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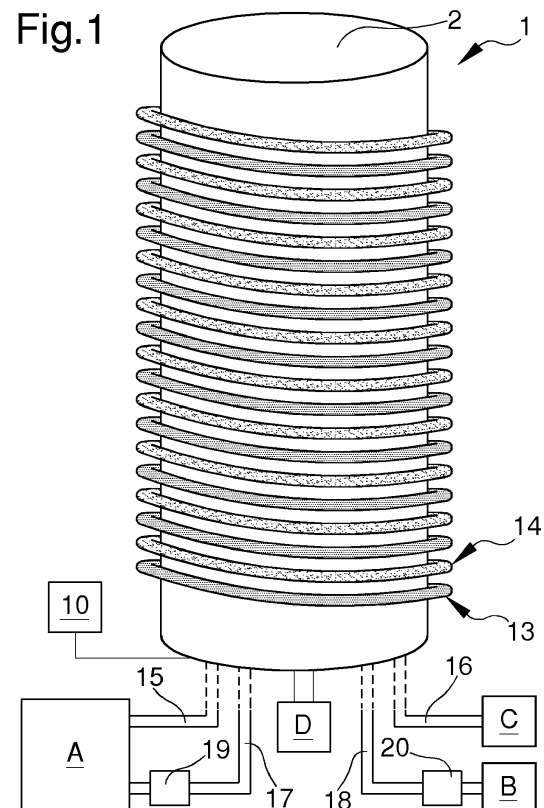
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(54) **APPARATUS FOR THE HEATING OF FLUIDS IN HEATING SYSTEMS AND/OR IN PLUMBING SYSTEMS**

(57) The apparatus (1) for the heating of fluids in heating systems and/or in plumbing systems comprises an external tank (2) containing a diathermic fluid (3), an internal tank (4, 5) connected to a heating system (A) and/or to a plumbing system (B), containing a fluid to be heated (6, 7), housed in the external tank (2) and immersed in the diathermic fluid (3), heating means (8) of the diathermic fluid (3) for the heating by thermal convection of the fluid to be heated (6, 7) in the internal tank (4, 5).



Description

Technical Field

[0001] The present invention relates to an apparatus for the heating of fluids in heating systems and/or in plumbing systems.

Background Art

[0002] With particular reference to the home building sector, the use of boilers for heating water within heating systems and/or plumbing systems has long been known and widespread.

[0003] Domestic boilers commonly operate two types of circuits: a hydraulic circuit and a fuel circuit, generally natural gas.

[0004] In turn, the hydraulic circuit is split into a first sub-circuit intended for heating radiators, which is connected to a primary heat exchanger, and into a second sub-circuit intended for domestic hot water distribution, which is connected to an additional secondary heat exchanger.

[0005] Within a special combustion chamber, mixing of gas with air is carried out, followed by combustion of the gas.

[0006] The thermal energy generated by such combustion is then used to heat water through the first and the second heat exchangers.

[0007] However, the boilers of known type have limitations and drawbacks.

[0008] In particular, the use of a combustible gas involves safety issues due to the high flammability of the gas used and also to the high risk of carbon monoxide produced by combustion.

[0009] This, therefore, involves the use of appropriate safety systems, as well as the need for periodic inspections.

[0010] In addition, the use of combustible gas involves a not insignificant environmental impact, an issue that is increasingly felt.

[0011] In addition, the localization of combustion within the combustion chamber does not allow even heat distribution and, therefore, even heating of the water to be delivered.

[0012] In order to heat water for domestic use, electric boilers (or water heaters) are also known to be used.

[0013] Specifically, an electric boiler comprises a water tank and a coil consisting of a resistor that, when electrically powered, gives off heat to heat the water inside the tank.

[0014] A thermostat regulates the water temperature by controlling the turning on and off of the coil.

[0015] The water thus heated is then mixed by a user with the cold water normally present in the plumbing system in order to obtain the desired temperature. However, even such electric boilers have limitations and drawbacks.

[0016] In particular, heating the water inside the tank by the electric heating element does not promote even heat distribution.

[0017] In addition, the heating element, since it necessarily has to reach very high temperatures, brings the water adjacent thereto to boil, resulting in precipitation of salts. This increases the risk of boiler damage, thus making periodic maintenance operations necessary.

10 Description of the Invention

[0018] The main aim of the present invention is to devise an apparatus for the heating of fluids in heating systems and/or in plumbing systems that enables even heating of the fluid to be distributed.

[0019] Another object of the present invention is to devise an apparatus for the heating of fluids in heating systems and/or in plumbing systems that will result in greater energy savings.

[0020] Another object of the present invention is to devise an apparatus for the heating of fluids in heating systems and/or in plumbing systems that contributes to environmental protection.

[0021] The aforementioned objects are achieved by this apparatus for the heating of fluids in heating systems and/or in plumbing systems according to the characteristics described in claim 1.

Brief Description of the Drawings

[0022] Other characteristics and advantages of the present invention will become more apparent from the description of a preferred, but not exclusive, embodiment of an apparatus for the heating of fluids in heating systems and/or in plumbing systems, illustrated by way of an indicative, yet non-limiting example, in the accompanying tables of drawings in which:

Figure 1 is an axonometric schematic view of the apparatus according to the invention;

Figure 2 is a cross-sectional schematic view of the apparatus according to the invention.

Embodiments of the Invention

[0023] With particular reference to these figures, reference numeral 1 globally indicates an apparatus for the heating of fluids in heating systems and/or in plumbing systems within homes and buildings in general.

[0024] The apparatus 1 comprises an external tank 2 containing a diathermic fluid 3. Preferably, the diathermic fluid 4 used can be of different types depending on the specific characteristics of heat resistance (e.g., up to 300 degrees) and of oxidation resistance.

[0025] In addition, the apparatus 1 comprises at least one internal tank 4, 5 connected to a heating system A and/or to a plumbing system B and containing a fluid to be heated 6, 7. The internal tank 4, 5 is housed in the

external tank 2 and is immersed in the diathermic fluid 3.

[0026] The apparatus 1 comprises heating means 8 of the diathermic fluid 3 for the heating by thermal convection of the fluid to be heated 6, 7 inside the internal tank 4, 5.

[0027] In this way, the thermal energy generated by the heating means 8 diffuses in a substantially even manner through the diathermic fluid 3, consequently uniformly heating the fluid to be heated 6, 7 contained in the internal tank 4, 5, immersed in the diathermic fluid itself.

[0028] With reference to a preferred embodiment, illustrated in the figures, the apparatus 1 comprises a first internal tank 4 connected to a heating system A of a building and containing a heat transfer fluid 6.

[0029] Preferably, the heat transfer fluid 6 is a diathermic fluid.

[0030] In this way, thermal energy coming from the diathermic fluid 3 inside the external tank 2 is transferred by convection to the heat transfer fluid 6 inside the first internal tank 4, which also consists of a diathermic fluid in an effective, fast and uniform manner.

[0031] Alternatively, the heat transfer fluid 6 may be water.

[0032] In addition, again according to the preferred embodiment, the apparatus 1 comprises a second internal tank 5 connected to a water supply network C and to a plumbing system B in the same building and containing domestic water 7. The first and second internal tanks 4 and 5 are both housed inside the external tank 2 and both immersed in the diathermic fluid 3 for the heating by thermal convection of the heat transfer fluid 6 and of the domestic water 7.

[0033] Therefore, heat energy is transferred from the diathermic fluid 3 to the heat transfer fluid 6 and to the domestic water 7 in a uniform and effective manner. In fact, since the first and second internal tanks 4 and 5 are completely immersed in the diathermic fluid 3, the heat is transferred by convection through the entire surface of the first and second internal tanks themselves to the heat transfer fluid 6 and the domestic water 7, respectively.

[0034] According to a preferred embodiment, the heating means 8 comprise at least one electrical coil arranged inside the external tank 2 and in contact with the diathermic fluid 3.

[0035] The electrical coil 8 is connected to a power supply line D.

[0036] Therefore, the apparatus 1 is powered solely by means of electricity. As a result, the apparatus 1 has a low environmental impact.

[0037] In addition, the use of an electrical coil 8 combined with the use of the diathermic fluid 3 allows achieving effective heat distribution and effective maintenance of the desired temperature, together with reduced energy consumption.

[0038] Preferably, the electrical coil 8 is arranged at the point where a lower portion of the external tank 2 is located. This specific location of the electrical coil 8 pro-

motes optimal upwards heat distribution along the diathermic fluid 3. However, a different placement of the electrical coil 8 and/or the use of a plurality of differently positioned electrical coils 8 cannot be ruled out.

[0039] For example, according to one possible embodiment, the apparatus 1 may comprise a plurality of electrical coils 8 arranged in sequence with each other from bottom to top, along a vertical axis substantially central to the external tank 2, and having different power outputs. In this way, optimal heat distribution within the external tank 2 can be achieved.

[0040] In addition, the apparatus 1 comprises at least one temperature sensor 9 arranged inside the external tank 2, immersed in the diathermic fluid 3, configured to detect the temperature of the diathermic fluid itself.

[0041] In addition, the apparatus 1 comprises a management and control unit 10 operatively connected to the electrical coil 8 and to the temperature sensor 9. Specifically, the management and control unit 10 is configured to control the switching on and off, or otherwise the temperature changes, of the electrical coil 8 depending on the temperature detected by the temperature sensor 9. Conveniently, the management and control unit 10 can be configured for the control by means of remote devices.

[0042] According to a preferred embodiment, the apparatus 1 comprises at least one additional temperature sensor 11, 12 arranged inside the internal tank 4, 5, configured to detect the temperature of the fluid to be heated 6, 7 and operatively connected to the management and control unit 10.

[0043] With reference to the preferred embodiment shown in the figures, the apparatus 1 comprises a first additional temperature sensor 11 arranged inside the first internal tank 4, configured to detect the temperature of the heat transfer fluid 6 and operatively connected to the management and control unit 10.

[0044] In addition, the apparatus 1 comprises a second additional temperature sensor 12 arranged inside the second internal tank 5, configured to detect the temperature of the domestic water 7 and operatively connected to the management and control unit 10.

[0045] The apparatus 1 comprises at least one heat recovery circuit 13, 14 connected to the internal tank 4, 5 and to at least one of either the heating system A or the plumbing system B.

[0046] The heat recovery circuit 13, 14 comprises at least one inlet duct 15, 16 of the fluid to be heated 6, 7 contained in the internal tank 2 and provided with at least one stretch extending inside the external tank 2, immersed in the diathermic fluid 3, and/or extending externally to the external tank 2, in contact with at least one portion of the wall of the external tank itself.

[0047] Therefore, the heat recovery circuit 13, 14 allows at least part of the thermal energy of the fluid 6, 7 to be recovered before re-injection into the internal tank 4, 5.

[0048] Preferably, the inlet duct 15, 16 extends substantially in a spiral-like fashion where at least one portion

of the wall of the external tank 2 is located.

[0049] Preferably, in addition, the inlet duct 15, 16 is provided with at least one stretch extending inside the external tank 2, immersed in the diathermic fluid 3, and with at least one stretch extending externally to the external tank 2, in contact with at least one portion of the wall of the external tank itself.

[0050] With reference to the preferred embodiment shown in the figures, the apparatus 1 comprises a first heat recovery circuit 13 provided with a first inlet duct 15 of the heat transfer fluid 6 connected to the heating system A and to the first internal tank 4, for the inlet of the heat transfer fluid 6 into the first internal tank 4 from the heating system A.

[0051] In addition, the first heat recovery circuit 13 comprises a first outlet duct 17 of the heat transfer fluid 6 connected to the first internal tank 4 and to the heating system A, for the delivery of the heat transfer fluid 6 from the first internal tank 4 to the heating system A.

[0052] The first inlet duct 15 is provided with at least one stretch extending inside the external tank 2, immersed in the diathermic fluid 3, and/or externally to the external tank 2, in contact with at least one portion of the external tank itself.

[0053] In addition, the apparatus 1 comprises a second heat recovery circuit 14 provided with a second inlet duct 16 of the domestic water 7 connected to the water supply network C and to the second internal tank 5, for the inlet of the domestic water 7 into the second internal tank 5 from the water supply network C.

[0054] In addition, the second heat recovery circuit 14 comprises a second outlet duct 18 of the domestic water 7 connected to the second internal tank 5 and to the plumbing system B, for the delivery of domestic water 7 from the second internal tank 5 to the plumbing system B.

[0055] The second inlet duct 16 is provided with at least one stretch extending inside the external tank 2, immersed in the diathermic fluid 3, and/or extending externally to the external tank 2, in contact with at least one portion of the external tank itself.

[0056] Preferably, at least one of either the first inlet duct 15 or the second inlet duct 16 extends substantially in a spiral pattern at the point where at least one portion of the external wall of the external tank 2 is located.

[0057] With reference to the preferred embodiment shown in the figures, both the first inlet duct 15 and the second inlet duct 16 extend substantially in a spiral pattern at the point where at least one portion of the external wall of the external tank 2 is located.

[0058] Specifically, the external tank 2 has a substantially cylindrical shape and both the first inlet duct 15 and the second inlet duct 16 extend in a spiral pattern, in alternating spirals, along the side wall of the external tank 2.

[0059] Preferably, at least one of either the first inlet duct 15 or the second inlet duct 16 is provided with at least one stretch extending internally to the external tank 2, immersed in the diathermic fluid 3, and with at least

one stretch extending externally to the external tank 2, in contact with at least one portion of the wall of the external tank itself.

[0060] With reference to the preferred embodiment shown in the figures, both the first inlet duct 15 and the second inlet duct 16 are provided with respective stretches extending internally to the external tank 2, immersed in the diathermic fluid 3, and with respective stretches extending externally to the external tank 2, in contact with at least one portion of the wall of the external tank itself.

[0061] In addition, according to a possible embodiment, the apparatus 1 comprises pumping means 19, 20 of the fluid to be heated 6, 7 from at least one internal tank 4, 5 towards the heating system A and/or towards the plumbing system B. Preferably, the apparatus 1 comprises a first pump 19 for the movement of the heat transfer fluid 6 from the first internal tank 4 towards the heating system A and a second pump 20 for the movement of domestic water 7 from the second internal tank 5 to the plumbing system B.

[0062] Conveniently, the apparatus 1 may comprise an expansion vessel operatively connected to the first internal tank 4, located externally to the external tank 2, and adapted to modulate any sudden changes in the pressure of the heat transfer fluid 6.

[0063] In addition, according to a preferred embodiment, the apparatus 1 comprises at least one safety valve operatively connected to the external tank 2 and adapted to allow venting and thus controlling the outflow of the diathermic fluid 3 in case of excessive pressures inside the external tank 2.

[0064] Conveniently, according to a possible embodiment, the apparatus 1 comprises an electronic mixer operatively connected to the management and control unit 10 and connected to the second inlet duct 16 of domestic water 7, connected to the water supply network C, and to the second outlet duct 18 of domestic water 7, connected to the second internal tank 5 and to the plumbing system B. According to this possible embodiment, the apparatus 1 comprises a first mixing sensor, arranged in the second internal tank 5 and adapted to detect the temperature of domestic water 7, and a second mixing sensor, arranged internally to the second inlet duct 16. Both mixing sensors are operatively connected to the management and control unit 10.

[0065] According to this embodiment, the management and control unit 10 is configured to control the electronic mixer for the modulation of the temperature of the domestic water 7 delivered to the plumbing system B depending on a preset temperature.

[0066] In this way, it is possible to deliver a flow of domestic water 7 at the programmed temperature by simply opening the tap, without the need to operate the same several times.

[0067] In addition, this allows a significant decrease in the collection of boiling domestic water 7 from the second internal tank 5, resulting in energy savings. In addition, this allows for the absence of circulating boiling water in

the pipes, with the dual benefit of not deteriorating the same and dispersing heat unnecessarily along the way.

[0068] According to a further possible embodiment, the apparatus 1 may comprise an additional tank for the domestic water 7, arranged outside the external tank 2 and connected to the second internal tank 5 via a dedicated circuit.

[0069] According to this possible embodiment, the apparatus 1 also comprises modulation means operatively connected to the management and control unit 10 and configured to modulate the flow of domestic water 7 between the second internal tank 5 and the additional tank. In addition, the additional tank can be provided with a respective heating resistor.

[0070] In this way, in addition to increased availability of domestic water 7, energy resources can be optimized. In fact, water flow between the two tanks is subject to a precise functional mode that assigns the delivery of hot domestic water 7 and the replenishment of water drawn from the additional tank. Thus, as domestic water 7 is collected from the second internal tank 5, the additional tank will replenish it by feeding the high temperature water stored therein. This mechanism, suitably programmed and controlled by the management and control unit 10, makes it possible to reduce the continuous ignition of the electrical coil 8 located inside the external tank 2, thus promoting the maintenance of the temperature therein.

[0071] Conveniently, moreover, to promote comfort in different rooms, sensors can be placed which detect the temperature of the rooms and transmit it to the management and control unit 10 which, appropriately programmed, computes the average temperature and, depending on the set-up, starts the heating circuit, which will automatically turn on and off when the pre-set room climate is reached.

[0072] Thus, since the heat transfer fluid 6 circulating in the radiators, coming from the first internal tank 4 inside the external tank 2 and immersed in the diathermic fluid 3, is characterized by high temperature (80 90 degrees), it will promote faster achievement of environmental comfort and greater stability of this condition.

[0073] The management and control unit 10, appropriately programmed, will make it possible to rationalize energy resources and daily organization.

[0074] It has in practice been ascertained that the described invention achieves the intended objects.

[0075] In particular, it is emphasized that the apparatus according to the invention enables even heating of the fluid to be distributed. Specifically, this is enabled by the use of the external tank containing a diathermic fluid and by one or more internal tanks containing the fluid to be heated and distributed, arranged inside the external tank and immersed in the diathermic fluid. The heat generated by the electrical coil is evenly distributed to the diathermic fluid, which heats by convection the fluid contained in the internal tanks.

[0076] In addition, the apparatus according to the in-

vention achieves greater energy savings than the solutions of known type.

[0077] In fact, the use of heating means of the electric type, together with the use of a diathermic fluid to distribute and maintain heat, allows for less heat dissipation and less energy consumption for the maintenance of a constant temperature.

10 Claims

1. Apparatus (1) for the heating of fluids in heating systems and/or in plumbing systems, **characterized by** the fact that it comprises:

- at least one external tank (2) containing a diathermic fluid (3);
- at least one internal tank (4, 5) connected to a heating system (A) and/or to a plumbing system (B), containing a fluid to be heated (6, 7), housed in said external tank (2) and immersed in said diathermic fluid (3);
- heating means (8) of said diathermic fluid (3) for the heating by thermal convection of said fluid to be heated (6, 7) in said at least one internal tank (4, 5).

2. Apparatus (1) according to claim 1, **characterized by** the fact that it comprises at least one heat recovery circuit (13, 14) connected to said at least one internal tank (4, 5) and to at least one of either said heating system (A) or said plumbing system (B), wherein said heat recovery circuit (13, 14) comprises at least one inlet duct (15, 16) of said fluid to be heated (6, 7) into said internal tank (4, 5) provided with at least one stretch extending inside said external tank (2), immersed in said diathermic fluid (3), and/or extending externally to said external tank (2), in contact with at least one portion of the wall of the external tank itself.

3. Apparatus (1) according to claim 2, **characterized by** the fact that said inlet duct (15, 16) extends substantially spirally at the point where at least one portion of the wall of said external tank (2) is located.

4. Apparatus (1) according to one or more of claims 2 and 3, **characterized by** the fact that said inlet duct (15, 16) is provided with at least one stretch extending inside said external tank (2), immersed in said diathermic fluid (3), and at least one stretch extending externally to said external tank (2), in contact with at least one portion of the wall of the external tank (2) itself.

5. Apparatus (1) according to one or more of the preceding claims, **characterized by** the fact that said heating means (8) comprise at least one electrical

coil (8) arranged inside said external tank (2) and in contact with said diathermic fluid (3).

6. Apparatus (1) according to claim 5, **characterized by** the fact that said electrical coil (8) is arranged at the point where a lower portion of said external tank (2) is located. 5
7. Apparatus (1) according to one or more of the preceding claims, **characterized by** the fact that it comprises at least one temperature sensor (9) arranged inside said external tank (2), immersed in said diathermic fluid (3), configured to detect the temperature of said diathermic fluid (3). 10
8. Apparatus (1) according to claim 7, **characterized by** the fact that it comprises at least one management and control unit (10) operatively connected to said heating means (8) and to said temperature sensor (9). 15
9. Apparatus (1) according to claim 8, **characterized by** the fact that it comprises at least one additional temperature sensor (11, 12) arranged inside said at least one internal tank (4, 5), configured to detect the temperature of said fluid to be heated (6, 7) and operatively connected to said management and control unit (10). 20
10. Apparatus (1) according to one or more of the preceding claims, **characterized by** the fact that it comprises: 25
 - at least a first internal tank (4) connected to a heating system (A) and containing a heat transfer fluid (6); 30
 - at least a second internal tank (5) connected to a water supply network (C) and to a plumbing system (B) and containing domestic water (7); 35
 - said first and second internal tanks (4, 5) being both housed inside said external tank (2) and immersed in said diathermic fluid (3) for the heating by thermal convection of said heat transfer fluid (6) and of said domestic water (7). 40
11. Apparatus (1) according to claim 10, **characterized by** the fact that it comprises at least a first heat recovery circuit (13) provided with: 45
 - a first inlet duct (15) of said heat transfer fluid (6) connected to said heating system (A) and to said first internal tank (4), for the inlet of said heat transfer fluid (6) into said first internal tank (4) from said heating system (A); 50
 - a first outlet duct (17) of said heat transfer fluid (6) connected to said first internal tank (4) and to said heating system (A), for the delivery of said heat transfer fluid (6) from said first internal 55

tank (4) to said heating system (A);

- wherein said first inlet duct (15) is provided with at least a stretch extending inside said external tank (2), immersed in said diathermic fluid (3), and/or externally to said external tank (2), in contact with at least one portion of the external tank (2) itself.

12. Apparatus (1) according to one or more of claims 10 and 11, **characterized by** the fact that it comprises at least a second heat recovery circuit (14) provided with:

- a second inlet duct (16) of said domestic water (7) connected to said water supply network (C) and to said second internal tank (5), for the inlet of said domestic water (7) into said second internal tank (5) from said water supply network (C);

- a second outlet duct (18) of said domestic water (7) connected to said second internal tank (5) and to said plumbing system (B), for the delivery of said domestic water (7) from said second internal tank (5) to said plumbing system (B);

- wherein said second inlet duct (16) is provided with at least one stretch extending inside said external tank (2), immersed in said diathermic fluid (3), and/or extending externally to said external tank (2), in contact with at least one portion of the external tank (2) itself.

13. Apparatus (1) according to one or more of claims 8 to 12, **characterized by** the fact that it comprises at least a first additional temperature sensor (11) arranged inside said first internal tank (4), configured to detect the temperature of said heat transfer fluid (6) and operatively connected to said management and control unit (10).

14. Apparatus (1) according to one or more of claims 8 to 13, **characterized by** the fact that it comprises at least a second additional temperature sensor (12) arranged inside said second internal tank (5), configured to detect the temperature of said domestic water (7) and operatively connected to said management and control unit (10).

15. Apparatus (1) according to one or more of claims 10 to 14, **characterized by** the fact that said heat transfer fluid (6) is a diathermic fluid (3).

Fig.1

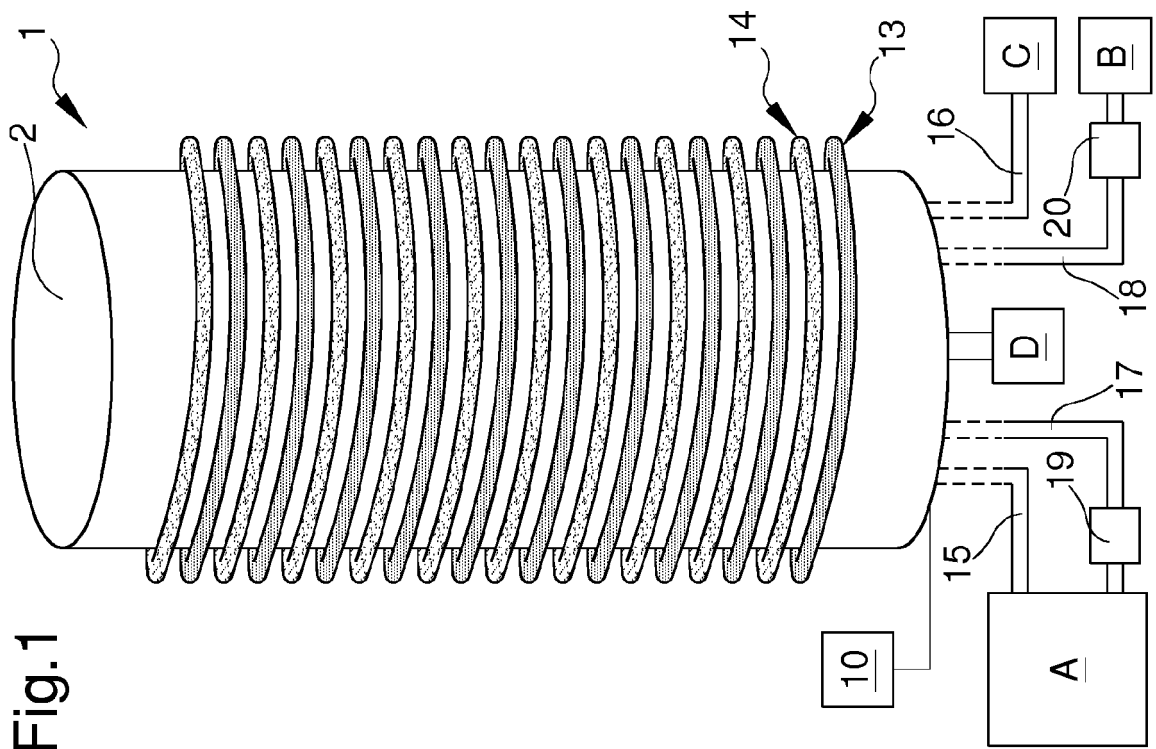
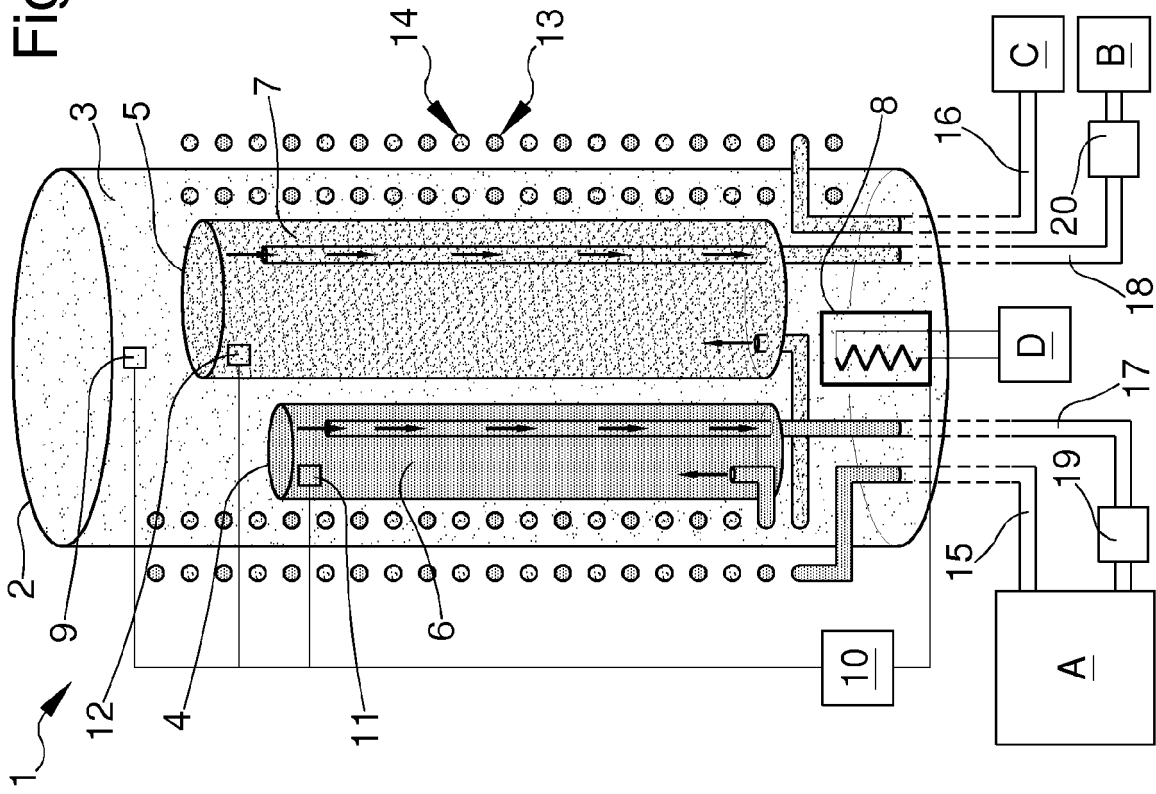


Fig.2





EUROPEAN SEARCH REPORT

Application Number

EP 22 18 4472

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			F24H F28F F24D F28D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		10 October 2022	Ast, Gabor
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 18 4472

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