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(54) **Exhaust gas recycling valve for a vehicle**

(57) An exhaust gas recycling valve for a vehicle includes a valve body (6), a sealing unit (7) and a control cable (8). The sealing unit (7) includes a sealing member (72) mounted movably within an accommodating space

(61) in the valve body (6) and disposed at a sealing position. The control cable (8) is fastened to the sealing unit (7) and an accelerator cable (900). When the accelerator cable (900) is operated, the sealing member (72) moves to a non-sealing position.

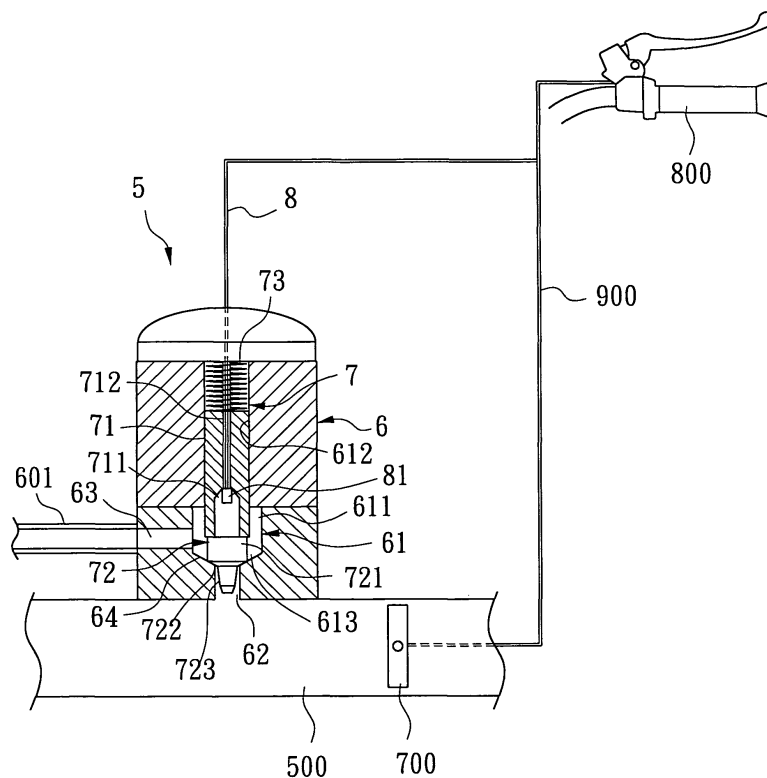


FIG. 3

Description

[0001] The invention relates to an exhaust gas recycling valve, and more particularly to an exhaust gas recycling valve that is manipulated by use of an accelerator cable.

[0002] Referring to Figure 1, which is a schematic diagram of a conventional exhaust gas recycling device used in a car, the exhaust gas recycling device 1 is adapted for connection with a car engine 100 that includes an air intake pipe 200 and an exhaust pipe 300. The exhaust gas recycling device 1 includes an exhaust gas recycling valve 11 configured as an electromagnetic valve and mounted on the car body, an electronic control unit (ECU) 12 for controlling opening and closing operations of the exhaust gas recycling valve 11, a first air-guiding pipe 13 in fluid communication with the exhaust pipe 300, and a second air-guiding pipe 14 in fluid communication with the air intake pipe 200. When the electronic control unit 12 opens the exhaust gas recycling valve 11, the first air-guiding pipe 13 is in fluid communication with the second air-guiding pipe 14. This allows exhaust gas to flow from the exhaust pipe 300 into the air intake pipe 200 via a flow path formed by the first air-guiding pipe 13, the exhaust gas recycling valve 11 and the second air-guiding pipe 14. The exhaust gas mixes with fresh air in the air intake pipe 200 for subsequent flow into the car engine 100.

[0003] When the electronic control unit 12 closes the exhaust gas recycling valve 11, the first air-guiding pipe 13 is not in fluid communication with the second air-guiding pipe 14. As such, flow of exhaust gas from the exhaust pipe 300 into the air intake pipe 200 via the flow path of the first air-guiding pipe 13, the exhaust gas recycling valve 11 and the second air-guiding pipe 14 is prevented.

[0004] As described above, a portion of the exhaust gas exhausted from the car engine 100 flows back into the air intake pipe 200 to mix with fresh air. Since this portion of exhaust gas includes a large quantity of carbon dioxide (CO₂), which will not oxidize and which can absorb a significant amount of heat, oxygen density in the car engine 100 is reduced. As a result, the maximum combustion temperature of the car engine 100 is lowered to thereby reduce nitrogen oxides (NO_x) in the exhaust gas.

[0005] However, due to the high temperature of the exhaust gas passing through the exhaust pipe 300, the exhaust gas recycling valve 11 is susceptible to damage. If extreme damage occurs, the exhaust gas recycling valve 11 may entirely malfunction, in which case exhaust gas recycling is not possible.

[0006] Referring to Fig. 2, another exhaust gas recycling device 2 is shown to include an exhaust gas recycling valve 3 in fluid communication with both an air intake pipe 500 and an air-guiding pipe 601 that is connected fixedly to and that is in fluid communication with an exhaust pipe (not shown).

[0007] The exhaust gas recycling valve 3 includes a

valve body 31, a sealing member 32, and a diaphragm unit 33 for controlling movement of the sealing member 32.

[0008] The valve body 31 has an interior chamber 311, a fixed first connecting pipe 312 in fluid communication with the interior chamber 311, and an exhaust gas passage 313 in fluid communication with the air-guiding pipe 601.

[0009] The sealing member 32 is disposed movably within the exhaust gas passage 313, and is driven by the diaphragm unit 33 to open or close the exhaust gas passage 313.

[0010] The diaphragm unit 33 is disposed in the interior chamber 311, and includes a diaphragm 331 dividing the interior chamber 311 into two chamber portions, a resilient member 332 configured as a coiled compression spring and disposed within one of the chamber portions, and a connecting rod 333 interconnecting the diaphragm 331 and the sealing member 32. The resilient member 332 presses against the diaphragm 331 so as to bias the sealing member 32 to close the exhaust gas passage 313.

[0011] The control unit 4 includes a second connecting pipe 41 that has two opposite ends which are connected respectively and fixedly to and which are in fluid communication with the air intake pipe 500 and the first connecting pipe 312. A pressure-regulating valve 42 is disposed on the second connecting pipe 41 for automatically adjusting the negative pressure in the second connecting pipe 41.

[0012] When a throttle valve 700 is rotated within the air intake pipe 500, the pressure-regulating valve 42 can automatically compensate for the negative pressure from the air intake pipe 500 so as to overcome the biasing force of the resilient member 332. Hence, the diaphragm 331 and the sealing member 32 are moved by means of the negative pressure from the connecting pipe 41 so as to open the exhaust gas passage 313. This causes the exhaust gas to flow from the exhaust pipe into the air intake pipe 500 through the air-guiding pipe 601 and the exhaust gas passage 313.

[0013] A drawback of this configuration, however, is that since the exhaust gas recycling valve 3 is disposed in proximity to an engine (not shown) and the temperature of the engine is relatively high, the diaphragm 331 is susceptible to damage, thereby reducing the service life of the exhaust gas recycling valve 3. Furthermore, the exhaust gas recycling valve 3 needs to be made from a high temperature-resistant material. Therefore, the manufacturing costs of the exhaust gas recycling valve 3 are increased.

[0014] Therefore, the object of this invention is to provide an exhaust gas recycling valve that can overcome the drawbacks associated with the prior art.

[0015] According to this invention, an exhaust gas recycling valve for a vehicle includes a valve body, a sealing unit and a control cable. The sealing unit includes a sealing member mounted movably within an accommodating

space in the valve body and disposed at a sealing position. The control cable is fastened to the sealing unit and an accelerator cable. When the accelerator cable is operated, the sealing member moves to a non-sealing position.

[0016] Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiment with reference to the accompanying drawings, of which:

Fig. 1 illustrates a conventional exhaust gas recycling device;

Fig. 2 illustrates another conventional exhaust gas recycling device;

Fig. 3 is a sectional view of the preferred embodiment of an exhaust gas recycling valve according to this invention; and

Fig. 4 is a sectional view of the preferred embodiment, illustrating how a sealing member is moved to a non-sealing position.

[0017] Referring to Fig. 3, the preferred embodiment of an exhaust gas recycling valve 5 for a vehicle (not shown), such as a motorcycle, according to this invention is shown to include a valve body 6, a sealing unit 7 and a control cable 8. The vehicle includes an air intake pipe 500 of an air intake system for feeding fresh air into an engine (not shown), an exhaust pipe (not shown) of an exhaust system for discharging exhaust gas from the engine, an air-guiding pipe 601 connected fixedly to and in fluid communication with the exhaust pipe, a throttle valve 700 disposed rotatably in the air intake pipe 500, a handle unit 800, and an accelerator cable 900 interconnecting the handle unit 800 and the throttle valve 700.

[0018] The exhaust gas recycling valve 5 is disposed between the air intake pipe 500 and the air-guiding pipe 601 so as to allow for flow of the exhaust gas from the air-guiding pipe 601 into the air intake pipe 500 via the exhaust gas recycling valve 5.

[0019] The valve body 6 is cylindrical, and has an accommodating space 61, a gas outlet 62 in fluid communication with the accommodating space 61, and a gas inlet 63 in fluid communication with both the accommodating space 61 and the air-guiding pipe 601. Each of the accommodating space 61 and the gas outlet 62 has a circular cross section. The gas outlet 62 has a diameter smaller than that of the accommodating space 61. The valve body 6 further has a shoulder 64 defined between the accommodating space 61 and the gas outlet 62. The accommodating space 61 has a large-diameter portion 611 in fluid communication with the gas inlet 63, a small-diameter portion 612 connected to an end of the large-diameter portion 611 and having a diameter smaller than that of the large-diameter portion 611, and a frustoconical portion 613 connected to an opposite end of the large-diameter portion 611. The frustoconical portion 613 has a large-diameter end connected to the large-diameter portion 611, and a small-diameter end connected to the

gas outlet 62 and having a diameter smaller than that of the large-diameter end.

[0020] The sealing unit 7 includes a sliding member 71, a sealing member 72, and a resilient member 73. The sealing member 72 is mounted movably within the accommodating space 61, and is disposed at a sealing position, where the gas outlet 62 is closed so as to prevent flow of the exhaust gas from the air-guiding pipe 601 into the air intake pipe 500 through the exhaust gas recycling valve 5. The sealing member 72 is disposed within the large-diameter portion 611. The resilient member 73 is disposed at an end portion of the small-diameter portion 612 distal from the large-diameter portion 611.

[0021] The sliding member 71 is received fittingly and movably within the small-diameter portion 612 of the accommodating space 61, is disposed between the sealing member 72 and the resilient member 73, and is formed with a counterbore therethrough. The counterbore has a thick bore portion 711 and a thin bore portion 712. The thin bore portion 712 has a diameter smaller than that of the thick bore portion 711.

[0022] The sealing member 72 includes a connecting portion 721, a frustoconical sealing portion 722 and a frustoconical insert portion 723. The sealing portion 722 has two opposite ends connected respectively and fixedly to the connecting portion 721 and the insert portion 723. The connecting portion 721 is connected fixedly to the sliding member 71, and covers the thick bore portion 711 of the counterbore in the sliding member 71. The sealing portion 722 is biased by the resilient member 73 to press against the shoulder 64 of the valve body 6 so as to close the gas outlet 62. The insert portion 723 is disposed entirely within the gas outlet 62 in the valve body 6, and has a diameter that reduces gradually in a direction away from the sealing portion 722.

[0023] The resilient member 73 is configured as a coiled compression spring, and is disposed in the small-diameter portion 612 of the accommodating space 61 so as to bias the sliding element 71 and the sealing member 72 to move toward the gas outlet 62, thereby closing the gas outlet 62.

[0024] The control cable 8 has two opposite ends fastened respectively to the sliding member 71 and the accelerator cable 900. The control cable 8 extends through the thin bore portion 712, and is formed with a stop element 81. The stop element 81 is disposed in the thick bore portion 711, and is sized so as not to move into the thin bore portion 712. Thus, the stop element 81 is confined between the sliding member 71 and the sealing member 72.

[0025] When the handle unit 800 is manipulated to operate the accelerator cable 900 so as to accelerate the vehicle, the sealing member 72 moves to a non-sealing position shown in Fig. 4, where the exhaust gas recycling valve 5 is opened so as to allow for flow of the exhaust gas from the air-guiding pipe 601 into the air intake pipe 500 through the exhaust gas recycling valve 5.

[0026] When the sealing member 72 is disposed at the

non-sealing position, the insert portion 723 of the sealing member 72 is disposed only partially within the gas outlet 62. This allows for flow of the exhaust gas from the exhaust gas recycling valve 5 into the air intake pipe 500 through a space between the insert portion 723 and a wall of the valve body 6 defining the gas outlet 62. As such, the rate of the exhaust gas flowing through the gas outlet 62 can be adjusted by changing the non-sealing position of the sealing member 72.

[0027] The exhaust gas recycling valve 5 is controlled mechanically by the accelerator cable 900, and therefore is not affected by the high temperature of exhaust gas. As a result, the exhaust gas recycling device 5 has a long service life.

Claims

1. An exhaust gas recycling valve (5) for a vehicle, the vehicle including an engine (100), an air intake system (500) connected to the engine (100) so as to allow for flow of air into the engine (100) through the air intake system (500), an exhaust system connected to the engine (100) so as to allow for flow of exhaust gas from the engine (100) through the exhaust system, and an accelerator cable (900), the exhaust gas recycling valve (5) being disposed between the air intake system (500) and the exhaust system so as to allow for flow of the exhaust gas from the exhaust system into the air intake system (500) via the exhaust gas recycling valve (5), **characterized in that** the exhaust gas recycling valve (5) includes:

a valve body (6) having an accommodating space (61), a gas outlet (62) in fluid communication with the accommodating space (61), and a gas inlet (63) in fluid communication with both the accommodating space (61) and the exhaust system;

a sealing unit (7) including a sealing member (72) that is mounted movably within the accommodating space (61) and that is disposed at a sealing position, where the gas outlet (62) is closed so as to prevent flow of the exhaust gas from the exhaust system into the air intake system (500) through the exhaust gas recycling valve (5); and

a control cable (8) having two opposite ends fastened respectively to the sealing unit (72) and the accelerator cable (900) such that, when the accelerator cable (900) is operated, the sealing member (72) moves to a non-sealing position, where the exhaust gas recycling valve (5) is opened so as to allow for the flow of the exhaust gas from the exhaust system into the air intake system (500) through the exhaust gas recycling valve (5).

2. The exhaust gas recycling valve as claimed in Claim 1, further **characterized in that** each of the accommodating space (61) and the gas outlet (62) in the valve body (6) has a circular cross section, the valve body 6 further having a shoulder (64) defined between the accommodating space (61) and the gas outlet (62), the gas outlet (62) having a diameter smaller than that of the accommodating space (61), the sealing member (72) having a frustoconical sealing portion (722) abutting against the shoulder (64) of the valve body (6) so as to close the gas outlet (62) when the sealing member (72) is disposed at the sealing position.
3. The exhaust gas recycling valve as claimed in Claim 1, further **characterized in that** the sealing member (72) has a frustoconical insert portion (723) that is disposed partially within the gas outlet (62) when the sealing member (72) is disposed at the non-sealing position, so as to allow for flow of the exhaust gas from the exhaust gas recycling valve (5) into the air intake system (500) through a space between the insert portion (723) and a wall of the valve body (6) defining the gas outlet (62).
4. The exhaust gas recycling valve as claimed in Claim 1, further **characterized in that** the accommodating space (61) has a large-diameter portion (611) in fluid communication with the gas inlet (63), a small-diameter portion (612) connected to an end of the large-diameter portion (611) and having a diameter smaller than that of the large-diameter portion (611), and a frustoconical portion (613) connected to an opposite end of the large-diameter portion (611), the frustoconical portion (613) having a large-diameter end connected to the large-diameter portion (611), and a small-diameter end connected to the gas outlet (62) and having a diameter smaller than that of the large-diameter end; and the sealing unit (7) further includes a sliding member (71) received fittingly and movably within the small-diameter portion (612) of the accommodating space (61) and connected fixedly to the sealing member (72), and a resilient member (73) disposed in the small-diameter portion (612) of the accommodating space (61) so as to bias the sliding member (71) and the sealing member (72) to move toward the gas outlet (62), thereby closing the gas outlet (62).
5. The exhaust gas recycling valve as claimed in Claim 4, further **characterized in that** the sliding member (71) has a counterbore that is formed therethrough, the counterbore having a thick bore portion (711) and a thin bore portion (712) that has a diameter smaller than that of the thick bore portion (711), the control cable (8) extending through the thin bore portion (712) and being formed with a stop element (81) that is disposed in the thick bore portion (711) and

that is sized so as not to move into the thin bore portion (712), the sealing member (72) covering the thick bore portion (711) so as to confine the stop element (81) between the sliding member (71) and the sealing member (72).

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6. The exhaust gas recycling valve as claimed in Claim 4, further **characterized in that** the sealing member (72) is disposed movably within the large-diameter portion (611), the resilient member (73) being disposed at an end portion of the small-diameter portion (612) distal from the large-diameter portion (611) and being configured as a coiled compression spring, the sliding member (71) being disposed between the sealing member (72) and the resilient member (73).

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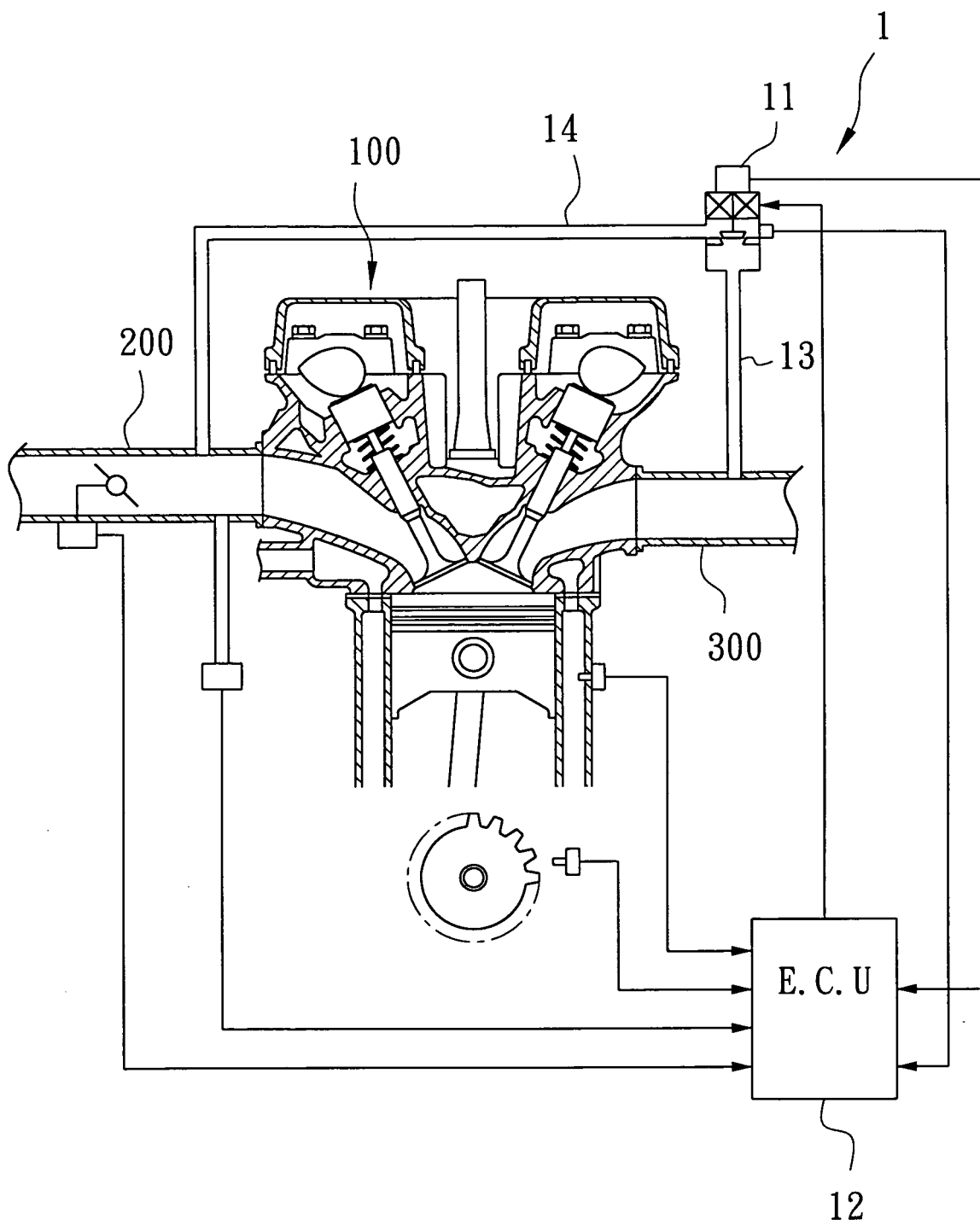


FIG. 1

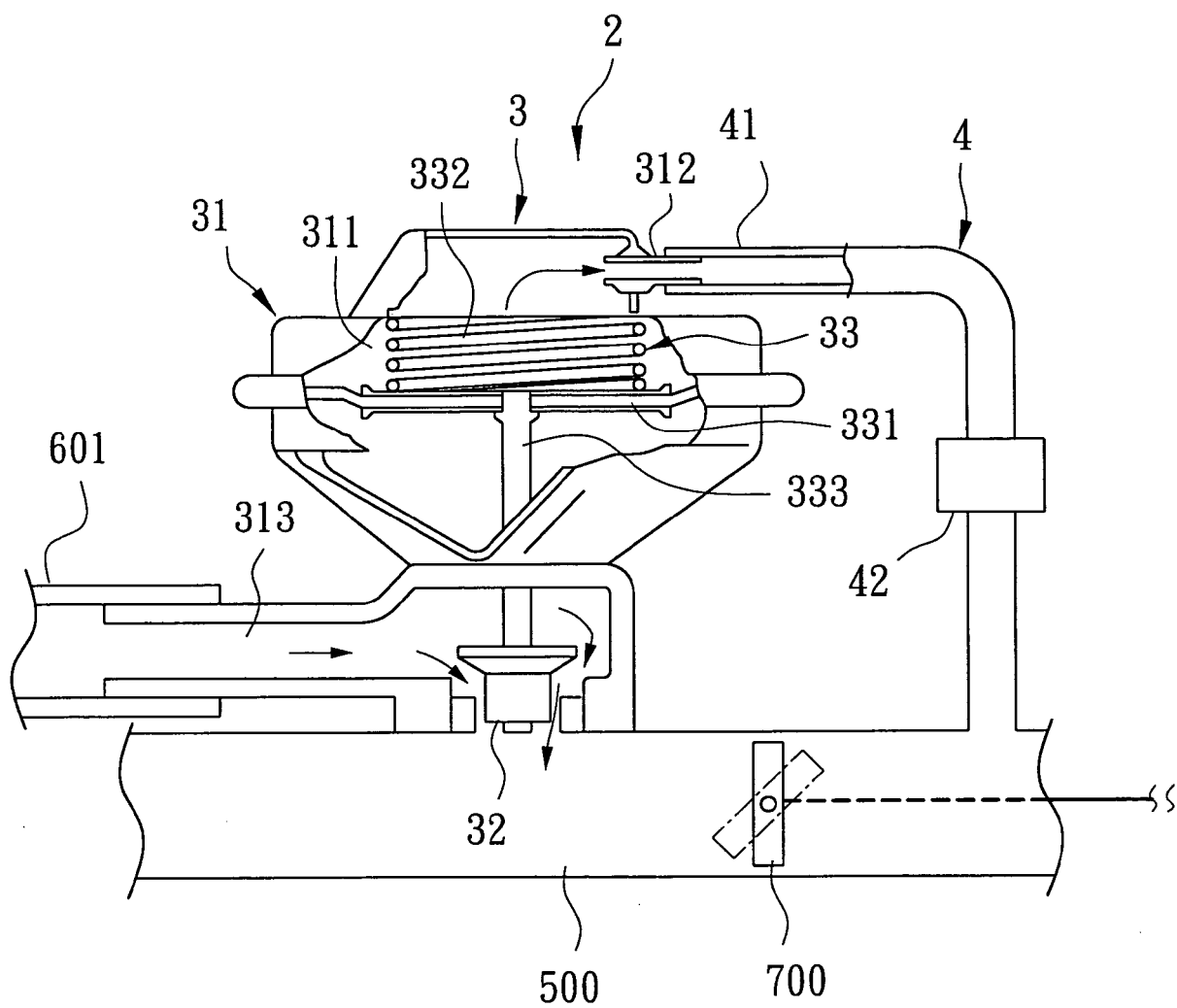


FIG. 2

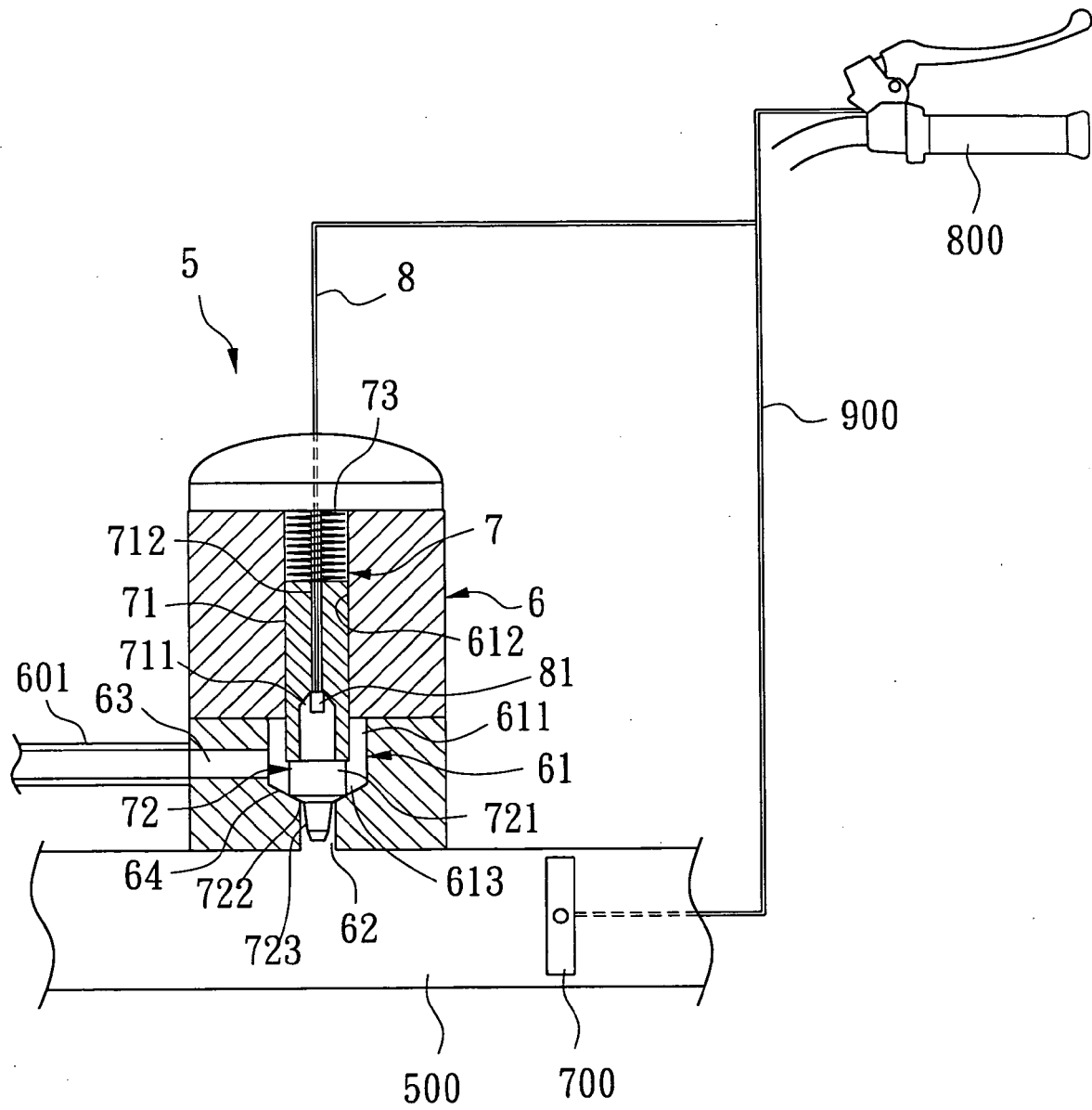


FIG. 3

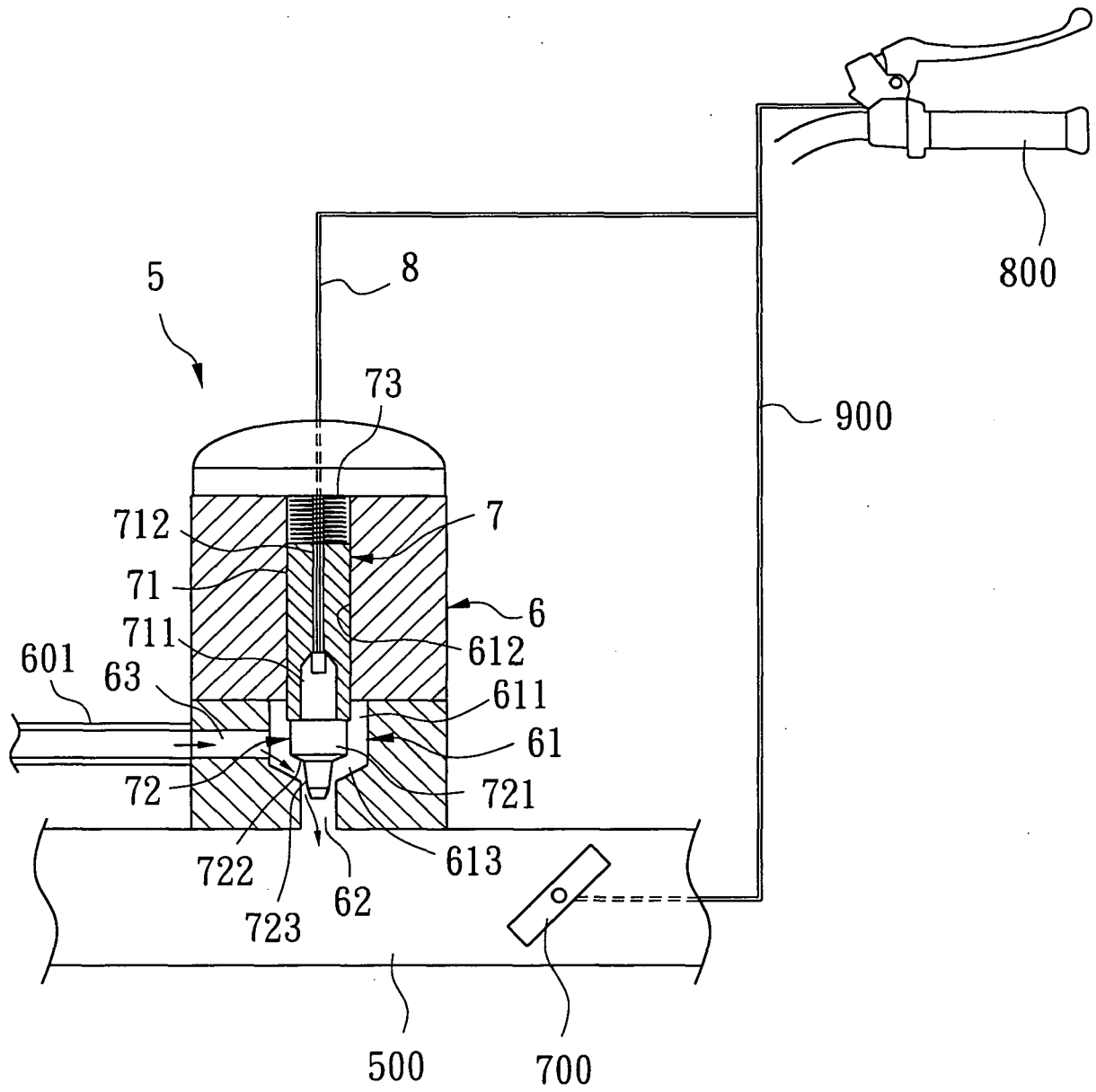


FIG. 4



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 00 1936

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Place of search The Hague		Date of completion of the search 22 June 2005	Examiner Van Zoest, A
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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