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(54) **A fluid-heating device for a washing machine, in particular a dishwasher**

(57) The heating device (10) comprises a hollow body (11) in which a (first) duct (15) for the passage of a flow of liquid (4) to be sent towards the washing chamber (2) is defined, and with which an electrical resistance heater (17) for heating the flow of liquid passing through the duct (15) is associated. A further or second duct (16), separated from the first duct by a thermally-conductive wall (14), is defined in the body (11) for the passage of an air-flow which is also to be supplied to the washing chamber (2) and which can be heated by the heater (17) during its passage through the second duct (16). The electrical resistance heater (17) is disposed in the second duct (16) and is connected in an arrangement for exchanging heat with the thermally-conductive wall (14).

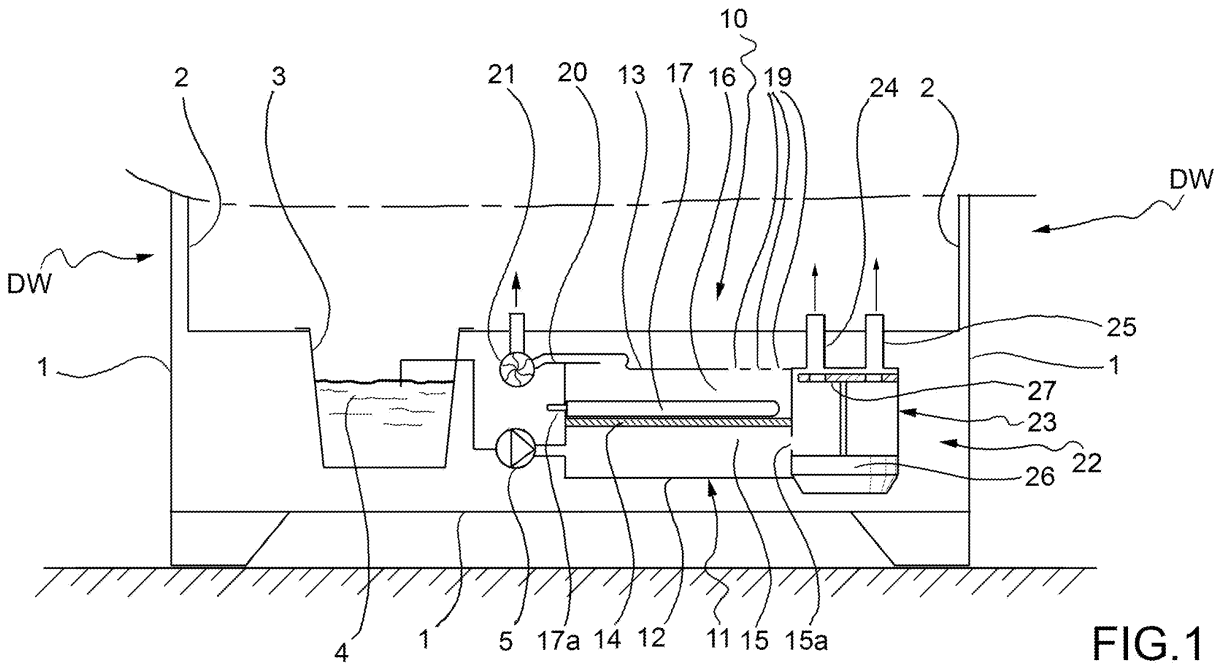

FIG.1

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Description

[0001] The present invention relates to a device for supplying and heating a washing liquid in a washing machine, in particular a dishwasher, in which a washing chamber is defined.

[0002] More specifically, the subject of the invention is a device comprising a hollow body in which a (first) duct for the passage of a flow of liquid to be sent towards the washing chamber is defined, and with which an electrical resistance heater for heating the flow of liquid passing through the duct is associated.

[0003] In dishwashers, in order for the crockery to be dried properly, it must be brought to a high temperature. According to the prior art, this is achieved by means of a final rinsing of the crockery with very hot water. However, this technique leads to a high energy consumption.

[0004] According to an alternative solution, during the final stage of a washing cycle, a forced air-flow is circulated through the same duct of the above-defined liquid-heating device and is heated by the same heater that is associated with the duct. This solution is highly efficient and leads to a substantial energy saving in comparison with rinsing with very hot water. However, it has the disadvantage that a quantity of liquid may remain in the duct of the device for heating the washing liquid and, although the quantity may be small, it may increase the moisture content of the air-flow which is subsequently heated in the device during the crockery-drying stage.

[0005] An object of the present invention is to provide a heating device of the type defined at the beginning which overcomes the above-mentioned disadvantages of the solutions of the prior art.

[0006] This and other objects are achieved, according to the invention, by a device of the type defined at the beginning, characterized in that a further or second duct, separated from the first duct by a thermally-conductive wall, is defined in the body for the passage of an air-flow which is also to be supplied to the washing chamber and which can be heated by the same heater during its passage through the further or second duct, the resistance heater being disposed in the second duct and being connected in an arrangement for exchanging heat with the thermally-conductive wall.

[0007] Further characteristics and advantages of the invention will become clear from the following detailed description which is given purely by way of non-limiting example with reference to the appended drawings, in which:

Figure 1 is a partial schematic view of a dishwasher provided with a device according to the present invention,

Figure 2 is a perspective view which shows an embodiment of a device according to the invention,

Figure 3 is a partially-exploded perspective view of the device shown in Figure 2, and

Figure 4 is a perspective view of a portion of the device of Figures 2 and 3.

[0008] In Figure 1, a dishwasher, generally indicated DW, comprises, in known manner, a support structure 1 inside which a washing chamber 2 is defined.

[0009] In its lower portion, the washing chamber 2 communicates with a sump 3 for collecting the liquid 4 which forms the washing bath.

[0010] In known manner, an electric feed pump 5 draws a flow of washing liquid from the sump 3 and sends it to a heating device according to the invention, generally indicated 10.

[0011] With reference also to Figures 2 and 3, the device 10 comprises a hollow body 11 which, in the embodiment shown by way of example, has a generally tubular configuration and is formed substantially by two half-shells 12 and 13 which are connected to one another in a fluid-tight manner with the interposition of a thermally-conductive separating wall, indicated 14 in Figures 1, 3 and 4.

[0012] Two passageways or ducts, indicated 15 and 16 in Figure 1, are thus defined in the region inside the body 11 for the passage of a flow of water and a flow of air which are used in the washing chamber 2, respectively.

[0013] The thermally-conductive wall 14 may advantageously be made of aluminium or an alloy thereof. An electrical resistance heater 17 of known type is connected, for example, by means of a welded joint 18 (Figure 4), to the surface of the wall 14 which faces the air duct 16 (crockery-drying air), the ends of the heater 17 with the respective terminals 17a extending outside the body 11.

[0014] As can be seen in Figures 3 and 4 in particular, in the embodiment illustrated, the thermally-conductive wall 14 is substantially flat and extends in a longitudinal plane inside the body 11.

[0015] With reference once again to Figure 1, the duct 16 for the heating of the air that is used to dry the crockery has one or more air-inlet openings, indicated 19, which are constituted, for example, by longitudinal slots formed in the half-shell 13, as can be seen in Figure 2 and 3. This shell also forms an air outlet, indicated 20 in Figures 1 to 3, which is connected to an electric circulation fan, indicated 21 in Figure 1. In operation, the electric fan is intended to convey to the washing chamber 2 an air-flow which is heated beforehand by the device 17 as that flow passes through the duct 16 of the device 10.

[0016] Still with reference to Figure 1, the duct 15 for the washing liquid is connected to the outlet or delivery of the electric pump 5.

[0017] In the embodiment shown by way of example, the heating device 10 is combined with an associated motorized flow-diverter device, generally indicated 22 in Figures 1 to 3. This device, which is of known type, comprises, basically, a hollow body 23 the interior of which communicates with the duct 15 of the heating device 10 through a passageway indicated 15a in Figure 1. The

body 23 forms two outlet connectors 24 and 25 (Figure 1) which are intended to be connected hydraulically to an upper spray rotor and to a lower spray rotor in the washing chamber 2, in known manner.

[0018] The flow-diverter device 22 comprises an electric motor 26 the rotor of which can rotate a disk 27 which is provided with openings through which the washing liquid that is heated as it passes through the duct 15 of the heating device 10 can be supplied selectively to one and/or the other outlet connector 24 and/or 25 and hence selectively to one and/or the other spray rotor.

[0019] With reference to Figures 2 and 3, the flow-diverter device 22 may advantageously be provided with an electrical device of known type, indicated 28, for detecting the turbidity of the washing liquid.

[0020] Again with reference to Figures 2 and 3, two openings or seats 29, 30 are advantageously formed in the half-shell 12 of the heating device 10; respective diaphragm and microswitch pressure sensors 31 and 32 for detecting the presence of water in the duct 15 are connected to the openings 29, 30.

[0021] In operation, each time a flow of heated water is to be supplied to the spray rotors, the operative control unit of the machine (the unit is not shown but is of known type) brings about activation of the electric pump 5 and the supply of a current to the resistance heater 17. Owing to thermal conduction through the thermally-conductive separating wall 14, the heater brings about rapid heating of the flow of washing liquid in the duct 15 as it passes through the duct. The diverter 22 supplies the heated washing liquid to the spray rotors.

[0022] When, upon completion of a washing cycle, the crockery is to be dried, the control unit of the machine activates the electric fan 21 which draws a flow of air into the duct 16 through the openings or slots 19. The unit also causes a current to flow through the heater 17 which heats the air-flow passing through the duct 16.

[0023] In a manner not illustrated, an electric temperature sensor and/or an electric humidity sensor may be associated with the heating device 10 to supply electrical signals indicative of the temperature and of the degree of humidity, respectively, of the air-flow used for drying the crockery and the control unit of the machine is advantageously arranged to control the activation of the resistance heater 17 and optionally also of the electric fan 21 according to the signals supplied by those sensors.

[0024] In embodiments not shown in the drawings, the body of the heating device 10 may comprise a substantially tubular outer wall and a thermally-conductive inner wall which is also tubular and extends longitudinally inside the outer wall. The inner, thermally-conductive wall defines a first duct in its interior and, jointly with the outer wall, defines a second, annular duct extending around the first duct. In one embodiment, a flow of washing liquid may pass through the inner duct and an air-flow for drying the crockery is then intended to flow through the outer duct. In another embodiment, the air-flow for drying the crockery is intended to flow through the inner duct and the flow of washing liquid is intended to flow through the outer duct. In both of the embodiments just described, the resistance heater is advantageously disposed in the duct through which the air-flow is intended to pass, in an arrangement for exchanging heat with the thermally-conductive wall which separates the two ducts.

[0025] Finally, it is pointed out that, although this description relates to a dishwasher as an example of use, a heating device according to the invention could also advantageously be used in machines of other types, for example, in laundry washing/drying machines.

[0026] Naturally, the principle of the invention remaining the same, the forms of embodiment and details of construction may be varied widely with respect to those described and illustrated purely by way of non-limiting example, without thereby departing from the scope of the invention as defined in the appended claims.

Claims

1. A device (10) for heating a washing liquid (4) in a washing machine (1), in particular a dishwasher (1), in which a washing chamber (2) is defined, the device (10) comprising:

   a hollow body (11) in which a (first) duct (15) for the passage of a flow of liquid (4) to be sent towards the washing chamber (2) is defined, and with which an electrical resistance heater (17) for heating the flow of liquid passing through the duct (15) is associated,
   the device (10) being **characterized in that** a further or second duct (16), separated from the first duct by a thermally-conductive wall (14), is defined in the body (11) for the passage of an air-flow that is also to be supplied to the washing chamber (2) and which can be heated by the heater (17) during its passage through the further or second duct (16), the electrical resistance heater (17) being disposed in the second duct (16) and being connected in an arrangement for exchanging heat with the thermally-conductive wall (14).

2. A device according to Claim 1 in which the body (11) has a generally tubular configuration and the thermally-conductive wall (14) is substantially flat and extends in a longitudinal plane in the body (11), dividing its interior into two regions (15, 16) which are separated from one another in a fluid-tight manner.

3. A device according to Claim 1 in which the body has a substantially tubular outer wall and a likewise tubular, thermally-conductive inner wall which defines an inner duct and extends longitudinally inside the outer wall defining, relative thereto, a second, annular duct outside the first duct.

4. A device according to Claim 3 in which the flow of liquid is intended to pass through the inner duct and the air-flow is intended to pass through the outer duct.

5. A device according to Claim 3 in which the air-flow is intended to pass through the inner duct and the flow of liquid is intended to pass through the outer duct.

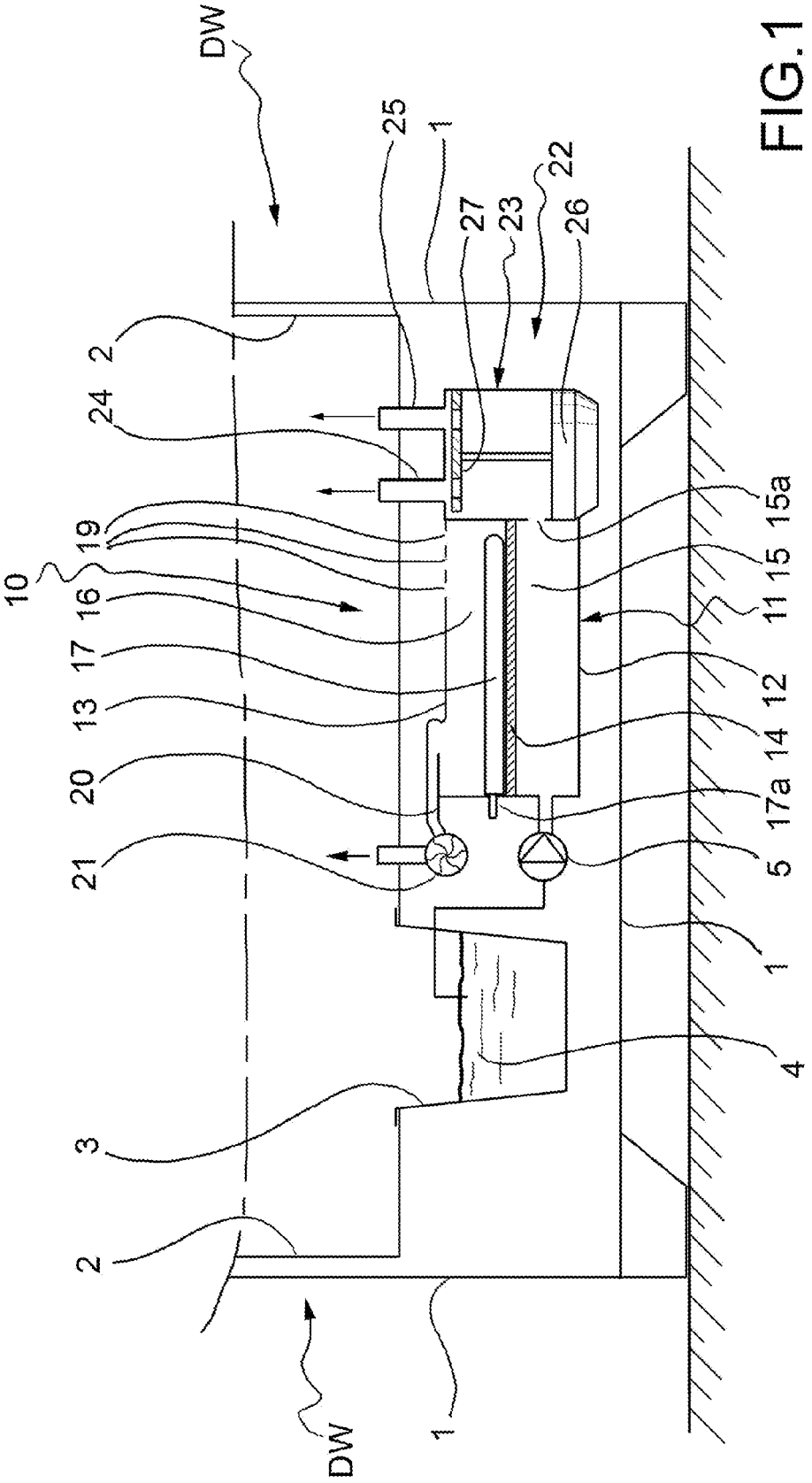
6. A device according to any one of the preceding claims in which the heater comprises an electrical resistor (17) welded to the thermally-conductive wall (14).

7. A device according to any one of the preceding claims, for a dishwasher (1) in which a first and a second washing-liquid spray rotor are provided in the washing chamber (2), and in which the outlet of the first duct communicates with a motorized flow-diverter device (22) which can direct the flow of liquid coming from the first duct (15) selectively towards one and/or the other spray rotor.

8. A device according to any one of the preceding claims, comprising an electrical temperature sensor which can supply electrical signals indicative of the temperature of the air in the second duct (16) or coming therefrom, and control means which can de-activate the heater (17) when the temperature exceeds a predetermined value.

9. A device according to any one of the preceding claims, further comprising an electrical humidity sensor which can supply electrical signals indicative of the degree of humidity of the air in the second duct (16) or coming therefrom, and control means which can drive the heater (17) according to the degree of humidity detected.

10. A device according to any one of the preceding claims in which the thermally-conductive wall (14) is made of aluminium or aluminium alloy.


DW
25
1
22
27
23
26
2
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10
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15a
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12
14
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DW
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FIG.1

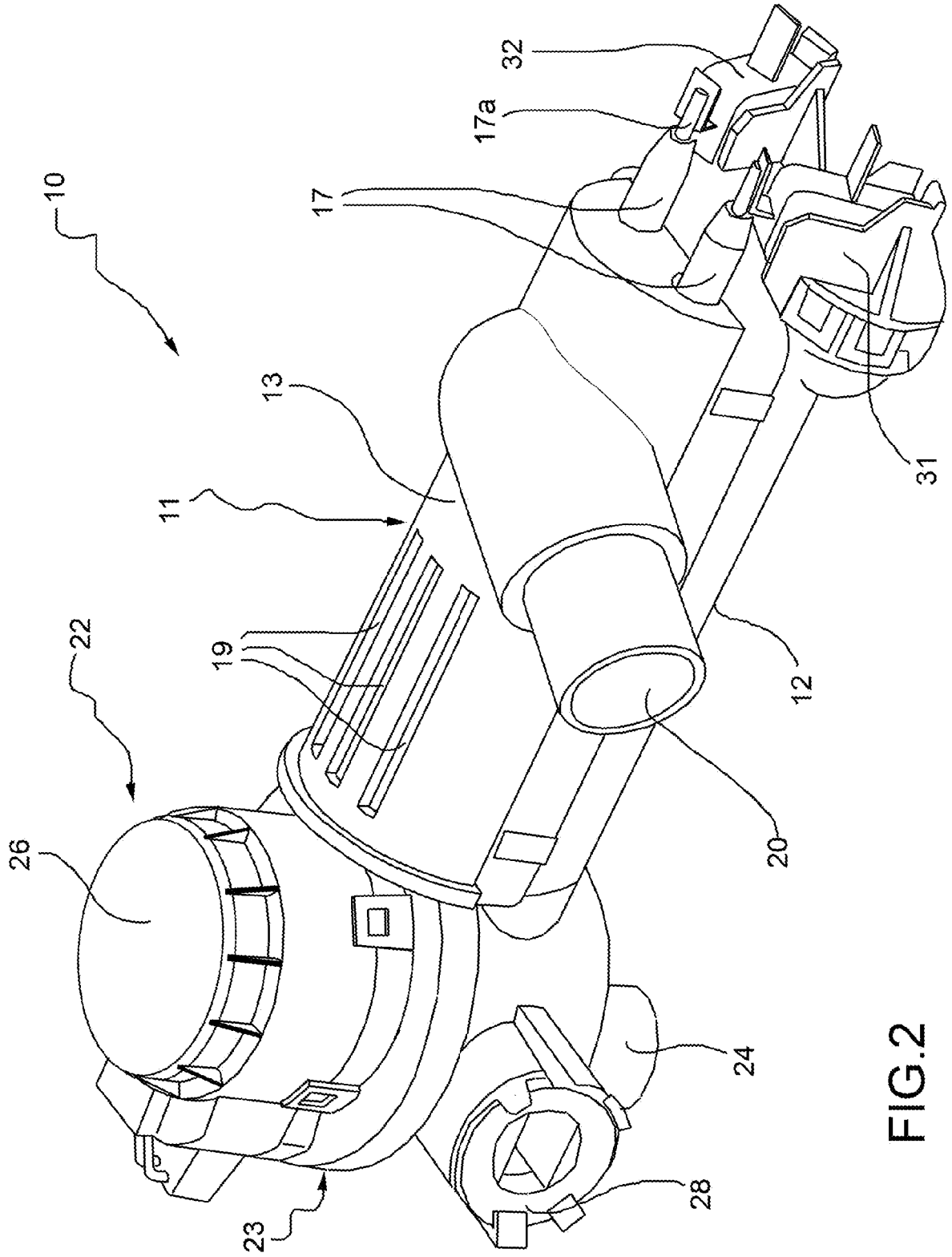

FIG.2

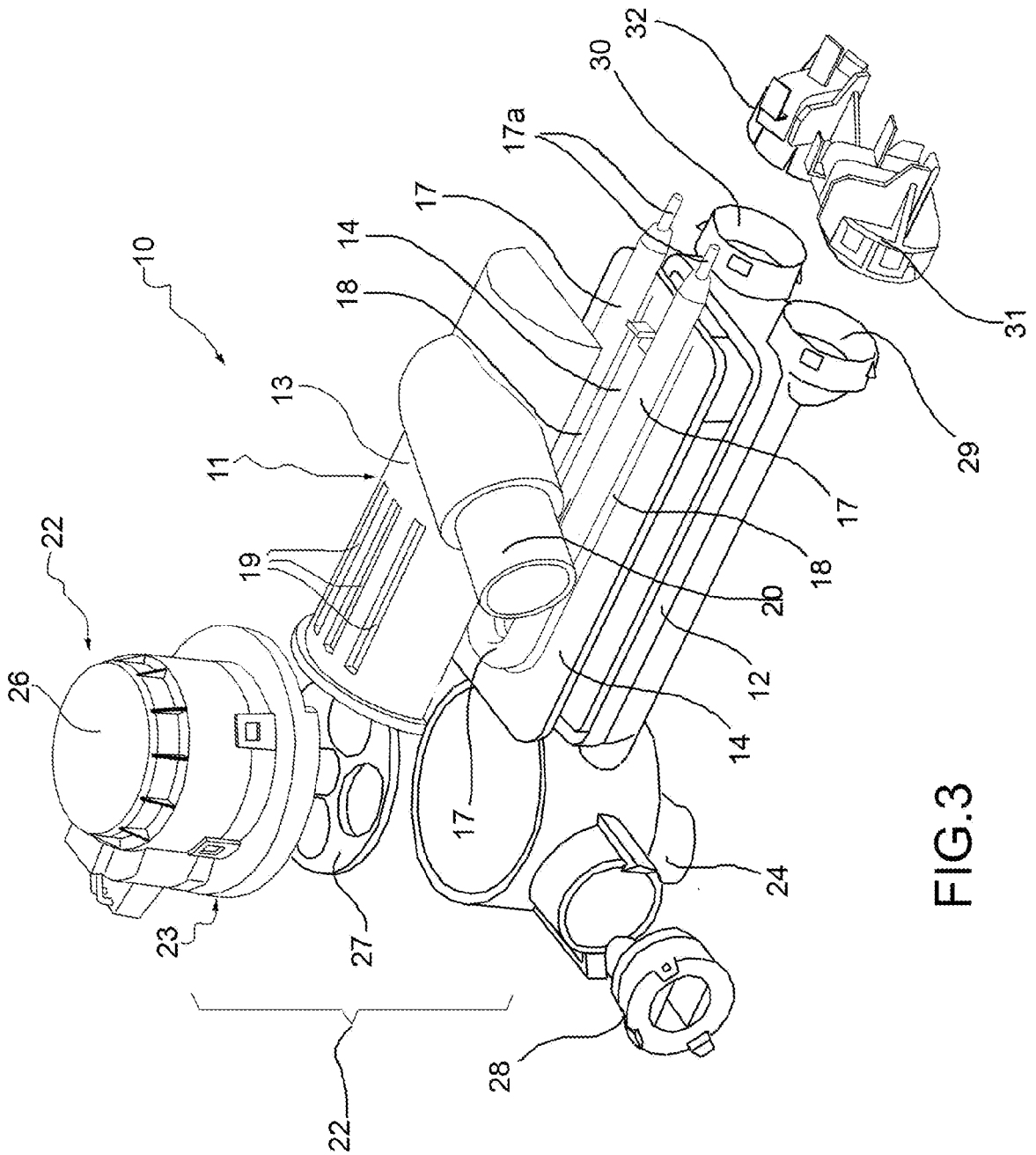

FIG.3

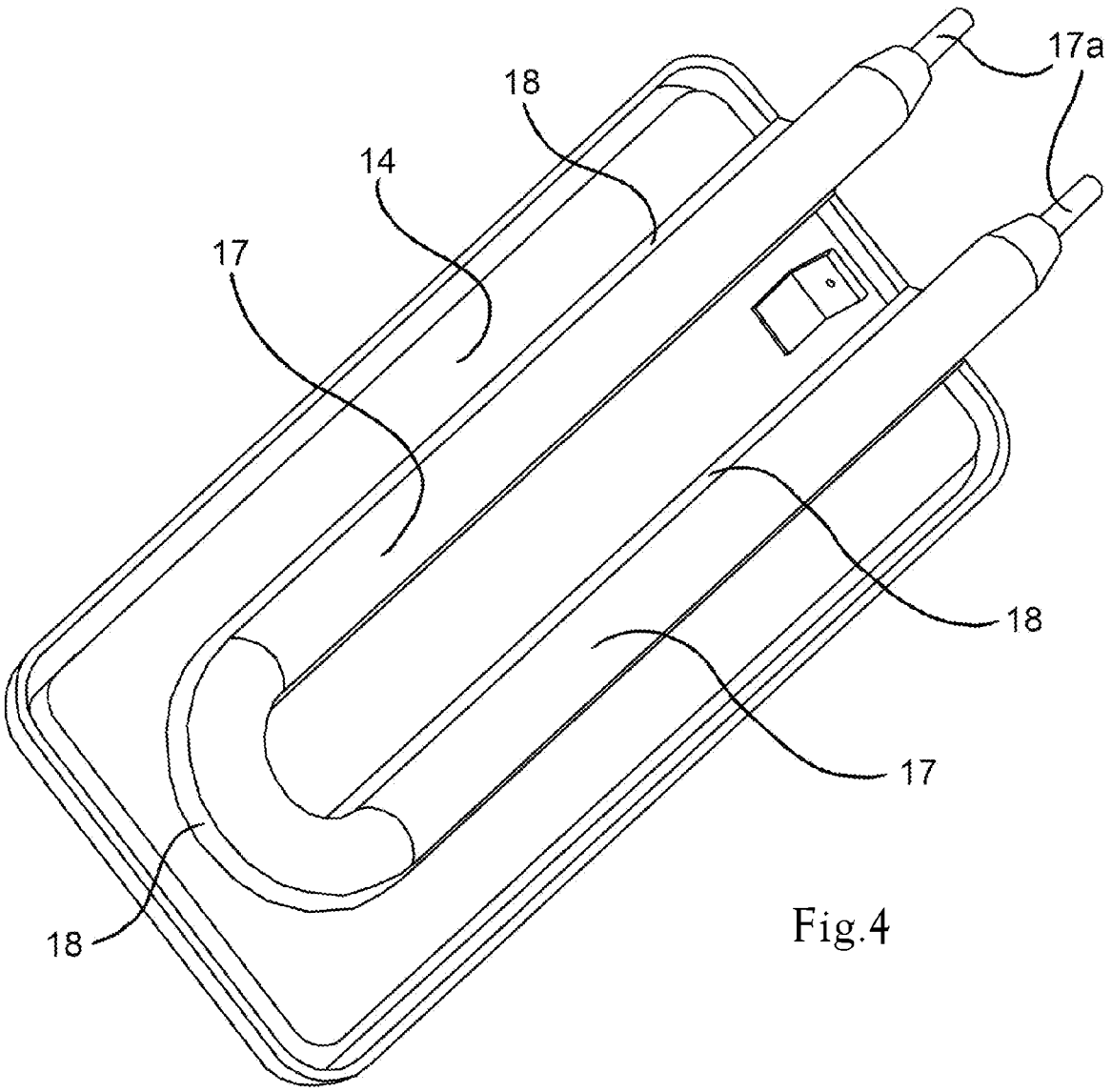

Fig.4

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EUROPEAN SEARCH REPORT

Application Number
EP 08 17 2277

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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)
D06F
A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 April 2009	Westermayer, Wilhelm

CATEGORY OF CITED DOCUMENTS

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1 EPO FORM 1503 03.82 (P04C01)

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