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(54) Household laundry washing and drying machine with a condensing device

(57) The present invention relates to a laundry washing and drying machine (1; 61; 71) comprising: an outer casing (2), a tub (3) external to a drum (9) suitable for receiving laundry (10) to be washed and/or dried and an air treating system (5) connecting an air outlet hole (3b) of the tub (3) to an air inlet hole (3a) of the tub (3) for circulating hot air through the tub (3). The air treating system (5) comprises: a condensing device (6) for dehumidifying moist air (H2) coming from the air outlet hole (3b); an air heating device (7) for heating dehumidified air coming from the condensing device (6) and producing hot air (H1) to be conveyed to the inlet hole (3a) and an air circulating device (14; 114; 214) for forcing air through the condensing device (6) and the heating device (7). The air circulating device (14; 114; 214) generates a first air stream for circulating the hot air (H1) through the tub (3) for drying the laundry (10) and generates a second air stream, different from the first air stream, for suction of liquid from the outlet hole (3b) for cleaning the condensing device (14; 114; 214).

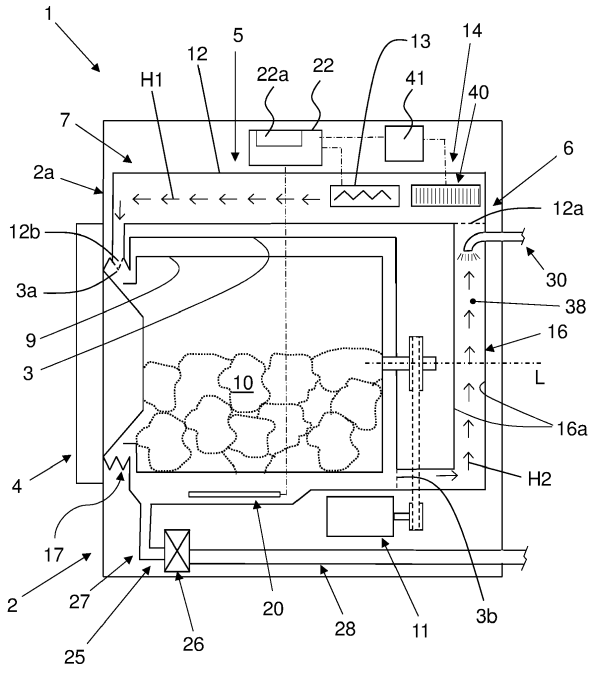

FIG. 3

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns the technical field of laundry washing and drying machines.

[0002] In particular, the present invention refers to laundry drying machines of the condenser type.

BACKGROUND ART

[0003] The present invention relates to a household laundry washing and drying machine.

[0004] As is known, today's front-loading laundry washing and drying machines generally comprise: a substantially parallelepiped-shaped outer boxlike casing, typically structured for resting on the floor; a substantially bell-shaped washing tub which is generally suspended in floating manner inside the casing via a number of coil springs and shock-absorbers, with the front opening/mouth directly facing a laundry loading/unloading pass-through opening provided in the front wall of the casing; a substantially cylindrical elastically-deformable bellows which connects in watertight manner the front mouth/opening of the bell-shaped washing tub to the laundry loading/unloading opening on front wall of the casing; and a porthole door which is hinged to the front wall of the casing to rotate to and from a closing position in which the door rests on the front face of the casing to close the laundry loading/unloading on the front wall and substantially watertight seal the washing tub.

[0005] The front-loading laundry washing and drying machines of the above type furthermore comprise: a substantially bell-shaped, cylindrical revolving drum which is structured for housing the laundry to be washed and/or dried, and is housed in axially rotating manner inside the washing tub for rotating about its longitudinal reference axis; an electric motor assembly which is located outside of the washing tub, and is structured for driving into rotation the revolving drum about its longitudinal reference axis inside the washing tub; and a, preferably closed-circuit, air duct assembly which is structured to circulate inside the washing tub a stream of hot air having a low moisture content, and which flows through the revolving drum and over the laundry inside the drum to dry the laundry.

[0006] The air duct assembly is structured for gradually drawing air from the washing tub; cooling down the air arriving from the washing tub so to extract and retain the surplus moisture in the air; heating the dehumidified air to a predetermined temperature, normally higher than the temperature of the air arriving from the washing tub; and feeding the heated, dehumidified, air back into the washing tub, where it flows over the laundry stored inside the revolving drum to dry the laundry.

[0007] In several models of known front-loading laundry washing and drying machines, the cooling down and dehumidification of the air drawn from the washing tub is performed inside a condensing duct, also called condenser, which is attached/integrated to/on the back of the washing tub, preferably inside the boxlike casing. The condensing duct is preferably provided with a water supply water device mounted thereon for supplying cooling water to condense, and remove moisture from air drawn from the washing tub.

[0008] In some known front-loading laundry washing and drying machines the heating up of the dehumidified air coming out of the condenser is performed inside an air heating device which is rigidly attached to the top of the washing tub so as to have a first end in direct communication with the condenser and a second end in direct communication with the washing tub close to the front mouth of the latter, and which internally houses a centrifugal fan that circulates the air across the washing tub and the resistor that heats up the dehumidified air directed back into the washing tub. The centrifugal fan typically comprises a fixed speed electric fan.

[0009] In such machines, during the drying phase a part of the lint that is removed from the laundry is transported by the flux of air and is deposited on the inner walls of the condenser, causing with time its clogging and hence a loss of overall drying efficiency.

[0010] In some known front-loading laundry washing and drying machines a periodic cleaning process of the inner walls of the condenser is performed.

[0011] US5226203A discloses a laundry washing and drying machine wherein a cleaning process is performed.

[0012] Here the cleaning process takes place during one or more phases of the washing cycle by activating the same fan which is used to circulate the air across the washing tub in the drying phase. Activation of the fan causes drawing of water from the tub during said one or more phases of the washing cycle. Drawing of water is carried out by means of the suction effect of the fan. The sucked water reaches a predetermined level within the condenser which causes the cleaning of lint deposited on the inner walls of the condenser itself. When the fan's functioning is stopped, the dirty water flows back inside the tub and from there discharged externally during a subsequent discharge phase of the washing cycle. However, the cleaning process of the condenser above described belonging to the known art poses some drawbacks.

[0013] A first drawback posed by this known process is constituted by the fact that the cleaning process may not be successful if a high quantity of lint is deposited on the inner walls of the condenser.

[0014] Another drawback posed by this known technique is that the inner walls of the condenser are not uniformly cleaned by the process, in particular the upper portion of the inner walls of the condenser which are hardly reached by the sucked water.

[0015] A further drawback posed by this known technique is that the cleaning process may require a long time to be preformed, with a consequent increase of the energy dissipation.

[0016] The aim of the present invention is therefore to solve the noted drawbacks and thus providing a washing and drying machine having an improved condenser cleaning system.

[0017] It is a first object of the invention to implement a washing and drying machine having an increased condenser cleaning effect with respect to the prior art process.

[0018] It is a further object of the invention to implement a washing and drying machine with a shorter condenser cleaning phase with respect to the prior art process. Another object of the present invention is to provide a washing and drying machine with reduced energy dissipation.

[0019] 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.

DISCLOSURE OF INVENTION

[0020] The applicant has found that by providing a laundry washing and drying machine provided with an air circulating device which generates a first air stream for circulating hot air through a tub for drying the laundry, and which generates a second air stream, different (i.e. having a different volumetric flow rate) from the first air stream, for sucking liquid from the tub and cleaning with this liquid a condensing device adapted for dehumidifying moist air coming from the tub, it is possible to enhance the cleaning of the condensing device.

[0021] The present invention relates, therefore, to a laundry washing and drying machine comprising:

- an outer casing;
- a tub external to a drum suitable for receiving laundry to be washed and/or dried;
- an air treating system connecting an air outlet hole of said tub to an air inlet hole of said tub for circulating hot air through said tub, said air treating system comprising:
- a condensing device for dehumidifying moist air coming from said air outlet hole;
- an air heating device for heating dehumidified air coming from said condensing device and producing hot air to be conveyed to said inlet hole;
- an air circulating device for forcing air through said condensing device and said heating device; wherein said air circulating device generates:
- a first air stream for circulating said hot air through said tub for drying said laundry;
- a second air stream, different (i.e. having a different volumetric flow rate) from the first air stream, for suction of liquid from said outlet hole for cleaning said condensing device.

[0022] The possibility of having two different air streams, one during the drying cycle and the other during the procedure for cleaning the condenser, allows using an optimized air stream (i.e. an optimized volumetric flow rate of the air flux) in any one of these two procedure, so as to improve the effectiveness of both the procedure (drying the laundry and cleaning the condenser), which is not possible in the cited prior art, in which there only one air stream.

[0023] Preferably, the intensity of the second air stream (i.e. the volumetric flow rate of the second air stream) is higher than the intensity of the first air stream.

[0024] In an advantageous embodiment, the air circulating device comprises a fan and a speed regulator device for the fan in order to generate the first or the second stream.

[0025] In a further advantageous embodiment, the air circulating device comprises a first fan to generate the first air stream and a second fan to generate the second air stream.

[0026] In an advantageous embodiment, the first fan is similar (i.e. similar in shape, so as to be able to generate substantially a same air flow) to the second fan and the working rotational speed of the second fan is higher than the working rotational speed of the first fan.

[0027] In a further advantageous embodiment, the power of the second fan is higher than the power of the first fan.

[0028] Preferably, the air circulating device comprises a speed regulator device for the first fan and/or a speed regulator device for the second fan.

[0029] In an advantageous embodiment, the fan comprises an electric centrifugal fan. Preferably, the speed regulator device comprises an inverter.

[0030] In a preferred embodiment of the invention, the condensing device comprises a duct and a water supply device for cooling down and dehumidifying moist air flowing through the duct.

[0031] In an advantageous embodiment, the machine comprises a liquid detecting device suitable for detecting the presence of liquid inside the tub.

[0032] Preferably the second air stream is generated when presence of liquid in the tub is detected by the liquid detecting device.

[0033] In an advantageous embodiment, the machine comprises a control unit suitable for the controlling the intensity of the first and/or the intensity of the second air stream.

[0034] Preferably, the machine comprises an interface unit accessible to a user.

[0035] In another aspect the invention relates to a method for operating a washing and drying machine, wherein the washing and drying machine comprises:

- a tub external to a drum suitable for receiving laundry to be washed and/or dried;
- an air treating system connecting an air outlet hole of the tub to an air inlet hole of the tub (3) for circulating hot air through the tub, the air treating system comprising:

- a condensing device for dehumidifying moist air coming from the air outlet hole;
- an air heating device for heating dehumidified air coming from the condensing device and producing hot air to be conveyed to the inlet hole;
- an air circulating device for forcing air through the condensing device and the heating device.

[0036] The method comprises using a first air stream for circulating hot air through the tub when drying the laundry, and using a second air stream, different from the first air stream, for suction of liquid from the outlet hole when cleaning the condensing device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] 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. In the drawings, corresponding characteristics and/or components are identified by the same reference numbers. In particular:

- Figure 1 is a perspective view, with parts removed for clarity, of a laundry washing and drying machine in accordance with the teachings of the present invention;
- Figure 2 shows an enlarged detail of Figure 1;
- Figure 3 shows a lateral schematic view of the laundry washing and drying machine of Figure 1;
- Figure 4 shows a construction variant of the laundry washing and drying machine of Figure 3;
- Figure 5 shows a further construction variant of the laundry washing and drying machine of Figure 3.

DETAILED DESCRIPTION OF THE INVENTION

[0038] The present invention has proved to be particularly successful when applied to a front-loading washing and drying machine; however it is clear that the present invention can be applied as well to a top-loading washing and drying machine. With reference to Figures 1 and 3, reference number 1 indicates as a whole a laundry washing and drying machine 1 according to the present invention.

[0039] The laundry washing and drying machine 1 preferably comprises, though not necessarily, a substantially parallelepiped-shaped outer boxlike casing 2 which is preferably structured for resting on the floor and a preferably, though not necessarily, substantially cylindrical, bell-shaped, hollow tub 3 which is suspended in floating manner inside the casing 2. The tub 3 preferably has its front opening or mouth directly facing a laundry loading/unloading pass-through opening provided in the front wall 2a of the boxlike casing 2. A substantially cylindrical, bell-shaped revolving drum 9 which is structured for housing the laundry 10 to be washed and/or dried, is housed in axially rotating manner inside the tub 3 so as to be able to freely rotate about its longitudinal reference axis L. In the example shown, tub 3 is advantageously suspended in floating manner inside casing 2, preferably via a suspension system preferably comprising a number of coil springs (not shown) and vibration dampers (not shown). The front opening/mouth of tub 3 is preferably connected in watertight manner to the laundry loading/unloading opening on front wall 2a via a substantially cylindrical, elastically-deformable bellows 17.

[0040] The revolving drum 9 is preferably arranged inside tub 3 so that the drum front opening is directly faced/aligned to the laundry loading/unloading opening on front wall 2a, and so that the rotation axis of the drum 9 is preferably locally substantially coincident with the substantially horizontally-oriented, longitudinal reference axis L of tub 3.

[0041] A porthole door 4 is hinged to the front wall 2a of casing 2 to rotate about a preferably, though not necessarily, vertically-oriented reference axis to and from a closing position in which the peripheral border of the porthole door 4 rests completely on front wall 2a for closing the laundry loading/unloading opening and watertight sealing the tub 3.

[0042] The front-loading laundry washing and drying machine 1 preferably furthermore comprises an electric motor assembly 11 which is structured for driving into rotation the revolving drum 9 about its longitudinal reference axis L inside the tub 3, advantageously by means of a belt/pulley system.

[0043] The machine 1 preferably comprises a water and detergent supplying assembly (not shown) which is structured for selectively feeding into the tub 3, according to the selected washing cycle, a given amount of detergent, softener and/or other washing agent suitably mixed with the fresh water arriving from the water mains, or simply a given amount of fresh water arriving from the water mains.

[0044] The laundry washing machine 1 advantageously comprises a water outlet circuit 25.

[0045] The water outlet circuit 25 preferably comprises a drain pump 26, a first pipe 27 connecting the tub 3 to the drain pump 26 and an outlet pipe 28 ending outside the casing 2. The water outlet circuit 25 is suited to drain the liquid, i.e. water or dirty water or water mixed with washing and/or rinsing products, from the tub 3 to the outside.

[0046] In different embodiments, the water outlet circuit 25 may be advantageously provided with a recirculation circuit, not illustrated, adapted to drain liquid from a bottom region of the tub 3 and to re-admit such a liquid into another region of the tub 3.

[0047] Advantageously the laundry washing machine 1 comprises a device, not shown, suited to sense (or detect) the liquid level inside the tub 3. The device preferably comprises a pressure sensor which senses the pressure in the tub 3. Advantageously, at the level of the

bottom of the laundry washing machine 1, and preferably on the bottom of the tub 3, there is a water heating element 20. The water heating element 20 preferably comprises an electric resistor suited to come into contact with the liquid present on the bottom of the tub 3 to heat said liquid.

[0048] The laundry washing machine 1 is provided with an air treating system 5 which is structured to circulate inside the tub 3 a stream of hot air H1 having a low moisture content, and which flows through the revolving drum 9 and over the laundry 10 located inside the drum 9 to dry the laundry 10.

[0049] The air treating system 5 is preferably structured for gradually drawing air from tub 3, cooling down the stream of moisture-laden air H2 arriving from the tub 3. so as to extract and retain the surplus moisture in the moist air, and heating the dehumidified air to a predetermined temperature, preferably higher than that of the moist air arriving from tub 3. Finally the heated, dehumidified air H1 is conveyed again into the tub 3, where it flows over the laundry 10 stored inside the revolving drum 9 to dry the laundry 10, as said above.

[0050] The air treating system 5 is advantageously housed inside the boxlike casing 2 and preferably comprises an air cooling device 6, an air heating device 7 arranged downstream of the air cooling device 6 and an air circulating device 14. The air cooling device 6 is preferably attached to the back of tub 3 and is fluidly connected to the tub 3, preferably at an outlet hole 3b provided on the bottom of the tub 3 itself. The air cooling device 6 is structured to cool down the air H2 arriving from tub 3 so as to extract the surplus moisture in the air drawn from tub 3.

[0051] The air heating device 7 is fluidly connected to both the tub 3 and the air cooling device 6, so as to allow the dehumidified air to flow from the air cooling device 6 to the tub 3, and it is structured to heat up the dehumidified air arriving from the air cooling device 6 before this air returns back into tub 3 through an inlet hole 3a.

[0052] In the example shown, the air cooling device 6 preferably comprises a cold-water condenser 16 which is preferably, but not necessarily, arranged on the back of tub 3, and which preferably uses a rain/shower of cold water arriving advantageously from a water mains 30 to cool down and dehumidify the moist air H2 that arrives from tub 3 and flows upwards in the air cooling device 6 up to the top of the later. The moist air H2 advantageously flows upwards through a condensing duct 38.

[0053] The air heating device 7 is preferably rigidly attached to the top of tub 3. Advantageously the air heating device 7 comprises a tubular body 12 and a heating element 13.

[0054] The tubular body 12 is preferably structured for being firmly fixed to the tub 3, preferably on the top of the latter, and preferably comprises a first opening or mouth 12a fluidly connected to, i.e. in direct communication with, the air cooling device 6, and a second opening or mouth 12b fluidly connected to, i.e. in direct communication with, the inside of the 17 bellows, or fluidly connected directly to the inside of tub 3, preferably close to the front opening of tub 3 in correspondence of its inlet hole 3a.

[0055] The heating element 13 preferably comprises a resistor (only schematically illustrated in Figure 2) or other equivalent heating element, which is housed inside the tubular body 12, and is structured to heat up, when electrically powered, the air that flows through the tubular body 12.

[0056] The air circulating device 14 preferably comprises an electric centrifugal fan 40, or other equivalent air circulating device, which is preferably housed inside the tubular body 12, preferably upstream of resistor 13, and is structured to circulate through the tubular body 12 an airflow that subsequently flows across the tub 3 and the air cooling device 6 for finally returning back to tubular body 12.

[0057] The centrifugal fan 40 is preferably recessed on a portion of the tubular body 12 suitably shaped to form the outer volute or impeller housing of centrifugal fan 40.

[0058] Preferably, though not necessarily, the air heating device 7 furthermore comprises one or more temperature sensors 37 which are located inside, or faced to the inside of, tubular body 12 and are structured for measuring the temperature of the air H1 flowing inside tubular body 12, preferably close to the second opening or mouth 12b of the tubular body 12.

[0059] The air treating system 5, therefore, allows the laundry 10 to be dried when the laundry washing and drying machine is performing a drying cycle, usually after a washing cycle.

[0060] Furthermore, after a drying cycle a condenser cleaning cycle is also preferably performed.

[0061] In fact, during a drying cycle a part of the lint that is removed from the laundry 10 is transported by the stream of moisture-laden air H2 and is deposited on the internal walls 16a of the condenser 16. This causes with time its clogging and hence a loss of overall drying efficiency. Cleaning of the inner walls 16a of the condenser 16 is therefore required.

[0062] The cleaning process consists in performing a periodic "washing" of the inner walls 16a of the condenser 16 by activating the air circulating device 14, and in particular the centrifugal fan 40, when a prefixed quantity of liquid is present in the tub 3. Presence of such prefixed quantity of liquid is advantageously carried out by means of the pressure sensor at the bottom of the tub 3, or by means of equivalent liquid level detecting means.

[0063] The cleaning process may preferably take place during the washing cycle when liquid, i.e. water and/or water mixed with detergent, occupied the bottom of the tub 3. In further embodiment the process may be started at any time, for example when the machine 1 is empty, by providing a prefixed quantity of water inside the tub 3.

[0064] The activation of the fan 40 causes, due to its non negligible prevalence, a suction of liquid through the outlet hole 3b of the tub 3, being said outlet hole 3b op-

portunely located at a lower level relative to the liquid's level inside the tub 3 corresponding to the prefixed quantity of water.

[0065] In this way, the liquid sucked by the suction effect of the fan 40 causes the cleaning of lint deposited on the inner walls 16a of the condenser 16.

[0066] When the fan's functioning is stopped, the liquid together with the removed lint go back inside the tub 3 and, from there, discharged outside in a subsequent discharge phase when the drain pump 26 is opportunely activated.

[0067] A control unit 22 is preferably connected to the various parts of the machine 1 in order to ensure its operation.

[0068] The control unit 22 is advantageously connected also to an interface unit 22a which is accessible to the user and by means of which the user selects and sets the desired parameters from time to time, in particular the desired washing and drying program. Advantageously, other parameters can optionally be inserted by the user, for example the washing temperature, the spinning speed, the load in terms of weight of the laundry to be washed, the type of fabric of the load, etc. Based on the parameters acquired by said interface unit 22a, the control unit 22 advantageously sets and controls the various parts of the laundry washing machine 1 in order to carry out the desired washing and drying program.

[0069] The user may therefore select a single washing program or a washing program followed by a drying program or a single drying program.

[0070] Furthermore, through the interface unit 22a the user can preferably select when the condenser cleaning cycle as to be performed. For example, the interface unit 22a could be provided with a dedicated "condenser cleaning cycle" button for manually starting the condenser cleaning cycle. In further embodiments, starting of the condenser cleaning cycle could be advantageously programmed through the interface unit 22a, for example by setting an automatic condenser cleaning cycle after or before each drying cycle or before each washing cycle.

[0071] According to the present invention, the air circulating device 14 is designed to generate a first air stream when a drying cycle is performed and to generate a second air stream, different from the first air stream, when a condenser cleaning cycle is performed. In other words, the first air stream generated by the air circulating device 14 during the drying process has a different volumetric flow rate with respect to the second air stream generated by the air circulating device 14 during a condenser cleaning cycle.

[0072] For this purpose the air circulating device 14 preferably comprises a speed regulator 41 for the electric centrifugal fan 40. The speed regulator 41 preferably comprises an inverter motor control which allows the rotational speed of the electric centrifugal fan 40 to be varied. Advantageously the electric centrifugal fan 40 can work at different speeds, preferably at different fixed desired speeds. The inverter motor control 41 is advantageously connected to the control unit 22 and opportunely driven by it.

[0073] When the machine 1 is performing a drying cycle, the electric centrifugal fan 40 is rotated at a first rotational speed, preferably between 2900 rpm and rpm 3800, more preferably at 3000 rpm. The first rotational speed generates a respective first air stream along the air cooling device 6 and along the air heating device 7. The intensity of the first air stream, which depends on the value of the first rotational speed, is advantageously chosen so that the laundry 10 can be optimally dried.

[0074] In a preferred embodiment, the first rotational speed may not be set at a constant value but can be advantageously varied during the drying cycle, preferably inside the above mentioned range.

[0075] Clearly the first rotational speed may also be constant during the drying cycle. When the machine 1 is performing a condenser cleaning cycle the electric centrifugal fan 40 is again rotated, but at a second rotational speed, preferably between 3900 rpm and rpm 4500, more preferably at 4200 rpm.

[0076] The second rotational speed generates a respective second air stream along the air cooling device 6 which causes suction of liquid through the outlet hole 3b of the tub 3, as explained above. The intensity of the second air stream, which depends on the value of the second rotational speed, is advantageously chosen so that the sucked liquid inside the condenser 16 may reach also the upper portion of the inner walls 16a of the condenser 16.

[0077] The intensity of this second air stream is preferably higher than the intensity of the first air stream. Therefore, the second rotational speed for the electric centrifugal fan 40 is opportunely chosen as having a higher value with respect to the first rotational speed.

[0078] In a preferred embodiment, the second rotational speed may not be set at a constant value but can be advantageously varied during the condensed cleaning cycle, preferably inside the above mentioned range.

[0079] In this case, during the condenser cleaning cycle the level of the sucked liquid inside the condenser 16 may vary according to the second rotational speed variation so that the cleaning effect for the inner walls 16a may be enhanced. Clearly the second rotational speed may also be constant during the condenser cleaning cycle.

[0080] According to the invention, the provision of a speed regulator 41 for the fan 40 makes it possible to increase the rotational speed of the fan 40 during the condenser cleaning cycle and, therefore, to increase the condenser cleaning effect with respect to the cleaning process of the know machine where a single fan working at fixed speed is used in both drying and cleaning cycles.

[0081] Moreover, the provision of a speed regulator 41 for the fan 40 which increases the intensity of the second air stream, i.e. the intensity of the cleaning air stream, allows the reduction of the duration of the condenser cleaning cycle with respect to the know cleaning process.

[0082] This also causes a reduction of the dissipated energy during the condenser cleaning cycle.

[0083] With reference to Figure 4 a construction variant of a laundry washing and drying machine 61 is described.

[0084] The laundry washing and drying machine 61 shown in Figure 4 differs from the laundry washing and drying machine 1 described with reference to Figures from 1 to 3 for the fact that the air circulating device 114 comprises a first electric centrifugal fan 140a working at a fixed first rotational speed and a second electric centrifugal fan 140b working at a fixed second rotational speed different from the first rotational speed.

[0085] The two electrical fans 140a, 140b may be advantageously chosen so as to be substantially similar (i.e. have substantially the same shape, and therefore the same blowing power) one to the other.

[0086] Preferably, the second rotational speed is higher than the first rotational speed.

[0087] Advantageously, the first electric centrifugal fan 140a is activated at the first rotational speed to generate the first air stream when a drying cycle is performed while the second centrifugal fan 140b is activated at the second rotational speed to generate the second air stream when a condenser cleaning cycle is performed. For example the second electrical fan 140b may comprise a motor having a higher power than the motor of the first electrical fan 140a.

[0088] The intensity of the second air stream is therefore higher than the intensity of the first air stream, thus achieving the advantages above mentioned in the description of the first preferred embodiment.

[0089] In a further preferred embodiment, the two electrical fans 140a, 140b may be different and suitable for generating two streams having different intensity even if they are rotated at the same rotational speed. With reference to Figure 5 a further construction variant of a laundry washing and drying machine 71 is described.

[0090] The laundry washing and drying machine 71 shown in Figure 5 differs from the laundry washing machine 1 described with reference to Figure 4 for the fact that the air circulating device 214 preferably comprises a first speed regulator 241a for the first electric centrifugal fan 240a and a second speed regulator 241b for the second electric centrifugal fan 240b. Each speed regulator 241a, 241b preferably comprises an inverter motor control which allows the rotational speed of the respective electric centrifugal fan 240a, 240b to be varied.

[0091] Preferably, the second rotational speed is higher than the first rotational speed.

[0092] Advantageously, the first electric centrifugal fan 240a is activated at the first rotational speed to generate the first air stream when a drying cycle is performed while the second centrifugal fan 240b is activated at the second rotational speed to generate the second air stream when a cleaning cycle is performed.

[0093] The intensity of the second air stream is therefore higher than the intensity of the first air stream, thus achieving the advantages above mentioned in the description of the first preferred embodiment.

[0094] Furthermore, the rotational speed of the first and the second fan 240a, 240b may not be set at a constant value but can be advantageously varied, preferably inside a predetermined range.

[0095] In this case, during the condenser cleaning cycle the level of the sucked liquid inside the condenser 16 may vary according to the second rotational speed variation so that the cleaning effect for the inner walls 16a may be enhanced. Also, during the drying cycle the intensity of the hot air stream H1 may vary according to the first rotational speed variation of the first fan 240a so that the heating effect may be enhanced.

[0096] In a further advantageous embodiment, not illustrated, the laundry washing and drying machine comprises a single fan which can be rotated at a single rotational speed, and an air flux regulating device, for example a electromechanical actuated shutter or bulkhead, adapted to regulate the air flow rate channelled by the fan to the tubular body 12; in this way, by actuating the air flux regulating device, it is possible to circulate in the tubular body 12, and therefore in the condensing device 6 and in the heating device 7, a first air stream during the drying cycle, and a second air stream, different from the first air stream during the condensing cleaning cycle.

[0097] Conclusively it can be stated that a laundry washing and drying machine according to the invention has an efficient condenser cleaning system.

[0098] It has thus been shown that the present invention allows all the set objects to be achieved. In particular, it makes it possible to obtain a laundry washing and drying machine with an increased condenser cleaning effect with respect to the known process.

[0099] In particular the present invention allows using an optimized air stream (i.e. an optimized volumetric flow rate of the air flux) both in the drying cycle and in the condenser cleaning cycle, so as to obtain the better performances in both these cycles. On the contrary, in the prior art there is a single air stream for both the above mentioned cycles, which doesn't allow using optimized air volumetric flow rate in both the cycles.

[0100] While the laundry washing and drying machine has been described with reference to a front-loading washing and drying machine, it should be noted that the present invention is not limited to the specific embodiment illustrated and described herein; on the contrary, further variants of the embodiments described herein fall within the scope of the present invention, which is defined in the claims.

Claims

1. A laundry washing and drying machine (1; 61; 71) comprising:

   - an outer casing (2);
   - a tub (3) external to a drum (9) suitable for

receiving laundry (10) to be washed and/or dried;
- an air treating system (5) connecting an air outlet hole (3b) of said tub (3) to an air inlet hole (3a) of said tub (3) for circulating hot air through said tub (3), said air treating system (5) comprising:
- a condensing device (6) for dehumidifying moist air (H2) coming from said air outlet hole (3b);
- an air heating device (7) for heating dehumidified air coming from said condensing device (6) and producing hot air (H1) to be conveyed to said inlet hole (3a);
- an air circulating device (14; 114; 214) for forcing air through said condensing device (6) and said heating device (7);

characterized in that
said air circulating device (14; 114; 214) generates:

- a first air stream for circulating said hot air (H1) through said tub (3) for drying said laundry (10);
- a second air stream, different from said first air stream, for suction of liquid from said outlet hole (3b) for cleaning said condensing device (14; 114; 214).

2. A machine (1; 61; 71) according to claim 1, **characterized in that** the intensity of said second air stream is higher than the intensity of said first air stream.

3. A machine (1; 71) according to claim 1 or 2, **characterized in that** said air circulating device (14; 214) comprises a fan (40; 240a, 240b) and a speed regulator device (41; 241a, 241b) for said fan (40; 240a, 240b) in order to generate said first or said second air stream.

4. A machine (61; 71) according to claim 1 or 2, **characterized in that** said air circulating device (114; 214) comprises a first fan (140a; 240a) to generate said first air stream and a second fan (140b; 240b) to generate said second air stream.

5. A machine (61) according to claim 4, **characterized in that** said first fan (140a) is similar to said second fan (140b) and the working rotational speed of said second fan (140b) is higher than the working rotational speed of said first fan (140b).

6. A machine (61) according to claim 4, **characterized in that** the power of said second fan (140b) is higher than the power of said first fan (140a).

7. A machine (71) according to any claim from 4 to 6, **characterized in that** said air circulating device (214) comprises a speed regulator device (241a) for said first fan (240a) and/or a speed regulator device (241b) for said second fan (240b).

8. A machine (1; 61; 71) according to any claim from 3 to 7, **characterized in that** said fan (40; 140a, 140b; 240a, 240b) comprises an electric centrifugal fan (40; 140a, 140b; 240a, 240b).

9. A machine (1; 71) according to claim 3 or 7, **characterized in that** said speed regulator device (41; 241a, 241b) comprises an inverter.

10. A machine (1; 61; 71) according to any preceding claim, **characterized in that** said condensing device (6) comprises a duct (38) and a water supply device (30) for cooling down and dehumidifying moist air (H2) flowing through said duct (38).

11. A machine (1; 61; 71) according to any preceding claim, **characterized in that** it comprises a liquid detecting device suitable for detecting the presence of liquid inside said tub.

12. A machine (1; 61; 71) according to claim 11, **characterized in that** said second air stream is generated when presence of liquid in said tub is detected by said liquid detecting device.

13. A machine (1; 61; 71) according to any preceding claim, **characterized in that** it comprises a control unit (22) suitable for controlling the intensity of said first and/or the intensity of said second air stream.

14. A machine (1; 61; 71) according to any preceding claim, **characterized in that** it further comprises an interface unit (22a) accessible to a user.

15. A method for operating a washing and drying machine (1; 61; 71), wherein said washing and drying machine comprises:

- a tub (3) external to a drum (9) suitable for receiving laundry (10) to be washed and/or dried;
- an air treating system (5) connecting an air outlet hole (3b) of said tub (3) to an air inlet hole (3a) of said tub (3) for circulating hot air through said tub (3), said air treating system (5) comprising:
- a condensing device (6) for dehumidifying moist air (H2) coming from said air outlet hole (3b);
- an air heating device (7) for heating dehumidified air coming from said condensing device (6) and producing hot air (H1) to be conveyed to said inlet hole (3a);
- an air circulating device (14; 114; 214) for forcing air through said condensing device (6) and

said heating device (7);

characterized in that said method comprises:

using a first air stream for circulating said hot air (H1) through said tub (3) when drying said laundry (10), and using a second air stream, different from said first air stream, for suction of liquid from said outlet hole (3b) when cleaning said condensing device (14; 114; 214).

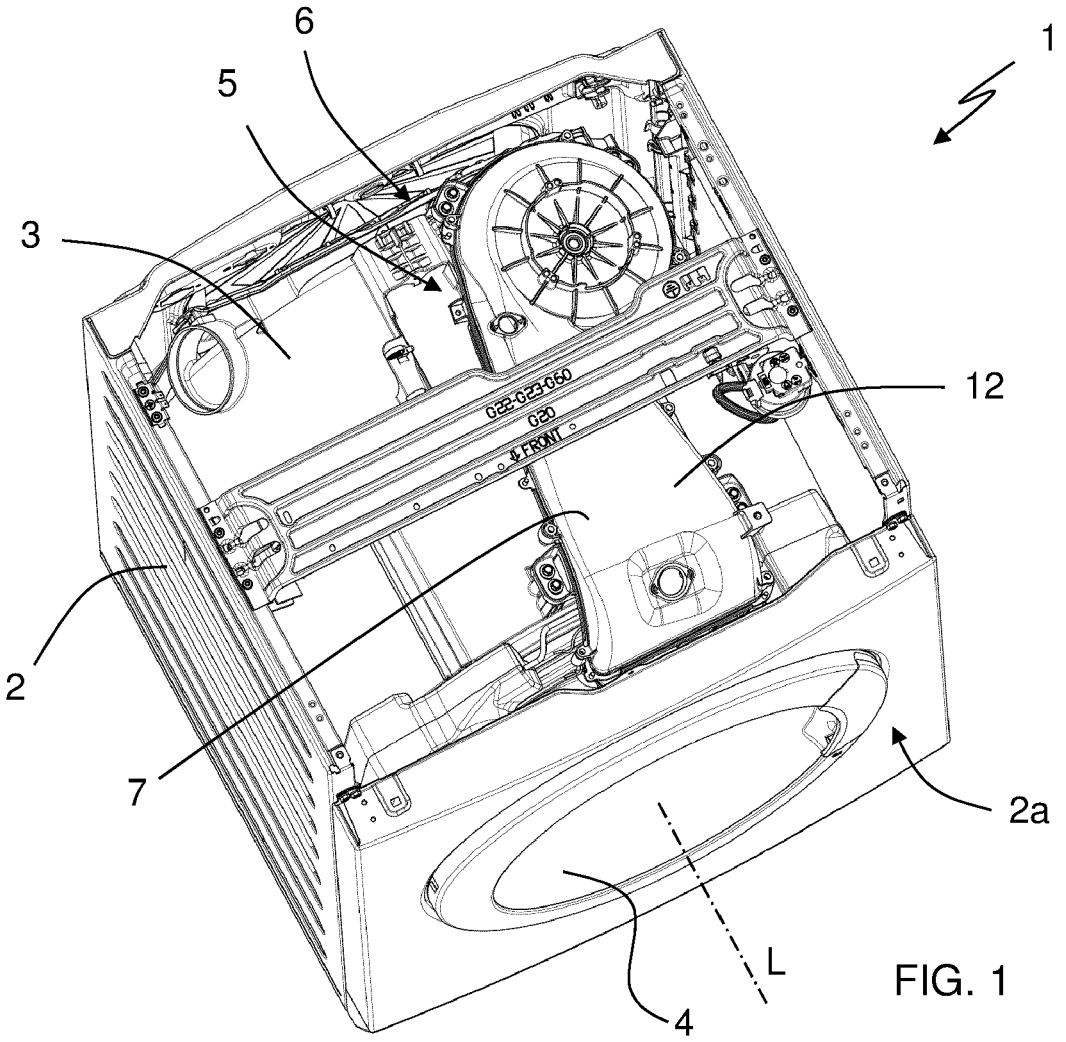

FIG. 1

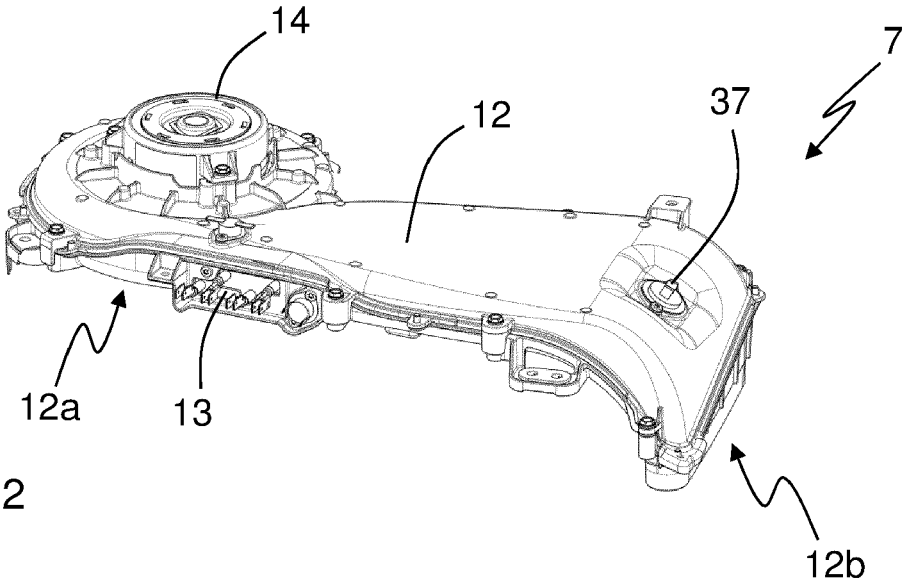

FIG. 2

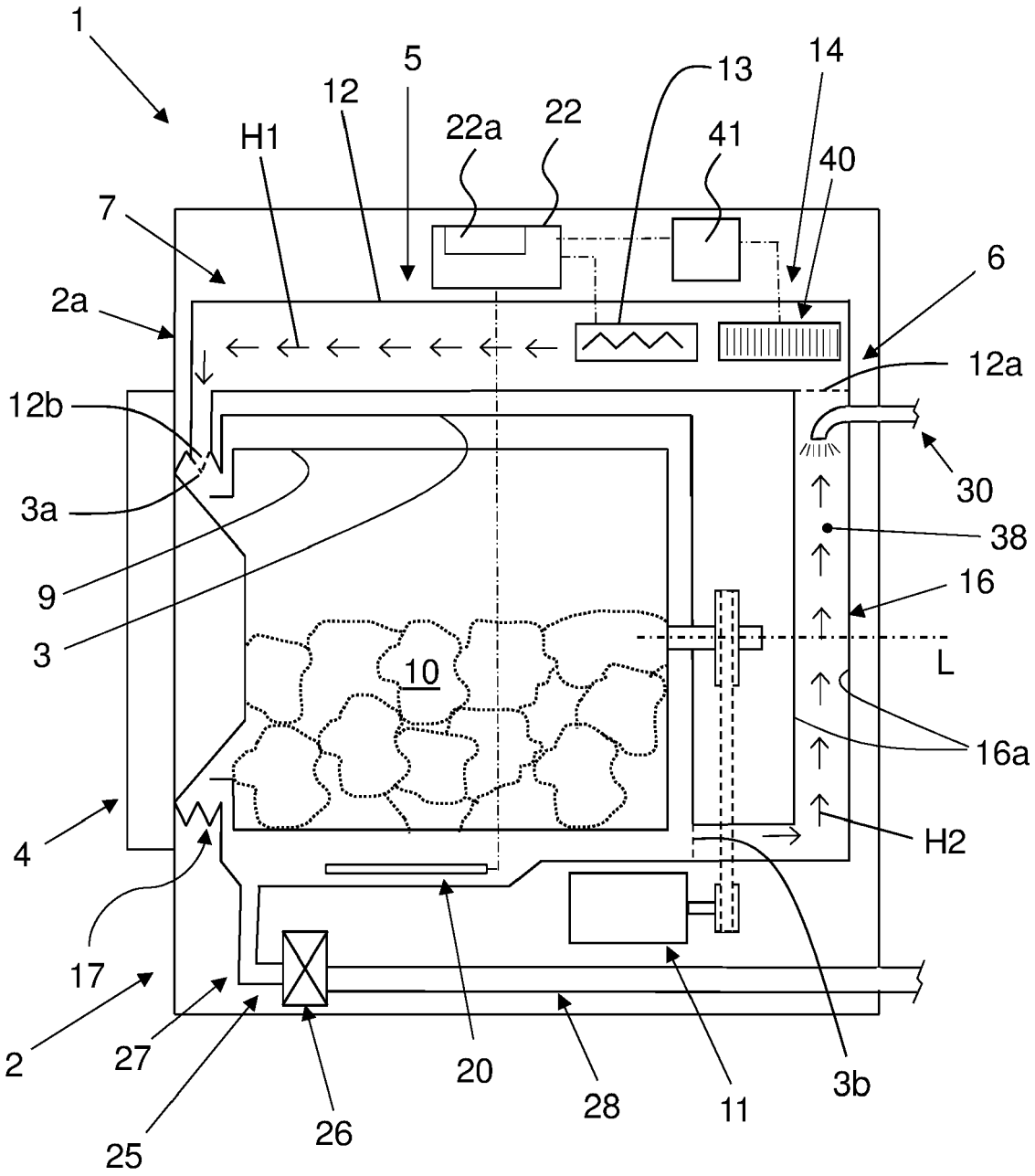
1
5
12
H1
22a
22
13
14
41
40
7
6
2a
12a
12b
30
3a
38
9
16
3
10
L
16a
4
H2
17
2
27
20
28
11
3b
25
26

FIG. 3

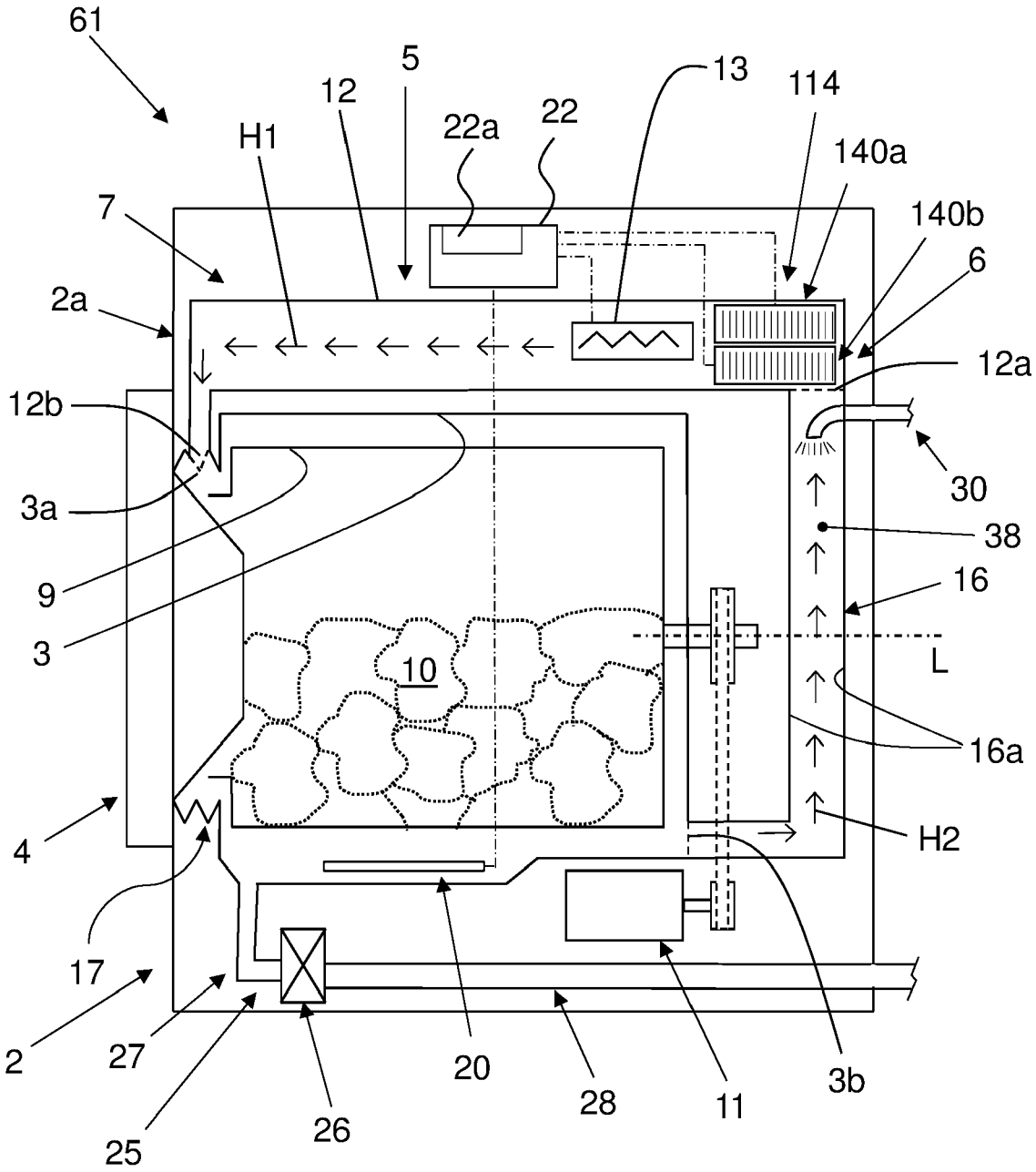
61
5
12
13
114
H1
22a
22
140a
7
140b
6
2a
12a
12b
30
3a
38
9
16
3
10
L
16a
4
H2
17
2
27
20
28
11
3b
25
26

FIG. 4

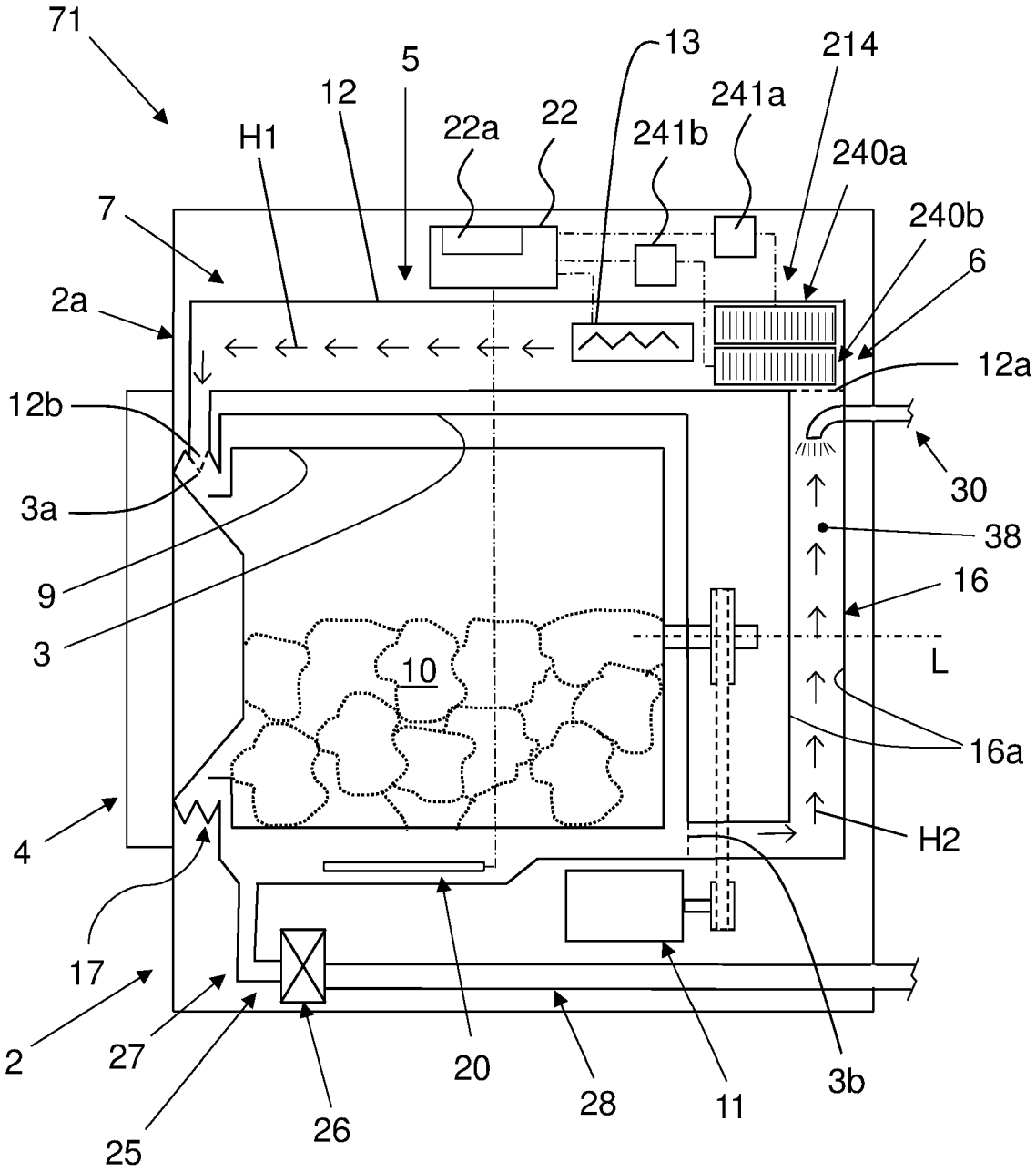
71
5
12
13
214
H1
22a
22
241a
241b
240a
7
240b
6
2a
12a
12b
30
3a
38
9
16
3
10
L
16a
4
H2
17
2
27
20
28
11
3b
25
26

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 12 15 7424

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D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 September 2012	Prosig, Christina

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