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(54) **Washer-drier machine**

Wasch- und Trocknungsmaschine

Machine lavante/séchante

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(56) References cited:
EP-A- 1 657 341 EP-A- 1 688 524
DE-A1- 2 459 319 DE-A1- 3 315 754
FR-A- 2 372 923

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Description

[0001] The present invention relates to a domestic washer-drier machine which provides for washing and drying the laundry.

[0002] Domestic washer-drier machines are known to comprise a support and housing structure, a washing tank being housed therein, which is provided with a front opening that can be closed by means of a porthole door that is hinged in front of the housing. Within the washing tank, a basket is pivotally housed about a horizontal or inclined axis for the laundry to be accommodated therein to be washed and/or dried. The basket also defines a front opening that is located such as to match the opening of the washing tank, in order to load/unload the laundry.

[0003] The washing tank is suitable to contain the washing liquid during the laundry washing steps, and to be a portion of the drying circuit during the laundry drying step.

[0004] In order to allow loading the tank with mains water and detergent and additive substances, a washing water delivery system is provided to be connected to the water system. This washing water delivery system comprises a plurality of electrovalves which are suitable to selectively adjust the supply to a plurality of flow paths extending downstream of these electrovalves through respective compartments of a detergent tray to the washing tank. On the bottom of the washing tank there is provided a drain duct with a discharge pump being associated thereto, which provides for the removal of the washing liquid from the tank and controls, together with the supply electrovalves, the liquid level within the tank. To heat the washing liquid contained within the tank, an electric resistance is provided, which is arranged within the tank in the gap between the tank wall and the laundry basket.

[0005] The drying circuit of prior art washer-drier machines typically comprises a suction unit, a heat exchanger and a heating unit with electric resistances intercommunicating by means of a drying circuit.

[0006] In such a closed-loop circuit, the air flow generated by the suction unit is heated by the electric resistances and sent to the basket, where it flows through the wet laundry thereby causing the water contained in the fabric to evaporate. In the heat exchanger, which is generally a container separate from the washing tank and provided with a spray nozzle, the wet air is cooled by a jet of cold water. Due to this cooling, the vapour condensates and is collected and discharged together with the cooling water. The de-humidified air is then sucked again by the suction unit and recirculated.

[0007] The cooling water is usually supplied to the heat exchanger by means of a cooling duct with a dedicated electrovalve which controls the loading of the mains water in the heat exchanger (condenser).

[0008] Prior art drying devices, while being satisfactory under many aspects, however, have a much complicated structure which is due to the presence of the condensation chamber and three different circuits:

- washing water supply,
- cooling water supply to the heat exchanger,
- drying air circuit,

5 which also involve a number of hydraulic components.

[0009] The structural complexity of known washer-drier machines and the high consumption of cooling water during the drying step are some of the causes of the high production and running costs that are related to this type of appliance.

10 **[0010]** EP1657341 A2 discloses a washer dryer According to the preamble of claim 1.

[0011] The object of the present invention is thus to provide a washer-drier machine having such characteristics as to reduce the consumption of mains water during the drying step.

15 **[0012]** Within the above general object, a further object of the present invention is to simplify the structure of the washer-drier machine and reduce the number of hydraulic components thereof.

[0013] This and other objects are achieved by means of a washer-drier machine according to claim 1. Advantageous embodiments are the object of the dependent claims.

20 **[0014]** According to the invention, the washer-drier machine comprises a laundry basket that is supported within a washing tank suitable to contain the washing liquid, in which the washing tank internally defines a condensation space suitable to contain a cooling water volume forming a free water surface spaced away from the basket such as to be capable of cooling the drying air flow downstream of the basket within the washing tank.

30 **[0015]** Thereby, the whole supply circuit of the condenser can be eliminated, as the latter can be easily supplied with mains water loaded by the washing water loading circuit, since it consists of a free surface of a water volume within the washing tank.

[0016] In addition, since a cooling water volume is maintained within the washing tank, a continuous use of a same water volume will be allowed until the latter reaches an upper threshold temperature for condensation purposes. This results in a considerable saving of cooling water during the drying step.

35 **[0017]** In accordance with a further important aspect of the invention, the operation of the washer-drier machine is controlled by a program which carries out, during the drying step, the following actions:

- arrangement of a cooling water volume such that the free water surface is left out of the basket bulk;
- control of the water level such that, during the drying step, due to the formation of the condensate, the free water surface does not exceed a predetermined upper level and/or
- 40 - control of the cooling water temperature such that, during the drying step, due to the thermal exchange with the drying air flow, the temperature of the water volume does not exceed a predetermined upper tem-

perature value.

[0018] In order to better understand the present invention and appreciate the advantages thereof, several embodiments thereof will be described below by way of non-limiting example, with reference to the annexed drawings, in which:

- Fig. 1 is a side sectional view of a washer-drier machine according to an embodiment of the invention;
- Fig. 2 is a front sectional view of the washer-drier machine in Fig. 1;
- Fig. 3 is a partially sectional top view of the washer-drier machine in Fig. 1;
- Fig. 4 is a side sectional view of a washer-drier machine according to a second embodiment of the invention;
- Fig. 5 is a front sectional view of the washer-drier machine in Fig. 4;
- Fig. 6 is a partially sectional top view of the washer-drier machine in Fig. 4.

[0019] With reference to the figures, a washer-drier machine 1 comprises a support and housing structure 2, a washing tank 3 being housed therein, which is provided with a front opening that can be closed by means of a porthole door 4 being hinged in the front of the housing 2. Within the washing tank 3, a basket 5 is pivotally housed about a horizontal or inclined axis, for the laundry to be accommodated therein to be washed and/or dried. The basket 5 also defines a front opening that is located such as to match the opening of the washing tank 3, in order to load/unload the laundry.

[0020] The washing tank 3 is suitable to contain the washing liquid during the laundry washing steps, and to be a portion of the drying circuit during the laundry drying step.

[0021] In order to allow loading the tank 3 with mains water and detergent and additive substances, a washing water delivery system is provided to be connected to the water system. This washing water delivery system comprises a plurality of washing flow paths extending from, for example, two supply electrovalves 6, 7, through corresponding compartments 8, 9, 10 of a detergent tray 12, to the washing tank 3.

[0022] On the bottom 13 of the washing tank 3, there is provided a drain duct 14 with a discharge pump 15 being associated thereto, which provides for the removal of the washing liquid from the tank 3 and controls, together with the supply electrovalves 6, 7 the level of liquid within the tank 3.

[0023] To heat the washing liquid contained within the tank 3, a coiled electric resistance 11 is provided, which is arranged within the tank 3, particularly on the bottom 13 of the latter, in the gap between the tank wall 3 and the laundry basket 5.

[0024] The washer-drier machine 1 further comprises a closed-loop drying circuit with a suction unit, for exam-

ple an fan impeller 17 driven by an electric motor 18, a heat exchanger as well as a heating unit with electric resistance 21, which communicate with each other by means of a drying circuit 16.

[0025] In such a closed-loop circuit, the air flow 22 generated by the suction unit 17, 18 is heated by the electric resistance 21 and sent to the basket 5, where it flows through the wet laundry thereby causing the water contained in the fabric to evaporate. The heat exchanger is arranged downstream of the laundry basket 5 (with reference to the direction of the drying air flow 22) and cools the wet air flowing from the basket 5.

[0026] Due to this cooling, the vapour condensates and is collected and discharged, for example together with a cooling water volume. The de-humidified air is then sucked again by the suction unit 17, 18 and recirculated.

[0027] According to an aspect of the invention, the washing tank 3 defines therein a condensation space 19 suitable to contain a cooling water volume 20 that forms a free water surface spaced away from the basket 5 such as to be capable of cooling the drying air flow 22 downstream of the basket 5 within the washing tank 3.

[0028] According to a preferred embodiment, this condensation space 19 is formed at the tank bottom 13, approximately below the basket 5.

[0029] Thereby, the whole supply circuit of the condenser can be eliminated, as the latter can be easily supplied with mains water loaded by the washing water loading circuit, since it consists of a free surface of a water volume 20 (condensation surface) within the washing tank 3.

[0030] Furthermore, as the cooling water volume 20 on the washing tank 3 is maintained, a continuous use of a same water volume is allowed until the latter is heated past a threshold temperature allowed for condensation purposes. This results in a considerable saving of cooling water during the drying step.

[0031] The washer-drier machine 1 comprises a control unit (not shown in the drawings) which allows setting a drying program that carries out the following steps:

- arrangement of the cooling water volume 20 such that the free water surface 23 is left out of the basket bulk 5;
- control of the water level such that, during the drying step, due to the formation of the condensate, the free water surface 23 does not exceed a predetermined upper level and/or
- control of the temperature of the cooling water volume 20 such that, during the drying step, due to the thermal exchange with the drying air flow 22, the temperature of the water volume 20 does not exceed a predetermined upper temperature value above which the difference of temperature between the condensation surface 23 and the drying air flow 22 is no longer sufficient to condensation purposes.

[0032] The step of controlling the level of cooling water

20 may comprise the step of detecting a value indicative of the level of cooling water 20 and at least partially draining the cooling water 20 through the drain duct 14, when the level of cooling water 20 exceeds said upper level.

[0033] The operation of detecting a value indicative of the level of cooling water 20 may be carried out by means of a pressure sensor 24 that is arranged at the tank bottom 13. This pressure sensor 24 (e.g., a so-called pressure switch) generates a pressure signal and sends it to the control unit that, in turn, controls the discharge pump 15 and causes the latter to at least partially drain the cooling water 20 and condensate from the washing tank 3. Alternatively, the pressure sensor 24 directly interacts with the power supply of the discharge pump 15 and causes the partial or total drainage of the tank 3 in response to the attainment of a determined water level, for example the above-cited upper level.

[0034] In accordance with a further embodiment, the control of the cooling water level 20 can be carried out with one or more level sensors (such as a sensor using the electrical conductivity of the cooling water 20) that are connected to the control unit and/or directly to the discharge pump 15.

[0035] The washer-drier machine and the washing and drying programs thereof may be configured such that the control of the level of cooling water 20 during the drying step and the control of the washing liquid level during the washing and rinse step are carried out by means of a same pressure sensor 24 or group of level sensors.

[0036] According to the invention, the control of the level of cooling water 20 is carried out by at least partially draining this water, at preset time intervals, wherein the duration of these intervals is determined, for example, on the basis of a series of tests or numerical simulations and takes into account the condensate accumulation on the tank bottom.

[0037] According to an embodiment, the process step of controlling the temperature of cooling water 20 comprises the step of detecting the temperature or a magnitude indicative of the temperature of the cooling water 20 and at least partially discharging the cooling water 20 through the drain duct 14 and feeding a corresponding amount of fresh mains water in the washing tank 3, when the temperature detected exceeds said upper value.

[0038] Advantageously, the operation of detecting the temperature of the cooling water 20 is carried out by means of a temperature sensor 25 arranged in the vicinity of the tank bottom 13. This temperature sensor 25 generates a temperature signal and sends it to the control unit, which, in turn controls the drain pump 15 and the supply electrovalves 6, 7.

[0039] When the upper temperature is reached or exceeded, the control unit causes the drain pump 15 to at least partially remove the cooling water 20 and condensate from the washing tank 3 and, subsequently, it opens the supply electrovalve 6 and/or 7 to feed a corresponding amount of cold mains water, preferably through the same water supply duct used during the washing step.

Alternatively, the temperature sensor 25 directly interacts with the power supply of the discharge pump 15 and supply electrovalves 6, 7 and causes the partial or total replacement of the cooling water 3 in response to the fact that the upper temperature has been attained or exceeded.

[0040] Advantageously, the washer-drier machine and the washing and drying programs are configured such that the control of the temperature of the cooling water 20 during the drying step and the control of the temperature of the washing liquid during the washing and rinse steps are carried out by means of a same temperature sensor 25 or groups of temperature sensors.

[0041] Alternatively to what has been described above, the control of the temperature of the cooling water 20 can be carried out by at least partially draining this water, at preset time intervals, wherein the duration of these intervals is determined, for example, on the basis of a series of tests or numerical simulations and takes into account the temperature increase in the mixture of cooling water and condensate on the tank bottom 13.

[0042] According to an embodiment, the control unit is configured such as to allow selecting a drying program in which during the last drying step, also known as the cool-down step, the condensation space 19 results to be completely without cooling water 20, which has been previously drained and not replaced with fresh mains water. In fact, experimental tests have proved that, during the cool-down step, the residual humidity can be extracted from the laundry without an active cooling by the drying air flow 22.

[0043] In accordance with a further embodiment, the control unit is configured such as to allow selecting a drying program in which only or also during the early drying step, the condensation space 19 results to be completely without cooling water 20, which will be loaded only about 20 min - 40 min, preferably 30 min after the beginning of the drying step. In fact, experimental tests have proved that a part of the humidity can be also extracted from the laundry during the early drying step without an active cooling by the cooling air flow 22.

[0044] According to an embodiment, the washing tank 3 which is preferably moulded from plastics, defines therein a suction portion 26 of the drying duct 16, i.e. the duct portion arranged downstream of the heat exchanger (consisting of the free surface 23 of the cooling water 20 on the tank bottom 13) and upstream of the suction unit 17, 18.

[0045] In accordance with an embodiment, this suction duct 26 extends within the washing tank 3 from a lower area thereof to an opening 27 in the upper area thereof and is defined by a portion of the inner surface of the tank 3 and by a lid 28 that is separately manufactured and subsequently connected to the inner surface of the washing tank 3.

[0046] Thereby, the same washing tank 3 can be advantageously used both with washing machines without drying function (without the inner lid 28), and with drier-

washer machines (with the inner lid 28).

[0047] In accordance with a further embodiment, (Fig. 5, 6), the washer-drier machine 1 comprises in addition to the heat exchanger consisting of the cooling water volume 20 on the tank bottom 13, a further heat exchanger 29, which is preferably arranged downstream of the first heat exchanger 19, 20 (with reference to the direction of the drying air flow 22)

[0048] In accordance with an embodiment, the additional heat exchanger 29 comprises a cooling coil 30 that can be supplied with mains water and is arranged in the supply path of the washing water, preferably between the supply electrovalve 6, 7 and the detergent tray 12.

[0049] Thereby, the additional heat exchanger 29 is also supplied by means of the same washing water supply circuit.

[0050] According to an embodiment, the cooling coil 30 of the additional heat exchanger 29 is formed, for example by means of blow moulding, at or in the lid 28 of the suction portion 26 of the drying duct 16.

[0051] Thereby, two further condensation surfaces are obtained, i.e. the inner surface 31 and the outer surface 32 of the lid 28, both arranged within the washing tank 3 and blown by the drying air 22.

[0052] Due to the direct hydraulic connection to one of the supply valves 6, 7, the cooling coil 30 cannot be emptied. By opening the supply valve 6, 7, the water contained within the cooling coil 30 can be only replaced with fresh mains water.

[0053] This allows, during the step of controlling the level of the condensation free surface 23, discharging part of the cooling water volume 20 and condensate accumulated on the tank bottom 3 independently of the additional heat exchanger 29 as well as simultaneously carrying out the replacement of the cooling water in both heat exchangers.

[0054] With reference to the embodiments providing also said further heat exchanger 30, in addition to the first heat exchanger consisting of the cooling water volume 20 on the bottom of the washing tank 3, the control unit is preferably configured such as to allow selecting a drying program, in which, during an early drying step, only the additional heat exchanger will be operated, whereas the condensation space 19 on the tank bottom 13 is not provided with cooling water 20.

[0055] Thereby, during the early drying step, a drier environment is obtained within the tank, which is thus even more favourable to the extraction and condensation of the initial high amount of humidity contained in the laundry.

[0056] The washer-drier machine according to the invention has a number of advantages.

[0057] Due to the free cooling water surface on the tank bottom and due to the fact that a major part of the drying circuit runs within the washing tank 3, a considerable space saving is obtained at the same laundry load relative to the traditional washer-drier machines.

[0058] In view of the particular conformation of the suc-

tion portion 26 of the drying circuit allows using the same tank structure both in washing machines and in the present washer-drier machine.

[0059] The supply of the cooling water 20 on the washing tank bottom 3 being carried out through the same ducts that are provided for carrying the washing water and detergent during the washing and rinse steps, a dedicated duct for supplying the heat exchanger is eliminated. This results in the elimination of at least one dedicated electrovalve for the heat exchanger and the spray nozzles and cooling ducts thereof.

[0060] In conclusion, the washer-drier machine according to the invention is a considerable simplification and unification, both in terms of structure and washing and drying programs.

[0061] Obviously, to the washer-drier machine according to the present invention, those skilled in the art, aiming at meeting contingent and specific requirements, may carry out further modifications and variations, all being however contemplated within the scope of protection of the invention, such as defined in the annexed claims.

Claims

1. A washer-drier machine (1) for washing and drying the Laundry comprising:

- a washing tank (3) suitable to contain the washing liquid;
 - a basket (5) suitable to accommodate the laundry and being pivotally supported within the washing tank (3) ;
 - a drying circuit (16, 17, 18, 19, 20, 21) with a suction unit (17, 18), a heat exchanger (19, 20) and a heating unit (21) which communicate with each other by means of a drying duct (16), said drying circuit (16, 17, 18, 19, 20, 21) being suitable of delivering a drying air flow (33) through said basket (5),
 - a control unit; and
 - level control means (24, 6, 7, 15) wherein the washing tank (3) defines therein a condensation space (19) suitable to contain a cooling water volume (20) that forms a free water surface (23) spaced away from the basket (5) such as to be capable of cooling the drying air flow (22) blowing from the basket (5) within the washing tank (3) and wherein during a drying step the control unit is configured such that said cooling a water volume (20) is held in said condensation space (19) and the level control means (24, 6, 7, 15):
- arrange said cooling water volume (20) such that said free water surface (23) is left out of the basket bulk;
 - control the cooling water level (20) such that, during the drying step, due to the for-

mation of the condensate, the free water surface (23) does not exceed a predetermined upper level arranged below the basket (5),

characterized in that said level control means (24, 6, 7, 15) comprise timer means driving the drainage of at least a part of the cooling water volume (20) and condensate, at preset time intervals.

2. The washer-drier machine (1) according to claim 1, wherein said condensation space (19) is formed at the bottom (13) of the washing tank (3).

3. The washer-drier machine (1) according to any preceding claim, comprising temperature control, 1 means (25, 6, 7, 15) which, during said drying step:

control the temperature of the cooling water volume (20) such that, during the drying step, due to the thermal exchange with the drying air flow (22), the temperature of the water volume (20) does not exceed a predetermined upper temperature value above which the difference of temperature between the condensation surface (23) and the drying air flow (22) is not longer sufficient to condensation purposes.

4. The washer-drier machine (1) according to claim 3, wherein said temperature control means (25, 6, 7, 15) are configured such has to detect, during this drying step, the temperature or a magnitude indicative of the temperature of the cooling water (20) and to at least partially drain the cooling water (20) and to feed a corresponding amount of fresh mains water to the washing tank (3), when the temperature or the indicative magnitude detected exceeds a value corresponding to said upper value.

5. The washer-drier machine (1) according to the preceding claim, wherein said temperature control means comprise a temperature sensor (25) arranged in the vicinity of the tank bottom (13).

6. The washer-drier machine (1) according to the preceding claim, wherein, in response to the attainment of said upper temperature value, said temperature sensor (25) generates a temperature signal and sends it to the control unit, which, in turn, controls the discharge pump (15) and the supply electrovalves (6, 7) and causes the latter to:

- at least partially remove the cooling water (20) and condensate from the washing tank (3) and,
- subsequently, feeding a corresponding amount of fresh mains water.

7. The washer-drier machine (1) according to claim 5, wherein the temperature sensor (25) directly interacts with the power supply of the discharge pump (15) and supply electrovalve (6, 7) and causes either the partial or total replacement of the cooling water (20) in response to the fact that said upper temperature has been attained or exceeded.

8. The washer-drier machine (1) according to any preceding claim, wherein during the drying step, the feeding of the cooling water volume (20) to the washing tank (3) is carried out through the same water supply duct that has been used during the washing step.

9. The washer-drier machine (1) according to any preceding claim when depending on claim 3, wherein a same temperature sensor (25) controls both the cooling water temperature (20) during the drying step and the washing liquid temperature during the washing and rinse steps.

10. The washer-drier machine (1) according to claim 3, wherein said temperature control means comprise timer means that drive the replacement of at least a part of the cooling water (20), at preset time intervals.

11. The washer-drier machine (1) according to any preceding claim, wherein the control unit is configured such as to allow selecting a drying program, wherein during a last drying (cool-down) step, said condensation space (19) results to be completely without cooling water (20).

12. The washer-drier machine (1) according to any preceding claim, wherein the control unit is configured such as to allow selecting a drying program, in which only or also during an early drying step, said condensation space (19) results to be completely without cooling water (20), which will be loaded only after said early step.

13. The washer-drier machine (1) according to any preceding claim, wherein the washing tank (3) defines therein a tubular suction duct (26) that is arranged downstream of the heat exchanger (19, 20) and upstream of the suction unit (17, 18).

14. The washer-drier machine (1) according to the preceding claim, wherein said suction duct (26) extends within the washing tank (3) from a lower area thereof to an opening (27) in the upper area thereof and is defined by a portion of the inner surface of the tank of (3) and by a lid (28) that is separately manufactured and subsequently connected to the inner surface of the washing tank (3).

15. The washer-drier machine (1) according to any pre-

ceding claim, comprising in addition to said heat exchanger (19, 20), an additional heat exchanger (29) arranged downstream of the first heat exchanger (19, 20) with reference to the direction of the drying air flow (22).

16. The washer-drier machine (1) according to the preceding claim, wherein said additional heat exchanger (29) comprises a cooling coil (30) that can be supplied with mains water and is arranged in the supply path of the washing water.
17. The washer-drier machine (1) according to the preceding claim, wherein said additional heat exchanger (29) is arranged in series between the supply electrovalve (6, 7) and a detergent to tray (12) and can be supplied by means of the same washing water supply circuit.
18. The washer-drier machine (1) according to one of claims 15 to 17, wherein the cooling coil (30) of the additional heat exchanger (29) is formed at or in the lid (28) of the suction duct (26), such as to provide two further condensation surfaces, both arranged within the washing tank (3).
19. The washer-drier machine (1) according to one of claims 15 to 18, wherein, during the step of controlling the level of the condensation free surface (23), at least a part of the cooling water volume (20) and condensate accumulated on the tank bottom (3) can be drained independently of the additional heat exchanger (29).
20. The washer-drier machine (1) according to one of claims 15 to 19, wherein the control unit is configured such as to allow selecting a drying program, in which, during an early drying step, only the additional heat exchanger (29) will be operated, whereas the condensation space (19) on the tank bottom (13) is not provided with cooling water (20).

Patentansprüche

1. Wasch-Trockner-Gerät (1) zum Waschen und Trocknen der Wäsche, umfassend:
 - einen Waschbehälter (3), welcher dazu geeignet ist, die Waschflüssigkeit zu beinhalten;
 - einen Korb (5), welcher dazu geeignet ist, die Wäsche aufzunehmen und innerhalb des Waschbehälters (3) drehbar gelagert zu sein;
 - einen Trocknungskreislauf (16, 17, 18, 19, 20, 21) mit einer Saugeinheit (17, 18), einem Wärmetauscher (19, 20) und einer Heizeinheit (21), welche miteinander mittels einer Trocknungsleitung (16) in Verbindung stehen, wobei die Trock-

nungsleitung (16, 17, 18, 19, 20, 21) dazu geeignet ist, einen Trocknungsluftstrom (33) durch den Korb (5) zu liefern,
- eine Regel-/Steuereinheit; und
- Niveau-Regel-/Steuermittel (24, 6, 7, 15)

wobei der Waschbehälter (3) darin einen Kondensationsraum (19) definiert, welcher dazu geeignet ist, ein Kühlwasservolumen (20) zu beinhalten, welches eine freie Wasserfläche (23) bildet, welche von dem Korb (5) beabstandet ist, um in der Lage zu sein, den Trocknungsluftstrom (22) zu kühlen, welcher von dem Korb (5) innerhalb des Waschbehälters (3) bläst, und wobei während eines Trocknungsschritts die Regel-/Steuereinheit derart eingerichtet ist, dass das Wasservolumen (20) in dem Kondensationsraum (19) gehalten ist und die Niveau-Regel-/Steuermittel (24, 6, 7, 15):

- das Kühlwasservolumen (20) derart anordnen, dass die freie Wasserfläche (23) aus der Korb-anordnung weggelassen wird;
- das Kühlwasserniveau (20) derart regeln/steuern, dass während des Trocknungsschritts, auf Grund der Bildung des Kondensats, die freie Wasserfläche (23) ein vorbestimmtes oberes Niveau, welches unterhalb des Korbs (5) angeordnet ist, nicht überschreitet,

dadurch gekennzeichnet, dass die Niveau-Regel-/Steuermittel (24, 6, 7, 15) Zeitgebermittel umfassen, welche den Ablass wenigstens eines Teils des Kühlwasservolumens (20) und des Kondensat zu voreingestellten Zeitintervallen antreiben.

2. Wasch-Trockner-Gerät (1) nach Anspruch 1, wobei der Kondensationsraum (19) an dem Boden (13) des Waschbehälters (3) gebildet ist.
3. Wasch-Trockner-Gerät (1) nach einem der vorhergehenden Ansprüche, umfassend Temperatur-Regel-/Steuermittel (25, 6, 7, 15), welche während des Trocknungsschritts:
 - die Temperatur des Kühlwasservolumens (20) derart regeln/steuern, dass während des Trocknungsschritts, auf Grund des Wärmeaustausches mit dem Trocknungsluftstrom (22), die Temperatur des Wasservolumens (20) einen vorbestimmten oberen Temperaturwert nicht übersteigt, über welchem der Temperaturunterschied zwischen der Kondensationsfläche (23) und den Trocknungsluftstrom (22) für Kondensationszwecke nicht ausreichend ist.
4. Wasch-Trockner-Gerät (1) nach Anspruch 3, wobei die Temperatur-Regel-/Steuermittel (25, 6, 7, 15) dazu eingerichtet sind, die Temperatur oder eine

Größe, welche die Temperatur des Kühlwassers (20) anzeigt, während dieses Trocknungsschritts zu erfassen und zumindest teilweise das Kühlwasser (20) abzulassen und eine entsprechende Menge an frischem Leitungswasser in den Waschbehälter (3) einzuspeisen, wenn die erfasste Temperatur oder die erfasste anzeigende Größe einen dem oberen Wert entsprechenden Wert überschreitet.

5. Wasch-Trockner-Gerät (1) nach dem vorhergehenden Anspruch, wobei die Temperatur-Regel-/Steuermittel einen Temperatursensor (25) umfassen, welcher in der Nähe des Behälterbodens (13) angeordnet ist. 10
6. Wasch-Trockner-Gerät (1) nach dem vorhergehenden Anspruch, wobei der Temperatursensor (25) in Reaktion auf das Erreichen des oberen Temperaturwerts ein Temperatursignal erzeugt und es an die Regel-/Steuereinheit sendet, welche wiederum die Abgabepumpe (15) und die Versorgungs-Elektroventile (6, 7) regelt/steuert und Letztere dazu veranlasst: 15
 - wenigstens teilweise das Kühlwasser (20) und das Kondensat aus dem Waschbehälter (3) zu entfernen und 20
 - anschließend eine entsprechende Menge von frischem Leitungswasser einzuspeisen. 25
7. Wasch-Trockner-Gerät (1) nach Anspruch 5, wobei der Temperatursensor (25) direkt mit der Stromversorgung der Abgabepumpe (15) und dem Versorgungs-Elektroventil (6, 7) wechselwirkt und entweder den teilweisen oder gesamten Austausch des Kühlwassers (20) in Reaktion auf die Tatsache, dass die obere Temperatur erreicht worden ist oder überschritten worden ist, veranlasst. 30
8. Wasch-Trockner-Gerät (1) nach einem der vorhergehenden Ansprüche, wobei während des Trocknungsschritts das Einspeisen des Kühlwasservolumens (20) in den Waschbehälter (3) durch die selbe Wasserzuführleitung ausgeführt wird, welche während des Waschschriffs verwendet worden ist. 35
9. Wasch-Trockner-Gerät (1) nach einem der vorhergehenden Ansprüche, wenn abhängig von Anspruch 3, wobei ein gleicher Temperatursensor (25) sowohl die Kühlwassertemperatur (20) während des Trocknungsschritts als auch die Waschflüssigkeitstemperatur während der Wasch- und Spül-Schritte regelt/steuert. 40
10. Wasch-Trockner-Gerät (1) nach Anspruch 3, wobei die Temperatur-Regel-/Steuermittel Zeitgebermittel umfassen, welche den Austausch wenigstens eines Teils des Kühlwassers (20) zu voreingestellten 45

Zeitintervallen antreiben.

11. Wasch-Trockner-Gerät (1) nach einem der vorhergehenden Ansprüche, wobei die Regel-/Steuereinheit dazu eingerichtet ist, ein Auswählen eines Trocknungsprogramms zu erlauben, wobei es sich während des letzten Trocknungs- (Herunterkühlungs-) Schritts ergibt, dass der Kondensationsraum (19) vollständig ohne Kühlwasser (20) ist. 5
12. Wasch-Trockner-Gerät (1) nach einem der vorhergehenden Ansprüche, wobei die Regel-/Steuereinheit dazu eingerichtet ist, ein Auswählen eines Trocknungsprogramms zu erlauben, in welchem es sich nur oder auch während eines frühen Trocknungsschritts ergibt, dass der Kondensationsraum (19) vollständig ohne Kühlwasser (20) ist, welches nur nach dem frühen Schritt eingegeben werden wird. 10
13. Wasch-Trockner-Gerät (1) nach einem der vorhergehenden Ansprüche, wobei der Waschbehälter (3) darin eine röhrenförmige Saugleitung (26) definiert, welche stromabwärts des Wärmetauschers (19, 20) und stromaufwärts der Saugereinheit (17, 18) angeordnet ist. 15
14. Wasch-Trockner-Gerät (1) nach dem vorhergehenden Anspruch, wobei sich die Saugleitung (26) innerhalb des Waschbehälters (3) von einem unteren Bereich davon zu einer Öffnung (27) in dem oberen Bereich davon erstreckt und durch einen Abschnitt der inneren Fläche des Behälters (3) und durch eine Klappe (28), welche getrennt hergestellt ist und anschließend mit der inneren Fläche des Waschbehälters (3) verbunden ist, definiert ist. 20
15. Wasch-Trockner-Gerät (1) nach einem der vorhergehenden Ansprüche, umfassend zusätzlich zu dem Wärmetauscher (19, 20) einen zusätzlichen Wärmetauscher (29), welcher stromabwärts des ersten Wärmetauschers (19, 20) in Bezug auf die Richtung des Trocknungsluftstroms (22) angeordnet ist. 25
16. Wasch-Trockner-Gerät (1) nach dem vorhergehenden Anspruch, wobei der zusätzliche Wärmetauscher (29) eine Kühlspule (30) umfasst, welche mit Leitungswasser versorgt werden kann und in dem Versorgungsweg des Waschwassers angeordnet ist. 30
17. Wasch-Trockner-Gerät (1) nach dem vorhergehenden Anspruch, wobei der zusätzliche Wärmetauscher (29) in Reihe zwischen dem Versorgungs-Elektroventil (6, 7) und einem Detergens-Fach (12) angeordnet ist und mittels des gleichen Waschwasserversorgungskreislaufs versorgt werden kann. 35

18. Wasch-Trockner-Gerät (1) nach einem der Ansprüche 15 bis 17, wobei die Kühlspule (30) des zusätzlichen Wärmetauschers (29) an oder in der Klappe (28) der Saugleitung (26) gebildet ist, um zwei weitere Kondensationsflächen bereitzustellen, welche beide innerhalb des Waschbehälters (3) angeordnet sind. 5
19. Wasch-Trockner-Gerät (1) nach einem der Ansprüche 15 bis 18, wobei während des Schritts des Regelns/Steuerns des Niveaus der Kondensations-Frei-Fläche (23) wenigstens ein Teil des Kühlwasservolumens (20) und des Kondensats, welche an dem Behälterboden (3) angesammelt sind, unabhängig von dem zusätzlichen Wärmetauscher (29) abgelassen werden können. 10 15
20. Wasch-Trockner-Gerät (1) nach einem der Ansprüche 15 bis 19, wobei die Regel-/Steuereinheit dazu eingerichtet ist, ein Auswählen eines Trocknungsprogramms zu erlauben, in welchem während eines frühen Trocknungsschritts nur der zusätzliche Wärmetauscher (29) betrieben werden wird, wobei der Kondensationsraum (19) an dem Behälterboden (13) nicht mit Kühlwasser (20) versehen ist. 20 25

Revendications

1. Machine lavante-séchante (1) destinée au lavage et au séchage du linge comprenant : 30
- une cuve de lavage (3) adaptée pour contenir le liquide de lavage ;
 - un panier (5) adapté pour recevoir le linge et supporté de manière pivotante à l'intérieur de la cuve de lavage (3) ; 35
 - un circuit de séchage (16, 17, 18, 19, 20, 21) avec une unité d'aspiration (17, 18), un échangeur de chaleur (19, 20) et une unité de chauffage (21) qui communiquent les uns avec les autres au moyen d'un conduit de séchage (16), ledit circuit de séchage (16, 17, 18, 19, 20, 21) étant adapté pour fournir un flux d'air de séchage (33) à travers ledit panier (5), 40
 - une unité de commande ; et
 - des moyens de commande de niveau (24, 6, 7, 15) 45
- dans laquelle la cuve de lavage (3) définit à l'intérieur de celle-ci un espace de condensation (19) adapté pour contenir un volume d'eau de refroidissement (20) qui forme une surface d'eau libre (23) espacée du panier (5) de façon à être capable de refroidir le flux d'air de séchage (22) soufflant du panier (5) à l'intérieur de la cuve de lavage (3) et dans laquelle pendant une étape de séchage, l'unité de commande est configurée de façon à ce que ledit volume 50 55

d'eau de refroidissement (20) soit maintenu dans ledit espace de condensation (19) et les moyens de commande de niveau (24, 6, 7, 15) :

- agencent ledit volume d'eau de refroidissement (20) de façon à ce que ladite surface d'eau libre (23) soit exclue du volume de panier ;
- commandent le niveau d'eau de refroidissement (20) de façon à ce que, pendant l'étape de séchage, en raison de la formation du condensat, la surface d'eau libre (23) ne dépasse pas un niveau supérieur prédéterminé situé sous le panier (5),

caractérisée en ce que lesdits moyens de commande de niveau (24, 6, 7, 15) comprennent des moyens de minuterie commandant l'évacuation d'au moins une partie du volume d'eau de refroidissement (20) et du condensat, à des intervalles de temps prédéfinis.

2. Machine lavante-séchante (1) selon la revendication 1, dans laquelle ledit espace de condensation (19) est formé au niveau de la partie inférieure (13) de la cuve de lavage (3).
3. Machine lavante-séchante (1) selon l'une quelconque des revendications précédentes, comprenant des moyens de commande de température (25, 6, 7, 15) qui, pendant ladite étape de séchage : 5
- commandent la température du volume d'eau de refroidissement (20) de façon à ce que, pendant l'étape de séchage, en raison de l'échange thermique avec le flux d'air de séchage (22), la température du volume d'eau (20) ne dépasse pas une valeur de température supérieure prédéterminée au-dessus de laquelle la différence de température entre la surface de condensation (23) et le flux d'air de séchage (22) n'est plus suffisante à des fins de condensation.
4. Machine lavante-séchante (1) selon la revendication 3, dans laquelle lesdits moyens de commande de température (25, 6, 7, 15) sont configurés de façon à détecter, pendant cette étape de séchage, la température ou une amplitude indiquant la température de l'eau de refroidissement (20) et à évacuer au moins partiellement l'eau de refroidissement (20) et à alimenter la cuve de lavage (3) en une quantité correspondante d'eau courante fraîche, lorsque la température ou l'amplitude indiquée détectée dépasse une valeur correspondant à ladite valeur supérieure.
5. Machine lavante-séchante (1) selon la revendication précédente, dans laquelle lesdits moyens de commande de température comprennent un capteur de

température (25) agencé au voisinage de la partie inférieure de la cuve (13).

6. Machine lavante-séchante (1) selon la revendication précédente, dans laquelle, en réponse à l'atteinte de ladite valeur de température supérieure, ledit capteur de température (25) génère un signal de température et l'envoie à l'unité de commande, qui, à son tour, commande la pompe d'évacuation (15) et les électrovalves d'alimentation (6, 7) et amène ces dernières :
 - à retirer au moins partiellement l'eau de refroidissement (20) et le condensat de la cuve de lavage (3) et,
 - ensuite, à fournir une quantité correspondante d'eau courante fraîche.
7. Machine lavante-séchante (1) selon la revendication 5, dans laquelle le capteur de température (25) interagit directement avec l'alimentation en courant de la pompe d'évacuation (15) et l'électrovalve d'alimentation (6, 7) et provoque le remplacement soit partiel soit total de l'eau de refroidissement (20) en réponse au fait que ladite température supérieure a été atteinte ou dépassée.
8. Machine lavante-séchante (1) selon une quelconque revendication précédente, dans laquelle pendant l'étape de séchage, l'alimentation de la cuve de lavage (3) en volume d'eau de refroidissement (20) est réalisée à travers le même conduit d'alimentation d'eau que celui utilisé pendant l'étape de lavage.
9. Machine lavante-séchante (1) selon une quelconque revendication précédente lorsque dépendante de la revendication 3, dans laquelle un même capteur de température (25) commande à la fois la température de l'eau de refroidissement (20) pendant l'étape de séchage et la température du liquide de lavage pendant les étapes de lavage et de rinçage.
10. Machine lavante-séchante (1) selon la revendication 3, dans laquelle lesdits moyens de commande de température comprennent des moyens de minuterie qui commandent le remplacement d'au moins une partie de l'eau de refroidissement (20), à des intervalles de temps prédéfinis.
11. Machine lavante-séchante (1) selon une quelconque revendication précédente, dans laquelle l'unité de commande est configurée de façon à permettre la sélection d'un programme de séchage, dans lequel pendant une dernière étape de (refroidissement) séchage, ledit espace de condensation (19) se retrouve entièrement sans eau de refroidissement (20).
12. Machine lavante-séchante (1) selon une quelconque

revendication précédente, dans laquelle l'unité de commande est configurée de façon à permettre la sélection d'un programme de séchage, dans lequel seulement ou aussi pendant une étape de séchage précoce, ledit espace de condensation (19) se retrouve entièrement sans eau de refroidissement (20), qui sera chargée uniquement après ladite étape précoce.

13. Machine lavante-séchante (1) selon une quelconque revendication précédente, dans laquelle la cuve de séchage (3) définit à l'intérieur de celle-ci un conduit d'aspiration tubulaire (26) qui est agencé en aval de l'échangeur de chaleur (19, 20) et en amont de l'unité d'aspiration (17, 18).
14. Machine lavante-séchante (1) selon la revendication précédente, dans laquelle ledit conduit d'aspiration (26) s'étend à l'intérieur de la cuve de lavage (3) d'une zone inférieure de celle-ci à une ouverture (27) dans la zone supérieure de celle-ci et est défini par une partie de la surface intérieure de la cuve (3) et par un couvercle (28) qui est fabriqué séparément et ensuite relié à la surface intérieure de la cuve de lavage (3).
15. Machine lavante-séchante (1) selon une quelconque revendication précédente, comprenant en plus dudit échangeur de chaleur (19, 20), un échangeur de chaleur supplémentaire (29) agencé en aval du premier échangeur de chaleur (19, 20) en se référant à la direction du flux d'air de séchage (22).
16. Machine lavante-séchante (1) selon la revendication précédente, dans laquelle ledit échangeur de chaleur supplémentaire (29) comprend un serpentin de refroidissement (30) qui peut être alimenté en eau courante et est agencé dans la trajectoire d'alimentation de l'eau de lavage.
17. Machine lavante-séchante (1) selon la revendication précédente, dans laquelle ledit échangeur de chaleur supplémentaire (29) est agencé en série entre l'électrovalve d'alimentation (6, 7) et un bac à détergent (12) et peut être alimenté au moyen du même circuit d'alimentation d'eau de lavage.
18. Machine lavante-séchante (1) selon l'une des revendications 15 à 17, dans laquelle le serpentin de refroidissement (30) de l'échangeur de chaleur supplémentaire (29) est formé au niveau du ou dans le couvercle (28) du conduit d'aspiration (26), de façon à fournir deux autres surfaces de condensation, agencées toutes deux à l'intérieur de la cuve de lavage (3).
19. Machine lavante-séchante (1) selon l'une des revendications 15 à 18, dans laquelle, pendant l'étape de

commande du niveau de la surface libre de condensation (23), au moins une partie du volume d'eau de refroidissement (20) et du condensat accumulés sur la partie inférieure de la cuve (3) peuvent être évacués indépendamment de l'échangeur de chaleur supplémentaire (29). 5

20. Machine lavante-séchante (1) selon l'une des revendications 15 à 19, dans laquelle l'unité de commande est configurée de façon à permettre la sélection d'un programme de séchage, dans lequel, pendant une étape de séchage précoce, seul l'échangeur de chaleur supplémentaire (29) sera actionné, tandis que l'espace de condensation (19) sur la partie inférieure de la cuve (13) n'est pas fournie en eau de refroidissement (20). 10 15

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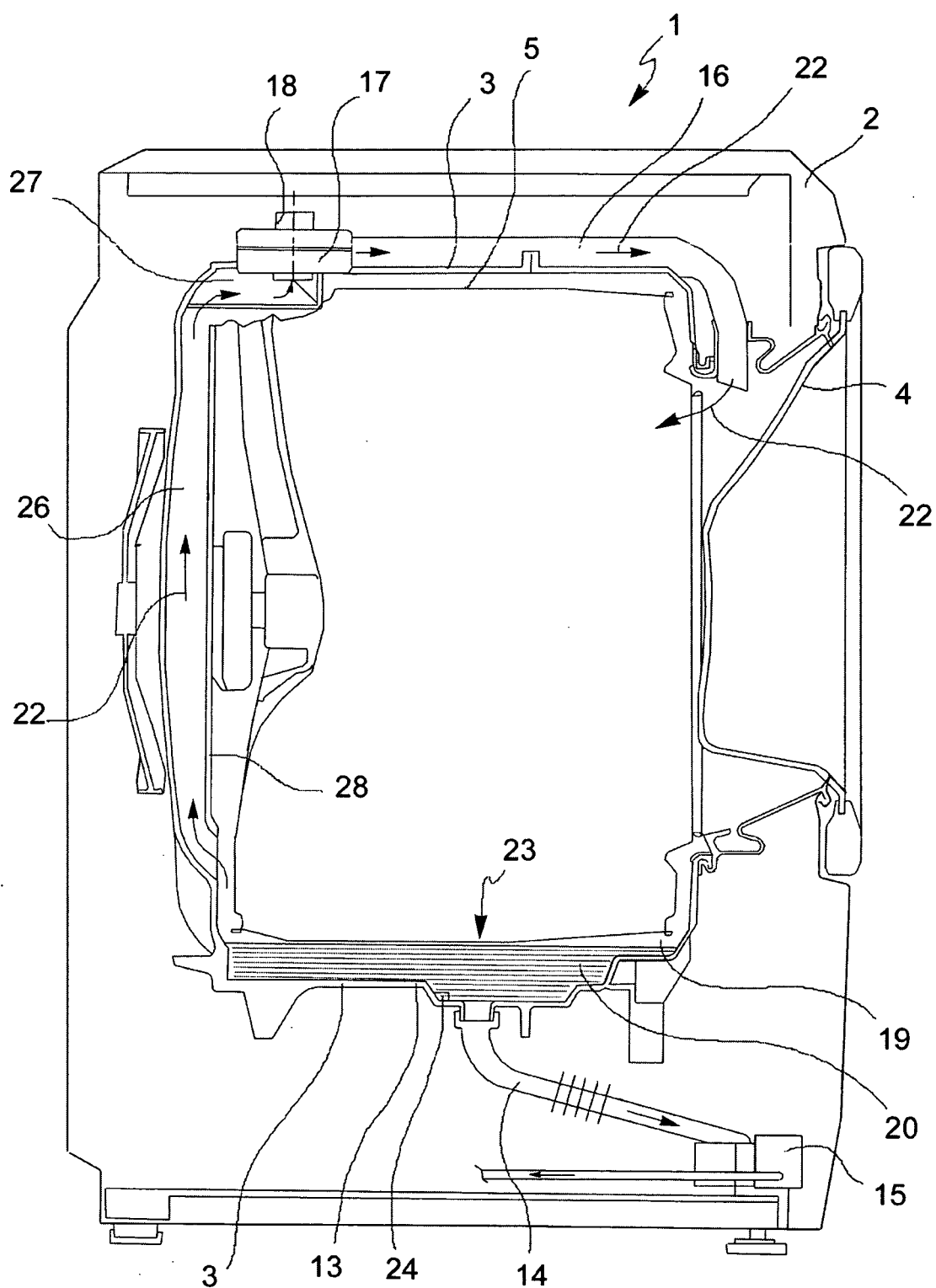


FIG. 1

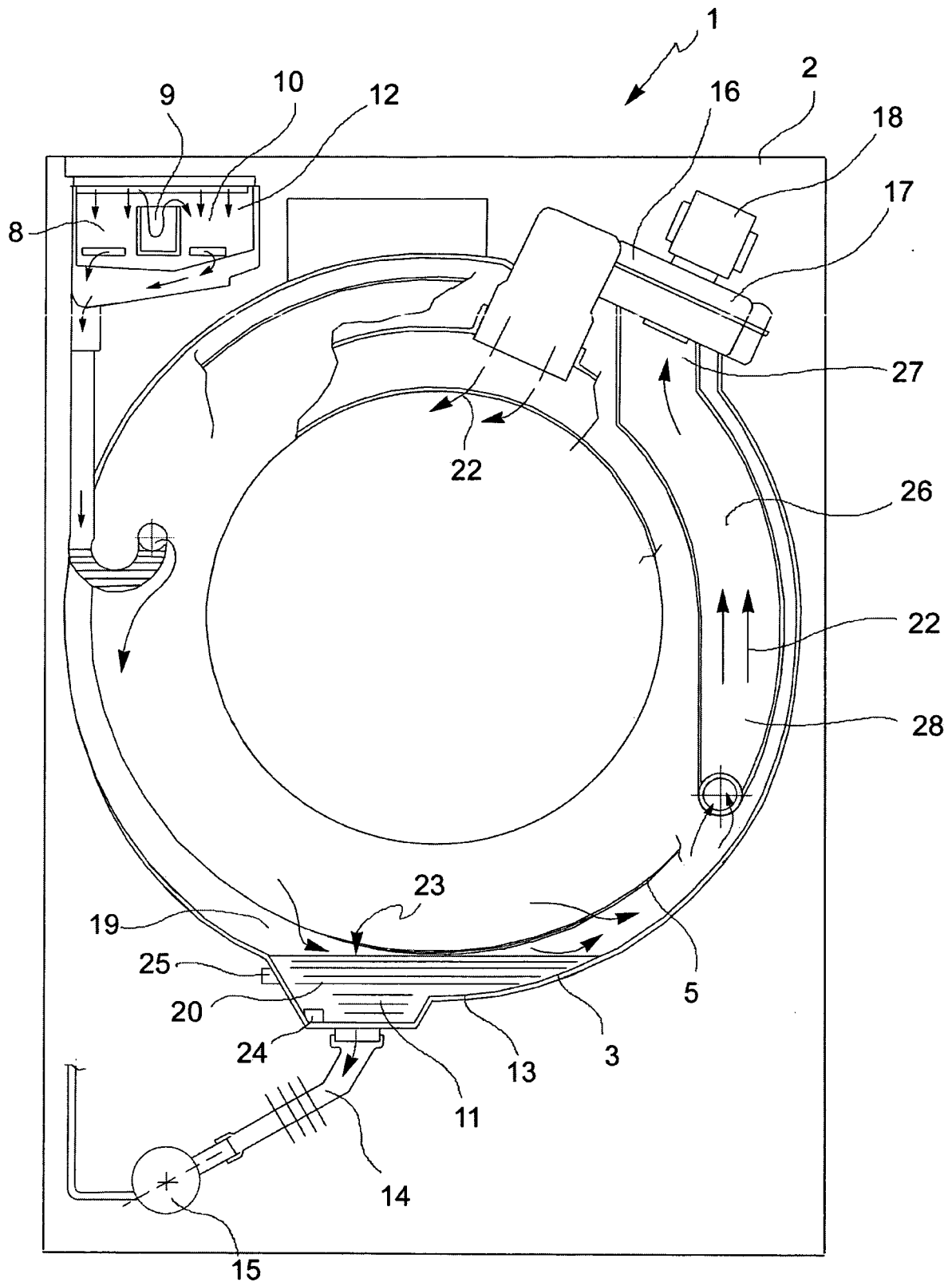


FIG. 2

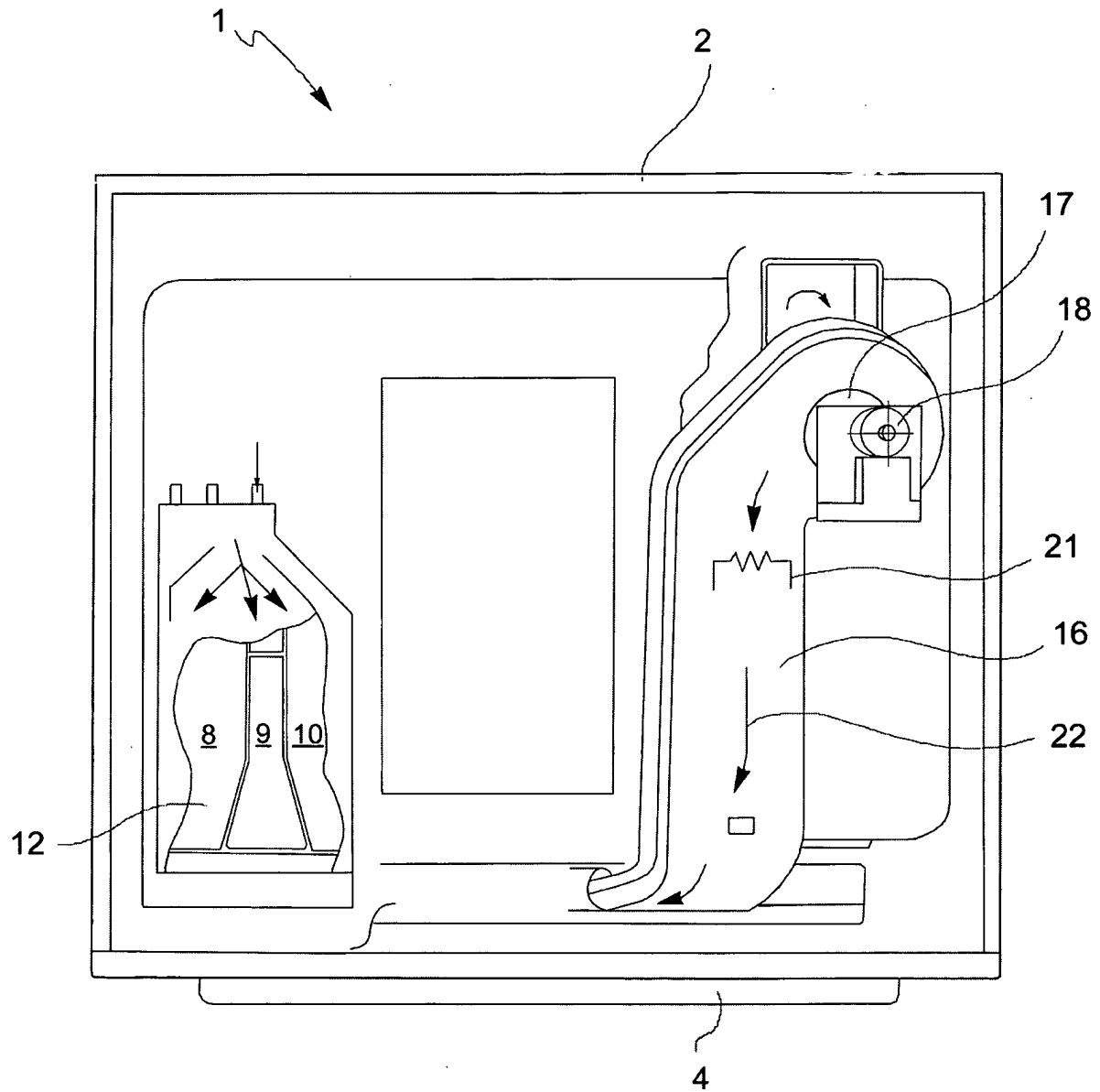


FIG. 3

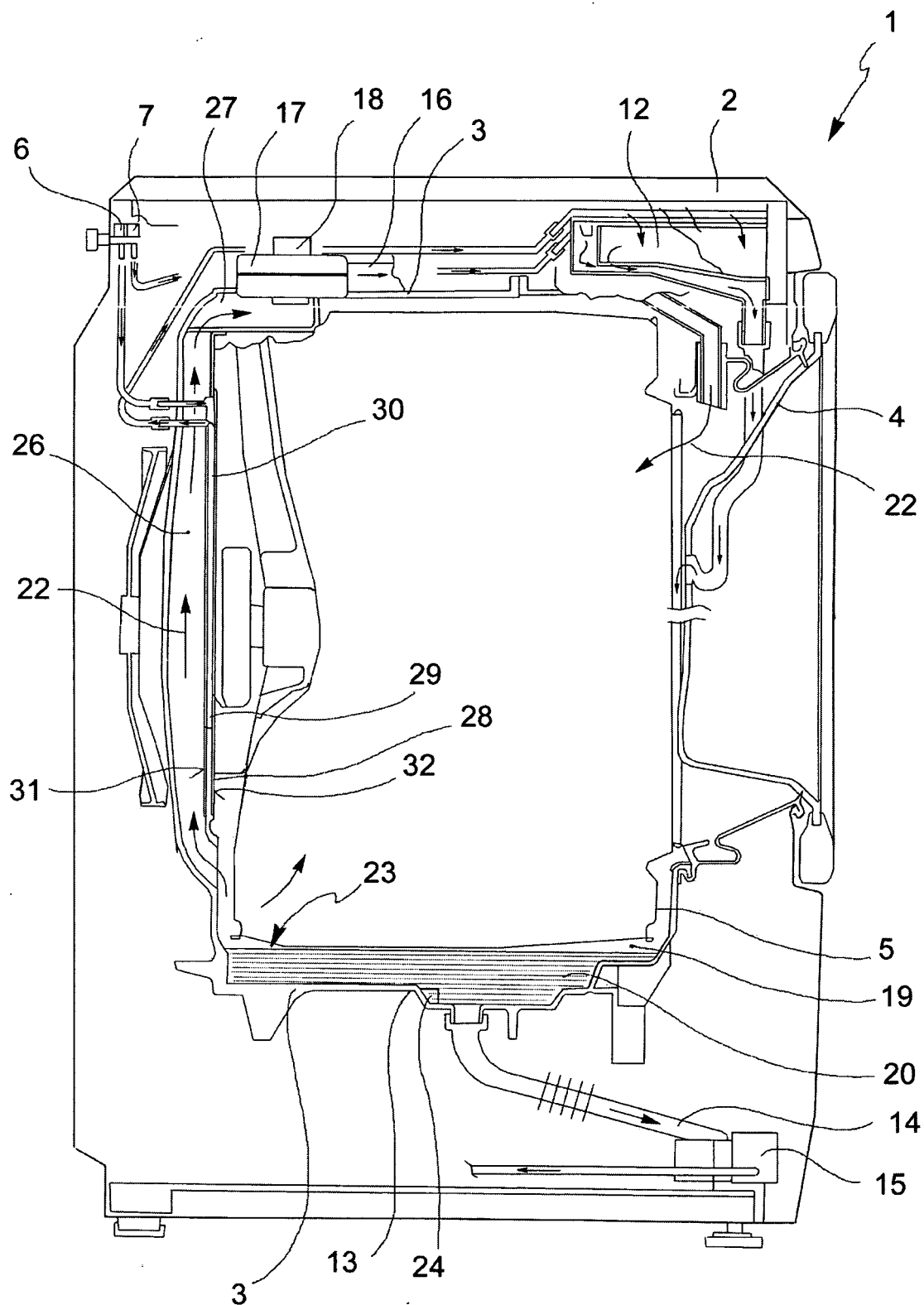


FIG. 4

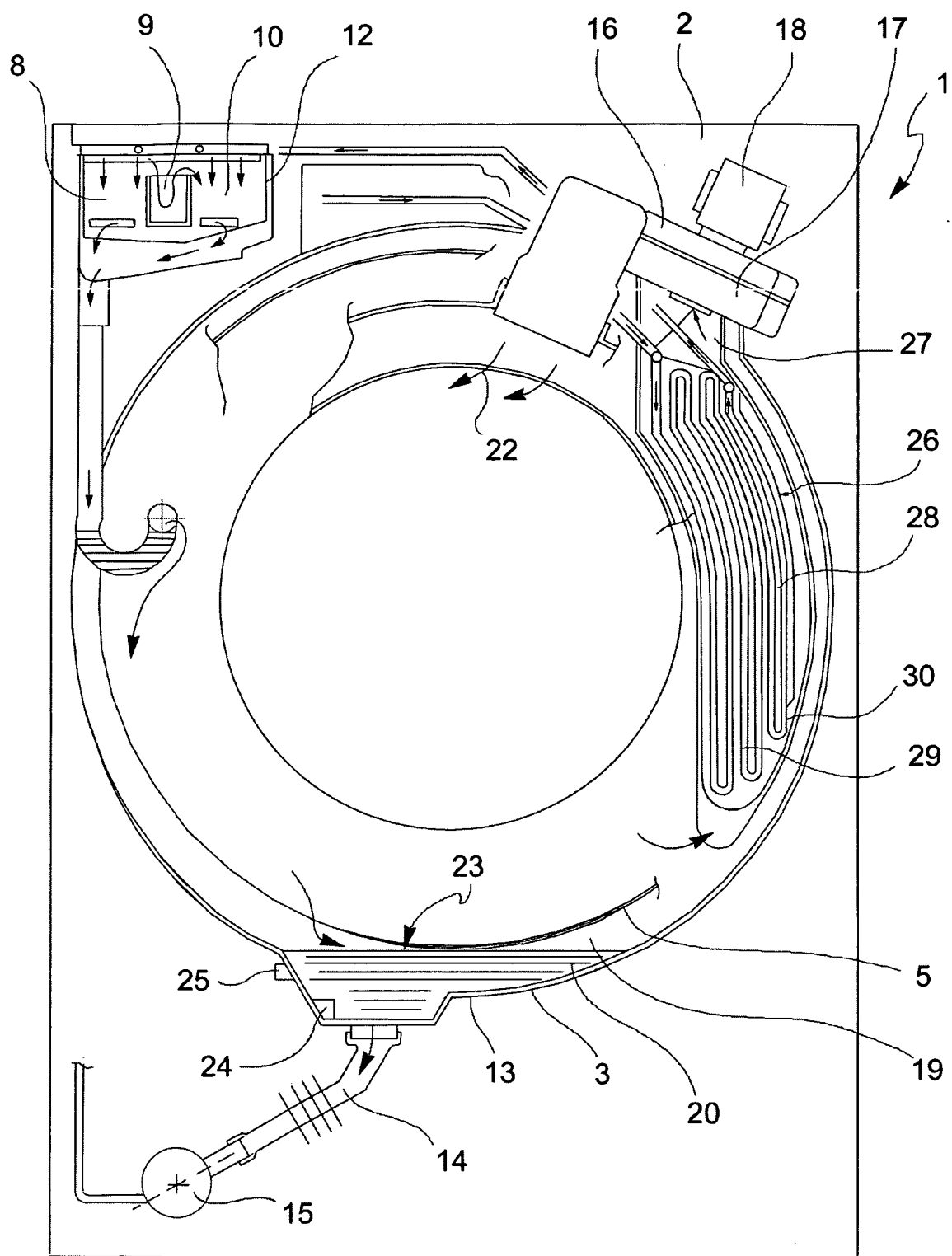


FIG. 5

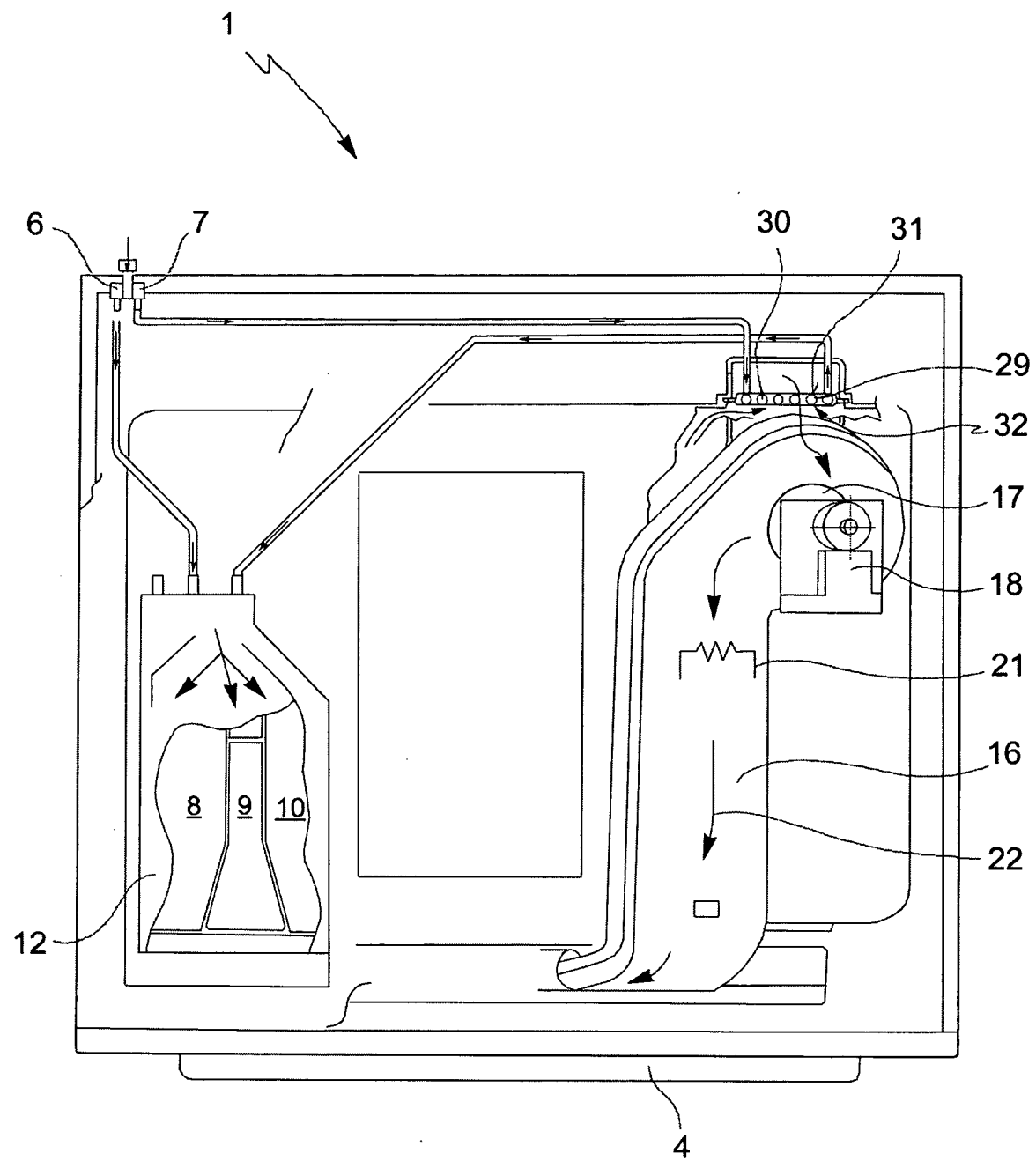


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1657341 A2 [0010]