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(54) **GARMENT CARE DEVICE WITH A TEMPERATURE SENSOR**

(57) The invention relates to a garment care device comprising a treatment surface for treating a garment. The garment care device comprises a steam generator (104) being in thermal contact with the treatment surface. The steam generator is heated by a heating element (144). The steam generator comprises a steaming surface (172) receiving water for generating steam. The steaming surface is inclined compared to the treatment

surface between a higher point (210) and a lower point (212). The garment care device further comprises a temperature sensor (152) having a temperature sensing element (216) for generating a signal for controlling the heating element. The temperature sensing element is arranged at a height (H) between the higher point and the lower point.

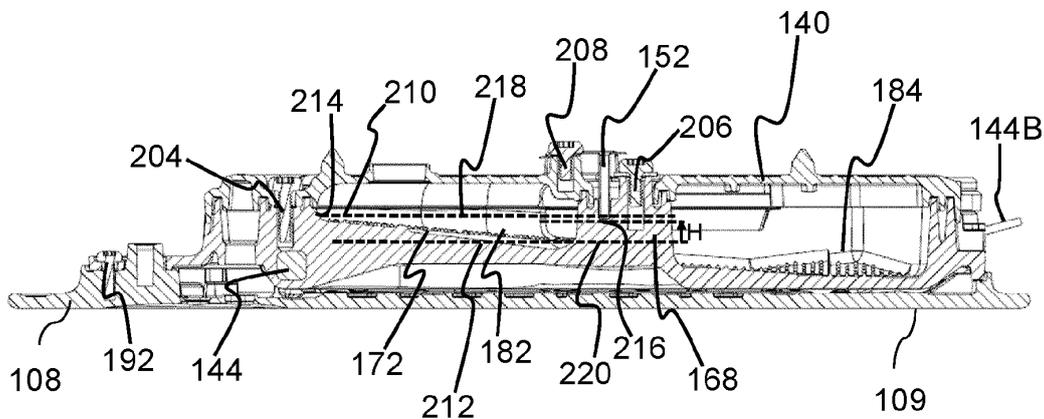


FIG. 7

Description

FIELD OF THE INVENTION

[0001] The invention relates to a garment care device having a steam generator whose temperature is controlled by a temperature sensor. The invention may be used in the field of garment care.

BACKGROUND OF THE INVENTION

[0002] Garment care devices are known to be used for removing creases from garments through the use of heat and moisture from steam. One type of garment care device comprises a base that houses a water tank and a hand unit, the hand unit comprising a steam generator and a treatment surface for treating a garment. Water from the water tank is supplied to the steam generator via a flexible hose between the base and the hand unit. Steam from the steam generator is supplied to the garment via steam vents delimited by the treatment surface.

[0003] A different type of garment care device comprises a hand unit which comprises the steam generator, the treatment surface, and the water tank. In such a design, the garment care device may not include a base separate from the hand unit.

[0004] Controlling the temperature of the steam generator is a key consideration in such garment care devices. The steam generator is generally heated by a heating element. The water supplied to the steam generator has a cooling effect on the steam generator. The temperature of steam generator is sensed by a temperature sensing element. Enhancing the responsiveness of the temperature sensing element (i.e. its capacity to detect quick variations of temperature) to the cooling provided by the water on the steaming surface, as well as the heating provided by the heating element, remain a challenge.

OBJECT AND SUMMARY OF THE INVENTION

[0005] It is an object of the invention to propose a garment care device that addresses the above-mentioned challenge.

[0006] The invention is defined by the independent claims. The dependent claims define advantageous embodiments.

[0007] To this end, the garment care device according to the invention comprises

- a treatment surface for treating a garment,
- a steam generator being in thermal contact with the treatment surface, the steam generator being heated by an heating element, the steam generator comprising a steaming surface receiving water for generating steam, the steaming surface being inclined compared to the treatment surface between a higher point and a lower point,

- a temperature sensor having a temperature sensing element for generating a signal for controlling the heating element, the temperature sensing element being arranged at a height being between the higher point and the lower point.

[0008] By positioning the temperature sensing element between the higher point and the lower point of the steaming surface, the garment care device can exhibit improved responsiveness to the cooling provided by the water on the steaming surface as well as the heating provided by the heating element.

[0009] The term "between the higher point and the lower point" as used herein is intended to encompass the height aligning with the higher point or with the lower point.

[0010] The higher point, the lower point, and the height can be determined from the distance of their projection from the treatment surface.

[0011] Preferably, the temperature sensor is any one of the following:

- thermistor, such as thermistor having pin-type shape,
- thermal diode,
- miniaturized thermostat, such as miniaturized mechanical thermostat.

[0012] The heating element is, for instance, arranged at a height which is lower than the lower point of the steaming surface.

[0013] Preferably, the temperature sensing element is arranged in a central area of the heating element. The central area can correspond to the centre of a rectangle inscribing the heating element.

[0014] In an embodiment, the steam generator comprises a main steaming area, a secondary steaming area, and a steam channel for delivering steam downstream towards the treatment surface.

[0015] Preferably, the steaming surface is provided in the main steaming area.

[0016] For example, the steam channel is arranged to guide the steam downstream towards the steam vents delimited by the treatment surface. In this case, the secondary steaming area provides an intermediate chamber between the main steaming area and the steam channel which can assist to mitigate the risk of liquid water being passed downstream towards the steam vents. Indeed, the secondary steaming area may vaporize into steam the extra water that would have overflowed from main steaming area.

[0017] Preferably, the temperature sensing element is arranged at a height not lower than the lowest point of the steaming surface in the main steaming area. Thus, the temperature control can be based on the conditions in the main steaming area of the steam generator.

[0018] Preferably, the temperature sensing element is arranged at a location such that its vertical projection

coincides with an area in which the heating element does not extend. This better enables the temperature control to be guided more by the temperature of the steam generator than the temperature of the heating element.

[0019] The garment care device preferably comprises a central groove in the steam generator for guiding water, which central groove is recessed relative to the steaming surface. In this embodiment, the central groove has a downstream extremity towards which the water is guided, and the temperature sensing element is arranged at or proximal to the downstream extremity.

[0020] Thus, the water is guided by the central groove towards the temperature sensing element. This can assist the temperature control to respond faster to the water supplied to the steam generator. The central groove extends, for example, along a longitudinal axis of the steaming surface.

[0021] The garment care device preferably comprises a protruding element arranged in the steam generator for mounting the temperature sensor.

[0022] The temperature sensor is, for example, detachably mounted to the protruding element.

[0023] Preferably, the protruding element comprises a cavity for mounting the temperature sensing element therein.

[0024] Preferably, the heating element comprises a heating element having an overall U-shape, which heating element comprises a pair of curved portions which arch inwardly towards each other in the direction of a longitudinal central axis of the steam generator, and wherein the protruding element elevates away from the steaming surface at a position between the pair of curved portions.

[0025] The pair of curved portions are, for example, arranged in the central area of the steam generator. This can assist to make the temperature sensing element more responsive to the heating provided by the heating element.

[0026] The garment care device preferably comprises a fuse assembly mounted on the protruding element.

[0027] In such an embodiment, the thermal fuse assembly is connected to the heating element, and prevents the heating element from heating the steam generator above a given temperature limit. When the temperature exceeds this given temperature limit, blowing of the thermal fuse assembly results in an open circuit which prevents operation of the heating element.

[0028] Preferably, the steaming surface is inclined by an angle in the range 2 to 10 degrees compared to the treatment surface. Such an angle facilitates the movement of water on the steaming surface, and thereby improve the water vaporisation within the steam generator.

[0029] Preferably, the difference of height between the higher point and the lower point is in the range 5 to 20 mm, preferably about 8 mm

[0030] The garment care device preferably comprises a control unit configured to receive the temperature signal in order to start or stop the heating element based on a

given temperature threshold.

[0031] The supply of electric current to the heating element can, for example, be stopped when temperature signal is indicative of a temperature which is equal to or higher than the given temperature threshold, and turned on when the temperature signal is indicative of a temperature which is below the given temperature threshold.

[0032] In another set of embodiments, the garment care device comprises:

- a base comprising a water tank,
- a hand unit containing the steam generator, and
- a hose cord for carrying water from the water tank to the steam generator.

[0033] Water is carried by a pump arranged either in the base or alternatively in the hand unit.

[0034] In one set of embodiments, the garment care device comprises:

- a hand unit,
- a water tank, and
- a pump for supplying water from the water tank to the steam generator, wherein the steam generator, the water tank, and the pump are contained in the hand unit.

[0035] In another set of embodiments, the garment care device comprises:

- a hand unit,
- a water tank arranged higher than the steam generator, and
- a valve arranged between the water tank and the steam generator, for supplying water from the water tank to the steam generator, wherein the steam generator, the water tank, and the valve are contained in the hand unit.

[0036] Detailed explanations and other aspects of the invention will be given below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] 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 schematically depicts a garment care device according to an example,
 Fig.2 schematically depicts a garment care device according to another example,
 Fig.3 schematically depicts a garment care device according to a further example,
 Fig.4A provides a planar view of a steam generator of an exemplary garment care device,

Fig.4B provides the planar view shown in Fig.4A together with a portion representing the arrangement of the heating element,

Fig.4C provides a perspective view of the steam generator shown in Fig.4A,

Fig.5 provides a top view of a steam generator as shown in Figs.4A to 4C with a cover mounted on the steam generator,

Fig.6 provides a cross-sectional view of the steam generator shown in Figs.4A to 4C which shows an inclined steaming surface,

Fig.7 provides a cross-sectional view of the steam generator shown in Fig.5 which shows the inclined steaming surface,

Fig.8 provides a magnified view of part of the cross-sectional view shown in Fig.7,

Fig.9 provides a further cross-sectional view of the steam generator shown in Fig.5,

Fig.10 provides a perspective view of an exemplary temperature sensor and thermal fuse assembly,

Fig.11 shows an exemplary temperature sensor,

Fig.12 shows an exemplary thermal fuse assembly.

DETAILED DESCRIPTION OF THE INVENTION

[0038] Fig.1 depicts a garment care device 100A according to a non-limiting example.

[0039] The device 100A comprises a treatment surface 109 for treating a garment (the garment being not shown). For example, treating a garment consists in de-wrinkling or steaming.

[0040] The device 100A also comprises a steam generator 104 being in thermal contact with the treatment surface. The steam generator 104 is heated by a heating element 144. The heating provided by the heating element enables the steam generator 104 to vaporize the water pumped thereto by the pump 106.

[0041] The steam generator 104 comprises a steaming surface receiving water for generating steam via vaporization. The steaming surface is inclined compared to the treatment surface between a higher point and a lower point. Those technical aspects will be further detailed in the following.

[0042] The device 100A also comprises a temperature sensor having a temperature sensing element for generating a signal for controlling the heating element. The temperature sensing element is arranged at a height (H) being between the higher point and the lower point. Those technical aspects will be further detailed in the following.

[0043] The exemplary garment care device 100A comprises a water tank 102 for containing water, and from which the steam generator 104 receives water.

[0044] The garment care device 100A further comprises a pump 106 arranged between the water tank 102 and the steam generator 104. The pump 106 is adapted to pump the water from the water tank 102 to the steam generator 104.

[0045] The pump can be arranged either in the base (as illustrated), or alternatively in the hand unit (not shown).

[0046] The treatment surface 109 corresponds to the external surface of a soleplate 108 and is intended to get into contact with the garment.

[0047] As shown in Fig.1, the soleplate 108 delimits a plurality of steam vents 110. The steam vents 110 are fluidly communicable with the steam generator 104. Fluid communication between the steam generator 104 and the steam vents 110 permits the steam generated in the steam generator 104 to be supplied to the garment adjacent, and in some cases contacting, the soleplate 108.

[0048] The treatment surface 109 is preferably an overall flat surface, meaning that it forms a surface inscribing in a plane (with or without small discontinuities, such as recesses around the steam vents 110).

[0049] For example, the steam vents 110 are arranged in such a way as to distribute the steam to different portions of the garment.

[0050] The steam vents 110 are in fluid communication with the steam generator 104. This permits the steam generated in the steam generator 104 to be supplied to the fabric being treated using the garment care device 100A.

[0051] Although Fig.1 shows a garment care device 100A having six steam vents, the number of steam vents could be larger or smaller.

[0052] The device 100A comprises a base 112 and a hand unit 114. The base 112 comprises the water tank 102 and the pump 106, and the hand unit 114 comprises the steam generator 104 and the soleplate 108.

[0053] A hose cord 116 comprises a water tube (not visible) for carrying the water from the water tank 102 to the steam generator 104. The hose cord 116 is preferably flexible in order to facilitate movement of the hand unit 114 whilst maintaining supply of water to the steam generator 104.

[0054] A control unit 120, for example a micro controller, is used to control (via an intermediate relay) the water flow rate of pump 106, which in turn allows controlling the flow of steam exiting the steam vents 110. The water flow rate of pump 106 can be varied by changing the duty cycle of its power supply.

[0055] In the non-limiting example shown in Fig.1, the garment care device 100A comprises a button 124. The button 124 is actuatable by a user of the garment care device 100A. Any suitable design of button 124 may be considered, such as a push button, slider button, a steam trigger, capacitive sensor, etc.

[0056] Preferably, the garment care device 100A comprises a handle 126 for grasping by the user in order to assist the user to move the treatment surface 109 relative to the garment to be treated. The handle 126 may thus be included in the hand unit 114.

[0057] The button 124 is preferably arranged proximal to the handle 126 such that the button 124 is actuatable while the user is grasping the handle 126, e.g. by action

of a finger.

[0058] For example, the button 124 takes the form of a steam trigger, such as a micro switch, arranged in the hand unit 114 and connected to a micro-controller included in the control unit 120 to receive a switching signal from the switch and control the pump 106 based on the switching signal.

[0059] The exemplary garment care device 100A comprises, in addition to the button 124, a sensing unit 128 configured to detect whether or not the user is holding the garment care device 100A. The button 124 and/or the sensing unit 128 can be used to control operation parameters of the garment care device 100A, resulting in steam delivery by the steam generator 104.

[0060] In the non-limiting example shown in Fig.1, the control unit 120 is connected (not shown) to the button 124 and to the sensing unit 128 such that the delivery of steam from the steam generator 104 is responsive to actuation of the button and/or a sensor signal received from the sensing unit 128.

[0061] Fig.2 schematically depicts another exemplary garment care device 100B. Fig.2 is based on Fig.1. Similar to the example shown in Fig.1, the garment care device 100B comprises a water tank 102 and a pump 106 for pumping water from the water tank 102 to a steam generator 104.

[0062] Water is carried from the water tank 102 to the steam generator 104 in the hand unit 114 via a water tube 135. The water tube 135 is included in the hose cord 116, as previously described.

[0063] In the non-limiting example shown in Fig.2, the garment care device 100B comprises a pressure relief valve arrangement 136 between the pump 106 and the steam generator 104. The pressure relief valve arrangement 136 is configured to relieve excess pressure in the garment care device 100B by directing water around a loop back to the water tank 102, rather than to the steam generator 104.

[0064] As schematically shown in Fig.2, the water which is pumped from the water tank 102 to the steam generator 104 via a dosing head 138. The dosing head 138 is sealed onto a cover 140 of the steam generator 104 by a dosing seal 142.

[0065] The steam generator 104 is preferably formed by a casting process using a suitable metal or metal alloy. The steam generator 104 can, for instance, be cast in aluminium.

[0066] Similarly, the cover 140 is preferably formed by a casting process using a suitable metal or metal alloy. The cover 140 can, for instance, be cast in aluminium. Thus, in some non-limiting examples, both the steam generator 104 and the cover 140 are cast in aluminium.

[0067] The design of the steam generator 104 and the cover 140 will be described in more detail herein below.

[0068] The soleplate 108 can also be cast from a suitable metal or metal alloy, such as aluminium. Such a metallic soleplate 108 is nonetheless preferably coated with a suitable material in order to provide a treatment

surface 109 having suitable fabric glide properties.

[0069] The steam generator 104 is heated by the heating element 144, for example an electrical heating element. The heating element 144 comprises a pair of electrical connections 144B for receiving power supply. The heat provided by the heating element 144 causes the water dosed into the steam generator 104 via the dosing head 138 to be vaporized. The resulting steam is supplied to the garment being treated via the steam vents 110 provided in the soleplate 108, as previously described.

[0070] As shown in Fig.2, power is supplied to the garment care device 100B via a power cord 148. In this particular example, the power cord 148 extends from the base 112 rather than from the hand unit 114. Power is nonetheless supplied to the hand unit 114, and in particular to the heating element 144, via electrical wiring provided in the hose cord 116, as previously described.

[0071] In the non-limiting example shown in Fig.2, the base 112 comprises a first printed circuit board assembly 150. The pump 106 is controlled by control electronics included in the first printed circuit board assembly 150. At least part of the above-described control unit 120 can, for example, be provided by such control electronics included in the first printed circuit board assembly 150.

[0072] More generally, the garment care device 100A, 100B comprises a temperature sensor 152 for generating a signal used for controlling the heating element 144. The arrangement of the temperature sensor 152 in relation to the steam generator 104 will be described in more detail in the following.

[0073] Controlling the heating element 144 based on the signal generated by the temperature sensor 152 can be implemented in any suitable manner. Preferably, a relay (not visible) is configured to switch the heating element 144 on and off based on the temperature sensed by the temperature sensor 152.

[0074] In a non-limiting example, the temperature sensor 152 comprises a temperature sensing element (not visible in Fig.2), and the temperature of the steam generator 104 is sensed by a change in resistance of the temperature sensing element.

[0075] More generally, the control unit 120 can, for example, receive a temperature signal from the temperature sensor 152 in order to start or stop the heating element 144 based on a given temperature threshold.

[0076] The supply of electric current to the heating element 144 can, for example, be stopped when temperature signal is indicative of a temperature which is equal to or higher than the given temperature threshold, and turned on when the temperature signal is indicative of a temperature which is below the given temperature threshold.

[0077] For example, the exemplary hand unit 114 shown in Fig.2 comprises a second printed circuit board assembly 154 which can also be regarded as a power printed circuit board assembly 154. A change in resistance signal from the thermistor element can, for example, be received by control circuitry included in the power

printed circuit board assembly 154 to control the switching on and off of the relay, and thus the heating provided by the heating element 144. Such temperature feedback control over the heating element 144 can, for instance, be based on the predefined firmware temperature settings.

[0078] In some non-limiting examples, a relay (not visible) is used to control the pump 106, and switching the relay on and off in order to control the supply of water to the steam generator 104 is based on the change in the resistance signal from the temperature sensing element. This feedback control over the pump 106 can, for example, be based on predefined firmware pump duty cycle settings.

[0079] The exemplary garment care device 100B shown in Fig.2 also comprises a thermal fuse assembly 156. The thermal fuse assembly 156 is in thermal contact with the steam generator 104, as shown, and prevents the heating element 144 from heating the steam generator 104 above a given temperature limit. When the temperature exceeds this given temperature limit, blowing of the thermal fuse assembly results in an open circuit which prevents operation of the heating element 144.

[0080] In the non-limiting example shown in Fig.2, the garment care device 100B comprises an indicator 158, for example comprising or in the form of a light emitting diode. The indicator 158 may be controlled, for example by the control circuitry included in the power printed circuit board assembly 154, to indicate a selected, for example user-selected, operating mode of the garment care device 100. The indicator may also be used to indicate the status of the device for example to indicate the device has heated up and is ready during start up.

[0081] Fig.3 shows yet another exemplary garment care device 100C having some similarities with the exemplary garment care devices 100A, 100B described above in relation to Figs.1 and 2. However, in the non-limiting example shown in Fig.3, the various components of the garment care device 100C are each included in the hand unit 114. In other words, the garment care device 100C does not have a base. Accordingly, the water tank 102, the steam generator 104, the control unit 120 and the pump 106 are included in the hand unit 114, together with the soleplate 108, the button 124, and the sensing unit 128. Alternatively (not shown), in the garment care device 100C, instead of using a pump 106 to carry water from the water tank to the steam generator, water can be carried from the water tank to the steam generator by gravity in arranging the water tank higher than the steam generator. A valve is arranged along the flow path between the water tank and the steam generator 104. If the valve is electrically controllable, it can be controlled by the control unit 120 for opening or closing the water path.

[0082] The garment care device 100C shown in Fig.3 takes the form of a steam iron. It may necessitate a smaller water tank 102 due to the water tank 102 being incorporated in the hand unit 114 rather than in a base, al-

though the garment care device 100C may nonetheless benefit from portability and have space-saving advantages due to not requiring such a base. The responsiveness of the steam delivery to the user inputs received via (at least) the button 124 and the sensing unit 128 may also be relatively rapid due to the proximity of the water tank 102 with respect to the steam generator 104.

[0083] Figs.4A and 4B provide planar views of the steam generator 104 of an exemplary garment care device 100A, 100B, 100C.

[0084] Fig.5 provides a top view showing a steam generator 104 as shown in Figs.4A to 4C with a cover 140. The cover 140 closes the steam generator 104. Fig.5 also depicts the soleplate 108, the temperature sensor 152 and thermal fuse assembly 156, seen from outside.

[0085] The cover 140 is preferably cast in a suitable metal alloy or metal, such as aluminium, as previously described.

[0086] The garment care device 100A, 100B, 100C comprises the heating element 144. The heating element 144 in this non-limiting example is embedded in a lower region of the steam generator 104.

The steam generator 104 is generally elongated along a longitudinal axis 160. The longitudinal axis 160 extends along a centreline which notionally divides the steam generator 104 into two halves. The steam generator 104 also has a wider back end 162 and a sharper front end 164.

[0087] The electrical connections 144B are preferably both disposed proximal to the back end 162 of the steam generator 104 but are spaced apart from each other so that the electrical connections 144B are positioned on either side of the longitudinal axis 160. The heating element 144 extends in a loop from one of the electrical connections 144B located proximal to the back end 162 to a turning point 166 proximal to the front end 164, and from the turning point 166 towards the other of the electrical connections 144B. The heating element 144 may thus be regarded as having an overall U-shape.

[0088] The loop formed by the heating element 144 is preferably symmetrical such that the longitudinal axis 160 defines an axis of symmetry for the heating element 144. This assists the heating element 144 to provide a relatively uniform heating of the steam generator 104.

[0089] The garment care device 100A, 100B, 100C preferably comprises a protruding element 168 arranged in the steam generator 104 for mounting the temperature sensor 152.

[0090] The protruding element 168 can be alternatively be referred to as a "boss" or "mounting feature" which receives the temperature sensing element, for example thermistor element, of the temperature sensor 152.

[0091] In the non-limiting example shown in Figs.4A and 4B, the protruding element 168 delimits a cavity 170, e.g. in the form of a pin hole, in which the temperature sensing element can be received.

[0092] The temperature sensing element is preferably arranged in a central area CA of the heating element 144.

The central area CA corresponds to the centre of a rectangle R inscribing the heating element 144, as shown in Fig.4B. This may assist to enhance responsiveness to both heating by the heating element 144, e.g. when the above-described relay switches-on the heating element 144, and the cooling by the water supplied into the steam generator 104.

[0093] More generally, the steam generator 104 comprises a steaming surface 172 which receives water for generating steam.

[0094] Coming back to Figs.4A and 4B, the protruding element 168 elevates away from the steaming surface 172. The cavity 170 is arranged such that the temperature sensing element, when received in the cavity 170, is in thermal contact with the interior of the steam generator 104.

[0095] The protruding element 168 is preferably positioned on the longitudinal axis 160. Such central positioning of the protruding element 168 can assist the feedback control over the heating element 144 because the centre of the steam generator 104 provides a representative location at which to sense the temperature. The positioning of the temperature sensing element of the temperature sensor 152 will be described in more detail in the following.

[0096] The loop formed by the heating element 144 preferably comprises a pair of curved portions 174A, 174B which arch inwardly towards each other in the direction of the longitudinal axis 160.

[0097] In the non-limiting example shown in Fig.4B, the pair of curved portions 174A, 174B are arranged to heat faster the central area CA of the steam generator 104.

[0098] Preferably, the protruding element 168 elevates away from the steaming surface 172 at a position between the pair of curved portions 174A, 174B. This can assist to make the temperature sensing element more responsive to the heating provided by the heating element.

[0099] This proximity of the curved portions 174A, 174B relative to the protruding element 168, and in particular the temperature sensing element received therein, may enhance the responsiveness to the feedback control over the heating element 144.

[0100] In the non-limiting example shown in Fig.4B, the protruding element 168 is arranged at a position along the longitudinal axis 160 at which the pair of curved portions 174A, 174B are closest to each other.

[0101] More generally, the temperature sensing element is positioned between opposing portions of the heating element 144, and the lateral distance between the temperature sensing element and one of the opposing portions is preferably the same as, or substantially the same as, the lateral distance between the temperature sensing element and the other of the opposing portions.

[0102] The steam generator 104 preferably comprises a central groove 176 for guiding water, with the central

groove 176 being recessed relative to the steaming surface 172. The central groove 176 has a downstream extremity towards which the water is guided.

[0103] Preferably, the temperature sensing element is arranged at or proximal to the downstream extremity of the central groove 176. Thus, the water is guided by the central groove 176 towards the temperature sensing element.

[0104] In the non-limiting example shown in Figs.4A and 4B, the central groove 176 extends along the longitudinal axis 160. In particular, the protruding element 168 is arranged at or proximal to the downstream extremity of the central groove such that water is guided to the protruding element 168.

[0105] A water dosing point 178 defines the position in the steaming surface 172 which initially receives water dosed into the steam generator 104. This water is, for instance, dosed via the dosing head 138 described above in relation to Fig.2.

[0106] The central groove 176 preferably extends from the water dosing point 178 towards the temperature sensing element of the temperature sensor 152. In the non-limiting example shown in Figs.4A and 4B, the central groove 176 extends along the longitudinal axis 160 from the water dosing point 178 to the protruding element 168 which receives the temperature sensing element. This can assist the feedback control over the heating element 144 to be more responsive to water present in the steam generator 104.

[0107] In the non-limiting example shown in Figs.4A and 4B, a pair of diverging secondary grooves 180A, 180B outwardly extend from the downstream extremity of the central groove 176. Each secondary groove 180A, 180B extends towards a respective part of the heating element 144 which is proximal to one of the electrical connections 144B. Thus, the secondary grooves 180A, 180B assist to transport water to, and thereby cool down, "hot spots" which align with the parts of the heating element 144 proximal to the electrical connections 144B.

[0108] The steam generator 104 preferably comprises a main steaming area 182 (delimited by large dotted line in Fig.4A), a secondary steaming area 184 (delimited by small dotted line in Fig.4A), and a steam channel 186 to distribute steam towards the steam vents. Most of the steam generation takes place in the main steaming area 182.

[0109] In the non-limiting example shown in Fig.4A, the steaming surface 172 is located in the main steaming area 182.

[0110] The steam channel 186 is for guiding the steam downstream towards the steam vents 110. The secondary steaming area 184 provides an intermediate chamber between the main steaming area 182 and the steam channel 186 which can assist to mitigate the risk of liquid water being passed downstream towards the steam vents 110.

[0111] In the case of the non-limiting example shown in Figs.4A and 4B, the main steaming area 182, the sec-

ondary steaming area 184, and the steam channel 186 are closed by the cover 140 when the cover 140 is secured to the steam generator 104.

[0112] Such securing of the cover 140 to the steam generator 104 can be implemented in any suitable manner. In the non-limiting example shown in Figs.4A and 4B, the steam generator 104 delimits apertures 190 which receive fasteners (not visible in Figs.4A and 4B), such as screws, in order to secure the cover 140 to the steam generator 104.

[0113] Whilst not visible in Figs.4A and 4B, the garment care device 100A, 100B, 100C preferably comprises a housing for enclosing components of the hand unit 114. Such a housing can, for instance, be secured to the soleplate 108 shown in Figs.4A and 4B.

[0114] Such securement of the housing to the soleplate 108 can be achieved in any suitable manner. In the non-limiting example shown in Figs.4A and 4B, fastening elements, such as screws, received in holes 192 are used for this purpose.

[0115] The thermal fuse assembly 156 described above in relation to Fig.2 is preferably secured to the protruding element 168. To this end, the protruding element 168 delimits a recess 194 for receiving a suitable fixing element (not visible in Figs.4A and 4B), such as a screw, in order to secure the thermal fuse assembly 156 to the protruding element 168.

[0116] Fig.4C provides a perspective view of the steam generator 104 shown in Fig.4A. A wall 196 extends around the steam generator 104 and partitions different parts of the steam generator 104. Most of the wall 196 engages the cover 140 in order to retain steam within the steam generator 104.

[0117] As shown in Fig.5, the cover 140 comprises a dosing hole 202 through which water can be dosed to the dosing point 178. The dosing head 138 can, for instance, be sealed onto the cover 140 via a dosing seal 142 provided around the dosing hole 202, as previously described in relation to Fig.2.

[0118] The cover 140 is secured to the steam generator 104 via fasteners 204. In this particular example, the fasteners 204 take the form of screws which screw into the above-described apertures 190 provided in the steam generator 104.

[0119] The garment care device 100A, 100B, 100C preferably comprises a thermal fuse assembly 156, as previously described. In the non-limiting example shown in Fig.5, the thermal fuse assembly 156 is secured to the steam generator 104 via a fixing element 206. In this example, the fixing element 206 takes the form of a screw which screws into the recess 194 provided in the protruding element 168.

[0120] The temperature sensor 152 included in the garment care device 100A, 100B, 100C can be affixed to the steam generator 104 via a further fixing element 208. In this non-limiting example, the further fixing element 208 is a screw which screws into an aperture (not visible in Fig.5) provided in the cover 140.

[0121] Fig.6 provides a cross-sectional view of the steam generator 104 to 4C. As shown in Fig.6, the steaming surface 172 on which the water is received for generating steam is inclined compared to the treatment surface 109 between a higher point 210 and a lower point 212.

[0122] In other words, the steaming surface 172 slopes downwardly in the direction of the wider back end 162 of the steam generator 104. This means that water flows on the steaming surface 172 away from the dosing point 178 and towards the back end 162 when the treatment surface 109 is horizontally orientated, e.g. by being placed on the horizontal surface of an ironing board (not shown).

[0123] Fig.7 provides a cross-sectional view of the steam generator 104 which shows the inclined steaming surface 172 and the temperature sensor 152 its temperature sensing element 216 (illustrated by a black dot).

[0124] Fig.8 provides a magnified view of part of the cross-sectional view of the steam generator 104 shown in Fig.7, where the temperature sensing element 216 is illustrated by a black dot.

[0125] Any suitable angle of incline θ , as shown in Fig. 8, may be selected in order to control the flow of water. Preferably, the steaming surface 172 is inclined by an angle θ in the range 2 to 10 degrees, such as about 5°, compared to the treatment surface 109.

[0126] This angle θ can, for example, be determined by measuring, at the lower point 212, the angle θ between a horizontal drawn parallel to the treatment surface 109 and the steaming surface 172, as shown in Fig.8.

[0127] In the depicted non-limiting example, the higher point 210 of the steaming surface 172 extends from a point at which the steaming surface 172 meets a sidewall surface 214 of the steam generator 104. This point can be identified by the shallower depth of the steaming surface 172 relative to that of the sidewall surface 214.

[0128] It is also noted that the higher point 210 and the lower point 212 are points on the steaming surface 172 itself, independently whether the steaming surface 172 has some protrusions or recesses at its surface.

[0129] The temperature sensing element 216 of the temperature sensor 152 is arranged at a height H which is between the higher point 210 and the lower point 212. This position has the advantage that the signal generated by the temperature sensor is sensitive both to the heating provided by the heating element 144 and the heat loss due to presence of water within the steam generator 104. The height H is preferably measured from the hashed line 220 aligning with the lower point 212.

[0130] The higher point 210, the lower point 212, and the height H can be determined from the distance of their projection from the treatment surface 109.

[0131] The term "between the higher point and the lower point" as used herein is intended to encompass the height H aligning with the higher point 210 or with the lower point 212.

[0132] The hashed line 218 in Figs.6 to 8 aligns with

the higher point 210 and is parallel with the plane of the treatment surface 109. Similarly, the hashed line 220 in Figs.6 to 8 aligns with the lower point 212 and is parallel with the plane of the treatment surface 109.

[0133] The temperature sensor 152 is, in the non-limiting example shown in Figs.7 and 8, a pin-type thermistor comprising a temperature sensing element 216 in the form of a thermistor element. In this case, it is the sensing point of the thermistor element which is arranged at the height H which is between the higher point 210 and the lower point 212.

[0134] In this particular example, the cavity 170 is in the form of a pin hole which is dimensioned to receive the thermistor element of the pin-type thermistor.

[0135] The temperature sensor 152 comprising or being in the form of thermistor, such as a pin-type thermistor, should not, however, be regarded as being limiting. Any suitable type of temperature sensor 152 can be considered, such as a thermo diode or a miniaturized mechanical thermostat.

[0136] The thermo diode can be regarded as a thermally operated semiconductor switch. The miniaturized mechanical thermostat comprises a small internal thermally operated switch.

[0137] Returning to the non-limiting example shown in Figs.6 to 8, the temperature sensing element 216, in this case in the form of a thermistor element, is received in the cavity 170 delimited by the protruding element 168. The cavity 170 extends sufficiently far in the direction of the treatment plate 109 that the above-described height H criterion is satisfied, as shown.

[0138] As best shown in Fig.8, the temperature sensor 152 included in the exemplary garment care device 100A, 100B, 100C is affixed to the steam generator 104 via a further fixing element 208 taking the form of a screw which screws for example into the aperture 222 provided in the cover 140.

[0139] Fig.9 provides a cross-sectional view along axis AA of Fig.4B, and shows the heating element 144 at the position of the curved portions 174A, 174B.

[0140] More generally, the (central area of the) heating element 144 is, for instance, arranged at a height H1 which is lower than the lower point 212 of the steaming surface 172.

[0141] Fig.10 provides a perspective view of an exemplary temperature sensor 152 and thermal fuse assembly 156. The fixing element 206, in the form of a screw, which can secure the thermal fuse assembly 156 to the steam generator 104, for example to the protruding element 168, is also shown in Fig.10.

[0142] The exemplary temperature sensor 152 shown in Fig.10 is the pin-type thermistor described above in relation to Figs.7 and 8. Further evident in Fig.10 is the further fixing element 208, in the form of a screw, which secures the temperature sensor 152 to the steam generator 104, and in particular to the cover 140 in the non-limiting example shown in Figs.7 and 8.

[0143] Figs. 11 and 12 respectively show the temper-

ature sensor 152 separately from the thermal fuse assembly 156, and the thermal fuse assembly 156 separately from the temperature sensor 152.

[0144] It has been found that the design shown in Figs. 4A to 4B and 5 to 9 provides enhanced temperature control, because of the positioning of the temperature sensing element 216 between the higher point 210 and the lower point 212 of the steaming surface 172 provide more responsiveness to the cooling provided by the water on the steaming surface 172 as well as the heating provided by the heating element 144.

[0145] The fact of positioning the protruding element 168 at the end of the main groove 176 helps the water to reach and cool the protruding element 168 faster. In this manner, the temperature sensing element 216, e.g. thermistor element, can effectively respond to the heat delivered by the heating element 144, and heat extracted by the water, which can make the whole system very responsive during dry and steam cycles.

[0146] Cooling of the hot spots of the steam generator 104 is improved because of the effective water spreading provided by the secondary grooves 180A, 180B extending from the downstream extremity of the central groove 176.

[0147] The above embodiments as described are only illustrative, and not intended to limit the technique approaches of the present invention. Although the present invention is described in details referring to the preferable embodiments, those skilled in the art will understand that the technique approaches of the present invention can be modified or equally displaced without departing from the protective scope of the claims of the present invention. In particular, although the invention has been described based on a garment care device, it can be applied to any household device having a steam generator. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A garment care device (100A, 100B, 100C) comprising:
 - a treatment surface (109) for treating a garment,
 - a heating element (144),
 - a steam generator (104) being in thermal contact with the treatment surface, the steam generator being heated by the heating element, the steam generator comprising a steaming surface (172) receiving water for generating steam, the steaming surface being inclined compared to said treatment surface (109) between a higher point (210) and a lower point (212),
 - a temperature sensor (152) having a temper-

- ature sensing element (216) for generating a signal for controlling the heating element, the temperature sensing element being arranged at a height (H) being between the higher point (210) and the lower point (212).
2. The garment care device according to claim 1, wherein the temperature sensing element (216) is arranged in a central area (CA) of the heating element (144).
 3. The garment care device according to claim 1 or claim 2, wherein the temperature sensing element (216) is arranged at a location such that its vertical projection coincides with an area in which the heating element (144) does not extend.
 4. The garment care device according to any one of claims 1 to 3, comprising a central groove (176) in the steam generator (104) for guiding water, which central groove is recessed relative to the steaming surface (172), the central groove having a downstream extremity towards which the water is guided, and wherein the temperature sensing element (216) is arranged at or proximal to said downstream extremity.
 5. The garment care device according to any one of claims 1 to 4, comprising a protruding element (168) arranged in the steam generator (104) for mounting the temperature sensor (152).
 6. The garment care device according to claim 5, wherein the protruding element (168) comprises a cavity (170) for mounting the temperature sensing element (216) therein.
 7. The garment care device according to claim 5 or claim 6, wherein the heating element (144) forms an overall U-shape comprising a pair of curved portions (174A, 174B) which arch inwardly towards each other in the direction of a longitudinal central axis (160) of the steam generator (104), and wherein the protruding element (168) protrudes away from the steaming surface (172) at a position between the pair of curved portions.
 8. The garment care device according to any one of claims 5 to 7, further comprising a fuse assembly (156) mounted on the protruding element (168).
 9. The garment care device according to any one of claims 1 to 8, wherein the steaming surface (172) is inclined by an angle (θ) in the range 2 to 10 degrees compared to the treatment surface (109).
 10. The garment care device according to any one of claims 1 to 9, wherein the difference of height between the higher point (210) and the lower point (212) is in the range 5 to 20 mm, preferably about 8 mm.
11. The garment care device according to any one of claims 1 to 10, further comprising a control unit (120) configured to receive the temperature signal in order to start or stop the heating element (144) based on a given temperature threshold.
 12. The garment care device according to any one of claims 1 to 11, further comprising:
 - a base (112) comprising a water tank (102),
 - a hand unit (114) containing the steam generator (104), and
 - a hose cord (116) for carrying water from the water tank to the steam generator.
 13. The garment care device according to any one of claims 1 to 11, further comprising:
 - a hand unit (114),
 - a water tank (102), and
 - a pump (106) for supplying water from the water tank to the steam generator, wherein the steam generator (104), the water tank, and the pump are contained in the hand unit.
 14. The garment care device according to any one of claims 1 to 11, further comprising:
 - a hand unit (114),
 - a water tank (102) arranged higher than the steam generator, and
 - a valve (106) arranged between the water tank and the steam generator, for supplying water from the water tank to the steam generator, wherein the steam generator (104), the water tank, and the valve are contained in the hand unit.

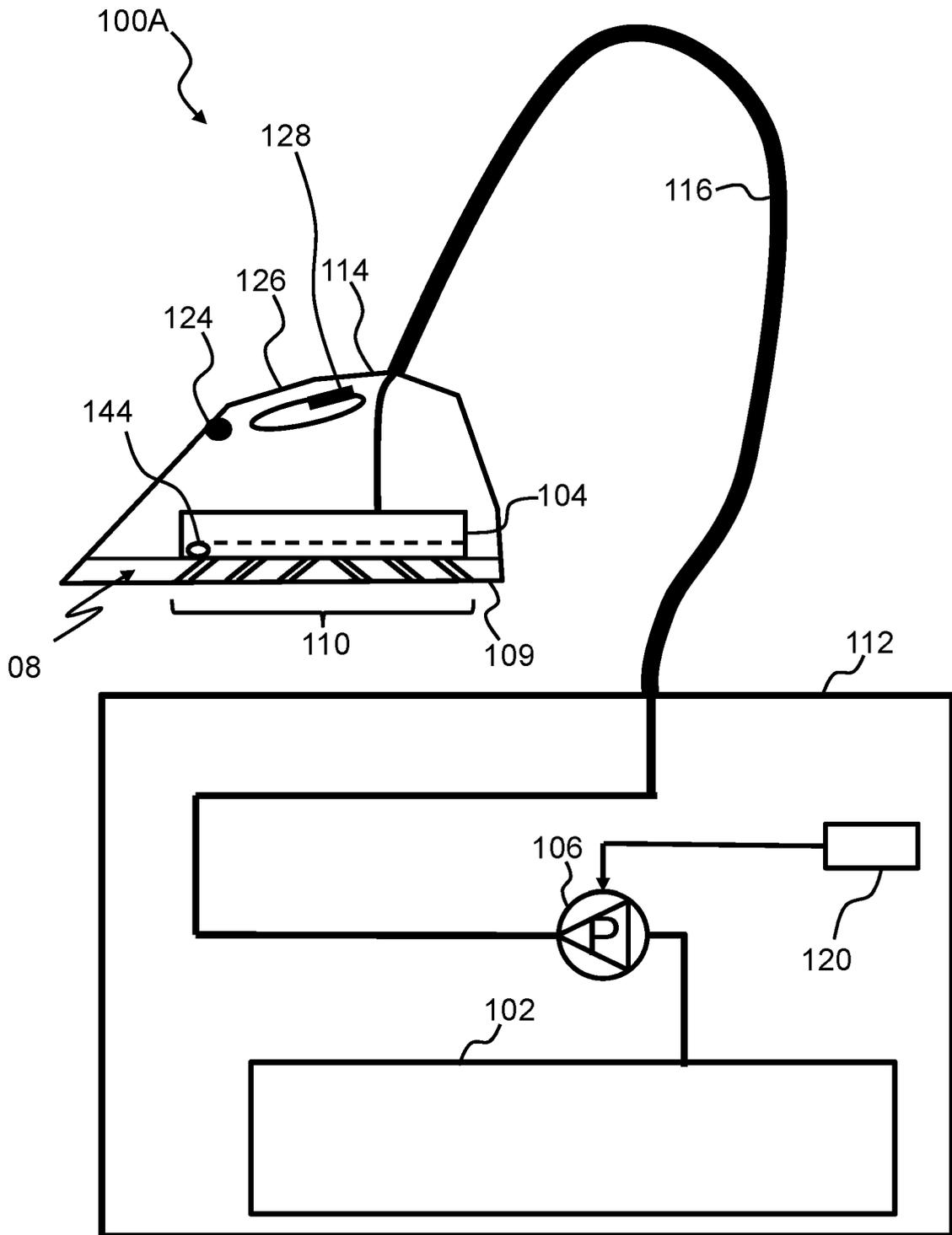


FIG.1

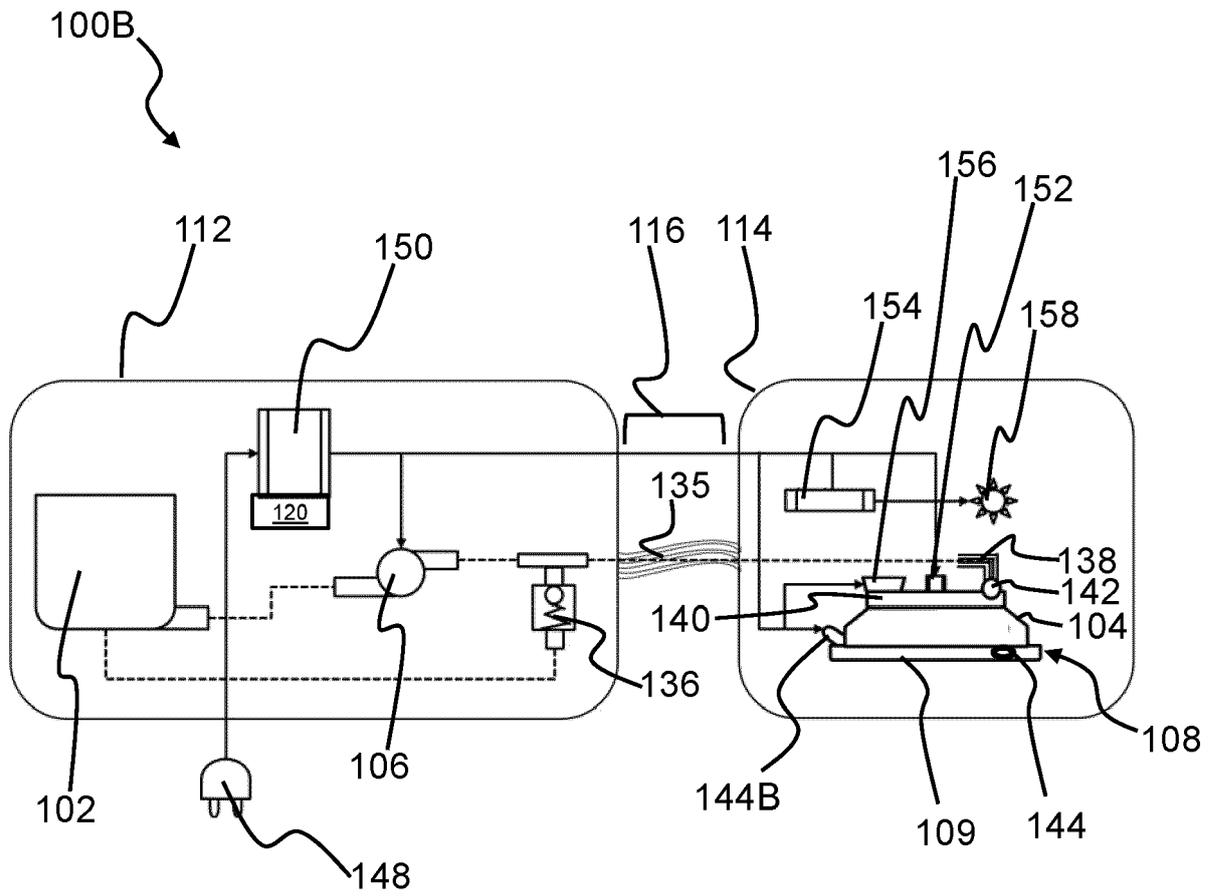


FIG.2

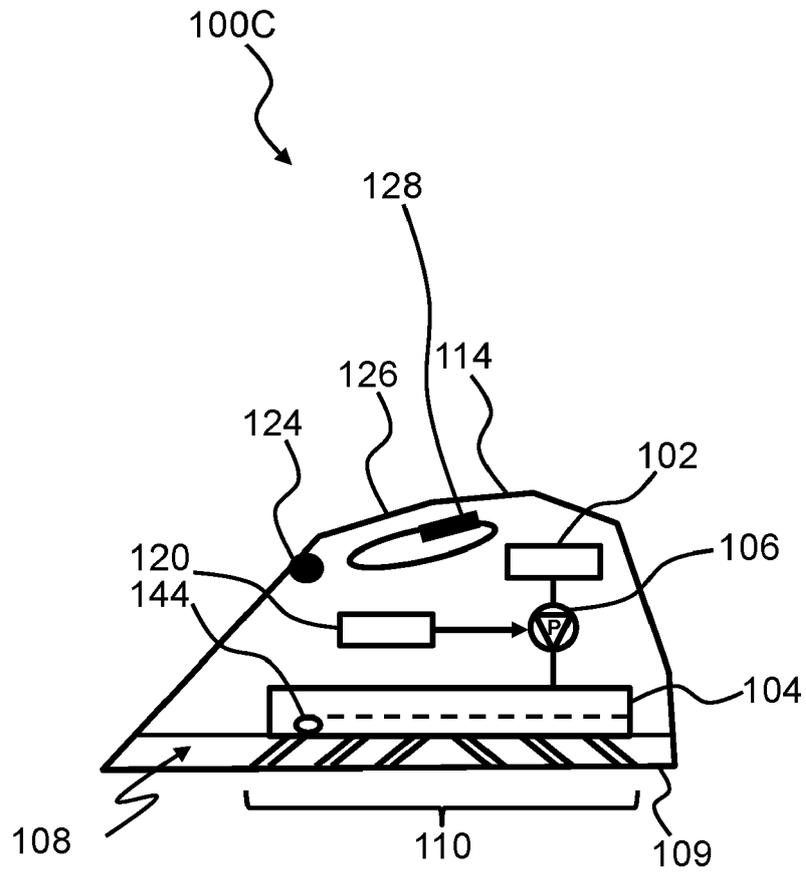


FIG.3

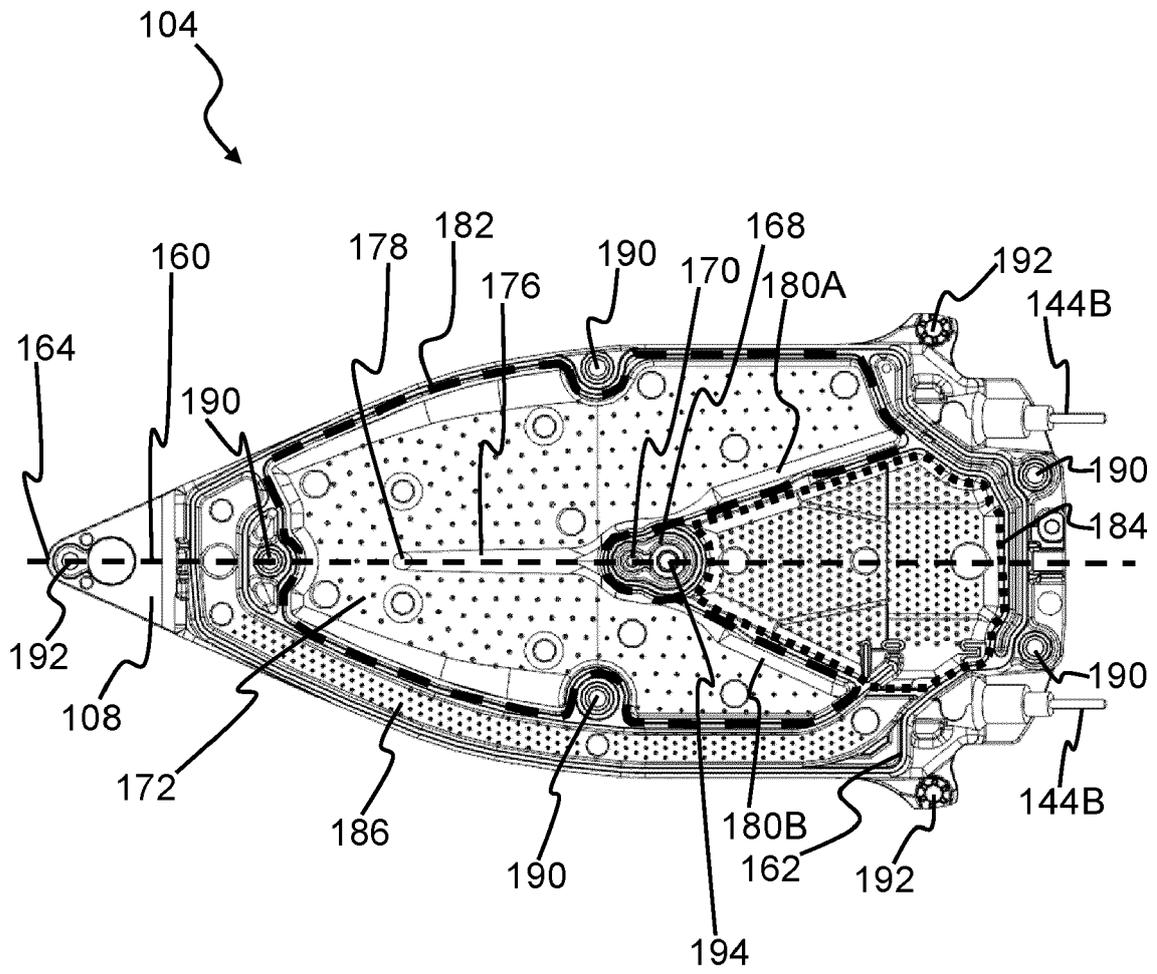


FIG.4A

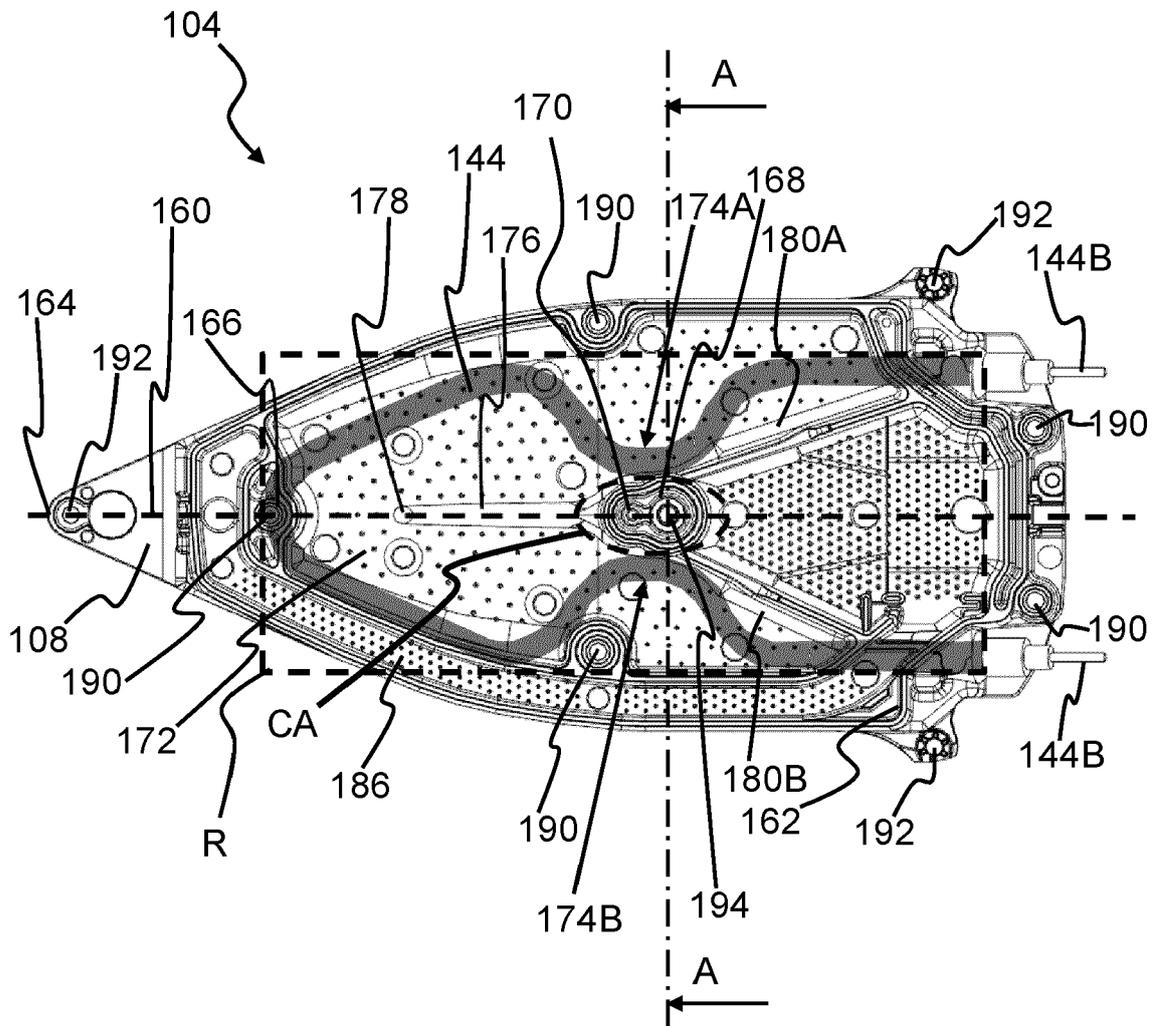


FIG.4B

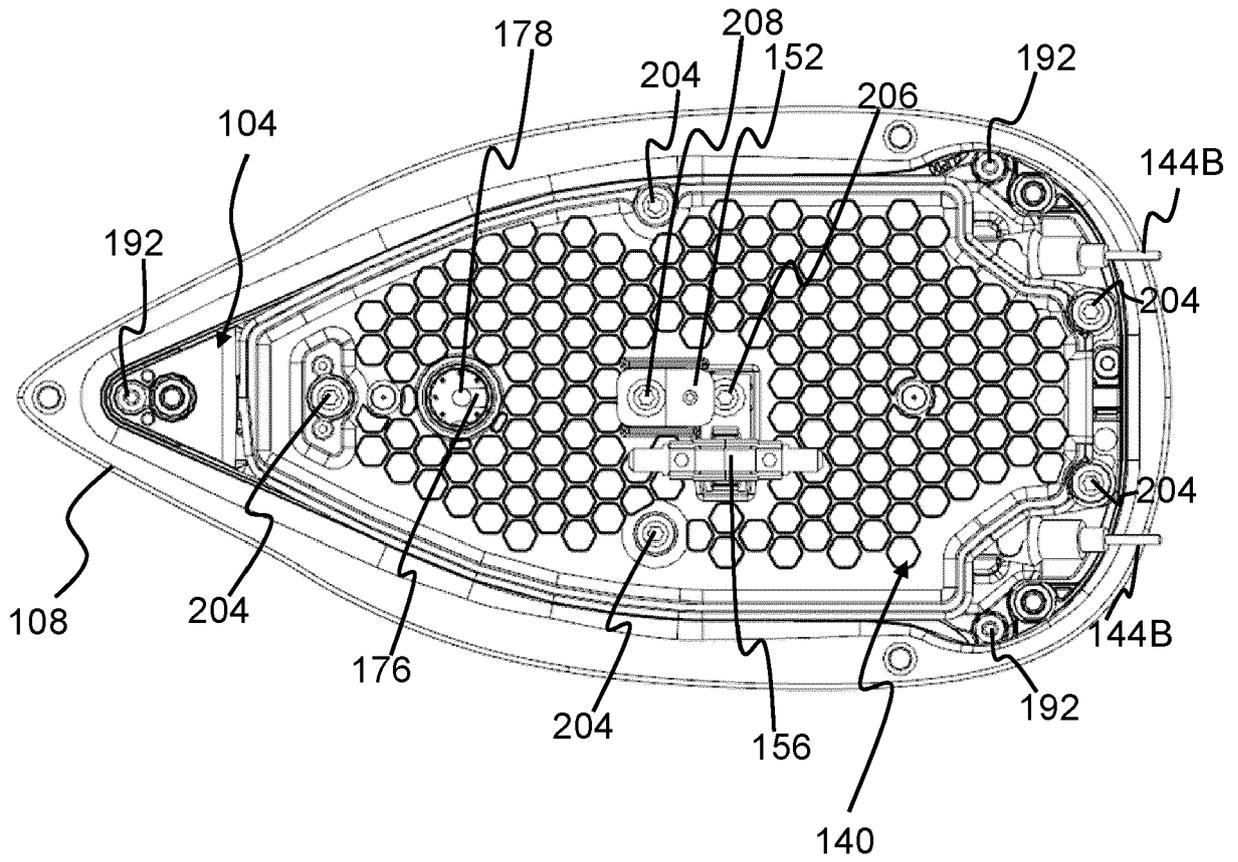


FIG.5

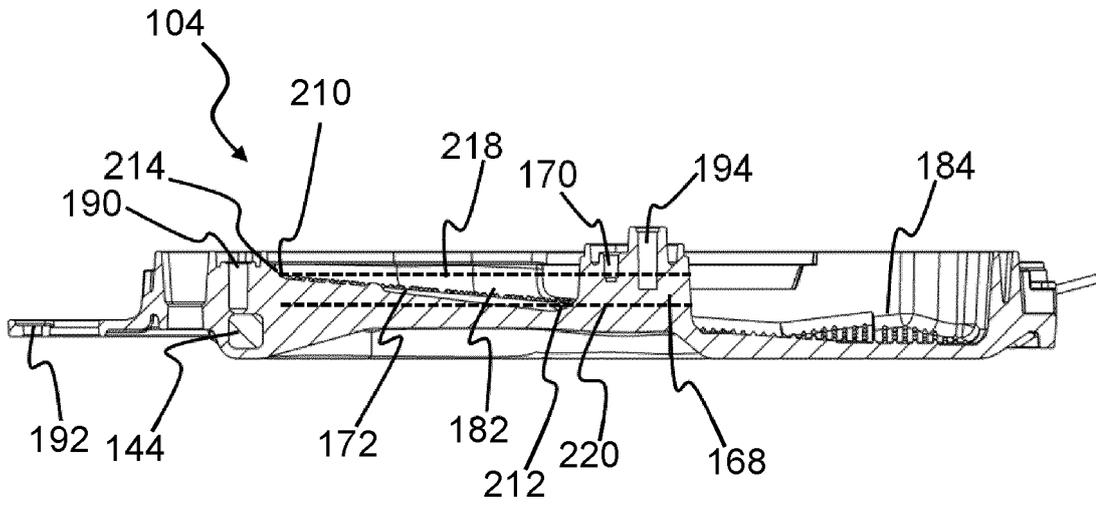


FIG. 6

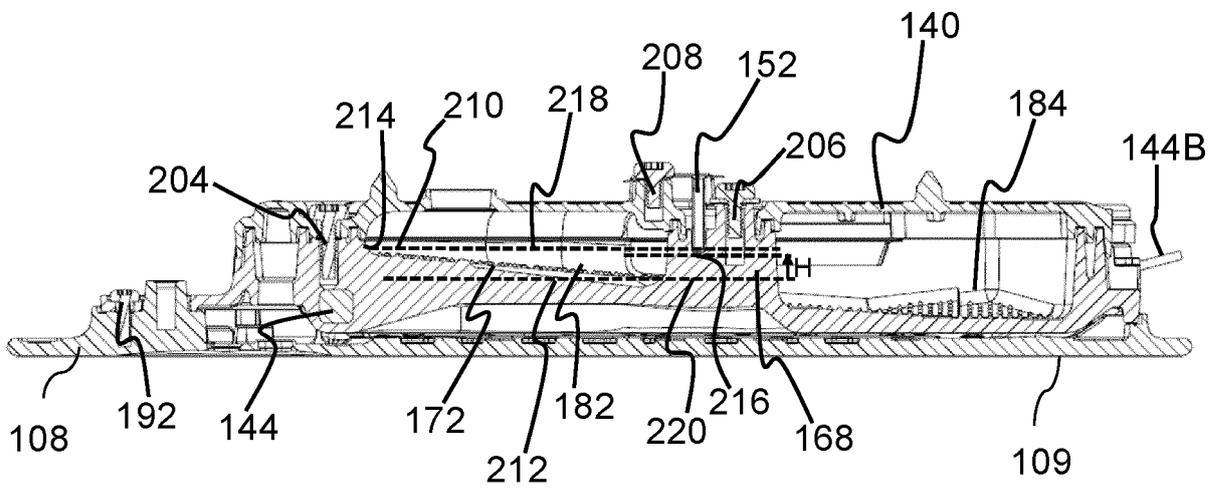


FIG. 7

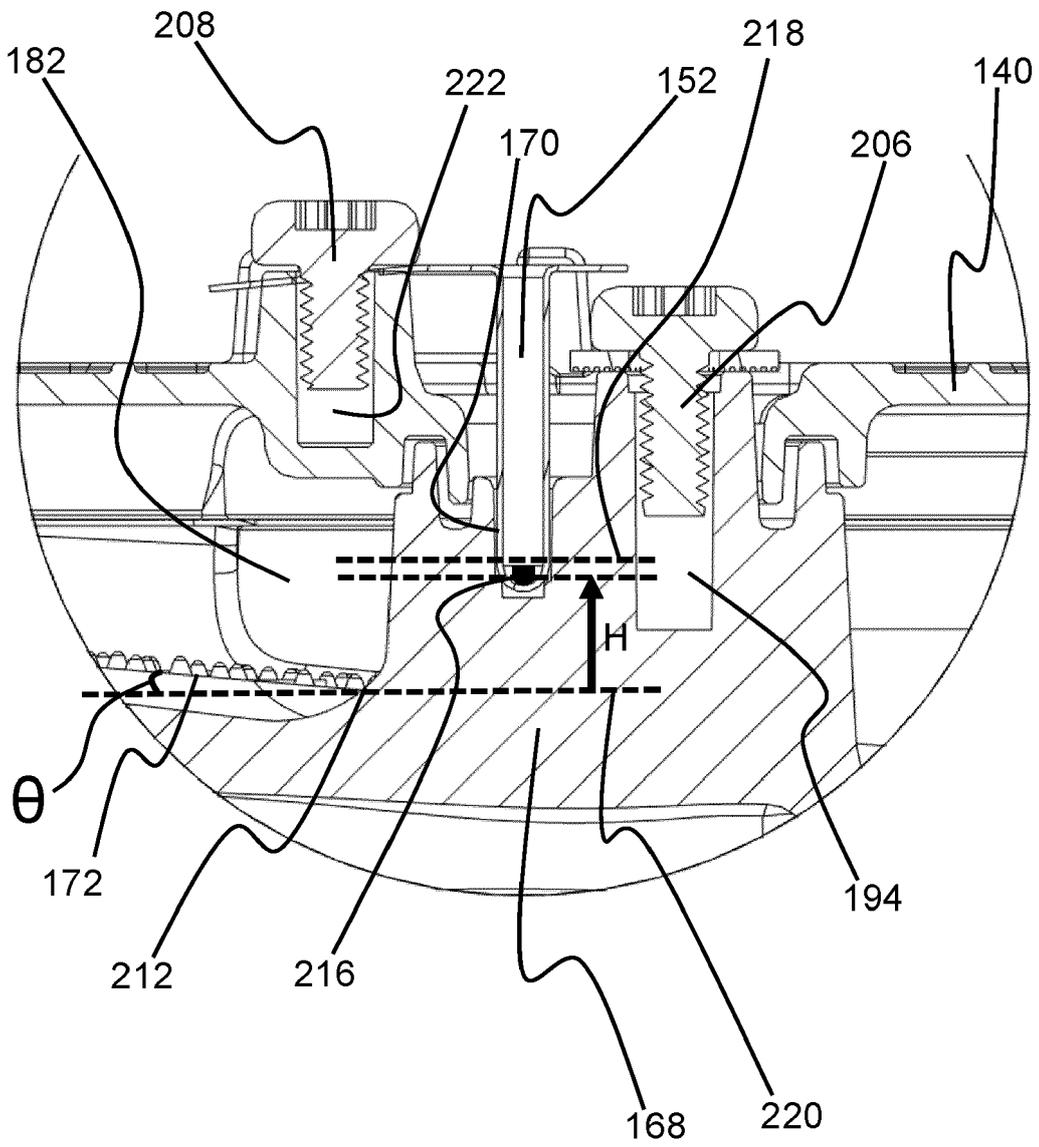


FIG. 8

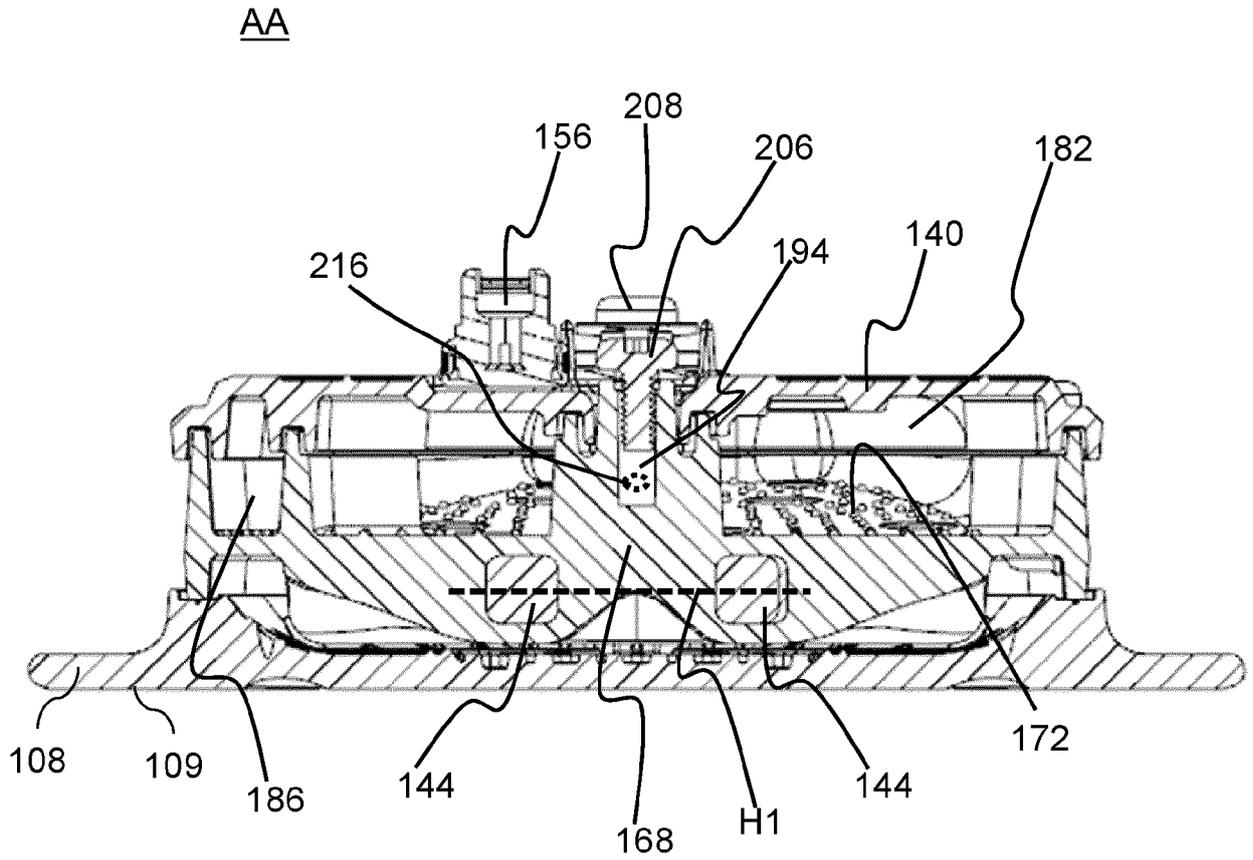


FIG.9

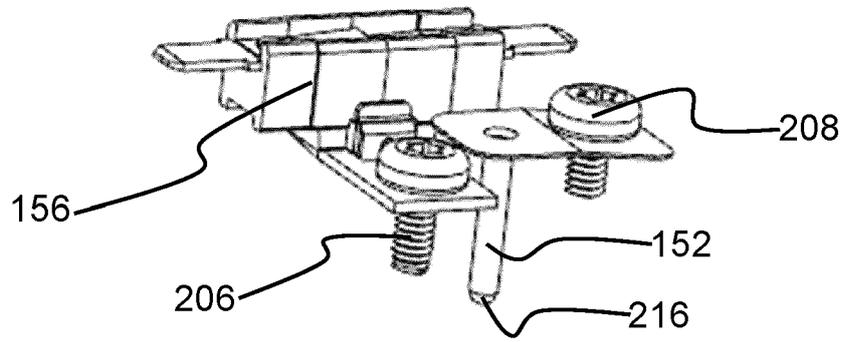


FIG. 10

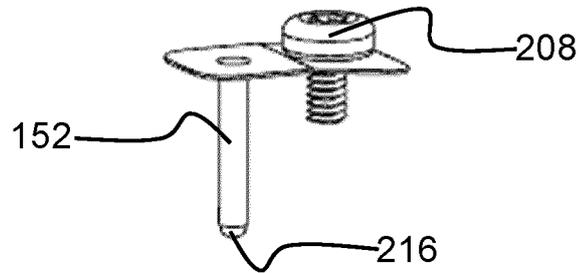


FIG. 11

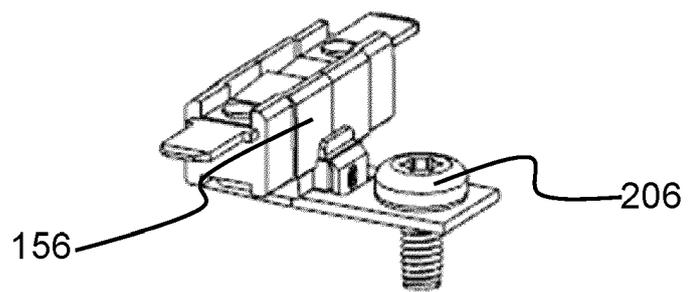


FIG. 12



EUROPEAN SEARCH REPORT

Application Number
EP 21 18 1088

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 November 2021	Examiner Werner, Christopher
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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