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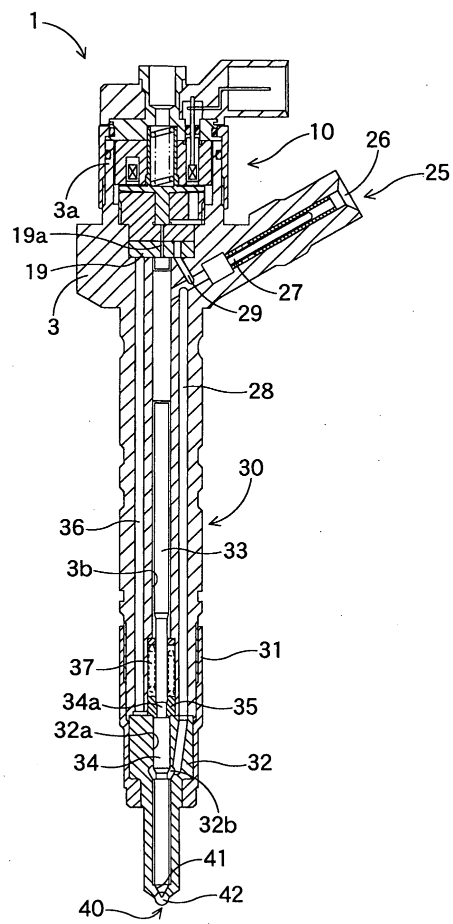
(54) Electromagnetic actuating valve of fuel injection device

(57) An electromagnetic actuating valve (10) of a fuel injection device (1) includes a stator (14), which incorporates an excitation coil (13) and is formed with an attraction surface (14a), an armature (16) disposed to face the stator (14), and a stopper member (15) fitted inside the stator (14). An outer peripheral surface of the stator (14) is fitted inside an upper portion (3a) of an injector body (3). The stator (14) is held between a lower surface of the housing (11) and a holding surface (15c) of the stopper member (15) in an axial direction. The armature (16) is formed with an attraction surface (16a) facing the attraction surface (14a) of the stator (14). A protruding ring (16c) protrudes from the attraction surface (16a) to face a lower surface of the stopper member (15). Thus, movement of the armature (16) is limited.

FIG. 1



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Description

[0001] The present invention relates to an electromagnetic actuating valve of a fuel injection device, which injects high-pressure fuel into a cylinder of an engine.

[0002] Usually, a fuel injection device (an injector) is disposed so that the fuel injection device can inject high-pressure fuel, which is supplied from a fuel supply pump, into a cylinder of an engine. A conventional fuel injection device includes a fuel supply section, a needle valve section disposed inside a main body of the fuel injection device, a nozzle section disposed at a tip end of the needle valve section, and an electromagnetic actuating valve for actuating the needle valve section. The electromagnetic actuating valve actuates the needle valve section to inject the high-pressure fuel from the nozzle section.

[0003] An electromagnetic actuating valve 70 for actuating a needle valve section is disclosed in Unexamined Japanese Patent Application Publication No. 2002-147310 (pages 2 to 5 and Fig. 1). The electromagnetic actuating valve 70 shown in Fig. 4 is disposed in an upper portion 3a of an injector body 3. The electromagnetic actuating valve 70 includes a housing 71, a stator 73 including an excitation coil 72, a case body 74 disposed around the stator 73 for holding the stator 73, an armature 75 capable of moving along a direction in which the armature 75 approaches to or recedes from the stator 73, and a stopper member 76, which is fitted inside the stator 73 and is capable of contacting the armature 75.

[0004] The stator 73 is formed in the shape of a cylinder. The stopper member 76 in the shape of a pipe is fitted inside the stator 73. The armature 75 is disposed to face the stator 73 along an axial direction. An end surface of the stator 73 on the armature 75 side provides an attraction surface 73a. The armature 75 is formed with an attraction surface 75a facing the attraction surface 73a and with a shaft portion 75b slidably held by a valve body 78. Thus, the armature 75 has a T-shaped longitudinal cross-section as shown in Fig. 4. An end surface of the shaft portion 75b opposite from the stator 73 faces a valve seat of the valve body 78. A seat portion 77 is provided around the end surface of the shaft portion 75b. If the attraction surface 75a of the armature 75 moves toward the attraction surface 73a of the stator 73, the seat portion 77 is opened. Thus, a pressure applied to the needle valve section (not shown) disposed below the electromagnetic actuating valve 70 in Fig. 4 is released to open a nozzle section (not shown).

[0005] The housing 71 holds an end surface of the stator 73. A stepped holding portion 74a of the case body 74 holds an outer edge of the other end surface of the stator 73. Thus, an axial position of the stator 73 is determined. A protrusion 75c is formed on an upper surface (the attraction surface 75a) of the armature 75 so that the protrusion 75c can contact the end surface of the stopper member 76 fitted inside the stator 73. Thus, direct contact between the attraction surface 73a of the stator 73 and the attraction surface 75a of the armature 75 can be prevented when the excitation coil 72 is excited and the armature 75 moves toward the stator 73.

[0006] In recent years, in order to protect the environment, reduction of carbon dioxide emission and purification of exhaust gas discharged from a vehicle have been promoted. Specifically, progress in technologies related to a diesel engine such as a multi-injection or an increase in a fuel injection pressure has been required. A fast-response electromagnetic actuating valve of an injector is required to realize the progress in the above technologies. Since a fast-response stator is required, a pressed-powder stator has been used as the stator. However, strength and hardness of the pressed-powder stator are low and the pressed-powder stator is brittle because the pressed-powder stator is formed by compressing iron powders to mainly retain mechanical bonding. Therefore, the stopper member 76 is disposed in a certain position so that the stopper member 76 can receive the shock of the operation of the armature 75.

[0007] In the above structure, the member (the case body 74) for holding the stator 73 and the stopper (the stopper member 76) for stopping the armature 75 are necessary respectively. Therefore, a cost is increased.

[0008] The size (specifically, the radial dimension) of the fuel injection device is limited because of the mountability to the engine. Moreover, the case body 74 is disposed around the stator 73 and the stopper member 76 is fitted inside the stator 73. Therefore, the size of the attraction surface 73a of the conventional stator 73 is reduced. As a result, an area of the magnetic pole is reduced and a magnetic character is weakened.

[0009] It is therefore an object of the present invention to provide a fast-response electromagnetic actuating valve of a fuel injection device by increasing a driving current and by improving a magnetic characteristic of a stator.

[0010] According to an aspect of the present invention, an electromagnetic actuating valve of a fuel injection device includes a housing, a stator, an armature, holding means, and stopper means. The housing fixes the stator. The stator includes an excitation coil. The armature reciprocates along a direction in which the armature approaches to or recedes from the stator. The armature opens and closes a seat portion formed in the electromagnetic actuating valve by the reciprocating movement. The holding means holds the stator along an axial direction. The stopper means stops the armature when the stator attracts the armature and the armature moves toward the stator. The holding means and the stopper means are provided by an integral component. Thus, the number of components is reduced and the cost can be reduced.

[0011] Since the holding means and the stopper means are provided by the integral component, an area of a magnetic pole of the stator can be increased. Thus, a magnetic characteristic can be improved. As a result, a fast-response electromagnetic actuating valve of a fuel injection device can be provided.

[0012] Features and advantages of embodiments will be appreciated, as well as methods of operation and the function of the related parts, from a study of the following detailed description, the appended claims, and the drawings, all of which form a part of this application. In the drawings:

Fig. 1 is a longitudinal cross-sectional view showing an injector having an electromagnetic actuating valve according to a first embodiment of the present invention;

Fig. 2 is a longitudinal cross-sectional view showing a substantial portion of the electromagnetic actuating valve according to the first embodiment;

Fig. 3 is a longitudinal cross-sectional view showing a substantial portion of an electromagnetic actuating valve according to a second embodiment of the present invention; and

Fig. 4 is a longitudinal cross-sectional view showing a substantial portion of an electromagnetic actuating valve of a related art.

(First Embodiment)

[0013] Referring to Fig. 1, a fuel injection device (an injector) 1 according to a first embodiment of the present invention is illustrated.

[0014] The injector 1 shown in Fig. 1 includes an injector body 3, an electromagnetic actuating valve 10, a fuel supply section 25, a needle valve section 30 and a nozzle section 40. The injector body 3 is formed in the shape of a cylinder. The electromagnetic actuating valve 10 is disposed above the injector body 3 in Fig. 1. High-pressure fuel is supplied to the fuel supply section 25 from a fuel supply pump through a common rail. The needle valve section 30 is disposed in the injector body 3. The nozzle section 40 is disposed at a tip end of the needle valve section 30.

[0015] The electromagnetic actuating valve 10 of the first embodiment includes a housing 11, a retaining nut 12, a cylindrical stator 14, a cylindrical stopper member 5, an armature 16, and a plate 19 as shown in Fig. 2. The electromagnetic actuating valve 10 is formed with a seat portion 18. The housing 11 is disposed above the injector body 3 in Fig. 2. The retaining nut 12 connects the housing 11 with an upper portion 3a of the injector body 3. The stator 14 contacts a lower surface of the housing 11 and includes an excitation coil 13. A lower surface of the stator 14 provides an attraction surface 14a. The stopper member 15 is fitted inside the stator 14. The armature 16 is disposed under the stator 14 so that the armature 16 can approach to and recede from the stator 14. The armature 16 is formed with an attraction surface 16a facing the attraction surface 14a of the stator 14 and with a shaft portion 16b, which slidably moves inside a valve body 17. The diameter of the shaft portion 16b is smaller than that of the attraction surface 16a. The seat portion 18 is formed between a lower end portion of the shaft portion 16b of the armature 16 and the valve body 17 for opening and closing an oil passage 17a. The plate 19 is disposed below the valve body 17 in Fig. 2 and is formed with a pressure chamber 19a.

[0016] The excitation coil 13, which is included in the stator 14, receives driving current through a lead wire 20a connected with a terminal 20, which is disposed in a connector 23. A lower portion of an outer peripheral surface of the stopper member 15, which is fitted inside the stator 14, protrudes outward in radial directions to provide a large diameter portion 15a as shown in Fig. 2. Thus, a step is formed between the large diameter portion 15a and a small diameter portion 15b of the stopper member 15 formed above the large diameter portion 15a in Fig. 2. The step provides a holding surface 15c for holding the stator 14. A lower portion of an inner peripheral surface of the stator 14 provides a large diameter hole portion 14b, which is fitted with the large diameter portion 15a of the stopper member 15.

[0017] The stopper member 15 is mounted in the stator 14 and the stator 14 is fixed by the housing 11. Thus, the stator 14 is held between the lower surface of the housing 11 and the holding surface 15c of the stopper member 15 in the axial direction. The outer peripheral surface of the stator 14 is fitted to an inner peripheral surface of the upper portion 3a of the injector body 3. The wall of the upper portion 3a of the injection body 3 is thinner than that of a lower portion of the injector body 3. Accordingly, the wide attraction surface 14a can be provided.

[0018] A coil spring 21 for biasing the armature 16 downward in Fig. 2 is disposed inside the stopper member 15. A fuel discharge passage 22 is formed so that the fuel discharge passage 22 extends upward from the inside of the stopper member 15.

[0019] A protruding ring 16c is formed so that the protruding ring 16c protrudes from the attraction surface 16a and faces the large diameter portion 15a of the stopper member 15. When the armature 16 moves upward because of the excitation of the excitation coil 13, the protruding ring 16c contacts the lower surface of the stopper member 15. Thus, the movement of the armature 16 is limited.

[0020] The retaining nut 12 is formed with a female screw portion, which is screwed with a male screw portion formed on the upper portion 3a of the injector body 3. Thus, the retaining nut 12 is connected to the upper portion 3a of the injector body 3. The valve body 17 is formed with a male screw portion on its outer peripheral surface, which is screwed into a female screw portion formed on the inner peripheral surface of the injector body 3. Thus, the valve body 17 is connected to the injector body 3. The valve body 17 is formed with an oil passage 17b, through which the fuel is discharged from the pressure chamber 19a to the discharge passage 22 when the armature 16 opens the seat portion 18.

[0021] The fuel supply section 25 is formed so that the fuel supply section 25 protrudes from the injector body 3 near the upper portion 3a. The fuel supply section 25 is formed with a fuel supply hole 26 and a fuel passage 27 leading from the fuel supply hole 26. The fuel passage 27 branches into a fuel passage 28 formed inside the injector body 3 and a fuel passage 29 communicating with the pressure chamber 19a.

[0022] The needle valve section 30 is formed below the electromagnetic actuating valve 10 so that the needle valve section 30 extends along the lower portion of the injector body 3. The needle valve section 30 includes the injector body 3 and a nozzle body 32 and is formed with an insertion hole 3b. The nozzle body 32 is connected to the lower portion of the injector body 3 through a retaining nut 31. The insertion hole 3b is formed so that the insertion hole 3b extends downward from the plate 19 in the axial direction in the injector body 3. A control pin 33, a part of a needle 34 and a ring-shaped member 35 are disposed in the insertion hole 3b. The control pin 33 is disposed so that the control pin 33 can move axially. The needle 34 moves axially with the control pin 33 while contacting the lower end of the control pin 33. The ring-shaped member 35 surrounds a contacting space where the lower portion of the control pin 33 contacts the upper portion of the needle 34.

[0023] The needle 34 is slidably disposed in a needle insertion hole 32a formed in the nozzle body 32. An upper end of a small diameter portion 34a of the needle 34 contacts the control pin 33. The nozzle section 40 is disposed at the lower end portion of the nozzle body 32. The nozzle section 40 is formed with a seat portion 41, which is provided between the nozzle body 32 and the lower end portion of the needle 34, and with an injection hole 42. A fuel sump 32b for storing the fuel is formed in an intermediate portion of the needle insertion hole 32a. The injector body 3 is formed with the fuel passage 28 parallel to the insertion hole 3b so that the fuel passage 28 communicates with the fuel sump 32b. The injector body 3 is formed with a leak passage 36 for returning the fuel.

[0024] Next, operation of the injector 1 and the electromagnetic actuating valve 10 will be explained.

[0025] The fuel, which is to be supplied into the cylinder of the engine, is supplied from a fuel supply pump into the injector 1 through a pressure accumulation pipe and the fuel supply hole 26. The fuel is supplied to the pressure chamber 19a through the fuel passage 27 and the fuel passage 29. Meanwhile, the fuel is supplied to the fuel sump 32b through the fuel passage 27 and the fuel passage 28.

[0026] When the fuel is accumulated in the pressure chamber 19a at a high pressure, the lower end of the shaft portion 16b of the armature 16 reaches the oil passage 17a of the valve body 17 because of the biasing force of the coil spring 21 and closes the seat portion 18. The fuel pressure in the pressure chamber 19a and a biasing force of a coil spring 37 disposed in the insertion hole 3b of the injector body 3 overcome the fuel pressure in the fuel sump 32b. Accordingly, the control pin 33 moves downward and presses down the needle 34 to block the injection hole 42.

[0027] If current is provided to the excitation coil 13, the excitation coil 13 is excited and forms a magnetic circuit between the attraction surface 14a of the stator 14 and the attraction surface 16a of the armature 16. Thus, the armature 16 moves upward toward the stator 14 against the biasing force of the coil spring 21. If the protruding ring 16c of the armature 16 contacts the lower surface of the stopper member 15, the armature 16 stops moving upward.

[0028] Thus, the seat portion 18 is opened, and the fuel in the pressure chamber 19a is discharged to the outside through the seat portion 18, the oil passage 17b and the discharge passage 22. Since the fuel pressure in the pressure chamber 19a decreases, the fuel pressure in the fuel sump 32b overcomes the fuel pressure in the pressure chamber 19a and the biasing force of the coil spring 37 and presses the control pin 33 and the needle 34 upward. Thus, the injection hole 42 is opened and the high-pressure fuel is injected from the nozzle section 40.

[0029] As explained above, in the electromagnetic actuating valve 10 according to the first embodiment, the outer peripheral surface of the stator 14 is fitted to the inside of the upper portion 3a of the injector body 3. The inner peripheral surface of the stator 14 has a step, and the stopper member 15 having the stepped holding surface 15c is fitted into the stator 14. Therefore, the stator 14 is held between the lower surface of the housing 11 and the holding surface 15c of the stopper member 15 in the axial direction. Moreover, a case body fitted to the outer peripheral surface of the stator 14 is omitted. Therefore, the external diameter of the stator 14 can be increased correspondingly. Thus, the area of the attraction surface 14a can be enlarged and an area of a magnetic pole can be enlarged. Thus, a magnetic characteristic provided between the attraction surface 14a of the stator 14 and the attraction surface 16a of the armature 16 can be improved. Thus, the fast-response electromagnetic actuating valve 10 of the injector 1 can be provided. Moreover, since the case body is omitted, the cost can be reduced.

(Second Embodiment)

[0030] Next, an electromagnetic actuating valve 50 according to a second embodiment of the present invention will be explained based on Fig. 3. The electromagnetic actuating valve 50 shown in Fig. 3 includes a connector member 51, a housing 52, a case body 53, a retaining nut 56, a cylindrical stator 55, an armature 57, and a plate 60. The electromagnetic actuating valve 50 is formed with a seat portion 59. The connector member 51 is disposed above the injector body 3 in Fig. 3. The housing 52 is disposed below the connector member 51 in Fig. 3. The case body 53 is fitted to an outer peripheral surface of the housing 52. The retaining nut 56 connects the case body 53 with the upper portion 3a of the injector body 3. The stator 55 contacts a lower surface of the housing 52 and includes an excitation coil 54. A lower surface of the stator 55 provides an attraction surface 55a. The armature 57 is disposed below the stator 55 in Fig. 3 so that the armature 57 can approach to and recede from the stator 55. The armature 57 is formed with an attraction surface 57a facing the attraction surface 55a of the stator 55 and with a shaft portion 57b, which can slidably move inside a valve body 58. The diameter of the shaft portion 57b is smaller than that of the attraction surface 57a. The seat portion 59 is formed between a lower end portion of the shaft portion 57b and the valve body 58 for opening and closing an oil passage 58a. The plate 60 is disposed below the valve body 58 and is formed with a pressure chamber 60a.

[0031] The case body 53 is fitted to the outer peripheral surfaces of the housing 52 and the stator 55. An upper locking portion 53a for locking an outer edge of an upper surface of the housing 52 and a lower locking portion 53b for locking an outer edge of the lower surface (the attraction surface 55a) of the stator 55 are formed on an inner peripheral surface of the case body 53. An outer locking portion 53c locked by the retaining nut 56 is formed on the outer peripheral surface of the case body 53. The lower end portion of the case body 53 extends downward from the lower locking portion 53b to cover upper portions of the armature 57 and the valve body 58. An upper surface of the lower locking portion 53b provides a holding surface for holding the stator 55, and a lower surface of the lower locking portion 53b provides a stopper surface for stopping the armature 57.

[0032] By mounting the stator 55 to the housing 52 and the case body 53, the stator 55 is held between the lower surface of the housing 52 and the lower locking portion 53b of the case body 53 in the axial direction. A coil spring 62 for biasing the armature 57 downward is disposed radially inside the stator 55, and the stopper member of the first embodiment is eliminated. Thus, the internal diameter of the stator 55 can be reduced and the attraction surface 55a can be enlarged correspondingly.

[0033] A protruding ring 57c is formed on the outer edge of the attraction surface 57a of the armature 57 so that the protruding ring 57c protrudes upward from the attraction surface 57a and faces the lower locking portion 53b of the case body 53. If the armature 57 moves upward because of the excitation of the excitation coil 54, the protruding ring 57c contacts the lower surface of the lower locking portion 53b. Thus, the movement of the armature 57 is limited.

[0034] The excitation coil 54, which is included in the stator 55, receives driving current through a lead wire 61a connected with a terminal 61, which is disposed in the connector member 51. The housing 52 is formed with a fuel discharge passage 63.

[0035] The retaining nut 56 is formed with a female screw portion, which is screwed with a male screw portion formed on the upper portion 3a of the injector body 3. Thus, the retaining nut 56 is connected with the upper portion 3a of the injector body 3. A male screw portion is formed on the outer peripheral surface of the valve body 58 and is screwed to a female screw portion formed on an inner peripheral surface of the injector body 3. Thus, the valve body 58 is connected to the injector body 3. The valve body 58 is formed with an oil passage 58b, through which the fuel is discharged from the pressure chamber 60a to the discharge passage 63 when the armature 57 opens the seat portion 59.

[0036] The fuel supply section, the needle valve section and the nozzle section provided below the electromagnetic actuating valve 50 in Fig. 3 are the same as the first embodiment.

[0037] In the electromagnetic actuating valve 50 of the second embodiment, if the fuel is accumulated in the pressure chamber 60a at a high pressure, the lower end of the shaft portion 57b of the armature 57 reaches the oil passage 58a of the valve body 58 and blocks the seat portion 59 because of the biasing force of the coil spring 62. The fuel pressure in the pressure chamber 60a and the biasing force of the coil spring 37 disposed in the insertion hole 3b of the injector body 3 overcome the fuel pressure in the fuel sump 32b. Thus, the control pin 33 moves downward and presses down the needle 34 to block the injection hole 42.

[0038] If current is supplied to the excitation coil 54, the excitation coil 54 is excited and forms a magnetic circuit between the attraction surface 55a of the stator 55 and the attraction surface 57a of the armature 57. Thus, the armature 57 moves upward in Fig. 3 toward the stator 55 against the biasing force of the coil spring 62. If the protruding ring 57c of the armature 57 contacts the lower surface of the lower locking portion 53b of the case body 53, the armature 57 stops moving upward.

[0039] Thus, the seat portion 59 is opened, and the fuel in the pressure chamber 60a is discharged to the outside from the seat portion 59 through the oil passage 58b and the discharge passage 63. Since the fuel pressure in the pressure chamber 60a decreases, the fuel pressure in the fuel sump 32b overcomes the fuel pressure in the pressure chamber 60a and the biasing force of the coil spring 37 and presses the control pin 33 and the needle 34 upward. Thus, the injection hole 42 is opened and the high-pressure fuel is injected from the nozzle section 40.

[0040] As explained above, in the electromagnetic actuating valve 50 of the second embodiment, the outer peripheral surface of the stator 55 is fitted inside the case body 53 and the coil spring 62 is inserted to the stator 55. Therefore, the stator 55 is held between the lower surface of the housing 11 and the lower locking portion 53b of the case body 53 in the axial direction. Moreover, no stopper member is fitted inside the stator

55. Therefore, the internal diameter of the stator 55 can be decreased and the attraction surface 55a can be enlarged. Thus, the area of the magnetic pole can be increased and the magnetic characteristic provided between the attraction surface 55a of the stator 55 and the attraction surface 57a of the armature 57 can be improved correspondingly. Thus, the fast-response electromagnetic actuating valve 50 of the injector 1 can be provided. Moreover, the cost can be reduced by eliminating the stopper member.

[0041] The structure of the electromagnetic actuating valve is not limited to the structure of the above embodiments if a member holding the stator in the axial direction provides a portion for limiting the movement of the armature. It is because the attraction surface of the stator attracting the armature can be enlarged and the area of the magnetic pole can be enlarged if the member holding the stator in the axial direction provides the portion for limiting the movement of the armature. Also in this case, the magnetic characteristic can be improved. For instance, a plastic portion of the connector covering the excitation coil may lock the stator from a position under the stator when the excitation coil is disposed inside the stator, and the housing may lock the stator from a position above the stator when the housing is integrated. In addition, the plastic portion of the connector member may be extended to the position under the excitation coil to form a stopper member for stopping the armature. Thus, the case body and the stopper member can be omitted, and the attraction surface of the stator can be enlarged further.

[0042] The lower locking portion for holding the stator in the axial direction may be formed on the injector body so that the lower locking portion has a function of a stopper for stopping the movement of the armature, instead of forming the lower locking portion on the case body of the second embodiment.

[0043] The present invention should not be limited to the disclosed embodiments, but may be implemented in many other ways without departing from the scope of the invention, as defined by the appended claims.

[0044] An electromagnetic actuating valve (10) of a fuel injection device (1) includes a stator (14), which incorporates an excitation coil (13) and is formed with an attraction surface (14a), an armature (16) disposed to face the stator (14), and a stopper member (15) fitted inside the stator (14). An outer peripheral surface of the stator (14) is fitted inside an upper portion (3a)of an injector body (3). The stator (14) is held between a lower surface of the housing (11) and a holding surface (15c) of the stopper member (15) in an axial direction. The armature (16) is formed with an attraction surface (16a) facing the attraction surface (14a) of the stator (14). A protruding ring (16c) protrudes from the attraction surface (16a) to face a lower surface of the stopper member (15). Thus, movement of the armature (16) is limited.

Claims

1. An electromagnetic actuating valve (10, 50) of a fuel injection device (1), the electromagnetic actuating valve (10, 50) including:

a stator (14, 55) including an excitation coil (13, 54); and
an armature (16, 57) capable of reciprocating along a direction in which the armature (16, 57) approaches to or recedes from the stator (14, 55), wherein the armature (16, 57) forms a magnetic circuit with the stator (14, 55) between a surface (16a, 57a) of the armature (16, 57) and a surface (14a, 55a) of the stator (14, 55) facing each other, and wherein the armature (16, 57) opens and closes a seat portion (18, 59), which is formed in the electromagnetic actuating valve (10, 50), by the reciprocating movement, **characterized by**:

an integral component providing holding means for holding the stator (14, 55) in an axial direction of the stator (14, 55) and stopper means for stopping the armature (16, 57) when the stator (14, 55) attracts the armature (16, 57).

2. The electromagnetic actuating valve (10, 50) as in claim 1, further including:

a housing (11, 52) for fixing the stator (14, 55) in the axial direction; and
a retaining nut (12, 56) for connecting the stator (14, 55) and the housing (11, 52) to a main body (3) of the fuel injection device (1).

3. The electromagnetic actuating valve (10) as in claim 1 or 2, wherein

the integral component is a stopper member (15), which is fitted into the stator (14) and is formed with a small diameter portion (15b), a large diameter portion (15a) protruding radially outward with respect to the small diameter portion (15b) and a stepped surface (15c) provided between the small diameter portion (15b) and the large diameter portion (15a) on a side opposite from the armature (16),

the stopper means is provided by an end surface of the large diameter portion (15a) on the armature (16) side, and

the holding means is provided by the stepped surface (15c).

4. The electromagnetic actuating valve (50) as in claim 1 or 2, wherein

the integral component is a case body (53) for covering an outer peripheral surface of the stator (55), the case body (53) being formed with a protrusion (53b) protruding radially inward from an inner peripheral surface of the case body (53) where the case body (53) covers the stator (55),

the holding means is provided by a surface of the protrusion (53b) on a side opposite from the armature (57), and

the stopper means is provided by the other surface of the protrusion (53b) on the armature (57) side.

5. The electromagnetic actuating valve (50) as in claim 1 or 2, wherein

the integral component is a case body (53) for covering outer peripheral surfaces of the housing (52) and the stator (55), the case body (53) being formed with a protrusion (53b) protruding radially inward from an inner peripheral surface of the case body (53) where the case body (53) covers the stator (55),

the holding means is provided by a surface of the protrusion (53b) on a side opposite from the armature (57), and

the stopper means is provided by the other surface of the protrusion (53b) on the armature (57) side.

FIG. 1

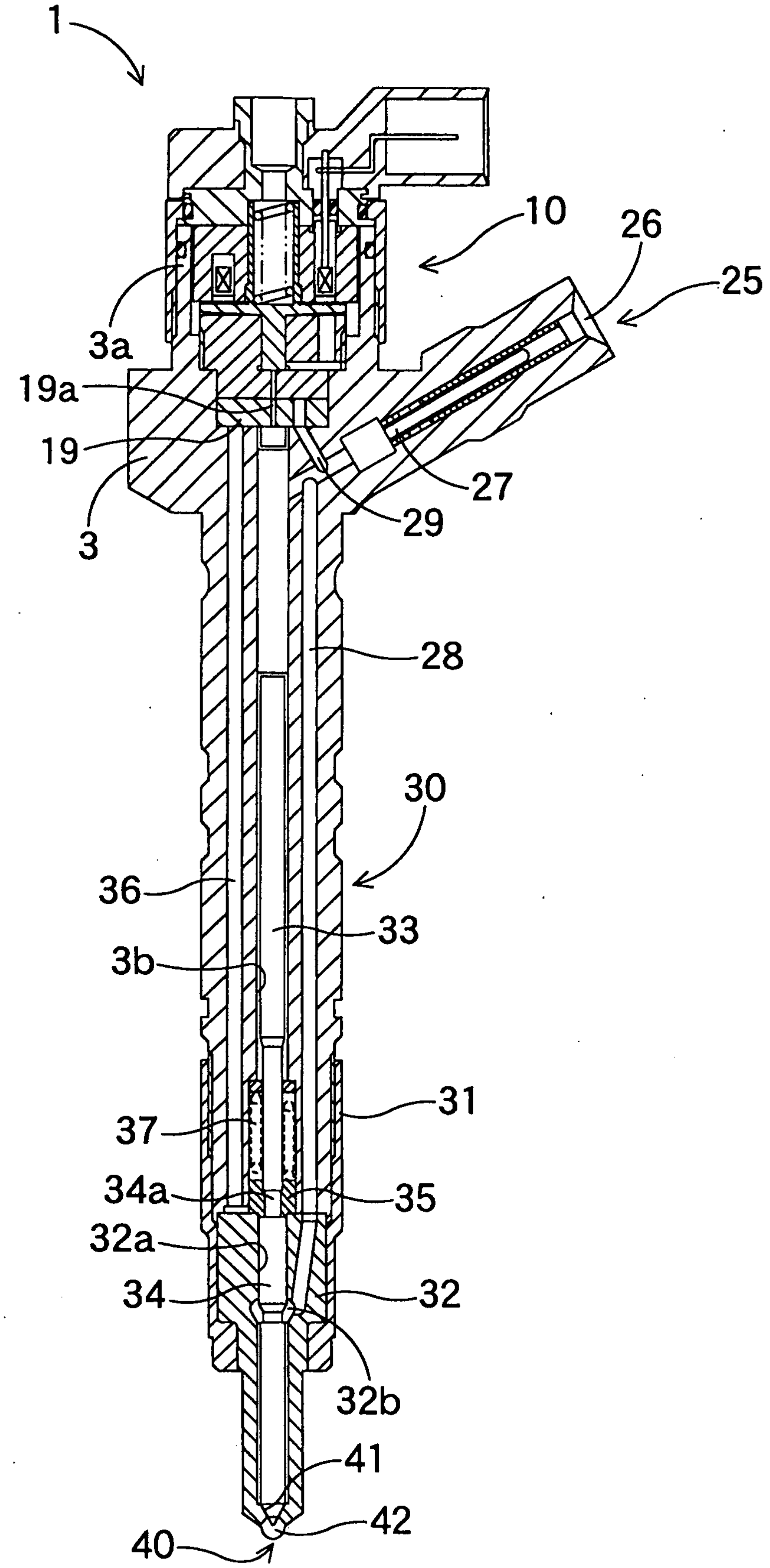
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FIG. 2

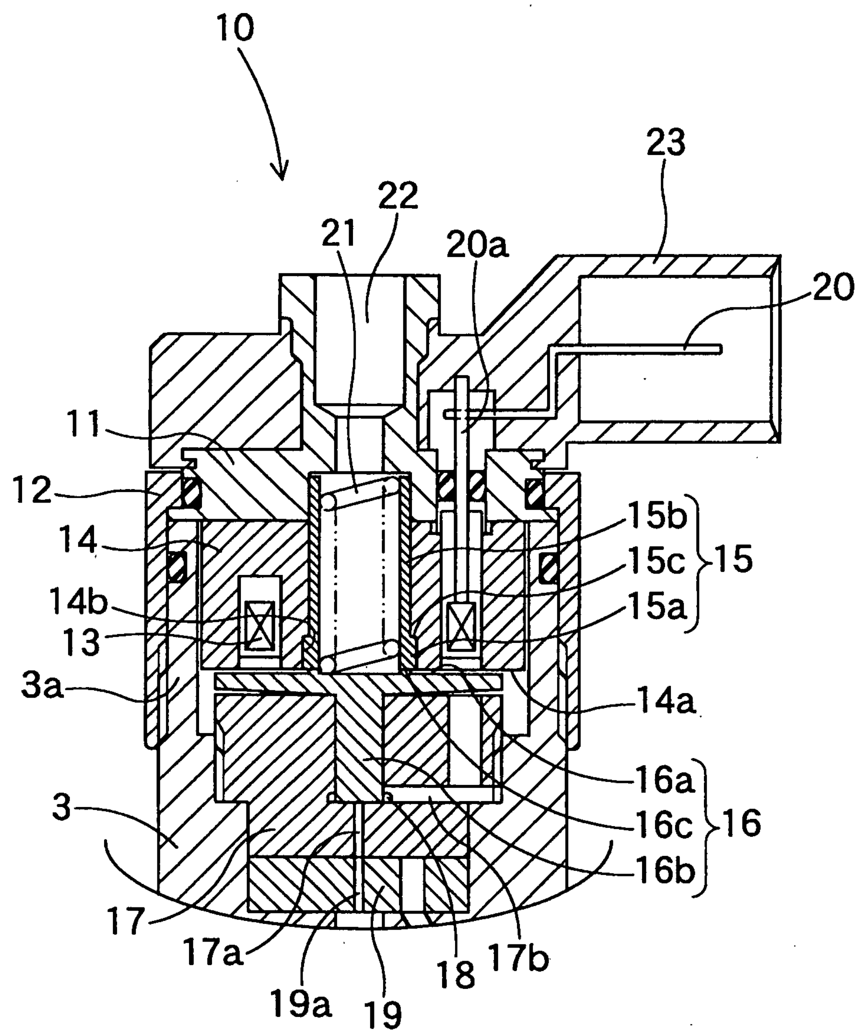
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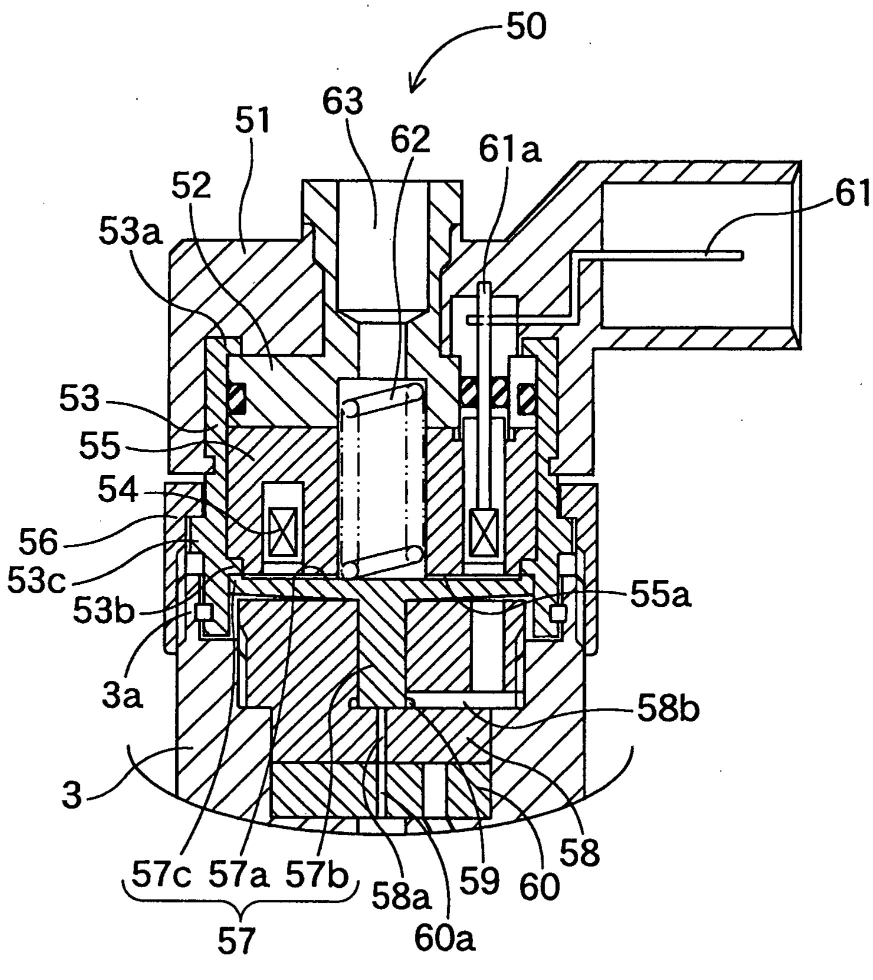
FIG. 3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58a
59
60
57
60a

FIG. 4