTION

[0025] Hereinafter, preferred embodiments of the present invention will be described based on the attached drawings.

EMBODIMENT 1

[0026] In FIGS. 1 to 3, a throttle body 1 as an intake passage member of an engine has an intake path 2 which connects to an intake port of the engine not shown, and a valve shaft 3a of a butterfly type throttle valve 3 which regulates an intake amount of the engine by opening and closing the intake path 2 is rotatably supported by the throttle body 1. A mounting hole 4 which opens to the intake path 2 not shown and a mounting seat 5 which extends in a radial direction from a peripheral edge of an outer end of the mounting hole 4 are formed at a side wall of the throttle body 1 at a downstream side from the throttle valve 3.

[0027] Meanwhile, an electromagnetic fuel injection valve 10 which is mounted to the throttle body 1 has a fuel injection portion 11 at one end thereof and a fuel inlet portion 12 at the other end. An outer shell 13 of a synthetic resin which is molded to embed a coil portion of an inside is formed at an outer periphery of an intermediate portion between the fuel injection portion 11 and the fuel inlet portion 12, and a power receiving coupler 14 which protrudes to one side of the outer shell 13 is integrally formed

at the outer shell 13.

[0028] A cushion ring 15 of rubber having a sealing function is fitted on an outer periphery of a root of the fuel injection portion 11 to abut to an end surface of the outer shell 13. An O-ring 17 as a seal member is fitted to an annular seal groove 16 formed on an outer periphery of the fuel inlet portion 12.

[0029] The fuel injection portion 11 of the fuel injection valve 10 is inserted into the mounting hole 4 of the throttle body 1, and the cushion ring 15 is overlaid on the mounting seat 5. The fuel injection valve 10 is retained by a retaining member 20 of a synthetic resin to compress the cushion ring 15.

[0030] The retaining member 20 will be described by referring to FIG. 1 and FIGS. 4 to 6.

[0031] The retaining member 20 includes a cylindrical cap portion 21 as a main body. An inner peripheral surface of the cap portion 21 is formed by a cylindrical fitting surface 22, and a tapered guide surface 23 which is formed at an inlet side of the fitting surface 22. The fuel inlet portion 12 of the fuel injection valve 10 is fitted in the fitting surface 22 through the guide surface 23, and the O-ring 17 is in close contact with the fitting surface 22.

[0032] A stopper step 24 which extends inward in the radial direction from an inner end of the fitting surface 22, and a recess 25 which is located at a center portion of the stopper step 24 to open to the fitting surface 22 side are formed at a ceiling portion 21a of the cap portion 21, so that an end surface of the fuel inlet portion 12 abuts to the stopper step 24 to restrict insertion depth of the fuel inlet portion 12 into the cap portion 21.

[0033] A pair of cylindrical mounting boss portions 26, 26 which protrude to an outside of the ceiling portion 21a, and a tubular fuel joint portion 27 are integrally formed at the ceiling portion 21a. Both the mounting boss portions 26, 26 are disposed so that their axes A, A are parallel with an axis B of the cap portion 21, and are connected to the ceiling portion 21a of the cap portion 21 via a relatively thin plate-shaped connecting portion 28. Apart of the tubular fuel joint portion 27 becomes a bulged portion 27a of a top surface of the ceiling portion 21a to protrude to one side of the ceiling portion 21a, and an inside of the fuel joint portion 27 communicates with the recess 25 of the inner surface of the ceiling portion 21a. Ribs 29, 29 which connect the bulged portion 27a and the respective mounting boss portions 26 are formed between the bulged portion 27a and the respective mounting boss portions 26.

[0034] In this manner, a pair of mounting boss portions 26, 26 are connected to the ceiling portion 21a of the cap portion 21 at regions away from the fitting surface 22 in an axial direction. These mounting boss portions 26, 26 are disposed so that both of their axes A, A are on two vertexes of a virtual triangle 30 with the axis B of the cap portion 21 as the remaining one vertex of the virtual triangle 30 in the plane view of the retaining member 20. On this occasion, distances between the axes A of the respective mounting boss portions 26 and the axis B of

the cap portion 21 are set to be substantially equal. A vertical angle α of the triangle 30 at the side of the axis B of the cap portion 21 is set to be an obtuse angle. The fuel joint portion 27 is disposed in the range of a vertically opposite angle β with respect to the vertical angle α . As shown in FIG. 1, when the retaining member 20 is fitted to the fuel injection valve 10, the position in the rotating direction of the fuel injection valve 10 is restricted so that the power receiving coupler 14 of the fuel injection valve 10 is within the range of the vertically opposite angle β .

[0035] The retaining member 20 formed of the cap portion 21, the mounting boss portions 26, 26, and the fuel joint portion 27 as described above is formed of a synthetic resin by molding, a metal bush 31 is press-fitted in or mold-connected to an inner peripheral surface of each of the mounting boss portions 26. The mounting boss portions 26, 26 are fixed to the throttle body 1 by bolts 35, 35, respectively. A positioning protrusion 32 is integrally provided to protrude at an outer peripheral surface of the cap portion 21. With this positioning protrusion 32 as a reference, the position of the power receiving coupler 14 of the fuel injection valve 10 is restricted, and by the restriction, the fuel joint portion 27 and the power receiving coupler 14 are disposed so that an angle θ formed by center lines C and D of them becomes 50° or more. Thus, a fuel supply pipe 33 which connects to a discharge port of a fuel pump not shown is connected to the fuel joint portion 27, and a power supplying coupler 34 is connected to the power receiving coupler 14.

[0036] Next, an operation of the first embodiment will be described.

[0037] On mounting the fuel injection valve 10 to the throttle body 1, the fuel inlet portion 12 of the fuel injection valve 10 is forced into the cap portion 21 of the retaining member 20 until an end surface of the fuel inlet portion 12 abuts to the stopper step 24, and the O-ring 17 is brought into close contact with the fitting surface 22. Then, with the positional relationship of the power receiving coupler 14 of the fuel injection valve 10 and the mounting boss portions 26, 26 of the retaining member 20 set as described above, the fuel injection portion 11 of the fuel injection valve 10 is inserted into the mounting hole 4 of the throttle body 1, and the cushion ring 15 is placed on the mounting seat 5. Next, the mounting boss portions 26, 26 are fixed to predetermined positions of the throttle body 1 with the bolts 35, 35.

[0038] Thus, the fastening force of the mounting boss portions 26, 26 to the throttle body 1 by the bolts 35, 35 acts on the cushion ring 15 as the compression force via the fuel injection valve 10 from the stopper step 24 of the cap portion 21, and the fuel injection valve 10 is elastically supported by the repulsive force to the compression force.

[0039] During operation of the engine, the high pressure fuel which the fuel pump not shown discharges is supplied to the fuel injection valve 10 through the fuel joint portion 27 of the retaining member 20 from the fuel supply pipe 33, and is injected to the intake port of the

engine from the fuel injection portion 11 at a valve opening time of the valve 10.

[0040] Since in the retaining member 20 of the synthetic resin, a pair of the mounting boss portions 26, 26 are connected to the regions, of the cap portion 21, which are away in the axial direction from the fitting surface 22, to which the fuel inlet portion 12 of the fuel injection valve 10 is fitted, even if thermal shrinkage occurs to the mounting boss portions 26, 26 during molding of the retaining member 20, its influence is not exerted on the fitting surface 22, and therefore, the favorable fitting surface 22 without strain can be always secured. Therefore, the fitting surface 22 and the fuel inlet portion 12 which is fitted to the fitting surface 22 via the O-ring 17 are always kept in a favorable sealed state, and a leak of the high pressure fuel can be reliably prevented.

[0041] Especially since both the mounting boss portions 26, 26 are connected to the ceiling portion 21a of the cap portion 21 via the plate-shaped connecting part 28, the influence of the thermal shrinkage of both the mounting boss portions 26, 26 on the fitting surface 22 can be effectively blocked in the plate-shaped connecting part 28. In addition, since the mounting boss portions 26, 26 are connected to a part of the fuel joint portion 27 which is the bulged portion 27a of the upper surface of the ceiling portion 21a of the cap portion 21 via the ribs 29, 29, the connection strength of both the mounting boss portions 26, 26 and the ceiling portion 21a is enhanced, and the fuel injection valve 10 can be firmly retained.

[0042] Since both the mounting boss portions 26, 26 in the plane view of the retaining member 20 are disposed so that both their axes A, A are on two vertexes of the triangle 30 with the axis B of the cap portion 21 as the remaining one vertex of the triangle 30, and the fuel joint portion 27 is disposed in the range of the vertically opposite angle β with respect to the vertical angle α of the triangle 30 on the axis B side of the cap portion 21, a pair of mounting boss portions 26, 26 and one fuel joint portion 27 are disposed in a dispersed manner around the cap portion 21, and when the fuel supply pipe 33 is attached to and detached from the fuel joint portion 27 in the state in which the retaining member 20 is mounted to the throttle body 1 during maintenance, the attaching and detaching can be facilitated without interference of the other components, and moreover, the load exerted on the fuel joint portion 27 can be dispersed to and supported by both the mounting boss portions 26, 26 via the cap portion 21 with good balance. Since the power receiving coupler 14 of the fuel injection valve 10 is also disposed in the range of the vertically opposite angle β , when the power supplying coupler 34 is attached to and detached from the power receiving coupler 14 in the state in which the fuel injection valve 10 is retained in the throttle body 1 with the retaining member 20, during maintenance, the load exerted on the fuel injection valve 10 is dispersed to and supported by both the mounting boss portions 26, 26 via the cap portion 21 with good balance. Thereby, both the mounting boss portions 26, 26, and thus the

retaining member 20 can be made compact and light. Such an effect is made further remarkable by especially setting the vertical angle α to be an obtuse angle.

[0043] By setting the distances between the axes A of the respective mounting boss portions 26 and the axis B of the cap portion 21 substantially equal, the respective mounting boss portions 26 can stably support the cap portion 21 under substantially the same conditions, which can also contribute to downsizing and reduction in weight of the retaining member 20.

[0044] Since the fuel joint portion 27 of the retaining member 20 and the power receiving coupler 14 of the fuel injection valve 10 are disposed so that the angle θ which is formed by their center lines C and D becomes 50° or more, during maintenance, attaching and detaching of the fuel supply pipe 33 to and from the fuel joint portion 27, and attaching and detaching of the power supplying coupler 34 to and from the power receiving coupler 14 can be easily performed without interference with one another, which can contribute to enhancement of assemblability.

EMBODIMENT 2

[0045] Next, the second embodiment of the present invention shown in FIG. 7 will be described.

[0046] In the second embodiment, in the retaining member 20 of a synthetic resin, a pair of mounting boss portions 26, 26 are connected to the peripheral edge of the opening of the guide surface 23 of the cap portion 21 via a connecting part 28' which is thinner than the cap portion 21, and these mounting boss portions 26, 26 are disposed with small spaces at the sides of the cap portion 21. The other construction is the same as that of the previous embodiment, and therefore, the redundant explanation will be omitted by assigning the same reference numerals and symbols to the parts corresponding to those in the previous embodiment in the drawings.

[0047] In the second embodiment, even if thermal shrinkage occurs to the mounting boss portions 26, 26 during molding of the retaining member 20 of the synthetic resin, the influence of the thermal shrinkage of both the mounting boss portions 26, 26 on the fitting surface 22 in the cap portion 21 can be blocked by the thin connecting portion 28', and the favorable fitting surface 22 without strain can be always secured as in the previous embodiment.

[0048] The thin connecting portion 28' which connects the cap portion 21 and the mounting boss portions 26, 26 is lower in rigidity than the cap portion 21, and therefore, when attaching and detaching of the fuel supply pipe 33 to and from the fuel joint portion 27 and attaching and detaching of the power supplying coupler 34 to and from the power receiving coupler 14 are performed during maintenance, if a large load is applied to the cap portion 21, the connecting part 28' moderately bends, whereby an excessive load can be prevented from being applied to the fitting portion of the fuel inlet portion 12 of the fuel

injection valve 10 and the cap portion 21, and therefore, strain of the fitting portion is avoided to make it possible to prevent the leak of the fuel.

[0049] Although the embodiments of the present invention have been described in detail, it will be understood that the present invention is not limited to the above-described embodiments, and various modifications in design may be made without departing from the subject matter of the invention defined in the claims.

Claims

1. A retaining member for a fuel injection valve which retains in an intake passage member (1) a fuel injection valve (10) having a fuel injection portion (11) at one end thereof inserted in a mounting hole (4) provided in the intake passage member (1), and comprises a cap portion (21), a fuel joint portion (27) and a mounting boss portion (26) which are integrally formed of a synthetic resin by molding so as to integrally connect the fuel joint portion (27) and the mounting boss portion (26) to the cap portion (21) which is liquid-tightly fitted on an outer periphery of a fuel inlet portion (12) at the other end of the fuel injection valve (10), the mounting boss portion (26) being connected to the intake passage member (1), the fuel joint portion (27) having an interior communicating with an inside of the cap portion (21), **characterized in that** the mounting boss portion (26) is connected to the cap portion (21) at a region of an inner periphery of the cap portion (21), which is away in an axial direction from a fitting surface (22) to the fuel inlet portion (12).
2. A retaining member for a fuel injection valve according to claim 1, wherein a pair of mounting boss portions (26) and one fuel joint portion (27) are disposed in a dispersed manner around the cap portion (21).
3. A retaining member for a fuel injection valve according to claim 1, wherein rigidity of a connecting part (28') between the cap portion (21) and the mounting boss portion (26) is made lower than rigidity of the cap portion (21).
4. A retaining member for a fuel injection valve according to claim 2 or 3, wherein the pair of mounting boss portions (26) are disposed so that axes (A) of both the mounting boss portions (26) are on two vertexes of a virtual triangle (30) with an axis (B) of the cap portion (21) as the remaining one vertex of the virtual triangle (30) in the plane view of the retaining member (20), and the fuel joint portion (27) is disposed in a range of a vertically opposite angle (β) with respect to a vertical

angle (α) of the triangle (30) on the axis (B) side of the cap portion (21).

5. A retaining member for a fuel injection valve according to claim 4,
wherein a power receiving coupler (14) which is provided to protrude at an outer peripheral portion of the fuel injection valve (10) is disposed in the range of the vertically opposite angle (β).

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6. A retaining member for a fuel injection valve according to claim 4,
wherein the vertical angle (α) is set to be an obtuse angle.

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7. A retaining member for a fuel injection valve according to claim 4,
wherein distances to the respective mounting boss portions (26) from the axis (B) of the cap portion (21) are set to be substantially equal.

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8. A retaining member for a fuel injection valve according to claim 5,
wherein an angle (θ) which is formed by a center line (C) of the fuel joint portion (27) and a center line (D) of the power receiving coupler (14) is set at 50° or more.

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FIG.1

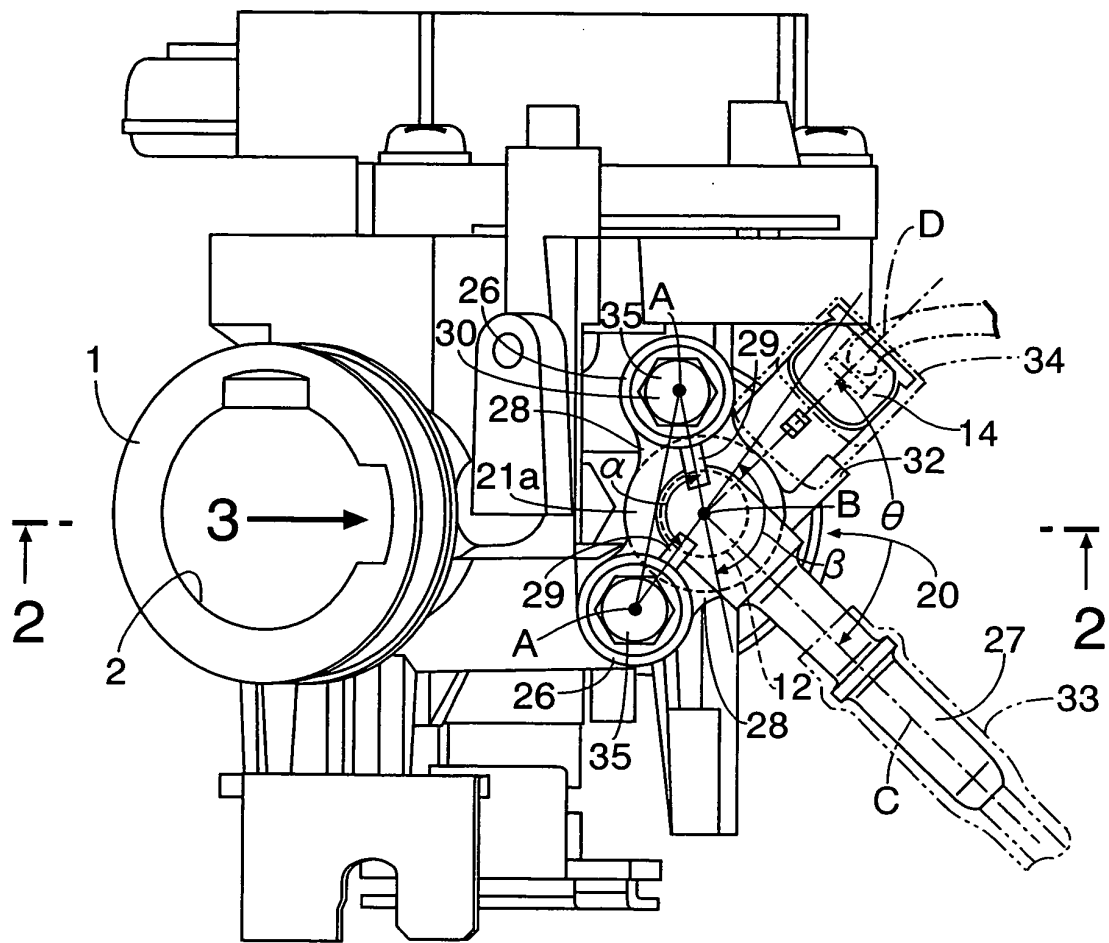


FIG.2

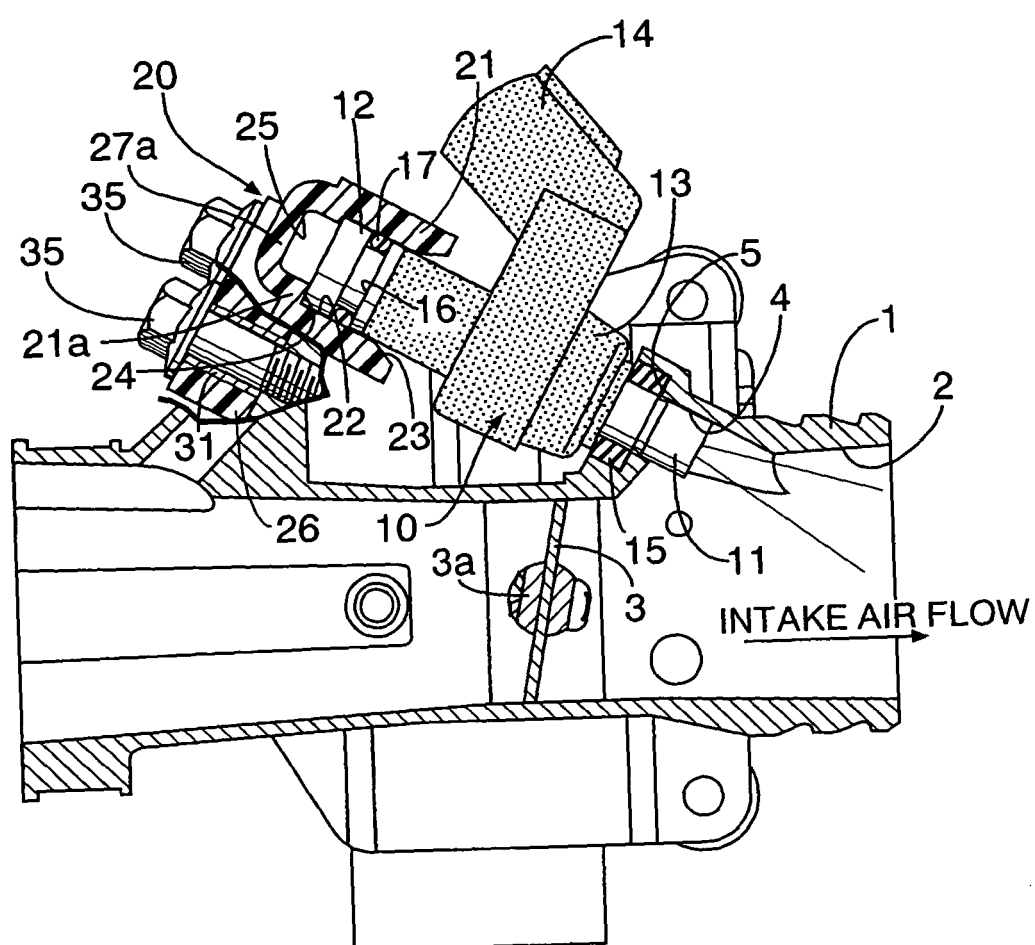


FIG.3

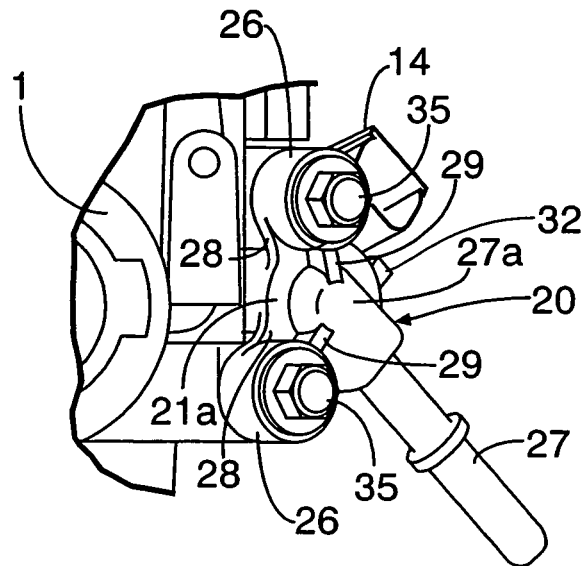


FIG.4

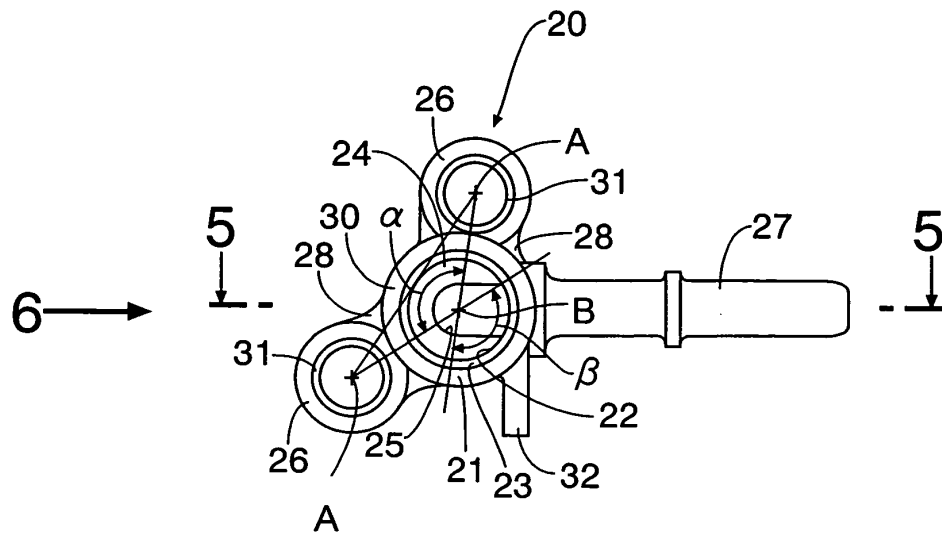


FIG.5

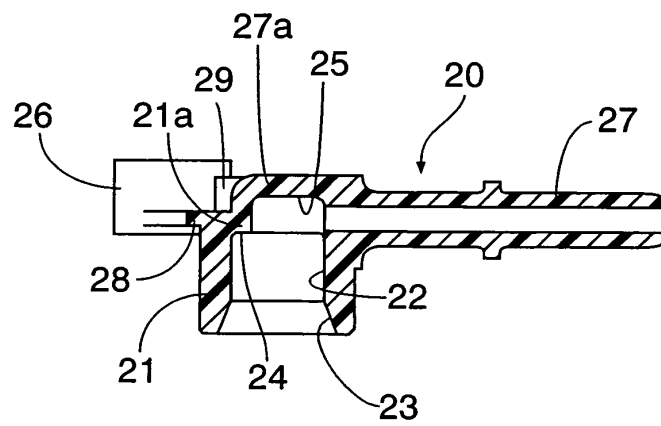


FIG.6

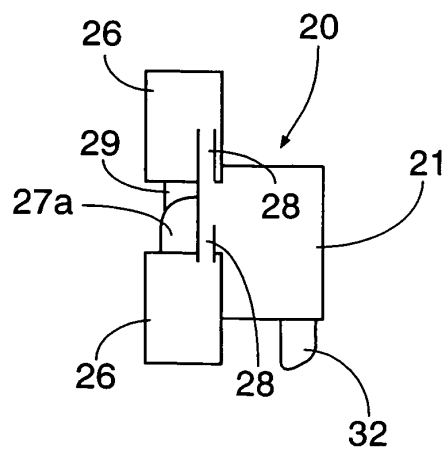
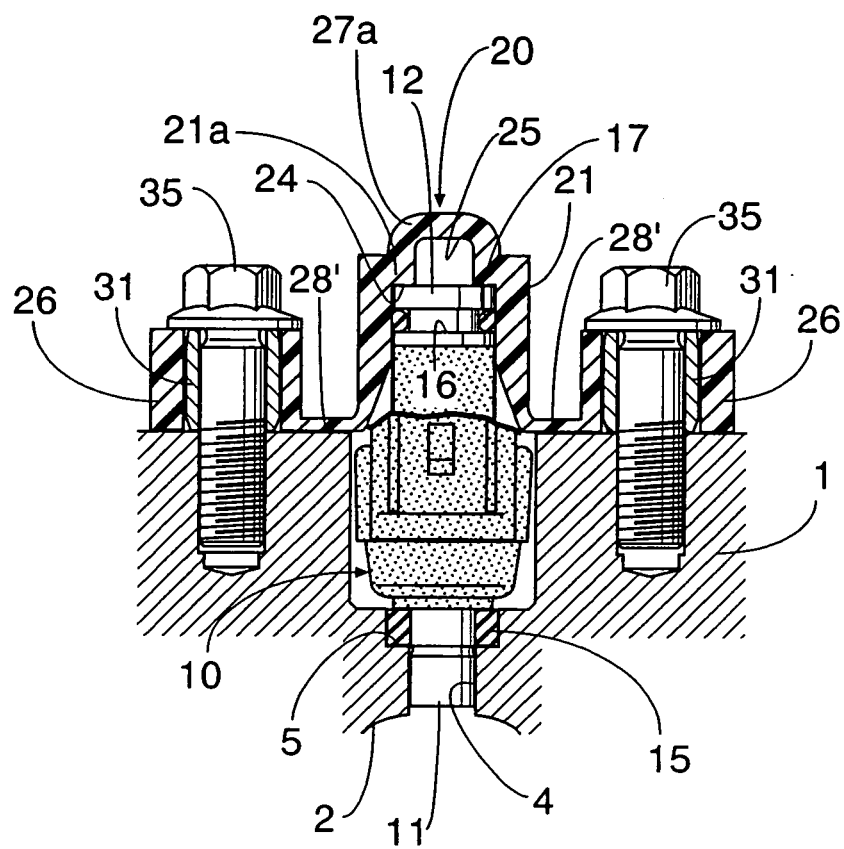


FIG.7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2006/305209

A. CLASSIFICATION OF SUBJECT MATTER

F02M55/02 (2006.01), **F02M69/00** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F02M55/02, **F02M69/00**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2006
Kokai Jitsuyo Shinan Koho	1971-2006	Toroku Jitsuyo Shinan Koho	1994-2006

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2004-183538 A (Honda Motor Co., Ltd.), 02 July, 2004 (02.07.04), Par. No. [0046]; Figs. 4, 8 (Family: none)	1-8
Y	JP 9-291867 A (Aisan Industry Co., Ltd.), 11 November, 1997 (11.11.97), Full text; all drawings & US 5735247 A1	3
Y	JP 2002-364487 A (Mitsubishi Electric Corp.), 18 December, 2002 (18.12.02), Figs. 3, 5 (Family: none)	1-8

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search
06 June, 2006 (06.06.06)Date of mailing of the international search report
13 June, 2006 (13.06.06)Name and mailing address of the ISA/
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 8-121285 A (Hitachi, Ltd.), 14 May, 1996 (14.05.96), Fig. 1 (Family: none)	1-8
Y	JP 6-221252 A (Toyota Motor Corp.), 09 August, 1994 (09.08.94), Fig. 1 (Family: none)	1-8

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2000054937 A [0002]