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(54) **HYDRAULIC MODULE WITH OPTIONAL PLATES AND HEATING DEVICE EQUIPPED WITH A HYDRAULIC MODULE**

(57) A hydraulic module for heating systems, **characterized in that** it comprises a basic body (1) and at least one optional plate (80) for a system heating device and/or at least one optional plate (90) for a combined heating device, which are hydraulically connectable to the basic body (1).

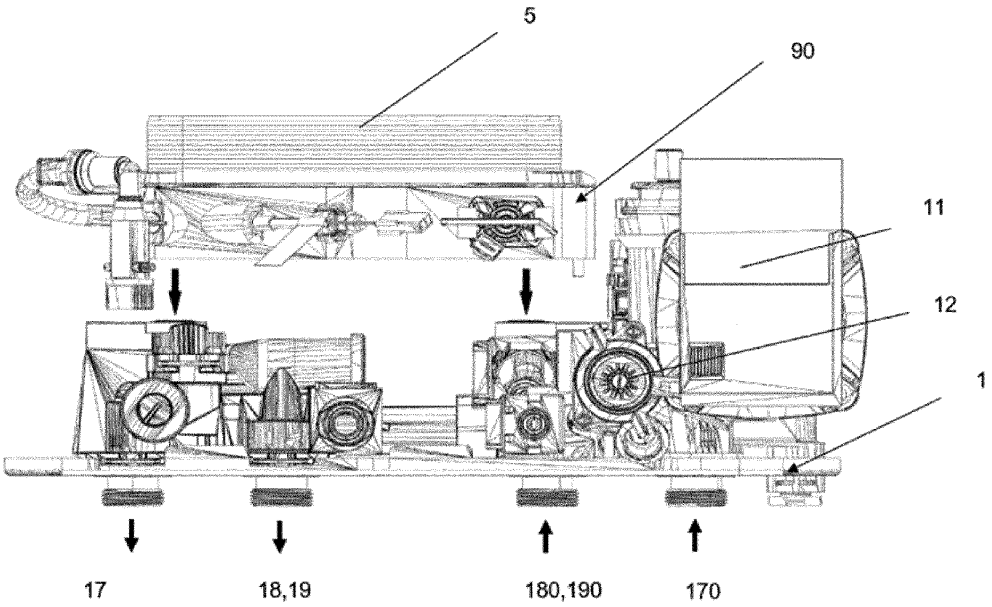

Fig. 5

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Description

Field of the invention

[0001] The invention relates to hydraulic modules that are part of heating devices intended for space heating and/or domestic hot water preparation.

Background of the invention

[0002] Current heating devices, such as wall-mounted water heaters, are located in buildings close to the water supply and have their inlet and outlet connectors arranged according to standards and norms, to ensure easy installation and maintenance. Connectors are used to connect the heating device to individual circuits for space heating and/or domestic hot water preparation and are connected to a hydraulic module inside the heating device.

[0003] Hydraulic modules are manufactured as separate units, they are built into the heating device and are primarily designed to provide circulation of heat transfer fluid through heat exchangers and to direct heated/cold water to/from the individual circuits by means of a circulating pump and a switch valve. The hydraulic module can also supply heat for heating to an external domestic hot water storage tank.

[0004] In addition to the basic function of circulating the heat transfer fluid, hydraulic modules implement more and more different functions (bypass function, filling loop, pressure, flow, temperature measurement, safety relief valve, etc.), which makes their design more and more complicated.

[0005] An example of a complex structural design of a hydraulic module, assembled from three structural parts to ensure a variety of functions, is described in the WO2018202436 A1 document. Its major disadvantage is that for the proper functioning of the hydraulic module, all three structural parts are required, each of which has a significantly different design. The structural parts are interconnected and attached to the plate heat exchanger, and the functions are implemented using a variety of connected components. The production, assembly, and maintenance of such a complex hydraulic module are demanding.

[0006] The DE102019215021 A1 document describes a hydraulic module for a heating device for arrangement on a base device forming a heating device, with connecting ducts routed through the hydraulic module for hydraulic connection of the base device to a heat source and/or a heat sink. The hydraulic module functions as a hydraulic interface between the heat generator and the heat accumulator on one side, and the heat source and the heat sink on the other side. The above described hydraulic module can be prepared for installation in the installation space through pre-assembly and can also be further expanded with additional sub-assemblies. The hydraulic module is either arranged on the top side of the base unit or alternatively, it can be spatially arranged between the accumulator module and the heat generator module. The hydraulic module is designed so that it can alternatively be spatially separated from the base unit and installed on the wall of the installation room. This solution indeed ensures greater variability compared to the one described in the WO2018202436 A1 document, but it requires a large amount of interconnecting accessories for various combinations of functions and devices.

[0007] The number of functions, and therefore the components provided by hydraulic modules in current heating systems, is continually increasing. This has a significant impact on the design of hydraulic modules, which are becoming increasingly complex and require a large number of connections.

[0008] The task of the invention is to create a hydraulic module design that ensures easy implementation of functions without structural changes to the basic design, while also minimizing the need for excess connections.

Summary of the invention

[0009] The shortcomings of the prior state of the art are solved by the present invention of a hydraulic module comprising a basic body and at least one optional plate.

[0010] The basic body and optional plates are separate structural components that comprise means that enable the basic body and the optional plates to be easily and watertightly interconnected, allowing for straightforward assembly and maintenance of the resulting hydraulic module.

[0011] One structural part constitutes the basic body of the hydraulic module, encompassing interconnections and basic functions necessary across all variants within a specific hydraulic module group. This entails at least one circulation pump and a three-way switch valve for heating circuit switching.

[0012] Another structural part, the optional plate, encompasses optional functions required only in certain variants within a specific group of hydraulic modules. It includes, for example, a bypass function, filling loop, flow sensor and other required functions. The optional functions depend on whether it is a heating device called "system heating device" - such heating devices produce heat to warm the space and possibly supply hot water to the storage tank - or whether it is a heating device called "combined heating device" - such heating devices produce heat to warm the space and, using a secondary plate heat exchanger, supply heat for domestic hot water preparation.

[0013] Thanks to such configuration, the proposed invention allows for the use of the same basic body of the hydraulic module for both system heating devices and combined heating devices. The optional plates are designed according to the required functions, and there can be several types of them. It is possible to combine several optional plates to form the final hydraulic module. The optional plates are hydraulically connectable to the basic

body of the hydraulic module and also connectable each to other. They are also stackable, for easy mechanical fixation. The integration of functions (components) into different optional plates is innovative. Optional plates can be easily and watertightly mounted to the basic body of the hydraulic module. In the case of combined heating devices, the optional plates are mounted between the basic body of the hydraulic module and the plate heat exchanger.

Brief description of drawings

[0014] The invention will be explained with reference to figures, but without being limited to them.

[0015] These show:

Fig. 1 - an optional plate for a system heating device designed for space heating and hot water supply for a heat exchanger located in the external water tank

Fig. 2 - the cross-section of the optional plate from Fig. 1

Fig. 3 - an optional plate for a combined heating device designed for space heating and domestic hot water preparation

Fig. 4 - the cross-section of the optional plate from Fig. 3

Fig. 5 - the basic body of the hydraulic module with the direction of connection of the optional plate from Fig. 3 indicated

Fig. 6 - the connection of two different optional plates on top of each other

Fig. 7 - a simplified diagram illustrating system heating devices and connection points for the optional plate for system heating devices

Fig. 8 - a simplified diagram illustrating combined heating devices and connection points for the optional plate for a combined heating device

Description of the embodiment examples

Example 1

Hydraulic module with an optional plate 80 for a system heating device

[0016] **Fig. 1 and 2** depict a lateral view and a cross-section of an example optional plate 80 for a system heating device which provides the function of bypass in the hydraulic module. The optional plate 80 is made of suitable plastic material, it has a cuboid shape, and it integrates interconnecting ducts and connection points. The plate is reinforced with ribs 3. On the shortest side surfaces there are moulded brackets 2 with holes for fixing screws. The bypass valve 13 is inserted into the connection duct on the optional plate 80 and is secured with a clip 4. The bypass valve 13 is connected to the bypass duct 7.

[0017] The diagram in **Fig. 7** depicts an exemplary system heating device 100 with a primary heat exchanger 10, a circulation pump 11, a three-way switch valve 12, and a bypass valve 13, wherein the bypass valve 13 is arranged on the optional plate 80, and the circulation pump 11 and three-way switch valve 12 are arranged on the basic body 1 of the hydraulic module.

[0018] The basic body 1 of the hydraulic module is equipped with connectors 17,170 to/from the heating water circuit and 19,190 to/from the external storage tank. Connectors 17 for the output of hot water intended for space heating and 170 (return from heating) connect the heating device to the radiator system (or other heat exchangers) in the heated space (not depicted). Connectors 19 (to the external tank) and 190 (from the external tank) connect the heating device to the heat exchanger in the external water storage tank (not depicted).

[0019] If the external storage tank is not utilized, connectors 19 and 190 can be sealed with a plug 6.

[0020] Connectors 19 and 190 can be advantageously interconnected to provide the bypass function.

[0021] The optional plate 80 can be hydraulically connected to the basic body 1 of the hydraulic module of the heating device and is equipped with connection points A, B, C, D.

[0022] Connection point A is a connection to the duct supplying heated water from the primary heat exchanger 10.

[0023] Connection point B is a connection to the duct supplying return water to the three-way valve 12.

[0024] Connection point C is a connection to the duct supplying heated water to the heat exchanger in the external storage tank via the connector 19.

[0025] Connection point D is a connection to the duct supplying return water from the external storage tank via the connector 190. For example, the heat exchanger in the external water storage tank is a coil.

Example 2

Hydraulic module with an optional plate 90 for a combined heating device

[0026] **Fig. 3 and Fig. 4** depict a lateral view and a cross-section of an example optional plate 90 for a combined heating device, which provides several functions in the hydraulic module.

[0027] The optional plate 90 is made of suitable plastic material, it has a cuboid shape, and it integrates interconnecting ducts and connection points. The plate is reinforced with ribs 3. On the shortest side surfaces there are moulded brackets 2 with holes for fixing screws. The bypass valve 13 is inserted into the connection duct on the optional plate 90 and is secured with a clip 4. Besides the bypass valve 13, the optional plate 90 also includes connecting ducts and connectors for the filling loop 14, temperature sensor 15, and flow sensor 16.

[0028] **Fig. 5** depicts the assembly of a hydraulic module consisting of the optional plate 90 for a combined

heating device and the basic body 1 of the hydraulic module.

[0029] The diagram in **Fig. 8** depicts the connection of an exemplary combined heating device 200 with a primary heat exchanger 10, a circulation pump 11, a three-way switch valve 12, and a bypass valve 13. The bypass valve 13 is connected to the bypass duct 7.

[0030] Connectors 17 (to the heating water circuit) and 170 (return from the heating water circuit) connect the heating device to the radiator system (or other heat exchangers) in the heated space (not depicted).

[0031] Connector 180 (return from the domestic hot water circuit) is connected to the flow sensor 16. Connector 18 (hot water outlet to the domestic hot water circuit) is connected to the temperature sensor 15 and to the filling loop 14.

[0032] The optional plate 90 for a combined heating device can be hydraulically connected to the basic body 1 of the hydraulic module of the heating device and is equipped with connection points A1, B1, E, F.

[0033] Connection point A1 is a connection to the duct supplying heated water from the primary heat exchanger 10.

[0034] Connection point B1 is a connection to the duct supplying return water to the three-way switch valve 12.

[0035] Connection point E is a connection to the duct supplying heated domestic water from the plate heat exchanger 5 to the domestic hot water circuit via the connector 18. Connection point F is a connection to the duct supplying cold domestic water to the plate heat exchanger 5 via the connector 180.

[0036] In the diagram in **Fig. 8**, the secondary plate heat exchanger 5, which is part of a combined heating device 200, is not depicted.

Example 3

Hydraulic module with an optional plate 80 for a system heating device and with an optional plate 90 for a combined heating device

[0037] **Fig. 6** shows the connection of two different optional plates (80, 90) on top of each other. By connecting this assembly to the basic body 1 of the hydraulic module and to the plate heat exchanger 5 (not depicted), another variant of a hydraulic module is created.

[0038] The optional plates (80, 90) are stacked, hydraulically interconnected and mechanically joined by brackets (2) and screws (not depicted).

[0039] As evident from the examples provided, the optional plates (80, 90) allow for integrating various combinations of functions, especially previously unused functions, facilitating the future design change of the hydraulic module.

[0040] Attaining variability simply requires adhering to the dimensions of the optional plates and the placement of the connection points.

[0041] In the examples provided, the connection points are made as recessed holes to accommodate O-ring seals, but other methods of connection are not limited by this.

Industrial applicability

[0042] The optional plates enable simple production and assembly of hydraulic modules, particularly offering a high level of variability in functions provided by heating devices equipped with such hydraulic modules.

[0043] At the same time this simplifies maintenance of the hydraulic module, as in the event of a malfunction, the faulty component can be diagnosed more easily, eliminating the need to replace the entire hydraulic module but only the faulty plate or malfunctioning valve or sensor.

List of reference marks

[0044]

100 - system heating device
200 - combined heating device
1 - basic body of the hydraulic module
2 - mounting brackets
3- reinforcing ribs
4 - clip
5 - plate heat exchanger
6 - plug
7 - bypass duct
80 - optional plate for a system heating device
90 - optional plate for a combined heating device
10 - primary heat exchanger
11 - circulation pump
12 - three-way switch valve
13 - bypass valve
14 - filling loop
15 - temperature sensor
16 - flow sensor
17,170 - connectors to the heating water circuit
18,180 - connectors to the domestic hot water circuit
19,190 - connectors to the external storage tank
The arrows indicate the direction of the flow (into, out of) the respective water circuit and (into, out of) the external tank
A, A1 - connection to the duct supplying heated water from the primary heat exchanger
B, B1 - connection to the duct supplying return water to the three-way valve
C - connection to the duct supplying heated water to the heat exchanger in the external tank
D - connection to the duct supplying return water from the heat exchanger in the external tank
E - connection to the duct supplying heated domestic water from the plate heat exchanger to the domestic hot water circuit
F - connection to the duct supplying cold domestic water to the plate heat exchanger

Claims

1. A hydraulic module for heating systems,
characterized in that
it comprises a basic body (1) and at least one optional plate (80) for a system heating device and/or at least one optional plate (90) for a combined heating device, which are hydraulically connectable to the basic body (1).

2. The hydraulic module according to claim 1,
characterized in that
the basic body (1) of the hydraulic module comprises at least one circulation pump (11), a three-way switch valve (12) for switching the heating circuits, connectors (17,170) to the heating water circuit, connectors (18,180) to the domestic hot water circuit and connectors (19,190) to the external water tank.

3. The hydraulic module according to claim 1 or 2
characterized in that

a bypass valve (13) is arranged on the optional plate (80) for a system heating device
and the optional plate (80) for the system heating device comprises brackets (2), ducts, connectors and connection points (A, B, C, D).

4. The hydraulic module according to claim 1 or 2,
characterized in that,

the bypass valve (13) is arranged on the optional plate (90) for a combined heating device
and the optional plate (90) for the combined heating device comprises connectors for a filling loop (14), for a temperature sensor (15) and for a flow sensor (16), brackets (2), ducts and connection points (A1, B1, E, F).

5. The system heating device (100), with a hydraulic module according to the claim (3), comprising the optional plate (80) for the system heating device, a primary heat exchanger (10), wherein the heating device (100) is connectable to a space heating circuit and to an external storage tank by means of connectors (17,170, 19,190)
characterized in that,

the connection point (A) is the connection to the duct supplying heated water from the primary heat exchanger (10),
the connection point (B) is the connection to the duct supplying return water to the three-way valve (12),
the connection point (C) is the connection to the duct supplying heated water to the heat exchanger in the external storage tank via the connector (19),
the connection point (D) is the connection to the duct supplying return water from the heat exchanger in the external storage tank via the connector (190)

6. The combined heating device (200), with a primary heat exchanger (10), with a plate heat exchanger (5), provided with a hydraulic module according to the claim (4), comprising an optional plate (90) for a combined heating device, wherein the heating device (200) is connectable to a space heating circuit and to a domestic hot water circuit by means of connectors (17,170,18,180),
characterized in that,

the connection point (A1) is a connection to the duct supplying heated water from the primary heat exchanger (10),
the connection point (B1) is a connection to the duct supplying return water to the three-way valve (12),
the connection point (E) is a connection to the duct supplying heated domestic water from the plate heat exchanger (5) to the domestic hot water circuit via the connector (18),
the connection point (F) is a connection to the duct supplying cold water from the domestic water circuit to the plate heat exchanger (5) via the connector (180).

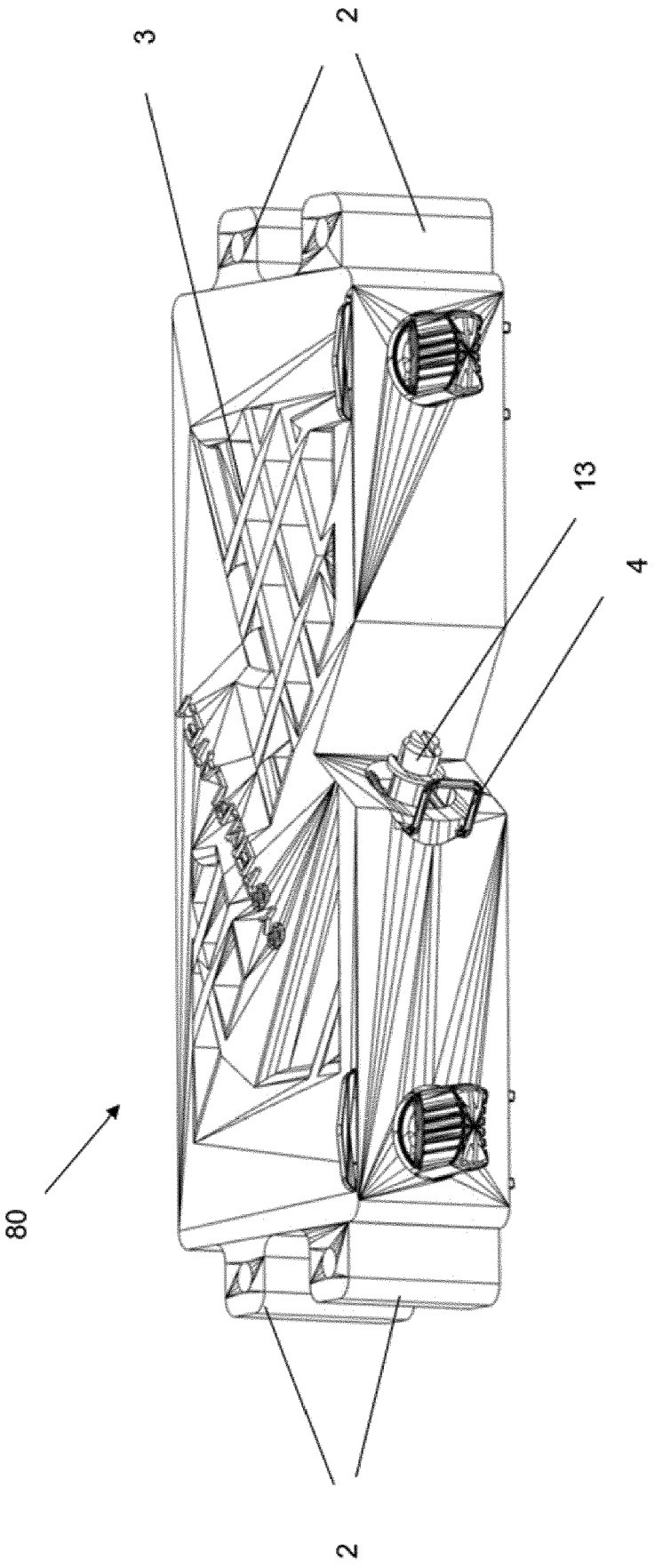

Fig. 1

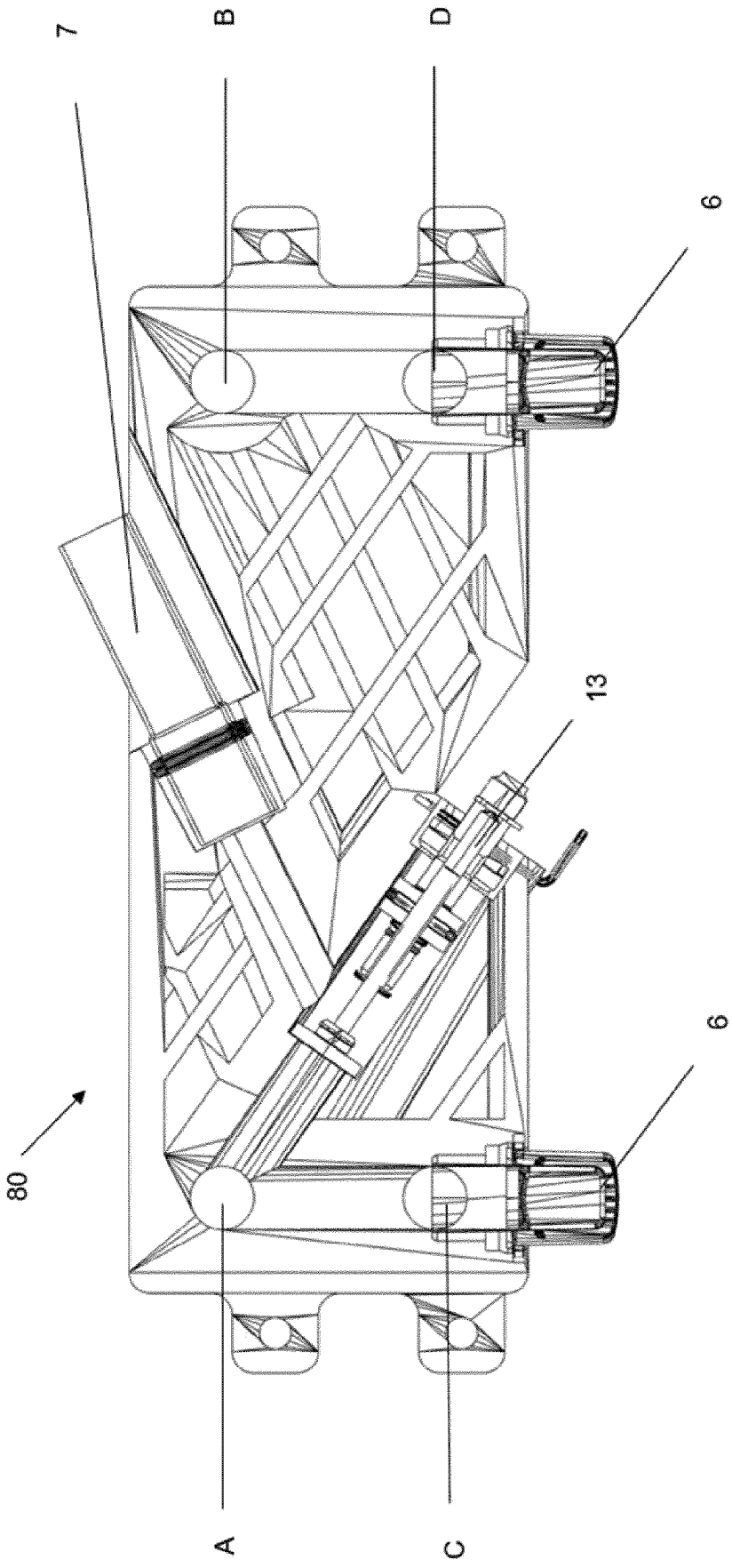

Fig. 2

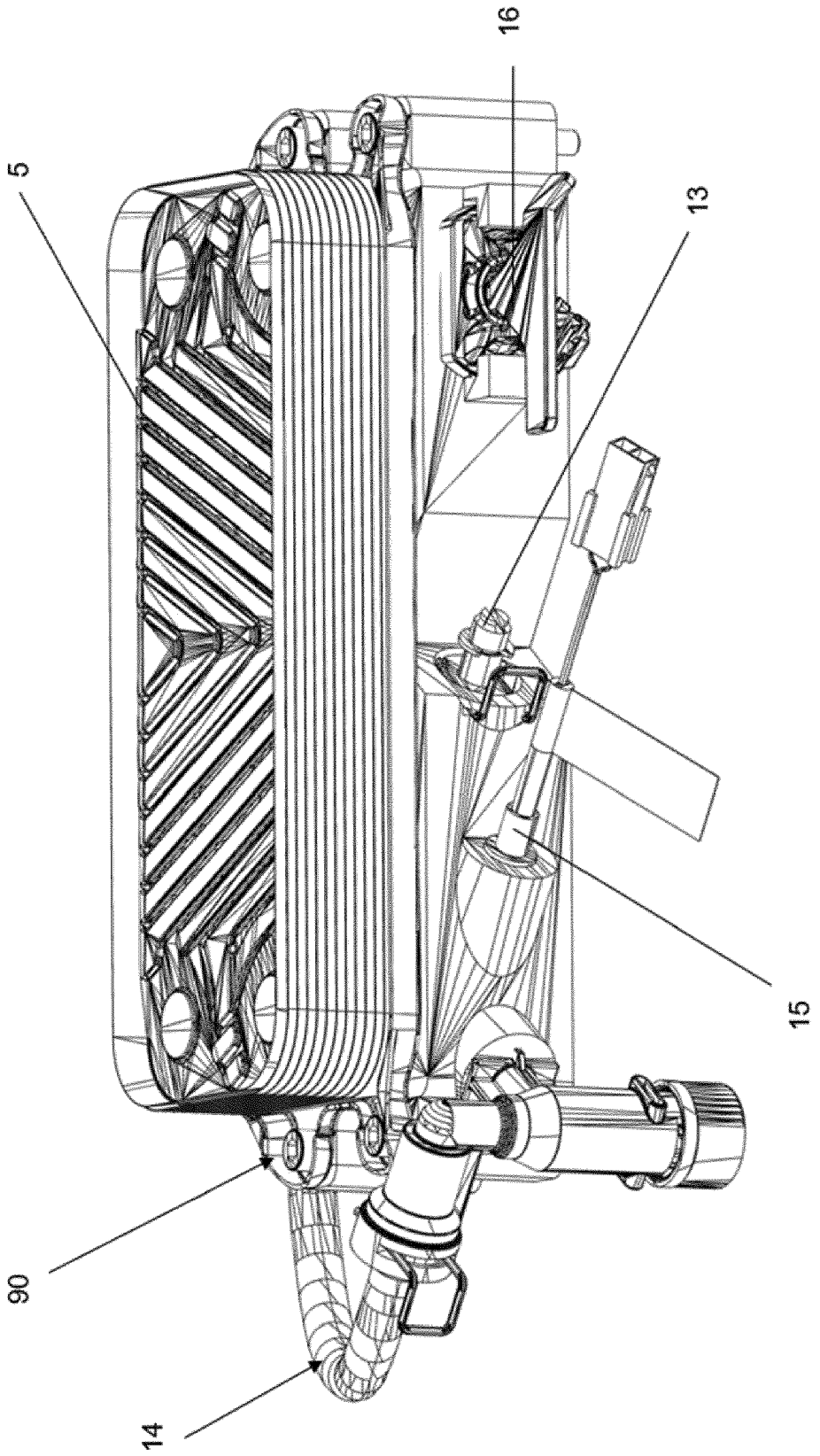

Fig. 3

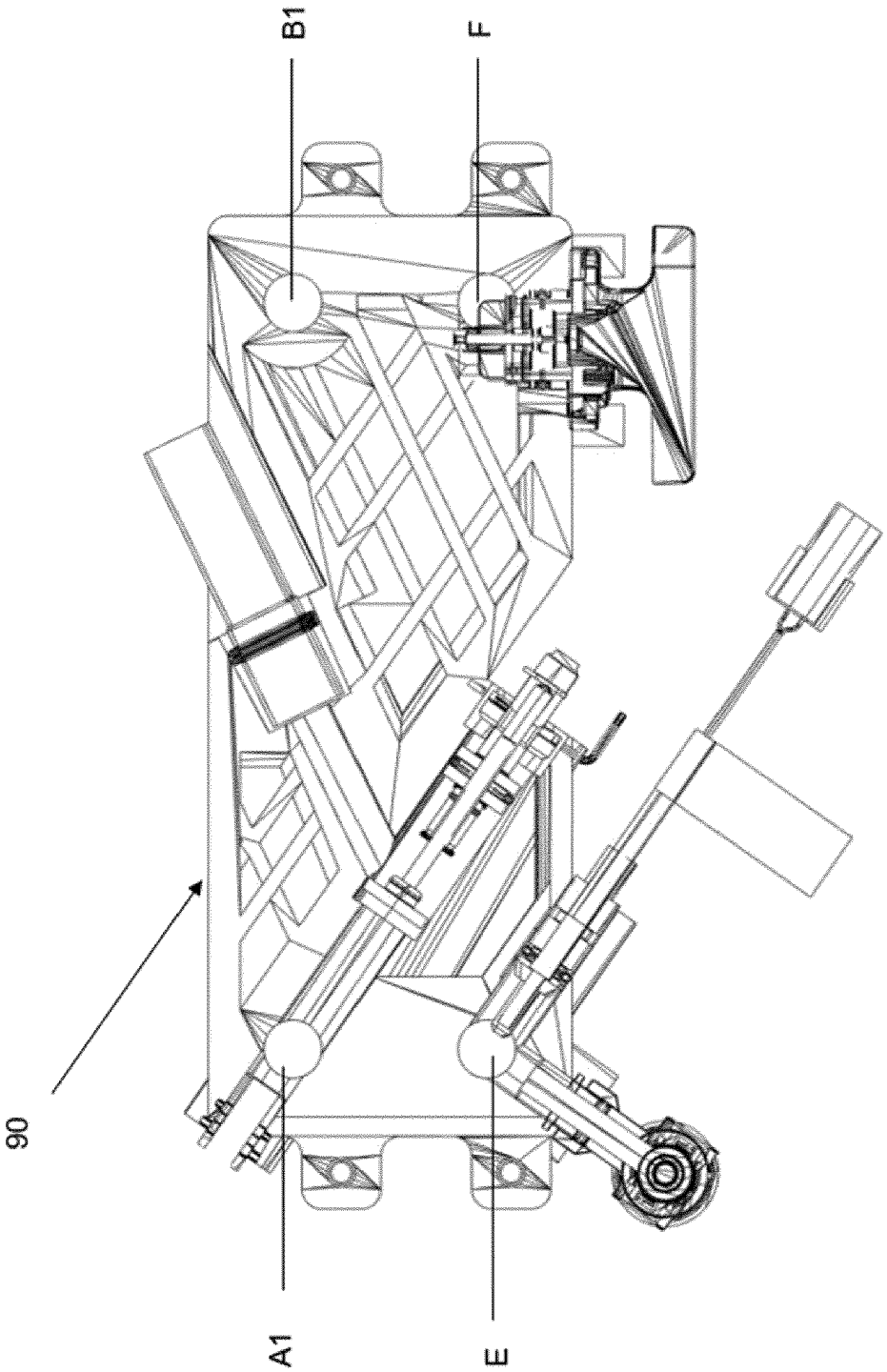

Fig. 4

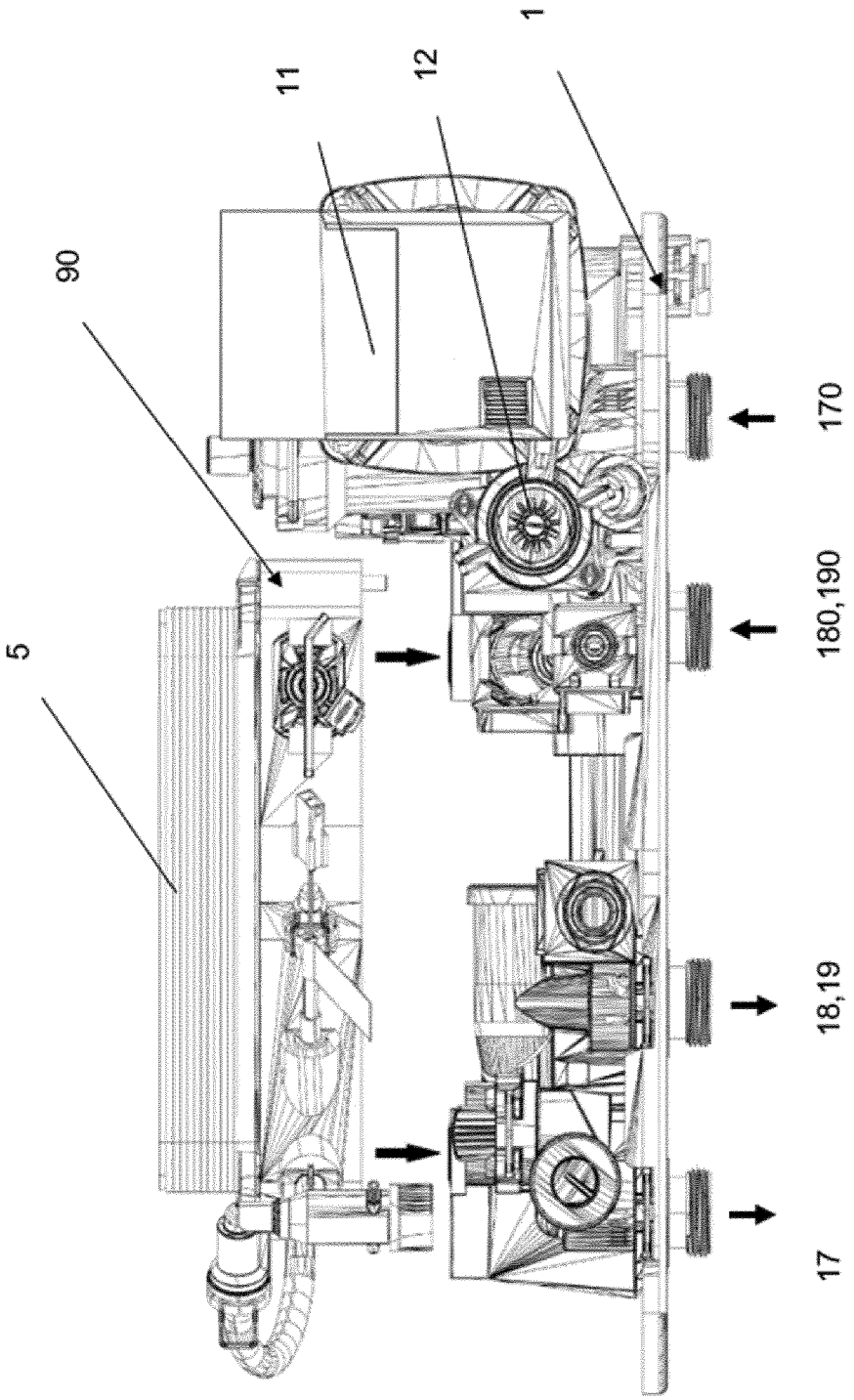

Fig. 5

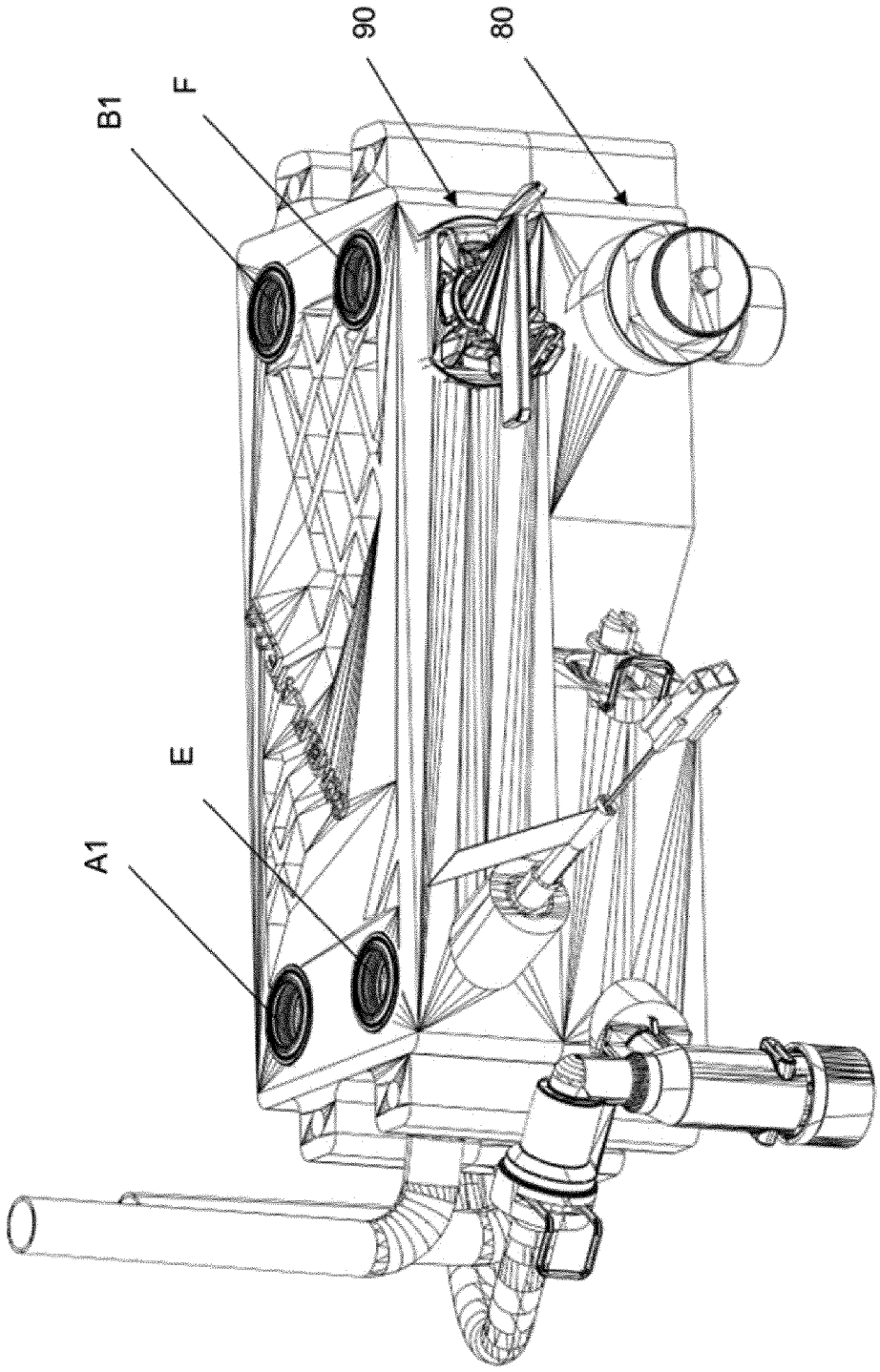

Fig. 6

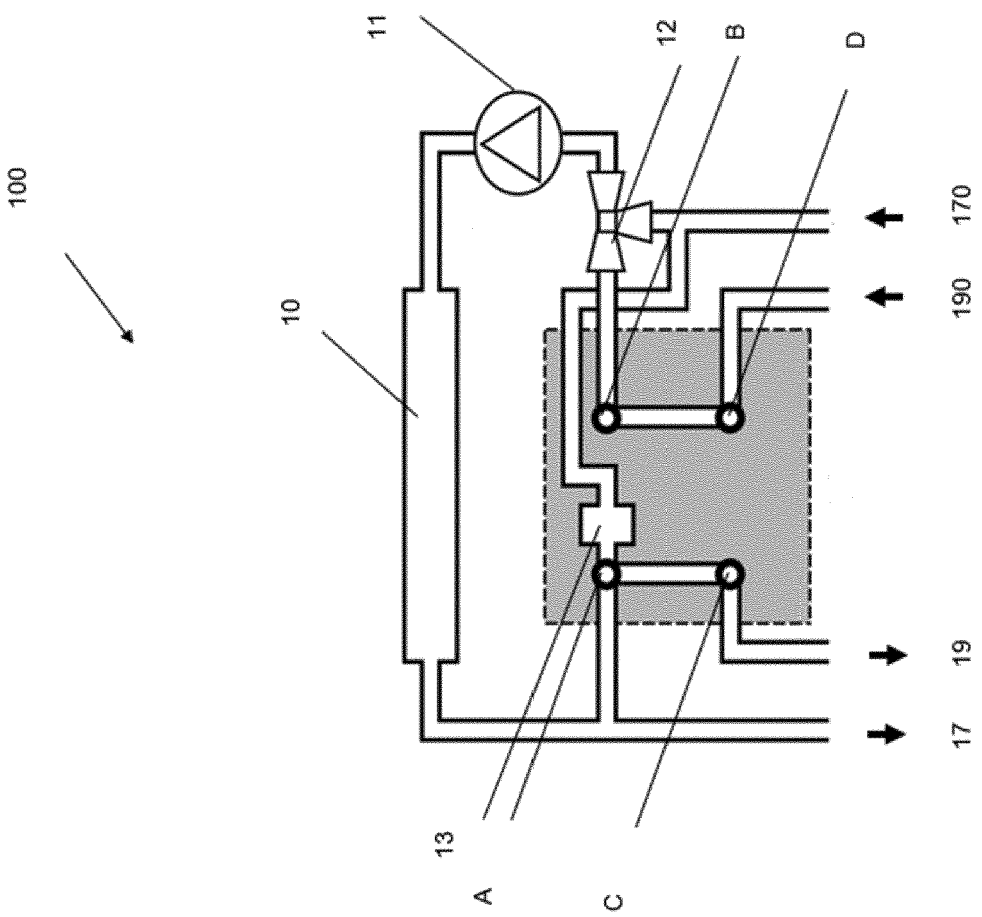

Fig. 7

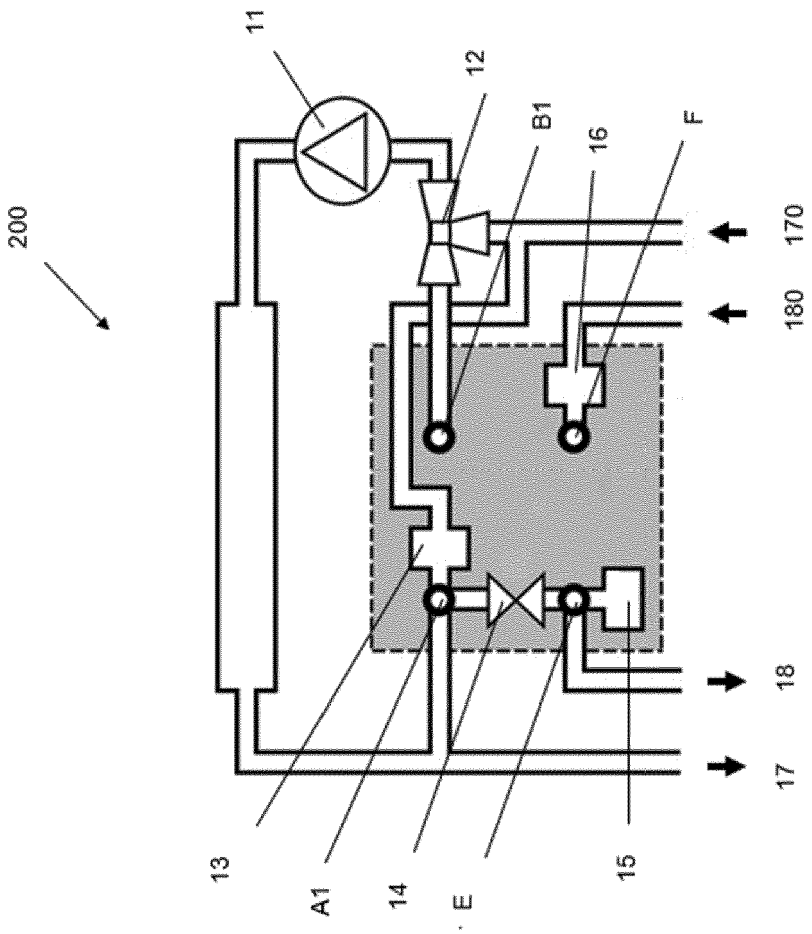

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 24 17 3271

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 408 292 A1 (NEFIT BUDERUS B V [NL]) 14 April 2004 (2004-04-14) * paragraphs [0017] - [0041]; claims 18-19; figures 3-11 *	1-6	INV. F24D3/08 F24H9/14 ADD. F24D19/10
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TECHNICAL FIELDS SEARCHED (IPC)
F24D
F24H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 September 2024	Hoffmann, Stéphanie

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09-09-2024

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