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(54) A HYDRAULIC ASSEMBLY

(57) A hydraulic assembly for a combined system (1) for room heating and for the production of domestic hot water having a hydraulic return valve assembly (19) and a hydraulic delivery valve assembly (20) both of which are hydraulically connected to a heat exchanger (18), which is provided with four coplanar connections (66); wherein the hydraulic return valve assembly (19) comprises a one-piece support body (31) having two first pairs of fittings (55, 56) arranged so as to lie on different planes and designed to establish, in a selective manner, the hydraulic connection to a first pair of connections (66), and wherein the hydraulic delivery valve assembly (20) comprises a one-piece support body (57) having two second pairs of fittings (62, 63) arranged so as to lie on different planes and designed to establish, in a selective manner, the hydraulic connection to a second pair of connections (66).

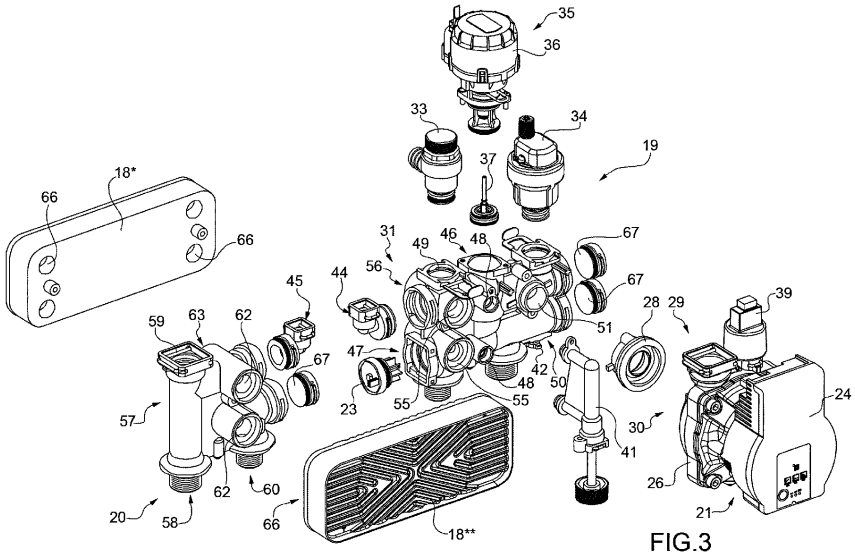

FIG.3

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102019000000472 filed on 11/01/2019.

TECHNICAL FIELD

[0002] This invention relates to a hydraulic assembly for a combined system for room heating and for the production of domestic hot water and to a wall-mounted boiler provided with such an assembly.

PRIOR ART

[0003] As is well known, the hydraulic assemblies for combined wall-mounted boilers developed in recent years have undergone a considerable rationalisation of hydraulic components with the progressive abandonment of single-function components connected to each other by means of pipes, in favour of increasingly compact multifunctional control and safety devices, which have been designed to perform all the hydraulic functions of the boiler.

[0004] Currently, the hydraulic layout of the boiler is basically defined by the use of only three valve devices, in combination with a secondary plate heat exchanger.

[0005] The three valve devices are:

- a centrifugal pump valve device
- a delivery valve device; and
- a return valve device.

[0006] The centrifugal pump valve device basically comprises an inlet connection located on a degassing chamber, an outlet connection located on a volute body containing the centrifugal impeller and an electric motor.

[0007] In turn, the delivery valve device basically comprises a double rear connection for the secondary exchanger and two connections, respectively, for the primary circuit (delivery) and the secondary circuit (domestic hot water outlet).

[0008] And finally, the return valve device basically comprises a double rear connection for the secondary exchanger and two connections, respectively, for the primary circuit (return) and for the secondary circuit (domestic cold water inlet).

[0009] The secondary plate heat exchanger for the production of domestic hot water of the conventional type, also used as a hydraulic bar, comprises two separate countercurrent circuits with four terminal connections located on the same plane that define the inlet and outlet of the primary and secondary circuit, respectively. On these four connections, the delivery and return valve devices are assembled so that the secondary exchanger is arranged alternately on the front or on the back of the delivery and return valve devices.

[0010] The air vent valve, the three-way diverter valve, the safety valve, the connection for connecting to the expansion tank, and the connection for the pressure gauge can be integrated with the centrifugal pump valve device.

[0011] Normally, the three-way diverter valve, the differential bypass valve, and the pressure switch can be integrated with the delivery valve device.

[0012] In normal use, the flow sensor (flowmeter) for controlling the sanitary removal, the system inlet valve, and the system drain tap can be integrated with the return valve body.

[0013] Hydraulic assemblies for wall-mounted combination boilers of the known type are described in EP1188991, EP1026456, DE20015722, EP3361182, CN102042637, EP3370011, and EP3252394.

[0014] The research is continuously aimed at reducing the production costs of wall-mounted boilers and reducing their size (increasingly configuring them as household appliances).

[0015] It has been noted, however, that the arrangement of the various components (including the secondary heat exchanger) normally involves the development of customised designs and therefore requires a lot of investment in equipment and moulds, with rather long depreciation times that are not compatible with the product's lifespans, which tend to be increasingly short.

DESCRIPTION OF THE INVENTION

[0016] The purpose of this invention is, therefore, to provide a hydraulic assembly for a combined system for room heating and for the production of domestic hot water that is free from the drawbacks of the state of the art and is, in particular, easy and economical to implement.

[0017] Another purpose of this invention is to provide a wall-mounted boiler provided with a hydraulic assembly for a combined system for room heating and for the production of domestic hot water that is free from the drawbacks of the state of the art and is, in particular, easy and economical to implement.

[0018] According to this invention, a hydraulic assembly is provided for a combined system for room heating and for the production of domestic hot water and a wall-mounted boiler provided with a hydraulic assembly according to the attached claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] This invention will now be described with reference to the attached drawings, which illustrate non-limiting embodiments thereof with the caveat that, given the particular complexity of the drawings and the large number of details, not all the elements have been numbered; wherein:

- Figure 1 shows a general hydraulic outline of a wall-

mounted gas boiler wherein a hydraulic assembly made in accordance with this invention is used;
- Figure 2 schematically shows an enlarged view of a detail in Figure 1;
- Figure 3 is an exploded perspective view of a first embodiment of the hydraulic assembly in Figure 1;
- Figure 4 is a front view of a second embodiment of the hydraulic assembly in Figure 1; and
- Figure 5 is a rear view of a third embodiment of the hydraulic assembly in Figure 1.

PREFERRED EMBODIMENTS OF THE INVENTION

[0020] In Figure 1, the reference number 1 denotes, as a whole, a combined system for room heating and for the production of domestic hot water.

[0021] The system 1 comprises a wall-mounted boiler 2 and a hydraulic network 3 hydraulically connected to each other. The hydraulic network 3 comprises, in turn, in a known way, a primary heating circuit 4 and a secondary circuit 5 in which domestic hot water flows. The primary circuit 4 comprises a pipe 6 for delivering hot water to at least one heating element 7 (preferably provided with a zone valve arranged near and immediately upstream of the heating element 7) and a pipe 8 for returning cold water to the wall-mounted boiler 2 from the heating element 7.

[0022] The secondary circuit 5, on the other hand, is joined to at least one domestic hot water dispenser body 9 (removal tap or mixer).

[0023] Again, as shown in Figure 1, the wall-mounted gas boiler 2 comprises:

- an atmospheric gas burner 10, to which a gas supply line 11 is joined, the line being controlled by a safety gas valve 12;
- a main heat exchanger 13;
- a chimney 14 provided with a fan 15, for the removal of the fumes produced by the combustion of gas;
- a pipe 16 for delivering cold water to the main heat exchanger 13 of heating cold water;
- a return pipe 17 from the main heat exchanger 13 of heating hot water;
- a secondary heat exchanger 18, advantageously, but not necessarily, of the "plate" type;
- a hydraulic delivery valve assembly 20 hydraulically connected to the secondary heat exchanger 18;
- a hydraulic return valve assembly 19 also hydraulically connected to the secondary heat exchanger 18; and
- a centrifugal pump assembly 21 hydraulically connected to the hydraulic return valve assembly 19.

[0024] It is important to point out that while the water circulating in the main heat exchanger 13 is heated directly by the heat produced by the burner 10, in the secondary heat exchanger 18 there is an exchange of heat between the hot water coming from the main heat exchanger 13 and the domestic cold water supplied by the hydraulic network fed by the aqueduct through a pipe 22.

[0025] The secondary heat exchanger 18 is activated when there is a demand for domestic hot water, that a user detects with a flowmeter 23 through the dispenser body 9. The primary circuit 4 also comprises an outlet pipe 61 for the domestic hot water from the secondary heat exchanger 18, through which the dispenser body 9 is supplied.

[0026] According to a preferred embodiment, the centrifugal pump assembly 21 comprises, in turn, an electric motor 24 that rotates an impeller 25, in turn enclosed in a pump body 26. A pressure switch 39 is preferably integrated with the centrifugal pump assembly 21.

[0027] The pump body 26 is provided with a fitting for the pressure switch 39, and a fitting 29 to connect to the return pipe 16, and a fitting 30 to connect, through the pump interface 28, to the hydraulic return valve assembly 19.

[0028] The hydraulic return valve assembly 19 is intended to regulate the flow of water to/from the wall-mounted boiler 2 and comprises, in addition to a corresponding one-piece support body 31, the following devices: an expansion tank 32, a safety valve 33 for the primary circuit 4 that, if needed, is predisposed to discharge the water through a drain pipe, an air vent valve 34, a three-way valve 35 intended to activate the sanitary phase of the wall-mounted boiler 2 diverting the flow towards the secondary heat exchanger 18 and having an electric motor 36, which in turn activates a corresponding deflector shutter 37 subjected to the action of a helicoidal spring 38, and a check valve 40.

[0029] Preferably, the hydraulic return valve assembly 19 also comprises the following devices: the domestic cold water flowmeter 23, a primary heating circuit 4 inlet valve 41, a system drain tap 42 that, if necessary, drains the water through a drain pipe 43 (through which the water drains even if the safety valve 33 is controlled).

[0030] The support body 31 is, therefore, provided with the following fittings:

- a fitting 44 for the expansion tank 32;
- a fitting 45 for the pressure gauge 27;
- a seat 46 for the three-way valve 35;
- a seat 47 for the domestic cold water flowmeter 23;
- two fittings 48 for the inlet valve 41;
- a fitting 49 for the safety valve 33;
- a fitting 50 for the system drain tap 42;
- a connection fitting 51 for the centrifugal pump assembly 21;
- a fitting 52 for the hydraulic network (if necessary, arranged so as to house, in a known way, a filter and a flow limiter);
- a fitting 53 for the primary heating circuit 4;
- a seat 54 for the check valve 40; and
- two pairs of fittings for connection to the secondary heat exchanger 18, indicated with the reference numbers 55 and 56. The pairs of fittings 55, 56 lie

on different planes. In particular, the pairs of fittings 55, 56 lie on parallel planes.

[0031] Each pair of fittings 55, 56 is arranged on opposite sides of the support body 31.

[0032] In particular, as shown in Figures 3 to 5, the pair of fittings 55 is arranged at the front of the support body 31 while the other pair of fittings 56 is arranged at the back of the support body 31.

[0033] The hydraulic valve assembly 20 is also designed to regulate the water flows to/from the wall-mounted boiler 2 through two connections, respectively, for the primary circuit (delivery) and for the secondary circuit (domestic hot water outlet), and it comprises a corresponding one-piece support body 57.

[0034] The support body 57 is provided with the following fittings:

- a fitting 58 for the primary circuit delivery pipe 6;
- a fitting 59 for the boiler delivery pipe 17;
- a fitting 60 for the outlet pipe 61 for domestic hot water coming from the secondary heat exchanger 18; and
- two pairs of fittings for connecting to the secondary heat exchanger 18, indicated with the reference numbers 62 and 63.

[0035] The pairs of fittings 62, 63 lie on different planes. In particular, the pairs of fittings 62, 63 lie on parallel planes. Each pair of fittings 62, 63 is arranged on opposite sides of the support body 57. In particular, as shown in Figures 3 to 5, the pair of fittings 62 is arranged at the front of the support body 57 while the pair of fittings 63 is arranged at the back of the support body 31.

[0036] It is evident that both one support body 31 and the other support body 57 can be provided with additional fittings, in addition to those listed, and possibly closed with appropriate caps 67.

[0037] Inside the secondary heat exchanger 18, two distinct countercurrent water courses are defined. More specifically, a heating water course 64 is defined in the domestic water phase, and a domestic water course 65 is defined when its removal from the dispensing element 9 is activated in countercurrent in relation to the course 64.

[0038] The heat exchanger 18 is, therefore, provided with four connections 66, of which, respectively, a pair of connections 66A, 66B for the inlet and outlet of the course 64 and a pair of connections 66C, 66D for the inlet and outlet of the course 65 (clearly the connections 66A, 66D for the inlet course 64 and the outlet course 65 are aligned at the same and first end of the heat exchanger 18 while the connections 66B, 66C for the inlet course 65 and the outlet course 64 are aligned at the same and a second end of the heat exchanger 18). The connections 66 lie on the same plane. In other words, the connections 66 are made at the same face of the box body that defines the secondary heat exchanger 18.

[0039] The pairs of fittings 55, 56 are intended to selectively make the hydraulic connection with a first pair of connections 66 and, similarly, the pairs of fittings 62, 63 are intended to selectively make the hydraulic connection with a second pair of connections 66 depending on the front/rear position of the secondary heat exchanger 18 with respect to the hydraulic return and delivery valve assemblies 19, 20.

[0040] According to a second embodiment shown in Figure 4, the secondary heat exchanger 18 is connected to pairs of fittings 55 and 62 in such a way that it is arranged in front of the support bodies 31 and 57. The pairs of fittings 55 and 62 are arranged, in use, on a common plane to connect with the connections 66.

[0041] Alternatively, in accordance with a third embodiment shown in Figure 5, the secondary heat exchanger 18 is connected to the pairs of fittings 56 and 63 so that it is arranged at the rear of the support bodies 31 and 57. The pairs of fittings 56 and 63 are arranged, in use, on a common plane to connect with the connections 66.

[0042] It is important to point out that this second embodiment presents, overall, a reduced overall size compared to the first embodiment since the secondary heat exchanger 18 is basically arranged side-by-side with the centrifugal pump assembly 21.

[0043] Alternatively, according to an initial embodiment shown in Figure 3, two secondary heat exchangers 18*, 18** are provided; the secondary heat exchanger 18* is connected, respectively, to the pairs of fittings 56 and 63 so as to be arranged at the rear with respect to the support bodies 31 and 57, while the other secondary heat exchanger 18** is connected, respectively, to the pairs of fittings 55 and 62 so as to be arranged at the front with respect to the support bodies 31 and 57.

[0044] The hydraulic return and delivery valve assemblies 19, 20 are, in fact, prepared to connect with the secondary heat exchanger 18 in two different positions, opposite each other; the position (front and/or rear) of the secondary heat exchanger 18 with respect to the hydraulic return and delivery valve assemblies 19, 20 is chosen according to the space requirements and without needing to change the position of the other devices (in particular, the flowmeter 23 is provided with a double outlet connection and is designed to convey domestic water to the secondary heat exchanger 18 positioned either on the front or back of the valve body).

[0045] As mentioned above, the deflector shutter 37 of the three-way valve 35 is controlled by the electric motor 36 and is subjected to the action of the helical spring 38 to alternatively close one way, corresponding to the fitting 53 with the primary heating circuit 4 for the domestic hot water production phase, or one way for room heating, leaving open, in any case, a hydraulic communication way with a centrifugal pump assembly 21 suction pipe.

[0046] Preferably, the deflector shutter 37 has a differentiated section on the two closing diameters in order to reduce the pressure drop towards the main way for the

room heating phase.

[0047] The main advantage of the assembly made up of the hydraulic return and delivery valve assemblies 19, 20 and by the secondary heat exchanger 18 consists in preparing the rational arrangement of the secondary heat exchanger 18 on the front or alternatively on the back of both the hydraulic return valve assembly 19 and the hydraulic delivery valve assembly 20. All this translates into a significant reduction in investment costs in moulds and equipment, as well as in a significant reduction in the overall size and a consequent reduction in production costs.

LIST OF REFERENCE NUMBERS OF THE FIGURES

[0048]

1 combined system
2 wall-mounted boiler
3 hydraulic network
4 primary circuit
5 secondary circuit
6 delivery pipe
7 heating element
8 return pipe
9 dispenser body
10 burner
11 gas supply line
12 safety valve
13 main heat exchanger
14 chimney
15 fan
16 cold water return delivery pipe
17 water delivery pipe
18 secondary heat exchanger
19 hydraulic return valve assembly
20 hydraulic delivery valve assembly
21 centrifugal pump assembly
22 pipe
23 flowmeter
24 electric motor pump
25 pump impeller
26 pump body
27 pressure gauge
28 return assembly-pump interface
29 boiler return-pump fitting
30 interface-pump fitting
31 return assembly support body
32 expansion tank
33 safety valve
34 air vent valve
35 three-way valve
36 three-way valve electric motor
37 three-way valve deflector shutter
38 three-way valve helical spring
39 pressure switch
40 check valve
41 inlet valve
42 drain tap
43 drain pipe
44 fitting for expansion tank
45 fitting for pressure gauge
46 three-way valve seat
47 flowmeter seat
48 inlet valve fitting
49 safety valve fitting
50 drain tap fitting
51 centrifugal pump fitting
52 domestic water network fitting
53 drain tap fitting
54 check valve seat
55 secondary exchanger fittings
56 secondary exchanger fittings
57 delivery assembly support body
58 primary circuit delivery fitting
59 boiler delivery fitting
60 domestic hot water outlet fitting
61 domestic hot water network pipe
62 secondary exchanger fittings
63 secondary exchanger fittings
64 internal plates course
65 internal plates course
66 secondary exchanger connections

Claims

1. A hydraulic assembly for a combined system (1) for room heating and for the production of domestic hot water comprising a wall-mounted boiler (2) hydraulically connected to a hydraulic network (3) having a primary heating circuit (4) and a secondary circuit (5) where domestic hot water flows; the assembly comprises a first heat exchanger (18; 18*); a hydraulic return valve assembly (19), which is hydraulically connected to the first heat exchanger (18); and a hydraulic delivery valve assembly (20), which is also hydraulically connected to the first heat exchanger (18); wherein the first heat exchanger (18; 18*) is provided with four coplanar connections (66) for the hydraulic connection to the hydraulic return valve assembly (19) and to the hydraulic delivery valve assembly (20); in which the hydraulic return valve assembly (19) comprises a first one-piece support body (31) and the hydraulic delivery valve assembly (20) comprises a second one-piece support body (57); the assembly is **characterized in that** the one-piece support body (31) has two first pairs of fittings (55, 56) arranged so as to lie on different planes and designed to establish, in a selective manner, the hydraulic connection to a first pair of connections (66), and **in that** the second one-piece support body (57) has two second pairs of fittings (62, 63) arranged so as to lie on different planes and designed to establish, in a selective manner, the hydraulic connection to a second pair of connections (66).

2. An assembly according to claim 1, wherein the two first pairs of fittings (55, 56) are arranged so as to lie on parallel planes.

3. An assembly according to claim 1 or 2, wherein the two second pairs of fittings (62, 63) are arranged so as to lie on parallel planes.

4. An assembly according to any one of the preceding claims and comprising a second heat exchanger (18**); wherein all said pairs of fittings (55, 56; 62, 63) are used to establish the hydraulic connection to the first heat exchanger (18*) and to the second heat exchanger (18**).

5. An assembly according to anyone of the preceding claims, wherein the hydraulic return valve assembly (19) integrates a three-way valve (35) that is designed to activate the domestic water phase of the wall-mounted boiler (2) by deflecting the flow towards the first heat exchanger (18; 18*) and having an electric motor (36), which operates a deflector shutter (37); wherein the cross section of the deflector shutter (37) has different closing diameters.

6. An assembly according to any one of the preceding claims, wherein the hydraulic return valve assembly (19) integrates a flow-meter (23), which is provided with a double outlet connection to convey domestic water both towards the first and towards the second heat exchanger (18; 18*).

7. A wall-mounted boiler (2) **characterized in that** it is provided with at least one hydraulic assembly (20) according to any one of the claims from 1 to 6.

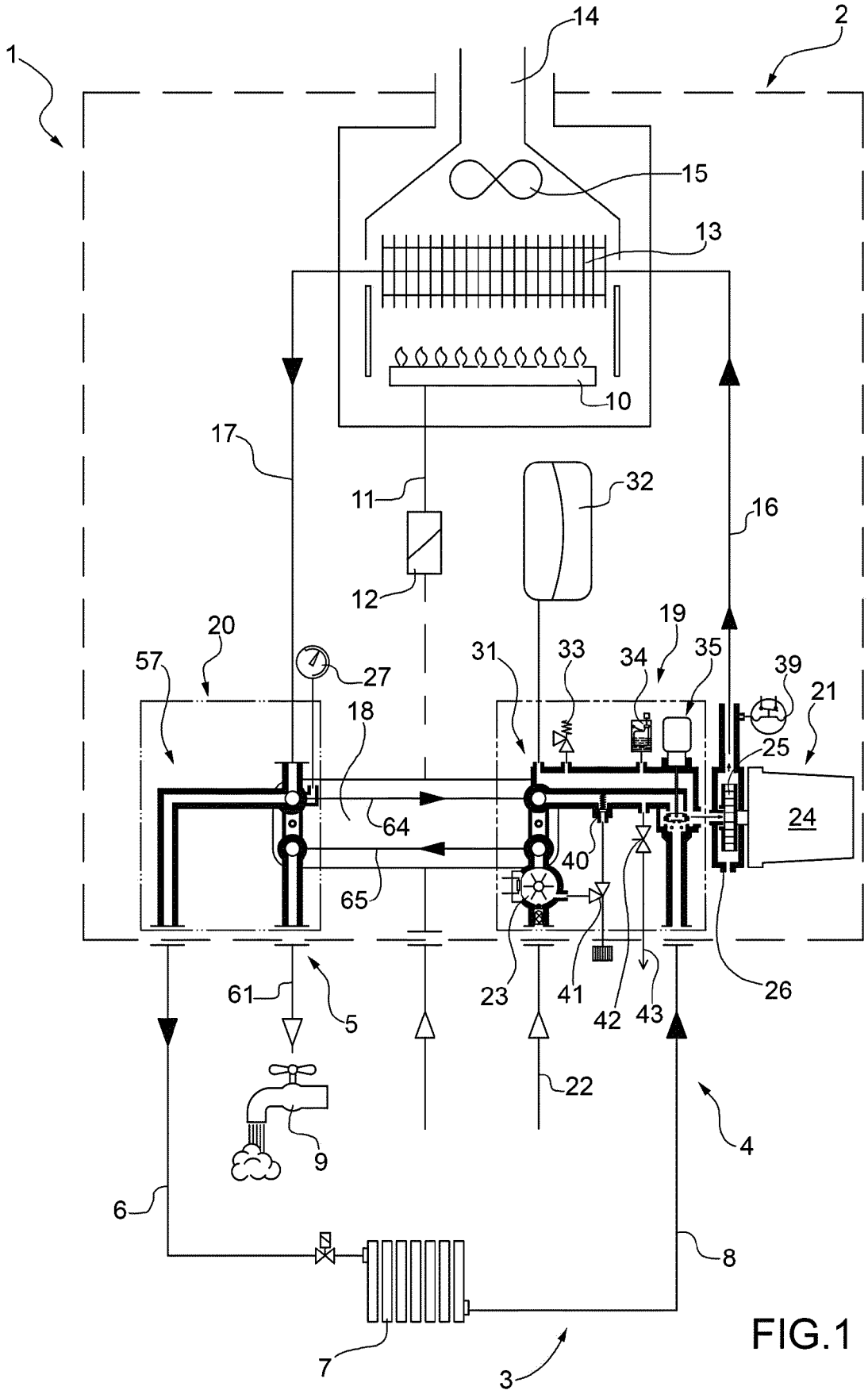
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FIG.1

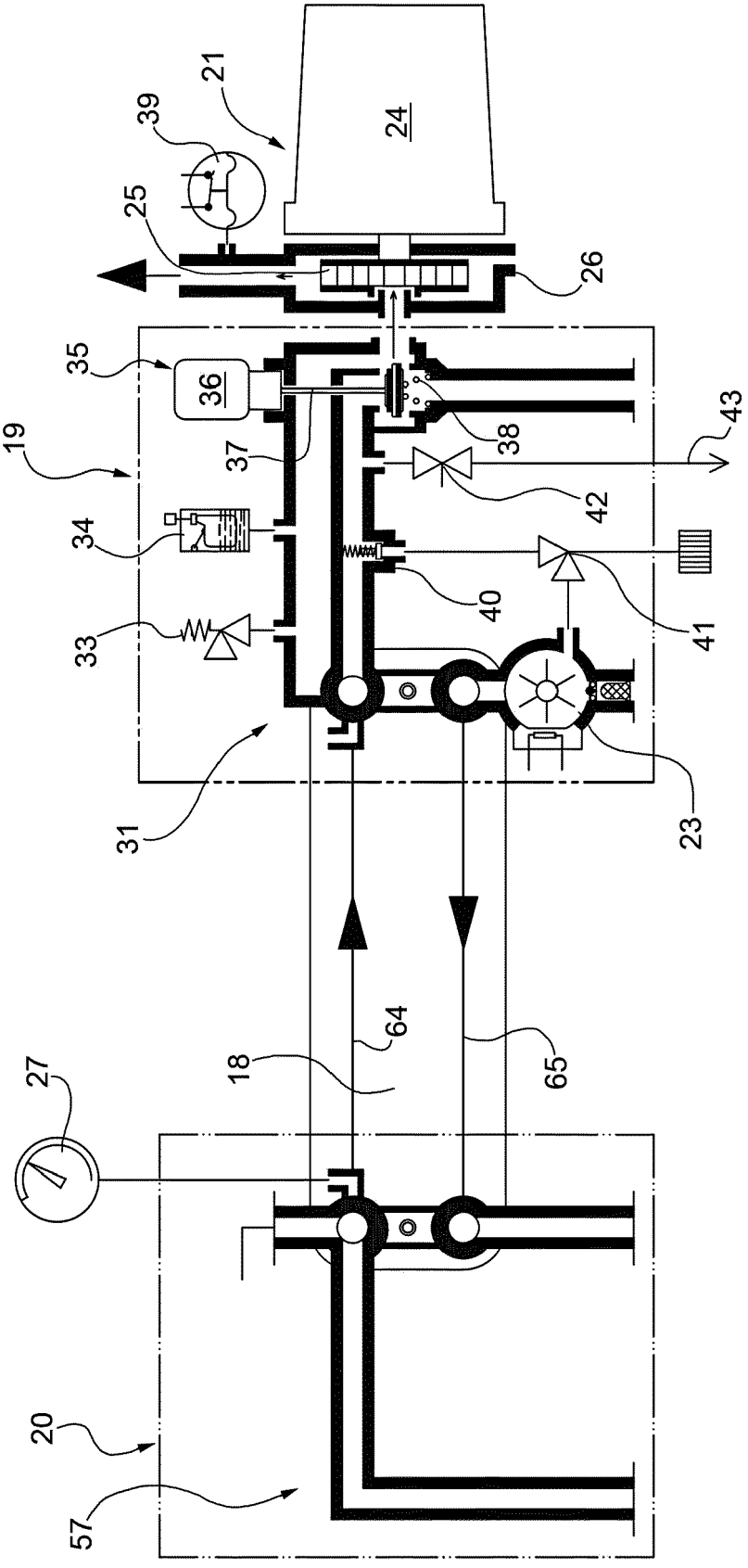

FIG.2

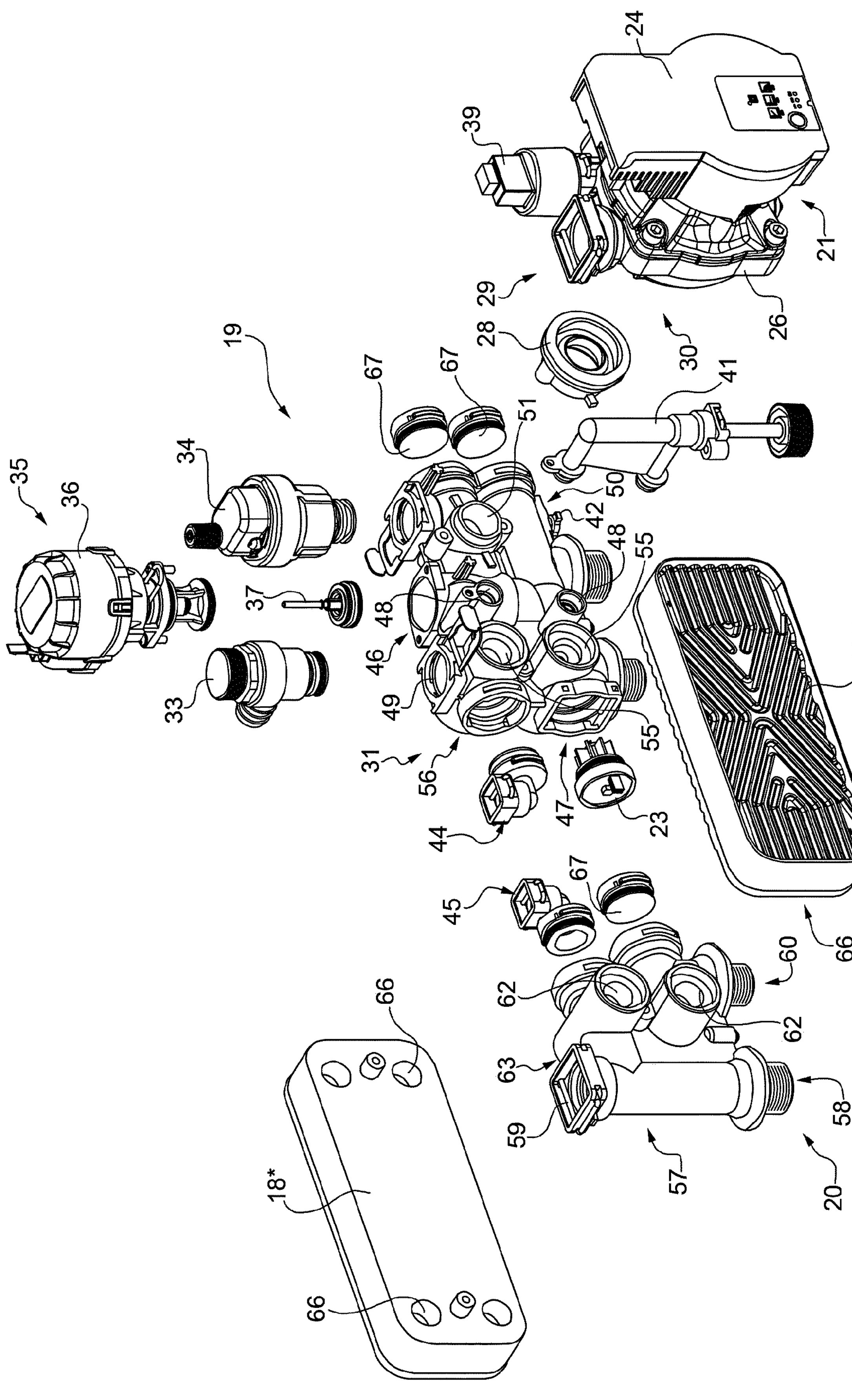

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FIG.3

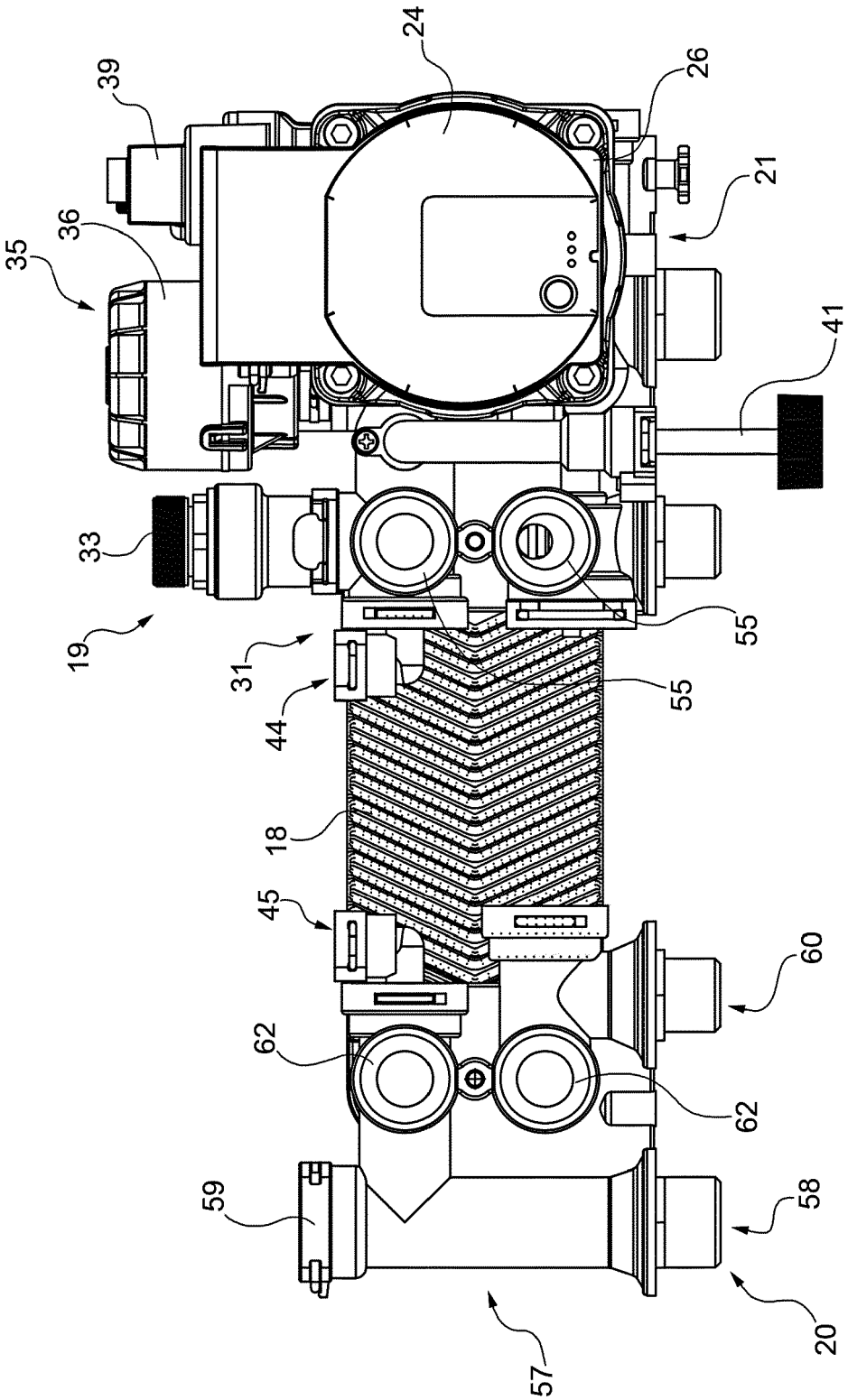

FIG.4

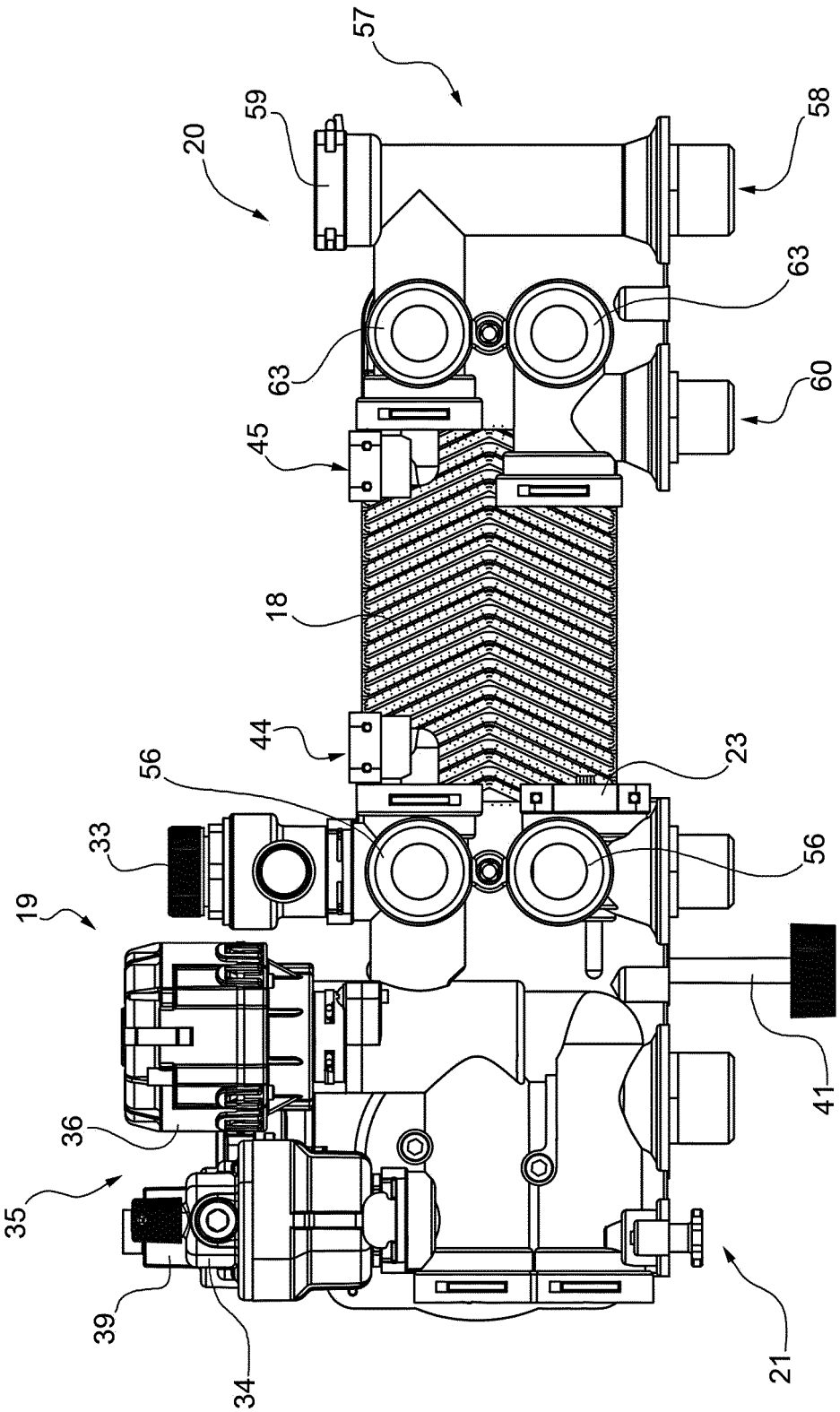

FIG.5

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EUROPEAN SEARCH REPORT

Application Number
EP 20 15 1289

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
Munich	16 April 2020	García Moncayo, O

CATEGORY OF CITED DOCUMENTS

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

REFERENCES CITED IN THE DESCRIPTION

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