(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 September 2016 (22.09.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/147159 Al

(51) International Patent Classification:
*H05B 6/06* (2006.01)

(21) International Application Number:
PCT/IB20 16/05 1545

(22) International Filing Date:
18 March 2016 (18.03.2016)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
15 159798.6 19 March 2015 (19.03.2015) EP

(71) Applicant: **ZANOTTI, Marco** [IT/IT]; Via Gambara, 33, 25034 Orzinuovi (BS) (IT).

(72) Inventors: **CAVALLI, Stefano;** c/o HTE Eng., Via Marco Biagi 27, 37019 Peschiera del Garda (IT). **TREVISAN, Marco;** c/o HTE Eng., Via Marco Biagi, 27, 37019 Peschiera del Garda (IT). **SILVA, Marcello;** c/o HTE Eng., Via Marco Biagi, 27, 37019 Peschiera del Garda (IT).

(74) Agent: **LAGHI, Alberto;** Piazza Bra, 28, 37121 Verona (IT).

(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, 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, KN, KP, KR, 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,

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**(54) Title:** INDUCTION COOKING DEVICE WITH INTEGRATED TEMPERATURE CONTROL

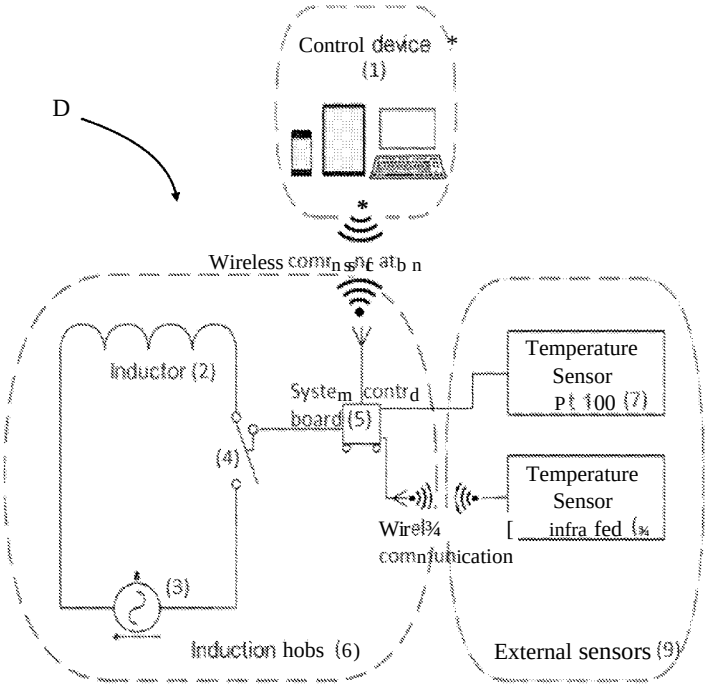


FIG. 1

**(57) Abstract:** An induction plate (6) for the cooking of foods wherein there is a control system (5) allowing to measure the internal food temperature with different types of temperature sensors (9), to maintain a temperature set by user via the power control (3) of inductor means (2), to perform a mixing (11) (13) inside a food containing pot (10) to perform differentiated and timed cooking, to be programmed with recipes available from the Internet, and to be remotely programmed and controlled via WI- FI, Bluetooth or m-bus technology, from computerized devices such as smartphones, tablets, and personal computers (1).

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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).

**Published:**

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

# INDUCTION COOKING DEVICE WITH INTEGRATED TEMPERATURE CONTROL.

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The present invention relates to an induction cooking device with integrated temperature control.

In particular, the present invention finds advantageous application in the field of induction cooking of food products in general, to which the following description will make explicit reference without thereby losing generality, with integrated control of the internal temperature of the food products themselves, integrated adjustable mixing, differentiated and timed cooking programming, preset cooking types, with automatic recipe recognition system and remote control interface via WI-FI, Bluetooth or m-bus technology, through the use of electronic devices such as smartphones, tablets, personal computers and the like.

As it is known, the professional or semi-professional appliances allowing to cook foods at controlled temperatures are substantially summarized by ovens and vacuum cooking appliances: ovens allow temperature control throughout the cooking process, allowing however only a limited range of cooking types, excluding all types of cooking presently made in pots. On the contrary, vacuum cooking appliances allow water bath cooking, while they exclude all cooking types requiring a temperature above 100°C.

On the other hand, other known cooking systems, such as gas stoves and magnetic induction devices are characterized by heat source power control means.

In gas stoves, power control is realized by adjusting the shutter valves that regulate

gas flow in the combustion nozzles; in induction stovetops or plates, the same adjustment is instead effected by means of a potentiometer allowing to adjust the amperage on the inductors: in such cases, the regulation of food temperature is determined by the balance between the calories transferred to the system (pot + food), the calories absorbed by the system in the time unit, and finally the calories dissipated by the system itself. Since the only controllable parameter are the calories transferred to the system through the regulation of the available heating power, it is complex, if not impossible, to achieve food temperature adjustment.

Currently, last-generation induction plates enable an indirect control of the cooking bath temperature through a thermocouple installed at the centre of the inductor, allowing to measure the temperature at the pot base.

Temperature measurement is performed directly in the cooking bath, but through the wall of the pot and the protective glass of the plate, providing a measure obviously affected by an error which is greater the smaller the temperature to be kept in the pot is, because it is more influenced by deviations arising from thermal resistances of said walls and by environmental dissipation of the same, causing the detection of a lower detected average temperature than the actual bath temperature.

The location of the thermocouple in the centre of the inductor and under the pot causes a very high temperature jump or *ripple* during the power cycle of the inductor, since it is strongly affected by the temperature of the pot; the measurement acquires concrete value only after a quite large lapse of time after the inductor is switched off, when the bath and the pot are thermalized, thus causing a bath temperature regulation ability which is definitely approximate and ineffective.

Furthermore, the positioning of the temperature sensor outside the pot allows only a qualitative measure of the temperature of the cooking bath and prevents all cooking

type with control of the internal food temperature.

The object of the present invention is therefore to provide a plate or stovetop induction cooking device capable of overcoming the problems and the drawbacks mentioned above.

In particular, an object of the present invention is to provide a cooking device capable of solving the above problems, adding to the current supply circuit of an induction plate a relay controlled by a Wi-Fi, Bluetooth or m-bus board, interfaced to a pt100 probe and infrared temperature sensor and software installed on a device (smartphone, tablet, computer) connected to Wi-Fi, Bluetooth or m-bus with the controller board.

The structural and functional characteristics of the present invention and its advantages over the known art will be clearer and more evident from the claims below, and in particular from an examination of the following description, referring to the attached drawings, showing the schematic representations of a preferred but non-limiting embodiment of the present induction cooking device, wherein:

- figure 1 shows a schematic view of the functional constructional components of an induction plate device of the present invention; and
- figure 2 shows the device of figure 1 in a partially sectional view and with parts removed for clarity.

With reference to the attached figures, globally indicated with D is a cooking device comprising an induction cooking plate or stovetop 6 for cooking foods in general.

The induction stovetop 6 for food cooking comprises a control system 5 allowing to measure the internal food temperature with different types of temperature sensors 9: while in use, plate 6 is arranged to maintain a temperature set by the user via the power control 3 of at least one inductor 2, to perform a mixing 11,13 inside a pot 10

for food containment, so as to perform differentiated and timed cooking and to be programmed with various recipes available from the internet or other and remotely programmed and controlled via WI-FI, Bluetooth or m-bus technology, preferably but not limited to computerized electronic devices such as smartphones, tablets and personal computers 1 or the like.

Specifically, figure 1 shows a schematic view of the temperature control system, where the power supply 3 of the inductor 2 of the induction stovetop 6 is controlled by a control board 5 through a relay 4, from which card 5 receives the cooking temperature measurement from external sensors means 9.

Figure 1 also shows two preferable but non-limitating types of the sensor means 9: a pt100, indicated with 7, and an infrared sensor, indicated with 8, and also that communication between temperature sensors 9 themselves and the control board 5 can be realized by an extensible cable or via Wi-Fi, Bluetooth or m-bus technology.

Figure 1 also shows the communication of the control board 5 with electronic devices 1 connected, preferably, via wireless connection, which have an installed software for interfacing with the cooking stovetop 6.

It is to be highlighted how the aforementioned infrared sensor 8 can be advantageously connected to the cooking stovetop 6 and positioned on the pot 10 or on the lid of the same, extracting it from stovetop 6 itself to which it is connected via extensible cable or wireless connection; furthermore, the infrared sensor 8 and sensor 7 (pt100) can be activated separately, in case the aim is to control the temperature of the bath (infrared) for water bath cooking, low temperature *(sous vide)* or frying, or to check the inner temperature of the treated food (pt100 probe made of AISI 316 steel).

The board 5 is designed to receive, with a fixed rate of one hundred readings per

second, the readings from temperature sensors 9, and sends them to the computerized electronic device on which software is installed (plate control interface, mobile phone, tablet, laptop, computer etc.), the operational algorithm implemented in the software checks whether the temperature T of the system reaches a minimum $T_{min}$ ($T_E$ - $\delta T$) or maximum $T_{max}$ ($T_E$ + $\delta T$) temperature equal to the desired operating temperature $T_E$ to less than a tolerance $\delta T$ fixed by the used sensor and by a suitable graduated scale on the control interface of the adopted device.

As shown in figure 2, the induction cooker 6 can also be adapted to achieve effective mixing of food: a mixing stirrer with ferromagnetic core 11, immersed in the pot 10, is dragged by an impeller 13, which in turn is controlled remotely by wireless devices 1 through the control board 5; the same figure 2 also shows the inductor 2 and the thermal glass 12 of the induction stovetop 6.

Alternatively to the stirrer, it is possible to use an immersion pump to be inserted directly in the pot 10 or through a whisk system driven by an electric motor 10 external to the pot itself.

Therefore, while in use, the mixing of the cooking bath is controlled through the computerized device by setting the switching on and off and the mixing power through a suitable graduated scale on the interface of the same computerized device.

It is also to be highlighted that, through the integration of a burner power control system by means of a modulator directly connected to said inductor 2, it is possible to allow to set the intensity of current within the inductor 2 itself determining the incoming heat flow module in the cooking stovetop 6. Burner power setting can thus

be done manually or automatically by means of a performance optimization algorithm allowing to reduce initial heating time and to optimize the power of the burner in function of the choice of operating temperature and the required precision (i.e. on the maximum allowed ripple for the fluctuation of the system temperature between $T_{MIN}$ e $T_{MAX}$ values).

Advantageously, the cooking stovetop 6 offers the possibility of setting a differentiated and timed cooking mode. Thus, the joint possibility of being able to control the operating temperature and the cooking time allows the setting of specific cooking programs, which can be done according to the following modes: for each cooking phase operating temperature, cooking time and, optionally, mixing and burner power must be set. The algorithm installed on the computerized device 1 automatically sets the operating modes to realize the cooking program set by optimizing the inductor power in such a way as to minimize the consumption of electric power. It is possible to set diversified programs for each single induction element of the used plate. The programming of the cooking surface 6 can also provide for rest pauses of the cooking process by turning off the induction element for a predetermined period or with a delay in the start of cooking.

There is also the possibility of finding preset recipes and cooking methods from an online database automatically updated with a specific app or directly downloadable from the Internet network. Various recipes can be accessed either in manual mode, searching the online database for the recipe, or automatically, by reading the bar code on purchased food with the computerized device 1 on which the cited App has been installed.

## CLAIMS

**1.** Induction cooking device (D) for cooking foods, comprising induction cooking stovetop (2) means (6) and at least one computerized device (1) suitable to drive and to control operations of said cooking stovetop means (6); said cooking stovetop means (6) being adapted to be connected to sensor means (9) for detecting the internal cooking temperature of said foods and control board means (5), said board means (5) being connected with said sensor means (9) and said computerized devices (1).

2. Device according to claim 1, characterized in that said sensor means (9) comprise at least one infrared sensor (8).

3. Device according to claim 1 or 2, characterized in that said board means (5) are connected to said induction stovetop means (6) and to said board means (5) via extensible cable or with wireless, Bluetooth or m-bus technology.

4. Device according to claim 2 or 3, characterized in that said infrared sensor (8) is connected to the cooking stovetop and positioned on a container (10) of said foods or on the lid of said container (10).

5. Device according to one or more of the preceding claims 1 to 4, characterized in that said cooking stovetop means (6) further comprise mixer means (11,13) suitable to achieve a mixing of said food placed within a container (10); said mixer means (11,13) being controlled by said computerized devices (1).

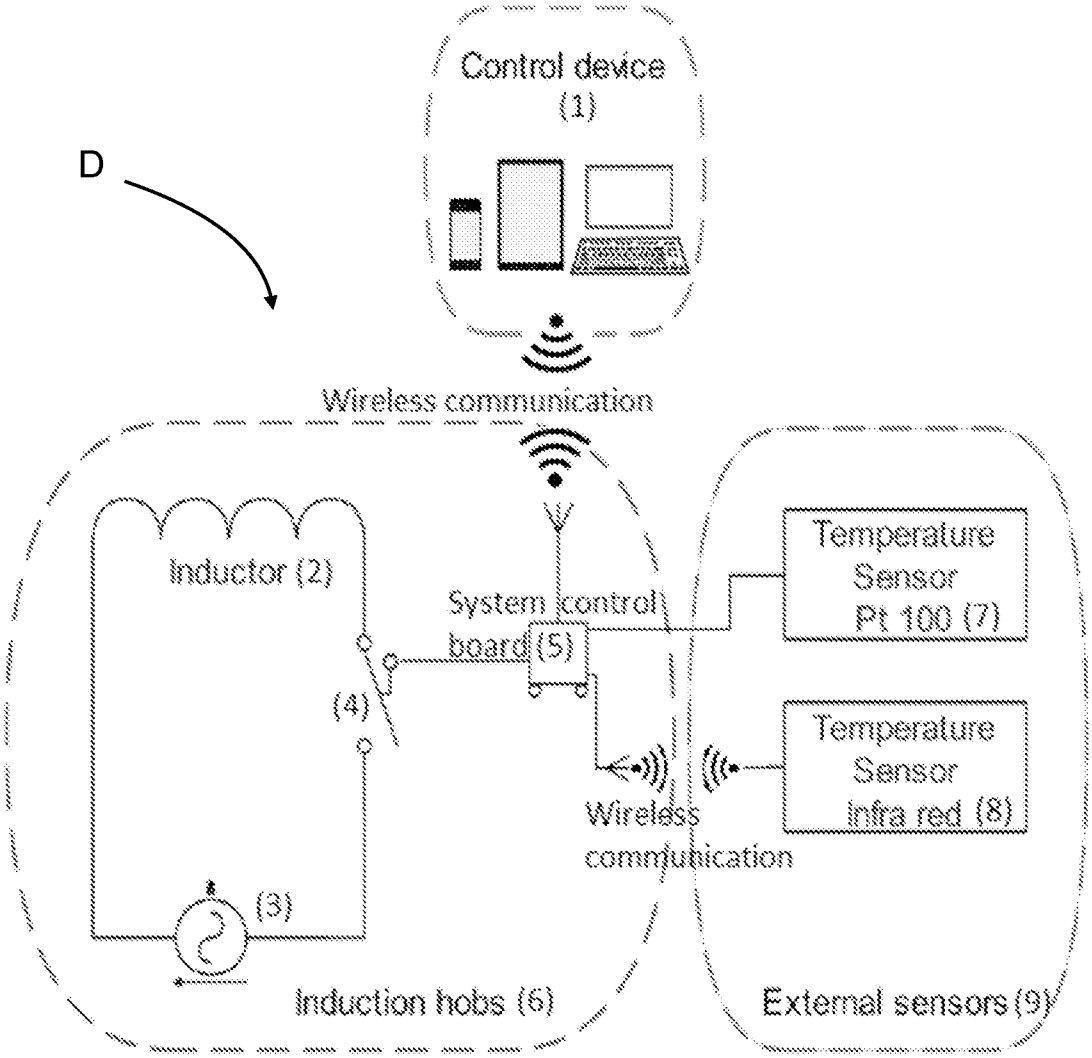
Control device
(1)
D
Wireless communication
Inductor (2)
System control
board (5)
(4)
(3)
Induction hobs (6)
Temperature
Sensor
Pt 100 (7)
Temperature
Sensor
Infra red (8)
Wireless
communication
External sensors (9)

**FIG. 1**

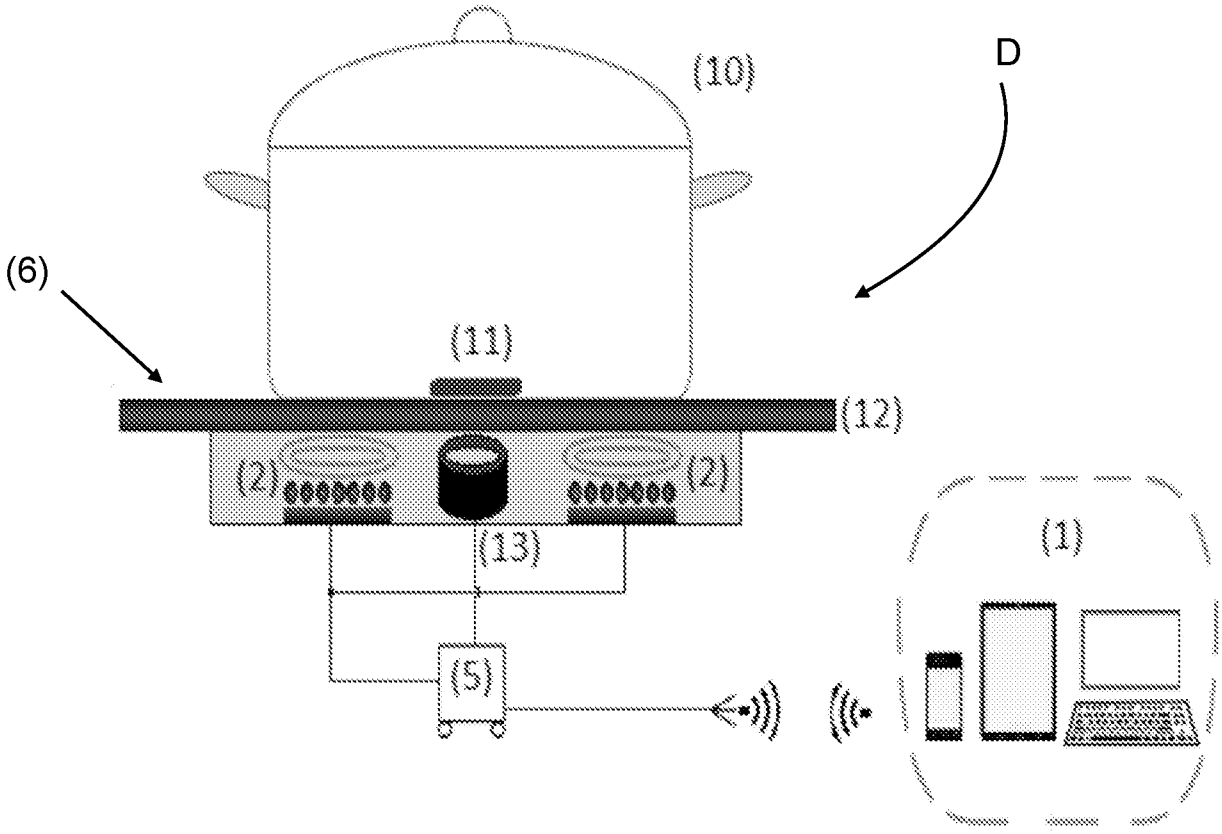


FIG. 2

# INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/051545

A. CLASSIFICATION OF SUBJECT MATTER
INV. H05B6/06
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)
H05B F24C G01K

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

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 14 June 2016 | 22/06/2016 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Pierron , Christophe |

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