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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 June 2021 (24.06.2021)

WIPO | PCT

(10) International Publication Number
WO 2021/122017 A1

(51) International Patent Classification:
F24C 7/08 (2006.01) *H01H 19/00* (2006.01)
G05G 1/08 (2006.01)

(21) International Application Number:
PCT/EP2020/084388

(22) International Filing Date:
03 December 2020 (03.12.2020)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
19383153.4 19 December 2019 (19.12.2019) 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, IT, JO, 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, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, 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,

(54) Title: CONTROL KNOB AND METHOD FOR CONTROLLING A HOUSEHOLD APPLIANCE

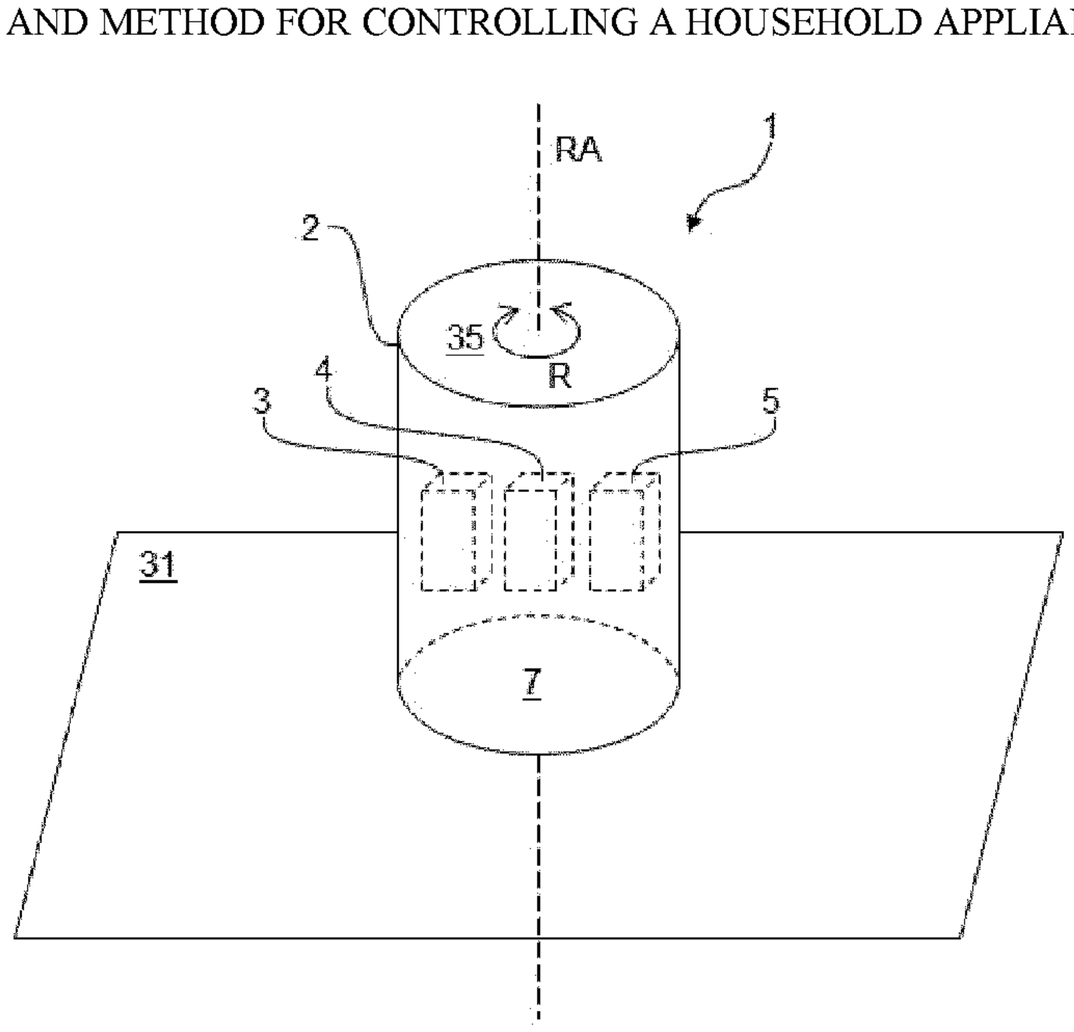


Fig. 2

(57) Abstract: A control knob for controlling a household appliance, comprising: a housing which is configured to be rotatably and removably connected to the household appliance; a calibration unit for determining a reference orientation of the housing when the housing is newly connected to the household appliance; an orientation sensor for determining a current orientation of the housing with respect to the determined reference orientation; and a wireless communication unit for wirelessly sending control information determined from the current orientation of the housing to the household appliance, the control information being information for controlling the household appliance.

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WO 2021/122017 A1

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))*

Control knob and method for controlling a household appliance

The present invention relates to a control knob for controlling a household appliance, to a control knob system, to a household system and to a method for controlling a household appliance with a control knob.

Control knobs are widely used to adjust parameters such as temperature, energy supply, program or the like of a household appliance.

As an example, the document WO 2012/118455 A2 shows a control knob for controlling energy supplied to a cooking device. Said control knob can be moved from the cooking device to a more convenient position, for example on a cooking pot. However, the control knob can be used only to control a single cooking device. Further, US 2019/0320058 A1 discloses a remote control of a grill using a smartphone. This solution requires an adequate interface on the smartphone. In US 2016/0063837 A1, a fixed control knob can be pushed into the household appliance and rotated to control the household appliance.

It is one object of the present invention to an improved control knob for controlling a household appliance. A further object is the provision of an improved method for controlling a household appliance.

According to a first aspect, a control knob for controlling a household appliance is provided. The control knob comprises:

a housing which is configured to be rotatably and removably connected to the household appliance;

a calibration unit for determining a reference orientation of the housing when the housing is newly connected to the household appliance;

an orientation sensor for determining a current orientation of the housing with respect to the determined reference orientation; and

a wireless communication unit for wirelessly sending control information determined from the current orientation of the housing to the household appliance, the control information being information for controlling the household appliance.

The control knob (also referred to as "knob" in the following) can in particular be moved from one household appliance to another. The control of the household appliance may easily be performed by rotating the control knob. Whenever it is connected to a new household appliance, the knob may be newly calibrated to optimize the control of the household appliance. In particular, due to the calibration by the calibration unit, it may not be necessary to adjust a position and/or orientation of the control knob prior to performing a control of the household appliance.

The household appliance or home appliance can for example be an electrical machine which accomplishes household functions. Examples for such a household appliance include dishwashers, cooking hobs, gas burners, ovens, refrigerators, washing machines, microwaves, electric fans, freezers or the like. "Controlling" the household appliance in particular refers to the selection of a parameter defining an operation of the household appliance. Such parameters may include a washing or cooking program, a temperature, an energy (gas or electricity) supply, a cycle duration or the like.

The control knob may comprise the housing, which can for example have a cylindrical shape. The control knob and in particular its housing may be connected to the household appliance. "Connected" for example means physically and/or communicatively connected. In particular, the housing of the knob may be connected to the household appliance by placing the housing on a surface of the household appliance, such that there is a contact surface between the housing and the household appliance or the control knob may be only communicatively connected and not physically connected to the household appliance by placing the control knob on a surface distant apart from the household appliance. The surface onto which the control knob is placed is preferably horizontal.

The housing and/or the knob are removably connected to the household appliance. In particular, the housing and/or the knob may not be fixed to the household appliance. There may for example not be any connecting means (such as a screw, tape, glue or clips) holding the housing to the household appliance. In particular, no recessed portion for accommodating the knob is provided on the household appliance or the like. The knob may thus easily be displaced, for example from one household appliance to another household appliance or from the household appliance to a surface distant apart from the

household appliance. In particular, the control knob can translationally be displaced along any direction with respect to the household appliance.

In the context of the present application, "rotated" may mean that the orientation of the housing is changed, for example by a user using the knob to control the household appliance.

The calibration unit may determine an orientation of the housing at the moment when it has just been (newly) connected to the household appliance. This initial orientation may be set as the reference orientation. In order to determine the reference orientation, the calibration unit may use a compass, in particular a digital compass, and/or a gyroscope. The determined reference orientation may be stored in a storage unit of the control knob. In particular, a new reference orientation is determined by the calibration unit every time that the knob is newly connected to a household device appliance. For example, the reference orientation is not only determined prior to a first ever use of the knob.

The orientation sensor may be the same compass and/or gyroscope as used by the calibration unit. The orientation sensor for example determines the (current) orientation of the housing after the reference position was determined. In particular, the current orientation that is determined by the orientation sensor is an orientation of the housing when the knob (including the housing) has been rotated by a user as compared to the reference orientation. In particular, the current orientation determined by the orientation sensor is an orientation of the housing relative to its reference orientation. For example, if the reference orientation is set to be 0°, the orientation sensor may determine current orientations of the housing between 0° and 360°.

In some embodiments, the orientation sensor is further configured to determine a rotation direction of the housing and/or knob. In this case, the orientation sensor for example determines current orientations of the housing between -360° and +360° (when the reference orientation is 0°). This may allow a wider setting range with the knob.

The orientations determined by the orientation sensor can be discontinuous (discrete) or continuous. The current orientations may correspond to different settings of the household appliance. In particular, orientating the knob in a certain manner may correspond to

selecting a parameter of the household appliance in the process of controlling the household appliance.

The knob for example determines or derives a control information from the current orientation of the housing detected by the orientation sensor. The control information may also solely comprise a current orientation information of the housing. In particular, the control information does not comprise a position information indicating a position of the housing or the like. The control information may be an information indicating which parameter of the household appliance to change and/or how to change it. For example, the control information may indicate that a gas supply to a gas hob as a household appliance should be increased, reduced or completely stopped.

The wireless communication unit may send this control information to the household appliance which can then in turn modify the controlled parameter in accordance with the received control information. The transmission of the control information may be performed through any wireless communication process, for example using Bluetooth, infrared, Wi-Fi or the like.

According to an embodiment, the control knob further comprises a display unit for displaying and/or indicating the current orientation of the housing determined by the orientation sensor. For example, the display unit further indicates different possible settings of the household appliance which are selectable through rotation of the housing.

The display unit is for example a screen. In particular, the display unit can indicate a current orientation of the housing with respect to its reference position in order to facilitate the orientation of the knob by a user. Indicating the current orientation of the housing may include showing marks for different possible setting selections and a marker for indicating the current orientation with respect to the other marks.

Further, providing the knob with a display unit can be particularly advantageous when the knob is used to control different household appliances. In particular, the display unit may display information relating to the specific household appliance to which it is connected, thereby facilitating the use of the knob.

According to a further embodiment, the wireless communication unit is configured to send a turn off signal to the household appliance for turning off the household appliance when the housing is disconnected from the household appliance.

A disconnection of the knob from the household appliance may mean a physical disconnection in which the knob is removed from the household appliance and/or moved away therefrom, and/or a communicative disconnection, for example when the control knob is turned off and/or actively disconnected from the household appliance. In particular, the user may not have to switch off the household appliance as it is switched off when the knob is moved away, in particular disconnected. Thus, forgetting to turn off the household appliance may be avoided.

Alternatively, the household appliance may also turn off autonomously when communication to the control knob is lost.

According to a further embodiment, the control knob is configured to be successively connected to different household appliances and to successively control the connected household appliance through rotation of the housing and through sending of a corresponding control information.

In particular, the same knob can be used to control different household appliances one after another along the lines described above and below. Conveniently, only a single knob is needed for controlling multiple household appliances, thereby for example reducing overall costs of the appliances.

According to a further embodiment, the orientation sensor, the wireless communication unit, the calibration unit and/or the display unit are provided within the housing. In particular, the knob may be a one-piece knob which rotates as a whole, for example with respect to the household appliance surface on which it is placed. For example, the knob is not a button comprising a fixed ring and a rotating portion rotating with respect to the fixed ring. This is advantageous in that the knob has a clean and pleasant design and/or is easier to use.

According to a further embodiment, the household appliance is a gas burner or a cooking hob, in particular a gas hob.

According to a further embodiment, the control information is information for modifying an amount of gas supplied to the gas burner or to a gas burner of the gas hob.

According to a further embodiment, the housing has a cylindrical shape and the current orientation of the housing is an indication for how much the housing has been rotated around an axis of the cylinder with respect to the reference orientation. In particular, the cylindrical housing may comprise two round parallel faces. One of these two faces for example contacts a surface of the household appliance when the knob is connected thereto.

According to a further embodiment, the housing is configured to be connected to the household appliance by placing it on a surface of the household appliance. In particular, the knob can control the household appliance by being placed on any surface of the household appliance and/or on a designated area thereof. For example, when the household appliance is a gas hob, the designated area may be a top surface of the gas hob.

According to a further embodiment, the control knob is waterproof. This may be realizable if the knob is a one-piece knob which rotates as a whole, as described above. In particular, the housing is waterproof. A waterproof control knob is for example advantageous in kitchen or bathroom environments in which water spillage is common.

According to a second aspect, a control knob system is provided, the control knob system including:

the control knob according to the first aspect or according to an embodiment thereof, further comprising a battery unit for powering the control knob; and

a charging station for charging the battery unit through induction, wires and/or charging pins.

The charging station may be used to charge the control knob. In particular, the control knob is placed on the charging station and/or charged by the charging station when it is

not used to control a household appliance, for example during nighttime. That way, the control knob may always be sufficiently charged and ready to be used to control the household appliance. In some embodiments, the control knob also includes a power indication unit for indicating the amount of power left in the battery unit. The power indication unit may be a LED and/or may be part of the display unit.

The embodiments and features described with reference to the control knob of the first aspect or according to an embodiment thereof apply mutatis mutandis to the control knob system of the second aspect. According to a further aspect, the charging station may be provided without and/or separately from the control knob.

According to a third aspect, a household system comprising a household appliance and the control knob according to the first aspect or according to an embodiment thereof which is connectable to the household appliance is provided.

The embodiments and features described with reference to the control knob of the first aspect or according to an embodiment thereof apply mutatis mutandis to the household system of the third aspect.

According to a fourth aspect, a method for controlling a household appliance with a control knob is provided. The method comprises:

rotatably and removably connecting a housing of the control knob to the household appliance;

determining a reference orientation of the housing when the housing is newly connected to the household appliance;

determining a current orientation of the housing with respect to the determined reference orientation;

wirelessly sending control information determined from the current orientation of the housing to the household appliance, the control information being information for controlling the household appliance; and

modifying settings of the household appliance based on the received control information.

According to an embodiment, the control knob used in the method is the control knob according to the first aspect or according to an embodiment thereof.

The embodiments and features described with reference to the control knob of the first aspect or according to an embodiment thereof apply mutatis mutandis to the method of the fourth aspect.

Further possible implementations or alternative solutions of the invention also encompass combinations – that are not explicitly mentioned herein – of features described above or below with regard to the embodiments. The person skilled in the art may also add individual or isolated aspects and features to the most basic form of the invention.

Further embodiments, features and advantages of the present invention will become apparent from the subsequent description and dependent claims, taken in conjunction with the accompanying drawings, in which:

Fig. 1 shows a perspective view of a household system;

Fig. 2 shows a perspective view of a control knob according to a first embodiment;

Fig. 3 shows a method for controlling a household appliance;

Fig. 4 shows an exploded view of a control knob according to a second embodiment;

Fig. 5 shows an example of a display on a display;

Fig. 6 shows another example of a display on the display; and

Fig. 7 shows a perspective view of a control knob system.

In the Figures, like reference numerals designate like or functionally equivalent elements, unless otherwise indicated.

Fig. 1 shows a perspective view of a household system 50 which comprises a household appliance 30 and a control knob 1. The household appliance 30 is a cooking device including an oven 33 and a cooking surface 31 with four burners 34. As shown in Fig. 1, the control knob 1 can be placed on the surface 31 for controlling the household appliance 30.

Fig. 2 shows a perspective view of the control knob 1 which is placed on the surface 31. The control knob 1 is formed of one cylindrical block formed by a cylindrical housing 2. The cylindrical housing includes two round surfaces 7, 35, which oppose each other parallelly. The knob 1 is movable as a whole: it can be displaced on the surface 31, removed from the surface 31 and/or translationally be moved to another household appliance. A calibration unit 3, an orientation sensor 4 and a communication unit 5 are provided on the inside of the housing 2. Their functionalities will be described in detail in view of Fig. 3 below.

The control knob 1 can be used to control the cooking device 30. Fig. 3 shows a method for controlling a household appliance 30. In the method of Fig. 3, the control knob 1 of Fig. 1 and 2 is used. In detail, in a method step S1, the housing 2 (and hence the entire knob 1) is rotatably and removably connected to the cooking device 30. This corresponds to the views of Fig. 1 and 2, in which the knob 1 is placed on the surface 31.

In the present example, the knob 1 controls the gas supply to the part of the cooking device 30 to which it is closest, namely the upper right gas burner 34 of the cooking device 30 (Fig. 1). By moving the knob 1 to a different area of the surface 21, the knob 1 can also control the gas supply to other gas burners 34.

The connection to the cooking device 30 is here a physical and communicative connection. The physical connection is realized through a contact between a lower surface 7 of the housing 2 and the surface 31, which oppose each other. There is no attachment between the knob 1 and the surface 31 so that the knob 1 can be easily removed from the surface 31. The communicative connection is realized by the communication unit 5 which wirelessly connects to the cooking device 30 and for example specifies for which gas burner 34 the knob 1 is to be used.

In a step S2 of Fig. 3, the calibration unit 3 determines a reference orientation O1 of the housing 2 when it is newly connected to the household appliance 30. To this end, the calibration unit 3 uses the orientation sensor 4 which is realized as a digital compass to sense the orientation O1 of the housing 2 when it is placed on the surface 31. The reference orientation O1 is stored in a storage unit of the knob 1 (not shown).

In a step S3 of Fig. 3, the orientation sensor 4 senses a current orientation O2 of the housing 2 after it is rotated as compared to its reference orientation O1. Namely, when a user rotates the knob 1 in a rotation direction R around a rotation axis RA (see Fig. 2) in order to modify a gas supply to the gas burner 34, its current orientation O2 changes. This new orientation O2 is determined by the orientation sensor 4 and expressed with respect to the reference orientation O1.

The knob 1 uses the determined orientation O2 to determine a control information CI therefrom. The control information CI is an information for controlling the burner 34, here for modifying a gas supply thereto.

In a step S4, the communication unit 5 wirelessly sends the control information CI determined from the determined orientation O2 of the housing 2 to the household appliance 30. In detail, the control information CI is sent to the cooking device 30 through Wi-Fi.

In a step S5, the cooking device 30 modifies the settings of the burner 34 to which the knob 1 is connected based on the received control information CI by adjusting the gas supply to the controlled gas burner 34.

Fig. 4 shows an exploded view of a control knob 1' according to another embodiment. Although the structure of the control knob 1' slightly diverges from that of the control knob 1 of Fig. 2, their functionalities are mostly identical. In particular, the control knob 1' of Fig. 4 is equally capable of controlling the household appliance 30 by performing the method steps S1 – S5 of Fig. 3.

In the control knob 1', the housing 2 is formed of side portions 11, of a lower portion 10 and of a cap 8, which are put together and fixed together by assembly screws 9. The knob

1' comprises an ignition unit 13 for turning the knob 1' on and off. Further, the knob 1' includes a battery unit 12 for providing the electric components inside the housing 2 with electric power. Beyond the previously described calibration unit 3, orientation sensor 4 and communication unit 5, the electric components of the knob 1' further include a display unit 6 which comprises a display 15, LEDs 14 and a visualization ring 16.

The LEDs 14 are used to illuminate the visualization ring 16 when the ignition button 13 is pushed and the knob 1' is on. That way, the user can easily see whether the knob 1' is turned on or off.

The display 15 indicates a current orientation O2 of the knob 1' as compared to the reference position O1, thereby facilitating the selection of the correct gas amount to be supplied to the burner 34. An example of a display on the display 15 is shown in Fig. 5. The display 15 has a circular shape and displays marks 17 with their corresponding labels "0 - 9". The mark 17 labelled "0" is selected for no gas supply to the gas burner 34, and the marks 17 labelled "1" to "9" are selected for an increasingly high gas supply to the gas burner.

The mark 17 with the label "0" corresponds to the reference orientation O1. The darkened mark 17 (with the label "4" in Fig 5) corresponds to the current orientation O2 of the knob 1'. As the knob 1' is rotated, the mark 17 which is darkened changes accordingly. By looking at the marks 17 on the display 15, the user can see which setting of the burner 34 he selected and modify the gas supply to the burner 34 by rotating the knob 1' in either direction R accordingly.

Instead of controlling the burner 34 of Fig. 1, the control knob 1, 1' can also be used to control the oven 33. In this case, the control knob 1, 1' can be used as described above. When used with the oven 33, the display 15 may adjust to the controlled device 33 and accordingly adapt its display. An example of such a modified display on the display 15 for controlling the oven 33 is disclosed in Fig. 6.

Therein, the display 15 displays a "0" indicating the reference orientation O1 in which the oven is off and six icons 18 indicating various modes for the oven 33. A luminous dot 19

indicates a current orientation O2 of the knob 1' and can be used to facilitate the selection of the modes.

Fig. 7 shows a perspective view of a control knob system 40 comprising the previously described knob 1, 1' and a battery unit 12 which gets charged by ignition by a charging station 41 onto which the knob 1, 1' is placed when it is not used. The charging station 41 may be incorporated in the surface 31 of the household appliance.

Although the present invention has been described in accordance with preferred embodiments, it is obvious for the person skilled in the art that modifications are possible in all embodiments. Instead of the cooking device 30, the household appliance controlled by the knob 1, 1' can also be a single standing burner, a washing machine, a dishwasher or the like.

In some further embodiments, the knob 1 comprises a selection unit (a button or touch screen of the display unit 6) for selecting the household appliance to be controlled. That way, the user can easily select which household appliance or which part thereof he wants to control.

The reference orientation O1 does not necessarily correspond to the "0"-mark 17. Rather, it can coincide with any "ON"-position of the gas burner 34.

Reference Numerals:

1, 1'	control knob
2	housing
3	calibration unit
4	orientation sensor
5	communication unit
6	display unit
7	lower surface
8	cap
9	assembly screw
10	lower portion
11	side portion
12	battery unit
13	ignition unit
14	LED
15	display
16	visualization ring
17	mark
18	icon
19	dot
30	household appliance
31	surface
33	oven
34	burner
35	upper surface
40	control knob system
41	charging station
50	household system
CI	control information
R	rotation direction
RA	rotation axis
O1	reference orientation
O2	current orientation
S1 – S5	method steps

CLAIMS

1. A control knob (1, 1') for controlling a household appliance (30), comprising:

a housing (2) which is configured to be rotatably and removably connected to the household appliance (30);

a calibration unit (3) for determining a reference orientation (O1) of the housing (2) when the housing (2) is newly connected to the household appliance (30);

an orientation sensor (4) for determining a current orientation (O2) of the housing (2) with respect to the determined reference orientation (O1); and

a wireless communication unit (5) for wirelessly sending control information (CI) determined from the current orientation (O2) of the housing (2) to the household appliance (30), the control information (CI) being information for controlling the household appliance (30).

2. The control knob according to claim 1, which further comprises a display unit (6) for displaying the current orientation (O2) of the housing (2) determined by the orientation sensor (4).

3. The control knob according to claim 2, wherein the display unit (6) further indicates different possible settings of the household appliance (30) which are selectable through rotation of the housing (2).

4. The control knob according to any one of claims 1 to 3, wherein the wireless communication unit (5) is configured to send a turn off signal to the household appliance (30) for turning off the household appliance (30) when the housing (2) is disconnected from the household appliance (30).

5. The control knob according to any one of claims 1 to 4, which is configured to be successively connected to different household appliances (30) and to successively control the connected household appliance (30) through rotation of the housing (2) and through sending of a corresponding control information (CI).

6. The control knob according to any one of claims 1 to 5, wherein the orientation sensor (4), the wireless communication unit (5), the calibration unit (3) and/or the display unit (6) are provided within the housing (2).

7. The control knob according to any one of claims 1 to 6, wherein the household appliance (30) is a gas burner (34) or a cooking hob, in particular a gas hob.

8. The control knob according to claim 7, wherein the control information is information for modifying an amount of gas supplied to the gas burner (34) or to a gas burner (34) of the gas hob.

9. The control knob according to any one of claims 1 to 8, wherein the housing (2) has a cylindrical shape and wherein the current orientation (O2) of the housing (2) is an indication for how much the housing (2) has been rotated around an axis (RA) of the cylinder with respect to the reference orientation (O1).

10. The control knob according to any one of claims 1 to 9, wherein the housing (2) is configured to be connected to the household appliance (30) by placing it on a surface (31) of the household appliance (30) and/or on a surface distant apart from the household appliance (30).

11. The control knob according to any one of claims 1 to 10, which is waterproof.

12. A control knob system (40) including:

the control knob (1, 1') according to any one of claims 1 to 11, further comprising a battery unit (12) for powering the control knob (1, 1'); and

a charging station (41) for charging the battery unit (12) through induction, wires and/or charging pins.

13. A household system (50) comprising a household appliance (30) and the control knob (1, 1') according to any one of claims 1 to 11 which is connectable to the household appliance (30).

14. A method for controlling a household appliance (30) with a control knob (1, 1'), comprising:

rotatably and removably connecting (S1) a housing (2) of the control knob (1, 1') to the household appliance (30);

determining (S2) a reference orientation (O1) of the housing (2) when the housing (2) is newly connected to the household appliance (30);

determining (S3) a current orientation (O2) of the housing (2) with respect to the determined reference orientation (O1);

wirelessly sending (S4) control information (CI) determined from the current orientation (O2) of the housing (2) to the household appliance (30), the control information (CI) being information for controlling the household appliance (30); and

modifying (S5) settings of the household appliance (30) based on the received control information (CI).

15. The method according to claim 14, wherein the control knob (1, 1') is a control knob (1, 1') according to any one of claims 1 to 11.

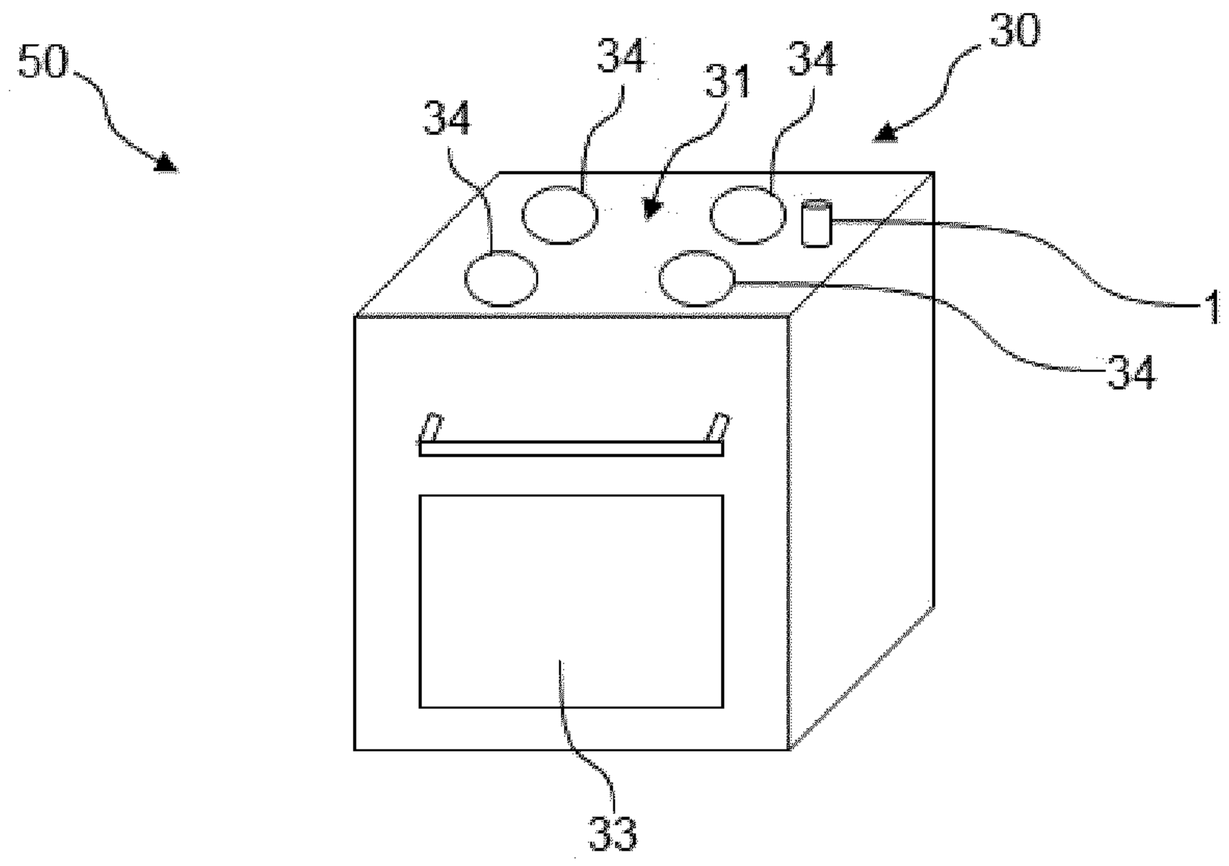


Fig. 1

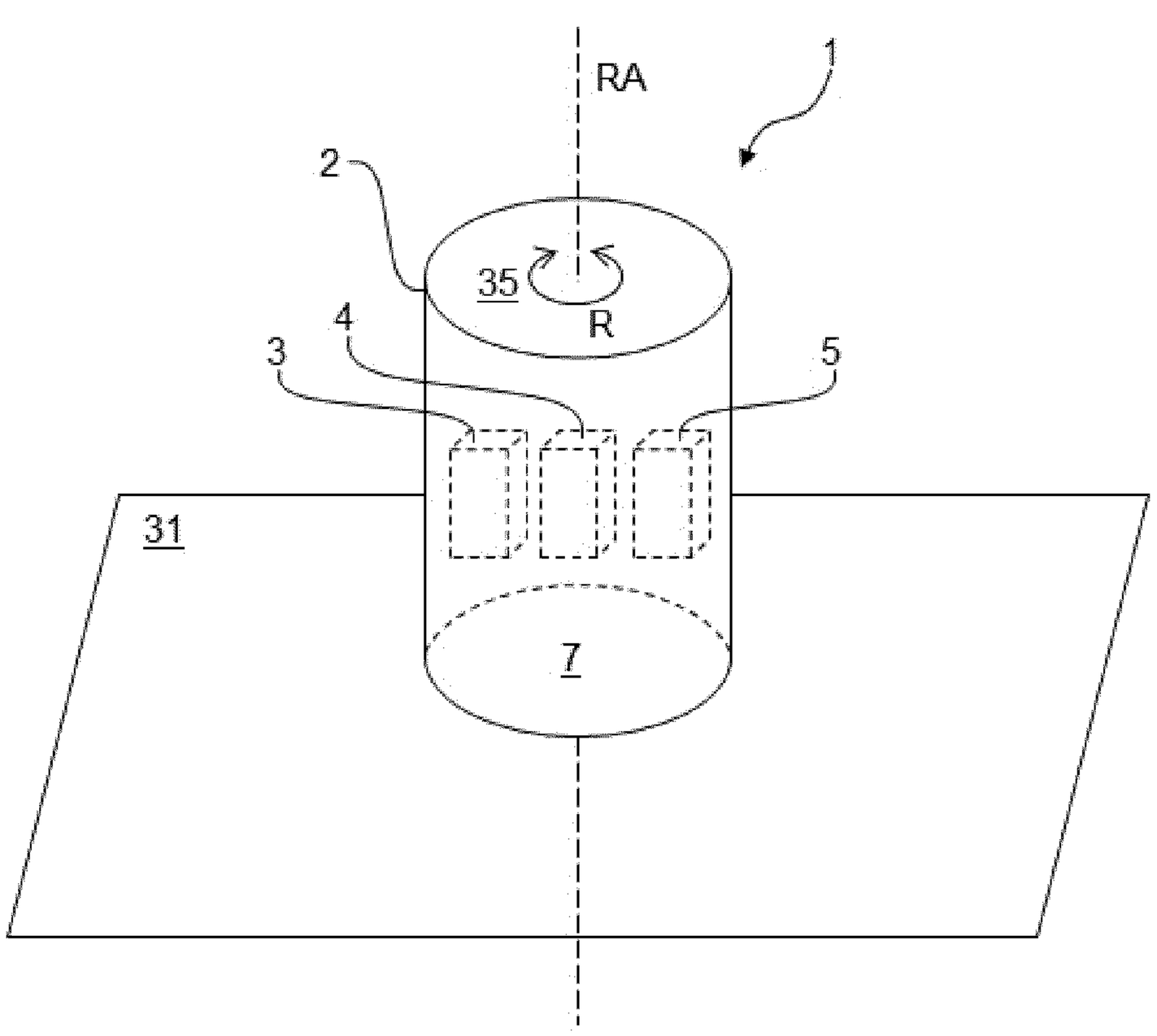


Fig. 2

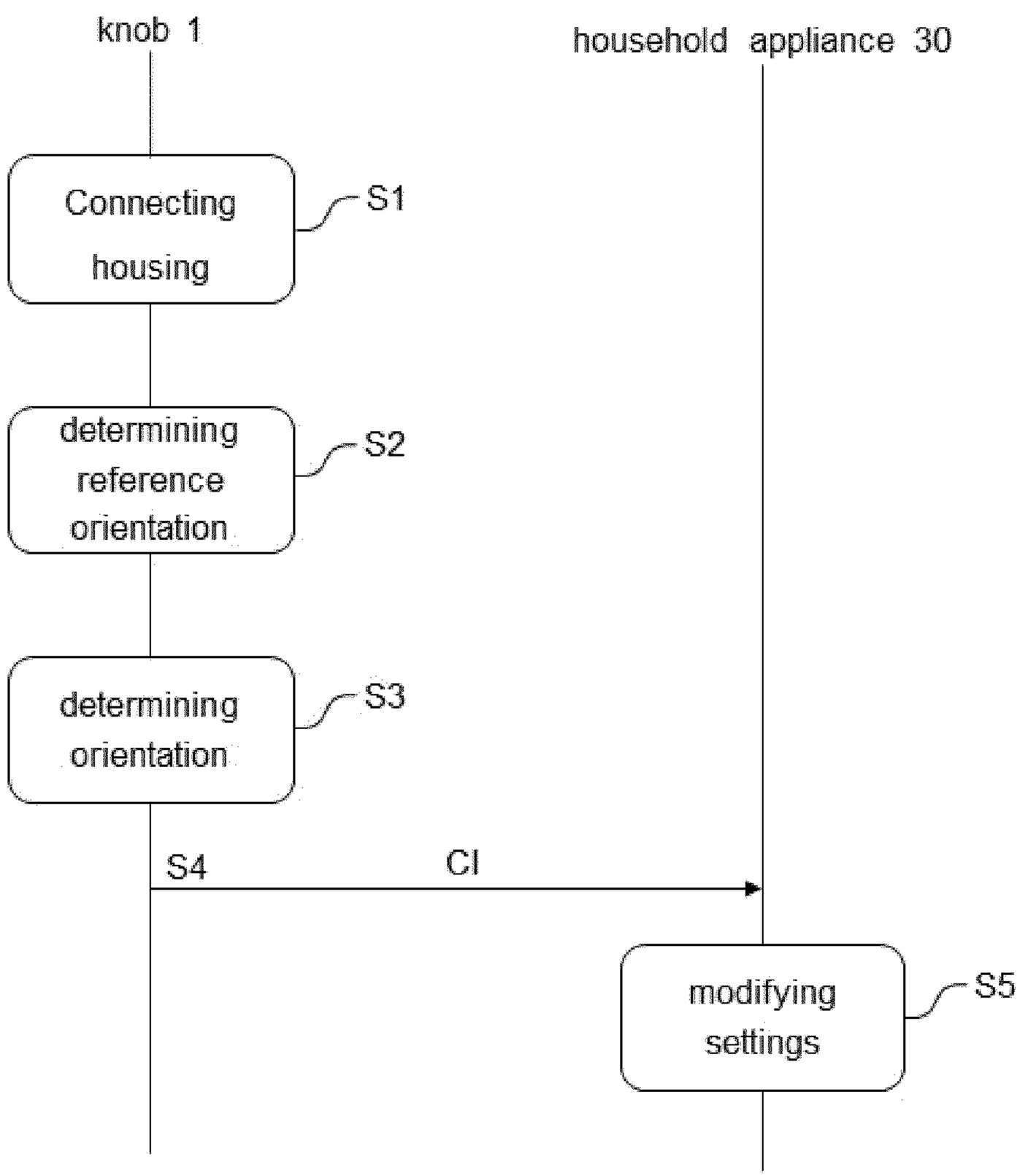

knob 1
household appliance 30
Connecting housing
S1
determining reference orientation
S2
determining orientation
S3
S4
CI
modifying settings
S5

Fig. 3

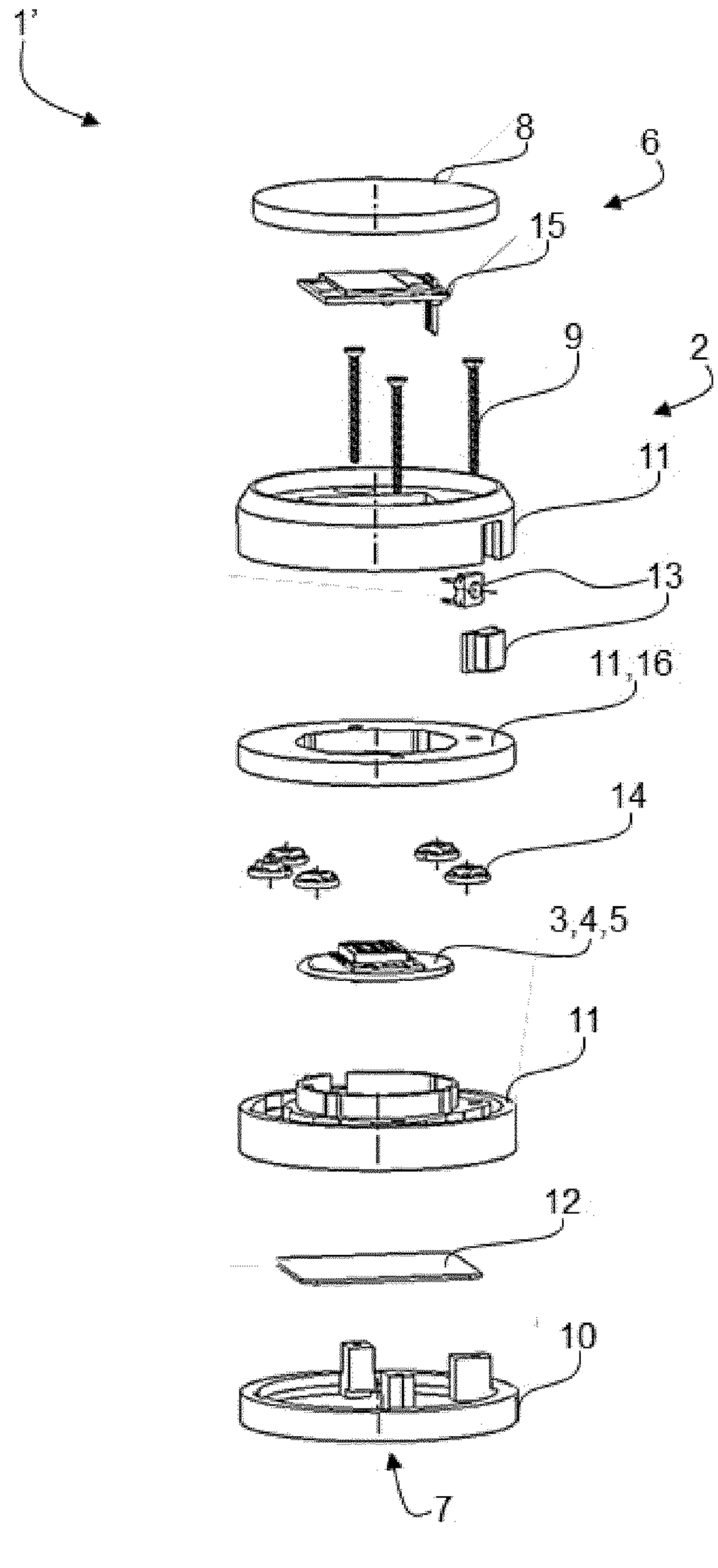


Fig. 4

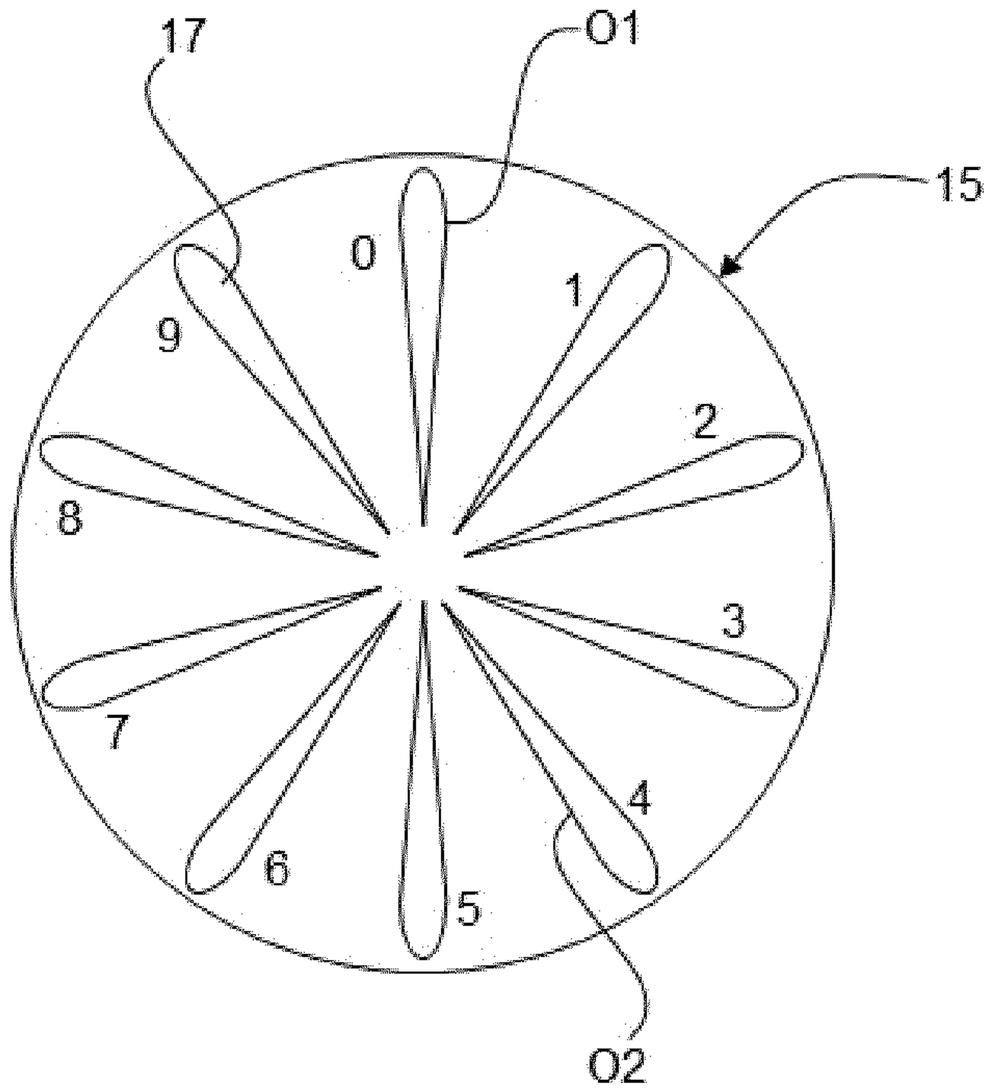


Fig. 5

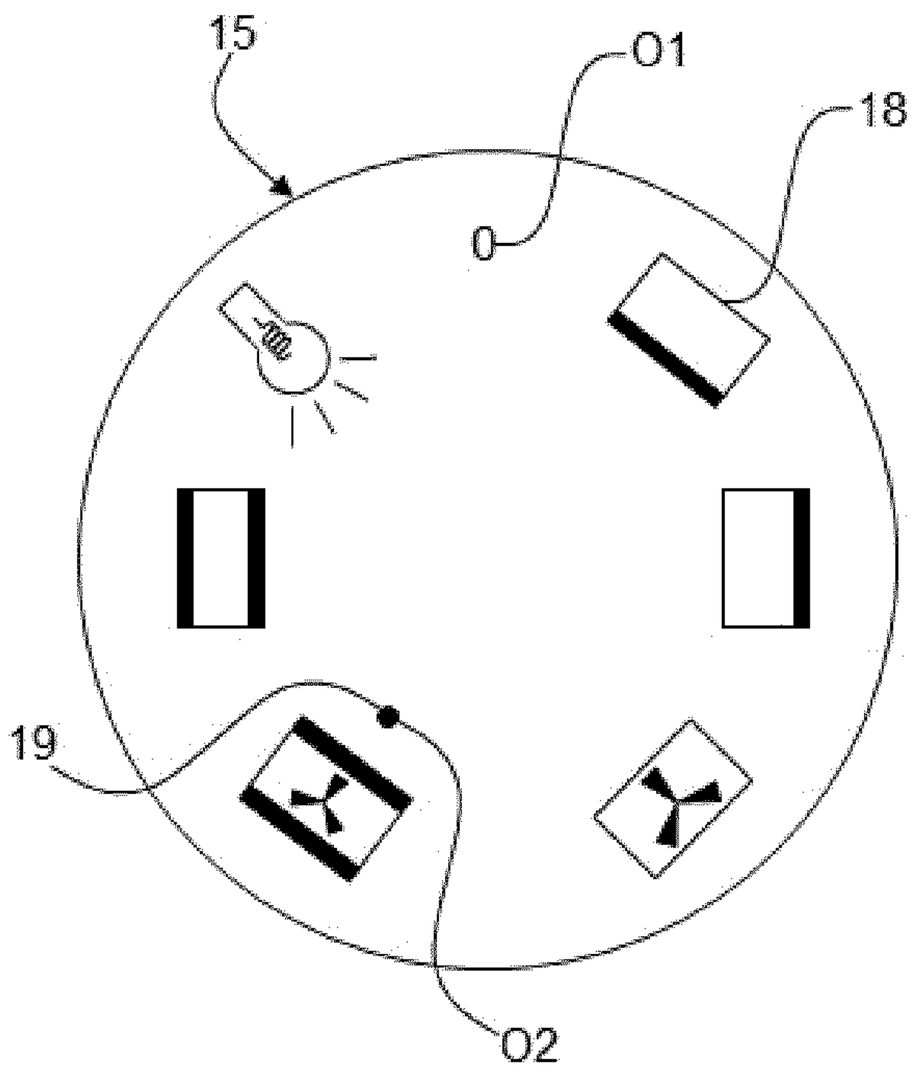


Fig. 6

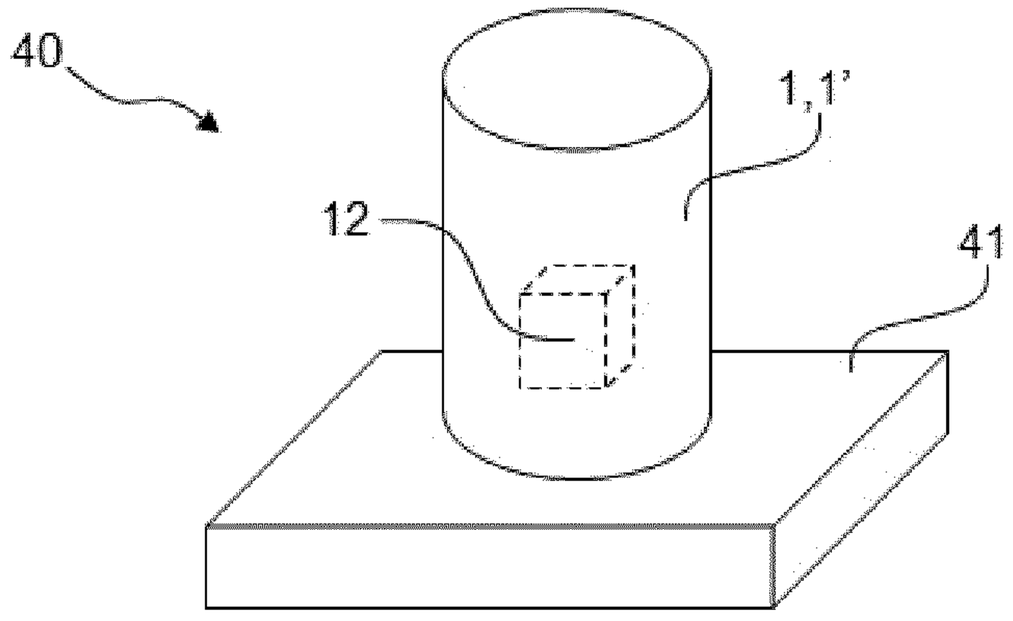


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/084388

A. CLASSIFICATION OF SUBJECT MATTER
INV. F24C7/08 G05G1/08 H01H19/00
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)
F24C G05G H01H

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.
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A	DE 10 2016 224302 A1 (BSH HAUSGERAETE GMBH [DE]) 7 June 2018 (2018-06-07) the whole document -----	1-15

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

[X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 February 2021	17/02/2021
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Rodriguez, Alexander

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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