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(54) Device for flow management in combined heating units for sanitary water and house rooms and boiler unit for combined heating of sanitary water and house rooms

(57) Boiler unit including a first circuit for heating of heat-transferring fluid to be sent to a heating system (17) for house rooms and a second circuit for heating of sanitary water to be sent to sanitary water users (16) with said first circuit including a primary heat exchanger (14) for heating the heat-transferring fluid and said second circuit including a secondary heat exchanger (21) for heating sanitary water with said boiler unit including de-

tection means (24) of the required heated sanitary water flow and means (22, 23) of diverting from said first circuit a fraction of the flow of the heat-transferring fluid to send it to the secondary heat exchanger (21) with said diversion means (22, 23) being controlled by control means (26) connected to the detection means (24) to regulate the size of said fraction as a function of the detected sanitary water flow requirement.

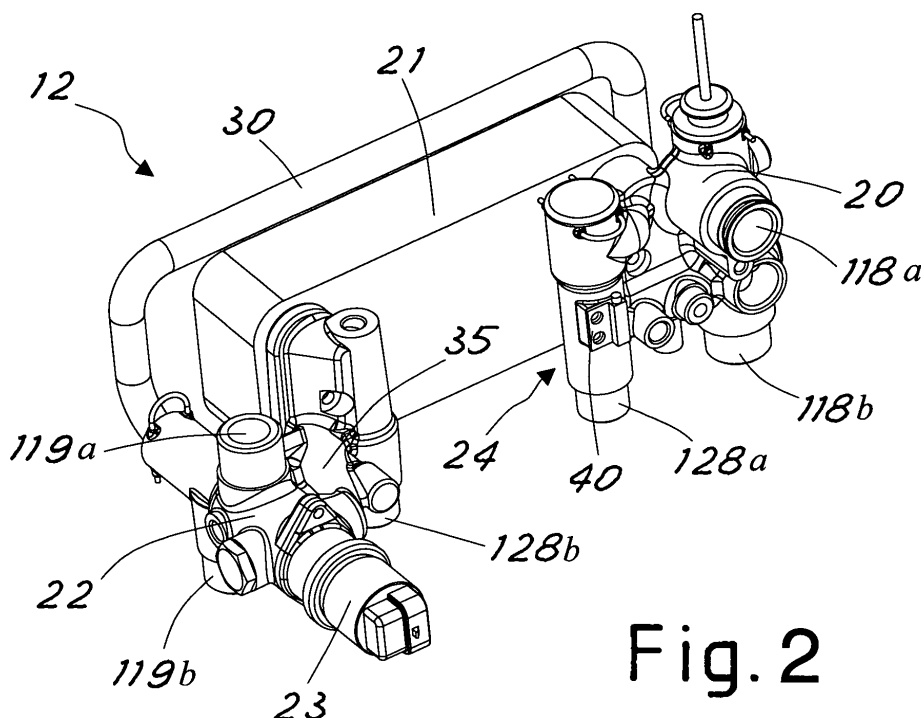


Fig. 2

Description

[0001] The present invention relates to a device for the management of heating flows in combined heating units for sanitary water and house rooms allowing optimising utilization of the thermal power from a boiler. More generally, the present invention relates to a boiler unit for combined heating of sanitary water and house rooms.

[0002] Realizing heating systems that utilize thermal power from a combustion boiler both to heat house rooms of a dwelling and for heating sanitary water to be used for example for showers, baths or other is known in the prior art. Such heating systems include opposite the boiler a primary heat exchanger traversed by the heat-transferring fluid (for example water) designed to run under the thrust of a purposeful recirculation pump in radiators arranged in the rooms to be heated. On the delivery pipe of the heat-transferring fluid coming out of the boiler is arranged a flow switching valve capable of feeding the hot fluid to a secondary heat exchanger as an alternative to the radiators. The secondary heat exchanger allows heating the sanitary water to be sent to the sanitary fixtures of the dwelling by taking the heat directly from the heat-transferring fluid of the heating system and thus utilizing the thermal power of the boiler.

[0003] But the three-way valve in the prior art systems is not able to divide the hot fluid flows by distributing the heating flows between the radiator circuit and that of the secondary heat exchanger. Indeed, the valve is controlled with a binary logic and can have only two extreme configurations, to wit, one for supplying the radiators (when sanitary water is not required by the domestic users) and one for supply of the secondary heat exchanger (when sanitary water is required). The 'switching' command of the valve is generated by appropriate control means when a purposeful minimum flow sensor fitted on the sanitary water pipe perceives a certain requirement for heated sanitary water, for example 2.5 l/m.

[0004] This type of heating system allows on the one hand use of the thermal power of the boiler with a dual purpose (domestic environment heating and sanitary water heating) but on the other often results in considerable waste of power. Indeed, when there is a minimal requirement for sanitary water, heating of the radiators in the home is stopped while using the entire and excessive available thermal power for heating a small quantity of water.

[0005] The general purpose of the present invention is to remedy the above-mentioned shortcomings by making available a combined heating device for house rooms and sanitary water allowing optimisation of the utilization of the available thermal power in every heating system operating situation.

[0006] In view of this purpose it was sought to provide in accordance with the present invention a boiler unit including a first circuit for heating of heat-transferring fluid to be sent to a heating system for house rooms and

a second circuit for heating of sanitary water to be sent to a user of sanitary water with said first circuit including a primary heat exchanger for heating the heat-transferring fluid and said second circuit including a secondary heat exchanger for heating the sanitary water with said boiler unit including means of detecting the heated sanitary water flow rate required and means of diverting from said first circuit a fraction of the flow of the heat-transferring fluid to send it to the secondary heat exchanger with said diverting means being controlled by control means connected to the detection means to regulate the size of said fraction as a function of the detected sanitary water flow requirement.

[0007] Again in accordance with the present invention it is sought to realize a device for management of flows in combined heating units for sanitary water and house rooms designed to be arranged between a primary heat exchanger for transfer of heat to a heat-transferring fluid and a domestic environment heating system traversed by said heat-transferring fluid with said device including the following:

- means of tapping a fraction of the flow of heat-transferring fluid with said means including at least two outlets and one inlet fed with heat-transferring fluid outgoing from the primary heat exchanger,
- a diversion water branch fed from an outlet of said tapping means, and
- control means for commanding said tapping means,

with said diversion branch forming a secondary heat exchanger and with a section of the sanitary water branch traversed by sanitary water with there being a device for measurement of the flow in the sanitary water branch and said measurement device being connected to said control means for regulating the amount of said fraction of flow tapped as a function of the measurement of the sanitary water flow.

[0008] To clarify the explanation of the innovative principles of the present invention and its advantages compared with the prior art there is described below with the aid of the annexed drawings a possible embodiment thereof by way of non-limiting example applying said principles. In the drawings:

FIG 1 shows a diagram of principle of the heating system in accordance with the present invention, FIG 2 shows a perspective view of the device for combined heating in accordance with the present invention,

FIG 3 shows a side view of the device of FIG 2 with some parts sectioned, and

FIG 4 shows a perspective view of the device of FIG 2 with some parts removed.

[0009] With reference to the figures, FIG 1 shows a heating system 11 realized in accordance with the present invention. Said heating system includes a pri-

mary heat exchanger 14 suited to heating a heat-transferring fluid and a heating system 17 for house rooms traversed by said heat-transferring fluid. The heating system 17 can include for example a series of prior art radiators. The heat-transferring fluid can advantageously be water. It is noted that by 'house rooms', dwelling rooms are not necessarily intended but even rooms used as offices.

[0010] The primary heat exchanger 14 and the heating system 17 are placed in communication through a water delivery branch 19 and a water return branch 18 of the heat-transferring fluid. The heat exchanger 14 uses the thermal power generated by a heat source 13 (for example a boiler) to heat the heat-transferring fluid. Advantageously the heat exchanger 14 is a water & fumes exchanger designed for transferring the heat from the hot fumes of the boiler to the water flowing in the water branches 18, 19.

[0011] In accordance with the present invention, between the primary heat exchanger 14 and the heating system 17 there is inserted a device 12 for management of the heating flows of the boiler unit. Said device 12 is also placed between an external water network 15 and sanitary water users 16 placed in communication through a sanitary water branch 28.

[0012] The device 12 includes a 3-way valve 22 fitted in the delivery branch 19 in accordance with that shown in the diagram of principle of FIG 1. Said valve includes an inlet fed with the hot heat-transferring fluid transferred by the section 19a of the delivery branch 19 that connects the primary exchanger 14 to the device 12. The valve 22 has two outlets one of which is connected to the section of the delivery branch 19b that connects the device 12 to the heating system 17 while the other feeds a water diversion branch 27 included in the device 12. Said diversion branch 27 then terminates as an affluent in the return branch 18 as shown. It is noted that the 3-way valve 22 is a valve operated by the motor 23 and is capable of distributing in various proportions the flow of heat-transferring fluid between the diversion branch 27 and the delivery branch 19b depending on the configuration that it takes on under the motor handling action.

[0013] The device 12 also includes an intermediate section 28c of the sanitary water branch 28 included between an initial section 28a connecting the water network 15 to the device 12 and a final section 28b connecting the device 12 to the final users of the sanitary water 16. The section of the sanitary water branch 28c realizes together with the diversion branch 27 a secondary heat exchanger 21. The sanitary water is heated in the exchanger 21.

[0014] Advantageously in the exchanger 21 the flow of heat-transferring fluid and that of the sanitary water are counterflowing as shown in the figure.

[0015] The device 12 in accordance with the present invention also includes a sanitary water flow measurement device 24. Said measurement device 24 is ar-

ranged on the sanitary water branch immediately upstream of the heat exchanger 21 and is connected to the control means 26 to supply them with a flow signal. The control means 26 are also connected to the motor 23 designed to drive the 3-way valve 22. In accordance with the present invention the valve 22 is regulated in the choking of the hot heat-transferring fluid flows allowing for the sanitary water flow figure required by the user. For example it could be regulated to have a flow in the diversion branch 27 virtually proportionate to the water flow in the sanitary water branch 28. In this manner an always adequate heating of the water to the sanitary users would be assured without wasting the thermal power generated in the boiler or interrupting the heating of the radiators of the heating system 17.

[0016] In accordance with a preferred embodiment of the present invention the device also includes a recirculation pump 20 fitted on the heat-transferring fluid return branch 18. The pump 20 is arranged advantageously opposite a section of the return branch 18c inside the device 12 and included between a section of the return branch 18b connecting the heating system 17 to the device 12 and a section of the return branch 18a connecting the device 12 to the primary heat exchanger 14.

[0017] As shown in the diagram of FIG 1 the pump 20 is in series with the primary exchanger 14 and is preceded upstream by a minimum flow sensor 24 also included in the device 12. The minimum flow sensor 24 is connected to the control means 26. When the sensor 24 perceives a certain flow (for example from 10 to 20 l/m) the burners of the boiler 13 function correctly. When the heat-transferring fluid flow to the primary exchanger 14 falls below a certain threshold the control means command stoppage of heat generation to avoid the exchanger 14 overheating excessively and being damaged.

[0018] In accordance with an embodiment of the present invention the device 12 also includes a by-pass duct 30 arranged in parallel with the diversion branch 27. Said by-pass branch 30 has the function of ensuring minimum flow of the heat-transferring fluid to allow keeping the boiler in operation even when the flow in the radiators 17 is relatively low. This situation can occur for example when the choking caused by the radiator holders imposes a substantial reduction of the flow of the heat transferring fluid in the heating system.

[0019] FIG 2 shows the device 12 in accordance with the present invention. As may be seen, said device 12 is made in a single block in which all the components are assembled. It includes two connections 119a and 119b to be connected respectively to the heat-transferring fluid delivery branches 19a and 19b. The valve 22 is advantageously arranged between the two above-mentioned connections and is connected to the driving motor 23. The device 12 also includes two connections 118a and 118b to be connected respectively to the return branches 18a and 18b. Preferably, the recirculation pump 20 is arranged between the two connections 118a

and 118b. The device also includes two connections for the sanitary water, to wit, one 128a for the sanitary water inlet and one 128b for its outlet.

[0020] Opposite the inlet connection 128a there is the sanitary water minimum flow sensor 24. In a central position the device 12 includes the secondary heat exchanger 21 with a shell having a shape nearly assimilable to that of a parallelepiped. Said secondary heat exchanger 21 is prior art and therefore not further described. In parallel with the exchanger 21 there is the by-pass duct 30.

[0021] FIG 3 shows a side cross section of the body of the valve 22. Said valve 22 includes an active body 31 which is moved horizontally by a shaft 32 connected to the motor 23. When it is in its end position shifted left as in the figure the body 31 denies passage of the heat-transferring fluid from the inlet 22a (supplied from the delivery branch 19a) to the outlet 22b (connected to the delivery branch 19b) of the valve 22. When it is moved right (configuration not shown in the figure) the body 31 prevents passage of the fluid through the outlet 35 that feeds the diversion branch 27 and the heat exchanger 21. In the intermediate positions the body 31 allows choking of the streams while distributing the heat-transferring fluid in such a manner as to optimise utilization of the boiler thermal power.

[0022] Also note in FIG 3 the non-return valve 33 arranged at the inlet to the by-pass tube 33 in accordance with known techniques in the field of heating systems.

[0023] FIG 4 shows a perspective view of the device 12 with some parts removed. In particular the sanitary water flow measurement device 24 is noted. It includes a turbine 41 arranged on the sanitary water branch 28 near the sanitary water inlet connection 128a. The turbine 41 rotates at a speed dependent on the water flow rate. It is coupled to a sensor 40 capable of sending a flow measurement signal to the control means 26 to appropriately command driving of the 3-way valve 22.

[0024] It is now clear that the preset purposes have been achieved. Indeed, a device (and more generally a boiler unit) has been realized for combined heating of house rooms and sanitary water that allows optimisation of the thermal power supplied by a boiler while sending to the secondary heat exchanger of the sanitary water only the amount of heat-transferring fluid necessary and this stratagem avoids stoppage of heating of the radiators each time hot water is required by the sanitary water users.

[0025] Naturally, the above description of an embodiment applying the innovative principles of the present invention is given by way of non-limiting example of said principles within the scope of the exclusive right claimed here.

Claims

1. Boiler unit including a first circuit for heating of heat-

transferring fluid to be sent to a heating system (17) for house rooms and a second circuit for heating of sanitary water to be sent to sanitary water users (16) with said first circuit including a primary heat exchanger (14) for heating the heat-transferring fluid and said second circuit including a secondary heat exchanger (21) for heating sanitary water with said boiler unit including detection means (24) of the required heated sanitary water flow and means (22, 23) of diverting from said first circuit a fraction of the flow of the heat-transferring fluid to send it to the secondary heat exchanger (21) with said diversion means (22, 23) being controlled by control means (26) connected to the detection means (24) to regulate the size of said fraction as a function of the detected sanitary water flow requirement.

2. Boiler unit in accordance with claim 1 **characterized in that** said tapping means (22, 23) include a powered 3-way proportional valve.

3. Boiler unit in accordance with claim 1 **characterized in that** said measuring device (24) includes a turbine (41) arranged on said second circuit.

4. Boiler unit in accordance with claim 1 **characterized in that** the heat-transferring fluid is water.

5. Boiler unit in accordance with claim 4 **characterized in that** the primary exchanger (14) is a water & fumes heat exchanger.

6. Boiler unit in accordance with claim 1 **characterized in that** said secondary exchanger (21) is a counterflowing flows exchanger.

7. Boiler unit in accordance with claim 1 **characterized in that** the diversion means and the detection means are assembled in a single body arranged between the exchangers, the heating system and the sanitary water users.

8. Device for management of flows in combined sanitary-water and domestic-environment heating units designed to be arranged between a primary heat exchanger (14) for transfer of heat to a heat-transferring fluid and a heating system (17) for house rooms traversed by said heat-transferring fluid with said device (12) including:

- means (22, 23) for tapping a fraction of the flow of the heat-transferring fluid with said means including at least two outlets and one inlet fed with heat-transferring fluid coming out of the primary exchanger (14),
- a water diversion branch (27) fed from an outlet of said tapping means, and
- control means (26) for commanding said tap-

ping means (22),

with said diversion branch (27) forming a secondary heat exchanger (21) with a section (28c) of a sanitary water branch (28) traversed by sanitary water with there being a measuring device (24) of the flow in the sanitary water branch (28) and said measuring device (24) being connected to said control means (26) to regulate the amount of said tapped flow fraction as a function of the measurement of the sanitary water flow rate.

9. Heating device in accordance with claim 8 **characterized in that** said tapping means include a 3-way proportional valve (22).
10. Heating device in accordance with claim 9 **characterized in that** said tapping means include a driving motor (23) for the 3-way valve (22).
11. Heating device in accordance with claim 8 **characterized in that** the diversion branch (27) and the section of the secondary water branch (28) are counterflowing opposite the secondary heat exchanger (21).
12. Heating device in accordance with claim 8 **characterized in that** said flow measuring device (24) includes a turbine (41) arranged on the sanitary water branch (28).
13. Heating device in accordance with claim 12 **characterized in that** said turbine (41) is arranged at the inlet of the secondary heat exchanger (21).
14. Heating device in accordance with claim 8 **characterized in that** it includes a pump (20) for heat-transferring fluid recirculation.
15. Heating device in accordance with claim 14 **characterized in that** said pump (20) is arranged in series with the primary heat exchanger (14).
16. Heating device in accordance with claim 8 **characterized in that** it includes a minimum flow sensor (25) in series with the primary heat exchanger (14).
17. Heating device in accordance with claims 15 and 16 **characterized in that** the minimum flow sensor (25) is arranged immediately upstream of said recirculation pump (20).
18. Heating device in accordance with claim 8 **characterized in that** it includes a by-pass branch (30) in parallel with said diversion branch (27) to ensure a minimum flow of heat-transferring fluid opposite the primary heat exchanger (14).

19. Heating device in accordance with claim 8 **characterized in that** it is formed in a single block.

20. Heating device in accordance with claim 19 **characterized in that** it includes two connections (118a, 118b) for connecting the heating device (12) to a return branch (18) from the heating system to the primary exchanger and two connections (119a, 119b) for connecting the device (12) to a delivery branch (19) from the primary exchanger to the heating plant and two connections (128a, 128b) for connecting the device (12) to the sanitary water branch (28).

21. Heating device in accordance with claim 8 **characterized in that** the flow in the water diversion branch (27) is virtually proportional to the flow of the sanitary water branch (28).

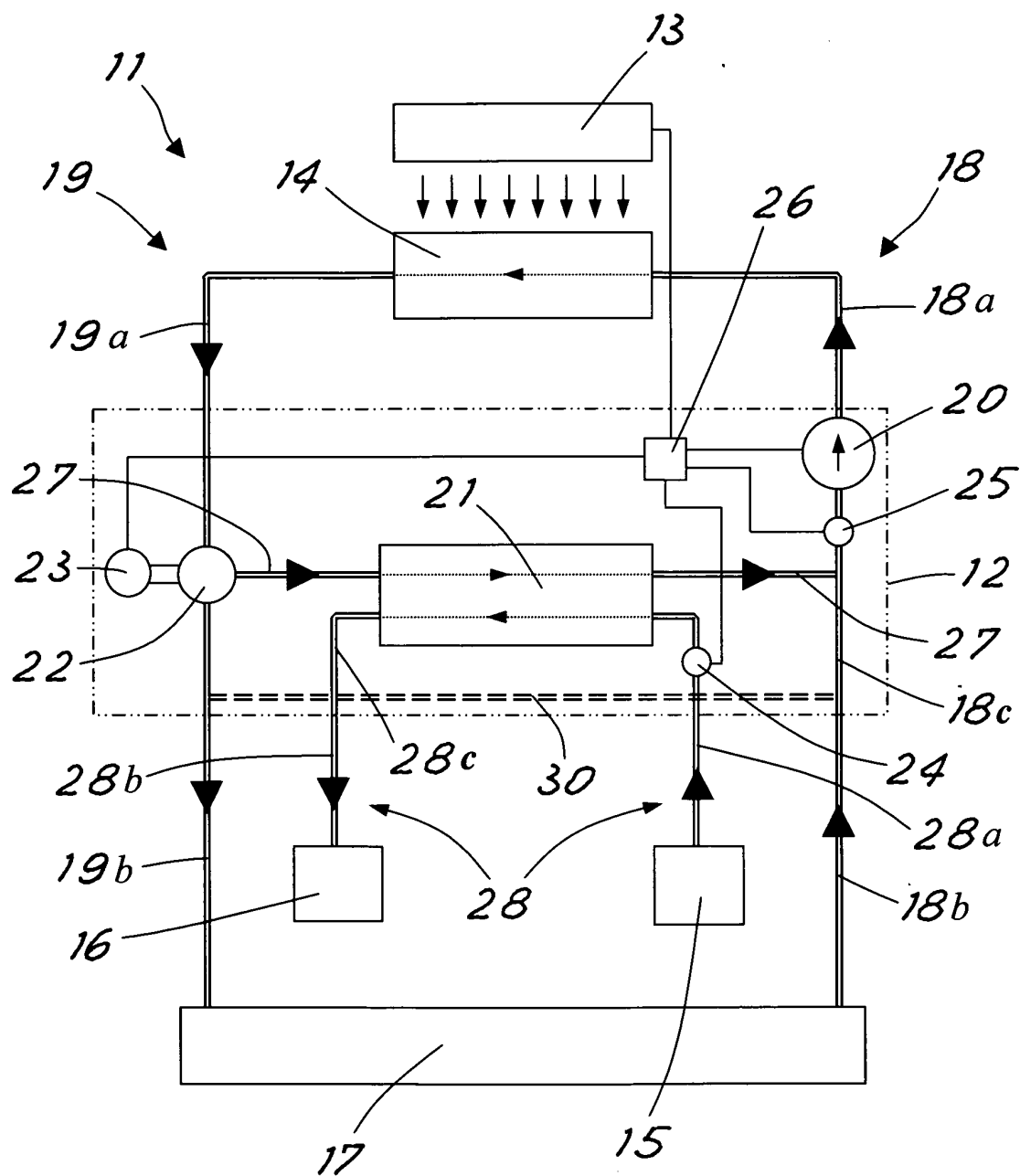
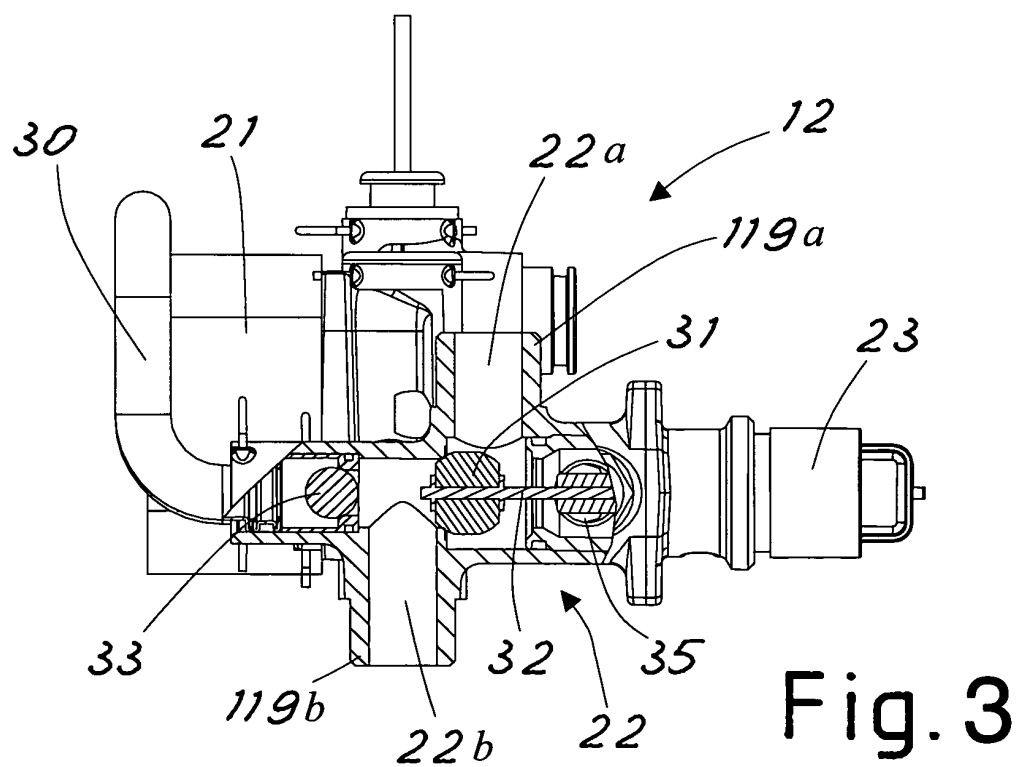
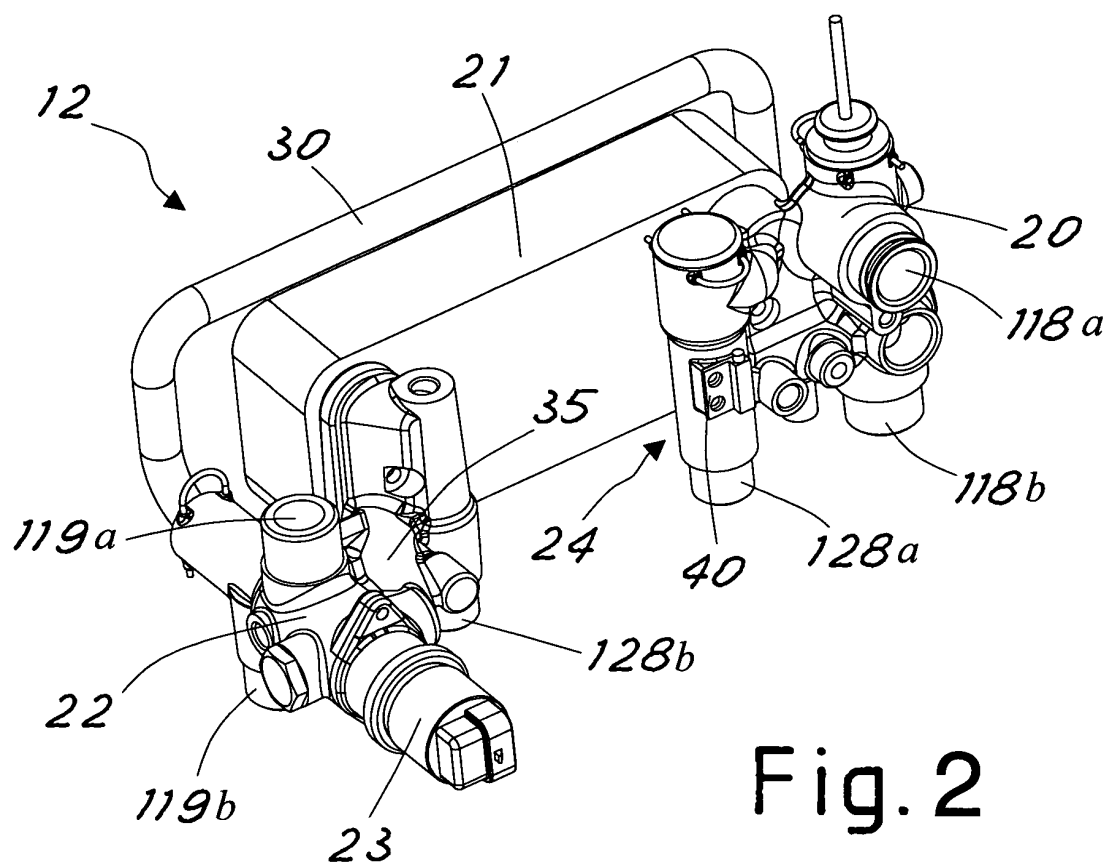


Fig. 1



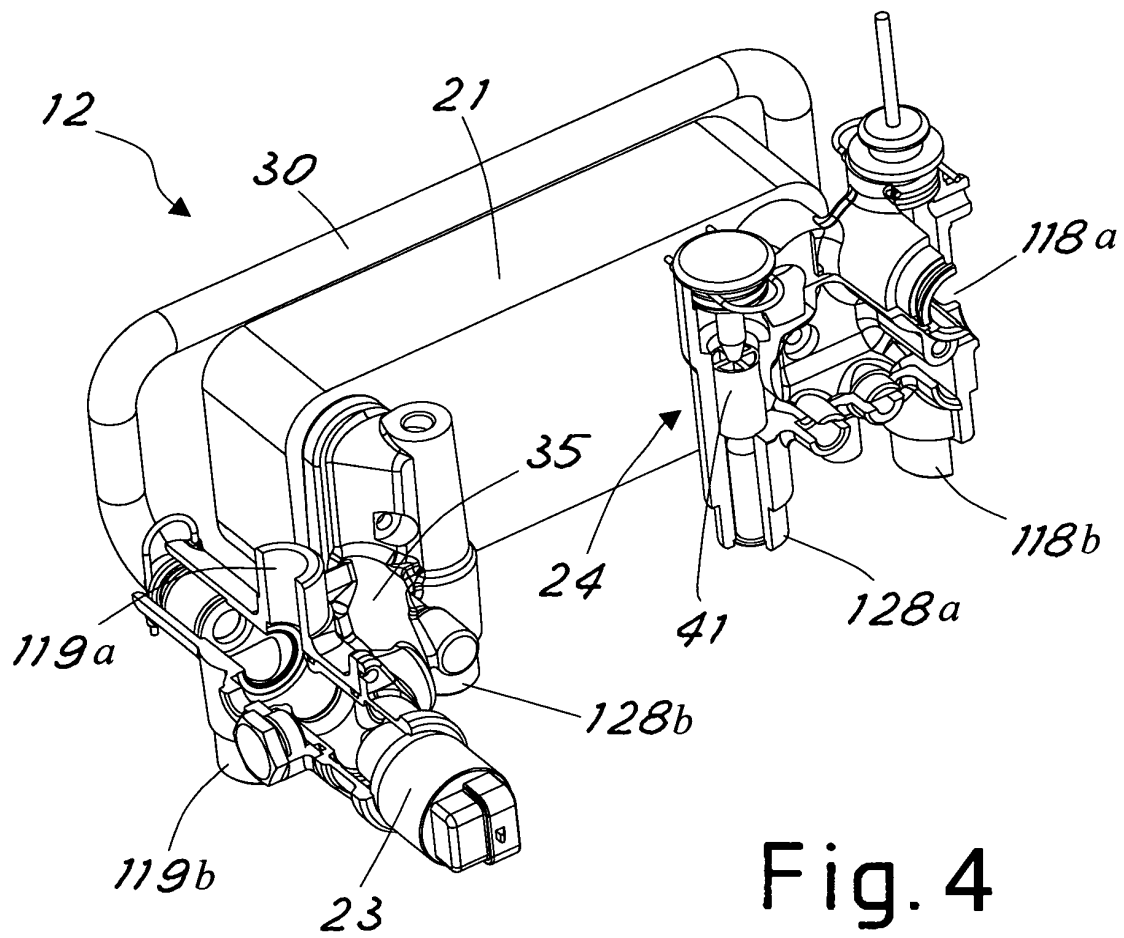


Fig. 4