



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
17.02.2021 Bulletin 2021/07

(51) Int Cl.:
D06F 75/10 (2006.01) **D06F 75/26** (2006.01)
D06F 75/00 (2006.01) **D06F 75/12** (2006.01)
D06F 75/14 (2006.01)

(21) Application number: **20191985.9**

(22) Date of filing: **21.08.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

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(30) Priority: **25.08.2017 EP 17187973**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
18753438.3 / 3 625 388

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Remarks:

This application was filed on 20-08-2020 as a divisional application to the application mentioned under INID code 62.

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

(57) The invention relates to a garment care device comprising a sensor (101) for generating an output signal characterizing a movement of said garment care device, wherein said sensor (101) is an accelerometer, a control unit (102) coupled to said sensor (101), the control unit (102) being 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,
- adjust at least one operating parameter of the garment care device based on the classification of short stroke and long stroke.

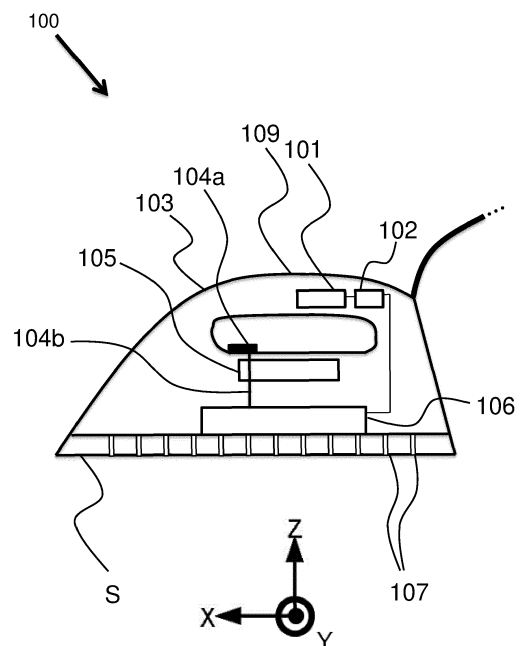


FIG.1

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.

[0004] Document US 2013/125427 discloses an iron comprising: a water reservoir; a heatable soleplate; at least one water outlet opening; a water atomization and distribution unit; a sensor; and a control unit.

[0005] Document JP H04 319398 discloses an iron adapted to adjust the temperature of a soleplate in response to a state sensor determining that the iron is in a given state.

[0006] Document JP H04 208200 discloses an iron adapted to control providing energy of a heater in accordance with a frequency of detection of reciprocation within a predetermined time.

[0007] Document JP H05 76700 discloses an iron adapted to change a water supply amount of an electrically driven water supply by detecting the temperature gradient of a base, position and operation of an iron. Document US 2010/242314 discloses a steam iron including a sensor for detecting and measuring movement of the steam iron, wherein steam generation can be adjusted based on speed of movement of the iron and tilt angle.

[0008] Document DE 21 2007 000070 discloses an iron comprising: a heating soleplate; a spraying means for spraying a product into one or more distinct zones; and a control means for selectively, automatically or on user command selectively sending the product to only one or some of the distinct zones.

[0009] Document US 2010/037495 discloses a steam appliance having a water pump controlled by an actuator or motion switch response to movement of the appliance.

OBJECT AND SUMMARY OF THE INVENTION

[0010] It is an object of the invention to propose a garment care device that avoids or mitigates above-mentioned problems.

[0011] The invention is defined by the independent claims. The dependent claims define advantageous embodiments.

[0012] 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, wherein said sensor is an accelerometer,
- 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, wherein said predefined displacement pattern corresponds to the amount of a linear displacement along a given direction of the garment care device,
- 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.

[0013] 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 parameters can be optimised to get improved ironing results without causing burn or scorching to the garment.

[0014] The invention also relates to a corresponding method of adjusting at least one operating parameter in a garment care device.

[0015] Detailed explanations and other aspects of the invention will be given below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] 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,
 Fig. 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,
 Fig. 8A-8B-8C 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 INVENTION

[0017] Fig.1 depicts a first embodiment of a garment care device 100 according to the invention.

[0018] The garment care device 100 comprises a sensor 101, such as an accelerometer, for generating an output signal characterizing a movement of said garment care device 100.

[0019] The garment care device 100 also comprises a control unit 102 coupled to the sensor 101.

[0020] The control unit 102 is adapted to identify and compare characteristics of the output signal to characteristics of a predefined displacement pattern. The predefined displacement pattern may correspond to the amount of a linear displacement of the garment care device along a given direction.

[0021] The linear displacement of the garment care device may include a single straight line between two points, but may also include more than a single straight line between two points.

[0022] For example, the linear displacement may be measured in a first and second direction, wherein the second direction is orthogonal to the first. In this way, it is possible to determine that the garment care device is travelling in an arc by measuring the linear displacement in both the first and second directions. The shape of the arc may be determined by the relative size of the linear displacement in the first direction and the linear displacement in the second direction. Further, the size of the arc may be determined by the absolute size of the linear displacement in the first and second directions. Additional directions may also be measured to identify more complex movement characteristics for comparison with the predefined displacement pattern.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] The garment care device 100 includes a body 103 and a handle 109. Preferably, the sensor 101 is arranged in a handle 109.

[0028] 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.

[0029] 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.

[0030] 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 plane.

[0031] 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 is 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 (or parallel to) 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 is 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.

[0032] 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.

[0033] 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. The predefined displacement pattern may correspond to a linear displacement of the garment care device along a given direction. 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 for example includes 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.

[0034] The orientation and the motion of the garment care device 100 are discussed below with reference to Figures 4 and 5.

[0035] 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 such that the surface of the soleplate S is in contact with a horizontal surface, such as the horizontal surface of an ironing board on which a garment to be ironed is arranged). 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 (b), 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 (c), 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.

[0036] 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.

[0037] 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.

[0038] Preferably, the predefined displacement pattern corresponds to the amount of a 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. In other words, the linear displacement may correspond to a value of a stroke length of a user using the garment care device.

[0039] 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.

[0040] By definition, the value of a stroke length of a user is the linear distance that allows classifying a stroke length between a short stroke and a long stroke. A short stroke is smaller than the linear distance, a long stroke

is larger than the linear distance.

[0041] 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.

[0042] The unit for the vertical axis of the graph is in milli g (or abbreviated as "mg"), with $1\text{ g} = 9.81\text{ m/s}^2$.

[0043] 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.

[0044] 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.

[0045] 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.

[0046] For that reason, the linear displacement of the garment care device referred above may also be called "average linear displacement of the garment care device".

[0047] Preferably, the given duration threshold d0 has a value in the range [200; 800] ms, preferably 550 ms.

[0048] Typically, an average value for a short stroke is less than 20 cm, and an average value for a long stroke is more than 20 cm.

[0049] To improve the robustness of the user's stroke characterization, instead of taking into account only one time interval between two consecutive zero-crossing points of the output signal, a plurality of consecutive time intervals between two consecutive zero-crossing points of the output signal can be taken into account, and make an average of those consecutive time intervals in order to obtain an averaged time interval d1' that will be compared to the duration threshold d0, and derive a classification on short stroke / long strike similarly as explained above with d1.

[0050] Alternatively, the characteristics of the predefined signal correspond to a first duration threshold d0_1 and to a second duration threshold d0_2:

- if the measured time interval d1 is smaller than the first duration threshold d0_1, 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

second duration threshold d0_2, the stroke of the user using the garment care device is identified as a long stroke.

[0051] Comparing the measured time interval d1 to two duration thresholds d0_1 and d0_2 avoids possible inaccurate stroke classification due to the border limits classification between short and long strokes. This means that when the measured time interval d1 is between d0_1 and d0_2, the corresponding stroke could be classified as "medium stroke" (i.e. a stroke longer than a short stroke but shorter than a long stroke).

[0052] Preferably, the first duration threshold d0_1 has a value in the range [100; 350] ms, preferably 300 ms, and the second duration threshold d0_2 has a value in the range [450; 800] ms, preferably 500 ms.

[0053] Preferably, in addition to taking into account the time interval d1 between two consecutive zero-crossing points of the output signal, another characteristic of the output signal taken into account corresponds to a measured amplitude a1 of the output signal between two consecutive zero-crossing points.

[0054] In this case:

- the characteristics of the output signal correspond to the time interval (d1) between two consecutive zero-crossing points of the output signal, and to a measured amplitude (a1) of the output signal between the two consecutive zero-crossing points.
- the characteristics of the predefined signal correspond to a given duration threshold (d0) and to a given amplitude threshold (a0).

[0055] The control unit (102) is adapted to classify the movement of the garment care device according to short stroke and long stroke as follows:

- if the measured time interval (d1) is smaller than the given duration threshold (d0), and if the measured amplitude (a1) is smaller than the given amplitude threshold a0, 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), and if the measured amplitude (a1) is larger than the given amplitude threshold a0, the stroke of the user using the garment care device is identified as a long stroke.

[0056] Preferably, the given amplitude threshold a0 has a value in the range [100; 300] mg, preferably 200 mg.

[0057] Preferably, the measured amplitude a1 corresponds to an averaged value of the output signal between two consecutive zero-crossing points of the output signal, such as using the absolute value of arithmetic mean or simple average.

[0058] Alternatively, if the output signal is in the digital form, the output signal between two consecutive zero-crossing points is considered larger than the given am-

plitude threshold a_0 only if the number of samples between two consecutive zero-crossing points of the output signal having values above the given amplitude threshold a_0 , is larger than a number threshold. This number threshold can also be expressed as a percentage, for example 50%.

[0059] If the number of samples between two consecutive zero-crossing points of the output signal having values above the given amplitude threshold a_0 , is smaller than the number threshold, the output signal between two consecutive zero-crossing points is considered smaller than the given amplitude threshold a_0 .

[0060] Preferably, instead of taking into account only the given duration threshold (d_0), the first duration threshold (d_{0_1}) and the second duration threshold (d_{0_2}) can be used.

[0061] In this case, the control unit (102) is adapted to classify the movement of the garment care device according to short stroke and long stroke as follows:

- if the measured time interval (d_1) is smaller than the first duration threshold (d_{0_1}), and if the measured amplitude (a_1) is smaller than the given amplitude threshold a_0 , the stroke of the user using the garment care device is identified as a short stroke,
- if the measured time interval (d_1) is larger than the second duration threshold (d_{0_2}), and if the measured amplitude (a_1) is larger than the given amplitude threshold a_0 , the stroke of the user using the garment care device is identified as a long stroke.

[0062] As mentioned above, to improve the robustness of the user's stroke characterization, instead of taking into account only one time interval between two consecutive zero-crossing points of the output signal, a plurality of consecutive time intervals between two consecutive zero-crossing points of the output signal can be taken into account. As follows:

- the device is considered having a short stroke movement if there are at least two (for example 3) consecutive time intervals between two consecutive zero-crossing points with amplitude smaller than the threshold amplitude a_0 (for example < 200 mg), and having duration d_1 smaller than the first duration threshold d_{0_1} (for example < 300 ms),
- the device is considered having a long stroke movement if there are at least two (for example 3) consecutive time intervals between two consecutive zero-crossing points with amplitude larger than the threshold amplitude a_0 (for example > 200 mg), and having duration d_1 larger than the second duration threshold d_{0_2} (for example > 500 ms).

[0063] In above situations, it is noted that in case the output signal generated by the sensor 101 contains a certain level of noise, for example a level of noise with amplitude of ± 50 mg, the time interval d_1 between two

consecutive zero-crossing points of the output signal is preferably calculated with an offset of a value equal to the noise level. An example is illustrated in Fig.2B.

[0064] 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 d_1 is larger than the given duration threshold d_0 , the control unit 102 is adapted to set the temperature of the steam generator 106 to a first temperature value T_1 . This means that long strokes of user are identified. In that case, a first temperature T_1 is set for the steam generator 106.
- if the time interval d_1 is smaller than the given duration threshold d_0 , the control unit 102 is adapted to set the temperature of the steam generator 106 to a second temperature value T_2 . This means that short strokes of user are identified. In that case, a second temperature T_2 is set for the steam generator 106.

[0065] Adjusting the temperature of the steam generator also results in a variation of temperature of the soleplate S.

[0066] 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.

[0067] 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.

[0068] 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.

[0069] Fig.3 depicts a second embodiment of a garment care device 300 according to the invention.

[0070] 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.

[0071] 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 dura-

tion 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.

[0072] Adjusting the flow rate value applied to the water pump allows varying the amount of steam that exits the steam vents 107.

[0073] 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.

[0074] 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.

[0075] 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.

[0076] 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.

[0077] Fig.6 depicts a third embodiment of a garment care device 600 according to the invention.

[0078] 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.

[0079] 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.

[0080] 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.

[0081] 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.

[0082] 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.

[0083] 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.

[0084] Fig.7 depicts a fourth embodiment of a garment care device 700 according to the invention.

[0085] 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.

[0086] 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 d_1 is larger than the given duration threshold d_0 , the control unit 102 is adapted to set the temperature of the boiler 707 to a first temperature value T_{11} . This means that long strokes of user are identified.
- if the time interval d_1 is smaller than the given duration threshold d_0 , the control unit 102 is adapted to set the temperature of the boiler 707 to a second temperature value T_{22} . This means that short strokes of user are identified.

[0087] Adjusting the temperature of the boiler allows varying the amount of steam that is generated in the boiler 707.

[0088] For example, $T_{11} < T_{22}$, such as $T_{11} = 140$ degrees and $T_{22} = 150$ 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

[0089] Alternatively, $T_{11} > T_{22}$, such as $T_{11} = 140$ degrees and $T_{22} = 130$ 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.

[0090] It is noted that the temperature difference between T_{11} and T_{22} is just given as an example. More generally, the temperature absolute difference between T_{11} and T_{22} could be up to 25 degrees.

[0091] 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.

[0092] 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.

[0093] 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 d_1 is larger than the given duration threshold d_0 , the control unit 102 is adapted to set the amount of steam that exits boiler 707 to a first steam rate value SR_1 . This means that long strokes of user are identified.
- if the time interval d_1 is smaller than the given duration threshold d_0 , the control unit 102 is adapted to set the amount of steam that exits boiler 707 to a second steam rate value SR_2 . This means that short strokes of user are identified.

[0094] For example, $SR_1 < SR_2$, such as $SR_1 = 100$ g/mn and $SR_2 = 150$ 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.

[0095] Alternatively, $SR_1 > SR_2$, such as $SR_1 = 180$ g/mn and $SR_2 = 150$ 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.

[0096] It is noted that the steam rate absolute difference between SR_1 and SR_2 is just given as an example. More generally, the steam rate difference between could be up to 150 g/mn.

[0097] It is noted that if the stroke is classified as "medium stroke", then the operating parameters (temperature of the steam generator, flow rate of the water pump, temperature of the boiler, amount of steam that exits boiler) of the garment care device are preferably kept unchanged.

[0098] Fig.8A-8B-8C illustrate various predefined displacement patterns used as a reference in a garment care device according to the invention.

placement patterns used as a reference in a garment care device according to the invention.

[0099] 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.

[0100] 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).

[0101] Detecting the displacement pattern of Fig.8A may be conducted as follows:

- 1) Y axis has pulse with a peak > 50 mg and peak width of > 100 ms, 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 < 50 mg (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.

[0102] Detecting the displacement pattern of Fig.8B may be conducted as follows, for clockwise direction:

- 1) Y axis has pulse with a peak > 50 mg and peak width of > 100 ms, 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.

[0103] Detecting the displacement pattern of Fig.8B may be conducted as follows, for counter 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 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.

[0104] Regarding Fig.8C, 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.

[0105] 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.

[0106] For example, the threshold is 1 g + 50 mg.

[0107] Preferably, an additional condition is that the acceleration signal AS along the vertical direction Z should be larger than this threshold during a certain duration, for example 80 ms.

[0108] 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 amount accordingly.

[0109] Reducing the steam amount may either results in decreasing the steam amount by a certain percentage, or completely stopping the generation of steam.

[0110] Detecting the displacement pattern of Fig.8C 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.

[0111] 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.

[0112] 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.

[0113] Preferably, the 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 the given direction D. Preferably, the given direction D is the X axis.

[0114] 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. This corresponds to what has been described above for garment care device.

[0115] Preferably, the step of comparing 902 further comprises comparing an averaged amplitude a1 of the output signal between two consecutive zero-crossing points, to a given amplitude threshold a0. This corresponds to what has been described above for the garment care device.

[0116] 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. 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, wherein said sensor (101) is an accelerometer,
 - a control unit (102) coupled to said sensor (101), the control unit (102) being adapted to
 - a) 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,
 - b) adjust at least one operating parameter of the garment care device based on the classification of short stroke and long stroke.
2. A garment care device as claimed in claim 1, 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).
3. A garment care device as claimed in claim 1, 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).
4. A garment care device as claimed in claim 3, wherein said first steam rate value (SR1) is smaller than said second steam rate value (SR2).
5. A garment care device as claimed in claim 3, wherein said first steam rate value (SR1) is larger than said second steam rate value (SR2).
6. A garment care device as claimed in anyone of claims 1 to 5, wherein:
 - if the time interval (d1) between two consecutive zero-crossing points of the output signal is smaller than a given duration threshold (d0), the stroke of the user using the garment care device is identified as a short stroke,
 - if the time interval (d1) between two consecutive zero-crossing points of the output signal is larger than said given duration threshold (d0), the stroke of the user using the garment care device is identified as a long stroke.
7. A garment care device as claimed in claim 6, wherein said 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.
8. A garment care device as claimed in claim 7, wherein said given duration threshold (d0) has a value in the range [200; 800] ms, preferably 550 ms.
9. A garment care device as claimed in anyone of claims 1 to 5, wherein:
 - if the measured time interval (d1) between two consecutive zero-crossing points of the output signal is smaller than a first duration threshold (d0_1), the stroke of the user using the garment care device is identified as a short stroke,
 - if the measured time interval (d1) between two consecutive zero-crossing points of the output signal is larger than a second duration threshold (d0_2), the stroke of the user using the garment care device is identified as a long stroke.
10. A garment care device as claimed in claim 9, wherein said first duration threshold (d0_1) has a value in the range [100; 350] ms, preferably 300 ms, and the second duration threshold (d0_2) has a value in the range [450; 800] ms, preferably 500 ms.

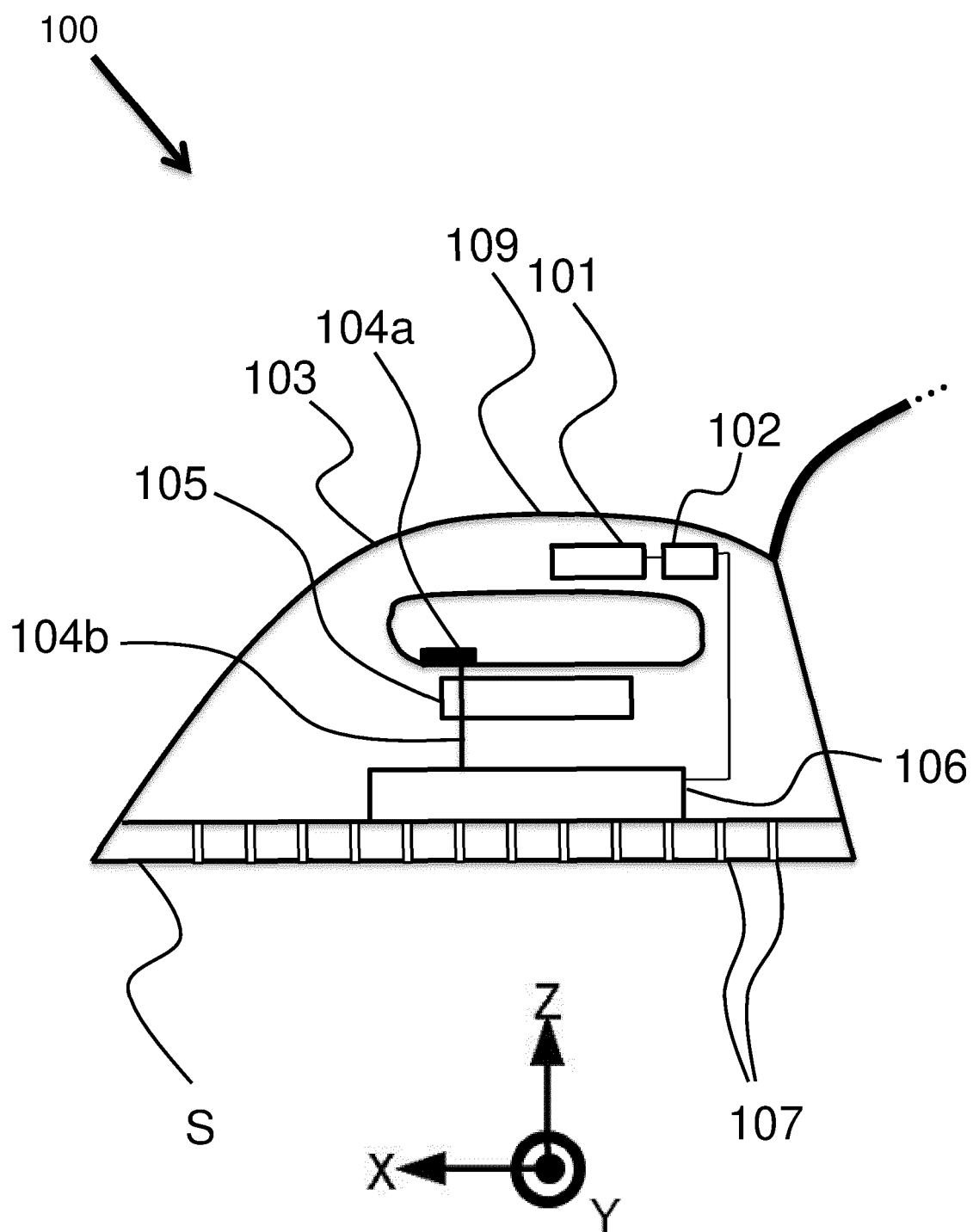


FIG.1

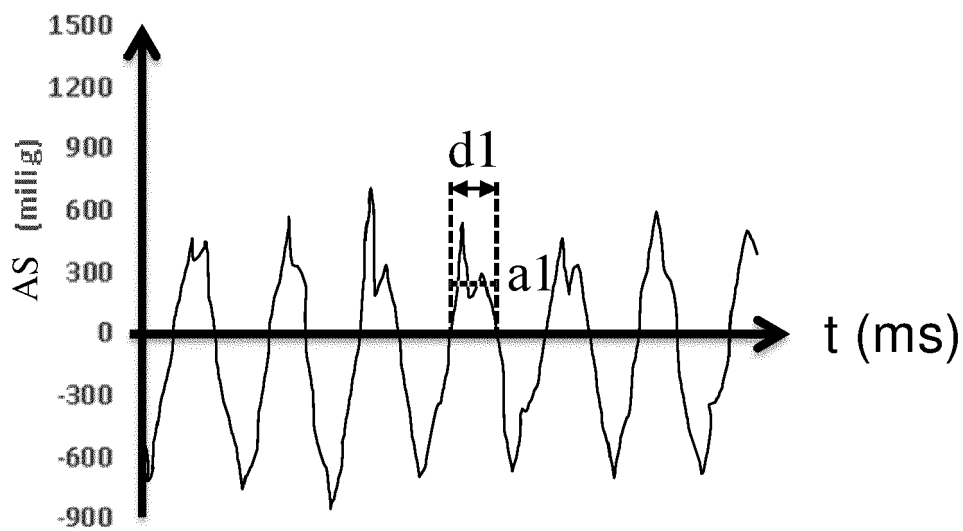


FIG.2A

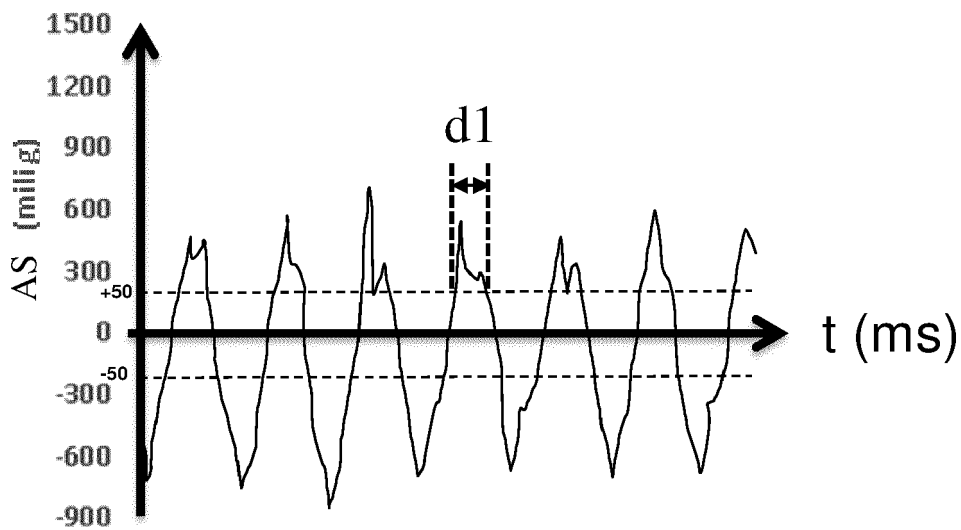


FIG.2B

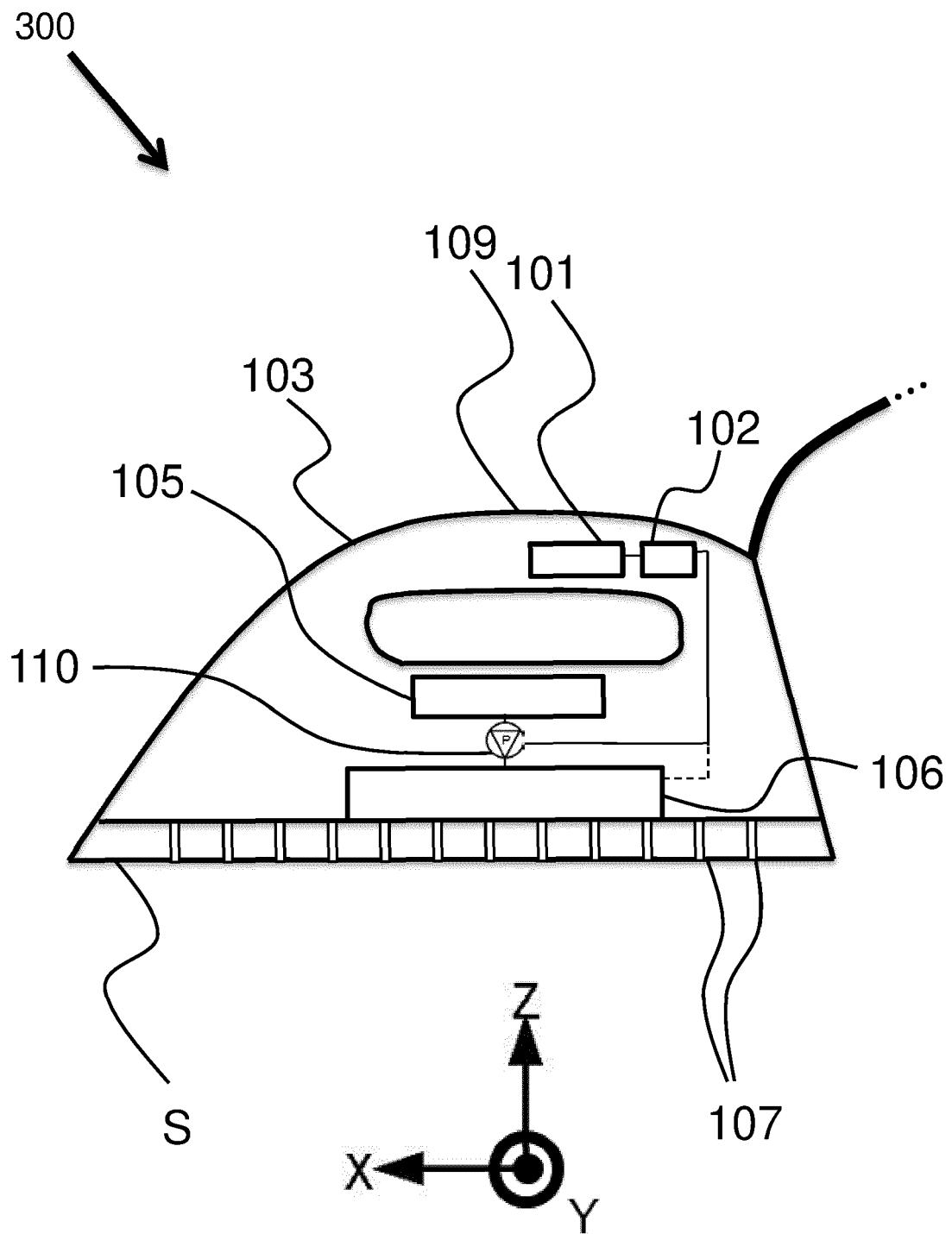


FIG.3

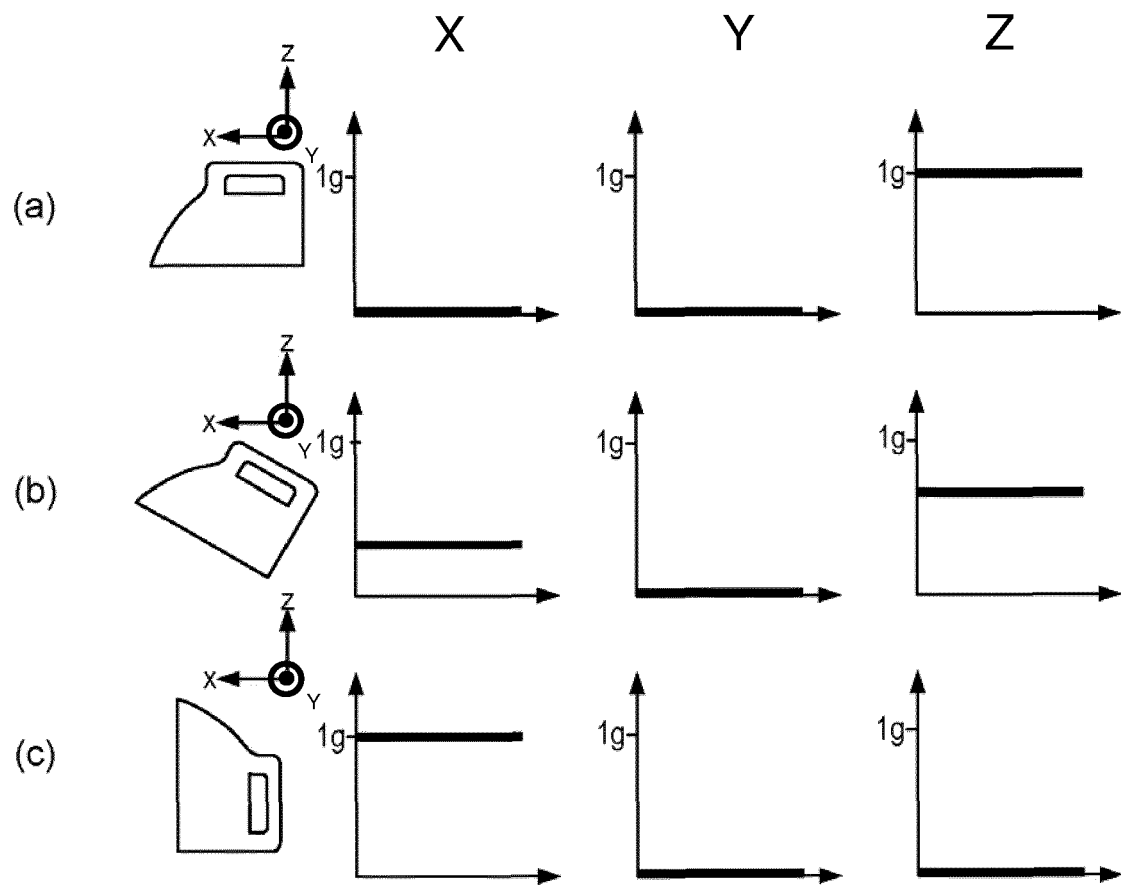


FIG.4

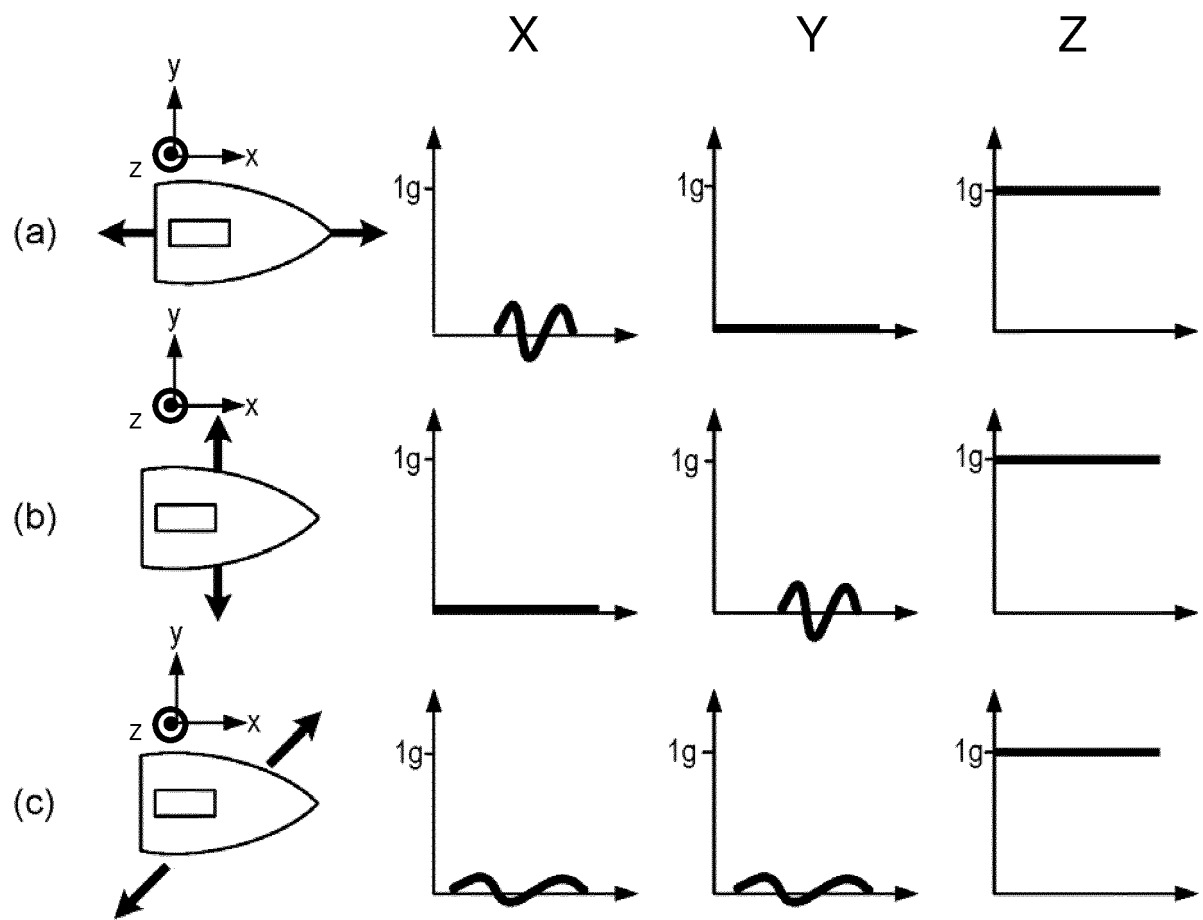


FIG.5

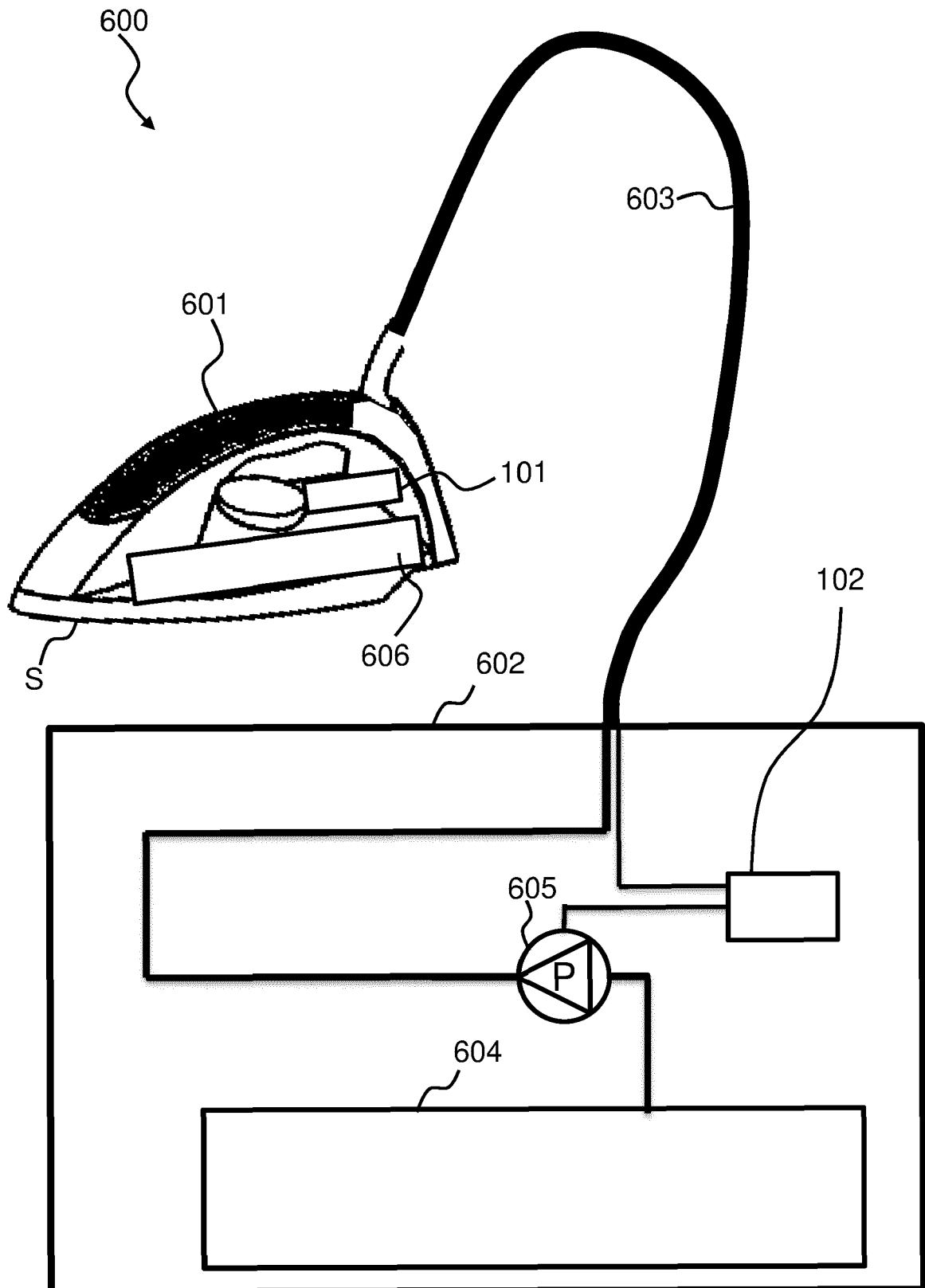


FIG.6

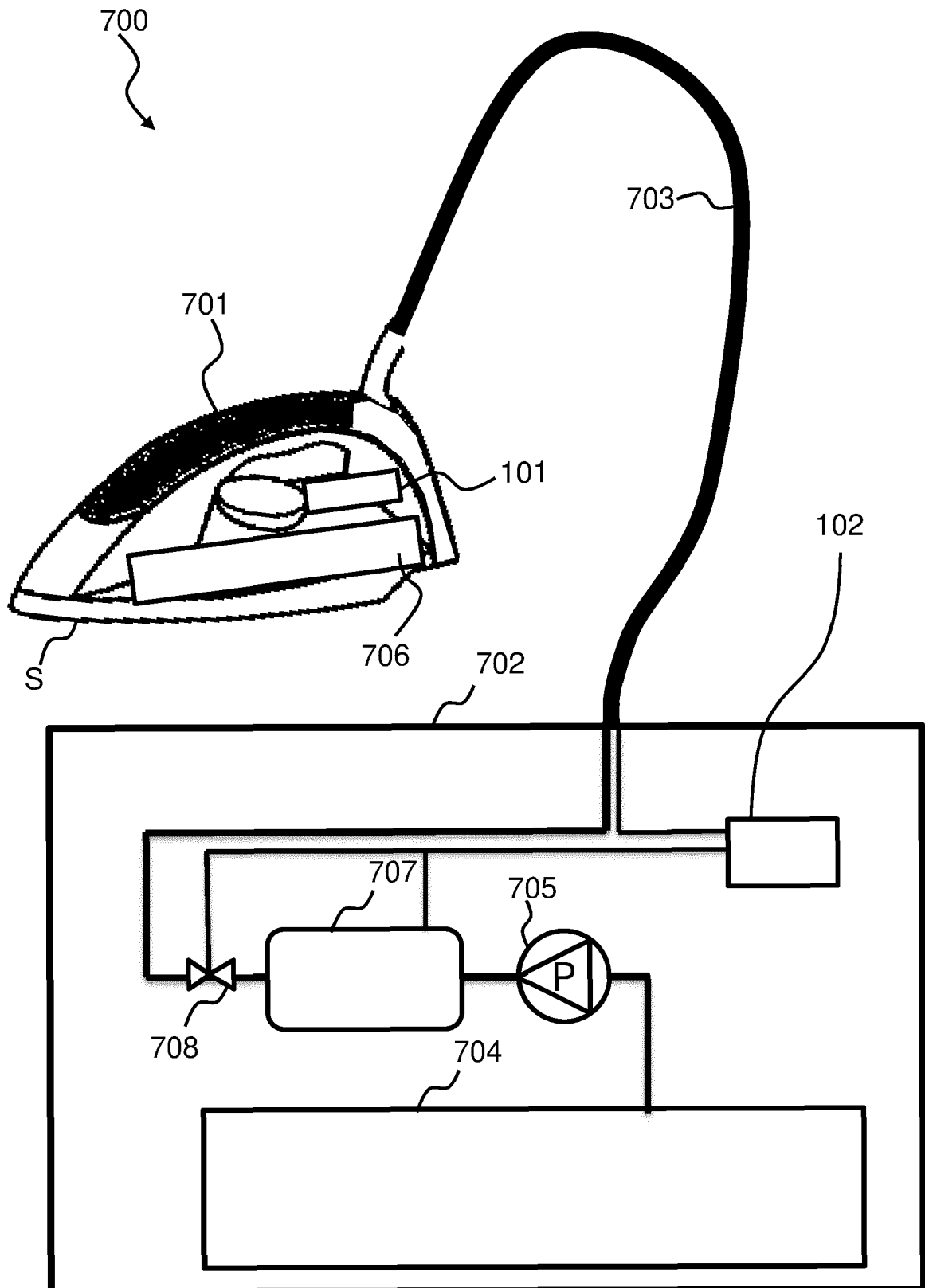


FIG.7

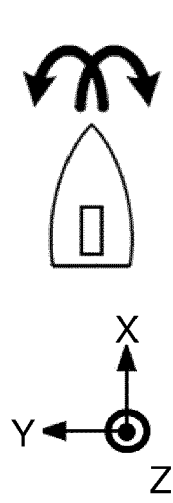


FIG. 8A

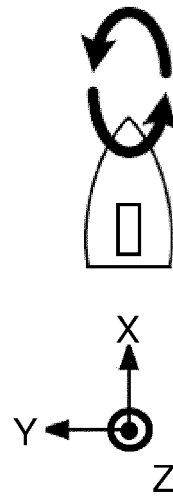


FIG. 8B

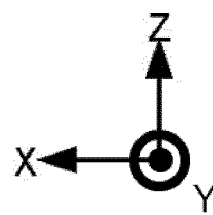
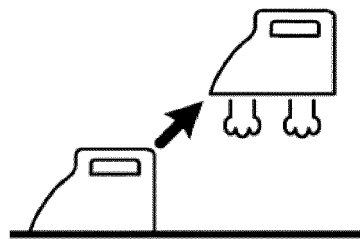


FIG. 8C

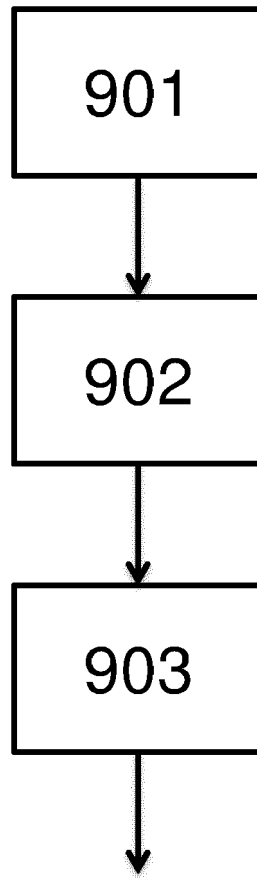


FIG.9



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