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(71) Applicant: **Electrolux Home Products Corporation N.V.**
1930 Zaventem (BE)

(72) Inventors:
- **Poloni, Fabio**
  33078 San Vito al Tagliamento (PN) (IT)
- **Rigo, Flavio**
  33170 Pordenone (IT)

(74) Representative: **Nardoni, Andrea et al**
Electrolux Italia S.p.A.
Corso Lino Zanussi, 30
33080 Porcia (PN) (IT)

(54) Washing-drying machine and method for operating the same

(57) The present invention relates to a washing-drying machine and to a method for operating said machine.

A washing-drying machine according to the invention comprises:
- an articles storing chamber (2);
- a water circuit (4) for supplying water to the chamber (2) said water circuit being connectable to a water supply;
- an air circuit (7) for circulating drying air within said chamber (2), said air circuit (7) having pumping means (10), heating means (9) for heating said drying air and condensing means (8, 108, 208) adapted to remove moisture from said drying air comprising a first water/air heat exchanger (12, 112, 212);

Said washing-drying machine is **characterized in that** said water/air heat exchanger (12, 112, 212) is fluidly connected to said water circuit (4) through a first fluid line (21) such that at least a portion of water provided for cooling heat exchanger (12, 112, 212) can be supplied within said articles storing chamber (2) for washing operations, and/or said articles storing chamber (2) is hydraulically connected to the water/air heat exchanger (12, 112, 212) through a pipe line (40, 27) such that at least a portion of water provided for washing operations can be supplied to cool said heat exchanger (12, 112, 212)..

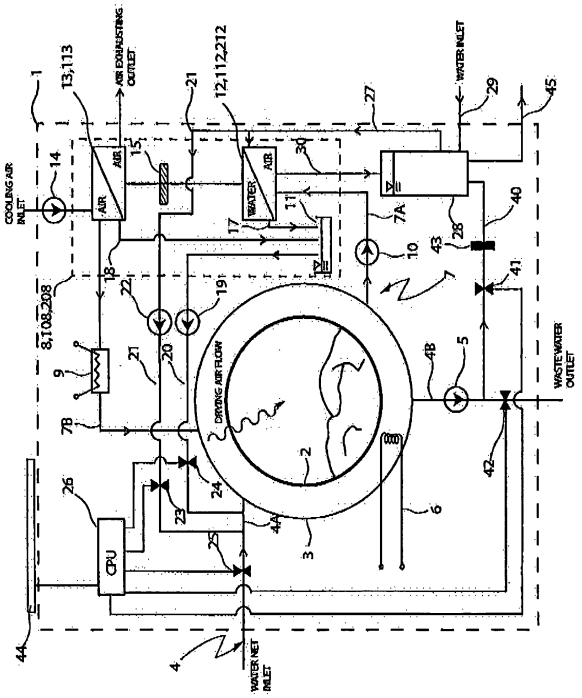

FIG. 1

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Description

[0001] The present invention relates to a washing-drying machine and to a method for operating said machine.

[0002] A washer-dryer appliance is generally provided for performing articles washing and drying operations in a single machine. In this view a washing-drying machine comprises a drum for receiving articles to be treated, which is rotatably mounted within a tub. A water circuit including pumping means is provided for allowing washing water to be supplied to and drained from said tub. An air circuit, having air circulating means and heating means, is provided for carrying out drying operation by circulating hot air through the drum. Condensing means are further provided in said air circuit for removing moisture from drying air passing through articles to be treated thereby allowing said air to be re-circulated cyclically within the air circuit. Moisture removed from articles is either collected in a tank periodically emptied by a user or it is directly exhausted by a pipe connected to a waste water net,

[0003] In washing-drying machines of known type, said condensing means generally comprise a box-like structure associated to the drying air circuit and a nozzle which is connected to a water supply for spraying said water against the drying air flow. A drawback of such known machines consists in that droplets of water nebulized by condensing means nozzle through the moist air flow can be partly transported by the flow downwards the condensing means and, in particular, towards electrically powered heating means causing potential security risks.

[0004] A further drawback of the above cited type of known washing-drying machines consists in that condensing efficiency is low, and, in particular, lower than that of a drying machine provided with a condenser in the form of a heat exchanger wherein drying air is dehydrated by means of a fluid flow, i.e. a flow of air or water. In such known washing-drying machines, drying cycles may require a long time and a high power consuming to be carried out while drying results achieved may be poor.

[0005] In order to improve efficiency of drying operations by reducing energy loss in the condenser, drying machines have been proposed in the market provided with additional heat exchangers for recovering energy by the hot drying air flow. FR 2 453 930 discloses one of said known drying machines having a first heat exchanger provided in the drying air circuit upstream the condensing unit for cooling said air flow before it enters such unit. Heat recovered in the first heat exchanger is conveyed back to the drying air flow by a second heat exchanger provided in the drying air circuit between the condensing unit and electrical heating means. First and second heat exchangers are connected by a common fluid path wherein a gaseous or liquid medium circulates in a closed loop for transferring heat from a part of the drying air circuit to another.

[0006] A drawback of a drying machine according to FR 2 453 930 consists in that its manufacture costs does not economically compensate energy savings that can be achieved with such machine. In addition, such machine is designed for carrying out only a drying process and it has no means for articles washing operations.

[0007] The aim of the present invention is therefore to solve the noted drawbacks and thus providing a washing-drying machine having an improved energy efficiency.

[0008] An object of the present invention is not only to provide a washing-drying machine having a shorter drying time compared to known machines, but also a method for operating said machine that allows to save both water and energy during washing and drying operations.

[0009] Another object of the invention is to provide a washing-drying machine having higher safety.

[0010] A further object of the invention is to provide a washing-drying machine wherein washing and drying operational cycles are integrated for high energy recovery.

[0011] Another object of the invention is to provide a method for operating a washing-drying machine wherein condensing capacity of air moisture condensing means can be adjusted for achieving a desired drying efficiency and/or limiting energy consumption.

[0012] Advantages, objects, and features of the invention will be set forth in part in the description and drawings which follow and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objects and advantages of the invention may be realised and attained as particularly pointed out in the appended claims.

[0013] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate possible embodiments of the invention and together with the description serve to explain the principles of the invention. Like reference numbers represents like features throughout the accompanying drawings, wherein:

[0014] Figure 1 shows schematically a washing-drying machine according to the invention;

[0015] Figure 2 shows a first embodiment of a condensing unit and drying air circuit of a washing-drying machine according to the invention;

[0016] Figure 3 shows a second embodiment of a condensing unit and drying air circuit of a washing-drying machine according to the invention;

[0017] With reference to Figure 1 a washing-drying machine 1 according to the invention comprises an articles storing chamber 2 preferably in the form of a drum rotatably mounted within a tub 3. A water circuit 4 comprises a first conduit 4A for supplying water drained from a water net, like a public water net, to storing chamber 2 and a second conduit 4B for exhausting water from said chamber 2. Pumping means 5 is provided in water circuit 4 for circulating water within said circuit 4. Heating means 6 are provided in the storing chamber 2 for heating water during an articles washing operation. A first valve means

25 is mounted in the water circuit 4 for controlling water flow within the circuit 4.

[0018] In order to perform an articles drying operation, washing-drying machine 1 comprises an air circuit 7 having a first conduit 7A in fluid communication with the articles storing chamber 2 for exhausting dying air passed through articles to be dried and for conveying said air, enriched in humidity, towards a condensing unit 8, indicated with dashed lines in Figure 1, where air moisture is removed. Air exiting the condensing unit 8 flows through a second conduit 7B connecting a condenser outlet port with an inlet port provided for allowing air to access the articles storing chamber 2. Heating means 9 are provided in conduit 7B for heating air before it enters chamber 2. Pumping means 10, such as a fan, is provided in the air circuit 7 for circulating drying air cyclically through the storing chamber 2. Moisture removed from drying air by the condensing unit 8 is collected in a reservoir 11.

[0019] According to the invention, said condensing unit 8 generally comprises a first heat exchanger 12 of water/air type, i.e. an exchanger wherein moist drying air is condensed by water-cooled means. Heat exchanger 12 is therefore hydraulically connected to a water supply like a water tank of suitable capacity placed within the washer-drying machine 1 as will be diffusely described below.

[0020] Condensing unit 8 further comprises a second heat exchanger 13 of air/air type, i.e. an exchanger wherein moist drying air is condensed by air-cooled means. Cooling air is taken from the environment surrounding the machine 1 by means of a fan 14 and it is exhausted from the second heat exchanger 13 to the same environment. First and second heat exchangers 12, 13 are connected in series relative to the drying air flow, such that one of them receives drying air exiting the other. The position order of heat exchangers 12, 13 relative to the drying air flow can be the most appropriate according to the arrangement of operational components inside the machine. One or more air filters 15 may be arranged in the drying air circuit 7, and preferably between the two heat exchangers 12, 13.

[0021] With reference to Figure 2 it is disclosed a first embodiment 108 of the condensing unit 8 and drying air circuit 7 illustrated in figure 1. In such embodiment, the same reference numbers have been used for indicating features already depicted schematically in Figure 1.

[0022] A condensing unit 108 according to the first embodiment of the inventions is formed by a first heat exchanger 112 of water/air type comprising a plurality of conduits 16 wherein cooling water is circulated for removing a first amount of moisture from drying air conveyed by air circuit 7 to pass through interstices provided among said plurality of conduits 16. The air circuit 7 comprises first and second conduits 7A, 7B in fluid communication with the articles storing chamber 2 (Figure 1). Heating means 9 are provided in the second conduit 7B for heating the drying air flow. Condensed moisture is exhausted from the heat exchanger 112 by a water outlet port 17. As shown in Figure 1, cooling water can be supplied from a pipe 27 hydraulically connected to a water tank 28 provided inside the machine 1 and periodically refilled either by water taken by said water net through a further pipe line 29 or by water recovered during a previous washing operation through a water recovering pipe line 40 (Figure 1) allowing at least a part of water used within the washing chamber 2 to be conveyed to tank 28. After being passed through the heat exchanger 12, 112 cooling water may be re-circulated cyclically between the heat exchanger 12, 112 and the water tank 28 by means of pipes 27 and 30 forming with exchanger 12 and with tank 28 a hydraulic loop circuit. An exhausting water conduit 45 is provided for periodically discharging cooling water from tank 28 so as to allow fresh water drained by a water net through pipe line 29 to fill tank 28. A more detailed description of the heat exchanger 12, 112 working operation is given with reference to the method for operating a washing -drying machine according to the invention.

[0023] Condensing unit 108 further comprises a second heat exchanger 113 of air/air type placed upstream relative to the first heat exchanger 112 such that drying air leaving the second heat exchanger 113 enters the first water/air heat exchanger 112. Cooling air taken from the environment surrounding the machine 1 is pumped to the heat exchanger 113 by a fan 14 while drying air flow moved within the air circuit 7 enters the heat exchanger 112. Cooling air flow and drying air flow cross each other without mixing so as to condense a second amount of moisture from drying air. Such amount of moisture is exhausted from the air/air heat exchanger 113 by a water outlet port 18. Air filtering means 15 are provided in the air circuit 7 between the heat exchangers 112, 113.

[0024] Taking now into consideration Figure 1 again, the whole amount of moisture removed from drying air by heat exchangers 112, 113, depicted in Figure 2, is collected in a reservoir 11 (not shown in Figure 2) and led into the articles storing chamber 2 during a step of a washing cycle by pumping means 19 and a first fluid line 20 fluidly connected to the water circuit 7, as it will be diffusely described hereafter. Condensed moisture has a low hardness and it can be advantageously stored in the reservoir 11 while a drying operation is in progress and later used for a subsequent washing and/or rinsing process. Even if the amount of water recovered by dried articles may not be enough for washing or rinsing the whole washing load, it contributes to reduce water consumption of the machine 1.

[0025] A further water recovery may be advantageously achieved by providing a further fluid line 21 hydraulically connected to water circuit 4, the heat exchanger 12, 112 and, by means of pipe 27, to water tank 28, the latter being refilled with cooling water which is either drained from a water net at the beginning of a drying cycle or recovered in a previous washing cycle and stored within tank 28. Said cooling water being re-circulated through the water/air heat exchanger 12, 112 during the drying

cycle. A pump 22 may be provided in fluid line 21 for leading cooling water used for condensing moisture of drying air in heat exchanger 12, 112 to the articles storing chamber 2 during washing operations following said drying cycle when water is needed for a washing or rinsing process, as it will be diffusely described hereafter. Pumps 19 and 22 may be the same, single pump, for both fluid lines 20, 21.

[0026] A third fluid line 40 hydraulically connects the articles storing chamber 2 to the water tank 28, via conduit 4B provided for exhausting water from said chamber 2 as shown in Figure 1 or, if desired, directly, i.e. by means of a dedicated pipe without involving conduit 4B. The provision of conduit 40 is useful for conveying water used for one or more steps of a washing cycle to a storage means (tank 28) for a later use, in particular for being used during a drying process to cool condensing means 8. In this way, an amount of water can be used both for a washing process and for drying operations, thereby reducing the machine overall water consumption. A filter unit 43 may be provided in the fluid line 40 in order to remove lint and/ or foreign matter from water drained from articles storing chamber 2.

[0027] Water recovery fluid lines 20, 21, 40 and main water circuit 4 are preferably provided with valve means 23, 24, 25, 41, 42 (Figure 1) in signal communication with a process control unit 26 which is programmed for selecting, during washing operations, one of the available water supply lines 4, 20, 21 for providing water within the articles storing chamber 2 and for recovering an amount of said water by storing the latter in a storage means 28 for being used in a drying process following said washing operations. Selection of water source and management of valve means 23, 24, 25, 41, 42, are made by unit 26 in accordance with the washing or drying program actually running in the machine 1. Said process control unit 26 is also in signal communication with washing/drying program input means 44, such as a program selection knob, a keyboard, push-buttons and so on, for allowing a user to input a command and/or selecting washing/ drying programs to be carried out on articles stored within chamber 2.

[0028] In Figure 3 it is shown a second embodiment 208 of a condensing unit 8 and drying air circuit 7 illustrated in Figure 1. In such embodiment, the same reference numbers have been used for indicating features already depicted in Figures 1 and 2.

[0029] Condensing unit 208 differs from the first embodiment depicted in Figure 2 in that the water/air heat exchanger 212 comprises a nozzle 231 hydraulically connected with a water source, such as the water tank 28 shown in figure 1, for nebulizing water against the drying air flowing within air circuit 7. Water/air heat exchanger 212 is associated to portion 7A of air circuit 7, i.e. the portion receiving the moist air exiting articles drying chamber 2. Fans 10 and 14 for circulating drying air and cooling air of the second air/air heat exchanger 113 respectively, heating means 9, filtering means 15 and the second heat exchanger 113 have the same features as those described with reference to Figure 2. In the second embodiment of Figure 3, water/air heat exchanger 212 is placed upstream relative to the second air/air heat exchanger 113. Water recovery from condensed moisture and from cooling water of water/air heat exchanger 212 is arranged as described with reference to Figures 1 and 2 and it will not be described here again.

[0030] There are now disclosed methods for operating a washing-drying machine according to the present invention for carrying out a washing operation and a drying process.

[0031] When a washing cycle has to be carried out, a desired washing program is selected by a user in a known manner, i.e. by way of input means 44 like a keyboard, a program selector knob and the like. Other washing parameters, like washing temperature, drum rotational speed during rinsing, overall washing time and the like may be input by a user, and further parameters may be acquired by appropriate sensors included in the machine like weight sensors, fabric types and the like (not illustrated). After the machine has been set for carrying out a washing process, control unit 26 checks whether water is present in reservoir 11 as result of moisture condensed in a previous drying cycle and further checks whether water is present within tank 28 as retained after a previous drying process or recovered in said tank 28 after a previous washing process. If water presence is detected within reservoir 11 and/or within tank 28, process control unit 26 selects one or more of the available water sources (reservoir 11, tank 28, main water net connected through line 4 to the machine) for supplying water to the articles storing chamber (2). If no water is stored in reservoir 11 and in tank 28, unit 26 selects the main water net as water supply source. The part of the washing cycle and the water source are chosen by the process control unit 26 based on pre-programmed data stored within control unit 26. Said data associate possible combinations of user input parameters and of parameters automatically acquired by the machine with particular programs of recovered water introduction inside the article storing chamber 2.

[0032] Furthermore, according to the selected washing program and to the washing parameters set by a user and parameters acquired by the machine itself, process control unit 26 may establish in which part of the washing cycle and whether or not an amount of water is to be recovered in the water tank 28 instead of being exhausted through conduit 4B. For example, a suitable part of a washing cycle for recovering water used for treating articles in the chamber 2 may be the last rinsing operation. In the latter case, water recovered from rinsing is clean enough to be used for cooling a condenser unit 8, 108, 208 in a drying cycle subsequent to a washing process. However, in order to allow recovering of water also in other, or in additional, parts of a washing cycle, a filter unit 43 is provided in fluid line 40. In this way, dirty water may be filtered and used to cool the condenser 8, 108,

208 during a drying cycle, thereby avoiding to dirty it.

[0033] Operationally, the process control unit 26 compares data input by a user when he/she chooses a washing program with data pre-programmed within control unit 26 so as to allow the latter to decide in which part of a chosen washing program water recovering can take place. Water recovering is made by the process control unit 26 by activating pump 5, closing valve means 42 in conduit 4B and opening valve means 41 in conduit 40. When water tank 28 is completely filled, valve means 41 in conduit 40 is closed and valve means 42 in conduit 4B is opened so as to exhaust water further contained in the article storage chamber 2.

[0034] After the process control unit 26 has set the part of the washing cycle in which recovered water has to be introduced into the storing chamber 2, the water source through which this operation has to be carried out, and in which part of a chosen washing program water recovering for a later use can take place, the selected washing program is started.

[0035] A drying process in a washing-drying machine according to the present invention may be carried out using a recovered amount of water already used during a previous washing cycle and stored within tank 28 as described above. Similarly to what has been already described with reference to the washing process, a desired drying program is selected by a user by way of input means 44 and further parameters (for example humidity of articles in the storing chamber 2, articles weight, articles type and so on) may be acquired by appropriate sensors (not illustrated) included in the machine to instruct the process control unit 26 about articles physical condition at the beginning of a drying cycle. After the machine has been set to carry out the desired drying process, control unit 26 compares said acquired parameters with data pre-programmed therein. The result of the comparison is the activation of one or both the heat exchangers 12, 112, 212 and 13, 113 in the condensing means 8 while circulating drying air through the article storing chamber 2 by means of air circuit 7. This allows the drying process to adapt drying efficiency of the machine according to the actual drying condition of articles to be treated. Process control unit 26 may also establish the sequence of activation of each heat exchanger 12, 112, 212 and 13, 113 and, particularly for the water/air heat exchanger 12, 112, 212, unit 26 may change cooling water source between tank 28, filled with water recovered by a previous washing process or retained therein after a preceding drying cycle, and water supplied to tank 28 by a main water net through pipe line 29.

[0036] Such change of cooling water source may be performed by process control unit 26 after that cooling water has been continuously re-circulated between the heat exchanger 12, 112, 212 and the water tank 28 by means of pipes 27 and 30. In fact, during a drying process, cooling water progressively heats up, thereby reducing capacity of heat exchanger 12, 112, 212 to condensate moisture in drying air. A temperature sensor (not shown) installed within tank 28 and in signal communication with process control unit 26 may be provided for communicating to such unit 26 that cooling water has reached a pre-determined hot temperature and, consequently, that efficiency of heat exchanger 12, 112, 212 is getting low. When said pre-determined temperature is met, tank 28 is emptied via conduit 45 and than refilled by pipe line 29 with fresh water from a main water net.

[0037] Thanks to data pre-programmed in the process control unit 26 heat exchangers 12, 112, 212 and 13, 113 may be activated in any desired sequence, and each of them may work both continuously both intermittently during the whole drying process. In addition, by monitoring drying status of articles inside chamber 2 during a drying cycle and by monitoring working parameters of each heat exchangers 12, 112, 212 and 13, 113, the process control unit 26 may adjust the working sequence of said heat exchangers in function of data provided by the monitoring operation. As a mere example, a drying cycle started with both heat exchangers 12, 112, 212 and 13, 113 in an active state, may be continued using only one of said heat exchangers, after that temperature of cooling water inside tank 28 reaches a pre-determined value. In such situation, process control unit 26 may deactivate water/air heat exchanger 12, 112, 212 by interrupting circulation of cooling water within water circuit 27, 30. If deactivation of the air/air heat exchanger 13, 113 is desired, process control unit 26 may turn off cooling air pumping means 14, leaving said heat exchanger 13, 113 passively passed through by drying air.

[0038] Conclusively it can be stated that a washing-drying machine 1 according to the invention has an improved energy efficiency. In particular with such a machine 1 is possible not only saving water during a washing process by using water recovered during a previous drying process but it is also possible to adjust the drying air moisture content very finely by deactivating one of the heat exchangers 12, 13; 112, 113; 212, 113. This can be done simply turning off air/air heat exchanger 13, 113 cooling air pumping means 14, and stopping cooling water supply to water/air heat exchanger 12, 112, 212 by means of a valve means installed in the pipe line 27 connecting heat exchanger 12, 112, 212 with water tank 28.

Claims

1. A washing-drying machine comprising:

a. an articles storing chamber (2);
b. a water circuit (4) for supplying water to the chamber (2) said water circuit being connectable to a water supply;
c. an air circuit (7) for circulating drying air within said chamber (2), said air circuit (7) having pumping means (10), heating means (9) for heating said drying air and condensing means (8, 108, 208) adapted to remove moisture from

said drying air comprising a first water/air heat exchanger (12, 112, 212);
characterized in that said water/air heat exchanger (12, 112, 212) is fluidly connected to said water circuit (4) through a first fluid line (21) such that at least a portion of water provided for cooling heat exchanger (12, 112, 212) can be supplied within said articles storing chamber (2) for washing operations, and/or said articles storing chamber (2) is hydraulically connected to the water/air heat exchanger (12, 112, 212) through a pipe line (40, 27) such that at least a portion of water provided for washing operations can be supplied to cool said heat exchanger (12, 112,212).

2. A washing-drying machine according to claim 1 wherein said water/air heat exchanger (12, 112, 212) is in fluid communication with a water tank (28) by means of a water re-circulating circuit (27, 30).

3. A washing-drying machine according to any preceding claim comprising a reservoir (11) for collecting said moisture wherein the reservoir (11) is fluidly connected to said water circuit (4) through a second fluid line (20) for supplying said moisture to the articles storing chamber (2) for washing operations.

4. A washing-drying machine according to any preceding claim wherein valve means (25, 23) are provided in said water circuit (4) and in said first fluid line (21) in signal communication with a process control unit (26) programmed for selecting a water source for supplying water to the articles storing chamber (2).

5. A washing-drying machine according to claim 3 and 4 wherein said process control unit (26) is in signal communication with further valve means (24, 41) provided respectively in said second fluid line (20) and in said pipe line (40).

6. A washing-drying machine according to any preceding claim wherein said condensing means (8, 108, 208) further comprises a second air/air heat exchanger (13, 113) connected in series with said first water/air heat exchanger (12, 112, 212).

7. A washing-drying machine according to any preceding claim wherein said first water/air heat exchanger (12, 112, 212) comprises a nozzle (231) hydraulically connected to a water supply (28) for spraying water against a drying air flow.

8. A washing-drying machine according to claims 6 and 7 wherein said first water/air heat exchanger (12, 112, 212) is placed upstream relative to the second air/air heat exchanger (13, 113).

9. A washing-drying machine according to any claim 1 to 6 wherein said first water/air heat exchanger (12, 112, 212) comprises a plurality of conduits (16) for circulating cooling water drained from a water supply (28), said conduits (16) being arranged within the air circuit (7) for being invested by a drying air flow.

10. A washing-drying machine according to claims 6 and 9 wherein said first water/air heat exchanger (12, 112, 212) is placed downstream relative to the second air/air heat exchanger (13, 113).

11. A washing-drying machine according to any preceding claim wherein said articles storing chamber (2) is rotatably mounted within a tub (3).

12. A washing-drying machine according to any preceding claim wherein air filtering means (15) are arranged in said air circuit (7).

13. A method for operating a washing-drying machine according to claims 1 to 12 for washing articles, said machine comprising an articles storing chamber (2), a process control unit (26), and a condensing unit (8, 108, 208) provided with a water/air heat exchanger (12, 112, 212), said method being **characterized by** operating said process control unit (26) such that a first amount of water is transferred from said heat exchanger (12, 112, 212) to said chamber (2) and by operating said process control unit (26) to establish whether or not a second amount of water is to be transferred from the chamber (2) to the heat exchanger (12, 112, 212) in addition to or in place of said first amount of water.

14. A method according to claim 13 wherein said first amount of water is drained from a water storage means (28) and/or from a reservoir (11) which is provided in said washing-drying machine for collecting condensate produced by the heat exchanger (12, 112, 212) during a drying process.

15. A method for operating a washing-drying machine for drying articles, said machine comprising an articles storing chamber (2), drying program input means (44), sensor means for acquiring articles physical condition at the beginning of a drying cycle, a condensing means (8, 108, 208) which includes a first water/air heat exchanger (12, 112, 212) and a second air/air heat exchanger (13, 113) provided for condensing moisture from a drying airflow passing through chamber (2), said method being **characterized by** the following steps:

a) Acquiring a drying program input by a user through said input means (44);
b) Operating the process control unit (26) for establishing the activation sequence of each of

said first and second heat exchangers (12, 112, 212; 13, 113) in response to user input of step a) and/or data acquired by said sensor means;
c) Starting the drying process;
d) Monitoring drying status of said articles and monitoring working parameters of each heat exchangers (12, 112, 212; 13, 113);
e) Operating the process control unit (26) for adjusting said activation sequence of said heat exchangers (12, 112, 212; 13, 113) in function of data provided by the monitoring operation;

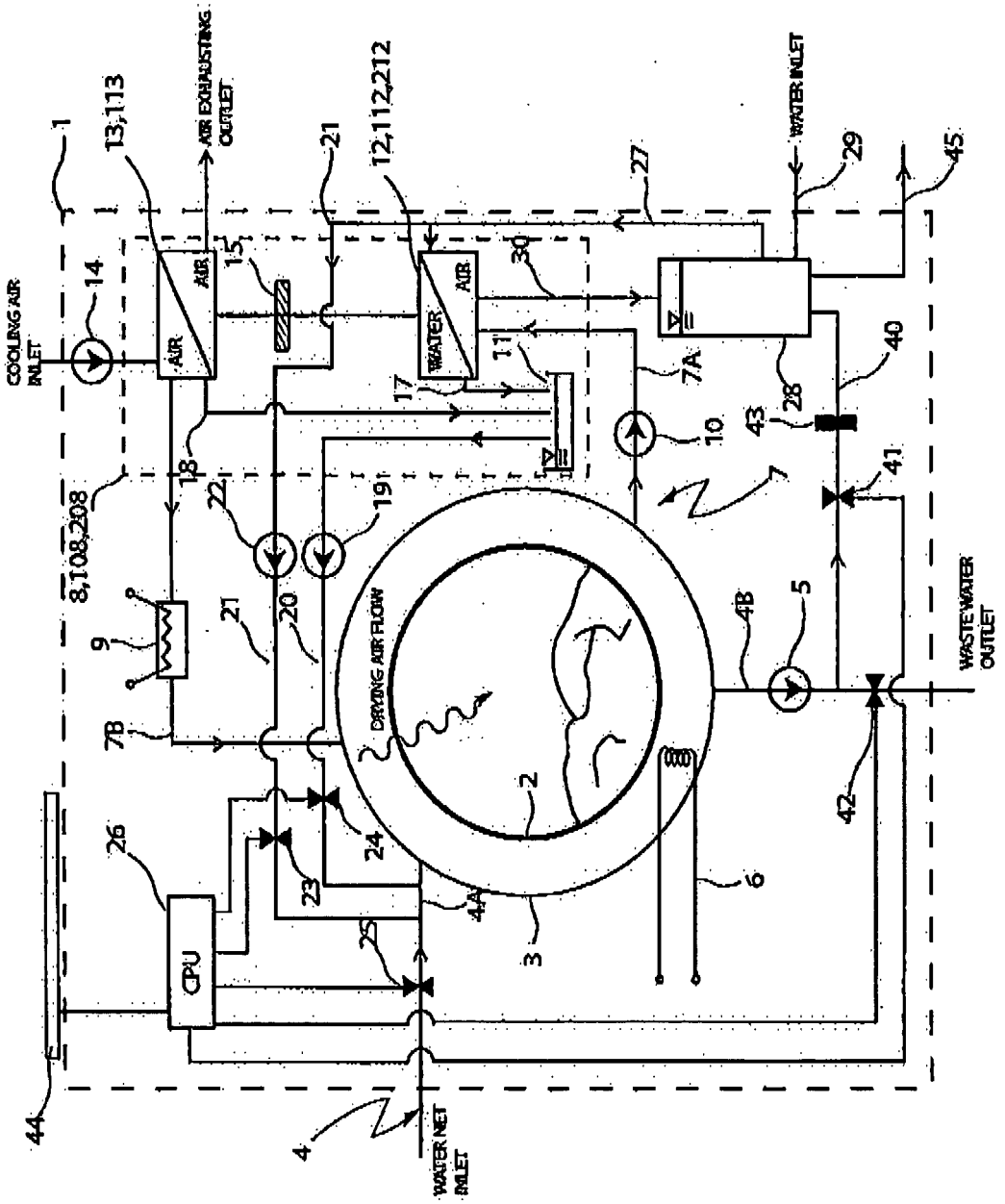
COOLING AIR INLET
AIR EXHAUSTING OUTLET
WATER INLET
WASTE WATER OUTLET
WATER NET INLET
DRYING AIR FLOW
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FIG. 1

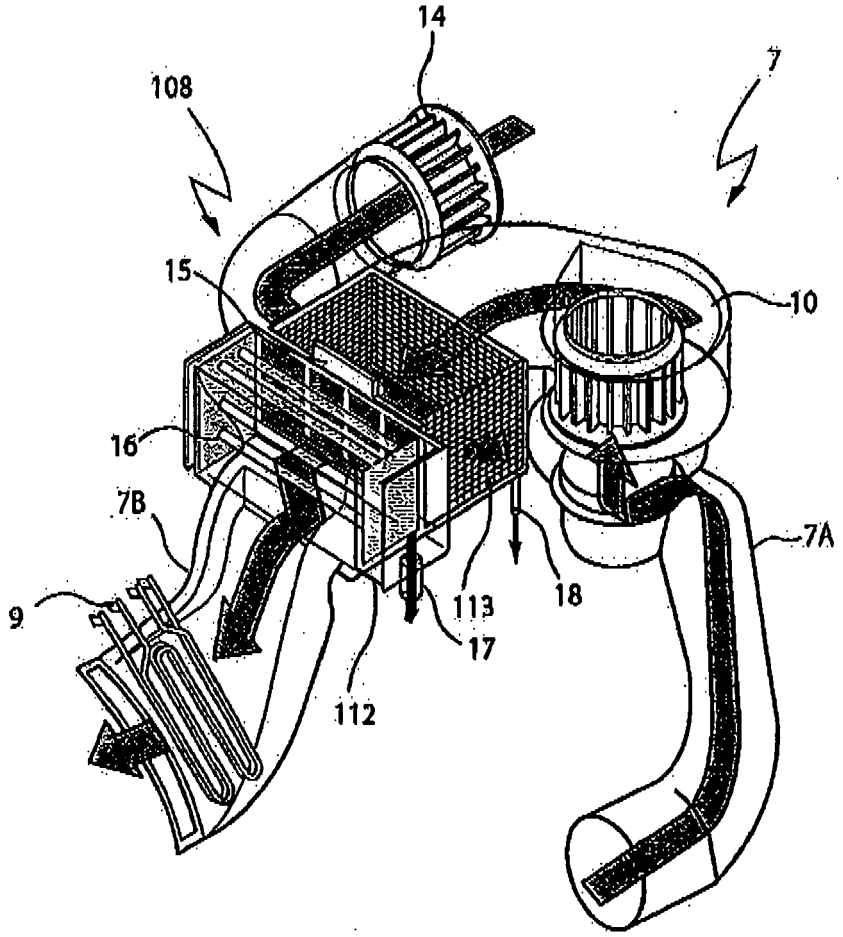

FIG.2

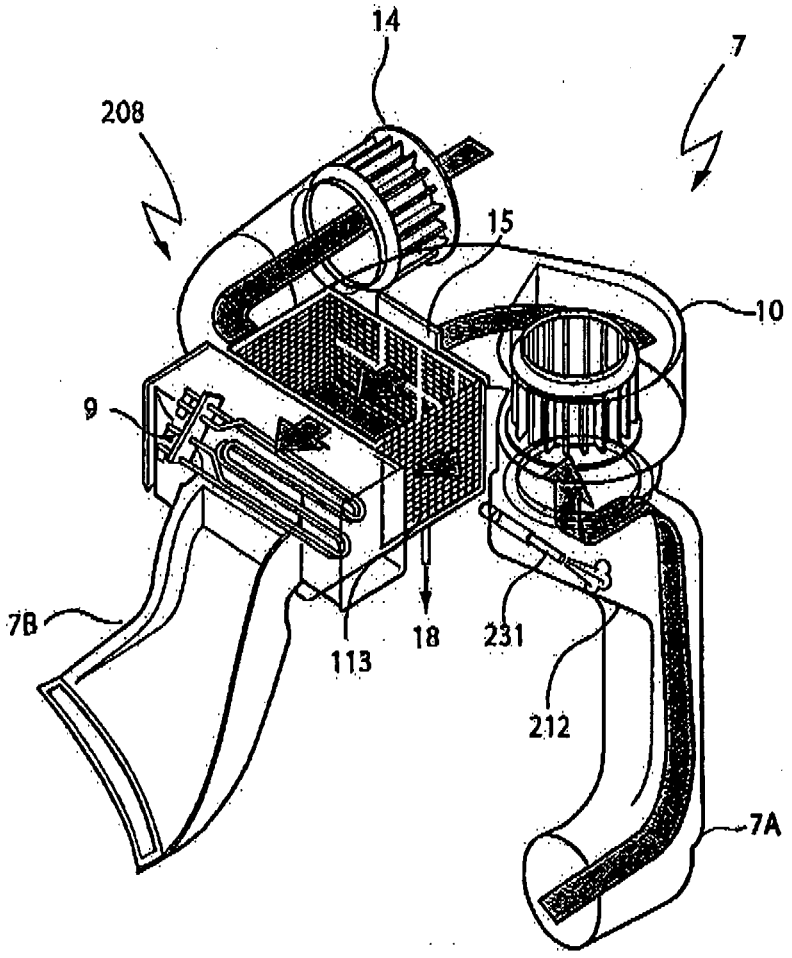

FIG.3

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EUROPEAN SEARCH REPORT

Application Number
EP 09 00 5345

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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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 December 2009	Diaz y Diaz-Caneja

CATEGORY OF CITED DOCUMENTS

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3

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 09 00 5345

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 09 00 5345

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-14

   The first invention relates to using the wash water as cooling water in the heat exchanger.

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2. claim: 15

   The second invention relates to a method of drying using two heat exchangers.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 00 5345

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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10-12-2009

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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