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(54) **CONTROL SYSTEM, INDUCTION COOKER AND METHOD**

(57) The present invention provides a control system (100) for an induction cooker (150, 250), the control system (100) comprising a current sensor (101, 201) configured to sense the current through a resonant induction circuit (152, 252) of a hob (151, 251, 400) of the induction cooker (150, 250), a control unit (102, 202) coupled to the current sensor (101, 201) and configured to determine an average current (103) through the resonant induction circuit (152, 252) during a startup phase of the resonant induction circuit (152, 252) and configured to determine the size (104) of a cooking vessel (153, 253, 401, 402, 403) on the hob (151, 251, 400) based on the determined average current (103), and a driving unit (105, 205) coupled to the resonant induction circuit (152, 252) and the control unit (102, 202) and configured to drive the resonant induction circuit (152, 252) with a predetermined power level during the startup phase and with a power level based on the determined size (104) of the cooking vessel (153, 253, 401, 402, 403) during normal operation of the resonant induction circuit (152, 252).

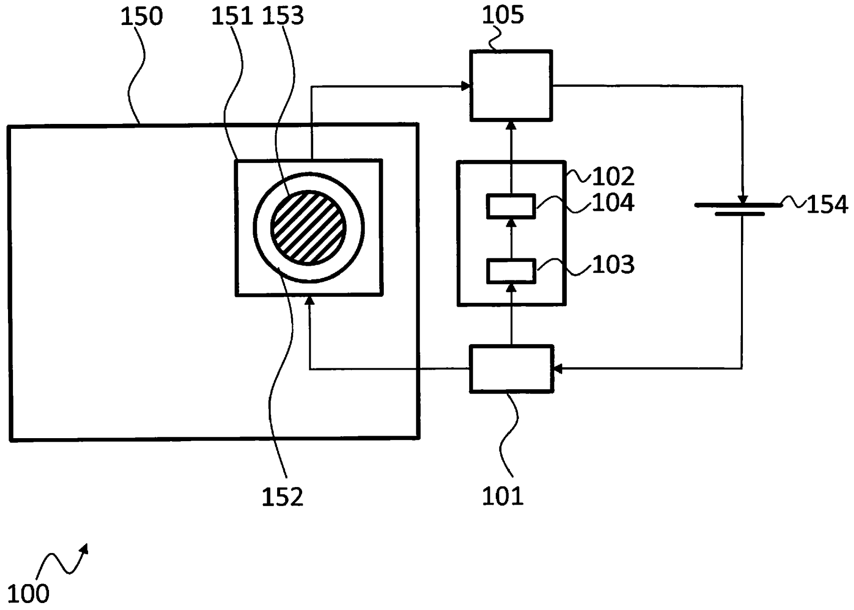

Fig. 1

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Description

TECHNICAL FIELD

[0001] The invention relates to a control system for an induction cooker. Further, the present invention relates to an induction cooker and a respective method.

BACKGROUND

[0002] Although applicable to any system that uses energy transfer via induction to heat an element, the present invention will be mainly described in combination with induction cookers.

[0003] Induction cookers are usually used to heat cooking vessels by magnetic induction. Usually a high frequency power signal is provided to an induction coil. This generates a magnetic field around the induction coil, which is magnetically coupled to a conductive cooking vessel, such as a pan, placed over the induction coil. The magnetic field then generates eddy currents in the cooking vessel, causing the cooking vessel to heat.

[0004] In induction cookers a coil of copper wire exists under the cooking zone and the cooking vessel must be placed according to the coil boundary, wherein the coil diameter determines the cooking zone. Usually a ceramic glass is placed between the coil and the cooking vessel. Induction cookers operate only with cooking vessels that are made of ferromagnetic material and the heating process should only start if a user puts a ferromagnetic material on the cooking zone.

[0005] The size, position and magnetic property of cooking vessel that is placed on the cooking surface affect the working power and heat transferred to the cooking vessel. In addition, using inappropriate cooking vessels (e.g. small size, non-ferromagnetic vessels) and placing them incorrectly may cause malfunctions (e.g. coil saturation, over-voltage) and damage an induction cooker. That is why cooking vessel detection is an important function in induction cookers.

[0006] When heating a cooking vessel with an induction cooker it is therefore important to know the state of the induction cooking system, e.g. the induction cooker and the cooking vessel. It is e.g. important to detect if a cooking vessel is placed on the induction cooker and to know the size the cooking vessel to accurately control the induction cooker.

[0007] Accordingly, there is a need for an improved control of induction cookers.

SUMMARY OF THE INVENTION

[0008] The present invention provides a control system with the features of claim 1, an induction cooker with the features of claim 9 and a method with the features of claim 10.

[0009] Accordingly, it is provided:

> A control system for an induction cooker, the control system comprising a current sensor configured to sense the current through a resonant induction circuit of a hob of the induction cooker, a control unit coupled to the current sensor and configured to determine an average current through the resonant induction circuit during a startup phase of the resonant induction circuit and configured to determine the size of a cooking vessel on the hob based on the determined average current, and a driving unit coupled to the resonant induction circuit and the control unit and configured to drive the resonant induction circuit with a predetermined power level during the startup phase and with a power level based on the determined size of the cooking vessel during normal operation of the resonant induction circuit.

[0010] Further, it is provided:

> An induction cooker comprising at least one hob comprising a resonant induction circuit, and a control unit according to the present invention coupled to the at least one hob.

[0011] Further, it is provided:

> A method for controlling an induction cooker, the method comprising sensing the average current through a resonant induction circuit of a hob of the induction cooker during a startup phase of the resonant induction circuit, determining the size of a cooking vessel on the hob based on the determined average current, and driving the resonant induction circuit with a predetermined power level during the startup phase and with a power level based on the determined size of the cooking vessel during normal operation of the resonant induction circuit.

[0012] The present invention is based on the finding that the damping factor measurement used in common induction cookers is only useful in terms of vessel detection. It is however not possible to determine the size and structure of the cooking vessel with this approach. Even for this limited functionality, a complex circuit structure is necessary.

[0013] The present invention therefore uses the knowledge that a cooking vessel on a cooking hob of an induction cooker, i.e. on the resonant induction circuit, influences the current through the resonant induction circuit. The present invention uses this knowledge and determines an average current through the resonant induction circuit under known driving conditions during the startup phase of the resonant induction circuit.

[0014] With the average value of the current through the resonant induction circuit, the present invention allows detecting a cooking vessel and at the same time providing information about the size of the cooking vessel. Further characteristics of the cooking vessel may also be derived, as will be explained below.

[0015] The startup phase may be defined as a phase of the resonant induction circuit directly after a user powers up the hob, i.e. the resonant induction circuit. During the startup phase the driving unit may drive the resonant induction circuit with a predetermined power level, e.g. with a fixed driving frequency. The fixed driving frequency may e.g. be the resonance frequency of the resonant induction circuit.

[0016] A cooking vessel on the hob, i.e. on the resonant induction circuit, will affect the input impedance and the resonance frequency of the resonant induction circuit. Objects, which are placed over the induction coil of the resonant induction circuit to cook, like e.g. pans or pots, will be referred to as cooking vessels throughout this description.

[0017] Since a cooking vessel influences the input impedance and the resonance frequency of the resonant induction circuit, not only the presence but also other characteristics, like e.g. the size, of the cooking vessel may be derived based on the driving current of the resonant induction circuit under known conditions, e.g. a known driving power and driving frequency.

[0018] After detecting the presence of a cooking vessel and the size of the cooking vessel, the driving circuit may adapt the output power according to the determined size of the cooking vessel, for normal operation, e.g. cooking.

[0019] Approximately 80-90% of the induction's electromagnetic energy can reach the content of the cooking vessel, i.e. the food. This ratio is 40% in gas and 70% in electricity. In addition to faster heating of induction cookers, temperature control may be implemented very precise. The cooking vessel temperature is adjusted to a selected level by the output power of the resonant induction circuit. For a determined temperature setting the required output power depends on the ferromagnetic structure and the size of the cooking vessel. A cooking vessel made of a ferromagnetic material with a high permeability requires less power to transfer a predetermined amount of power or heat to the cooking vessel. On induction cookers ferromagnetic materials with high permeability are therefore preferred as cooking vessels.

[0020] The size of the cooking vessel is another important factor affecting heat dissipation. When the cooking vessel is large, the amount of energy it can absorb is larger than for smaller cooking vessels. Therefore the determination of the size and the ferromagnetic properties of the cooking vessel is a very important parameter in order to achieve the required level of heat and power efficiency in induction cookers.

[0021] With the present invention the appropriate driving power for a specific cooking vessel may easily be determined and an efficient operation of the induction cooker may be provided.

[0022] It is understood, that although only one current sensor for a hob of the induction cooker is expressly described, the control system may comprise any number of current sensors for any number of resonant induction circuits of the induction cooker. The induction cooker may therefore comprise an arbitrary number of hobs.

[0023] It is further understood, that the control unit and the driving unit may either be separate entities in the control system or may be integrated into other entities of the induction cooker. The control unit and the driving unit may e.g. be integrated into a control and driving arrangement of the induction cooker.

[0024] Further embodiments of the present invention are subject of the further subclaims and of the following description, referring to the drawings.

[0025] In an embodiment, the control unit may be configured to measure a plurality of current values during the startup phase in predetermined intervals and calculate the average current as the sum of the measured current values divided by the number of measured current values.

[0026] The current sensor may be any type of current sensor, like e.g. a current transformer or a shunt resistor that may be coupled e.g. to an analog-to-digital converter of the control unit. In any case, the value determined by the current sensor will reflect the magnitude of the current through the resonant induction circuit of the induction cooker.

[0027] The absolute values that are processed in the control unit may therefore be values that are e.g. provided by the analog-to-digital converter. In case of a 13bit analog-to-digital converter the values may therefore range e.g. between 0 and 8192. The real current values represented by the values provided by the analog to digital converter strongly depend on the respective resonant induction circuit and may strongly differ between different induction cookers or resonant induction circuit of a specific induction cooker.

[0028] The relation between the current and the values provided by the analog-to-digital converter will further depend on the type of current sensor. For example in case that a shunt resistor is used as current sensor, the analog-to-digital converter will measure a voltage over the current sensor that depends on the current and the resistance value of the shunt resistor according to $U_{measured}=R_{shunt}/I$. Therefore, the current I may be determined as $U_{measured}/R_{Shunt}$.

[0029] It is however also understood, that the control unit may directly process the values provided by the analog-to-digital converter that will usually comprise a linear relationship to the measured voltage, without converting the values into current values.

[0030] In an embodiment, the predetermined interval may comprise an interval of 5 ms to 20 ms, especially 10 ms.

[0031] Measuring the average current during the startup phase may easily be performed by measuring a plurality of single current values in predetermined intervals. The intervals may e.g. depend on the driving frequency of the resonant induction circuit during the startup phase. Further, the absolute timing may be synchronized with the driving cycles of the resonant induction circuit. The current measurements may e.g. be performed during an on state of a driving switch of the resonant induction circuit.

[0032] In another embodiment, the startup phase may comprise a duration of 0,5 s to 5 s, especially 1 s or 2 s or 3 s or 4 s.

[0033] The duration of the startup phase may be flexibly chosen according to the application. The longer the startup phase lasts, the longer the resonant induction circuit will be driven with the predetermined power level.

[0034] In an embodiment, the control unit may be configured to determine the size of the cooking vessel as being small or being medium or being large based on the average current.

[0035] The control unit may e.g. comprise predetermined value ranges for determining the sizes of cooking vessels on the hob or on the resonant induction circuit.

[0036] It is understood, that the exact ranges may depend strongly on the respective resonant induction circuit and e. g. the driving circuitry or in general on the respective induction cooker. Therefore, at this point no specific absolute values for a determined induction cooker will be given. It is however understood, that these values or value ranges may be experimentally determined for a specific induction cooker, e.g. by placing cooking vessels of different sizes onto the hob and measuring the resulting average current.

[0037] Providing three different ranges for the sizes, small, medium and large, of the cooking vessels will usually be sufficient. It is however understood, that more than three sizes, e.g. 4, 5, 6 or more and therefore as many value ranges may also be provided.

[0038] Regarding the above example with a 13bit analog-to-digital converter that provides values between 0 and 8192, the overall circuit may be designed such that on an induction coil or hob of 160 mm diameter a small cooking vessel may result in values between 0 and 1000. A medium sized cooking vessel may e.g. result in values between 1001 and 2000, and a large cooking vessel may result in values between 2001 and 5000. Values larger than 5000 may indicate a ferromagnetic vessel with very high permeability that independently of the size may be driven with a fixed power rating.

[0039] In another embodiment, the control unit may comprise a look-up table that provides for hobs of different sizes and the measured average current value the size of the cooking vessel, wherein higher values of the measured average current are reflected by a larger size of the cooking vessel in the look-up table.

[0040] In the above example the values of the analog-to-digital converter of the different sized cooking vessels are given for a 160 mm induction coil or hob. With the look-up table the values may be given for different sizes of induction coils or hobs. The control unit may therefore be used for different hobs of the induction cooker.

[0041] An exemplary possible look-up table may look as follows:

Measured value		**0-1000**	**1001-2000**	**2001-3000**	**3001-4000**	**4001-5000**	**>5000**
Size	160 mm	S (1000W)	M (1400W)	L (1650W)	L (1650W)	L (1650W)	ferromag. (1400W)
	210 mm	S (1100W)	S (1100W)	M (1650W)	L (2350W)	L (2350W)	ferromag. (1650W)
	290 mm	S (1200W)	S (1550W)	S (1750W)	M (2750W)	L (3350W)	ferromag. (2750W)

[0042] In the table the measured value in the top column refers to the value provided by the analog-to-digital converter. It is understood, that this is done for easier processing by the control unit. It is further understood, that the measured values could also be provided as current values. The values 160 mm, 210 mm and 290 mm refer to the size of the induction coil or cooking hob. The letter S refers to a small cooking vessel, the letter M to a medium sized cooking vessel, and the letter L to a large cooking vessel. The values behind the size letters indicate the maximum power for driving the resonant induction circuit with the detected cooking vessel.

[0043] The above table provides a maximum power level for the respective cooking vessel and a respective cooking hob. It is understood, that the control unit and/or the driving unit may also perform a mapping of a user-set power level according to the maximum power level. If for example a user may select between ten power levels, every power level may represent 10% of the respective maximum power. Level 1 will therefore provide 10% of the maximum power to the resonant induction circuit, level 2 will provide 20%, level 3 will provide 30% and so on. It is understood, that other mappings, e.g. non-linear mappings may also be provided.

[0044] In an embodiment, the driving unit may be configured to drive the resonant induction circuit with a predetermined fixed power value if the measured average current is above a predefined threshold value.

[0045] As already explained above, certain cooking vessel with high magnetic permeability, like e.g. iron, may result in very large average current values. If such a cooking vessel is detected, the maximum output power may be limited to a predefined fixed power value, as may e.g. be seen in the above presented table for measured values of more than 5000.

[0046] In another embodiment, the control unit may be configured to further determine the average current during normal operation of the resonant induction circuit and determine a position shift of the cooking vessel based on a comparison of the average current measured during normal operation of the resonant induction circuit and during the startup phase of the resonant induction circuit.

[0047] It is understood, that the control unit may repeat the performed measurements. This means that the average current may not only be determined during the startup phase. The control unit may e.g. indicate to the driving unit during normal operation of the resonant induction circuit to control the resonant induction circuit like in the startup phase with a constant power output. The control unit may then reassess the average current value and verify if the same or similar values are measured.

[0048] If the measured average current is lower than during the startup phase, the cooking vessel may have been moved such that the bottom of the cooking vessel partially is outside of the hob. Therefore, by measuring the average current during normal operation, an assertion of the position of the cooking vessel may be performed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049] 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 control system according to the present invention;

Fig. 2 shows a block diagram of an embodiment of an induction cooker according to the present invention; and

Fig. 3 shows a flow diagram of an embodiment of a method according to the present invention.

Fig. 4 shows arrangements of cooking vessels on hobs that may be detected with an embodiment of a control system according to the present invention.

[0050] In the figures like reference signs denote like elements unless stated otherwise.

DETAILED DESCRIPTION OF THE DRAWINGS

[0051] Fig. 1 shows a block diagram of a control system 100 for controlling an induction cooker 150. The induction cooker 150 comprises a hob 151 with a resonant induction circuit 152 and a cooking vessel 153 placed on the hob 151. The hob 151 is supplied with electrical power by power source 154.

[0052] The control system 100 comprises a current sensor 101 that is provided in a supply line of the hob 151 and is coupled to a control unit 102. The control unit 102 is coupled to a driving unit 105 that drives the hob 151.

[0053] The current sensor 101 senses the current that runs through the resonant induction circuit 152. The control unit 102 is coupled to the current sensor 101 to receive the measured current values and determine an average current 103 based on the current values measured by the current sensor 101. The control unit 102 determines the average current 103 during a startup phase of the resonant induction circuit 152, e.g. for a startup phase of 1 s. The control unit 102 may e.g. sum up current values that are measured at intervals of e.g. 10 ms for the duration of 1 s and divide the result by the number of measured values, e.g. 100. The driving unit 105 may drive the resonant induction circuit 152 with a predetermined power and/or frequency during this startup phase.

[0054] Based on the average current 103 the control unit 102 may then determine the size 104 of the cooking vessel 153. The control unit 102 may then provide to the driving unit 105 either the size 104 of the cooking vessel 153 or control values that are based on the size 104 of the cooking vessel 153.

[0055] The driving unit 105 will then drive the resonant induction circuit 152 accordingly. The driving unit 105 may e. g. drive the resonant induction circuit 152 with a maximum power based on the determined size 104 of the cooking vessel 153. Driving may e.g. include closing and opening a switch in the supply line of the resonant induction circuit 152 with a predetermined frequency and duty cycle.

[0056] The control unit 102 may e.g. be capable of differentiating three different sizes of the possible cooking vessel

153, e.g. small, medium and large. The control unit 102 or the driving unit 105 may then determine the appropriate maximum power level for the respective resonant induction circuit 152 based on the size of the hob 151 or the induction coil of the hob 151. In the control unit 102 a respective look-up table may be provided.

[0057] Fig. 2 shows a block diagram of an induction cooker 250 with a control system 200.

[0058] The induction cooker 250, i.e. the resonant induction circuit 252 may be supplied with electrical energy by a rectifier circuit 254 that may be supplied with electrical energy, e.g. an AC current, from a mains power outlet and provide DC current to the resonant induction circuit 252. The resonant induction circuit 252 comprises the induction coil 256 with a parallel capacitor 257. Further, a bulk capacitor is provided between the output connections of the rectifier circuit 254, and a switching element 255 is provided between the induction coil 256 with a parallel capacitor 257 and the negative input of the rectifier circuit 254. On the other end the induction coil 256 with a parallel capacitor 257 are connected to the positive input of the rectifier circuit 254.

[0059] The control system 200 comprises a current sensor 201 that is arranged between the supply line that connects the switching element 255 to the rectifier circuit 254 and ground. The current sensor 201 may e.g. be a shunt resistor 201 with a resistance value in the milliohm region. It is understood, that any other current sensor may also be used. The current sensor 201 is coupled to the control unit 202 that - as already explained above - determines the size of the cooking vessel 253 based on an average current value measured during a startup phase of the resonant induction circuit 252. The control unit 202 then provides respective information to the driving unit 205 that drives the switching element 255 accordingly.

[0060] For sake of clarity in the following description of the method based Fig. 3 the reference signs used above in the description of apparatus based Figs. 1,2 and 4 will be maintained.

[0061] Fig. 3 shows a flow diagram of an embodiment of a method for controlling an induction cooker 150, 250.

[0062] The method comprises sensing S1 the average current 103 through a resonant induction circuit 152, 252 of a hob 151, 251, 400 of the induction cooker 150, 250 during a startup phase of the resonant induction circuit 152, 252, determining S2 the size 104 of a cooking vessel 153, 253, 401, 402, 403 on the hob 151, 251, 400 based on the determined average current 103, and driving S3 the resonant induction circuit 152, 252 with a predetermined power level during the startup phase and with a power level based on the determined size 104 of the cooking vessel 153, 253, 401, 402, 403 during normal operation of the resonant induction circuit 152, 252.

[0063] Sensing S1 the average current 103 may comprise measuring a plurality of current values during the startup phase in predetermined intervals and calculating the average current 103 as the sum of the measured current values divided by the number of measured current values. The predetermined interval may comprise an interval of 5 ms to 20 ms, especially 10 ms. In addition, the startup phase may comprise a duration of 0,5 s to 5 s, especially 1 s or 2 s or 3 s or 4 s.

[0064] Determining S2 the size 104 may comprise determining the size 104 of the cooking vessel 153, 253, 401, 402, 403 as being small or being medium or being large based on the average current 103, especially using a look-up table that provides for hobs 151, 251, 400 of different sizes 104 and the measured average current 103 value the size 104 of the cooking vessel 153, 253, 401, 402, 403. Higher values of the measured average current 103 are reflected by a larger size 104 of the cooking vessel 153, 253, 401, 402, 403 in the look-up table.

[0065] Driving S3 may comprise driving the resonant induction circuit 152, 252 with a predetermined fixed power value if the measured average current 103 is above a predefined threshold value.

[0066] The average current 103 may further be determined during normal operation of the resonant induction circuit 152, 252 and a position shift of the cooking vessel 153, 253, 401, 402, 403 may be identified based on a comparison of the average current 103 measured during normal operation of the resonant induction circuit 152, 252 and during the startup phase of the resonant induction circuit 152, 252.

[0067] Fig. 4 shows arrangements of cooking vessels 401, 402, 403 on hob 400 that can be detected with the control system 100, 200.

[0068] The cooking vessel 401 is large compared to the cooking vessel 402. When used with an induction cooker 150, 250 that includes a control system 100, 200, the cooking vessel 401 will lead to a high value of the average current measured during the startup phase of the induction cooker 150, 250. In contrast, the cooking vessel 402 will lead to a low value of the average current measured during the startup phase of the induction cooker 150, 250.

[0069] The lower part of Fig. 4 shows the same cooking vessel 403 in two different positions on hob 403. The cooking vessel 403 on the left is placed in the center of the hob 400. In this position the cooking vessel 403 will lead to a large value of the average current measured during the startup phase of the induction cooker 150, 250.

[0070] On the right, the cooking vessel 403 is placed off-center such that only part of the cooking vessel 403 is inside of the hob 400. In this position the cooking vessel 403 will lead to a low value of the average current measured during normal operation of the induction cooker 150, 250.

[0071] Comparing the current value measured during startup and during normal operation therefore allows identifying of the cooking vessel 403 was moved during operation.

[0072] 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.

[0073] Thus, the present invention provides a control system 100 for an induction cooker 150, 250, the control system 100 comprising a current sensor 101, 201 configured to sense the current through a resonant induction circuit 152, 252 of a hob 151, 251, 400 of the induction cooker 150, 250, a control unit 102, 202 coupled to the current sensor 101, 201 and configured to determine an average current 103 through the resonant induction circuit 152, 252 during a startup phase of the resonant induction circuit 152, 252 and configured to determine the size 104 of a cooking vessel 153, 253, 401, 402, 403 on the hob 151, 251, 400 based on the determined average current 103, and a driving unit 105, 205 coupled to the resonant induction circuit 152, 252 and the control unit 102, 202 and configured to drive the resonant induction circuit 152, 252 with a predetermined power level during the startup phase and with a power level based on the determined size 104 of the cooking vessel 153, 253, 401, 402, 403 during normal operation of the resonant induction circuit 152, 252.

List of reference signs

[0074]

100	control system
101, 201	current sensor
102, 202	control unit
103	average current
104	size
105, 205	driving unit
150, 250	induction cooker
151, 251	hob
152, 252	resonant induction circuit
153, 253	cooking vessel
154, 254	power source
255	switching device
256	coil
257, 258	capacitor
400	hob
401, 402, 403	cooking vessel
S1, S2, S3	method steps

Claims

1. Control system (100) for an induction cooker (150, 250), the control system (100) comprising:

a current sensor (101, 201) configured to sense the current through a resonant induction circuit (152, 252) of a hob (151, 251, 400) of the induction cooker (150, 250),
a control unit (102, 202) coupled to the current sensor (101, 201) and configured to determine an average current (103) through the resonant induction circuit (152, 252) during a startup phase of the resonant induction circuit (152, 252) and configured to determine the size (104) of a cooking vessel (153, 253, 401, 402, 403) on the hob (151, 251, 400) based on the determined average current (103), and
a driving unit (105, 205) coupled to the resonant induction circuit (152, 252) and the control unit (102, 202) and configured to drive the resonant induction circuit (152, 252) with a predetermined power level during the startup phase and with a power level based on the determined size (104) of the cooking vessel (153, 253, 401, 402, 403) during normal operation of the resonant induction circuit (152, 252).

2. Control system (100) according to any one of the preceding claims, wherein the control unit (102, 202) is configured to measure a plurality of current values during the startup phase in predetermined intervals and calculate the average current (103) as the sum of the measured current values divided by the number of measured current values.

3. Control system (100) according to claim 1, wherein the predetermined interval comprises an interval of 5 ms to 20 ms, especially 10 ms.

4. Control system (100) according to any one of the preceding claims, wherein the startup phase comprises a duration of 0,5 s to 5 s, especially 1 s or 2 s or 3 s or 4s.

5. Control system (100) according to any one of the preceding claims, wherein the control unit (102, 202) is configured to determine the size (104) of the cooking vessel (153, 253, 401, 402, 403) as being small or being medium or being large based on the average current (103).

6. Control system (100) according to claim 5, wherein the control unit (102, 202) comprises a look-up table that provides for hobs (151, 251, 400) of different sizes (104) and the measured average current (103) value the size (104) of the cooking vessel (153, 253, 401, 402, 403), wherein higher values of the measured average current (103) are reflected by a larger size (104) of the cooking vessel (153, 253, 401, 402, 403) in the look-up table.

7. Control system (100) according to any one of the preceding claims, wherein the driving unit (105, 205) is configured to drive the resonant induction circuit (152, 252) with a predetermined fixed power value if the measured average current (103) is above a predefined threshold value.

8. Control system (100) according to any one of the preceding claims, wherein the control unit (102, 202) is configured to further determine the average current (103) during normal operation of the resonant induction circuit (152, 252) and determine a position shift of the cooking vessel (153, 253, 401, 402, 403) based on a comparison of the average current (103) measured during normal operation of the resonant induction circuit (152, 252) and during the startup phase of the resonant induction circuit (152, 252).

9. Induction cooker (150, 250) comprising:

at least one hob (151, 251, 400) comprising a resonant induction circuit (152, 252), and
a control unit (102, 202) according to any one of the preceding claims coupled to the at least one hob (151, 251, 400).

10. Method for controlling an induction cooker (150, 250), the method comprising:

sensing (S1) the average current (103) through a resonant induction circuit (152, 252) of a hob (151, 251, 400) of the induction cooker (150, 250) during a startup phase of the resonant induction circuit (152, 252),
determining (S2) the size (104) of a cooking vessel (153, 253, 401, 402, 403) on the hob (151, 251, 400) based on the determined average current (103), and
driving (S3) the resonant induction circuit (152, 252) with a predetermined power level during the startup phase and with a power level based on the determined size (104) of the cooking vessel (153, 253, 401, 402, 403) during normal operation of the resonant induction circuit (152, 252).

11. Method according to claim 10, wherein sensing (S1) the average current (103) comprises measuring a plurality of current values during the startup phase in predetermined intervals and calculating the average current (103) as the sum of the measured current values divided by the number of measured current values.

12. Method according to any one of the preceding claims 10 and 11, wherein the predetermined interval comprises an interval of 5 ms to 20 ms, especially 10 ms; and/or
wherein the startup phase comprises a duration of 0,5 s to 5 s, especially 1 s or 2 s or 3 s or 4 s.

13. Method according to any one of the preceding claims 10 to 12, wherein determining (S2) the size (104) comprises determining the size (104) of the cooking vessel (153, 253, 401, 402, 403) as being small or being medium or being large based on the average current (103), especially using a look-up table that provides for hobs (151, 251, 400) of different sizes (104) and the measured average current (103) value the size (104) of the cooking vessel (153, 253, 401, 402, 403), wherein higher values of the measured average current (103) are reflected by a larger size (104)

of the cooking vessel (153, 253, 401, 402, 403) in the look-up table.

14. Method according to any one of the preceding claims 10 to 13, wherein driving (S3) comprises driving the resonant induction circuit (152, 252) with a predetermined fixed power value if the measured average current (103) is above a predefined threshold value.

15. Method according to any one of the preceding claims 10 to 14, wherein the average current (103) is further determined during normal operation of the resonant induction circuit (152, 252) and a position shift of the cooking vessel (153, 253, 401, 402, 403) is identified based on a comparison of the average current (103) measured during normal operation of the resonant induction circuit (152, 252) and during the startup phase of the resonant induction circuit (152, 252).

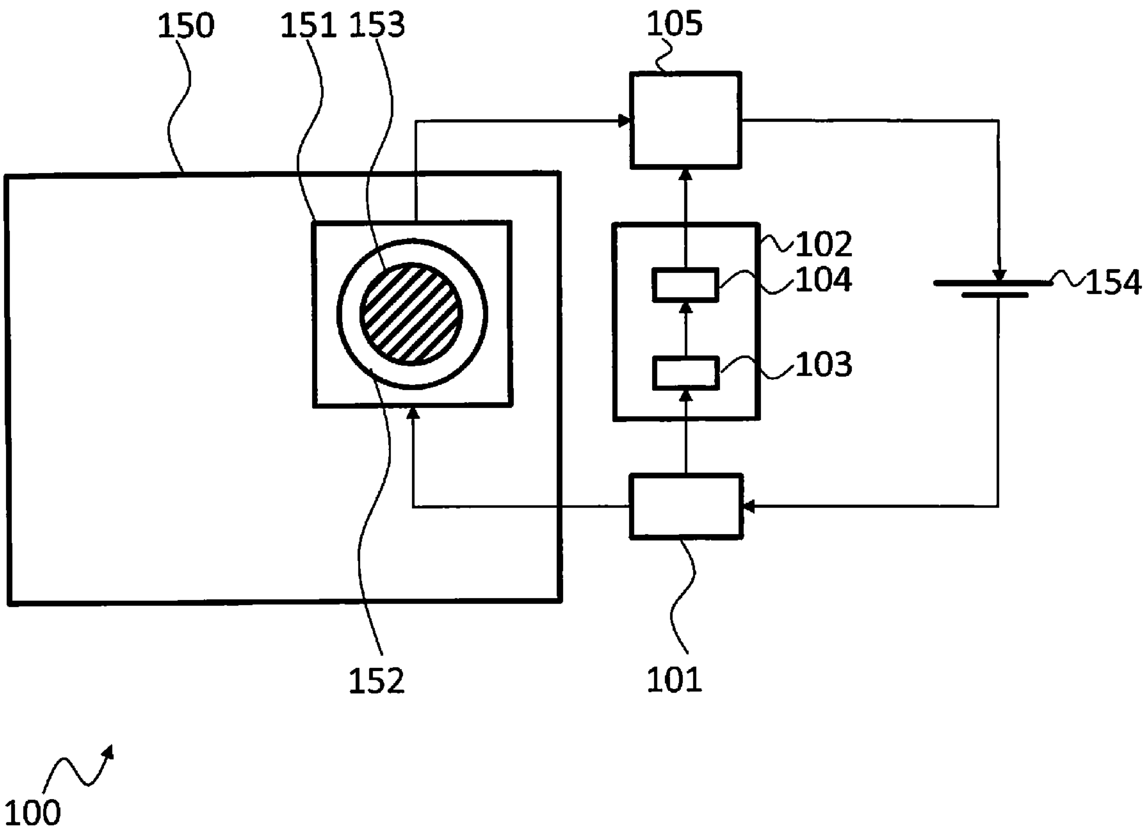

Fig. 1

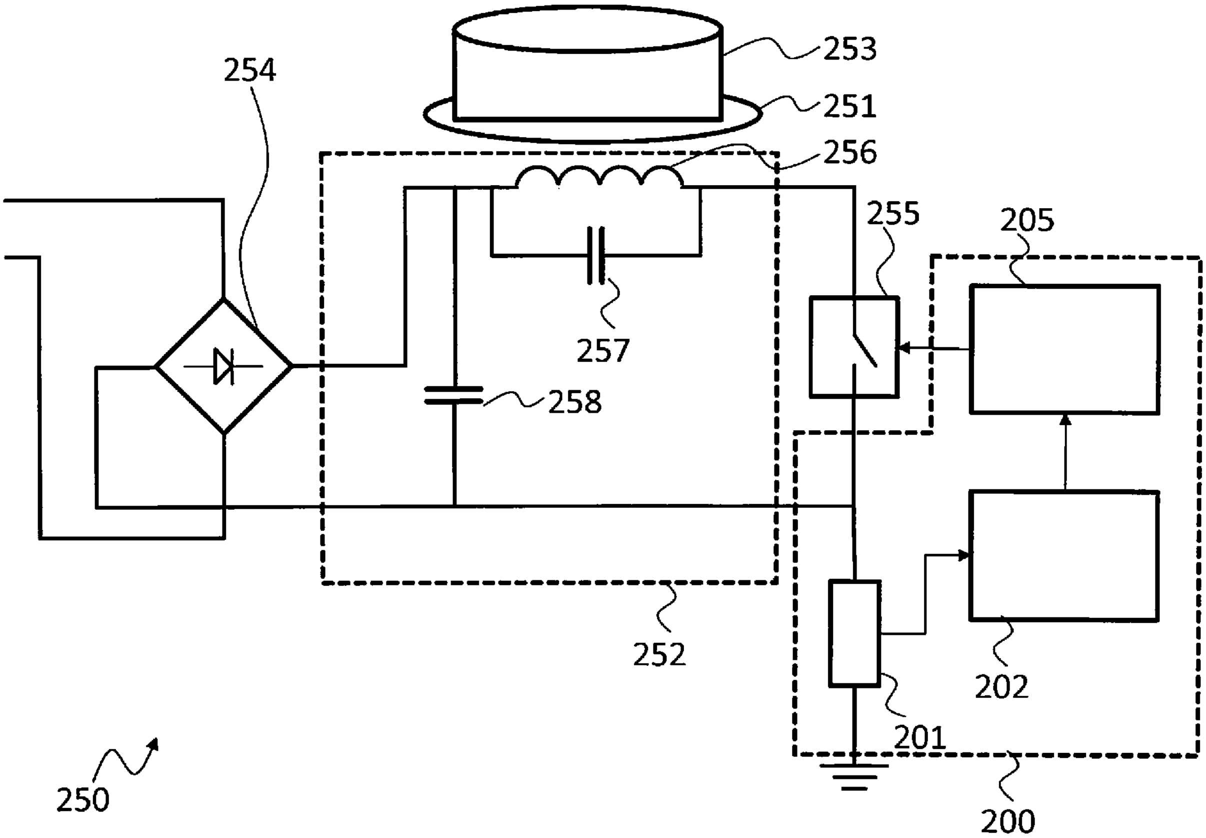

Fig. 2

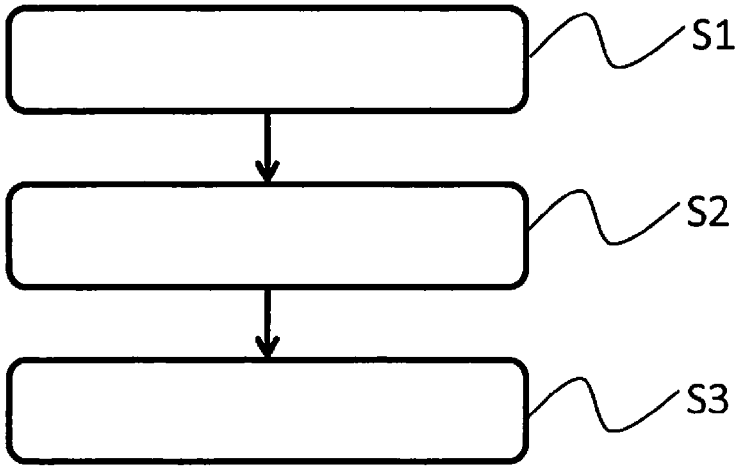

Fig. 3

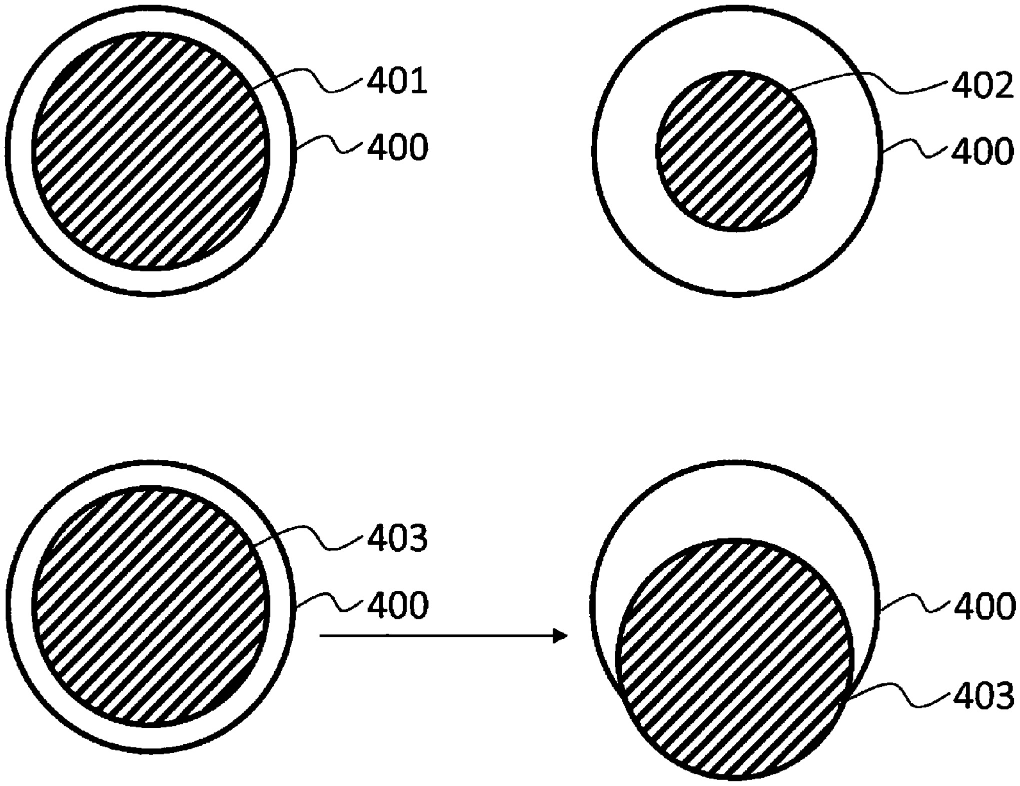

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 17 18 7545

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			H05B

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	9 February 2018	Pierron, Christophe

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