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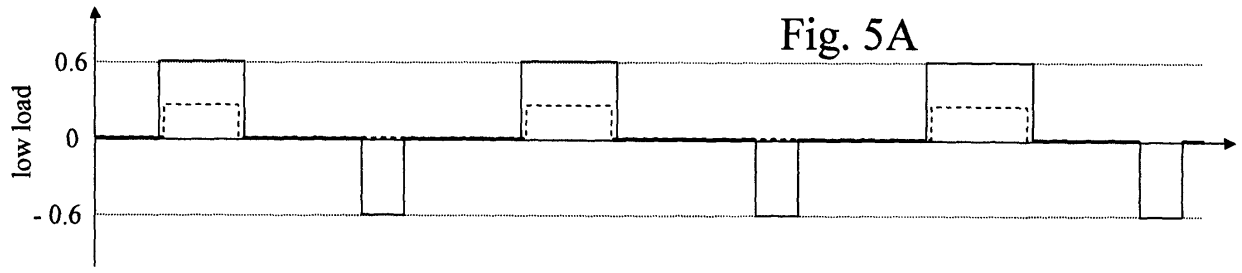
## (54) Textile treatment apparatus having rotable drum

(57) The invention relates to a textile treatment apparatus or treatment method, in particular dryer or washing machine having refreshment, anti-crease and/or drying function. The apparatus comprises: a control unit adapted to control at least one treatment program, in particular at least one treatment program comprising at least one drying, refreshment and/or anti-crease program sequence; an input unit for selecting and/or initiating the at least one treatment program by a user; a drum for storing textiles to be treated; and a drive unit for rotating the drum. According to the invention, the control unit is adapted to modify the drum rotation mode in dependency of one or more of the following: the textile type to be treated, the humidity of the textiles, the textile weight, and the duration of the treatment program or treatment program sequence and/or from one program sequence to another program sequence of the at least one treatment program.

Fig. 5A

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## Description

**[0001]** The invention relates to a textile treatment apparatus and method, in which textiles to be treated are stored in a drum and the stored textiles can be treated according to a refreshment sequence, drying sequence and/or anti-crease sequence.

**[0002]** EP 1 852 539 A1 discloses a dryer and a drying method implementing an anti-crease and optionally a long anti-crease sequence after a main drying sequence. In the anti-crease and the long anti-crease sequences hot water steam is supplied into the drum storing the textiles. Supplying steam during the anti-crease sequences preserves the quality of the textiles achieved after executing the main drying sequence. Maintaining or preserving the textile quality means that during the storing (anti-crease) or extended storing (long anti-crease) no additional wrinkles are formed in the stored textiles.

**[0003]** It is an object of the invention to further optimize the result of a drying sequence, refreshment sequence and/or anti-crease sequence for the treated textiles.

**[0004]** The invention is defined in claims 1 and 24, respectively.

**[0005]** Particular embodiments are set out in the dependent claims.

**[0006]** Figs. 1A to 1C illustrate the starting insight of the inventors, when treating textiles in a rotating drum in a dry mode (without applying liquid) in a treatment apparatus like a washing machine having dryer function or a dryer. The rotation axis of the drum 2 is non-vertical, i.e. horizontally, substantially horizontally or within an angle of $\pm$ 45° from the horizontal. Several pieces of laundry 6 are stored in the inner space 4 of the drum 2 and the surfaces of the laundry 6 exposed to the ambient air of the inner space 4 are in exchange with the inner atmosphere in respect of humidity and temperature. The higher the ratio of exposed laundry surfaces to hidden or covered laundry surfaces, the higher the exchange of humidity and temperature between the ambient and the textile surface/volume. Fig. 1A shows the example where the drum 2 rotates with a high rotation speed. At this rotation speed the satellization of the laundry 6 is achieved, i.e. the laundry 6 adheres to the inner surface of the drum and does not fall down under gravity, even in the upper turning point of the drum.

**[0007]** Fig. 1B shows the situation at a medium rotation speed of the drum. During the upward movement of the laundry from the lowest point in the drum, the laundry steadily releases from the inner wall, and the centrifugal force is so low before reaching the upper turning point of the drum that the laundry falls down in a free fall within and nearly midway through the inner space 4. As indicated by the inner arrows, the surface exposed to the ambient air in the inner space 4 is maximized in Fig. 1B due to the minimized contact area to the inside of the drum and the minimized contact area between the laundry surfaces among each other.

**[0008]** Fig. 1C shows the situation when the drum rotation speed is further reduced. In this case the centrifugal force is low and the laundry releases at an early angle starting from the lowest point of the drum such that the laundry 'rolls' down the ascending portion of the inner drum wall. The laundry is wound up to a roll and exposes a small surface area to the ambient air, as the laundry surfaces contact each other widely.

**[0009]** It was further found that the idealized state depicted in Fig. 1B is not always at the same rotation speed, even if a drum 2 of the same diameter and inner surface is used:

a) Using an identical laundry load (textile type and weight) the damp laundry behaves as shown in Fig. 1B at a specific speed. If this specific speed is maintained, but the laundry is wet, it behaves as shown in Fig. 1C. When, on the other hand, the laundry is dry, it behaves as shown in Fig. 1A.

b) When considering the identical textile type at a fixed humidity, medium load or volume textile at a specific rotation speed will result in the tumbling mode shown in Fig. 1B. When more laundry is loaded into the drum 6 (same textile type and humidity) one achieves the mode shown in Fig. 1A. When, as compared to Fig. 1B, the laundry load is reduced, one achieves the rolling mode as shown in Fig. 1C.

c) When, as a third example, different types of textiles are used while maintaining the weight and the humidity of the laundry, wool will behave in the mode shown in Fig. 1B, while jeans-type textiles will roll on the inner wall as shown in Fig. 1C. Finally, toweling will adhere to the inner wall of the drum as shown in Fig. 1A.

**[0010]** The textile treatment apparatus according to claim 1 comprises a control unit that is adapted to control at least one treatment program sequence. Preferably the control unit has access to a plurality of different treatment program sequences according to the selection of a user and/or activated in dependency of a user selected program option and/or an automatically detected starting condition. The treatment program sequence may be a drying program sequence, a refreshment program sequence (e.g. dry cleaning) or an anti-crease program sequence. The treatment program sequence may be either one of these sequences or a combination of these sequences. A full combination of treatment program sequences is for example first to perform a drying sequence, then to perform a refreshment sequence, and finally to perform an anti-crease sequence. Optionally, a long anti-crease program sequence may be appended as known from EP 1 852 539 A1.

**[0011]** The textiles (laundry/garment) to be treated are stored in a drum of the textile treatment apparatus, wherein preferably the drum rotation axis is horizontal, approximately horizontal or within an angle of inclination relative to the horizontal within ± 45°. The drum is driven by a drive unit. By the drive unit the drum can be rotated in a forward direction, more preferably it can also be rotated in an inverse direction. The start and stop of rotation is controlled by the control unit in that it provides corresponding control signals for rotation/stop to the drive unit. Thereby the control unit controls the start time and stop time of rotation, which means the duration of drum rotation periods and drum halt periods. In the preferred embodiment the control unit also controls the direction of rotation (forward/inverse). Preferably the drive periods in forward/inverse direction are independently controllable.

**[0012]** The control unit of the textile treatment apparatus is adapted to modify the drum rotation mode in dependency of the textile type, the humidity of the textiles, or the textile weight. Or the modification is made in dependency of two or all of these textile parameters. The drum rotation mode is sometimes called the mechanics, i.e. the (physical) mechanical action onto the textiles by the drum rotation. The mechanics is influenced by the rotation speed (of course it is assumed that the drum as such can not be modified), the ratio of drum rotation periods versus drum stop periods, and the ratio of forward drum rotation period to inverse rotation period.

**[0013]** As mentioned above and when the drum is rotating, the drum rotation speed is optimized in dependency of the textile type, the humidity and/or the textile weight, preferably to achieve the ideal tumbling mode as shown in Fig. 1B. In Fig. 1B the mechanical work of the textiles can not be avoided (the laundry 6 adheres to the inner wall of the drum and drops onto the inner wall at the lower point of the drum after the free fall), but the surface interaction with the ambient air is maximized. In contrast thereto the mechanical stress onto the textile is high in the roll mode shown in Fig. 1C. In the mode of Fig. 1A the satellization speed is exceeded, so that there is no mechanical work onto the laundry, however, the increased centrifugal force, in particular at the lower turning point of the drum 2, results in the forming of compression wrinkles. In addition to the optimization of the rotation speed, the mechanical work onto the laundry can be reduced by not rotating the drum (drum stop periods). However, in this case, the wrinkle formation is enhanced. Also, it is necessary to rearrange the textiles in the drum such that an even interaction between laundry surface and surrounding atmosphere can be achieved for an even treatment of the stored textiles.

**[0014]** According to a preferred embodiment, the textile treatment apparatus comprises a supply unit for supplying an additive to the drum. Preferably the additive is supplied directly into the drum for maximum efficiency in the interaction of the textile and the supplied additive. Preferably the modification of the drum rotation mode is made at least during the steam supply sequence, preferably only in the additive supply sequence, or more preferably only during the additive supply phase. The additive supply sequence may be the complete treatment program sequence, preferably it is only the refreshment and/or anti-crease program sequence, more preferably it is only a portion thereof. An additive supply phase is a phase, during which the additive is effectively supplied to the drum. For example, the additive supply sequence can include one or more periods or phases - which do not completely cover the sequence - during which the additive is supplied to the drum.

**[0015]** The type of textiles to be treated is detected automatically by a textile type detection unit of the treatment apparatus, and/or preferably the textile type is input by a user when or before starting the treatment program sequence. Preferably the drum rotation speed and/or the ratio of drum rotation periods to drum stop periods is increased for non-sensitive or resistant textiles like jeans or certain type of synthetics. In this way the interaction between textile surface and ambient atmosphere is higher (maximized) over the normal drum rotation mode. 'Higher' refers here to the nominal or normal rotation speed and/or ratio of drum rotation/drum halt (duty ratio) which is set for 'normal' textiles. Normal textiles are for example: T-shirts, sweatshirts or casual shirts. Additionally or alternatively the drum rotation speed and/or the ratio of drum rotation periods to drum stop periods is decreased or lowered in case of delicate textiles, as for example wool, business or silk textiles. In this way the mechanical action onto the delicate textiles is significantly reduced.

**[0016]** According to an embodiment, the treatment apparatus comprises a weight detection unit for detecting the weight of the textiles stored in the drum and/or an input element, so that the user can input an estimate of the textile weight or volume (the latter as a measure for the textile weight). In an embodiment the humidity detection value can be used to calculate an average dry weight of the laundry based on the type of textile detected or input under consideration of the weight or volume input by the user.

**[0017]** In a preferred embodiment the activation or start of specific treatment sequences is prevented, when a predefined weight or volume value is exceeded. For example, a refreshment and/or anti-crease sequence are/is not started and preferably the non-execution is indicated to a user. This inhibition is done as a good quality of refreshment and/or anti-crease treatment can only be achieved, when the drum is not fully loaded or the laundry is not too heavy.

**[0018]** In a preferred embodiment the drum rotation speed and/or the ratio of drum rotation period to drum stop period is increased (decreased) at higher (lower) textile weight or amount. If there are more or more voluminous textiles within the drum, the textiles have to be agitated and redistributed more intense or more often to achieve an even treatment of the stored textiles.

**[0019]** In a preferred embodiment, similarly to the above mentioned embodiments, the drum rotation speed and/or ratio of drum rotation period to drum stop periods is adapted in dependency of the textile humidity value, wherein the

higher speed and/or higher ratio is set at higher humidity values, while they are reduced at lower humidity values. Preferably the drum rotation speed and/or ratio is updated from time to time, permanently or at specific times during the treatment sequence to adjust to the changing textile humidity. When for example a drying sequence is performed and the drying is in progress, the weight of the laundry and thus the agitation mode (adherent/tumbling/rolling - compare Figs. 1A-1C) is changing over time. An optimum laundry quality can be achieved in that the mechanical action onto the laundry is reduced with decreasing humidity.

**[0020]** Preferably specific program sequences are only activated, after a predefined start humidity of the textile humidity is given or has been achieved in a prior drying program sequence. If the detected textile humidity is too high, preferably a drying program sequence is activated automatically by the control unit.

**[0021]** In a further embodiment, if it is detected that the start humidity is at or above a predefined textile humidity value, the control unit does not actuate a specific textile treatment sequence, for example the refreshment program sequence. In this case the control unit assumes that the textiles (laundry) have been washed prior to starting the treatment program and that a textile refreshment is not necessary, as the textiles have already been cleaned (dry cleaning is not necessary after wet cleaning).

**[0022]** In an embodiment the modification of the drum rotation mode is made in dependency of one or more of the following program parameters: The duration of the treatment program (lapsed program time); The duration of the treatment program sequence (lapsed program sequence time); Or it is modified when a transition is made from one program sequence to another program sequence of the at least one treatment program (e.g. the mechanic mode may be unchanged in each of the treatment program sequences, but it may change from program sequence to program sequence). Preferably the modification(s) comprise(s) one or more of the following modifications: The rotation duty ratio (ratio of drum rotation time/drum stop time - e.g. seen from period to period, seen in the average over time, seen from sequence to sequence, the lapsed time or the like); The ratio of forward/inverse rotation direction (e.g. seen from period to period, seen in the average over time, seen from sequence to sequence, the lapsed time or the like); The rotation maximum and/or average speed; and The rotation cycle periodicity (e.g. from period to period or over the program (sequence) time). The modification over time (at least over a portion of the program or sequence time) can be made steadily or monotone increasingly/decreasingly, or in form of modification steps or variation cycles.

**[0023]** The explanations given above apply for the textile treatment apparatus as well as for the textile treatment method, wherein in the textile treatment apparatus the method steps are implemented by executing the treatment program by the control unit. I.e. control steps implemented by the control unit of the apparatus can be taken as representing method steps and vice versa.

**[0024]** Throughout the specification "treatment program" is a complete program executed in the treatment apparatus or provided by the method - from the start (e.g. started by the user or under a timer control) to the end (no further program steps and laundry treatment is finished). The treatment program may be partitioned into treatment program sequences or may comprise only one program treatment sequence. Program treatment sequences are for example: Pre-treatment, drying, refreshment, anti-crease, long-anti-crease or similar program sequences. Each or at least some of the treatment program sequences have program phases or periods that may be different phases or periods or periodically repeating phases or periods. The refreshment program sequence has for example periods or phases of steam supply and phases or periods without steam being supplied.

**[0025]** Reference is made in detail to preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings and tables, which show:

Fig. 1A-1C different movement modes of the laundry at high rotation speed (satellization speed, Fig. 1A), optimum rotation speed for tumbling mode (Fig. 1B) and at low rotation speed with roll movement (Fig. 1C);

Fig. 2 a block diagram of the functional elements of a refreshment machine;

Fig. 3A-3C three time diagrams for drum movement and steam supply for delicate textiles (Fig. 3A), normal textiles (Fig. 3B) and resistant textiles (Fig. 3C);

Fig. 4 a time diagram for the drum movement and steam supply during drying/anti-crease program sequences;

Fig. 5A-5B time diagrams for the drum movement and steam supply during the refreshment at low load of textiles (Fig. 5A) and at high load (Fig. 5B);

Table 2 a work flow for synthetics refreshment;

Table 3 a work flow for woolen refreshment; and

Table 4 a work flow for business wear refreshment.

**[0026]** Fig. 2 shows a block diagram of the functional elements of a refreshment machine 10. Basically the refreshment machine 10 is based on a dryer having a steam supply unit 24 to supply steam into the interior of the drum 2. It is to be understood that the refreshment machine 10 can also be implemented in a washing machine having a dryer function in respect of temporarily ventilating air through the drum 2. The embodiment shown in Fig. 2 also has the optional special function and arrangement that via a drive unit 14 the drum 2 and a blower 16 for blowing air through the drum 2 can be driven independently of each other. This has the advantage that for example during the steam supply phases (when steam is sprayed or supplied to the interior of the drum 2 from the steam supply unit 24) the air flow through the drum is stopped or significantly reduced. Thereby the steam is kept within the drum's interior space 4 and is not blown out of the drum 2. In alternate embodiments one drive motor is used for the drum, and the blower and the blower and drum are rotated in a rotation direction by the common motor, in which the air blowing capability of the blower is designed inherently or reduced as compared to the forward or normal rotation direction. In still another embodiment a clutch or other decoupling means is provided to decouple the blower rotation from the drum rotation during the steam supply phases.

**[0027]** The preferred refreshment machine 10 has a condenser unit 18 and can be operated like a condenser-type dryer, wherein the air is circulated within the refreshment machine 10 and humidity condensers in an air channel where the condenser element of condenser unit 18 is arranged. Of course, the refreshment machine 10 can also be implemented as an exhaust air type dryer, in which the humidity loaded air is exhausted out of the refreshment machine's body. Mixed types of condenser-type and exhaust-type refreshment machine can also be implemented.

**[0028]** The execution of drying program sequences, refreshment sequences, anti-crease sequences and long anti-crease sequences are controlled by a control unit 12 that receives detection signals and transmits control signals to subunits of the refreshment machine 10. A humidity sensor 20 is arranged at the drum 2 and detects the laundry humidity by conductivity measurements on the laundry 6. This has the advantage that the humidity can be detected with the drum turbine at rest or when no air is flow through the drum 2. The signal of the humidity sensor 20 is sent to the control unit 12 for processing at the beginning and during the execution of program sequences that use the humidity value as an input signal.

**[0029]** The steam supply unit 24 is also controlled by the control unit 12, wherein one or more heaters for transforming water into steam by heating are activated and deactivated. Also a water level signal of a water tank associated to the steam supply unit 24 sends a signal to the control unit 12 such that heating can be stopped, if the water level is below a predefined value. A water pump unit 22 is also controlled by the control unit 12, wherein the water pump unit 22 is arranged at the condenser unit 18 to collect the condensed water. The control unit 12 actuates the pump for pumping the condensed water from the collection reservoir of the water pump unit into the water reservoir of the steam supply unit 24, when a predefined water level in the tank of the water pump unit has been reached or after a program sequence (for example a drying program sequence) has been finished.

**[0030]** An additional additive supply unit 26 is provided that - in addition to the steam from the steam supply unit 24 - provides a treatment agent into the drum 2, preferably by a separate supply line and spray nozzle such that the treatment agent does not come into contact with the hot steam provided by the steam supply unit 24. One or more treatment agents may be provided by the additive supply unit 26, for example a fragrance, a dry cleaning agent, a disinfectant, a bleach or the like.

**[0031]** A display 28 arranged at the front panel of the refreshment machine 10 indicates the current program status and the selected (automatically selected by the control unit or selected by the user) options to the user. At the input panel 30 the user inputs the selected program for treating the laundry loaded into the drum and options which may be activated or deactivated according to the user's preferences. As potential refreshment programs the user can for example activate programs like wool dry refreshment (without steam), silk dry refreshment (without steam), normal steam refreshment (with steam), wool steam refreshment, delicate steam refreshment or casual steam refreshment. These program selections include a type of treatment to be performed by the refreshment machine 10 as well as a type of textile or glass of textile to be treated. For example, the casual steam refreshment is adapted for the textile types sweatshirt, resistant shirts, casual shirts, and so on. The normal steam refreshment is optimized for laundry, in which creases or wrinkles have to be removed, and which is insensitive to higher mechanical work during the treatment process. The cotton steam refresh is for example for jeans and involves a maximum of mechanical work onto the laundry. The business refreshment or reduced steam refreshment is designed for delicate laundry like wool jackets or sack coats.

**[0032]** Optional program selections that can be made by the user via the input panel 30 are for example an activation or deactivation of a long anti-crease program sequence that can be appended to an anti-crease program sequence in connection with particular ones of the treatment program sequences. Also the user can optionally activate a pre-drying, if for example hand-wash garment or laundry or damp laundry is stored in the drum 2.

**[0033]** The control unit 12 further controls an air heater 32 arranged in an air channel upstream to the drum 2 for heating the air blown into the drum 2. Air heating is for example required for a drying program sequence or when the laundry stored in the drum 2 has to be heated to a predefined temperature before the steam is introduced into the drum

during steam supply periods. The temperature of the air blown out of the drum 2 is detected by a temperature sensor 34, the signal of which is sent to the control unit 12. Optionally a weight sensor 36 is provided which is in this case associated with the drive unit and detects the power required to start drum rotation. From the power required by the motor to drive the drum 2 it can be deduced how high the torque caused by the stored laundry is, which itself depends on the laundry weight. The weight sensor 36 is optionally, and instead the input panel 30 can provide a selection for the laundry weight or volume of the laundry. For example, the user inputs one of the selections minimum, medium or maximum for selecting a low, medium or high load amount of laundry.

**[0034]** Fig. 3A to 3C show different mechanical modes of drum movement in dependency of the textile type, wherein Fig. 3A shows the drum movement over time for delicate textile, Fig. 3B for textiles of normal sensitivity, and Fig. 3C for resistant textiles. The drum movements are shown by the continuous lines, respectively, and in those embodiments forward rotation (positive numbers) and inverse rotations (negative numbers) of the drum are executed. In the diagrams the abscissa shows the time and the ordinate shows the relative rotation speed and the relative steam flow rate shown by the dashed line. The relative of normalized rotation speed is related to a nominal or normal rotation speed which is normally used during the drying mode for drying the textiles. For example, the nominal rotation speed is 50 rpm, so that the point 75 in Fig. 3A represents a maximum rotation speed of about 37 rpm, and the point 5 in Fig. 3C represents a rotation speed of 75 rpm. By comparing the Figures 3A-3C it can be seen that the drum rotation maximum speed is reduced over the normal maximum speed for delicate textiles, while it is increased for resistant textiles over the mode selected for normal textiles. Further, the on/off duty time or ratio, i.e. the ratio of drum rotation periods to the drum stop periods, is increasing, starting from delicate articles over normal textiles to resistant textiles. As a consequence, the mechanical work onto delicate textiles is reduced by selecting a reduced rotation speed and a reduced rotation duty cycle, while for resistant textile the mechanical work is increased by increasing the rotation speed and the rotation duty cycle. In Fig. 3A the on/off rotation duty cycle is exemplified for a first full period, wherein for the on-time the intervals ONla and ON1b have to be added and to be divided by the off-time which is the sum of the OFF1a and OFF1b periods. It is to be noted that the embodiment illustrated by Figs. 3A to 3C is optimized in minimizing the mechanical work the laundry undergoes in dependency of its sensitivity/insensitivity. An optimization in regard of maximum surface exchange with the surrounding ambient as discussed for Figs. 1A to 1C is not considered here in any case. However, such an optimization can be provided for the modes shown in Figs. 3A to 3C at the same time, if for example the load or volume of the textiles loaded into the drum is prescribed or recommended to the user when loading the drum of the refreshment machine. For example, it is recommended to the user to use only a low volume of delicate textiles or a low textile load when using delicate textiles in the treatment sequence shown in Fig. 3A. On the other hand, the user is user is recommended to load more textiles (higher volume or higher weight) into the drum, when resistant textiles are treated by the treatment sequence shown in Fig. 3C.

**[0035]** The Figs. 3A to 3C also show the steam flow rate normalized to the steam flow rate used for treating normal textiles as shown in Fig. 3B. This means that for delicate textiles the steam flow rate is reduced, but the duty cycle for steam supply is higher as compared to the treatment sequence for normal textiles (Fig. 3B). In the treatment sequence for resistant textiles (Fig. 3C) the steam duty cycle is increased again starting from normal textile treatment and also the steam flow rate is increased. This means that the average steam flow rate is higher for resistant textiles than for normal and delicate textiles and the steam treatment intensity is the highest. Therefore, the total steam treatment time (not shown) for resistant textiles can be shorter than for normal or delicate textiles.

**[0036]** Fig. 4 shows a portion of a treatment program sequence depicting in an illustrative manner, a drying program sequence followed by an anti-crease program sequence. The drum rotation speed and the steam flow rate are normalized as in Fig. 3A to 3C. Here wet laundry taken from a washing machine and laden in the drum of the refreshment machine 10 is first dried. As a wet cleaning by the washing machine has been performed, no refreshment treatment or dry cleaning as shown in Fig. 3A or Fig. 5A-5B is required. During the drying phase the laundry's humidity is detected by the humidity sensor 20 and the control unit 12 adapts the drum rotation speed as well as the rotation duty cycle during the drying phase (program sequence). At the beginning of the drying phase the mechanical work onto the laundry is higher to improve the drying process. With the laundry humidity decreasing, it is not necessary to use high rotation speeds and high rotation duty cycles for a maximum drying process so that both the maximum rotation speed and the rotation duty cycle are continuously decreased with the decreasing average humidity under the control of the control unit 12. The drying program sequence is finished, when a predetermined value of the average laundry humidity is detected and the control unit switches from the drying program sequence to the anti-crease program sequence.

**[0037]** During the anti-crease program sequence the maximum rotation speed and the rotation duty cycle are fixed and both depend on the type of textiles as has been inputted by the user via input panel 30. During the anti-crease program sequence steam is supplied into the drum 2 which improves the maintenance of the drying result as regards the number of wrinkles or creases in the laundry stored in the drum. The inventors have also observed that by application of the anti-crease program sequence the result in regard of wrinkles from the drying program sequence can even be improved by reducing the number or extent of wrinkles. The average humidity of the laundry varies during the anti-crease program sequence, wherein the humidity rises during the steam supply periods, while it is decreasing between the steam

supply periods. Between the steam supply periods a weak ventilation through the drum 2 is provided by the driving the blower 16 at low speed.

**[0038]** Fig. 5A and 5B show an optimization of drum rotation speed, rotation duty cycle and steam supply in dependency of the load of the laundry stored in the drum 2. Rotation speed and steam flow rate are normalized as described in connection with Fig. 3. If the textile weight or volume is low (low load), the maximum rotation speed and the rotation duty cycle are reduced as shown in Fig. 5A. At high laundry weight or volume (high load Fig. 5B) a higher maximum rotation speed and rotation duty cycle are selected as compared to an average load (not shown) in which the normalized maximum rotation speed is 1, the duty cycle is between the duty cycles shown in Figs. 5A and 5B and the maximum steam flow rate is also between the flow rates shown in Figs. 5A and 5B. Figs. 5A and 5B represent the preferred embodiment for the steam supply in that the steam supply period lies within the rotation periods of drum rotation. Thereby, saturation of steam in the inner space 4 of drum 2 is avoided which could result in formation of condensation droplets.

**[0039]** Table 1 below shows a matrix of the mechanic mode which is implemented by the control unit 12 in dependency of the type of textiles for which some examples are given in the second column of Table 1. All mechanic modes listed relate to refreshment program sequences during which steam is supplied periodically into the drum 2 - compare for example Figs. 3A-3C, Figs. 5A and 5B. However, the mechanic mode as such (i.e. the Drum Movement Control) can also be implemented in other program sequences that do not use steam - see for example Tables 2 to 4.

**Table 1: Duty Cycles of Drum Movement for different Textile Types**

| Mechanic Mode (Drum Movement) | Type of Textiles (Examples) | Drum Movement Control (rel. Duration) | | | |
|---|---|---|---|---|---|
| | | Forward | Pause | Inverse | Pause |
| Normal-Steam (Cotton) | Iron Aid Optimized Cotton Shirt, Jeans, Synthetics | extra long | extra short | extra long | extra short |
| Wool-Steam | Woolen Pullover | normal | extra long | short | extra long |
| Delicate-Steam (Reduced or Business Refresh) | Woolen Jacket, Sack Coat, Cashmere Wool, Silk | short | normal | short | normal |
| Casual-Steam | Sweatshirt, Casual Shirt | long | short | long | short |

**[0040]** In column "Drum Movement Control (rel. duration)" of table 1, the duration periods for one full drum movement cycle is indicated in relative durations. A "full drum movement cycle (or period)" is for example indicated in Fig. 3A by the references ON1a, OFF1a, ONlb and OFF1b. The Column "Forward" indicates the duration of forward drum rotation direction (compare ON1a) which is for example "extra long" in the "Normal-Steam" mechanic mode. Under reference to the mechanic mode "Normal-Steam" the "Pause" or duration between the forward duration period portion and the inverse rotation period portion is "extra short" (corresponding to OFFla in Fig. 3A). In the "Normal-Steam" mechanic mode the duration of rotating in the inverse rotation direction "Inverse" (compare ON1b) is also "extra long" and a "extra short" "Pause" (rotation stop) follows (compare OFF1b). This means that the mechanical work onto the laundry is maximized which can be used for maximum steam supply during steam supply phases and for maximum textile drying efficiency in drying phases.

**[0041]** As can be concluded from Table 1, in dependency of the mechanic mode the duty cycle of rotation is extremely dependent on the mechanic mode selected. For the "Normal-Steam" mechanic mode the rotation duty ratio is very high (extra long/extra short gives for example a ratio of 15), while for the "Wool-Steam" mechanic mode the rotation duty ratio is low (normal/extra long is for example a ratio of 0.5 or less). Further, in the "Wool-Steam" mechanic mode the inverse rotation period ("short") is shorter than the forward rotation period ("normal").

**[0042]** As mentioned above, the "Normal-Steam" mechanic mode is iron aid optimized, wherein the mechanical work onto the textiles is high, however, the long periods of steam supply result in an improved removal of wrinkles and creases in the textiles treated.

**[0043]** Table 2 shows a full treatment program for the program selection synthetics steam treatment including an optional drying/anti-crease program sequence (steps 2-5), a mandatory anti-crease program sequence (steps 6-9) and a succeeding anti-crease program sequence (steps 10-11). The latter one is adapted to maintain the wrinkles state of the laundry (Knitterbild) resulting from the preceding ant-crease phase(s). Normally this program is used to remove wrinkles from previously washed (fresh or unused) laundry.

**[0044]** In step 1 a wet/dry detection is performed, in which the control unit 12 detects via the humidity sensor 20 whether the textiles laden into the drum 2 are wet or already dry. During the wet/dry detection the ventilation through the drum "Ventilation" is at normal airflow rate or nominal flow rate (ON Normal). The drum movement (Mechanic Mode) is set to "Normal Steam" as defined in Table 1, wherein here the rotation speed is set to nominal or normal drum rotation

speed. The "Steam Supply" is switched OFF as indicated in the last column of table 2.

**[0045]** In step 1 a flow jump decision is made, wherein, if the laundry humidity is above a predefined value, a drying program sequence (step 2) and a pretreatment anti-crease program sequence ("Anti-Crease 1" - steps 3 to 5) is started to remove wrinkles mainly due to start with wet laundry. If the laundry in the drum is already dry (e.g. the laundry was dried after washing), the workflow jumps from step 1 to step 6 to start the main treatment program sequence ("Anti-Crease 2" - steps 6 to 8) to remove wrinkles.

**[0046]** During the drying sequence (step 2) the textiles are dried to a predefined humidity range of residual humidity (damp or cupboard dry), while the ventilation "ON High" through the drum 2 (i.e. the blower 16 rotation speed) is higher than the nominal ventilation flow rate.

**[0047]** In steps 3 to 5 the anti-crease program sequence 1 is executed as a pretreatment to remove starting wrinkles of the dried laundry as compared to dry laundry that is loaded into the drum for anti-crease processing only. This means that the laundry loaded in a wet state into the drum and which is running through the drying program sequence 2 undergoes an anti-wrinkle "boost". The anti-crease program sequence includes two steam phases in steps 3 and 5 during which the control unit switches the ventilation off by or sets the ventilation to a reduced flow rate. During the steam supply periods (indicated by "ON" in the last column) a total amount of water is supplied as steam into the drum 2 in dependency of the laundry weight/volume. For table 2 "Min" means a supply of a low water amount (in form of steam), "Med" of medium water amount, and "Max" of maximum water amount.

**[0048]** Generally in the treatment procedures, the steam generator 24 is heated by its internal heater for water evaporation and the laundry is heated by air heater 32 (e.g. arranged in a duct for blowing air into drum 2 by blower 16. After the drying program sequence (step 2) heating of the laundry is normally not necessary, however, when step 6 starts with cold laundry, a preceding warming-up of the laundry may be necessary to achieve an optimized steam treatment result.

**[0049]** Between the steam treatment phases (between steps 3/5, 6/8) the drying and penetration phase is switched (steps 4, 7). During these phases on the one hand the excess humidity is removed by ventilation and on the other hand the humidity may homogenously penetrate the laundry to equilibrate the humidity between the laundry surface and the laundry core (the inner volume of the textiles).

**[0050]** In the column "Mechanic Mode" table 2 has the indication "Normal-Steam" which corresponds to the mechanic mode "Normal-Steam" as shown in table 1. This means that the drum movement is implemented as indicated in table 1, wherein the steam supply is only provided during the steps 3, 5, 6, and 8 as indicated in table 2.

**[0051]** In the intermediate program sequence (step 9) the laundry is cooled by ventilation using a high air flow rate through the drum and the condenser unit 18 may be operated in case of circulation air drying. This enables removal of the laundry by the user after the intermediate sequence and before executing the maintaining (or preservation) anti-crease phase, such that the user does not come in contact with hot laundry. Also in step 9 the condensed water from the reservoir of the condenser unit 18 is pumped to the reservoir of the steam supply unit 24.

**[0052]** Steps 10 and 11 represent the preservation anti-crease program sequence during which mainly the formation of new wrinkles is prevented or even the wrinkle removal result achieved during the main treatment program sequences 1 and 2 (steps 3 to 8) is improved. Steps 10 and 11 may be repeated several times - three times in this.example. In step 11 the laundry is dried down to the cupboard humidity'or, if optionally selected by the user, the residual humidity is kept at damp level which helps the user ironing the laundry after removal from the refreshment machine 10.

**[0053]** Table 3 shows a workflow for a treatment program "Wool Refreshment" in which the starting condition of the wool textiles is dry and in which normally no anti-crease program sequence is following the refreshment program sequence. Step 1 serves for slackening the stored textiles (woolen textiles) and steps 2 to 4 represent the main treatment program sequence, namely the refreshment program sequence. Under reference to tables 1 and 2 the individual elements in the array of table 3 are self-explaining, wherein the column "Mechanic Mode" indicates that the drum is moved according to the mechanic mode "Wool Steam" from table 1. If necessary, the laundry can be heated up during step 1, when the optimization of the steam treatment result (for step 2) requires a minimum temperature of the laundry (wool textiles).

**[0054]** Steps 5 and 6 represent an anti-crease preparation program sequence used for preparing the laundry for an optional anti-crease program sequence following after step 6 (not shown), wherein in this case the anti-crease sequence has to be actively started by the user. An anti-crease program sequence can for example be started, when the user has no time to remove and hang up the textiles and so the formation of wrinkles is prevented by activating the anti-crease program sequence comparable to steps 10 and 11 of table 2 adapted to wool treatment. The water amount Min/Med/Max is as in table 2, but amounts relatively adapted for wool treatment (i.e. Min of table 2 does not necessarily mean the same amount of water in table 3).

**[0055]** Table 4 represents a workflow for a treatment program optimized for "business" clothes refreshment in which no drying program sequence is used, but in which an anti-crease program sequence follows (steps 6 and 7) after a refreshment program sequence (steps 2 to 4). With reference to the individual elements described in connection with tables 1 to 3, table 4 is self-explanatory. The particularity of table 4 is indicated in the column "Mechanic Mode" in which

during the refreshment program sequence (steps 2 to 4) the "Delicate Steam" mechanic mode of table 1 is implemented, while during the intermediate phase (step 5) and the anti-crease program sequence (steps 6 and 7) the "Normal-Steam Mechanic Mode" of table 1 is implemented. For the relative water amounts supplied into the drum as steam reference is made to the explanations above for tables 2 and 3.

**Reference Numerals List**

**[0056]**

| | |
|---|---|
| 2 | drum |
| 4 | inner space |
| 6 | laundry |
| 10 | refreshment machine |
| 12 | control unit |
| 14 | drive unit |
| 16 | blower |
| 18 | condenser unit |
| 20 | humidity sensor |
| 22 | .water pump unit |
| 24 | steam supply unit |
| 26 | additive supply unit |
| 28 | display |
| 30 | input panel |
| 32 | air heater |
| 34 | temperature sensor |
| 36 | weight sensor |

**Claims**

**1.** Textile treatment apparatus (10), in particular dryer or washing machine having refreshment, anti-crease and/or drying function, comprising:

a control unit (12) adapted to control at least one treatment program, in particular at least one treatment program comprising at least one drying, refreshment and/or anti-crease program sequence;
an input unit (30) for selecting and/or initiating the at least one treatment program by a user;
a drum (2) for storing textiles (6) to be treated; and
a drive unit (14) for rotating the drum (2);

**characterized in that** the control unit (12) is adapted to modify the drum rotation mode in dependency of one or more of the following:

a) the textile type to be treated,
b) the humidity of the textiles,
c) the textile weight, and
d) the duration of the treatment program or treatment program sequence and/or from one program sequence to another program sequence of the at least one treatment program.

**2.** Apparatus according to claim 1, wherein the apparatus (10) comprises a supply unit (24, 26) adapted to supply at least one additive to the drum (2), in particular to supply steam.

**3.** Apparatus according to claim 2, wherein the control unit (12) is adapted to control the supply of the at least one additive during a drum rotation period wherein the drum (2) is rotated according to the modified rotation mode, in particular adapted to control the supply of steam in dependency of the modified drum rotation mode.

**4.** Apparatus according to claim 2 or 3, wherein the control unit (12) is adapted to control the supply of the at least one additive during or essentially during the drum rotation movement.

5. Apparatus according to claim 2, 3 or 4, wherein the control unit (12) is adapted to stop or reduce the air flow through the drum during an additive supply phase.

6. Apparatus according to any of the previous claims 2 to 5, wherein the supply unit (24, 26) has at least one nozzle unit arranged to supply the additive directly into the drum (2).

7. Apparatus according to any of the previous claims, wherein the apparatus. (10) comprises a textile type detection unit adapted to detect the textile type and/or wherein the input unit (30) comprises a first input element for manually inputting the textile type.

8. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to set a higher drum rotation speed and/or higher ratio of drum rotation periods /drum stop periods for non-sensitive textiles, in particular for Jeans or bed clothes.

9. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to set a lower drum rotation speed and/or lower ratio of drum rotation periods /drum stop periods for delicate textiles, in particular for woolen, business or silk textiles.

10. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to set a normal drum rotation speed for textiles of average sensitivity, in particular for cotton T-shirts or shirts or casual textiles.

11. Apparatus according to any of the previous claims, wherein the apparatus (10) comprises a weight detection unit (36) adapted to detect the weight of the textiles stored in the drum (2) and/or wherein the input unit (30) comprises a second input element for manually inputting the textile weight or amount.

12. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to prevent or inactivate a refreshment and/or anti-crease sequence, if the textile weight or amount is at or above a predefined weight or volume value.

13. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to indicate to a user of not starting or inactivating the refreshment and/or anti-crease sequence.

14. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to set a higher drum rotation speed and/or higher ratio of drum rotation periods /drum stop periods at higher textile weight or amount.

15. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to set a lower drum rotation speed and/or lower ratio of drum rotation periods /drum stop periods at lower textile weight or amount.

16. Apparatus according to any of the previous claims, wherein the apparatus (10) comprises a humidity detection unit (20) adapted to detect the humidity of the textiles stored in the drum (2) and/or wherein the input unit (30) comprises a third input element for manually inputting the textile start humidity.

17. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to set a lower drum rotation speed and/or lower ratio of drum rotation periods /drum stop periods at lower textile humidity.

18. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to set a higher drum rotation speed and/or higher ratio of drum rotation periods /drum stop periods at higher textile humidity.

19. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to increase the ratio of rotation periods / stop periods of the drum rotation.

20. Apparatus according to any of the previous claims, wherein the modification is made over time with the textile humidity changing over time.

21. Apparatus according to any of the previous claims, wherein the control unit (12) is adapted to activate a refreshment and/or anti-crease sequence only if a start humidity of the textiles is at or below a predefined first humidity value.

22. Apparatus according to any of the previous claims, wherein the control unit (12) activates a drying sequence before

activating the refreshment and/or anti-crease sequence, if the a start humidity of the textiles is at or above predefined second humidity value.

**23.** Apparatus according to claim 22, wherein the drying sequence is executed until the textile humidity drops to or below a predefined third humidity value.

**24.** Method of treating textiles in a textile treatment apparatus (10), in particular in a dryer or a washing machine having refreshment, anti-crease and/or drying function, comprising:

selecting by a user and/or automatically selecting by the treatment apparatus (10) one of a plurality of treatment programs, the treatment program including at least one treatment program sequence, in particular at least one drying, refreshment and/or anti-crease program sequence;
starting the selected treatment program;
at least temporarily agitating textiles (6) stored in a drum (2) of the apparatus (10) by rotating the drum;

**characterized in that** the rotation mode of the drum (2) is modified in dependency of one or more of the following:

a) the textile type to be treated,
b) the humidity of the textiles,
c) the textile weight, and
d) the duration of the treatment program or treatment program sequence and/or from one program sequence to another program sequence of the at least one treatment program.

**25.** Method according to claim 24, wherein the modification of the drum rotation mode includes one or more of the following: the maximum and/or average drum rotation speed, the duty ratio of rotation periods/stop periods, the ratio of forward/inverse rotation direction, the duration of rotation periods and the duration of stop periods.

**26.** Method according to claim 24 or 25, wherein at least temporarily at least one additive is supplied into the drum (2), preferably during periods of drum rotation.

**27.** Method according to claim 26, wherein the one or one of the at least one additives is steam.

**28.** Method according to claim 26 or 27, wherein the air flow through the drum (2) is stopped or reduced during at least an additive supply period

**29.** Method or apparatus according any of the previous claims, wherein execution of a refreshment sequence is skipped when the start humidity value of the textiles is at or above a predefined fourth value.

**30.** Method or apparatus according any of the previous claims, wherein increasing (decreasing) the ratio of rotation periods / stop periods of the drum rotation is performed by increasing (decreasing) the rotation periods of the drum and/or by decreasing (increasing) the stop periods of the drum.

**31.** Method or apparatus according any of the previous claims, wherein the ratio of rotation periods / stop periods is reduced (increased) over the normal ratio of rotation periods / stop periods by a factor of at least 1.5, preferably by at least a factor of 2, 3 or 5.

**32.** Method or apparatus according any of the previous claims, wherein in case of drum speed reduction (increase), the drum rotation speed is reduced (increased) over the normal drum rotation speed by a factor of at least 1.3, preferably by at least 1.5, 1.7 or 2.

**33.** Method or apparatus according any of the previous claims, wherein during the course of the running treatment program the ratio of drum rotation periods / stop periods is increased and/or the drum rotation speed is increased, in particular the average or maximum drum rotation speed.

**34.** Method or apparatus according any of the previous claims, wherein in the modified drum rotation mode the ratio of forward rotation period / inverse rotation period is modified.

**35.** Method or apparatus according claim 34, wherein the ratio of forward rotation period / inverse rotation period is

increased or the inverse rotation is not activated in case of delicate textiles, higher textile weight (load volume) and/or higher textile humidity.

**36.** Method or apparatus according claim 34 or 35, wherein the ratio of forward rotation period / inverse rotation period is decreased in case of resistant (non-sensitive) textiles, lower textile weight (load volume) and/or low textile humidity.

**37.** Method or apparatus according any of the previous claims, wherein the treatment program is one or a combination of the following: a refreshment program, an anti-crease program, a drying program, an iron-aid program.

**38.** Method or apparatus according any of the previous claims, wherein at least one of the following additives is supplied to the laundry during the maintaining sequence: pure water, a mixture comprising water, a dry detergent, a disinfectant, an impregnant and/or a softener.

**39.** Method or apparatus according any of the previous claims, wherein water or a mixture comprising more than 90% by weight water, preferably more than 95%, is the only additive supplied to the laundry.

**40.** Method or apparatus according any of the previous claims, wherein the at least one additive is supplied as a fog, as an aerosol or as steam to the laundry, in particular a droplet-free steam.

**41.** Method or apparatus according any of the previous claims, wherein the steam temperature is above 90°C, preferably above 100° or 110°C.

**42.** Method or apparatus according any of the previous claims, wherein the at least one additive is supplied in intervals and/or in a flushing manner to the laundry (6).

**43.** Method or apparatus according any of the previous claims, wherein a modification of the drum rotation mode in dependency of the duration of the treatment program or treatment program sequence and/or from one program sequence to another program sequence of the at least one treatment program comprises modification of one or more of the following:

the rotation duty ratio,
the ratio of forward /inverse rotation direction,
the rotation maximum and/or average speed, and
the rotation cycle periodicity.

Fig. 1A

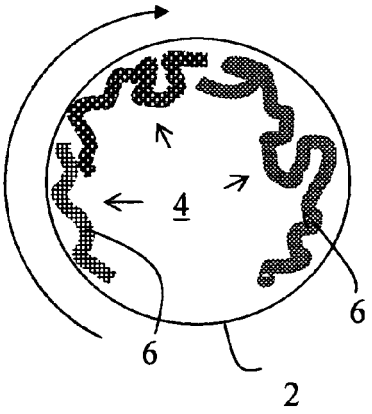


Fig. 1B

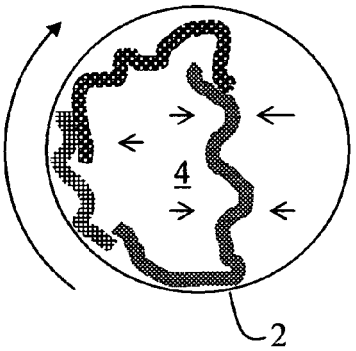


Fig. 1C

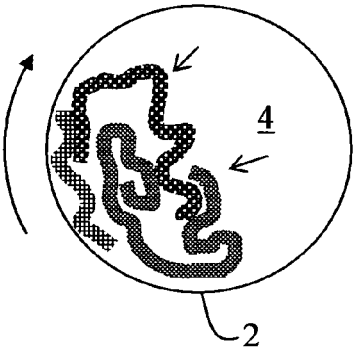


Fig. 2

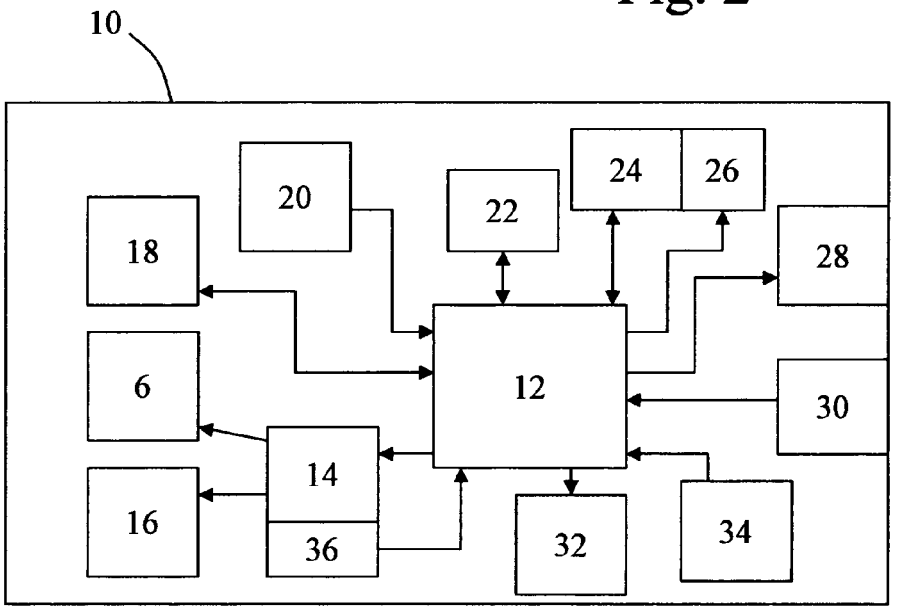

Fig. 3A

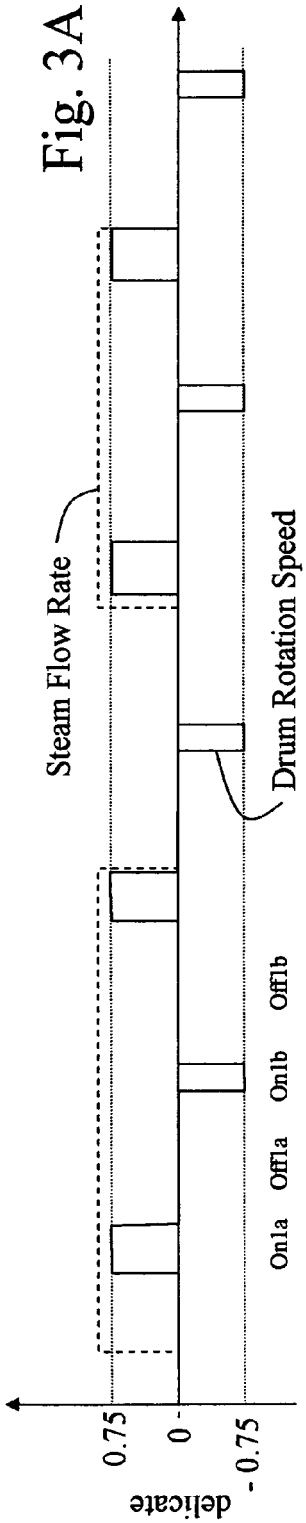


Fig. 3B

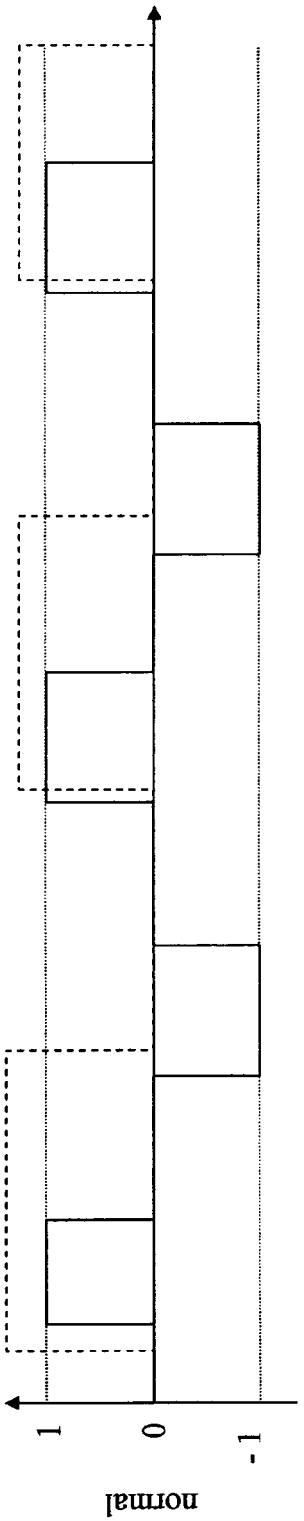


Fig. 3C

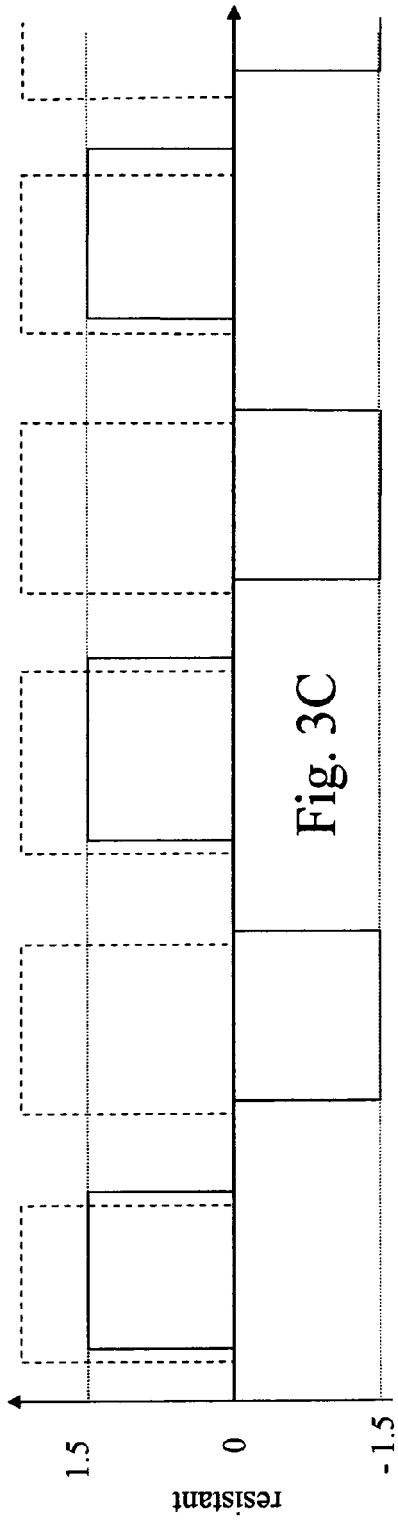

Fig. 4

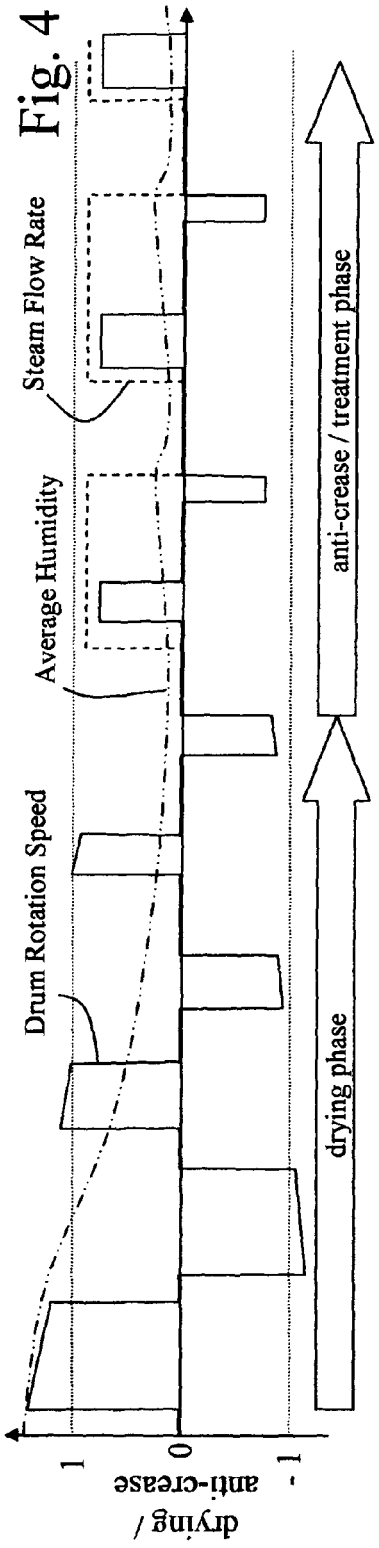


Fig. 5A

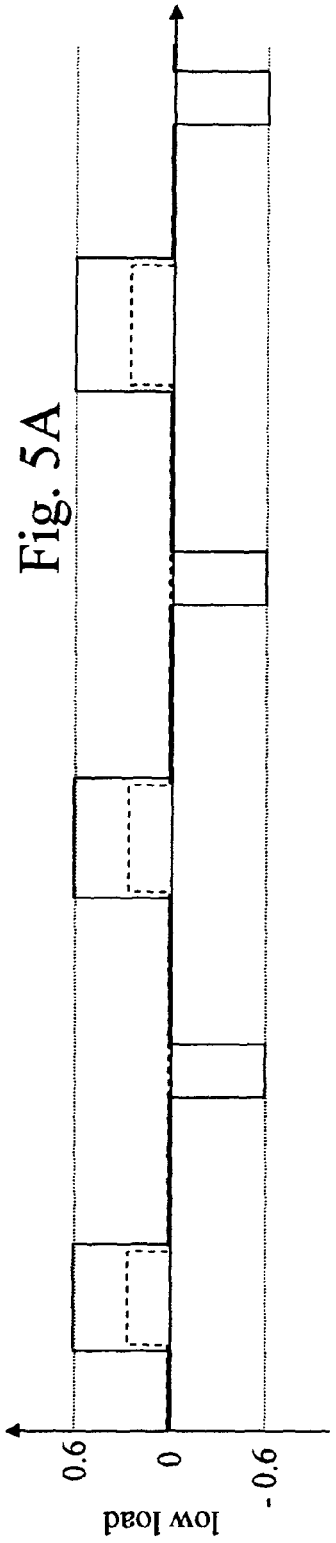


Fig. 5B

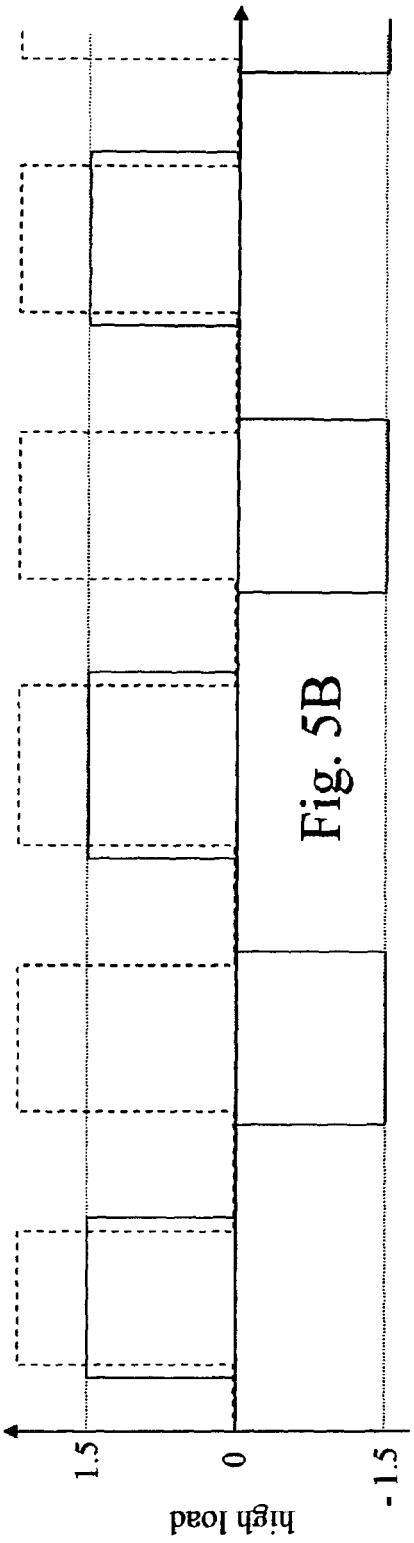

**TABLE 2**

Steam Treatment Synthetics with preceding Drying and succeeding Anti-Crease

| | Step | Phase | Humidity-Detection Target | Ventilation | Mechanic Mode | Steam Supply |
|---|---|---|---|---|---|---|
| | 1 | Wet/Dry Detection | Detection activated | ON Normal | Normal Steam | OFF |
| Drying | 2 | Drying Phase 1 Dependent on Load Min / Med / Max | Damp or Cupboard | ON High | Normal Steam | OFF |
| Main-Treatment: Anti-Crease 1 | 3 | Steam Phase 1 Dependent on Load Min / Med / Max | | OFF (Reduced) | Normal Steam | ON Min / Med / Max |
| | 4 | Drying Phase Intermediate | | ON Reduced | | OFF |
| | 5 | Steam Phase 2 Dependent on Load Min / Med / Max | Damp | OFF (Reduced) | | ON Min / Med / Max |
| Main-Treatment: Anti-Crease 2 | 6 | Steam Phase 1 Dependent on Load Min / Med / Max | | OFF (Reduced) | Normal Steam | ON Min / Med / Max |
| | 7 | Drying Phase Intermediate | | ON Reduced | | OFF |
| | 8 | Steam Phase 2 Dependent on Load Min / Med / Max | Damp | OFF (Reduced) | | ON Min / Med / Max |
| Inter-Medi. | 9 | Cooling Phase / Pumping | | ON High | Normal Steam | OFF |
| Anti-Crease (repeated) | 10 | Steam Phase Anti-Crease | Damp | OFF (Reduced) | Normal Steam | ON Min / Med / Max |
| | 11 | Ventilation / Cooling | Cupboard / Optional: Iron Damp | ON Normal | | OFF |
| | 12 | End | | OFF | OFF | OFF |

**TABLE 3**
Refreshment Wool without Drying and Anti-Crease

| | Step | Phase | Humidity-Detection Target | Ventilation | Mechanic Mode | Steam Supply |
|---|---|---|---|---|---|---|
| | 1 | Ventilation (Laundry Heating) | | ON Normal | Wool Steam | OFF |
| Main-Treatment: Refresh | 2 | Steam Phase 1 Dependent on Load Min / Med / Max | Damp | OFF (Reduced) | Wool Steam | ON Min / Med / Max |
| | 3 | Drying / Ventilation | Cupboard | ON Reduced | | |
| | 4 | Steam Phase 2 Dependent on Load Min / Med / Max | | OFF (Reduced) | | ON Min / Med / Max |
| Anti-Crease Preparatio | 5 | Cooling Phase / Pumping | Cupboard | ON High | Wool Steam | OFF |
| | 6 | Pre-Anti-Crease | | ON Normal | | OFF |
| | 7 | End | | OFF | OFF | OFF |

**TABLE 4**
Refreshment Business without preceding Drying but with succeeding Anti-Crease

| | Step | Phase | Humidity-Detection Target | Ventilation | Mechanic Mode | Steam Supply |
|---|---|---|---|---|---|---|
| | 1 | Ventilation (Laundry Heating) | | ON Normal | Delicate Steam | OFF |
| Main-Treatment: Refresh | 2 | Steam Phase 1 Dependent on Load Min / Med / Max | Damp | OFF (Reduced) | Delicate Steam | ON Min / Med / Max |
| | 3 | Drying / Ventilation | Cupboard | ON Reduced | | |
| | 4 | Steam Phase 2 Dependent on Load Min / Med / Max | Damp | OFF (Reduced) | | ON Min / Med / Max |
| Inter-Medi. | 5 | Cooling Phase / Pumping | | ON High | Normal Steam | OFF |
| Anti-Crease (repeated) | 6 | Steam Phase Anti-Crease | Damp | OFF (Reduced) | Normal Steam | ON Min / Med / Max |
| | 7 | Ventilation / Cooling | Cupboard / Optional: Iron Damp | ON Normal | | OFF |
| | 8 | End | | OFF | OFF | OFF |

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 08 00 0726

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
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| Y | * paragraph [0002] - paragraph [0009] * * paragraph [0018] - paragraph [0026]; figure 1 * | 2-7,11, 20-22, 26-28, 38,40-42 | |
| X | EP 1 852 541 A (ELECTROLUX HOME PROD CORP [BE]) 7 November 2007 (2007-11-07) * paragraph [0006] - paragraph [0007] * * paragraph [0015] - paragraph [0018] * * paragraph [0027]; figures 1,3,4 * | 1-5, 24-28, 38,42 | |
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| X | US 2006/125428 A1 (SCHULZE INGO [DE] ET AL) 15 June 2006 (2006-06-15) * paragraph [0008] - paragraph [0010] * * paragraph [0014] - paragraph [0018]; figure 1 * | 1,8-10, 13,19, 24,25, 30,37,43 | |

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 2 July 2008 | Fachin, Fabiano |

CATEGORY OF CITED DOCUMENTS

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# EUROPEAN SEARCH REPORT

Application Number
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| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
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| Y | EP 1 852 539 A (ELECTROLUX HOME PROD CORP [BE]) 7 November 2007 (2007-11-07)<br>* paragraph [0001] - paragraph [0012] *<br>* paragraph [0014] - paragraph [0015] *<br>* paragraph [0017] - paragraph [0019] *<br>* paragraph [0023] - paragraph [0028] *<br>* paragraph [3637]; figures 1-3 * | 2-6,11, 22, 26-28, 38,40,42 | |
| Y | EP 1 852 542 A (ELECTROLUX HOME PROD CORP [BE]) 7 November 2007 (2007-11-07)<br>* paragraph [0007] - paragraph [0015]; figures 1-3 * | 2-4,20, 26,27 | TECHNICAL FIELDS SEARCHED (IPC) |
| A | EP 1 441 060 A (ELECTROLUX HOME PROD CORP [BE]) 28 July 2004 (2004-07-28)<br>* paragraph [0005] - paragraph [0015]; figures 1,2 * | 1,2,24, 26,27 | |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 2 July 2008 | Fachin, Fabiano |

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 00 0726

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02-07-2008

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