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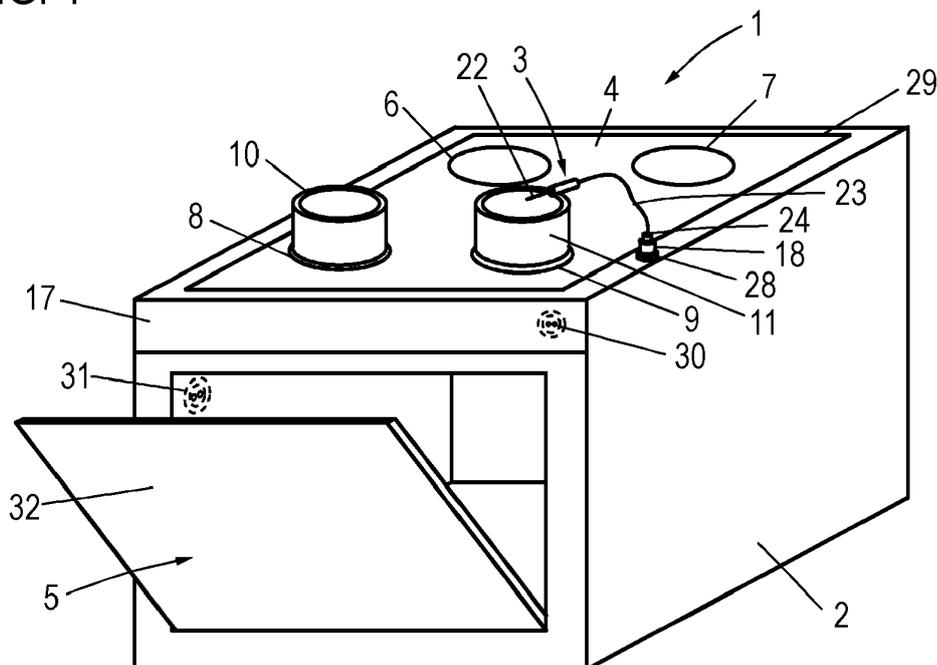
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(54) **COOKING APPLIANCE**

(57) Cooking appliance that is or comprises a cooking hob (4), wherein the cooking hob (4) comprising at least one heating element (12 - 15) for heating a vessel (10, 11) placed on the cooking hob (4) and a control unit (21) for controlling the heating element (12 - 15), wherein the appliance (2) comprises an electrical connector (18)

for detachably connecting a temperature sensing means (3), wherein the control unit (21) is configured to receive a measurement signal via the connector (18) when the temperature sensing means (3) is connected to the connector (18) and to control the heating element (12 - 15) based on the measurement signal.

**FIG. 1**



## Description

**[0001]** The invention concerns a cooking appliance that is or comprises a cooking hob, wherein the cooking hob comprises at least one heating element for heating a vessel placed on the cooking hob and a control unit for controlling the heating element. Additionally, the invention concerns a cooking system.

**[0002]** For cooking hobs it is well known to provide control units that allow a user to set a certain temperature for a certain cooking zone. The temperature of the cooking zone can then be measured by an internal sensor and a heating element can be switched on or off depending on the measured and the selected temperature to provide a given temperature at the cooking zone.

**[0003]** For cooking hobs that e.g. use induction heating and that e.g. use a glass or ceramic surface that has a relatively low heat conduction, positioning temperature sensing means below this surface only provides the limited accuracy.

**[0004]** It is therefore the object of the present invention to provide a more robust approach to temperature control, wherein preferably the increase of complexity of the cooking appliance should be limited to allow for ease of use and to limit cost.

**[0005]** The objective is solved by the initially discussed cooking appliance, wherein the appliance comprises an electrical connector for detachably connecting a temperature sensing means, wherein the control unit is configured to receive a measurement signal via the connector when the temperature sensing means is connected to the connector and to control the heating element based on the measurement signal.

**[0006]** It is therefore suggested to provide the temperature sensing means as a separate component that can be connected to the cooking appliance to allow for a precise temperature control. A temperature probe of the temperature sensing means can e.g. be placed inside a vessel or attached to a vessel placed on the cooking hob to directly measure the temperature at a relevant position. It is e.g. also possible to insert a probe of the temperature sensing means into food that is prepared within the vessel to e.g. measure a core temperature. Therefore, the cooking appliance according to the present invention allows for a robust temperature measurement at a relevant position and therefore for precise temperature control. This is e.g. highly advantageous when low cooking temperatures should be used, especially when cooking in a closed volume should be performed at low temperatures. This approach to cooking is often called "sous-vide cooking" which translates as cooking under vacuum. To allow for precise temperature control a closed loop control can be established using the measurement signal acquired via the temperature sensing means.

**[0007]** Since the temperature sensing means can be detached from the cooking appliance it can be easily cleaned and/or used for other purposes, e.g. to measure a temperature within an oven or for another device. Pro-

viding an electrical connector for the temperature sensing means also allows for a purely passive design of the temperature sensing means. This is advantageous since damage to the temperature sensing means during cleaning or a similar procedure can be easily avoided, and the temperature sensing means can be relatively simple and can therefore be provided at a low cost.

**[0008]** The heating element can directly create heat, e.g. be a resistive heater. It is however also possible that the heating element is designed to create heat in the vessel, e.g. by induction heating. The temperature sensor can e.g. be a thermo-resistor and the measured signal can be a voltage drop across such a resistor or the resistance itself. When a measurement signal is discussed this signal can be an analog signal e.g. a voltage, a current or a resistance. It can however also be a digital signal, e.g. generated by digitising such an analog signal and/or further processing.

**[0009]** In the simplest case the heating element can be controlled based on the measurement signal by simply switching the heating element on or off based on the measurement signal. It is e.g. possible to switch off the heating element when the measurement signal exceeds a certain threshold value or a vice versa. To allow for a higher precision of temperature control it can be advantageous to adjust the heating power of the heating element in several steps or continuously. This can e.g. be achieved by controlling the amplitude of an induction current in an induction heater or a heating current in a resistive heater, e.g. by pulse-width modulation.

**[0010]** The electrical connector can comprise at least one electrical contact designed to electrically contact a further electrical contact of the temperature sensing means when the temperature sensing means is connected to the electrical connector. E.g. a plug and socket connection can be used. It is e.g. possible to provide two electrical contacts of the temperature sensing means, e.g. the two connectors of a thermo-resistor, and to bring these contacts into contact with electrical contacts of the electrical connector of the cooking appliance. An alternative to a direct electrical connection of electrical contacts would e.g. be an electromagnetic coupling via coupled coils. A direct electrical connection is however advantageous since it is less sensitive to interference and can therefore provide a higher accuracy for temperature measurements.

**[0011]** The cooking appliance can comprise an oven, wherein the oven comprises at least one further heating element, wherein the control unit or a further control unit is configured to receive a measurement signal via the connector when the temperature sensing means is connected to the connector and to control the further heating element based on the measurement signal. It is e.g. possible, that the cooking appliance can operate in two modes of operation. In one mode of operation the heating element of the cooking hob can be controlled depending on the measurement signal and in a second mode of operation the further heating element of the oven can be

controlled depending on the measurement signal. The selected mode of operation and therefore which of the heating elements is controlled depending on the measurement signal can e.g. be selected by a user via a user interface. It is therefore possible to use a single electrical connector to provide precise temperature control for the cooking hob or for the oven depending on the current requirements. This provides additional features for user with very limited additional technical complexity.

**[0012]** The cooking appliance can comprises the or an oven, the oven comprising the further or at least one further heating element and the or a further control unit for controlling the further heating element, wherein the further control unit is configured to receive the measurement signal via the connector when the temperature sensing means is connected to the connector and wherein the control unit is configured to receive the measurement signal from the further control unit. In other words, the control unit can indirectly receive the measurement signal via the further control unit. This can e.g. be possible when the control unit and the further control unit communicate via a communication bus or via some other means, which might e.g. be advantageous to e.g. provide a common control panel for both devices. With this approach only the further control unit needs to directly interact with the temperature sensing means. E.g. analog-digital-converters to digitize the measurement signal need to be only provided for the further control unit. The discussed approach is especially advantageous when the electrical connector is already placed at the oven e.g. inside the oven or at a frame of the oven.

**[0013]** The cooking hob can be an inductive cooking hob. As previously discussed, the surface of the cooking hob stays relatively cool in this case. Therefore, the use of a flexible temperature sensing means is especially advantageous in this case.

**[0014]** The cooking appliance can be a freestanding cooker or cooking range. In this case an advantageous placement of the electrical connector is possible, especially in a frame of the hob as discussed below. When the cooking hob is integrated into a work bench, it might be necessary to feed the electrical connector through the surface, e.g. a glass surface, of the cooking hob or through the top of the work bench.

**[0015]** The cooking appliance can comprise a control panel comprising at least one input device for receiving user inputs, wherein the electrical connector is placed within or adjacent to the control panel. This placement allows a user to easily and intuitively access the electrical connector. The control panel can e.g. provide dials, a touch sensitive surface or other input devices to e.g. set the temperature for at least one cooking zone of the cooking hob and/or of an oven. The control panel might also allow a selection of a heating element or a group of heating elements that is controlled in dependence of the measurement signal. It might e.g. be possible to select if the temperature of an oven or of a cooking zone of the cooking hob is controlled in dependence of the measure-

ment signal.

**[0016]** The control panel can be arranged in front of the cooking hob or behind the cooking hob seen from a position of a user operating the cook top. The front of a cooking appliance can e.g. also have a door for an oven. The control panel can be positioned on top of the cooking hob or on an adjacent surface of a work bench into which the cooking hob is integrated. It is also possible to arrange the user interface at an angle to the top surface of the cooking hob. It is e.g. possible to place it at an angle between 45° and 90° to the top surface of the cooking hob. The user interface can be placed below the top surface of the cooking hob, e.g. in an area between an oven door and the top of the cooking hob. It can also be arranged behind the cooking hob and angled upwards from the top surface of the cooking hob. The control panel can be fixed to the cooking hob. It can also be advantageous to provide it as a separate component from the cooking hob that is e.g. attached to a work bench housing the cooking hob. The top surface of the cooking hob can be at least partially surrounded by a frame, wherein the electrical connector can be housed in the frame. The frame is especially formed from a different material than the surface of the cooking hob. It is e.g. possible that the surface of the cooking hob is formed from glass or ceramics. The frame can e.g. be formed from plastic or wood. The frame can be a frame on the edge of a freestanding appliance, or it can be placed between the cooking hob and a work bench that surrounds the cooking hob. Placing the electrical connector within a frame that surrounds the top surface of the cooking hob allows for a convenient placement of the electrical connector close to relevant positions for temperature measurements while at the same time avoiding the need to penetrate the surface of the cooking hob.

**[0017]** The cooking appliance can comprise the or an oven, wherein the electrical connector can be arranged within the oven or on a frame of the oven. A placement within the oven might require the door of the oven to be slightly open to feed a signal wire of the temperature sensing means through the open door. It can however be advantageous when the electrical connector is also used for controlling a further heating element of the oven as discussed above. In this case the temperature sensing means can be easily used within the oven to control the oven temperature and/or fed through the open door to measure temperatures concerning the cooking hob.

**[0018]** Additionally, in the invention concerns a cooking system comprising the cooking appliance according to the present invention and the temperature sensing means.

**[0019]** The temperature sensing means preferably comprises a further electrical connector connected to or designed to be connected to the electrical connector of the cooking appliance, a temperature probe placed or designed to be placed in the vessel or attached or designed to be attached to the vessel and at least one signal wire electrically connecting the probe to the further elec-

trical connector.

**[0020]** The temperature sensing means, preferably the further electrical connector, preferably comprise at least one electrical contact designed to connect the electrical contact of the electrical connector of the cooking appliance as previously discussed.

**[0021]** The above and further aspects, features and advantages of the present invention will be further discussed with respect to the following embodiment of the present invention and the accompanying drawings which shows schematically:

Fig. 1 an embodiment of a cooking system according to the present invention comprising an embodiment of a cooking appliance according to the present invention, and

Fig. 2 a schematic representation of the interaction of the components of the cooking system shown in fig. 1.

**[0022]** Fig. 1 shows a cooking system 1 that comprises a cooking appliance 2 and a temperature sensing means 3 detachably connected to the cooking appliance 2. The cooking appliance 2 comprises a cooking hob 4 that has e.g. for cooking zones 6, 7, 8, 9, on which vessels 10, 11 can be placed to heat the vessels 10, 11 and food therein.

**[0023]** As shown in fig. 2, that shows the interaction between the various components of the cooking appliance 2, the cooking hob comprises at least one heating element 12, 13, 14, 15 for each of the cooking zones 6, 7, 8, 9. The power provided to each of the heating elements 12, 13, 14, 15 and therefore the temperature of the vessels 10, 11 on the respective cooking zone 12, 13, 14, 15 is controlled by a control unit 21. To allow for a closed loop temperature control the temperature sensing means 3 is detachably connected to an electrical connector 18 of the appliance and the control unit 21 is configured to receive a measurement signal of the temperature sensing means 3 via the connector 18 and to control the heating elements 12, 13, 14, 15 based on the measurement signal. It is e.g. possible to adjust a desired temperature via input devices 16, e.g. knobs or other input devices arranged on the control panel 17, and then implement a closed loop control to achieve the desired temperature.

**[0024]** The control unit 21 could acquire the measurement signal directly, e.g. via an internal or external analog-digital-converter. E.g. a resistance or a voltage on a thermos-resistor of the temperature sensing means 3 could be measured.

**[0025]** In the example the measurement signal is however transferred digitally via a bus 20 from a further control unit 19 that is configured to control the oven 5. The further control unit 19 can e.g. be configured to receive the measurement signal via the connector 18 and to control a further heating element 25, e.g. located in the cavity of the oven 5, based on the measurement signal. It can

e.g. possible to adjust a desired temperature by an input device 26 and implement a closed loop as discussed above. A further input device 27 can allow a selection, which of the heating elements 12, 13, 14, 15, 25 should be controlled based on the measurement signal.

**[0026]** In alternative embodiments the functions of the control units 19, 21 could also be combined in a single control unit or the control unit 21 of the cooking hob could acquire the measurement signal from the connector 18 and provide relevant information to the further control unit 19 via the bus 20.

**[0027]** The temperature sensing means 3 preferably comprises a temperature probe 22 that can be replaced in the respective vessel 10, 11 or attached to the respective vessel, a further electrical connector 24 for connecting the temperature sensing means 3 to the electrical connector 18 of the appliance 2 and a signal wire 23 electrically connecting the probe 22 to the further electrical connector 24. The electrical connector 18 and the electrical connector 24 are designed in such a way that at least a pair of electrical contacts of the electrical connector 18 and the further electrical connector 24 are in mechanical and electrical contact with each other when the further electrical connector 24 is attached to the electrical connector 18. Preferably two pairs of electrical contacts are used to allow for a measurement of a voltage drop across the probe 22 and/or a resistance.

**[0028]** In the example the appliance 2 is a freestanding cooker. Alternatively, it could be a cooking range or the cooking hob 4 could be integrated into a work bench. The cooking hob 4 can e.g. be an induction cooking hob.

**[0029]** There are several advantageous positions at which the electrical connector 18 could be placed. In the example in fig. 1 the electrical connector 18 is placed at a position 28 within a frame 29 that surrounds the cooking hob 4. The surface of the cooking hob 4 can e.g. be formed from glass or ceramic. If a frame 29 from a different material, e.g. wood or plastic, is used, this allows for an easy integration of the electrical connector 18 into the frame 29.

**[0030]** Alternatively, the electrical connector 18 could be placed on the control panel 17, e.g. in the position 30. This allows for an easy access and intuitive use of the connector.

**[0031]** When the temperature sensing means 3 should also be used to control the temperature in the oven 5, as previously discussed, it can be especially advantageous to place the connector 24 at the position 31 inside the cavity of the oven 5. This allows for a measurement of the temperature within the oven by the temperature sensing means 3 while the oven door 32 is closed without having to feed the signal wire 23 through the oven door 32. For measuring the temperature in vessels 10, 11 on top of the cooking hob 4, the oven door 32 can be slightly ajar to feed through the signal wire 23.

## List of reference numerals

### [0032]

1	cooking system
2	cooking appliance
3	temperature sensing means
4	cooking hob
5	oven
6	cooking zone
7	cooking zone
8	cooking zone
9	cooking zone
10	vessel
11	vessel
12	heating element
13	heating element
14	heating element
15	heating element
16	input device
17	control panel
18	connector
19	control unit
20	bus
21	control unit
22	temperature probe
23	signal wire
24	connector
25	heating element
26	input device
27	input device
28	position
29	frame
30	position
31	position
32	oven door

## Claims

1. Cooking appliance that is or comprises a cooking hob (4), wherein the cooking hob (4) comprising at least one heating element (12 - 15) for heating a vessel (10, 11) placed on the cooking hob (4) and a control unit (21) for controlling the heating element (12 - 15), **characterized in that** the appliance (2) comprises an electrical connector (18) for detachably connecting a temperature sensing means (3), wherein the control unit (21) is configured to receive a measurement signal via the connector (18) when the temperature sensing means (3) is connected to the connector (18) and to control the heating element (12 - 15) based on the measurement signal.
2. Cooking appliance according to claim 1, wherein the electrical connector (18) comprises at least one electrical contact designed to electrically contact a further

electrical contact of the temperature sensing means (3) when the temperature sensing means (3) is connected to the electrical connector (18).

3. Cooking appliance according to claim 1 or 2, wherein the cooking appliance (2) comprises an oven (5), wherein the oven (5) comprises at least one further heating element (25), wherein the control unit (21) or a further control unit (19) is configured to receive a measurement signal via the connector (18) when the temperature sensing means (3) is connected to the connector (18) and to control the further heating element (25) based on the measurement signal.
4. Cooking appliance according to one of the preceding claims, wherein the cooking appliance (2) comprises the or an oven (5), the oven (5) comprising the further or at least one further heating element (25) and the or a further control unit (19) for controlling the further heating element (25), wherein the further control unit (19) is configured to receive the measurement signal via the connector (18) when the temperature sensing means (3) is connected to the connector and wherein the control unit (21) is configured to receive the measurement signal from the further control unit (19).
5. Cooking appliance according to one of the preceding claims, wherein the cooking hob (4) is an induction cooking hob.
6. Cooking appliance according to one of the preceding claims, wherein the cooking appliance (2) is a free-standing cooker or cooking range.
7. Cooking appliance according to one of the preceding claims, wherein the cooking appliance (2) comprises a control panel (17) comprising at least one input device (16, 26, 27) for receiving user inputs, wherein the electrical connector (18) is placed within or adjacent to the control panel (17).
8. Cooking appliance according to one of claims 1 to 6, wherein the cooking hob (4) is at least partially surrounded by a frame (29), wherein the electrical connector (18) is housed in the frame (29).
9. Cooking appliance according to one of the claims 1 to 6, wherein the cooking appliance (2) comprises the or an oven (5), wherein the electrical connector (18) is arranged within the oven (5) or on a frame of the oven (5).
10. Cooking system comprising the cooking appliance (2) according to one of the preceding claims and the temperature sensing means (3).

11. Cooking system according to claim 10, wherein the temperature sensing means (3) comprises a further electrical connector (24) connected to or designed to be connected to the electrical connector (18) of the cooking appliance (2), a temperature probe (22) placed or designed to be placed in the vessel (10, 11) or attached or designed to be attached to the vessel (10, 11) and at least one signal wire (23) electrically connecting the probe (22) to the further electrical connector (24).

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FIG. 1

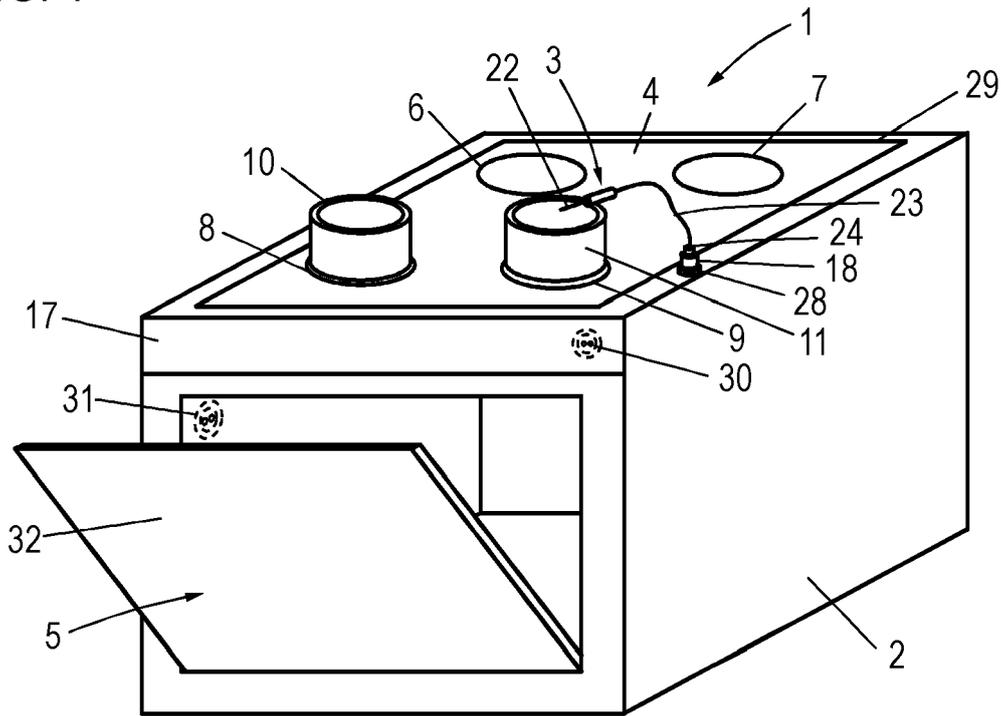
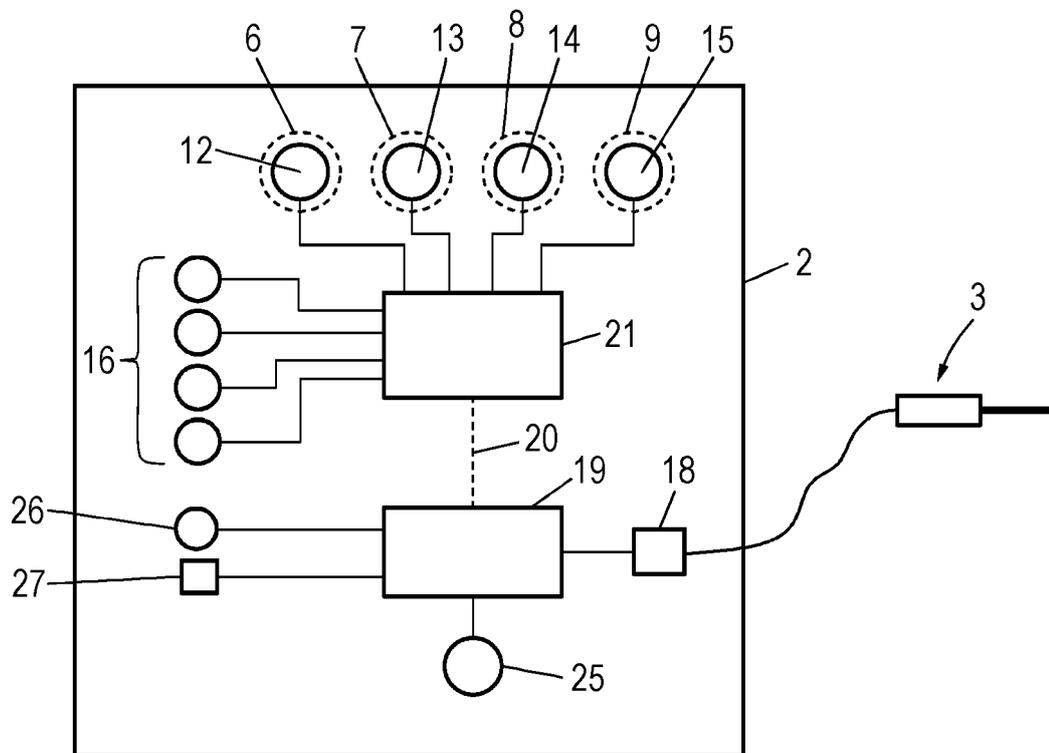


FIG. 2





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