



- (51) **International Patent Classification:**
A47J 36/32 (2006.01)
- (21) **International Application Number:**
PCT/EP2017/051346
- (22) **International Filing Date:**
24 January 2017 (24.01.2017)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
PCT/CN2016/073497
4 February 2016 (04.02.2016) CN
16159555.8 10 March 2016 (10.03.2016) EP
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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

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(54) **Title:** A SENSING APPARATUS AND A COOKING DEVICE USING THE SAME

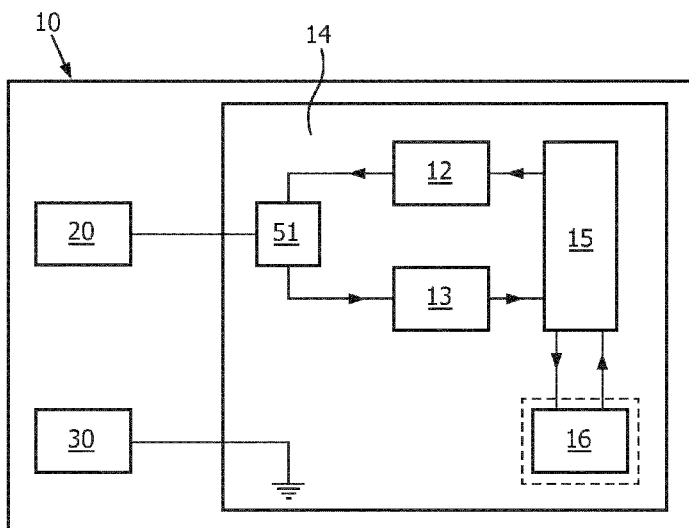


FIG. 2

(57) **Abstract:** A sensing apparatus (10) configured to monitor a cooking status of food, comprising: - an emitting unit (12) adapted to emit a plurality of first radio frequency signals into the food; - a receiving unit (13) adapted to receive a plurality of second radio frequency signals reflected from the food and/or transmitting through the food; - a conductive probe element (20) adapted to contact the food during cooking; and - a conductive connection element (30) adapted to electrically connect the sensing apparatus to a conductive cooking vessel (40) having a conductive area for contacting the food during cooking. Wherein the probe element and connection element are electrically connected through the food and the conductive cooking vessel during cooking to form an electrical circuit.

WO 2017/133916 A1

Published:

— with international search report (Art. 21(3))

A sensing apparatus and a cooking device using the same

FIELD OF THE INVENTION

The present invention generally relate to a sensing apparatus for monitoring a status of the food under cooking, especially its doneness, and a cooking apparatus as well as a cooking method utilizing such a sensing apparatus.

BACKGROUND OF THE INVENTION

Air frying cooking is a convectional radiant heating method recently adapted for home cooking. The food cooked by air frying has texture, aroma and flavour similar to conventionally fried food and meanwhile has much less fat contents, so it is becoming more and more popular. However, one problem is in order to form the convectional air flow, the food needs to be kept in a closed space during cooking. That means the cook cannot observe the food materials, so it is very difficult to monitor or control the cooking process accurately. Consequently, now the cooking is performed in accordance with a pre-set cooking procedure, or the users need to interrupt the cooking and get the food materials out for observation. The cooking results cannot be ensured or it is not convenient. These problems also exist in some other cooking methods like oven cooking.

In recent years, more and more devices have been made out to help household cooks to monitor and control the cooking process at real time. In one example, a probe of needle shape with several temperature sensors embedded is used to insert into the food under cooking. This probe is connected to a smart phone or a computer through Wi-Fi or Bluetooth[®]. The sensors can reflect the inner temperature distribution to the users, so the cooking process can be monitored and controlled without direct observation. However, the disadvantage of this kind of probe is also obvious. It will affect the appearance of the food materials. What is worse, it may bring some concerns of contamination to food.

WO2015140013A1 discloses an automatic method and device for monitoring the doneness of food without “destroying” the food. Radio frequency (RF) signals are emitted to the food materials under cooking. By reflection and/or transmission, the signals will be affected by the denatured protein so that the doneness of the food can be estimated from the final received signals.

A following problem is, traditional open-end coaxial probes (see Fig. 1) that are used for RF sensing are not suitable for high temperature environment. Coaxial probes contain a number of organic materials 102 in its structure (cable jacket, strain reliever, insulator etc) surround and between the two concentric conductors 101, 103, which will
5 change dielectric property, even decompose and give off gases under cooking temperature of 200 °C. Although it is possible to replace them with more heat-resisting materials (e.g. mica, porcelain, glass etc), the processing and assembly will be much more complex and expensive.

SUMMARY OF THE INVENTION

10 In view of the foregoing, there is a need in the art for a solution capable of sensing the food status under cooking by sensing RF signals cheaply and conveniently. This object is achieved by providing a sensing apparatus comprising:

- an emitting unit adapted to emit a plurality of first radio frequency signals into the food;
- 15 - a receiving unit adapted to receive a plurality of second radio frequency signals reflected from the food and/or transmitting through the food;
- a conductive probe element adapted to contact the food during cooking; and
- a conductive connection element adapted to electrically connect the sensing apparatus to a conductive cooking vessel having a conductive area for contacting the food
20 during cooking;

wherein the probe element and connection element are electrically connected through the food and the conductive cooking vessel during cooking to form an electrical circuit.

In order to overcome the problems brought by traditional open-end coaxial
25 probes, this invention proposes to use a conductive probe element to replace one of the concentric conductors, and use the conductive cooking vessel to replace the other concentric conductors. In this way, an electrical circuit is formed along the probe element, the food and the conductive cooking vessel. By adjusting the alternative current of radio frequency, RF signals can be emitted and received just like in the traditional open-end coaxial probes. Since
30 there is not a layer of organic materials therebetween, the thermal endurance problem can be perfectly solved.

Here the conductive cooking vessel could be an iron wok, a metal grill or other metal cookers, while it can also be a cooking vessel made of insulative materials but containing some conductive paths. The only requirement is these conductive paths are

adapted to be electrically connected to the conductive connection element. The conductive cooking vessel could also have an insulative coating for other purposes, like Teflon[®]. In this case, the coating cannot cover the whole inner surface of the vessel, but leaving a conductive area for contacting the food.

5 It is possible for the sensing apparatus to comprise a body part to carry the emitting unit and the receiving unit. This conductive probe element and connection element could be fixed on the body part or connected to the body part by an electrical wire.

In one group of embodiments, the sensing apparatus could be designed that the probe element extends from the body part to form a cantilever. In these embodiments, the
10 probe element could extend into the cooking vessel from above and touch the top surface of the food.

In a preferable embodiment, the probe element comprises an adjustment element for adjusting the position of the probe element relative to the conductive cooking vessel. By this, even if the dimension, especially the thickness of the food, varies, the probe
15 element is still applicable.

The probe element could further comprise an insulative outer layer, but leaving a small conductive area as a tentacle for contacting the food. By this, the contact area and the electric path are more clearly defined. Thus, the measured reflectance will be mainly determined by the dielectric property and thickness of food but independent of food lateral
20 dimension which is unknown to current sensing arrangement.

A difference from the traditional open-end coaxial probes is, without a space well enclosed by the two concentric conductors, high frequency RF signals are not easily restricted along a defined path between the two partially parallel conductors as a significant portion of RF signals will be emitted to space before and after passing the food substance and
25 be erroneously counted as absorption by food. Thus, the suitable range for the first radio frequency signals delivered by the proposed probe configuration is from 10k to 20M Hz.

Meanwhile, the body part above mentioned could be an independent housing, or a part of the cooking vessel. In the former situation, the connection element is adapted to electrically connect the sensing apparatus to the conductive cooking vessel detachably, i.e.
30 the sensing apparatus is a separate accessory. In the latter situation, the sensing apparatus could be an embedded part of the cooking vessel.

In another group of embodiments, the probe element could be adapted to extend from the body part along the inner surface of the conductive cooking vessel. In these embodiments, the probe element will touch the bottom surface of the food. In this situation,

the current coming from the probe element or the cooking vessel will not pass through the whole thickness but only the surface part of the food. This situation is quite similar to that in the traditional open-end coaxial probes, and the dielectric property change in a larger area of food can be sensed due to the wider gap between the two conductors in the current probe.

- 5 Although the current does not pass through the core part of the food, a correlation could be built up between the core temperature and the surface temperature in advance, so the doneness of the food could still be monitored at real time.

The sensing apparatus could further comprise a signal communication unit for sending the second radio frequency signals to a control unit for determining the cooking
10 status. In some embodiments, the communication unit can also receive control orders from the control unit. The control unit is adapted to control the emitting unit to emit the plurality of first radio frequency signals, receive the plurality of second radio frequency signals from the receiving unit, and determine the cooking status. It could be a part of the sensing apparatus or an App installed in a smart phone connected to the apparatus through a Wi-Fi or Bluetooth[®].

15 In another aspect, this invention relates to a cooking device comprising:

- a sensing apparatus mentioned above; and
- a conductive cooking vessel having a conductive area for contacting the food during cooking.

In one embodiment, the probe element is arranged on the inner surface of the
20 conductive cooking vessel and insulative with it. The probe element could be supported and separated from the inner surface by for example some insulative spacers.

In another embodiment, the conductive cooking vessel comprises a cut-off channel, and the probe element extends within the channel. This embodiment is especially suitable where meat is grilled on a cooking vessel of a grid grill. In this situation the cook
25 does not have a potential concern on the leakage of the meat juice.

Preferably, the cooking device could further comprise a thickness sensing element arranged on the cooking vessel or the probe element for sensing the thickness of the food. This thickness results could be used to further correct the doneness sensing results.

The invention also provides a method for cooking food by utilizing a cooking
30 device mentioned above, comprising:

- placing the food on the conductive area of the conductive cooking vessel;
- adjusting the probe element so that the food contacts with both the probe element and the conductive area;
- emitting a plurality of first radio frequency signals into the food;

- receiving a plurality of second radio frequency signals reflected from the food and/or transmitting through the food;
- determining the doneness of the food based on the second radio frequency signals; and
- 5 - adjusting the cooking based on the doneness of the food.

In one embodiment, the doneness of the food is determined based on the amplitude and phase of the second radio frequency signal relative to those of the first radio frequency.

10 Other features and advantages of embodiments of the present invention will also be understood from the following description of exemplary embodiments when read in conjunction with the accompanying drawings, which illustrate, by way of example, spirit and principles of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Examples of the invention will now be described in detail with reference to the accompanying drawings, in which:

Fig. 1 is a cross section view of a traditional open-end coaxial probe, showing the basic working principle of RF sensing;

20 Fig. 2 shows a block diagram of an embodiment of the sensing apparatus in accordance with this invention;

Fig. 3A shows a schematic view of an embodiment of the cooking device in accordance with this invention;

Fig. 3B is a top view of the embodiment of the cooking device in Fig. 3, with the probe element and food removed to show the inner surface of the cooking device;

25 Fig. 4A shows another embodiment of the cooking device in accordance with this invention;

Figs. 4B and 4C respectively show the relationship between the amplitude ratio of the second RF signals relative to the first RF signal and the doneness of the food, indicated by the core temperature of food, and the resistance derived from such relative
30 second RF signal and the doneness of the food in one cooking process;

Figs. 5A and 5B show two examples of the cooking vessel and the arrangement of the probe element;

Fig. 5C shows the relationship between the amplitude ratio of the second RF signals relative to the first RF signal and the doneness of the food in one cooking process; and

5 Fig. 5D shows the relationship between the resistance and the doneness of the food in one cooking process.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The present invention will now be discussed with reference to several example embodiments. It should be understood that these embodiments are discussed only for the
10 purpose of enabling those skilled persons in the art to better understand and thus implement the subject matter described herein, rather than suggesting any limitation on the scope of the subject matter.

With reference to Fig. 2, it shows a block diagram of an embodiment of the sensing apparatus in accordance with this invention. The sensing apparatus comprises a body
15 housing 14, a conductive probe element 20 and a conductive connection element 30.

The housing 14 can be used to enclose the electrical circuit part which includes a coupler 51, an emitting unit 12 for emitting RF signals and a receiving unit 13 for receiving RF signals reflected from the food and/or transmitting through the food. The
20 coupler 51 is used to electrically couple the probe element 20 with the emitting unit 12 and the receiving unit 13, so that RF wave is mainly reflected from the food substance and the reflected second signals can be separated from the emitted first signals for further processing. The connection element 30 is electrically connected to the ground of the circuit board as a reference conductor.

During cooking, the connection element 30 is electrically connected to the
25 conductive cooking vessel, and food is placed on the conductive area. As a result, when the probe element 20 is placed on the food, an electric circuit is formed along the probe element 20, the food, the cooking vessel and the connection element 30. The generated alternative current of radio frequency could produce a radio frequency electromagnetic field that travels along the probe until being reflected by substance at the open far end of the probe.

30 A communication unit 15 is used to sending the received RF signals from the receiving unit 13 to a control unit 16 for determining the cooking status, and/or receiving orders from the control unit 16 to control the emitting unit 12. In this embodiment, the control unit 16 is integrated in the housing 14, but a skilled person can easily envisage that it

could also be an App installed in a smart phone. In the latter situation, transmission unit 15 includes a cable connector, or a Wi-Fi or Bluetooth[®] module.

Figs. 3A and 3B show an embodiment of the cooking device in accordance with this invention, wherein Fig. 3A is a side view and Fig. 3B is a top view. The probe element 20 and the food 11 have been removed in Fig. 3B to show the inner surface of the cooking device.

The cooking device 80 comprises a sensing apparatus 10 and a conductive cooking vessel 40.

As shown in Fig. 3A, the sensing apparatus 10 comprises a probe element 20, a connection element 30 and a main body. Similar to the previous embodiment shown in Fig. 2, an emitting unit 12 and a receiving unit 13 are arranged within the housing 14 of the main body for emitting the first RF signals to the food and receiving the second RF signals reflected from the food. A communication unit 15 of a Wi-Fi module is arranged to connect the circuit to a remote control part (not shown).

In this embodiment, the connection element 30 is made of for example metal. It has two functions: First it fixes the main body to the cooking vessel 40 mechanically. Second it electrically connects the metal cooking vessel 40 to the ground of the circuit board. It can be easily envisaged that this connection element 30 could be a rivet or a screw spike that can permanently attach the housing 14 to the cooking vessel 40, or a detachable connection like a clamp.

The cooking vessel 40 is also made of metal. Similar to many of the cookers in the market, the inner surface of the cooking vessel 40 is coated with a thin layer of Teflon[®] 52, so during cooking the food like meat will not stick to the inner surface. However, Teflon[®] is not conductive. In this situation, a conductive area 41 is left in the central part of the inner surface. Thus, when the food is placed on this conductive area 41, the electric circuit 50 can still be formed. To facilitate the cooks, the conductive area 41 could be marked with a painting or a ring. The controller may also alert the cook when the food 11 is not placed properly.

The electrical probe element 20 is in the form of a cantilever, which has a far end 22 to touch the food to be cooked. The probe element 20 could for example comprise a metal strip and an insulative outer layer. This insulative layer confines the contact with the food to only the exposed conductive part thus clearly defines the electric circuit within the food independent of the dimension perpendicular to the thickness. In this embodiment, an adjustment element 21 is arranged to adjust the position of the probe element 20, especially

the position of its far end 22, relative to the cooking vessel 40. By this arrangement, the cooking device 80 can be applicable to different kinds of food especially having different thickness. Furthermore, this adjustment element 21 can be used to measure the thickness of the food, too. In a simple example, the adjustment element 21 can include a vertical ladder and the horizontal cantilever of the probe element 20 can be adjusted and locked on it. This ladder can have scales to indicate the thickness of the food. However, it is easily understood that the thickness of the food can also be measured or sensed by other methods.

Fig. 4A shows another embodiment of the cooking device in accordance with this invention. The biggest difference from the previous embodiment is now the cooking vessel can be made of insulative materials, so in order to form the necessary electric circuit, a metal strip 41 is embedded along the bottom and side wall of the cooking vessel 40 as the reference conductor.

Some other features are optional. In this embodiment, the probe element 20 is also in the form of a metal strip. An insulating stand 23 is arranged between the two metal strips as a spacer to ensure the probe element 20 and the metal strips 41 will not be shorted. A spring articular 21 is formed on the probe element so that the cantilever part of the metal strip can be adjusted relative to the food and an elastic force can be maintained to ensure the reliable contact between the far end 22 of the probe element and the food.

In this embodiment, a beef steak 11 is cooked by air frying and the RF reflectance is measured during cooking using the probe arrangement depicted in Fig. 4A. The beef steak is of 2cm thick and an ellipsoid cross section with 9.6 and 5.2 cm axes, and the air frying cooker is Philips HD 9240. The cooking temperature in this case is set at 180 °C. The core temperature of the steak is monitored by a needle thermal coupler. The initial core temperature is about 20 °C and the heating is stopped after the core temperature reaches 80 °C.

Figs. 4B and 4C respectively show the relationship between the RF reflectance measured by the probe arrangement depicted in Fig. 4A and the core temperature of the food, and the resistance derived (according to the equation below) from such RF reflectance and the core temperature of the food in one cooking process.

$$Z(f)=R(f)+j \cdot X(f)=Z_0 \cdot (1+S(f))/(1-S(f))$$

Where $S(f)$ is the RF reflectance at a frequency of f , which is the complex ratio between the backward (reflected) and forward traveling electrical fields. And its absolute value $|S(f)|$ represents the amplitude ratio between the backward and forward electrical fields

and is often expressed in logarithmic scale (dB). Z_0 is the characteristic impedance of the transmission line and in practice also the output impedance of the RF emitter. $Z(f)$ is the derived complex impedance at frequency f of the reflector observed at the emitter output. The impedance has both real part called resistance $R(f)$ and imaginary part called reactance $X(f)$.

5 Resistance represents the dissipation of electrical energy into heat while reactance represents the capacitive or inductive storage of energy. Since in the adopted frequency range of 20k-20MHz, dissipation of energy by ionic conduction in food dominates, so resistance $R(f)$ can largely reflect the property of food during cooking.

As shown in Figs. 4B and 4C, the RF reflectance and the derived resistance of
10 the sensed food region increase with the rise of core temperature from 20 °C until a certain degree within the interval of 60-71 °C, corresponding to medium doneness level, as free water released from thermally denatured protein dilutes the ionic strength in the food. Beyond this temperature range, the reflectance and resistance decrease with further
15 temperature rise as water evaporation increases ionic strength, indicating the process approaching well-done and then overcooked statuses. This distinct deflection in RF signals along with protein denaturation in meat would allow easily identifying medium doneness of meat during cooking without using a traditional invasive core temperature probe.

Figs. 5A and 5B show two examples of the cooking vessel and the arrangement of the probe element. In Fig. 5A, the cooking vessels 40 is in the form of metal
20 grid grill having a side wall. Similar to the embodiment in Fig. 3A, the connection element (not shown) is directly electrically connected to the grid grill 40 and the probe element 20 extends along the inner and bottom surfaces of the grid grill 40, and is fixed and supported by some insulative spacers 23. From the side view, it can be found clearly that the probe element 20 is above the metal grid grill 40 so they will not be shorted with the grid. During cooking, a
25 beef steak 11 is placed on both of the probe element 20 and the grid grill 40, so a circuit is formed and RF signals are emitted to the food and return to the sensing apparatus.

The embodiment shown in Fig. 5B is slightly different. An area is cut off from the metal grid grill 40 to form a channel 24. The probe element 20 extends along and within the channel 24 so it will not touch the grid grill 40. It could be in the form of an elastic metal
30 strip and arranged a little higher than the grid grill, so when the food is placed on, a good touching could be ensured.

A beef steak 11 is cooked by an air frying cooker, and the RF reflectance is measured during cooking using the probe arrangement depicted in Fig. 5A. This time, the beef steak is of 2.3 cm thick and an ellipsoid cross section with 10 and 5 cm axes.

Figs. 5C and 5D shows the relationship between the surface RF reflectance and the derived surface resistance versus the doneness of the food in the cooking process. In the early stage of cooking, the core temperature of the steak rises from 20 to 50 °C, which corresponds to “rare” in doneness level. With the temperature rising, the reflectance of the steak increases, indicating a decreased absorption caused by a decreased resistance to RF waves at food surface due to enhanced ionic strength at surface. In the middle stage, the core temperature of the steak is further increased from 50 to 70 °C, which corresponds to “medium” doneness. In this stage, the reflectance decreases slightly (by -1dB), indicating a minor increase of absorption caused by a slightly increased resistance to RF waves. In the final stage, the core temperature of the steak is over 70 °C, which means the steak is cooked “well done”. It can be observed that the reflectance decreases whereas resistance increases sharply. These three distinct segments showing RF signals change with the core temperature changes would allow to identify and monitor the doneness level of meat without using a traditional invasive core temperature probe.

Various modifications, adaptations to the foregoing exemplary embodiments of this invention may become apparent to those skilled in the relevant arts in view of the foregoing description, when read in conjunction with the accompanying drawings. Any and all modifications will still fall within the scope of the non-limiting and exemplary embodiments of this invention. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

Any reference signs in the claims should not be construed as limiting the scope.

CLAIMS:

1. A sensing apparatus (10) configured to monitor a cooking status of food (11), comprising:

- an emitting unit (12) adapted to emit a plurality of first radio frequency signals into the food (11);

5 - a receiving unit (13) adapted to receive a plurality of second radio frequency signals reflected from the food (11) and/or transmitting through the food (11);

- a conductive probe element (20) adapted to contact the food (11) during cooking; and

10 - a conductive connection element (30) adapted to electrically connect the sensing apparatus (10) to a conductive cooking vessel (40) having a conductive area (41) for contacting the food (11) during cooking;

wherein the probe element (20) and connection element (30) are electrically connected through the food (11) and the conductive cooking vessel (40) during cooking to form an electrical circuit (50).

15

2. The sensing apparatus (10) according to claim 1, further comprising a body part (14) carrying the emitting unit (12) and the receiving unit (13).

3. The sensing apparatus (10) according to claim 2, wherein the probe element
20 (20) extends from the body part (14) to form a cantilever.

4. The sensing apparatus (10) according to claim 1, wherein the probe element (20) comprises an adjustment element (21) for adjusting the position of the probe element (20) relative to the conductive cooking vessel (40).

25

5. The sensing apparatus (10) according to claim 1, wherein the first radio frequency signals emitted by the emitting unit (12) are in the range of 10k-20M Hz.

6. The sensing apparatus (10) according to claim 1, wherein the connection element (30) is adapted to electrically connect the sensing apparatus (10) to the conductive cooking vessel (40) detachably.

5 7. The sensing apparatus (10) according to claim 2, wherein the probe element (20) is adapted to extend from the body part (14) along the inner surface of the conductive cooking vessel (40).

8. The sensing apparatus (10) according to claim 1, further comprising a signal
10 communication unit (15) for sending the second radio frequency signals to a control unit (16) for determining the cooking status.

9. The sensing apparatus (10) according to claim 8, further comprising a control
15 unit (16) adapted to control the emitting unit (12) to emit the plurality of first radio frequency signals, receive the plurality of second radio frequency signals from the receiving unit (13), and determine the cooking status.

10. A cooking device (80) comprising:
- a sensing apparatus (10) in accordance with any of the previous claims; and
20 - a conductive cooking vessel (40) having a conductive area (41) for contacting the food (11) during cooking.

11. The cooking device (80) according to claim 10, wherein the probe element (20)
25 is on the inner surface of the conductive cooking vessel (40) and insulative with it.

12. The cooking device (80) according to claim 10, wherein the conductive
cooking vessel (40) comprises a cut-off channel (81), and the probe element (20) extends
within the channel (81).

30 13. The cooking device (80) according to claim 10, further comprising a thickness sensing element arranged on the cooking vessel (40) or the probe element (20) for sensing the thickness of the food (11).

14. A method (90) for cooking food (11) by utilizing a cooking apparatus (80) according to any one of claims 10-13 comprising:

- placing the food (11) on the conductive area (41) of the conductive cooking vessel (40);
- 5 - adjusting the probe element (20) so that the food (11) contacts with both the probe element (20) and the conductive area (41);
- emitting a plurality of first radio frequency signals into the food (11);
- receiving a plurality of second radio frequency signals reflected from the food (11) and/or transmitting through the food (11);
- 10 - determining the doneness of the food (11) based on the second radio frequency signals; and
- adjusting the cooking based on the doneness of the food (11).

15. A method (90) for cooking food (11) according to claim 14, wherein the
15 doneness of the food (11) is determined based on the amplitude and phase of the second radio frequency signal relative to those of the first radio frequency.

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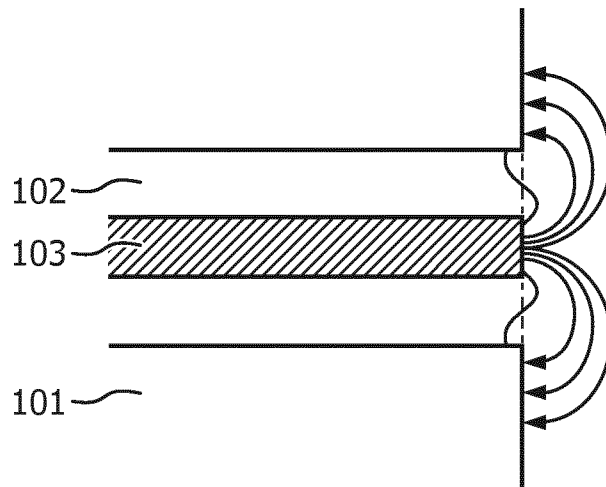


FIG. 1

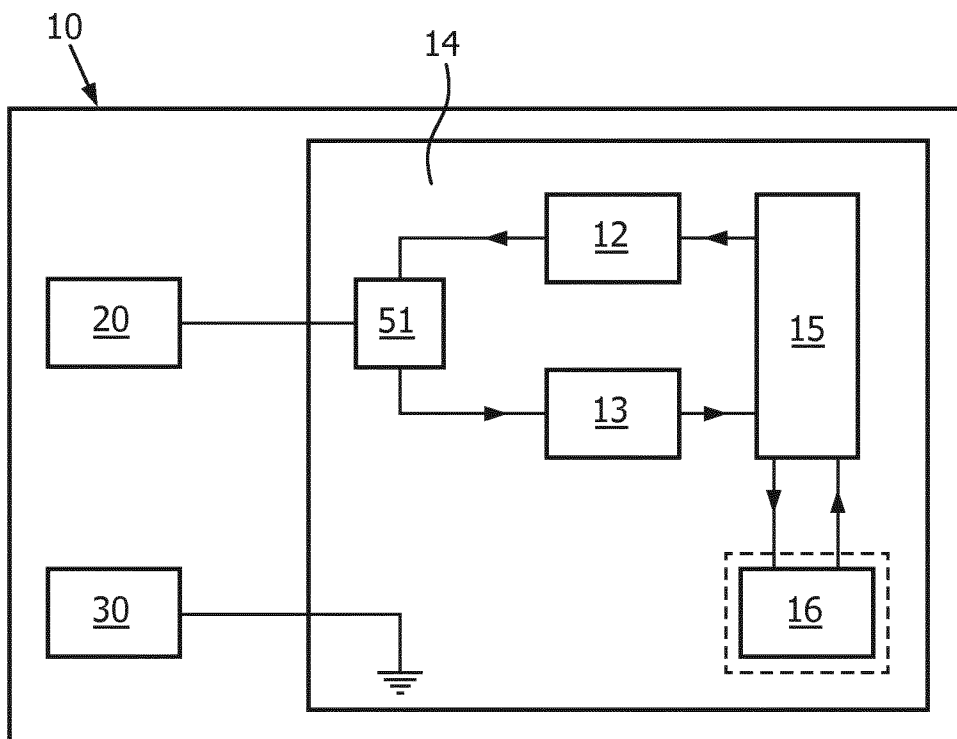


FIG. 2

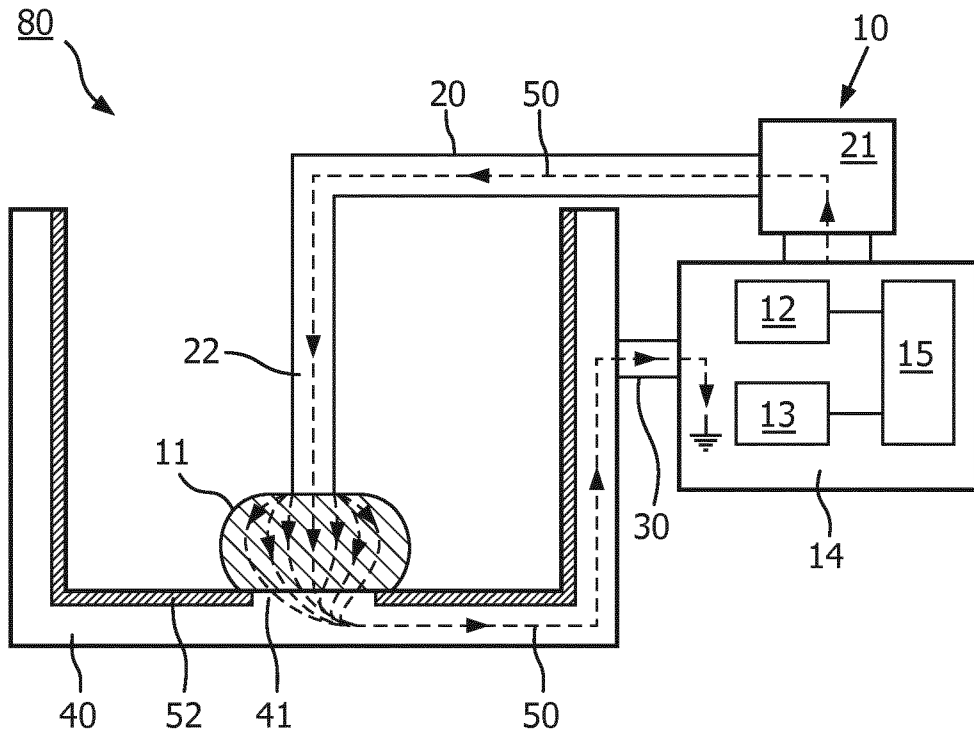


FIG. 3A

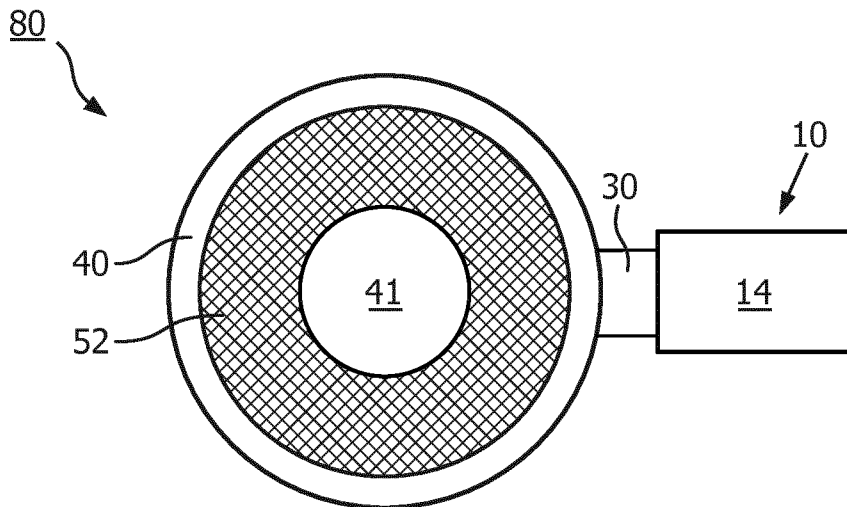


FIG. 3B

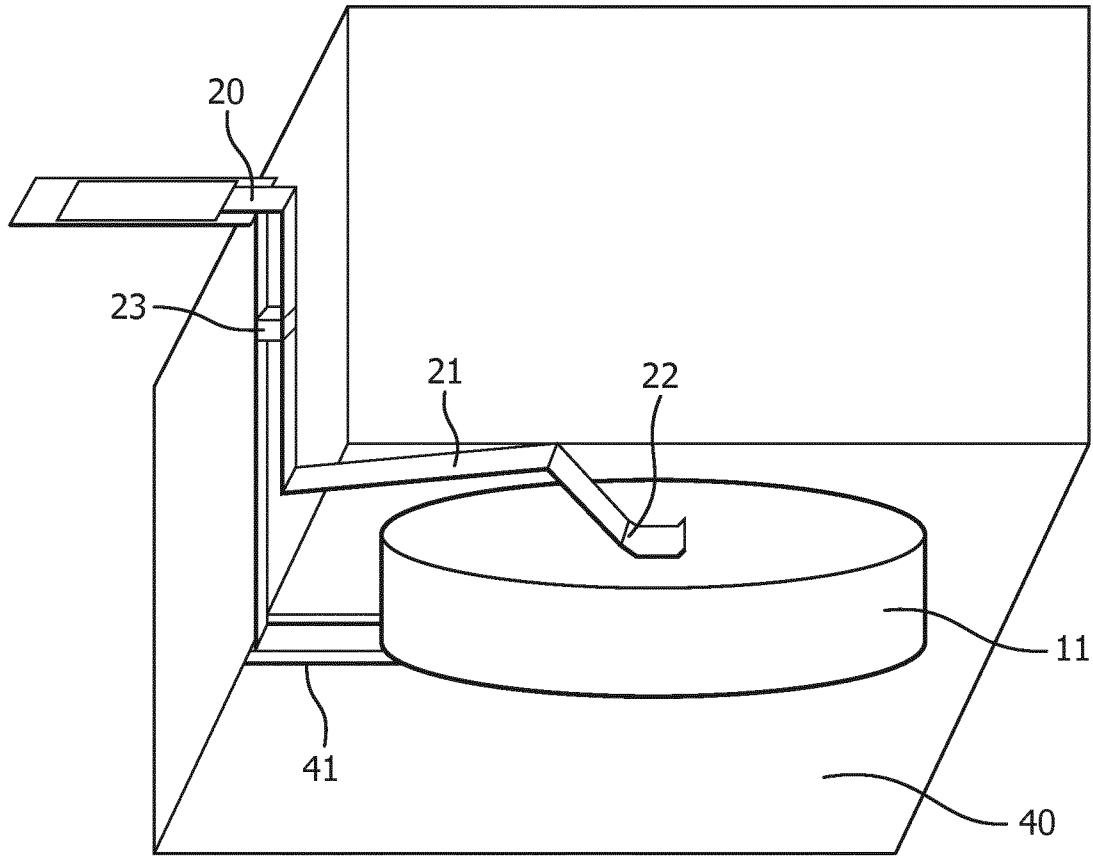


FIG. 4A

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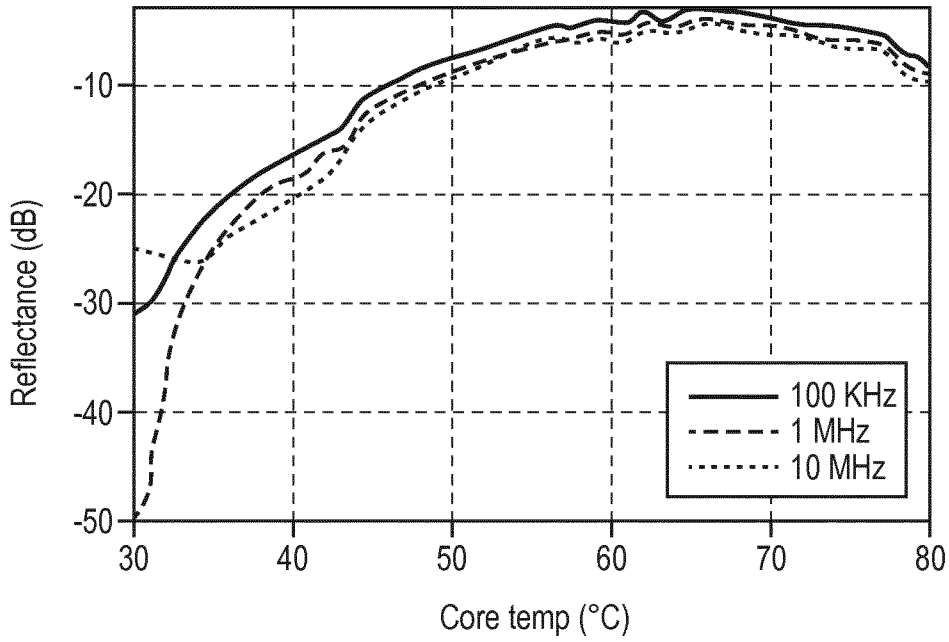


FIG. 4B

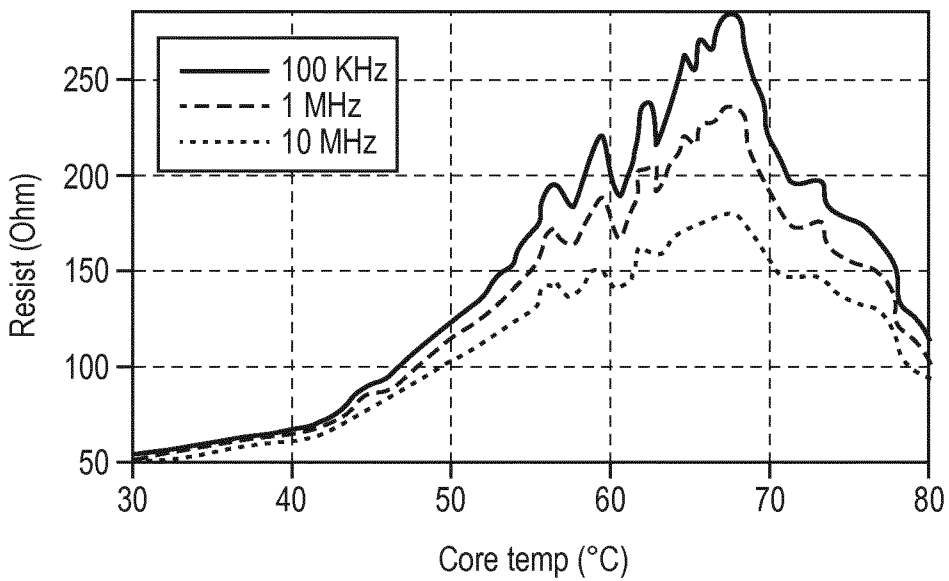


FIG. 4C

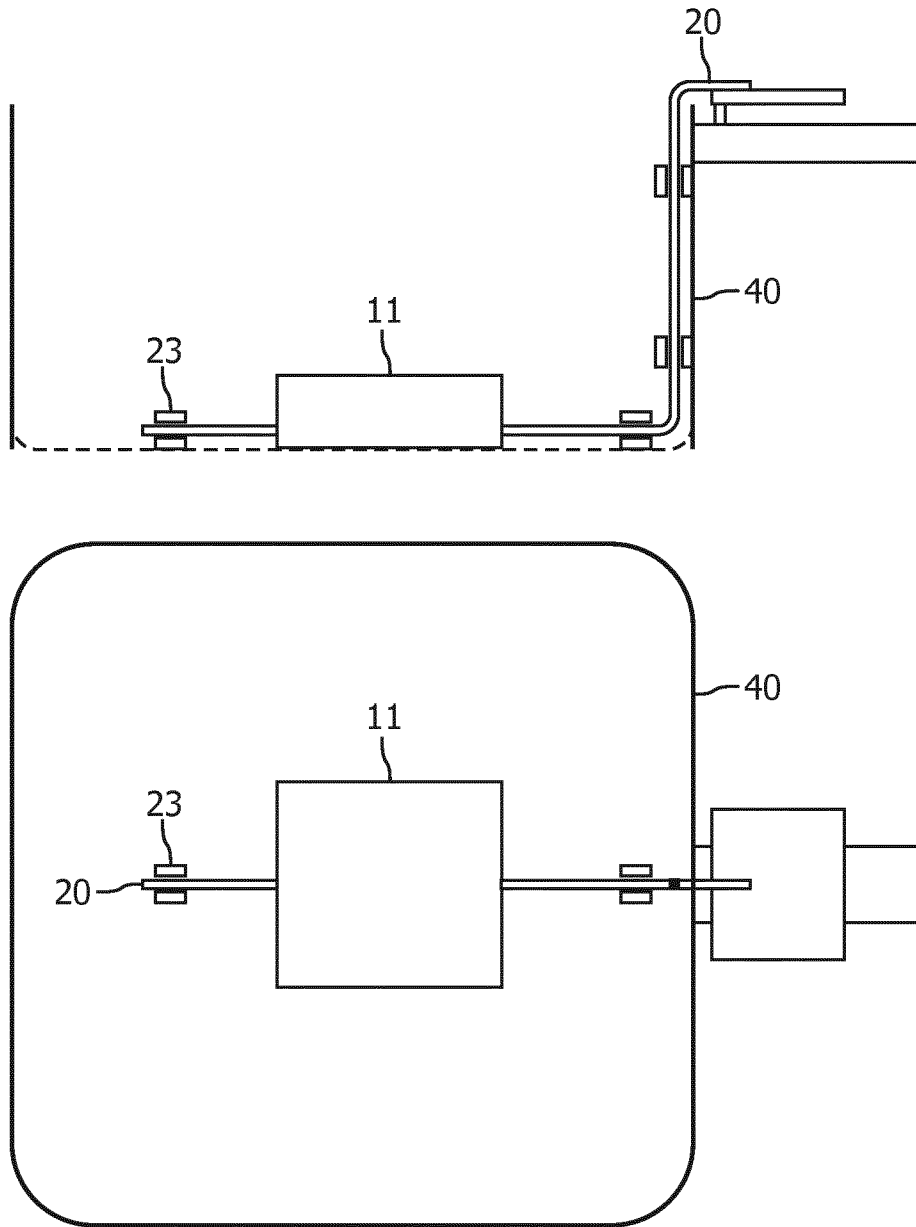


FIG. 5A

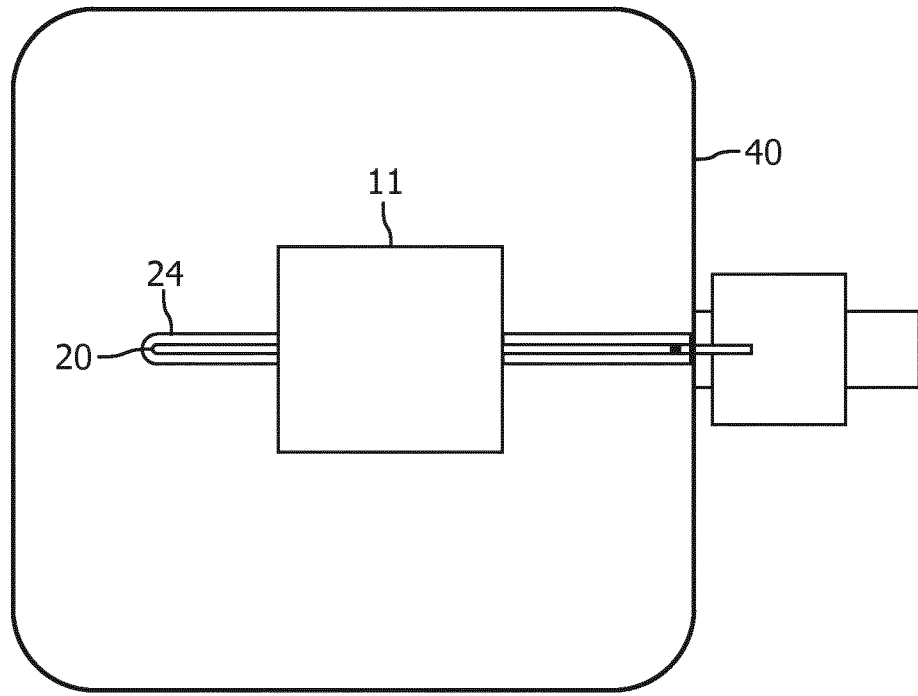


FIG. 5B

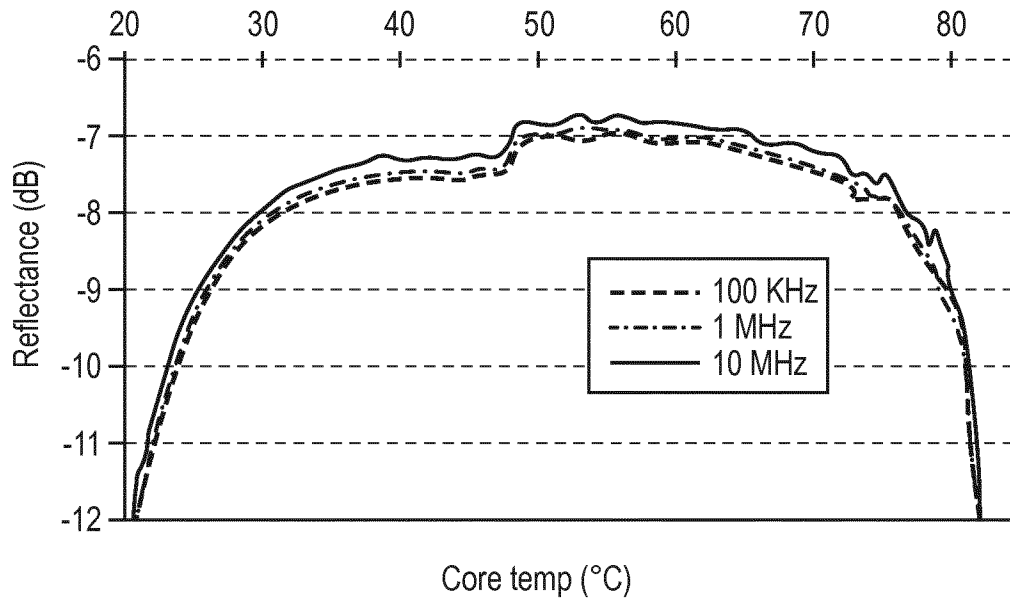


FIG. 5C

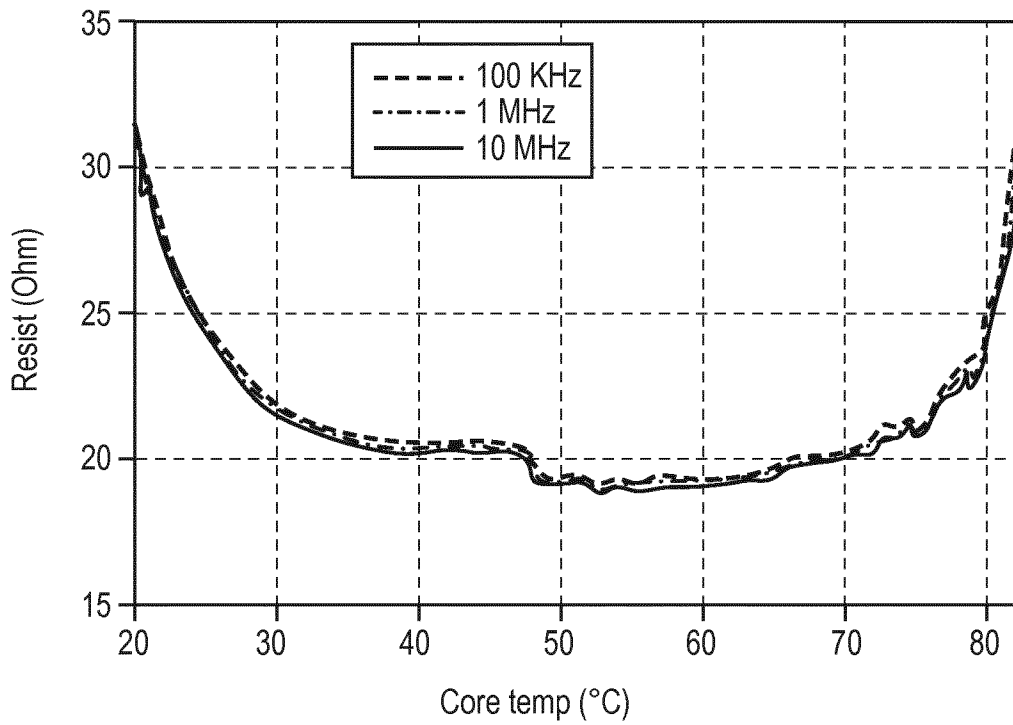


FIG. 5D

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/051346

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47J36/32
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
A47J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2015/140013 A1 (KONINKL PHILIPS NV [NL]) 24 September 2015 (2015-09-24) cited in the application	1-11,14, 15
A	page 5, line 19 - page 21, line 22; figures 7-9,10d	12,13
A	----- WO 2013/033330 A2 (GOJI LTD; HADAD SHARON [IL]; LIBMAN AVNER [IL]; YAARI IGAL [US]; BEN-H) 7 March 2013 (2013-03-07) paragraph [0052] - paragraph [0081]; figure 1b -----	1-15

Further documents are listed in the continuation of Box C.

See patent family annex.

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Date of the actual completion of the international search
27 March 2017

Date of mailing of the international search report
07/04/2017

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/051346

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		CN 105722263 A	29-06-2016
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