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(54) Refrigerator appliance with cool water dispensing unit

(57) A refrigerator appliance is described comprising a heat insulated case (2) and a unit for dispensing water coming from an external water network. The unit comprises a first direct operation solenoid valve (8) connected with said external water network, a tank (10) located inside the heat insulated case (2) and which receives water coming from the external water network through the first solenoid valve (8), a second direct operation solenoid valve (14) located downstream of said tank (10), a water dispenser (13) external to the refrigerator appliance. The first solenoid valve (8) has an orifice (87) for the flow of water inside the tank (10) and said second solenoid valve (14) has an orifice (140) for the flow of the water toward the dispenser (13). The orifice (87) of the first solenoid valve (8) has a section smaller than the orifice (140) of the second solenoid valve (14) in order to reduce the pressure inside the water circuit comprised between the two solenoid valves (8, 14).

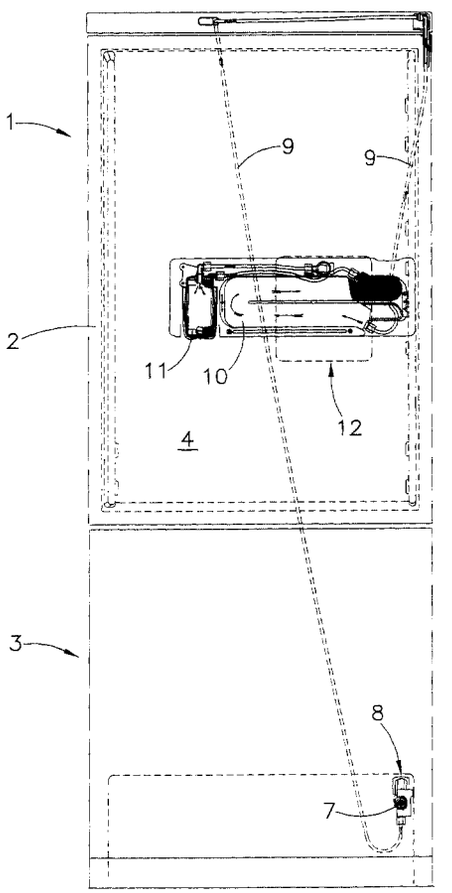

FIG.1

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Description

[0001] The present invention refers to a refrigerator appliance with unit for dispensing cool water.

[0002] Household refrigerators are known that, within them, are provided with drink dispensing devices. Such devices are suitable to contain, inside of the heat insulated case of the refrigerator, a bottle containing the desired drink, in upside down position, and they comprise a tap, for instance a pressure type one, that opens when one wants to fill a glass with the drink. In this way, the drink in the bottle is kept at the temperature present inside the heat insulated case of the refrigerator.

[0003] Some refrigerators are provided with devices for dispensing water coming from an external water network. In such case a circuit for the connection to an external water network and a hydraulic circuit internal to the refrigerator which is suitable to take the water up to a tank internal to the heat insulated case of the refrigerator are provided; a tap connected with the aforesaid tank provides for dispensing water on the outside.

[0004] However the tank, usually made of plastic material, can break if the pressure of the water increases and this happens due both to the cooling of the drinking water as well as due to the increase in the pressure of the water coming from the external water network.

[0005] In view of the state of the art herein described, scope of the present invention is to provide a refrigerator appliance with cool water dispensing unit that allows to solve the aforesaid inconvenience.

[0006] According to the present invention, such scope has been attained by means of a refrigerator appliance comprising a heat insulated case and a unit for dispensing water coming from an external water network, said unit comprising a first direct operation solenoid valve connected with said external water network, a tank located inside said heat insulated case and which receives water coming from the external water network through said first solenoid valve, a second direct operation solenoid valve located downstream of said tank, a water dispenser external to the refrigerator appliance, said first solenoid valve having an orifice for the flow of water inside the tank and said second solenoid valve having an orifice for the flow of water toward the dispenser, characterized in that said orifice of said first solenoid valve has a section smaller than the orifice of said second solenoid valve in order to reduce the pressure inside the water circuit comprised between said two solenoid valves.

[0007] Owing to the present invention it is possible to realize a refrigerator appliance provided with a unit for dispensing drinking water on the outside which is provided with a hydraulic circuit in which the water has a flow rate that keeps constant with changes in pressure.

[0008] In addition the positioning of the filtering device assigned to the elimination of chlorine and other organic compounds from the drinking water downstream of the tank allows that only a small amount of water is constantly non chlorinated and therefore not disinfected.

[0009] The characteristics and the advantages of the present invention will become evident from the following detailed description of an embodiment thereof, that is illustrated as a non-limiting example in the enclosed drawings, in which:

Figure 1 is a schematic view from the back, in section according to a vertical plane, of a refrigerator according to a first embodiment of the invention;
Figure 2 is a side section according to a vertical plane of the refrigerator in Figure 1;
Figure 3 is a magnified view of the filtering device and of the tank of the refrigerator in Figure 1;
Figure 4 is a front view of the network solenoid valve of the refrigerator in Figure 1;
Figure 5 is a view in section according to a vertical plane of the solenoid valve in Figure 4;
Figure 6 is a front view of the solenoid valve of the dispenser of the refrigerator in Figure 1;
Figure 7 is a view in section according to a vertical plane of the solenoid valve in Figure 6;
Figure 8 is a perspective view of the filtering device of the refrigerator in Figure 1;
Figure 9 is a view of the device for the connection of the network solenoid valve with the external water network;
Figure 10 is a schematic view of the detail of the filtering device and of a tank of a refrigerator according to a variant of the first embodiment of the invention.

[0010] With reference to Figures 1 and 2 a refrigerator according to a first embodiment of the present invention is shown. The refrigerator comprises in a way known per se a cabinet 1 that encloses on its inside a heat insulated case 2 and, on the bottom of the same, a freezing cell 3. The heat insulated case 2 and the freezing cell 3 are frontally open and they are provided with doors 4 and 5 that are hinged to the cabinet 1 so as to be revolving around a vertical axis. On the back of the case 2 a condenser and a compressor are provided that are part of a known refrigeration system not visible in the figures.

[0011] The refrigerator is provided with a water inlet 7, that is connectable with the household water network. A solenoid valve 8 is associated with the water inlet 7. In output from the solenoid valve 8, a water transport duct 9, housed in a back interspace of the cabinet 1, goes up to the top of cabinet 1, continues into a upper interspace of the cabinet 1 toward the front part of the same, passes through the door 4 and end up in a water accumulation tank 10 that is destined to contain a reserve of drinking water. The tank 10 is mounted onto the internal wall of the door 4 as a bracket and it preferably has an elongated shape. With the tank 10 a filtering device 11 is associated that is suitable to carry out a chemical filtering function of the water supplied by the water

network, for the elimination of possible organic compounds, of products of the reaction of the chlorine contained in the water, of substances reliesed by the pipes of the water network, better visible in Figure 3.

[0012] To the filtering device 11 a dispensing device 12 is connected comprising a tap 13 that takes the filtered water on the outside. Between the filtering device 11 and the dispensing device 12 a second solenoid valve 14 is located.

[0013] The dispensing device 12 comprises a tap 13 consisting of a right angle tubular the duct 15 and it is provided with a button 16 adjacent to one end 30 of the tap which is connected with the valve means 14 and control to the opening or the closing of the same tap.

[0014] The dispensing device 12 also comprises a frame 17, made up of a sheet of plastic material, applied onto the outside of the door 4 of the heat insulated case 3 in a substantially central position. The frame 17 comprises a recessed part 18 provided with a substantially rectangular hole 19 on top and an upper projection 20. The latter is suitable to contain the external portion of the tap 13 in such a way that the end 30 of the same tap can project from the hole 19 together with the button 16. The recessed part 18 of the frame 17 is made in such a way so as to allow to fill with water not only a glass but even other types of larger containers such as bottles.

[0015] The solenoid valve 8 is activated at every pressure on the button 19. In this way the inflow of water from the water network external to the tank 10 is allowed through the duct 9 and the quantity of water that flows into the tank is equal to the amount of water that is drawn by the user with the tank 10 always kept full.

[0016] Preferably the connection of the inlet 7 with the external water network is carried out by means of a coupling device 21, shown in Figure 9, that is made up of a hose 22 and two threaded ring nuts 23, 24 provided with appropriate internal packings. The ring nuts 23, 24 are respectively connectable with the threaded inlet 7 of the solenoid valve 8 and with a tap existing in the building where the refrigerator is located. If too long the hose 22 can be shortened by uncoupling it from its connection with a ring nut, by cutting it and by subsequently coupling it with the ring nut.

[0017] The solenoid valve 8, better visible in Figures 4 and 5, is of the direct operation type and it is provided with a liter counter 70 for the count of the amount of water that flows inside it. The solenoid valve 8 comprises a body 80 that is made up of the threaded hole 7 for the connection with the external water network in such a way that the water passes through a hole 81 with a diameter that is decreasing while getting toward the inside of solenoid valve 8 and preferably provided with a mesh 82 for the filtering of the water. The hole 81 leads inside a chamber 83 that has a cylindrical shape but transversally cut by an oblique wall 84. The chamber 83 has a cylindrical body 85 inside of it that together with the wall 84 delimits the chamber 83 on the bottom. The cylindrical body 85 is hollow and it has on its top 86 a round orifice 87, preferably 1.6mm in diameter, for the flow of water through its inside; the orifice 87 is normally closed by a piston 88 that is thrust by a spring 89 located in a tubular duct 90 of a piece 95 for the closing of the chamber 83. The tubular duct 90 is in turn located inside a body 91 containing a coil that allows the lifting of the piston 88 according to a known operation and therefore the flow of the water inside the cylindrical body 85. The latter takes the water to the liter counter 30 that provides to count the amount of water that is brought through the outlet 92 inside of the tube 9.

[0018] The second solenoid valve 14, controlled by the button 19 too, is a directed operation solenoid valve, better shown in Figures 6 and 7, which is similar to the solenoid valve 8 but has a round orifice 140, for the flow of water larger than the orifice 88 found in the solenoid valve 8, it preferably has a diameter of 2mm. Such solenoid valve 14 allows the water of the dispensing unit not to come to contact with the external air. For this second solenoid valve 14 too a duct 141 for the inlet of the filtered water is provided that through the holes 142 that are made in a packing 144 flows into an area 143. If the piston 145 does not close the orifice 140 the filtered water can flow inside a tube 146 that leads it toward the tap 13.

[0019] Even if not shown in the figures a non-return valve for the water to avoid the flow of water from the dispensing unit toward the water network is located upstream of the solenoid valve 8 or it is inserted into it.

[0020] The operation of the dispensing unit is as following.

[0021] The water coming from the water network passes through the supply hose 22 and the inlet 7 of the solenoid valve 8 and through the hole 81 it is lead inside the chamber 83.

[0022] If one wants to fill any container with water one operates on the button 19 that controls the opening of the solenoid valves 8 and 14. In that way the coil 91 provides to the lifting of the piston 88 and therefore to the flow of water through the orifice 87, the hollow cylindrical body 85, the liter counter 30 and through the outlet 92 toward the tube 9.

[0023] After having flowed inside the tube 9 the water reaches the tank 10 located on the internal wall of the door 4 of heat insulated case 2. The tank 10 is generally made up of plastic material, it has an elongated U-shape and it is provided with two threaded inlets 101, 102 obtained by moulding during the same moulding of the tank 10.

[0024] Once the tank 10 has been filled the water reaches the filtering device 11 made up of a body 110 to which a filter 111 is connected on the bottom that is arranged inside a container 112 screwable to the body 110 and which has a glass-like shape. Finally the water goes through the solenoid valve 14 and it reaches the device 12 for its output on the outside.

[0025] When one operates on the button 19 so as to stop the output of water the same button simultaneously

controls the closing of the solenoid valve 8 by means of the lowering of the piston 88 on the orifice 87 and of the solenoid valve 14 by closing the orifice 140 by means of the piston 145. However the difference in dimension between the two orifices 87 and 140 determines a delayed closing of the orifice 140 and this causes a reduction in the pressure of the water inside the output circuit that is called residual pressure. This allows to prevent possible breaks of the tank 10 and possible high pressure water jets from the tap 13. Preferably the aim is to guarantee a water pressure inside the dispenser unit that is comprised between 0.2 and 2 bars with a network pressure comprised between 0.2 bars and 8 bars, considering the fact that the cooling of the drinking water inside the tank causes the pressure of the water to raise, for instance the passage from 10 degrees to 4 degrees determines an increase in the pressure of the water inside of tank 10 equal to 1atm.

[0026] The solenoid valve 8 is preferably calibrated at 8 bars in order to be able to resist possible sudden changes in pressure (the so-called the "water hammer") of the water in the external water network.

[0027] The solenoid valve 14 is preferably calibrated at 4 bars. In this way such solenoid valve 14 signals the breakdown of the solenoid valve 8 by closing itself; in fact a breakdown of the solenoid valve 8 determines an increase in pressure inside the circuit of the dispensing unit that cause the closing of the solenoid valve 14 thus stopping in such way the output of water. If that happens the user can contact the service department for the control of the dispenser system of the refrigerator appliance.

[0028] Preferably a variation of the aforesaid embodiment is provided whereby an air bag 200, made of a chamber 201 containing air and insulated by a membrane 202 from the part of the tank 10 that contains water, is inserted inside the tank 10 in order to additionally lower the residual pressure inside the dispensing unit, as shown in Figure 10.

[0029] The presence of two solenoid valves 8 and 14 facilitates the operation of substitution of the filter 111 that can take place also in the presence of water in the water circuit between two solenoid valves 8, 14. Such operation is carried out every time the liter counter counts an amount of water equal to 1000 liters; that is signaled by the ignition of an appropriate LED that can preferably be already flashing when the count reaches 950 litres. Such operation provides for the unscrewing of the glass 110 that contains the filter 111, the uncoupling of the same and its substitution, and the subsequent screwing back of the glass, as shown in Figure 8.

Claims

1. Refrigerator appliance comprising a heat insulated case (2) and a unit for dispensing water coming from an external water network, said unit comprising a first direct operation solenoid valve (8) connected with said external water network, a tank (10) located inside said heat insulated case (2) and which receives water coming from the external water network through said first solenoid valve (8), a second direct operation solenoid valve (14) located downstream of said tank (10), a water dispenser (13) external to the refrigerator appliance, said first solenoid valve (8) having an orifice (87) for the flow of water inside the tank (10) and said second solenoid valve (14) having an orifice (140) for the flow of the water toward the dispenser (13), **characterized in that** said orifice (87) of said first solenoid valve (8) has a section smaller than the orifice (140) of said second solenoid valve (14) in order to reduce the pressure inside the water circuit comprised between said two solenoid valves (8, 14).

2. Refrigerator appliance according to claim 1, **characterized in that** the orifice (87) of said first solenoid valve (8) is circular and it is substantially 1.6 millimetres in diameter and the orifice (140) of said second solenoid valve (14) is circular and it is substantially 2 millimetres in diameter.

3. Refrigerator appliance according to claim 1, **characterized in that** said second solenoid valve (14) is calibrated in pressure in minor way as compared with said first solenoid valve (8) in such a way that its closing signals a breakdown of the first solenoid valve (8).

4. Refrigerator appliance according to claim 3, **characterized in that** said first solenoid valve (8) is calibrated at 8 bars and said second solenoid valve (14) is calibrated at 4 bars.

5. Refrigerator appliance according to claim 1, **characterized in that** said first solenoid valve (8) is provided with a liter counter (70) for the count of the amount of water that flows through it.

6. Refrigerator appliance according to claim 1, **characterized in that** said dispensing unit comprises a filtering device (11) located between said tank (10) and said second solenoid valve (14).

7. Refrigerator appliance according to claim 6, **characterized in that** said filtering device (11) comprises a filter (111) and a container shaped as a glass (112) that is easy removable for the substitution of the filter (111).

8. Refrigerator appliance according to claim 7 and 5, **characterized in that** it provides for the substitution of said filter (111) of the filtering device (11) to the attainment of a pre-established amount of water that flows through said first solenoid valve (8).

9. Refrigerator appliance according to claim 6, **characterized in that** said heat insulated case (2) is open and it is closed by a door (4) and said tank (10) and said filtering device (11) are arranged on the internal wall of said door (4) of said heat insulated case (2).

10. Refrigerator appliance according to claim 1, **characterized in that** there are provided means (21) for the connection of said first solenoid valve (8) to the external water network, said connection means (21) comprising a flexible and shortenable hose (22).

11. Refrigerator appliance according to claim 1, **characterized in that** said tank (10) comprises an air bag (200) in order to additionally reduce the pressure inside said water circuit between the two solenoid valves (8, 14).

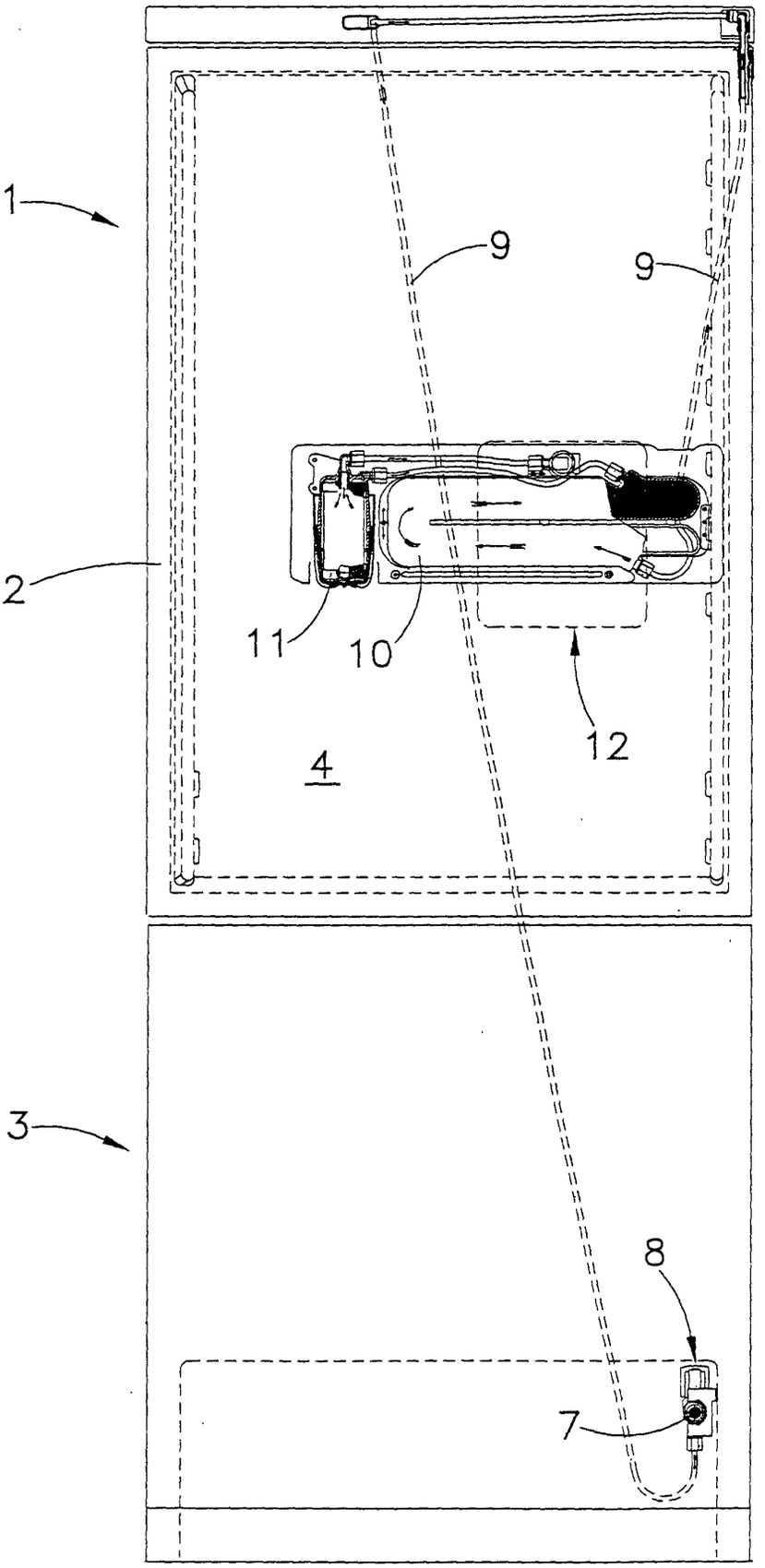

FIG.1

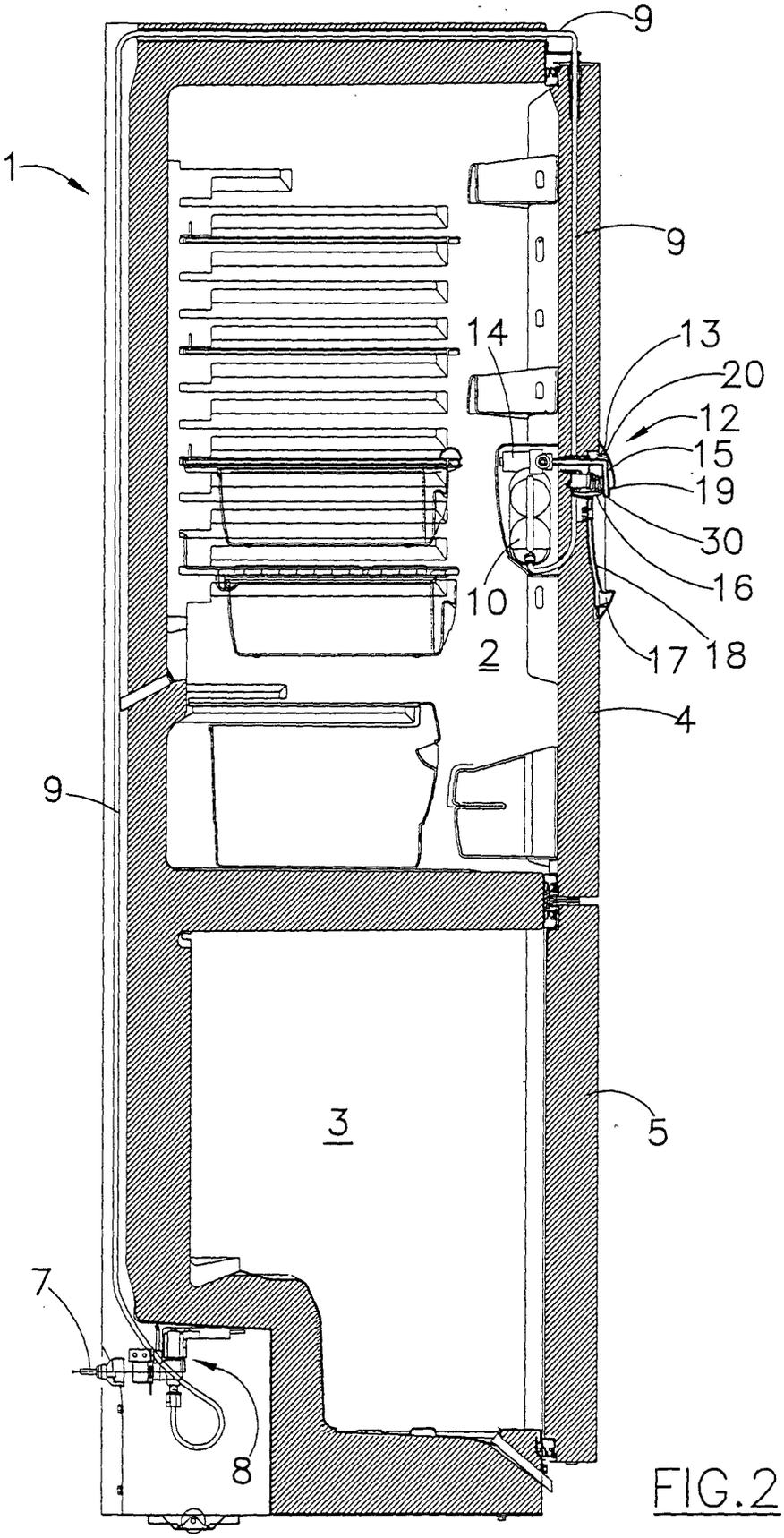

FIG.2

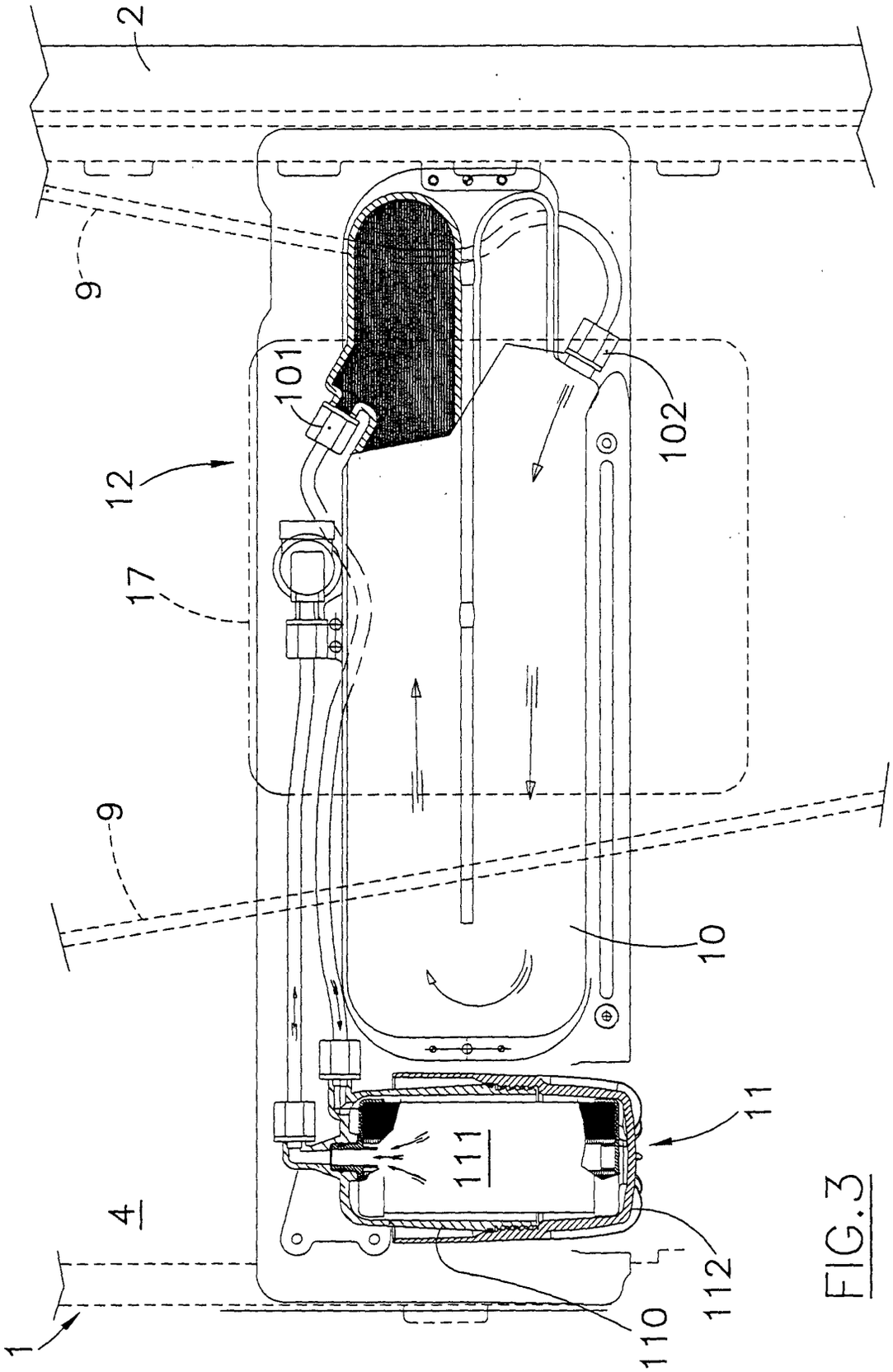

FIG.3

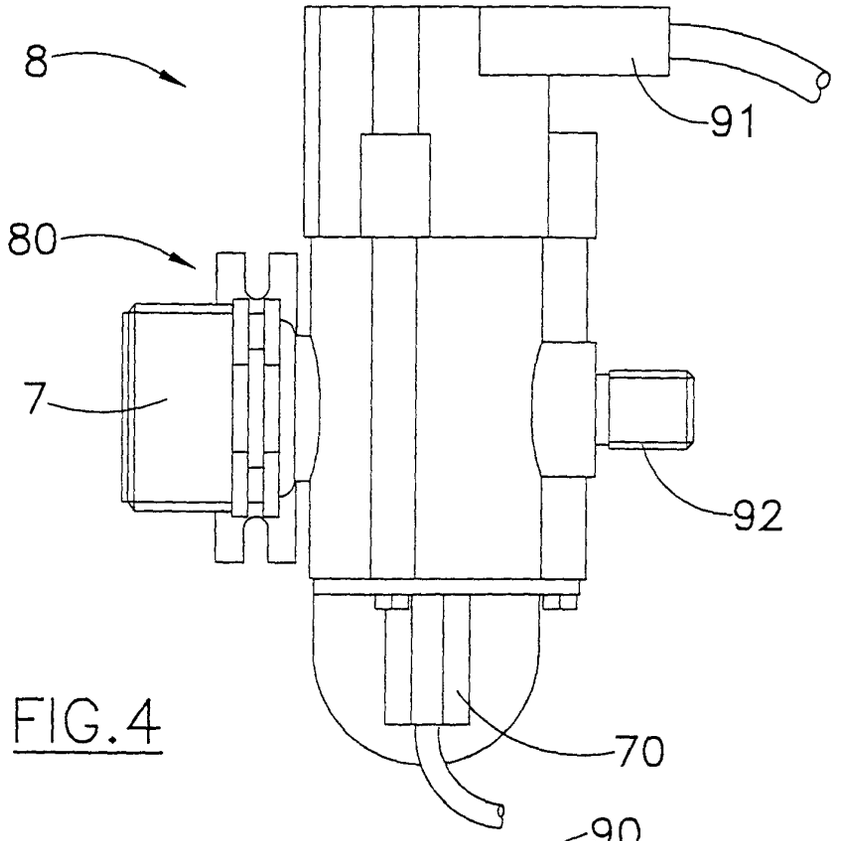

FIG.4

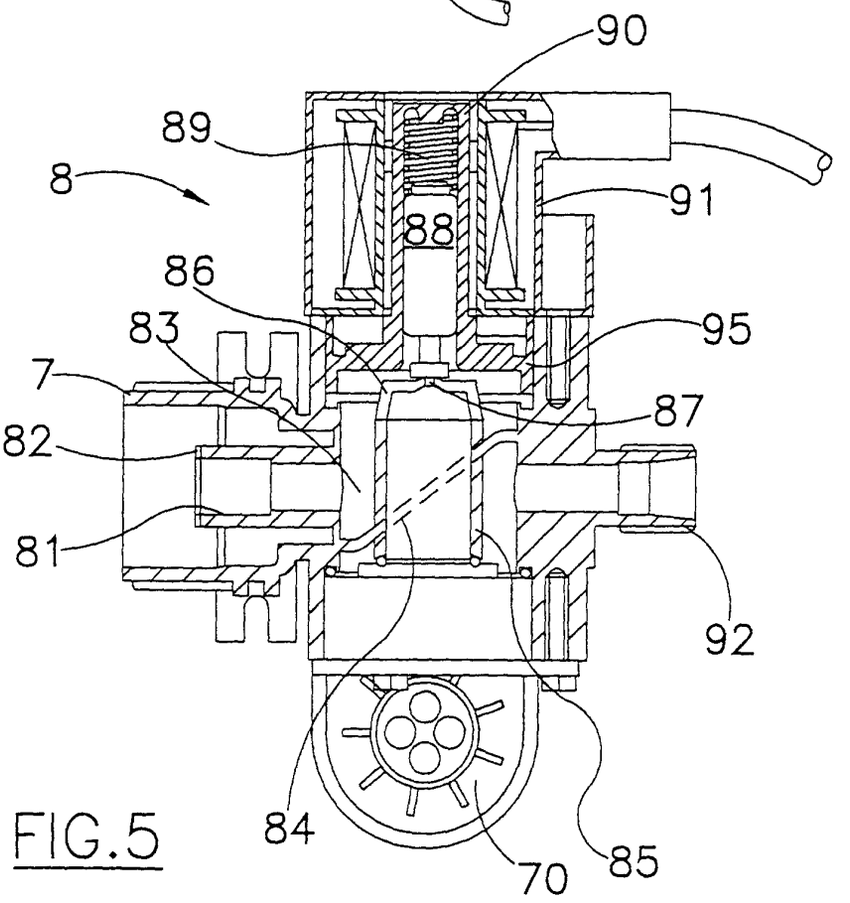

FIG.5

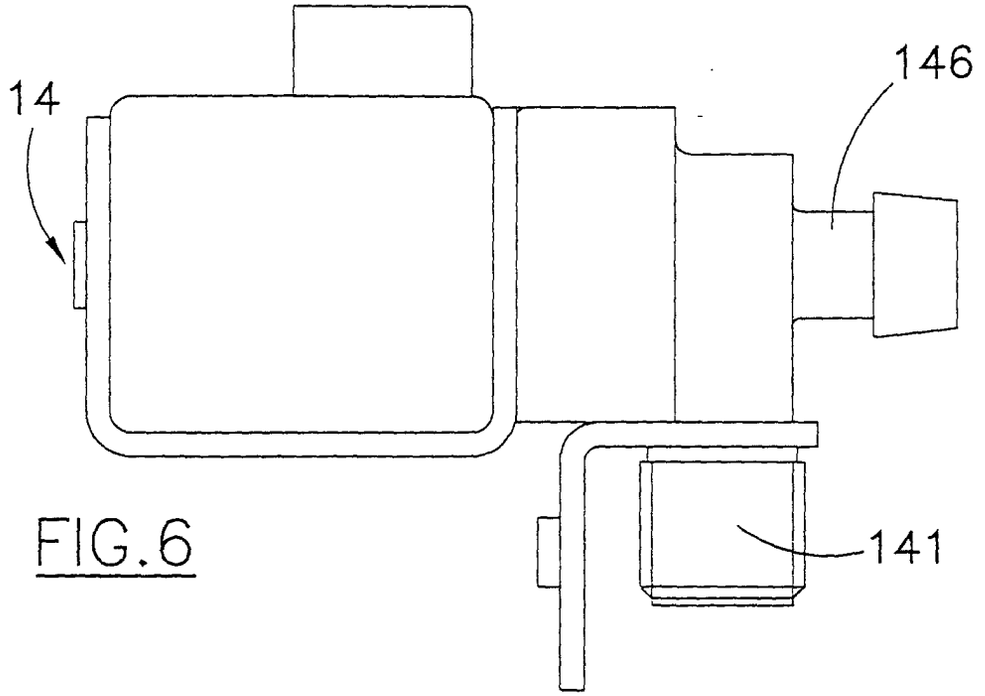

FIG.6

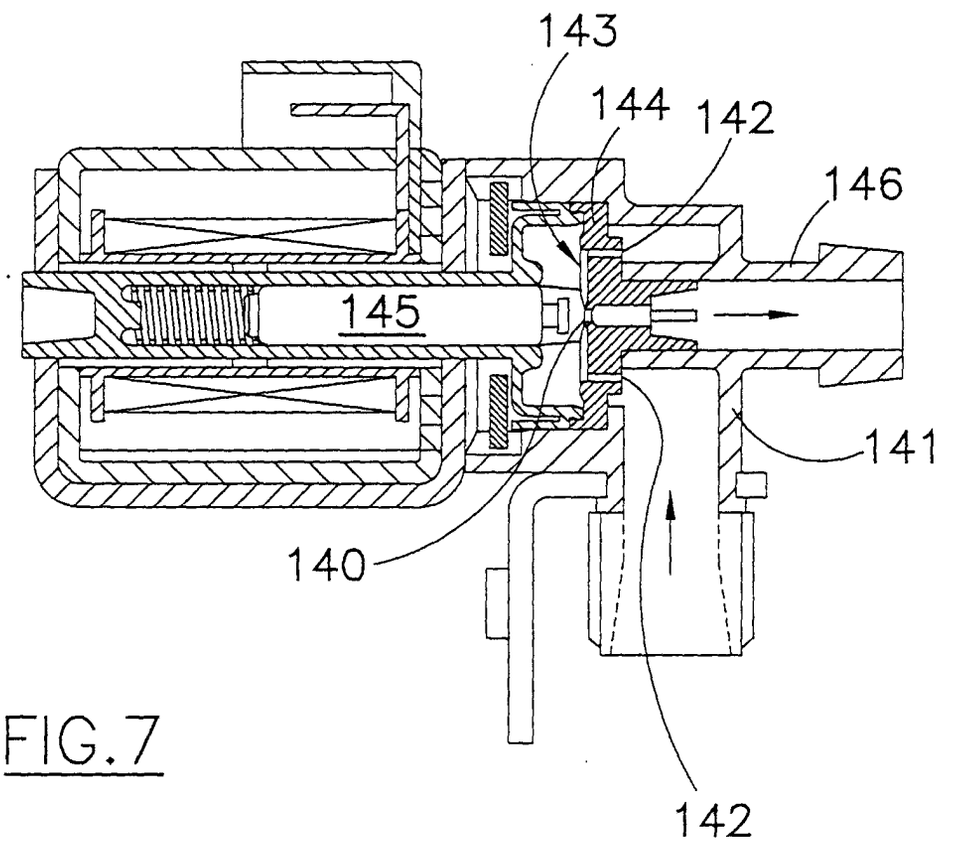

FIG.7

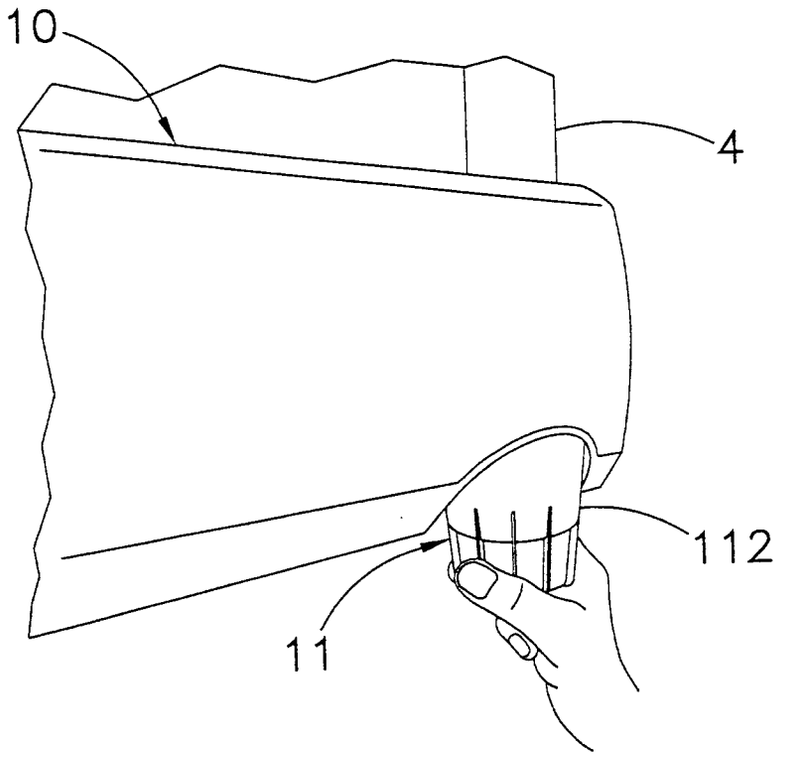

FIG.8

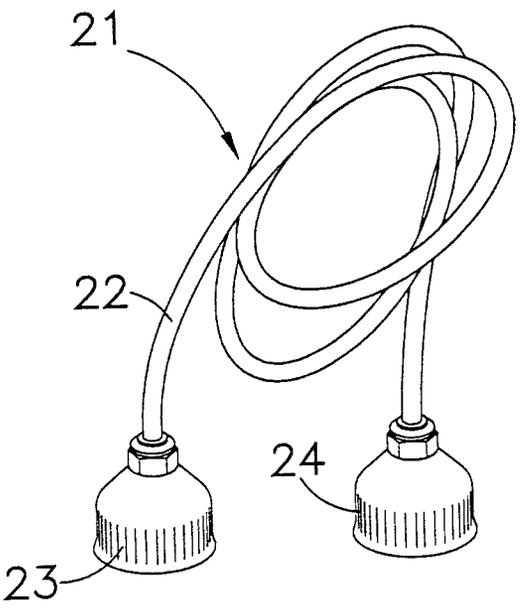

FIG.9

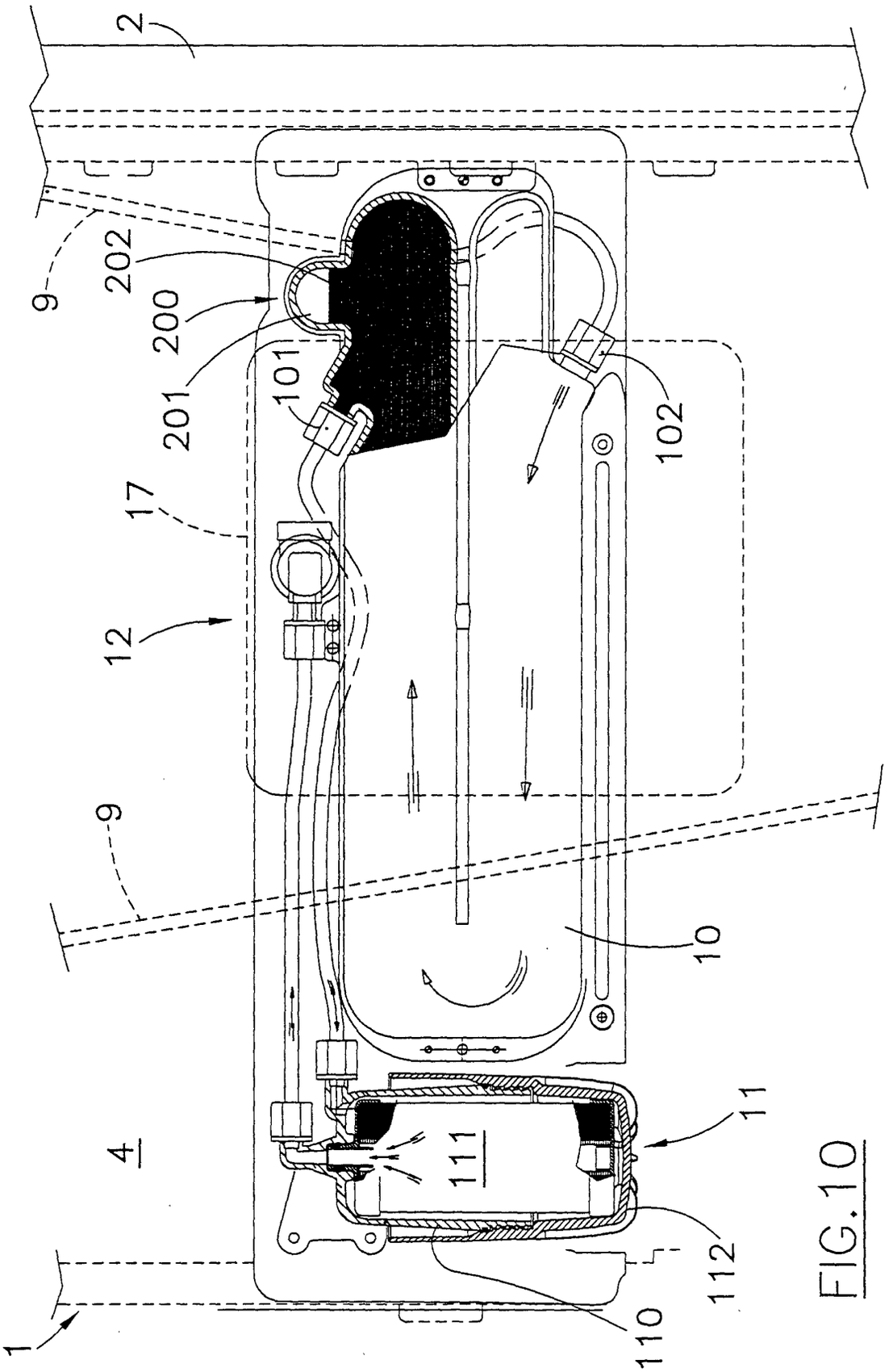

FIG.10