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(54) **A machine for drying laundry for domestic use**

Maschine zum Trocknen von Wäsche für die Anwendung im Haushalt

Machine permettant de sécher le linge pour utilisation domestique

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Description

Field of the invention

[0001] The present invention relates to a laundry-drier machine.

State of the art

[0002] Laundry-drier machines are typically provided with a cabinet, rotatably housed within which is a drum, designed to contain the laundry to be dried. In some solutions, the drum has a perforated cylindrical wall and is rotatably mounted within a tank: this is typically the case of the so-called washer-drier machines, i.e., machines that enable washing and subsequent drying of a load of laundry. Drier machines in a strict sense, instead, are not normally provided with a tank. In some solutions, the drum is constituted by a non-perforated cylindrical wall, associated to which are a front flange and a rear flange, provided with openings for passage of a flow of drying air. In other solutions, the drum basically consists of just the cylindrical wall, the open ends of which are rotatably constrained to respective front and rear containment elements, with interposition of suitable sliding seal means.

[0003] The machine has a ventilation system, for generating and conveying a forced flow of air, and heating means, for heating the air of the forced flow. The ventilation system typically comprises a ducting, associated to which are a fan and the means for heating the air.

[0004] In the majority of known solutions, the heating means comprise at least one electrical resistance, but in recent times - mainly for reasons of energy efficiency - there has been a widespread use of heat pumps.

[0005] Heat-pump machines envisage two substantially closed circuits: the first circuit is the circuit for the forced air, which is passed over the garments, whilst the second circuit is the circuit for the coolant, which passes into a compressor set between an evaporator and a condenser. In said applications, the temperature of the coolant increases following upon the compression undergone by means of the compressor. The coolant is then made to pass into a condenser, where it transfers heat to the flow of forced air, which is thus heated. From the condenser, the coolant passes first into an expansion valve, which expands and cools the fluid, and then into the evaporator, to return again to the compressor. The condenser performs the same function of heating of the flow of air as the one performed by the electrical resistance in the other known solutions.

[0006] Irrespective of the type of heating means, the fan forces the air into the drum, via a delivery branch of the ventilation circuit after the air itself has been heated via heating means. The hot air traverses the inside of the drum and collects the moisture yielded by the laundry items contained therein, said items being thus progressively dried. The moist air exits from the drum through its front wall, which is provided with a central opening, used - in the case of front-loading machines - also for loading and unloading the laundry.

[0007] In traditional "condensation" machines, the front opening of the drum is in fluid communication with the intake branch of the ventilation system, upstream of the fan, along which there is a condenser device designed to extract the moisture from the air taken in from the drum, said dehumidified air being then re-heated and re-introduced into the drum via the delivery branch of the system. In heat-pump machines, the corresponding evaporator is directly exploited to bring about condensation of the moisture of the air of the forced flow. The water resulting from condensation is collected in a suitable container, from which, via a pump, it is brought into a container accessible by the user, for corresponding manual emptying.

[0008] Traditional electrical-resistance machines usually envisage also an open ventilation circuit, via which fresh air is taken from outside the cabinet of the machine, by means of a front fan. A duct inside the base of the machine deviates the flow of this air towards the condenser device. The air thus cools the condenser device and at the same time exits therefrom slightly heated. This slightly heated air - which can possibly be exploited to reduce the temperature of the motor of the machine - then exits from the cabinet from the bottom part of the motor compartment.

[0009] The operating programs that can be executed on the machine according to the known art are used for drying the items of laundry and, possibly, for reducing bad smells or creasing of the laundry. These programs generally have a relatively long duration, of roughly between 30 and 210 minutes. The temperature of the air is in general comprised between 55°C and 65°C.

[0010] It should be recalled that an operating program is aimed at execution of a cycle of treatment of laundry items and is made up of a predetermined automatic sequence of operating steps, which, executed by a control logic, cause passage from a start-of-cycle state to an end-of-cycle state. To each operating step there corresponds, on the part of the control logic, activation of determined electrical loads and monitoring of physical quantities, such as for example the time and/or the humidity and/or the temperature, representing the current state of execution of the program and designed to determine the actions of control during execution of the cycle. Start of a program generally occurs following upon a command imparted by a user, for example by means of a start button. Starting from the start-of-cycle state the aforesaid predetermined automatic sequence of operating steps is carried out.

[0011] The end of the program is determined by reaching of a certain predetermined condition associated to the program itself, detected by the control system of the machine. Said predetermined condition is typically represented by reaching of a predetermined program time, or of a temperature of the drying air or of a certain rate of humidity of the air or moisture of the load of laundry.

Passage of the predetermined program time can be measured by the control unit of the machine, typically provided with an internal clock of its own, whilst the temperature and/or humidity can be detected via suitable sensor means belonging to the control system. Once said predetermined condition is reached, the treatment cycle is completed, and consequently the program goes into the end-of-cycle state and terminates.

[0012] Laundry-drier machines are also usually provided with a sensor for opening/closing the door of the machine. In the case where, after starting a drying program, the user opens the door of the machine - for example, for adding garments to be dried - the program is interrupted or paused. When the door is reclosed, the program restarts from the current state at the moment when it was paused, typically by pressing the start button. It should be noted that the drying process entails rotation of the drum of the machine at a relatively low speed (roughly comprised between 45 and 55 r.p.m.), and this causes during running of the program the drum not to have to be blocked in the closed condition, unlike what occurs in the course of a washing program, where the speed of rotation of the drum can reach high values, even higher than 1000 r.p.m.

[0013] A laundry drying machine including a switch for detecting the condition of the machine's door is known, for instance, from US 4 531 307 A, upon which the preamble of claim 1 is based.

Summary of the invention

[0014] The object of the present invention is basically to provide, in a simple and inexpensive way, a laundry-drier machine having functions additional to the traditional ones, for the benefit of the user.

[0015] Said purpose is achieved, according to the present invention, by a laundry-drier machine and by a method of control of operation of a laundry-drier machine having the characteristics specified in the annexed claims. The claims form an integral part of the technical teaching provided in relation to the invention.

Brief description of the drawings

[0016] Further purposes, characteristics and advantages of the invention will emerge clearly from the ensuing detailed description, with reference to the annexed drawings, which are provided purely by way of explanatory and non-limiting example and in which:

- Figure 1 is a partial and schematic cross section of a laundry-drier machine according to the invention;
- Figure 2 is a schematic representation of a control panel of the machine of Figure 1;
- Figure 3 is a simplified diagram of a system for conditioning the air of the machine of Figure 1, which uses a reversible heat pump;
- Figures 4 and 5 are simplified diagrams representing operation of the reversible heat pump of the system of Figure 3, in two different operating modes.

Description of preferred embodiments of the invention

[0017] Reference to "an embodiment" or "one embodiment" in the context of the present description is intended to indicate that a particular configuration, structure, or characteristic described in relation to the embodiment is comprised in at least one embodiment. Hence, phrases such as "in an embodiment" or "in one embodiment" and the like, that may be present in various points of the present description, do not necessarily all refer to one and the same embodiment. Moreover, the particular configurations, structures, or characteristics can be combined in any adequate way in one or more embodiments. The references used in what follows are merely provided for convenience and do not define the sphere of protection or the scope of the embodiments.

[0018] It is pointed out that in the sequel of the present description, the word "*end*", when referred to an operating program or cycle of the machine, indicates a condition in which all the operating steps envisaged by the program for the purposes of achieving the specific objective of the program itself have been executed, this corresponding to a predetermined condition being reached by a monitored quantity, such as time elapsed and/or moisture content of the garments or humidity of the air and/or temperature of the air.

[0019] It is moreover pointed out that in the sequel of the present description only the elements useful for an understanding of the invention will be described in particular detail, taking for granted that the machine forming the subject of the invention comprises all the other elements in themselves known for normal operation of a laundry-drier machine.

[0020] With particular reference to Figure 1, designated as a whole by 1 is a laundry-drier machine according to the present invention. In the case illustrated, the machine 1 is a drier machine, namely, a machine designed to perform only drying functions, of the condensation type.

[0021] The machine 1 has a load-bearing structure or cabinet 2, rotatably mounted within which is a drum 3, designed for containing the laundry. The drum 3 has a generally cylindrical shape and is mounted for rotating about a substantially horizontal axis of rotation. Provided within the cabinet 2 are means, of a type in itself known, for rotatably supporting the drum 3, which can, for example, be of a rolling type, such as wheels or rollers, or of a sliding type, such as runners.

[0022] The cabinet 2 has a front face, comprising a front wall 2a, having an opening - not indicated - on which a door 4 is mounted for enabling access to the inside of the drum 3. In the front face of the cabinet 2, in particular in its upper region, a control panel or user interface of the machine is provided, designated as a whole by 5. The panel 5 forms part of a control system of the machine,

which includes a control unit 6, preferably of an electronic microcontroller type, prearranged for controlling execution of a plurality of operating programs of the machine.

[0023] A possible simplified embodiment of the control panel 5 is represented in Figure 2. The panel 5 comprises at least one ON/OFF button, designated by ON, means for selection and start of one from a plurality of operating programs and, preferably, display means. In the example, the aforesaid selection and starting means comprise a rotary selector S with a number of positions and a program-start button R, but other means can obviously be used for the purpose, such as a series of pushbuttons or a selector with linear slider with a number of positions. In the example, the display means comprise a display D, which in possible variant embodiments can be replaced by warning lights. In the embodiment exemplified, moreover, also provided on the panel 5 are signaling means, for example, represented by a buzzer, designated by B. It should be noted that a warning means of an acoustic type can be installed in another position, also inside the cabinet 2, and hence not necessarily on the control panel 5.

[0024] The machine 1 comprises ventilation means, designed for generating a forced flow of air, and heating means, designed for heating the air of the forced flow.

[0025] In the example of embodiment illustrated, the ventilation means include a substantially closed path for the air (not indicated), defined in a known way within the cabinet 2, and possibly comprising a hollow part of the door 4. The aforesaid path substantially extends between an opening of the front wall of the drum 3 and at least one opening of the rear wall of the drum 3. In Figure 1, the white arrows designated by F indicate the forced flow along the aforesaid path and through the drum 3. The ventilation means further comprise a fan 7 that is operative along the aforesaid path and that is preferably - but not necessarily - driven by the same motor 8 that is to bring about rotation of the drum 3. Along the path for the air a filter 9, of a conception in itself known, is preferably provided, which can be inspected by the user of the machine 1.

[0026] In the embodiment exemplified, the means for heating the air include a heat pump 10, which operates along the path for the air and comprises a first heat exchanger 11, a second heat exchanger 12, and a compressor 13, which is operatively set between the two heat exchangers 11 and 12. The heat pump 10 can possibly include a respective filter for the air. The heat exchangers can be of any type known in the sector, for example ones comprising a coil for a working fluid of the heat pump, in particular a coolant, where the compressor and the heat exchangers are connected in a closed circuit for said fluid. The path of the air is such that the flow F will be forced to traverse, or in any case lap, the heat exchangers 11 and 12, for providing a heat exchange with the coolant of the heat pump 10.

[0027] Once again with reference to the non-limiting example of Figure 1, designated by 14 is a tray for collecting the water produced by condensation of the moisture present in the air of the forced flow F at output from the drum 3. In the example, associated to the tray 14 is a pump 14a, which, via a duct 15, takes the condensation water from the tray 14 to a removable container 16, positioned in the top part of the machine 1. To the container 16 there can be associated an overflow duct, not represented, in communication with the tray 14 itself.

[0028] According to a characteristic of the invention, the machine 1 comprises change-over means, designated as a whole by 20 in Figures 1 and 3, which can be controlled by the control unit 6 for assuming a first operating condition and a second operating condition, in which the heat pump 10 causes heating and cooling, respectively, of the air of the forced flow F. The control unit 6 is provided for controlling the change-over means 20 in order to assume the aforesaid second operating condition following upon selection of at least one of the operating programs, which can be selected via the selection means S.

[0029] In the preferred embodiment of the invention, the heat pump 10 is a reversible heat pump, configured in such a way that:

- when the air of the flow F is to be heated, for example in the course of a typical drying program, the change-over means 20 are in the respective first operating condition, with the heat exchanger 11 that operates as evaporator and the second heat exchanger 12 operates as condenser, whilst
- when the air of the flow F is to be cooled, for example in the course of a program for refreshing the laundry, described hereinafter, the change-over means 20 are in the respective second operating condition, with the heat exchanger 12 that now operates as evaporator and the heat exchanger 11 that operates as condenser.

[0030] In the illustrated preferred embodiment, and as will emerge more clearly hereinafter, the ventilation means of the machine are provided for obtaining a unidirectional forced flow in such a way that, in both of the operating conditions of the change-over means 20, the forced flow F of air to be heated or cooled, after leaving the drum 3, passes first through the heat exchanger 11, irrespective of whether the latter at the moment operates as condenser or as evaporator, and subsequently through the heat exchanger 12.

[0031] In one embodiment, and as may be seen in particular in Figures 4 and 5, the change-over means 20 include valve means of the heat pump 10, which preferably comprise a four-way switchable valve 21.

[0032] In its first switching condition (visible in Figure 4), the valve 21 is operative for directing the frigorific fluid of the heat pump 10 from the heat exchanger 11 to the compressor 13, and from the compressor 13 to the heat exchanger 12.

[0033] In this condition, as already explained above,

the heat exchanger 11 operates as evaporator, and is cold, whilst the heat exchanger 12 operates as condenser, and is hot. The flow of air F leaving the drum 3 reaches the heat exchanger 11, where condensation of the corresponding moisture is produced, and then reaches the heat exchanger 12, for being heated. The condensation water is collected in the tray 14.

[0034] In its second switching condition (visible in Figure 5), the valve 21 is instead operative for directing the frigorific fluid of the heat pump 10 from the heat exchanger 12 to the compressor 13, and from the compressor 13 to the heat exchanger 11.

[0035] In this condition, there is in practice a reversal of the frigorific cycle, as compared to the previous case, with the heat exchanger 11 that operates as condenser, and is hot, whilst the heat exchanger 12 operates as evaporator, and is cold. The flow of air F leaving the drum 3 reaches the heat exchanger 11, where it heats up, and then reaches the heat exchanger 12, for being cooled. In this condition, the air leaving the drum 3 is in any case already relatively cooled air substantially without humidity (as will emerge hereinafter, the program with cold flow F is used for the treatment of dry garments).

[0036] Obviously, the heat pump 10 envisages a line of return of the frigorific fluid between the two exchangers 11 and 12, along which a reduction of pressure of the frigorific fluid must take place. In the example of embodiment, and as illustrated in Figures 3-5, said line comprises a capillary duct, represented schematically by the block 22, within which the reduction of pressure occurs by lamination of the flow. When the valve 21 is in the respective first switching condition, the capillary duct 22 enables flow of the frigorific fluid from the heat exchanger 12 to the heat exchanger 11, as may be seen in Figure 4. Instead, when the valve 21 is in the respective second switching condition, the capillary duct 22 enables flow of the frigorific fluid from the heat exchanger 11 to the heat exchanger 12.

[0037] As mentioned previously, operation of the heat pump 10 to bring about cooling of the air of the forced flow F is exploited for the purposes of execution of a program for refreshing dry laundry, which can be selected via the means S and can be started via the pushbutton R of the user interface. In the course of said refreshing program, the valve 21 is in the condition of Figure 5, and the control system of the machine controls the heat pump 10 for sending and maintaining the air of the forced flow F at a substantially predetermined temperature, preferably between 5°C and 12°C, for example approximately 10°C. In this way, it is possible to cool items of laundry contained in the drum 3 that are already dry.

[0038] The program in question can thus be used to refresh dry garments, for example in order to render them pleasant to wear, for example in the summer, once they have been taken out of the drum 3. The same program, or a similar refreshing program, can be provided for abating the concentration of acari in certain garments or smells of a load of laundry.

[0039] The operating programs, which can be selected via the selection means S, comprise treatment programs that terminate when at least one condition arises, which can be detected by the control system of the machine. As per the known art, the condition or conditions that determine the end of one of said programs may comprise program time and/or temperature of the air of the forced flow and/or rate of humidity of the air of the forced flow or of moisture of the items of laundry. Expiry of the program time can be conveniently measured by the control unit 6, the microcontroller of which is equipped with an internal clock of its own, whilst the temperature of the air and the moisture of the garments can be detected by the unit 6 via purposely provided sensor means of a type in itself known, represented by the blocks 25a and 25b of Figure 1, which form part of the control system. In the example, the moisture of the items of laundry is measured by means of a sensor 25b, for example a conductivity sensor, which operates directly inside the drum so as to come into contact with the garments themselves.

[0040] According to an important feature of the invention, the operating programs of the machine comprise at least one program, the end of which is determined by a condition of the door 4. Consequently, for said purpose, the control unit 6 is programmed to bring about the end of said further program following upon the detection of the condition of opening of the door 4 made via sensor means, designated in Figure 1 with 26. The sensor means 26 can, for example comprise, a microswitch, which can switch between a state of closing and a state of opening, which are obtained when the door is closed or open, respectively.

[0041] The operating program, the end of which depends upon the condition of the door 4, can, for example, be the refreshing program referred to above. In this perspective, then, the user can set the dry garment or garments to be refreshed in the drum 3, close the door 4 and, after turning the machine 1 on and selecting the program via the selector S, start the program itself by pressing the pushbutton R. The control unit 6 thus governs the motor 8 in order to bring about rotation of the drum 3 and start of the fan 7, as well as of the heat pump 10, with switching of the valve 21 into the position of Figure 5. The load of the drum 3 is then progressively cooled, until a predetermined temperature is reached, for example approximately 10°C, which can be detected via the sensor means 25a. When said predetermined temperature is reached, the unit 6 controls the heat pump 10 so as to cause, once again with the aid of the sensor 25a, a substantial maintenance of the predetermined temperature. According to a further feature of the invention, the predetermined temperature is then maintained up to end of the program.

[0042] Preferably, after the aforesaid temperature has been reached the control system (possibly with pre-set delay time) supplies a warning to the user, for example an indication of an acoustic or visual type. For this purpose, as has been seen previously, the machine 1 can

be provided with suitable signaling means, represented in the example of Figure 2 by a buzzer B. Alternatively, or in addition, a signalling of a visual type is possible, exploiting the display D or other suitable warning means, for example, of a luminous type. The user, thus informed that the program temperature has reached, and consequently that the load has been refreshed, can open the door 4 of the machine when desired, thus determining the end of the program itself, and take out the load. The warning may, for example, be of a continuous or intermittent type. Verification of the state of the door 4 that causes the end of the program is activated by the control unit 6 only after the predetermined temperature has been reached. In this way, after start of the program and before the aforesaid temperature is reached, the user has the possibility of suspending the program temporarily by opening the door 4 (for example, for adding one or more garments to be refreshed). Upon reclosing of the door 4, and following upon a restart command by the user, for example by pressing the button R, the program resumes execution, proceeding from the current state at the moment of opening of the door. In this embodiment, then, only opening of the door 4 after a predetermined temperature has been reached causes ending of the program.

[0043] In general terms, the program proceeds, after start of warning for the user, if the door 4 is not opened, with the control unit 6 that governs the heat pump 10 so as to maintain the predetermined temperature of the flow F. In a possible embodiment, the control logic can be configured for terminating the program when a predetermined maximum period of time elapses (for example, measured to starting from start of the program, or from reaching of the predetermined temperature, or from start of the warning for the user). Until expiry of the aforesaid period, in any case, the heat pump 10 and the fan 7 remain operative for maintaining the predetermined temperature of the flow F.

[0044] The operating program the end of which depends upon the condition of the door 4 may also be a program different from the aforesaid refreshing program, such as for example a program for warming dry laundry, which can also be selected via the means S and can be started by pressing the pushbutton R of the user interface 5. In the course of said warming program, the valve 21 is in the condition of Figure 4, and the control system of the machine governs the heat pump 10 in order to bring and maintain the air of the forced flow F to a temperature substantially of between 34°C and 38°C, for example approximately 36°C. The this way, it is possible to warm the items of laundry that are already dry introduced into the drum 3 or render them tepid. The program in question can hence be used, for example, for bringing certain garments up to body temperature, in order to render them pleasant to wear, such as, for example, in the case of a bathrobe to wear after a bath or a shower. The same program, or a similar warming program, can be envisaged for warming particular garments are worn during fitness session for slimming purposes because they increase perspiration (for example, neoprene garments that, if heated before being worn, accentuate their function).

[0045] Execution of such a warming program is basically performed in a way similar to what has been described above with reference to the refreshing program, obviously taking into account that the air of the flow F is in this case heated. Hence, in the course of the program, the control unit 6 governs the heat pump 10, with switching of the valve 21 into the position of Figure 4, so as to warm the load of the drum 3 progressively, in a substantially monotonic/linear way, until a predetermined temperature is reached, for example approximately 36°C, which can be detected via the sensor means 25a. When said predetermined temperature is reached, the unit 6 controls the heat pump 10 and the fan 7 so as to cause a substantial maintenance of the temperature thus reached. Also in this case, preferably, the control system issues the warning that the predetermined temperature has been reached, for example via the buzzer B. The user, thus warned that the load has been warmed, can open the door 4, so bringing about end of the program, and take out the load. Also in relation to the warming program, the control logic is configured in such a way that the end of the program occurs upon opening of the door 4, after the predetermined temperature is reached or else - if the door is not opened - upon expiry of a predetermined maximum period of time, measured starting from start of the program, or from reaching of the predetermined temperature, or from start of the warning for the user.

[0046] It should be emphasized that, in the course of the refreshing program or of the warming program referred to above, the control system of the machine monitors, via the sensor means 25a, just the temperature of the air of the forced flow F, without monitoring humidity: what is important, in fact, for the purposes of warming or refreshing of the garments to be warn, is the fact that the pre-defined temperature is reached, which must preferably be maintained util the user brings about end of cycle by opening the door 4.

[0047] It should moreover be recalled that the typical operating programs envisaged for drying laundry, here including the drying programs that can be executed by the machine 1, envisage one or more steps in which the air is heated and forced through the drum 3 in order to dry the laundry, and at least one final step, substantially a cooling step, in the course of which the means for heating the air are inactive and the ventilation means are, instead, active. This final cooling step of a drying cycle is carried out mainly because, below a threshold of absolute humidity, it becomes more advantageous to work by reducing the temperature, in order to have a higher relative humidity and favour condensation. In practice, in a typical drying cycle, the temperature of the air is brought up to a value of stability or else to a predetermined value, which is then maintained via thermostatting for a certain time, considering that when the garments are almost dry

the temperature starts to rise. The program, before terminating, carries out the aforesaid final cooling step.

[0048] According to a preferential characteristic, instead, in the course of the program for warming dry laundry described above, the aforesaid final cooling step is absent: this precisely owing to the fact that the ultimate purpose is to take out the garments warmed to a substantially predetermined temperature.

[0049] From the description provided, the characteristics of the present invention emerge clearly, as likewise its advantages.

[0050] The fact that, according to the invention, the end of one or more programs can be determined by mere opening of the door of the machine, enables reaching and maintenance of predetermined treatment conditions up to any desired instant, not pre-determined by the machine, but rather determined by an action of the user.

[0051] In other words, a substantial advantage is that the desired final condition for the garments (heating or cooling to a certain temperature) is maintained until the user intervenes directly on the machine by opening its door: instead, in the case where the program were to terminate at a predetermined time, or when a certain temperature is reached, the effectiveness of the treatment would be markedly reduced if the user were to take out the garments from the machine after some delay). A correlated advantage is the optimization of the duration of the program, and consequently of its energy consumption, which is adapted to the effective needs of the user: this is obtained with the minimum of interactions required from the user, limiting said interactions to opening of the door (which is an action in any case necessary to take out the load of laundry).

[0052] The fact that, in a preferred embodiment of the invention, the frigorific cycle of the heat pump can be reversed enables enhancement of the functions of the machine, to the evident benefit of the users, who can take advantage of new useful programs, such as the refreshing program described previously.

[0053] The use of a heat pump of a reversible type is particularly advantageous in view of the fact that it enables implementation in a simple and economic way of both the aforesaid refreshing program and the aforesaid warming program (as well as the traditional drying programs). However, it will be appreciated that obtainment of an operating program with heating of the forced air, whose end is caused by the door opening, can be implemented also by using air heating means differing from a reversible heat pump, such as for example a non-reversible heat pump or one or more traditional electric resistances.

[0054] It is clear that numerous variations may be made by the person skilled in the sector to the laundry-drier machine described by way example, without thereby departing from the scope of the invention as defined in the annexed claims.

[0055] In the examples of embodiment described previously, the treatment temperatures for the refreshing program and for the warming program are temperatures pre-defined by the program. In possible variant embodiments, it is possible to equip the user interface of the machine with a purposely provided selector, of a type in itself known, for enabling the user to set a desired temperature within the range of possible temperatures.

[0056] The invention may, of course, be applied also to machines for washing and drying laundry, by introducing arrangements that are evident for the person skilled in the art, taking into account that in this case the laundry drum turns inside a tank.

Claims

1. A machine for drying laundry, having a cabinet (2) within which a rotatable laundry drum (3) is housed, the drum (3) being accessible by a user through a door (4) of the machine (1), the machine comprising:

- ventilation means (7), adapted for generating a forced flow of air (F), the ventilation means including one fan,
- heating means (10), adapted for heating air of the forced flow (F),
- a control system (5, 6, 25a, 25b, 26) including a control unit (6), prearranged for controlling execution of a plurality of operating programs of the machine, a user interface (5), having selection means (S) for selecting a desired operating program among the said plurality of operating programs, and sensor means (26) for detecting a condition of the door (4) of the machine (1),

wherein the plurality of operating programs comprises operating programs which end upon achievement of a condition detectable by the control system (5, 6, 25a, 25b, 26), **characterized in that**

- the plurality of operating programs comprises at least one first operating program for which said condition is a condition of opening of the door (4) of the machine (1), the at least one first operating program being selectable through the selection means (S),
- the control system (5, 6, 25a, 25b, 26) is prearranged for controlling, during the at least one first operating program, the ventilation means (7) and the heating means (10) for bringing air of the forced flow (F) to a substantially predetermined temperature, and then maintaining the air of the forced flow (F) at such a temperature until ending of the at least one first operating program, and
- the control system (5, 6, 25a, 25b, 26) is prearranged for causing ending of the at least one first operating program as a result of the detection of the said condition of opening of the door

(4), carried out through corresponding sensor means (26), after said substantially predetermined temperature has been reached.

2. The machine according to claim 1, wherein the at least one first operating program comprises at least one of

- a program for warming dry laundry, the control system (5, 6, 25a, 25b, 26) being in particular configured for bringing the air of the forced flow (F) to, and then maintaining it at, a temperature substantially comprised between 34 and 38 °C during the program for heating dry laundry, and
- a program for refreshing dry laundry, the control system (5, 6, 25a, 25b, 26) being in particular configured for bringing the air of the forced flow (F) to, and then maintaining it at, a temperature substantially comprised between 5 and 12 °C during the program for refreshing dry laundry.

3. The machine according to claim 2, wherein the control system (5, 6, 25a, 25b, 26) is configured for monitoring, during execution of the at least one first operating program, only the temperature of the air of the forced flow (F), without any monitoring of the humidity of the air or of the laundry, for the achievement of a determined temperature of the forced flow (F) and the subsequent maintenance thereof.

4. The machine according to claim 2 or 3, wherein the control system (5, 6, 25a, 25b, 26) comprises signaling means (B, D), for signalling achievement of a determined temperature of air of the forced flow (F), the signaling means (B, D) comprising in particular at least one of acoustic signaling means (B) and visual signaling means (D).

5. The machine according to claim 2 or 3, wherein

- the plurality of operating programs comprises laundry treatment programs during which the ventilation means (7) are active for forcing the forced flow (F) through the drum (3), with the heating means (10) being active, said treatment programs including a final step during which the heating means (10) are inactive and the ventilation means (7) are active, and
- during the said program for warming dry laundry the said final step is absent.

6. The machine according to one of the preceding claims, wherein the control system (5, 6, 25a, 25b, 26) is prearranged for

- counting time, and
- upon expiry of a predetermined time period, causing ending of the said at least one first operating program,

the control system (5, 6, 25a, 25b, 26) being in particular prearranged for maintaining air of the forced flow (F) at a substantially predetermined temperature until expiry of the above said predetermined time period.

7. The machine according to claim 1, wherein the heating means include one heat pump (10) having one first heat exchanger (11), one second heat exchanger (12) and one compressor (13) operatively arranged between the first and the second heat exchanger (11, 12).

8. The machine according to claims 2 and 7, also comprising change-over means (20), controllable by the control unit (6) to take on one first operating condition and one second operating condition, for obtaining from the heat pump (10) heating or cooling of air of the forced flow (F), respectively, and wherein the control unit (6) is prearranged for controlling the change-over means (20) to take on the second operating condition as a result of the selection of the program for refreshing dry laundry.

9. The machine according to claim 8, wherein the heat pump is a reversible heat pump (10), and wherein

- in the first operating condition of the change-over means (20), the first heat exchanger (11) operates as an evaporator and the second heat exchanger (12) operates as a condenser, and
- in the second operating condition of the change-over means (20), the first heat exchanger (11) operates as a condenser and the second heat exchanger (12) operates as an evaporator.

10. The machine according to claim 9, wherein the ventilation means (7) are prearranged for generating a unidirectional forced flow, in such a way that, in both the operating conditions of the change-over means (20) the forced flow (F) of air to be heated or cooled, respectively, after exiting the drum (3) passes first through the first heat exchanger (11) and then through the second heat exchanger (12) of the heat pump (10).

11. The machine according to claim 9 or 10, wherein the change-over means (20) include valve means (21) of the heat pump (10), switchable between one first and one second switching condition, and wherein:

- in the first switching condition the valve means (21) are operative for addressing a work fluid, or refrigerant, of the heat pump (10) from the first heat exchanger (11) to the compressor (13) and from the compressor (13) to the second heat

exchanger (12), and
- in the second switching condition the valve means (21) are operative for addressing the work fluid of the heat pump (10) from the second heat exchanger (12) to the compressor (13) and from the compressor (13) to the first heat exchanger (11),

where in particular the valve means comprises a four-way valve (21).

12. The machine according to claim 11, wherein the heat pump (10) also comprises a return line (22) of the flow of the work fluid of the heat pump (10), arranged for allowing:

- a flow of the work fluid from the second heat exchanger (12) to the first heat exchanger (11), when the valve means (21) are in the respective first switching condition, and
- a flow of the work fluid from the first heat exchanger (11) to the second heat exchanger (12), when the valve means (21) are in the respective second switching condition,

where in particular the return line (22) comprises at least one capillary duct adapted to cause lamination of the work fluid of the heat pump (10).

13. A method for controlling operation of a machine for drying laundry (1) of the type in which air of a forced flow (F) is made to pass through a laundry drum (3), the method comprising selection, through selection means (S), of one of a plurality of operating programs whose execution is controlled by a control system (5, 6, 25a, 25b, 26), each operating program ending upon achievement of a condition detectable by the control system (5, 6, 25a, 25b, 26), **characterized in that**, for at least one first operating program, the said condition is a condition of opening of a door (4) of the machine (1), detectable through corresponding sensor means (26) belonging to the control system (5, 6, 25a, 25b, 26), during the at least one first operating program air of the forced flow (F) being brought to a substantially predetermined temperature, which temperature is then maintained until ending of the at least one first operating program, ending of the at least one first operating program being caused as a result of the detection of the said condition of opening of the door (4), after said substantially predetermined temperature has been reached.

14. The method according to claim 13, wherein the at least one first operating program comprises at least one of

- a program for warming dry laundry, particularly during which air of the forced flow (F) is brought to, and then maintained at, a temperature substantially comprised between 34 and 38 °C,
- a program for refreshing dry laundry, particularly during which air of the forced flow (F) is brought to, and then maintained at, a temperature substantially comprised between 5 and 12 °C.

15. The method according to claim 13 or 14, wherein, during execution of the at least one first operating program, only the temperature of the air of the forced flow (F) is monitored, without any monitoring of the humidity of the air or of the laundry, for the achievement of a determined temperature of the forced flow (F) and the subsequent maintenance thereof.

Patentansprüche

1. Maschine zum Trocknen von Wäsche mit einem Behälter (2), in dem eine drehbare Wäschetrommel (3) untergebracht ist, wobei die Trommel (3) für einen Benutzer durch eine Tür (4) der Maschine (1) zugänglich ist, wobei die Maschine aufweist:

- Belüftungsmittel (7), die zur Erzeugung eines erzwungenen Luftstroms (F) angepasst sind, wobei die Belüftungsmittel einen Lüfter umfassen,
- Heizmittel (10), die angepasst sind, um Luft des erzwungenen Stroms (F) zu erwärmen,
- ein Steuersystem (5, 6, 25a, 25b, 26), das eine Steuereinheit (6), die vorbereitet ist, eine Ausführung mehrerer Betriebsprogramme der Maschine zu steuern, eine Benutzerschnittstelle (5), die Auswahlmittel (S) zum Auswählen eines gewünschten Betriebsprogramms unter den mehreren Betriebsprogrammen aufweist, und Sensormittel (26) zum Erfassen eines Zustands der Tür (4) der Maschine (1) umfasst,

wobei die mehreren Betriebsprogramme Betriebsprogramme umfassen, die bei Erreichen eines durch das Steuersystem (5, 6, 25a, 25b, 26) erfassbaren Zustands enden, **dadurch gekennzeichnet, dass**

- die mehreren Betriebsprogramme mindestens ein erstes Betriebsprogramm umfassen, für das der Zustand ein Zustand des Öffnens der Tür (4) der Maschine (1) ist, wobei das mindestens eine erste Betriebsprogramm durch die Auswahlmittel (S) auswählbar ist,
- das Steuersystem (5, 6, 25a, 25b, 26) vorbereitet ist, während des mindestens einen ersten Betriebsprogramms die Belüftungsmittel (7) und die Heizmittel (10) zu steuern, um Luft des erzwungenen Stroms (F) auf eine im Wesentli-

chen vorbestimmte Temperatur zu bringen und dann die Luft des erzwungenen Stroms (F) bei der Temperatur bis zum Ende des mindestens einen ersten Betriebsprogramms zu halten, und
- das Steuersystem (5, 6, 25a, 25b, 26) vorbereitet ist, zu einem Enden des mindestens einen ersten Betriebsprogramms als Ergebnis der Erfassung des Zustands eines Öffnens der Tür (4), die durch die korrespondierenden Sensormittel (26) ausgeführt wird, zu führen, nachdem die im Wesentlichen vorbestimmte Temperatur erreicht wurde.

2. Maschine nach Anspruch 1, wobei das mindestens eine erste Betriebsprogramm mindestens eines umfasst von:

- einem Programm zum Aufwärmen trockener Wäsche, wobei das Steuersystem (5, 6, 25a, 25b, 26) insbesondere eingerichtet ist, die Luft des erzwungenen Stroms (F) zu bringen auf eine und dann zu halten bei einer Temperatur, die im Wesentlichen zwischen 34 und 38 °C liegt, während des Programms zum Erwärmen trockener Wäsche und
- einem Programm zum Auffrischen trockener Wäsche, wobei das Steuersystem (5, 6, 25a, 25b, 26) insbesondere eingerichtet ist, die Luft des erzwungenen Luftstroms (F) zu bringen auf eine und dann zu halten bei einer Temperatur, die im Wesentlichen zwischen 5 und 12 °C liegt, während des Programms zum Auffrischen trockener Wäsche.

3. Maschine nach Anspruch 2, wobei das Steuersystem (5, 6, 25a, 25b, 26) eingerichtet ist, während der Ausführung des mindestens einen ersten Betriebsprogramms nur die Temperatur der Luft des erzwungenen Stroms (F) zu überwachen ohne Überwachung der Feuchtigkeit der Luft oder der Wäsche zum Erreichen einer bestimmten Temperatur des erzwungenen Stroms (F) und der darauffolgenden Aufrechterhaltung davon.

4. Maschine nach Anspruch 2 oder 3, wobei das Steuersystem (5, 6, 25a, 25b, 26) Signalisierungsmittel (B, D) zum Signalisieren des Erreichens einer vorbestimmten Temperatur der Luft des erzwungenen Stroms (F) umfasst, wobei die Signalisierungsmittel (B, D) insbesondere mindestens eines von akustischen Signalisierungsmitteln (B) und visuellen Signalisierungsmitteln (D) umfassen.

5. Maschine nach Anspruch 2 oder 3, wobei

- die mehreren Betriebsprogramme Wäschebehandlungsprogramme umfassen, während derer die Belüftungsmittel (7) aktiv sind, um den erzwungenen Strom (F) durch die Trommel (3) zu zwingen, wobei die Heizmittel (10) aktiv sind, und die Behandlungsprogramme einen finalen Schritt umfassen, während dem die Heizmittel (10) inaktiv und die Belüftungsmittel (7) aktiv sind, und
- während dem Programm zum Aufwärmen trockener Wäsche der finale Schritt fehlt.

6. Maschine nach einem der vorhergehenden Ansprüche, wobei das Steuersystem (5, 6, 25a, 25b, 26) vorbereitet ist zum

- Zählen von Zeit und
- nach Ablauf einer vorbestimmten Zeitperiode zu einem Enden des mindestens einen ersten Betriebsprogramms zu führen,

wobei das Steuersystem (5, 6, 25a, 25b, 26) insbesondere vorbereitet ist, die Luft des erzwungenen Stroms (F) bei einer im Wesentlichen vorbestimmten Temperatur zu halten, bis die oben genannte vorbestimmte Zeitperiode abgelaufen ist.

7. Maschine nach Anspruch 1, wobei die Heizmittel eine Wärmepumpe (10) umfassen, die einen ersten Wärmetauscher (11), einen zweiten Wärmetauscher (12) und einen Kompressor (13) umfasst, der betrieblich zwischen dem ersten und dem zweiten Wärmetauscher (11, 12) angeordnet ist.

8. Maschine nach Anspruch 2 und 7, außerdem umfassend Umschaltmittel (20), die durch die Steuereinheit (6) steuerbar sind, um einen ersten Betriebszustand und einen zweiten Betriebszustand einzunehmen, um entsprechend von der Wärmepumpe (10) ein Erwärmen oder Kühlen der Luft des erzwungenen Stroms (F) zu erhalten, und wobei die Steuereinheit (6) vorbereitet ist, die Umschaltmittel (20) zu steuern, um den zweiten Betriebszustand als Ergebnis der Auswahl des Programms zum Auffrischen trockener Wäsche einzunehmen.

9. Maschine nach Anspruch 8, wobei die Wärmepumpe eine reversible Wärmepumpe (10) ist und wobei

- in dem ersten Betriebszustand der Umschaltmittel (20) der erste Wärmetauscher (11) als ein Verdampfer und der zweite Wärmetauscher (12) als ein Kondensator operieren und
- im zweiten Betriebszustand der Umschaltmittel (20) der erste Wärmetauscher (11) als Kondensator und der zweite Wärmetauscher (12) als Verdampfer operieren.

10. Maschine nach Anspruch 9, wobei die Belüftungsmittel (7) vorbereitet sind, einen unidirektionalen erzwungenen Strom derart zu erzeugen, dass in bei-

den Betriebszuständen der Umschaltmittel (20) der erzwungene Strom (F) der Luft, der erwärmt oder gekühlt werden soll, entsprechend nach dem Austritt aus der Trommel (3) zunächst den ersten Wärmetauscher (11) und dann den zweiten Wärmetauscher (12) der Wärmepumpe (10) passiert.

11. Maschine nach Anspruch 9 oder 10, wobei die Umschaltmittel (20) Ventilmittel (21) der Wärmepumpe (10) umfassen, die zwischen einem ersten und einem zweiten Schaltzustand schaltbar sind, und wobei:

- im ersten Schaltzustand die Ventilmittel (21) wirksam sind zum Richten einer Arbeitsflüssigkeit oder eines Kältemittels der Wärmepumpe (10) vom ersten Wärmetauscher (11) zum Kompressor (13) und vom Kompressor (13) zum zweiten Wärmetauscher (12) und
- im zweiten Schaltzustand die Ventilmittel (21) wirksam sind zum Richten der Arbeitsflüssigkeit der Wärmepumpe (10) vom zweiten Wärmetauscher (12) zum Kompressor (13) und vom Kompressor (13) zum ersten Wärmetauscher (11),

wobei insbesondere die Ventilmittel ein Vier-Wege-Ventil (21) umfassen.

12. Maschine nach Anspruch 11, wobei die Wärmepumpe (10) außerdem eine Rückleitung (22) des Flusses der Arbeitsflüssigkeit der Wärmepumpe (10) umfasst, die eingerichtet ist, zu erlauben:

- einem Fluss der Arbeitsflüssigkeit vom zweiten Wärmetauscher (12) zum ersten Wärmetauscher (11), wenn die Ventilmittel (21) in einem entsprechenden ersten Schaltzustand sind und
- einem Fluss der Arbeitsflüssigkeit vom ersten Wärmetauscher (11) zum zweiten Wärmetauscher (12), wenn die Ventilmittel (21) in dem entsprechenden zweiten Schaltzustand sind,

wobei insbesondere die Rückleitung (22) mindestens einen kapillaren Kanal umfasst, der angepasst ist, zu einer Lamination der Arbeitsflüssigkeit der Wärmepumpe (10) zu führen.

13. Verfahren zum Steuern des Betriebs einer Maschine zum Trocknen von Wäsche (1) von der Art, bei der Luft eines erzwungenen Stroms (F) dazu gebracht wird, eine Wäschetrommel (3) zu passieren, wobei das Verfahren die Auswahl durch Auswahlmittel (S) eines mehrerer Betriebsprogramme umfasst, dessen Ausführung durch ein Steuersystem (5, 6, 25a, 25b, 26) steuerbar ist, wobei jedes Betriebsprogramm nach dem Erreichen eines Zustands endet, der durch das Steuersystem (5, 6, 25a, 25b, 26) erfassbar ist, **dadurch gekennzeichnet, dass** für zumindest ein erstes Betriebsprogramm der Zustand ein Zustand eines Öffnens einer Tür (4) der Maschine (1) ist, der durch korrespondierende Sensormittel (26) detektierbar ist, die zum Steuersystem (5, 6, 25a, 25b, 26) gehören, während des mindestens einen ersten Betriebsprogramms Luft des erzwungenen Stroms (F) auf eine im Wesentlichen vorbestimmte Temperatur gebracht wird, dessen Temperatur dann bis zum Enden des mindestens einen ersten Betriebsprogramms aufrechterhalten wird, das Erfassen des Zustands des Öffnens der Tür (4) zum Enden des mindestens einen ersten Betriebsprogramms, nachdem die im Wesentlichen vorbestimmte Temperatur erreicht wurde, führt.

14. Verfahren nach Anspruch 13, wobei das mindestens eine erste Betriebsprogramm mindestens eines umfasst von:

- einem Programm zum Aufwärmen trockener Wäsche, insbesondere während dem Luft des erzwungenen Stroms (F) gebracht wird auf und dann gehalten wird bei einer Temperatur, die im Wesentlichen zwischen 34 und 38 °C liegt,
- einem Programm zum Auffrischen trockener Wäsche, insbesondere während dem Luft des erzwungenen Luftstroms (F) gebracht wird auf und dann gehalten wird bei einer Temperatur, die im Wesentlichen zwischen 5 und 12 °C liegt.

15. Verfahren nach Anspruch 13 oder 14, wobei während der Ausführung des mindestens einen ersten Betriebsprogramms nur die Temperatur der Luft des erzwungenen Stroms (F) überwacht wird, ohne die Feuchtigkeit der Luft oder der Wäsche zu überwachen, um eine bestimmte Temperatur des erzwungenen Stroms (F) und der darauffolgenden Aufrechterhaltung davon zu erreichen.

Revendications

1. Machine à sécher le linge, ayant une carrosserie (2) à l'intérieur de laquelle est logé un tambour à linge rotatif (3), le tambour (3) étant accessible à un utilisateur par l'intermédiaire d'une porte (4) de la machine (1), la machine comprenant :

- des moyens de ventilation (7) appropriés pour générer un flux d'air forcé (F), les moyens de ventilation comprenant un ventilateur,
- des moyens de chauffage (10) appropriés pour chauffer l'air du flux forcé (F),
- un système de commande (5, 6, 25a, 25b, 26) comprenant une unité de commande (6), préconfiguré pour commander l'exécution d'une pluralité de programmes de fonctionnement de la machine, une interface utilisateur (5) ayant

des moyens de sélection (S) pour sélectionner un programme de fonctionnement souhaité parmi ladite pluralité de programmes de fonctionnement, et des moyens de détection (26) pour détecter un état de la porte (4) de la machine (1),

dans laquelle la pluralité de programmes de fonctionnement comprend des programmes de fonctionnement qui se terminent lors de la réalisation d'un état détectable par le système de commande (5, 6, 25a, 25b, 26), **caractérisée en ce que**

- la pluralité de programmes de fonctionnement comprend au moins un premier programme de fonctionnement pour lequel ledit état est un état d'ouverture de la porte (4) de la machine (1), le au moins un premier programme de fonctionnement pouvant être sélectionné par l'intermédiaire des moyens de sélection (S),
- le système de commande (5, 6, 25a, 25b, 26) est préconfiguré pour commander, pendant le au moins un premier programme de fonctionnement, les moyens de ventilation (7) et les moyens de chauffage (10) pour amener l'air du flux forcé (F) à une température essentiellement prédéterminée, puis maintenir l'air du flux forcé (F) à une telle température jusqu'à la fin du au moins un premier programme de fonctionnement, et
- le système de commande (5, 6, 25a, 25b, 26) est préconfiguré pour provoquer la fin du au moins un premier programme de fonctionnement à la suite de la détection dudit état d'ouverture de la porte (4), réalisée par l'intermédiaire des moyens de détection correspondants (26), après que ladite température essentiellement prédéterminée a été atteinte.

2. Machine selon la revendication 1, dans laquelle le au moins un premier programme de fonctionnement comprend au moins un élément parmi

- un programme pour réchauffer du linge sec, le système de commande (5, 6, 25a, 25b, 26) étant en particulier configuré pour amener l'air du flux forcé (F), puis le maintenir, à une température essentiellement comprise entre 34 °C et 38 °C pendant le programme pour réchauffer du linge sec, et
- un programme pour rafraîchir du linge sec, le système de commande (5, 6, 25a, 25b, 26) étant en particulier configuré pour amener l'air du flux forcé (F), puis le maintenir, à une température essentiellement comprise entre 5 °C et 12 °C pendant le programme pour rafraîchir du linge sec.

3. Machine selon la revendication 2, dans laquelle le système de commande (5, 6, 25a, 25b, 26) est configuré pour surveiller, pendant l'exécution du au moins un premier programme de fonctionnement, uniquement la température de l'air du flux forcé (F), sans aucune surveillance de l'humidité de l'air ou du linge, pour l'atteinte d'une température prédéterminée du flux forcé (F) et son maintien ultérieur.

4. Machine selon la revendication 2 ou 3, dans laquelle le système de commande (5, 6, 25a, 25b, 26) comprend des moyens de signalement (B, D), pour signaler l'atteinte d'une température prédéterminée de l'air du flux forcé (F), les moyens de signalement (B, D) comprenant en particulier au moins un élément parmi des moyens de signalement sonore (B) et des moyens de signalement visuel (D).

5. Machine selon la revendication 2 ou 3, dans laquelle

- la pluralité de programmes de fonctionnement comprend des programmes de traitement du linge pendant lesquels les moyens de ventilation (7) sont actifs pour forcer le flux forcé (F) à travers le tambour (3), les moyens de chauffage (10) étant actifs, lesdits programmes de traitement comprenant une étape finale pendant laquelle les moyens de chauffage (10) sont inactifs et les moyens de ventilation (7) sont actifs, et
- pendant ledit programme pour réchauffer du linge sec, ladite étape finale est absente.

6. Machine selon l'une des revendications précédentes, dans laquelle le système de commande (5, 6, 25a, 25b, 26) est préconfiguré pour

- compter le temps, et
- à l'expiration d'une période de temps prédéterminée, provoquer la fin dudit au moins un premier programme de fonctionnement,

le système de commande (5, 6, 25a, 25b, 26) étant en particulier préconfiguré pour maintenir l'air du flux forcé (F) à une température essentiellement prédéterminée jusqu'à l'expiration de ladite période de temps prédéterminée ci-dessus.

7. Machine selon la revendication 1, dans laquelle les moyens de chauffage comprennent une pompe à chaleur (10) ayant un premier échangeur de chaleur (11), un deuxième échangeur de chaleur (12) et un compresseur (13) fonctionnellement disposé entre le premier et le deuxième échangeurs de chaleur (11, 12).

8. Machine selon les revendications 2 et 7, comprenant également des moyens d'inversion (20) qui peuvent être commandés par l'unité de commande (6) pour adopter un premier état de fonctionnement et un

deuxième état de fonctionnement, pour obtenir respectivement, de la pompe à chaleur (10), le chauffage ou le refroidissement de l'air du flux forcé (F), et dans laquelle l'unité de commande (6) est préconfigurée pour commander les moyens d'inversion (20) pour qu'ils adoptent le deuxième état de fonctionnement à la suite de la sélection du programme pour rafraîchir du linge sec.

9. Machine selon la revendication 8, dans laquelle la pompe à chaleur est une pompe à chaleur réversible (10), et dans laquelle

- dans le premier état de fonctionnement des moyens d'inversion (20), le premier échangeur de chaleur (11) fonctionne en tant qu'évaporateur et le deuxième échangeur de chaleur (12) fonctionne en tant que condenseur, et
- dans le deuxième état de fonctionnement des moyens d'inversion (20), le premier échangeur de chaleur (11) fonctionne en tant que condenseur et le deuxième échangeur de chaleur (12) fonctionne en tant qu'évaporateur.

10. Machine selon la revendication 9, dans laquelle les moyens de ventilation (7) sont préconfigurés pour générer un flux forcé unidirectionnel, de telle sorte que, dans les deux états de fonctionnement des moyens d'inversion (20), le flux d'air forcé (F) respectivement à chauffer ou à refroidir, après être sorti du tambour (3), passe d'abord à travers le premier échangeur de chaleur (11), puis à travers le deuxième échangeur de chaleur (12) de la pompe à chaleur (10).

11. Machine selon la revendication 9 ou 10, dans laquelle les moyens d'inversion (20) comprennent des moyens de vanne (21) de la pompe à chaleur (10) qui peuvent être commutés entre un premier et un deuxième états de commutation, et dans laquelle :

- dans le premier état de commutation, les moyens de vanne (21) sont fonctionnels pour faire passer un fluide de travail ou un agent frigorigène de la pompe à chaleur (10) du premier échangeur de chaleur (11) au compresseur (13) et du compresseur (13) au deuxième échangeur de chaleur (12), et
- dans le deuxième état de commutation, les moyens de vanne (21) sont fonctionnels pour faire passer le fluide de travail de la pompe à chaleur (10) du deuxième échangeur de chaleur (12) au compresseur (13) et du compresseur (13) au premier échangeur de chaleur (11),

dans laquelle en particulier les moyens de vanne comprennent une vanne à quatre voies (21).

12. Machine selon la revendication 11, dans laquelle la pompe à chaleur (10) comprend également une canalisation de retour (22) de l'écoulement du fluide de travail de la pompe à chaleur (10), conçue pour permettre :

- un écoulement du fluide de travail du deuxième échangeur de chaleur (12) au premier échangeur de chaleur (11) lorsque les moyens de vanne (21) sont dans le premier état de commutation respectif, et
- un écoulement du fluide de travail du premier échangeur de chaleur (11) au deuxième échangeur de chaleur (12) lorsque les moyens de vanne (21) sont dans le deuxième état de commutation respectif,

dans laquelle en particulier la canalisation de retour (22) comprend au moins un conduit capillaire conçu pour provoquer la stratification du fluide de travail de la pompe à chaleur (10).

13. Procédé de commande du fonctionnement d'une machine à sécher le linge (1) du type dans lequel l'air d'un flux forcé (F) est forcé à travers un tambour à linge (3), le procédé comprenant la sélection, par l'intermédiaire de moyens de sélection (S), d'un parmi une pluralité de programmes de fonctionnement dont l'exécution est commandée par un système de commande (5, 6, 25a, 25b, 26), chaque programme de fonctionnement se terminant lors de la réalisation d'un état détectable par le système de commande (5, 6, 25a, 25b, 26), **caractérisé en ce que**, pour au moins un premier programme de fonctionnement, ledit état est un état d'ouverture d'une porte (4) de la machine (1), détectable par l'intermédiaire de moyens de détection correspondants (26) appartenant au système de commande (5, 6, 25a, 25b, 26), pendant le au moins un premier programme de fonctionnement, l'air du flux forcé (F) étant amené à une température essentiellement prédéterminée, laquelle température est ensuite maintenue jusqu'à la fin du au moins un premier programme de fonctionnement, la fin du au moins un premier programme de fonctionnement étant provoquée à la suite de la détection dudit état d'ouverture de la porte (4), après que ladite température essentiellement prédéterminée a été atteinte.

14. Procédé selon la revendication 13, dans lequel le au moins un premier programme de fonctionnement comprend au moins un élément parmi

- un programme pour réchauffer du linge sec, particulièrement pendant lequel l'air du flux forcé (F) est amené, puis maintenu à une température essentiellement comprise entre 34 °C et 38 °C,

- un programme pour rafraîchir du linge sec, particulièrement pendant lequel l'air du flux forcé (F) est amené, puis maintenu à une température essentiellement comprise entre 5 °C et 12 °C.

15. Procédé selon la revendication 13 ou 14, dans lequel, pendant l'exécution du au moins un premier programme de fonctionnement, seule la température de l'air du flux forcé (F) est surveillée, sans aucune surveillance de l'humidité de l'air ou du linge, pour l'atteinte d'une température prédéterminée du flux forcé (F) et son maintien ultérieur.

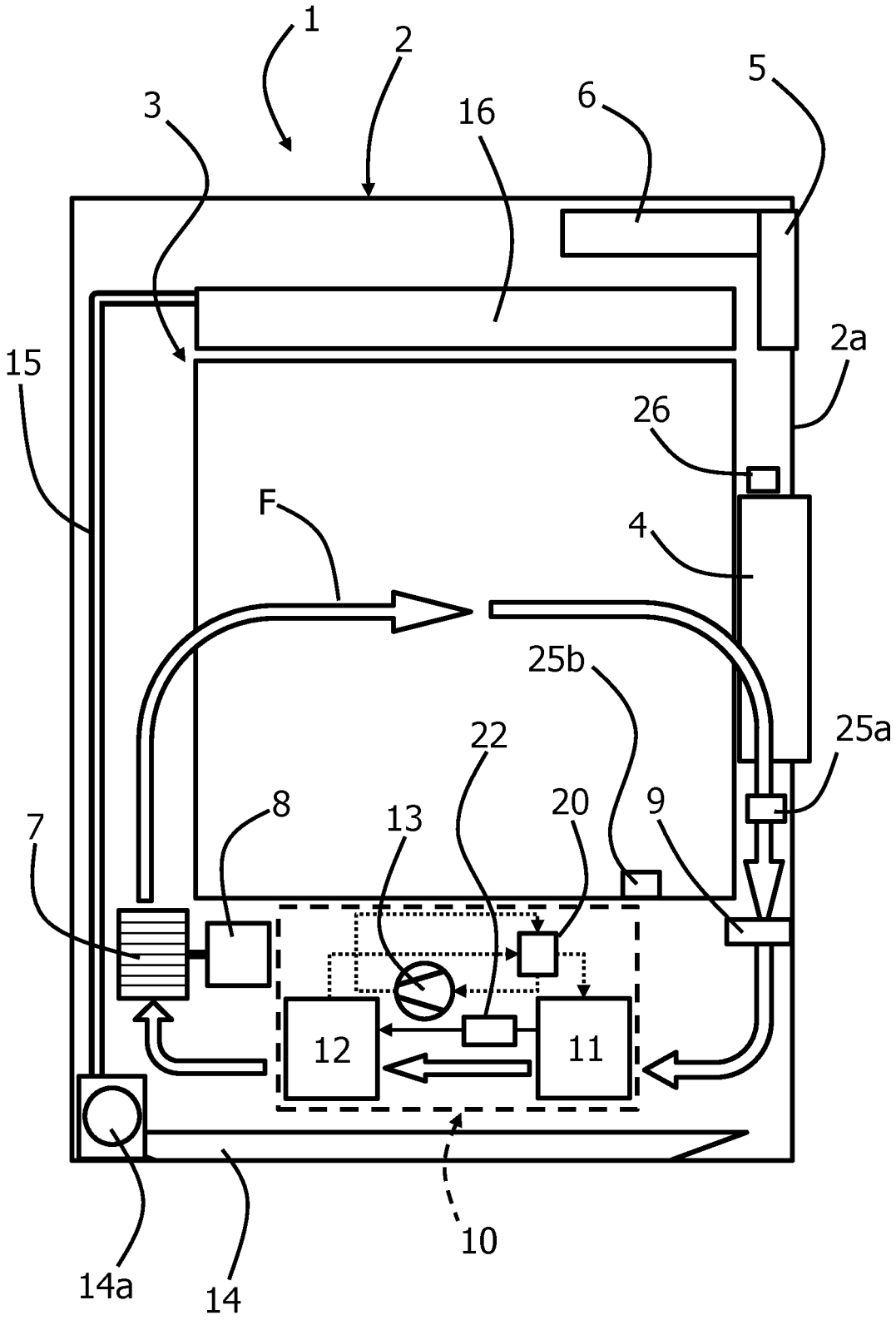


Fig. 1

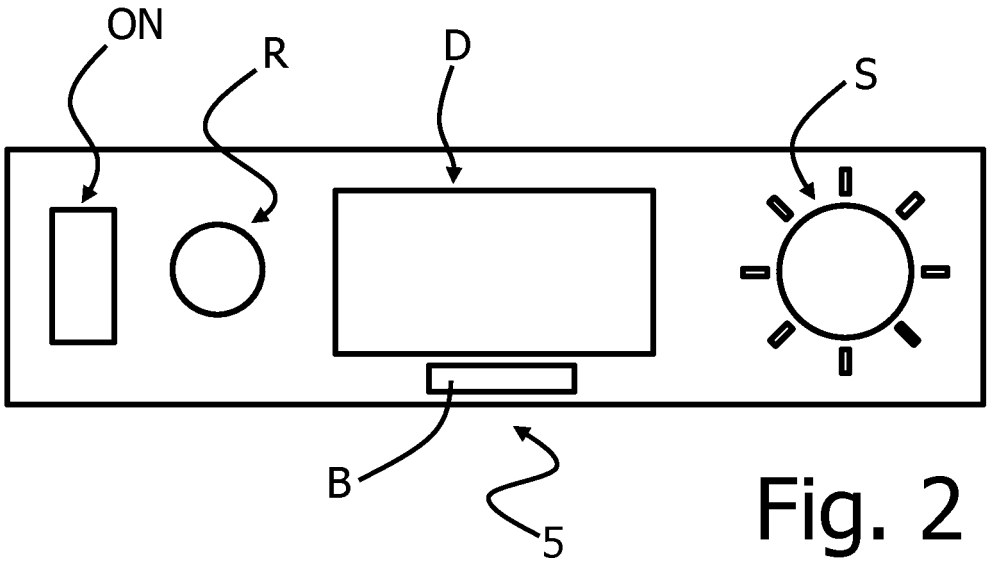


Fig. 2

Fig. 3

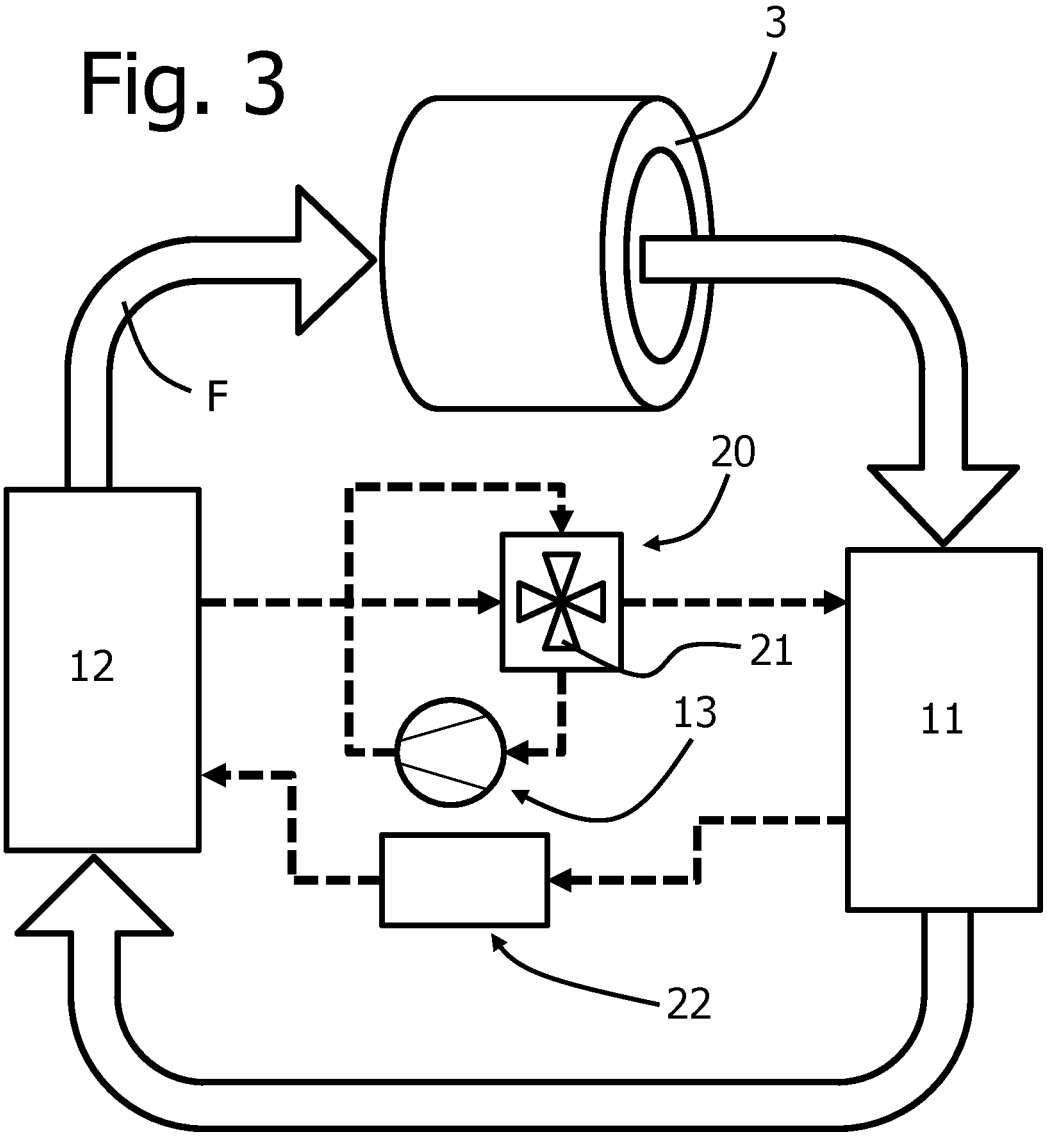


Fig. 4

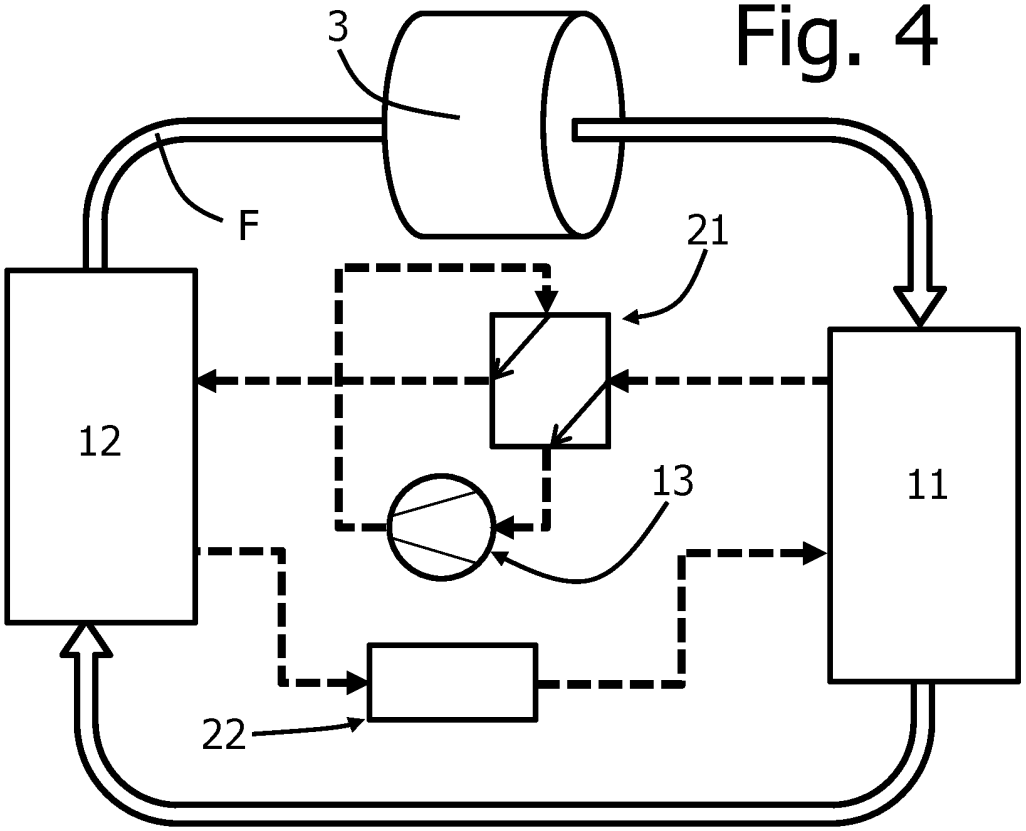
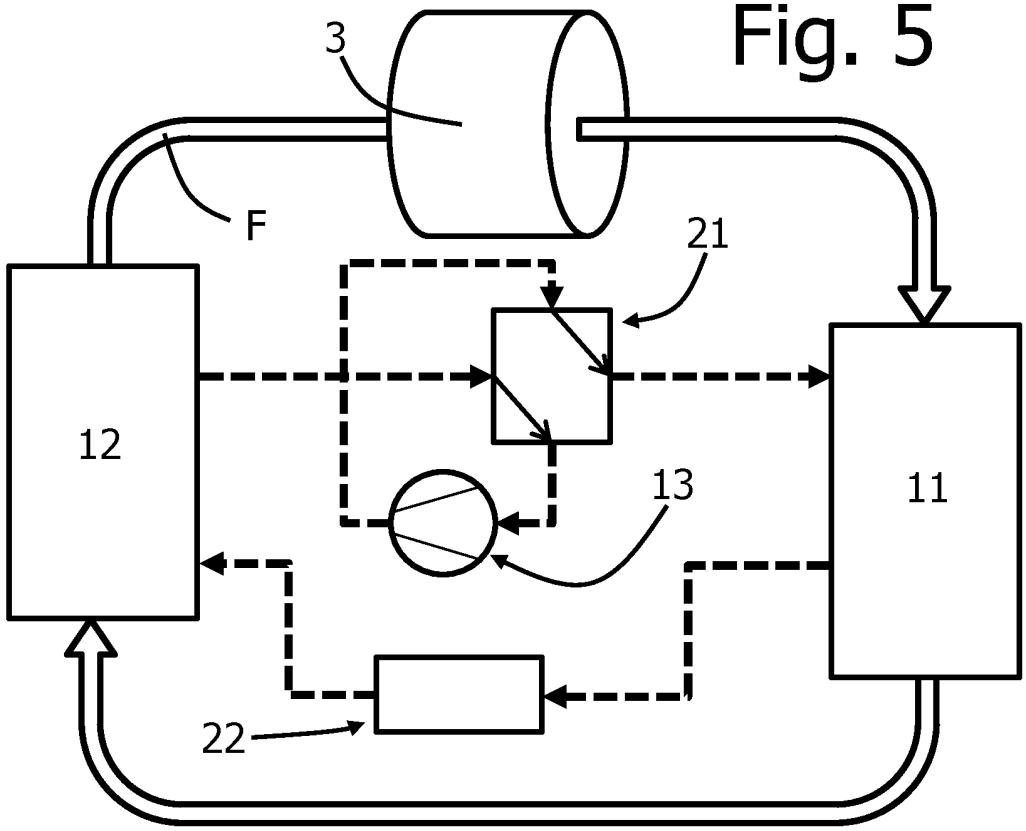


Fig. 5



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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