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(54) **AN APPARATUS FOR DETERMINING WHETHER A DEVICE IS IN A FIRST ORIENTATION OR A SECOND ORIENTATION**

(57) Apparatus (2) for determining whether a device (1) is in a first orientation or a second orientation. The apparatus (2) includes: a reservoir (7) containing a liquid (10) and a heating element (8). The heating element (8) is located within the reservoir (7) such that the heating element (8) is not in contact with the liquid (10) when the device (1) is in a first orientation and the heating element

(8) is in contact with the liquid (10) when the device (1) is in a second orientation. A temperature sensor (9) is provided and is configured to obtain a measure of the temperature of the heating element (8). The temperature of the heating element (8) detected by the temperature sensor (9) varies depending on whether the device (1) is in the first orientation or the second orientation.

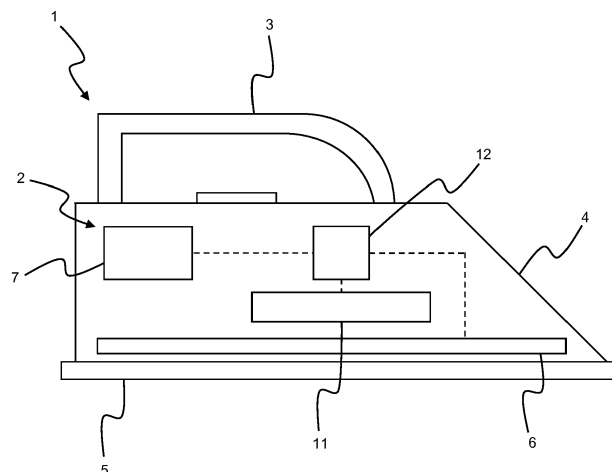


Figure 3

Description

Technical Field

[0001] The present disclosure relates to an apparatus for determining whether a device is in a first orientation or a second orientation

Background

[0002] A clothes iron is a small hand-held appliance with a handle holding a flat surface known as a sole plate. The sole plate, when heated by an inbuilt sole plate heating element, is used to press clothes to remove creases. When the iron is in a horizontal orientation, the sole plate is the bottom surface of the iron so that it can easily be pressed against and moved along clothes to remove creases. When the iron is in a vertical orientation, the sole plate is a side surface of the iron and the iron can be safely set down on another object such as an ironing board without the sole plate coming into contact with the object, which may create a risk of a fire.

Summary

[0003] According to an aspect disclosed herein, there is provided an apparatus for determining whether a device is in a first orientation or a second orientation, the apparatus comprising: a reservoir containing a liquid; a heating element, the heating element being located within the reservoir such that the heating element is not in contact with the liquid when the device is in a first orientation and the heating element is in contact with the liquid when the device is in a second orientation; and a temperature sensor configured to obtain a measure of the temperature of the heating element, whereby the temperature of the heating element detected by the temperature sensor varies depending on whether the device is in the first orientation or the second orientation.

[0004] This allows the apparatus to be used to effectively determine whether a device is in a first orientation or a second orientation. Such an apparatus can be used, for example, in monitoring whether an iron is in a vertical orientation or a horizontal orientation.

[0005] In an example, the heating element and the temperature sensor are in direct physical contact with one another.

[0006] In an example, the heating element is a constant current heating element.

[0007] According to a second aspect disclosed herein, there is provided an iron comprising the apparatus described above.

[0008] In an example, the iron comprises an operation sensor configured to detect if the iron is being operated by a user.

[0009] In an example, the operation sensor is a piezo-electric sensor.

[0010] In an example, the operation sensor is config-

ured to detect if one or more of (i) pressure is being applied to a sole plate of the iron and (ii) the sole plate of the iron is being moved over a surface.

[0011] In an example, the iron comprises a controller, wherein the controller is configured to deactivate the iron if the controller determines, based on the temperature of the heating element, that the iron is in a horizontal orientation and if the controller determines that the iron is not being operated by a user.

[0012] In an example, the controller is configured to determine if the iron is in a horizontal orientation if the temperature of the heating element is different from a predetermined threshold temperature.

[0013] In an example, the controller is configured to periodically determine if the iron is in a horizontal orientation.

Brief Description of the Drawings

[0014] To assist understanding of the present disclosure and to show how embodiments may be put into effect, reference is made by way of example to the accompanying drawings in which:

Figure 1 shows schematically a perspective view of a first example of an iron, the iron being in a horizontal orientation;

Figure 2 shows schematically a perspective view of iron shown in Figure 1, the iron being in a vertical orientation;

Figure 3 shows schematically a side cross section view of the iron shown in Figure 1 including an apparatus for determining whether the iron is in a first orientation or a second orientation;

Figure 4 shows a close up side cross section view of a reservoir of the apparatus shown in Figure 3; and

Figure 5 shows a close up side cross section view of a reservoir of the apparatus shown in Figure 3.

Detailed Description

[0015] A clothes iron is a small hand-held appliance with a handle holding a flat surface known as a sole plate. The sole plate, when heated, is used to press clothes to remove creases. When the iron is in a (generally) horizontal orientation, the sole plate is the bottom surface of the iron so that it can easily be pressed against and moved along clothes to remove creases. When the iron is in a (generally) vertical orientation, the sole plate is a side surface of the iron so that the iron can be safely set down on another object such as an ironing board without the sole plate coming into contact with the object, which may create a risk of a fire.

[0016] There is a particularly high risk of a fire if an iron

is accidentally left in its horizontal orientation on an ironing board or on an item of clothing or other item because the iron remains activated and thus the sole plate continually heats the ironing board or item.

[0017] Referring now to Figures 1, 2 and 3, there is shown schematically an example of a clothes iron 1 including an apparatus 2 for determining whether the iron 1 is in a first orientation or a second orientation. In this example, the first orientation is a vertical orientation (as shown in Figure 1) and the second orientation is a horizontal orientation (as shown in Figure 2). The orientation of the iron is how it is oriented, i.e. aligned or positioned. In this example, the iron 1 is an electric steam iron.

[0018] Although in this example the apparatus 2 is provided within the iron 1 and determines whether the iron 1 is in a first orientation or a second orientation, in other examples, the apparatus 2 may be provided in another device in which it would be advantageous to determine if that device is in a first orientation or a second orientation.

[0019] The iron 1 includes a handle 3 attached to a body 4. A sole plate 5 is connected to the body 4 such that when the iron 1 is held in a horizontal orientation, the sole plate 5 is lowermost of the iron 1. This allows the sole plate 5 to be used to press clothes when heated. The sole plate 5 is heated by a sole plate heating element 6. The iron 1 also provides for a connection (not shown) to a source of electricity such as a mains electricity connection, which supplies electricity to heat the sole plate heating element 6.

[0020] Referring now particularly to Figures 3, 4 and 5, the apparatus 2 includes a reservoir 7, a heating element 8 and a temperature sensor 9.

[0021] The reservoir 7 contains a quantity of a liquid 10. In this example the reservoir 7 is approximately half filled with the liquid 10. In this example, the liquid 10 is water. In another example, the liquid 10 is another liquid with a relatively high specific heat capacity. An advantage of the liquid 10 having a high specific heat capacity is that the temperature of the liquid 10 does not increase quickly when the liquid 10 is in contact with the heating element 8. This means that the liquid 10 can be used to more effectively cool the heating element 8, as is explained below. The reservoir 7 contains the heating element 8 and the temperature sensor 9.

[0022] In this example, the heating element 8 is located within the reservoir 7 such that the heating element 8 is not in contact with the liquid 10 when the iron 1 is in a vertical orientation (see Figure 4) and the heating element 8 is in contact with the liquid 10 when the iron 1 is in a horizontal orientation (see Figure 5). In another example, the heating element 8 is located within the reservoir 7 such that the heating element 8 is in contact with the liquid 10 when the iron 1 is in a vertical orientation and the heating element 8 is not in contact with the liquid 10 when the iron 1 is in a horizontal orientation. To this end, the heating element 8 may be located towards a corner of the reservoir 7. In this example, the reservoir 7

comprises a cuboid shape. In other examples, the reservoir 7 may be another shape so long as the shape can contain the heating element 8, the temperature sensor 9 and the liquid 10 in a manner described below. In an example, the reservoir 7 may comprise a shape that can be accommodated in a particular region of the body 4 of the iron 1. For example, the reservoir may comprise a trapezoidal prism shape or a frustum shape.

[0023] The heating element 8 in this example is a constant current heating element. Such a heating element is supplied with a constant current via the mains electricity connection. In this example, the heating element 8 is a resistive heating element.

[0024] The temperature sensor 9 is connected to the heating element 8. In this example, the heating element 8 and the temperature sensor 9 are electrically connected to one another in parallel. The temperature sensor 9 is configured to obtain a measure of the temperature of the heating element 8. To this end, the temperature sensor 9 is in thermal contact with the heating element 8. In a specific example, the temperature sensor 9 is in direct physical contact with the heating element 8. The temperature sensor 9 may be, for example, a negative temperature coefficient thermistor or a positive temperature coefficient thermistor.

[0025] The temperature of the heating element 8 detected by the temperature sensor 9 will increase up to a particular predetermined threshold temperature if the liquid 10 is not in contact with the heating element 8. Information on the predetermined threshold temperature may be stored on a data storage (not shown). If the liquid 10 does come into contact with the heating element 8 then the liquid 10 will cool the heating element 8 so that the temperature of the heating element 8 detected by the temperature sensor 9 is below the predetermined threshold temperature. That is, the temperature of the heating element 8 detected by the temperature sensor 9 varies depending on whether or not the heating element 8 is in contact with the liquid 10. Given that whether or not the liquid 10 is in contact with the heating element 8 depends on the orientation of the iron 1, as discussed above, the temperature of the heating element 8 detected by the temperature sensor 9 varies depending on whether the iron 1 is in a vertical orientation or a horizontal orientation. This difference in temperature detected by the temperature sensor 9 provides for a way of determining which orientation a device (i.e. the iron 1) is in.

[0026] In this example, an operation sensor 11 is provided. The operation sensor 11 is configured to detect if the device, which in this example is an iron 1, is being operated by a user. In particular, in this example, the operation sensor 11 is configured to detect if one or more of (i) pressure is being applied to the sole plate 5 of the iron 1 (e.g. pressure by a user's hand) and (ii) the sole plate 5 of the iron 1 is being moved over a surface (e.g. clothing or other material on an ironing board). In this example, the operation sensor 11 is a piezoelectric sensor.

[0027] The apparatus 2 includes a controller 12, which may be a processor or the like. The controller 12 is connected to the sole plate heating element 6, the reservoir 7, the temperature sensor 9 and the operation sensor 11.

[0028] The controller 12 is configured to deactivate the iron 1 (or a component of the iron 1 e.g. the sole plate heating element 6) if it determines that the iron 1 is in a horizontal orientation and that the iron 1 is not being operated (used) by a user. In this situation, the iron 1 may have been accidentally left with its heated sole plate 5 in contact with another surface, such as an ironing board or an item of clothing, which may present a fire hazard. In particular, the controller 12 is configured to deactivate the iron 1 if the iron 1 is in a horizontal orientation, if pressure is not being applied to the sole plate 5 of the iron 1 and if the sole plate 5 of the iron 1 is not being moved over a surface. Deactivating the iron 1 in this situation reduces the risk of a fire caused by the heated sole plate 5.

[0029] In an example, the controller 12 is configured to, whilst the iron is activated, periodically compare the temperature of the heating element 8 sensed by the temperature sensor 9 with the predetermined threshold temperature. If the temperature of the heating element 8 is the same or is substantially the same as the predetermined threshold temperature then the controller 12 determines that the iron 1 is in its vertical orientation. If the temperature of the heating element 8 is below the predetermined threshold temperature then the controller 12 determines that the iron 1 is in its horizontal orientation.

[0030] In an example the controller 12 is configured to obtain information from the operation sensor 11 to determine if the iron 1 is being operated by a user if the controller 12 determines that the iron 1 is in its horizontal orientation.

[0031] An example of use of the iron 1 and the apparatus 2 shown in Figures 1 to 5 will now be described.

[0032] Initially, the iron 1 is deactivated and is in its vertical orientation as shown in Figure 1. A user, wanting to use the iron 1 to press creases from an item of clothing, activates the iron 1 by connecting the iron 1 to a source of electricity and pressing a switch (not shown) located on the iron 1. Consequently, electricity is supplied to the sole plate heating element 6, which increases in temperature and heats the sole plate 5.

[0033] At the same time, electricity is supplied to the heating element 8 connected to the temperature sensor 9. The heating element 8 thus activates and increases in temperature up to the predetermined threshold temperature. In this example, since the iron 1 is in its vertical orientation, the liquid 10 is not in contact with the heating element and therefore the temperature of the heating element 8 detected by the temperature sensor 9 is equal to the predetermined threshold temperature.

[0034] Whilst the iron 1 is activated, the controller 12 periodically compares the temperature of the heating element 8 with the predetermined threshold temperature. In this example, when the iron 1 is in its vertical orienta-

tion, the liquid 10 is not in contact with the heating element 8 (see Figure 4) and the liquid 10 therefore does not reduce the temperature of the heating element 8 sensed by the temperature sensor 9. Consequently, the controller 12 determines that the temperature of the heating element 8 is the same (or is substantially the same) as the predetermined threshold temperature. As a result, the controller 12 recognises that the iron 1 is in its vertical orientation. The controller 12 then, takes no further action regarding the current orientation of the iron 1.

[0035] A user, now wanting to use the iron 1 to press creases from an item of clothing, rotates the iron 1 from its vertical orientation to its horizontal orientation, which is shown in Figure 2. As can be seen, when the iron 1 is in its horizontal orientation, the sole plate 5 is lowermost of the iron 1 so that, when heated, it can be used to press creases from clothing. A user then places the sole plate 5 of the iron 1 on an item of clothing, applies pressure and moves the iron 1 over the surface the clothing to press out any creases, as is known in the art.

[0036] In this example, when the iron 1 is in its horizontal orientation, the liquid 10 is in contact with the heating element 8 (see Figure 5). Since the liquid 10 is at a lower temperature than the heating element 8, contact between the liquid 10 and the heating element 8 reduces the temperature of the heating element 8 that is sensed by the temperature sensor 9. Consequently, the controller 12 determines that the temperature of the heating element 8 is below the predetermined threshold temperature. As a result, the controller 12 recognises that the iron 1 is in its horizontal orientation.

[0037] Since the controller has determined that the iron 1 is in its horizontal orientation, the controller 12 then obtains information from the operation sensor 11 to determine whether or not the iron 1 is being operated (used) by a user. In this example, the controller 12 determines that the operation sensor 11 has detected that pressure is being applied to the sole plate 5 of the iron 1 and that the sole plate 5 of the iron 1 is being moved over a surface (e.g. clothing or other material arranged on an ironing board). The controller 12 therefore recognises that although the iron 1 is in its horizontal orientation, it is being operated by a user. The controller 12 then takes no further action regarding the current orientation of the iron 1.

[0038] After using the iron 1 to press creases from items of clothing, the user should then put the iron 1 back into its vertical orientation and set it down on a surface such as an ironing board so that the heated sole plate 5 does not accidentally come into contact with another surface. However, in this example, the user has absentmindedly set the iron 1 down on the ironing board whilst the iron is in its horizontal orientation. Therefore, the sole plate 5, which has been heated to a high temperature by the sole plate heating element 6, is put into contact with the ironing board. This presents a fire risk.

[0039] The controller 12 compares the temperature of the heating element 8 with the predetermined threshold temperature and recognises that the iron 1 is in its hori-

zontal orientation in the manner described above. The controller 12 then obtains information from the operation sensor 11 to determine whether or not the iron 1 is being operated by a user. The controller 12 determines that the operation sensor 11 has not detected that any pressure is being applied to the sole plate 5 of the iron 1 or that the sole plate 5 of the iron 1 is being moved over a surface. The controller 12 therefore assumes that the iron 1 is not being operated by a user. Consequently, in order to mitigate the risk of the iron 1 causing a fire, the controller 12 stops the supply of electricity to the sole plate heating element 6 so that it does not keep heating the sole plate 5, and deactivates the iron. The user can reactivate the iron 1 by pressing the switch (not shown).

[0040] An advantage of this arrangement is that the risk of a fire being caused by the iron 1 being left activated and in a horizontal orientation (where the sole plate 5 may be in contact with another surface) is mitigated by a controller 12 automatically deactivating the iron 1, or in this example automatically stopping electricity being supplied to the sole plate heating element 6, when the controller 12 determines that the iron 1 is in a horizontal orientation and is not being operated (used) by a user.

[0041] It will be understood that the processor or processing system or circuitry referred to herein may in practice be provided by a single chip or integrated circuit or plural chips or integrated circuits, optionally provided as a chipset, an application-specific integrated circuit (ASIC), field-programmable gate array (FPGA), digital signal processor (DSP), graphics processing units (GPUs), etc. The chip or chips may comprise circuitry (as well as possibly firmware) for embodying at least one or more of a data processor or processors, a digital signal processor or processors, baseband circuitry and radio frequency circuitry, which are configurable so as to operate in accordance with the exemplary embodiments. In this regard, the exemplary embodiments may be implemented at least in part by computer software stored in (non-transitory) memory and executable by the processor, or by hardware, or by a combination of tangibly stored software and hardware (and tangibly stored firmware).

[0042] The examples described herein are to be understood as illustrative examples of embodiments of the invention. Further embodiments and examples are envisaged. Any feature described in relation to any one example or embodiment may be used alone or in combination with other features. In addition, any feature described in relation to any one example or embodiment may also be used in combination with one or more features of any other of the examples or embodiments, or any combination of any other of the examples or embodiments. Furthermore, equivalents and modifications not described herein may also be employed within the scope of the invention, which is defined in the claims.

Claims

1. An apparatus for determining whether a device is in a first orientation or a second orientation, the apparatus comprising:
 - a reservoir containing a liquid;
 - a heating element, the heating element being located within the reservoir such that the heating element is not in contact with the liquid when the device is in a first orientation and the heating element is in contact with the liquid when the device is in a second orientation; and
 - a temperature sensor configured to obtain a measure of the temperature of the heating element, whereby the temperature of the heating element detected by the temperature sensor varies depending on whether the device is in the first orientation or the second orientation.
2. An apparatus according to claim 1, wherein the heating element and the temperature sensor are in direct physical contact with one another.
3. An apparatus according to claim 1 or claim 2, wherein the heating element is a constant current heating element.
4. An iron comprising the apparatus of any of claims 1 to 3.
5. An iron according to claim 4, comprising an operation sensor configured to detect if the iron is being operated by a user.
6. An iron according to claim 4, wherein the operation sensor is a piezoelectric sensor.
7. An iron according to claim 5 or claim 6, wherein the operation sensor is configured to detect if one or more of (i) pressure is being applied to a sole plate of the iron and (ii) the sole plate of the iron is being moved over a surface.
8. An iron according to any of claims 5 to 7, comprising a controller, wherein the controller is configured to deactivate the iron if the controller determines, based on the temperature of the heating element, that the iron is in a horizontal orientation and if the controller determines that the iron is not being operated by a user.
9. An iron according to claim 8, wherein the controller is configured to determine if the iron is in a horizontal orientation if the temperature of the heating element is different from a predetermined threshold temperature.

10. An iron according to claim 8 or claim 9, wherein the controller is configured to periodically determine if the iron is in a horizontal orientation.

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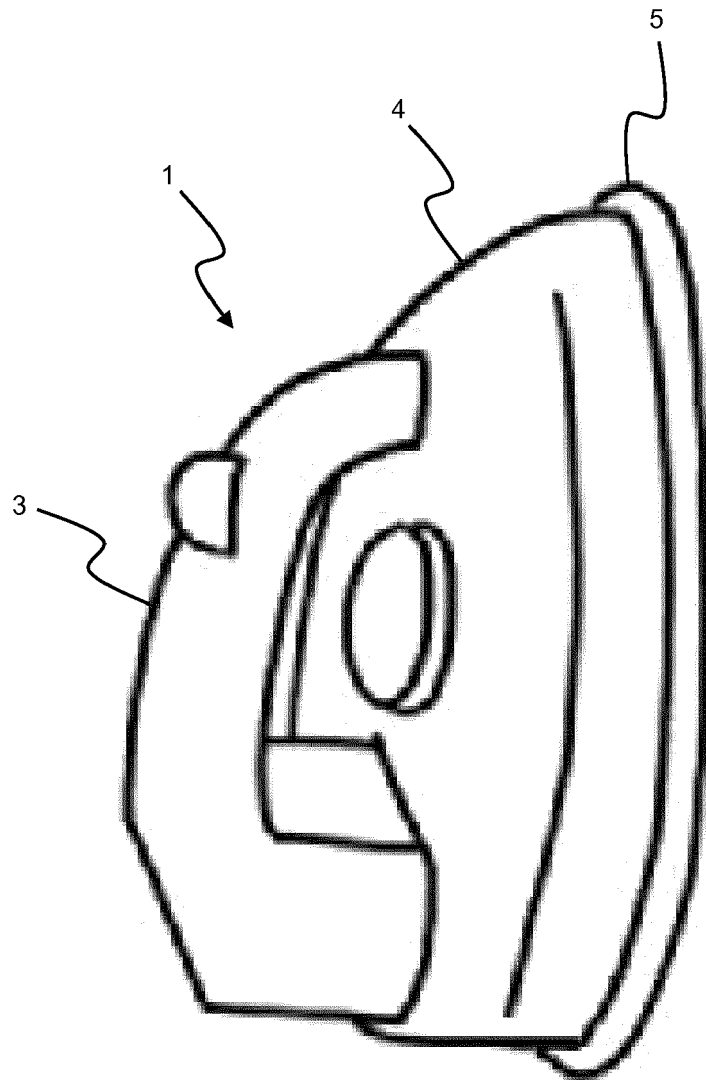


Figure 1

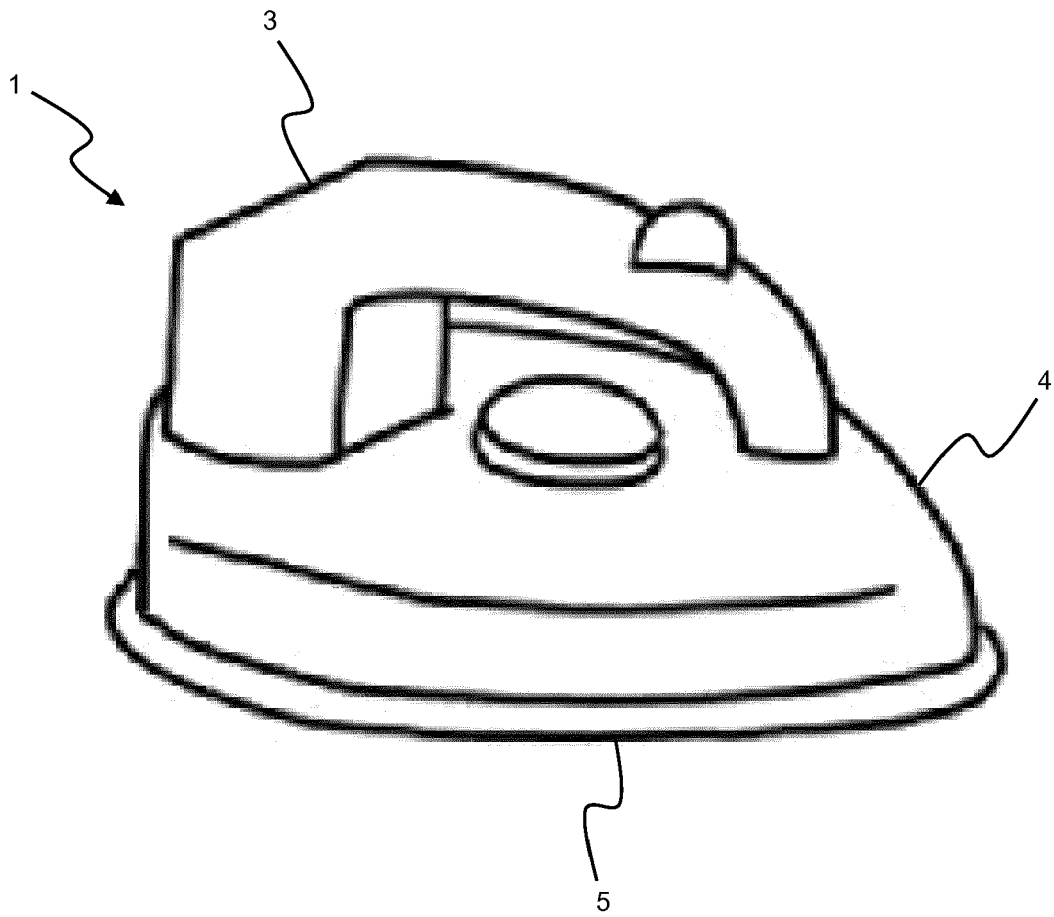


Figure 2

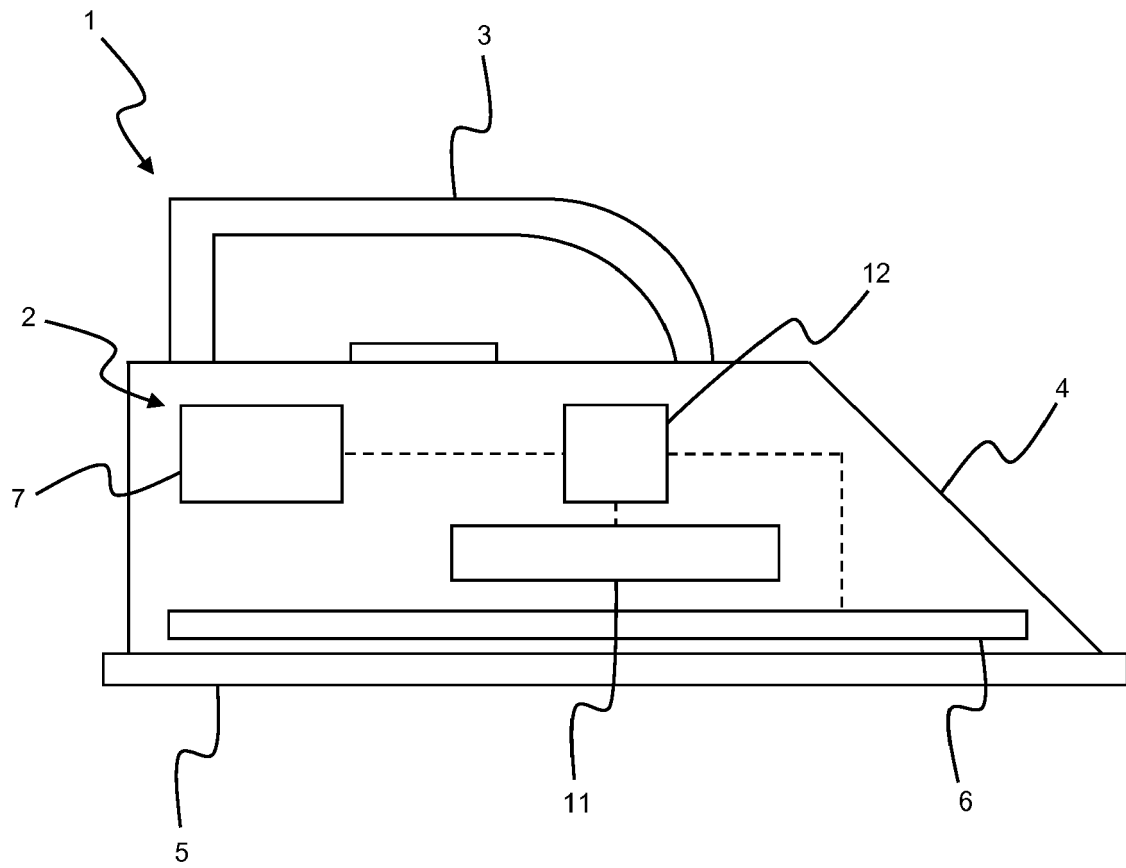


Figure 3

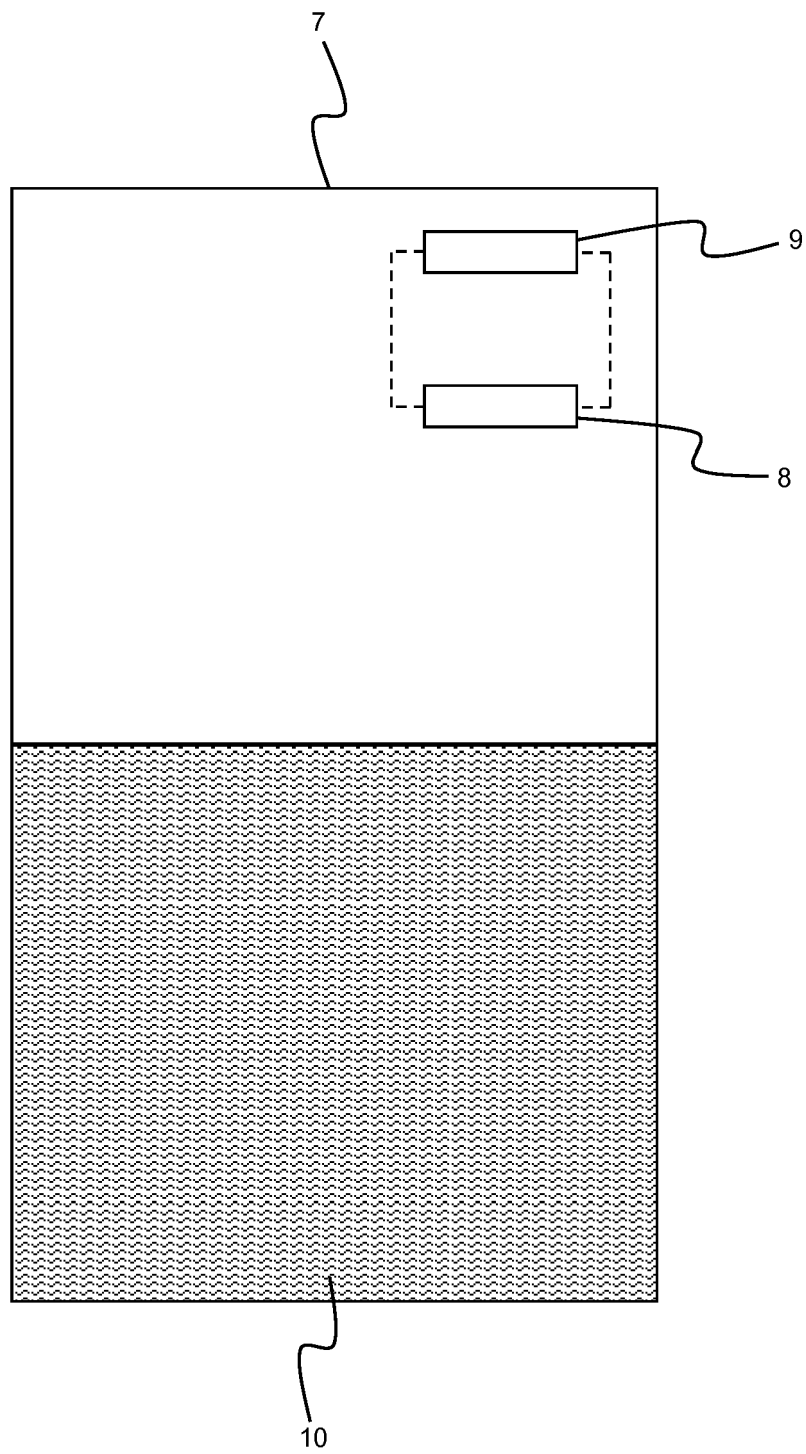


Figure 4

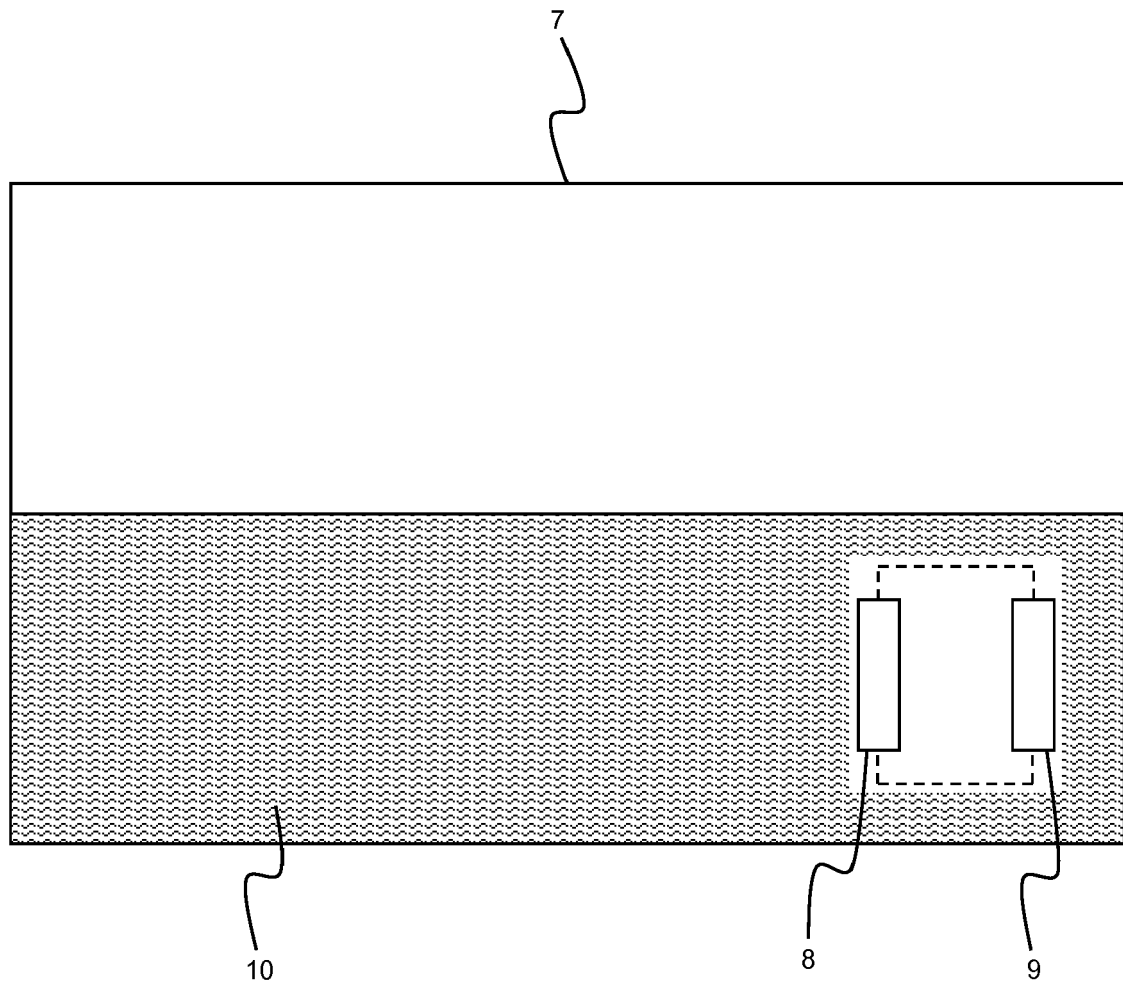


Figure 5



EUROPEAN SEARCH REPORT

Application Number
EP 17 20 1676

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 205 934 523 U (WANG HUAZHEN) 8 February 2017 (2017-02-08) * the whole document *	1-10	INV. D06F75/26
A	WO 96/23099 A1 (PHILIPS ELECTRONICS NV [NL]; PHILIPS NORDEN AB [SE]) 1 August 1996 (1996-08-01) * the whole document *	1-10	
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			TECHNICAL FIELDS SEARCHED (IPC)
			D06F H05B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 April 2018	Examiner Diaz y Diaz-Caneja
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 17 20 1676

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82