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(54) Gas differential pressure valve with single diaphragm

(57) A gas differential pressure valve with single diaphragm includes a body (1), a valve assembly (2), a first solenoid valve (3) and a second solenoid valve (4). The body has a first gas chamber (12), a second gas chamber (13), a third gas chamber (14), a first channel (15) and a second channel (16). The valve assembly is disposed in the body and a part of the valve assembly extends out of the body. The diaphragm separates the first gas chamber into a first pressure chamber (121) and a second pressure chamber (122). The first solenoid valve (3) is disposed in the second gas chamber (13). The second solenoid valve (4) is disposed in the third gas chamber (14). The second channel (16) is connected to the second pressure chamber (122) and the third gas chamber (14). Therefore, when the first channel (15) is jammed or the first solenoid valve (3) is broken, gas also can be cut off. It offers a further security for users.

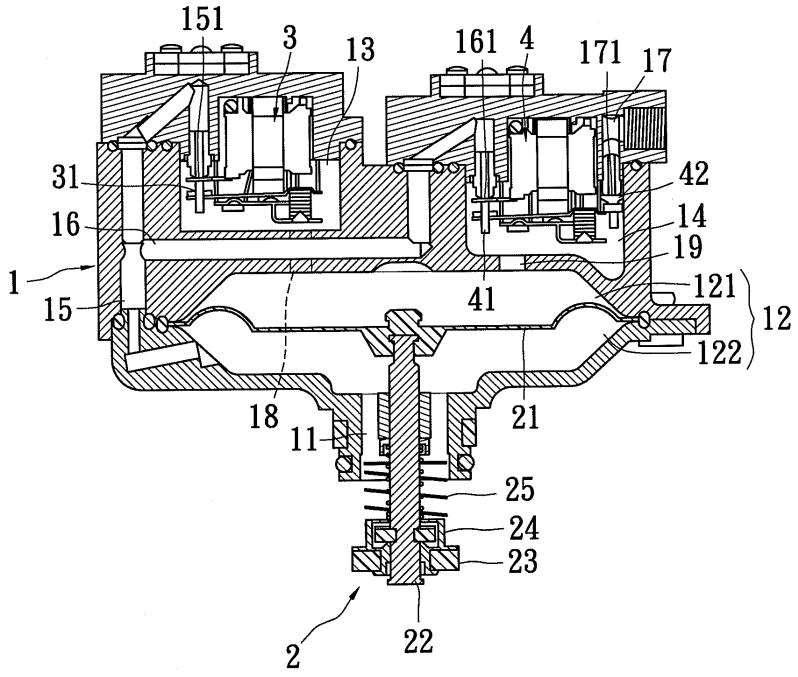

FIG. 3

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a gas differential pressure valve with single diaphragm, in particular to an improved gas differential pressure valve with single diaphragm, which is controlled by solenoid valves.

2. Description of Related Art

[0002] Please refer to FIG.1; the conventional gas differential pressure valve installed on a gas channel 4a includes a body 1a, a normal open valve 2a, and a normal close valve 3a. Gas goes into a second pressure chamber 12a via an inlet channel 11 a within the body 1a, and then goes into a first pressure chamber 14a via a channel 13a and the normal open valve 2a. At this time, a glow plug (not shown in FIGures) discharge to spark. At the same time, the normal close valve 3a is excited (driven by electricity). It means a valve plug 31a of the normal close valve 3 a is open to let gas in the first pressure chamber 14a go into a nozzle (not shown in FIGures) via an outlet channel 15a. Gas is lighted to be a pilot light by the glow plug.

[0003] Please refer to FIG.2, after the pilot light is lighted, the glow plug would stop discharging. At this time, the normal open valve 2a is excited. It means a valve plug 21a of the normal open valve 2a stops gas into the first pressure chamber 14a. The first pressure chamber 14a is under the condition that gas only travels in one direction, so that the pressure of gas in the first pressure chamber 14a is less than the second pressure chamber 12a. As a result, a diaphragm 16a disposed between the second pressure chamber 12a and the first pressure chamber 14a moves toward to the first pressure chamber 14a, further pushes a valve plug 17a which is connected to the diaphragm 16a to detach from a flowing hole 41a of the gas channel 4a, so that gas can go into a burner (not shown in FIGures) via the flowing hole 41a. Gas is lighted to be a primary light for heating water.

[0004] When the channel 13a is jammed by dust or the normal open valve 2a has a breakdown, the normal open valve 2a can not be driven to open again, so that gas can not go into the first pressure chamber 14a, therefore the diaphragm 16a can not move toward the second pressure chamber 12a to push the valve plug 17a to press up against to the flowing hole 41a. Even if the water heater cut off its power supply, gas still supply to the burner, so that a great deal of gas will leak out. It would lead to a blast and blaze by slightly fire and endanger users' life.

[0005] Therefore, it is necessary to design an improved gas differential pressure valve with single diaphragm to overcome the above-mentioned problems.

SUMMARY OF THE INVENTION

[0006] The primary object of the present invention is to provide an improved gas differential pressure valve with single diaphragm that can supply an excess security protection, prevent from blasting caused by gas leakage efficiently, and increase the security of users.

[0007] In order to achieve the above object, the present invention provides a gas differential pressure valve with single diaphragm, which includes a body, a valve assembly, a first solenoid valve, and a second solenoid valve. The body has an inlet channel, a first gas chamber, a second gas chamber, a third gas chamber, a first channel, a second channel and an outlet channel. The valve assembly is disposed in the body and a part of the valve assembly is out of the body. The valve assembly has a diaphragm which is disposed in the first gas chamber and separates the first gas chamber into a fist pressure chamber and a second pressure chamber. The first pressure chamber connects to the second gas chamber and the third gas chamber respectively. The inlet channel connects to the second pressure chamber. The first channel connects to the second pressure chamber and the second gas chamber, and the connection junction of the first channel and the second gas chamber is defined a first valve port. The second channel connects to the second pressure chamber and the third gas chamber, and the connection junction of the second channel and the third gas chamber is defined a second valve port. The outlet channel connects to the third gas chamber and the connection junction of the outlet channel and the third gas chamber is defined a third valve port. The first solenoid valve is disposed in the second gas chamber. The first solenoid valve has a first valve plug located on the first valve port. The second solenoid valve disposed in the third gas chamber has a second valve plug and a third valve plug. The second valve plug is located on the second valve port. The third valve plug is located on the third valve port.

[0008] The present invention has advantageous features as follows. The body has the second channel, the second channel connects to the second pressure chamber and the third gas chamber, the second valve plug is located on the second valve port. As a result, when the first channel is jammed or the first solenoid valve has a breakdown, the gas also can be cut off by the second solenoid valve. The present invention supplies an excess security protection, prevents from blasting caused by a great deal of gas leakage efficiently, and increases the security of users.

[0009] For further understanding of the present invention, reference is made to the following detailed description illustrating the embodiments and examples of the present invention. The description is for illustrative purpose only and is not intended to limit the scope of the claim.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The drawings included herein provide a further understanding of the present invention. A brief introduction of the drawings is as follows:

[0011] FIG. 1 is a cross-section view showing a conventional gas differential pressure valve lighting a pilot light;

[0012] FIG. 2 is a cross-section view showing a conventional gas differential pressure valve lighting a primary light;

[0013] FIG. 3 is a cross-section view showing a gas differential pressure valve with single diaphragm of the present invention;

[0014] FIG. 4 is a cross-section view showing the first lighting step of the present invention;

[0015] FIG. 5 is a cross-section view showing the second lighting step of the present invention;

[0016] FIG. 6 is a cross-section view showing the third lighting step of the present invention;

[0017] FIG. 7 is a cross-section view showing the fourth lighting step of the present invention.

[0018] FIG. 8 is a cross-section view showing another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Please refer to FIG. 3, the present invention provide a gas differential valve whit single diaphragm which includes a body 1, a valve assembly 2, a first solenoid valve 3, and a second solenoid valve 4. The body 1 has an inlet channel 11, a first gas chamber 12, a second gas chamber 113, a third gas chamber 14, a first channel 15 and a second channel 16, an outlet channel 17, a first through hole 18, and a second through hole 19. The outlet channel 17 connects to the third gas chamber 14, and the connection junction of the outlet channel 17 and the third chamber 14 is defined a third valve port 171.

[0020] The valve assembly 2 which can extend and contract is disposed in the body 1 and a part of the valve assembly 2 extends out of the body 1. The valve assembly 2 has a diaphragm 21, a valve rod 22, a valve plug 23, an abutting portion 24, and a spring 25. The diaphragm 21 is made of rubber. The diaphragm 21 is disposed in the first gas chamber 12 and the edge of the diaphragm 21 is fixed on the inner wall of the body 1. The first gas chamber 12 is separated into a first pressure chamber 121 and a second pressure chamber 122 by the diaphragm 21. A first through hole 18 is connected to the first pressure chamber 121 and the second gas chamber 13. A second through hole 19 is connected to the first pressure chamber 121 and the third gas chamber 14. The inlet channel 11 is connected to the second pressure chamber 122. The first channel 15 is connected to the second pressure chamber 122 and the second gas chamber 13, and the connection junction of the first channel 15 and the second gas chamber 13 is defined a first valve port 151. In this embodiment, one end of the second channel 16 is connected to the first channel 15, the other end of the second channel 16 is connected to the third gas chamber 14, and the connection junction of the second channel 16 and the third gas chamber 14 is defined a second valve port 161. Therefore, gas can flow into the third gas chamber 14 via the inlet channel 11, the second pressure chamber 122, the first channel 15 and the second channel 16. The valve rod 22 is located on the wall of the inlet channel 11, and one end of the valve rod 22 is connected to the diaphragm 21. The valve plug 23 and the abutting portion 24 are disposed at the other end of the valve rod 22. The spring 25 is displaced on the valve rod 22, and two ends of the spring 25 are respectively pressed up against the wall of the inlet channel 11 and the abutting portion 24.

[0021] The first solenoid valve 3 is disposed in the second gas chamber 13. The first solenoid valve 3 has a first valve plug 31. The first solenoid valve 3 is called a normal open valve. It means the first valve plug 31 is open in a normal state. In other word, the first valve plug 31 is detached from the first valve port 151. The valve plug 31 can press up against the first valve port 151 by controlling the first solenoid valve 3 excited for preventing gas flow into the second gas chamber 13 from the first channel 15.

[0022] The second solenoid valve 4 is disposed in the third gas chamber 14. The second solenoid valve 4 has a second valve plug 41 and a third valve plug 42. In this embodiment, the action of the third valve plug 42 is opposite to the second valve plug 41. The second solenoid valve 4 is called normal-open-normal-close valve. It means the second valve plug 41 is open in a normal state, and the second valve plug 41 is detached from the second valve port 161. The third valve plug 42 is close and presses up against the third valve port 171. By controlling the second solenoid valve 4 excited, the second valve plug 41 can press up against the second valve port 161 for preventing gas flow into the third gas chamber 14 from the second channel 16. The third valve plug 42 is detached from the third valve port 171 for controlling gas flow into outlet channel 17 from the third gas chamber 14.

[0023] Please refer to FIG.4 to FIG.7; the gas differential pressure valve is installed on a gas channel 5 of a water heater (not shown in figures). One end of the gas channel 5 is connected to gas source; the other end is connected to a burner (not shown in figures). The valve plug 23 of the valve assembly 2 presses up against a flowing hole 51 of the gas channel 5 for preventing gas flow into the burner via the flowing hole 51. The opening of the outlet channel 17 is connected with a nozzle 6 for lighting the pilot light. In the first step of lighting (please refer to FIG.4), the first valve plug 31 and the second valve plug 41 is open, the third valve plug 42 is close, and gas can respectively flow into the second gas chamber 13 and the third gas chamber 14 via the inlet channel 11, the second pressure chamber 122, the first channel 15, the second channel 16, and then flow into the first pressure chamber 121 via the first through hole 18 and

the second through hole 19.

[0024] In the second step of lighting (please refer to FIG.5), the second solenoid valve 4 is controlled to be excited, so that the second valve plug 41 changes open to close to prevent gas flow into the third gas chamber 14 from the second channel 16. At the same time, the third valve plug 42 changes close to open, so that gas can flow into the nozzle 6 via the third gas chamber 14 and the outlet channel 17 to light the pilot light.

[0025] In the third step of lighting (please refer to FIG. 6), after the pilot light is lighted, the first solenoid valve 3 is controlled to be excited, the first valve plug 31 changes open to close to prevent gas flow into the second gas chamber 13 from the first channel 15. At this time, because gas can not flow into the second gas chamber 13 and the third gas chamber 14, and continually flow to the nozzle to be burned, so that the pressure of the first pressure chamber 121 is less than the second pressure chamber 122, therefore the diaphragm 21 starts to deform and move toward to the first pressure chamber 121, and the valve plug 23 is pulled to detach from the flowing hole 51, so that gas can flow into the burner via the flowing hole 51. Gas is lighted to be a primary light by the pilot light for supplying a water heater to heat water.

[0026] In the fourth step of lighting (please refer to FIG. 7), because gas in the first pressure chamber 121, the second gas chamber 13 and the third gas chamber 14 is out of, so that the pilot light is burn out. The pressure of the first pressure chamber 121 is more less than the second pressure chamber 122, so that the diaphragm 21 greatly moves toward the first pressure chamber 121. There is more gas flowing into the burner.

[0027] Please refer to FIG.8; the FIG.8 is a cross-section view showing another embodiment of the present invention. The differences between this embodiment and the above embodiment are that one end of the second channel 16 is connected to the second pressure chamber 122, the other end of the second channel 16 is connected to the third gas chamber 14.

[0028] In conclusion, the advantages of the present invention are as follows:

[0029] The body 1 has the second channel 16, and the second channel 16 is connected to the second pressure chamber 122 and the third gas chamber 14, the second valve plug 41 of the second solenoid valve 4 is located on the second valve port 161, therefore after the pilot light is lighted, even if the first channel 15 is jammed by dust or the first solenoid valve 3 is broken, the second solenoid valve 4 can be controlled not to be excited, the second valve plug 41 is open, so that gas can flow into the first pressure chamber 121 via the second channel 16, the third gas chamber 14, the second through hole 19, and then push the diaphragm 21 to move toward the second pressure chamber 122. The valve plug 23 of the valve assembly 2 would press up against the flowing hole 51 to prevent gas from flowing into the burner. As a result, the water heater is turned off. It supplies an excess security and prevents from blasting. It increases the security of users.

[0030] The above-mentioned descriptions represent merely the preferred embodiment of the present invention, without any intention to limit the scope of the present invention thereto. Various equivalent changes, alternations, or modifications based on the claims of present invention are all consequently viewed as being embraced by the scope of the present invention.

Claims

1. A gas differential pressure valve with single diaphragm, comprising:

   a body having an inlet channel, a first gas chamber, a second gas chamber, a third gas chamber, a first channel, a second channel and an outlet channel;

   a valve assembly disposed in the body, a part of the valve assembly extending out the body, wherein the valve assembly has a diaphragm, the diaphragm separates the first gas chamber into a first pressure chamber and a second pressure chamber, the first pressure chamber is connected to the second gas chamber and the third gas chamber respectively, the inlet channel is connected to the second pressure chamber, the first channel is connected to the second pressure chamber and the second gas chamber, the connection junction of the first channel and the second gas chamber is defined a first valve port, the second channel is connected to the second pressure chamber and the third gas chamber, the connection junction of the second channel and the third gas chamber is defined a second valve port, the outlet channel is connected to the third gas chamber, the connection junction of the outlet channel and the third gas chamber is defined a third valve port;

   a first solenoid valve disposed in the second gas chamber, the first solenoid valve having a first valve plug, the first valve plug disposed on the first valve port; and

   a second solenoid valve disposed in the third gas chamber, the second solenoid valve having a second valve plug and a third valve plug, the second valve plug disposed on the second valve port, the third valve plug disposed on the third valve port.

2. The gas differential pressure valve with single diaphragm as claimed in claim 1, wherein one end of the second channel is connected to the first channel, the other end of the second channel is connected to the third gas chamber.

3. The gas differential pressure valve with single dia-

phragm as claimed in claim 1, wherein one end of the second channel is connected to the second pressure chamber, the other end of the second channel is connected to the third gas chamber.

4. The gas differential pressure valve with single diaphragm as claimed in claim 1, wherein the valve assembly has a valve rod, a valve plug, an abutting portion and a spring, the valve rod is located in the inlet channel, one end of the valve rod is connected to the diaphragm, the valve plug and the abutting portion is located on the other end of the valve rod, the spring is located on the valve rod and two ends of the spring is pressed up against the wall of the inlet channel and the abutting portion.

5. The gas differential pressure valve with single diaphragm as claimed in claim 1, wherein a first through hole is connected between the first pressure chamber and the second gas chamber, a second through hole is connected between the first pressure chamber and the third gas chamber.

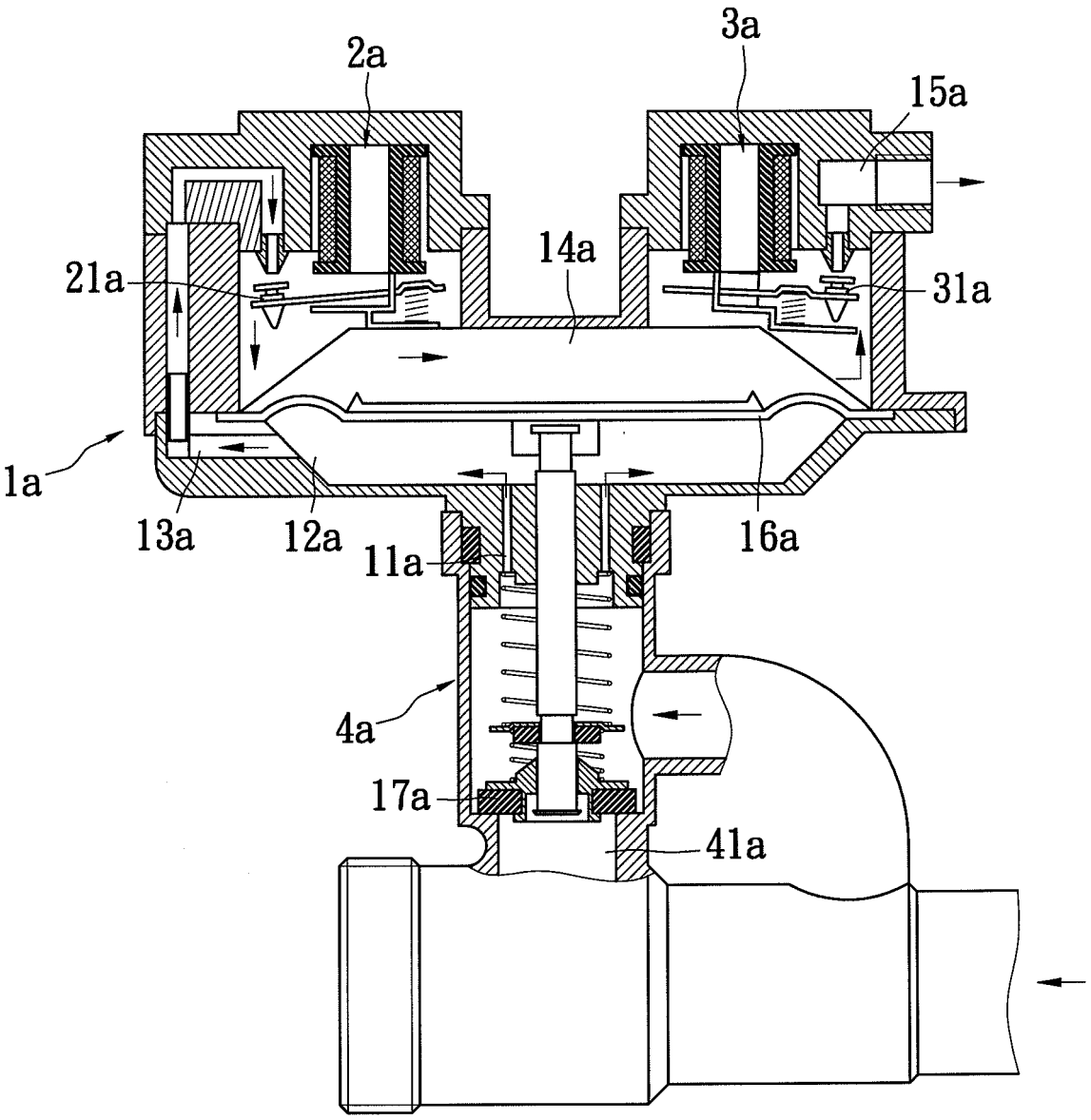

FIG. 1
PRIOR ART

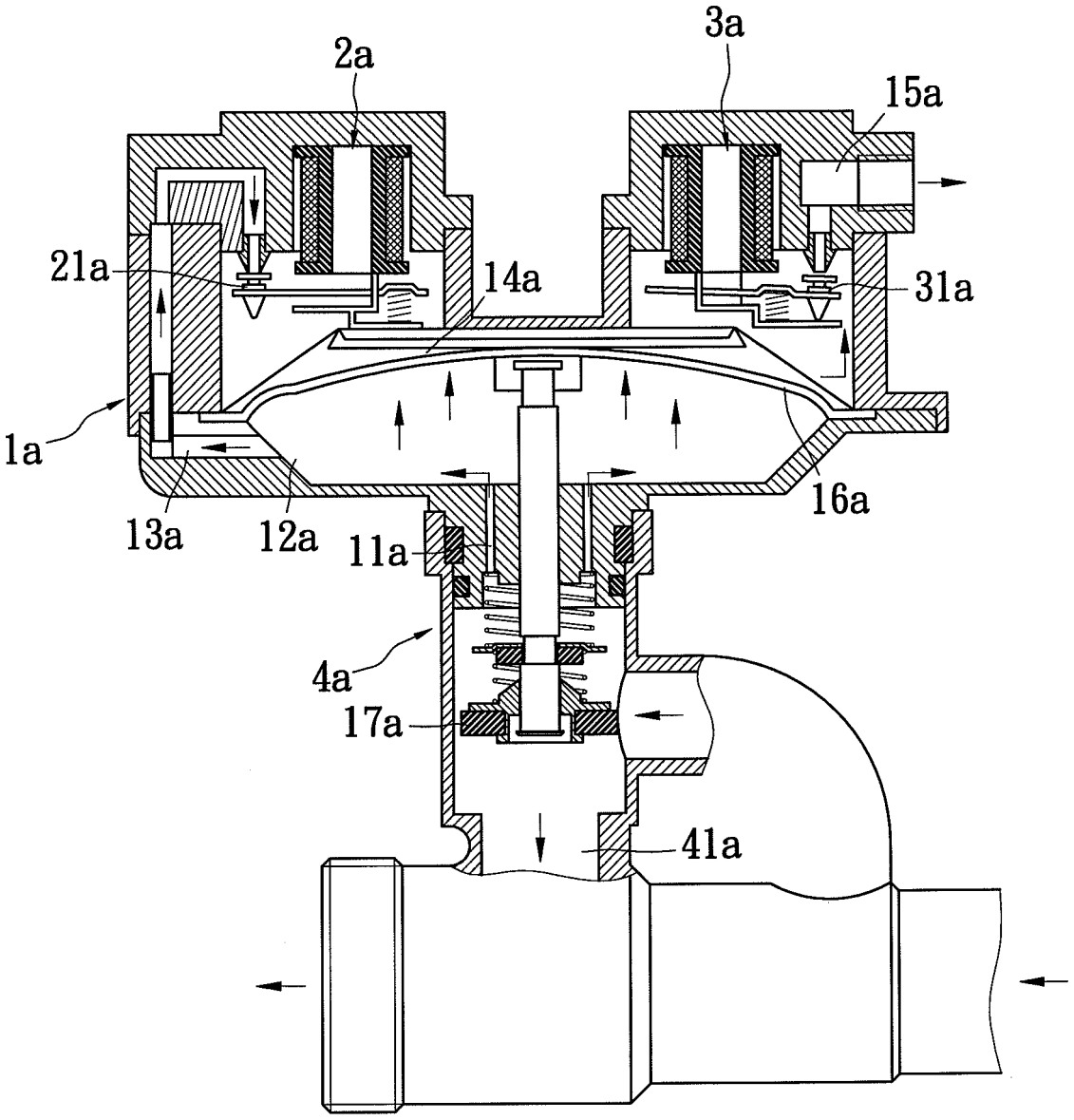

FIG. 2
PRIOR ART

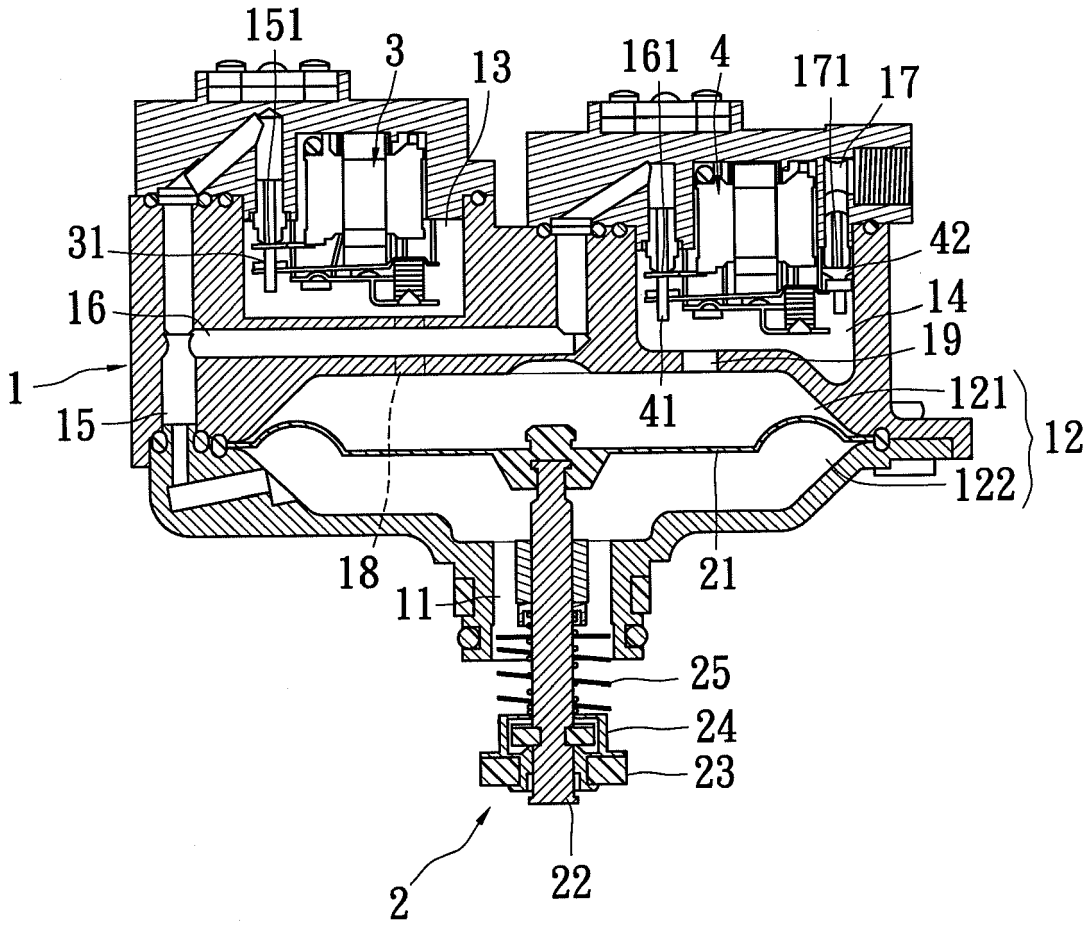
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FIG. 3

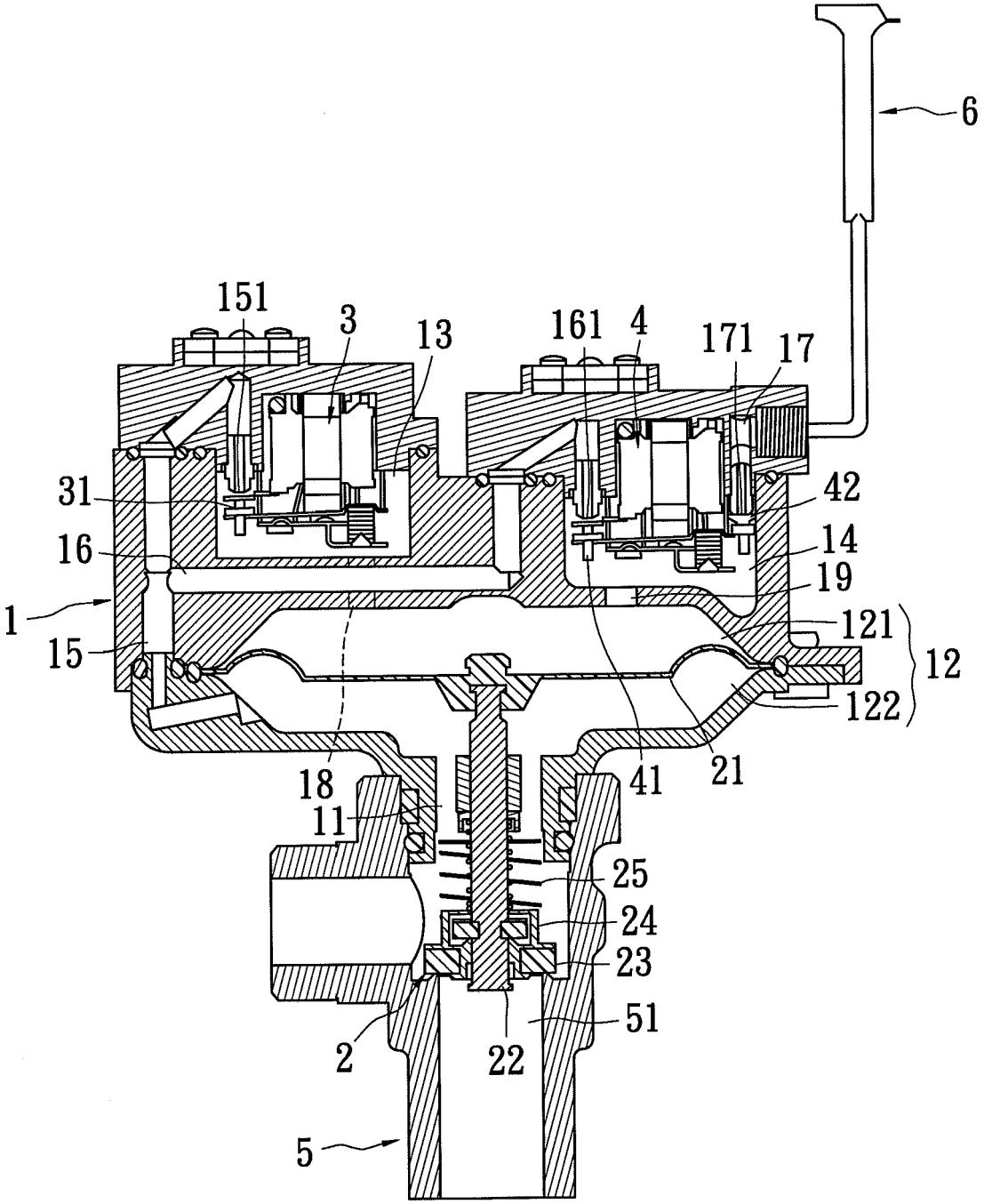
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FIG. 4

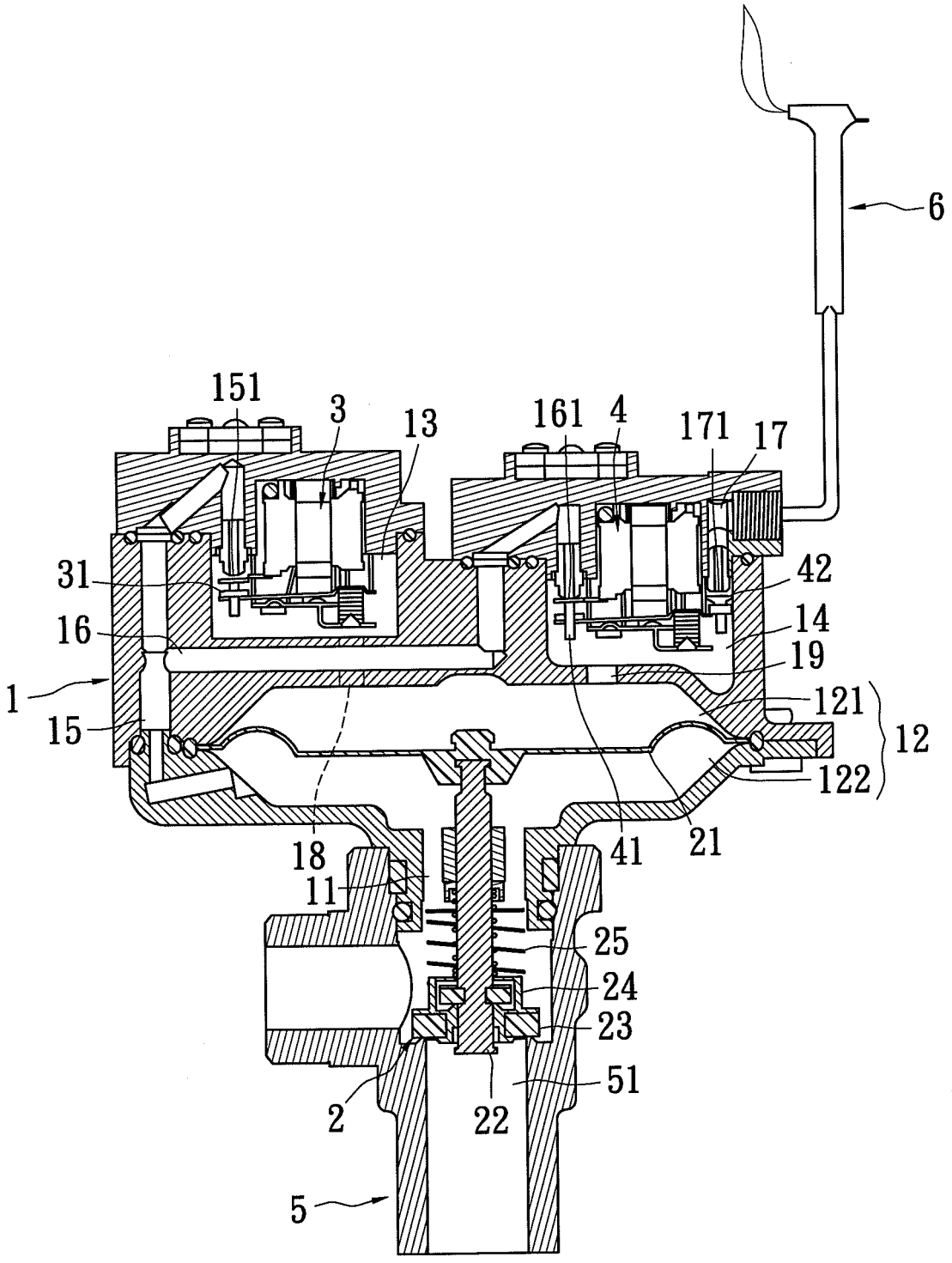
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FIG. 5

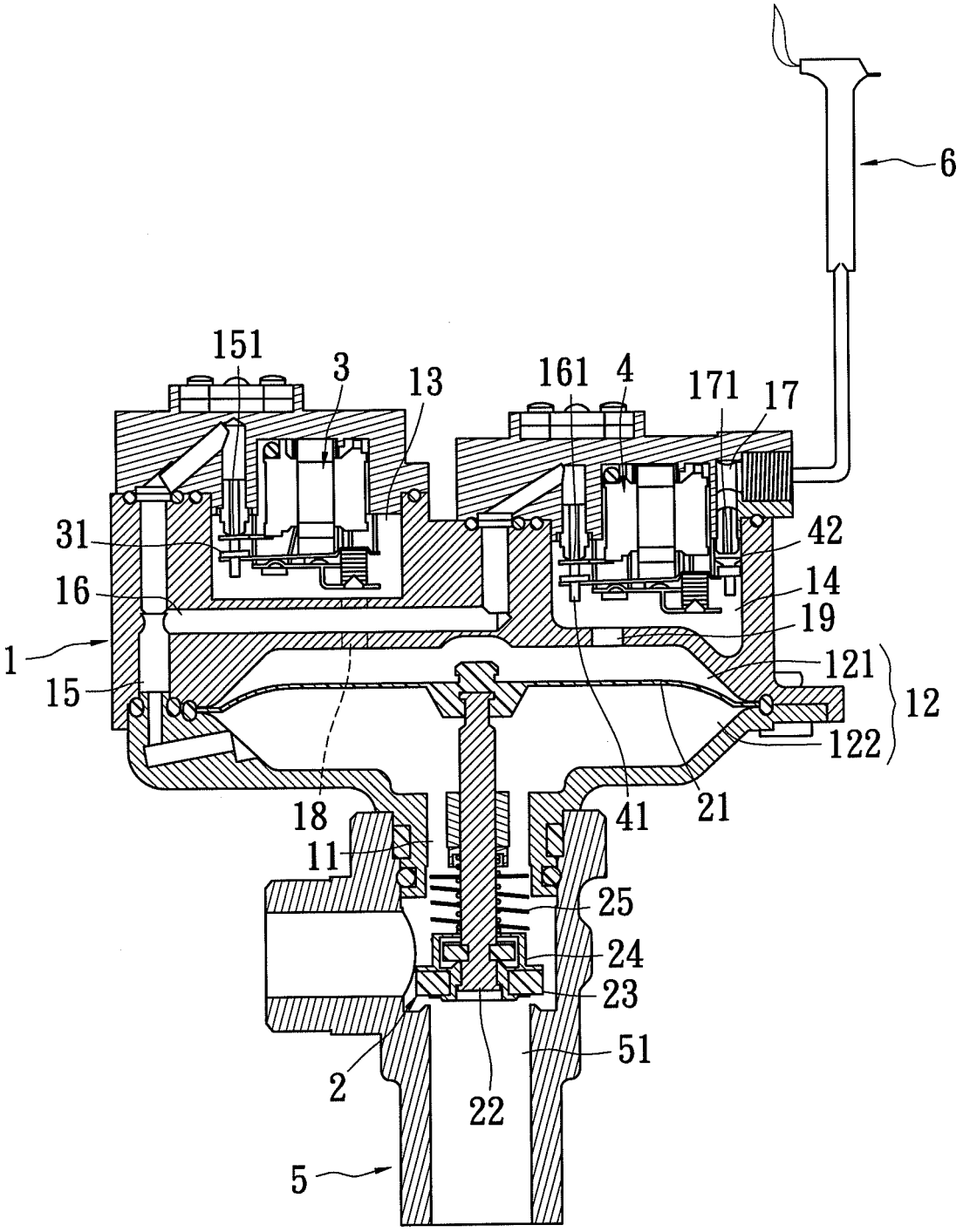
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FIG. 6

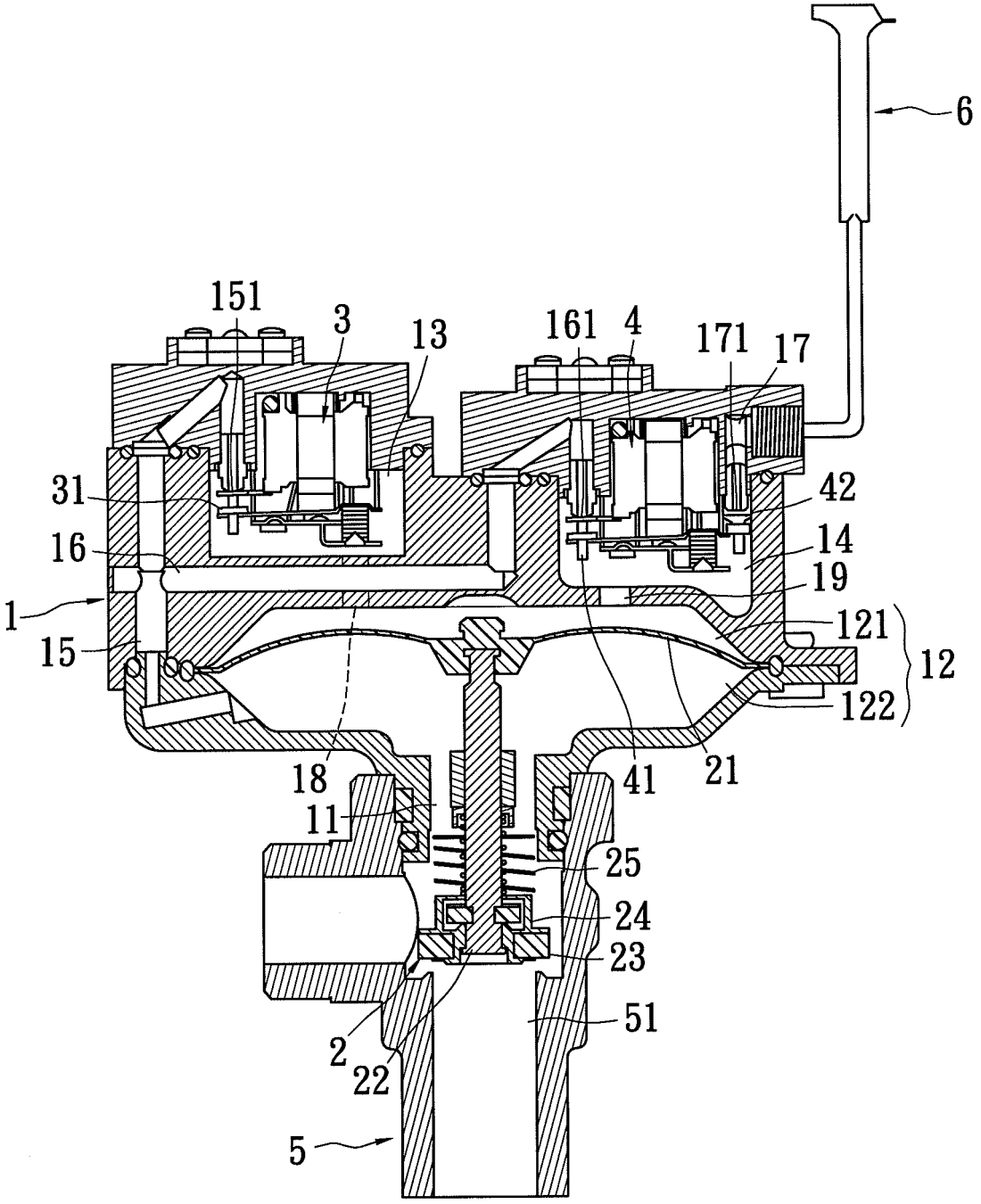
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FIG. 7

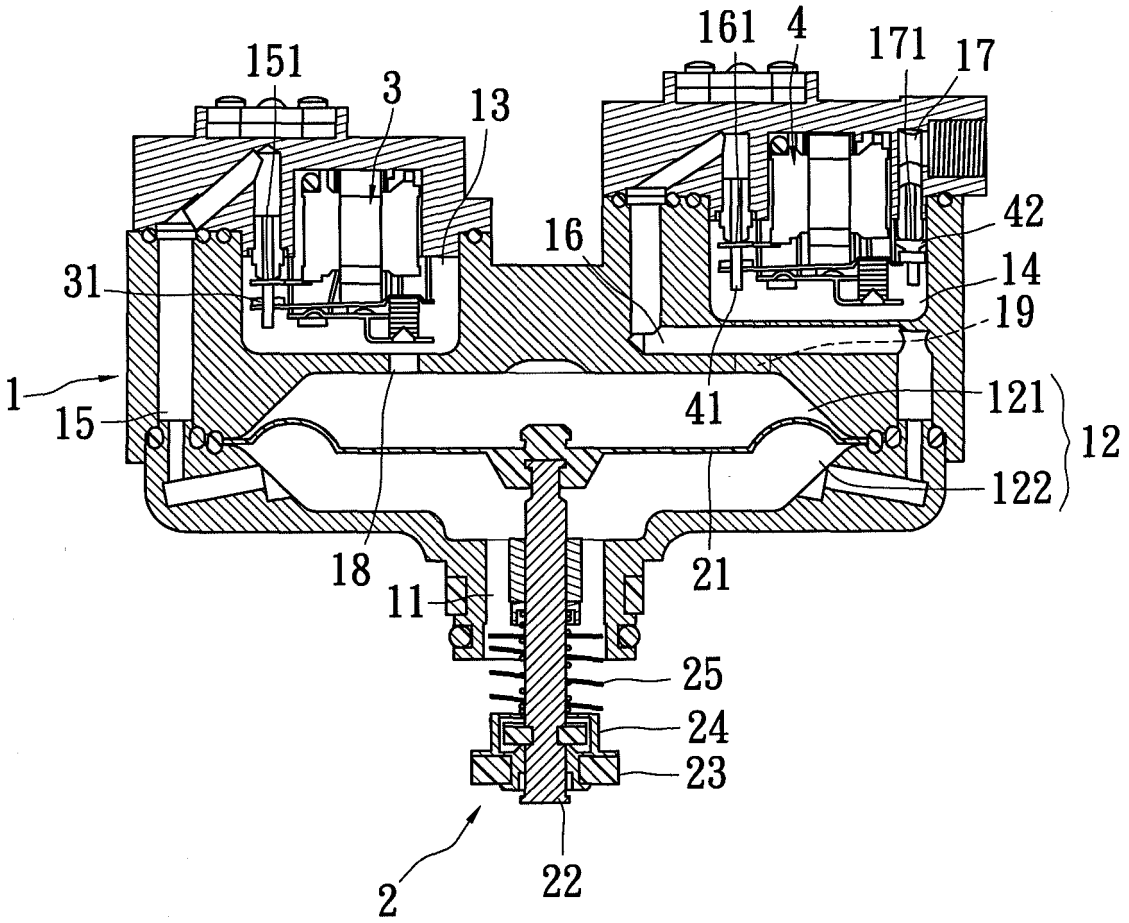
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FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 09 16 1349

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 October 2009	Coli, Enrico

CATEGORY OF CITED DOCUMENTS

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23-10-2009

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82