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(54) **GARMENT CARE DEVICE WITH MOVEMENT SENSOR**

(57) The invention relates to a garment care device (100) comprising a sensor (101) for generating an output signal characterizing a movement of said garment care device, and a control unit (102) coupled to said sensor (101). The control unit (102) is adapted to identify and compare characteristics of said output signal to characteristics of a predefined displacement pattern, and to adjust at least one operating parameter of the garment care device based on the result of the comparison between characteristics of said output signal and characteristics of said predefined displacement pattern.

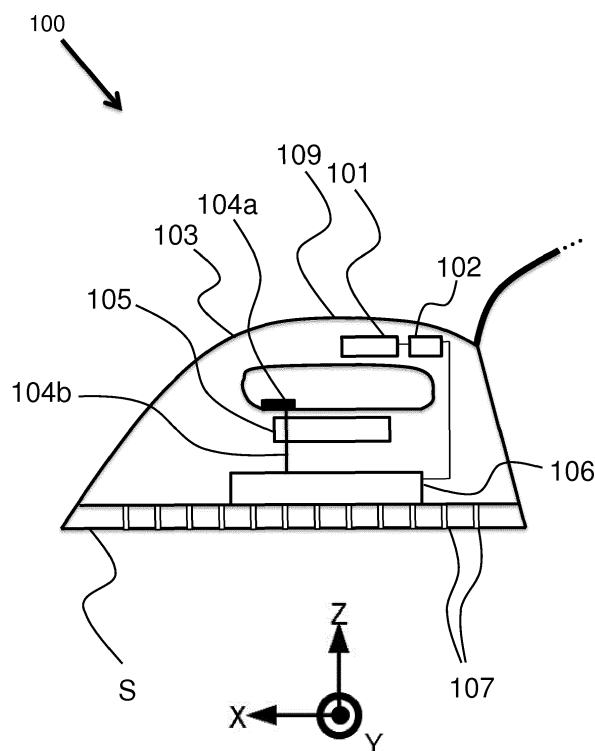


FIG.1

Description

FIELD OF THE INVENTION

[0001] The invention relates to the field of garment care.

BACKGROUND OF THE INVENTION

[0002] In the field of garment care, some known steam iron products are equipped with a ball sensor which allows determining between a first position (for example horizontal) and a second position (for example vertical). This type of sensor is mainly used for safety purposes. For example, if the ball sensor is identified being in the first position (for example horizontal) for a period duration above a certain threshold, the power supply of the device is automatically turned-off to avoid the ironing table or garments being burnt. For example, if the ball sensor is identified being in the second position (for example vertical), the steam generation is stopped to avoid user gets injured by the hot steam.

[0003] However, this type of ball sensor has some obvious limitations linked to the fact that it can only detect a binary change of position of the device.

SUMMARY OF THE INVENTION

[0004] It is an object of the invention to propose a garment care device that avoids or mitigates above-mentioned problems.

[0005] The invention is defined by the independent claims. The dependent claims define advantageous embodiments.

[0006] To this end, the garment care device according to the invention comprises:

- a sensor for generating an output signal characterizing a movement of the garment care device,
- a control unit coupled to the sensor, the control unit being adapted to:

- a) identify and compare characteristics of the output signal to characteristics of a predefined displacement pattern,
- b) adjust at least one operating parameter of the garment care device based on the result of the comparison between characteristics of the output signal and characteristics of said predefined displacement pattern.

[0007] Adjusting an operating parameter of the garment care device while taking into account the movement of the garment care device comparatively to a predefined displacement pattern, allows having optimal setting of operating modes of the device. In particular, user gesture recognition can be used to influence the ironing parameters accordingly. With this solution, the ironing param-

eters are improved without sacrificing the garment safety.

[0008] The invention also relates to a corresponding method of adjusting at least one operating parameter in a garment care device.

[0009] Detailed explanations and other aspects of the invention will be given below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] 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 first embodiment of a garment care device according to the invention,
Figs. 2A-2B illustrate examples of signals generated by an accelerometer used as sensor in a garment care device according to the invention,
Fig. 3 depicts a second embodiment of a garment care device according to the invention,
Fig. 4 shows example readings from a sensor of the type accelerometer used in a garment care device according to the invention when being rested and oriented in three different orientations,
Fig. 5 shows example readings from a sensor of the type accelerometer used in a garment care device according to the invention when being moved in three different orientations,
Fig. 6 depicts a third embodiment of a garment care device according to the invention,
Fig. 7 depicts a fourth embodiment of a garment care device according to the invention,
Figs. 8A-8B-8C-8D illustrate various predefined displacement patterns used as a reference in a garment care device according to the invention,
Fig. 9 depicts a flow chart of a method according to the invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0011] Fig. 1 depicts a first embodiment of a garment care device 100 according to the invention.

[0012] The garment care device 100 comprises a sensor 101 for generating an output signal characterizing a movement of said garment care device 100.

[0013] The garment care device 100 also comprises a control unit 102 coupled to the sensor 101.

[0014] The control unit 102 is adapted to identify and compare characteristics of the output signal to characteristics of a predefined displacement pattern.

[0015] The control unit 102 is also adapted to adjust at least one operating parameter of the garment care device 100 based on the result of the comparison between characteristics of said output signal and characteristics of said predefined displacement pattern.

[0016] It is understood that the sensor 101 may also

comprise a processing unit (not shown) to generate output signal. Alternatively, the processing unit may correspond to the control unit 102.

[0017] In order to provide a more efficient ironing experience, garment care device constructed in accordance with the present invention are provided with a sensor capable of measuring orientation and/or motion data which can be used to adjust one or more operating parameters of the garment care device, or to activate or deactivate particular functions that may assist the user of the garment care device or improve safety aspects of the iron.

[0018] While embodiments of the invention are described in relation to steam irons (i.e. irons capable of generating and ejecting steam towards a garment), it will be appreciated that the scope of the invention is not limited to steaming devices, and intended to cover irons without steam generating functionality.

[0019] The garment care device 100 includes a body 103 and a handle 109. Preferably, the sensor 101 is arranged in a handle 109.

[0020] By locating the sensor 101 and/or control unit 102 in the handle 109, the risk of damaging those components, for example as a result of water leaking from the reservoir 105, maybe reduced. Furthermore, an additional protective housing (not shown) may provide additional protection to the sensor 101 and/or control unit 102.

[0021] For example, to generate steam, the garment care device depicted in Fig. 1 comprises a water tank 105, a steam generator 106 receiving water from the reservoir 105. The steam generated in the steam generator 106 exits via steam vents 107 in the soleplate S. In order to control the amount of steam generated, a steam mode selector 104a is manually actuated by user. The movement of steam mode selector 104a results in a movement of a dosing pin 104b. The dosing pin 104b thus moves up or down to vary the amount of water entering into the steam chamber.

[0022] For example, the sensor 101 is an accelerometer of the type Micro ElectroMechanical Systems (MEMS) which is adapted to generate at least one acceleration signal along any axis X, Y, Z forming an orthonormal reference, with Z corresponding to a vertical direction, and X-Y forming a horizontal plan.

[0023] The orientation of the garment care device may be measured in terms of axis X, axis Y, and axis Z. When the garment care device 100 is being used to press a garment on a surface (such as an ironing board) with soleplate S, the garment care device 100 may be considered to be in a horizontal position X-Y. In other words, the iron 100 is oriented as such that the surface of the soleplate S is substantially in the X-Y plane. When a user stands the garment care device 100 on its end, such that the soleplate S does not touch a garment on an ironing board, for example, then the garment care device 100 may be considered to be orientated such that the surface of the soleplate S is in a plane substantially perpendicular

to the X-Y plane. In this orientation, the garment care device 100 may be considered to be "upright". In addition to these two specific orientations, the sensor is capable of determining an orientation and movement of the iron 100 in any other orientation.

[0024] The movement of the garment care device 100 can be measured in terms of the change in position of the garment care device 100 along the X axis, Y axis and/or the Z axis. In addition to the direction of motion of the garment care device 100, an amount of movement (e.g. an absolute and/or relative distance) can be measured. A speed of movement of the iron 100 may also be measured by the sensor 101.

[0025] The control unit 102 is configured to adjust an operating parameter of the garment care device 100 based on a predetermined relationship between the measured orientation and/or the identified motion of the garment care device and predefined displacement pattern. To this end, the garment care device 100 may include storage means, such as a memory, for storing a database or look-up table. The database or look-up table may include a plurality of relationships, each relationship defining an operating parameter adjustment to be made responsive to a determination that the garment care device is in a particular orientation and/or that the garment care device has moved in a particular way.

[0026] The orientation and the motion of the garment care device 100 are discussed below with reference to Figs. 4 and 5.

[0027] Fig. 4 shows example readings from a sensor 101 of the type accelerometer used in a garment care device 100 according to the invention when being rested and oriented in three different orientations.

- The first row (a) shows accelerometer data measured in the X, Y and Z directions when the garment care device is in a "horizontal" orientation (e.g. when the garment care device is oriented with the surface of the soleplate S in contact with a horizontal surface, such as a garment to be pressed). In this orientation, the sensor 101 does not register a change from the calibrated level in the X or Y-directions, but does register a measurement (equivalent to the Earth's gravitational pull having value $1\text{ g} = 9.81\text{ m/s}^2$) in the Z-direction.
- In row 4b, the garment care device is inclined with respect to the horizontal surface (e.g. the ironing board), which may be typical if the garment care device is based in a dock or on a base unit. In this orientation, the sensor 101 measures no acceleration along the y axis, but measures some acceleration along both the X axis and the Z axis.
- In row 4c, the garment care device is in an "upright" position, in which the garment care device is oriented such that the surface of the soleplate S may be substantially vertical. In this orientation, the accelerometer 120 measures an acceleration equivalent to the gravitational pull of the earth along the -X axis, but

measures no acceleration along either the Y axis or the Z axis.

[0028] Fig. 5 shows example readings from a sensor 101 of the type accelerometer used in a garment care device 100 according to the invention when being moved in three different orientations.

[0029] The garment care device 100 is considered to be held "horizontally" (i.e. in the X-Y plane), and moved in the directions indicated by the arrows.

- In row (a), the garment care device 100 is shown to be moving forwards and backwards (e.g. along the X axis, in a +X direction, then a -X direction, then a +X direction, and so on). With this motion, the sensor 101 measures acceleration along the Z axis equivalent to the Earth's gravitational pull, but measures no acceleration along the Y axis. The acceleration measured by the sensor 101 along the X axis varies as the garment care device is moved one way then the other.
- Row (b) represents movement of the garment care device from side to side, along the Y axis. Again, the sensor measures acceleration along the Z axis equivalent to the Earth's gravitational pull, but measures no acceleration along the X axis. In this example, however, the acceleration along the Y axis varies as the garment care device moves one way (in the +Y direction) then the other way (in the -Y direction) along the Y axis.
- Row (c) is representative of the garment care device being moved diagonally in the X-Y plane. The acceleration along the Z axis is equivalent to the Earth's gravitational pull. However, in this example, the acceleration measured along the X axis and the Y axis varies as the garment care device is moved diagonally one way, then the other.

[0030] Preferably, the predefined displacement pattern corresponds to the amount of an average linear displacement along a given direction D of the garment care device 100. For example, the given direction D corresponds to X axis, as illustrated in row (a) of Fig. 5.

[0031] In other words, the average linear displacement may correspond to an average value of a stroke length of a user using the garment care device.

[0032] By definition, the stroke length along a given direction D, corresponds to the linear distance of the garment care device between a starting position with zero speed, to the next position with zero speed.

[0033] By definition, the average value of a stroke length of a user is the average linear distance that allows classifying a stroke length between a short stroke and a long stroke. A short stroke is smaller than the average linear distance, a long stroke is larger than the average linear distance.

[0034] Fig. 2A is an illustration of an example of a signal AS generated by an accelerometer used in a garment

care device according to the invention.

[0035] The unit for the vertical axis of the graph is in milli g (or abbreviated as "mg"), with $1\text{ g} = 9.81\text{ m/s}^2$.

[0036] In the present case, the sensor 101 is an accelerometer, and the output signal generated by the sensor 101 is an acceleration signal AS varying along the time in the given direction D, such as, for example, the X axis.

[0037] The characteristics of the output signal correspond to the time interval d1 between two consecutive zero-crossing points of the output signal. The characteristics of the predefined signal correspond to a given duration threshold d0:

- If the measured time interval d1 is smaller than the given duration threshold d0, the stroke of the user using the garment care device is identified as a short stroke.
- If the measured time interval d1 is larger than the given duration threshold d0, the stroke of the user using the garment care device is identified as a long stroke.

[0038] The given duration threshold d0 corresponds to the average value of the time interval between two consecutive zero-crossing points of the output signal corresponding to an average value of a user's stroke length.

[0039] It is noted that in case the output signal generated by the sensor 101 contains a certain level of noise, for example +/- 50 mg, the time interval d1 between two consecutive zero-crossing points of the output signal should be calculated with an offset corresponding to the estimated value of the noise level. An example is illustrated in Fig. 2B.

[0040] Preferably, the given duration threshold d0 has a value in the range [200; 800] ms, preferably 550 ms.

[0041] Typically, an average value for a short stroke has is less than 20 cm, and an average value for a long stroke is more than 20 cm.

[0042] In the embodiment of Fig. 1, the control unit 102 is adapted to adjust at least one operating parameter of the garment care device 100, in particular adjust the temperature of the steam generator 106 such that:

- if the time interval d1 is larger than the given duration threshold d0, the control unit 102 is adapted to set the temperature of the steam generator 106 to a first temperature value T1. This means that long strokes of user are identified. In that case, a first temperature T1 is set for the steam generator 106.
- if the time interval d1 is smaller than the given duration threshold d0, the control unit 102 is adapted to set the temperature of the steam generator 106 to a second temperature value T2. This means that short strokes of user are identified. In that case, a second temperature T2 is set for the steam generator 106.

[0043] Adjusting the temperature of the steam generator also results in a variation of temperature of the sole-

plate S.

[0044] For example, $T_1 < T_2$, such as $T_1 = 175$ degrees and $T_2 = 180$ degrees. This selection of temperatures is relevant if it is primarily considered that short strokes reflect a situation in which user is ironing a relatively small area with tough wrinkles that requires higher temperature.

[0045] Alternatively, $T_1 > T_2$, such as $T_1 = 155$ degrees and $T_2 = 150$ degrees. This selection of temperatures is relevant if it is primarily considered that long strokes reflect a situation in which user is ironing a relatively large area over which higher thermal energy can be dissipated without burning the garments.

[0046] It is noted that the temperature difference of 5 degrees between T_1 and T_2 is just given as an example. More generally, the temperature absolute difference between T_1 and T_2 could be up to 30 degrees.

[0047] Fig. 3 depicts a second embodiment of a garment care device 300 according to the invention.

[0048] This second embodiment is based on the first embodiment of Fig. 1, at the difference that a water pump 110 is used to carry water from the water tank 105 to the steam generator 106.

[0049] The control unit 102 is adapted to adjust at least one operating parameter of the garment care device 300, in particular adjust the flow rate of the water pump 110 such that:

- if the time interval d_1 is larger than the given duration threshold d_0 , the control unit 102 is adapted to activate the water pump 110 with a first flow rate value FR_1 . This means that long strokes of user are identified. In that case, a first flow rate value FR_1 is applied to the water pump 110.
- if the time interval d_1 is smaller than the given duration threshold d_0 , the control unit 102 is adapted to activate the water pump 110 with a second flow rate value FR_2 . This means that short strokes of user are identified. In that case, a second flow rate value FR_2 is applied to the water pump 110.

[0050] Adjusting the flow rate value applied to the water pump allows varying the amount of steam that exits the steam vents 107.

[0051] For example, $FR_1 < FR_2$, such as $FR_1 = 25$ g/mn and $FR_2 = 31$ g/mn. This selection of flow rate is relevant if it is primarily considered that short strokes reflect a situation in which user is ironing a relatively small area with tough wrinkles that requires a higher amount of steam.

[0052] Alternatively, $FR_1 > FR_2$, such as $FR_1 = 45$ g/mn and $FR_2 = 40$ g/mn. This selection of flow rate is relevant if it is primarily considered that long strokes reflect a situation in which user is ironing a relatively large area over which higher amount of steam can be absorbed by the garments.

[0053] It is noted that the flow rate absolute difference between FR_1 and FR_2 is just given as an example. More

generally, the flow rate difference between could be up to 50 g/mn.

[0054] It is noted that in the embodiment of Fig. 3, the control unit 102 can also be adapted to adjust the temperature of the steam generator 106, similarly as in the embodiment of Fig. 1.

[0055] Fig. 6 depicts a third embodiment of a garment care device 600 according to the invention.

[0056] This embodiment comprises a mobile unit 601 cooperating with a base unit 602 via a hose cord 603. The base unit 602 comprises a water reservoir 604 and a water pump 605 for providing water as fluid in the hose cord 603. Water which reaches the mobile unit 601 is evaporated in a steam generator 606. The control unit 102 is preferably arranged in the base unit 602, and communicate with the sensor 101 via a wire embedded inside the hose cord 603. The hose cord 603 is also adapted to carry power supply to the steam generator 606.

[0057] The control unit 102 is adapted to adjust at least one operating parameter of the garment care device 600, in particular adjust the flow rate of the water pump 605 such that:

- if the time interval d_1 is larger than the given duration threshold d_0 , the control unit 102 is adapted to activate the water pump 110 with a first flow rate value FR_{11} . This means that long strokes of user are identified. In that case, a first flow rate value FR_{11} is applied to the water pump 110.
- if the time interval d_1 is smaller than the given duration threshold d_0 , the control unit 102 is adapted to activate the water pump 110 with a second flow rate value FR_{22} . This means that short strokes of user are identified. In that case, a second flow rate value FR_{22} is applied to the water pump 110.

[0058] For example, $FR_{11} < FR_{22}$, such as $FR_{11} = 50$ g/mn and $FR_{22} = 100$ g/mn. This selection of flow rate is relevant if it is primarily considered that short strokes reflect a situation in which user is ironing a relatively small area with tough wrinkles that requires a higher amount of steam.

[0059] Alternatively, $FR_{11} > FR_{22}$, such as $FR_{11} = 150$ g/mn and $FR_{22} = 100$ g/mn. This selection of flow rate is relevant if it is primarily considered that long strokes reflect a situation in which user is ironing a relatively large area over which higher amount of steam can be absorbed by the garments.

[0060] It is noted that the flow rate absolute difference between FR_{11} and FR_{22} is just given as an example. More generally, the flow rate difference between could be up to 100 g/mn.

[0061] It is noted that in the embodiment of Fig. 6, the control unit 102 can also be adapted to adjust the temperature of the steam generator 606, similarly as in the embodiment of Fig. 1.

[0062] Fig. 7 depicts a fourth embodiment of a garment care device 700 according to the invention.

[0063] This embodiment comprises a mobile unit 701 cooperating with a base unit 702 via a hose cord 703. The base unit 702 comprises a water reservoir 704, a boiler 707 and a water pump 705 for providing water into the boiler 707. The boiler 707 generates steam as fluid in the hose cord 703. Steam which reaches the mobile unit 701 is further heated in a steam generator 706. The control unit 102 is preferably arranged in the base unit 702, and communicate with the sensor 101 via a wire embedded inside the hose cord 703. The hose cord 703 is also adapted to carry power supply to the steam generator 706.

[0064] The control unit 102 is adapted to adjust at least one operating parameter of the garment care device 700, in particular the temperature of the boiler 707 such that:

- if the time interval d1 is larger than the given duration threshold d0, the control unit 102 is adapted to set the temperature of the boiler 707 to a first temperature value T11. This means that long strokes of user are identified.
- if the time interval d1 is smaller than the given duration threshold d0, the control unit 102 is adapted to set the temperature of the boiler 707 to a second temperature value T22. This means that short strokes of user are identified.

[0065] Adjusting the temperature of the boiler allows varying the amount of steam that is generated in the boiler 707.

[0066] For example, $T11 < T22$, such as $T11 = 140$ degrees and $T22 = 150$ degrees. This selection of temperatures is relevant if it is primarily considered that short strokes reflect a situation in which user is ironing a relatively small area with tough wrinkles that requires a higher amount of steam

[0067] Alternatively, $T11 > T22$, such as $T11 = 140$ degrees and $T22 = 130$ degrees. This selection of temperatures is relevant if it is primarily considered that long strokes reflect a situation in which user is ironing a relatively large area over which higher amount of steam can be absorbed by the garments.

[0068] It is noted that the temperature difference between T11 and T22 is just given as an example. More generally, the temperature absolute difference between T11 and T22 could be up to 25 degrees.

[0069] It is noted that in the embodiment of Fig. 7, the control unit 102 can also be adapted to adjust the temperature of the steam generator 706, similarly as in the embodiment of Fig. 1.

[0070] The embodiment of Fig. 7 may also comprise a valve 708 arranged at the exit of the boiler 707. The valve 708 is controlled by the control unit 102 to open more or less, in order to regulate the amount of steam exiting the boiler 707 and provided in the hose cord 703.

[0071] In this specific embodiment, the control unit 102 may also be adapted to adjust at least one operating parameter of the garment care device 700, in particular

the amount of steam that exits the boiler 707 such that:

- if the time interval d1 is larger than the given duration threshold d0, the control unit 102 is adapted to set the amount of steam that exits boiler 707 to a first steam rate value SR1. This means that long strokes of user are identified.
- if the time interval d1 is smaller than the given duration threshold d0, the control unit 102 is adapted to set the amount of steam that exits boiler 707 to a second steam rate value SR2. This means that short strokes of user are identified.

[0072] For example, $SR1 < SR2$, such as $SR1 = 100$ g/mn and $SR2 = 150$ g/mn. This selection of steam rate is relevant if it is primarily considered that short strokes reflect a situation in which user is ironing a relatively small area with tough wrinkles that requires a higher amount of steam.

[0073] Alternatively, $SR1 > SR2$, such as $SR1 = 180$ g/mn and $SR2 = 150$ g/mn. This selection of steam rate is relevant if it is primarily considered that long strokes reflect a situation in which user is ironing a relatively large area over which higher amount of steam can be absorbed by the garments.

[0074] It is noted that the steam rate absolute difference between SR1 and SR2 is just given as an example. More generally, the steam rate difference between could be up to 150 g/mn.

[0075] Figs. 8A-8B-8C-8D illustrate various predefined displacement patterns used as a reference in a garment care device according to the invention.

[0076] Preferably, in other embodiments of a garment care device 100, 300, 600, 700 according to the invention, the predefined displacement pattern corresponds to any one of the following displacement patterns:

- a given short repeated arc movements of the garment care device, as illustrated in Fig. 8A: this movement may reflect pressing garment in a region around a button.
- a given repeated circular or elliptical movement of the garment care device, as illustrated in Fig. 8B: this movement may reflect pressing a particularly wrinkled area of the garment.
- a given succession of elementary movements between an horizontal plan and a vertical plan, as illustrated in Fig. 8C: for example, the movement pattern corresponds to a change of position of the device from a horizontal position into an upright position, followed by a movement to tilt the device to one side.

[0077] Above reference displacement patterns are preferably stored in a memory. For example, the acceleration signal of each of those displacement patterns is stored. When the garment care device is in use, the output signal of the sensor 101 is successively compared to any one of those stored acceleration signals. If the

output signal of the sensor 101 matches with one of those stored acceleration signal, an operating parameter of the garment care device can be adjusted by the control unit as follows:

- if the displacement pattern of Fig. 8A is identified, the control unit 102 may adjust the operating parameter of the garment care device in order to increase the generation of steam, or trigger a burst of steam,
- if the displacement pattern of Fig. 8B is identified, the control unit 102 may adjust the operating parameter of the garment care device in order to increase the generation of steam, or trigger a burst of steam, or increase the temperature of the steam generator (so indirectly increase the temperature of the soleplate S.
- if the displacement pattern of Fig. 8C is identified: In a first example, the amount of steam generated is increased if the device is tilted to the right, and the amount of steam generated is decreased if the device is tilted to the left. In a second example, a first steaming mode (e.g. continuous steam) is triggered if the device is tilted to the right, and a second steaming mode (e.g. pulsed steam) is triggered if the device is tilted to the left.

[0078] Detecting the displacement pattern of Fig. 8A may be conducted as follows:

- 1) Y axis has pulse with a peak > 50mg and peak width of > 100ms, measured from the time it passes threshold of detection (>50 mg corresponding to the noise threshold, if any) going-up and threshold of detection going-down.
- 2) X axis has no considerable peak. Peak < 50mg (threshold of noise)
- 3) Preferably a minimum of two measurements that steps 1) and 2) is consecutively satisfied before the system recognize this sideways movement pattern.

[0079] Detecting the displacement pattern of Fig. 8B may be conducted as follows, for clockwise direction:

- 1) Y axis has pulse with a peak > 50mg and peak width of > 100ms, measured from the time it passes threshold of detection (>50 mg corresponding to the noise threshold, if any) going-up and threshold of detection going-down.
- 2) X axis also has same condition as step 1).
- 3) It is needed to verify that the Y axis is > X axis value when Y is rising. Preferably, a minimum of two consecutive acceleration data is needed to verify that Y axis rises above X axis.
- 4) Steps 1) 2) 3) need to be verified preferably two times to confirm clockwise direction.

[0080] Detecting the displacement pattern of Fig. 8B may be conducted as follows, for counter clockwise di-

rection:

- 1) Y axis has pulse with a peak > 50mg and peak width of > 100ms, measured from the time it passes threshold of detection (>50 mg corresponding to the noise threshold, if any) going-up and threshold of detection going-down.
- 2) X axis also has same condition as step 1).
- 3) It is needed to verify that the X axis is > Y axis value when X is rising. Preferably, a minimum of two consecutive acceleration data is needed to verify that X axis rises above Y axis.
- 4) Steps 1) 2) 3) need to be verified preferably two times to confirm counter clockwise direction.

[0081] Detecting the displacement pattern of Fig. 8C may be conducted as follows:

- 1) First, the Z axis will confirm a vertical position as it goes from 1g to 0g. The X axis will be changing from 0g to 1 g. The value depends on the specific angle, in this case it is assumed that the angle is the ideal case of 90 deg.
- 2) After that, at this vertically oriented heel resting position (70 deg to 130 deg range), the tilting to the right is identified using 3 axis:

- a) X axis should have a value between 0g and +/-1 g depending on the angle
 - b) Y axis should have a value between 0g and +/-1g depending on the angle
 - c) Z axis should be near 0g.
- Value for 2a) and 2b) can be 1g multiplied by sine or cosine of the angle in degrees.

- 3) Both conditions 1 and 2 should be confirmed for at least 500ms.

[0082] Regarding Fig. 8D, it depicts a garment care device according to the invention as described previously according to any of the embodiments of Figs. 1-3-6-7 comprising a steam generator. The sensor 101 (not shown) is adapted to generate an acceleration signal AS varying along the time in a vertical direction Z. The at least one operating parameter comprises the steam amount generated by the steam generator, such that if the acceleration signal AS along the vertical direction Z is above a threshold larger than 1 g, the steam amount generated by the steam generator is reduced, alternatively stopped.

[0083] The above threshold assumes that when the garment care device does not move and its soleplate is in a horizontal position, the acceleration measured on the Z axis equals 1 g.

[0084] For example, the threshold is 1 g + 50 mg.

[0085] Preferably, an additional condition is that the acceleration signal AS along the vertical direction Z should be larger than this threshold during a certain du-

ration, for example 80 ms.

[0086] Since this relatively fast sudden lift-up of the garment care device may characterizes a potential risk for the user, the control unit 102 adjust the steam mount accordingly.

[0087] Reducing the steam amount may either results in decreasing the steam amount by a certain percentage, or completely stopping the generation of steam.

[0088] Detecting the displacement pattern of Fig. 8D may be conducted as follows:

1) Z axis has pulse with a peak > 50mg and peak width of > 50ms, measured from the time it passes threshold of detection (>50 mg corresponding to the noise threshold, if any) going-up and threshold of detection going-down.

2) It's important to note that the Z axis is at about 1g reference point. So the motion threshold should be 1g +/- 50mg to take into account the noise level.

[0089] Fig. 9 depicts a flow chart of a method according to the invention, of adjusting at least one operating parameter in a garment care device, such as a garment care device 100, 300, 600, 700 as described previously.

[0090] The method comprises the steps of:

- generating 901 an output signal characterizing a movement of the garment care device,
- comparing 902 characteristics of the output signal to characteristics of a predefined displacement pattern,
- adjusting 903 at least one operating parameter of the garment care device based on the result of the comparison between characteristics of the output signal and characteristics of the predefined displacement pattern.

[0091] Preferably, the predefined displacement pattern corresponds to the amount of an average linear displacement along a given direction D of the garment care device, and the output signal is an acceleration signal varying along the time in the given direction D. Preferably, the given direction D is the X axis. The step of comparing 902 comprises comparing the time interval d1 between two consecutive zero-crossing points of the output signal, to a given duration threshold d0).

[0092] 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 the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality.

[0093] Any reference signs in the claims should not be

construed as limiting the scope.

Claims

1. A garment care device (100, 300, 600, 700) comprising:

- a sensor (101) for generating an output signal characterizing a movement of said garment care device,
- a control unit (102) coupled to said sensor (101), the control unit (102) being adapted to:

- a) identify and compare characteristics of said output signal to characteristics of a predefined displacement pattern,
- b) adjust at least one operating parameter of the garment care device based on the result of the comparison between characteristics of said output signal and characteristics of said predefined displacement pattern.

2. A garment care device as claimed in claim 1, wherein said predefined displacement pattern corresponds to the amount of an average linear displacement along a given direction (D) of the garment care device.

3. A garment care device as claimed in claim 2, wherein said sensor (101) is an accelerometer.

4. A garment care device as claimed in any one of the preceding claims, wherein said control unit (102) is adapted to identify characteristics of said output signal for classifying the movement of said garment care device according to short stroke and long stroke when the garment care device is used by a user.

5. A garment care device as claimed in claim 4, wherein:

- said sensor (101) is an accelerometer, and the output signal is an acceleration signal (AS) varying along the time in said given direction (D),
- the characteristics of the output signal correspond to the time interval (d1) between two consecutive zero-crossing points of the output signal,
- the characteristics of the predefined signal correspond to a given duration threshold (d0),
- the control unit (102) is adapted to classify the movement of said garment care device according to short stroke and long stroke as follows:

- a) if the measured time interval d1 is smaller than the given duration threshold d0, the

- movement of said garment care device is identified as a short stroke,
b) if the measured time interval d1 is larger than the given duration threshold d0, the movement of said garment care device is identified as a long stroke.
6. A garment care device as claimed in claim 4 or 5, further comprising a steam generator (106, 606) and a water pump (110, 605) to carry water into said steam generator (106, 606), wherein said at least one operating parameter comprises the flow rate of said water pump (110, 605) such that:
- if the movement of said garment care device is identified as a long stroke, the control unit (102) is adapted to activate the water pump (110, 605) with a first flow rate value (FR1, FR11),
 - if the movement of said garment care device is identified as a short stroke, the control unit (102) is adapted to activate the water pump (110, 605) with a second flow rate value (FR2, FR22).
7. A garment care device as claimed in claim 4 or 5, further comprising a steam generator (106, 606, 706), wherein said at least one operating parameter further comprises the temperature of said steam generator (106, 606, 706) such that:
- if the movement of said garment care device is identified as a long stroke, the control unit (102) is adapted to set the temperature of the steam generator (106, 606, 706) to a first temperature value (T1),
 - if the movement of said garment care device is identified as a short stroke, the control unit (102) is adapted to set the temperature of the steam generator (106, 606, 706) to a second temperature value (T2).
8. A garment care device as claimed in claim 4 or 5, further comprising a boiler (707) arranged in a base unit (702), wherein said at least one operating parameter further comprises the temperature of said boiler (707) such that:
- if the movement of said garment care device is identified as a long stroke, the control unit (102) is adapted to set the temperature of the boiler (707) to a first temperature value (T11),
 - if the movement of said garment care device is identified as a short stroke, the control unit (102) is adapted to set the temperature of the boiler (707) to a second temperature value (T22).
9. A garment care device as claimed in claim 4 or 5, further comprising a boiler (707) arranged in a base unit (702), wherein said at least one operating parameter further comprises the amount of steam that exits said boiler (707) such that:
- if the movement of said garment care device is identified as a long stroke, the control unit (102) is adapted to set the amount of steam that exits the boiler (707) to a first steam rate value (SR1),
 - if the movement of said garment care device is identified as a short stroke, the control unit (102) is adapted to set the amount of steam that exits the boiler (707) to a second steam rate value (SR2).
10. A garment care device (100) as claimed in any one of the claims 5 to 9, wherein the duration threshold (d0) is a value in the range [200; 800] ms.
11. A garment care device as claimed in claim 1, wherein said predefined displacement pattern corresponds to any one of the following displacement patterns:
- a given short repeated arc movements of the garment care device,
 - a given repeated circular or elliptical movement of the garment care device,
 - a given succession of elementary displacement portions in an horizontal plan,
 - a given succession of elementary movements between an horizontal plan and a vertical plan.
12. A garment care device as claimed in claim 1, further comprising a steam generator (106, 606, 706), wherein said sensor (101) is adapted to generate an acceleration signal (AS) varying along the time in a vertical direction (Z), wherein said at least one operating parameter comprises the steam amount generated by said steam generator (106, 606, 706), such that if the acceleration signal (AS) is above 1.1 g, the steam amount generated by said steam generator (106, 606, 706) is reduced.
13. Method of adjusting at least one operating parameter in a garment care device, the method comprising the steps of:
- generating (901) an output signal characterizing a movement of said garment care device,
 - comparing (902) characteristics of said output signal to characteristics of a predefined displacement pattern,
 - adjusting (903) at least one operating parameter of the garment care device based on the result of the comparison between characteristics of said output signal and characteristics of

said predefined displacement pattern.

14. Method according to claim 13, wherein said predefined displacement pattern corresponds to the amount of a linear displacement along a given direction (D) of the garment care device, and the output signal is an acceleration signal varying along the time in said given direction (D),
wherein said step of comparing (902) comprises comparing the time interval (d1) between two consecutive zero-crossing points of the output signal, to a given duration threshold (d0).

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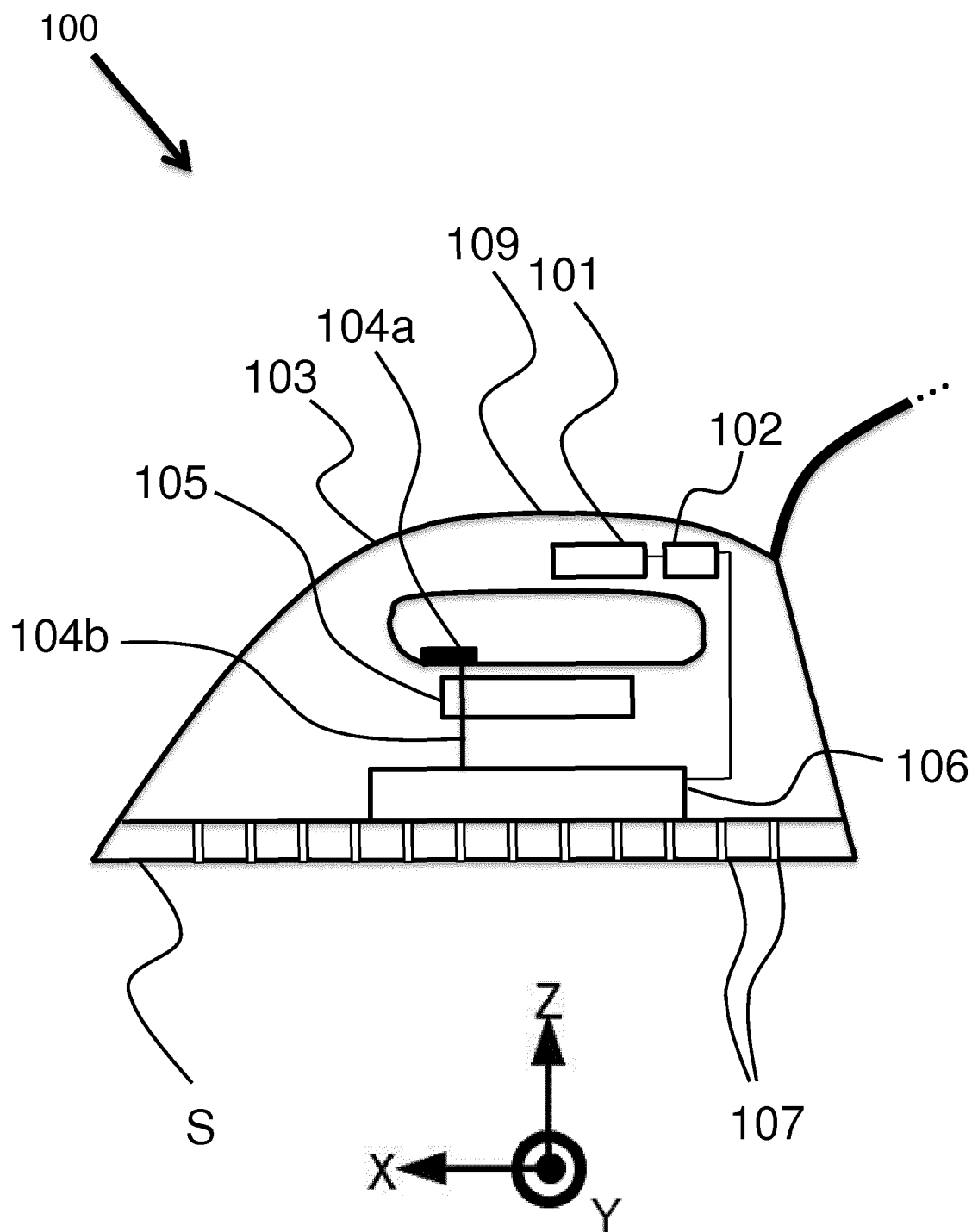


FIG.1

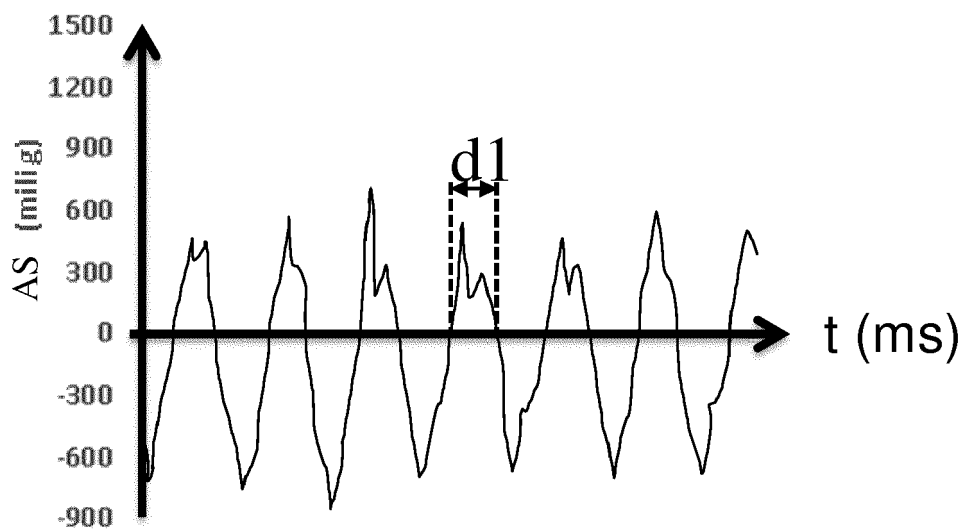


FIG.2A

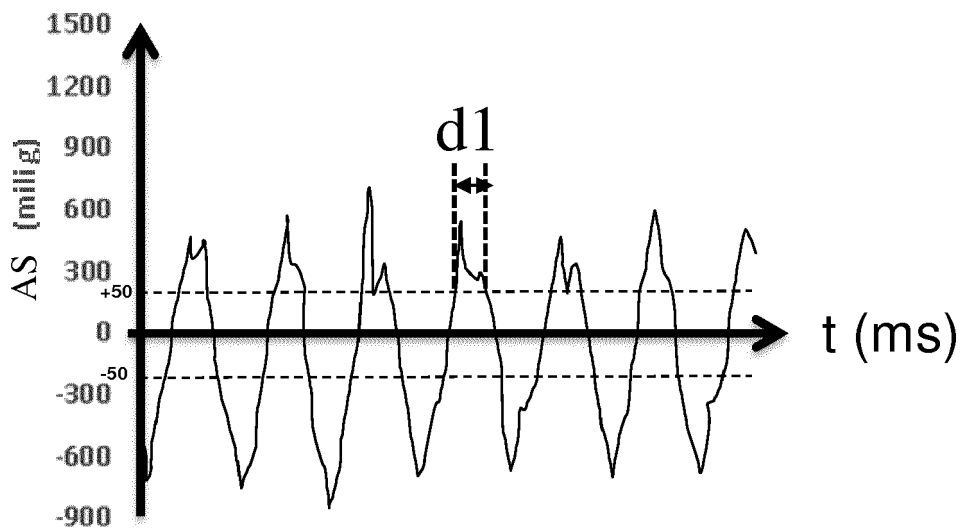


FIG.2B

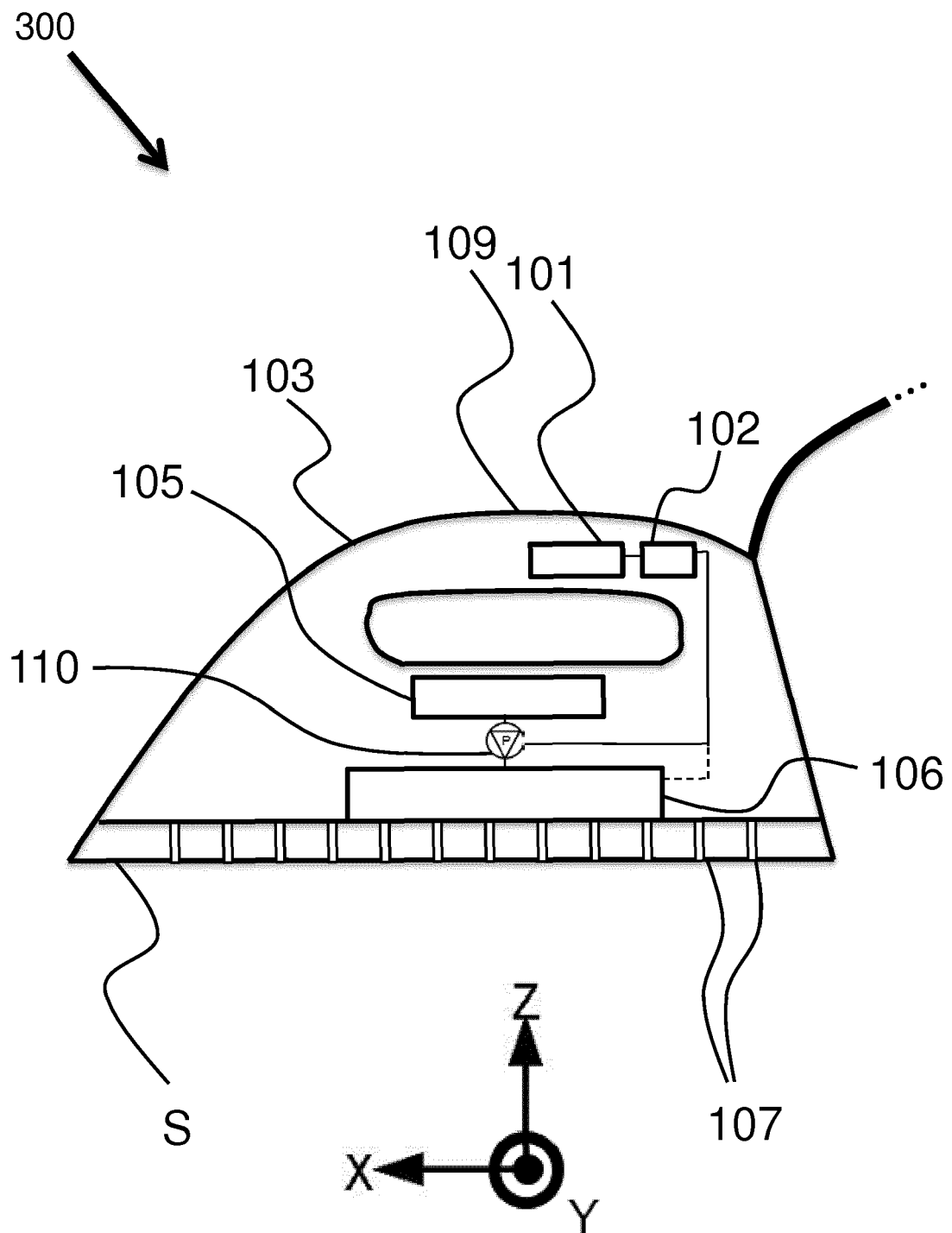


FIG.3

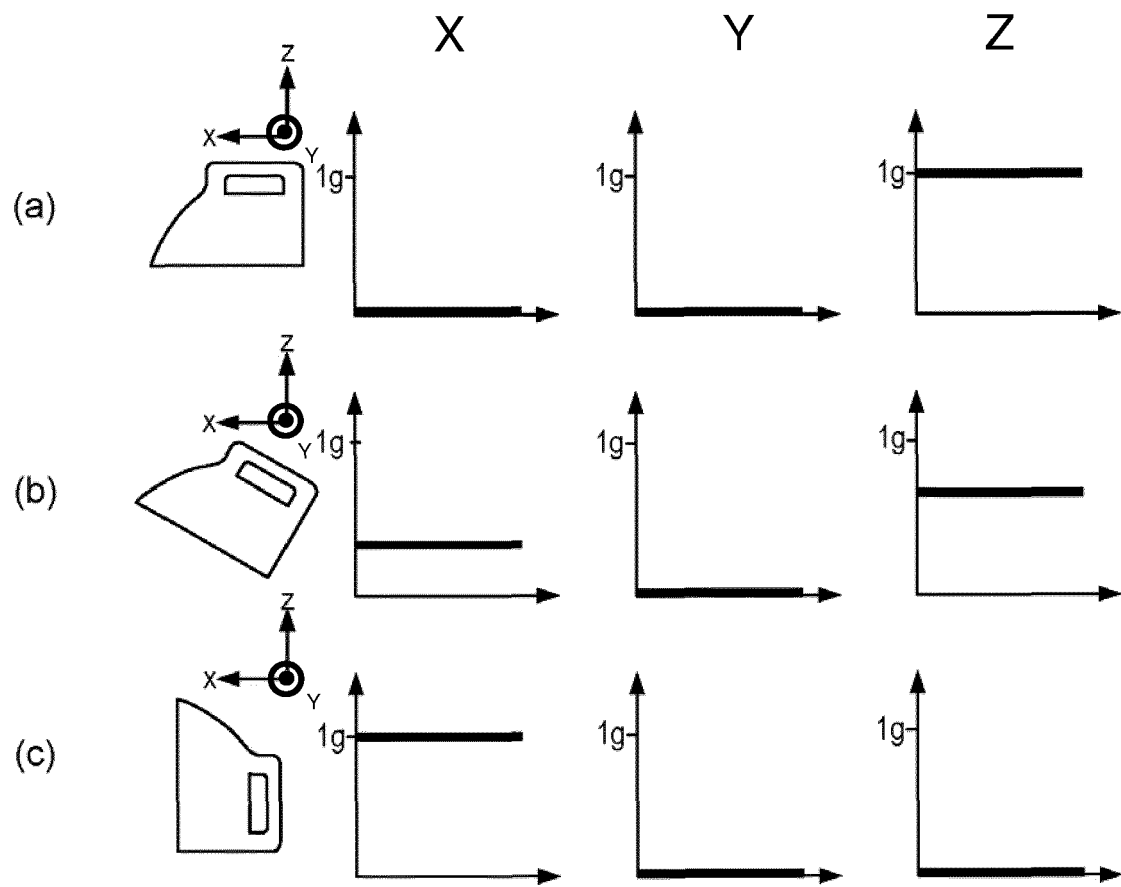


FIG.4

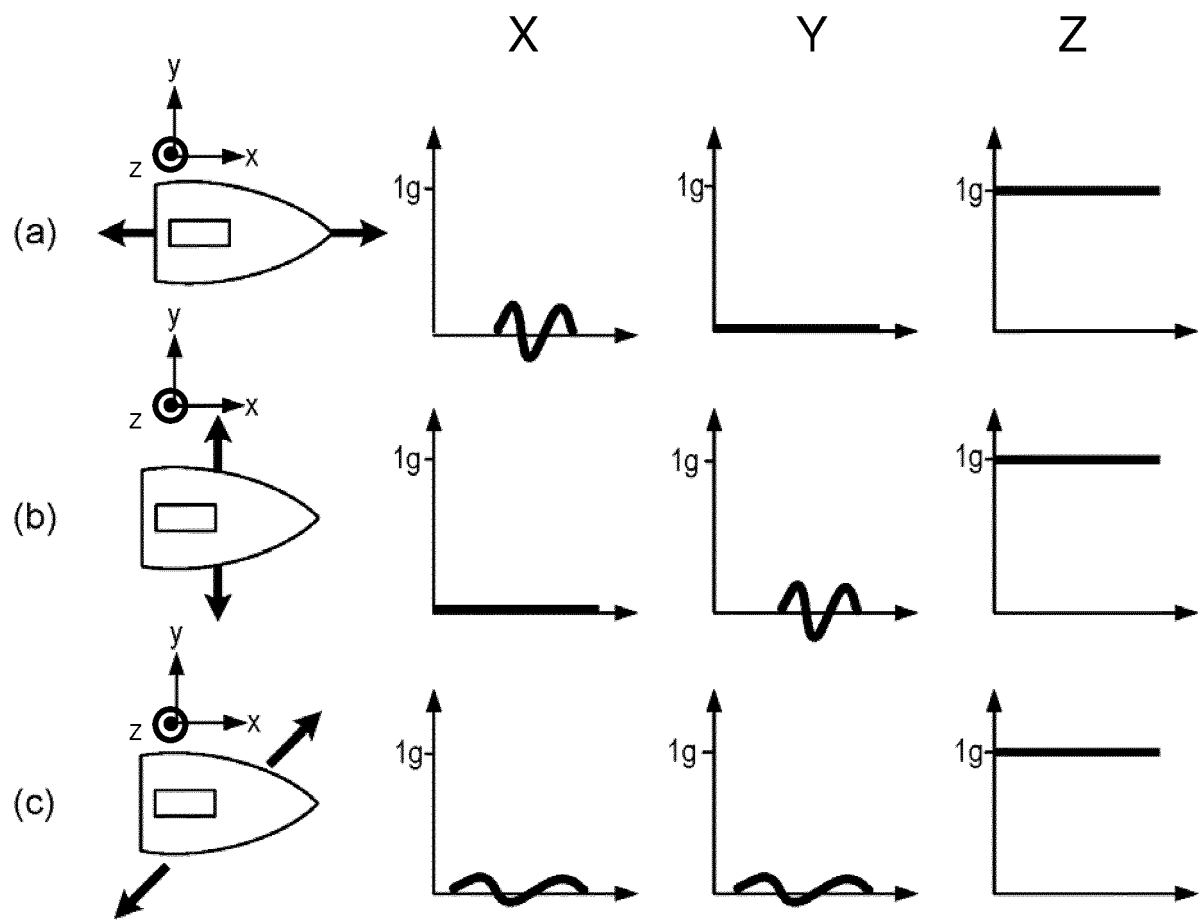


FIG.5

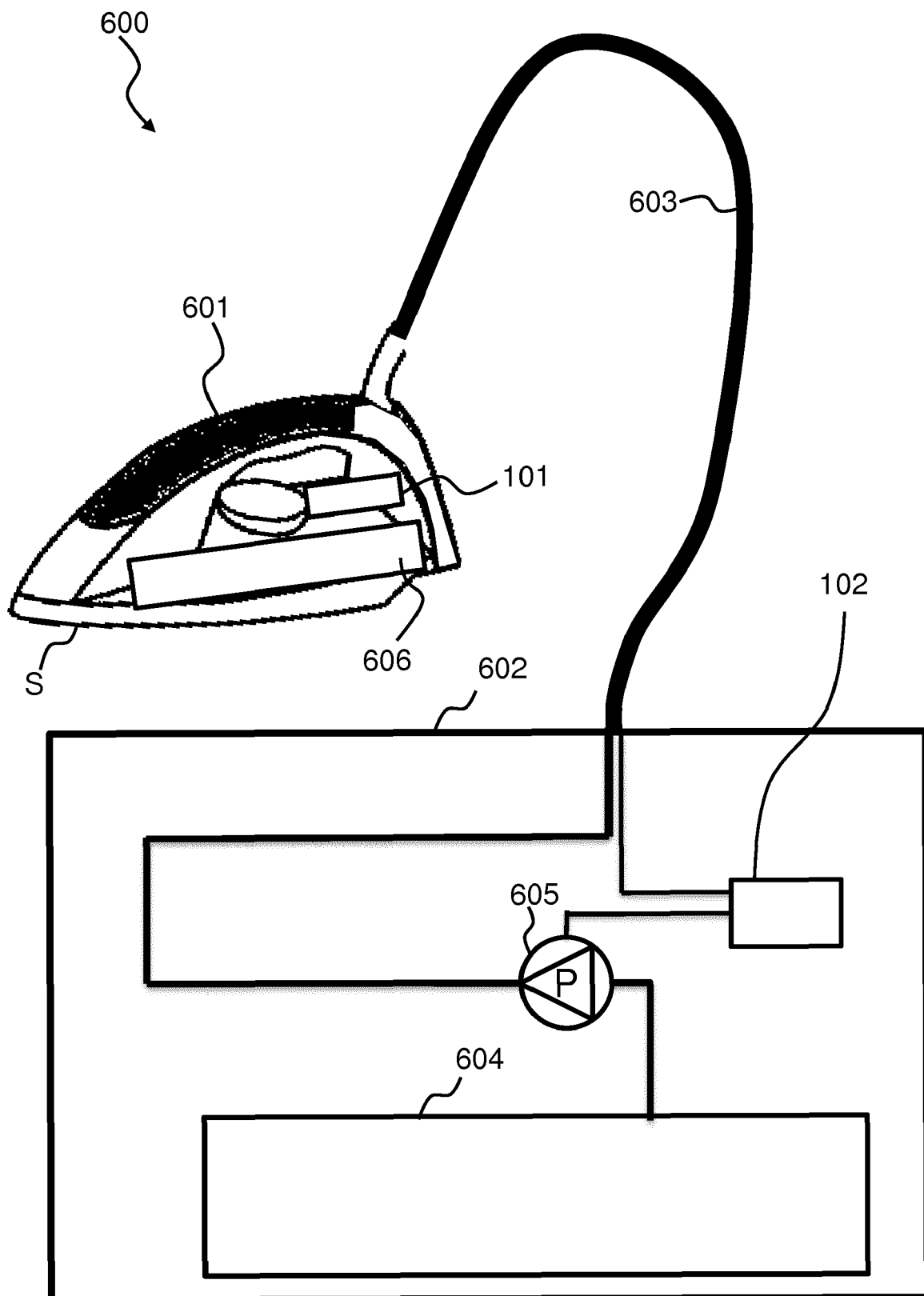


FIG.6

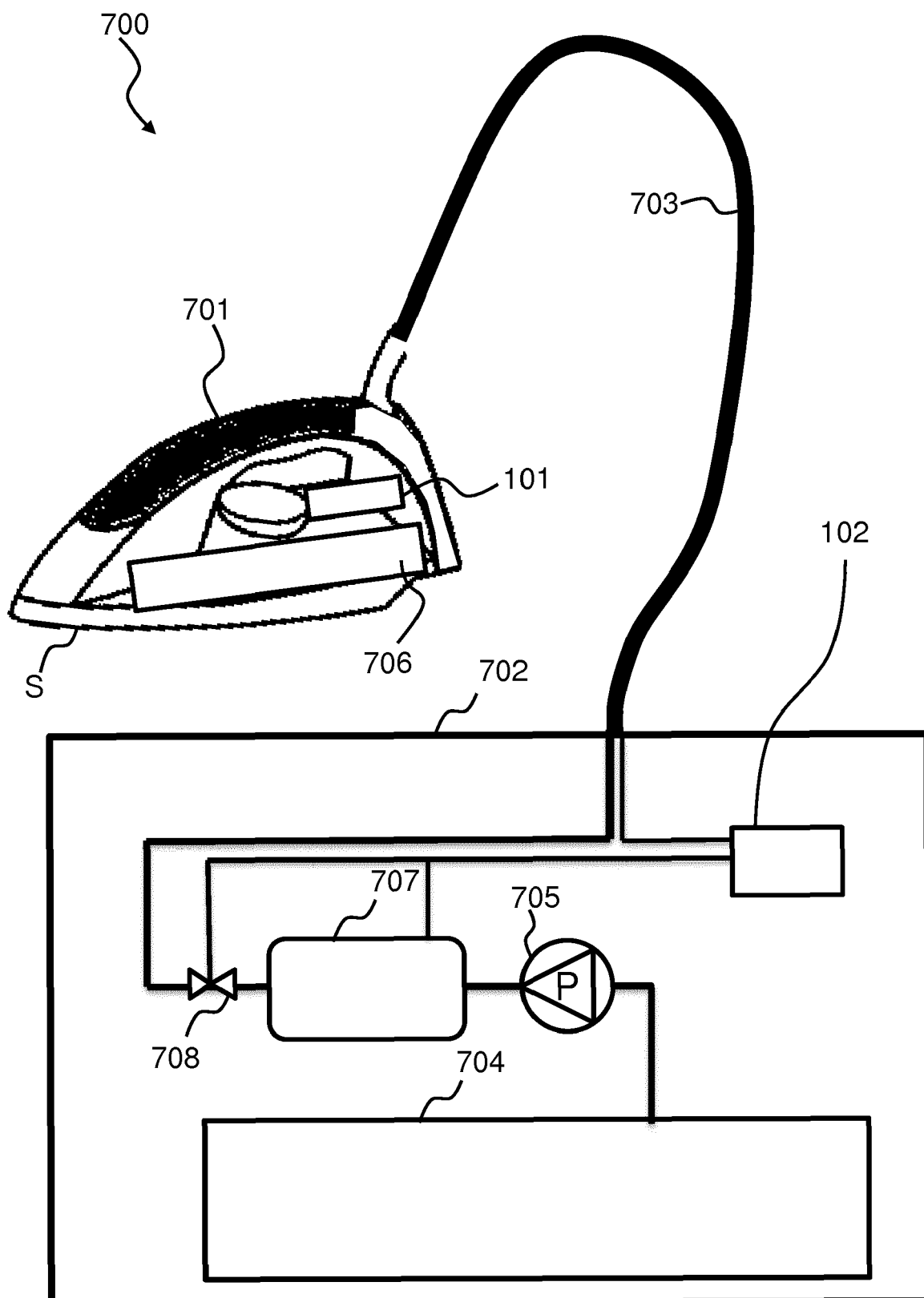


FIG.7

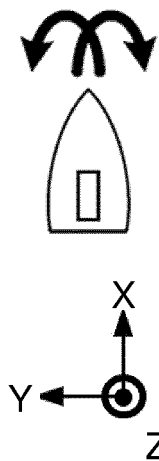


FIG. 8A

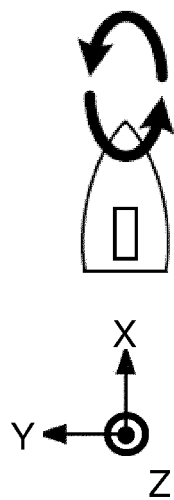


FIG. 8B

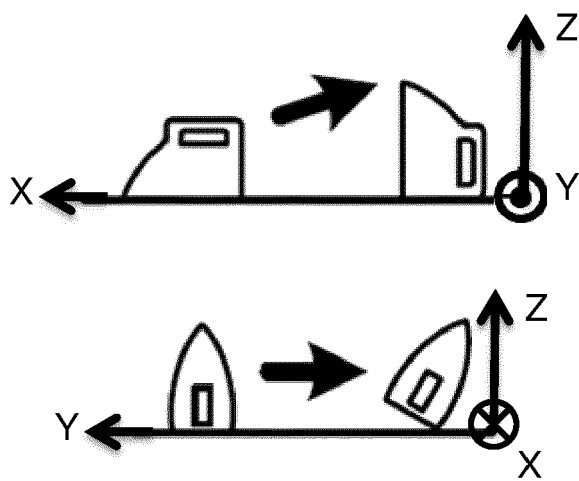


FIG. 8C

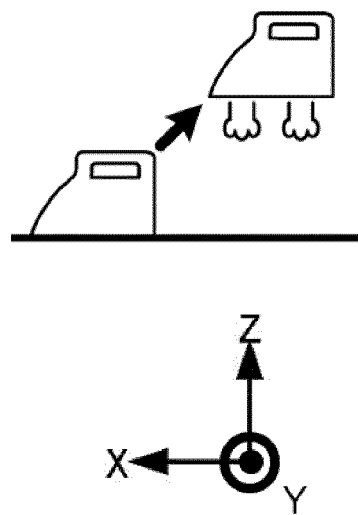


FIG. 8D

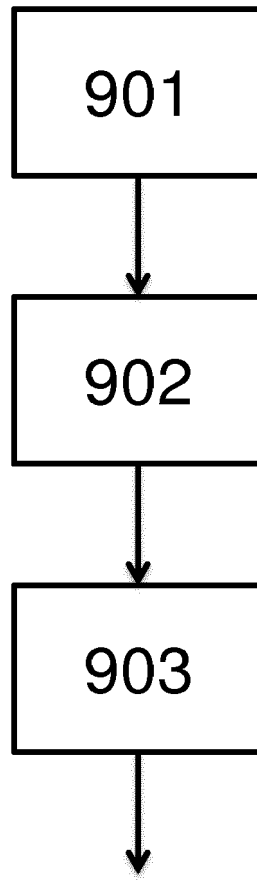


FIG.9



EUROPEAN SEARCH REPORT

Application Number
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Place of search Munich		Date of completion of the search 31 January 2018	Examiner Prosig, Christina
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