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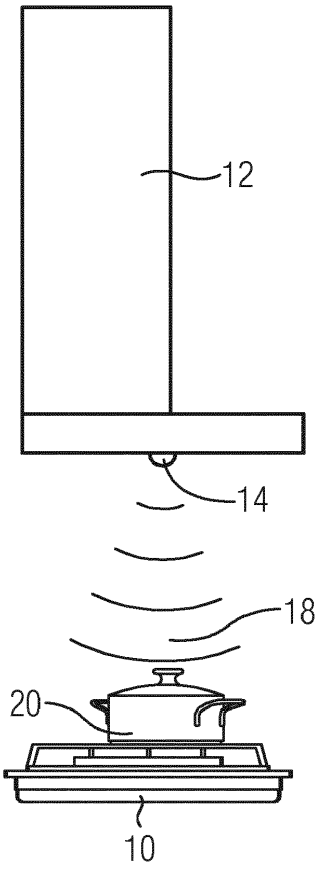
(54) METHOD AND SYSTEM FOR DETECTING THE PRESENCE AND/OR THE ABSENCE OF A COOKING VESSEL ON A GAS COOKING APPLIANCE WITH AT LEAST ONE GAS BURNER

(57) The present invention relates to a method for detecting the presence and/or the absence of a cooking vessel (20) on a gas cooking appliance (10) with at least one gas burner, particularly on a gas cooking hob (10). Said method comprises the steps of transmitting an ultrasonic sound signal (16; 18) from above to the gas cooking appliance (10) by an ultrasonic transmitter, receiving a reflection of said ultrasonic sound signal (16; 18) by an ultrasonic receiver, detecting the time difference between the transmission of the ultrasonic sound signal (16; 18) and the reception of the reflected ultrasonic sound signal (16; 18), and determining the distance between a reflecting object on the one hand and the ultrasonic transmitter and/or the ultrasonic receiver on the other hand.

FIG 2



EP 3 581 851 A1

Description

[0001] The present invention relates to a method for detecting the presence and/or the absence of a cooking vessel on a gas cooking appliance with at least one gas burner, particularly on a gas cooking hob. Further, the present invention relates to a system for detecting the presence and/or the absence of a cooking vessel on a gas cooking appliance with at least one gas burner, particularly on a gas cooking hob.

[0002] Most of the conventional gas cooking appliances with gas burners do not have any devices for detecting the presence of the cooking vessel. Some known devices base on mechanical interaction between the cooking vessel and the gas cooking appliance. Other known devices base on a signal from a thermocouple related to the presence of the cooking vessel.

[0003] It is an object of the present invention to provide a method and system for detecting the presence of a cooking vessel on a gas cooking appliance with one or more gas burners, which is retrofit in a conventional gas cooking appliance.

[0004] The object is achieved by the method for detecting the presence of a cooking vessel on a gas cooking appliance according to claim 1.

[0005] According to the present invention a method for detecting the presence and/or the absence of a cooking vessel on a gas cooking appliance with at least one gas burner, particularly on a gas cooking hob, wherein said method comprises the steps of:

- transmitting an ultrasonic sound signal from above to the gas cooking appliance by an ultrasonic transmitter,
- receiving a reflection of said ultrasonic sound signal by an ultrasonic receiver,
- detecting the time difference between the transmission of the ultrasonic sound signal and the reception of the reflected ultrasonic sound signal, and
- determining the distance between a reflecting object on the one hand and the ultrasonic transmitter and/or the ultrasonic receiver on the other hand.

[0006] The core of the present invention is that the presence and/or the absence of the cooking vessel on the gas cooking appliance are determined by external components, so that the gas cooking appliance requires no structural modification.

[0007] For example, the presence of the cooking vessel on the gas cooking appliance is detected, if the distance between the reflecting object and the ultrasonic transmitter and/or ultrasonic receiver is smaller than the distance between the gas cooking appliance and the ultrasonic transmitter and/or ultrasonic receiver, respectively.

[0008] In contrast, the absence of the cooking vessel on the gas cooking appliance may be detected, if the distance between the reflecting object and the ultrasonic transmitter and/or ultrasonic receiver corresponds with the distance between the gas cooking appliance and the ultrasonic transmitter and/or ultrasonic receiver, respectively.

[0009] For example, the transmission of the ultrasonic sound signal may be repeated periodically. Is a test run of the inventive method, the length of the emitted pulse is 10 μs, while the time between said emitted pulses is 500 ms. Alternatively, other temporal patterns are also possible.

[0010] Particularly, a signal is emitted, if the presence or the absence of the cooking vessel on the gas cooking appliance has been detected.

[0011] Preferably, the signal is an acoustic and/or visual signal.

[0012] For example, the ultrasonic transmitter and/or the ultrasonic receiver are arrangeable or arranged at a support device above the gas cooking appliance.

[0013] Particularly, the ultrasonic transmitter and/or the ultrasonic receiver are arrangeable or arranged at a kitchen hood above the gas cooking appliance.

[0014] Especially, the ultrasonic transmitter and/or the ultrasonic receiver are arrangeable or arranged vertically above the gas cooking appliance.

[0015] Further, the present invention relates to a system for detecting the presence and/or the absence of a cooking vessel on a gas cooking appliance with at least one gas burner, particularly on a gas cooking hob, wherein:

- the system comprises at least one sonar sensor arrangeable or arranged above the gas cooking appliance and directable or directed to said gas cooking appliance,
- the sonar sensor includes an ultrasonic transmitter and an ultrasonic receiver,
- the ultrasonic transmitter is provided for transmitting an ultrasonic signal to the gas cooking appliance,
- the ultrasonic receiver is provided for receiving said ultrasonic signal reflected by the gas cooking appliance or an object arranged on said gas cooking appliance,
- the system comprises a detection device for detecting the time difference between the transmission of the ultrasonic sound signal and the reception of the reflected ultrasonic sound signal, and
- the system comprises a calculation unit for determining the distance between a reflecting object on the one hand and the ultrasonic transmitter and/or the ultrasonic receiver on the other hand.

[0016] Furthermore, the system may comprise at least one output device for indicating the presence and/or the absence of the cooking vessel on the gas cooking appliance.

[0017] Preferably, the output device provides an acoustic and/or visual signal.

[0018] For example, the sonar sensor is mountable or

mounted at a support device arranged above the gas cooking appliance.

[0019] Particularly, the sonar sensor is mountable or mounted at a kitchen hood arranged above the gas cooking appliance.

[0020] At last, the system is provided for the method mentioned above.

[0021] Novel and inventive features of the present invention are set forth in the appended claims.

[0022] The present invention will be described in further detail with reference to the drawings, in which

FIG 1 illustrates a schematic side view of a system for detecting the presence and/or the absence of a cooking vessel on a gas cooking hob according to a preferred embodiment of the present invention, wherein no cooking vessel is arranged on the gas cooking hob, and

FIG 2 illustrates a schematic side view of the system for detecting the presence and/or the absence of the cooking vessel on the gas cooking hob according to the preferred embodiment of the present invention, wherein the cooking vessel is arranged on the gas cooking hob.

[0023] FIG 1 illustrates a schematic side view of a system for detecting the presence and/or the absence of a cooking vessel 20 on a gas cooking hob 10 according to a preferred embodiment of the present invention. In FIG 1 no cooking vessel 20 is arranged on the gas cooking hob.

[0024] The system comprises a sonar sensor 14 and a support device 12 for supporting said sonar sensor 14. In this example, the support device is a kitchen hood 12 arranged above the gas cooking hob 10. Essentially, the kitchen hood 12 is provided for sucking and delivering exhaust from the area above the gas cooking hob 10. Additionally, the kitchen hood 12 is used as support device for the sonar sensor 14. In general, an arbitrary device in a similar distance above the gas cooking hob 10 is suitable for supporting the sonar sensor 14.

[0025] For example, the sonar sensor 14 is connected to an electronically controlled coking 10 in order to take some decisions or actions according to the feedback of the sonar sensor 14. Further, the sonar sensor 14 and a calculation unit thereof may produce acoustic and/or visual alerts or send some wireless signals, e.g. Bluetooth or Wifi, to a mobile device like a smartphone.

[0026] The sonar sensor 14 includes an ultrasonic transmitter and an ultrasonic receiver. The ultrasonic transmitter is provided for transmitting an ultrasonic signal 16 to the gas cooking hob 10. The ultrasonic receiver is provided for receiving said ultrasonic signal 16 reflected by the gas cooking hob 10. The time difference between the transmission by the ultrasonic transmitter and the reception by the ultrasonic receiver is detected. Since the sound velocity is known, the distance between the sonar sensor 14 and the reflecting object can be determined from said time difference. If the determined distance conforms to the distance between the sonar sensor 14 and the gas cooking hob 10, then no object is arranged on the gas cooking hob 10. By this way, the sonar sensor 14 acts as detector for detecting the presence of the cooking vessel 20.

[0027] For example, the frequency of the ultrasonic signal 16 and 18 is between 20 kHz and 150 kHz. Is a test run of the present invention, the used frequency of the ultrasonic signal 16 and 18 was 40 kHz.

[0028] FIG 2 illustrates a schematic side view of the system for detecting the presence and/or the absence of the cooking vessel 20 on the gas cooking hob 10 according to the preferred embodiment of the present invention. In FIG 2 one cooking vessel 20 is arranged on the gas cooking hob.

[0029] In FIG 2 the sonar sensor 14 is also arranged at the kitchen hood 12 and in the same distance from the gas cooking hob 10. The ultrasonic transmitter sends the ultrasonic signal 16 to the gas cooking hob 10. However, the ultrasonic signal 16 is reflected by the cooking vessel 20. Thus, the time difference between the transmission by the ultrasonic transmitter and the reception by the ultrasonic receiver is smaller than in the case without any cooking vessel 20 on the gas cooking hob 10.

[0030] The transmission of the ultrasonic signal 16 by the ultrasonic transmitter is repeated periodically. If the cooking vessel 20 is removed from the gas cooking hob 10, then the time difference between the transmission and the reception of the ultrasonic signal increases. The increase of said time difference is indicated by a signal. For example, an acoustic signal is output by the sonar sensor 14 or another component of the system. Alternatively or additionally, an optical is output by the sonar sensor 14 or another component of the system.

[0031] The system of the present invention may be added to an existing gas cooking hob 10 without any changes of said gas cooking hob 10. The system may be arranged at the kitchen hood 12 or another support device above the gas cooking hob 10.

[0032] Although an illustrative embodiment of the present invention has been described herein with reference to the accompanying drawings, it is to be understood that the present invention is not limited to that precise embodiment, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

List of reference numerals

[0033]

10 gas cooking hob
12 kitchen hood

14 sonar sensor
16 first sound signal
18 second sound signal
20 cooking vessel

Claims

1. A method for detecting the presence and/or the absence of a cooking vessel (20) on a gas cooking appliance (10) with at least one gas burner, particularly on a gas cooking hob (10), wherein said method comprises the steps of:

   - transmitting an ultrasonic sound signal (16; 18) from above to the gas cooking appliance (10) by an ultrasonic transmitter,
   - receiving a reflection of said ultrasonic sound signal (16; 18) by an ultrasonic receiver,
   - detecting the time difference between the transmission of the ultrasonic sound signal (16; 18) and the reception of the reflected ultrasonic sound signal (16; 18), and
   - determining the distance between a reflecting object on the one hand and the ultrasonic transmitter and/or the ultrasonic receiver on the other hand.

2. The method according to claim 1,
   characterised by
   the presence of the cooking vessel (20) on the gas cooking appliance (10) is detected, if the distance between the reflecting object and the ultrasonic transmitter and/or ultrasonic receiver is smaller than the distance between the gas cooking appliance (10) and the ultrasonic transmitter and/or ultrasonic receiver, respectively.

3. The method according to claim 1 or 2,
   characterised by
   the absence of the cooking vessel (20) on the gas cooking appliance (10) is detected, if the distance between the reflecting object and the ultrasonic transmitter and/or ultrasonic receiver corresponds with the distance between the gas cooking appliance (10) and the ultrasonic transmitter and/or ultrasonic receiver, respectively.

4. The method according to any one of the preceding claims,
   characterised by
   the transmission of the ultrasonic sound signal (16; 18) is repeated periodically.

5. The method according to any one of the preceding claims,
   characterised in that
   a signal is emitted, if the presence or the absence of the cooking vessel (20) on the gas cooking appliance (10) has been detected.

6. The method according to any one of the preceding claims,
   characterised in that
   the signal is an acoustic and/or visual signal.

7. The method according to any one of the preceding claims,
   characterised in that
   the ultrasonic transmitter and/or the ultrasonic receiver are arrangeable or arranged at a support device (12) above the gas cooking appliance (10).

8. The method according to any one of the preceding claims,
   characterised in that
   the ultrasonic transmitter and/or the ultrasonic receiver are arrangeable or arranged at a kitchen hood (12) above the gas cooking appliance (10).

9. The method according to any one of the preceding claims,
   characterised in that
   the ultrasonic transmitter and/or the ultrasonic receiver are arrangeable or arranged vertically above the gas cooking appliance (10).

10. A system for detecting the presence and/or the absence of a cooking vessel (20) on a gas cooking appliance (10) with at least one gas burner, particularly on a gas cooking hob (10), wherein:

    - the system comprises at least one sonar sensor (14) arrangeable or arranged above the gas cooking appliance (10) and directable or directed to said gas cooking appliance (10),
    - the sonar sensor (14) includes an ultrasonic transmitter and an ultrasonic receiver,
    - the ultrasonic transmitter is provided for transmitting an ultrasonic signal (16) to the gas cooking appliance (10),
    - the ultrasonic receiver is provided for receiving said ultrasonic signal (16) reflected by the gas cooking appliance (10) or an object arranged on said gas cooking appliance (10),
    - the system comprises a detection device for detecting the time difference between the transmission of the ultrasonic sound signal (16; 18) and the reception of the reflected ultrasonic sound signal (16; 18), and
    - the system comprises a calculation unit for determining the distance between a reflecting object on the one hand and the ultrasonic transmitter and/or the ultrasonic receiver on the other hand.

11. The system according to claim 10,
characterised by
the system comprises at least one output device for indicating the presence and/or the absence of the cooking vessel (20) on the gas cooking appliance (10).

12. The system according to claim 10 or 11,
characterised by
the output device provides an acoustic and/or visual signal.

13. The system according to any one of the claims 10 to 12,
characterised in that
the sonar sensor (14) is mountable or mounted at a support device (12) arranged above the gas cooking appliance (10).

14. The system according to any one of the claims 10 to 13,
characterised in that
the sonar sensor (14) is mountable or mounted at a kitchen hood (12) arranged above the gas cooking appliance (10).

15. The system according to any one of the claims 10 to 14,
characterised in that
the system is provided for a method according to any one of the claims 1 to 9.

FIG 1

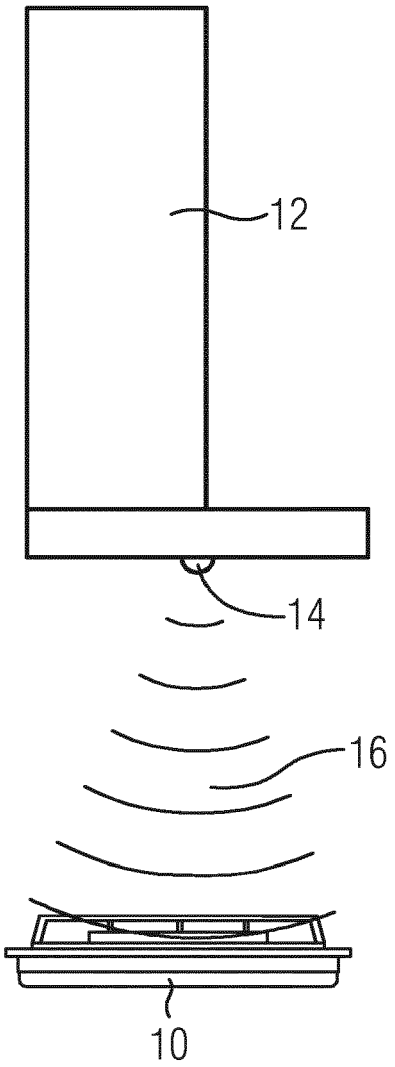
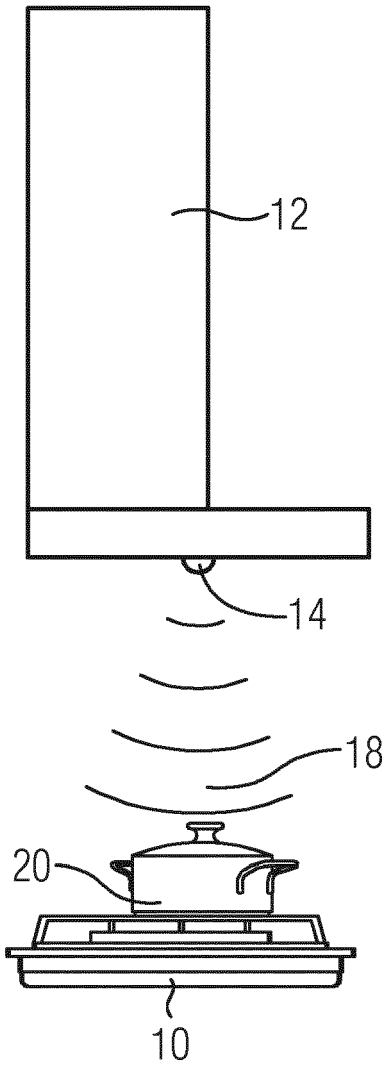


FIG 2



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EUROPEAN SEARCH REPORT

Application Number
EP 18 17 8149

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	WO 2010/142425 A1 (ELECTROLUX HOME PROD CORP [BE]; CORLEONI FRANCESCO [IT]) 16 December 2010 (2010-12-16) * page 1, line 7 - page 1, line 8 * * page 1, line 32 - page 1, line 34 * * page 2, line 14 - page 2, line 20 * * page 4, line 4 - page 4, line 6 * * page 5, line 16 - page 5, line 22 * * figure 1 * -----	1-4, 7-10, 13-15 5,6,11, 12	INV. F24C7/08 F24C15/10 ADD. F24C15/20
X A	JP 4 410363 B2 (HARMAN CO LTD) 3 February 2010 (2010-02-03) * figures 1, 6 * * paragraphs [0001], [0009], [0011], [0012], [0015] * -----	10,15 4	
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TECHNICAL FIELDS SEARCHED (IPC)

F24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 November 2018	Jalal, Rashwan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 17 8149

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