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(54) Washing machine with integrated steam generator

(57) A washing machine including: a tub (2) provided within an outer body, a drum (3), rotatably supported inside the tub (2), at least one heater (10) aimed at generating steam to be provided to the tub (2), wherein the heater (10) is integrated into the back of the tub, between a rear portion (14) of the drum (3) and an outer rear wall (12) of the tub (2).

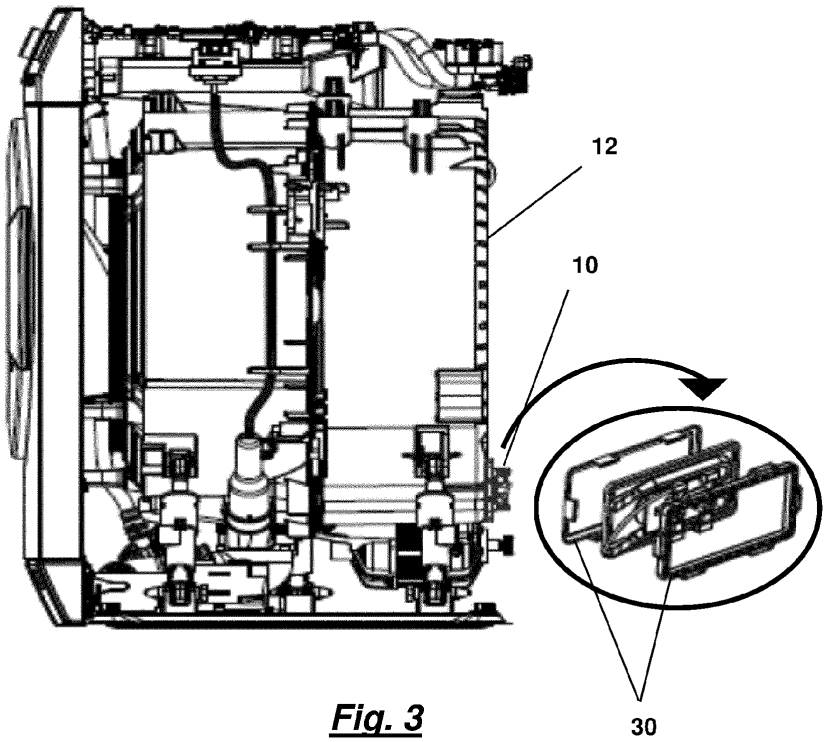

Fig. 3

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Description

Field of technology

[0001] The present invention relates to a water bearing appliance intended for washing and/or drying clothes, having an article treating chamber, where the clothes to be washed/dried are introduced, including a steam cycle. In particular said household appliance may be a washing machine, or a washer-dryer, that is a laundry washing machine with additional drying function.

Background

[0002] Generally, a water bearing appliance (e.g. a washing or a washing/drying machine) includes an article treating chamber rotatably supported within a cabinet and made to rotate by means of a driving device, typically including an electric motor connected to the article treating chamber e.g. via a belt.

[0003] With reference to Figure 1 showing a functional schematic view of a state of the art washing machine, such machine includes a rotating drum 3, for carrying out a washing, rotatably supported within a tub 2 situated within a cabinet or outer body (not shown in the Figure). Water necessary to carry out the washing is derived from a main via a common supply pipe 4 and introduced into the tub 2 via washing water supply pipe 5, by opening of a first solenoid valve EV1. Water is loaded by the washing water supply pipe 5 into one compartment of the detergent drawer 6. The water then flows from the drawer into the tub reaching the sump 7, where it is heated by a heater H. Laundry is introduced into the drum through, for example, an aperture in the front wall of the body.

[0004] Some machines are also equipped with a recirculation system, including a recirculation pump RP and a recirculation pipe 8. During washing, water is taken from the sump and put again into the tub and the drum thus improving washing performance. A pressure sensor P (either analogic or digital) takes care to maintain the water level L. When the cycle has finished and the water has to be drained out, a drain pump DP pushes the water out via a discharge pipe 9.

[0005] The most recent washing machines provides also a steam cycle, during which some steam is generated and supplied into to the tub, thus reaching the laundry inside the drum so as to heat up the laundry and the water present inside the tub. This system has also the advantage of carrying out a sterilization of the laundry. From patent application WO-A-2006/129912 a washing machine is known adapted to generate and apply steam in order to enhance washing performance while enabling sterilization of laundry. The washing machine includes a heater installed in the tub and a controller. The controller operates the heater to heat the water contained in the tub to generate steam, rather than just warming the water. The washing machine further comprises a water level sensor to detect a water level in the tub, and the controller operates the heater according to a detection result of the water level sensor. The washing machine has an additional advantageous effect in that, due to the steam, the laundry is also sterilized.

[0006] Other modifications were made in the attempt to save energy and simplify the washing machine configuration.

[0007] Patent application WO-A-2006/129913 discloses a method of controlling washing operation of a washing machine, which method comprises the steps of supplying water into a tub, soaking the laundry with water, and supplying steam by heating the water using a heater installed in the tub to generate the steam.

[0008] Patent application JP-A-04158896 discloses a fully automatic washing machine, in which a steam generating cycle is performed before a washing cycle to obtain good washing and sterilizing effect. A small quantity of supply water is introduced and heated in the tub before the washing cycle, in a manner not to wet the laundry and to produce steam that sterilizes the laundry and loosens the fibers thereof.

[0009] In the washing machine described in CH-A-695383, after washing and spinning the laundry, a small quantity of water is introduced in the tub via a secondary intake pipe and is then heated to form steam aimed at smoothing the creases of the laundry. In case that a sterilization of the laundry is also desired, the water is heated at higher temperature. The system described in the CH-A-695383 can be also applied to a tumble dryer.

[0010] Some washing machines, known as washer-dryer machines, beside the washing cycle also include a drying cycle, in which a drying process is carried out on the laundry using steam and/or an air circulation system, possibly including a condenser device to remove the water. The drying air circulates in an air recirculation pipe connected to the tub.

[0011] Environmental and energy consumption issues are becoming more and more important. A key parameter to save energy and water is to reduce the amount of water actually used to wash the laundry. Heating of the wetted load accounts for the major part of the energy consumption of a washing machine.

[0012] Thus, by reducing the amount of water used during the main wash, less energy is required to heat up the contents of the drum.

[0013] A drawback of above mentioned systems is the difficulty of assembly and design. Also a method and system allowing to limit the temperature losses in order to improve the energy consumption and reduction of water consumption would be highly appreciated.

Objects of the disclosure

[0014] It is an object of the present disclosure to overcome at least some of the problems associated with the prior art.

[0015] A further object of the present invention is to provide a water bearing appliance (e.g. a washing ma-

chine, or a washer-dryer, i.e. a laundry washing machine with additional drying function) which allows easy assembly and energy saving.

[0016] An object of the present invention is to propose a washing or dryer machine with a more compact configuration, including a steam generating system which can be easily applied, with minimal changes, to standard washing machines and dryers as well as to washing-dryer machines with concentrated wash and steam function.

[0017] Another object of the invention is to propose a washing or dryer machine in which steam temperature losses are reduced, with a substantial energy saving, and in which the steam flow inside the drum is optimized.

Summary

[0018] The present disclosure provides a water bearing appliance as set out in the accompanying claims.

[0019] Accordingly, the present disclosure provides a washing machine including: a tub provided within an outer body, a drum, rotatably supported inside the tub, at least one heater aimed at generating steam to be provided to the tub, wherein the heater is integrated into the back of the tub, between a rear portion of the drum and an outer rear wall of the tub.

[0020] Preferably, the back portion of the tub comprises a seat for housing the heater.

[0021] Preferably, the seat is provided at an inner rear wall of the tub or at an outer rear wall of the tub or in the thickness of the back of the tub between the inner rear wall and the outer rear wall of the tub.

[0022] Preferably, a cover is provided to be coupled to the outer wall of the tub so as to close the seat of the heater from outside the tub.

[0023] Preferably, the heater is fixed to the cover.

[0024] Preferably, the seat of the heater forms a water collecting chamber aimed at collecting a small amount of water to produce steam.

[0025] Preferably, a partition wall is situated beside the rear wall of the drum, a steam duct being obtained between the partition wall and the rear wall, the heater being placed within the steam duct and the generated steam being conveyed along the steam duct inside the tub.

[0026] Preferably, water is sprayed onto the heater to generate steam.

[0027] Preferably, the heater, when mounted, closes in a water tight manner an opening in the outer rear wall of the tub.

[0028] Preferably, the water collecting chamber is integrated within the steam duct.

[0029] Preferably, the heater is positioned in the lower part of the tub, so that it can be partially covered by water.

[0030] Preferably, the water within the tub is maintained at a level not to wet the laundry, during formation of steam.

[0031] Preferably, a thermostat is provided aimed at interrupting the power supply to the heater when the temperature reaches a certain level due to the water level being too low to cover or partially cover the heater.

[0032] Preferably, a temperature sensor is provided for fine regulation of the heater.

[0033] Preferably, water is supplied to the heater for steam generation via a separate independent path by-passing a detergent dispenser.

[0034] Optionally the heater can be placed within a water collecting chamber integrated within the steam duct and aimed at collecting a small amount of water to produce steam.

[0035] According to a second embodiment of the present invention, the heater is positioned in a lower part of the tub, so that it can be covered or partially covered by water, and in a region corresponding or connected to said steam duct.

[0036] While water within the tub is kept at a level not to wet the laundry, during formation of steam, the steam is driven by natural convection along the duct and into the tub.

[0037] Optionally, the machine according to the invention further comprises a temperature sensor used for fine regulation of the steam temperature, this temperature sensor being also possibly used as an indirect measurement of the water level within the lower part of the tub.

[0038] In order to reduce the number of components, the heater for generating steam could be the only heater inside the tub and it also heats the water within the lower part of the tub, used to wash the laundry.

[0039] The present invention offers a number of benefits. One of the advantages of the invention derives from the integration of the heater sub-assembly (optionally including the steam duct) in the rear cover of the tub. Cover is modular, thus requiring minimal changes if standard washing machine are produced with concentrated wash and steam functions.

[0040] Another advantage is a reduction in the loss of steam temperature, due to the use of pipes or air ducts made in the tub. This optimizes the steam flow inside the drum.

[0041] A further advantage is a shorter assemblage time required to produce the machine, as the steam duct is mounted together with the tub rear wall or cover.

[0042] A further advantage is the reduced quantity of water to be heated to produce steam; in particular according to the first embodiment, a small amount of water is sprayed onto the heater. Steam is produced quickly and with low energy consumption.

[0043] Another advantage of the second embodiment, is the possible use of one heater only, used both to heat water for washing the laundry and to produce the steam.

Brief description of the drawings

[0044] Reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 s a schematic representation of a prior art washing machine;

Figures 2a and 2b show the drum in perspective rear view and a sectional schematic view of the drum respectively;

Figure 3 shows a particular solution for the assembly of the heater within the rear wall of the tub.

Figures 4a and 4b are schematic representations of the washing machine incorporating a first embodiment of the invention, respectively showing a front view and a side view thereof;

Figures 5a and 5b are schematic representations of the washing machine incorporating a second embodiment of the invention, respectively showing a front view and a side view thereof;

Figures 6a and 6b are schematic representations of the washing machine as in figures 5a and 5b, including an improvement;

Figures 7a and 7b are schematic representations of the washing machine as in figures 5a and 5b, including another improvement

Detailed description of preferred embodiments

[0045] While the invention has been described in connection with preferred embodiments, it is not intended to limit the scope of the invention to the particular form set forth, but on the contrary, it is intended to cover such alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims. As an example the following description refers to washing machine, but those skilled in the art will appreciate that different kind of water bearing machines (e.g. washer/dryer) could implement the solution proposed by the present invention.

[0046] According to the invention, in a general aspect, a heater 10 is integrated into the back of the tub 2 between a rear portion 14 of drum 3 (particularly a rear wall of the drum) and an outer rear wall 12 of the tub 2, i.e. the wall of the tub facing a rear wall of the cabinet where the tub is accommodated. The heater 10 is adapted to generate steam which is provided to the drum 14.

[0047] Preferably, the back portion of the tub comprises a seat for housing the heater 10. Preferably, the seat can provided at an inner rear wall of the tub or at an outer rear wall of the tub or in the thickness of the back of the tub 2 between the inner rear wall and the outer rear wall 12 of the tub.

[0048] In practice the seat can be provided in a single piece-construction with the back of the tub 2, for example by injection molding.

[0049] The seat can be provided so as to directly face the interior of the tub and hence the rear portion of the drum or the seat can be provided in the thickness of the back of the tub 2 and in this case the seat is fluidly connected with the interior of the tub 2. The seat can simply provides a support for the heater 10, for example when the heater 10 is coupled to the inner rear wall of the tub.

[0050] Preferably, a cover is provided to be coupled to the outer wall 12 of the tub so as to close the seat of the heater 12 from outside the tub 3. In a further preferred embodiment, the heater is fixed to the cover.

[0051] According to a further embodiment of the present invention an opening is provided in the outer rear wall 12 of the tub. The opening can be closed by a watertight shutter (or wicket, or door) which allows easy access to the internal part of the tub and to the heater. Ideally the heater is placed next to the opening. In the embodiment shown in Figure 3 a particular solution is represented according to which the heater 10 itself acts as shutter and, when mounted, closes in a watertight manner the opening. The heater is fixed to the tub by means of washers (e.g. rubber washers) 30 to ensure the connection is watertight so that leakage is avoided.

[0052] The above mentioned embodiments allow an easy access to the heater 10 from outside.

[0053] In another embodiment shown in Figure 2b, the heater is placed between the outer rear wall 12 of the tub and a partition wall 13 situated beside the rear wall 14 of the drum 3. Such space between the rear wall and the partition wall constitutes a duct through which the steam generated by the heater is more efficiently conveyed to the drum. However the steam duct is just a possible implementation of the present invention: the heater can well be in direct contact (i.e. not separated by a partition wall) with the drum.

[0054] Reference will now be made in detail to a further preferred embodiment of the present invention, in particular to Figures 4A and 4B. The washing machine generally comprises a body (not shown in the Figures), which defines the appearance of the washing machine, an outer tub 2 provided within the body, and a drum 3, rotatably supported inside the tub 2.

[0055] The drum 3 is rotated by a motor 16 e.g. by means of a belt 17. Water coming from a main, flows along a common supply pipe 4 and is introduced into the tub 2 via washing water supply pipe 5, e.g. by opening of a first solenoid valve EV1. Water is loaded into one compartment of the detergent drawer 6. The water then flows from the drawer into the tub reaching the sump 7.

[0056] Preferably, a steam duct 11 is provided for allowing steam generated by a heater 10 to be introduced into the tub 2 to perform a steam cycle.

[0057] Laundry is introduced into the drum 3 through an aperture (not shown) in the front wall of the body.

[0058] Preferably, in accordance with a first embodiment of the present invention, the heater 10 is positioned inside the steam duct 11, between the outer rear wall 12 and the partition wall 13. Water is, preferably, sprayed onto the heater 10, to generate steam, the water being conducted into the steam duct 11 through an additional pipe 18, branching from the common supply pipe 4, and by utilizing an additional solenoid valve EV4.

[0059] A small amount of water is spilled onto the heater 10 from the additional pipe 18, just enough to produce the required steam. Hence, when in direct contact, the water evaporates forming steam, which is then conducted into the tub 2 and into the laundry by natural convective forces.

[0060] This allows a substantial energy saving, as only a limited quantity of water is heated. In a preferred embodiment of the present invention, possible water in excess not evaporated drops down by gravity along the steam duct and into the sump 7, where the drain pump DP provides to drain it out. The drain pump may be functioning during all the steam cycle (as it happens in the washer-dryers during the drying phase) or a pressure sensor P can be used to monitor the water level in the sump 7 and trigger the action of the pump.

[0061] In a further embodiment of the present invention, the heater 10 is situated within a water collecting chamber 15 preferably integrated within the steam duct 11 and aimed at collecting a small amount of water necessary to produce steam. Water in excess overflows from the chamber 15 and falls down into the sump.

[0062] In a further embodiment the steam duct 11 can be omitted and the seat of the heater forms the water collecting chamber 15

[0063] Those skilled in the art will appreciate the advantages of the integration of the heater 10 into the back of the tub 2 between a rear portion 14 of drum 3 and an outer rear wall 12 of the tub 2. This optimizes both assembling and the steam flow into the tub and the drum.

[0064] According to another embodiment of the invention, shown in Figures 5A and 5B, the heater 10 is integrated to the back of the tub 2 between a rear portion 14 of drum 3 and an outer rear wall 12 of the tub 2, but is positioned at a lower part of the tub 2, so that it can be partially covered by water. Preferably the heater is position in an area not lower than the lower margin of the drum.

[0065] Of course the partition wall 13, shown in Figures 5A and 5B, can be omitted. Water is loaded into the tub 2 by opening the solenoid valve EV1 and flowing to the sump 7 by gravity through the standard path. The pressure sensor P keeps the level at a lower level L_0 below the drum limit, to avoid wetting the laundry, but high enough to partially cover the heater 10, which produces the steam. The generated steam is driven by natural convection through the steam duct 11, thus reaching the drum 3 and the laundry.

[0066] As the water level goes below a certain level L_0, due to steam generation, a solenoid valve (e.g. EV1) is opened to refill the sump 7 to the proper level.

[0067] For safety reason, the heater 10 can feature a thermostat which interrupts the power supply when the temperature reaches a certain level due to the water level being too low to partially cover the heater 10.

[0068] Optionally, a temperature sensor T may be used for fine regulation of the steam temperature, this temperature sensor being also possibly used as an indirect measurement of the water level L_0.

[0069] In fact, if the water level is too low, the temperature increases, whereas, if it is too high the temperature decreases.

[0070] All in all, the system with such configurations can rely on up to three different ways to monitor and maintain the water level:

- using a pressure sensor,
- using a temperature sensor,
- using a heater thermostat.

[0071] Optionally, a further improvement can be incorporated in the invention, about the water loading system. If the water to be transformed into steam is loaded, as in the traditional way, through the detergent drawer, it may happen that detergent residuals come into contact with the heater, thus generating bad smell and possibly causing malfunction of the system.

[0072] To avoid this, a separate independent path can be used for the water, which is loaded by means of an additional pipe 20, branched from the main pipe 4, and an additional solenoid valve EV4. This configuration is shown in Figures 6A and 6B. When solenoid valve EV4 is opened, water flows through the additional pipe 20 and enters the tub 2 just beneath the detergent drawer 6. Then, it flows to the sump 7 following the conventional path. In this way, the detergent drawer 6 is bypassed.

[0073] Another improvement is shown in Figures 7A and 7B. In this case, water is led directly to the sump 7 by the additional pipe 19, thus by-passing the full conventional path normally followed by the water-detergent solution falling from the detergent drawer 6.

[0074] An advantage of the second embodiment here described is the fact that the heater 10 for generating steam is the only heater 10 inside the tub 2 and it also heats the water used to wash the laundry.

[0075] A further advantage is the reduced water consumption and the reduced amount of free wash liquid during the main wash. Due to the reduced quantity of water, a consistent energy saving is possible, because less energy is required to heat up the content of the drum.

[0076] It will be understood that, while in the foregoing reference was mainly made to a household appliance embodied in the form of a laundry washing machine, the present invention is suitable for a washer-dryer, and in general for any apparatus intended for washing/drying clothes.

[0077] It will be appreciated that alterations and modifications may be made to the above without departing from the scope of the disclosure. Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the solution described above many modifications and alterations. Particularly, although the present disclosure has been described with a certain degree of particularity with reference to preferred embodiment(s) thereof, it should be understood that various omissions, substitutions and changes in the form and

details as well as other embodiments are possible; moreover, it is expressly intended that specific elements described in connection with any disclosed embodiment of the disclosure may be incorporated in any other embodiment as a general matter of design choice.

[0078] For example, similar considerations apply if the components have different structure or include equivalent units. Also, it should be easily understood by those skilled in the art that the present invention may be extended to a large variety of household appliances not only to a washing machine that has been used in the above description as mere example of how the present invention may be embodied.

Claims

1. A washing machine including: a tub (2) provided within an outer body, a drum (3), rotatably supported inside the tub (2), at least one heater (10) aimed at generating steam to be provided to the tub (2),
characterized in that
the heater (10) is integrated into the back of the tub, between a rear portion (14) of the drum (3) and an outer rear wall (12) of the tub (2).

2. The washing machine of claim 1, wherein the back portion of the tub comprises a seat for housing the heater (10).

3. The washing machine of claim 2, wherein the seat is provided at an inner rear wall of the tub (2) or at an outer rear wall of the tub or in the thickness of the back of the tub (2) between the inner rear wall and the outer rear wall (12) of the tub.

4. The washing machine of any preceding claim, wherein a cover is provided to be coupled to the outer wall (12) of the tub so as to close the seat of the heater (12) from outside the tub (3).

5. The washing machine of claim 4, wherein heater (10) is fixed to the cover.

6. The washing machine of any preceding claim, wherein the seat of the heater (10) forms a water collecting chamber (15) aimed at collecting a small amount of water to produce steam.

7. The washing machine of any preceding claim including a partition wall (13) situated beside the rear wall of the drum, a steam duct (11) being obtained between the partition wall (13) and the rear wall (12), the heater (10) being placed within the steam duct and the generated steam being conveyed along the steam duct inside the tub (2).

8. The washing machine of any preceding claim, wherein water is sprayed onto the heater (10) to generate steam.

9. The washing machine of claim 4, wherein the heater (10), when mounted, closes in a water tight manner an opening in the outer rear wall (12) of the tub (2).

10. The washing machine of any claim 6 and 7, wherein the water collecting chamber (15) is integrated within the steam duct (11).

11. The washing machine of any preceding claim, wherein the heater (10) is positioned in the lower part of the tub (2), so that it can be partially covered by water.

12. The washing machine of claim 11, wherein the water within the tub (2) is maintained at a level not to wet the laundry, during formation of steam.

13. The washing machine of claim 11 or 12, wherein a thermostat is provided aimed at interrupting the power supply to the heater (10) when the temperature reaches a certain level due to the water level being too low to cover or partially cover the heater (10).

14. A washing machine of any preceding claim, further comprising a temperature sensor used for fine regulation of the heater (10).

15. A washing machine of any preceding claim, wherein water is supplied to the heater (10) for steam generation via a separate independent path by-passing a detergent dispenser (6).

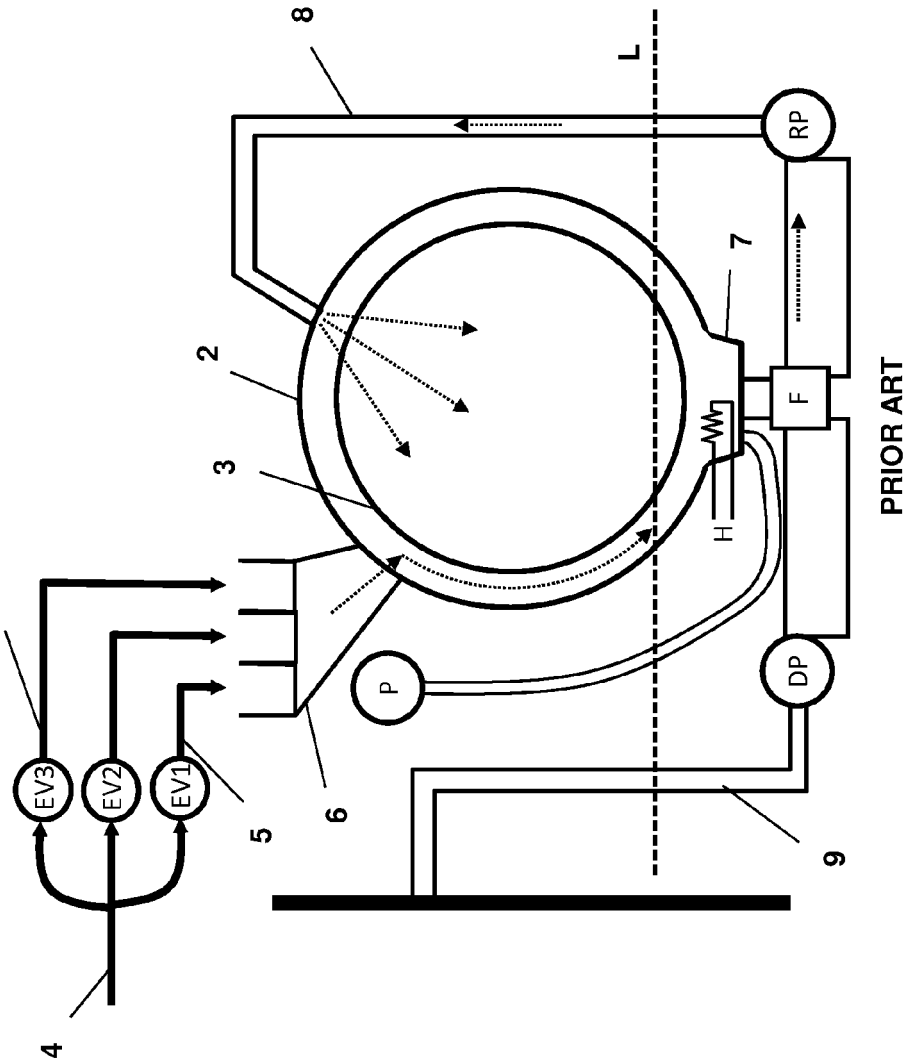


Fig. 1

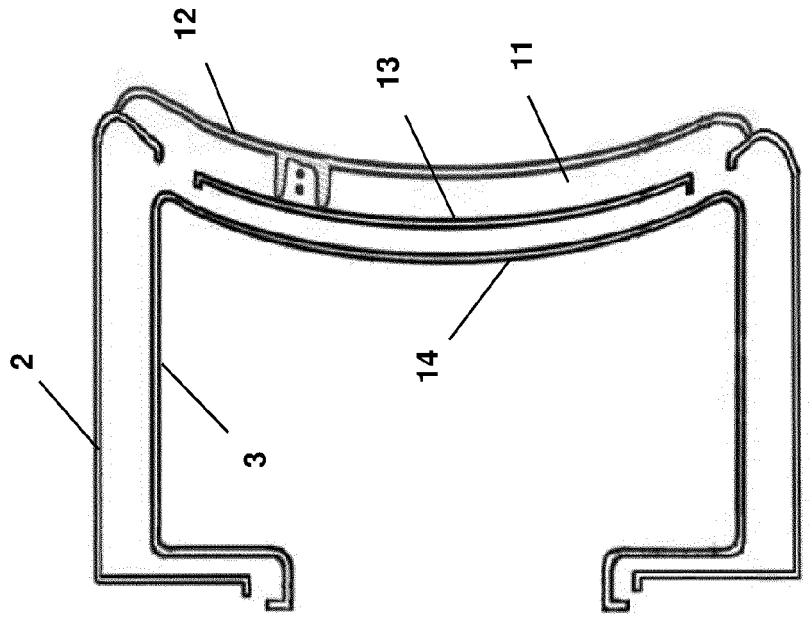


Fig. 2b

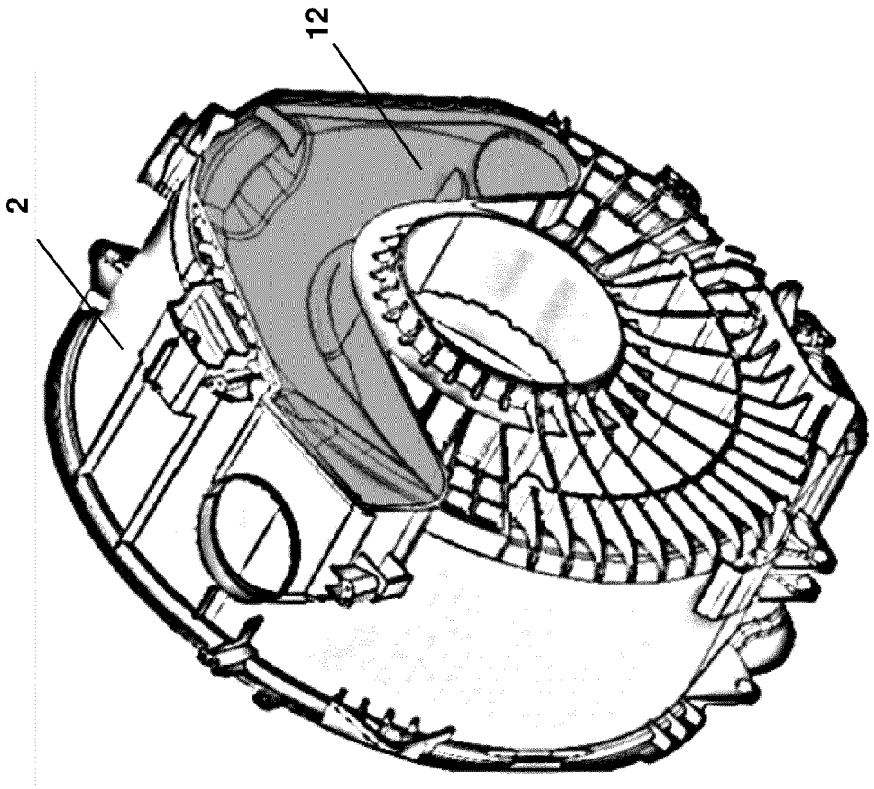


Fig. 2a

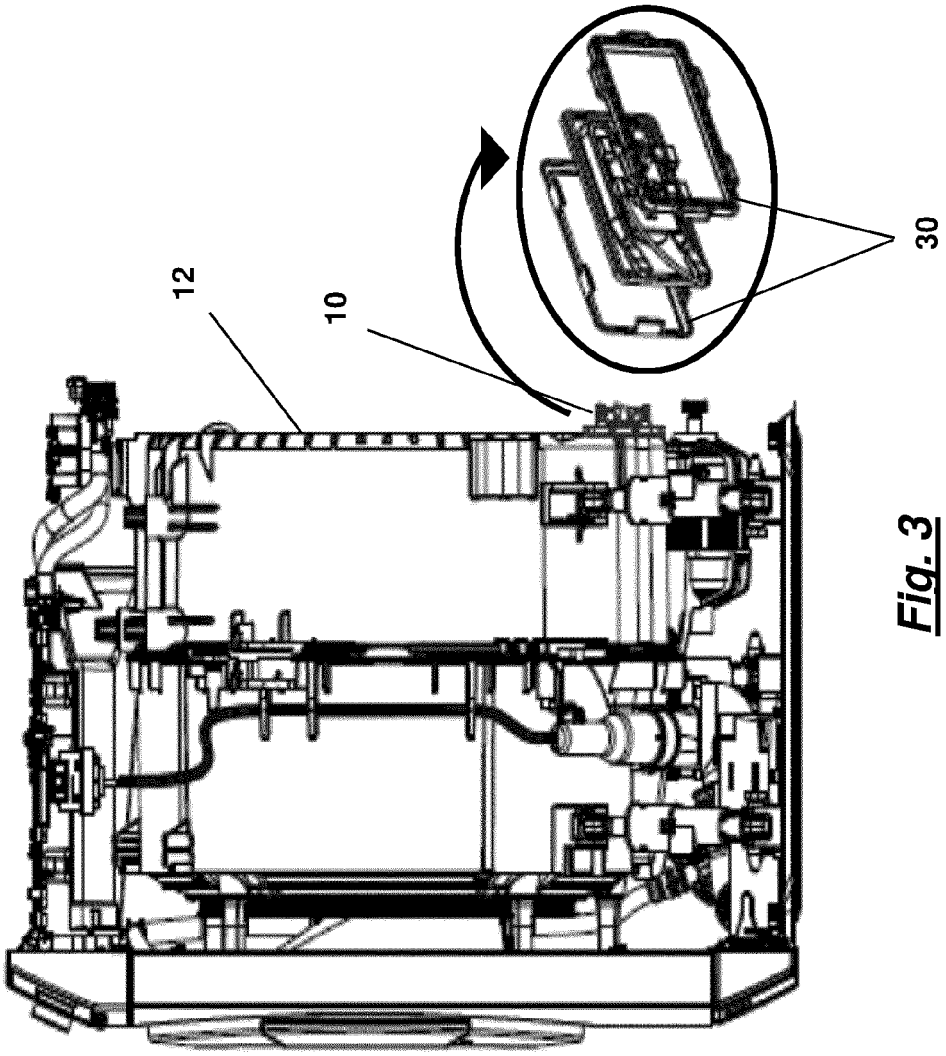
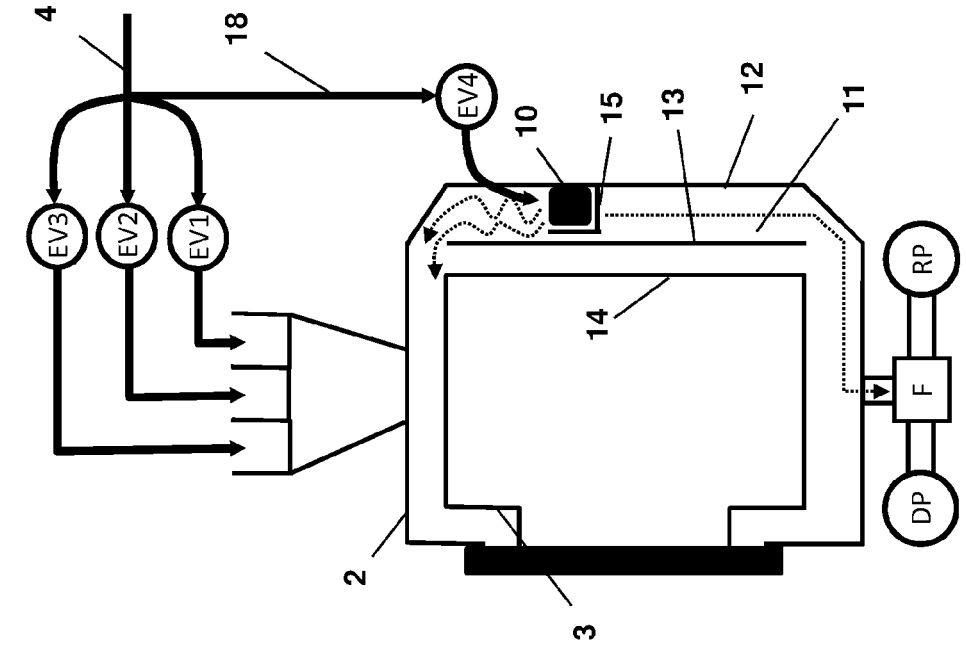


Fig. 3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EV4
10
15
13
12
11
EV3
EV2
EV1
RP
14
F
DP
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3

Fig. 4b

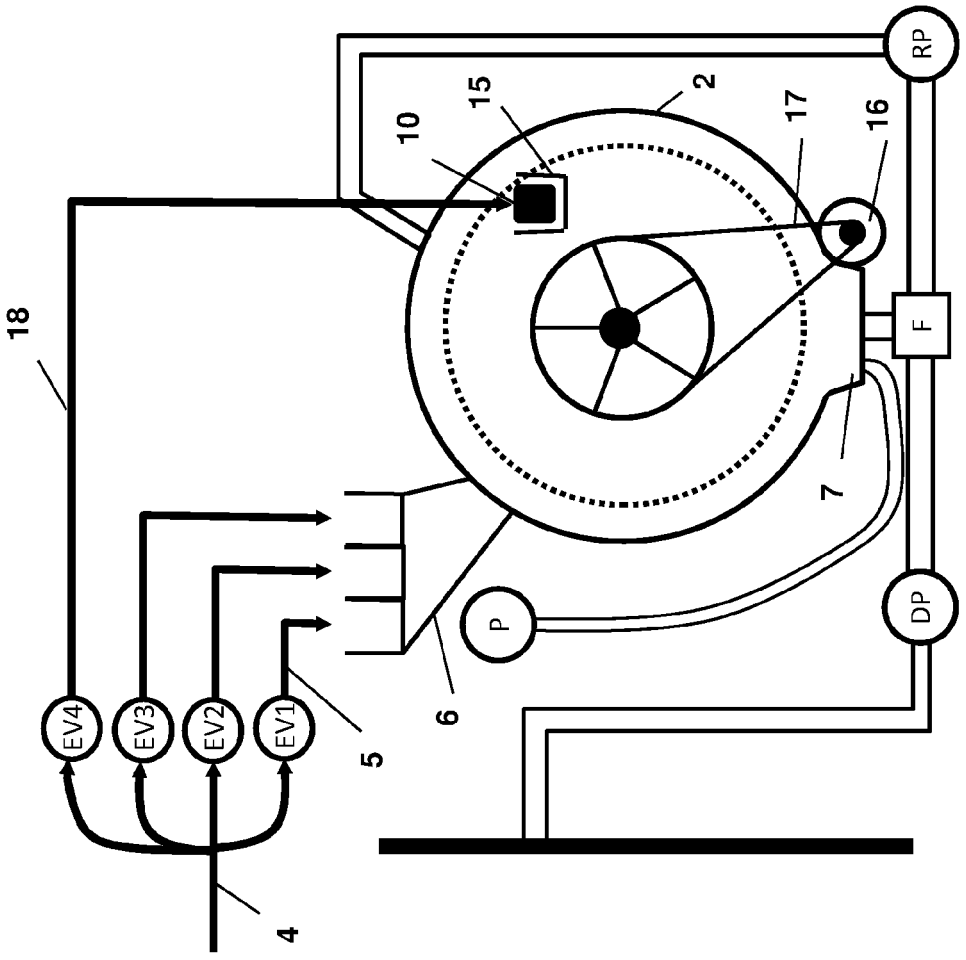
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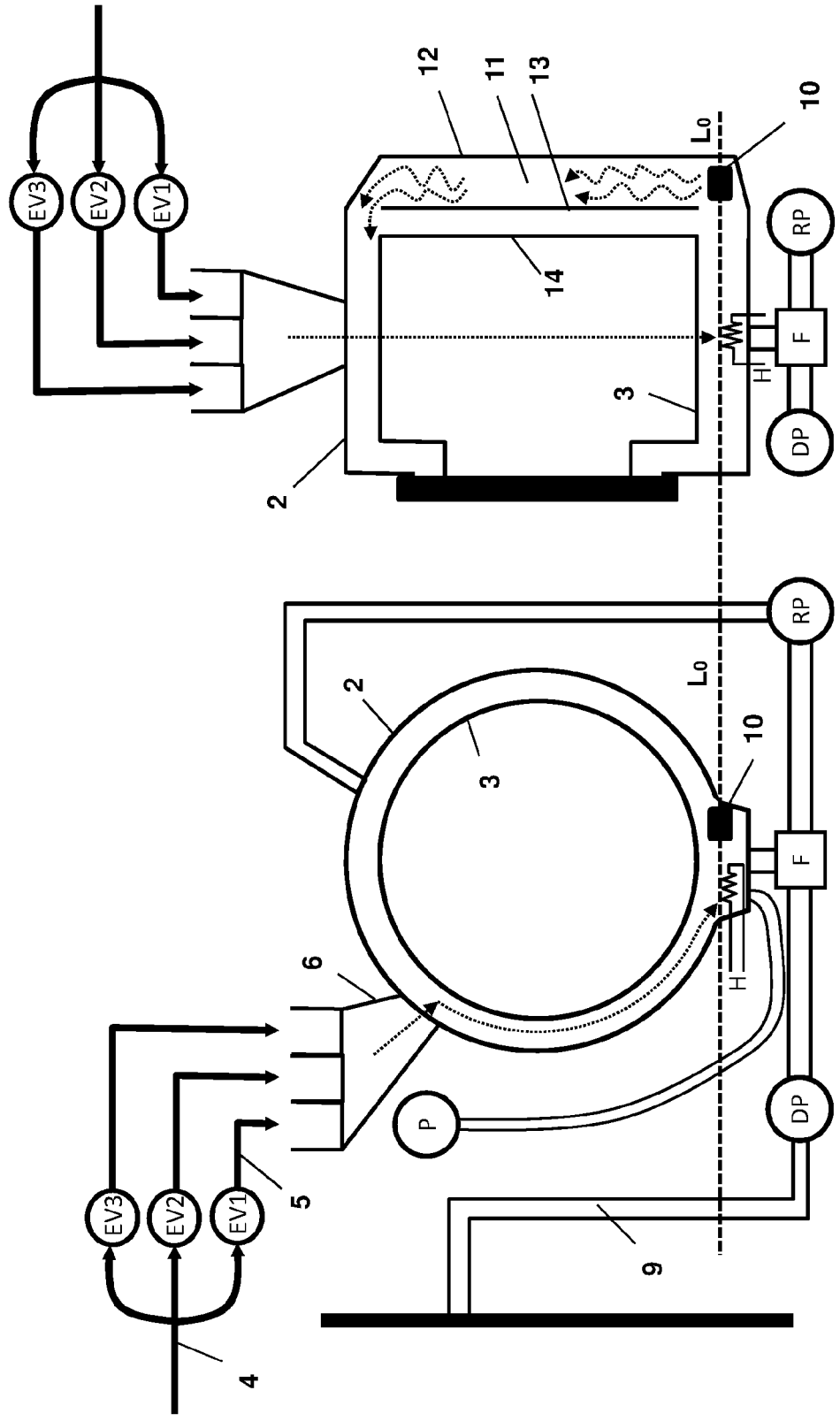
Fig. 4a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EV2
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Fig. 5b

Fig. 5a

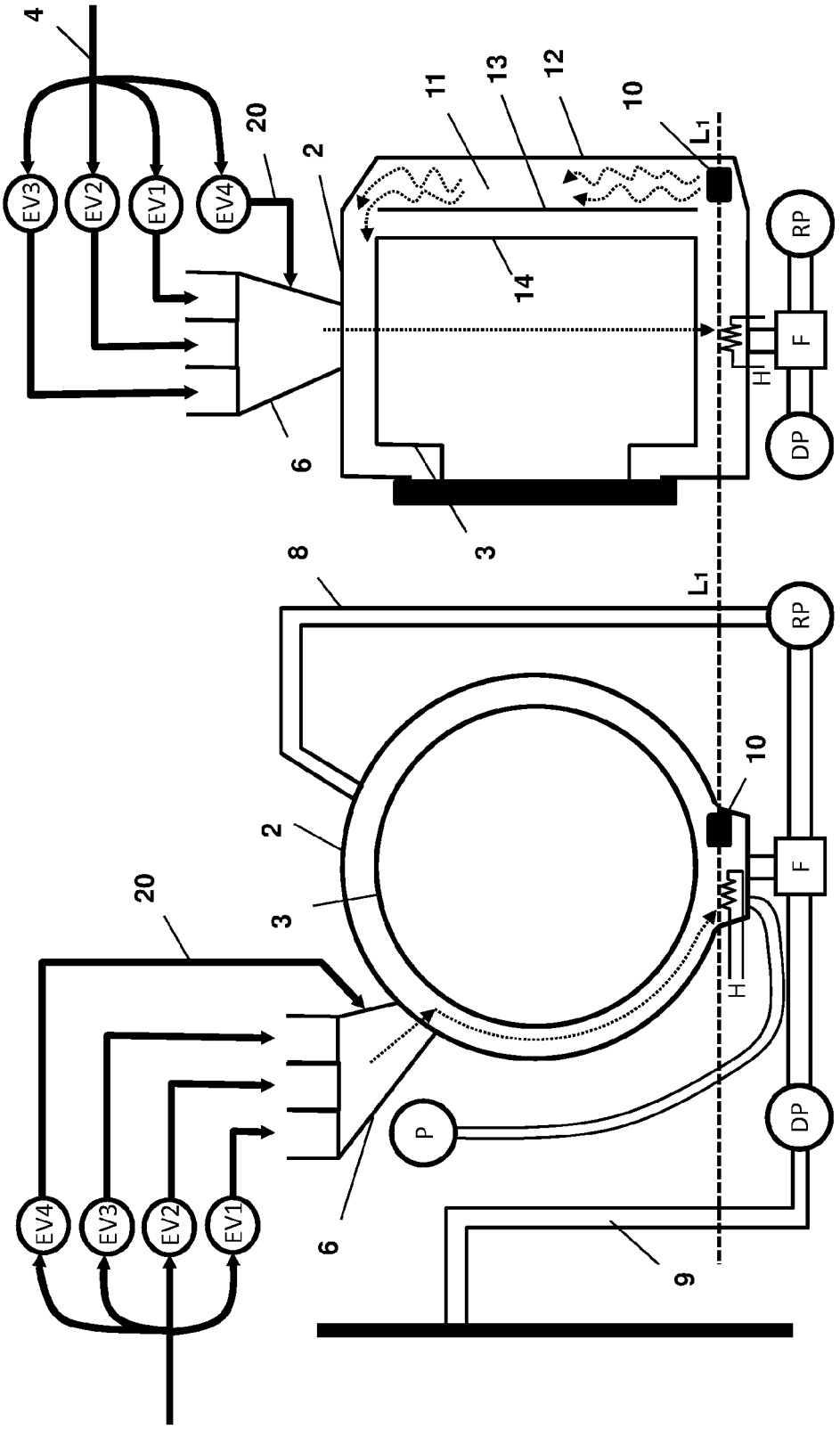
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Fig. 6b

Fig. 6a

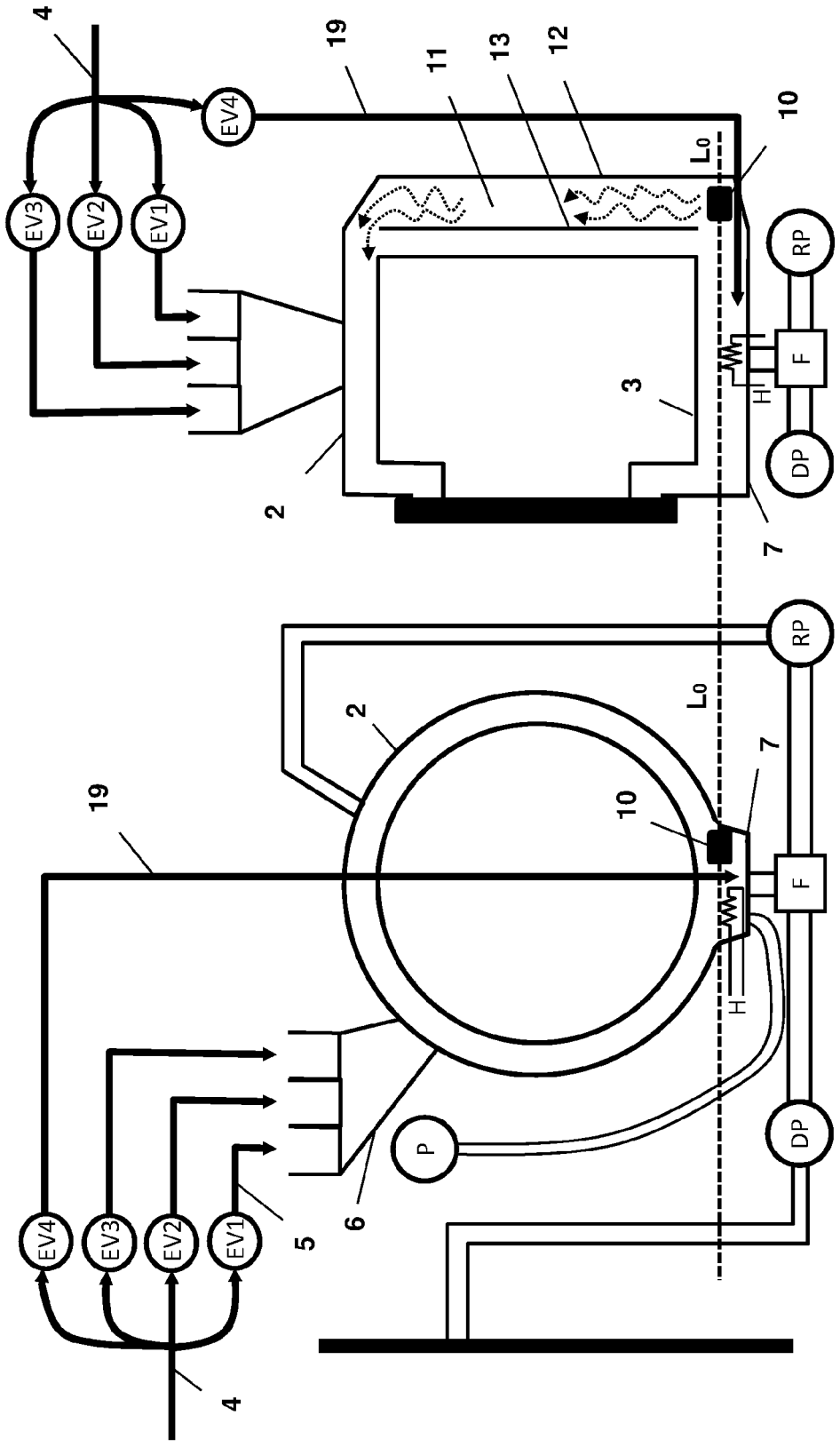
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Fig. 7b

RP
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L0
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EV4
EV3
EV2
EV1
5
6
4

Fig. 7a

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EUROPEAN SEARCH REPORT

Application Number
EP 11 19 2933

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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D06F

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Place of search	Date of completion of the search	Examiner
Munich	30 May 2012	Stroppa, Giovanni

CATEGORY OF CITED DOCUMENTS

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