(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 994 311 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
19.04.2000 Bulletin 2000/16

(51) Int. Cl.[7]: **F24D 19/10**

(21) Application number: **99114717.4**

(22) Date of filing: **28.07.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **14.10.1998 IT MI982202**

(71) Applicant: **FUGAS s.r.l.**
20090 Trezzano sul Naviglio (Milan) (IT)

(72) Inventor: **Fugazza, Giuseppe**
20090 Trezzano Sul Naviglio (MI) (IT)

(74) Representative:
Robba, Pierpaolo et al
Interpatent,
Via Caboto 35
10129 Torino (IT)

(54) Hydraulic assembly for heating systems also supplying sanitary water, equipped with a hot water tank

(57) A hydraulic assembly for a heating system also supplying sanitary water and equipped with a hot water tank (3). The assembly comprises a block (10) in which there are formed the seats for the a three-way valve (45) and for an electric linear actuator (27) controlled by a thermostat (36) housed in the tank (4). The three-way valve can compensate a possible excessive length of the stroke of the linear actuator.

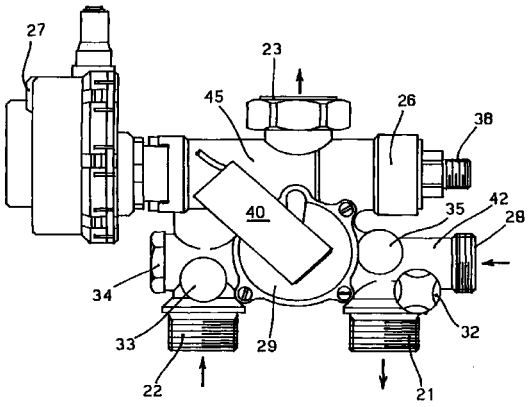

FIG. 2

EP 0 994 311 A2

Description

[0001] The present invention relates to a hydraulic assembly or distributor for heating systems also supplying sanitary water of the type known as tank heating systems or "non instant" heating systems, that is residential heating systems in which the water heated by a burner is used for heating both the premises radiators and the sanitary water for various purposes.

[0002] This kind of "mixed" heating system has been long known, and provides for a thermally insulated tank containing a supply of sanitary hot water that has been previously heated in the tank itself through a water-water heat exchanger receiving hot water from the heating system. The water inside the tank is kept at a predetermined temperature so as to be immediately delivered when the user turns on a tap. At the same time, in response to such a request of hot water, the heating delivery water is diverted from the radiators to the heat exchanger contained in the tank, for heating additional sanitary water to be delivered to the user.

[0003] The advantages of this type of heating system substantially resides in a smaller heating capacity requested to the burner, a higher overall efficiency, and a smoother initial delivery of the hot water, without the fluctuations cold-too hot-right of the "instant delivery" heating systems.

[0004] EP-A- 797 057 in the name of the present applicant discloses a hydraulic assembly made up by to sub-assemblies or valve units for a heating system also supplying sanitary water of the instant delivery type.

[0005] EP-A- 652 408 and EP-A- 236 235 disclose hydraulic assemblies for systems of the instant delivery type, comprising a single block in which there are realised seats for housing almost all the assembly components so as to reduce the space occupied by the system.

[0006] More particularly the assembly disclosed by EP-A-652 408 employs a manostat which, as a consequence of the sanitary water draw, actuates the three-way valve through a lever, and provides for an inner duct connecting the seats of the bypass valve, of the safety manostat, of the safety valve and of the return conduit of the main circuit.

[0007] In the above mentioned system the bypass valve is always connected with the pump, both when the heating system is operating in the cold season and when sanitary water is being drawn off.

[0008] Also the assembly disclosed in EP-A- 236 235 employs a manostat, i.e. an actuator of hydraulic type, for controlling the three-way valve.

[0009] All the above discussed assemblies have been designed for systems of the instant delivery type, with an instant small-size heat exchanger, e.g. a plate-type heat exchanger directly mounted to the assembly, and such design cannot be used in a system equipped with a hot water storage tank.

[0010] In instant heating systems the three-way valve is generally actuated by hydraulic drives and this type of control system is not adapted to be used with a tank. In fact, when in a non-instant heating system hot water is drawn from the tank, such water draw does not cause a pressure drop, so that it could not be adapted to actuate a three-way valve. Moreover, when hot water is not being drawn by the user it would be impossible to circulate the heating water through the coil in the storage tank for raising the temperature of the water contained therein. As an example, in a heating system using a three-way valve actuated by a hydraulic drive, the water in the storage tank could not be kept hot when the heating system is not in use (e.g. in summer).

[0011] The object of the present invention is to realise a hydraulic assembly or group for non-instant heating systems, such assembly having a very compact structure, reducing the piping and the connections number between the components and being inexpensive both to be manufactured and to be installed.

[0012] According to the invention, these objects are achieved through a hydraulic assembly for a mixed system as claimed in claim 1.

[0013] Further advantageous characteristics of the invention are recited in the dependent claims.

[0014] In the assembly according to the invention, the three-way valve is actuated by an electric linear actuator, preferably an electric motor, controlled by a thermostat located inside the tank. The same electric signal is used both for controlling the electric actuator operating the three-way valve, and for lighting the burner. Thus, even when the heating system is not (permanently) operating, the burner can be started to obtain sanitary hot water.

[0015] However, when using an electric actuator, the stroke length of the actuator can result in being not properly dimensioned for actuating a microswitch (for turning off the energy supply to the actuator) after actuating the three-way valve. Under these conditions, the actuator would remain fed even after the three-way valve has been actuated, and could be permanently damaged. According to the invention there is provided a three-way valve with two plugs or head meters separated by a spring for creating a so called "additional stroke" adapted to compensate for possible differences between the length of the actuator stroke and the length of the valve stroke

[0016] Finally, the assembly according to the invention provides for a bypass valve only in the heating circuit.

[0017] The invention will now be disclosed with reference to the attached drawings illustrating a preferred but non-limiting embodiment thereof, in which:

Fig. 1 is a general block diagram of a mixed heating system employing the assembly according to the invention;

Fig. 2 is a front view showing the structure of the hydraulic assembly according to the present inven-

tion;

Fig. 3 is a top view of the hydraulic assembly of Fig. 2;

Fig. 4 is a more detailed and complete diagram of a mixed heating system employing an assembly according to the invention; and

Figures 5 and 6 show two transverse cross-section views of the three-way valve for illustrating the operation thereof.

[0018] By firstly referring to Fig. 1, the shown mixed heating system comprises a gas burner 1 with a (main) finned heat exchanger 2, a pump 9 for circulating the water (primary water) of the heating circuit, a thermally insulated storage tank 3 containing a water-water heat exchanger 4, of the coil type, for delivering the so-called sanitary water or secondary water, that is water drawn from the mains that will eventually leave the system after being heated), a number of radiators 5-8, and a hydraulic assembly 10 according to the invention.

[0019] Inside the heat exchanger 2 the gas burner 1 heats the water of a closed (primary) circuit that is then delivered either to the radiators 5-8 or to the heat exchanger 4 through a duct schematically represented in Figure 1 by the numeral reference 12. Most of the time the primary water is normally delivered to the radiators. A three-way valve 45, disposed in the return path of the heating system, provides to exclude the heating , i.e. to divert the hot water from the radiators, when required, as will be explained later, and a pump 9 circulates the heating water.

[0020] Following a request of sanitary hot water, the three-way valve 45 blocks the water circulation towards the radiators 5-8 and causes the hot water to flow along the coil of the water/water heat exchanger 4 in the tank 3. Under these conditions the sanitary water contained in the storage tank and supplied by the water mains through a fitting inlet 13, is heated and will be delivered through the duct 14, schematically representing the user's hydraulic system.

[0021] Referring now to Figures 2 and 3 and to the diagram of Fig. 4, the block 10 according to the invention comprises a water delivery fitting 21 for the connection to the radiators, a return fitting 22 from the radiators, a connection 23 for the pump 9, a seat for housing the three-way valve 45, and a return fitting 26 to the heat exchanger 4.

[0022] An electric linear actuator 27, for example an electric motor equipped with proper gears, is mounted laterally of the assembly and is controlled by a thermostat 36 housed in the tank 3. The axis of the motor 27 is aligned with the axis of the three-way valve. In its central portion the block 10 houses a safety pressure switch 29 utilising the pressure drop in the heating circuit for actuating the burner. In case of lack of water within the system, such pressure switch 29 behaves like a safety device.

[0023] Block 10 further comprises a fitting 31 for a valve 32 for replenishing the system through a conduit 39, a fitting 38 to an expansion tank, a fitting 33 to a drain valve for the system, a fitting 34 to a pressure gauge and an optional fitting 35.

[0024] Inside the assembly there is further disposed an automatic bypass valve 41 that is connected between the return 22 and the delivery 21 of the radiators. This bypass valve 41 is connected to the radiator circuit 21, 22 only. As already indicated, when the values of the load losses (pressure drops) due to the heat exchanger in the tank are known, the bypass valve in the tank circuit can be eliminated.

[0025] Finally there is further provided a microswitch 40 for the precedence-establishing pressure switch that prevents the operation of the gas control valve when water in the heating system is scarce or missing at all.

[0026] Fig. 4 schematically shows the arrangement of a system in which the hydraulic assembly according to the invention applies.

[0027] With reference to Figures 5 and 6 the construction and the operation of the three-way valve will be illustrated.

[0028] One end (fitting) of the three-way valve 45 is connected to a fitting 51 of the heating system return, the other end (fitting) is connected to a tank return fitting 52, and the central end (fitting) is connected to the fitting 23 of the pump 9. The valve comprises a shaft 58 axially movable under the control of the electric actuator or motor 27 (schematically indicated with dashed lines) through a cam (not shown) that axially moves the shaft 58 proportionally to the rotation of the motor.

[0029] On the shaft 58 there are slidably fitted two plugs or head members 54 and 55, provided with seal rings or O-rings, adapted to close the respective side ports towards the fittings 51 and 52, and a helical spring 56 is disposed between the two plugs, coaxially with the shaft. The end of the shaft 58 near to the fitting 52 is enlarged to form a pin 60 urging a helical spring 57 partially housed inside an axial seat 63 in the valve body 62.

[0030] In the arrangement shown in Fig. 5, the plug 54 closes the port towards the heating water thus opening the radiators-pump-heat exchanger 2 circuit, while at the same time allowing the circulation in the exchanger 2-coil 4-pump circuit. More particularly, the springs 56 and 57 urge the plug 54 into the closing position by applying a constant and predetermined force onto the O-ring.

[0031] In the arrangement shown in Fig. 6, the electric linear actuator 27 urges the shaft 58 to the right, thus opening the plug port 54 and closing the plug port 55. The stroke length of the electric linear actuator is about 6,5 mm, i.e. it is longer than the stroke allowed to the plugs which is about 4,5 mm., for compressing the spring with a given force. Thanks to the arrangement according to the invention, the shaft 58 can further advance after the slidable plug 55 has reached the clo-

sure position, and accommodate the whole stroke length of the linear actuator by compressing the spring 57 through the pin 60. On the other hand the spring 58 compresses the O-ring of the plug 55.

[0032] This way the motor 27 can continue to rotate even after the three-way valve has been actuated until the motor cam reaches a (not shown) microswitch interrupting the power supply to the motor.

[0033] Although the invention has been illustrated with reference to a preferred embodiment thereof, more generally the invention can have other applications and modifications falling within the invention scope, as will be evident to the skilled of the art.

Claims

1. A hydraulic assembly for a heating system also supplying sanitary water and equipped with a hot water storage tank (3), said heating system comprising: a gas burner (1), a main gas/water heat exchanger (2), a water/water heat exchanger (4) disposed inside said storage tank (3) for heating the sanitary water, a three-way valve (45) for selectively closing the heating circuit of said main gas/water heat exchanger (2), at least one radiator (5-8), and a pump (9) for circulating the heating water, characterised in that said assembly comprises a block (10) in which block said three-way valve (45) is housed and further seats are formed for an electric linear actuator (27), said actuator (27) being controlled by a thermostat (36) contained inside said tank (4), and that said three-way valve (45) comprises an axially movable shaft (58) on which two plugs or head members (54, 55) are slidably fitted, with a helical spring (56) coaxially disposed on said shaft between said two plugs (54, 55).

2. A hydraulic assembly according to claim 1, characterised in that the end of said shaft (58) opposed to the one on which the electric linear actuator (27) acts is enlarged to form a pin (60) urging a helical spring (57) partially housed in an axial seat (63) in the valve body (62).

3. A hydraulic assembly according to claim 1 or 2, characterised in that said electric linear actuator (27) is an electric motor.

4. A hydraulic assembly according to the preceding claims, characterised in that it incorporates a bypass valve (41) that is connected to the radiator circuit (21, 22) only.

5. A hydraulic assembly according to the preceding claims, characterised in that in said block (10) there are further formed a connection or fitting (31) for a valve (32), a fitting (38) for an expansion tank, a fitting (33) for a system drain valve, a fitting (34) for a pressure gauge and an optional fitting (35).

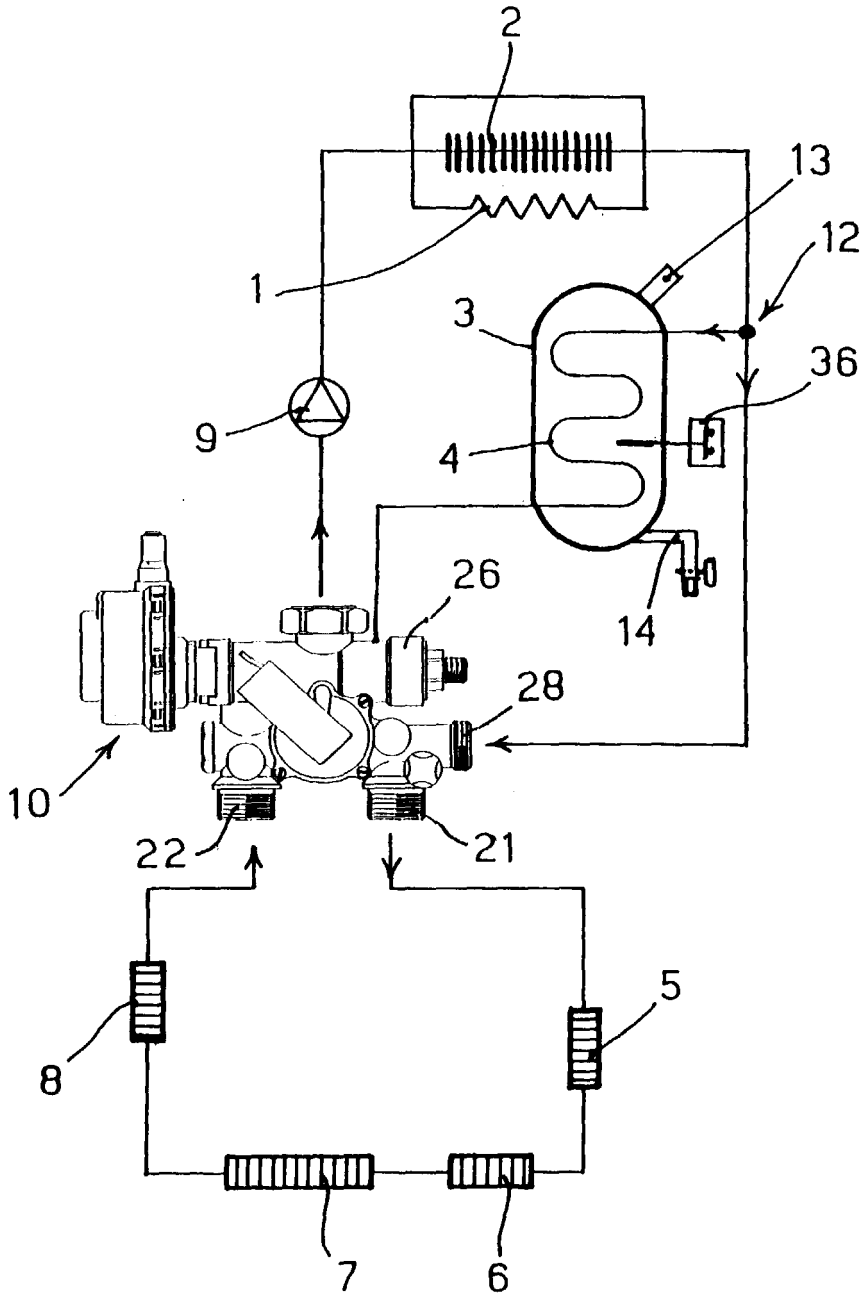

FIG. 1

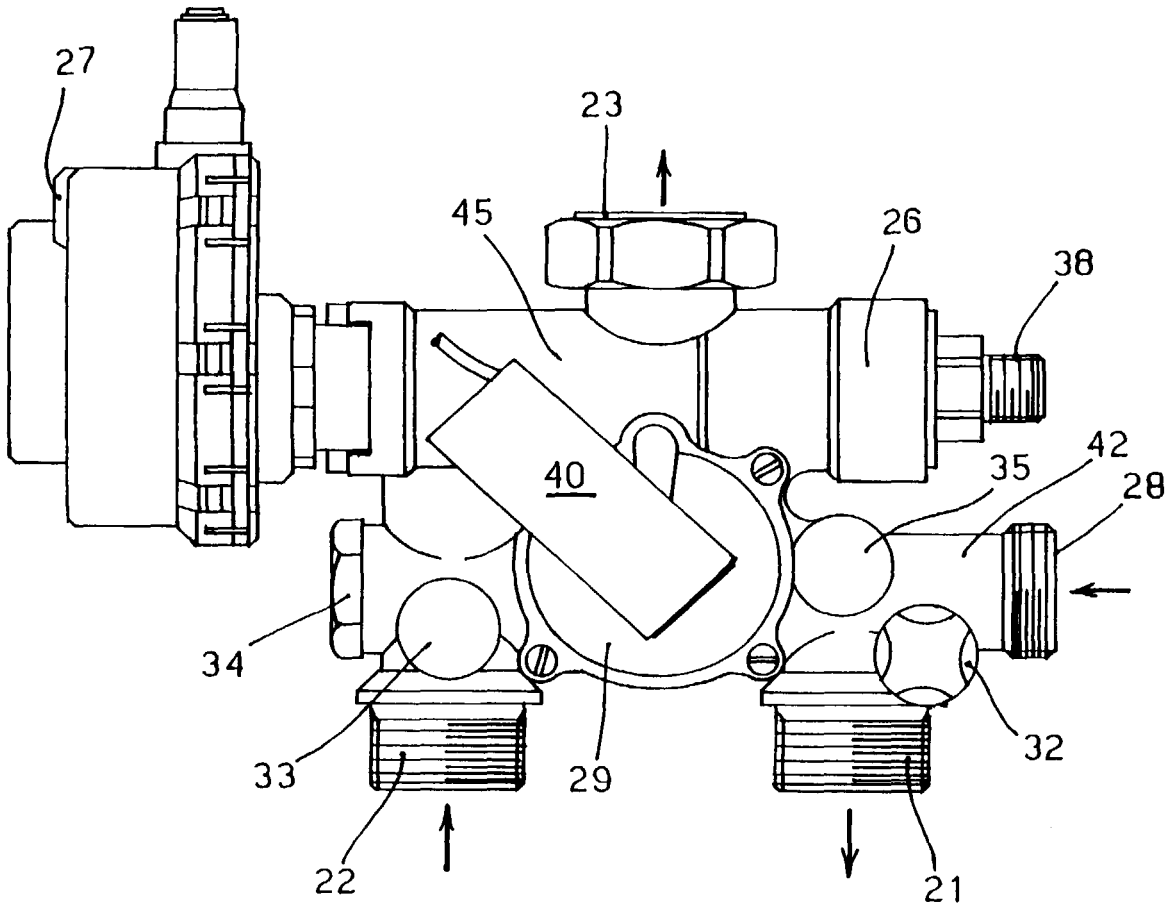

FIG. 2

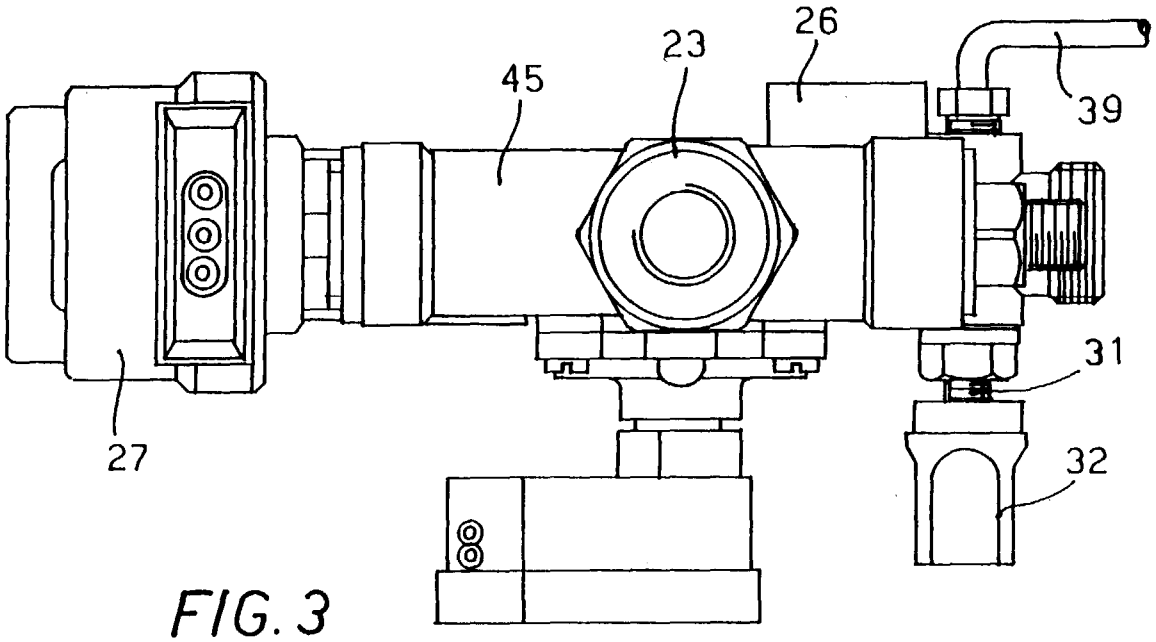
26
23
45
39
31
27
32

FIG. 3

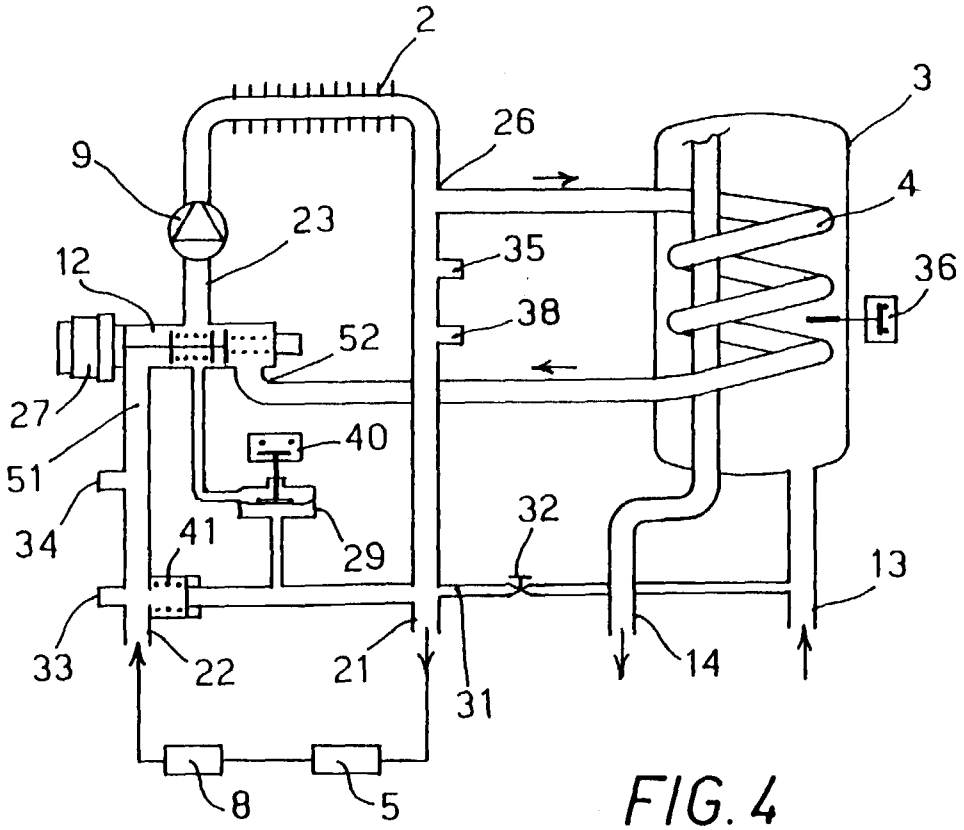
2
3
26
9
4
23
35
12
36
38
52
27
40
51
32
34
41
29
13
33
22
21
31
14
8
5

FIG. 4

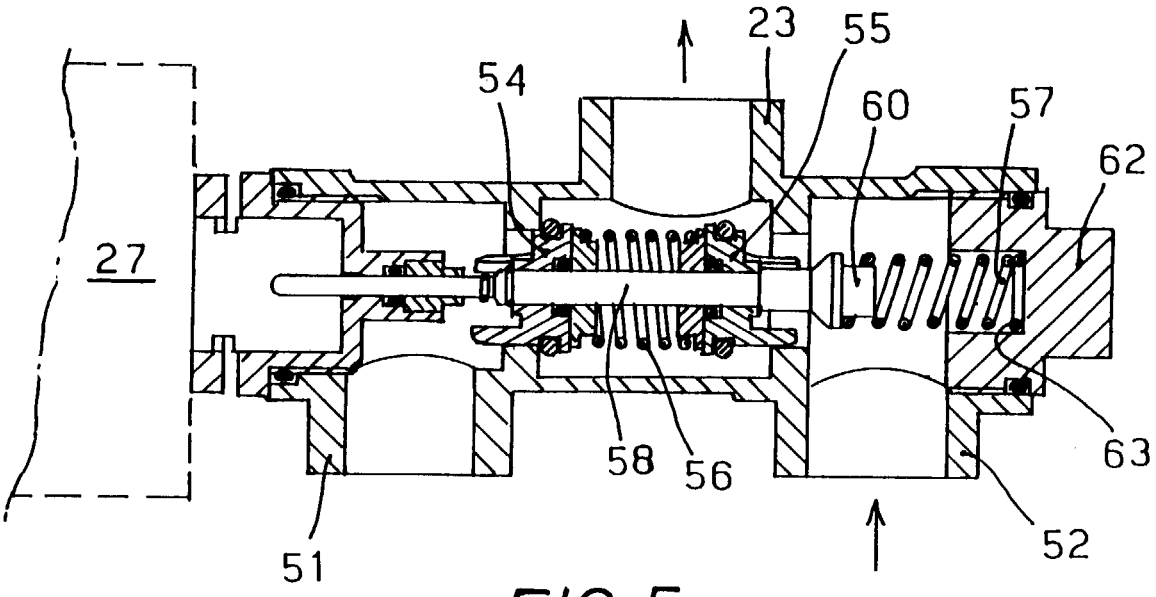

FIG. 5

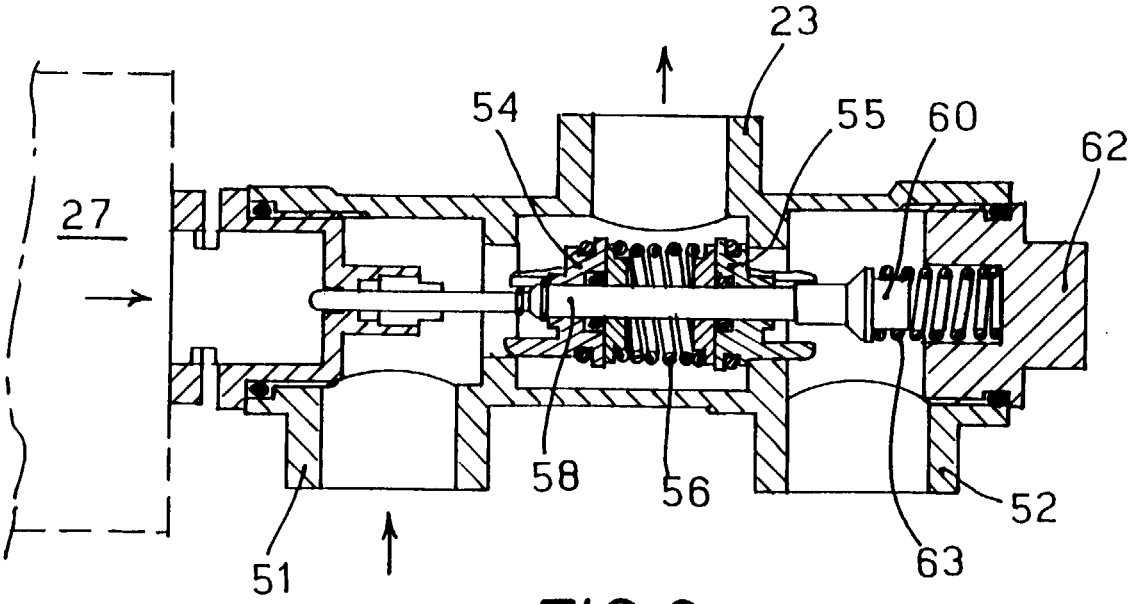

FIG. 6