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(54) DETECTION SYSTEM AND DETECTION METHOD

(57) The present invention provides a detection system (100, 200, 300, 400) for detecting spillage (151, 451) of heated cooking goods over a cooking surface (150, 450) of a cooker, the detection system (100, 200, 300, 400) comprising a thermally variable first contact element (101, 201, 206, 207, 401) arranged with the cooking surface (150, 450) and configured to influence a detection region (102, 402) when the heated cooking goods spill over the cooking surface (150, 450) and heat up the first contact element (101, 201, 206, 207, 401), a second contact element (103, 203, 208, 209, 303, 308, 309, 403) arranged in the detection region (102, 402) of the first contact element (101, 201, 206, 207, 401) and configured to detect the influence of the first contact element (101, 201, 206, 207, 401) in the detection region (102, 402), and an evaluation device (104, 404) that is electrically coupled to the first contact element (101, 201, 206, 207, 401) and the second contact element (103, 203, 208, 209, 303, 308, 309, 403) and that is configured to detect the spillage (151, 451) of the heated cooking goods if the influence of the first contact element (101, 201, 206, 207, 401) is detected by the second contact element (103, 203, 208, 209, 303, 308, 309, 403) in the detection region (102, 402).

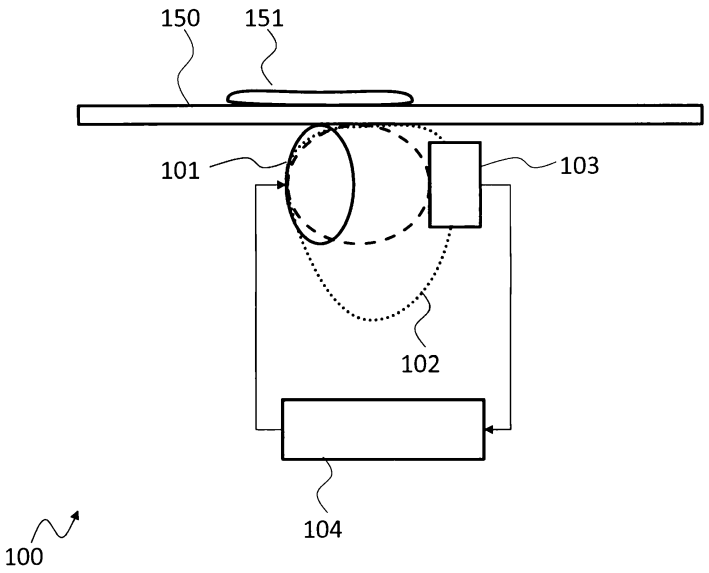

Fig. 1

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Description

TECHNICAL FIELD

[0001] The invention relates to a detection system for detecting spillage of heated cooking goods over a cooking surface of a cooker. In addition, the present invention relates to a respective detection method.

BACKGROUND

[0002] Although applicable to any cooking system, like e.g. a gas cooker or a ceramic hob, the present invention will mainly be described in conjunction with induction cookers or induction hobs.

[0003] Modern cookers, like e.g. induction cookers, comprise different sensors and protection means. Such cookers may e.g. comprise heat sensors and an alarm device that detects an overheat situation in the power electronics or the magnetic system of the cooking hobs. If an overheat situation is detected and a critical heat level is reached by the power electronics of the magnetic system of the induction cooker, the power electronics may be deactivated until a safe or suitable heat level is reached again.

[0004] However, the critical heat level in the cooking device is independent of a temperature of the cooking goods and the boiling temperature of the cooking goods that will usually be about 100°C. The boiling and a following spillage of cooking goods may therefore not be detected with common overheat protection systems. However, the spillage of cooking goods is one of the most common accidents on cookers and causes heavy staining and visible contamination of the cooking surface of the cooker. Accordingly, there is a need for detecting the spillage of cooking goods in cooking devices.

SUMMARY OF THE INVENTION

[0005] The present invention provides a detection system with the features of claim 1 and a detection method with the features of claim 9.

[0006] Accordingly, it is provided:

> A detection system for detecting spillage of heated cooking goods over a cooking surface of a cooker, the detection system comprising a thermally variable first contact element arranged with the cooking surface and configured to influence a detection region when the heated cooking goods spill over the cooking surface and heat up the first contact element, a second contact element arranged in the detection region of the first contact element and configured to detect the influence of the first contact element in the detection region, and an evaluation device that is electrically coupled to the first contact element and the second contact element and that is configured to detect the spillage of the heated cooking goods if the influence of the first contact element is detected by the second contact element in the detection region.

[0007] Further, it is provided:

> A detection method for detecting spillage of heated cooking goods over a cooking surface of a cooker, the detection method comprising influencing a detection region with a thermally variable first contact element when the heated cooking goods spill over the cooking surface and heat up the first contact element, sensing the influence of the first contact element in the detection region with a second contact element arranged in the detection region, and detecting the spillage of the heated cooking goods if the influence of the first contact element is sensed.

[0008] The present invention is based on the finding that it is difficult to directly measure the temperature of the cooking goods. For example wireless digital temperature sensors or the like would be necessary to perform such measurements. However, such wireless digital temperature sensors would require complex electronics and power supply.

[0009] The present invention in contrast provides a set of contact elements, wherein at least one of the contact elements is temperature sensitive. The term temperature sensitive refers to the first contact element being influenced by a change of temperature in a manner that may be detected with the second contact element. The first contact element may e.g. be thermally deformable, i.e. the first contact element will deform depending on the temperature of the first contact element. In this context the first contact element is being referred to being in a normal state or being not-deformed or being un-deformed, when the first contact element comprises approximately room temperature. Consequently, the first contact element will be referred to as being deformed or as reaching into the detection region, when the first contact element is heated to a temperature above room temperature. It is understood that a positive relation may be present between the grade of deformation of the first contact element and the temperature of the first contact element, i.e. the

higher the temperature the larger the deformation of the first contact element will be. The first contact element will therefore deform into the detection region. The detection region therefore defines a space or region in which the first contact element is not present in the normal state or which is not influenced by the first contact element in the normal state. However, the first contact element will reach into the detection region as soon as it deforms under the impact of higher temperatures than room temperature.

[0010] The first contact element is positioned with the cooking surface of the respective cooking device such that heat that is provided to the cooking surface, e.g. by spilled liquids or cooking goods, is transferred to the first contact element. To this end, the first contact element may e.g. be positioned on top of the cooking surface or embedded in a recess of the cooking surface. Since the cooking surface may conduct heat, the first contact element may also be positioned below the cooking surface. It is understood, that the first contact element may comprise a plurality of sections, and that one or multiple first contact elements or separate sections of a single first contact element may be provided. The same applies to the second contact element.

[0011] The second contact element is positioned in the detection region. This means that at a certain grade of influence, e.g. deformation, the first contact element will be detected by the second contact element, e.g. touch the second contact element, and for example an electrical contact will be established between the first contact element and the second contact element.

[0012] It is understood, that with a deformable first contact element the exact position of the second contact element in relation to the first contact element may be adjusted according to the desired trigger point or trigger temperature. The closer the second contact element is positioned to the first contact element the earlier the electrical contact will be established between the first contact element and the second contact element, i.e. less temperature increase of the first contact element is necessary to establish the electrical contact.

[0013] This electrical contact may be detected by the evaluation device as an indication of the spillage of heated goods on the cooking surface of the cooking device.

[0014] It is understood, that any other type of thermally variable or sensitive element may be used as the first contact element. For example ferromagnetic materials with changing magnetic properties may be used. The magnetic properties of these materials may change with a change of temperature and these changes may be detected.

[0015] In the cooking device other control means may then use the information about the detected spillage and control e.g. the power level of the single cooking hobs accordingly.

[0016] With the present invention it is therefore possible to detect a spillage or overflow of heated cooking goods with a very simple yet effective arrangement and to take respective counteractions.

[0017] Further embodiments of the present invention are subject of the further subclaims and of the following description, referring to the drawings.

[0018] In an embodiment, the first contact element may comprise a flexible gas reservoir that is filled with a thermally expandable gas, especially an ideal gas, especially helium or argon.

[0019] Usually gas will change its volume with changing temperature of the gas. This is especially true for ideal gases like e.g. helium or argon. Such a gas may therefore be used to convert a temperature change into a mechanical force and finally into a movement by containing the gas in the flexible gas reservoir. The flexible gas reservoir may e.g. comprise a rubber bladder or a bladder of any other flexible material that may contain the gas and expand with the gas.

[0020] Therefore if the gas expands because its temperature rises, the volume of the flexible gas reservoir will increase. This means that the flexible gas reservoir will expand into the detection region and will at a predetermined point come into contact with the second contact element, thereby establishing the electrical contact or may be sensed without direct contact.

[0021] It is understood, that an electrical conductivity of the first contact element, the flexible gas reservoir in this case, may be established by a coating of the flexible gas reservoir with a conductive material or by providing respective conductive plates on the flexible gas reservoir or by using a conductive flexible material.

[0022] In another embodiment, the first contact element may comprise a bimetallic element.

[0023] Bimetallic elements in contrast to the above mentioned gases do not change their volume but their shape. Bimetallic strips for example bend to one side if their temperature rises. A bimetallic strip may therefore e.g. rest or comprise a straight shape at normal or room temperature and may bend to one side until it touches the second contact element if it is heated up by spilled cooking liquids or cooking goods.

[0024] In a further embodiment, the first contact element may comprise a magnetic element and the second contact element may comprise a magnetic sensor element.

[0025] The magnetic element may e.g. be combined with any other element that deforms with a temperature change. The magnetic element may e.g. be arranged on a bimetallic element or on a flexible gas reservoir. The magnetic sensor element may be any type of sensor element that may detect changes in the magnetic field. Such sensing elements may e.g. comprise hall sensors, hall switches or the like. The term "electrical contact" may in this case refer to the distance between the first contact element and the second contact element being close enough, such that a magnitude of the magnetic field in the magnetic sensor element reaches a predetermined threshold value. The magnetic sensor element

may in this case output an electric signal, e.g. a voltage that indicates the electrical contact.

[0026] Using a magnetic sensor element allows individually calibrating every single detection system by configuring the threshold value for the magnetic field at which the electrical contact signal is generated e.g. in a magnetic switch or a control unit. Further, a control unit of the cooking device or the detection system may e.g. perform regular automatic adjustments. For example, the magnetic field strength measured by the magnetic sensor element may be measured at startup of the detection system and a predetermined increase, absolute or on a percentage basis, of the magnetic field strength may cause the electric contact to be detected.

[0027] It is understood, that a material that changes its magnetic properties as a function of temperature may also be used. If a material for example increases or decreases its magnetization with an increasing temperature, this may be detected with the second contact element. As alternative a permanent magnet may be used and a material with temperature-dependent ferromagnetic properties may be provided between the permanent magnet and the magnetic sensor element. In this case, no moving elements are required to detect the temperature change and therefore the spillage of cooking goods or liquids. It is understood, that in the case of magnetic elements and sensors the contact elements need not necessarily be electrically conductive

[0028] In an embodiment, the detection system may comprise a number, i.e. one or more, e.g. a plurality, of thermally conductive elements, especially heat pipe elements, that are arranged between the cooking surface of the cooker and the first contact element.

[0029] As thermally conductive element any type of element may be used that conducts heat better than the material of the cooking surface. The cooking surface will usually be made of glass or a ceramic material. Such materials may conduct heat rather bad. In order to rapidly transport the heat from spilled cooking goods to the first contact element the thermally conductive elements may be selected such that they conduct the heat better than the cooking surface. For example heat conductive channels or pipes may be provided in the cooking surface that reach from the top of the cooking surface to the bottom of the cooking surface. The conductive channels or pipes may be a kind of heat pipe like they are e.g. used in cooling arrangements e.g. for computers. However other thermally conductive elements may also be used, such as for example metallic elements or the like. Especially in combination with the magnetic sensor element, the thermally conductive elements may at the same time comprise changing magnetic properties with changing temperature.

[0030] In another embodiment, the detection system may comprise a cooling device that is coupled to the evaluation device and that is configured to initiate active cooling of the first contact element, and especially the cooking surface, if the spillage is detected by the evaluation device.

[0031] A cooling device may be any type of active cooling device that cools the spilled cooking goods and/or the cooking vessel containing the cooking goods. The cooling device may e.g. comprise an air or fan based cooling device, for example with a fan that blows air to the cooking vessel or over the cooking surface. Another cooling device may e. g. comprise a liquid based cooling device. Liquid conduits may e.g. be provided in the cooking surface under the cooking vessel and may e.g. actively be flooded with a cooling liquid.

[0032] In a further embodiment, the detection system may comprise an alarm device that is coupled to the evaluation device and that is configured to provide an alarm signal if the spillage is detected by the evaluation device.

[0033] The alarm device may e.g. serve to call the attention of a nearby user to the cooker and the spilled cooking goods or liquids. The alarm may e.g. comprise an audible alarm or a visual alarm or both.

[0034] In another embodiment, the detection system may comprise a switching device that is coupled to the evaluation device and that is configured to switch off a power supply of the cooker if the spillage is detected by the evaluation device.

[0035] The term "power supply" may refer to the power supply of only some elements of the cooker. The powers supply may e.g. be an internal power supply of the power electronics of the cooker. Some parts of the cooker may therefore stay powered, such as e.g. a control unit and a user interface or user input elements of the cooker. This means that the cooker will not completely shut down if spillage is detected but only turn off the power electronics that generate the power for transferring heat to the cooking vessel on the cooking surface.

[0036] The switching device may e.g. be a relay or other switch that turns off the power supply. It is understood, that the switching device may however also be a kind of logic- or software based switch that simply stops the generation of driving signals for the power electronics in the cooker.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] For a more complete understanding of the present invention and advantages thereof, reference is now made to the following description taken in conjunction with the accompanying drawings. The invention is explained in more detail below using exemplary embodiments, which are specified in the schematic figures of the drawings, in which:

Fig. 1 shows a block diagram of an embodiment of a detection device according to the present invention;

Fig. 2 shows a block diagram of another embodiment of a detection device according to the present invention;

Fig. 3 shows a block diagram of another embodiment of a detection device according to the present invention;

Fig. 4 shows a block diagram of another embodiment of a detection device according to the present invention;

Fig. 5 shows a flow diagram of an embodiment of a detection method according to the present invention.

[0038] In the figures like reference signs denote like elements unless stated otherwise.

DETAILED DESCRIPTION OF THE DRAWINGS

[0039] Fig. 1 shows a block diagram of a detection device 100. The detection device 100 serves for detecting spillage 151 of heated cooking goods over a cooking surface 150 of a cooker. To this end the detection device 100 comprises a thermally variable first contact element 101 that is exemplarily arranged under the cooking surface 150 to influence a detection region 102. The detection device 100 further comprises a second contact element 103 that is arranged in the detection region 102. An evaluation unit 104 is coupled with the first contact element 101 and the second contact element 103.

[0040] In Fig. 1 on the cooking surface 150 a spillage 151 can be seen that is caused by overflow of hot, boiling cooking liquids. The spillage 151 is therefore hot, this means at least some degrees hotter than the first contact element 101. The heat from the spillage 151 will therefore heat up the first contact element 101 through the cooking surface 150.

[0041] The first contact element 101 influences the detection region 102 as a function of the temperature that is imposed on the first contact element 101. In Fig. 1 the first contact element 101 is shown as expanding first contact element 101 that expands into the detection region 102 when it is heated up, shown with a dashed line.

[0042] The second contact element 103 is arranged in the detection region 102 such that it detects the influence of the first contact element 101 in the detection region 102. In the detection device 100 the second contact element 103 establishes physical contact with the expanded first contact element 101 to detect the influence. The first contact element 101 is shown in the deformed state touching the second contact element 103 with the dashed line.

[0043] The evaluation device 104 is electrically coupled to the first contact element 101 and the second contact element 103 and detects the spillage 151 of the heated cooking goods, if an electrical contact is established between the first contact element 101 and the second contact element 103. This means that the first contact element 101 and the detection region 102 are also electrically conductive. The evaluation unit 104 may e.g. simply measure a resistance between the first contact element 101 and the second contact element 103 or may apply a voltage to the first contact element 101 and measure the presence of this voltage at the second contact element 103 or vice versa.

[0044] Fig. 2 shows a block diagram of another detection device 200. The detection device 200 is shown installed at least in part between a glass surface 255 and a glass bottom 256 of a cooking surface and around an induction hob 257, although any other type of hob could be used.

[0045] The detection device 200 comprises a ring-shaped circumference, and a plurality of first contact elements 201, 206, 207 or sections of a first contact element are arranged under the glass surface 255 and extend under the glass bottom 256. Non-conductive regions separate the single first contact elements 201, 206, 207 from each other. The first contact elements 201, 206, 207 are provided as flexible gas reservoirs that are filled with a gas, in this case an ideal gas 216 like e.g. argon or helium. This means that the first contact elements 201, 206, 207 will expand if the ideal gas 216 expands in response to being heated up. Conductive strips 205, 210, 211 are provided on the glass surface 255 that are used to electrically contact the first contact elements 201, 206, 207.

[0046] The detection device 200 comprises the second contact elements 203, 208, 209 as electric contact elements that are arranged under the first contact elements 201, 206, 207 on the glass bottom 256 as conductive strips. This means that physical and electrical contact will be established between the first contact elements 201, 206, 207 and the respective second contact elements 203, 208, 209 when the first contact elements 201, 206, 207 expand.

[0047] To improve the heat conduction from the glass surface 255 to the first contact elements 201, 206, 207, the detection device 200 comprises thermally conductive elements 217 that extend from the glass surface 255 to the thermally conductive elements 217 on the circumference of the detection device 200. The thermally conductive elements 217 may e.g. be a kind of heat pipes that transport the heat from the glass surface 255 to the glass bottom 256 and therefore shorten the detection time for detecting the spillage. It is understood, that the thermally conductive elements 217 may be sealed on the top end, such that the glass surface 255 is not notably deformed by the thermally conductive elements 217 and provides a smooth and flat surface.

[0048] The evaluation of the first contact elements 201, 206, 207 and the second contact elements 203, 208, 209 may be performed e.g. by a controller of the cooker in which the detection device 200 is used. However, in Fig. 3 an alternative evaluation arrangement will be shown, that does not require a digital controller.

[0049] Fig. 3 shows a block diagram of another detection device 300 that is based on the detection device 200. The detection device 300 also comprises a ring-shaped circumference, and a plurality of first contact elements or sections

of a first contact element are arranged under the glass surface 355 and extend under the glass bottom 356. Non-conductive regions separate the single first contact elements from each other. The first contact elements are also provided as flexible gas reservoirs that are filled with a gas, in this case an ideal gas like e.g. argon or helium. This means that the first contact elements will expand if the ideal gas expands in response to being heated up. Conductive strips 305, 310, 311 are provided on the glass surface 355 that are used to electrically contact the first contact elements. The detection device 300 also comprises the second contact elements 303, 308, 309 as electric contact elements that are arranged under the first contact elements. This means that physical and electrical contact will be established between the first contact elements and the respective second contact elements 303, 308, 309 when the first contact elements expand. It is noted that for sake of clarity not all elements of the detection device 300 are separately referenced, this is especially valid for those elements that correspond to the elements of the detection device 200.

[0050] The detection device 300 further comprises three energy sources 320, 321, 322, e.g. power adaptors or transformers that transform a mains voltage into an operating voltage for the respective elements. The energy sources 320, 321, 322 are each coupled with their negative output to one of the second contact elements 303, 308, 309. The positive output of the energy source 320 is coupled to a cooling device 323, the positive output of the energy source 321 is coupled to an alarm device 324, and the positive output of the energy source 322 is coupled to a switching device 325. On the other end, the cooling device 323, the alarm device 324, and the switching device 325 are each coupled to the respective conductive strip 305, 310, 311.

[0051] With this arrangement an electric circuit formed e.g. of the energy source 320, the cooling device 323, the conductive strip 305, the respective first contact element, and the second contact element 303 will be closed, when the first contact element touches the second contact element. This means that the cooling device 323 will automatically be initiated or started when the respective first contact element comes into contact with the second contact element 303. It is understood, that this exemplary arrangement may be modified e.g. to comprise amplifiers and/or power switches that are controlled by the closing of the electric circuit and power the cooling device 323. The above also applies to the alarm device 324 and the switching device 325.

[0052] It can be seen in Fig. 3 how the present invention allows easily detecting the spillage of cooking goods and taking countermeasures or calling the attention of a user.

[0053] Fig. 4 shows a block diagram of a detection device 400. The detection device 400 is based on the detection device 100 and is also arranged under a cooking surface 450 with a spillage 451. The detection device 400 comprises a first contact element 401 and a second contact element 403 that is arranged in the detection region 402 which is influenced by the first contact element 401. An evaluation unit 404 is coupled to the first contact element 401 and the second contact element 403.

[0054] The first contact element 401 is provided as a bimetallic strip that bends into the detection region 402 when it is heated up. Further, a magnetic element 430 is provided on the tip of the bimetallic strip and a magnetic sensor element 431 is provided in the second contact element 403. This means that the magnetic element 430 moves into the detection region 402 when the first contact element 401 bends into the detection region 402. With this movement, the magnetic element 430 comes closer to the magnetic sensor element 431. The distance between the magnetic element 430 and the magnetic sensor element 431 influences the magnetic field that is generated by the magnetic element 430 as it is measured in the magnetic sensor element 431. If the magnetic element 430 comes closer to the magnetic sensor element 431 the magnitude of the magnetic field in the magnetic sensor element 431 will increase. It is understood, that a threshold value may be determined, and that the magnetic sensor element 431 may output a detection signal if the magnitude of the magnetic field in the magnetic sensor element 431 is larger than the predetermined threshold value.

[0055] Depending on the type of magnetic sensor element 431 it is possible to calibrate, e.g. determine the threshold value for, every single one of the detection devices 400 e.g. in an end of line test or during operation in predetermined situations. For example a control unit of a cooker could initiate calibration of the magnetic sensor element 431 right after startup of the cooker, i.e. when no hot spillage may be present.

[0056] For sake of clarity in the following description of the method based Fig. 5 the reference signs used above in the description of apparatus based Figs. 1 - 4 will be maintained.

[0057] Fig. 5 shows a flow diagram of an embodiment of a detection method for detecting spillage 151, 451 of heated cooking goods over a cooking surface 150, 450 of a cooker.

[0058] The detection method comprises influencing S1 a detection region 102, 402 with a thermally variable first contact element 101, 201, 206, 207, 401 when the heated cooking goods spill over the cooking surface 150, 450 and heat up the first contact element 101, 201, 206, 207, 401, sensing S2 the influence of the first contact element 101, 201, 206, 207, 401 in the detection region 102, 402 with a second contact element 103, 203, 208, 209, 303, 308, 309, 403 arranged in the detection region 102, 402, and detecting S3 the spillage 151, 451 of the heated cooking goods if the influence of the first contact element 101, 201, 206, 207, 401 is sensed.

[0059] Influencing S1 may e.g. be performed with a flexible gas reservoir that is filled with a thermally expandable gas, especially an ideal gas 216, especially helium or argon. As alternative or in addition, influencing S1 may be performed with a bimetallic element. As further alternative or in addition, influencing S1 may also be performed with a magnetic

element 430 and sensing may be performed with a magnetic sensor element 431.

[0060] In addition, the detection method may comprise conducting heat with a number of thermally conductive elements 217, 317, especially heat pipe elements, between the cooking surface 150, 450 of the cooker and the first contact element 101, 201, 206, 207,401.

[0061] Further, the detection method may comprise actively cooling the first contact element 101, 201, 206, 207, 401, and especially the cooking surface 150, 450, if the spillage 151, 451 is detected, providing an alarm signal if the spillage 151, 451 is detected, and/or switching off a power supply of the cooker if the spillage 151, 451 is detected by the evaluation device 104, 404.

[0062] Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a variety of alternate and/or equivalent implementations exist. It should be appreciated that the exemplary embodiment or exemplary embodiments are only examples, and are not intended to limit the scope, applicability, or configuration in any way. Rather, the foregoing summary and detailed description will provide those skilled in the art with a convenient road map for implementing at least one exemplary embodiment, it being understood that various changes may be made in the function and arrangement of elements described in an exemplary embodiment without departing from the scope as set forth in the appended claims and their legal equivalents. Generally, this application is intended to cover any adaptations or variations of the specific embodiments discussed herein.

[0063] Thus, the present invention provides a detection system 100, 200, 300, 400 for detecting spillage 151, 451 of heated cooking goods over a cooking surface 150, 450 of a cooker, the detection system 100, 200, 300, 400 comprising a thermally variable first contact element 101, 201, 206, 207, 401 arranged with the cooking surface 150, 450 and configured to influence a detection region 102, 402 when the heated cooking goods spill over the cooking surface 150, 450 and heat up the first contact element 101, 201, 206, 207, 401, a second contact element 103, 203, 208, 209, 303, 308, 309, 403 arranged in the detection region 102, 402 of the first contact element 101, 201, 206, 207, 401 and configured to detect the influence of the first contact element 101, 201, 206, 207, 401 in the detection region 102, 402, and an evaluation device 104, 404 that is electrically coupled to the first contact element 101, 201, 206, 207, 401 and the second contact element 103, 203, 208, 209, 303, 308, 309, 403 and that is configured to detect the spillage 151, 451 of the heated cooking goods if the influence of the first contact element 101, 201, 206, 207, 401 is detected by the second contact element 103, 203, 208, 209, 303, 308, 309, 403 in the detection region 102, 402.

[0064] List of reference signs

100, 200, 300, 400	detection system
101, 201, 206, 207, 401	first contact element
102, 402	detection region
103, 203, 208, 209	second contact element
303, 308, 309, 403	second contact element
104, 404	evaluation device
205, 210, 211	conductive strip
305, 310, 311	conductive strip
215	non-conductive region
216	ideal gas
217, 317	thermally conductive elements
320, 321, 322	energy source
323	cooling device
324	alarm device
325	switching device
430	magnetic element
431	magnetic sensor element
150, 450	cooking surface
151, 451	spillage
255, 355	glass surface
256, 356	glass bottom
257, 357	induction hob
S1, S2, S3	method steps

Claims

1. Detection system (100, 200, 300, 400) for detecting spillage (151, 451) of heated cooking goods over a cooking surface (150, 450) of a cooker, the detection system (100, 200, 300, 400) comprising:

   a variable first contact element (101, 201, 206, 207, 401) arranged with the cooking surface (150, 450) and configured to influence a detection region (102, 402) when the heated cooking goods spill over the cooking surface (150, 450) and heat up the first contact element (101, 201, 206, 207, 401),
   a second contact element (103, 203, 208, 209, 303, 308, 309, 403) arranged in the detection region (102, 402) of the first contact element (101, 201, 206, 207, 401) and configured to detect the influence of the first contact element (101, 201, 206, 207, 401) in the detection region (102, 402), and
   an evaluation device (104, 404) that is electrically coupled to the first contact element (101, 201, 206, 207, 401) and the second contact element (103, 203, 208, 209, 303, 308, 309, 403) and that is configured to detect the spillage (151, 451) of the heated cooking goods if the influence of the first contact element (101, 201, 206, 207, 401) is detected by the second contact element (103, 203, 208, 209, 303, 308, 309, 403) in the detection region (102, 402).

2. Detection system (100, 200, 300, 400) according to claim 1, wherein the first contact element (101, 201, 206, 207, 401) comprises a flexible gas reservoir that is filled with a thermally expandable gas, especially an ideal gas (216), especially helium or argon.

3. Detection system (100, 200, 300, 400) according to claim 1, wherein the first contact element (101, 201, 206, 207, 401) comprises a bimetallic element.

4. Detection system (100, 200, 300, 400) according to any one of the preceding claims, wherein the first contact element (101, 201, 206, 207, 401) comprises a magnetic element (430) and wherein the second contact element (103, 203, 208, 209, 303, 308, 309, 403) comprises a magnetic sensor element (431).

5. Detection system (100, 200, 300, 400) according to any one of the preceding claims, comprising a number of thermally conductive elements (217, 317), especially heat pipe elements, that are arranged between the cooking surface (150, 450) of the cooker and the first contact element (101, 201, 206, 207, 401).

6. Detection system (100, 200, 300, 400) according to any one of the preceding claims, comprising a cooling device (323) that is coupled to the evaluation device (104, 404) and that is configured to initiate active cooling of the first contact element (101, 201, 206, 207, 401), and especially the cooking surface (150, 450), if the spillage (151, 451) is detected by the evaluation device (104, 404).

7. Detection system (100, 200, 300, 400) according to any one of the preceding claims, comprising an alarm device (324) that is coupled to the evaluation device (104, 404) and that is configured to provide an alarm signal if the spillage (151, 451) is detected by the evaluation device (104, 404).

8. Detection system (100, 200, 300, 400) according to any one of the preceding claims, comprising a switching device (325) that is coupled to the evaluation device (104, 404) and that is configured to switch off a power supply of the cooker if the spillage (151, 451) is detected by the evaluation device (104, 404).

9. Detection method for detecting spillage (151, 451) of heated cooking goods over a cooking surface (150, 450) of a cooker, the detection method comprising:

   influencing (S1) a detection region (102, 402) with a thermally variable first contact element (101, 201, 206, 207, 401) when the heated cooking goods spill over the cooking surface (150, 450) and heat up the first contact element (101, 201, 206, 207, 401),
   sensing (S2) the influence of the first contact element (101, 201, 206, 207, 401) in the detection region (102, 402) with a second contact element (103, 203, 208, 209, 303, 308, 309, 403) arranged in the detection region (102, 402), and
   detecting (S3) the spillage (151, 451) of the heated cooking goods if the influence of the first contact element (101, 201, 206, 207, 401) is sensed.

10. Detection method according to claim 9, wherein influencing (S1) is performed with a flexible gas reservoir that is

filled with a thermally expandable gas, especially an ideal gas (216), especially helium or argon.

11. Detection method according to claim 9, wherein influencing (S1) is performed with a bimetallic element.

12. Detection method according to any one of the preceding claims 9 - 11, wherein influencing (S1) is performed with a magnetic element (430) and wherein sensing is performed with a magnetic sensor element (431).

13. Detection method according to any one of the preceding claims 9 - 12, comprising conducting heat with a number of thermally conductive elements (217, 317), especially heat pipe elements, between the cooking surface (150, 450) of the cooker and the first contact element (101, 201, 206, 207, 401).

14. Detection method according to any one of the preceding claims 9 - 13, comprising actively cooling the first contact element (101, 201, 206, 207, 401), and especially the cooking surface (150, 450), if the spillage (151, 451) is detected.

15. Detection method according to any one of the preceding claims 9 - 14, comprising providing an alarm signal if the spillage (151, 451) is detected; and/or switching off a power supply of the cooker if the spillage (151, 451) is detected by the evaluation device (104, 404).

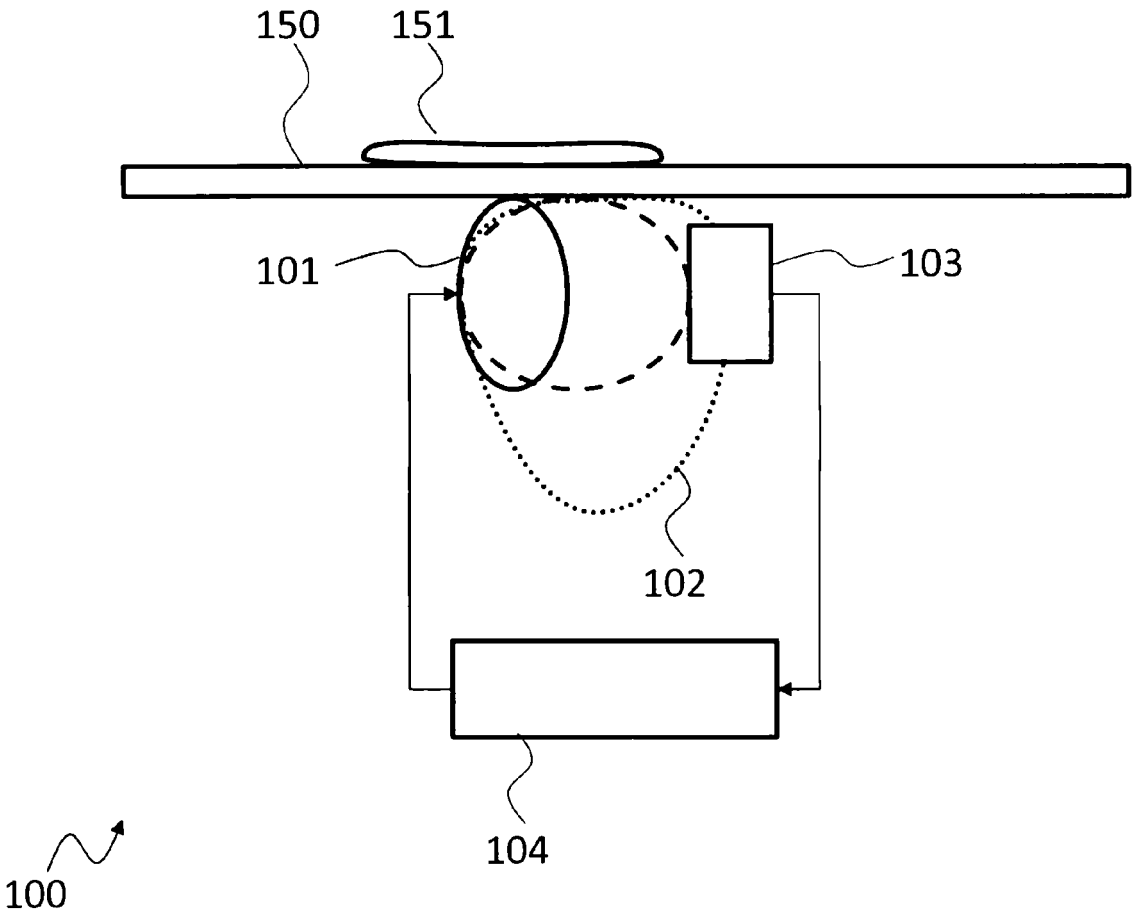

Fig. 1

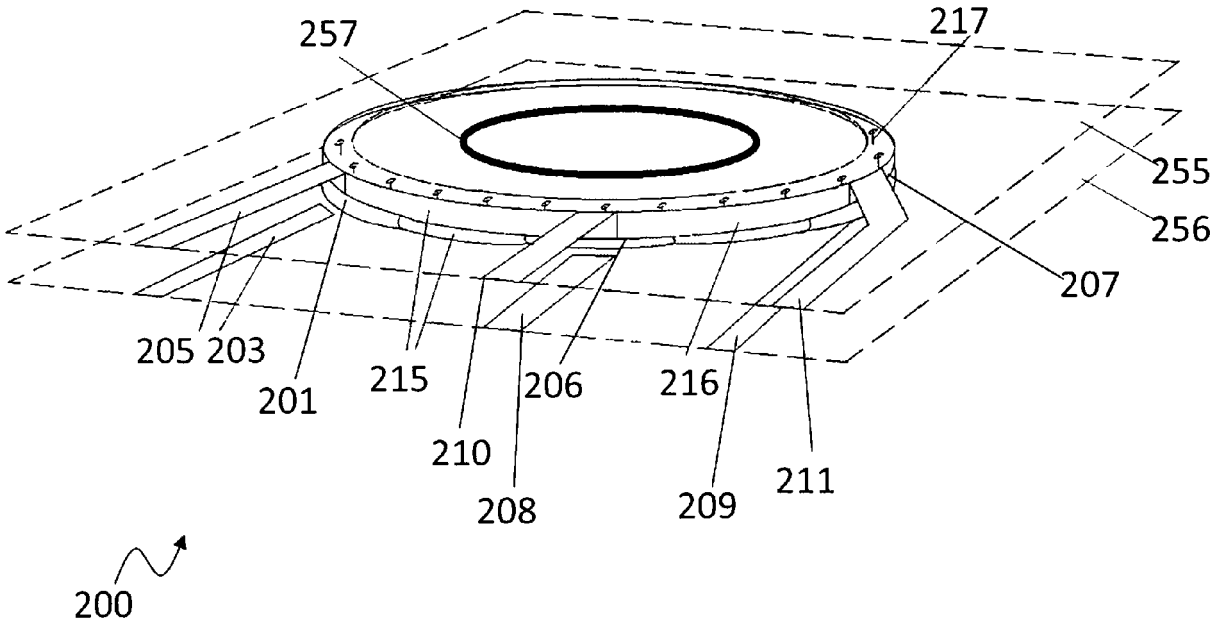

Fig. 2

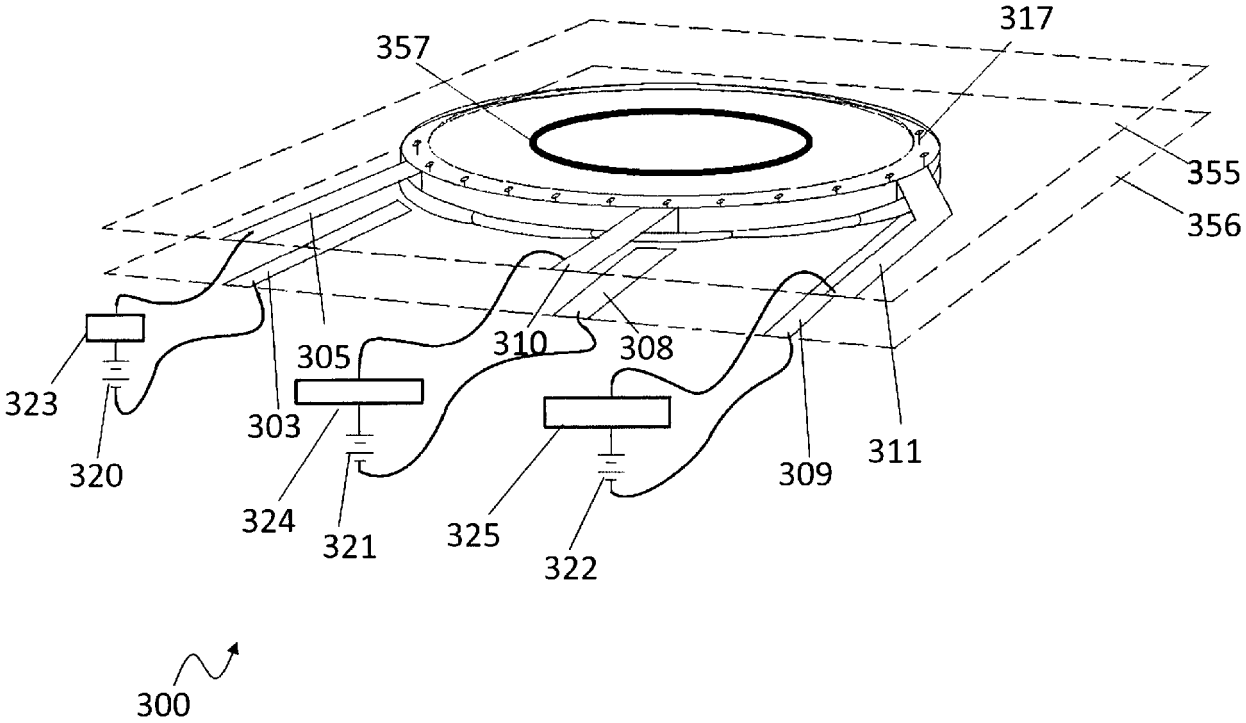
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Fig. 3

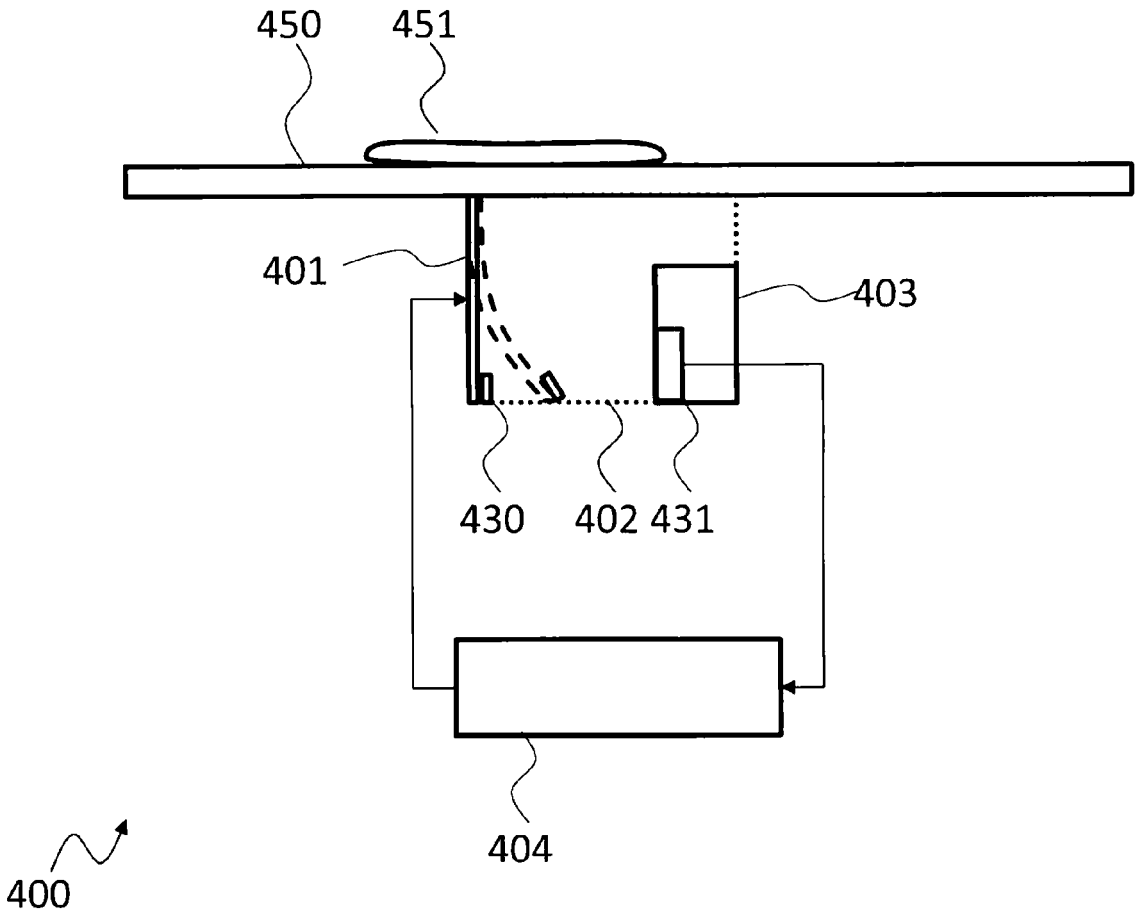

Fig. 4

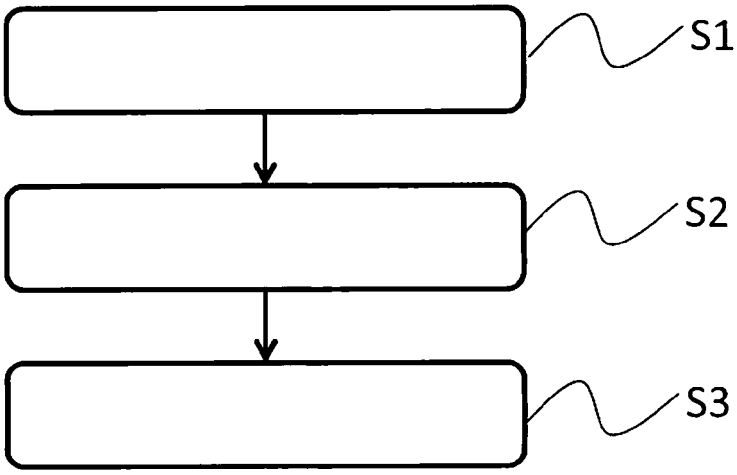

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 17 20 4586

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F24C
H05B
G05D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 June 2018	Verdoodt, Luk

CATEGORY OF CITED DOCUMENTS

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