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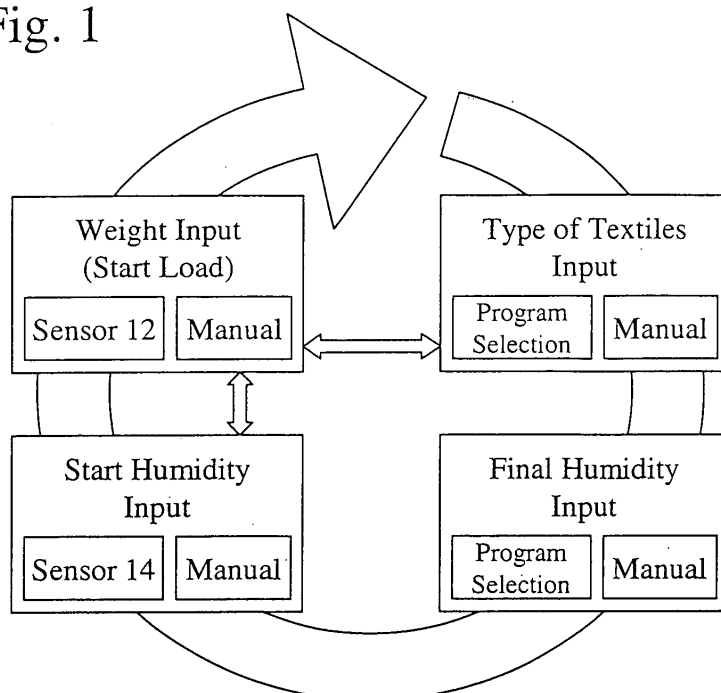
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(54) **Dryer with additive-assisted drying program**

(57) The invention relates to a method of drying textiles in a dryer, wherein the drying sequence includes the supply of at least one additive to the textiles. According to the invention at least one additive supply parameter is modified in dependency of a program selection and/or textile characteristic. Also a dryer is provided comprising a control unit adapted to control a plurality of program

sequences and/or program options of the sequence and a supply unit adapted to supply at least one additive to the textiles to be dried in the dryer. According to the invention the control unit is adapted to control the supply unit in dependency of the at least one selected program sequence and/or a signal transmitted to the control unit by a weight detector (12) and/or humidity sensor (14).

Fig. 1



Description

[0001] The present invention relates to a dryer having a supply unit to supply an additive like steam into the storing compartment and onto the textiles stored therein during a drying sequence. It also relates to a method of drying textiles using an additive supplied to the textiles.

[0002] EP 1 441 060 A1 discloses a tumble dryer having one or two injection units arranged in proximity of the loading door of the dryer to inject an additive like water steam, a cleaning detergent, a fragrance or a disinfectant into the drum. It is proposed to reduce, stop or reverse the air flow through the drum to optimize the efficiency of the injected additive. For modifying the air flow, a fan is arranged in an air channel supplying drying air in to the drum, wherein the fan is driven by a motor separate from the driving motor of the drum and which is independently controlled by a control unit.

[0003] It is an object of the invention to provide a method for drying textiles and a dryer supplying at least one additive to the textiles, which optimize the effect of the supplied additives and also the consumption of additives.

[0004] The invention is defined in claims 1 and 12, respectively.

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

[0006] According to the method of claim 1 at least one additive is supplied during the drying sequence or cycle to the textiles loaded into the drying compartment of a dryer. Preferably the dryer is a tumble dryer. The dryer may be of a condensation type in which the drying air is circulated in a closed loop or may be of an exhaust type where the drying air is exhausted to the outside of the dryer. Or it maybe a mixed system as for example proposed in DE 103 028 64 A1. The at least one additive is for example supplied to the textiles by either introducing it into an air channel, directly into the drum or storing compartment, or it is introduced into the tub surrounding the drum. Introduction into the air or onto the textiles may be performed by a supply unit producing steam, aerosol, fog, droplets, by sublimation, or by heating the at least one additive. The additive can also be supplied by a mixture of these introduction types or using different supply ways adequate for the type of additive to be applied to the textiles.

[0007] In the method of claim 1, at least one additive supply parameter of at least one of the additives is modified in dependency of a program selection and/or a textile characteristic. Thereby it is avoided that the at least one additive is supplied in a fixed manner and amount during the drying cycle, independent of the actual requirement for treating the cloths. Due to the dependency of the additive supply on the program selection and/or the textile characteristic the effect of the additive treatment is optimized on the one hand and also the consumption of the at least one additive is reduced. In a program-controlled dryer apparatus preferably the modification is automatically made by a control unit of the dryer apparatus in accordance with stored program sequences and sub-sequences .

[0008] According to a preferred embodiment the textile characteristic which is used to adjust the supply parameter(s) is the weight of the textiles to be dried, the type of the textiles, the degree of soiling or staining and/or the humidity of the textiles, in particular the starting humidity of the textiles. For example more additive is required for a high weight of the textiles loaded or a minimal additive amount can be supplied, if the weight of the textiles is low - i.e. if the drum of the dryer is only minimally filled. Also the effect of the applied additive on the textiles depends on the type of textile and/or the time of introduction (e.g. textile temperature). For example cotton clothes react different from synthetic material. In case the additive treatment is mainly or completely based on a water steam treatment, the supply of water steam or droplets may be reduced, if the laundry loaded into the dryer has a high starting humidity, if for example a low spinning speed has been used in the previous wash cycle of a washing machine.

[0009] In an embodiment the start humidity of the textiles can be input manually by the user or it can be detected by a humidity detector of the dryer, if provided therewith. Alternatively or additionally the weight or start weight of the textiles can be manually input by the user or can be detected by a weight detector. Both values, the start humidity of the textiles and the weight, can be used to estimate the dry weight of the textiles or clothes. For' example if wet clothes has been loaded and indicated by a user selection, the dry weight can be calculated or at least estimated from the wet weight of the laundry.

[0010] Preferably the type of textiles is considered when adjusting or setting at least one of the additive supply parameters to be used in the program sequence. The type is manually selected by an input of the user or it is selected by selecting a program which is specifically adapted for a predefined type of textiles. If for example a program "cotton steam-pre ironing" is selected, the cotton-type of textiles is indicated thereby. Such a selection may also be determined by for example a program called "synthetic steam pre-ironing" from which a synthetic fabric type is concluded. In a further embodiment a user selection and program selection may be combined: if for example the program selection can not be used to determine the textile type, a menu selection point is activated requesting a textile type selection or input from the user.

[0011] Note that depending on the program selection of the user, the drying cycle may comprise different drying sub-sequences, like main drying sequence, auxiliary treatment sequence and/or post treatment sequence, which all or partially can include at least a phase where at least one of the additives is supplied to the textiles. Then in dependency of the program selection and/or textile, characteristic, at least a portion or all of these sub-sequences can have a modified supply of the additive. Sub-sequences are for example a steam treatment phase, a main drying phase, a pre-drying

phase, an anti-crease phase or the like.

[0012] According to an embodiment the additive supply parameter which is modified for the at least one additive is the total amount, the flow rate and/or other parameters. An adjustment of the composition of additives can for example be made in dependency of the selected or derived textile type. When for example a selection has been made for a program adapted for wool treatment, then chemical treatment additives are excluded from the composition and preferably only a water-comprising additive is supplied to the wool textiles. Also if a refreshment program has been selected, a degree of soiling and/or staining can be indicated by the user and the supply amount of chemically active additives is increased. Types of additives to be supplied onto the textiles are for example: water, fragrance additives, disinfectant additive, soiling-resolving additives, or a combination thereof.

[0013] Reference is made in detail to preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings which show:

Fig. 1 a scheme of input program selections and program options,

Fig. 2 control elements of a dryer, and

Fig. 3 a diagram depicting an exemplary program cycle including different sub-sequences of the drying cycle.

[0014] Fig. 1 shows schematically the selection variety of available programs and program options to be selected by the user. Mandatory selections (program selection) and option selections (weight input, start humidity input, final humidity input) are shown. For running the exemplary dryer 2 of Fig. 2 not all the optional user selections or the optional detection results have to be implemented. Preferably the weight input is implemented since for example the amount of additive to be supplied onto the laundry crucially depends on the laundry weight. In the following exemplary embodiment all input types shown in Fig. 1 are described - while keeping in mind that these have not to be implemented in any case or in any model of the tumble dryer. Some of the inputs are made prior to the starting of the program cycle (for example the program selection) while other inputs are made in the starting phase. For example the start humidity may be determined by a humidity sensor 14 of the dryer 2 when the drying process has already been started. Preferably the user selections and inputs are made prior to starting the drying cycle.

[0015] As indicated in Fig. 1 the input of the type of textiles (cotton, synthetics, wool, silk etc.) is made either by a program selection or manually by the user. If for example the user selected program is specific for the type of textiles, no separate input for the type of textiles has to be made by the user. If the program is not destined for a specific type of textiles, a corresponding input can be optionally requested from the user.

[0016] The same way the final humidity input for the final humidity of the laundry at the end of the drying cycle is either predetermined by a corresponding program selection or can optionally be input by the user. If for example a program is selected including an "iron aid" or "pre-ironing" then the final humidity of the laundry is higher than in a program without such iron-specific determination. Optionally the user may add this option to any of the drying programs by selecting this program option manually. Selection is made by pressing a button "iron aid" which assists the subsequent ironing by a higher humidity of the laundry.

[0017] The starting humidity of the laundry may automatically be determined by the humidity sensor 14 in a starting phase of the drying sequence or may manually be input by the user. For example the user input has the selections wet, damp or dry. The latter selection is for example used in combination with a refreshment program.

[0018] The weight of the laundry loaded into the compartment of the dryer 2 can either be determined by a weight sensor 12 automatically or maybe input by the user. For example the user input is a weight selection like "high", "medium" and "low". Or it may be a drum volume input like "full", "half full" and "few pieces". If such load input by volume is made, the type of textiles can be considered to derive the actual weight of the laundry (see arrow between inputs 'weight' and 'type' in Fig. 1). Also when inputting the weight and the start humidity, the dry weight of the textiles can be deduced by subtracting the expected water weight using the humidity input (see arrow between inputs 'start humidity' and 'type' in Fig. 1). Of course also the type of textiles can be considered to calculate the dry weight which in turn is one of the factors to be included when determining an additive parameter like the amount of additive to be supplied to the laundry.

[0019] Fig. 2 shows principal elements of the tumble dryer 2 in a block diagram. The tumble dryer 2 is an electronically controlled program dryer, the program being executed and controlled by a central processing unit 4. The user interface of the dryer comprises a display section 10 and an input panel 8. The input panel 8 has a program selector 20 for selecting the main program, an indicator section 22 to input for example the type of textile, the weight and the start humidity, and an option selector 24 to select for example the "iron aid" and so on. The signals of the weight sensor 12 and the humidity sensor 14 are transmitted to the CPU for monitoring and controlling the drying process. Control signals are sent from the CPU 4 to a motor 6 driving the drum and to an additive injector 16 to inject the additives as for example known from DE 103 02 864 A1 having a spraying device 31 and a stream generator 33 as described therein.

[0020] An exemplary user interaction with the user interface for the selection and options shown in Fig. 1 is now

described: The display section 10 is a touch screen accepting user inputs by touching soft buttons displayed on the screen which represent at least portion of the input panel 8. As soon as the dryer is energized, the principal programs to be selected by the user are shown on the display and one of these principal programs is selected. If a type of textiles is not determined by the principal selection, different types of textiles for selection are displayed. Thereafter a selection for the loaded volume as described above is shown - thereby implementing an implicit weight selection. When the weight or load selection has been made, a start button is displayed at the same time with additional options like start humidity and final humidity option button as mentioned above. These additional options can be activated by the user or can be skipped by starting the drying cycle with the start button.

[0021] Table I illustrates an example of a selectable drying program in which auxiliary program sub-sequences are added to the main drying program sub-sequences according to the program selection or option selection of the user (see also Fig. 3). Due to the weight, start humidity and textile type input the duration of the sub-sequences are adapted, the end humidity of the laundry of the sub-sequences are adapted and the type and amount of additive to be applied to the laundry (if necessary in this respective subsequence).

Table I: Basic Parameters of Program Sub-Sequences of the Overall Drying Sequence

Program Sequence Parameter	Auxiliary Program	Main Program		Auxiliary Program
	Pre Drying	Gas Phase Treatment	Main Drying	Anti Crease
	duration	duration	duration	duration
	start/end humidity	(start/end humidity)	start/end humidity	start/end humidity
		consumption/type of additives		consumption/type of additives

[0022] Fig. 3 shows a time diagram illustrating a principal drying program including the steam treatment. Optionally a pre-drying is activated due to the selection or detection that the laundry has a high starting humidity. In this case the high start humidity is not compatible with the steam treatment which requires a lower degree of humidity of the laundry for starting the steam treatment. Another option which has been selected by the user is an anti-crease phase which follows the main drying and prevents the generation of crinkles in the laundry when it is not immediately removed from the dryer's drum after finishing the main drying.

[0023] In Fig. 3 the program cycle starts with a ventilation phase in which the start humidity and the start weight of the laundry are determined by weight sensor 12 and humidity sensor 14. The ventilation phase is followed by the pre-drying phase during which the start humidity is reduced. The pre-drying phase is followed by the steam treatment phase in which an additive is applied to the laundry via the additive injector 16. The steam treatment phase is followed by the main drying phase in which no additive is supplied and which dries the laundry to the end humidity value given by the principal program or to the value modified by the program option selected by the user.

[0024] After the main drying phase the anti-crease phase is started which preserves the laundry in the state resulting after the main drying phase. An additive is also supplied during the anti-crease phase in dependency of a weight determination which is indicated in Fig. 3 as end weight detection. The additive injected in the anti-crease phase is preferably water only which also maybe used during the steam treatment phase. Preferably during the steam treatment phase additional additives are injected like a detergent.

[0025] As indicated by the dotted lines, the individual phases may partially overlap each other. For example the steam treatment phase maybe portion of the pre-drying and/or the main drying phase. Also cooling down in intermediate phases maybe provided (not shown), for example before starting the steam treatment or before starting the anti-crease treatment. Thereby pre-defined temperatures or temperatures ranges are achieved which also optimize the effects of the additives injected.

Reference Numerals List

[0026]

5	2	tumble dryer
	4	CPU
	6	motor
	8	input panel
	10	display section
10	12	weight sensor
	14	humidity sensor
	16	additive injector
	20	program selector
	22	indicator section
15	24	option selector

Claims

- 20 1. Method of drying textiles in a dryer (2), the drying sequence including the supply of at least one additive to the textiles, wherein at least one additive supply parameter is modified in dependency of a program selection and/or textile characteristic.
- 25 2. The method of claim 1, wherein the textile characteristic is the weight of the textiles to be dried, the type of the textiles, the degree of soiling, the degree of staining and/or the humidity of the textiles.
3. The method of claim 2, wherein the humidity of the textiles is a start humidity and/or an intermediate humidity.
- 30 4. The method of claim 3, wherein the start humidity is manually input by the user or detected by a humidity detector (14) of the dryer (2).
5. The method of any of the previous claims, wherein the weight of the textiles is manually input by the user and/or detected by a weight detector (12) of the dryer (2).
- 35 6. The method of any of the previous claims, wherein the type of the textiles is manually input by the user separately selecting the type or by selecting a program adapted to the type of textiles.
7. The method of any of the previous claims, wherein the program selection includes at least one of the following selections: a refreshment program, a cotton steam treatment program, a cotton shirt program, a synthetic program, 40 a synthetic steam treatment program, a synthetic shirt program, an iron aid program, a smoothing program, an anti-crease program, a chemical dry program.
8. The method of any of the previous claims, wherein the at least one modified additive supply parameter is modified in at least one of the following sub-sequences of the drying sequence: a steam treatment phase, a main drying phase, a pre-drying phase, an anti-crease phase. 45
9. The method of any of the previous claims, wherein the additive supply parameter includes at least one of the following: a total amount of additive to be supplied, the flow rate of additive supply, the repetition of additive supply, the duration of supply, the start of supply, the composition of additives, the selection of additive among at least two additives, a phase of the drying sequence. 50
10. The method of any of the previous claims, wherein the additive is injected as steam or aerosol, in particular the steam being water steam or mainly comprising water.
- 55 11. The method of any of the previous claims, wherein the additive comprises or is a refreshment agent.
12. Dryer, in particular tumble dryer (2), comprising:

a control unit (4) adapted to control a plurality of program sequences and/or program options of the sequence;
a control panel (8) for selecting at least one program option and/or program sequence by the user; and
a supply unit (16) adapted to supply at least one additive to the textiles to be dried in the dryer (2);

- 5 **characterized in that**
the control unit (4) is adapted to control the supply unit (16) in dependency of the at least one selected program sequence and/or a signal transmitted to the control unit by a weight detector (12) and/or humidity sensor (14).
- 10 **13.** The dryer of claim 12, comprising a display unit (10) adapted to display a selection menu to the user.
- 15 **14.** The dryer of claim 12 or 13, wherein the control panel (8) comprises at least one of the following: a program selector (20), a weight selector (22), a start humidity selector (22), a textile type selector, a iron-aid selector (24), a end humidity selector (24), a refreshment selector (20), an anti-crease selector (24), a standby selector (24), a dry-cleaning selector (20).
- 20 **15.** The dryer of claim 12, 13 or 14, wherein the control unit (4) is adapted to execute a program implementing the method of any of claims 1 to 11.

Fig. 1

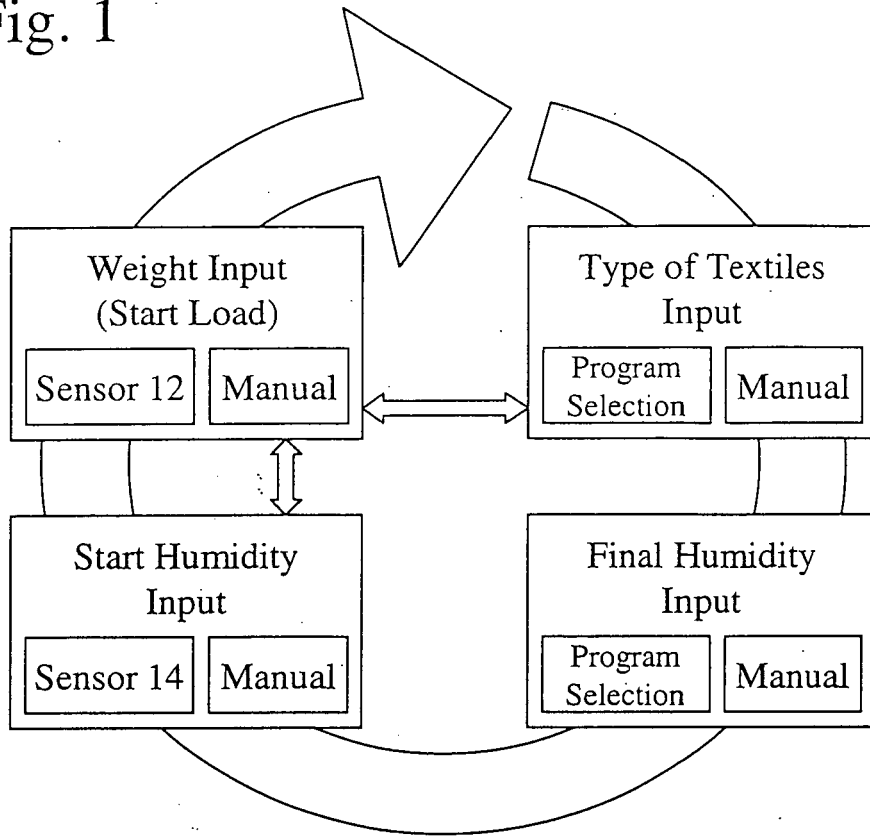


Fig. 2

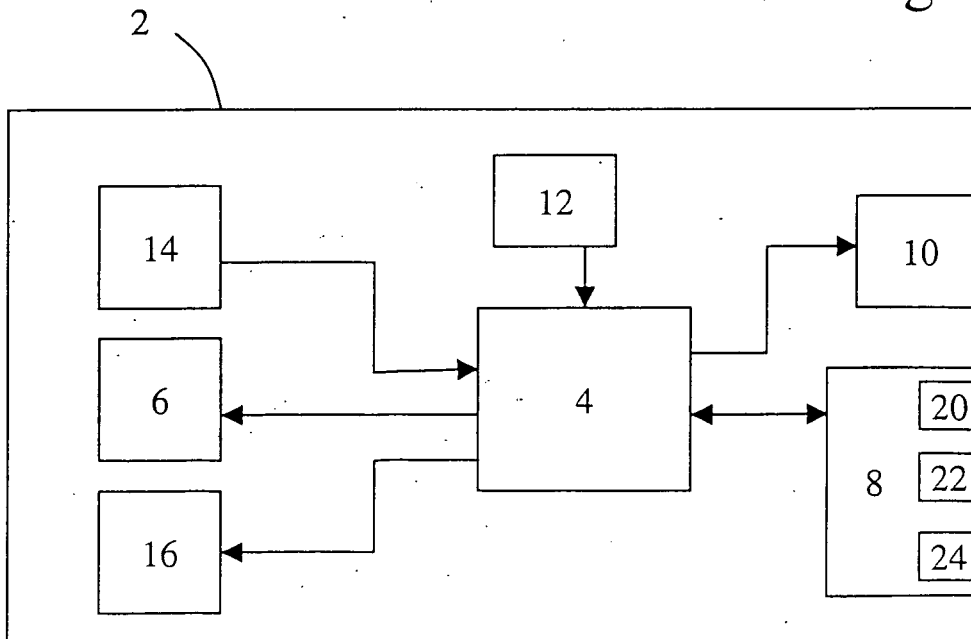
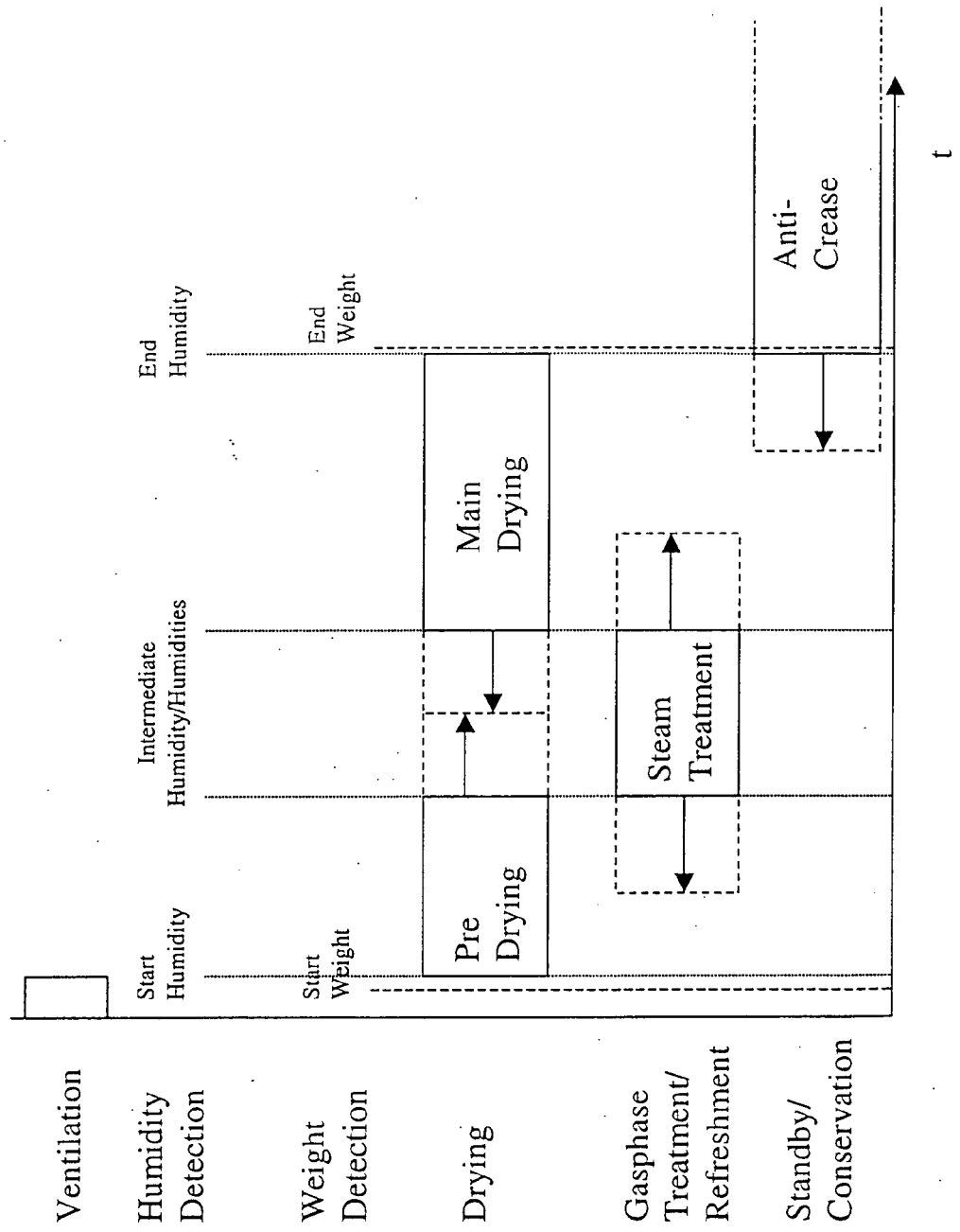


Fig. 3





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 06 00 9016

DOCUMENTS CONSIDERED TO BE RELEVANT			
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 August 2006	Examiner DIAZ, M
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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 06 00 9016

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