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(54) **GARMENT CARE DEVICE WITH SENSING UNIT**

(57) The invention relates to a garment care device (100A) comprising a water tank (102) for containing water, a steam generator (104) in fluid communication with the water tank for generating steam, and a soleplate (108) defining an overall flat surface (109) comprising a plurality of steam vents (110) in fluid communication with the steam generator. Controlling means (120) control the flow of steam exiting the steam vents. The controlling means take a first state resulting in steam exiting the steam vents, and a second state resulting in steam not exiting the steam vents. The garment care device further comprises a button (124) adapted to be actuated by a user, a first sensing unit (128) for detecting if the user is holding or not the garment care device, and a processing unit connected to the button and to the first sensing unit. The processing unit sets the controlling means in the first state if the following primary conditions are fulfilled: the button has been continuously pressed by the user during at least a first time duration, and after the first time duration, the first sensing unit detects that the user is holding the garment care device.

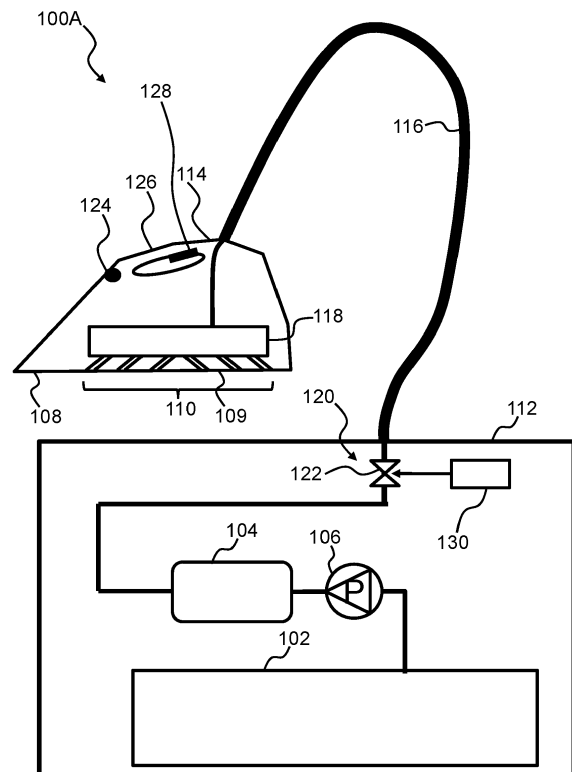


FIG.1

Description

FIELD OF THE INVENTION

[0001] The invention relates to a garment care device, and in particular controlling steam delivery from the garment care device.

[0002] The invention may be used in the field of garment care.

BACKGROUND OF THE INVENTION

[0003] Steam irons are known which are capable of removing wrinkles from garments in a similar manner to garment steamers. Garment steamers enable the user to perform vertical steaming of hanging garments without the use of an ironing board.

[0004] Conventional steam irons or pressurized steam generators include a so-called "steam lock" feature that allows the product to produce steam continuously, in similar manner to garment steamers. The steam lock feature is selectable by the user so that they can switch to and from the continuous steaming mode according to, for example, whether the device is intended to be used for steaming a hanging garment or for ironing a garment on an ironing board.

[0005] A disadvantage of such conventional steam irons/pressurized steam generators is that the steam lock is required to be switched on and off by the user, for example whenever a garment is adjusted or a steamed garment is changed for a garment which is yet to be steamed.

[0006] Should the steam lock be left on by the user, for example during adjusting a garment or changing garments, so that steam flows continuously throughout the entire ironing session, energy and water risk being wasted, and steam dips may occur in the boiler of the device.

OBJECT AND SUMMARY OF THE INVENTION

[0007] It is an object of the invention to propose a garment care device that avoids or mitigates the above-mentioned problems.

[0008] The invention is defined by the independent claims. The dependent claims define advantageous embodiments.

[0009] To this end, the garment care device according to the invention comprises

- a water tank for containing water,
- a steam generator in fluid communication with the water tank for generating steam,
- a soleplate defining an overall flat surface comprising a plurality of steam vents in fluid communication with the steam generator,
- controlling means for controlling the flow of steam exiting the steam vents, the controlling means being adapted to take a first state resulting in steam exiting

the steam vents, and a second state resulting in steam not exiting the steam vents,

- a button adapted to be actuated by a user of the garment care device,
- a first sensing unit for detecting if the user is holding or not the garment care device,
- a processing unit connected to the button and to the first sensing unit, the processing unit being adapted to set the controlling means in the first state if the following primary conditions are fulfilled:

- the button has been continuously pressed by the user during at least a first time duration, and
- after the first time duration, the first sensing unit detects that the user is holding the garment care device.

[0010] Thus, the user need only actuate the button for the first time duration, and continue to hold the garment care device thereafter in order for adoption of the first state and for steam to correspondingly exit the steam vents.

[0011] In this manner, the user is not required to continually actuate, e.g. press, the button in order to operate the garment care device in a continuous steaming mode.

[0012] Moreover, the primary conditions will not, or no longer, be fulfilled when the user is not, or ceases, holding of the garment care device, and the steam will accordingly not exit the steam vents. In this manner, safety, particularly prior to steaming, is improved. Wastage of steam and energy is also minimised or prevented when the user is not holding the garment care device, for instance when the user is adjusting a garment or changing a steamed garment for a garment which is yet to be steamed.

[0013] The controlling means preferably comprise a valve arranged between the steam generator and the steam vents. Such a valve provides an effective and responsive way of selecting the first state or the second state.

[0014] Alternatively or additionally, the controlling means comprise a pump arranged between the water tank and the steam generator. The pump provides an effective and readily implementable way of selecting the first state or the second state.

[0015] Preferably, the garment care device further comprises a second sensing unit connected to the processing unit for measuring an angular position of the overall flat surface compared to a horizontal surface. In this case, the primary conditions also include the following additional condition:

- after the first time duration, the second sensing unit detects that the angular position is larger than a given angle threshold.

[0016] Continuous steaming in the first state is likely to be preferred by the user for steaming a hanging fabric

or garment, but such continuous steaming may be inappropriate when using the garment care device for ironing a garment on the horizontal surface of an ironing board. These user preferences are accounted for by the primary conditions including the additional requirement that the second sensing unit detects that the angular position is larger than the given angle threshold.

[0017] The given angle threshold is at least 20 degrees, preferably in the range of 20°C to 40°C, e.g. 30°C, compared to the horizontal.

[0018] This range for the given angle threshold reflects that the first state is triggered by an inclined orientation away from the horizontal, and may also assist to prevent unintentional triggering of the first state resulting from the soleplate being positioned, e.g. seated, on an inclined base/cradle.

[0019] Preferably, the additional condition that, after the first time duration, the second sensing unit detects that the angular position is larger than the given angle threshold is fulfilled when the angular position is larger than the given angle threshold for at least a given minimum time duration.

[0020] The given minimum time duration can assist to ensure stability of the angular position measurement, and can be, for instance, in the range of 100 to 500 milliseconds, such as 200 milliseconds.

[0021] Preferably, the garment care device comprises a third sensing unit for measuring movement of the garment care device. In this case, the primary conditions also include the following additional condition:

- after the first time duration, the third sensing unit detects a movement having a first value larger than a first movement threshold.

[0022] This may assist to improve the responsiveness of, and thus improve the user's experience of using, the garment care device. This is because the steam is permitted to exit the steam vents provided, e.g. as soon as, the user is moving the garment care device.

[0023] Preferably, the processing unit is adapted to set the controlling means in the second state if the first sensing unit detects that, at a certain time, the user is not holding the garment care device anymore.

[0024] The term "certain time" is intended to mean in the present context the time at which the user is not, or no longer, holding the garment care device. Thus, the steaming provided when the controlling means are in the first state is stopped, or at least temporarily paused, when the user is no longer holding the garment care device.

[0025] Preferably, the processing unit is adapted to set the controlling means in the first state again if the following secondary conditions are fulfilled:

- the first sensing unit detects that within a second time duration starting from the certain time, the user is holding the garment care device again.

[0026] This enables the steaming to be resumed following a temporary pause in the steaming resulting from the user no longer holding the garment care device.

[0027] The second time duration can be, for example, in the range of 10 to 30 seconds, such as 15 seconds.

[0028] When the garment care device includes the second sensing unit, the secondary conditions preferably also include the following condition:

- during the second time duration, the second sensing unit detects that the angular position of the overall flat surface compared to the horizontal surface is larger than the given angle threshold.

[0029] Thus, tilting of the soleplate so that the given angle threshold is exceeded can be conveniently used as one of the secondary conditions which permit resumption of continuous steaming following the temporary pause.

[0030] Alternatively or additionally, when the garment care device includes the third sensing unit, the secondary conditions preferably also include the following condition:

- during the second time duration, the third sensing unit detects a movement having a second value larger than a second movement threshold.

[0031] Thus, moving the at least part of the garment care device so that the second movement threshold is exceeded can be conveniently used as one of the secondary conditions which permit resumption of continuous steaming following the temporary pause.

[0032] Preferably, the processing unit is adapted to maintain the controlling means in the first state as long as the third sensing unit detects that the movement of the garment care device is above a third movement threshold.

[0033] The third movement threshold can be the same as or different from the first and second movement thresholds. In a non-limiting example, the third movement threshold is lower than the first movement threshold and/or the second movement threshold. The third movement threshold can thus account, for example, for relatively small movements associated with directing steam at one part of a fabric in order to remove a stubborn wrinkle.

[0034] Preferably, the processing unit is adapted to set the controlling means in the second state as soon as the button is actuated by the user.

[0035] In this manner, steaming is stopped by adoption of the second state as a result of the user actuating the button while the controlling means are in the first state. Preferably, the first time duration is in the range of 1 to 5 seconds, such as 2 seconds. Such a first time duration assists to prevent unintentional adoption of the first state by the controlling means, whilst minimising inconvenience and discomfort otherwise caused to the user due to having to actuate, e.g. press, the button for a relatively

prolonged period of time.

[0036] Preferably, the first sensing unit comprises a capacitive sensor configured to detect when the user is touching the garment care device. Alternative sensor types can also be considered for the first sensing unit, such as an optical sensor, an ultrasonic sensor, etc.

[0037] According to another aspect there is provided a method of controlling steam generation in a garment care device comprising:

- a water tank for containing water,
- a steam generator in fluid communication with the water tank for generating steam,
- a soleplate defining an overall flat surface comprising a plurality of steam vents in fluid communication with the steam generator,
- controlling means for controlling the flow of steam exiting the steam vents, the controlling means being adapted to take a first state resulting in steam exiting the steam vents, and a second state resulting in steam not exiting the steam vents,
- a button adapted to be actuated by a user of the garment care device,
- a first sensing unit for detecting if the user is holding or not the garment care device,

the method comprising the step of setting the controlling means in the first state if the following primary conditions are fulfilled:

- the button has been continuously pressed by the user during at least a first time duration, and
- after the first time duration, the first sensing unit detects that the user is holding the garment care device.

[0038] A computer program product is also provided, which computer program product comprises instructions codes which, when executed by the processing unit of the garment care device defined above, cause the garment care device to implement the method as defined above.

[0039] Embodiments described herein in relation to the garment care device are applicable to the method and computer program product, and embodiments described herein in relation to the method and computer program product, for example the control logic used in such a computer program product, are applicable to the garment care device.

[0040] Detailed explanations and other aspects of the invention will be given below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] Particular aspects of the invention will now be explained with reference to the embodiments described hereinafter and considered in connection with the accompanying drawings, in which identical parts or sub-steps

are designated in the same manner:

Fig.1 depicts a garment care device according to a first example,

Fig.2 depicts a garment care device according to a second example,

Fig.3 depicts a garment care device according to a third example,

Fig.4 depicts a garment care device according to a fourth example,

Fig.5 depicts a hand unit of a garment care device according to a fifth example, and

Fig.6 provides a flowchart of an exemplary method of controlling steam generation in a garment care device.

DETAILED DESCRIPTION OF THE INVENTION

[0042] Fig.1 depicts a garment care device 100A according to a first example. The garment care device 100A comprises a water tank 102 for containing water. A steam generator 104 for generating steam is in fluid communication with the water tank 102.

[0043] In the non-limiting example depicted in Fig. 1, water is pumped from the water tank 102 to the steam generator 104 by a pump 106. Steam is generated in the steam generator 104 from the water pumped thereto by the pump 106. To this end, the steam generator 104 includes a heating element (not visible), such as a resistive heating element, arranged to heat the water therein to generate the steam.

[0044] The garment care device 100A further comprises a soleplate 108. The soleplate 108 has, or may be regarded as defining, a surface for treating fabrics.

[0045] As shown in Fig.1, the soleplate 108 delimits a plurality of steam vents 110. The steam vents 110 are fluidly communicable with the steam generator 104, as will be explained in more detail herein below. Fluid communication between the steam generator 104 and the steam vents 110 permits the steam generated in the steam generator 104 to be supplied to a fabric (not visible) adjacent, and in some cases contacting, the soleplate 108.

[0046] The surface of the soleplate 108 is an overall flat surface 109. The term "overall flat" refers to the surface 109 being planar but including discontinuities, in particular due to the presence of the steam vents 110.

[0047] The exemplary garment care device 100A depicted in Fig.1 comprises a base 112 and a hand unit 114. The base 112 comprises the water tank 102, the steam generator 104, and the pump 106. The hand unit 114 comprises the soleplate 108, as shown.

[0048] A hose cord 116 includes a steam tube (not visible) for carrying steam from the steam generator 104 to the steam vents 110. The hose cord 116 is preferably flexible in order to facilitate movement of the hand unit 114 whilst maintaining supply of steam from the steam generator 104 to the steam vents 110.

[0049] In the non-limiting example shown in Fig.1, steam from the steam generator 104 is received in a steam chamber 118 included in the hand unit 114. The steam vents 110 are in fluid communication with the steam chamber 118. Thus, the steam in the steam chamber 118 is carried by the steam vents 110 towards the fabric to be treated.

[0050] The steam vents 110 may, for example, be arranged in such a way as to distribute the steam to different portions of the fabric.

[0051] Whilst Fig.1 shows a garment care device 100A having six steam vents, this is merely for the purpose of illustration, and any suitable alternative number of steam vents 110 may be considered, such as two, three, four, five, seven, eight, nine, ten, eleven, twelve, or more.

[0052] Moreover, the garment care device 100A need not comprise the base 112 and hand unit 114 components shown in Fig.1, and an example of an alternative design will be described in more detail herein below with reference to Figs.3 and 4.

[0053] More generally, the garment care device 100A comprises controlling means 120 configured to control the flow of steam exiting the steam vents 110. The controlling means 120 adopt a first state and a second state. In the first state, steam is permitted by the controlling means 120 to exit the steam vents 110.

[0054] In the second state, steam is not permitted by the controlling means 120 to exit the steam vents 110. This may, for example, be implemented by the controlling means 120 preventing the fluid communication between the steam generator 104 and the steam vents 110 in the second state, thereby to prevent the exit of steam from the steam vents 110.

[0055] The controlling means 120 can, for example, be alternatively termed a "steam controller", due its function of controlling whether or not steam is permitted to exit the steam vents 110.

[0056] The controlling means 120 can be implemented in any suitable manner. In the non-limiting example shown in Fig.1, the controlling means 120 comprise, or are at least partly defined by, a valve 122 arranged between the steam generator 104 and the steam vents 110.

[0057] The valve 122 can have any suitable design provided that it can be controlled in response to certain primary conditions being fulfilled, as will be described in more detail herein below. The valve 122 may, for example, comprise, or be in the form of, an electro-valve or solenoid valve.

[0058] In the exemplary garment care device 100A depicted in Fig.1, the first state is adopted by the valve 122 being open to permit steam generated in the steam generator 104 to pass to and exit the steam vents 110. The second state is adopted by the valve 122 being closed to prevent the steam generated in the steam generator 104 from passing to and exiting the steam vents 110.

[0059] The controlling means 120, including the valve 122, are included in the base 112 in the example shown in Fig.1. However, this should not be regarded as being

limiting, and at least part of the controlling means 120, e.g. the valve 122, may be positioned elsewhere in the garment care device 100A, such as in the hand unit 114.

[0060] More generally, the garment care device 100A comprises a button 124. The button 124 is actuatable by a user of the garment care device 100A.

[0061] Any suitable design of button 124 may be considered, such as a push button, slider button, etc.

[0062] Preferably, the garment care device 100A comprises a handle 126 for grasping by the user in order to assist the user to move the soleplate 108 relative to the fabric to be treated. The handle 126 may thus be included in the hand unit 114.

[0063] When the handle 126 is included in the garment care device 100A, the button 124 is preferably arranged proximal to the handle 126 such that the button 124 is actuatable while the user is grasping the handle 126, e.g. by the hand and/or the digits thereof which is or are grasping the handle 126.

[0064] The garment care device 100A comprises, in addition to the button 124, a first sensing unit 128 configured to detect whether or not the user is holding the garment care device 100A.

[0065] The first sensing unit 128 may have any suitable design or may be of any suitable type that is capable of detecting whether or not the user is holding at least part of the garment care device 100A. For example, the first sensing unit 128 comprises, or is defined by, a sensor, such as a touch sensor configured to detect holding of the at least part of the garment care device 100A by the user.

[0066] A capacitive sensor may be a particularly suitable touch sensor for detecting holding of the garment care device 100A by the user.

[0067] Preferably, the first sensing unit 128 is provided on or proximal to the handle 126, as shown in Fig.1. Such positioning of the first sensing unit 128 means that holding of the at least part of the garment care device 100A is detected by the first sensing unit 128 when the user makes contact with, and preferably grasps, the handle 126.

[0068] In the non-limiting example shown in Fig. 1, the first sensing unit 128 is arranged on the underside of the handle 126 such that the holding is detected when the user's hand and/or digits reach around to the underside when grasping the handle 126.

[0069] Alternatively, the first sensing unit 128 is arranged such as to detect contact being made with the upper side of the handle 126. An example of this will be explained herein below with reference to Fig. 5.

[0070] More generally, the garment care device 100A comprises a processing unit 130 connected to the button 124 and to the first sensing unit 128.

[0071] The processing unit 130 is configured to set the controlling means 120 to adopt the first state if the following primary conditions are fulfilled: the button 124 has been continuously pressed by the user during at least a first time duration, and after the first time duration, the

first sensing unit 128 detects that the user is holding the garment care device 100A.

[0072] Preferably, the first time duration is in the range of 1 to 5 seconds, such as 2 seconds. Such a first time duration assists to prevent unintentional adoption of the first state by the controlling means 120, whilst minimising inconvenience and discomfort otherwise caused to the user due to having to actuate, e.g. press, the button 124 for a relatively prolonged period of time.

[0073] Thus, the user need only actuate the button 124 for the first time duration, and continue to hold the at least part of the garment care device 100A thereafter in order for adoption of the first state, and correspondingly for steam to exit the steam vents 110.

[0074] In this manner, the user is not required to continually actuate, e.g. press, the button 124 in order to operate the garment care device 100A in a continuous steaming mode.

[0075] Moreover, the primary conditions will not, or no longer, be fulfilled when the user is not holding the at least part of the garment care device 100A, and the steam will accordingly not exit the steam vents 110. In this manner, wastage of steam and energy is minimised or prevented when the user is not holding the at least part of the garment care device 100A, e.g. when the user is adjusting a garment or changing a steamed garment for a garment which is yet to be steamed.

[0076] In the case of the exemplary garment care device 100A shown in Fig. 1, the processing unit 130 is configured to control the valve 122, e.g. comprising an electro-valve or solenoid valve, of the controlling means 120 to open to allow steam to pass from the steam generator 104 to the steam vents 110 based on the above-described primary conditions being fulfilled.

[0077] The processing unit 130 is further configured to control the valve 122 of the controlling means 120 to close in order to prevent steam from passing from the steam generator 104 to the steam vents 110 when at least one of the above-described primary conditions is not fulfilled.

[0078] Controlling the flow of steam by the processing unit 130 sending control signals to the valve 122 of the controlling means 120 provides an effective way of toggling between the first state and the second state. The control over steam exiting the steam vents 110 may thus be relatively rapidly responsive to the user inputs received via (at least) the button 124 and the first sensing unit 128.

[0079] The processing unit 130 can be implemented in numerous ways, with software and/or hardware, to perform the various required functions. A processor is one example of a processing unit 130 which employs one or more microprocessors that can be programmed using software (e.g., microcode) to perform the functions. The processing unit 130 may, however, be implemented with or without employing a processor, and also may be implemented as a combination of dedicated hardware to perform some functions and a processor, e.g. one or more programmed microprocessors and associated cir-

cuitry, to perform other functions.

[0080] Examples of controller components that may be employed in various embodiments of the present disclosure include, but are not limited to, conventional microprocessors, application specific integrated circuits (ASICs), and field-programmable gate arrays (FPGAs).

[0081] In some examples, the processing unit 130 is associated with one or more storage media such as volatile and non-volatile computer memory such as RAM, PROM, EPROM, and EEPROM. The storage media can be encoded with one or more programs that, when executed on one or more processors and/or controllers, perform the required functions. Various storage media may be fixed within the processing unit 130 or may be transportable, such that the one or more programs stored thereon can be loaded into the processing unit 130.

[0082] In the exemplary garment care device 100A shown in Fig. 1, the processing unit 130 is included in the base 112, although other suitable locations for the processing unit 130, such as in the hand unit 114, can be considered. An example of the latter will be described in more detail herein below with reference to Figs. 3 and 4.

[0083] When the processing unit 130 is included in the base 112, the button 124 and the first sensing unit 128 can be connected with the processing unit 130 in any suitable manner, e.g. via wiring (not visible) included in the hose cord 116.

[0084] Fig. 2 depicts a garment care device 100B according to a second example in which the controlling means 120 comprise a pump 106 arranged between the water tank 102 and the steam generator 104.

[0085] In the non-limiting example shown in Fig. 2, the steam generator 104 is included in the hand unit 114. In this case, the steam chamber 118 is included in, or may define, the steam generator 104. The steam vents 110 are in fluid communication with the steam chamber 118 of the steam generator 104. Fluid communication between the steam generator 104 and the steam vents 110 permits the steam generated in the steam generator 104 to be supplied to a fabric adjacent, and in some cases contacting, the soleplate 108, as previously described in relation to Fig. 1.

[0086] The processing unit 130 is configured to control the pump 106 of the controlling means 120 to pump water from the water tank 102 to the steam generator 104 in order to generate steam, which steam is allowed to pass from the steam generator 104 to and through the steam vents 110 based on the above-described primary conditions being fulfilled.

[0087] When at least one of the above-described primary conditions is not fulfilled, the processing unit 130 is configured to control the pump 106 of the controlling means 120 to not pump, or cease pumping, the water from the water tank 102 to the steam generator 104. In this way, steam production is prevented from taking place, and so steam does not exit the steam vents 110.

[0088] In other words, steam being permitted to exit the steam vents 110 or otherwise is based on controlling

production of the steam by regulating pumping of water from the water tank 102 to the steam generator 104. This provides an effective and readily implementable way of toggling between the first state and the second state.

[0089] In the non-limiting example depicted in Fig.2, the water tank 102, the pump 106 of the controlling means 120, and the processing unit 130 are included in the base 112, and the steam generator 104 is included in the hand unit 114.

[0090] In this case, the hose cord 116 correspondingly comprises a water tube (not visible) for carrying the water from the water tank 102 in the base 112 to the steam generator 104 in the hand unit 114.

[0091] Figs.1 and 2 both depict pressurized steam generator (PSG) architectures. The steam generator 104, in other words boiler, is included in the base 112 in the device depicted in Fig.1. Such a boiler 104 is not included in the base 112 in the device shown in Fig.2. Nevertheless, the water tank 102 is included in the base 112 in both of these examples. But as briefly mentioned above, these designs should not be regarded as being limiting.

[0092] Fig.3 depicts a garment care device 100C according to a third example which has some similarities with the garment care device 100B depicted in Fig.2, in that the controlling means 120 comprise a pump 106 arranged between the water tank 102 and the steam generator 104.

[0093] In the non-limiting example shown in Fig.3, the various components of the garment care device 100C are each included in the hand unit 114. Accordingly, the water tank 102, the steam generator 104 which comprises or is defined by the steam chamber 118, the controlling means 120, in this case comprising or in the form of the pump 106, and the processing unit 130 are included in the hand unit 114, together with the soleplate 108, the button 124, and the first sensing unit 128.

[0094] The shown in Fig.3 corresponds to a steam iron, sometimes referred to as "DTS". It may necessitate a smaller water tank 102 due to the water tank 102 being incorporated in the hand unit 114 rather than in a base, although the garment care device 100C may nonetheless benefit from portability and have space-saving advantages due to not requiring such a base. The responsiveness of the steam delivery to the user inputs received via (at least) the button 124 and the first sensing unit 128 may also be relatively rapid due to the proximity of the water tank 102 with respect to the steam generator 104.

[0095] More generally, the processing unit 130 is preferably adapted to set the controlling means 120 in the second state as soon as the button 124 is actuated by the user, and it also exits the "continuous steaming" totally.

[0096] In this manner, steaming is stopped by adoption of the second state as a result of the user actuating the button 124 while the garment care device 100A, 100B, 100C is in the first state.

[0097] Following adoption of the first state, steaming, in other words continuous steaming, is started and the

user should not actuate the button 124 unless they wish to stop the steaming. However in this non-limiting example, the user can exit the first state at any time by (re-)actuating the button 124. For example, such re-actuation can be implemented by a relatively short actuation of the button 124, e.g. for less than 2 seconds, or alternatively via a relatively long actuation of the button 124, e.g. for longer than 2 seconds.

[0098] Unintended or accidental actuation of the button 124 is considered to be unlikely or rare, and is not considered to significantly impact user safety. This is at least partly because the primary conditions also comprise the requirement that, after the first time duration during which the button 124 has been continuously pressed by the user, the first sensing unit 128 detects that the user is holding the garment care device 100A, 100B, 100C.

[0099] The placement of the button 124, e.g. relative to the handle 126, may also assist to ensure that the user is less likely to actuate the button 124 unintentionally during steaming with the controlling means 120 in the first state. Nevertheless, unintentional or accidental actuation of the button 124 may not give rise to a safety concern when such unintentional actuation causes the garment care device 100A, 100B, 100C to switch from the first state in which steam is permitted to exit the steam vents 110 to the second state resulting in steam not exiting the steam vents 110.

[0100] The processing unit 130 is preferably adapted to set the controlling means 120 in the second state if the first sensing unit 128 detects that at a certain time, the user is not holding the garment care device 100A, 100B, 100C, in other words the at least part of the garment care device 100A, 100B, 100C, anymore. This can be, for example, an alternative to or in addition to setting the controlling means 120 to adopt the second state as soon as the button 124 is actuated by the user.

[0101] The term "certain time" is intended to mean in the present context the time at which the user is not, or no longer, holding the at least part, e.g. the handle 126, of the garment care device 100A, 100B, 100C.

[0102] Thus, the steaming, e.g. continuous steaming, provided when the controlling means 120 are in the first state is stopped, or at least temporarily paused, when the user is no longer holding the at least part of the garment care device 100A, 100B, 100C.

[0103] Preferably, the processing unit 130 is adapted to set the controlling means 120 in the first state again if the following secondary conditions are fulfilled: the first sensing unit 128 detects that within a second time duration starting from the certain time, the user is holding the garment care device 100A, 100B, 100C again.

[0104] This means the steaming is resumed following the steaming being paused by the user no longer holding the at least part of the garment care device 100A, 100B, 100C.

[0105] The second time duration can be, for example, in the range of 10 to 30 seconds, such as 15 seconds.

[0106] If the user does not hold the garment care de-

vice 100A, 100B, 100C again within the second time duration, the garment care device 100A, 100B, 100C, and in particular the processing unit 130 thereof, can revert to a first mode in which the primary conditions must be fulfilled in order for the first state to be adopted.

[0107] In other words, the garment care device 100A, 100B, 100C exits a second/steaming mode, e.g. a vertical steaming mode which will be described in more detail herein below with reference to Fig.4, and enters the first mode if the user does not hold the garment care device 100A, 100B, 100C again within the second time duration. In this case, the user will have to satisfy the primary conditions again in order for the first state to be adopted by first actuating the button 124 during at least the first time duration. This will also be described herein below with reference to Fig.6.

[0108] Fig.4 depicts a garment care device 100D according to a fourth example in which the garment care device 100D further comprises a second sensing unit 132 connected to the processing unit 130. It is noted that this is also applicable for embodiments of Figs. 1 and 2. The second sensing unit 132 is configured to measure an angular position A1 of the overall flat surface 109 of the soleplate 108 compared to a horizontal surface HS.

[0109] In other words, the second sensing unit 132 measures the angle A1 of the longitudinal axis LA of the soleplate 108 relative to the horizontal.

[0110] In this non-limiting example, the primary conditions also include the following additional condition: after the first time duration, the second sensing unit 132 detects that the angular position A1 is larger than a given angle threshold A2.

[0111] The garment care device 100D, and in particular the hand unit 114 of the garment care device 100D, is preferably usable in different orientations.

[0112] For example, a horizontal orientation of the soleplate 108 can be used for ironing fabrics on a horizontal surface HS, e.g. of a horizontally orientated ironing board. The orientation of the soleplate 108 may, however, be changed in order to allow the garment care device 100D to be used for steaming, for instance, fabrics or garments hanging from a hanger. The latter may mean that the soleplate 108, and in particular the longitudinal axis LA of the soleplate 108, becomes non-horizontally-orientated, for example 90° to the horizontal, or more generally at an angle between the horizontal and the vertical. For example, the orientation detected as vertical is based on an inclination angle threshold of 30° compared to the horizontal, and any detected angles below 30° is considered as horizontal, and vice versa as vertical.

[0113] The user may prefer different steaming control according to whether the garment care device 100D is being used for (e.g. horizontal) ironing or (e.g. vertical) steaming of a hanging fabric or garment. Continuous steaming in the first state is considered to be preferred by the user for steaming a hanging fabric or garment. It is for this reason that the primary conditions in this example include the additional requirement that the second

sensing unit 132 detects that the angular position A1 is larger than the given angle threshold A2.

[0114] This additional condition is to allow steam release only when soleplate is in vertical orientation after user has entered the so called vertical steaming mode by the long press of button.

[0115] It is noted that this is distinct from certain conventional solutions in which, for safety reasons, continuous steaming is stopped when the soleplate exceeds an equivalent of the given angle threshold A2. Such safety considerations may not apply in the present example because of the other primary conditions which are required to be fulfilled in order for the controlling means 120 to adopt the first state.

[0116] The given angle threshold A2 is at least 20 degrees, preferably in the range of 20°C to 40°C, e.g. 30°C, compared to the horizontal.

[0117] This range for the given angle threshold A2 reflects that the first state is triggered by an inclined orientation away from the horizontal, and may also assist to prevent unintentional triggering of the first state resulting from the soleplate 108 being positioned, e.g. seated, on an inclined base/cradle.

[0118] The second sensing unit 132 can include any suitable sensor for measuring the angular position A1, in other words tilt angle, of the soleplate 108. For example, the second sensing unit 132 comprises an accelerometer, such as a micro electromechanical system (MEMS) accelerometer.

[0119] Such an accelerometer, e.g. MEMS accelerometer, permits measurement of acceleration along vertical and horizontal axes to derive the tilt angle A1 of the soleplate 108.

[0120] The angle measurement is preferably a static measurement, in that no comparison is made with previous measurements.

[0121] Preferably, the additional condition that after the first time duration, the second sensing unit 132 detects that the angular position A1 is larger than the given angle threshold A2 is fulfilled when the angular position A1 is larger than the given angle threshold A2 for at least a given minimum time duration.

[0122] The given minimum time duration can assist to ensure stability of the angular position A1 measurement. The given minimum time duration is preferably in the range of 100 to 500 ms, such as 200 ms.

[0123] When, for example, the second sensing unit 132 comprises the MEMS accelerometer, and the given angle threshold A2 is at least 20 degrees, preferably in the range of 20°C to 40°C, preferably 30°C, compared to the horizontal, the given minimum time duration being in the range of 100 to 500 ms, preferably 200 ms, may ensure stability of the detected signal. This is because sufficient sampling, e.g. more than 20 samples, can be held during such a time duration.

[0124] As described above, the processing unit 130 is, in certain examples, adapted to set the controlling means 120 in the first state again if the secondary condition that

the first sensing unit 128 detects that, within the second time duration, the user is holding the at least part of the garment care device 100D again. This is so that continuous steaming can be resumed. When the garment care device 100D includes the second sensing unit 132, the secondary conditions preferably also include the condition that during the second time duration, the second sensing unit 132 detects that the angular position A1 of the overall flat surface 109 of the soleplate 108 compared to the horizontal surface HS is larger than the given angle threshold A2.

[0125] Thus, tilting of the soleplate 108 sufficiently so that the given angle threshold A2 is exceeded can be conveniently used as one of the secondary conditions which permit resumption of continuous steaming via the first state of the controlling means 120 following a temporary pause or interruption.

[0126] At this point it is noted that the design in which the second sensing unit 132 is included in the garment care device 100D can also be applied to the designs depicted in Figs. 1 and 2 in which a base 112 is included in the garment care device 100A, 100B. For example, and similarly to the garment care device 100D shown in Fig.4, the second sensing unit 132 can be included in the hand unit 114 of the garment care device 100A, 100B.

[0127] Similar considerations are applicable to the third sensing unit 134 described herein below, since the third sensing unit 134 can also be incorporated into either of the designs depicted in Figs. 1 and 2, for instance by including the third sensing unit 134 in the hand unit 114 of the garment care device 100A, 100B.

[0128] The garment care device 100D preferably comprises such a third sensing unit 134 configured to measure movement of the garment care device 100D, in other words at least part of the garment care device 100D. In the non-limiting example shown in Fig.4, the third sensing unit 134 is included in the hand unit 114.

[0129] Whilst the third sensing unit 134 is included in addition to the second sensing unit 132 in the example depicted in Fig.4, this is not intended to be limiting. In other examples, the third sensing unit 134 is included as an alternative to the second sensing unit 132, or the second sensing unit 132 is included as an alternative to the third sensing unit 134.

[0130] When the third sensing unit 134 is included in the garment care device 100D, the primary conditions also include the additional condition that after the first time duration, the third sensing unit 134 detects a movement having a first value larger than a first movement threshold.

[0131] This may assist to improve the responsiveness of, and thus improve the user's experience of using, the garment care device 100D by the steam exiting the steam vents 110 provided, e.g. as soon as, the user is moving the at least part of the garment care device 100D.

[0132] Movement detection by the third sensing unit 134 may be a dynamic measurement in which each sample is compared to the previous sample, and movement

is detected by determining whether or not the change between the samples is above a certain threshold.

[0133] The third sensing unit 134 can include any suitable motion sensor for sensing movement of the at least part of the garment care device 100D. For example, the third sensing unit 134 comprises an accelerometer, such as a micro electromechanical system (MEMS) accelerometer.

[0134] The accelerometer can be the same as or different from the accelerometer described above in relation to the second sensing unit 132, in examples in which the garment care device 100D comprises the second sensing unit 132 and the third sensing unit 134.

[0135] When such an accelerometer is included in the third sensing unit 134, the movement detected by the third sensing unit 134 is an acceleration, and the additional condition is that the acceleration detected by the third sensing unit 134 is larger than a first acceleration threshold; the latter corresponding to the above-mentioned first movement threshold.

[0136] In a non-limiting example, movement is detected by measuring the acceleration in any one of three orthogonal axes. A detection algorithm thus checks for acceleration values along the X-axis, Y-axis, and Z-axis respectively. If acceleration, or change in acceleration, along any of these axes is greater than the first acceleration threshold, or first acceleration change threshold, for a sufficient time duration, the acceleration-related condition is fulfilled.

[0137] For instance, if an acceleration exceeds a first acceleration threshold in the range of 5 to 20 milli g, preferably 10 milli g, during at least 50 to 500 milliseconds, preferably 100 milliseconds, the acceleration-related additional condition is fulfilled. It is noted these milli g values can be converted to S.I. units by noting that 1 milli g = 0.001 g; and 1 g = 9.81m/s².

[0138] The acceleration-related additional condition and the angular orientation-related additional condition can also be used in combination when the third sensing unit 134 and the second sensing unit 132 respectively are included in the garment care device 100D.

[0139] Thus, the controlling means 120 are controlled by the processing unit 130 to adopt the first state provided that the angular position A1 is larger than the given angle threshold A2, e.g. more than 30°, and provided that the movement has a first value larger than the first movement threshold. Employing movement detection in the primary conditions in this manner assists to ensure that steaming in the first state is not triggered when the at least part of the garment care device 100D, e.g. the hand unit 114, is stationary but docked in a base/cradle at an angle which causes the angular position A1 to exceed the given angle threshold A2. In this respect, docking of the hand unit 114 can be, for instance, at an angle exceeding 40°, such as 43°.

[0140] As described above, the processing unit 130 can be adapted to set the controlling means 120 in the first state again if the secondary condition that the first

sensing unit 128 detects that, within the second time duration, the user is holding the at least part of the garment care device 100D again. This is so that continuous steaming can be resumed. When the garment care device 100D includes the third sensing unit 134, the secondary conditions preferably also include the condition that, during the second time duration, the third sensing unit 134 detects a movement having a second value which is larger than a second movement threshold.

[0141] Thus, moving the at least part of the garment care device 100D sufficiently so that the second movement threshold is exceeded can be conveniently used as one of the secondary conditions which permit resumption of continuous steaming via the first state of the controlling means 120 following a temporary pause or interruption.

[0142] In a non-limiting example, the first movement threshold is the same as the second movement threshold, such that a first or second movement of sufficient magnitude can exceed both movement thresholds.

[0143] In other examples, the second movement threshold is greater than the first movement threshold so that resumption of steaming in the second/steaming mode following a pause is required to be triggered by a more pronounced movement of the at least part of the garment care device 100D.

[0144] More generally, the processing unit 130 is preferably adapted to maintain the controlling means 120 in the first state as long as the third sensing unit 134 detects that the movement of the garment care device 100D, in other words at least part of the garment care device 100D, is above a third movement threshold.

[0145] The third movement threshold can, for example, be lower than the first movement threshold and/or the second movement threshold. This means that steam can continue to be released by the controlling means 120 being in the first state even when there are only relatively small movements of the at least part of the garment care device 100D being detected. This may assist the garment care device 100D to continue to supply steam continuously when, for example, the user holds the hand unit 114 in one place over a fabric in order to remove a stubborn wrinkle.

[0146] Fig.5 provides a perspective view of a hand unit 114 of a garment care device 100A, 100B, 100C, 100D. In this non-limiting example, the first sensing unit 128, the second sensing unit 132, and the third sensing unit 134 are assembled into the handle 126 of the hand unit 114.

[0147] More generally, by locating one or more of the sensing unit(s) 128, 132, 134 in the handle 126, the risk of damaging such components, for example by heat from the steam generator 104/steam chamber 118, or as a result of water leaking from the water tank 102, may be reduced.

[0148] A printed circuit board assembly 136 comprising the sensor of the second and third sensing units 132, 134, e.g. the above-described accelerometer, is mount-

ed in the handle 126 within a first housing part 138.

[0149] The printed circuit board assembly 136 further comprises electronics included in the first sensing unit 128. In this example, the first sensing unit 128 comprises a capacitive sensor. A capacitive flex 140 of the capacitive sensor is built inside the top cover 137 of the handle 126. The capacitive flex 140 is disposed on top of a second housing part 142 which, together with the first housing part 138, encloses the printed circuit board assembly 136. An elastomeric or rubber material 144 is also included to fill up the air gap which would otherwise be present within the top cover 137 of the handle 126.

[0150] Fig.6 provides a flowchart of a non-limiting exemplary method of controlling steam generation in a garment care device 100D. Decision box 200 of the control logic depicted in Fig.6 corresponds to whether or not the button 124 is actuated, e.g. pressed, for longer than the first time duration D1, e.g. 2 seconds.

[0151] If the answer to decision box 200 is "No", alternative modes can, for example, be offered to the user in box 202, such as Manual, Auto, Speed. These options can, for example, be provided, e.g. looped, via a suitable user interface. The user interface can include an indicator, such as a light emitting diode (LED), which indicates the alternative mode selected by the user. This is represented in box 204.

[0152] For example, the speed mode is indicated by the LED being continuously illuminated, the auto mode is indicated by the LED flashing or blinking, and the manual mode is indicated by the LED not being illuminated. Other suitable ways of representing the modes of the garment care device 100D can be considered.

[0153] If the answer to decision box 200 is "Yes", this can optionally be indicated via the user interface in box 206. This provides feedback to the user that they have actuated the button 124 for more than the first time duration D1. For example, an LED can flash or blink and/or a buzzer can provide an audible indication, such as a beep.

[0154] Decision box 208 corresponds to whether or not the user is detected to be holding the garment care device 100D. This makes use of the first sensing unit 128, which can comprise a touch sensor, e.g. a capacitive touch sensor, as previously described.

[0155] If the answer to decision box 208 is "No", the control logic proceeds to decision box 210. Decision box 210 corresponds to if the user has been detected as not holding the garment care device 100D for more than the second time duration D2.

[0156] If the answer to decision box 210 is "Yes", the control logic returns to decision box 200. This means that the user is required to actuate the button 124 for longer than the first time duration if the user wishes to go back to the decision box 208.

[0157] If the answer to decision box 210 is "No", the control logic returns to decision box 208.

[0158] If the answer to decision box 208 is "Yes", the control logic proceeds to decision box 212. Decision box

212 corresponds to whether or not the angular position A1 of the overall flat surface 109 of the soleplate 108 exceeds the given angle threshold A2, e.g. 30°. This makes use of the second sensing unit 132, which may comprise an accelerometer, as previously described.

[0159] If the answer to decision box 212 is "No", the control logic returns to decision box 212 via a loop.

[0160] If the answer to decision box 212 is "Yes", the control logic proceeds to decision box 214. Decision box 214 corresponds to whether or not a movement of at least part of the garment care device 100D has a first value MV1 which is larger than a first movement threshold MV1_TH. This makes use of the third sensing unit 134, which may comprise an accelerometer, e.g. the same accelerometer as included in the second sensing unit 132, as previously described.

[0161] Alternatively, the decision is whether or not a movement of at least part of the garment care device 100D has a second value MV2 larger than a second movement threshold MV2_TH, as previously described in respect of the secondary conditions for resuming steaming following a temporary pause.

[0162] If the answer to decision box 214 is "No", the control logic returns to decision box 214 via a loop.

[0163] If the answer to decision box 214 is "Yes", the control logic proceeds to box 216. Box 216 corresponds to the controlling means 120 adopting the first state such that steam exits the steam vents 110.

[0164] Decision box 218 corresponds to whether or not the user is detected, via the first sensing unit 128, to be holding the garment care device 100D while the steam is exiting the steam vents 110.

[0165] If the answer to decision box 218 is "Yes", the control logic returns to box 216 via a loop, and the steam continues to exit the steam vents 110.

[0166] If the answer to decision box 218 is "No", the control logic proceeds to box 220. Box 220 corresponds to adoption of the second state by the controlling means 120, such that the steam no longer exits the steam vents 110. This may, for example, be a pause in the exiting of steam from the steam vents 110.

[0167] The control logic then proceeds to decision box 208 and the paused steaming is either resumed via "Yes" answers to decision blocks 208, 212 and 214, or the control logic returns, via "No" and "Yes" answers to decision blocks 208 and 210 respectively, to decision block 200. In the latter scenario, the user is once again required to actuate, e.g. press, the button 124 for more than the first time duration D1 should the user wish for the controlling means 120 to (re-)adopt the first state such that steam exits the steam vents 110.

[0168] The above embodiments as described are only illustrative, and not intended to limit the technique approaches of the present invention. Although the present invention is described in details referring to the preferable embodiments, those skilled in the art will understand that the technique approaches of the present invention can be modified or equally displaced without departing from

the protective scope of the claims of the present invention. In particular, although the invention has been described based on a garment care device, it can be applied to any household device having a steam generator. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A garment care device (100A, 100B, 100C, 100D) comprising:

- a water tank (102) for containing water,
- a steam generator (104) in fluid communication with the water tank for generating steam,
- a soleplate (108) defining an overall flat surface (109) comprising a plurality of steam vents (110) in fluid communication with the steam generator,
- controlling means (120) for controlling the flow of steam exiting the steam vents, the controlling means being adapted to take a first state resulting in steam exiting the steam vents, and a second state resulting in steam not exiting the steam vents,
- a button (124) adapted to be actuated by a user of said garment care device,
- a first sensing unit (128) for detecting if said user is holding or not said garment care device,
- a processing unit (130) connected to said button and to said first sensing unit, said processing unit being adapted to set the controlling means in said first state if the following primary conditions are fulfilled:

- said button has been continuously pressed by said user during at least a first time duration (D1), and
- after said first time duration (D1), said first sensing unit detects that the user is holding the garment care device.

2. A garment care device (100A, 100B, 100C, 100D) as claimed in claim 1, wherein said controlling means (120) comprise:

- a valve (122) arranged between the steam generator (104) and the steam vents (110), or
- a pump (106) arranged between the water tank (102) and the steam generator (104).

3. A garment care device (100A, 100B, 100C, 100D) as claimed in claim 1 or claim 2, wherein said garment care device further comprises a second sensing unit (132) connected to said processing unit (130) for measuring an angular position (A1) of said overall

flat surface (109) compared to a horizontal surface (HS), wherein said primary conditions also include the following additional condition:

- after said first time duration (D1), the second sensing unit detects that said angular position is larger than a given angle threshold (A2). 5
- 4. A garment care device (100A, 100B, 100C, 100D) as claimed in claim 3, wherein the additional condition that after said first time duration, the second sensing unit (132) detects that said angular position (A1) is larger than said given angle threshold (A2) is fulfilled when the angular position is larger than said given angle threshold for at least a given minimum time duration. 10
- 5. A garment care device (100A, 100B, 100C, 100D) as claimed in claim 3 or claim 4, further comprising a third sensing unit (134) for measuring movement of said garment care device, wherein said primary conditions also include the following additional condition: 15
 - after said first time duration (D1), the third sensing unit detects a movement having a first value (MV1) larger than a first movement threshold (MV1_TH). 20
- 6. A garment care device (100A, 100B, 100C, 100D) as claimed in any one of the preceding claims, wherein said processing unit (130) is adapted to set the controlling means (120) in said second state if said first sensing unit (128) detects that at a certain time, the user is not holding said garment care device anymore. 25
- 7. A garment care device (100A, 100B, 100C, 100D) as claimed in claim 6, wherein said processing unit (130) is adapted to set the controlling means (120) in said first state again if the following secondary conditions are fulfilled: 30
 - said first sensing unit (128) detects that within a second time duration (D2) starting from said certain time, the user is holding the garment care device again. 35
- 8. A garment care device (100A, 100B, 100C, 100D) as claimed in claim 7, wherein said secondary conditions also include the following condition: 40
 - during said second time duration (D2), the second sensing unit (132) detects that the angular position (A1) of said overall flat surface (109) compared to the horizontal surface (HS) is larger than said given angle threshold (A2). 45

9. A garment care device (100A, 100B, 100C, 100D) as claimed in claim 7 or claim 8, wherein said secondary conditions also include the following condition:

- during said second time duration (D2), the third sensing unit (134) detects a movement having a second value (MV2) larger than a second movement threshold (MV2_TH). 50

10. A garment care device (100A, 100B, 100C, 100D) as claimed in claim 5, wherein said processing unit (130) is adapted to maintain the controlling means (120) in said first state as long as said third sensing unit (134) detects that the movement of said garment care device is above a third movement threshold. 55

11. A garment care device (100A, 100B, 100C, 100D) as claimed in any one of the preceding claims, wherein said processing unit (130) is adapted to set the controlling means (120) in said second state as soon as said button (124) is actuated by the user. 60

12. A garment care device (100A, 100B, 100C, 100D) as claimed in any one of the preceding claims, wherein the first time duration (D1) is in the range of 1 to 5 seconds. 65

13. A garment care device (100A, 100B, 100C, 100D) as claimed in any one of the preceding claims, wherein the first sensing unit (128) comprises a capacitive sensor configured to detect when the user is touching the garment care device. 70

14. A method of controlling steam generation in a garment care device (100A, 100B, 100C, 100D) comprising: 75

- a water tank (102) for containing water,
- a steam generator (104) in fluid communication with the water tank for generating steam,
- a soleplate (108) defining an overall flat surface (109) comprising a plurality of steam vents (110) in fluid communication with the steam generator,
- controlling means (120) for controlling the flow of steam exiting the steam vents, the controlling means being adapted to take a first state resulting in steam exiting the steam vents, and a second state resulting in steam not exiting the steam vents,
- a button (124) adapted to be actuated by a user of said garment care device,
- a first sensing unit (128) for detecting if said user is holding or not said garment care device,
- said method comprising the step of setting the controlling means in said first state if the following primary conditions are fulfilled: 80

- said button has been continuously pressed by said user during at least a first time duration (D1), and
- after the first time duration (D1), said first sensing unit detects that the user is holding the garment care device.

- 15.** Computer program product comprising instructions codes which, when executed by the processing unit (130) of the garment care device (100A, 100B, 100C, 100D) according to any one of claims 1 to 13, cause the garment care device to implement the method as claimed in claim 14.

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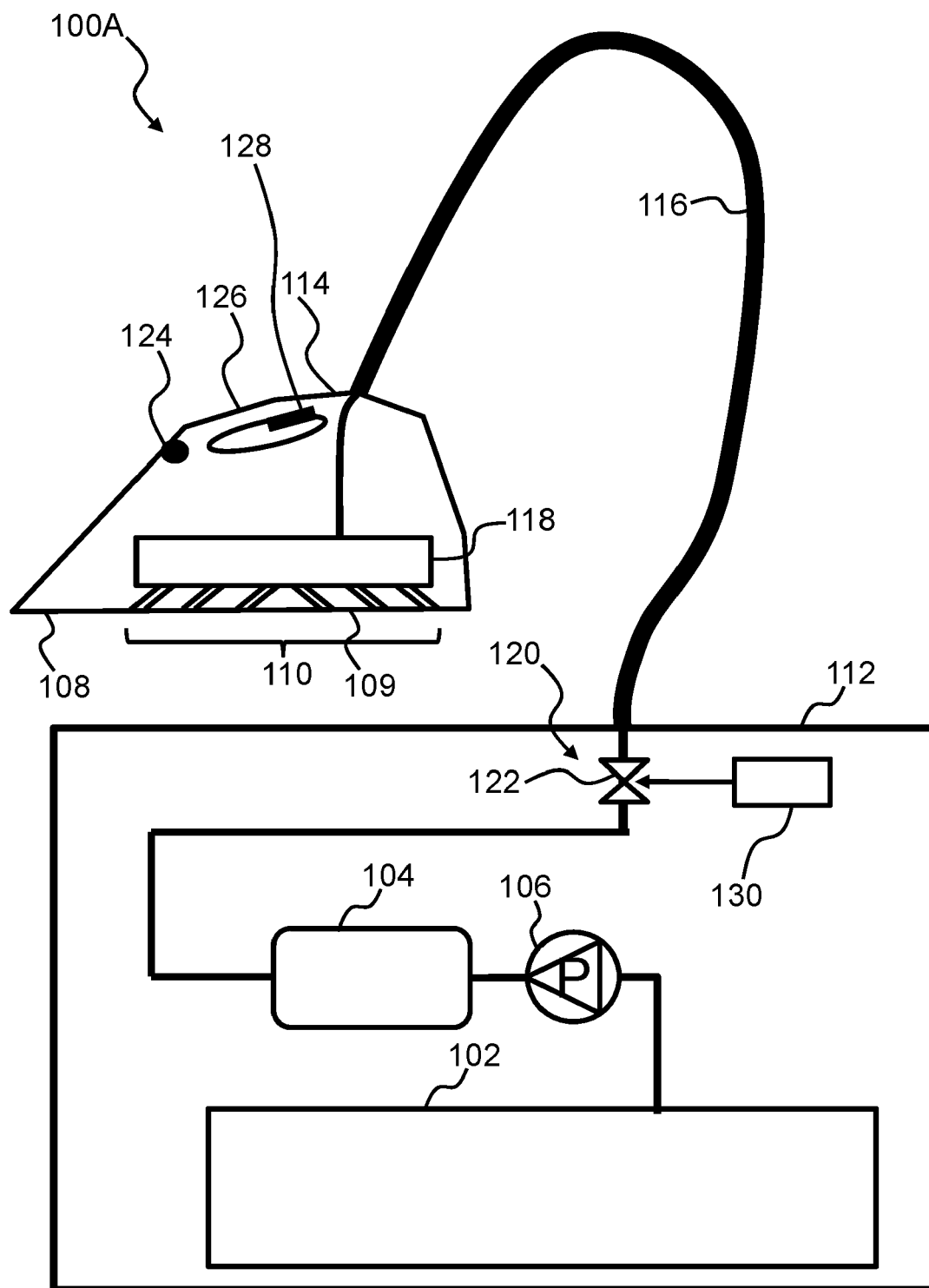


FIG.1

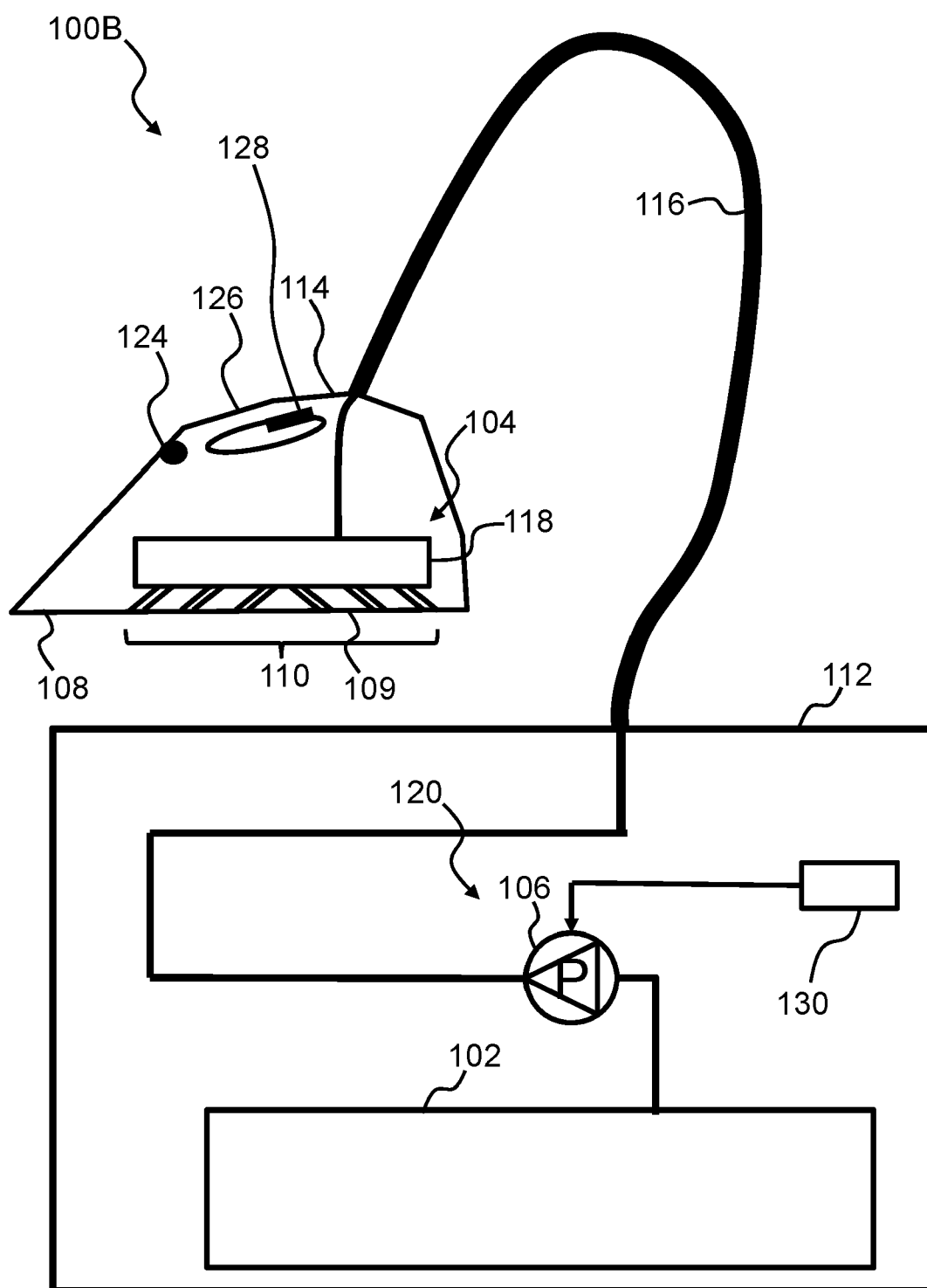


FIG.2

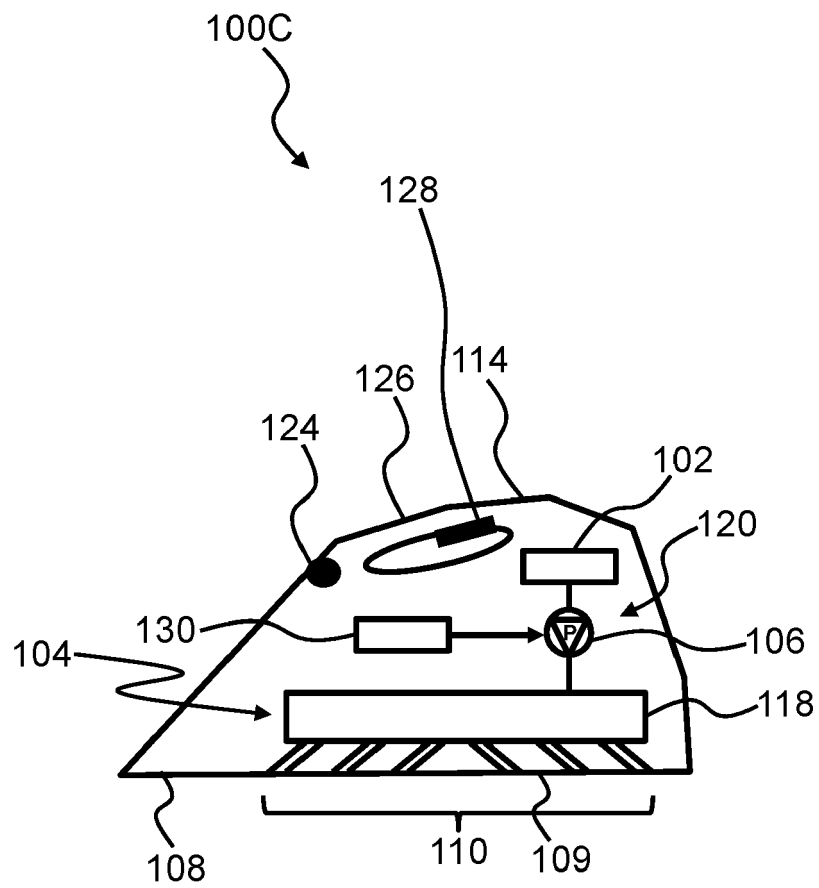


FIG.3

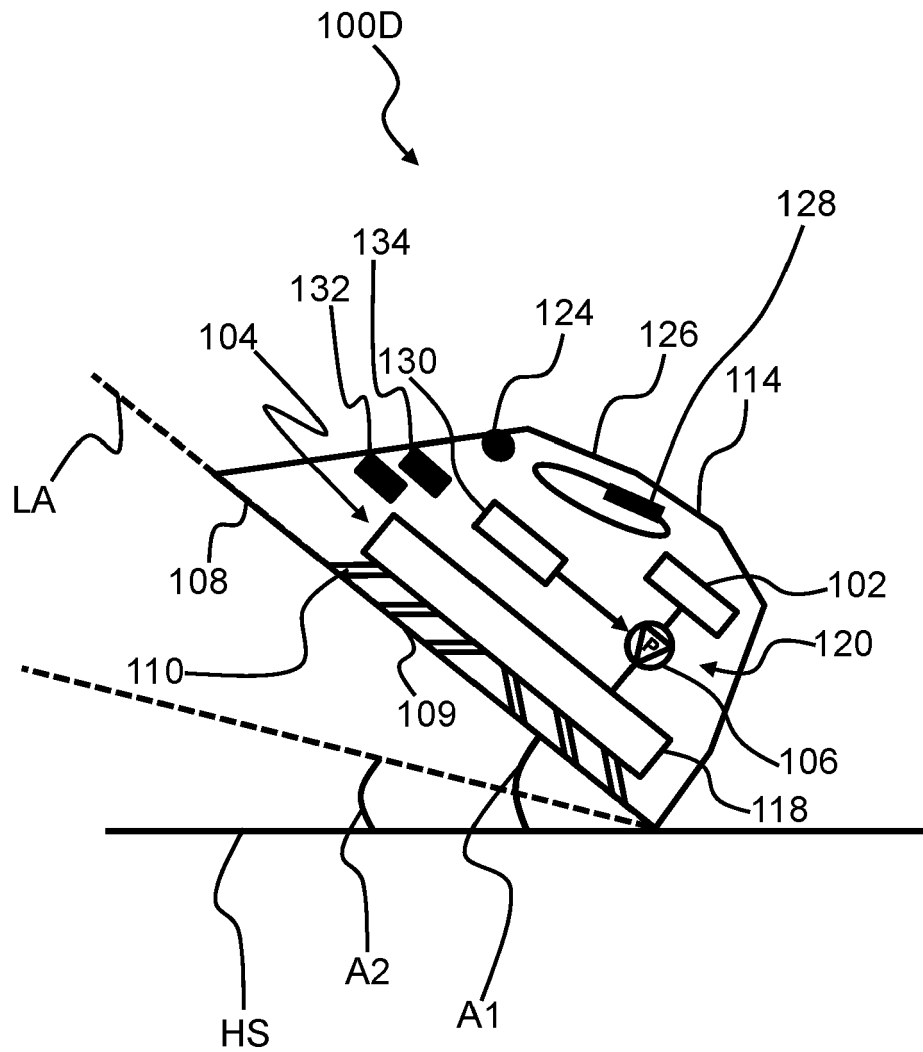


FIG.4

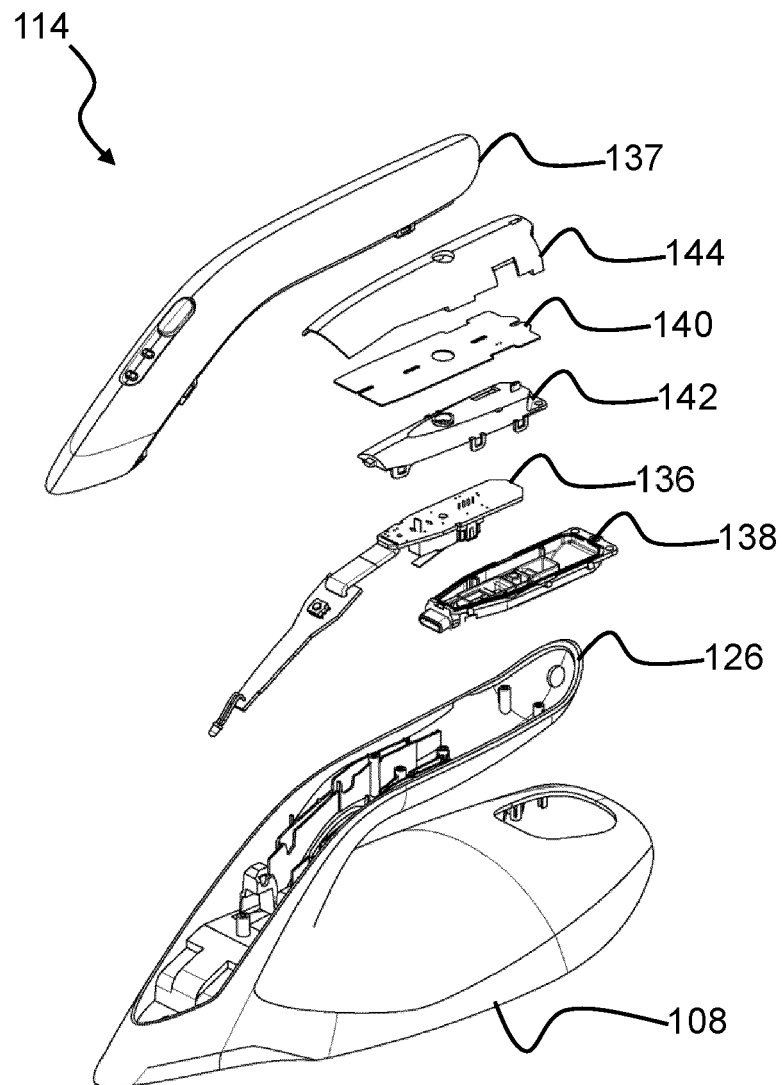


FIG.5

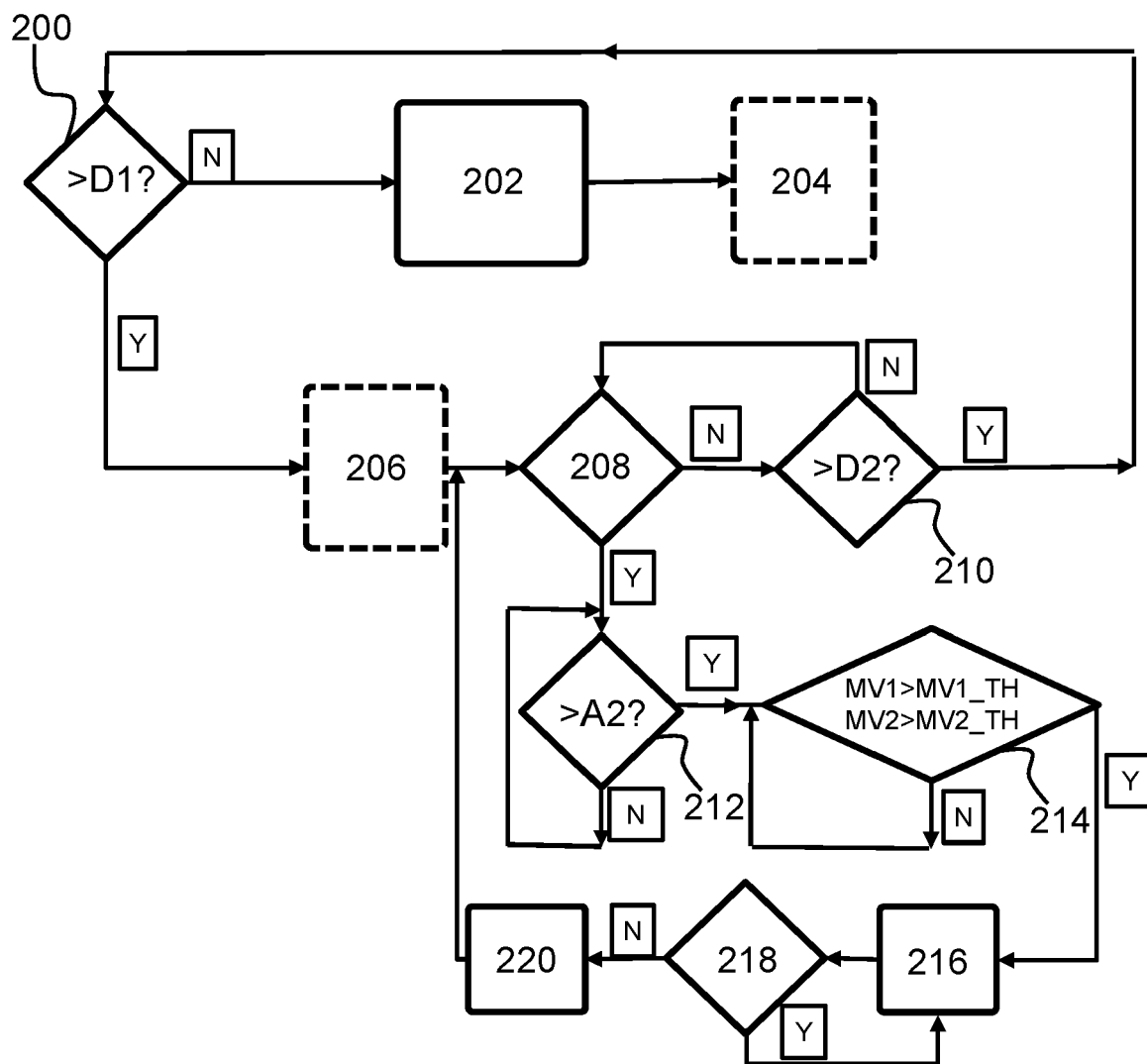


FIG.6



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 21 1770

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Place of search Munich		Date of completion of the search 7 May 2021	Examiner Weidner, Maximilian
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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